Citrix NetScaler
Policy Configuration and Reference Guide

Citrix® NetScaler® 9.2

Last Updated: July 2010

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Preface

Before you begin to configure policies and expressions as described in this document, take a few minutes to review this chapter and learn about related documentation, other support options, and ways to send us feedback.

In This Preface

About This Guide

New in This Release

Audience

Formatting Conventions

Related Documentation

Getting Service and Support

Documentation Feedback

About This Guide

The *Citrix NetScaler Policy Configuration and Reference Guide* provides configuration and reference information for controlling the behavior of NetScaler features by using policies and expressions. This guide discusses classic and advanced policies and expressions. It also covers additional topics for advanced policy configuration, including policy labels, HTTP service callouts, traffic rate policies, and pattern sets.

This guide provides the following information:

- Chapter 1, "Introduction to Policies and Expressions." Describes the purpose of expressions, policies, and actions, and how different NetScaler applications make use of them.
- Chapter 2, "Configuring Advanced Policies." Describes the structure of advanced policies and how to configure them individually and as policy banks.

- Chapter 3, “Configuring Advanced Expressions: Getting Started.” Describes expression syntax and semantics, and briefly introduces how to configure expressions and policies.
- Chapter 4, “Advanced Expressions: Evaluating Text.” Describes expressions that you configure when you want to operate on text (for example, the body of an HTTP POST request or the contents of a user certificate).
- Chapter 5, “Advanced Expressions: Working with Dates, Times, and Numbers.” Describes expressions that you configure when you want to operate on any type of numeric data (for example, the length of a URL, a client's IP address, or the date and time that an HTTP request was sent).
- Chapter 6, “Advanced Expressions: Parsing HTTP, TCP, and UDP Data.” Describes expressions for parsing IP and IPv6 addresses, MAC addresses, and data that is specific to HTTP and TCP traffic.
- Chapter 7, “Advanced Expressions: Parsing SSL Certificates.” Describes how to configure expressions for SSL traffic and client certificates, for example, how to retrieve the expiration date of a certificate or the certificate issuer.
- Chapter 8, “Advanced Expressions: IP and MAC Addresses, Throughput, VLAN IDs.” Describes expressions that you can use to work with any other client- or server-related data not discussed in other chapters.
- Chapter 9, “Advanced Expressions: String Sets, String Patterns, and Data Formats.” Describes expressions that you can use to parse structured text and convert it into different formats.
- Chapter 10, “Advanced Policies: Controlling the Rate of Traffic.” Describes policies that you can configure to control the flow of traffic to different destinations, primarily for the purpose of throttling excessive traffic.
- Chapter 11, “Advanced Policies: Sending HTTP Service Callouts to Applications.” Describes expressions that you can use to send HTTP requests to external applications.
- Chapter 12, “Configuring Classic Policies and Expressions.” Provides details on how to configure the simpler policies and expressions known as classic policies and classic expressions.
- Appendix A, “Expressions Reference.” A reference for classic and advanced expression arguments.
- Appendix B, “Summary Examples of Advanced Expressions and Policies.” Examples of classic and advanced expressions and policies, in both quick reference and tutorial format, that you can customize for your own use.

- Appendix C, "Tutorial Examples of Advanced Policies for Rewrite." Examples of advanced policies for use in the Rewrite feature.
- Appendix D, "Tutorial Examples of Classic Policies." Examples of classic policies for NetScaler features such as Application Firewall and SSL.
- Appendix E, "Migration of Apache mod_rewrite Rules to Advanced Policies." Examples of functions that were written using the Apache HTTP Server mod_rewrite engine, with examples of these functions after translation into Rewrite and Responder policies on the NetScaler.
- Appendix F, "New Advanced Expression Operators in This Release." A summary of the new advanced expression operators and methods. This list supplements the advanced expressions documented in Appendix A.

New in This Release

NetScaler nCore Technology uses multiple CPU cores for packet handling and greatly improves the performance of many NetScaler features. Release 9.2 adds nCore support for many additional features, including load balancing and virtual private networks (VPNs). For a summary of the new features and remaining unsupported nCore features, see the *Citrix NetScaler 9.2 Release Notes*.

You can now use advanced policies and expressions to configure Compression, Authorization, and Application Firewall. Advanced expressions provide a rich set of expression elements along with options to control the flow of evaluation within a policy bank. These elements and options enable you to maximize the capabilities of these NetScaler features. Advanced policies, which comprise a set of rules and actions that use the advanced expression format, further enhance your ability to analyze data at various network layers and at different points along the flow of traffic. For more information about the benefits of using advanced policies and expressions, see "Benefits of Using Advanced Policies," on page 2.

The *Citrix NetScaler Policy Configuration and Reference Guide* has been updated with information about new operators that you can use in advanced policy expressions. For more information about the new expression operators, see Appendix F, "New Advanced Expression Operators in This Release."

Audience

This guide is intended for the following audience:

- NetScaler administrators who want to learn more about policies and expressions or who need to configure policies to control the behavior of particular features.

- NetScaler programmers who want to develop advanced policies and expressions.

The concepts and tasks described in this guide require you to have a basic understanding of the NetScaler system and the particular feature for which you want to configure a policy.

Formatting Conventions

This documentation uses the following formatting conventions

Formatting Conventions

Convention	**Meaning**
Boldface	Information that you type exactly as shown (user input); elements in the user interface.
<angled braces>	Placeholders for information or parameters that you provide. For example, <FileName> in a command means you type the actual name of a file. Also, new terms, and words used as specific terms, as opposed to their ordinary, descriptive meaning.
`Monospace`	System output or characters in a command line. User input and placeholders also are formatted using monspace text.
{braces}	A series of items, one of which is required in command statements. For example, **{ yes | no }** means you must type **yes** or **no**. Do not type the braces themselves.
[brackets]	Optional items in command statements. For example, in the following command, `[-range` *`positiveInteger`*`]` means that you have the option of entering a range, but it is not required: **`add lb vserver`** *`name serviceType IPAddress port`* `[`**`-range`** *`positiveInteger`*`]` Do not type the brackets themselves.
| (vertical bar)	A separator between options in braces or brackets in command statements. For example, the following indicates that you choose one of the following load balancing methods: *`lbMethod`* **`=`** `(` **`ROUNDROBIN`** `|` **`LEASTCONNECTION`** `|` **`LEASTRESPONSETIME`** `|` **`URLHASH`** `|` **`DOMAINHASH`** `|` **`DESTINATIONIPHASH`** `|` **`SOURCEIPHASH`** `|` **`SRCIPDESTIPHASH`** `|` **`LEASTBANDWIDTH`** `|` **`LEASTPACKETS`** `|` **`TOKEN`** `|` **`SRCIPSRCPORTHASH`** `|` **`LRTM`** `|` **`CALLIDHASH`** `|` **`CUSTOMLOAD`** `)`
… (ellipsis)	You can repeat the previous item or items in command statements. For example, **/route:***DeviceName***[,…]** means you can type additional *DeviceNames* separated by commas.

Related Documentation

A complete set of documentation is available on the **Documentation** tab of your NetScaler and from http://support.citrix.com/. (Most of the documents require Adobe Reader, available at http://adobe.com/.)

To view the documentation

1. From a Web browser, log on to the NetScaler.
2. Click the **Documentation** tab.
3. To view a short description of each document, hover your cursor over the title. To open a document, click the title.

Getting Service and Support

Citrix offers a variety of resources for support with your Citrix environment, including the following:

- The Knowledge Center is a self-service, Web-based technical support database that contains thousands of technical solutions, including access to the latest hotfixes, service packs, and security bulletins.
- Technical Support Programs for both software support and appliance maintenance are available at a variety of support levels.
- The Subscription Advantage program is a one-year membership that gives you an easy way to stay current with the latest product version upgrades and enhancements.
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For detailed information about Citrix services and support, see the Citrix Systems Support Web site at
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You can also participate in and follow technical discussions offered by the experts on various Citrix products at the following sites:

- http://community.citrix.com
- http://twitter.com/citrixsupport

Documentation Feedback

You are encouraged to provide feedback and suggestions so that we can enhance the documentation. You can send email to the following alias or aliases, as appropriate. In the subject line, specify “Documentation Feedback.” Be sure to include the document name, page number, and product release version.

- For NetScaler documentation, send email to nsdocs_feedback@citrix.com.
- For Command Center documentation, send email to ccdocs_feedback@citrix.com.
- For Access Gateway documentation, send email to agdocs_feedback@citrix.com.

You can also provide feedback from the Knowledge Center at http://support.citrix.com/.

To provide feedback from the Knowledge Center home page

1. Go to the Knowledge Center home page at http://support.citrix.com.
2. On the Knowledge Center home page, under **Products**, expand **NetScaler**, and then click the release for which you want to provide feedback.
3. On the **Documentation** tab, click the guide name, and then click **Article Feedback**.
4. On the **Documentation Feedback** page, complete the form, and then click **Submit**.

Introduction to Policies and Expressions

For many NetScaler features, policies control how the feature evaluates data, which ultimately determines what the feature does with the data. A policy uses a logical *expression*, also called a *rule*, to evaluate requests, responses, or other data, and applies one or more *actions* determined by the outcome of the evaluation. Or a policy can apply a *profile*, which defines a complex action.

Some NetScaler features use advanced policies, which provide greater capabilities than do the older, classic, policies. If you migrated to a newer release of the NetScaler software and have configured classic policies for features that now use advanced policies, you might have to manually migrate policies to the advanced-policy format.

In This Chapter

Advanced and Classic Policies

Advanced and Classic Expressions

About Migration from Classic to Advanced Policies and Expressions

Before You Proceed

Advanced and Classic Policies

Classic policies evaluate basic characteristics of traffic and other data. For example, classic policies can identify whether an HTTP request or response contains a particular type of header or URL.

Advanced policies can perform the same type of evaluations as classic policies. In addition, advanced policies enable you to analyze more data (for example, the body of an HTTP request) and to configure more operations in the policy rule (for example, transforming data in the body of a request into an HTTP header).

In addition to assigning a policy an action or profile, you bind the policy to a particular point in the processing associated with the NetScaler features. The bind point is one factor that determines when the policy will be evaluated.

Benefits of Using Advanced Policies

Advanced policies use a powerful expression language that is built on a class-object model, and they offer several options that enhance your ability to configure the behavior of various NetScaler features. With advanced policies, you can do the following:

- Perform fine-grained analyses of network traffic from layers 2 through 7.
- Evaluate any part of the header or body of an HTTP or HTTPS request or response.
- Bind policies to the multiple bind points that the advanced policy infrastructure supports at the default, override, and virtual server levels.
- Use goto expressions to transfer control to other policies and bind points, as determined by the result of expression evaluation.
- Use special tools such as pattern sets, policy labels, rate limit identifiers, and HTTP callouts, which enable you to configure policies effectively for complex use cases.

Additionally, the configuration utility extends robust graphical user interface support for advanced policies and expressions and enables users who have limited knowledge of networking protocols to configure policies quickly and easily. The configuration utility also includes a policy evaluation feature for advanced policies. You can use this feature to evaluate an advanced policy and test its behavior before you commit it, thus reducing the risk of configuration errors.

Basic Components of an Advanced or a Classic Policy

Following are a few characteristics of both classic and advanced policies:

- **Name.** Each policy has a unique name.
- **Rule.** The rule is a logical expression that enables the NetScaler feature to evaluate a piece of traffic or another object.

  For example, a rule can enable the NetScaler to determine whether an HTTP request originated from a particular IP address, or whether a Cache-Control header in an HTTP request has the value “No-Cache”.

  Advanced policies can use all of the expressions that are available in a classic policy, with the exception of classic expressions for the SSL VPN client. In addition, advanced policies enable you to configure more complex expressions.

- **Bindings.** To ensure that the NetScaler can invoke a policy when it is needed, you associate the policy, or bind it, to one or more bind points.

  You can bind a policy globally or to a virtual server. For more information, see "About Policy Bindings," on page 7.

- **An associated action.** An action is a separate entity from a policy. Policy evaluation ultimately results in the NetScaler performing an action.

  For example, a policy in the Integrated Cache can identify HTTP requests for .gif or .jpeg files. An action that you associate with this policy determines that the responses to these types of requests are served from the cache.

  For some features, you configure actions as part of a more complex set of instructions known as a profile. For more information, see "Order of Evaluation Based on Traffic Flow," on page 9.

How Different NetScaler Features Use Policies

The NetScaler supports a variety of features that rely on policies for operation. The following table summarizes how the NetScaler features use policies:

NetScaler Feature, Policy Type, and Policy Usage

Feature Name	Policy Type	How You Use Policies in the Feature
System	Classic	For the Authentication function, policies contain authentication schemes for different authentication methods. For example, you can configure LDAP and certificate-based authentication schemes. You also configure policies in the Auditing function.
DNS	Advanced	To determine how to perform DNS resolution for requests.
SSL	Classic	To determine when to apply an encryption function and add certificate information to clear text. To provide end-to-end security, after a message is decrypted, the SSL feature re-encrypts clear text and uses SSL to communicate with Web servers.
Compression	Classic and Advanced	To determine what type of traffic is compressed.
Integrated Caching	Advanced	To determine whether HTTP responses are cacheable.
Responder	Advanced	To configure the behavior of the Responder function.

NetScaler Feature, Policy Type, and Policy Usage

Feature Name	**Policy Type**	**How You Use Policies in the Feature**
Protection Features	Classic	To configure the behavior of the Filter, SureConnect, and Priority Queueing functions.
Content Switching	Classic and Advanced	To determine what server or group of servers is responsible for serving responses, based on characteristics of an incoming request. Request characteristics include device type, language, cookies, HTTP method, content type, and associated cache server.
AAA - Traffic Management	Classic Exceptions: • Traffic policies support only advanced policies • Authorization policies support both classic and advanced policies.	To check for client-side security before users log in and establish a session. Traffic policies, which determine whether single sign-on (SSO) is required, use only the advanced policy format. Authorization policies authorize users and groups that access intranet resources through the appliance.
Cache Redirection	Classic	To determine whether responses are served from a cache or from an origin server.
Rewrite	Advanced	To identify HTTP data that you want to modify before serving. The policies provide rules for modifying the data. For example, you can modify HTTP data to redirect a request to a new home page, or a new server, or a selected server based on the address of the incoming request, or you can modify the data to mask server information in a response for security purposes. The URL Transformer function identifies URLs in HTTP transactions and text files for the purpose of evaluating whether a URL should be transformed.
Application Firewall	Classic and Advanced	To identify characteristics of traffic and data that should or should not be admitted through the firewall.
Access Gateway, Clientless Access function	Advanced	To define rewrite rules for general Web access using the Access Gateway.

NetScaler Feature, Policy Type, and Policy Usage

Feature Name	Policy Type	How You Use Policies in the Feature
Access Gateway	Classic	To determine how the Access Gateway performs authentication, authorization, auditing, and other functions. Authorization policies, however, can be configured with both classic and advanced policy formats.

About Actions and Profiles

Policies do not themselves take action on data. Policies provide read-only logic for evaluating traffic. To enable a feature to perform an operation based on a policy evaluation, you configure actions or profiles and associate them with policies.

Note: Actions and profiles are specific to particular features. For information about assigning actions and profiles to features, see the documentation for the individual features.

About Actions

Actions are steps that the NetScaler takes, depending on the evaluation of the expression in the policy. For example, if an expression in a policy matches a particular source IP address in a request, the action that is associated with this policy determines whether the connection is permitted.

The types of actions that the NetScaler can take are feature specific. For example, in Rewrite, actions can replace text in a request, change the destination URL for a request, and so on. In Integrated Caching, actions determine whether HTTP responses are served from the cache or an origin server.

In some NetScaler features actions are predefined, and in others they are configurable. In some cases, (for example, Rewrite), you configure the actions using the same types of expressions that you use to configure the associated policy rule.

About Profiles

Some NetScaler features enable you to associate profiles, or both actions and profiles, with a policy. A profile is a collection of settings that enable the feature to perform a complex function. For example, in the Application Firewall, a profile for XML data can perform multiple screening operations, such as examining the data for illegal XML syntax or evidence of SQL injection.

Use of Actions and Profiles in Particular Features

The following table summarizes the use of actions and profiles in different NetScaler features. The table is not exhaustive. For more information on specific uses of actions and profiles for a feature, see the documentation for the feature.

Use of Actions and Profiles in Different NetScaler Features

Feature	**Use of an Action**	**Use of a Profile**
Application Firewall	Synonymous with a profile	All Application Firewall features use profiles to define complex behaviors, including pattern-based learning. You add these profiles to policies.
Access Gateway	The following features of the Access Gateway use actions: • **Pre-Authentication.** Uses Allow and Deny actions. You add these actions to a profile. • **Authorization.** Uses Allow and Deny actions. You add these actions to a policy. • **TCP Compression.** Uses various actions. You add these actions to a policy.	The following features use a profile: • Pre-Authentication • Session • Traffic • Clientless Access After configuring the profiles, you add them to policies.
Rewrite	You configure URL rewrite actions and add them to a policy.	Not used.
Integrated Caching	You configure caching and invalidation actions within a policy	Not used.
AAA - Traffic Management	You select an authentication type, set an authorization action of ALLOW or DENY, or set auditing to SYSLOG or NSLOG.	You can configure session profiles with a default timeout and authorization action.
Protection Features	You configure actions within policies for the following functions: • Filter • Compression • Responder • SureConnect	Not used.
SSL	You configure actions within SSL policies	Not used.

Use of Actions and Profiles in Different NetScaler Features

Feature	Use of an Action	Use of a Profile
System	The action is implied. For the Authentication function, it is either Allow or Deny. For Auditing, it is Auditing On or Auditing Off.	Not used.
DNS	The action is implied. It is either Drop Packets or the location of a DNS server.	Not used.
SSL Offload	The action is implied. It is based on a policy that you associate with an SSL virtual server or a service.	Not used.
Compression	Determine the type of compression to apply to the data.	Not used.
Content Switching	The action is implied. If a request matches the policy, the request is directed to the virtual server associated with the policy.	Not used.
Cache Redirection	The action is implied. If a request matches the policy, the request is directed to the origin server.	Not used.

About Policy Bindings

A policy is associated with, or bound to, an entity that enables the policy to be invoked. For example, you can bind a policy to request-time evaluation that applies to all virtual servers. A collection of policies that are bound to a particular bind point constitutes a *policy bank*.

Following is an overview of different types of bind points for a policy:

Request time global. A policy can be available to all components in a feature at request time.

Response time global. A policy can be available to all components in a feature at response time.

Request time, virtual server-specific. A policy can be bound to request-time processing for a particular virtual server. For example, you can bind a request-time policy to a cache redirection virtual server to ensure that particular requests are forwarded to a load balancing virtual server for the cache, and other requests are sent to a load balancing virtual server for the origin.

Response time, virtual server-specific. A policy can also be bound to response-time processing for a particular virtual server.

User-defined policy label. For advanced policies, you can configure custom groupings of policies (policy banks) by defining a policy label and collecting a set of related policies under the policy label.

Other bind points. The availability of additional bind points depends on type of policy (classic or advanced), and specifics of the relevant NetScaler feature. For example, classic policies that you configure for the Access Gateway have user and group bind points.

For additional information about advanced policy bindings, see "Binding Advanced Policies," on page 16, "Configuring a Policy Bank for a Virtual Server," on page 32. For additional information on classic policy bindings, see "Configuring a Classic Policy," on page 201.

About Evaluation Order of Policies

For classic policies, policy groups and policies within a group are evaluated in a particular order, depending on the following:

- The bind point for the policy, for example, whether the policy is bound to request-time processing for a virtual server or global response-time processing. For example, at request time, the NetScaler evaluates all request-time classic policies before evaluating any virtual server-specific policies.
- The priority level for the policy. For each point in the evaluation process, a priority level that is assigned to a policy determines the order of evaluation relative to other policies that share the same bind point. For example, when the NetScaler evaluates a bank of request-time, virtual server-specific policies, it starts with the policy that is assigned to the lowest priority value. In classic policies, priority levels must be unique across all bind points.

For advanced policies, as with classic policies, the NetScaler selects a grouping, or bank, of policies at a particular point in overall processing. Following is the order of evaluation of the basic groupings, or banks, of advanced policies:

1. Request-time global override
2. Request-time, virtual server-specific (one bind point per virtual server)
3. Request-time global default
4. Response-time global override
5. Response-time virtual server-specific
6. Response-time global default

However, within any of the preceding banks of policies, the order of evaluation is more flexible than in classic policies. Within a policy bank, you can point to the next policy to be evaluated regardless of the priority level, and you can invoke policy banks that belong to other bind points and user-defined policy banks.

Order of Evaluation Based on Traffic Flow

As traffic flows through the NetScaler and is processed by various features, each feature performs policy evaluation. Whenever a policy matches the traffic, the NetScaler stores the action and continues processing until the data is about to leave the NetScaler. At that point, the NetScaler typically applies all matching actions. Integrated Caching, which only applies a final Cache or NoCache action, is an exception.

Some policies affect the outcome of other policies. Following are examples:

- If a response is served from the Integrated Cache, some other NetScaler features do not process the response or the request that initiated it.
- If the Content Filtering feature prevents a response from being served, no subsequent features evaluate the response.

If the Application Firewall rejects an incoming request, no other features can process it.

Advanced and Classic Expressions

One of the most fundamental components of a policy is its *rule*. A policy rule is a logical expression that enables the policy to analyze traffic. Most of the policy's functionality is derived from its expression.

An expression matches characteristics of traffic or other data with one or more parameters and values. For example, an expression can enable the NetScaler to accomplish the following:

- Determine whether a request contains a certificate.
- Determine the IP address of a client that sent a TCP request.
- Identify the data that an HTTP request contains (for example, a popular spreadsheet or word processing application).
- Calculate the length of an HTTP request.

About Advanced Expressions

Any feature that uses advanced policies also uses advanced expressions. For information on which features use advanced policies, see the table, “NetScaler Feature, Policy Type, and Policy Usage,” on page 3.

Advanced expressions have a few other uses. In addition to configuring advanced expressions in policy rules, you configure advanced expressions in the following situations:

- **Integrated Caching**: You use advanced expressions to configure a selector for a content group in the Integrated Cache.
- **Load Balancing**: You use advanced expressions to configure token extraction for a load balancing virtual server that uses the TOKEN method for load balancing.
- **Rewrite**: You use advanced expressions to configure Rewrite actions.
- **Rate-based policies**: You use advanced expressions to configure Limit Selectors when configuring a policy to control the rate of traffic to various servers.

Following are a few simple examples of advanced expressions:

- An HTTP request URL contains no more than 500 characters.

  ```
  http.req.url.length <= 500
  ```

- An HTTP request contains a cookie that has fewer than 500 characters.

  ```
  http.req.cookie.length < 500
  ```

- An HTTP request URL contains a particular text string.

  ```
  http.req.url.contains(".html")
  ```

About Classic Expressions

Classic expressions enable you to evaluate basic characteristics of data. They have a structured syntax that performs string matching and other operations.

Following are a few simple examples of classic expressions:

- An HTTP response contains a particular type of Cache Control header.

  ```
  res.http.header Cache-Control contains public
  ```

- An HTTP response contains image data.

  ```
  res.http.header Content-Type contains image/
  ```

- An SSL request contains a certificate.

  ```
  req.ssl.client.cert exists
  ```

About Migration from Classic to Advanced Policies and Expressions

The NetScaler supports either classic or advanced policies within a feature. You cannot have both types in the same feature. Over the past few releases, some NetScaler features have migrated from using classic policies and expressions to advanced policies and expressions. If a feature of interest to you have changed to the advanced format, you may have to manually migrate the older information. Following are guidelines for deciding if you need to migrate your policies:

- If you configured classic policies in a version of the Integrated Caching feature prior to release 9.0 and then upgrade to version 9.0 or later, there is no impact. All legacy policies are migrated to the advanced policy format.
- For other features, you need to manually migrate classic policies and expressions to the advanced format if the feature has migrated its format.

Before You Proceed

Before configuring expressions and policies, be sure you understand the relevant NetScaler feature and the structure of your data, as follows:

- Read the documentation on the relevant feature.
- Look at the data stream for the type of data that you want to configure.

  You may want to run a trace on the type of traffic or content that you want to configure. This will give you an idea of the parameters and values, and operations on these parameters and values, that you need to specify in an expression.

Configuring Advanced Policies

You can create advanced policies for various NetScaler features, including DNS, Rewrite, Responder, and Integrated Caching, and the clientless access function in the Access Gateway. Policies control the behavior of these features.

When you create an advanced policy, you assign it a name, a rule (an expression), feature-specific attributes, and an action that is taken when data matches the policy. After creating the policy, you determine when it is invoked by binding it globally or to either request-time or response-time processing for a virtual server.

Policies that share the same bind point are known as a *policy bank*. For example, all policies that are bound to a virtual server constitute the policy bank for the virtual server. When binding the policy, you assign it a priority level to specify when it is invoked relative to other policies in the bank. In addition to assigning a priority level, you can configure an arbitrary evaluation order for policies in a bank by specifying Goto expressions.

In addition to policy banks that are associated with a built-in bind point or a virtual server, you can configure *policy labels*. A policy label is a policy bank that is identified by an arbitrary name. You invoke a policy label, and the policies in it, from a global or virtual-server-specific policy bank. A policy label or a virtual-server policy bank can be invoked from multiple policy banks.

For some features, you can use the policy manager to configure and bind policies.

In This Chapter

Creating or Modifying an Advanced Policy

Binding Advanced Policies

Unbinding an Advanced Policy

Creating Policy Labels

Configuring a Policy Label or Virtual Server Policy Bank

Invoking or Removing a Policy Label or Virtual Server Policy Bank

Configuring and Binding Policies with the Policy Manager

Creating or Modifying an Advanced Policy

All advanced policies have some common elements. Creating an advanced policy consists, at minimum, of naming the policy and configuring a rule. The policy configuration tools for the various features have areas of overlap, but also differences. For the details of configuring a policy for a particular feature, including associating an action with the policy, see the documentation for the feature.

To create a policy, begin by determining the purpose of the policy. For example, you may want to define a policy that identifies HTTP requests for image files, or client requests that contain an SSL certificate. In addition to knowing the type of information that you want the policy to work with, you need to know the format of the data that the policy is analyzing.

Next, determine whether the policy is globally applicable, or if it pertains to a particular virtual server. Also consider the effect that the order in which your policies are evaluated (which will be determined by how you bind the policies) will have on the policy that you are about to configure.

To create an advanced policy by using the NetScaler command line

At the NetScaler command prompt, type:

```
add responder|dns|cs|rewrite|cache policy <policyName> -rule
<expression> [<feature-specific information>]
```

To modify an existing advanced policy by using the NetScaler command line

At the NetScaler command prompt, type:

```
set responder|dns|cs|rewrite|cache policy <policyName> -rule
<expression> [<feature-specific information>]
```

Advanced-Policy Parameters

Argument	**Specifies**
`policyName`	A unique name for the policy. (Cannot be changed for an existing policy.) Note that in the Content Switching feature, the name cannot start with `app_` because this is a reserved name. Policies with this name are not displayed in the configuration utility.
expression	A logical expression. See "Configuring Advanced Expressions: Getting Started," on page 39.
feature-specific information	Varies by feature. Includes a built-in or user-defined action that you associate with the policy. See the documentation for the feature to which the policy applies.

To create or modify an advanced policy by using the configuration utility

1. In the navigation pane, expand the name of the feature for which you want to configure a policy, and then click **Policies**. For example, you can select **Content Switching**, **Integrated Caching**, **DNS**, **Rewrite**, or **Responder**.
2. In the details pane, click **Add**, or select an existing policy and click **Open**. A policy configuration dialog box appears.
3. Specify values for the following parameters. (An asterisk indicates a required parameter. For a term in parentheses, see the corresponding parameter in the table above.)
    - Name* (policyName)
    - Expression* (expression)
    - Other parameters, as required (feature-specific information)
4. Click **Create**, and then click **Close**.
5. Click **Save**.

Note: After you create a policy, you can view the policy’s details by clicking the policy entry in the configuration pane. Details that are highlighted and underlined are links to the corresponding entity (for example, a named expression).

Policy Configuration Examples

These examples show how policies and their associated actions are entered at the NetScaler command line. In the configuration utility, the expressions would appear in the Expression window of the feature-configuration dialog box for the integrated caching or rewrite feature.

Following is an example of creating a caching policy. Note that actions for caching policies are built in, so you do not need to configure them separately from the policy.

```
add cache policy BranchReportsCachePolicy -rule
q{http.req.url.query.value("actionoverride").contains("branchReport
s")} -action cache
```

Following is an example of a Rewrite policy and action:

```
add rewrite action myAction1 INSERT_HTTP_HEADER "myHeader"
"valueForMyHeader"
```

```
add rewrite policy myPolicy1
"http.req.url.contains(\"myURLstring\")" myAction1
```

Note: At the command line, quote marks within a policy rule (the expression) must be escaped or delimited with the `q` delimiter. For more information, see "Configuring Advanced Expressions in a Policy," on page 57.

Binding Advanced Policies

After defining a policy, you indicate when the policy is to be invoked by binding the policy to a bind point and specifying a priority level. You can bind a policy to only one bind point. A bind point can be global, that is, it can apply to all virtual servers that you have configured. Or, a bind point can be specific to a particular virtual server, which can be either a load balancing or a content switching virtual server. Not all bind points are available for all features.

The order in which policies are evaluated determines the order in which they are applied, and features typically evaluate the various policy banks in a particular order. Sometimes, however, other features can affect the order of evaluation. Within a policy bank, the order of evaluation depends on the values of parameters configured in the policies. Most features apply all of the actions associated with policies whose evaluation results in a match with the data that is being processed. The integrated caching feature is an exception.

Feature-Specific Differences in Policy Bindings

You can bind policies to built-in, global bind points (or banks), to virtual servers, or to policy labels.

However, the NetScaler features differ in terms of the types of bindings that are available. The following table summarizes how you use policy bindings in various NetScaler features that use advanced policies.

Feature-Specific Bindings for Advanced Policies

Feature Name	**Virtual Servers Configured in the Feature**	**Policies Configured in the Feature**	**Bind Points Configured for the Policies**	**Use of Advanced Policies in the Feature**
DNS	none	DNS policies	Global	To determine how to perform DNS resolution for requests.

Feature-Specific Bindings for Advanced Policies

Feature Name	Virtual Servers Configured in the Feature	Policies Configured in the Feature	Bind Points Configured for the Policies	Use of Advanced Policies in the Feature
Content Switching **Note:** This feature can support either advanced or classic policies, but not both.	Content Switching (CS)	Content Switching policies	• Content switching or cache redirection virtual server • Policy label	To determine what server or group of servers is responsible for serving responses, based on characteristics of an incoming request. Request characteristics include device type, language, cookies, HTTP method, content type, and associated cache server.
Integrated Caching	none	Caching policies	• Global override • Global default • Policy label • Load balancing, content switching, or SSL offload virtual server	To determine whether HTTP responses can be stored in, and served from, the NetScaler's integrated cache.
Responder	none	Responder policies	• Global override • Global default • Policy label • Load balancing, content switching, or SSL offload virtual server	To configure the behavior of the Responder function.
Rewrite	none	Rewrite policies	• Global override • Global default • Policy label • Load balancing, content switching, or SSL offload virtual server	To identify HTTP data that you want to modify before serving. The policies provide rules for modifying the data. For example, you can modify HTTP data to redirect a request to a selected server based on the address of the incoming request, or to mask server information in a response for security purposes.
URL Transform function in the Rewrite feature	none	Transformation policies	• Global override • Global default • Policy label	To identify URLs in HTTP transactions and text files for the purpose of evaluating whether a URL should be altered.

Feature-Specific Bindings for Advanced Policies

Feature Name	Virtual Servers Configured in the Feature	Policies Configured in the Feature	Bind Points Configured for the Policies	Use of Advanced Policies in the Feature
Access Gateway (clientless VPN functions only)	VPN server	Clientless Access policies	• VPN Global • VPN server	To determine how the Access Gateway performs authentication, authorization, auditing, and other functions, and to define rewrite rules for general Web access using the Access Gateway.

Bind Points and Order of Evaluation

For an advanced policy to take effect, you must ensure that the policy is invoked at some point during processing. To do so, you associate the policy with a *bind point*. The collection of policies that is bound to a bind point is known as a policy bank.

Following are the bind points that the NetScaler evaluates, listed in the typical order of evaluation:

1. **Request-time override.** When a request flows through a feature, the NetScaler first evaluates request-time override policies for the feature.
2. **Request-time Load Balancing virtual server.** If policy evaluation cannot be completed after all the request-time override policies have been evaluated, the NetScaler processes request-time policies for load balancing virtual servers.
3. **Request-time Content Switching virtual server.** If policy evaluation cannot be completed after all the request-time policies for load balancing virtual servers have been evaluated, the NetScaler processes request-time policies for content switching virtual servers.
4. **Request-time default.** If policy evaluation cannot be completed after all request-time, virtual server-specific policies have been evaluated, the NetScaler processes request-time default policies.
5. **Response-time override.** At response time, the NetScaler starts with policies that are bound to the response-time override bind point.
6. **Response-time Load Balancing virtual server.** If policy evaluation cannot be completed after all response-time override policies have been evaluated, the NetScaler process the response-time policies for load balancing virtual servers.
7. **Response-time Content Switching virtual server.** If policy evaluation cannot be completed after all policies have been evaluated for load

balancing virtual servers, the NetScaler process the response-time policies for content switching virtual servers.

8. **Response-time default.** If policy evaluation cannot be completed after all response-time, virtual-server-specific policies have been evaluated, the NetScaler processes response-time default policies.

Advanced Policy Evaluation Across Features

In addition to attending to evaluation of policies within a feature, if you have bound policies to a content switching virtual server, note that these policies are evaluated before other policies. Binding a policy to a content switching vserver produces a different result in NetScaler versions 9.0.x and later than in 8.x versions. In NetScaler 9.0 and later versions, evaluation occurs as follows:

- Content switching policies are evaluated before other policies. If a content switching policy evaluates to TRUE, the target load balancing vserver is selected.
- If all content switching policies evaluate to FALSE, the default load balancing vserver under the content switching VIP is selected.

After a target load balancing vserver is selected by the content switching process, policies are evaluated in the following order:

1. Policies that are bound to the global override bind point.
2. Policies that are bound to the default load balancing vserver.
3. Policies that are bound to the target content switching vserver.
4. Policies that are bound to the global default bind point.

To be sure that the policies are evaluated in the intended order, follow these guidelines:

- Make sure that the default load balancing vserver is not directly reachable from the outside; for example, the vserver IP address can be 0.0.0.0.
- To prevent exposing internal data on the load balancing default vserver, configure a policy to respond with a “503 Service Unavailable” status and bind it to the default load balancing vserver.

Entries in a Policy Bank

Each entry in a policy bank has, at minimum, a policy and a priority level. You can also configure entries that change the priority-based evaluation order, and you can configure entries that invoke external policy banks.

The following table summarizes each entry in a policy bank.

Format of Each Entry in a Policy Bank

Policy Name	**Priority**	**Goto Expression**	**Invocation Type**	**Policy Bank to be Invoked**
The policy name, or a “dummy” policy named NOPOLICY. The NOPOLICY entry controls evaluation flow without processing a rule. For more information, see “Evaluation Order Within a Policy Bank,” on page 20.	An integer.	*Optional*. Identifies the next policy in the bank to evaluate, or ends any further evaluation.	*Optional*. Indicates that an external policy bank will be invoked. This field restricts the choices to a global policy label or a virtual server.	*Optional*. Used with Invocation Type. This is the label for a policy bank or a virtual server name. The NetScaler returns to the current bank after processing the external bank.

If the policy evaluates to TRUE, the NetScaler stores the action that is associated with the policy. If the policy evaluates to FALSE, the NetScaler evaluates the next policy. If the policy is neither TRUE nor FALSE, the NetScaler uses the associated Undef (undefined) action.

Evaluation Order Within a Policy Bank

Within a policy bank, the evaluation order depends on the following items:

- **A priority.** The most minimal amount of information about evaluation order is a numeric priority level. The lower the number, the higher the priority.
- **A Goto expression.** If supplied, the Goto expression indicates the next policy to be evaluated, typically within the same policy bank.. Goto expressions can only proceed forward in a bank. To prevent looping, a policy bank configuration is not valid if a Goto statement points backwards in the bank.
- **Invocation of other policy banks.** Any entry can invoke an external policy bank. The NetScaler provides a built-in entity named NOPOLICY that does not have a rule. You can add a NOPOLICY entry in a policy bank when you want to invoke another policy bank, but do not want to process any other rules prior to the invocation. You can have multiple NOPOLICY entries in multiple policy banks.

Values for a Goto expression are as follows:

- **NEXT.** This keyword selects the policy with the next higher priority level in the current policy bank.
- **An integer.** If you supply an integer, it must match the priority level of another policy in the current policy bank.
- **END.** This keyword stops evaluation after processing the current policy, and no additional policies in this bank are processed.
- **Blank.** If the Goto expression is empty, it is the same as specifying END.
- **A numeric expression.** This is an advanced expression that resolves to a priority number for another policy in the current bank.
- **USE_INVOCATION_RESULT.** This phrase can be used only if you are invoking an external policy bank. Entering this phrase causes the NetScaler to perform one of the following actions:
    - If the final Goto in the invoked policy bank has a value of END or is empty, the invocation result is END, and evaluation stops.
    - If the final Goto expression in the invoked policy bank is anything other than END, the NetScaler performs a NEXT.

The following table illustrates a policy bank that uses Goto statements and policy bank invocations.

Example of a Policy Bank That Uses Gotos and External Bank Invocations

Policy Name	**Priority**	**Goto**	**Invocation**	**Policy Bank to be Invoked**
ClientCertificatePolicy (rule: does the request contain a client certificate?)	100	300	None	None
SubnetPolicy (rule: is the client from a private subnet?)	200	NEXT	None	None
NOPOLICY	300	USE INVOCATION RESULT	Request vserver	My_Request _VServer
NOPOLICY	350	USE INVOCATION RESULT	Policy Label	My_Policy_ Label
WorkingHoursPolicy (rule: is it working hours?)	400	END	None	None

How Policy Evaluation Ends

Evaluation of a policy bank ends when the following takes place:

- A policy evaluates to TRUE and its Goto statement value is END.

  No further policies or policy banks in this feature are evaluated.

- An external policy bank is invoked, its evaluation returns an END, and the Goto statement uses a value of USE_INVOCATION_RESULT or END.

  Evaluation continues with the next policy bank for this feature. For example, if the current bank is the request-time override bank, the NetScaler next evaluates request-time policy banks for the virtual servers.

- The NetScaler has walked through all the policy banks in this feature, but has not encountered an END.

  If this is the last entry to be evaluated in this policy bank, the NetScaler proceeds to the next feature.

How Features Use Actions After Policy Evaluation

After evaluating all relevant policies for a particular data point (for example, an HTTP request), the NetScaler stores all the actions that are associated with any policy that matched the data.

For most features, all the actions from matching policies are applied to a traffic packet as it leaves the NetScaler. The Integrated Caching feature only applies one action: CACHE or NOCACHE. This action is associated with the policy with the lowest priority value in the “highest priority” policy bank (for example, request-time override policies are applied before virtual server-specific policies).

Binding a Policy Globally

The following binding procedures are typical. However, refer to the documentation for the feature of interest to you for complete instructions.

To bind an Integrated Caching advanced policy globally by using the NetScaler command line

At the NetScaler command prompt, type:

```
bind cache global <policyName> -priority <positiveInteger> [-type
REQ_OVERRIDE | REQ_DEFAULT | RES_OVERRIDE | RES_DEFAULT]
```

Example

```
bind cache global myCachePolicy -priority 100 -type req_default
```

The `type` argument is optional to maintain backward compatibility. If you omit the `type`, the policy is bound to REQ_DEFAULT or RES_DEFAULT, depending on whether the policy rule is a response-time or a request-time expression.

To bind a Rewrite advanced policy globally by using the NetScaler command line

At the NetScaler command prompt, type:

```
bind rewrite global <policyName> <positiveIntegerAsPriority> [-type
REQ_OVERRIDE | REQ_DEFAULT | RES_OVERRIDE | RES_DEFAULT]
```

The `type` argument is optional for globally bound policies, to maintain backward compatibility. If you omit the `type`, the policy is bound to REQ_DEFAULT or RES_DEFAULT, depending on whether the policy rule is a response-time or a request-time expression.

Example

```
bind rewrite global myPolicy1 200
```

To bind a Responder advanced policy globally by using the NetScaler command line

At the NetScaler command prompt, type:

```
bind responder global <policyName> <positiveIntegerAsPriority>
[-type OVERRIDE | DEFAULT ]
```

To bind a DNS advanced policy globally by using the NetScaler command line

At the NetScaler command prompt, type:

```
bind dns global <policyName> <positiveIntegerAsPriority>
```

To bind an Integrated Caching, Responder, or Rewrite advanced policy globally by using the configuration utility

1. In the navigation pane, click the name of the feature for which you want to bind the policy.
2. In the details pane, click **<Feature Name> policy manager**.
3. In the **Policy Manager** dialog box, select the bind point to which you want to bind the policy (for example, for Integrated Caching or Rewrite, you could select **Request** and **Default Global**). The Responder does not differentiate between request-time and response-time policies.
4. Click **Insert Policy** and, from the **Policy Name** pop-up menu, select the policy name. A priority is assigned automatically to the policy, but you can click the cell in the **Priority** column and drag it anywhere within the dialog box if you want the policy to be evaluated after other policies in this bank. The priority is automatically reset. Note that priority values within a policy bank must be unique.
5. Click **Apply Changes**.

6. Click **Close**.

To bind a DNS advanced policy globally by using the configuration utility

1. In the navigation pane, expand **DNS**, and then click **Policies**.
2. In the details pane, click **Global Bindings.**
3. In the global bindings dialog box, click Insert Policy, and select the policy that you want to bind globally.
4. Click in the **Priority** field and enter the priority level.
5. Click **OK**.

Binding a Policy to a Virtual Server

A globally bound policy applies to all load balancing and content switching virtual servers.

Note that when binding a policy to a virtual server, you must identify it as a request-time or a response-time policy.

To bind an advanced policy to a load balancing or content switching virtual server by using the NetScaler command line

At the NetScaler command prompt, type:

```
bind lb|cs vserver <virtualServerName> -policyName <policyName>
-priority <positiveInteger> -type REQUEST|RESPONSE
```

To bind an advanced policy to an SSL offload virtual server by using the NetScaler command line

At the NetScaler command prompt, type:

```
bind ssl vserver <virtualServerName> -policyName <policyName>
-priority <positiveInteger>
```

To bind an advanced policy to a virtual server by using the configuration utility

1. In the navigation pane, expand **Load Balancing**, **Content Switching**, **SSL Offload**, **AAA- Application Traffic**, or **Access Gateway**, and then click **Virtual Servers**.
2. In the details pane, double-click the virtual server to which you want to bind the policy, and then click **Open**.
3. On the **Policies** tab, click the icon for the type of advanced policy that you want to bind (the choices are feature-specific), and then click the name of the policy. Note that for some features, you can bind both classic and advanced policies to the virtual server.

4. If you are binding a policy to a Content Switching virtual server, in the **Target** field select a load balancing virtual server to which traffic that matches the policy is sent.
5. Click **OK**.

Displaying Policy Bindings

You can display policy bindings to verify that they are correct.

To display advanced policy bindings by using the NetScaler command line

At the NetScaler command prompt, type:

```
show <featureName> policy <policyName>
```

To display global policy bindings for Integrated Caching, Rewrite, or Responder by using the configuration utility

1. In the navigation pane, expand the feature that contains the advanced policy that you want to view, and then click **Policy Manager**.
2. In the details pane, click the policy. Bound policies have a check mark next to them.
3. At the bottom of the page, under **Details**, next to **Bound to,** view the entity to which the policy is bound.

To display global policy bindings for DNS or Clientless Access in the Access Gateway by using the configuration utility

1. In the navigation pane, expand **DNS**, and then click **Policies**.
2. In the details pane, click **Global Bindings**.

To display global policy bindings for Content Switching by using the configuration utility

1. In the navigation pane, expand **Content Switching**, and then click **Policies**.
2. In the details pane, click **Show Bindings**.

Unbinding an Advanced Policy

If you want to re-assign a policy or delete it, you must first remove its binding.

To unbind an advanced policy globally by using the NetScaler command line

At the NetScaler command prompt, to unbind an Integrated Caching or Rewrite policy, type:

```
unbind cache|rewrite global <policyName> [-type
req_override|req_default|res_override|res_default]
[-priority <positiveInteger>]
```

The priority is required only for the “dummy” policy named NOPOLICY.

At the NetScaler command prompt, to unbind a Responder policy, type:

```
unbind responder global <policyName> [-type override|default]
[-priority <positiveInteger>]
```

The priority is required only for the “dummy” policy named NOPOLICY.

At the NetScaler command prompt, to unbind a DNS policy, type:

```
unbind responder global <policyName>
```

To unbind an advanced policy from a virtual server by using the NetScaler command line

At the NetScaler command prompt, type:

```
unbind <featureType> vserver <virtualServerName> -policyName
<policyName> [-priority <positiveInteger>] [-type REQUEST|RESPONSE]
```

The priority is required only for the “dummy” policy named NOPOLICY.

To unbind an Integrated Caching, Responder, or Rewrite advanced policy globally by using the configuration utility

1. In the navigation pane, click the feature with the policy that you want to unbind (for example, **Integrated Caching**).
2. In the details pane, click **<Feature Name> policy manager**.
3. In the **Policy Manager** dialog box, select the bind point with the policy that you want to unbind, for example, **Default Global**.
4. Click the policy name that you want to unbind, and then click **Unbind Policy**.
5. Click **Apply Changes**.
6. Click **Close**.

To unbind a DNS advanced policy globally by using the configuration utility

1. In the navigation pane, expand **DNS**, and then click **Policies**.
2. In the details pane, click **Global Bindings.**
3. In the global bindings dialog box, in the **Active** column, clear the check box next to the policy that you want to unbind.
4. Click **OK**.

To unbind an advanced policy from a Load Balancing or Content Switching virtual server by using the configuration utility

1. In the navigation pane, expand **Load Balancing** or **Content Switching**, and then click **Virtual Servers**.
2. In the details pane, double-click the virtual server from which you want to unbind the policy.
3. On the **Policies** tab, in the **Active** column, clear the check box next to the policy that you want to unbind.
4. Click **OK**.

Creating Policy Labels

In addition to the built-in bind points where you set up policy banks, you can also configure user-defined policy labels and associate policies with them.

Within a policy label, you bind policies and specify the order of evaluation of each policy relative to others in the bank of policies for the policy label. The NetScaler also permits you to define an arbitrary evaluation order as follows:

- You can use “goto” expressions to point to the next entry in the bank to be evaluated after the current one.
- You can use an entry in a policy bank to invoke another bank.

Creating a Policy Label

Each feature determines the type of policy that you can bind to a policy label, the type of load balancing virtual server that you can bind the label to, and the type of content switching virtual server from which the label can be invoked. For example, a TCP policy label can only be bound to a TCP load balancing virtual server. You cannot bind HTTP policies to a policy label of this type. And you can invoke a TCP policy label only from a TCP content switching virtual server.

After configuring a new policy label, you can invoke it from one or more banks for the built-in bind points.

To create a policy label by using the NetScaler command line

At the NetScaler command prompt, to create a caching policy label, type:

```
add cache policylabel <policyLabelName> -evaluates req|res
```

At the NetScaler command prompt, to create a Content Switching policy label, type:

```
add cs policylabel <policyLabelName> http|tcp|rtsp|ssl
```

At the NetScaler command prompt, to create a Rewrite policy label, type:

```
add rewrite policylabel <policyLabelName>
http_req|http_res|url|text|clientless_vpn_req|clientless_vpn_res
```

At the NetScaler command prompt, to create a Responder policy label, type:

```
add rewrite policylabel <policyLabelName>
```

Note: Invoke this policy label from a policy bank. For more information, see "Binding a Policy to a Policy Label," on page 29.

To create a policy label by using the configuration utility

1. In the navigation pane, expand the feature for which you want to create a policy label, and then click **Policy Labels**.

   The choices are **Integrated Caching**, **Rewrite**, **Content Switching**, **Rewrite**, or **Responder**.
2. In the details pane, click **Add**.
3. In the **Name** box, enter a unique name for this policy label.
4. Enter feature-specific information for the policy label. For example, for Integrated Caching, in the **Evaluates** drop-down menu, you would select **REQ** if you want this policy label to contain request-time policies, or select **RES** if you want this policy label to contain response-time policies. For Rewrite, you would select a **Transform** type. For information on integrated caching, see the *Citrix NetScaler Application Optimization Guide.* For information on rewrite, see the *Citrix NetScaler Application Security Guide*.
5. Click **Create**.
6. Configure one of the built-in policy banks to invoke this policy label. For more information, see "Binding a Policy to a Policy Label," on page 29.

Binding a Policy to a Policy Label

As with policy banks that are bound to the built-in bind points, each entry in a policy label is a policy that is bound to the policy label. As with policies that are bound globally or to a vserver, each policy that is bound to the policy label can also invoke a policy bank or a policy label that is evaluated after the current entry has been processed. The following table summarizes the entries in a policy label.

Entries in a Policy Bank

Attribute	**Description**
Name	The name of a policy, or, to invoke another policy bank without evaluating a policy, the “dummy” policy name NOPOLICY. You can specify NOPOLICY more than once in a policy bank, but you can specify a named policy only once.
Priority	An integer. This setting can work with the Goto expression.
Goto Expression	Determines the next policy to evaluate in this bank. You can provide one of the following values: • **NEXT**: Go to the policy with the next higher priority. • **END**: Stop evaluation. • **USE_INVOCATION_RESULT**: Applicable if this entry invokes another policy bank. If the final Goto in the invoked bank has a value of END, evaluation stops. If the final Goto is anything other than END, the current policy bank performs a NEXT. • **Positive number**: The priority number of the next policy to be evaluated. • **Numeric expression**: An expression that produces the priority number of the next policy to be evaluated. The Goto can only proceed forward in a policy bank. If you omit the Goto expression, it is the same as specifying END.
Invocation Type	Designates a policy bank type. The value can be one of the following: • Request Vserver: Invokes request-time policies that are associated with a virtual server. • Response Vserver: Invokes response-time policies that are associated with a virtual server. • Policy label: Invokes another policy bank, as identified by the policy label for the bank.
Invocation Name	The name of a virtual server or a policy label, depending on the value that you specified for the Invocation Type.

Configuring a Policy Label or Virtual Server Policy Bank

After you have created policies, and created policy banks by binding the policies, you can perform additional configuration of polices within a label or policy bank. For example, before you configure invocation of an external policy bank, you might want to wait until you have configured that policy bank.

Configuring a Policy Label

A policy label consists of a set of policies and invocations of other policy labels and virtual server-specific policy banks. An **Invoke** parameter enables you to invoke a policy label or a virtual server-specific policy bank from any other policy bank. A special-purpose **NoPolicy** entry enables you to invoke an external bank without processing an expression (a rule). The **NoPolicy** entry is a “dummy” policy that does not contain a rule.

For configuring policy labels from the NetScaler command line, note the following elaborations of the command syntax:

- *gotoPriorityExpression* is configured as described in “Entries in a Policy Bank,” on page 29.
- The `type` argument is required. This is unlike binding a conventional policy, where this argument is optional.
- You can invoke the bank of policies that are bound to a virtual server by using the same method as you use for invoking a policy label.

To configure a policy label by using the NetScaler command line

At the NetScaler command prompt, type:

```
bind cache|rewrite|responder policylabel <policylabelName>
-policyName <policyName> -priority <priority>
-gotoPriorityExpression <gotopriorityExpression> -invoke
reqvserver|resvserver|policylabel <policyLabelName>|<vserverName>
```

To invoke a policy label from a Rewrite policy bank with a NOPOLICY entry by using the NetScaler command line

At the NetScaler command prompt, type:

```
bind rewrite global NOPOLICY <priority>
-gotoPriorityExpression <gotopriorityExpression>
-type REQ_OVERRIDE|REQ_DEFAULT|RES_OVERRIDE|RES_DEFAULT
-invoke reqvserver|resvserver|policylabel
<policyLabelName>|<vserverName>
```

To invoke a policy label from an Integrated Caching policy bank by using the NetScaler command line

At the NetScaler command prompt, type:

```
bind cache global NOPOLICY -priority <priority>
-gotoPriorityExpression <gotopriorityExpression>
-type REQ_OVERRIDE|REQ_DEFAULT|RES_OVERRIDE|RES_DEFAULT
-invoke reqvserver|resvserver|policylabel
<policyLabelName>|<vserverName>
```

Example

```
bind cache global NOPOLICY -priority 104 -gotoPriorityExpression
next  -type RES_OVERRIDE -invoke resvserver lab2
```

To invoke a policy label from a Responder policy bank by using the NetScaler command line

At the NetScaler command prompt, type:

```
bind responder global NOPOLICY <priority>
<gotopriorityExpression>
-type OVERRIDE|DEFAULT -invoke vserver|policylabel
<policyLabelName>|<vserverName>
```

Example

```
bind responder global NOPOLICY 100 NEXT -type OVERRIDE -invoke
policylabel responderlabel2
```

To configure a policy label by using the configuration utility

1. In the navigation pane, expand the feature for which you want to configure a policy label, and then click **Policy Labels**.

   The choices are **Integrated Caching**, **Rewrite**, or **Responder**.

2. In the details pane, double-click the label that you want to configure.

3. If you are adding a new policy to this policy label, click **Insert Policy**, and in the **Policy Name** field, select ***New Policy***. For more information about adding a policy, see "Creating or Modifying an Advanced Policy," on page 14.

   Note that if you are invoking a policy bank, and do not want a rule to be evaluated prior to the invocation, click **Insert Policy**, and in the **Policy Name** field select **NOPOLICY**.

4. For each entry in this policy label, configure the following:

   - **Policy Name**: This is already determined by the ***Policy Name***, new policy, or **NOPOLICY** entry that you inserted in this bank.

   - **Priority**: A numeric value that determines either an absolute order of evaluation within the bank, or is used in conjunction with a Goto expression.

   - **Expression**: The policy rule. Advanced policy expressions are described in detail in the following chapters. For an introduction, see "Configuring Advanced Expressions: Getting Started," on page 39.

   - **Action**: The action to be taken if this policy evaluates to TRUE.

   - **Goto Expression**: Optional. Used to augment the Priority level to determine the next policy or policy bank to evaluate. For more information on possible values for a Goto expression, see the table, "Entries in a Policy Bank," on page 29.

- **Invoke**: Optional. Invokes another policy bank.

Configuring a Policy Bank for a Virtual Server

You can configure a bank of policies for a virtual server. The policy bank can contain individual policies, and each entry in the policy bank can optionally invoke a policy label or a bank of policies that you configured for another virtual server. If you invoke a policy label or policy bank, you can do so without triggering an expression (a rule) by selecting a NOPOLICY "dummy" entry instead of a policy name.

To add policies to a virtual server policy bank by using the NetScaler command line

At the NetScaler command prompt, type:

```
bind lb|cs vserver <virtualServerName> -policyName <policyName>
-priority <positiveInteger> -gotoPriorityExpression <expression>
-type REQUEST|RESPONSE
```

To invoke a policy label from a virtual server policy bank with a NOPOLICY entry by using the NetScaler command line

At the NetScaler command prompt, type:

```
bind lb|cs vserver <virtualServerName> -policyName
NOPOLICY_REWRITE|NOPOLICY_CACHE|NOPOLICY_RESPONDER -priority
<integer> -type REQUEST|RESPONSE -gotoPriorityExpression
<gotopriorityExpression> -invoke reqVserver|resVserver|policyLabel
<vserverName>|<labelName>
```

Example

```
bind lb vserver myLoadBalancingVserver1 -policyname
NOPOLICY-REWRITE -priority 200 -type REQUEST
-gotoPriorityExpression NEXT -invoke policyLabel myPolicyLabel
```

To configure a virtual server policy bank by using the configuration utility

1. In the left navigation pane, expand **Load Balancing, Content Switching**, **SSL Offload**, **AAA - Application Traffic**, or **Access Gateway**, as appropriate, and then click **Virtual Servers**.
2. In the details pane, select the virtual server that you want to configure, and then click **Open**.
3. In the **Configure Virtual Server** dialog box click the **Policies** tab.

4. To create a new policy in this bank, click the icon for the type of policy or policy label that you want to add to the virtual server's bank of policies, click **Insert Policy**.

   Note that if you want to invoke a policy label without evaluating a policy rule, select the NOPOLICY "dummy" policy.

5. To configure an existing entry in this policy bank, enter the following:

   - **Priority**: A numeric value that determines either an absolute order of evaluation within the bank or is used in conjunction with a Goto expression.
   - **Expression**: The policy rule. Advanced policy expressions are described in detail in the following chapters. For an introduction, see "Configuring Advanced Expressions: Getting Started," on page 39.
   - **Action**: The action to be taken if this policy evaluates to TRUE.
   - **Goto Expression**: Optional. Determines the next policy or policy bank to evaluate. For more information on possible values for a Goto expression, see the table, "Entries in a Policy Bank," on page 29.
   - **Invoke**: Optional. To invoke another policy bank, select the name of the policy label or virtual server policy bank that you want to invoke.

6. When you are done, click **OK**.

Invoking or Removing a Policy Label or Virtual Server Policy Bank

Unlike a policy, which can only be bound once, you can use a policy label or a virtual server's policy bank any number of times by invoking it. Invocation can be performed from two places:

- From the binding for a named policy in a policy bank.
- From the binding for a NOPOLICY "dummy" entry in a policy bank.

Typically, the policy label must be of the same type as the policy from which it is invoked. For example, you would invoke a Responder policy label from a Responder policy.

Note: When binding or unbinding a global NOPOLICY entry in a policy bank at the command line, you specify a priority to distinguish one NOPOLICY entry from another.

To invoke a policy label or virtual server policy bank by using the NetScaler command line

At the NetScaler command prompt, for Rewrite or Integrated Caching, type:

```
bind cache|rewrite global <policy_Name> -priority
<positive_integer> [-gotoPriorityExpression <expression>] -type
REQ_OVERRIDE|REQ_DEFAULT|RES_OVERRIDE|RES_DEFAULT] -invoke
reqvserver|resvserver|policylabel <label_name>
```

Example

```
bind cache global myCachePolicy -priority 100 -type req_override
-invoke policylabel myCachePolicyLabel
```

At the NetScaler command prompt, for the Responder, type:

```
bind responder global <policy_Name> <priority_as_positive_integer>
[<gotoPriorityExpression>] -type
REQ_OVERRIDE|REQ_DEFAULT|OVERRIDE|DEFAULT -invoke
vserver|policylabel <label_name>
```

Example

```
bind responder global testpolicy3 300 -invoke policylabel
myResponderLabel
```

At the NetScaler command prompt, for a virtual server, type:

```
bind lb vserver <vserver_name> -policyName <policy_Name> -priority
<positive_integer> [-gotoPriorityExpression <expression>] -type
REQUEST|RESPONSE -invoke reqvserver|resvserver|policylabel
<policy_Label_Name>
```

Example

```
bind lb vserver myLBVserver -policyname testCachePolicy -priority
5555 -type request -invoke policylabel cachePolicyLabel
```

To remove a policy label invocation from a NOPOLICY entry by using the NetScaler command line

At the NetScaler command prompt, for Rewrite or Integrated Caching, type:

```
unbind rewrite|cache global NOPOLICY -priority <positiveInteger>
-type REQ_OVERRIDE|REQ_DEFAULT|RES_OVERRIDE|RES_DEFAULT
```

Example

```
unbind rewrite global NOPOLICY -priority 100 -type REQ_OVERRIDE 200
```

At the NetScaler command prompt, for the Responder, type:

```
unbind responder global NOPOLICY -priority <positiveInteger> -type
OVERRIDE|DEFAULT
```

Example

```
unbind responder global NOPOLICY -priority 200 -type OVERRIDE
```

At the NetScaler command prompt, for a virtual server, type:

```
unbind lb|cs vserver <virtualServerName> -policyName
NOPOLICY-REWRITE|NOPOLICY-RESPONDER|NOPOLICY-CACHE -type
REQUEST|RESPONSE -priority <positiveInteger>
```

Example

```
unbind lb vserver myLBVserver -policyName NOPOLICY-REWRITE
-priority 200 -type REQUEST
```

To invoke a policy label or virtual server policy bank by using the configuration utility

1. Bind a policy, as described in "Binding a Policy Globally," on page 22, "Binding a Policy to a Virtual Server," on page 24, or "Binding a Policy to a Policy Label," on page 29.

   Alternatively, you can enter a NOPOLICY "dummy" entry instead of a policy name. You do this if you do not want to evaluate a policy before evaluating the policy bank.

2. In the **Invoke** field, select the name of the policy label or virtual server policy bank that you want to evaluate if traffic matches the bound policy.

To remove a policy label invocation by using the configuration utility

Open the policy and clear the **Invoke** field. Unbinding the policy also removes the invocation of the label.

Configuring and Binding Policies with the Policy Manager

Some applications provide a specialized Policy Manager in the NetScaler configuration utility to simplify configuring policy banks. It also lets you find and delete policies and actions that are not being used.

The Policy Manager is currently available for the Rewrite, Integrated Caching, and Responder features.

The following are keyboard equivalents for the procedures in this section:

- For editing a cell in the Policy Manager, you can tab to the cell and click F2 or press the space bar on the keyboard.
- To select an entry in a drop-down menu, you can tab to the entry, press the space bar to view the drop-down menu, use the up- and down-arrow keys to navigate to the entry that you want, and press the space bar again to select the entry.
- To cancel a selection in a drop-down menu, press the **Escape** key.

- To insert a policy, tab to the row above the insertion point and click **Control + Insert**, or click **Insert Policy**.
- To remove a policy, tab to the row that contains the policy and press **Delete**. Note that when you delete the policy, the NetScaler searches the **Goto Expression** values of other policies in the bank. If any of these **Goto Expression** values match the priority level of the deleted policy, they are removed.

To configure policy bindings and banks by using the Policy Manager

1. In the navigation pane, click the feature to which you want to configure the policy bank.

   The choices are **Responder**, **Integrated Caching**, or **Rewrite**.
2. In the details pane, click **<Feature Name> policy manager**.
3. For features other than **Responder**, determine the bind point, click **Request** or **Response**, and then click one of the request-time or response-time bind points. The options are **Override Global**, **LB Virtual Server**, **CS Virtual Server**, **Default Global**, or **Policy Label**.

   If you are configuring the **Responder**, the **Request** and **Response** flow types are not available.
4. To bind a policy to this bind point, click **Insert Policy**, and select a previously configured policy, a **NOPOLICY** label, or the **New policy** option. Depending on the option that you select, you have the following choices:
   - **New policy**: Create the policy as described in "Creating or Modifying an Advanced Policy," on page 14, and then configure the priority level, GoTo expression, and policy invocation as described in the table, "Format of Each Entry in a Policy Bank" on page 20.
   - **Existing policy**, **NOPOLICY**, or **NOPOLICY<feature name>**: Configure the priority level, GoTo expression, and policy invocation as described in the table, "Format of Each Entry in a Policy Bank" on page 20.
5. Repeat the preceding steps to add entries to this policy bank.
6. To modify the priority level for an entry, you can do any of the following:
   - Double-click the **Priority** field for an entry and edit the value.
   - Click and drag a policy to another row in the table.
   - Click **Regenerate Priorities**.

In all three cases, priority levels of all other policies are modified as needed to accommodate the new value. **Goto Expressions** with integer values are also updated automatically. For example, if you change a priority value of 10 to 100, all policies with a **Goto Expression** value of 10 are updated to the value 100.

7. To change the policy, action, or policy bank invocation for an row in the table, click the down arrow to the right of the entry and do one of the following:

   - To change the policy, select another policy name or select **New Policy** and follow the steps in "Creating or Modifying an Advanced Policy," on page 14.
   - To change the **Goto Expression**, select **Next**, **End**, **USE_INVOCATION_RESULT**, or select **more** and enter a advanced expression whose result returns the priority level of another entry in this policy bank.
   - To modify an invocation, select an existing policy bank, or click **New Policy Label** and follow the steps in "Binding a Policy to a Policy Label," on page 29.

8. To unbind a policy or a policy label invocation from this bank, click any field in the row that contains the policy or policy label, and then click **Unbind Policy**.
9. When you are done, click **Apply Changes**.

To remove unused policies by using the Policy Manager

1. In the navigation pane, click the feature for which you want to configure the policy bank.

   The choices are **Responder**, **Integrated Caching**, or **Rewrite**.

2. In the details pane, click **<Feature Name> policy manager**.
3. In the **<Feature Name> Policy Manager** dialog box, click **Cleanup Configuration**.
4. In the **Cleanup Configuration** dialog box, select the items that you want to delete, and then click **Remove**.
5. Click **Close**.

Configuring Advanced Expressions: Getting Started

Advanced policies evaluate data on the basis of information that you supply in advanced expressions. An advanced expression analyzes data elements (for example, HTTP headers, source IP addresses, the NetScaler system time, and POST body data).

To create an advanced expression, you select a prefix that identifies a piece of data that you want to analyze, and then you specify an operation to perform on the data. For example, an operation can match a piece of data with a text string that you specify, or it can transform a text string into an HTTP header. Other operations match a returned string with a set of strings or a string pattern. You configure compound expressions by specifying Boolean and arithmetic operators, and by using parentheses to control the order of evaluation. You can also include classic expressions in an advanced expression.

Advanced expressions are typically part of a policy, and you can assign names to frequently used expressions so that you do not have to enter the full expression repeatedly in multiple policies. But for some features, you configure advanced expressions outside the context of a policy.

In This Chapter

Expression Characteristics

Basic Elements of an Advanced Expression

Compound Advanced Expressions

Classic Expressions in Advanced Expressions

Configuring Advanced Expressions in a Policy

Configuring Named Advanced Expressions

Configuring Advanced Expressions Outside the Context of a Policy

Expression Characteristics

Policies and a few other entities include *rules* that the NetScaler uses to evaluate a packet in the traffic flowing through it, to extract data from the NetScaler system itself, to send a request (a *callout*) to an external application, or to analyze another piece of data. A rule takes the form of a logical expression that is compared against traffic and ultimately returns values of TRUE or FALSE.

The elements of the rule can themselves return TRUE or FALSE, string, or numeric values.

Before configuring an advanced expression, you need to understand the characteristics of the data that the policy or other entity is to evaluate. For example, when working with the Integrated Caching feature, a policy determines what data can be stored in the cache. With Integrated Caching, you need to know the URLs, headers, and other data in the HTTP requests and responses that the NetScaler receives. With this knowledge, you can configure policies that match the actual data and enable the NetScaler to manage caching for HTTP traffic. This information helps you determine the type of expression that you need to configure in the policy.

Basic Elements of an Advanced Expression

An advanced expression consists of, at a minimum, a prefix (or a single element used in place of a prefix). Most expressions also specify an operation to be performed on the data that the prefix identifies. You format an expression, of up to 1,499 characters, as follows:

```
<prefix>.<operation> [<compound-operator>
<prefix>.<operation>. . .]
```

Where:

- <prefix> is an anchor point for starting an expression.

  The prefix is a period-delimited key that identifies a unit of data. For example, the following prefix examines HTTP requests for the presence of a header named Content-Type:

  ```
  http.req.header("Content-Type")
  ```

  Prefixes can also be used on their own to return the value of the object that the prefix identifies.

- <operation> identifies an evaluation that is to be performed on the data identified by the prefix.

  For example, consider the following expression:

  ```
  http.req.header("Content-Type").eq("text/html")
  ```

In this expression, the following is the operator component:

```
eq("text/html")
```

This operator causes the NetScaler to evaluate any HTTP requests that contain a Content-Type header, and in particular, to determine if the value of this header is equal to the string `text/html`.

- <compound-operator> is a Boolean or arithmetic operator that forms a compound expression from multiple *prefix* or *prefix.operation* elements.

  For example, consider the following expression:

  ```
  http.req.header("Content-Type").eq("text/html") &&
  http.req.url.contains(".html")
  ```

Prefixes

An expression prefix represents a discrete piece of data. For example, an expression prefix can represent an HTTP URL, an HTTP Cookie header, or a string in the body of an HTTP POST request. An expression prefix can identify and return a wide variety of data types, including the following:

- A client IP address in a TCP/IP packet
- NetScaler system time
- An external callout over HTTP
- A TCP or UDP record type

In most cases, an expression prefix begins with one of the following keywords:

- **`CLIENT`**: Identifies a characteristic of the client that is either sending a request or receiving a response, as in the following examples:
  - The prefix `client.ip.dst` designates the destination IP address in the request or response.
  - The prefix `client.ip.src` designates the source IP address.
- **`HTTP`**: Identifies an element in an HTTP request or a response, as in the following examples:
  - The prefix `http.req.body(`*`integer`*`)` designates the body of the HTTP request as a multiline text object, up to the character position designated in *integer*.
  - The prefix `http.req.header("`*`header_name`*`")` designates an HTTP header, as specified in *header_name*.

    - The prefix `http.req.url` designates an HTTP URL in URL-encoded format.

- **`SERVER`**: Identifies an element in the server that is either processing a request or sending a response.
- **`SYS`**: Identifies a characteristic of the NetScaler that is processing the traffic.
- **`TARGET:`**Represents all the strings that result from a search in the target text. This prefix can be used only in the string expression that specifies replacement text in a rewrite action. The expression that is used to search the target text must be a regular expression, and the type of action must be `REPLACE_ALL`, `INSERT_AFTER_ALL`, or `INSERT_BEFORE_ALL`. Any operator that is used with the `TARGET` prefix operates on all the strings that are found in the target text.

  For example, if a search that uses a regular expression finds *n* occurrences of the specified string, and if the action type is `REPLACE_ALL`, the expression `TARGET.TO_UPPER` changes the case of all *n* occurrences of the string to upper case.

Note: DNS policies support only SYS, CLIENT, and SERVER objects.

In addition, in the Access Gateway, the Clientless VPN function can use the following types of prefixes:

- **`TEXT`**: Identifies any text element in a request or a response.
- **`TARGET`**: Identifies the target of a connection.
- **`URL`**: Identifies an element in the URL portion of an HTTP request or response.

As a general rule of thumb, any expression prefix can be a self-contained expression. For example, the following prefix is a complete expression that returns the contents of the HTTP header specified in the string argument (enclosed in quotation marks):

```
http.res.header.("myheader")
```

Or you can combine prefixes with simple operations to determine TRUE and FALSE values. For example, the following returns a value of TRUE or FALSE:

```
http.res.header.("myheader").exists
```

You can also use complex operations on individual prefixes and multiple prefixes within an expression, as in the following example:

```
http.req.url.length + http.req.cookie.length <= 500
```

Which expression prefixes you can specify depends on the NetScaler feature. The following table describes the expression prefixes that are of interest on a per-feature basis.

Permitted Types of Expression Prefixes in Various NetScaler Feature

Feature	**Types of Expression Prefix Used in the Feature**
DNS	`SYS, CLIENT, SERVER`
Responder in Protection Features	`HTTP, SYS, CLIENT`
Content Switching	`HTTP, SYS, CLIENT`
Rewrite	`HTTP, SYS, CLIENT, SERVER, URL, TEXT, TARGET, VPN`
Integrated Caching	`HTTP, SYS, CLIENT, SERVER`
Access Gateway, Clientless Access	`HTTP, SYS, CLIENT, SERVER, URL, TEXT, TARGET, VPN`

Note: For details on the permitted expression prefixes in a feature, see the documentation for that feature.

Single-Element Expressions

The simplest type of advanced expression contains a single element. This element can be one of the following:

- `true`. An advanced expression can consist simply of the value `true`. This type of expression always returns a value of TRUE. It is useful for chaining policy actions and triggering Goto expressions.
- `false`. An advanced expression can consist simply of the value `false`. This type of expression always returns a value of FALSE.
- A prefix for a compound expression. For example, the prefix `HTTP.REQ.HOSTNAME` is a complete expression that returns a host name, and `HTTP.REQ.URL` is a complete expression that returns a URL. The prefix could also be used in conjuction with operations and additional prefixes to form a compound expression.

Operations

In most expressions, you specify an operation on the data that the prefix identifies. For example, suppose that you specify the following prefix:

```
http.req.url
```

This prefix extracts URLs in HTTP requests. This expression prefix does not require any operators to be used in an expression. However, when you configure an expression that processes HTTP request URLs, you can specify operations that analyze particular characteristics of the URL. Following are a few possibilities:

- Search for a particular host name in the URL.
- Search for a particular path in the URL.
- Evaluate the length of the URL.
- Search for a string in the URL that indicates a time stamp and convert it to GMT.

The following is an example of a prefix that identifies an HTTP header named Server and an operation that searches for the string `IIS` in the header value:

```
http.res.header("Server").contains("IIS")
```

Following is an example of a prefix that identifies host names and an operation that searches for the string `www.mycompany.com` as the value of the name:

```
http.req.hostname.eq("www.mycompany.com")
```

Basic Operations on Expression Prefixes

The following table describes a few of the basic operations that can be performed on expression prefixes:

Basic Operations for Expressions

Operation	**Determines whether or not**
`CONTAINS(<string>)`	The object matches <string>. Following is an example: `http.req.header("Cache-Control").contains("no-cache")`
`EXISTS`	A particular item is present in an object. Following is an example: `http.res.header("MyHdr").exists`
`EQ(<text>)`	A particular non-numeric value is present in an object. Following is an example: `http.req.method.eq(post)`
`EQ(<integer>)`	A particular numeric value is present in an object. Following is an example: `client.ip.dst.eq(10.100.10.100)`
`LT(<integer>)`	An object's value is less than a particular value. Following is an example: `http.req.content_length.lt(5000)`

Basic Operations for Expressions

Operation	**Determines whether or not**
`GT(<integer>)`	An object's value is greater than a particular value. Following is an example: http.req.content_length.gt(5)

The following table summarizes a few of the available types of operations.

Basic Types of Operations

Operation Type	**Description**
Text operations	Match individual strings and sets of strings with any portion of a target. The target can be an entire string, the start of a string, or any portion of text in between the start and the end of the string. For example, you can extract the string "XYZ" from "XYZSomeText". Or, you can compare an HTTP header value with an array of different strings. You can also transform text into another type of data. Following are examples: • Transform a string into an integer value • Create a list from the query strings in a URL • Transform a string into a time value
Numeric operations	Numeric operations include applying arithmetic operators, evaluating content length, the number of items in a list, dates, times, and IP addresses.

Compound Advanced Expressions

You can configure an advanced expression that contains Boolean or arithmetic operators and multiple atomic operations. The following compound expression contains a boolean AND:

```
http.req.hostname.eq("mycompany.com") && http.req.method.eq(post)
```

The following expression adds the value of two targets, and compares the result to a third value:

```
http.req.url.length + http.req.cookie.length <= 500
```

A compound expression can contain any number of logical and arithmetic operators. The following expression evaluates the length of an HTTP request on the basis of its URL and cookie, evaluates text in the header, and performs a Boolean AND on these two results:

```
http.req.url.length + http.req.cookie.length <= 500 &&
http.req.header.contains("some text")
```

You can use parentheses to control the order of evaluation in a compound expression.

Booleans in Compound Expressions

You configure compound expressions with the following operators:

- **&&**. This operator is a logical AND. For the expression to evaluate to TRUE, all components that are joined by the And must evaluate to TRUE. Following is an example:

  ```
  http.req.url.hostname.eq("myHost") &&
  http.req.header("myHeader").exists
  ```

- ||. This operator is a logical OR. If any component of the expression that is joined by the OR evaluates to TRUE, the entire expression is TRUE.
- **!**. Performs a logical NOT on the expression.

In some cases, the NetScaler configuration utility offers AND, NOT, and OR operators in the **Add Expression** dialog box. However, these are of limited use. Citrix recommends that you use the operators &&, ||, and ! to configure compound expressions that use Boolean logic.

Parentheses in Compound Expressions

You can use parentheses to control the order of evaluation of an expression. The following is an example:

```
http.req.url.contains("myCompany.com") ||
(http.req.url.hostname.eq("myHost") &&
http.req.header("myHeader").exists)
```

The following is another example:

```
(http.req.header("Content-Type").exists &&
http.req.header("Content-Type").eq("text/html")) ||
(http.req.header("Transfer-Encoding").exists ||
http.req.header("Content-Length").exists)
```

Compound Operations for Strings

The following table describes operators that you can use to configure compound operations on string data.

String-Based Operations for Compound Advanced Expressions

All string operations
Operations that produce a string value

String-Based Operations for Compound Advanced Expressions

All string operations	
str + *str*	Concatenates the value of the expression on the left of the operator with the value on the right. Following is an example: `http.req.hostname + http.req.url.protocol`
str + *num*	Concatenates the value of the expression on the left of the operator with a numeric value on the right. Following is an example: `http.req.hostname + http.req.url.content_length`
num + *str*	Concatenates the numeric value of the expression on the left side of the operator with a string value on the right. Following is an example: `http.req.url.content_length + http.req.url.hostname`
str + *ip*	Concatenates the string value of the expression on the left side of the operator with an IP address value on the right. Following is an example: `http.req.hostname + 10.00.000.00`
ip + *str*	Concatenates the IP address value of the expression on the left of the operator with a string value on the right.Following is an example: `client.ip.dst + http.req.url.hostname`
str1 ALT *str2*	Uses the *string1* or *string2* value that is derived from the expression on either side of the operator, as long as neither of these expressions is a compound expressions.Following is an example: `http.req.hostname alt client.ip.src`
Operations on strings that produce a result of TRUE or FALSE	
str == *str*	Evaluates whether the strings on either side of the operator are the same. Following is an example: `http.req.header("myheader") == http.res.header("myheader")`
str <= *str*	Evaluates whether the string on the left side of the operator is the same as the string on the right, or precedes it alphabetically.
str >= *str*	Evaluates whether the string on the left side of the operator is the same as the string on the right, or follows it alphabetically.
str < *str*	Evaluates whether the string on the left side of the operator precedes the string on the right alphabetically.
str > *str*	Evaluates whether the string on the left side of the operator follows the string on the right alphabetically.
str !!= *str*	Evaluates whether the strings on either side of the operator are different.
Logical operations on strings	

String-Based Operations for Compound Advanced Expressions

All string operations	
bool && *bool*	This operator is a logical AND. When evaluating the components of the compound expression, all components that are joined by the AND must evaluate to TRUE. Following is an example: `http.req.method.eq(GET) && http.req.url.query.contains("viewReport && my_pagelabel")`
bool || *bool*	This operator is a logical OR. When evaluating the components of the compound expression, if any component of the expression that is joined by the OR evaluates to TRUE, the entire expression is TRUE. Following is an example: `http.req.url.contains(".js") || http.res.header.("Content-Type").contains("javascript")`
!*bool*	Performs a logical NOT on the expression.

Compound Operations for Numbers

You can configure compound numeric expressions. For example, the following expression returns a numeric value that is the sum of an HTTP header length and a URL length:

```
http.req.header.length + http.req.url.length
```

The following table describes operators that you can use to configure compound expressions for numeric data.

Arithmetic Operations for Compound Advanced Expressions

Operator	**Description**
Arithmetic operations on number	
num + *num*	Add the value of the expression on the left of the operator to the value of the expression on the right. Following is an example: `http.req.content_length + http.req.url.length`
num – *num*	Subtract the value of the expression on the right of the operator from the value of the expression on the left.
num * *num*	Multiply the value of the expression on the left of the operator with the value of the expression on the right. Following is an example: `client.interface.rxthroughput * 9`
num / *num*	Divide the value of the expression on the left of the operator by the value of the expression on the right.

Arithmetic Operations for Compound Advanced Expressions

Operator	**Description**
num % *num*	Calculate the modulo, or the numeric remainder on a division of the value of the expression on the left of the operator by the value of the expression on the right. For example, the values "15 mod 4" equals 3, and "12 mod 4" equals 0.
~*number*	Returns a number after applying a bitwise logical negation of the *number*. The following example assumes that *numeric.expression* returns 12 (binary 1100): `~numeric.expression.` The result of applying the ~ operator is -11 (a binary 1110011, 32 bits total with all ones to the left). Note that all returned values of less than 32 bits before applying the operator implicitly have zeros to the left to make them 32 bits wide.
number ^ *number*	Compares two bit patterns of equal length and performs an XOR operation on each pair of corresponding bits in each *number* argument, returning 1 if the bits are different, and 0 if they are the same. Returns a number after applying a bitwise XOR to the *integer* argument and the current *number* value. If the values in the bitwise comparison are the same, the returned value is a 0. The following example assumes that *numeric.expression1* returns 12 (binary 1100) and *numeric.expression2* returns 10 (binary 1010): `numeric.expression1 ^ numeric.expression2` The result of applying the ^ operator to the entire expression is 6 (binary 0110). Note that all returned values of less than 32 bits before applying the operator implicitly have zeros to the left to make them 32 bits wide.
number | *number*	Returns a number after applying a bitwise OR to the *number* values. If either value in the bitwise comparison is a 1, the returned value is a 1. The following example assumes that *numeric.expression1* returns 12 (binary 1100) and *numeric.expression2* returns 10 (binary 1010): `numeric.expression1 | numeric.expression2` The result of applying the | operator to the entire expression is 14 (binary 1110). Note that all returned values of less than 32 bits before applying the operator implicitly have zeros to the left to make them 32 bits wide.

Arithmetic Operations for Compound Advanced Expressions

Operator	**Description**
number & *number*	Compares two bit patterns of equal length and performs a bitwise AND operation on each pair of corresponding bits, returning 1 if both of the bits contains a value of 1, and 0 if either bits are 0. The following example assumes that *numeric.expression1* returns 12 (binary 1100) and *numeric.expression2* returns 10 (binary 1010): `numeric.expression1 & numeric.expression2` The whole expression evaluates to 8 (binary 1000). Note that all returned values of less than 32 bits before applying the operator implicitly have zeros to the left to make them 32 bits wide.
num << *num*	Returns a number after a bitwise left shift of the *number* value by the right-side *number* argument number of bits. Note that the number of bits shifted is *integer* modulo 32. The following example assumes that *numeric.expression1* returns 12 (binary 1100) and *numeric.expression2* returns 3: `numeric.expression1 << numeric.expression2` The result of applying the LSHIFT operator is 96 (a binary 1100000). Note that all returned values of less than 32 bits before applying the operator implicitly have zeros to the left to make them 32 bits wide.
num >> *num*	Returns a number after a bitwise right shift of the *number* value by the *integer* argument number of bits. Note that the number of bits shifted is *integer* modulo 32. The following example assumes that *numeric.expression1* returns 12 (binary 1100) and *numeric.expression2* returns 3: `numeric.expression1 >> numeric.expression2` The result of applying the RSHIFT operator is 1 (a binary 0001). Note that all returned values of less than 32 bits before applying the operator implicitly have zeros to the left to make them 32 bits wide.
Numeric operators that produce a result of TRUE or FALSE	
num == *num*	Determine if the value of the expression on the left of the operator is equal to the value of the expression on the right.
num != *num*	Determine if the value of the expression on the left of the operator is not equal to the value of the expression on the right.
num > *num*	Determine if the value of the expression on the left of the operator is greater than the value of the expression on the right.
num < *num*	Determine if the value of the expression on the left of the operator is less than the value of the expression on the right.
num >= *num*	Determine if the value of the expression on the left of the operator is greater than or equal to the value of the expression on the right.

Arithmetic Operations for Compound Advanced Expressions

Operator	**Description**
num <= *num*	Determine if the value of the expression on the left of the operator is less than or equal to the value of the expression on the right
Operations on numbers of data type “integer”	
number.ADD (*integer*)	Returns a number after adding the *integer* argument to the *number* value. Following is an example: `http.req.content_length.add(10)`
number.SUB (*integer*)	Returns a number after subtracting the *integer* argument from the *number* value. Following is an example: `http.req.header.length.sub(10)`
number.DIV (*integer*)	Returns a number after dividing the *number* value by the *integer* argument. Following is an example: `http.req.content_length.div(2)`
number.MUL (*integer*)	Returns a number after multiplying the *number* by the *integer* argument value. Following is an example: `http.req.content_length.mul(2)`
number. BETWEEN (*lower_integer, higher_integer*)	Returns a Boolean TRUE if the *number* value is greater than or equal to the *lower_integer* argument and less than or equal to the *higher_integer* argument. Following is an example: `http.req.content_length.between(5, 500)`
number.EQ (*integer*)	Return a Boolean TRUE if the *number* value is equal to the *integer* argument. Following is an example: `http.req.content_length.eq(50)`
number.NE (*integer*)	Returns a Boolean TRUE if the value designated by *number* is not equal to the argument. Following is an example: `http.req.content_length.ne(50)`
number.GE (*integer*)	Return a Boolean TRUE if the *number* value is greater than or equal to the *integer* argument. Following is an example: `http.req.content_length.ge(500)`

Arithmetic Operations for Compound Advanced Expressions

Operator	**Description**
number.GT (*integer*)	Return a Boolean TRUE if the *number* value is greater than the *integer* argument. Following is an example: `http.req.content_length.gt(500)`
number.LE (*integer*)	Return a Boolean TRUE if the *number* value is less than or equal to the *integer* argument. Following is an example: `http.req.content_length.le(5)`
number.LT (*integer*).	Return a Boolean TRUE if the *number* value is less than the *integer* argument. Following is an example: `http.req.content_length.lt(5)`
number.NEG	Returns a number after negating the current *number* value. Following is an example: `http.req.content_length.neg`

number.BITAND (*integer*)	Returns a number after applying a bitwise AND to the *integer* argument and the current *number* value.
	
	A bitwise AND operates on each pair of corresponding bits, returning 1 if both of the bits contains a value of 1, and 0 if either bits are 0. The following example assumes that *numeric.expression* returns 12 (binary 1100):
	
	`numeric.expression.bitand(10)`
	
	The binary value of 10 is 1010, and the result of applying the BITAND operator to the whole expression is 8 (binary 1000).
	
	The following is another example of an expression that uses a BITAND. Assume that the expression prior to the BITAND returns a value of 8:
	
	`http.req.header(\"test\").contains_index(\"pat1\" ).bitand(4)`
	
	The result of this expression is 0.
	
	An ampersand (&) performs a similar function to BITAND, but takes another expression as an argument rather than an integer.
	
	Note that all returned values of less than 32 bits before applying the operator implicitly have zeros to the left to make them 32 bits wide.

Arithmetic Operations for Compound Advanced Expressions

Operator	**Description**

number.BITNEG	Returns a number after applying a bitwise logical negation of the *number*. The following example assumes that *numeric.expression* returns 12 (binary 1100):
	`numeric.expression.bitneg()`
	The result of applying the BITNEG operator is -11 (a binary 1110011, 32 bits total with all ones to the left).
	The following is another example of an expression that uses a BITNEG. Assume that the expression prior to the BITNEG returns a value of 8:
	`http.req.header(\"test\").contains_index(\"pat1\" ).bitneg`
	The result of this expression is -9.
	A tilde (~) performs a similar function to BITNEG, but takes another expression as an argument rather than an integer.
	Note that all returned values of less than 32 bits before applying the operator implicitly have zeros to the left to make them 32 bits wide.

number.BITOR (*integer*)	Returns a number after applying a bitwise OR to the *integer* argument and the current *number* value. If either value in the bitwise comparison is a 1, the returned value is a 1. The following example assumes that *numeric.expression* returns 12 (binary 1100):
	`numeric.expression.bitor(10)`
	The binary value of 10 is 1010, and the result of applying the BITOR operator to the entire expression is 14 (binary 1110).
	The following is another example of an expression that uses a BITOR. Assume that the expression prior to the BITOR returns a value of 8:
	`http.req.header(\"test\").contains_index(\"pat1\" ).bitor(8)`
	The result of this expression is 8.
	A bar (|) performs a similar function to BITOR, but takes another expression as an argument rather than an integer.
	Note that all returned values of less than 32 bits before applying the operator implicitly have zeros to the left to make them 32 bits wide.

Arithmetic Operations for Compound Advanced Expressions

Operator	**Description**

number.BITXOR (*integer*)	Returns a number after applying a bitwise XOR to the *integer* argument and the current *number* value. If the values in the bitwise comparison are the same, the returned value is a 0. The following example assumes that *numeric.expression* returns 12 (binary 1100):
	`numeric.expression.bitxor(10)`
	The binary value of 10 is 1010, and the result of applying the BITXOR operator to the entire expression is 6 (binary 0110).
	The following is another example of an expression that uses a BITXOR. Assume that the expression prior to the BITXOR returns a value of 8:
	`http.req.header(\"test\").contains_index(\"pat1\" ).bitxor(8)`
	The result of this expression is 0.
	A caret (^) performs a similar function to BITXOR, but takes another expression as an argument rather than an integer.
	Note that all returned values of less than 32 bits before applying the operator implicitly have zeros to the left to make them 32 bits wide.

number.LSHIFT (*integer*)	Returns a number after a bitwise left shift of the *number* value by the *integer* argument number of bits.
	Note that the number of bits shifted is *integer* modulo 32. The following example assumes that *numeric.expression* returns 12 (binary 1100):
	`numeric.expression.lshift(3)`
	The result of applying the LSHIFT operator is 96 (a binary 1100000).
	The following is another example of an expression that uses an LSHIFT. Assume that the expression prior to the LSHIFT returns a value of 8:
	`http.req.header(\"test\").contains_index(\"pat1\" ).lshift(2)`
	The result of this expression is 32.
	A double less-than (<<) performs a similar function to LSHIFT, but takes another expression as an argument rather than an integer.
	Note that all returned values of less than 32 bits before applying the operator implicitly have zeros to the left to make them 32 bits wide.

Arithmetic Operations for Compound Advanced Expressions

Operator	**Description**

number.RSHIFT (*integer*)	Returns a number after a bitwise right shift of the *number* value by the *integer* argument number of bits.
	
	Note that the number of bits shifted is *integer* modulo 32. The following example assumes that *numeric.expression* returns 12 (binary 1100):
	
	`numeric.expression.rshift(3)`
	
	The result of applying the RSHIFT operator is 1 (a binary 0001).
	
	The following is another example of an expression that uses an RSHIFT. Assume that the expression prior to the RSHIFT returns a value of 8:
	
	`http.req.header(\"test\").contains_index(\"pat1\").rshift(2)`
	
	The result of this expression is 2.
	
	A double greater-than (>>) performs the same function as RSHIFT, but takes another expression as an argument rather than an integer.
	
	Note that all returned values of less than 32 bits before applying the operator implicitly have zeros to the left to make them 32 bits wide.

Operations on numbers of data type “double”	
double.ADD(*i*)	Returns a value of data type double after adding the argument *i* to the value represented by *double*. Parameters: *i* - Value of type double
double.BETWEEN(*i*, *j*)	Returns a Boolean value (TRUE or FALSE) that indicates whether the value represented by *double* is greater than or equal to the lower argument *i* and lesser than or equal to the upper argument *j*. Parameters: *i* - Lower value of type double *j* - Upper value of type double
double.DIV(*i*)	Returns a value of data type double after dividing the value (represented by *double*) by the argument *i*. Parameters: *i* - Value of type double
double.EQ(*i*)	Returns a Boolean value (TRUE or FALSE) that indicates whether the value represented by *double* is equal to the argument *i*. Parameters: *i* - Value of type double

Arithmetic Operations for Compound Advanced Expressions

Operator	**Description**
double.GE(*i*)	Returns a Boolean value (TRUE or FALSE) that indicates whether the value represented by *double* is greater than or equal to the argument *i*. Parameters: *i* - Value of type double
double.GT(*i*)	Returns a Boolean value (TRUE or FALSE) that indicates whether the value represented by *double* is greater than the argument *i*. Parameters: *i* - Value of type double
double.LE(*i*)	Returns a Boolean value (TRUE or FALSE) that indicates whether the value represented by *double* is lesser than or equal to the argument *i*. Parameters: *i* - Value of type double
double.LT(*i*)	Returns a Boolean value (TRUE or FALSE) that indicates whether the value represented by *double* is lesser than the argument *i*. Parameters: *i* - Value of type double
double.MUL(*i*)	Returns a value of data type double after multiplying the argument *i* with the value represented by *double*. Parameters: *i* - Value of type double
double.NE(*i*)	Returns Boolean value TRUE if the value represented by *double* is not equal to the argument *i*, and FALSE otherwise. Parameters: *i* - Value of type double
double.NEG	Negates the value represented by *double*.
double.SUB(*i*)	Returns a value of data type double after subtracting the argument *i* from the value represented by *double*. Parameters: *i* - Value of type double

Classic Expressions in Advanced Expressions

Classic expressions describe basic characteristics of traffic. In some cases, you may want to use the classic expression syntax in an advanced policy. You can do so with the advanced expression configuration tool. This can be helpful when manually migrating older, classic expressions to the advanced expression format.

Note that when you upgrade the NetScaler to version 9.0 or higher, Integrated Caching policies are automatically upgraded to advanced policy format, and the expressions in these policies are upgraded to the advanced expression method of describing a classic expression.

The following is the syntax for all advanced expressions that use the classic expression syntax:

```
sys.eval_classic_expr("expression")
```

The following are examples of classic expressions that you can embed in an advanced expression using this syntax:

```
sys.eval_classic_expr("req.ssl.client.cipher.bits > 1000")

sys.eval_classic_expr("url contains abc")

sys.eval_classic_expr("req.ip.sourceip == 10.102.1.61 -netmask
255.255.255.255")

sys.eval_classic_expr("time >= *:30:00GMT")

sys.eval_classic_expr("e1 || e2")

sys.eval_classic_expr("req.http.urllen > 50")

sys.eval_classic_expr("dayofweek == wedGMT")
```

Configuring Advanced Expressions in a Policy

You can configure an advanced expression of up to 1,499 characters in a policy. The user interface for advanced expressions depends to some extent on the feature for which you are configuring the expression, and on whether you are configuring an expression for a policy or for another use.

When configuring expressions on the command line, you delimit the expression by using quotation marks (“. . .”or '. . .'). Within an expression, you escape additional quotation marks by using a back-slash (\). For example, the following are standard methods for escaping quotation marks in an expression:

```
"\"abc\""

‘\"abc\"’
```

You must also use a backslash to escape question marks and other backslashes on the command line. For example, the expression `http.req.url.contains(“\?”)` requires a backslash so that the question mark is parsed. Note that the backslash character will not appear on the command line after you type the question mark. On the other hand, if you escape a backslash (for example, in the expression `'http.req.url.contains("\\\\http")'`), the escape characters are echoed on the command line.

To make an entry more readable, you can escape the quotation marks for an entire expression. At the start of the expression you enter the escape sequence “q” plus one of the following special characters: `/{<|~$^+=&%@`?`.

You enter only the special character at the end of the expression, as follows:

```
q@http.req.url.contains("sometext") && http.req.cookie.exists@
```

```
q~http.req.url.contains("sometext") && http.req.cookie.exists~
```

Note that an expression that uses the { delimiter is closed with }.

For some features (for example, Integrated Caching and Responder), the configuration utility’s policy configuration dialog box provides a secondary dialog box for configuring expressions. This dialog box enables you to choose from drop-down lists that show the available choices at each point during expression configuration. You cannot use arithmetic operators in these configuration dialogs, but most other advanced expression features are available. To use arithmetic operators , write your expressions in free-form format.

To configure an advanced policy rule by using the NetScaler command line

At the NetScaler command prompt, type:

```
add cache|dns|rewrite|cs policy policyName -rule expression
featureSpecificParameters
```

Following is an example of configuring a caching policy:

```
add cache policy cacheReports -rule
q~http.req.url.query.value("actionoverride").contains("branchReport
s")~ -action cache
```

To configure an advanced policy expression by using the configuration utility

1. In the navigation pane, click the name of the feature where you want to configure a policy, for example, you can select **Integrated Caching**, **Responder**, **DNS**, **Rewrite**, or **Content Switching**, and then click **Policies**.
2. Click **Add**.
3. For most features, click in the **Expression** field. For **Content Switching**, click **Configure** and then click **Advanced Syntax**.

4. Click the **Prefix** icon (the house) and select the first expression prefix from the drop-down list. For example, in Responder, the options are **HTTP**, **SYS**, and **CLIENT**. The next set of applicable options appear in a drop-down list.
5. Double-click the next option to select it, and then type a period (.). Again, a set of applicable options appears in another drop-down list.
6. Continue selecting options until an entry field (signalled by parentheses) appears. When you see an entry field, enter an appropriate value in the parentheses. For example, if you select **GT(int)** (greater-than, integer format), you specify an integer in the parentheses. Text strings are delimited by quotation marks. Following is an example:

   HTTP.REQ.BODY(1000).BETWEEN("this","that")
7. To insert an operator between two parts of a compound expression, click the **Operators** icon (the sigma), and select the operator type. Following is an example of a configured expression with a Boolean OR (signalled by double vertical bars, ||):

   HTTP.REQ.URL.EQ("www.mycompany.com")||HTTP.REQ.BODY(1000).BETWEEN("this","that")
8. To insert a named expression, click the down arrow next to the **Add** icon (the plus sign) and select a named expression.
9. To configure an expression by using drop-down menus, and to insert built-in expressions, click the **Add** icon (the plus sign). The **Add Expression** dialog box works in a similar way to the main dialog box, but it provides drop-down lists for selecting options, and it provides text fields for data entry instead of parentheses. This dialog box also provides a **Frequently Used Expressions** drop-down list that inserts commonly used expressions. When you are done adding the expression, click **OK**.
10. When finished, click **Create**.

To test an advanced policy expression by using the configuration utility

1. In the navigation pane, click the name of the feature for which you want to configure a policy (for example, you can select **Integrated Caching**, **Responder**, **DNS**, **Rewrite**, or **Content Switching**), and then click **Policies**.
2. Select a policy and click **Open**.
3. To test the expression, click the Advanced Expression Evaluator icon (the check mark).
4. In the **Advanced Expression Evaluator** dialog box, select the **Flow Type** that matches the expression.

5. In the **HTTP Request Data** or **HTTP Response Data** field, paste the HTTP request or response that you want to parse with the expression, and click **Evaluate**.

   Note that you must supply a complete HTTP request or response, and the header and body should be separated by blank line. Some programs that trap HTTP headers do not also trap the response. If you are copying and pasting only the header, insert a blank line at the end of the header to form a complete HTTP request or response.

6. Click **Close** to close this dialog box.

Configuring Named Advanced Expressions

Instead of re-typing the same expression multiple times in multiple policies, you can configure a named expression and refer to the name any time you want to use the expression in a policy. For example, you could create the following named expressions:

- **ThisExpression:** `http.req.body(100).contains("this")`
- **ThatExpression:** `http.req.body(100).contains("that")`

You can then use these named expressions in a policy expression. For example, the following is a legal expression based on the preceding examples:

```
ThisExpression || ThatExpression
```

To configure a named advanced expression by using the NetScaler command line

At the NetScaler command prompt, type:

```
add policy expression expressionName rule
```

Following is an example:

```
add policy expression advancedNamedExpression
"http.req.body(100).contains(\"the other\")"
```

The expression can be up to 1,499 characters.

To configure a named advanced expression by using the configuration utility

1. In the navigation pane, expand **AppExpert**, and then click **Expressions**.
2. Click **Advanced Expressions**.
3. Click **Add**.
4. Enter a name and a description for the expression.

5. Configure the expression as described in "To configure an advanced policy expression by using the configuration utility," on page 58.

Configuring Advanced Expressions Outside the Context of a Policy

A number of functions, including the following, can require an advanced expression that is not part of a policy:

- **Integrated Caching selectors**. You define multiple non-compound expressions (selectlets) in the definition of the selector. Each selectlet is in an implicit logical AND relationship with the others.
- **Load Balancing**. You configure an expression for the TOKEN method of load balancing for a load balancing virtual server.
- **Rewrite actions**. Expressions define the location of the rewrite action and the type of rewriting to be performed, depending on the type of rewrite action that you are configuring. For example, a DELETE action only uses a target expression. A REPLACE action uses a target expression and an expression to configure the replacement text.
- **Rate-based policies**: You use advanced expressions to configure Limit Selectors. You can use these selectors when configuring policies to throttle the rate of traffic to various servers. You define up to five non-compound expressions (selectlets) in the definition of the selector. Each selectlet is in an implicit logical AND with the others.

To configure an advanced expression outside a policy by using the NetScaler command line (cache selector example)

From the NetScaler command line, enter the command for configuring the object that requires an advanced expression. Following is an example of configuring a cache selector. Note that line breaks in the following example are for readability. Do not insert line breaks in the command:

```
add cache selector mainpage_selector
"http.req.cookie.value(\"ABC_def\")"
"http.req.url.query.value(\"_ghi\")" http.req.url.path
"http.req.body(150).typecast_nvlist_t(\'=\',\'&\').value(\"por
tlet_C{actionForm.endDate}\")"
"http.req.body(150).typecast_nvlist_t(\'=\',\'&\').value(\"por
tlet_C{actionForm.startDate}\")"
```

Following is an equivalent command that uses the more readable `q` delimiter, as described in "Configuring Advanced Expressions in a Policy," on page 57:

```
add cache selector mainpage_selector
q~http.req.cookie.value("ABC_def")~
```

```
q~http.req.url.query.value("_ghi")~ http.req.url.path
q~http.req.body(150).typecast_nvlist_t('=','&').value("portlet
_C{actionForm.endDate}")~
q~http.req.body(150).typecast_nvlist_t('=','&').value("portlet
_C{actionForm.startDate}")~
```

Advanced Expressions: Evaluating Text

You can configure an advanced expression to examine text in a request or a response. For example, a expression can perform string matching on the following types of data:

- An HTTP header type
- An HTTP header value
- A user or group name in an HTTP request
- A file type in a URL
- A string in an HTTP POST body

You can configure text expressions to be case sensitive or case insensitive and to use or ignore spaces.You can also configure complex expressions for text, for example, by skipping *x* number of bytes before starting a search of a POST body or by finding a string that occurs after the end of another string.

The rest of this chapter discusses the expression prefixes that extract text and the operations that you can perform on the extracted text.

In This Chapter

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Complex Operations on Text

Note: You can apply complex functions to text expressions. For example, you can transform a text string to a name-value list. Or, you can perform a match against a pattern or set of patterns. For information on these advanced text expressions, see “Advanced Expressions: String Sets, String Patterns, and Data Formats,” on page 157.

About Text Expressions

You can configure various expressions for working with text that flows through the NetScaler. Following are some examples of how you can parse text using an advanced expression:

- Determine that a particular HTTP header exists.

  For example, you may want to identify HTTP requests that contains a particular Accept-Language header for the purpose of directing the request to a particular server.

- Determine that a particular HTTP URL contains a particular string.

  For example, you may want to block requests for particular URLs. Note that the string can occur at the beginning, middle, or end of another string.

- Identify a POST request that is directed to a particular application.

  For example, you may want to identify all POST requests that are directed to a database application for the purpose of refreshing cached application data.

Note that there are specialized tools for viewing the data stream for HTTP requests and responses. For example, you can download a Firefox Web browser plug-in that displays HTTP request and response headers from the following URL:

https://addons.mozilla.org/en-US/firefox/addon/3829

The following plug-in displays headers, query strings, POST data, and other information:

https://addons.mozilla.org/en-US/firefox/addon/6647

After downloading these plug-ins, they are accessible from the Firefox Tools menu.

About Operations on Text

A text-based expression consists of at least one prefix to identify an element of data and usually (although not always) an operation on that prefix. Text-based operations can apply to any part of a request or a response. Basic operations on text include various types of string matches.

For example, the following expression compares a header value with a string:

```
http.req.header("myHeader").contains("some-text")
```

Following expressions are examples of matching a file type in a request:

```
http.req.url.suffix.contains("jpeg")
```

```
http.req.url.suffix.eq("jpeg")
```

In the preceding examples, the `contains` operator permits a partial match and the `eq` operator looks for an exact match.

Other operations are available to format the string before evaluating it, for example, to strip out quotes and white spaces, to convert the string to all lowercase, or to concatenate strings.

Note: Complex operations are available to perform matching based on patterns or to convert one type of text format to another type. For more information, see "Advanced Expressions: String Sets, String Patterns, and Data Formats," on page 157.

Compounding and Precedence in Text Expressions

You can apply various operators to combine text prefixes or expressions. For example, the following expression concatenates the returned values of each prefix:

```
http.req.hostname + http.req.url
```

Following expression is an example of forming a compound text expression that uses a logical AND. In this example, both components of the expression must be TRUE for a request to match the expression:

```
http.req.method.eq(post) && http.req.body(1024).
startswith("destination=")
```

Note: For more information on operators for compounding, see "Compound Advanced Expressions," on page 45.

Categories of Text Expressions

The primary categories of text expressions that you can configure are:

- Information in HTTP headers, HTTP URLs, and the POST body in HTTP requests.

  For more information, see "Expression Prefixes for Text in HTTP Requests and Responses," on page 67.

- Information regarding a VPN or a clientless VPN.

  For more information, see "Expression Prefixes for VPNs and Clientless VPNs," on page 76.

- TCP payload information.

TCP payload expressions are discussed in another chapter. For more information, see "Advanced Expressions: Parsing HTTP, TCP, and UDP Data," on page 113.

- Text in an Secure Sockets Layer (SSL) certificate.

  SSL and certificate expressions are discussed in another chapter. For information on SSL and certificate data, see "Advanced Expressions: Parsing SSL Certificates," on page 141 and "Expressions for SSL Certificate Dates," on page 101.

Note: Parsing a document body, such as the body of a POST request, can affect performance. You may want to test the performance impact of policies that evaluate a document body.

Guidelines for Text Expressions

From a performance standpoint, it typically is best to use protocol-aware functions in an expression. For example, the following expression makes use of a protocol-aware function:

```
HTTP.REQ.URL.QUERY
```

The performance of the previous expression is typically better than the following equivalent expression that is based on string parsing:

```
HTTP.REQ.URL.AFTER_STR("?")
```

In the first case, the expression looks specifically at the URL query. In the second case, the expression scans the data for the first occurrence of a question mark.

There is also a performance benefit from structured parsing of text, as in the following expression:

```
HTTP.REQ.HEADER("Example").TYPECAST_LIST_T(',').GET(1)
```

(For more information on typecasting, see "Transforming Text and Numbers into Different Data Types," on page 169.) The typecasting expression, which collects comma-delimited data and structures it into a list, typically would perform better than the following unstructured equivalent:

```
HTTP.REQ.HEADER("Example").AFTER_STR(",").BEFORE_STR(",")
```

Finally, unstructured text expressions typically have better performance than regular expressions. For example, the following is an unstructured text expression:

```
HTTP.REQ.HEADER("Example").AFTER_STR("more")
```

The previous expression would generally provide better performance than the following equivalent, which uses a regular expression:

```
HTTP.REQ.HEADER("Example").AFTER_REGEX(re/more/)
```

For more information on regular expressions, see “Matching Text With a Pattern,” on page 164.

Expression Prefixes for Text

The following sections discuss expression prefixes for strings.

Expression Prefixes for Text in HTTP Requests and Responses

An HTTP request or response typically contains text, such as in the form of headers, header values, URLs, and POST body text. You can configure expressions to operate on one or more of these text-based items in an HTTP request or response.

The following table describes the expression prefixes that you can configure to extract text from different parts of an HTTP request or response.

HTTP Expression Prefixes that Return Text

Prefix	Description
`HTTP.REQ.BODY(`*`integer`*`)`	Returns the body of an HTTP request as a multiline text object, up to the character position designated in *integer*. There is no maximum value for the body argument, but you should use as small a value as is practical. Larger values can affect performance. **Note:** Although it is possible to specify this prefix without an integer argument, this usage is deprecated.
`HTTP.REQ.HOSTNAME`	Returns the HTTP host name in the first line of the request, if there is one. Otherwise, this prefix returns the value in the last occurrence of the HOST header. Note that there are two similar prefixes that return host names, as follows: • `http.req.url.hostname` only returns the host name from the URL • `http.req.header("Host")` only returns the value from the Host header. To use this value as a host name you must typecast this string, as illustrated in the following example: `http.req.header("host").typecast_http_hostname_t` For more information on typecasting, see “Transforming Text and Numbers into Different Data Types,” on page 169.

HTTP Expression Prefixes that Return Text

Prefix	Description
`HTTP.REQ.HOSTNAME.DOMAIN`	Returns the domain name part of the host name. For example, if the host name is www.myhost.com or www.myhost.com:8080, the domain is myhost.com. Returns incorrect results if the host name has an IP address. For information on expressions for IP addresses, see "Advanced Expressions: IP and MAC Addresses, Throughput, VLAN IDs," on page 149. All text operations that you specify after this prefix are case insensitive.
`HTTP.REQ.HOSTNAME.SERVER`	Returns the server name part of the host name. If the host name is www.myhost.com or www.myhost.com:8080, the server is www.myhost.com. All text operations that you specify after this prefix are case insensitive.
`HTTP.REQ.METHOD`	Returns the value of the METHOD in an HTTP request, or matches the method type if you provide it as an argument, for example, `http.req.method.eq(get)`. If you enclose the argument in quotes, evaluation is case-sensitive.
`HTTP.REQ.URL`	Returns the HTTP URL.
`HTTP.REQ.URL.HOSTNAME`	Returns the host name in the HTTP URL. Do not use this prefix in bidirectional policies. Note that there are two similar prefixes that return host names, as follows: • `HTTP.REQ.HOSTNAME` returns the host name from the URL if there is one; otherwise, it returns the value in the last occurrence of the Host header. • `HTTP.REQ.HEADER("Host")` only returns the value from the Host header. To use this value as a host name you must typecast this string, as illustrated in the following example: `http.req.header("host").typecast_http_hostname_t` For more information on typecasting, see "Transforming Text and Numbers into Different Data Types," on page 169.

HTTP Expression Prefixes that Return Text

Prefix	**Description**
`HTTP.REQ.URL.HOSTNAME.DOMAIN`	Returns the domain name part of the host name. For example, if the host name is www.myhost.com or www.myhost.com:8080, the domain is myhost.com. This operation returns incorrect results if the host name has an IP address. For information on expressions for IP addresses, see "Advanced Expressions: IP and MAC Addresses, Throughput, VLAN IDs," on page 149. All text operations that you specify after this prefix are case insensitive unless explicitly set by the SET_TEXT_MODE operator.
`HTTP.REQ.URL.HOSTNAME.SERVER`	Returns the server name part of the host name. For example, if the host name is www.myhost.com or www.myhost.com:8080, the server is www.myhost.com. All text operations that you specify after this prefix are case insensitive.
`HTTP.REQ.URL.PATH`	Returns a slash- (/) separated list from the path in a URL. For example, if the URL is http://www.myhost.com/a/b/c/mypage.html?a=1, this prefix returns the string /a/b/c/mypage.html. The expression `http.req.url.path.get(1)` returns "a" from the preceding URL. For more information on the GET operation, see "Expressions for Extracting Segments of URLs," on page 129.
`HTTP.REQ.URL.PATH_AND_QUERY`	Returns the portion of the URL that follows the host name. For example, if the URL is http://www.myhost.com/a/b/c/mypage.html?a=1, this prefix returns /a/b/c/mypage.html?a=1.
`HTTP.REQ.URL.PROTOCOL`	Returns the protocol in the URL. This prefix cannot be used in bidirectional policies. Following is an example: `http.req.hostname + http.req.url.protocol`
`HTTP.REQ.URL.QUERY`	Returns a name-value list, using the delimiters "=" and "&", from the query component in the URL. Following is an example: `http.req.url.query.contains("viewReport && my_pagelabel")`

HTTP Expression Prefixes that Return Text

Prefix	**Description**
`HTTP.REQ.URL.QUERY.VALUE`	Returns the value from the name-value pair in the argument supplied to this prefix, using the delimiter "=" from the query component in the URL. Following is an example: `http.req.url.query.value("action")` The first component that matches the name is selected. The matching process honors the IGNORECASE and the NOIGNORECASE text modes. The URLENCODED and the NOURLENCODED text modes are ignored.
`HTTP.REQ.URL.SUFFIX`	Returns the file name suffix in a URL. For example, if the path in the URL is /a/b/c/mypage.html, this suffix selects "html". Following is another example: `http.req.url.suffix.contains("jpeg")`
`HTTP.REQ.USER`	Returns the AAA user associated with the current HTTP transaction.
`HTTP.REQ.USER.EXTERNAL_GROUPS`	Returns a list of the external groups to which a user belongs. The groups are separated by a comma (","). For example, HTTP.REQ.USER.EXTERNAL_GROUPS returns a comma-separated list of all the external groups to which the user belongs.
`HTTP.REQ.USER.EXTERNAL_GROUPS.IGNORE_EMPTY_ELEMENTS`	Ignores the empty elements in the list of external groups to which the user belongs. If the element delimiter in the list is a comma (","), then the following list has an empty element following "a=10": a=10,,b=11, ,c=89 But the element following "b=11" is not considered an empty element. For example, consider the following header in an HTTP request packet: Cust_Header : 123,,24, ,15 Then the following expression returns a value of 4: HTTP.REQ.HEADER("Cust_Header").TYPECAST_LIST_T(','). IGNORE_EMPTY_ELEMENTS.COUNT The following expression returns a value of 5: HTTP.REQ.HEADER("Cust_Header").TYPECAST_LIST_T(',').COUNT.

HTTP Expression Prefixes that Return Text

Prefix	**Description**
`HTTP.REQ.USER.EXTERNAL_GROUPS(sep)`	Returns a list of all the external groups to which the user belongs. The groups are separated by the given delimiter. For example, the following expression gives a list of all the external groups, and the groups are separated by a colon (":"): HTTP.REQ.USER.EXTERNAL_GROUPS(':') Parameters: sep - delimiter
`HTTP.REQ.USER.EXTERNAL_GROUPS.IGNORE_EMPTY_ELEMENTS`	Ignores the empty elements in the list of external groups to which the user belongs. If the element delimiter in the list is a comma (","), then the following list has an empty element following "a=10": a=10,,b=11, ,c=89 But the element following "b=11" is not considered an empty element. For example, consider the following header in an HTTP request packet: Cust_Header : 123,,24, ,15 The following expression returns a value of 4: HTTP.REQ.HEADER("Cust_Header").TYPECAST_LIST_T(','). IGNORE_EMPTY_ELEMENTS.COUNT The following expression returns a value of 5: HTTP.REQ.HEADER("Cust_Header").TYPECAST_LIST_T(',').COUNT
`HTTP.REQ.USER.GROUPS`	Returns a list of the internal and external groups to which the user belongs. The groups are separated by a comma (","). In this list, internal groups are listed first, followed by external groups.

HTTP Expression Prefixes that Return Text

Prefix	**Description**
`HTTP.REQ.USER.GROUPS.IGNORE_EMPTY_ELEMENTS`	Ignores the empty elements in the list of groups to which the user belongs. If the element delimiter in the list is a comma (","), then the following list has an empty element following "a=10": a=10,,b=11, ,c=89 But the element that follows "b=11" is not considered an empty element. For example, consider the following header in an HTTP request packet: Cust_Header : 123,,24, ,15 The following expression returns a value of 4: HTTP.REQ.HEADER("Cust_Header").TYPECAST_LIST_T(','). IGNORE_EMPTY_ELEMENTS.COUNT The following expression returns a value of 5: HTTP.REQ.HEADER("Cust_Header").TYPECAST_LIST_T(',').COUNT
`HTTP.REQ.USER.GROUPS(sep)`	Returns a list of groups to which the user belongs. The groups in the list are separated by the delimiter specified as the argument. For example, the following expression returns a colon-separated list of all the groups to which the user belongs. HTTP.REQ.USER.GROUPS(':') In this list, internal groups are listed first, followed by external groups. Parameters: sep - delimiter

HTTP Expression Prefixes that Return Text

Prefix	**Description**
`HTTP.REQ.USER.GROUPS. IGNORE_EMPTY_ELEMENTS`	Ignores the empty elements in the list of groups to which the user belongs. If the element delimiter in the list is a comma (","), then the following list has an empty element following "a=10": a=10,,b=11, ,c=89 But the element following "b=11" is not considered an empty element. For example, consider the following header in an HTTP request packet: Cust_Header : 123,,24, ,15 The following expression returns a value of 4: HTTP.REQ.HEADER("Cust_Header").TYPECAST_ LIST_T(','). IGNORE_EMPTY_ELEMENTS.COUNT The following expression returns a value of 5: HTTP.REQ.HEADER("Cust_Header").TYPECAST_ LIST_T(',').COUNT.
`HTTP.REQ.USER.INTERNAL_ GROUPS`	Returns a list of internal groups to which the user belongs. The groups are separated by a comma (","). For example, the following expression returns a comma-separated list of all the internal groups to which a user belongs. HTTP.REQ.USER.INTERNAL_GROUPS
`HTTP.REQ.USER.INTERNAL_ GROUPS.IGNORE_EMPTY_ ELEMENTS`	Ignores the empty elements in the list of internal groups to which the user belongs. If the element delimiter in the list is a comma (","), then the following list has an empty element following "a=10": a=10,,b=11, ,c=89 But the element following "b=11" is not considered an empty element. For example, consider the following header in an HTTP request packet: Cust_Header : 123,,24, ,15 The following expression returns a value of 4: HTTP.REQ.HEADER("Cust_Header").TYPECAST_ LIST_T(','). IGNORE_EMPTY_ELEMENTS.COUNT The following expression returns a value of 5: HTTP.REQ.HEADER("Cust_Header").TYPECAST_ LIST_T(',').COUNT

HTTP Expression Prefixes that Return Text

Prefix	Description
`HTTP.REQ.USER.INTERNAL_GROUPS(sep)`	Returns a list of the internal groups to which the user belongs. The groups are separated by the given delimiter. For example, the following expression returns a colon-separated list of all the internal groups to which the user belongs. HTTP.REQ.USER.INTERNAL_GROUPS(':') Parameters: sep - delimiter
`HTTP.REQ.USER.INTERNAL_GROUPS.IGNORE_EMPTY_ELEMENTS`	Ignores the empty elements in the list of internal groups to which the user belongs. If the element delimiter in the list is a comma (","), then the following list has an empty element following "a=10": a=10,,b=11, ,c=89 But the element following "b=11" is not considered an empty element. For example, consider the following header in an HTTP request packet: Cust_Header : 123,,24, ,15 The following expression returns a value of 4: HTTP.REQ.HEADER("Cust_Header").TYPECAST_LIST_T(','). IGNORE_EMPTY_ELEMENTS.COUNT The following expression returns a value of 5: HTTP.REQ.HEADER("Cust_Header").TYPECAST_LIST_T(',').COUNT.

`HTTP.REQ.USER.IS_MEMBER_OF(`*`group`*`_name)`	Returns a boolean TRUE if the user who is named in the request is a member of the argument specified in *group*.
	
	Following is an example:
	
	`http.req.user.is_member_of("mygroup")`
	
	`Parameter:`
	
	`group_name: The name of the group.`

`HTTP.REQ.USER.NAME`	Returns the name of the user in the request. Following is an example: `http.req.username.contains("rohit")`
`HTTP.REQ.USER.PASSWD`	Returns the password of the user.

HTTP Expression Prefixes that Return Text

Prefix	**Description**
`HTTP.REQ.VERSION`	Returns the HTTP version listed in the request. Following is an example: `http.req.version "\"HTTP/1.0\"`
`HTTP.RES.BODY(`*`integer`*`)`	Returns a portion of the HTTP response body. The length of the returned text is equal to the number in the *integer* argument. If there are fewer characters in the body than are specified in *integer*, the entire body is returned. Following is an example: `http.res.body(100).suffix('L',1)`
`HTTP.RES.STATUS_MSG`	Returns the HTTP response status message.
`HTTP.RES.VERSION`	Returns the HTTP version listed in the response.
`HTTP.REQ.URL.HOSTNAME. EQ("`*`hostname`*`")`	Returns a Boolean TRUE value if the host name matches the *hostname* argument. The comparison is case insensitive and if textmode is URLENCODED, the host name is decoded before comparison. For example, if the host name is www.mycompany.com., the following is TRUE: `http.req.url.hostname.eq("www.mycompany. com")`
`HTTP.REQ.URL.HOSTNAME. PORT`	Returns the port in the host name. The string following and including the first colon (“:”) is considered the port value. For example, if the host name is www. mycompany.com:8080, the port is ":8080". If the host name is www.mycompany.com: the port is ":". If the host name is www.mycompany.com, the port is "" and points to a location just after ".com". If the numerical value in the port is missing, it assumes a default value of 80 or 443 (for HTTPS connections).
`HTTP.REQ.URL.HOSTNAME. SERVER`	Returns the server name portion of the host name. For example, if the host name is www.mycompany.com or www.mycompany.com:8080, the returned server name is www.mycompany.com. This method sets the text mode to case insensitive. All text operations after this method are case insensitive.
`HTTP.REQ.IS_NTLM_OR_ NEGOTIATE`	Returns a Boolean TRUE if the request is a part of an NTLM or NEGOTIATE connection.
`HTTP.REQ.URL.CVPN_ ENCODE`	Converts the URL to the clientless VPN format.

HTTP Expression Prefixes that Return Text

Prefix	Description
`HTTP.REQ.URL.PATH. IGNORE_EMPTY_ELEMENTS`	Ignores the empty elements in the list. For example, if the element delimiter in the list is a comma, the following list has an empty element following a=10: a=10,b=11, ,c=89 The element following b=11 is not considered an empty element. As another example, consider the following header: Cust_Header : 123,,24, ,15 The following expression returns a value of 4: `http.req.header("Cust_Header").typecast_ list_t(',').ignore_empty_elements.count` The following expression returns a value of 5: `http.req.header("Cust_Header").typecast_ list_t(',').` count

`HTTP.REQ.URL.QUERY. IGNORE_EMPTY_ELEMENTS`	This method ignores the empty elements in a name-value list. For example, if the list delimiter is a semicolon, the following list has an empty element following a=10:
	a=10;;b=11; ;c=89
	The element following b=11 is not considered an empty element.
	For example, consider the following header:
	Cust_Header : a=1;;b=2; ;c=3
	The following expression returns a value of 4:
	`http.req.header("Cust_Header").typecast_ nvlist_t('=',';').ignore_empty_elements. count`
	The following expression returns a value of 5:
	`http.req.header("Cust_Header").typecast_ nvlist_t('=',';'). count`

Expression Prefixes for VPNs and Clientless VPNs

The advanced expression engine provides prefixes that are specific to parsing VPN or Clientless VPN data. This data includes the following:

- Host names, domains, and URLs in VPN traffic.
- Protocols in the VPN traffic.

- Queries in the VPN traffic.

These text elements are often URLs and components of URLs. In addition to applying the text-based operations on these elements as described elsewhere in this chapter, you can parse these elements using operations that are specific to parsing URLs. For more information, see "Expressions for Extracting Segments of URLs," on page 129.

The following table describes the expression prefixes for this type of data.

VPN and Clientless VPN Expression Prefixes that Return Text

VPN and Clientless VPN Expression	Description
`VPN.BASEURL.CVPN_DECODE`	Extracts the original URL from a clientless VPN URL.
`VPN.BASEURL.CVPN_ENCODE`	Converts a URL to clientless VPN format.
`VPN.BASEURL.HOSTNAME`	Extracts the HTTP host name from the host name in the URL. This prefix cannot be used in bidirectional policies.
`VPN.BASEURL.HOSTNAME.DOMAIN`	Extracts the domain name from the host name. For example, if the host name is www.mycompany.com or www.mycompany.com:8080, this prefix extracts mycompany.com. This prefix returns incorrect results if the host name is an IP address. For information on expressions for IP addresses, see "Advanced Expressions: IP and MAC Addresses, Throughput, VLAN IDs," on page 149. All text operations after this prefix are case insensitive.
`VPN.BASEURL.HOSTNAME.EQ ("`*`hostname`*`")`	Returns a Boolean TRUE if the host name matches *hostname*. The comparison is case insensitive. For example, if the host name is www.mycompany.com, the following returns TRUE: `vpn.baseurl.hostname.eq("www.mycompany.com")` If the text mode is URLENCODED, the host name is decoded before comparison. For more information, see "Operations for HTTP, HTML, and XML Encoding and "Safe" Characters," on page 131.

VPN and Clientless VPN Expression Prefixes that Return Text

VPN and Clientless VPN Expression	Description
`VPN.BASEURL.HOSTNAME.SERVER`	Evaluates the server portion of the host name. For example, if the host name is www. mycompany.com or www.mycompany.com:8080, the server is www.mycompany.com. All text operations after this prefix are case insensitive.
`VPN.BASEURL.PATH`	Extracts a slash- (/) separated list from the path component of the URL. For example, this prefix extracts /a/b/c/mypage.html from the following URL: http://www.mycompany.com/a/b/c/mypage. html?a=1 The following expression selects just the "a": `http.req.url.path.get(1)` For more information on the GET operation, see "Expressions for Extracting Segments of URLs," on page 129.

`VPN.BASEURL.PATH.IGNORE_ EMPTY_ELEMENTS`	This prefix ignores the elements in a list. For example, the following comma-separated list has an empty element after "a=10":
	
	a=10,,b=11, ,c=89
	
	The element following b=11 contains a space, and by default, is not considered an empty element.
	
	Consider the following HTTP header:
	
	Cust_Header : 123,,24, ,15
	
	The following expression returns a count of 4 when evaluating this header:
	
	`http.req.header("Cust_Header"). typecase_list_t(',').ignore_empty_ elements.count`
	
	The following expression returns a count of 5 when evaluating this header:
	
	`http.req.header("Cust_Header"). typecase_list_t(','). count`

`VPN.BASEURL.PATH_AND_QUERY`	Evaluates the text in the URL that follows the host name. For example, if the URL is http://www. mycompany.com/a/b/c/mypage.html?a=1, this prefix evaluates /a/b/c/mypage.html?a=1.

VPN and Clientless VPN Expression Prefixes that Return Text

VPN and Clientless VPN Expression	Description
`VPN.BASEURL.PROTOCOL`	Evaluates the protocol in the URL. Do not use this prefix in bidirectional policies.
`VPN.BASEURL.QUERY`	Extracts a name-value list, using the “=” and “&” delimiters from the query string in a URL.

`VPN.BASEURL.QUERY.IGNORE_ EMPTY_ELEMENTS`	This method ignores the empty elements in a name-value list. For example, in the following name-value list, there is an empty element following “a=10”:
	
	a=10;;b=11; ;c=89
	
	The element following b=11 contains a space and is not considered an empty element.
	
	Consider the following HTTP header:
	
	Cust_Header : a=1;;b=2; ;c=3
	
	The following expression produces a count of 4 after evaluating this header:
	
	`http.req.header("Cust_Header"). typecast_nvlist_t('=',';').ignore_ empty_elements.count`
	
	The following expression produces a count of 5 after evaluating the header:
	
	`http.req.header("Cust_Header"). typecast_nvlist_t('=',';').`

`VPN.BASEURL.SUFFIX`	Evaluates the file name suffix in a URL. For example, if the path is /a/b/c/my.page.html, this operation selects “html”.
`VPN.CLIENTLESS_BASEURL`	Evaluates the clientless VPN base URL.
`VPN.CLIENTLESS_BASEURL. CVPN_DECODE`	Extracts the original URL from the clientless VPN formatted URL.
`VPN.CLIENTLESS_BASEURL. CVPN_ENCODE`	Converts a URL to the clientless VPN format.
`VPN.CLIENTLESS_BASEURL. HOSTNAME`	Evaluates the host name in the URL. Do not use this prefix in bidirectional policies.

VPN and Clientless VPN Expression Prefixes that Return Text

VPN and Clientless VPN Expression	Description
`VPN.CLIENTLESS_BASEURL. HOSTNAME.DOMAIN`	Evaluates the domain name part of the host name. For example, if the host name is www. mycompany.com or www.mycompany.com:8080, the domain is mycompany.com. This operation returns incorrect results if the host name is an IP address. For information on expressions for IP addresses, see “Advanced Expressions: IP and MAC Addresses, Throughput, VLAN IDs,” on page 149. All text operations after this prefix are case insensitive.
`VPN.CLIENTLESS_BASEURL. HOSTNAME.EQ("`*`hostname`*`")`	Returns a Boolean TRUE if the host name matches *hostname*. For example, if the host name is www. mycompany.com or www.mycompany.com:8080, the following is true: `vpn.clientless_baseurl. hostname. eq("www.mycompany.com")` The comparison is case insensitive. If the textmode is URLENCODED, the host name is decoded before comparison. For more information, see “Operations for HTTP, HTML, and XML Encoding and “Safe” Characters,” on page 131.
`VPN.CLIENTLESS_BASEURL. HOSTNAME.SERVER`	Evaluates the server part of a host name. For example, if the host name is www. mycompany.com or www.mycompany.com:8080, the server is www.mycompany.com. All text operations after this prefix are case insensitive.
`VPN.CLIENTLESS_BASEURL.PATH`	Evaluates a slash- (/) separated list in the URL path. For example, this prefix selects /a/b/c/mypage.html from the following URL: http://www.mycompany.com/a/b/c/mypage. html?a=1 The following expression selects “a” from the preceding URL: `http.req.url.path.get(1)` For more information on the GET operation, see “Expressions for Extracting Segments of URLs,” on page 129.

VPN and Clientless VPN Expression Prefixes that Return Text

VPN and Clientless VPN Expression	Description

`VPN.CLIENTLESS_BASEURL.PATH.IGNORE_EMPTY_ELEMENTS`	Ignores empty elements in a list. For example, if the list delimiter is a comma (,) the following list has an empty element following "a=10":
	a=10,b=11, ,c=89
	The element following b=11 contains a space and is not considered an empty element.
	Consider the following HTTP header:
	Cust_Header : 123,,24, ,15
	The following expression returns a value of 4 after evaluating this header:
	`http.req.header("Cust_Header").typecast_list_t(',').ignore_empty_elements.count`
	The following expression returns a value of 5 after evaluating this header:
	`http.req.header("Cust_Header").typecast_list_t(',').`

`VPN.CLIENTLESS_BASEURL.PATH_AND_QUERY`	Evaluates the text following the host name in a URL. For example, this prefix selects /a/b/c/mypage.html?a=1 from the following URL: http://www.mycompany.com/a/b/c/mypage.html?a=1
`VPN.CLIENTLESS_BASEURL.PROTOCOL`	Evaluates the protocol in the URL. Do not use this prefix in bidirectional policies.
`VPN.CLIENTLESS_BASEURL.QUERY`	Extracts a name-value list that uses the delimiters "=" and "&" from a URL query string.

VPN and Clientless VPN Expression Prefixes that Return Text

VPN and Clientless VPN Expression	**Description**

`VPN.CLIENTLESS_BASEURL.QUERY.IGNORE_EMPTY_ELEMENTS`	Ignores empty elements in a name-value list. For example, the following list contains an empty element after “a=10”:
	
	a=10;;b=11; ;c=89
	
	The element following b=11 contains a space and is not considered an empty element.
	
	As another example, consider the following http header:
	
	Cust_Header : a=1;;b=2; ;c=3
	
	The following expression returns a value of 4 after evaluating the preceding header:
	
	`http.req.header("Cust_Header").typecast_nvlist_t('=',';').ignore_empty_elements.count`
	
	The following expression returns a value of 5 after evaluating the preceding header:
	
	`http.req.header("Cust_Header").typecast_nvlist_t('=',';')`

`VPN.CLIENTLESS_BASEURL.SUFFIX`	Evaluates the file suffix in a URL. For example, if the URL path is /a/b/c/mypage.html then this operation selects html.
`VPN.CLIENTLESS_HOSTURL`	Selects the clientless VPN host URL.
`VPN.CLIENTLESS_HOSTURL.CVPN_DECODE`	Selects the original URL from the clientless VPN formatted URL.
`VPN.CLIENTLESS_HOSTURL.CVPN_ENCODE`	Converts a URL to clientless VPN format.
`VPN.CLIENTLESS_HOSTURL.HOSTNAME`	Extracts the host name in the URL. Do not use this prefix in bidirectional policies.
`VPN.CLIENTLESS_HOSTURL.HOSTNAME.DOMAIN`	Extracts the domain name from the host name. For example, if the host name is www.mycompany.com or www.mycompany.com:8080, the domain is mycompany.com. This operation returns incorrect results if the host name contains an IP address. For information on expressions for IP addresses, see “Advanced Expressions: IP and MAC Addresses, Throughput, VLAN IDs,” on page 149. All text operations after this prefix are case insensitive.

VPN and Clientless VPN Expression Prefixes that Return Text

VPN and Clientless VPN Expression	Description
`VPN.CLIENTLESS_HOSTURL.HOSTNAME.EQ("`*`hostname`*`")`	Results in Boolean TRUE if the host name matches the *hostname* argument. The comparison is case insensitive. For example, if the host name is www.mycompany.com or www.mycompany.com., the following expression returns TRUE: `vpn.clilentless_hosturl. hostname.eq("www.mycompany.com")` If the text mode is URLENCODED, the host name is decoded before comparison. For more information, see "Operations for HTTP, HTML, and XML Encoding and "Safe" Characters," on page 131.
`VPN.CLIENTLESS_HOSTURL.HOSTNAME.SERVER`	Evaluates the server part of the host name. For example, if the host name is www.mycompany.com or www.mycompany.com:8080, the server is www.mycompany.com. The comparison is case insensitive, and all text operations after this method are case insensitive.
`VPN.CLIENTLESS_HOSTURL.PATH`	Evaluates a slash- (/) separated list on the path component of the URL. For example, consider the following URL: http://www.mycompany.com/a/b/c/mypage.html?a=1 This prefix selects /a/b/c/mypage.html from the preceding URL.

VPN and Clientless VPN Expression Prefixes that Return Text

VPN and Clientless VPN Expression	Description

`VPN.CLIENTLESS_HOSTURL.PATH.IGNORE_EMPTY_ELEMENTS`	This method ignores the empty elements in a list. For example, if the delimiter in a list is “,” the following list contains an empty element after the entry “a=10”:
	
	a=10,b=11, ,c=89
	
	The element following b=11 contains a space and is not considered an empty element.
	
	Consider the following header:
	
	Cust_Header : 123,,24, ,15
	
	The following expression returns a value of 4 for this header:
	
	`http.req.header("Cust_Header").typecast_list_t(','). ignore_empty_elements.count`
	
	The following expression returns a value of 5 for the same header:
	
	`http.req.header("Cust_Header").typecast_list_t(',').`

`VPN.CLIENTLESS_HOSTURL.PATH_AND_QUERY`	Evaluates the portion of the URL that follows the host name. For example, consider the following URL: http://www.mycompany.com/a/b/c/mypage.html?a=1 This prefix returns /a/b/c/mypage.html?a=1 from the preceding URL.
`VPN.CLIENTLESS_HOSTURL.PROTOCOL`	Evaluates the protocol in the URL. Do not use this prefix in bidirectional policies.
`VPN.CLIENTLESS_HOSTURL.QUERY`	Extracts a name-value list, using the “=” and “&” delimiters from a URL query string.

VPN and Clientless VPN Expression Prefixes that Return Text

VPN and Clientless VPN Expression	Description

`VPN.CLIENTLESS_HOSTURL.QUERY.IGNORE_EMPTY_ELEMENTS`	Ignores empty elements in a name-value list. For example, the following list uses a semicolon (;) delimiter. This list contains an empty element after “a=10”:
	
	a=10;;b=11; ;c=89
	
	In the preceding example, the element following b=11 is not considered an empty element.
	
	Consider the following header:
	
	Cust_Header : a=1;;b=2; ;c=3
	
	The following expression returns a value of 4 after evaluating this header:
	
	`http.req.header("Cust_Header").typecast_nvlist_t('=',';').ignore_empty_elements.count`
	
	The following expression returns a value of 5 after evaluating the same header:
	
	`http.req.header("Cust_Header").typecast_nvlist_t('=',';')`

`VPN.CLIENTLESS_HOSTURL.SUFFIX`	Extracts a file name suffix in a URL. For example, if the path is /a/b/c/my.page.html, this prefix selects html.
`VPN.HOST.DOMAIN`	Extracts the domain name part of the host name. For example, if the host name is www.mycompany.com or www.mycompany.com:8080, the domain is mycompany.com. This prefix returns incorrect results if the host name contains an IP address. For information on expressions for IP addresses, see “Advanced Expressions: IP and MAC Addresses, Throughput, VLAN IDs,” on page 149. All text operations after this prefix case insensitive.

VPN and Clientless VPN Expression Prefixes that Return Text

VPN and Clientless VPN Expression	Description
`VPN.HOST.EQ("`*`hostname`*`")`	Returns a Boolean TRUE value if the host name matches the *hostname*. The comparison is case insensitive. For example, if the host name is www. mycompany.com or www.mycompany.com:8080, the following returns TRUE: `vpn.host.eq("www.mycompany.com")` If the text mode is URLENCODED the host name is decoded before comparison. For more information, see "Operations for HTTP, HTML, and XML Encoding and "Safe" Characters," on page 131.
`VPN.HOST.SERVER`	Extracts the server name part of the host name. For example, if the host name is www.mycompany. com or www.mycompany.com:8080, the server is www.mycompany.com. All text operations after this prefix are case insensitive.

Operations on Text

The following sections describe text operations that examine text.

Be aware of the following conditions for any text-based operation:

- For any operation that takes a string argument, the string cannot exceed 255 characters.
- You can include white space when you specify a string in an expression.

Basic Operations on Text

The following table lists basic operations on text.

Basic Operations on Text

Basic Text Operation	Description
`text``.CONTAINS("`*`string`*`")`	Returns a Boolean TRUE value if the target contains *string*. Following is an example: `http.req.url.contains(".jpeg")`

Basic Operations on Text

Basic Text Operation	Description
`text.EQ("string")`	Returns a Boolean TRUE value if the target is an exact match with *string*. For example, the following expression returns a Boolean TRUE for a URL with a host name of "myhostabc": `http.req.url.hostname.eq("myhostabc")`
`text.STARTSWITH("string")`	Returns a Boolean TRUE value if the target begins with *string*. For example, the following expression returns a Boolean TRUE for a URL with a host name of "myhostabc": `http.req.url.hostname.startswith("myhost")`
`text.ENDSWITH("string")`	Returns a Boolean TRUE value if the target ends with *string*. For example, the following expression returns a Boolean TRUE for a URL with a host name of "myhostabc": `http.req.url.hostname.endswith("abc")`

Operations for Calculating the Length of a String

The following operation returns a numeric value that shows the number of characters (not bytes) of a string:

```
text.LENGTH
```

For example, you may want to identify request URLs that exceed a particular length. Following is the expression that implements this example:

```
HTTP.REQ.URL.LENGTH < 500
```

After taking a count of the characters or elements in a string, you can apply numeric operations to them. For more information, see "Advanced Expressions: Working with Dates, Times, and Numbers," on page 95.

Operations for Controlling Case Sensitivity

The following operation turns case sensitivity on or off for an expression.

Operations on Case Sensitivity of Text

Case Operation	Description
`text.SET_TEXT_MODE(IGNORECASE|NOIGNORECASE)`	This operation turns case sensitivity on or off for all text operations.

Operations on Case Sensitivity of Text

Case Operation	**Description**
`text.TO_LOWER`	Converts the target to lowercase. For example, the string "ABCd:" is converted to "abcd:".
`text.TO_UPPER`	Converts the target to uppercase. For example, the string "abcD:" is converted to "ABCD:".

Complex Operations on Text

In addition to performing simple string matching, you can configure expressions that examine more complex aspects of text, including examining the length of a string and looking within a text block for patterns rather than specific strings.

Be aware of the following for any text-based operation:

- For any operation that takes a string argument, the string cannot exceed 255 characters.
- You can include white space when you specify a string in an expression.

Operations on the Length of a String

The following operations extract strings based on a character count.

Operations on Strings Based on a Character Count

Character Count Operation	**Description**
`text.TRUNCATE(count)`	Returns a string after truncating the end of the target by the number of characters in *count*. If the entire string is shorter than *count*, nothing is returned.
`text.TRUNCATE(character, count)`	Returns a string after truncating the text after *character* by the number of characters specified in *count*.
`text.PREFIX(character, count)`	Selects the longest prefix in the target that has at most *count* occurrences of *character.*

Operations on Strings Based on a Character Count

Character Count Operation	**Description**

`text.SUFFIX(character, count)`	Selects the longest suffix in the target that has at most *count* occurrences of *character*.
	For example, consider the following response body:
	`JLEwx`
	The following expression returns a value of "JLEwx":
	`http.res.body(100).suffix('L',1)`
	The following expression returns "LLEwx":
	`http.res.body(100).suffix('L',2)`

`text.SUBSTR(starting_ offset, length)`	Select a string with *length* number of characters from the target object. Begin extracting the string after the *starting_offset*. If the number of characters after the offset are fewer than the value of the *length* argument, select all the remaining characters.
`text.SKIP(character, count)`	Select a string from the target after skipping over the longest prefix that has at most *count* occurrences of *character*.

Operations on a Portion of a String

You can extract a subset of a larger string using one of the operations in the following table.

Basic Operations on a Portion of a String

Basic Text Operation	**Description**
`text.BEFORE_ STR("string")`	Returns the text that precedes the first occurrence of *string*. If there is no match for *string*, the expression returns a text object of 0 length. Following is an example: `http.res.body(1024).after_str("start_ string").before_str("end_string"). contains("https")`
`text.AFTER_ STR("string")`	Returns the text that follows the first occurrence of *string*. If there is no match for *string*, the expression returns a text object of 0 length. Following is an example: `http.res.body(1024).after_str("start_ string").before_str("end_string"). contains("https")`

Basic Operations on a Portion of a String

Basic Text Operation	**Description**
`text.BETWEEN("starting string", "ending string")`	Returns a Boolean TRUE value if the length of the text object is greater than or equal to the sum *starting string*, *ending string* argument lengths, and if a prefix of the target matches *starting string*, and if the suffix of the target matches *ending string*.
`text.PREFIX(prefix length)`	Returns the starting string from a target block of text that contains the number of characters in the *length* argument. If the *prefix length* argument exceeds the number of characters in the target, the entire string is selected.
`text.SUFFIX(suffix length)`	Returns the ending string from a target block of text that contains the number of characters in the *length* argument. If the *suffix length* argument exceeds the number characters in the target, the entire string is selected.
`text.SUBSTR("string")`	Select the first block of text in the target that matches the *string*.
`text.SKIP(prefix length)`	Selects the text in the target after skipping over a *prefix length* number of characters. If the entire target has fewer characters than *prefix length*, the entire target is skipped.
`text.STRIP_END_WS`	Selects the text after removing white space from the end of the target.
`text.STRIP_START_WS`	Selects the text after removing white space from the beginning of the target.

`text.UNQUOTE(character)`	Selects the *character*, removes white space that immediately precedes and follows the *character*, and if the remaining text is quoted by *character*, this prefix also removes the quotes.
	
	For example, the operation UNQUOTE("") changes the following text:
	
	`"abc xyz def "`
	
	To the following:
	
	`abc xyz def`

Operations for Comparing the Alphanumeric Order of Two Strings

The COMPARE operation examines the first non-matching character of two different strings. This operation is based on lexicographic order, which is the method used when ordering terms in dictionaries.

This operation returns the arithmetic difference between the ASCII values of the first non-matching characters in the compared strings. The following differences are examples:

- The difference between “abc” and “abd” is -1 (based on the third pair-wise character comparison).
- The difference between “@” and “abc” is -33.
- The difference between “1” and “abc” is -47.

The following is the syntax for the COMPARE operation.

```
text.COMPARE("string")
```

Extracting the *n*th Integer from a String of Bytes that Represent Text

You can use the following operators to treat a string of bytes that represent text as a sequence of 8-bit, 16-bit, or 32-bit signed or unsigned integers, and then extract the *n*th integer from the sequence.

Operations for Extracting the nth Integer from a String of Bytes that Represent Text

Operation	Description
`text.GET_SIGNED16(n, endianness)`	Treats the string of bytes represented by text as a sequence of 16-bit signed integers and returns the *n*th integer. The second argument takes a value of 0 for little endian or 1 for big endian.
`text.GET_SIGNED32(n, endianness)`	Treats the string of bytes represented by text as a sequence of 32-bit signed integers and returns the *n*th integer. The second argument takes a value of 0 for little endian or 1 for big endian.
`text.GET_SIGNED8(n)`	Treats the string of bytes represented by text as a sequence of 8-bit signed integers and returns the *n*th integer.
`text.GET_UNSIGNED16(n, endianness)`	Treats the string of bytes represented by text as a sequence of 16-bit unsigned integers and returns the *n*th integer. The second argument takes a value of 0 for little endian or 1 for big endian.
`text.GET_UNSIGNED8(n)`	Treats the string of bytes represented by text as a sequence of 8-bit unsigned integers and returns the *n*th integer.

Converting Text to a Hash Value

You can convert a text string to a hash value by using the .HASH operator. This operator returns a 31-bit positive integer as a result of the operation. Following is the format of the expression:

text.HASH

This operator ignores case and white spaces. For example, after the operation, the two strings "Ab c" and "a bc" would produce the same hash value.

Encoding and Decoding Text by Applying the Base64 Encoding Algorithm

The following two operators encode and decode a text string by applying the Base64 encoding algorithm:

Operators for Encoding and Decoding a Text String by Using Base64 Encoding

Operator	**Description**
text.B64ENCODE	Encodes the text string (designated by *text)* by applying the Base64 encoding algorithm.
text.B64DECODE	Decodes the Base64-encoded string (designated by *text)* by applying the Base64 decoding algorithm. The operation raises an UNDEF if *text* is not in B64-encoded format.

Refining the Search in a Rewrite Action by Using the EXTEND Operator

The EXTEND operator is used in rewrite actions that specify patterns or pattern sets and target the bodies of HTTP packets. When a pattern match is found, the EXTEND operator extends the scope of the search by a predefined number of bytes on both sides of the matching string. A regular expression can then be used to perform a rewrite on matches in this extended region. Rewrite actions that are configured with the EXTEND operator perform rewrites faster than rewrite actions that evaluate entire HTTP bodies using only regular expressions.

The format of the EXTEND operator is EXTEND(*m*,*n*), where *m* and *n* are the number of bytes by which the scope of the search is extended before and after the matching pattern, respectively. When a match is found, the new search scope comprises *m* bytes that immediately precede the matching string, the string itself, and the *n* bytes that follow the string. A regular expression can then be used to perform a rewrite on a portion of this new string.

The EXTEND operator can be used only if the rewrite action in which it is used fulfills the following requirements:

- The search is performed by using patterns or patterns sets (not regular expressions)
- The rewrite action evaluates only the bodies of HTTP packets.

Additionally, the EXTEND operator can be used only with the following types of rewrite actions:

- replace_all
- insert_after_all

- delete_all
- insert_before_all

For example, you might want to delete all instances of "http://exampleurl.com/" and "http://exampleurl.au/" in the first 1000 bytes of the body. To do this, you can configure a rewrite action to search for all instances of the string "exampleurl," extend the scope of the search on both sides of the string when a match is found, and then use a regular expression to perform the rewrite in the extended region. The following example extends the scope of the search by 20 bytes to the left and 50 bytes to the right of the matching string:

```
add rewrite action delurl_example delete_all 'HTTP.REQ.
BODY(1000)' -pattern exampleurl -refineSearch 'extend(20,50).
regex_select(re#http://exampleurl.(com|au)#)'
```

Converting Text to Hexadecimal Format

The following operator converts text to hexadecimal format and extracts the resulting string:

```
text.BLOB_TO_HEX("string")
```

For example, this operator converts the byte string “abc” to “61:62:63”.

CHAPTER 5

Advanced Expressions: Working with Dates, Times, and Numbers

Most numeric data that the NetScaler processes consists of dates and times. However, advanced expressions also work with other numeric data, for example, the lengths of HTTP requests and responses.

You can configure advanced expressions to evaluate and to perform operations on dates, times, and other numeric data. For example, you can configure an expression to perform the following:

- Extract an expiration date and time from an SSL certificate, and determine if it falls within a specified range.
- Extract the NetScaler system time.
- Extract other numeric data points, for example, a status code or a version number.
- Extract a full IP address or MAC address, or a subset of one.
- Add the lengths of two strings.

This chapter concentrates on date and time data, and a few other types of non-date-related numeric data.

In This Chapter

Format of Dates and Times in an Expression

Dates and Times in a Rewrite Action

Expressions for the NetScaler System Time

Expressions for SSL Certificate Dates

Expressions for HTTP Request and Response Dates

Expression Prefixes for Numeric Data Other Than Date and Time

Note: Numeric operations are also covered in "Compound Operations for Numbers," on page 48 and "Advanced Expressions: Parsing HTTP, TCP, and UDP Data," on page 113.

Format of Dates and Times in an Expression

When configuring an advanced expression in a policy that works with dates and times, for example, the NetScaler system time or a date in an SSL certificate, you specify a time format as follows:

```
GMT|LOCAL [yyyy] [month] [d] [h] [m] [s]
```

Where:

- `yyyy` is a four-digit year after `GMT` or `LOCAL`.
- `month` is a three-character abbreviation for the month, for example, `Jan`, `Dec`.
- `d` is a day of the week or an integer for the date.

  You cannot specify the day as Monday, Tuesday, and so on. You specify either an integer for a specific day of the month, or you specify a date as the first, second, third weekday of the month, and so on. Following are examples of specifying a day of the week:

  - `Sun_1` is the first Sunday of the month.
  - `Sun_3` is the third Sunday of the month.
  - `Wed_3` is the third Wednesday of the month.
  - `30` is an example of an exact date in a month.
- `h` is the hour, for example, 10h.
- `s` is the number of seconds, for example, `30`s.

The following example expression is TRUE if the time is between10:00 a.m. and 5:30 p.m. local time, as determined from the time zone setting on the NetScaler. (Note that not all local time zones are supported.):

```
http.req.date.between(GMT 2008 Jan, GMT 2009 Jan)
```

The following example expression is TRUE for March and all months that follow March in the calendar year, based on GMT time:

```
sys.time.ge(GMT 2008 Mar)
```

When you specify a date and time, note that the format is case sensitive and must preserve the exact number of blank spaces between entries.

Note: In an expression that requires two time values, both must use `GMT` or both must use `LOCAL`. You cannot mix the two in an expression.

Dates and Times in a Rewrite Action

Unlike using the `SYS.TIME` prefix in an advanced policy expression, if you specify `SYS.TIME` in a rewrite action, the NetScaler returns a string in conventional date format (for example, Sun, 06 Nov 1994 08:49:37 GMT). For example, the following rewrite action replaces the `http.res.date` header with the NetScaler system time using a conventional date format:

```
add rewrite action sync_date replace http.res.date sys.time
```

Expressions for the NetScaler System Time

The `SYS.TIME` expression prefix extracts the Netscaler system time. You can configure expressions that establish whether a particular event occurred at a particular time or within a particular time range according to the NetScaler system time.

The following table describes the available expressions that you can configure using the `SYS.TIME` prefix and its associated operations.

Expressions that Return NetScaler System Dates and Times

NetScaler Time Operation	**Description**
`SYS.TIME.BETWEEN(`*`time1, time2`*`)`	Returns a Boolean TRUE if the returned value is later than *`time1`* and earlier than *`time2`*. You format the *time1*, *time2* arguments as follows: • They must both be GMT or both LOCAL. • *Time2* must be later than *time1*. For example, if the current time is GMT 2005 May 1 10h 15m 30s, and it is the first Sunday of the month, you can specify the following: • `sys.time.between(GMT 2004, GMT 2006)` • `sys.time.between(GMT 2004 Jan, GMT 2006 Nov)` • `sys.time.between(GMT 2004 Jan, GMT 2006)` • `sys.time.between(GMT 2005 May Sun_1, GMT 2005 May Sun_3)` • `sys.time.between(GMT 2005 May 1, GMT May 2005 1)` • `sys.time.between(LOCAL 2005 May 1, LOCAL May 2005 1)`
`SYS.TIME.DAY`	Returns the current day of the month as a number from 1 through 31.
`SYS.TIME.EQ(`*`time`*`)`	Returns a Boolean TRUE if the current time is equal to the *time* argument. For example, if the current time is GMT 2005 May 1 10h 15m 30s, and it is the first Sunday of the month, you can specify the following (evaluation results are shown in parentheses): • `sys.time.eq(GMT 2005)` (TRUE in this example.) • `sys.time.eq(GMT 2005 Dec)` (FALSE in this example.) • `sys.time.eq(LOCAL 2005 May)` (Evaluates to TRUE or FALSE in this example, depending on the current time zone.) • `sys.time.eq(GMT 10h)` (TRUE in this example.) • `sys.time.eq(GMT 10h 30s)` (TRUE in this example.) • `sys.time.eq(GMT May 10h)` (TRUE in this example.) • `sys.time.eq(GMT Sun)` (TRUE in this example.) • `sys.time.eq(GMT May Sun_1)` (TRUE in this example.)

Expressions that Return NetScaler System Dates and Times

NetScaler Time Operation	**Description**
`SYS.TIME.GE(`*`time`*`)`	Returns a Boolean TRUE if the current time is later than or equal to *time*. For example, if the current time is GMT 2005 May 1 10h 15m 30s, and it is the first Sunday of the month, you can specify the following (evaluation results are shown in parentheses): • `sys.time.ge(GMT 2004)` (TRUE in this example.) • `sys.time.ge(GMT 2005 Jan)` (TRUE in this example.) • `sys.time.ge(LOCAL 2005 May)` (TRUE or FALSE in this example, depending on the current time zone.) • `sys.time.ge(GMT 8h)` (TRUE in this example.) • `sys.time.ge(GMT 30m)` (FALSE in this example.) • `sys.time.ge(GMT May 10h)` (TRUE in this example.) • `sys.time.ge(GMT May 10h 0m)` (TRUE in this example.) • `sys.time.ge(GMT Sun)` (TRUE in this example.) • `sys.time.ge(GMT May Sun_1)` (TRUE in this example.)
`SYS.TIME.GT(`*`time`*`)`	Returns a Boolean TRUE if the time value is later than the *time* argument. For example, if the current time is GMT 2005 May 1 10h 15m 30s, and it is the first Sunday of the month, you can specify the following (evaluation results are shown in parentheses): • `sys.time.gt(GMT 2004)` (TRUE in this example.) • `sys.time.gt(GMT 2005 Jan)` (TRUE in this example.) • `sys.time.gt(LOCAL 2005 May)` (TRUE or FALSE, depending on the current time zone.) • `sys.time.gt(GMT 8h)` (TRUE in this example.) • `sys.time.gt(GMT 30m)` (FALSE in this example.) • `sys.time.gt(GMT May 10h)` (FALSE in this example.) • `sys.time.gt(GMT May 10h 0m)` (TRUE in this example.) • `sys.time.gt(GMT Sun)` (FALSE in this example.) • `sys.time.gt(GMT May Sun_1)` (FALSE in this example.)
`SYS.TIME.HOURS`	Returns the current hour as an integer from 0 to 23.

Expressions that Return NetScaler System Dates and Times

NetScaler Time Operation	**Description**
`SYS.TIME.LE(`*`time`*`)`	Returns a Boolean TRUE if the current time value precedes or is equal to the *time* argument. For example, if the current time is GMT 2005 May 1 10h 15m 30s, and it is the first Sunday of the month, you can specify the following (evaluation results are shown in parentheses): • `sys.time.le(GMT 2006)` (TRUE in this example.) • `sys.time.le(GMT 2005 Dec)` (TRUE in this example.) • `sys.time.le(LOCAL 2005 May)` (TRUE or FALSE depending on the current timezone.) • `sys.time.le(GMT 8h)` (FALSE in this example.) • `sys.time.le(GMT 30m)` (TRUE in this example.) • `sys.time.le(GMT May 10h)` (TRUE in this example.) • `sys.time.le(GMT Jun 11h)` (TRUE in this example.) • `sys.time.le(GMT Wed)` (TRUE in this example.) • `sys.time.le(GMT May Sun_1)` (TRUE in this example.)
`SYS.TIME.LT(`*`time`*`)`	Returns a Boolean TRUE if the current time value precedes the *time* argument. For example, if the current time is GMT 2005 May 1 10h 15m 30s, and it is the first Sunday of the month, you can specify the following (evaluation results are shown in parentheses): • `sys.time.lt(GMT 2006)` (TRUE in this example.) • `sys.time.lt.time.lt(GMT 2005 Dec)` (TRUE in this example.) • `sys.time.lt(LOCAL 2005 May)` (TRUE or FALSE depending on the current time zone.) • `sys.time.lt(GMT 8h)` (FALSE in this example.) • `sys.time.lt(GMT 30m)` (TRUE in this example.) • `sys.time.lt(GMT May 10h)` (FALSE in this example.) • `sys.time.lt(GMT Jun 11h)` (TRUE in this example.) • `sys.time.lt(GMT Wed)` (TRUE in this example.) • `sys.time.lt(GMT May Sun_1)` (FALSE in this example.)
`SYS.TIME.MINUTES`	Returns the current minute as an integer from 0 to 59.
`SYS.TIME.MONTH`	Extracts the current month and returns an integer from 1 (January) to 12 (December).
`SYS.TIME.RELATIVE_BOOT`	Calculates the number of seconds to the closest previous or scheduled reboot, and returns an integer. If the closest boot time is in the past, the integer is negative. If it is in the future, the integer is positive.

Expressions that Return NetScaler System Dates and Times

NetScaler Time Operation	Description
`SYS.TIME. RELATIVE_NOW`	Calculates the number of seconds between the current NetScaler system time and the specified time, and returns an integer showing the difference. If the designated time is in the past, the integer is negative; if it is in the future, the integer is positive.
`SYS.TIME.SECONDS`	Extracts the seconds from the current NetScaler system time, and returns that value as an integer from 0 to 59.
`SYS.TIME.WEEKDAY`	Returns the current weekday as a value from 0 (Sunday) to 6 (Saturday).
`SYS.TIME.WITHIN` (*`time1, time2`*)	Returns a Boolean TRUE if all time elements (day, hour, and so on) exist within the range defined by *`time1, time2`*. If you omit an element of time in *time1*, for example, the day or hour, it is assumed to have the lowest value in its range. If you omit an element in *time2*, it is assumed to have the highest value of its range. The ranges for the elements of time are as follows: month 1-12, day 1-31, weekday 0-6, hour 0-23, minutes 0-59 and seconds 0-59. If you specify the year, you must do so in both *time1* and *time2*. For example, if the time is GMT 2005 May 10 10h 15m 30s, and it is the second Tuesday of the month, you can specify the following (evaluation results are shown in parentheses): • `sys.time.within(GMT 2004, GMT 2006)` (TRUE in this example.) • `sys.time.within(GMT 2004 Jan, GMT 2006 Mar)` (FALSE, May is not in the range of January to March.) • `sys.time.within(GMT Feb, GMT)` (TRUE, May is in the range of February to December.) • `sys.time.within(GMT Sun_1, GMT Sun_3)` (TRUE, the second Tuesday is between the first Sunday and the third Sunday.) • `sys.time.within(GMT 2005 May 1 10h, GMT May 2005 1 17h)` (TRUE in this example.) • `sys.time.within(LOCAL 2005 May 1, LOCAL May 2005 1)` (TRUE or FALSE, depending on the NetScaler system time zone.)
`SYS.TIME.YEAR`	Extracts the year from the current system time and returns that value as a four-digit integer.

Expressions for SSL Certificate Dates

You can determine the validity period for SSL certificates by configuring an expression that contains the following prefix:

```
CLIENT.SSL.CLIENT_CERT
```

The following example expression matches a particular time for expiration with the information in the certificate:

```
client.ssl.client_cert.valid_not_after.eq(GMT 2009)
```

The following table describes time-based operations on SSL certificates.

Operations on Certificate (client.ssl.client_cert) Dates and Times

SSL Certificate Operation	Description
`*certificate*.VALID_NOT_AFTER`	Returns the last day before certificate expiration. The return format is the number of seconds since GMT January 1, 1970 (0 hours, 0 minutes, 0 seconds).
`*certificate*.VALID_NOT_AFTER.BETWEEN(*time1, time2*)`	Returns a Boolean TRUE value if the certificate validity is between the *time1* and *time2* arguments. Both *time1* and *time2* must be fully specified. Following are examples: • GMT 1995 Jan is fully specified. • GMT Jan is not fully specified • GMT 1995 20 is not fully specified. • GMT Jan Mon_2 is not fully specified. The *time1* and *time2* arguments must be both GMT or both LOCAL, and *time2* must be bigger than *time1*. For example, if it is GMT 2005 May 1 10h 15m 30s, and the first Sunday of the month, you can specify the following (evaluation results are in parentheses). • `. . .between(GMT 2004, GMT 2006)` (TRUE) • `. . .between(GMT 2004 Jan, GMT 2006 Nov)` (TRUE) • `. . .between(GMT 2004 Jan, GMT 2006)` (TRUE) • `. . .between(GMT 2005 May Sun_1, GMT 2005 May Sun_3)` (TRUE) • `. . .between(GMT 2005 May 1, GMT May 2005 1)` (TRUE) • `. . .between(LOCAL 2005 May 1, LOCAL May 2005 1)` (TRUE or FALSE, depending on the NetScaler system time zone.)
`*certificate*.VALID_NOT_AFTER.DAY`	Extracts the last day of the month that the certificate is valid, and returns a number from 1 through 31, as appropriate for the date.

Operations on Certificate (client.ssl.client_cert) Dates and Times

SSL Certificate Operation	**Description**
`certificate.` `VALID_NOT_AFTER.` `EQ(time)`	Returns a Boolean TRUE if the time is equal to the *time* argument. For example, if the current time is GMT 2005 May 1 10h 15m 30s, and it is the first Sunday of the month, you can specify the following (evaluation results for this example are in parentheses): • `. . .eq(GMT 2005)` (TRUE) • `. . .eq(GMT 2005 Dec)` (FALSE) • `. . .eq(LOCAL 2005 May)` (TRUE or FALSE, depending on the current time zone) • `. . .eq(GMT 10h)` (TRUE) • `. . .eq(GMT 10h 30s)` (TRUE) • `. . .eq(GMT May 10h)` (TRUE) • `. . .eq(GMT Sun)` (TRUE) • `. . .eq(GMT May Sun_1)` (TRUE)
`certificate.` `VALID_NOT_AFTER.` `GE(time)`	Returns a Boolean TRUE if the time value is greater than or equal to the argument time. For example, if the time value is GMT 2005 May 1 10h 15m 30s, and it is the first Sunday of the month of May in 2005, you can specify the following (evaluation results for this example are in parentheses): • `. . .ge(GMT 2004)` (TRUE) • `. . .ge(GMT 2005 Jan)` (TRUE) • `. . .ge(LOCAL 2005 May)` (TRUE or FALSE, depending on the current time zone.) • `. . .ge(GMT 8h)` (TRUE) • `. . .ge(GMT 30m)` (FALSE) • `. . .ge(GMT May 10h)` (TRUE) • `. . .ge(GMT May 10h 0m)` (TRUE) • `. . .ge(GMT Sun)` (TRUE) • `. . .ge(GMT May Sun_1)` (TRUE)
`certificate.` `VALID_NOT_AFTER.` `GT(time)`	Returns a Boolean TRUE if the time value is greater than the argument time. For example, if the time value is GMT 2005 May 1 10h 15m 30s, and it is the first Sunday of the month of May in 2005, you can specify the following (evaluation results for this example are in parentheses): • `. . .gt(GMT 2004)` (TRUE) • `. . .gt(GMT 2005 Jan)` (TRUE) • `. . .gt(LOCAL 2005 May)` (TRUE or FALSE, depending on the current time zone.) • `. . .gt(GMT 8h)` (TRUE) • `. . .gt(GMT 30m)` (FALSE) • `. . .gt(GMT May 10h)` (FALSE) • `. . .gt(GMT Sun)` (FALSE) • `. . .gt(GMT May Sun_1)` (FALSE)

Operations on Certificate (client.ssl.client_cert) Dates and Times

SSL Certificate Operation	Description
`*certificate*. VALID_NOT_AFTER.HOURS`	Extracts the last hour that the certificate is valid and returns that value as an integer from 0 to 23.
`*certificate*. VALID_NOT_AFTER. LE(*time*)`	Returns a Boolean TRUE if the time precedes or is equal to the `*time*` argument. For example, if the time value is GMT 2005 May 1 10h 15m 30s, and it is the first Sunday of the month of May in 2005, you can specify the following (evaluation results for this example are in parentheses): • `. . .le(GMT 2006)` (TRUE) • `. . .le(GMT 2005 Dec)` (TRUE) • `. . .le(LOCAL 2005 May)` (TRUE or FALSE, depending on the current time zone.) • `. . .le(GMT 8h)` (FALSE) • `. . .le(GMT 30m)` (TRUE) • `. . .le(GMT May 10h)` (TRUE) • `. . .le(GMT Jun 11h)` (TRUE) • `. . .le(GMT Wed)` (TRUE) • `. . .le(GMT May Sun_1)` (TRUE)
`*certificate*. VALID_NOT_AFTER. LT(*time*)`	Returns a Boolean TRUE if the time precedes the *time* argument. For example, if the current time is GMT 2005 May 1 10h 15m 30s, and it is the first Sunday of the month, you can specify the following: • `. . .lt(GMT 2006)` (TRUE) • `. . .lt(GMT 2005 Dec)` (TRUE) • `. . .lt(LOCAL 2005 May)` (TRUE or FALSE, depending on the current time zone.) • `. . .lt(GMT 8h)` (FALSE) • `. . .lt(GMT 30m)` (TRUE) • `. . .lt(GMT May 10h)` (FALSE) • `. . .lt(GMT Jun 11h)` (TRUE) • `. . .lt(GMT Wed)` (TRUE) • `. . .lt(GMT May Sun_1)` (FALSE)
`*certificate*. VALID_NOT_AFTER.MINUTES`	Extracts the last minute that the certificate is valid and returns that value as an integer from 0 to 59.
`*certificate*. VALID_NOT_AFTER.MONTH`	Extracts the last month that the certificate is valid and returns that value as an integer from 1 (January) to 12 (December).
`*certificate*. VALID_NOT_AFTER. RELATIVE_BOOT`	Calculates the number of seconds to the closest previous or scheduled reboot and returns an integer. If the closest boot time is in the past, the integer is negative. If it is in the future, the integer is positive.

Operations on Certificate (client.ssl.client_cert) Dates and Times

SSL Certificate Operation	**Description**
`certificate.VALID_NOT_AFTER.RELATIVE_NOW`	Calculates the number of seconds between the current system time and the specified time and returns an integer. If the time is in the past, the integer is negative; if it is in the future, the integer is positive.
`certificate.VALID_NOT_AFTER.SECONDS`	Extracts the last second that the certificate is valid and returns that value as an integer from 0 to 59.
`certificate.VALID_NOT_AFTER.WEEKDAY`	Extracts the last weekday that the certificate is valid. Returns a number between 0 (Sunday) and 6 (Saturday) to give the weekday in the time value.
`certificate.VALID_NOT_AFTER.WITHIN(time1, time2)`	Returns a Boolean TRUE if the time lies within all the ranges defined by the elements in *time1*, *time2*. If you omit an element of time from *time1*, it is assumed to have the lowest value in its range. If you omit an element from *time2*, it is assumed to have the highest value of its range. If you specify a year in *time1*, you must specify it in *time2*. The ranges for elements of time are as follows: month 1-12, day 1-31, weekday 0-6, hour 0-23, minutes 0-59 and seconds 0-59. For the result to be TRUE, each element in the time must exist in the corresponding range that you specify in *time1*, *time2*. For example, if time is GMT 2005 May 10 10h 15m 30s, and it is the second Tuesday of the month, you can specify the following (evaluation results are in parentheses): • `. . .within(GMT 2004, GMT 2006)` (TRUE) • `. . .within(GMT 2004 Jan, GMT 2006 Mar)` (FALSE, May is not in the range of January to March.) • `. . .within(GMT Feb, GMT)` (TRUE, May is in the range for February to December) • `. . .within(GMT Sun_1, GMT Sun_3)` (TRUE, the second Tuesday lies within the range of the first Sunday through the third Sunday) • `. . .within(GMT 2005 May 1 10h, GMT May 2005 1 17h)` (TRUE) • `. . .within(LOCAL 2005 May 1, LOCAL May 2005 1)` (TRUE or FALSE, depending on the NetScaler system time zone)
`certificate.VALID_NOT_AFTER.YEAR`	Extracts the last year that the certificate is valid and returns a four-digit integer.
`certificate.VALID_NOT_BEFORE`	Returns the date that the client certificate becomes valid. The return format is the number of seconds since GMT January 1, 1970 (0 hours, 0 minutes, 0 seconds).

Operations on Certificate (client.ssl.client_cert) Dates and Times

SSL Certificate Operation	Description
`*certificate*.VALID_NOT_BEFORE.BETWEEN(*time1, time2*)`	Returns a Boolean TRUE if the time value is between the *time1, time2* arguments. Both the *time1, time2* arguments must be fully specified. Following are examples: • GMT 1995 Jan is fully specified. • GMT Jan is not fully specified. • GMT 1995 20 is not fully specified. • GMT Jan Mon_2 is not fully specified. The *time1, time2* arguments must be both GMT or both LOCAL, and *time2* must be bigger than *time1*. For example, if the time value is GMT 2005 May 1 10h 15m 30s, and it is the first Sunday of the month of May in 2005, you can specify the following (evaluation results for this example are in parentheses): • `. . .between(GMT 2004, GMT 2006)` (TRUE) • `. . .between(GMT 2004 Jan, GMT 2006 Nov)` (TRUE) • `. . .between(GMT 2004 Jan, GMT 2006)` (TRUE) • `. . .between(GMT 2005 May Sun_1, GMT 2005 May Sun_3)` (TRUE) • `. . .between(GMT 2005 May 1, GMT May 2005 1)` (TRUE) • `. . .between(LOCAL 2005 May 1, LOCAL May 2005 1)` (TRUE or FALSE, depending on the NetScaler system time zone.)
`*certificate*.VALID_NOT_BEFORE.DAY`	Extracts the last day of the month that the certificate is valid and returns that value as a number from 1 through 31 representing that day.
`*certificate*.VALID_NOT_BEFORE.EQ(*time*)`	Returns a Boolean TRUE if the time is equal to the *time* argument. For example, if the time value is GMT 2005 May 1 10h 15m 30s, and it is the first Sunday of the month of May in 2005, you can specify the following (evaluation results for this example are in parentheses): • `. . .eq(GMT 2005)` (TRUE) • `. . .eq(GMT 2005 Dec)` (FALSE) • `. . .eq(LOCAL 2005 May)` (TRUE or FALSE, depending on the current time zone.) • `. . .eq(GMT 10h)` (TRUE) • `. . .eq(GMT 10h 30s)` (TRUE) • `. . .eq(GMT May 10h)` (TRUE) • `. . .eq(GMT Sun)` (TRUE) • `. . .eq(GMT May Sun_1)` (TRUE)

Operations on Certificate (client.ssl.client_cert) Dates and Times

SSL Certificate Operation	Description
`*certificate*.VALID_NOT_BEFORE.GE(*time*)`	Returns a Boolean TRUE if the time is greater than (after) or equal to the *time* argument. For example, if the time value is GMT 2005 May 1 10h 15m 30s, and it is the first Sunday of the month of May in 2005, you can specify the following (evaluation results are in parentheses): • `. . .ge(GMT 2004)` (TRUE) • `. . .ge(GMT 2005 Jan)` (TRUE) • `. . .ge(LOCAL 2005 May)` (TRUE or FALSE, depending on the current time zone.) • `. . .ge(GMT 8h)` (TRUE) • `. . .ge(GMT 30m)` (FALSE) • `. . .ge(GMT May 10h)` (TRUE) • `. . .ge(GMT May 10h 0m)` (TRUE) • `. . .ge(GMT Sun)` (TRUE) • `. . .ge(GMT May Sun_1)` (TRUE)
`*certificate*.VALID_NOT_BEFORE.GT(*time*)`	Returns a Boolean TRUE if the time occurs after the *time* argument. For example, if the time value is GMT 2005 May 1 10h 15m 30s, and it is the first Sunday of the month of May in 2005, you can specify the following (evaluation results are in parentheses): • `. . .gt(GMT 2004)` (TRUE) • `. . .gt(GMT 2005 Jan)` (TRUE) • `. . .gt(LOCAL 2005 May)` (TRUE or FALSE, depending on the current time zone.) • `. . .gt(GMT 8h)` (TRUE) • `. . .gt(GMT 30m)` (FALSE) • `. . .gt(GMT May 10h)` (FALSE) • `. . .gt(GMT May 10h 0m)` (TRUE) • `. . .gt(GMT Sun)` (FALSE) • `. . .gt(GMT May Sun_1)` (FALSE)
`*certificate*.VALID_NOT_BEFORE.HOURS`	Extracts the last hour that the certificate is valid and returns that value as an integer from 0 to 23.

Operations on Certificate (client.ssl.client_cert) Dates and Times

SSL Certificate Operation	Description
`*certificate*.VALID_NOT_BEFORE.LE(*time*)`	Returns a Boolean TRUE if the time precedes or is equal to the *time* argument. For example, if the time value is GMT 2005 May 1 10h 15m 30s, and it is the first Sunday of the month of May in 2005, you can specify the following (evaluation results for this example are in parentheses): • `. . .le(GMT 2006)` (TRUE) • `. . .le(GMT 2005 Dec)` (TRUE) • `. . .le(LOCAL 2005 May)` (TRUE or FALSE, depending on the current time zone.) • `. . .le(GMT 8h)` (FALSE) • `. . .le(GMT 30m)` (TRUE) • `. . .le(GMT May 10h)` (TRUE) • `. . .le(GMT Jun 11h)` (TRUE) • `. . .le(GMT Wed)` (TRUE) • `. . .le(GMT May Sun_1)` (TRUE)
`*certificate*.VALID_NOT_BEFORE.LT(*time*)`	Returns a Boolean TRUE if the time precedes the *time* argument. For example, if the time value is GMT 2005 May 1 10h 15m 30s, and it is the first Sunday of the month of May in 2005, you can specify the following (evaluation results for this example are in parentheses): • `. . .lt(GMT 2006)` (TRUE) • `. . .lt(GMT 2005 Dec)` (TRUE) • `. . .lt(LOCAL 2005 May)` (TRUE or FALSE, depending on the current time zone.) • `. . .lt(GMT 8h)` (FALSE) • `. . .lt(GMT 30m)` (TRUE) • `. . .lt(GMT May 10h)` (FALSE) • `. . .lt(GMT Jun 11h)` (TRUE) • `. . .lt(GMT Wed)` (TRUE) • `. . .lt(GMT May Sun_1)` (FALSE)
`*certificate*.VALID_NOT_BEFORE.MINUTES`	Extracts the last minute that the certificate is valid. Returns the current minute as an integer from 0 to 59.
`*certificate*.VALID_NOT_BEFORE.MONTH`	Extracts the last month that the certificate is valid. Returns the current month as an integer from 1 (January) to 12 (December).
`*certificate*.VALID_NOT_BEFORE.RELATIVE_BOOT`	Calculates the number of seconds to the closest previous or scheduled NetScaler reboot and returns an integer. If the closest boot time is in the past, the integer is negative; if it is in the future, the integer is positive.
`*certificate*.VALID_NOT_BEFORE.RELATIVE_NOW`	Returns the number of seconds between the current NetScaler system time and the specified time as an integer. If the designated time is in the past, the integer is negative. If it is in the future, the integer is positive.

Operations on Certificate (client.ssl.client_cert) Dates and Times

SSL Certificate Operation	Description
`certificate.VALID_NOT_BEFORE.SECONDS`	Extracts the last second that the certificate is valid. Returns the current second as an integer from 0 to 59.
`certificate.VALID_NOT_BEFORE.WEEKDAY`	Extracts the last weekday that the certificate is valid. Returns the weekday as a number between 0 (Sunday) and 6 (Saturday).
`certificate.VALID_NOT_BEFORE.WITHIN(time1, time2)`	Returns a Boolean TRUE if each element of time exists within the range defined in the *time1*, *time2* arguments. If you omit an element of time from *time1*, it is assumed to have the lowest value in its range. If you omit an element of time from *time2*, it is assumed to have the highest value in its range. If you specify a year in *time1*, it must be specified in *time2*. The ranges for elements of time are as follows: month 1-12, day 1-31, weekday 0-6, hour 0-23, minutes 0-59 and seconds 0-59. For example, if the time is GMT 2005 May 10 10h 15m 30s, and it is the second Tuesday of the month, you can specify the following (evaluation results are in parentheses): • `. . .within(GMT 2004, GMT 2006)` (TRUE) • `. . .within(GMT 2004 Jan, GMT 2006 Mar)` (FALSE, May is not in the range of January to March.) • `. . .within(GMT Feb, GMT)` (TRUE, May is in the range of February to December.) • `. . .within(GMT Sun_1, GMT Sun_3)` (TRUE, the second Tuesday is between the first Sunday and the third Sunday.) • `. . .within(GMT 2005 May 1 10h, GMT May 2005 1 17h)` (TRUE) • `. . .within(LOCAL 2005 May 1, LOCAL May 2005 1)` (TRUE or FALSE, depending on the NetScaler system time zone)
`certificate.VALID_NOT_BEFORE.YEAR`	Extracts the last year that the certificate is valid. Returns the current year as a four-digit integer.

Expressions for HTTP Request and Response Dates

The following expression prefixes return the contents of the HTTP Date header as text or as a date object.

Prefixes That Evaluate HTTP Date Headers

Prefix	**Description**
`HTTP.REQ.DATE`	Returns the contents of the HTTP Date header as text or as a date object.The date formats recognized are: RFC822. Sun, 06 Jan 1980 08:49:37 GMT RFC850. Sunday, 06-Jan-80 09:49:37 GMT ASCTIME. Sun Jan 6 08:49:37 1980
`HTTP.RES.DATE`	Returns the contents of the HTTP Date header as text or as a date object.The date formats recognized are: RFC822. Sun, 06 Jan 1980 8:49:37 GMT RFC850. Sunday, 06-Jan-80 9:49:37 GMT ASCTIME. Sun Jan 6 08:49:37 1980

These values can be evaluated as follows:

- **As a number.** The numeric value of an HTTP Date header is returned in the form of the number of seconds since Jan 1 1970.

  For example, the expression `http.req.date.mod(86400)` returns the number of seconds since the beginning of the day. These values can be evaluated using the same operations as other non-date-related numeric data. For more information, see "Expression Prefixes for Numeric Data Other Than Date and Time," on page 111.

- **As an HTTP header.** Date headers can be evaluated using the same operations as other HTTP headers.

  For more information, see "Advanced Expressions: Parsing HTTP, TCP, and UDP Data," on page 113.

- **As text.** Date headers can be evaluated using the same operations as other strings.

  For more information, see "Advanced Expressions: Evaluating Text," on page 63.

Expression Prefixes for Numeric Data Other Than Date and Time

In addition to expressions that operate on time, you can configure expressions for the following types of numeric data:

- The length of HTTP requests, the number of HTTP headers in a request, and so on.

  For more information, see "Expressions for Numeric HTTP Payload Data Other Than Dates," on page 130.

- IP and MAC addresses.

  For more information, see "Expressions for IP Addresses and IP Subnets," on page 149.

- Client and server data in regard to interface IDs and transaction throughput rate.

  For more information, see "Expressions for Numeric Client and Server Data," on page 155.

- Numeric data in client certificates other than dates.

  For information on these prefixes, including the number of days until certificate expiration and the encryption key size, see "Prefixes for Numeric Data in SSL Certificates," on page 143.

Advanced Expressions: Parsing HTTP, TCP, and UDP Data

You can configure advanced expressions to parse the payload for HTTP requests and responses, including headers and body content. For example, you can ensure that an HTTP request or response contains a header of a particular type, or you can extract a particular segment from a URL path. You can also configure expressions to transform the URL encoding and apply HTML or XML “safe” coding for subsequent evaluation.

Similarly, you can analyze the payload in a TCP or UDP packet using an advanced expression. For example, you can extract the source or destination port and evaluate DNS record types.

In This Chapter

About Evaluating HTTP and TCP Payload

Expressions for HTTP Headers

Expressions for Extracting Segments of URLs

Expressions for Numeric HTTP Payload Data Other Than Dates

Operations for HTTP, HTML, and XML Encoding and “Safe” Characters

Expressions for TCP, UDP, and VLAN Data

XPath and JSON Expressions

Note: You can also use text-based and numeric advanced expressions to evaluate HTTP request and response data. For more information, see “Advanced Expressions: Evaluating Text,” on page 63 and “Advanced Expressions: Working with Dates, Times, and Numbers,” on page 95.

About Evaluating HTTP and TCP Payload

The payload of an HTTP request or response consists of header fields, URLs, the body content, the version, status, and so on. For example, the following expression performs a simple matching operation on an HTTP request to determine if it contains a header named “myHeader”:

```
http.req.header("myHeader").exists
```

The following example compound expression evaluates HTTP headers. You could use the following expression in various NetScaler features, such as Integrated Caching, Rewrite, and Responder:

```
(http.req.header("Content-Type").exists &&  http.req.
header("Content-Type").eq("text/html")) || (http.req.
header("Transfer-Encoding").exists) || (http.req.
header("Content-Length").exists)
```

The payload of a TCP or UDP packet is the data portion of the packet. You can configure advanced expressions to examine features of a TCP or UDP packet, including the following:

- Source and destination domains
- Source and destination ports
- The text in the payload
- Record types

About Evaluating the Payload Body

There are three expression prefixes that extract text from the body of the payload, as follows:

- **`HTTP.REQ.BODY(`*`integer`*`).`** Returns the body of an HTTP request as a multiline text object, up to the character position designated in the *integer* argument. If there are fewer characters in the body than is specified in the argument, the entire body is returned.
- **`HTTP.RES.BODY(`*`integer`*`).`** Returns a portion of the HTTP response body. The length of the returned text is equal to the number in the integer argument. If there are fewer characters in the body than is specified in integer, the entire body is returned.
- **`CLIENT.TCP.PAYLOAD(`*`integer`*`).`** Returns TCP payload data as a string, starting with the first character in the payload and continuing for the number of characters in the *integer* argument.

Following is an example that evaluates to TRUE if a response body of 1024 bytes contains the string “https”, and this string occurs after the string “start string” and before the string “end string”:

```
http.res.body(1024).after_str("start_string").before_str("end_
string").contains("https")
```

Note: You can apply any text operation to the payload body. For information on operations that you can apply to text, see “Advanced Expressions: Evaluating Text,” on page 63.

Expressions for HTTP Headers

One common method of evaluating HTTP traffic is to examine the headers in a request or a response. A header can perform a number of functions, including the following:

- Provide cookies that contain data about the sender.
- Identify the type of data that is being transmitted.
- Identify the route that the data has traveled (the Via header).

As noted in the section “About Evaluating HTTP and TCP Payload,” on page 114, the `EXISTS` operation identifies if a request or a response contains a particular object. Following is a request-time example that determines if a particular header type exists:

```
http.req.header("myHeader").exists
```

You can configure expressions to identify almost any data in a header, including header types and values, and almost any type of information in a Cookie header.

Note: Note that if the same operation is used to evaluate header and text data, the header-based operation always overrides any text-based operation.

Prefixes for HTTP Headers

The following table describes expression prefixes that extract HTTP headers.

Prefixes That Extract HTTP Headers

HTTP Header Prefix	**Description**
`HTTP.REQ.HEADER("`*`header_name`*`")`	Returns the contents of the HTTP header specified by the *header_name* argument. The header name cannot exceed 32 characters. Note that this prefix returns the value from the Host header by default. To use this value as a host name you need to typecast it as follows: `http.req.header("host").typecast_ http_hostname_t` For more information on typecasting, see "Transforming Text and Numbers into Different Data Types," on page 169.
`HTTP.REQ.FULL_HEADER("`*`header_ name`*`")`	Returns the contents of the HTTP header specified by the *header_name* argument, including the terminating `\r\n\r\n`. The header name cannot exceed 32 characters.
`HTTP.REQ.DATE`	Returns the contents of the HTTP Date header.The following date formats are recognized: RFC822. Sun, 06 Jan 1980 8:49:37 GMT RFC850. Sunday, 06-Jan-80 9:49:37 GMT ASCII TIME. Sun Jan 6 08:49:37 1980 To evaluate a Date header as a date object, see "Advanced Expressions: Working with Dates, Times, and Numbers," on page 95.
`HTTP.REQ.COOKIE`	(Name/Value List) Returns the contents of the HTTP Cookie header.
`HTTP.REQ.TXID`	Returns the HTTP transaction ID. The value is a function of an internal transaction number, system boot time and system MAC address.
`HTTP.RES.HEADER("`*`header_name`*`")`	Returns the contents of the HTTP header specified by the *header_name* argument. The header name cannot exceed 32 characters.
`HTTP.RES.FULL_HEADER("`*`header_ name`*`")`	Returns the contents of the HTTP header specified by the *header_name* argument, including the terminating `\r\n\r\n`. The header name cannot exceed 32 characters.

Prefixes That Extract HTTP Headers

HTTP Header Prefix	Description

`HTTP.RES.SET_COOKIE`
 	
or
 	
`HTTP.RES.SET_COOKIE2`
	Returns the HTTP Set-Cookie header object in a response.

`HTTP.RES.SET_COOKIE("`*`name`*`")`
 	
or
 	
`HTTP.RES.SET_COOKIE2("`*`name`*`")`
	Returns the cookie of the specified name if it is present. If it is not present, returns a text object of length 0. Returns UNDEF if more than 15 Set-Cookie headers are present and the specified cookie was not found in these headers.

`HTTP.RES.SET_COOKIE("`*`name`*`"). DOMAIN`
 	
or
 	
`HTTP.RES.SET_COOKIE2("`*`name`*`"). DOMAIN`
	Returns the value of the first Domain field in the cookie. For example, if the cookie is Set-Cookie : Customer = "ABC"; DOMAIN=". abc.com"; DOMAIN=.xyz.com, the following expression returns .abc.com:
	
	`http.res.set_cookie. cookie("customer").domain`
	
	A string of zero length is returned if the Domain field or its value is absent.

`HTTP.RES.SET_COOKIE. EXISTS("`*`name`*`")`
 	
`or`
 	
`HTTP.RES.SET_COOKIE2. EXISTS("`*`name`*`")`
	Returns a Boolean TRUE if a Cookie with the name specified in the *name* argument exists in the Set-Cookie header.
	
	This prefix returns UNDEF if more than 15 Set-Cookie headers are present and the named cookie is not in the first 15 headers.

`HTTP.RES.SET_COOKIE. COOKIE("`*`name`*`").EXPIRES`
 	
or
 	
`HTTP.RES.SET_COOKIE2. COOKIE("`*`name`*`").EXPIRES`
	Returns the Expires field of the cookie. This is a date string that can be evaluated as a number, as a time object, or as text. If multiple Expires fields are present, the first one is returned. If the Expires field is absent, a text object of length zero is returned.
	
	To evaluate the returned value as a time object, see "Advanced Expressions: Working with Dates, Times, and Numbers," on page 95.

Prefixes That Extract HTTP Headers

HTTP Header Prefix	Description

`HTTP.RES.SET_COOKIE.COOKIE("`*name*`").PATH|PATH.GET(`*n*`)`
or
`HTTP.RES.SET_COOKIE2.COOKIE("`*name*`").PATH|PATH.GET(`*n*`)`
	Returns the value of Path field of the cookie as a slash- (“/”) separated list. Multiple instances of a slash are treated as single slash. If multiple Path fields are present, the value of the first instance is returned.
	For example, the following is a cookie with two path fields:
	`Set-Cookie : Customer = "ABC"; PATH="/a//b/c"; PATH= "/x/y/z"`
	The following expression returns /a//b/c from this cookie:
	`http.res.set_cookie.cookie("Customer").path`
	The following expression returns b:
	`http.res.set_cookie.cookie("Customer").path.get(2)`
	Quotes are stripped from the returned value. A string of zero length is returned if the Path field or its value is absent.

`HTTP.RES.SET_COOKIE.COOKIE("`*name*`").PATH.IGNORE_EMPTY_ELEMENTS`
or
`HTTP.RES.SET_COOKIE2.COOKIE("`*name*`").PATH.IGNORE_EMPTY_ELEMENTS`
	Ignores the empty elements in the list. For example, in the list a=10,b=11, ,c=89, the element delimiter in the list is , and the list has an empty element following a=10. The element following b=11 is not considered an empty element.
	As another example, in the following expression, if a request contains Cust_Header : 123,,24, ,15 the following expression returns a value of 4:
	`http.req.header("Cust_Header").typecast_list_t(',').ignore_empty_elements.count`
	The following expression returns a value of 5:
	`http.req.header("Cust_Header").typecast_list_t(',').count`

Prefixes That Extract HTTP Headers

HTTP Header Prefix	Description

`HTTP.RES.SET_COOKIE. COOKIE("`*`name`*`").PORT`
 	
or
 	
`HTTP.RES.SET_COOKIE2. COOKIE("`*`name`*`").PORT`
	Returns the value of Port field of the cookie. Operate as a comma-separated list.
	
	For example, the following expression returns 80. 2580 from Set-Cookie : Customer = "ABC"; PATH="/a/b/c"; PORT= "80, 2580":
	
	`http.res.set_cookie. cookie("ABC").port`
	
	A string of zero length is returned if the Port field or value is absent.

`HTTP.RES.SET_COOKIE. COOKIE("`*`name`*`").PORT.IGNORE_ EMPTY_ELEMENTS`
 	
or
 	
`HTTP.RES.SET_COOKIE2. COOKIE("`*`name`*`").PORT.IGNORE_ EMPTY_ELEMENTS`
	Ignores the empty elements in the list. For example, in the list a=10,b=11, ,c=89, the element delimiter in the list is , and the list has an empty element following a=10. The element following b=11 is not considered an empty element.
	
	As another example, in the following expression, if a request contains Cust_Header : 123,,24, ,15 the following expression returns a value of 4:
	
	`http.req.header("Cust_Header"). typecast_list_t(',').ignore_ empty_elements.count`
	
	The following expression returns a value of 5:
	
	`http.req.header("Cust_Header"). typecast_list_t(',').count`

`HTTP.RES.SET_COOKIE. COOKIE("`*`name`*`").VERSION`
 	
or
 	
`HTTP.RES.SET_COOKIE2. COOKIE("`*`name`*`").VERSION`
	Returns the value of the first Version field in the cookie as a decimal integer.
	
	For example, the following expression returns 1 from the cookie Set-Cookie : Customer = "ABC"; VERSION = "1"; VERSION = "0"
	
	`http.res.set_cookie. cookie("CUSTOMER").version`
	
	A zero is returned if the Version field or its value is absent or if the value is not a decimal number.

`HTTP.RES.SET_COOKIE. COOKIE("`*`name`*`", `*`integer`*`)`
 	
or
 	
`HTTP.RES.SET_COOKIE2. COOKIE("`*`name`*`", `*`integer`*`)`
	Returns the *n*th instance (0-based) of the cookie with the specified name. If the cookie is absent, returns a text object of length 0.
	
	Returns UNDEF if more than 15 Set-Cookie headers are present and the cookie is not found.

Prefixes That Extract HTTP Headers

HTTP Header Prefix	Description

`HTTP.RES.SET_COOKIE. COOKIE("`*`name`*`", `*`integer`*`).DOMAIN`
 	
or
 	
`HTTP.RES.SET_COOKIE2. COOKIE("`*`name`*`", `*`integer`*`).DOMAIN`
	Returns the value of the Domain field of the first cookie with the specified name. For example, the following expression returns a value of abc.com from the cookie Set-Cookie : Customer = "ABC"; DOMAIN=".abc.com"; DOMAIN=.xyz.com
	
	`http.res.set_cookie. cookie("CUSTOMER").domain`
	
	A string of zero length is returned if the Domain field or its value is absent.

`HTTP.RES.SET_COOKIE. COOKIE("`*`name`*`", `*`integer`*`). EXPIRES`
 	
or
 	
`HTTP.RES.SET_COOKIE2. COOKIE("`*`name`*`", `*`integer`*`). EXPIRES`
	Returns the *n*th instance (0-based) of the Expires field of the cookie with the specified name as a date string. The value can be operated upon as a time object that supports a number of date formats. If the Expires attribute is absent a string of length zero is returned.

`HTTP.RES.SET_COOKIE. COOKIE("`*`name`*`", `*`integer`*`).PATH | PATH.GET(i)`
 	
or
 	
`HTTP.RES.SET_COOKIE2. COOKIE("`*`name`*`", `*`integer`*`).PATH | PATH.GET(i)`
	Returns the value of the Path field of the *n*th cookie, as a '/' separated list. Multiple /s are treated as a single /.
	
	For example, the following expression returns /a//b/c from the cookie Set-Cookie : Customer = "ABC"; PATH="/a//b/c"; PATH= "/x/y/z"
	
	`http.res.set_cookie. cookie("CUSTOMER").path`
	
	The following returns b:
	
	`http.res.set_cookie. cookie("CUSTOMER").path`.get(2)
	
	A string of zero length is returned if the Path field or its value is absent.

Prefixes That Extract HTTP Headers

HTTP Header Prefix	**Description**

`HTTP.RES.SET_COOKIE.COOKIE("`*`name`*`", `*`integer`*`).PATH.IGNORE_EMPTY_ELEMENTS`
 	
or
 	
`HTTP.RES.SET_COOKIE2.COOKIE("`*`name`*`", `*`integer`*`).PATH.IGNORE_EMPTY_ELEMENTS`
	Ignores the empty elements in the list. For example, in the list a=10,b=11, ,c=89, the element delimiter in the list is , and the list has an empty element following a=10. The element following b=11 is not considered an empty element.
	
	As another example, in the following expression, if a request contains Cust_Header : 123,,24, ,15 the following expression returns a value of 4:
	
	`http.req.header("Cust_Header").typecast_list_t(',').ignore_empty_elements.count`
	
	The following expression returns a value of 5:
	
	`http.req.header("Cust_Header").typecast_list_t(',').count`

`HTTP.RES.SET_COOKIE.COOKIE("`*`name`*`", `*`integer`*`).PORT`
 	
or
 	
`HTTP.RES.SET_COOKIE2.COOKIE("`*`name`*`", `*`integer`*`).PORT`
	Returns the value or values of the Port field of the named cookie as a ',' separated list. For example, the following expression returns 80, 2580 from the cookie Set-Cookie : Customer = "ABC"; PATH="/a/b/c"; PORT= "80, 2580"
	
	`http.res.set_cookie.cookie("ABC").port`
	
	A string of zero length is returned if the Port field or its value is absent.

`HTTP.RES.SET_COOKIE.COOKIE("`*`name`*`", `*`integer`*`).PORT.IGNORE_EMPTY_ELEMENTS`
 	
or
 	
`HTTP.RES.SET_COOKIE2.COOKIE("`*`name`*`", `*`integer`*`).PORT.IGNORE_EMPTY_ELEMENTS`
	Ignores the empty elements in the list. For example, in the list a=10,b=11, ,c=89, the element delimiter in the list is , and the list has an empty element following a=10. The element following b=11 is not considered an empty element.
	
	As another example, in the following expression, if a request contains Cust_Header : 123,,24, ,15 the following expression returns a value of 4:
	
	`http.req.header("Cust_Header").typecast_list_t(',').ignore_empty_elements.count`
	
	The following expression returns a value of 5:
	
	`http.req.header("Cust_Header").typecast_list_t(',').count`

Prefixes That Extract HTTP Headers

HTTP Header Prefix	**Description**
`HTTP.RES.SET_COOKIE.COOKIE("`*`name`*`", `*`integer`*`).VERSION` or `HTTP.RES.SET_COOKIE2.COOKIE("`*`name`*`", `*`integer`*`).VERSION`	Returns the value of Version field of the *n*th cookie as a decimal integer. A string of zero length is returned if the Port field or its value is absent.
`HTTP.RES.TXID`	Returns the HTTP transaction ID. The value is a function of an internal transaction number, system boot time and system MAC address.

Operations for HTTP Headers

The following table describes operations that you can specify with the prefixes for HTTP headers.

Note that if the same operation is also used to evaluate text, the header-based operation always overrides any text-based operation. For example, the `AFTER_STR` operation, when applied to a header, overrides text-based `AFTER_STR` operations for all instances of the current header type.

Operations That Evaluate HTTP Headers

HTTP Header Operation	**Description**
`http header``.EXISTS`	Returns a Boolean TRUE if an instance of the specified header type exists. Following is an example: `http.req.header("Cache-Control").exists`

Operations That Evaluate HTTP Headers

HTTP Header Operation	Description

`http header``.CONTAINS("`*`string`*`")`	Returns a Boolean TRUE if the string argument appears in any instance of the header value.
	
	Note: This operation overrides any text-based Contains operations on all instances of the current header type.
	
	Following is an example of request with two headers:
	
	`HTTP/1.1 200 OK\r\n`
	
	`MyHeader: abc\r\n`
	
	`Content-Length: 200\r\n`
	
	`MyHeader: def\r\n`
	
	`\r\n`
	
	The following returns a Boolean TRUE:
	
	`http.res.header("MyHeader").contains("de")`
	
	The following returns FALSE. Note that the NetScaler does not concatenate the different values.
	
	`http.res.header("MyHeader").contains("bcd")`

`http header``.COUNT`	Returns the number of headers in a request or response, to a maximum of 15 headers of the same type. The result is undefined if there are more than 15 instances of the header.
	
	Following is sample data in a request:
	
	`HTTP/1.1 200 OK\r\n`
	
	`MyHeader: abc\r\n`
	
	`Content-Length: 200\r\n`
	
	`MyHeader: def\r\n`
	
	`\r\n`
	
	When evaluating the preceding request, the following returns a count of 2:
	
	`http.res.header("MyHeader").count`

Operations That Evaluate HTTP Headers

HTTP Header Operation	**Description**

`http header`.AFTER_ STR("*string*")	Extracts the text that follows the first occurrence of the *string* argument.The headers are evaluated from the last instance to the first.
	
	Following is an example of a request:
	
	`HTTP/1.1 200 OK\r\n`
	
	`MyHeader: 111abc\r\n`
	
	`Content-Length: 200\r\n`
	
	`MyHeader: 111def\r\n`
	
	`\r\n`
	
	The following extracts the string "def" from the last instance of MyHeader. This is value "111def".
	
	`http.res.header("MyHeader").after_ str("111")`
	
	The following extracts the string "c" from the first instance of MyHeader. This is the value "abc111".
	
	`http.res.header`("MyHeader")`.after_ str`("1ab")

`http header`.BEFORE_ STR("*string*")	Extracts the text that appears prior to the first occurrence of the input *string* argument.The headers are evaluated from the last instance to the first.
	
	Following is an example of a request that contains headers:
	
	`HTTP/1.1 200 OK\r\n`
	
	`MyHeader: abc111\r\n`
	
	`Content-Length: 200\r\n`
	
	`MyHeader: def111\r\n`
	
	`\r\n`
	
	The following extracts the string "def" from the last instance of MyHeader. This is the value "def111".
	
	`http.res.header("MyHeader").before_ str("111")`
	
	The following extracts the string "a" from the first instance of MyHeader. This is the value "abc111".
	
	`http.res.header("MyHeader").before_ str("bc1")`

Operations That Evaluate HTTP Headers

HTTP Header Operation	**Description**

`*http header*.INSTANCE(*instance number*)`	An HTTP header can occur multiple times in a request or a response. This operation returns the header that occurs *instance number* of places before the final instance. For example, `instance(0)` selects the last instance of the current type, `instance(1)` selects the next-to-last instance, and so on. This prefix cannot be used in bidirectional policies.
	
	The *instance number* argument cannot exceed 14. Following is an example of a request with two headers:
	
	`HTTP/1.1 200 OK\r\n`
	
	`MyHeader: abc\r\n`
	
	`Content-Length: 200\r\n`
	
	`MyHeader: def\r\n`
	
	`\r\n`
	
	The following returns a text object that refers to "MyHeader: abc\r\n":
	
	`http.res.header("MyHeader").instance(1)`

`*http header*.SUBSTR("*string*")`	Extracts the text that matches the *string* argument. The headers are evaluated from the last instance to the first. Following is an example of a request with two headers that contain the string "111":
	
	`HTTP/1.1 200 OK\r\n`
	
	`MyHeader: abc111\r\n`
	
	`Content-Length: 200\r\n`
	
	`MyHeader: 111def\r\n`
	
	`\r\n`
	
	The following returns "111" from the last instance of MyHeader. This is the header with the value "111def".
	
	`http.res.header("MyHeader").substr("111")`

Operations That Evaluate HTTP Headers

HTTP Header Operation	**Description**

`*http header*.VALUE(*instance number*)`	An HTTP header can occur multiple times in a request or a response. `VALUE(0)` selects the value in the last instance, `VALUE(1)` selects the value in the next-to-last instance, and so on. The *instance number* argument cannot exceed 14.
	Following is an example of a request with two headers:
	`HTTP/1.1 200 OK\r\n`
	`MyHeader: abc\r\n`
	`Content-Length: 200\r\n`
	`MyHeader: def\r\n`
	`\r\n`
	The following returns "abc\r\n":
	`http.res.header("MyHeader").value(1)`

Prefixes for Cache-Control Headers

The following prefixes apply specifically to Cache-Control headers.

Prefixes That Extract Cache-Control Headers

HTTP Header Prefix	**Description**
`HTTP.REQ.CACHE_CONTROL`	Returns a Cache-Control header in an HTTP request.
`HTTP.RES.CACHE_CONTROL`	Returns a Cache-Control header in an HTTP response.

Operations for Cache-Control Headers

You can apply any of the operations for HTTP headers to Cache-Control headers. For more information, see “Operations for HTTP Headers,” on page 122.

In addition, the following operations identify specific types of Cache-Control headers. See RFC 2616 for details on these header types.

Operations That Evaluate Cache-Control Headers

HTTP Header Operation	Description

`Cache-Control header.`
`NAME(integer)`
	Returns as a text value the name of the Cache-Control header that corresponds to the *n*th component in a name-value list, as specified by *integer*.
	
	The index of the name-value component is 0-based. If the index that is specified by the *integer* argument is greater than the number of components in the list, a zero-length text object is returned.
	
	Following is an example:
	
	`http.req.cache_control.name(3).`
	`contains("some_text")`

`Cache-Control header.`
`IS_INVALID`
	Returns a Boolean TRUE if the Cache-Control header is not present in the request or response.
	
	Following is an example:
	
	`http.req.cache_control.is_invalid`

`Cache-Control header.`
`IS_PRIVATE`
	Returns a Boolean TRUE if the Cache-Control header has the value Private.
	
	Following is an example:
	
	`http.req.cache_control.is_private`

`Cache-Control header.`
`IS_PUBLIC`
	Returns a Boolean TRUE if the Cache-Control header has the value Private.
	
	Following is an example:
	
	`http.req.cache_control.is_public`

`Cache-Control header.`
`IS_NO_STORE`
	Returns a Boolean TRUE if the Cache-Control header has the value No-Store.
	
	Following is an example:
	
	`http.req.cache_control.is_no_store`

`Cache-Control header.`
`IS_NO_CACHE`
	Returns a Boolean TRUE if the Cache-Control header has the value No-Cache.
	
	Following is an example:
	
	`http.req.cache_control.is_no_cache`

`Cache-Control header.`
`IS_MAX_AGE`
	Returns a Boolean TRUE if the Cache-Control header has the value Max-Age.
	
	Following is an example:
	
	`http.req.cache_control.is_max_age`

Operations That Evaluate Cache-Control Headers

HTTP Header Operation	Description
`Cache-Control header``.IS_MIN_FRESH`	Returns a Boolean TRUE if the Cache-Control header has the value Min-Fresh. Following is an example: `http.req.cache_control.is_min_fresh`
`Cache-Control header``.IS_MAX_STALE`	Returns a Boolean TRUE if the Cache-Control header has the value Max-Stale. Following is an example: `http.req.cache_control.is_max_stale`
`Cache-Control header``.IS_MUST_REVALIDATE`	Returns a Boolean TRUE if the Cache-Control header has the value Must-Revalidate. Following is an example: `http.req.cache_control.is_must_revalidate`
`Cache-Control header``.IS_NO_TRANSFORM`	Returns a Boolean TRUE if the Cache-Control header has the value No-Transform. Following is an example: `http.req.cache_control.is_no_transform`
`Cache-Control header``.IS_ONLY_IF_CACHED`	Returns a Boolean TRUE if the Cache-Control header has the value Only-If-Cached. Following is an example: `http.req.cache_control.is_only_if_cached`
`Cache-Control header``.IS_PROXY_REVALIDATE`	Returns a Boolean TRUE if the Cache-Control header has the value Proxy-Revalidate. Following is an example: `http.req.cache_control.is_proxy_revalidate`
`Cache-Control header``.IS_S_MAXAGE`	Returns a Boolean TRUE if the Cache-Control header has the value S-Maxage. Following is an example: `http.req.cache_control.is_s_maxage`
`Cache-Control header``.IS_UNKNOWN`	Returns a Boolean TRUE if the Cache-Control header is of an unknown type. Following is an example: `http.req.cache_control.is_unknown`

Operations That Evaluate Cache-Control Headers

HTTP Header Operation	Description
`Cache-Control header``.MAX_AGE`	Returns the value of the Cache-Control header Max-Age. If this header is absent or invalid, 0 is returned. Following is an example: `http.req.cache_control.max_age.le(3)`
`Cache-Control header``.MAX_STALE`	Returns the value of the Cache-Control header Max-Stale. If this header is absent or invalid, 0 is returned. Following is an example: `http.req.cache_control.max_stale.le(3)`
`Cache-Control header``.MIN_FRESH`	Returns the value of the Cache-Control header Min-Fresh. If this header is absent or invalid, 0 is returned. Following is an example: `http.req.cache_control.min_fresh.le(3)`
`Cache-Control header``.S_MAXAGE`	Returns the value of the Cache-Control header S-Maxage. If this header is absent or invalid, 0 is returned. Following is an example: `http.req.cache_control.s_maxage.eq(2)`

Expressions for Extracting Segments of URLs

You can extract URLs and portions of URLs, such as the host name, or a segment of the URL path. For example, the following expression identifies HTTP requests for image files by extracting image file suffixes from the URL:

```
http.req.url.suffix.eq("jpeg") || http.req.url.suffix.eq("gif")
```

Most expressions for URLs operate on text and are described in "Expression Prefixes for Text in HTTP Requests and Responses," on page 67. This section discusses the GET operation. The GET operation extracts text when used with the following prefixes:

- `HTTP.REQ.URL.PATH`
- `VPN.BASEURL.PATH`
- `VPN.CLIENTLESS_BASEURL.PATH`

The following table describes prefixes for HTTP URLs that are not described elsewhere.

Prefixes That Extract URLs

URL Prefix	**Description**

`HTTP.REQ.URL.PATH.GET(n)`	Returns a slash- ("/") separated list from the URL path. For example, consider the following URL:
	`http://www.mycompany.com/dir1/dir2/dir3/index.html?a=1`
	The following expression returns dir1 from this URL:
	`http.req.url.path.get(1)`
	The following expression returns dir2:
	`http.req.url.path.get(2)`

`HTTP.REQ.URL.PATH.GET_REVERSE(n)`	Returns a slash- ("/") separated list from the URL path, starting from the end of the path. For example, consider the following URL:
	`http://www.mycompany.com/dir1/dir2/dir3/index.html?a=1`
	The following expression returns index.html from this URL:
	`http.req.url.path.get_reverse(0)`
	The following expression returns dir3:
	`http.req.url.path.get_reverse(1)`

Expressions for Numeric HTTP Payload Data Other Than Dates

The following table describes prefixes for numeric values in HTTP data other than dates. You would use numeric operations with the following prefixes.

Prefixes That Evaluate HTTP Request or Response Length

Prefix	**Description**
`HTTP.REQ.CONTENT_LENGTH`	Returns the length of an HTTP request as a number. Following is an example: http.req.content_length < 500
`HTTP.RES.CONTENT_LENGTH`	Returns the length of the HTTP response as a number. Following is an example: http.res.content_length <= 1000

Prefixes That Evaluate HTTP Request or Response Length

Prefix	Description
`HTTP.RES.STATUS`	Returns the response status code

Operations for HTTP, HTML, and XML Encoding and "Safe" Characters

The following operations work with the encoding of HTML data in a request or response and XML data in a POST body.

Operations That Evaluate HTML and XML Encoding

HTML or XML Operation	Description
`text``.HTML_XML_SAFE`	Transforms special characters into XML safe format, as in the following examples: • A left-pointing angle bracket (<) is converted to &lt; • A right-pointing angle bracket (>) is converted to &gt; • An ampersand (&) is converted to &amp; This operation safeguards against cross-site scripting attacks. This is a read-only operation. After applying the transformation, additional operators that you specify in the expression are applied to the selected text. Following is an example: `http.req.url.query.html_xml_safe.contains("myQueryString")`
`text``.HTTP_HEADER_SAFE`	Converts all new line ('\n') characters in the input text to '%0A' to enable the input to be used safely in HTTP headers. This operation safeguards against response-splitting attacks. This is a read-only operation.

Operations That Evaluate HTML and XML Encoding

HTML or XML Operation	Description
`*text*.HTTP_URL_SAFE`	Converts unsafe URL characters to '%xx' values, where "xx" is a hex-based representation of the input character. For example, the ampersand (&) is represented as %26 in URL-safe encoding. This is a read-only operation. Following are URL safe characters. All others are unsafe: • Alpha-numeric characters: a-z, A-Z, 0-9 • Asterix: "*" • Ampersand: "&" • At-sign: "@" • Colon: ":" • Dollar: "$" • Dot: "." • Equals: "=" • Exclamation mark: "!" • Hyphen: "-" • Open and close parentheses: "(", ")" • Plus: "+" • Semicolon: ";" • Single quote: "'" • Slash: "/" • Tilde: "~" • Underscore: "_"
`*text*.MARK_SAFE`	Marks the text as safe without applying any type of data transformation.

`*text*.SET_TEXT_ MODE(URLENCODED|NOURLENCODED)`	Transforms all %HH encoding in the byte stream. This operation works with characters (not bytes). By default, a single byte represents a character in ASCII encoding. However, if you specify URLENCODED mode, three bytes can represent a character.
	
	In the following example, a PREFIX(3) operation selects the first 3 characters in a target.
	
	`http.req.url.hostname.prefix(3)`
	
	In the following example, the NetScaler can select up to 9 bytes from the target:
	
	`http.req.url.hostname.set_text_ mode(urlencoded).prefix(3)`

`*text*.SET_TEXT_MODE(PLUS_AS_ SPACE|NO_PLUS_AS_SPACE)`	Specifies how to treat the plus character (+). The PLUS_AS_SPACE option replaces a plus character with white space. For example, the text "hello+world" becomes "hello world." The NO_ PLUS_AS_SPACE option leaves plus characters as they are.

Operations That Evaluate HTML and XML Encoding

HTML or XML Operation	Description
`text.SET_TEXT_MODE(BACKSLASH_ENCODED|NO_BACKSLASH_ENCODED)`	Specifies whether or not backslash decoding is performed on the text object represented by *text*. If `BACKSLASH_ENCODED` is specified, the `SET_TEXT_MODE` operator performs the following operations on the text object: • All occurrences of "\\XXX" will be replaced with the character "*Y*" (where *XXX* represents a number in the octal system and *Y* represents the ASCII equivalent of *XXX*). The valid range of octal values for this type of encoding is 0 to 377. For example, the encoded text "http\72//" and "http\072//" will both be decoded to "http://", where the colon (:) is the ASCII equivalent of the octal value "72". • All occurrences of "\\x*HH*" will be replaced with the character "*Y*" (*HH* represents a number in the hexadecimal system and *Y* denotes the ASCII equivalent of *HH*. For example, the encoded text "http\x3a//" will be decoded to "http://", where the colon (:) is the ASCII equivalent of the hexadecimal value "3a". • All occurrences of "\\\\u*WWXX*" will be replaced with the character sequence "*YZ*" (Where *WW* and *XX* represent two distinct hexadecimal values and *Y* and *Z* represent their ASCII equivalents of *WW* and *XX* respectively. For example, the encoded text "http%u3a2f/" and "http%u003a//" will both be decoded to "http://", where "3a" and "2f" are two hexadecimal values and the colon (:) and forward slash ("/") represent their ASCII equivalents respectively. • All occurrences of "\b", "\n", "\t", "\f", and "\r" are replaced with the corresponding ASCII characters. If `NO_BACKSLASH_ENCODED` is specified, backslash decoding is not performed on the text object.
`text.SET_TEXT_MODE(BAD_ENCODE_RAISE_UNDEF|NO_BAD_ENCODE_RAISE_UNDEF)`	Performs the associated undefined action if either the `URLENCODED` or the `BACKSLASH_ENCODED` mode is set and bad encoding corresponding to the specified encoding mode is encountered in the text object represented by *text*. If `NO_BAD_ENCODE_RAISE_UNDEF` is specified, the associated undefined action will not be performed when bad encoding is encountered in the text object represented by *text*.

Expressions for TCP, UDP, and VLAN Data

TCP and UDP data takes the form of a string or a number. For expression prefixes that return string values for TCP and UDP data, you can apply any text-based operations. For more information, see "Advanced Expressions: Evaluating Text," on page 63.

For expression prefixes that return numeric value, such as a source port, you can apply an arithmetic operation. For more information, see "Basic Operations on Expression Prefixes," on page 44 and "Compound Operations for Numbers," on page 48.

The following table describes prefixes that extract TCP and UDP data.

Prefixes that Extract TCP and UDP Data

GET Operation	Description
`CLIENT.TCP.PAYLOAD(`*`integer`*`)`	Returns TCP payload data as a string, starting with the first character in the payload and continuing for the number of characters in the *integer* argument. You can apply any text-based operation to this prefix.
`CLIENT.TCP.SRCPORT`	Returns the ID of the current packet's source port as a number.
`CLIENT.TCP.DSTPORT`	Returns the ID of the current packet's destination port as a number.
`CLIENT.UDP.DNS.DOMAIN`	Returns the DNS domain name.

`CLIENT.UDP.DNS.DOMAIN.`
`EQ("`*`hostname`*`")`
	Returns a Boolean TRUE if the domain name matches the *hostname* argument. The comparison is case insensitive.
	
	Following is an example:
	
	`client.udp.dns.domain.eq("www.`
	`mycompany.com")`

`CLIENT.UDP.DNS.IS_AAAAREC`	Returns a Boolean TRUE if the record type is AAAA. These types of records indicate an IPv6 address in forward lookups.
`CLIENT.UDP.DNS.IS_ANYREC`	Returns a Boolean TRUE if it is of any record type.
`CLIENT.UDP.DNS.IS_AREC`	Returns a Boolean TRUE if the record is type A. Type A records provide the host address.
`CLIENT.UDP.DNS.IS_CNAMEREC`	Returns a Boolean TRUE if the record is of type CNAME. In systems that use multiple names to identify a resource, there is one canonical name and a number of aliases. The CNAME provides the canonical name.

Prefixes that Extract TCP and UDP Data

GET Operation	**Description**
`CLIENT.UDP.DNS.IS_MXREC`	Returns a Boolean TRUE if the record is of type MX (mail exchanger). This DNS record describes a priority and a host name. The MX records for the same domain name specify the email servers in the domain and the priority for each server.
`CLIENT.UDP.DNS.IS_NSREC`	Returns a Boolean TRUE if the record is of type NS. This is a name server record that includes a host name with an associated A record. This enables locating the domain name that is associated with the NS record.
`CLIENT.UDP.DNS.IS_PTRREC`	Returns a Boolean TRUE if the record is of type PTR. This is a domain name pointer and is often used to associate a domain name with an IPv4 address.
`CLIENT.UDP.DNS.IS_SOAREC`	Returns a Boolean TRUE if the record is of type SOA. This is a start of authority record.
`CLIENT.UDP.DNS.IS_SRVREC`	Returns a Boolean TRUE if the record is of type SRV. This is a more general version of the MX record.
`CLIENT.UDP.DSTPORT`	Returns the numeric ID of the current packet's UDP destination port.
`CLIENT.UDP.SRCPORT`	Returns the numeric ID of the current packet's UDP source port.
`CLIENT.UDP.RADIUS`	Returns RADIUS data for the current packet.
`CLIENT.UDP.RADIUS.ATTR_TYPE(`*`type`*`)`	Returns the value for the attribute type specified as the argument.
`CLIENT.UDP.RADIUS.USERNAME`	Returns the RADIUS user name.
`CLIENT.TCP.MSS`	Returns the maximum segment size (MSS) for the current connection as a number.
`CLIENT.VLAN.ID`	Returns the numeric ID of the VLAN through which the current packet entered the NetScaler.
`SERVER.TCP.DSTPORT`	Returns the numeric ID of the current packet's destination port.
`SERVER.TCP.SRCPORT`	Returns the numeric ID of the current packet's source port.
`SERVER.VLAN`	Operates on the VLAN through which the current packet entered the NetScaler.
`SERVER.VLAN.ID`	Returns the numeric ID of the VLAN through which the current packet entered the NetScaler.

XPath and JSON Expressions

The advanced expression engine supports expressions for evaluating and retrieving data from XML and JavaScript Object Notation (JSON) files. This enables you to find specific nodes in an XML or JSON document, determine if a node exists in the file, locate nodes in XML contexts (for example, nodes that have specific parents or a specific attribute with a given value), and return the contents of such nodes. Additionally, you can use XPath expressions in rewrite expressions.

The advanced expression implementation for XPath comprises an advanced expression prefix (such as “HTTP.REQ.BODY”) that designates XML text and the XPATH operator that takes the XPath expression as its argument.

JSON files are either a collection of name/value pairs or an ordered list of values. You can use the XPATH_JSON operator, which takes an XPath expression as its argument, to process JSON files.

XPath and JSON Expression Prefixes that Return Text

XPath Prefix	**Description**
text.XPATH(xpathex)	Operate on an XML file and return a Boolean value. For example, the following expression returns a Boolean TRUE if a node called “creator” exists under the node “Book” within the first 1000 bytes of the XML file. HTTP.REQ.BODY(1000). XPATH(xp%boolean(//Book/creator)%) Parameters: xpathex - XPath Boolean expression
text.XPATH(xpathex)	Operate on an XML file and return a value of data type “double.” For example, the following expression converts the string “36” (a price value) to a value of data type “double” if the string is in the first 1000 bytes of the XML file: HTTP.REQ.BODY(1000). XPATH(xp%number(/Book/price)%) Parameters: xpathex - XPath numeric expression

XPath Prefix	Description
text.XPATH(xpathex)	Operate on an XML file and return a node-set or a string. Node-sets are converted to corresponding strings by using the standard XPath string conversion routine. For example, the following expression selects all the nodes that are enclosed by "/Book/creator" (a node-set) in the first 1000 bytes of the body: HTTP.REQ.BODY(1000).XPATH(xp%/Book/creator%) Parameters: xpathex - XPath expression
text.XPATH_JSON(xpathex)	Operate on a JSON file and return a Boolean value. For example, {consider the following JSON file: { "Book":{ "creator":{ "person":{ "name":'<name>' } }, "title":'<title>' } } The following expression operates on the JSON file and returns a Boolean TRUE if the JSON file contains a node named "creator," whose parent node is "Book," in the first 1000 bytes: HTTP.REQ.BODY(1000).XPATH_JSON(xp%boolean(/Book/creator)%) Parameters: xpathex - XPath Boolean expression
text.XPATH_JSON(xpathex)	Operate on a JSON file and return a value of data type "double." For example, consider the following JSON file: { "Book":{ "creator":{ "person":{ "name":'<name>' } }, "title":'<title>', "price":"36" } } The following expression operates on the JSON file and converts the string "36" to a value of data type "double" if the string is present in the first 1000 bytes of the JSON file. HTTP.REQ.BODY(1000).XPATH_JSON(xp%number(/Book/price)%) Parameters: xpathex - XPath numeric expression

XPath Prefix	Description
text.XPATH_JSON(xpathex)	Operate on a JSON file and return a node-set or a string. Node-sets are converted to corresponding strings by using the standard XPath string conversion routine. For example, consider the following JSON file: { "Book":{ "creator":{ "person":{ "name":'<name>' } }, "title":'<title>' } } The following expression selects all the nodes that are enclosed by “/Book" (a node-set) in the first 1000 bytes of the body of the JSON file and returns the corresponding string value, which is "<name><title>": HTTP.REQ.BODY(1000).XPATH_ JSON(xp%/Book%) Parameters: xpathex - XPath expression
text.XPATH_JSON_WITH_ MARKUP(xpathex)	Operate on an XML file and return a string that contains the entire portion of the document for the result node, including markup such as including the enclosing element tags. For example, consider the following JSON file: {"Book":{ "creator":{ "person":{ "name":'<name>' } }, "title":'<title>' } } The following expression operates on the JSON file and selects all the nodes that are enclosed by “/Book/creator" in the first 1000 bytes of the body, which is “creator:{ person:{ name:'<name>' } }.” HTTP.REQ.BODY(1000).XPATH_JSON_ WITH_MARKUP(xp%/Book/creator%) The portion of the JSON body that is selected by the expression is marked for further processing. Parameters: xpathex - XPath expression

XPath Prefix	**Description**
text.XPATH_WITH_ MARKUP(xpathex)	Operate on an XML file and return a string that contains the entire portion of the document for the result node, including markup such as including the enclosing element tags. For example, the following expression operates on an XML file and selects all the nodes enclosed by “/Book/creator" in the first 1000 bytes of the body. HTTP.REQ.BODY(1000).XPATH_WITH_ MARKUP(xp%/Book/creator%) The portion of the JSON body that is selected by the expression is marked for further processing. Parameters: xpathex - XPath expression

Advanced Expressions: Parsing SSL Certificates

You can configure expressions that parse information in X.509 Secure Sockets Layer (SSL) certificates, including the following:

- Issuers
- Keys
- Subjects
- Signatures
- Expiration dates

In This Chapter

About SSL and Certificate Expressions

Prefixes for Text-Based SSL and Certificate Data

Prefixes for Numeric Data in SSL Certificates

Expressions for SSL Certificates

Note: For information on parsing dates and times in a certificate, see "Format of Dates and Times in an Expression," on page 96 and "Expressions for SSL Certificate Dates," on page 101.

About SSL and Certificate Expressions

A client certificate is an electronic document that can be used to authenticate a user's identity. The NetScaler examines information in client certificates that conform to the X.509 standard. These client certificates contain, at a minimum, the following information:

- Version
- Serial number
- Signature algorithm ID
- Issuer name
- Validity period
- Subject (user) name
- A public key
- Signatures

You can configure a policy that examines both SSL connections and data in a client certificate. For example, suppose that you want to send SSL requests that use low strength ciphers to a particular load balancing virtual server farm. The following command is an example of a Content Switching policy that parses cipher strength in a request and matches cipher strengths that are less than or equal to 40:

```
add cs policy p1 -rule "client.ssl.cipher_bits.le(40)"
```

As another example, you can configure a policy that determines whether a request contains a client certificate:

```
add cs policy p2 -rule "client.ssl.client_cert EXISTS"
```

Finally, you can configure a policy that examines particular information in a client certificate. For example, the following policy ensures that the certificate has one or more days before expiration:

```
add cs policy p2 -rule "client.ssl.client_cert exists && client.
ssl.client_cert.days_to_expire.le(1)"
```

Prefixes for Text-Based SSL and Certificate Data

The following table describes expression prefixes that identify text-based items in SSL transactions and client certificates.

Prefixes That Return Text or Boolean Values for SSL and Client Certificate Data

Prefix	**Description**
`CLIENT.SSL.CLIENT_CERT`	Returns the SSL client certificate in the current SSL transaction.
`CLIENT.SSL.CLIENT_CERT. TO_PEM`	Returns the SSL client certificate in binary format.
`CLIENT.SSL. CIPHER_EXPORTABLE`	Returns a Boolean TRUE if the SSL cryptographic SSL cryptographic cipher is exportable.

Prefixes That Return Text or Boolean Values for SSL and Client Certificate Data

Prefix	Description
`CLIENT.SSL.CIPHER_NAME`	Returns the name of the SSL Cipher if invoked from an SSL connection, and a NULL string if invoked from a non-SSL connection.
`CLIENT.SSL.IS_SSL`	Returns a Boolean TRUE if the current connection is SSL-based.

Prefixes for Numeric Data in SSL Certificates

The following table describes prefixes that evaluate numeric data other than dates in SSL certificates. These prefixes can be used with the operations that are described in "Basic Operations on Expression Prefixes," on page 44 and "Compound Operations for Numbers," on page 48.

Prefixes That Evaluate Numeric Data Other Than Dates in SSL Certificates

Prefix	Description
`CLIENT.SSL.CLIENT_CERT. DAYS_TO_EXPIRE`	Returns the number of days that the certificate is valid, or returns -1 for expired certificates.
`CLIENT.SSL.CLIENT_CERT. PK_SIZE`	Returns the size of the public key used in the certificate.
`CLIENT.SSL.CLIENT_CERT. VERSION`	Returns the version number of the certificate. If the connection is not SSL-based, returns zero (0).
`CLIENT.SSL.CIPHER_BITS`	Returns the number of bits in the cryptograhic key. Returns 0 if the connection is not SSL based.
`CLIENT.SSL.VERSION`	Returns a number that represents the SSL protocol version, as follows: • **0**. The transaction is not SSL based. • **0x002**. The transaction is SSLv2. • **0x300**. The transaction is SSLv3. • **0x301**. The transaction is TLSv1.

Note: For expressions related to expiration dates in a certificate, see "Expressions for SSL Certificate Dates," on page 101.

Expressions for SSL Certificates

You can parse SSL certificates by configuring expressions that use the following prefix:

```
CLIENT.SSL.CLIENT_CERT
```

This section discusses the expressions that you can configure for certificates, with the exception of expressions that examine certificate expiration. Time-based operations are described in "Advanced Expressions: Working with Dates, Times, and Numbers," on page 95.

The following table describes operations that you can specify for the `CLIENT.SSL.CLIENT_CERT` prefix.

Operations That Can Be Specified with the CLIENT.SSL.CLIENT_CERT Prefix

SSL Certificate Operation	Description
`certificate``.EXISTS`	Returns a Boolean TRUE if the client has an SSL certificate.
`certificate``.ISSUER`	Returns the Distinguished Name (DN) of the Issuer in the certificate as a name-value list. An equals sign ("=") is the delimiter for the name and the value, and the slash ("/") is the delimiter that separates the name-value pairs. Following is an example of the returned DN: `/C=US/O=myCompany/OU=www.mycompany.com/CN=www.mycompany.com/emailAddress=myuserid@mycompany.com`

`certificate``.ISSUER.IGNORE_EMPTY_ELEMENTS`	Returns the Issuer and ignores the empty elements in a name-value list. For example, consider the following:
	`Cert-Issuer: /c=in/st=kar//l=bangelore //o=mycompany/ou=sales/ /emailAddress=myuserid@mycompany.com`
	The following Rewrite action returns a count of 6 based on the preceding Issuer definition:
	`sh rewrite action insert_ssl_header`
	`Name: insert_ssl`
	`Operation: insert_http_header`
	`Target:Cert-Issuer`
	`Value:CLIENT.SSL.CLIENT_CERT.ISSUER.COUNT`
	However, if you change the value to the following, the returned count is 9:
	`CLIENT.SSL.CLIENT_CERT.ISSUER.IGNORE_EMPTY_ELEMENTS.COUNT`

`certificate``.AUTH_KEYID`	Returns a string that contains the Authority Key Identifier extension of the X.509 V3 certificate.
`certificate``.AUTH_KEYID.CERT_SERIALNUMBER`	Returns the SerialNumber field of the Authority Key Identifier as a blob.

Operations That Can Be Specified with the CLIENT.SSL.CLIENT_CERT Prefix

SSL Certificate Operation	**Description**
`*certificate*.AUTH_KEYID.EXISTS`	Returns a Boolean TRUE if the certificate contains an Authority Key Identifier extension.
`*certificate*.AUTH_KEYID.ISSUER_NAME`	Returns the Issuer Distinguished Name in the certificate as a name-value list. An equals sign (“=”) is the delimiter for the name and the value, and the slash (“/”) is the delimiter that separates the name-value pairs. Following is an example: `/C=US/O=myCompany/OU=www.mycompany.com/CN=www.mycompany.com/emailAddress=myuserid@mycompany.com`
`*certificate*.AUTH_KEYID.ISSUER_NAME.IGNORE_EMPTY_ELEMENTS`	Returns the Issuer Distinguished Name in the certificate as a name-value list and ignores the empty elements in the list. For example, the following name-value list has an empty element following “a=10”: a=10;;b=11; ;c=89 The element following b=11 is not considered an empty element.
`*certificate*.AUTH_KEYID.KEYID`	Returns the keyIdentifier field of the Authority Key Identifier as a blob.
`*certificate*.CERT_POLICY`	Returns a string that contains the client certificate policy. Note that this represents a sequence of certificate policies.

Operations That Can Be Specified with the CLIENT.SSL.CLIENT_CERT Prefix

SSL Certificate Operation	**Description**
`*certificate*.KEY_USAGE(*string*)`	Returns a Boolean value to indicate whether the specified key usage extension bit value in the X.509 certificate is set. The *string* argument specifies which bit is checked. Following are valid arguments: • **`DIGITAL_SIGNATURE`**. Returns TRUE if the digital signature bit is set; otherwise, it returns FALSE. • **`NONREPUDIATION`**. Returns TRUE if the nonrepudiation bit is set; otherwise, it returns FALSE. • **`KEYENCIPHERMENT`**. Returns TRUE if the key encipherment bit is set; otherwise, it returns FALSE. • **`DATAENCIPHERMENT`**. Returns TRUE if the data encipherment bit is set; otherwise, it returns FALSE. • **`KEYAGREEMENT`**. Returns TRUE if the key agreement bit is set; otherwise, it returns FALSE. • **`KEYCERTSIGN`**. Returns TRUE if the key cert sign bit is set; otherwise, it returns FALSE. • **`CRLSIGN`**. Returns TRUE if the CRL bit is set; otherwise, it returns FALSE. • **`ENCIPHERONLY`**. Returns TRUE if the encipher only bit is set; otherwise, it returns FALSE. • **`DECIPHERONLY`**. Returns TRUE if the decipher only bit is set; otherwise, it returns FALSE.
`*certificate*.PK_ALGORITHM`	Returns the name of the public key algorithm used by the certificate.
`*certificate*.PK_SIZE`	Returns the size of the public key used in the certificate.
`*certificate*.SERIALNUMBER`	Returns the serial number of the client certificate. If this is a non-SSL transaction or there is an error in the certificate, this operation returns an empty string.
`*certificate*.SIGNATURE_ALGORITHM`	Returns the name of the cryptographic algorithm used by the CA to sign this certificate.

Operations That Can Be Specified with the CLIENT.SSL.CLIENT_CERT Prefix

SSL Certificate Operation	**Description**
`*certificate*.SUBJECT`	Returns the Distinguished Name of the Subject as a name-value. An equals sign ("=") separates names and values and a slash ("/") delimits name-value pairs. Following is an example: `/C=US/O=myCompany/OU=www.mycompany.com/CN=www.mycompany.com/emailAddress=myuserid@mycompany.com`

`*certificate*.SUBJECT.IGNORE_EMPTY_ELEMENTS`	Returns the Subject as a name-value list, but ignores the empty elements in the list. For example, consider the following:
	`Cert-Issuer: /c=in/st=kar//l=bangelore //o=mycompany/ou=sales/ /emailAddress=myuserid@mycompany.com`
	The following Rewrite action returns a count of 6 based on the preceding Issuer definition:
	`sh rewrite action insert_ssl_header`
	`Name: insert_ssl`
	`Operation: insert_http_header`
	`Target:Cert-Issuer`
	`Value:CLIENT.SSL.CLIENT_CERT.ISSUER.COUNT`
	However, if you change the value to the following, the returned count is 9:
	CLIENT.SSL.CLIENT_CERT.ISSUER.IGNORE_EMPTY_ELEMENTS.COUNT

`*certificate*.SUBJECT_KEYID`	Returns the Subject KeyID of the client certificate. If there is no Subject KeyID, this operation returns a zero-length text object.

Advanced Expressions: IP and MAC Addresses, Throughput, VLAN IDs

You can configure expressions that parse IP and MAC addresses, IP subnets, and transaction throughput rates.

In This Chapter

Expressions for IP Addresses and IP Subnets

Expressions for MAC Addresses

Expressions for Numeric Client and Server Data

Expressions for IP Addresses and IP Subnets

You can use advanced expressions to parse IP addresses and subnets. For example, you can identify whether a request has originated from a client in a particular subnet, as follows:

```
client.ip.src.in_subnet(147.1.0.0/16)
```

The following is an example of a Rewrite policy that examines subnets and provides a different rewrite action for the Host header, depending on the subnet in the request:

```
add rewrite action URL1-rewrite-action replace
"http.req.header(\"Host\")" "\"www.mycompany1.com\""

add rewrite policy URL1-rewrite-policy
"http.req.header(\"Host\").contains(\"www.test1.com\") &&
client.ip.src.in_subnet(147.1.0.0/16)" URL1-rewrite-action

add rewrite action URL2-rewrite-action replace
"http.req.header(\"Host\")" "\"www.mycompany2.com\""

add rewrite policy URL2-rewrite-policy
"http.req.header(\"Host\").contains(\"www.test2.com\") &&
client.ip.src.in_subnet(10.202.0.0/16)" URL2-rewrite-action
```

Note: As the preceding example shows, if you configure an advanced expression on the command line, you must escape the quotation marks. For more information, see "Configuring Advanced Expressions in a Policy," on page 57.

Prefixes for IPV4 Addresses and IP Subnets

The following table describes prefixes that return IPv4 addresses and subnets and segments of the addresses.

You can apply the IP address-specific operations to this prefix, as described in this chapter. You can also apply numeric operations. For more information on numeric operations, see "Basic Operations on Expression Prefixes," on page 44 and "Compound Operations for Numbers," on page 48.

Prefixes That Evaluate IP and MAC Addresses

Prefix	**Description**
`CLIENT.IP.SRC`	Returns the source IP of the current packet as an IP address or as a number.
`CLIENT.IP.DST`	Returns the destination IP of the current packet as an IP address or as a number.
`SERVER.IP.SRC`	Returns the source IP of the current packet as an IP address or as a number.
`SERVER.IP.DST`	Returns the destination IP of the current packet as an IP address or as a number.

Operations for IPV4 Addresses

An IPv4 address is a traditional format that uses four numeric values that are separated by periods, for example, *nn.nnn.nn.nnn*.

The following table describes operations on IP addresses.

Operations on IPV4 Addresses

Prefix	**Description**
`ip address.EQ(address)`	Returns a Boolean TRUE if the IP address value is same as the *address* argument. The following example checks whether the client's destination IP address is equal to 10.100.10.100: `client.ip.dst.eq(10.100.10.100)`

Operations on IPV4 Addresses

Prefix	Description
`*ip address*.GET1. . .GET4`	Returns a portion of an IP address as a numeric value. For example, if the IP address value is 10.100.200.1, the following is returned: `client.ip.src.get1` Returns 10 `client.ip.src.get2` returns 100 `client.ip.src.get3` returns 200
`*ip address*.IN_SUBNET(*subnet*)`	Returns a Boolean TRUE if the *subnet* argument matches the subnet of the IP address value. For example, the following determines whether the client's destination IP address subnet is 10.100.10.100/18: `client.ip.dst.eq(10.100.10.100/18)`
`*ip address*.SUBNET(*n*)`	Returns the IP address after applying the subnet mask specified as the argument. The subnet mask can take values between 0 and 32. For example: CLIENT.IP.SRC.SUBNET(24) will return 192.168.1.0 if the IP address represented by the prefix is 192.168.1.[0-255].
`*ip address*.IS_IPV6`	Returns a Boolean TRUE if this is an Internet Protocol version 6 (IPv6) host for the client or server. Following is an example: `client.ip.src.is_ipv6`
`*ip address*.MATCHES("*hostname*")`	Returns a Boolean TRUE if the IP address for the host specified in *hostname* matches the current IP address. The *hostname* cannot exceed 255 characters.

`*ip address*.MATCHES_LOCATION(*location*)`	Returns a Boolean TRUE if the location of the IP address matches the *location* argument. The Location string can take the following form: *qual1.qual2.qual3.qual4.qual5.qual6*,
	for example: NorthAmeria.CA.*
	Following is an example:
	`client.ip.src.matches_location(\"Europe.GB.17.London.*.*\")`

About IPv6 Expressions

IP addresses that are formatted for Internet Protocol version 6 (IPv6) enable more flexibility when assigning addresses than the older IPv4 format. An IPv6 address in a URL has a different appearance from a traditional URL. The following is an example of an IPv6 URL:

http://[9901:0ab1:22a2:88a3:3333:4a4b:5555:6666]/

The brackets in the IPv6 URL differentiate the IP address and the port number. The following expression is an example of an IPv6 URL that contains a port number:

https://[9901:0ab1:22a2:88a3:3333:4a4b:5555:6666]:8080/

IPv6 addresses are always in hex format (RFC 2373).

Note that you can only use the '+' operator to combine IPv6 expressions with other expressions. The output is a concatenation of the string values that are returned from the individual expressions. You cannot use any other arithmetic operator with an IPv6 expression. The following syntax is an example:

```
client.ipv6.src + server.ip.dst
```

For example, if the client source IPv6 address is ABCD:1234::ABCD, and the server destination IPv4 address is 10.100.10.100, the preceding expression returns "ABCD:1234::ABCD10.100.10.100".

Note that when the NetScaler receives an IPv6 packet, it assigns a temporary IPv4 address from an unused IPv4 address range and changes the source address of the packet to this temporary address. At response time, the outgoing packet's source address is replaced with the original IPv6 address.

Note: You can combine an IPv6 expression with any other expression except an expression that produces a Boolean result.

Expression Prefixes for IPv6 Addresses

When an IP address uses IPv6 format, it can be treated as text data. For example, the prefix `client.ipv6.dst` returns a string that can be evaluated as text.

The following table describes IPv6 expression prefixes.

IPv6 Expression Prefixes that Return Text

Prefix	Description
`CLIENT.IPV6`	Operates on the IPv6 address in with the current packet.
`CLIENT.IPV6.DST`	Returns the IPv6 address in the destination field of the IP header.

`CLIENT.IPV6.SRC`	Returns the IPv6 address in the source field of the IP header. Following are examples:
	`client.ipv6.src.in_subnet(2007::2008/64)`
	`client.ipv6.src.get1.le(2008)`

`SERVER.IPV6`	Operates on the IPv6 address in with the current packet.

IPv6 Expression Prefixes that Return Text

Prefix	**Description**
`SERVER.IPV6.DST`	Returns the IPv6 address in the destination field of the IP header.

`SERVER.IPV6.SRC`	Returns the IPv6 address in the source field of the IP header. Following are examples:
	`server.ipv6.src.in_subnet(2007::2008/64)`
	`server.ipv6.src.get1.le(2008)`

You can specify a GET operation to extract segments of IPv6 addresses and URL paths and apply numeric operations on these segments. Note that with IPv6 addresses, the GET operation returns numbers. This is different from operations on the entire IPv6 address, which return text.

Operations for IPV6 Prefixes

The following table describes operations on IPv6 IP addresses:

Operations That Evaluate IPv6 Addresses

IPv6 Operation	**Description**
`ipv6``.EQ(`*`IPv6_address`* `)`	Returns a Boolean TRUE if the IP address value is same as the *`IPv6_address`* argument. Following is an example: `client.ipv6.dst.eq(ABCD:1234::ABCD)`
`ipv6``.GET1. . .GET8`	Evaluates a segment of an IPv6 address. For example, if the *`ipv6`* address is 1000:1001:CD10:0000:0000:89AB:4567:CDEF, the following values can be returned: • `client.ipv6.dst.get5` extracts 0000, which is the fifth set of bits in the address. • `client.ipv6.dst.get6` extracts 89AB. • `client.ipv6.dst.get7` extracts 4567.
`ipv6``.IN_SUBNET(`*`subnet`*`)`	Returns a Boolean TRUE if the IPv6 address value is in the subnet specified by the *ip subnet* argument. Following is an example: `client.ipv6.dst.eq(1000:1001:CD10:0000:0000:89AB:4567:CDEF/60)`
`ipv6``.IS_IPV4`	Returns a Boolean TRUE if this is an IPv4 client, and returns a Boolean FALSE if it is not.

Operations That Evaluate IPv6 Addresses

IPv6 Operation	Description
`ipv6.SUBNET(n)`	Returns the IPv6 address after applying the subnet mask specified as the argument. The subnet mask can take values between 0 and 128. For example: CLIENT.IPV6.SRC.SUBNET(24)

Expressions for MAC Addresses

MAC addresses are colon-delimited hexadecimal codes in the format ##:##:##:##:##:##, where # represents the numbers 0-9 and the letters A-F.

Prefixes for MAC Addresses

The following table describes prefixes that return MAC addresses.

Prefixes That Evaluate MAC Addresses

Prefix	Description
`client.ether.dstmac`	Returns the MAC address in the destination field of the Ethernet header.
`client.ether.srcmac`	Returns the MAC address in the source field of the Ethernet header.

Operations for MAC Addresses

All MAC addresses are given as colon-delimited hexadecimal codes in the format ##:##:##:##:##:##. The following table describes operations on MAC addresses.

Operations on MAC Addresses

Prefix	Description
mac address`.EQ(`*address*`)`	Returns a Boolean TRUE if the MAC address value is same as the *address* argument.
mac address`.GET1. . .GET4`	Returns a numeric value extracted from the segment of the MAC address that is specified in the GET operation. For example, if the MAC address is 12:34:56:78:9a:bc, the following returns 34: `client.ether.dstmac.get2`

Expressions for Numeric Client and Server Data

The following table describes prefixes for working with numeric client and server data, including throughput, port numbers, and VLAN IDs.

Prefixes That Evaluate Numeric Client and Server Data

Prefix	**Description**
`client.interface.rxthroughput`	Returns an integer representing the raw received traffic throughput in kilobytes per second (KBps) for the previous seven seconds.
`client.interface.txthroughput`	Returns an integer representing the raw transmitted traffic throughput in KBps for the previous seven seconds.
`client.interface.rxtxthroughput`	Returns an integer representing the raw received and transmitted traffic throughput in KBps for the previous seven seconds.
`server.interface.rxthroughput`	Returns an integer representing the raw received traffic throughput in KBps for the previous seven seconds.
`server.interface.txthroughput`	Returns an integer representing the raw transmitted traffic throughput in KBps for the previous seven seconds.
`server.interface.rxtxthroughput`	Returns an integer representing the raw received and transmitted traffic throughput in KBps for the previous seven seconds.
`server.vlan.id`	Returns a numeric ID of the VLAN through which the current packet entered the NetScaler.
`client.vlan.id`	Returns a numeric ID for the VLAN through which the current packet entered the NetScaler.

Advanced Expressions: String Sets, String Patterns, and Data Formats

You can configure an operation that matches text in a target against a set of strings (an array) or a single string within an array. You can also match a target against a pattern defined in a regular expression. You can use a regular expression to specify wildcard characters in a pattern, such as text, numbers, and spaces.

Finally, you can use typecasting to convert one type of data into another type. For example, you can extract a string from an HTTP request POST body and format it as an HTTP header for the purpose of inserting the header into an HTTP response.

In This Chapter

Matching Text With Strings in a Set

Matching Text With a Pattern

Transforming Text and Numbers into Different Data Types

Matching Text With Strings in a Set

A pattern set compares a target with multiple static strings. A pattern set can be efficient if an expression would otherwise have a large number of Boolean OR operations. A pattern set reduces the overhead that would be required to process the ORs.

For example, you can define a pattern set with the strings “host1” and “host2”, “host3” and compare the target against each string. You can also compare the target with just one particular string in the set. For example, you can define a pattern set with the strings “vserver1”, “vserver2”, vserver3” and compare the target against only the string “vserver1”. For this type of comparison, you specify a unique index that is assigned to each string in the pattern set.

You can use a pattern set in any expression that evaluates HTTP headers or text. For information about expression prefixes for HTTP headers, see “Expressions for HTTP Headers,” on page 115. For information about expression prefixes for text, see “Expression Prefixes for Text,” on page 67.

Note: The patterns in a pattern set can be regular expressions in PCRE format.

Operators That Use a Pattern Set

The following table describes operations that match text and HTTP header values with a collection of static strings in a pattern set.

Operators That Compare Text and HTTP Headers With a Pattern Set

Matching Operators	**Description**
`text.CONTAINS_ANY (pattern_set_name)`	Evaluates whether the target contains any of the strings that are bound to *pattern_set_name*. Returns a Boolean TRUE value if the target contains any of the strings that are bound to *pattern_set_name*.
`text.SUBSTR_ANY(pattern_set_name)`	Selects the first sub-string that matches any string in the given pattern set. The pattern set cannot have strings longer than 255 characters. Parameters: `pattern_set_name` - The name of the pattern set.
`http header.CONTAINS_ANY (pattern_set_name)`	Works with the following prefixes: • `HTTP.REQ.COOKIE` • `HTTP.REQ.HEADER("header_name")` • `HTTP.RES.HEADER("header_name")` • `HTTP.RES.SET_COOKIE` • `HTTP.RES.SET_COOKIE2` Evaluates whether the target contains any of the strings that are bound to *pattern_set_name*. Returns a Boolean TRUE if the target contains any string that is bound to *pattern_set_name*.
`text.EQUALS_ANY (pattern_set_name)`	Evaluates whether the target matches any of the strings that are bound to *pattern_set_name*. Returns a Boolean TRUE value if the target is an exact match with any of the strings that are bound to *pattern_set_name*.

Operators That Compare Text and HTTP Headers With a Pattern Set

Matching Operators	**Description**
`*http header*.EQUALS_ANY (*pattern_set_name*)`	Works with the following prefixes: • `HTTP.REQ.COOKIE` • `HTTP.REQ.HEADER("header_name")` • `HTTP.RES.HEADER("header_name")` • `HTTP.RES.SET_COOKIE` • `HTTP.RES.SET_COOKIE2` Evaluates whether the target matches any of the strings that are bound to *pattern_set_name*. Returns a Boolean TRUE if the target is an exact match with any string that is bound to *pattern_set_name*.
text.ENDSWITH_ANY(*pattern_set_name*)	Evaluates whether the target ends with any of the strings that are bound to *pattern_set_name*. Returns a Boolean TRUE value if the target ends with any of the strings that are bound to *pattern_set_name*.
text.STARTSWITH_ANY(*pattern_set_name*)	Evaluates whether the target starts with any of the strings that are bound to *pattern_set_name*. Returns a Boolean TRUE value if the target starts with any of the strings that are bound to *pattern_set_name*.
text.STARTSWITH_INDEX(*pattern_set_name*)	Evaluates whether the target starts with any of the strings that are bound to *pattern_set_name*. If a match is found, this operation returns the numerical index of the matching string.
text.ENDSWITH_INDEX(*pattern_set_name*)	Evaluates whether the target ends with any of the strings that are bound to *pattern_set_name*. If a match is found, this operation returns the numerical index of the matching string.
text.CONTAINS_INDEX(*pattern_set_name*)	Evaluates whether the target contains any of the strings that are bound to *pattern_set_name*. If a match is found, this operation returns the numerical index of the matching string.

Operators That Compare Text and HTTP Headers With a Pattern Set

Matching Operators	**Description**
`http header.CONTAINS_INDEX (pattern_set_name)`	Operates on all the instances of the current header type. Evaluates all header values, and returns the index of the matching pattern in the *pattern set name* argument that is present in any instance of a header value. This operations works with the following prefixes: • `HTTP.REQ.COOKIE` • `HTTP.REQ.HEADER("header_name")` • `HTTP.RES.HEADER("header_name")` • `HTTP.RES.SET_COOKIE` • `HTTP.RES.SET_COOKIE2`
`text.EQUALS_INDEX(pattern_set_name)`	Evaluates whether the target is an exact match with any of the strings that are bound to *pattern_set_name*. If an exact match is found, this operation returns the numerical index of the matching string.
`http header.EQUALS_INDEX (pattern_set_name)`	Operates on all the instances of the current header type. Evaluates all header values and returns the index of the matching pattern in the *pattern set name* argument that is present in any instance of a header value. This operations works with the following prefixes: • `HTTP.REQ.COOKIE` • `HTTP.REQ.HEADER("header_name")` • `HTTP.RES.HEADER("header_name")` • `HTTP.RES.SET_COOKIE` • `HTTP.RES.SET_COOKIE2`

Configuring a Pattern Set

A pattern set contains a name and string patterns. Each string pattern is assigned an index that enables you to select the associated string from the set.

When you configure a pattern set, you can assign index values to the patterns, or you can let the NetScaler assign the index values, as follows:

- When configuring the first pattern in the pattern set, if you omit an index the NetScaler generates an index and issues an error if you specify an index value for any additional patterns in the set.
- If you provide an index for the first pattern in the set, you must provide an index for all subsequent patterns in the set.

Note: Pattern sets are case-sensitive.

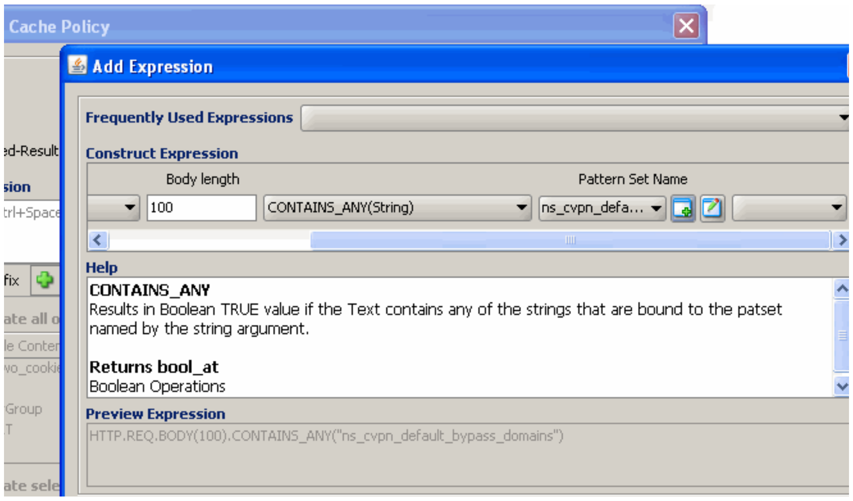
To create a named pattern set using the AppExpert in the configuration utility

1. In the navigation pane, expand **AppExpert**, and click **Pattern Sets**.
2. In the details pane, click **Add**.
3. In the **Create Pattern Set** dialog box, enter a name in the **Name** field, and then click **Add**.
4. In the **Add Pattern** dialog box, enter a pattern in the **Pattern** field.
5. If you want to manually assign an index number to this pattern set, in the **Index** field, enter an integer. Note that if you manually add an index to this entry, you must do this for all entries in the set. Otherwise, the NetScaler will automatically assign an index to each entry in the set.
6. Click **Create**.
7. Continue to add patterns, as needed, as described in the previous steps.
8. Click **Create**.

To add a pattern set to a policy expression using the configuration utility

1. In the navigation pane, click the name of the feature for which you want to configure an advanced policy, for example, you can select **Integrated Caching**, **Responder**, **DNS**, **Rewrite**, or **Content Switching**, and then click **Policies**.
2. Click **Add**.
3. In the **Create Policy** dialog box for most features, instead of clicking directly in the **Expression** field, click the **Add** icon (the plus sign). For **Content Switching**, click **Configure**, click **Advanced Syntax**, and then click the **Add** icon (the plus sign).
4. In the **Add Expression** dialog box, select the initial expression parameters from the drop-down menus.
5. Select one of the "_ANY" or "_INDEX" operators (for example, CONTAINS_ANY or EQUALS_INDEX). For more information about pattern set operators, see the table, "Operators That Compare Text and HTTP Headers With a Pattern Set," on page 158.

The following screen shot is an example of an “_ANY” operator..



CONTAINS_ANY
Results in Boolean TRUE value if the Text contains any of the strings that are bound to the patset named by the string argument.

Returns bool_at
Boolean Operations

HTTP.REQ.BODY(100).CONTAINS_ANY("ns_cvpn_default_bypass_domains")

6. To use an existing pattern set, select it from the **Pattern Set Name** drop-down menu.
7. To create a new pattern set, click the icon for creating a new pattern set, and configure the pattern set as follows:
   - In the **Name** field, enter a name, and then click **Add**.
   - In the **Add Pattern** dialog box, enter a pattern in the **Pattern** field.
   - If you want to manually assign an index to this pattern set, in the **Index** field, enter an integer. Note that if you manually add an index to an entry, you must do this for all entries in the set. Otherwise, the NetScaler automatically assigns an index to each entry in the set.
   - Click **Create**.
8. Repeat the previous step until you have added all of the patterns that you want.
9. Click **Create**.

   Note: To view the new pattern set, click the icon for modifying a pattern set.

To create and use a CONTAINS_ANY pattern set using the NetScaler command line

1. At a NetScaler command prompt, type:

```
add policy patset patternName
```

   Where *pattern_name* is the name of a pattern that you want to configure.

2. Associate a pattern with the named pattern set, as follows:

   bind policy patset *pattern_name pattern*

   Where *pattern_name* is the name of a pattern that you want to configure and *pattern* is an actual text pattern. Following is an example:

   ```
   add policy patset myPatSet
   bind policy patset myPatSet aaa
   bind policy patset myPatSet bbb
   bind policy patset myPatSet ccc
   ```

3. To view the named pattern set and its associated patterns, enter the following command:

   show policy patset *pattern_name*

   Where *pattern_name* is the name of a pattern that you want to view.

4. Configure the pattern set as part of an expression in a policy.

   For more information, see "Creating or Modifying an Advanced Policy," on page 14. Following is an example that uses the pattern set myPatSet, and returns TRUE if the value of the HTTP header named myHeader contains any of the strings that you defined earlier in this procedure:

   ```
   add cache policy testPatSet -rule
   http.req.header("myHeader").contains_any("myPatSet") -action
   cache
   ```

To configure and use an index-based pattern set using the NetScaler command line

1. At a NetScaler command prompt, type:

   add policy patset *patternName*

   Where *pattern_name* is the name of a pattern that you want to configure.

2. Associate a pattern and an index with the named pattern set, as follows:

   bind policy patset *patternName pattern* **-index** *number*

   Where *patternName* is the name of a pattern that you want to configure, *pattern* is an actual text pattern, and *number* is the index value. Following is an example:

   ```
   add policy patset myPatSet1
   bind policy patset myPatSet1 aaa -index 1
   bind policy patset myPatSet1 bbb -index 5
   bind policy patset myPatSet1 ccc -index 4
   ```

3. To view the named pattern set and its associated patterns, type:

```
show policy patset pattern_name
```

Where *patternName* is the name of a pattern that you want to view.

4. Configure the pattern set as part of an expression.

   For example, you can configure it in a policy rule. For more information, see "Creating or Modifying an Advanced Policy," on page 14. Following is an example that uses the pattern set myPatSet, and returns TRUE if the value of the HTTP header named myHeader contains any of the strings that you defined earlier in this procedure:

```
add cache policy testPatSet -rule
http.req.header("myHeader").contains_index("myPatSet1") -
action cache
```

Matching Text With a Pattern

In addition to matching text with a set of patterns, you can define an arbitrary pattern that uses wildcards. In most types of expressions, you should avoid using wildcards. For example, the following expression is legal but may have unexpected results:

```
http.req.url.path.contains("/*.jpeg")
```

Note that this expression would not, for example, match the following URL:

http://10.102.58.201/icon.jpeg

Following is an example of a regular expression that matches a URL that contains the file name suffix, ".jpeg":

```
http.req.url.regex_match(re/*.jpeg/)
```

In general, for simple pattern matching, it is preferable to use the CONTAINS or EQ operation to perform a partial string match. For example, the following expressions check the file name extension:

```
http.req.url.suffix.contains("jpeg")
```

```
http.req.url.suffix.eq("jpeg")
```

However, if you need to match more complex patterns in text, you can define a regular expression. For example, the following example selects "text" from "text/plain":

```
http.res.header("content-type").before_regex(re#/#)
```

The NetScaler supports regular expression syntax as described on the following Web site:

http://www.pcre.org/pcre.txt

For an introduction to regular expressions, see the following URLs:

http://www.regular-expressions.info/quickstart.html

http://www.silverstones.com/thebat/Regex.html

These sites provide tutorial and reference information on regular expressions.

Note: Processing of regular expressions can be slow, and should only be used if other expression types do not satisfy your requirements.

Basic Characteristics of Regular Expressions

The following are a few characteristics of a regular expression:

- The string “re” followed by a delimiter indicates the start of a regular expression within an advanced policy expression.

  The expression is ended with a matching delimiter. For example, `(re#/#)` extracts information before or after a slash.

- A regular expression cannot exceed 1499 characters.
- To represent a digit, use the string *d* (a backslash, followed by d).
- To represent white space, use *s* (a backslash, followed by s).
- The regular expression can contain white space. The white space is ignored.

The following are differences between the NetScaler syntax and PCRE syntax:

- The NetScaler does not allow back references.
- You should not use recursive regular expressions.
- The dot meta-character also matches new lines.
- Unicode is not supported.
- The operation `SET_TEXT_MODE(IGNORECASE)` overrides the `(?i)` internal option in the regular expression.

Operations for Regular Expressions

Operations for regular expressions are evaluated somewhat differently, depending on whether they evaluate text or HTTP headers. Operations that evaluate headers override any text-based operations for all instances of the current header type.

The following table describes operations that use regular expressions.

Operations That Apply Regular Expressions to Text and HTTP Headers

Regular Expression Operation	**Description**
`*text*.BEFORE_REGEX(*regular expression*)`	Selects text that precedes the string that matches the *regular expression* argument. If the *regular expression* does not match any data in the target, the expression returns a text object of length of 0. The following expression selects the string "text" from "text/plain". `http.res.header("content-type").before_regex(re#/#)`
`*text*.AFTER_REGEX(*regular expression*)`	Selects text that follows the string that matches the *regular expression* argument. If the regular expression does not match any text in the target, the expression returns a text object of length of 0. The following expression extracts "Example" from "myExample": `http.req.header("etag").after_regex(re/my/)`
`*text*.REGEX_SELECT(*regular expression*)`	Selects a string that matches the *regular expression* argument. If the *regular expression* does not match the target, a text object of length of 0 is returned. The following example extracts the string "NS-CACHE-9.0: 90" from a Via header: `http.req.header("via").regex_select(re!NS-CACHE-\d\.\d:\s*\d{1,3}!)`

Operations That Apply Regular Expressions to Text and HTTP Headers

Regular Expression Operation	**Description**

`text.REGEX_MATCH(regular expression)`	Returns TRUE if the target matches a *regular expression* argument of up to 1499 characters.
	
	The regular expression must be of the following format:
	
	`re<delimiter>regular expression< delimiter>`
	
	Both delimiters must be the same. Additionally, the regular expression must conform to the Perl-compatible (PCRE) regular expression library syntax. For more information, go to http://www.pcre.org/pcre.txt. In particular, see the pcrepattern man page. However, make note of the following:
	
	• Back-references are not allowed.
	• Recursive regular expressions are not recommended.
	• The dot metacharacter also matches new lines.
	• The Unicode character set is not supported.
	• SET_TEXT_MODE(IGNORECASE) overrides the “(?i)” internal option specified in the regular expression.
	
	The following are examples:
	
	`http.req.hostname.regex_match(re/[[:alpha:]]+(abc){2,3}/)`
	
	`http.req.url.set_text_mode(urlencoded).regex_match(re#(a*b+c*)#)`
	
	The following example matches ab and aB:
	
	`http.req.url.regex_match(re/a(?i)b/)`
	
	The following example matches ab, aB, Ab and AB:
	
	`http.req.url.set_text_mode(ignorecase).regex_match(re/ab/)`
	
	The following example performs a case-insensitive, multiline match where the dot meta-character also matches a new line:
	
	`http.req.body.regex_match(re/(?ixm)(^ab (.*) cd$) /)`

Operations That Apply Regular Expressions to Text and HTTP Headers

Regular Expression Operation	**Description**
`http header.AFTER_ REGEX(regular expression)`	Evaluates all instances of the header and extracts the text following the string that matches the *regular expression* argument in any instance of the header value. The header instances are matched from the last to the first. The following example extracts "BBCCDD" from "AABBCCDD". `http.req.header("etag").after_ regex(re/AA/)`
`http header.BEFORE_ REGEX(regular expression)`	For any instance of the header, this operation returns the text that precedes the string matching the *regular expression* argument. The header instances are evaluated from the last to the first. The following example extracts "text" from "text/ plain": `http.res.header("content- type").before_regex(re#/#)`

`http header.REGEX_ MATCH(regular expression)`	This operation returns a Boolean TRUE if the *regular expression* argument matches any instance of the header value. The header instances are evaluated from the last to the first.
	
	Following are examples:
	
	`http.req.hostname.regex_match(re/ [[:alpha:]]+(abc){2,3}/)`
	
	`http.req.url.set_text_ mode(urlencoded).regex_ match(re#(a*b+c*)#)`
	
	The following example matches the strings “ab” and “aB”:
	
	`http.req.url.regex_match(re/a(?i)b/)`
	
	The following example matches the strings “ab”, “aB”, “Ab”, and “AB”:
	
	`http.req.url.set_text_ mode(ignorecase).regex_match(re/ab/)`
	
	The following example performs a case-insensitive, multi-line match, where the dot (.) meta-character also matches a new line:
	
	`http.req.body.regex_match(re/(?ixm) (^ab (.*) cd$) /)`

Operations That Apply Regular Expressions to Text and HTTP Headers

Regular Expression Operation	Description
`http header.REGEX_ SELECT(regular expression)`	Selects the text that matches the *regular expression* argument in any instance of the *http header* value. The header instances are matched from the last to the first. The following example selects "NS-CACHE-9.0: 90": `http.req.header("via").regex_ select(re!NS-CACHE- \d\.\d:\s*\d{1,3}!)`

Transforming Text and Numbers into Different Data Types

You can extract text or a number and treat it like another type of data. For example, you can do the following:

- Extract a string from an HTTP request body and treat it like an HTTP header.
- Extract a value from one type of request header and insert it in a response header of a different type.

After typecasting the data, you can apply any operation that is appropriate for the new data type. For example, if you typecast text to an HTTP header, you can apply any operation that is applicable to HTTP headers to the returned value.

The following table describes various typecasting operations.

Typecasting Operations

Operation	**Description**

`text.TYPECAST_LIST_T(separator)`	Treats the text in an HTTP request or response body as a list whose elements are delimited by the character in the *separator* argument.
	
	Text mode settings have no effect on the separator. For example, even if you set the text mode to IGNORECASE, and the separator is the letter “p,” an uppercase “P” is not treated as a separator.
	
	The following example creates a Rewrite action that constructs a list from an HTTP request body and extracts the fourth item in the list:
	
	`add rewrite action myreplace_action REPLACE 'http.req.body(100)' 'http.req.body(100).typecast_list_t('?').get(4)'`
	
	`set rewrite policy myreplace_policy -action myreplace_action`
	
	This policy returns the string “fourth item” from the following request:
	
	`GET?first item?second item?third item?fourth item?`
	
	The following example extracts the fourth item from the last from the list.
	
	`add rewrite action myreplace_action1 REPLACE 'http.req.body(100)' 'http.req.body(100).typecast_list_t('?').get_reverse(4)'`
	
	`set rewrite policy myreplace_policy1 -action myreplace_action1`
	
	This policy returns the string “first item” from the following request:
	
	`GET?first item?second item?third item?fourth item`
	
	Note that the GET_REVERSE operations ignores empty elements in a list.

Typecasting Operations

Operation	**Description**

`text.TYPECAST_NVLIST_T(separator, delimiter)`
 	
or
 	
`text.TYPECAST_NVLIST_T(separator, delimiter, quote)`
	Treats the text as a name-value list. The *separator* argument identifies the character and separates the name and the value. The *delimiter* argument identifies the character that separates each name-value pair. The *quote* character is required when typecasting text into a name-value list that supports quoted strings. Any delimiters that appear within the quoted string are ignored.
	
	The text mode has no effect on the delimiters. For example, if the current text mode is IGNORECASE and you specify “p” as the delimiter, an uppercase “P” is not treated as a delimiter.
	
	For example, the following policy counts the number of name-value pairs and inserts the result in a header named `name-value-count`:
	
	`add rewrite action mycount_action insert_http_header name-value-count 'http.req.header("Cookie").typecast_nvlist_t('=',';').count'`
	
	`set rewrite policy mycount_policy -action mycount_action`
	
	This policy can extract a count of arguments in Cookie headers and insert the count in a `name-value-count` header:
	
	`Cookie: name=name1; rank=rank1`

`text.TYPECAST_TIME_T`	Treats the designated text as a date string. The following formats are supported:
	
	• RFC822: Sun, 06 Nov 1994 08:49:37 GMT
	• RFC850: Sunday, 06-Nov-94 08:49:37 GMT
	• ASCII TIME: Sun Nov 6 08:49:37 1994
	• HTTP Set-Cookie Expiry date: Sun, 06-Nov-1994 08:49:37 GMT
	
	For example, the following policy searches for the string “dec” and converts it to a time value. This policy matches all requests that contain “dec” in the request body:
	
	`Add rewrite policy mytime_policy "http.req.body(100).typecast_time_t.contains("dec")" mytime_action`
	
	`bind rewrite global mytime_policy 100`

Typecasting Operations

Operation	Description

`*numeric string*.TYPECAST_IP_ADDRESS_T`	Treats a numeric string like an IP address.
	
	For example, the following policy matches HTTP requests that contains Cookie headers with a value of: `12.34.56.78\r\n`.
	
	`set rewrite policy ip_check_policy -rule 'http.req.cookie.value("ip").typecast_ip_address_t.eq(12.34.56.78)'`
	
	`bind rewrite global ip_check_policy 200 -type req_default`

`*numeric string*.TYPECAST_IPV6_ADDRESS_T`	Treats a string as an IPv6 address in the following format: `0000:0000:CD00:0000:0000:00AB:0000:CDEF`

`*text*.TYPECAST_HTTP_URL_T`	Treats the designated text as the URL in the first line of an HTTP request header. The supported format is [*protocol*://*hostname*]*path*?*query*, and the text mode is set to URLENCODED by default.
	
	For example, the following policy replaces a URL-encoded part of a string in an HTTP header named `Test`.
	
	`add rewrite action replace_header_string replace "http.req.header(\"Test\").typecast_http_url_t.path.before_str(\"123\").after_str(\"ABC\")" "\"string\""`
	
	`add rewrite policy rewrite_test_header_policy true replace_header_string`
	
	`bind rewrite global rewrite_test_header_policy 1 END -type res_override`
	
	Consider the following header:
	
	`Test: ABC%12123\r\n`
	
	This policy would replace the preceding header with the value `ABC%string123\r\n`.

Typecasting Operations

Operation	**Description**

`number``.TYPECAST_NUM_T(DECIMAL)`	Converts a numeric string into decimal format. For example, the following policy extracts a numeric portion of a query string, adds 4 to the number, and inserts an HTTP header named Company with a value of the resulting decimal value.
	`add rewrite action myadd_action insert_http_header Company "http.req.url.query.typecast_num_t(decimal).add(4)"`
	`add rewrite policy myadd_policy true myadd_action`
	`bind rewrite global myadd_policy 300 END -type RES_DEFAULT`
	For example, this policy would extract “4444” from the following:
	`/test/file.html?4444`
	The action that is associated with the policy would insert the following HTTP response header:
	`Company: 4448\r\n`

`text``.TYPECAST_HTTP_HOSTNAME_T`	Provides operations for parsing an HTTP host name as it appears in HTTP data. The format for a host name is abc.def.com:8080.

`text``.TYPECAST_HTTP_METHOD_T`	Converts text to an HTTP method.
	For example, suppose that you define the following pattern set:
	`add policy patset method_pattern`
	`bind policy patset method_pattern TRACE`
	`bind policy patset method_pattern GET`
	`bind policy patset method_pattern POST`
	`bind policy patset method_pattern PUT`
	`bind policy patset method_pattern HEAD`
	`bind policy patset method_pattern OPTIONS`
	`bind policy patset method_pattern DELETE`
	The following policy matches any HTTP request that contains a Host header with any of the preceding values:
	`Add rewrite policy method_policy "http.req.header(\"Host\").typecast_http_method_t.contains_any(\"pat1\")" act1`

`text``.TYPECAST_DNS_DOMAIN_T`	Enables the designated text to be parsed like a DNS domain name in the format ab.def.com.

Typecasting Operations

Operation	**Description**
`*text*.TYPECAST_HTTP_HEADER_T`	Overrides the behavior of certain methods that are used with protocol-aware prefixes. This operator can be used only with protocol-aware prefixes that qualify standard HTTP headers, that is, prefixes of the format HTTP.REQ.<STANDARD_HEADER> (for example, HTTP.REQ.COOKIE and HTTP.REQ.SET_COOKIE). Protocol-aware prefixes of the format HTTP.REQ.<STANDARD_HEADER> are used with several methods, such as COUNT and VALUE("string"). TYPECAST_HTTP_HEADER_T overrides the behavior of these methods. Following are two examples of how TYPECAST_HTTP_HEADER_T overrides the behavior of methods associated with protocol-aware prefixes for HTTP headers: **Example 1:** HTTP.REQ.COOKIE.COUNT returns the total number of name-value pairs present in Cookie headers. HTTP.REQ.COOKIE.TYPECAST_HTTP_HEADER_T.COUNT, however, overrides this behavior and returns the number of instances of the COOKIE header. **Example 2:** HTTP.REQ.COOKIE.VALUE(*n*) accepts an unsigned integer *n* (whose value can range from 0 to 14) as an argument and selects the value of the first name-value pair in the *n*th instance of the Cookie header, starting from the last instance. Therefore, HTTP.REQ.COOKIE.VALUE(0) selects the value of the first name-value pair in the last instance of the Cookie header, HTTP.REQ.COOKIE.VALUE(1) selects the value of the first name-value pair in the second to last instance of the Cookie header, and so on. When used with TYPECAST_HTTP_HEADER_T, however, the method returns the entire value of the *n*th occurrence of the Cookie header, starting from the last instance. Therefore, HTTP.REQ.COOKIE.TYPECAST_HTTP_HEADER_T.VALUE(0) selects the entire value of the last instance of the Cookie header, HTTP.REQ.COOKIE.TYPECAST_HTTP_HEADER_T.VALUE(1) selects the entire value of the second to last instance of the Cookie header, and so on. TYPECAST_HTTP_HEADER_T returns an error if used with prefixes that are not protocol-aware. It returns an error regardless of whether or not the header that is used in the prefix is a standard HTTP header. For example, the following expression returns an error even though the prefix contains a standard header: HTTP.REQ.HEADER("Cookie").TYPECAST_HTTP_HEADER_T.CONTAINS("abc")

Typecasting Operations

Operation	Description
`text.TYPECAST_HTTP_HEADER_T("name")`	Converts the designated text to a multi-line HTTP header that you specify in a *name* argument. For example, the following expression converts “MyHeader” to “InHeader”: `http.req.header("MyHeader").typcast_http_header_t("InHeader")` Typically, text operations that you specify in this type of expression apply to only the last line of this header, with some exceptions. For example, the CONTAINS operation operates on values in all the lines in instances of this header type.
`text.TYPCAST_COOKIE_T`	Treats the designated text as an HTTP cookie as it appears in a Set-Cookie or Set-Cookie2 header. You can apply name-value list operations as well as text operations to the designated text. For example, you can designate an equals (=) as the name-value delimiter and the semicolon (;) as the list element delimiter. If you apply name-value list operations, note that the list is parsed as if IGNORE_EMPTY_ELEMENTS were in effect. Each cookie begins with a *cookie-name*=*cookie-value* pair, optionally followed by attribute-value pairs that are separated by a semicolon, as follows: `cookie1=value1;version=n.n;value;domain=value;path=value` If the same attribute appears more than once in a cookie, the value for the first instance of the attribute is returned.
`number.TYPECAST_DOUBLE_AT`	Transforms the number to a value of data type “double”.
`number.TYPECAST_IP_ADDRESS_AT`	Converts the number to an IP address.
`number.TYPECAST_TIME_AT`	Converts the number to time format.

Typecasting Operations

Operation	**Description**
`*number*.TYPECAST_TIME_AT.BETWEEN(*time1*, *time2*)`	Returns a Boolean value (TRUE or FALSE) that indicates whether the time value designated by *number* is between the lower and upper time value arguments *time1* and *time2*. The following are prerequisites for this operator: • Both the lower and upper time arguments must be fully specified. For example, GMT 1995 Jan is fully specified. But GMT Jan, GMT 1995 20 and GMT Jan Mon_2 are not fully specified. • Both arguments must be either GMT or Local. • The day of the week must not be present in either argument. However, the day of the month can be specified as the first, second, third, or fourth weekday of the month (example Wed_3 is the third Wednesday of the month). • The upper time argument, *time2*, must be bigger than the lower time argument, *time1*. The following examples assume that the current time value is GMT 2005 May 1 10h 15m 30s and that the day is the first Sunday of the month of May in 2005. The result of the evaluation is given after each example. BETWEEN(GMT 2004, GMT 2006): TRUE BETWEEN(GMT 2004 Jan, GMT 2006 Nov): TRUE BETWEEN(GMT 2004 Jan, GMT 2006): TRUE BETWEEN(GMT 2005 May Sun_1, GMT 2005 May Sun_3): TRUE BETWEEN(GMT 2005 May 1, GMT May 2005 1): TRUE BETWEEN(LOCAL 2005 May 1, LOCAL May 2005 1): The result depends on the NetScaler system's timezone. Parameters: time1 - Lower time value time2 - Upper time value
`*number*.TYPECAST_TIME_AT.DAY`	Extracts the day of the month from the current system time and returns the value as a number that corresponds to the day of the month. The value that is returned ranges from 1 to 31.

Typecasting Operations

Operation	**Description**
`*number*.TYPECAST_ TIME_AT.EQ(*t*)`	Returns a Boolean value (TRUE or FALSE) that indicates whether the time value designated by *number* is equal to the time value argument *t*. The following examples assume that the current time value is GMT 2005 May 1 10h 15m 30s and that the day is the 1st Sunday of the month of May in 2005. The result of the evaluation is given after each example. EQ(GMT 2005): TRUE EQ(GMT 2005 Dec): FALSE EQ(Local 2005 May): TRUE or FALSE, depending on the current timezone. EQ(GMT 10h): TRUE EQ(GMT 10h 30s): TRUE EQ(GMT May 10h): TRUE EQ(GMT Sun): TRUE EQ(GMT May Sun_1): TRUE Parameters: *t* - Time
`*number*.TYPECAST_ TIME_AT.GE(*t*)`	Returns a Boolean value (TRUE or FALSE) that indicates whether the time value designated by *number* is greater than or equal to the time value argument *t*. The following examples assume that the current time value is GMT 2005 May 1 10h 15m 30s and that the day is the 1st Sunday of the month of May in 2005. The result of the evaluation is given after each example. GE(GMT 2004): TRUE GE(GMT 2005 Jan): TRUE GE(Local 2005 May): TRUE or FALSE, depending on the current timezone. GE(GMT 8h): TRUE GE(GMT 30m): FALSE GE(GMT May 10h): TRUE GE(GMT May 10h 0m): TRUE GE(GMT Sun): TRUE GE(GMT May Sun_1): TRUE Parameters: *t* - Time

Typecasting Operations

Operation	**Description**
`number.TYPECAST_ TIME_AT.GT(t)`	Returns a Boolean value (TRUE or FALSE) that indicates whether the time value designated by *number* is greater than the time value argument *t*. The following examples assume that the current time value is GMT 2005 May 1 10h 15m 30s and that the day is the 1st Sunday of the month of May in 2005. The result of the evaluation is given after each example. GT(GMT 2004): TRUE GT(GMT 2005 Jan): TRUE GT(Local 2005 May): TRUE or FALSE, depending on the current timezone. GT(GMT 8h): TRUE GT(GMT 30m): FALSE GT(GMT May 10h): FALSE GT(GMT May 10h 0m): TRUE GT(GMT Sun): FALSE GT(GMT May Sun_1): FALSE Parameters: *t* - Time
`number.TYPECAST_ TIME_AT.HOURS`	Extracts the hour from the current system time and returns the corresponding value as an integer that ranges from 0 to 23.

Typecasting Operations

Operation	**Description**
number.TYPECAST_ TIME_AT.LE(*t*)	Returns a Boolean value (TRUE or FALSE) that indicates whether the time value designated by *number* is lesser than or equal to the time value argument *t*. The following examples assume that the current time value is GMT 2005 May 1 10h 15m 30s and that the day is the 1st Sunday of the month of May in 2005. The result of the evaluation is given after each example. LE(GMT 2006): TRUE LE(GMT 2005 Dec): TRUE LE(Local 2005 May): TRUE or FALSE, depending on the current timezone. LE(GMT 8h): FALSE LE(GMT 30m): TRUE LE(GMT May 10h): TRUE LE(GMT Jun 11h): TRUE LE(GMT Wed): TRUE LE(GMT May Sun_1): TRUE Parameters: *t* - Time
number.TYPECAST_ TIME_AT.LT(*t*)	Returns a Boolean value (TRUE or FALSE) that indicates whether the time value designated by *number* is lesser than the time value argument *t*. The following examples assume that the current time value is GMT 2005 May 1 10h 15m 30s and that the day is the 1st Sunday of the month of May in 2005. The result of the evaluation is given after each example. LT(GMT 2006): TRUE LT(GMT 2005 Dec): TRUE LT(Local 2005 May): TRUE or FALSE, depending on the current timezone. LT(GMT 8h): FALSE LT(GMT 30m): TRUE LT(GMT May 10h): FALSE LT(GMT Jun 11h): TRUE LT(GMT Wed): TRUE LT(GMT May Sun_1): FALSE Parameters: *t* - Time

Typecasting Operations

Operation	**Description**
`*number*.TYPECAST_ TIME_AT.MINUTES`	Extracts the minute from the current system time and returns the value as an integer that ranges from 0 to 59.
`*number*.TYPECAST_ TIME_AT.MONTH`	Extracts the month from the current system time and returns the value as an integer that ranges from 1 (January) to 12 (December).
`*number*.TYPECAST_ TIME_AT.RELATIVE_ BOOT`	Calculates the number of seconds that have elapsed after the most recent reboot or the number of seconds to the next scheduled reboot, depending on which of these is closer to the current time, and returns an integer. If the closest boot time is in the past, the integer is negative; if the closest boot time is in the future (scheduled reboot time), the integer is positive.
`*number*.TYPECAST_ TIME_AT.RELATIVE_NOW`	Calculates the number of seconds between the current system time and the specified time, and returns the value as an integer. If the designated time is in the past, the integer is negative; if it is in the future, the integer is positive.
`*number*.TYPECAST_ TIME_AT.SECONDS`	Extracts the seconds from the current system time and returns the value as an integer that ranges from 0 to 59.
`*number*.TYPECAST_ TIME_AT.WEEKDAY`	Returns an integer that corresponds to the day of the week; 0 for Sunday and 6 for Saturday.

Typecasting Operations

Operation	**Description**
`*number*.TYPECAST_TIME_AT.WITHIN(*time1*, *time2*)`	Returns a Boolean value (TRUE or FALSE) that indicates whether the time value designated by *number* lies within all the ranges defined by lower and upper time value arguments *time1* and *time2*. If an element of time such as the day or the hour is left unspecified in the lower argument, *time1*, then it is assumed to have the lowest value possible for its range. If an element is left unspecified in the upper argument , *time2*, then it is assumed to have the highest value possilbe for its range. If the year is specified in one of the arguments, then it must be specified in the other argument as well. Following are the ranges for different elements of time: • month: 1-12 • day: 1-31 • weekday: 0-6 • hour: 0-23 • minutes: 0-59 • seconds: 0-59. Each element of time in the lower time value argument defines a range in combination with the corresponding element in the upper time value argument. For the result to be TRUE, each element of time in the time value designated by *number* must lie in the corresponding range specified by the lower and upper arguments. The following examples assume that the current time value is GMT 2005 May 10 10h 15m 30s.and that the day is the second Tuesday of the month. The result of the evaluation is given after each example. WITHIN(GMT 2004, GMT 2006): TRUE WITHIN(GMT 2004 Jan, GMT 2006 Mar): FALSE (May doesn't fall in the Jan-Mar range.) WITHIN(GMT Feb, GMT): TRUE (May falls in the Feb-Dec range.) WITHIN(GMT Sun_1, GMT Sun_3): TRUE (2nd Tuesday lies within 1st Sunday and the 3rd Sunday.) WITHIN(GMT 2005 May 1 10h, GMT May 2005 1 17h): TRUE WITHIN(LOCAL 2005 May 1, LOCAL May 2005 1): The result depends on the NetScaler system's timezone. Parameters: *time1* - Lower time value *time2* - Upper time value

Typecasting Operations

Operation	**Description**
`*number*.TYPECAST_ TIME_AT.YEAR`	Extracts the year from the current system time and returns the value as a four-digit integer.
`*double*.TYPECAST_NUM_ AT`	Transforms the double-precision number represented by *double* to an integer.

Advanced Policies: Controlling the Rate of Traffic

You can limit access to virtual servers or any other user-defined entity and prevent overloading the network by configuring policies and expressions that control the rate of traffic. You can also configure the NetScaler to perform any other supported action based on the traffic rate, including redirecting traffic if the rate exceeds a particular threshold. To do this, you configure policies that enable the NetScaler to monitor the traffic rate.

In This Chapter

About Policies that Monitor the Traffic Rate

Expressions for Controlling the Traffic Rate

Configuring Policies That Control the Traffic Rate

Note: This chapter provides a brief overview of limiting the traffic rate. For more information, see the chapter on controlling data flow based on the traffic rate in the *Citrix NetScaler AppExpert Guide*.

About Policies that Monitor the Traffic Rate

You can configure policies that monitor the following types of traffic:

- The number of HTTP requests that the NetScaler intercepts.
- The number of DNS requests that the NetScaler intercepts.
- The bandwidth usage.

Expressions for Controlling the Traffic Rate

The following expression prefix can be used to parse the traffic rate:

sys.check_limit("*limit_identifier*")

Where *limit_identifier* is a NetScaler function that indicates the type of traffic to be monitored. For an example, see "Summary Examples of Advanced Expressions and Policies," on page 237. For more information on configuring limit identifiers, see the *Citrix NetScaler Traffic Management Guide*.

This prefix can be used in any NetScaler feature that uses advanced policies and expressions, such as Rewrite and Responder.

Configuring Policies That Control the Traffic Rate

For complete instructions on configuring rate-limiting policies, see the *Citrix NetScaler Traffic Management Guide*. Following is an overview of configuring policies to control the rate of traffic.

Task overview: Configuring policies to limit the amount of traffic

1. Optionally, configure a rate limit selector.
2. Configure a rate limit identifier, and if you have configured a rate limit selector, include it in the rate limit identifier's definition. The rate limit identifier assesses particular types of traffic for a user-configured time interval, and returns a boolean TRUE if the amount of traffic exceeds a user-configured limit within the time interval.
3. Configure an advanced policy that applies the rate limit identifier to particular types of data, for example, to HTTP requests with particular IP addresses or subnets to particular file types. The policy expression must be a compound expression that contains at least two components:

   - An expression that identifies traffic to which the rate limit identifier is applied, for example: `http.req.url.contains("myAspx.aspx")`.
   - An expression that identifies a rate limit identifier, for example: `sys.check_limit("myLimitIdentifier")`.

   Following is a complete example of the policy rule:

   ```
   http.req.url.contains("myAspx.aspx") &&
   sys.check_limit("myLimitIdentifier")
   ```

Advanced Policies: Sending HTTP Service Callouts to Applications

You can use HTTP callouts to obtain information from external applications. For example, if a server makes a request, you can use an HTTP callout to determine if this server is on a “deny access” list. The callout policy sends an HTTP request to an external application. An agent that you deploy in front of the application formats the request for the application. When the application returns a response, the agent formats the response for the NetScaler, and the callout policy extracts data of interest from the response. For example, you can configure a callout that sends a client's source domain to a server that looks up bad domains from a list. When the server sends a response, the callout can extract just the “allowed” or “denied” portion of the response.

You configure an HTTP callout as a specialized type of policy. After configuring an HTTP callout policy, you can invoke it from policies and other functions (for example, actions) that use advanced expressions. The expression prefix `SYS.HTTP_CALLOUT` invokes a callout policy. For example, you can invoke an HTTP callout policy from a Rewrite action and insert the value that is returned by the callout in an HTTP response header.

Note that you cannot invoke an HTTP callout in a DELETE Rewrite action.

In This Chapter

About Calling Out to an External Application

About HTTP Callout Policies

Configuring an HTTP Callout Policy

Invoking an HTTP Callout Policy

Note: To deploy an HTTP callout, in addition to configuring the policy as described in this chapter, you must also create an agent that formats the callout request for the receiving application and formats the application's response to the NetScaler. For details on the callout agent, see the chapter on HTTP callouts in the *Citrix NetScaler AppExpert Guide*.

About Calling Out to an External Application

A callout to an external application consists of an HTTP request and a set of parameters that parse the response to the request. You configure the entire request, or significant parameters in the request, in the HTTP callout policy. The HTTP callout policy also contains information about the recipient of the request and advanced expressions for parsing the HTTP response when it is received.

A callout can send only an HTTP request. The service can only be an HTTP or HTTPS service.

After configuring an HTTP callout policy, you do not bind it or add it to a policy bank, as you would another policy. Instead, you invoke it using an advanced expression in one of the following:

- Content Switching: For content switching of HTTP and TCP data
- Rewrite
- Responder: For content filtering functions
- Load Balancing: For token-based load balancing

Task overview: Configuring a callout to an external application

1. Create a callout policy in the Rewrite feature, as described in "Configuring an HTTP Callout Policy," on page 188.
2. In the feature where the callout policy is needed, invoke the callout policy from an advanced expression, as described in "Invoking an HTTP Callout Policy," on page 193.
3. Configure an HTTP callout agent to format the callout to the receiving application, as described in the "HTTP Service Callout" chapter in the *Citrix NetScaler AppExpert Guide*.

About HTTP Callout Policies

You configure HTTP callout policies in the Rewrite feature. After you define the callout policy, it can be invoked from a policy expression in other NetScaler features. For information on configuring the callout policy, see "Configuring an HTTP Callout Policy," on page 188. For information on invoking the callout policy, see "Invoking an HTTP Callout Policy," on page 193.

An HTTP callout policy contains the following components:

- Parameters that identify the application to be queried.

- Parameters that the NetScaler uses to create an HTTP request or a single parameter that contains a fully-formed HTTP request.
- Parameters for extracting data of interest from the HTTP response.

Note on the Format of an HTTP Request

You can specify a literal HTTP request in an HTTP callout policy. Even though this is not required, it is useful to have a general idea of the format of an HTTP request before configuring an HTTP callout.

An HTTP request contains a series of lines that each end with a carriage return and a line feed, represented as either `<CR><LF>` or `\r\n`.

The first line of a request contains the HTTP method and target. For example, a message line for a GET request contains the keyword GET and a string that represents the object that is to be fetched, as in the following example:

```
GET /mysite/mydirectory/index.html HTTP/1.1\r\n
```

The rest of the request contains HTTP headers, including a required Host header and, if applicable, a message body.

The request ends with a bank line (an extra `<CR><LF>` or `\r\n`).

Following is an example of a request:

```
Get /mysite/index.html HTTP/1.1\r\n
Host: 10.101.101.10\r\n
Accept: */*\r\n
\r\n
```

Note on the Format of an HTTP Response

Because the callout policy extracts data from an HTTP response, it is useful to have a general idea of the format of an HTTP response before configuring an HTTP callout policy.

An HTTP response contains a status message, response HTTP headers, and the requested object, or, if the requested object cannot be served, an error message.

Following is an example of a response:

```
HTTP/1.1 200 OK\r\n
Content-Length: 55\r\n
Content-Type: text/html\r\n
Last-Modified: Wed, 12 Aug 1998 15:03:50 GMT\r\n
Accept-Ranges: bytes\r\n
ETag: “04f97692cbd1:377”\r\n
Date: Thu, 19 Jun 2008 19:29:07 GMT\r\n
\r\n
<55-character response>
```

Configuring an HTTP Callout Policy

You configure an HTTP callout policy by using the AppExpert feature. You invoke this policy by specifying the `SYS.HTTP_CALLOUT` expression prefix in an advanced expression. For details on invocation, see "Invoking an HTTP Callout Policy," on page 193.

The following table describes the elements in an HTTP callout policy.

Elements in an HTTP Callout Policy

Parameter	**Specifies**
Name (`name`)	Name of the callout, 127 characters maximum.
IP address and port (`ipAddress|* port|*`) or Virtual server name (`vserver`)	IPv4 or IPv6 address of the server to which the callout is sent, or a wildcard, and the port on the server to which the callout is sent, or a wildcard. Or, the name of a load balancing, content switching, or cache redirection virtual server with a service type of HTTP.

Elements in an HTTP Callout Policy

Parameter	**Specifies**
Attribute-based request to send to the server (mutually exclusive with sending an expression-based request to the server)	HTTP Method (`httpMethod`). Method used in the HTTP request that this callout sends. Valid values: `GET` or `POST`. Default: `GET`.

	Host expression (`hostExpr`).
	
	Advanced text expression to configure the Host header. Maximum length: 255.
	
	The expression can contain a literal value or it can be an advanced expression that derives the value. Examples:
	
	`"10.101.10.11"`
	
	`"http.req.header("Host")"`

	URL stem expression (`urlStemExpr`)
	
	An advanced string expression for generating the URL stem. Maximum length: 8191.
	
	The expression can contain a literal string or an expression that derives the value. Examples:
	
	`""/mysite/index.html""`
	
	`"http.req.url"`

	HTTP Headers (`headers`). Advanced text expression to insert HTTP headers and their values in the HTTP callout request. You must specify a value for every header. You specify the header name as a string and the header value as an advanced expression.
	Query Parameters (`parameters`). Advanced expression to insert query parameters in the HTTP request that the callout sends. You must specify a value for every parameter that you configure. If the callout request uses the GET method, these parameters are inserted in the URL. If the callout request uses the POST method, these parameters are inserted in the POST body. You configure the query parameter name as a string and the value as an advanced expression. The parameter values are URL encoded.

Elements in an HTTP Callout Policy

Parameter	**Specifies**
Expression-based request to send to the server (`fullReqExpr`)	Exact HTTP request that the NetScaler is to send as an advanced expression to 8191 characters. If you specify this parameter, you must omit the `httpMethod`, `hostExpr`, `urlStemExpr`, `headers`, and `parameters` arguments. The request expression is constrained by the feature where the callout is used. For example, an HTTP.RES expression cannot be used in a request-time policy bank or in a TCP content switching policy bank. The NetScaler does not check the validity of this request. You must manually validate the request.
Return type (`returnType`)	Type of data that the target application returns in the response to the callout. Valid values: • `TEXT:` Treat the returned value as a text string. • `NUM:` Treat the returned value as a number. • `BOOL:` Treat the returned value as a Boolean value. **Note:** You cannot change the return type after it is set.
Expression to extract data from the response (`resultExpr`)	Advanced expression that extracts `HTTP.RES` objects from the response to the HTTP callout. The maximum length is 8191. The operations in this expression must match the return type. For example, if you configure a return type of `text`, the result expression must be a text-based expression. If the return type is `num`, the result expression (`resultExpr`) must return a numeric value similar to the following: `"http.res.body(10000).length"` **Note:** In some cases, if you set a return type of TEXT and the result sent from the server exceeds 16 KB, the result expression can return NULL. For example, this can happen when the result is a concatenated string that exceeds 16 KB.

Note: If a request or response that you configure in an HTTP callout (`-fullReqExpr` or `-resultExpr`) contains the expression `SYS.HTTP_CALLOUT`, the callout can recursively generate additional callouts. You should avoid this. Also, be sure that the HTTP callout configuration is complete. For example, if the callout contains a rule but not a server where the callout is to be sent, it can return a value of “undefined.”

To configure a callout policy using the configuration utility

1. In the left navigation pane, expand **AppExpert**, and then click **HTTP Callouts**.

2. In the details pane, click **Add**.
3. In the **Create HTTP Callout** dialog box, in the **Name** field, enter a name for the callout.
4. In the **Server to receive callout request** section, select the name of a virtual server to which you want to send the callout, or specify an IP address and port for the server. If this server uses IPv6 format, select the **IPv6** check box to enable the **IP Address** field to accept the appropriate address format.
5. In the **Request to send to the server** section, do one of the following:
   - To configure individual parameters for the request, click **Attribute-based** and specify the attribute-based parameters described in the table, "Elements in an HTTP Callout Policy," on page 188. For an example of the content of an HTTP request, see "Note on the Format of an HTTP Request," on page 187.
   - To configure the entire HTTP request, click **Expression-based** and enter the expression in the text box, as described in "Configuring Advanced Expressions in a Policy," on page 57, with one exception. Unlike other expression entry fields, the request must start with the string `GET` or `POST`. For an example of an expression that formats a legal request, see "To configure a callout policy using the NetScaler command line," on page 191.
6. In the **Server Response** section, click the **Return Type** drop-down menu and select **BOOL**, **NUM**, or **TEXT**, depending on the format of the data that you expect the server to return. In the **Expression to extract data from the response** field, enter an expression to extract the data that you want from the HTTP response to this callout.

   For more information on configuring an advanced expression, see "Configuring Advanced Expressions in a Policy," on page 57. Note that this expression must start with the string `http.res`. For an example of an HTTP response, see "Note on the Format of an HTTP Response," on page 187. For an example of an expression that parses the response, see "To configure a callout policy using the NetScaler command line," on page 191.
7. Click **Create**.

To configure a callout policy using the NetScaler command line

1. At a NetScaler command prompt, type:

   `add policy httpCallout` *`calloutName`*
2. Enter the following command to configure the policy.

The following is the basic syntax for an HTTP callout policy. Note that in the following syntax, line breaks have been added for readability. You specify the command parameters without entering a line break:

```
set policy httpCallout calloutName
{
-IPAddress [ipAddress|ipv6Address|*] -port [port|*] |
-vServer virtualServerName]
}
-returnType BOOL|NUM|TEXT
{
[-httpMethod (GET|POST)
 -hostExpr string or expression
 -urlStemExpr string or expression
 -headers Name(value) ...
 -parameters Name(value) ...] |
[-fullReqExpr string]
}
-resultExpr string
```

For parameter descriptions, see the table, "Elements in an HTTP Callout Policy," on page 188:

Examples

```
add policy httpCallout myCallout
```

```
set httpCallout myCallout -ipaddress 10.101.10.10 -port 80
-returnType text -httpMethod GET -hostExpr "'/10.101.10.11/'"
-urlStemExpr "'/mysite/index.html/'" -parameters name("My Name")
-resultExpr http.res.header("Hostname")
```

```
add policy httpCallout myCallout2
```

```
set httpCallout myCallout2 -vserver my_HTTP_LB_vserver -returnType
num -httpMethod GET -hostExpr 'http.req.header("Host")'
-urlStemExpr "http.req.url" -parameters Name("My Name") -headers
Name("MyHeader") -resultExpr "http.res.body(10000).length"
```

```
add policy httpCallout fullReqCallout
```

```
set policy httpCallout fullReqCallout -vserver my_HTTP_LB_vserver
-returnType num -httpMethod GET -fullReqExpr q{"GET " + http.req.
url + " HTTP/" + http.req.version.major + "." + http.req.version.
minor.sub(1) + "r\nHost: 10.101.10.10\r\nAccept: */*\r\n\r\n"}
```

To modify a callout policy using the NetScaler command line

At a NetScaler command prompt, type:

```
unset httpCallout calloutName -argument
```

Where:

- *calloutName* is the name of the HTTP callout policy that you are configuring.
- *argument* is one of the arguments that you supplied when you configured the callout, including `returnType`, `parameters`, `fullReqEx`, and so on.

After unsetting the configuration, use the `set` command to apply any new settings.

Examples

```
unset httpCallout myCallout -parameters
```

```
unset httpCallout myCallout -headers
```

```
unset httpCallout myCallout -resultExpr
```

To delete a callout policy using the NetScaler command line

At a NetScaler command prompt, type:

```
rm policy httpCallout calloutName
```

Where *calloutName* is the name of the HTTP callout policy that you are deleting.

Example

```
rm policy httpCallout myCallout
```

To view a callout policy using the NetScaler command line

At a NetScaler command prompt, type:

```
show httpCallout
```

Invoking an HTTP Callout Policy

You can invoke the callout from a policy or another entity that uses advanced expressions (for example, a Rewrite action). For a list of features that support HTTP callouts, see "About Calling Out to an External Application," on page 186.

You can invoke an HTTP callout policy by including the following in an advanced expression:

```
SYS.HTTP_CALLOUT(calloutName)
```

Only `HTTP.RES` based advanced expressions can be used to build the result.

Note that you must know the return type of the HTTP callout policy that you are invoking. The expression must conform to the return type of the invoked policy. For example, if the return type of the HTTP callout policy is `TEXT`, the following expression is valid:

```
sys.http_callout(authCallout).contains("someText")
```

If the return type is NUM, the following expression is valid:

```
sys.http_callout(authCallout).gt(500)
```

The following example shows the use of SYS.HTTP_CALLOUT to retrieve a source IP address and insert it in a header of an HTTP request. (**Bold** is used for emphasis.)

```
set policy httpCallout extractSrcIPCallout -ipAddress 10.101.
10.10 -port 80 -returnType text -hostExpr "\"10.101.10.10\""
-urlStemExpr "\"/mysite/index.html\"" -resultExpr 'server.ip.
src'

add rewrite action insertSrcIPAction insert_http_header Name
"sys.http_callout(extractSrcIPCallout)" -bypassSafetyCheck yes

add rewrite policy insertSrcIPPolicy "http.req.
header(\"MyHeader\").exists" insertSrcIPAction

bind rewrite global insertHostHeaderPolicy 100 END -type
req_default
```

The following example shows the use of SYS.HTTP_CALLOUT to retrieve notification regarding whether a client IP address is blocked from a server and configure a “You are banned” message in the Responder. (**Bold** is used for emphasis.)

```
add policy httpCallout blockedCalloutPolicy

set policy httpCallout blockedCalloutPolicy -returnType text
-ipAddress 10.100.10.10 -port 80 -fullReqExpr '"Get
/cgi-bin/is_ip_blocked?ip=" + client.ip.src + "http/1.1\r\n" +
"Host: my_server\r\n\r\n"' -resultExpr 'http.res.
header("Result")'

add responder action blockedResponderAction respondwith
'"HTTP/1.1 200OK\r\n Content=Length: 17 \r\n\r\nYour IP is
banned"'

add responder policy blockedResponderPolicy "http.req.url.
eq("/") && sys.http.callout(blockedCalloutPolicy).
eq("Blocked") blockedResponderAction

bind responder global blockedResponderPolicy 100 END -type
res_override
```

Notes on Invoking a Callout

When invoking an HTTP callout in a policy or an action, be sure that the callout invocation does not trigger additional callouts. For example, a policy should not invoke an HTTP callout named MyCalloutPL if the policy expression contains the URL /mycallout.pl. The following is an example:

```
add responder policy 'http.req.url.eq("/callout.pl").NOT && sys.
http_callout(MyCalloutPL)' some_action
```

Also, if you modify an expression in an HTTP callout policy, you may get an error if any policy that invokes it is bound to a new policy label or bind point. For example, suppose that you create an HTTP callout policy named myCalloutPolicy1, and invoke it from a rewrite policy named rewriteCalloutPolicy1. If you change the expression in myCalloutPolicy1, you might receive an error when binding rewriteCalloutPolicy1 to a new bind point. The work-around is to modify these expressions before using the callout in the policy.

Configuring Classic Policies and Expressions

A number of NetScaler features use classic policies and classic expressions. As with advanced policies, classic policies can be global or specific to a virtual server.

The configuration method and bind points for classic policies are somewhat different from those of advanced policies. As with advanced expressions, you can configure named expressions and use each named expression in multiple classic policies.

In This Chapter

Where Classic Policies Are Used

Viewing Classic Policies

Configuring a Classic Policy

Binding a Classic Policy

Creating Named Classic Expressions

Where Classic Policies Are Used

The following table summarizes NetScaler features that use classic policies and specifics regarding support for these policies:

Policy Type and Bind Points for Policies in Features That Use Classic Policies

Feature	**Virtual Servers**	**Supported Policies**	**Policy Bind Points**	**How You Use the Policies**
System	None	Authentication policies (Note that Command and Auditing policies in the System feature are unrelated to classic policies.)	Global	For the Authentication function, policies contain authentication schemes for different authentication methods. For example, you can configure LDAP and certificate-based authentication schemes.

Policy Type and Bind Points for Policies in Features That Use Classic Policies

Feature	Virtual Servers	Supported Policies	Policy Bind Points	How You Use the Policies
SSL	None	SSL policies	• Global • Load Balancing virtual server	To determine when to apply an encryption function and add certificate information to clear text. To provide end-to-end security. After a message is decrypted, the SSL feature re-encrypts clear text and uses SSL to communicate with back-end Web servers.
Content Switching (Can use either classic or advanced policies, but not both)	Content Switching virtual server	Content Switching policies	• Content Switching virtual server • Cache Redirection virtual server	To determine what server or group of servers is responsible for serving responses, based on characteristics of an incoming request. Request characteristics include device type, language, cookies, HTTP method, content type and associated cache server.
Compression	None	HTTP Compression policies	• Global • Content Switching virtual server • Load Balancing virtual server • SSL Offload virtual server • Service	To determine what type of HTTP traffic is compressed.
Protection Features, Filter	None	Content Filtering policies	• Global • Content Switching virtual server • Load Balancing virtual server • SSL Offload virtual server • Service	To configure the behavior of the filter function.
Protection Features, SureConnect	None	SureConnect policies	• Load Balancing virtual server • SSL Offload virtual server • Service	To configure the behavior of the SureConnect function.
Protection Features, Priority Queueing	None	Priority Queueing policies	• Load Balancing virtual server • SSL Offload virtual server	To configure the behavior of the Priority Queueing function.

Policy Type and Bind Points for Policies in Features That Use Classic Policies

Feature	**Virtual Servers**	**Supported Policies**	**Policy Bind Points**	**How You Use the Policies**
HTML Injection	None	HTML Injection Policies	• Global • Load Balancing virtual server • Content Switching virtual server • SSL Offload virtual server	To enable the NetScaler to insert text or scripts into an HTTP response that it serves to a client.
AAA - Traffic Management	None	Authentication, Authorization, Auditing, and Session policies	• Authentication virtual server (authentication, session, and auditing policies) • Load Balancing or Content Switching virtual server (authorization and auditing policies) • Global (session and audit policies) • AAA group or user (session, auditing, and authorization policies)	To configure rules for user access to specific sessions and auditing of user access.
Cache Redirection	Cache Redirection virtual server	Cache Redirection policies Map policies	Cache Redirection virtual server	To determine whether HTTP responses are served from a cache or an origin server.
Application Firewall	None	Application Firewall policies	Global	To identify characteristics of traffic and data that should or should not be admitted through the firewall.

Policy Type and Bind Points for Policies in Features That Use Classic Policies

Feature	Virtual Servers	Supported Policies	Policy Bind Points	How You Use the Policies
Access Gateway	VPN server	Pre-Authentication policies	• AAA Global • VPN vserver	To determine how the Access Gateway performs authentication, authorization, auditing, and other functions and To define rewrite rules for general Web access using the Access Gateway.
		Authentication policies	• System Global • AAA Global • VPN vserver	
		Auditing policies	• User • User group • VPN vserver	
		Session policies	• VPN Global • User • User Group • VPN vserver	
		Authorization policies	• User • User Group	
		Traffic policies	• VPN Global • User • User Group • VPN vserver	
		TCP Compression policies	VPN Global	

Viewing Classic Policies

You can view classic policies using the configuration utility and the command line, including the policy's name, expression, and bindings.

To view classic policies and policy bindings using the configuration utility

1. In the navigation pane, expand the function whose policies you want to view, for example, expand **Application Firewall**.
2. Click **Policies**.
3. To view details for a specific policy, click the policy entry. Details appear in the **Details** area of the configuration pane. Details that are highlighted and underlined are links to the corresponding entity (for example, a named expression).
4. To view bindings for a specific policy, click the policy and then click **Show Bindings**.
5. If the feature supports globally bound policies, to view global bindings, click **Global Bindings**. Note that you cannot bind a Content Switching,

Cache Redirection, SureConnect, Priority Queuing, or Access Gateway Authorization policy globally.

To view classic policies and policy bindings using the command line

Type the following command:

```
show featureName policy policyName
```

Note that if you omit the policy name, all policies are listed without the binding details. Following is an example:

```
show appfw policy test
```

Configuring a Classic Policy

You can configure classic policies and classic expressions using the configuration utility or the command line. When configuring the policy rule, you can use predefined named expressions that are stored in the AppExpert feature, in the Expressions folder. No matter where it is configured, the policy rule cannot exceed 1,499 characters. For more information on named expression, see "Creating Named Classic Expressions," on page 209. After configuring the policy you bind it globally or to a virtual server.

Note that there are small variations in the method that you use to configure a policy, depending on the feature in which the policy resides.

Note: You can also embed a classic expression in an advanced expression using the syntax **`SYS.EVAL_CLASSIC_EXPR(`*`classic_expression`*`)`**, specifying the *classic expression* as the argument.

To create a policy with classic expressions using the configuration utility

1. In the navigation pane, expand the feature for which you want to configure a policy.
2. Access the policy configuration pane as follows:
   - For Content Switching, Cache Redirection, and the Application Firewall, select **Policies**.
   - For SSL, expand **SSL**, click **Policies**, and then select the **Policies** tab.
   - For the Access Gateway, expand **Policies** and then select the policy type.
   - For System Authentication, select **Authentication** and then select the **Policies** tab.

- For Filter, SureConnect, and Priority Queuing, expand **Protection Features**, click the appropriate function, and then select the **Policies** tab.
- For the Access Gateway, expand **Access Gateway**, expand **Policies**, select the appropriate function, and then select the **Policies** tab.

3. For most features, click the **Add** button.
4. In the **Policy Name** or **Name** text box, enter a name for the policy.

   You must begin a policy name with a letter or underscore. A policy name can consist of 1 to 127 characters, including letters, numbers, hyphen (-), period (.), pound sign (#), space ( ), and underscore (_).
5. For most policies, you associate an action or a profile. In the **Action** list box click the name of an action, or, in the case of an Access Gateway or Application Firewall policy, select a profile to associate with this policy. A profile is a set of configuration options that operate as a set of actions that are applied when the data being analyzed matches the policy rule.

   For information on creating a profile, see “Configuring Policies and Profiles on the Access Gateway” at http://edocs.citrix.com/ or the *Citrix Application Firewall Guide*.
6. Create an expression that describes the type of data that you want this policy to match.

   Depending on the type of policy you wish to create, you can choose a predefined expression, or you can create a new expression. For information on how to create an expression for most types of classic policies, see “To configure an expression in a classic policy using the configuration utility,” on page 204.

   Named expressions are predefined expressions that you can reference by name in a policy rule. For more information on named expressions, see “Creating Named Classic Expressions,” on page 209. For a list of all the default named expressions and a definition of each, see “Expressions Reference,” on page 211.
7. Click **Create** to create your new policy.

   Your new policy is created and appears in the Policies page list.
8. Click **Close** to return to the Policies screen for the type of policy you were creating.

To create a classic policy using the NetScaler command line

1. At the command line, type:

   ```
   add feature policy name -rule expression -action action
   ```

- For *`feature`*, substitute the feature for which you are creating the policy. For example, for Access Gateway policies, type **`accessgw`**. For Application Firewall policies, type **`appfw`**. For SSL policies, type **`ssl`**.
- For *`name`*, substitute a name for the policy. You must begin a policy name with a letter or underscore. A policy name can consist of 1 to 127 characters, including letters, numbers, hyphen (-), period (.), pound sign (#), space ( ), and underscore (_).
- For *`expression`*, configure the expression as described in "To create a classic policy expression using the NetScaler command line," on page 206.
- For *`action`*, substitute the name of the action you want to associate with this policy. For Access Gateway and Application Firewall policies, you substitute the appropriate profile instead of an action.

Configuring a Classic Expression

Classic expressions consist of the following hierarchy of elements:

- **Flow Type.** Whether the connection is incoming or outgoing. For incoming connections, the flow type is REQ. For outgoing connections, it is RES.
- **Protocol.** Which protocol you want. Your choices are HTTP, SSL, TCP, and IP.
- **Qualifier**. The protocol attribute you want. Your choices are dependent upon the protocol you selected.
- **Operator.** The type of test you want to perform on the connection data. Your choices depend upon the connection information you are testing. If the connection information you are testing is text, you can use any of several text operators. If it is a number, you can use standard numeric operators.
- **Value.** The string or number against which the connection data element—defined by the flow type, protocol, and qualifier—is tested. The value can be literal, or can consist of an expression, that matches the data type of the connection data element.

In a policy, classic expressions can be combined into more complex expressions using boolean and comparative operators.

The following classic expression returns the client source IP for an incoming connection.

```
REQ.IP.SOURCEIP
```

You read the expression from left to right. The leftmost term is either `REQ`, designating a request, or `RES`, designating a response. Successive terms define a specific type of connection and specific attribute of that connection type. Each term is separated from any preceding or following terms with a period. Arguments appear in parentheses following the term to which they apply.

In the example, the `IP` parameter identifies an IP address in the request. Finally, the term `SOURCEIP` designates the source IP address rather than the destination IP address.

This expression fragment may not be useful by itself. You can extend an expressio to determine whether the returned value meets specific criteria.The following expression tests whether the client source IP is in the subnet 200.0.0.0/8, and returns a boolean TRUE value if the client IP is located within the designated network:

```
REQ.IP.SOURCEIP == 200.0.0.0 -netmask 255.0.0.0
```

To configure an expression in a classic policy using the configuration utility

1. To create a new expression, in the **Create Policy** dialog box you typically click **Add**. Note that for Content Switching policies, you click **Configure** to view the expression configuration dialog box.
2. In the **Add Expression** dialog box, under **Flow Type**, choose a flow type.

   The flow type is typically REQ or RES. The REQ option specifies that the policy will apply to all incoming connections, or requests. The RES option applies the policy to all outgoing connections, or responses.

   For Application Firewall policies, you should leave the expression type set to **General Expression**, and the flow type set to **`REQ`**. The Application Firewall treats each request and response as a single paired entity, so all Application Firewall policies begin with **`REQ`**.
3. Under **Protocol**, click the down arrow and choose the protocol you want for your policy expression. Your choices are:
   - **HTTP.** Evaluates HTTP requests that are sent to a Web server. In classic expressions, HTTP includes HTTPS requests, as well.
   - **SSL.** Evaluates SSL data associated with the current connection.
   - **TCP.** Evaluates the TCP data associated with the current connection.
   - **IP.** Evaluates the IP addresses associated with the current connection.
4. In the **Qualifier** list box, and choose a qualifier for your policy.

   The qualifier defines the type of data to be evaluated. The list of qualifiers that appears depends on which protocol you selected in the previous step. The following list describes the qualifier choices for the HTTP protocol.

For a complete list of protocols and qualifiers, see “Classic Expressions,” on page 224. The following choices appear for the HTTP protocol:

- **METHOD.** Filters HTTP requests that use a particular HTTP method.
- **URL.** Filters HTTP requests to a specific Web page.
- **URLQUERY.** Filters HTTP requests that contain a particular query string, choose **`URLQUERY`** as your qualifier.
- **VERSION.** Filters HTTP requests to a particular host.
- **HEADER.** Filters based on a particular HTTP header.
- **URLLEN.** Filters based on the length of the URL.
- **URLQUERY.** Filters based on the query portion of the URL.
- **URLQUERYLEN.** Filters based on the length of the query portion of the URL only.

5. Under **Operator**, choose the operator for your policy expression. For a complete list of choices see the *Operators* table in “Classic Expressions,” on page 224. Some common operators are:

Operator	**Description**
==	Matches the following string exactly, or is exactly equal to the following number.
!=	Does not match the following string.
>	Is greater than the following number.
<	Is less than the following number.
>=	Is greater than or equal to the following number.
<=	Is less than or equal to the following number.
CONTAINS	Contains the following string.
CONTENTS	The contents of the designated header, URL, or URL query.
EXISTS	The specified header or query exists.
NOTCONTAINS	Does not contain the following string.
NOTEXISTS	The specified header or query does not exist.

6. If a **Value** text box appears, type a string or numeric value, as appropriate.

For example, you chose **`REQ`** as the **Flow Type**, **HTTP** as the **Protocol**, and **HEADER** as the qualifier, type the value of the header string in the **Value** field and the header type for which you want to match the string in the **Header Name** text box.

7. Click **OK**.
8. To create a compound expression, click **Add**. Note that the type of compounding that is done depends on the following choices on the Create Policy dialog box:
   - **Match Any Expression**. The expressions are in a logical OR relationship.
   - **Match All Expressions**. The expressions are in a logical AND relationship.
   - **Tabular Expressions**. Click the **AND**, **OR**, and parentheses buttons to control evaluation.
   - **Advanced Free-Form**. Enter the expressions components directly in the Expression field, and click the **AND**, **OR**, and parentheses buttons to control evaluation.

To create a classic policy expression using the NetScaler command line

1. Start the policy as described in "To create a classic policy using the NetScaler command line," on page 202.

   `add` *`feature`* **`policy`** *`name`* **`-rule`** *`expression`* **`-action`** *`action`*

2. For *`expression`*, substitute a classic expression that defines the connections you want to match using this policy. This regular expression can take many forms, but all follow this syntax:

   ```
   "<flow
   type>.<protocol>.<qualifier>.<operator>[.<value>][.<header
   name>]"
   ```

   Note: All rules must be enclosed in double quotes.

   For each of the designated elements, you substitute the appropriate value. The following list describes each element and provides the right values or explains how to determine what they are:

   - **Flow type.** Whether the policy filters requests or responses.

     The flow type can be either **`REQ`** or **`RES`** for Access Gateway or SSL policies. For Application Firewall policies, it is always **`REQ`**, because the Application Firewall filters each request and its associated response as a unit.

- **Protocol.** The protocol of the connections that this policy will filter. This can be **`HTTP`**, **`SSL`**, **`TCP`**, or **`IP`**.
- **Qualifier.** The aspect of the protocol that the policy should consider. The list of valid qualifiers varies depending on which protocol you chose. For a list of all valid qualifiers for each Protocol, and a description of each, see "Classic Expressions," on page 224.
- **Operator.** The symbol that describes the condition you want the Application Firewall to test. For a list of all valid operators and a description of each, see "Classic Expressions," on page 224.
- **Value.** The text or number that the expression is comparing to the current connection to determine whether it matches the policy or not. For example, if you are testing the URL header to see if it contains the subdomain **`shopping.example.com`**, you type the string **`shopping.example.com`**. If you are testing the length of the URL header to see if it is greater than 1024 characters, you type the number **`1024`**.
- **Header Name.** If you chose **`HEADER`** as your Qualifier, you must also include the name of the header that contains the attribute or string you want the NetScaler appliance to use for the test.

Binding a Classic Policy

Depending on the policy type, you can bind the policy either globally or to a virtual server. Policy bind points are described in the table, "Policy Type and Bind Points for Policies in Features That Use Classic Policies," on page 197.

Note: You can bind the same classic policy to multiple bind points.

To bind a classic policy globally using the configuration utility

1. If the policy can be bound globally, click **Global Bindings**.
2. To bind the policy, select **Insert Policy**, and then click the name of the policy that you want to bind.
3. In the **Priority** field, type the priority value.

   The lower the number, the sooner this policy is evaluated relative to other policies. For example, a policy assigned a priority of 10 is performed before a policy with a priority of 100. You can use the same priority for different policies. All features that use classic policies implement only the first policy that a connection matches. So policy priority is important to get the results you intended.

As a best practice, leave room to add policies by setting priorities with intervals of 50 (or 100) between each policy.

4. Click **OK**.

To bind a classic policy globally using the NetScaler command line

At the command line, type:

```
bind feature global policy_name priority
```

- For *`feature`*, for Application Firewall policies, you substitute **`appfw`**. For Access Gateway policies, you substitute **`accessgw`**. For SSL policies, you substitute **`ssl`**.
- For *`policy_name`*, substitute the name of the policy you just created.
- For *`priority`*, substitute a positive integer that represents the priority you want to assign to that policy.

  In the NetScaler OS, policy priorities work in reverse order—the higher the number, the lower the priority. For example, if you have three policies with priorities of 10, 100, and 1000, the policy assigned a priority of 10 is performed first, then the policy assigned a priority of 100, and finally the policy assigned an order of 1000. All features except the Rewrite feature on the NetScaler appliance implement only the first policy that a connection matches, not any additional policies that it might also match.

  You can leave yourself plenty of room to add other policies in any order, and still set them to evaluate in the order you want, by setting priorities with intervals of 50 (or, better, 100) between each policy when you globally bind your policies. If you do this, you can add additional policies at any time without having to reassign the priority of an existing policy. You simply look at the priorities assigned to the preceding and following policies, and assign a new policy a priority between that of those two numbers.

To bind a classic policy to a virtual server using the configuration utility

1. Expand the feature that contains the virtual server, for example, expand **Content Switching** or **Load Balancing**, and then click **Virtual Servers**.
2. Select the virtual server to which you want to bind a policy and then click **Open**.
3. In the **Configure Virtual Server** dialog box, click the **Policies** tab.
4. Click the icon for the type policy that you want, click **Insert Policy**, and then click the name of the policy that you want to bind.

5. In the **Priority** field, set the priority.
6. If you are binding policy to a Content Switching virtual server, in the **Target** field select a load balancing virtual server to which traffic that matches the policy is sent.
7. Click **OK**.

Creating Named Classic Expressions

Named classic expressions are expressions that are given a name and can be used in any classic policy. Some named expressions are built-in, and a subset of these are read-only. You can also configure new named classic expressions.

Built-in named expressions fit into one of four categories: General, Anti-Virus, Personal Firewall, and Internet Security. General named expressions have a wide variety of uses, including the following:

- Allowing a value of TRUE or FALSE to always be returned for all traffic. The general named expressions `ns_true` and `ns_false` provide these options.
- Identifying data of a particular type (for example, .htm, .doc, or .gif files).
- Determining the presence of caching headers.
- Determining whether a round trip between a client and the NetScaler is slow (over 80 milliseconds).

Anti-Virus, Personal Firewall, and Internet Security named expressions test clients for the presence of a particular program and version and are used primarily to create Access Gateway policies.

For descriptions of the default named expressions, see “Classic Expressions,” on page 224.

Note: You cannot modify or delete built-in named expressions.

To create a named classic expression using the configuration utility

1. In the navigation pane, expand **AppExpert,** expand **Expressions**, and then click **Classic Expressions**.
2. In the details pane, click **Add**.

   Note that some of the built-in expressions in the **Expressions** list are read only.

3. In the **Create Policy Expression** dialog box, in the **Expression Name** field, enter a name for your new expression.

   You must begin a policy name with a letter or underscore. A policy name can consist of 1 to 127 characters, including letters, numbers, hyphen (-), period (.), pound sign (#), space ( ), and underscore (_).

4. In the **Create Policy Expression** dialog box, in the **Client Security Message** dialog box, type an error message.

   This field is optional; you can leave it blank. This error message is used for Client Security based expressions in the Access Gateway. This setting delivers custom error messages to VPN users through a client when a client security check fails. For all other features, this error message is ignored.

5. In the **Description** field, type the purpose of this expression.

6. Create the expression.

   - You can choose inputs to this expression from the **Named Expressions** list boxes.

   - You can create a new expression, as described in "To configure an expression in a classic policy using the configuration utility," on page 204,

7. When you are done, click **Close**.

   If you have created a new expression, scroll to the bottom of the **Expressions** list to see it.

Expressions Reference

The following tables list expressions and expression elements that you can use to identify specific types of data. The first table applies to advanced expressions, in alphabetic order. The remaining tables cover the different types of classic expressions.

In This Appendix

Advanced Expressions

Classic Expressions

Advanced Expressions

The following table is a listing of advanced expression prefixes, with cross-references to descriptions of these prefixes and the operators that you can specify for them. Note that some prefixes can work with multiple types of operators. For example, a cookie can be parsed by using operators for text or operators for HTTP headers.

You can use any element in the following tables as a complete expression on its own, or you can use various operators to combine these expression elements with others to form more complex expressions.

Note: The Description column in the following table contains cross-references to additional information about prefix usage and applicable operators for the prefix.

Expression Prefix	Notes and Links to Prefix and Applicable Operator Descriptions
`CLIENT.ETHER`	"Prefixes for MAC Addresses," on page 154 "Operations for MAC Addresses," on page 154

Expression Prefix	Notes and Links to Prefix and Applicable Operator Descriptions
`CLIENT.ETHER.[DSTMAC | SRCMAC]`	"Prefixes for MAC Addresses," on page 154 "Operations for MAC Addresses," on page 154
`CLIENT.INTERFACE`	Designates an expression that refers to the ID of the network interface through which the current packet entered the Application Switch. See the other CLIENT.INTERFACE prefix descriptions in this table.
`CLIENT.INTERFACE.ID`	Extracts the ID of the network interface that received the current packet of data. See the other CLIENT.INTERFACE prefix descriptions in this table.
`CLIENT.INTERFACE.ID.EQ("`*`id`*`")`	Returns Boolean TRUE if the interface's ID matches the ID that is passed as the argument. For example: CLIENT.INTERFACE.ID.EQ("1/1") See "Booleans in Compound Expressions," on page 46
`CLIENT.INTERFACE.[RXTHROUGHPUT | RXTXTHROUGHPUT | TXTHROUGHPUT]`	"Expressions for Numeric Client and Server Data," on page 155 "Compound Operations for Numbers," on page 48
`CLIENT.IP`	Operates on the IP protocol data associated with the current packet. See the other CLIENT.IP prefixes in this table.
`CLIENT.IP.DST`	"Prefixes for IPV4 Addresses and IP Subnets," on page 150 "Operations for IPV4 Addresses," on page 150 "Compound Operations for Numbers," on page 48
`CLIENT.IP.SRC`	"Prefixes for IPV4 Addresses and IP Subnets," on page 150 "Operations for IPV4 Addresses," on page 150 "Compound Operations for Numbers," on page 48
`CLIENT.IPV6`	Operates on IPv6 protocol data. See the other CLIENT.IPV6 prefixes in this table.
`CLIENT.IPV6.DST`	"Expression Prefixes for IPv6 Addresses," on page 152 "Operations for IPV6 Prefixes," on page 153
`CLIENT.IPV6.SRC`	"Expression Prefixes for IPv6 Addresses," on page 152 "Operations for IPV6 Prefixes," on page 153

Expression Prefix	Notes and Links to Prefix and Applicable Operator Descriptions
`CLIENT.SSL`	Operates on the SSL protocol data for the current packet. See the other CLIENT.SSL prefixes in this table.
`CLIENT.SSL.CIPHER_BITS`	"Prefixes for Numeric Data in SSL Certificates," on page 143 "Compound Operations for Numbers," on page 48
`CLIENT.SSL.CIPHER_EXPORTABLE`	"Prefixes for Text-Based SSL and Certificate Data," on page 142 "Booleans in Compound Expressions," on page 46
`CLIENT.SSL.CLIENT_CERT`	"Expressions for SSL Certificates," on page 143 "Expressions for SSL Certificate Dates," on page 101
`CLIENT.SSL.IS_SSL`	"Prefixes for Text-Based SSL and Certificate Data," on page 142 "Booleans in Compound Expressions," on page 46
`CLIENT.SSL.VERSION`	"Prefixes for Numeric Data in SSL Certificates," on page 143 "Compound Operations for Numbers," on page 48
`CLIENT.TCP`	Operates on TCP protocol data. See the other CLIENT.TCP prefixes in this table.
`CLIENT.TCP.[DSTPORT | MSS | SRCPORT]`	"Expressions for TCP, UDP, and VLAN Data," on page 134 "Compound Operations for Numbers," on page 48
`CLIENT.TCP.PAYLOAD(`*`integer`*`)`	"Expressions for TCP, UDP, and VLAN Data," on page 134 "Advanced Expressions: Evaluating Text," on page 63
`CLIENT.UDP`	Operates on the UDP protocol data associated with the current packet. See the other CLIENT.UDP prefixes in this table.
`CLIENT.UDP.DNS.DOMAIN`	"Expressions for TCP, UDP, and VLAN Data," on page 134 "Advanced Expressions: Evaluating Text," on page 63
`CLIENT.UDP.DNS.DOMAIN.EQ("`*`hostname`*`")`	"Expressions for TCP, UDP, and VLAN Data," on page 134 "Booleans in Compound Expressions," on page 46

Expression Prefix	Notes and Links to Prefix and Applicable Operator Descriptions
`CLIENT.UDP.DNS.[IS_AAAAREC | IS_ANYREC | IS_AREC | IS_CNAMEREC | IS_MXREC | IS_NSREC | IS_PTRREC | IS_SOAREC | IS_SRVREC]`	"Expressions for TCP, UDP, and VLAN Data," on page 134 "Booleans in Compound Expressions," on page 46
`CLIENT.UDP.[DSTPORT | SRCPORT]`	"Expressions for TCP, UDP, and VLAN Data," on page 134 "Compound Operations for Numbers," on page 48
`CLIENT.VLAN`	Operates on the VLAN through which the current packet entered the NetScaler. See the other CLIENT.VLAN prefixes in this table.
`CLIENT.VLAN.ID`	"Expressions for TCP, UDP, and VLAN Data," on page 134 "Compound Operations for Numbers," on page 48
`HTTP.REQ`	Operates on HTTP requests. See the other HTTP.REQ prefixes in this table.
`HTTP.REQ.BODY(`*`integer`*`)`	"Expression Prefixes for Text in HTTP Requests and Responses," on page 67 "Operations on Text," on page 86
`HTTP.REQ.CACHE_CONTROL`	"Prefixes for Cache-Control Headers," on page 126 "Operations for Cache-Control Headers," on page 126
`HTTP.REQ.CONTENT_LENGTH`	"Expressions for Numeric HTTP Payload Data Other Than Dates," on page 130 "Compound Operations for Numbers," on page 48
`HTTP.REQ.COOKIE`	"Prefixes for HTTP Headers," on page 116 "Operations for HTTP Headers," on page 122 "Advanced Expressions: Evaluating Text," on page 63
`HTTP.REQ.DATE`	"Format of Dates and Times in an Expression," on page 96 "Expressions for HTTP Request and Response Dates," on page 110 "Advanced Expressions: Evaluating Text," on page 63 "Compound Operations for Numbers," on page 48 "Operations for HTTP Headers," on page 122

Expression Prefix	**Notes and Links to Prefix and Applicable Operator Descriptions**
`HTTP.REQ.HEADER("`*`header_name`*`")`	"Expression Prefixes for Text in HTTP Requests and Responses," on page 67 "Prefixes for HTTP Headers," on page 116 "Operations for HTTP Headers," on page 122
`HTTP.REQ.FULL_HEADER("`*`header_name`*`")`	"Prefixes for HTTP Headers," on page 116 "Operations for HTTP Headers," on page 122
`HTTP.REQ.HOSTNAME`	"Expression Prefixes for Text in HTTP Requests and Responses," on page 67
`HTTP.REQ.HOSTNAME.[DOMAIN | Server]`	"Expression Prefixes for Text in HTTP Requests and Responses," on page 67 "Operations on Text," on page 86
`HTTP.REQ.HOSTNAME.EQ("`*`hostname`*`")`	"Expression Prefixes for Text in HTTP Requests and Responses," on page 67 "Booleans in Compound Expressions," on page 46 "Basic Operations on Expression Prefixes," on page 44
`HTTP.REQ.HOSTNAME.PORT`	"Expression Prefixes for Text in HTTP Requests and Responses," on page 67 "Compound Operations for Numbers," on page 48
`HTTP.REQ.IS_VALID`	Returns TRUE if the HTTP request is properly formed. See "Booleans in Compound Expressions," on page 46
`HTTP.REQ.METHOD`	"Expression Prefixes for Text in HTTP Requests and Responses," on page 67 "Operations on Text," on page 86 "Complex Operations on Text," on page 88
`HTTP.REQ.TRACKING`	Returns the HTTP body tracking mechanism. See the descriptions of other HTTP.REQ.TRACKING prefixes in this table.
`HTTP.REQ.TRACKING.EQ("`*`tracking_mechanism`*`")`	Returns TRUE or FALSE. See "Booleans in Compound Expressions," on page 46
`HTTP.REQ.URL`	Obtains the HTTP URL object from the request and sets the text mode to URLENCODED by default. See "Expression Prefixes for Text in HTTP Requests and Responses," on page 67

Expression Prefix	**Notes and Links to Prefix and Applicable Operator Descriptions**
`HTTP.REQ.URL.[CVPN_ENCODE | HOSTNAME | HOSTNAME.DOMAIN | SERVER | PATH | PATH_AND_QUERY | PROTOCOL | QUERY | SUFFIX | VERSION]`	"Expression Prefixes for Text in HTTP Requests and Responses," on page 67 "Operations on Text," on page 86 "Complex Operations on Text," on page 88
`HTTP.REQ.URL.HOSTNAME.EQ("`*`hostname`*`")`	"Expression Prefixes for Text in HTTP Requests and Responses," on page 67 "Booleans in Compound Expressions," on page 46
`HTTP.REQ.URL.HOSTNAME.PORT`	"Expression Prefixes for Text in HTTP Requests and Responses," on page 67 "Compound Operations for Numbers," on page 48
`HTTP.REQ.URL.PATH.IGNORE_EMPTY_ELEMENTS`	Ignores spaces in the data. See the table "HTTP Expression Prefixes that Return Text," on page 67
`HTTP.REQ.URL.QUERY.IGNORE_EMPTY_ELEMENTS`	Ignores spaces in the data. See the table "HTTP Expression Prefixes that Return Text," on page 67
`HTTP.REQ.USER.IS_MEMBER_OF`	"HTTP Expression Prefixes that Return Text," on page 67
`HTTP.REQ.USER.NAME`	"HTTP Expression Prefixes that Return Text," on page 67
`HTTP.REQ.VERSION`	"Expression Prefixes for Text in HTTP Requests and Responses," on page 67
`HTTP.REQ.VERSION.[MAJOR | MINOR]`	Operates on the major or minor HTTP version string. See "Expression Prefixes for Text in HTTP Requests and Responses," on page 67 and "Compound Operations for Numbers," on page 48
`HTTP.RES`	Operates on HTTP responses.
`HTTP.RES.BODY(`*`integer`*`)`	"Expression Prefixes for Text in HTTP Requests and Responses," on page 67 "Operations on Text," on page 86 "Complex Operations on Text," on page 88
`HTTP.RES.CACHE_CONTROL`	"Prefixes for Cache-Control Headers," on page 126 "Operations for Cache-Control Headers," on page 126
`HTTP.RES.CONTENT_LENGTH`	"Expression Prefixes for Text in HTTP Requests and Responses," on page 67 "Operations for HTTP Headers," on page 122 "Compound Operations for Numbers," on page 48

Expression Prefix	Notes and Links to Prefix and Applicable Operator Descriptions
`HTTP.RES.DATE`	"Format of Dates and Times in an Expression," on page 96 "Expressions for HTTP Request and Response Dates," on page 110 "Expression Prefixes for Text in HTTP Requests and Responses," on page 67 "Compound Operations for Numbers," on page 48 "Operations for HTTP Headers," on page 122
`HTTP.RES.HEADER("`*`header_name`*`")`	"Expression Prefixes for Text in HTTP Requests and Responses," on page 67 "Prefixes for HTTP Headers," on page 116 "Operations for HTTP Headers," on page 122
`HTTP.REQ.FULL_HEADER("`*`header_name`*`")`	"Prefixes for HTTP Headers," on page 116 "Operations for HTTP Headers," on page 122
`HTTP.REQ.TXID`	"Prefixes for HTTP Headers," on page 116 "Operations for HTTP Headers," on page 122
`HTTP.RES.IS_VALID`	Returns TRUE if the HTTP response is properly formed. See "Booleans in Compound Expressions," on page 46.
`HTTP.RES.SET_COOKIE`	"Prefixes for HTTP Headers," on page 116 "Operations for HTTP Headers," on page 122 "Advanced Expressions: Evaluating Text," on page 63
`HTTP.RES.SET_COOKIE.COOKIE("`*`name`*`")`	"Prefixes for HTTP Headers," on page 116 "Operations for HTTP Headers," on page 122 "Advanced Expressions: Evaluating Text," on page 63
`HTTP.RES.SET_COOKIE.COOKIE.[DOMAIN | PATH | PORT ]`	"Prefixes for HTTP Headers," on page 116 "Operations for HTTP Headers," on page 122 "Advanced Expressions: Evaluating Text," on page 63

Expression Prefix	Notes and Links to Prefix and Applicable Operator Descriptions
`HTTP.RES.SET_COOKIE.COOKIE.EXPIRES`	Obtains the Expires field of the cookie as a date string. The value of the Expires attribute can be operated upon as a time object. If multiple Expires fields are present, this expression operates on the first one. If the Expires attribute is absent, a string of length zero is returned. Also see: "Prefixes for HTTP Headers," on page 116 "Operations for HTTP Headers," on page 122 "Advanced Expressions: Evaluating Text," on page 63 "Compound Operations for Numbers," on page 48
`HTTP.RES.SET_COOKIE.COOKIE.PATH.IGNORE_EMPTY_ELEMENTS`	Ignores spaces in the data. For an example, see the table "Expression Prefixes for Text in HTTP Requests and Responses," on page 67.
`HTTP.RES.SET_COOKIE.COOKIE.PORT.IGNORE_EMPTY_ELEMENTS`	Ignores spaces in the data. For an example, see the table "HTTP Expression Prefixes that Return Text," on page 67.
`HTTP.RES.SET_COOKIE.COOKIE.VERSION`	"Prefixes for HTTP Headers," on page 116 "Compound Operations for Numbers," on page 48
`HTTP.RES.SET_COOKIE.COOKIE("`*name*`", `*integer*`)[.PORT | PATH | DOMAIN | VERSION | EXPIRES]`	"Prefixes for HTTP Headers," on page 116 "Advanced Expressions: Evaluating Text," on page 63
`HTTP.RES.SET_COOKIE.COOKIE.EXPIRES`	"Prefixes for HTTP Headers," on page 116 "Operations for HTTP Headers," on page 122 "Advanced Expressions: Evaluating Text," on page 63 "Compound Operations for Numbers," on page 48
`HTTP.RES.SET_COOKIE.EXISTS("`*name*`")`	"Prefixes for HTTP Headers," on page 116 "Booleans in Compound Expressions," on page 46
`HTTP.RES.SET_COOKIE2`	"Prefixes for HTTP Headers," on page 116 "Operations for HTTP Headers," on page 122 "Advanced Expressions: Evaluating Text," on page 63
`HTTP.RES.SET_COOKIE2.COOKIE("`*name*`")`	"Prefixes for HTTP Headers," on page 116 "Operations for HTTP Headers," on page 122 "Advanced Expressions: Evaluating Text," on page 63

Expression Prefix	**Notes and Links to Prefix and Applicable Operator Descriptions**
`HTTP.RES.SET_COOKIE2.COOKIE.[DOMAIN | PATH | PORT ]`	"Prefixes for HTTP Headers," on page 116 "Operations for HTTP Headers," on page 122 "Advanced Expressions: Evaluating Text," on page 63
`HTTP.RES.SET_COOKIE2.COOKIE.PATH.IGNORE_EMPTY_ELEMENTS`	Ignores spaces in the data. For an example, see the table "HTTP Expression Prefixes that Return Text," on page 67.
`HTTP.RES.SET_COOKIE2.COOKIE.PORT.IGNORE_EMPTY_ELEMENTS`	Ignores spaces in the data. For an example, see the table "HTTP Expression Prefixes that Return Text," on page 67 See also "Advanced Expressions: Evaluating Text," on page 63 and "Compound Operations for Numbers," on page 48.
`HTTP.RES.SET_COOKIE2.COOKIE("`*`name`*`", `*`integer`*`)[.PORT | PATH | DOMAIN | VERSION | EXPIRES]`	"Prefixes for HTTP Headers," on page 116 "Operations for HTTP Headers," on page 122 "Advanced Expressions: Evaluating Text," on page 63
`HTTP.RES.SET_COOKIE2.COOKIE.DOMAIN`	"Prefixes for HTTP Headers," on page 116 "Operations for HTTP Headers," on page 122 "Advanced Expressions: Evaluating Text," on page 63
`HTTP.RES.SET_COOKIE2.COOKIE.EXPIRES`	"Prefixes for HTTP Headers," on page 116 "Operations for HTTP Headers," on page 122 "Advanced Expressions: Evaluating Text," on page 63 "Compound Operations for Numbers," on page 48
`HTTP.RES.SET_COOKIE2.COOKIE.VERSION`	"Prefixes for HTTP Headers," on page 116 "Operations for HTTP Headers," on page 122 "Advanced Expressions: Evaluating Text," on page 63 "Compound Operations for Numbers," on page 48
`HTTP.RES.SET_COOKIE2.EXISTS("`*`name`*`")`	"Prefixes for HTTP Headers," on page 116 "Operations for HTTP Headers," on page 122 "Booleans in Compound Expressions," on page 46
`HTTP.RES.STATUS`	"Expression Prefixes for Text in HTTP Requests and Responses," on page 67 "Compound Operations for Numbers," on page 48

Expression Prefix	Notes and Links to Prefix and Applicable Operator Descriptions
`HTTP.RES.STATUS_MSG`	"Expression Prefixes for Text in HTTP Requests and Responses," on page 67
`HTTP.RES.TRACKING`	Returns the HTTP body tracking mechanism. See the descriptions of other HTTP.REQ.TRACKING prefixes in this table.
`HTTP.RES.TRACKING.EQ("`*`tracking_method`*`")`	Returns TRUE or FALSE. See "Booleans in Compound Expressions," on page 46
`HTTP.RES.TXID`	"Prefixes for HTTP Headers," on page 116 "Operations for HTTP Headers," on page 122
`HTTP.RES.VERSION`	"Expression Prefixes for Text in HTTP Requests and Responses," on page 67
`HTTP.RES.VERSION.[MAJOR | MINOR]`	Operates on the major or minor HTTP version string. See "Expression Prefixes for Text in HTTP Requests and Responses," on page 67 and "Compound Operations for Numbers," on page 48.
`SERVER`	Designates an expression that refers to the server. This is the starting point for access into parameters such as Ether and SSL. See the other SERVER prefixes in this table.
`SERVER.ETHER`	Operates on the ethernet protocol data associated with the current packet. See the other SERVER prefixes in this table.
`SERVER.ETHER.DSTMAC`	"Prefixes for MAC Addresses," on page 154 "Operations for MAC Addresses," on page 154
`SERVER.INTERFACE`	Designates an expression that refers to the ID of the network interface that received the current packet of data. See the other SERVER.INTERFACE prefixes in this table.
`SERVER.INTERFACE.ID.EQ("`*`id`*`")`	Returns Boolean TRUE if the interface's ID matches the ID that is passed as the argument. For example: SERVER.INTERFACE.ID.EQ("LA/1") See "Booleans in Compound Expressions," on page 46
`SERVER.INTERFACE.[RXTHROUGHPUT | RXTXTHROUGHPUT | TXTHROUGHPUT]`	"Expressions for Numeric Client and Server Data," on page 155 "Compound Operations for Numbers," on page 48
`SERVER.IP`	Operates on the IP protocol data associated with the current packet. See the other SERVER.IP prefixes in this table.

Expression Prefix	Notes and Links to Prefix and Applicable Operator Descriptions
`SERVER.IP.[DST | SRC]`	"Prefixes for IPV4 Addresses and IP Subnets," on page 150 "Operations for IPV4 Addresses," on page 150 "Compound Operations for Numbers," on page 48
`SERVER.IPV6`	Operates on IPv6 protocol data. See the other SERVER.IPV6 prefixes in this table.
`SERVER.IPV6.DST`	"Expression Prefixes for IPv6 Addresses," on page 152 "Operations for IPV6 Prefixes," on page 153
`SERVER.IPV6.SRC`	"Expression Prefixes for IPv6 Addresses," on page 152 "Operations for IPV6 Prefixes," on page 153
`SERVER.TCP`	Operates on TCP protocol data. See the other CLIENT.TCP prefixes in this table.
`SERVER.TCP.[DSTPORT | MSS | SRCPORT]`	"Expressions for TCP, UDP, and VLAN Data," on page 134 "Compound Operations for Numbers," on page 48
`SERVER.VLAN`	Operates on the VLAN through which the current packet entered the NetScaler. See the other SERVER.VLAN prefixes in this table.
`SERVER.VLAN.ID`	"Expressions for TCP, UDP, and VLAN Data," on page 134 "Compound Operations for Numbers," on page 48
`SYS`	Designates an expression that refers to the NetScaler itself, not to the client or server.. See the other SYS prefixes in this table.
`SYS.EVAL_CLASSIC_EXPR(`*`classic_expression`*`)`	"Classic Expressions in Advanced Expressions," on page 57 "Booleans in Compound Expressions," on page 46
`SYS.HTTP_CALLOUT(`*`http_callout`*`)`	"Advanced Policies: Sending HTTP Service Callouts to Applications," on page 185
`SYS.CHECK_LIMIT`	"Advanced Policies: Controlling the Rate of Traffic," on page 183
`SYS.TIME`	"Expressions for the NetScaler System Time," on page 97 "Compound Operations for Numbers," on page 48

Expression Prefix	**Notes and Links to Prefix and Applicable Operator Descriptions**
`SYS.TIME.[BETWEEN(`*`time1, time2`*`) | EQ(`*`time`*`) | GE(`*`time`*`) | GT(`*`time`*`) | LE(`*`time`*`) | LT(`*`time`*`) | WITHIN(`*`time1, time2`*`)]`	"Expressions for the NetScaler System Time," on page 97 "Booleans in Compound Expressions," on page 46 "Compound Operations for Numbers," on page 48
`SYS.TIME.[DAY | HOURS | MINUTES | MONTH | RELATIVE_BOOT | RELATIVE_NOW SECONDS | WEEKDAY | YEAR]`	"Expressions for the NetScaler System Time," on page 97 "Compound Operations for Numbers," on page 48
`VPN.BASEURL.[CVPN_DECODE | CVPN_ENCODE | HOSTNAME | HOSTNAME.DOMAIN | HOSTNAME.SERVER | PATH | PATH_AND_QUERY | PROTOCOL | QUERY | SUFFIX]`	"Expression Prefixes for VPNs and Clientless VPNs," on page 76
`VPN.BASEURL.HOSTNAME.EQ("`*`hostname`*`")`	"Expression Prefixes for VPNs and Clientless VPNs," on page 76 "Booleans in Compound Expressions," on page 46
`VPN.BASEURL.HOSTNAME.PORT`	"Expression Prefixes for VPNs and Clientless VPNs," on page 76 "Compound Operations for Numbers," on page 48
`VPN.BASEURL.PATH.IGNORE_EMPTY_ELEMENTS`	Ignores spaces in the data. For an example, see the table "HTTP Expression Prefixes that Return Text," on page 67
`VPN.BASEURL.QUERY.IGNORE_EMPTY_ELEMENTS`	Ignores spaces in the data. For an example, see the table "HTTP Expression Prefixes that Return Text," on page 67.
`VPN.CLIENTLESS_BASEURL`	"Expression Prefixes for VPNs and Clientless VPNs," on page 76
`VPN.CLIENTLESS_BASEURL.[CVPN_DECODE | CVPN_ENCODE | HOSTNAME | HOSTNAME.DOMAIN | HOSTNAME.SERVER | PATH | PATH_AND_QUERY | PROTOCOL | QUERY | SUFFIX]`	"Expression Prefixes for VPNs and Clientless VPNs," on page 76
`VPN.CLIENTLESS_BASEURL.HOSTNAME.EQ("`*`hostname`*`")`	"Expression Prefixes for VPNs and Clientless VPNs," on page 76 "Booleans in Compound Expressions," on page 46
`VPN.CLIENTLESS_BASEURL.HOSTNAME.PORT`	"Expression Prefixes for VPNs and Clientless VPNs," on page 76 "Compound Operations for Numbers," on page 48

Expression Prefix	**Notes and Links to Prefix and Applicable Operator Descriptions**
`VPN.CLIENTLESS_BASEURL.PATH.IGNORE_EMPTY_ELEMENTS`	Ignores spaces in the data. For an example, see the table "HTTP Expression Prefixes that Return Text," on page 67.
`VPN.CLIENTLESS_BASEURL.QUERY.IGNORE_EMPTY_ELEMENTS`	Ignores spaces in the data. For an example, see the table "HTTP Expression Prefixes that Return Text," on page 67.
`VPN.CLIENTLESS_HOSTURL`	"Expression Prefixes for VPNs and Clientless VPNs," on page 76
`VPN.CLIENTLESS_HOSTURL.[CVPN_DECODE | CVPN_ENCODE | HOSTNAME | HOSTNAME.DOMAIN | HOSTNAME.SERVER | PATH | PATH_AND_QUERY | PROTOCOL | QUERY | SUFFIX]`	"Expression Prefixes for VPNs and Clientless VPNs," on page 76
`VPN.CLIENTLESS_HOSTURL.HOSTNAME.EQ("`*`hostname`*`")`	"Expression Prefixes for VPNs and Clientless VPNs," on page 76 "Booleans in Compound Expressions," on page 46
`VPN.CLIENTLESS_HOSTURL.HOSTNAME.PORT`	"Expression Prefixes for VPNs and Clientless VPNs," on page 76 "Compound Operations for Numbers," on page 48
`VPN.CLIENTLESS_HOSTURL.PATH.IGNORE_EMPTY_ELEMENTS`	Ignores spaces in the data. For an example, see the table "HTTP Expression Prefixes that Return Text," on page 67.
`VPN.CLIENTLESS_HOSTURL.QUERY.IGNORE_EMPTY_ELEMENTS`	Ignores spaces in the data. For an example, see the table "HTTP Expression Prefixes that Return Text," on page 67.
`VPN.HOST`	"Expression Prefixes for VPNs and Clientless VPNs," on page 76
`VPN.HOST.[DOMAIN | Server]`	"Expression Prefixes for VPNs and Clientless VPNs," on page 76
`VPN.HOST.EQ("`*`hostname`*`")`	"Expression Prefixes for VPNs and Clientless VPNs," on page 76 "Booleans in Compound Expressions," on page 46
`VPN.HOST.PORT`	"Expression Prefixes for VPNs and Clientless VPNs," on page 76 "Advanced Expressions: Evaluating Text," on page 63 "Compound Operations for Numbers," on page 48

Classic Expressions

The following tables provide a complete list of NetScaler classic expressions. These expressions continue to be supported for backward compatibility with NetScaler versions earlier than 8.1, and for features that have not yet implemented the PI expression language.

In the table of operators, the result type of each operator is shown at the beginning of the description. In the other tables, the level of each expression is shown at the beginning of the description. For named expressions, each expression is shown as a whole.

Operators

Expression Element	**Definition**
==	Boolean. Returns TRUE if the current expression equals the argument. For text operations, the items being compared must exactly match one another. For numeric operations, the items must evaluate to the same number.
!=	Boolean. Returns TRUE if the current expression does not equal the argument. For text operations, the items being compared must not exactly match one another. For numeric operations, the items must not evaluate to the same number.
CONTAINS	Boolean. Returns TRUE if the current expression contains the string that is designated in the argument.
NOTCONTAINS	Boolean. Returns TRUE if the current expression does not contain the string that is designated in the argument.
CONTENTS	Text. Returns the contents of the current expression.
EXISTS	Boolean. Returns TRUE if the item designated by the current expression exists.
NOTEXISTS	Boolean. Returns TRUE if the item designated by the current expression does not exist.

Expression Element	Definition
>	Boolean. Returns TRUE if the current expression evaluates to a number that is greater than the argument.
<	Boolean. Returns TRUE if the current expression evaluates to a number that is less than the argument.
>=	Boolean. Returns TRUE if the current expression evaluates to a number that is greater than or equal to the argument.
<=	Boolean. Returns TRUE if the current expression evaluates to a number that is less than or equal to the argument.

General Expressions

Expression Element	Definition
REQ	Flow Type. Operates on incoming (or request) packets.
REQ.HTTP	Protocol Operates on HTTP requests.
REQ.HTTP.METHOD	Qualifier Designates the HTTP method.
REQ.HTTP.URL	Qualifier Designates the URL.
REQ.HTTP.URLTOKENS	Qualifier Designates the URL token.
REQ.HTTP.VERSION	Qualifier Designates the HTTP version.
REQ.HTTP.HEADER	Qualifier Designates the HTTP header.
REQ.HTTP.URLLEN	Qualifier Designates the number of characters in the URL.
REQ.HTTP.URLQUERY	Qualifier Designates the query portion of the URL.

Expression Element	Definition
REQ.HTTP.URLQUERYLEN	Qualifier Designates the length of the query portion of the URL.
REQ.SSL	Protocol Operates on SSL requests.
REQ.SSL.CLIENT.CERT	Qualifier Designates the entire client certificate.
REQ.SSL.CLIENT.CERT.SUBJECT	Qualifier Designates the client certificate subject.
REQ.SSL.CLIENT.CERT.ISSUER	Qualifier Designates the issuer of the client certificate.
REQ.SSL.CLIENT.CERT.SIGALGO	Qualifier Designates the validation algorithm used by the client certificate.
REQ.SSL.CLIENT.CERT.VERSION	Qualifier Designates the client certificate version.
REQ.SSL.CLIENT.CERT.VALIDFROM	Qualifier Designates the date before which the client certificate is not valid.
REQ.SSL.CLIENT.CERT.VALIDTO	Qualifier Designates the date after which the client certificate is not valid.
REQ.SSL.CLIENT.CERT.SERIALNUMBER	Qualifier Designates the serial number of the client certificate.
REQ.SSL.CLIENT.CIPHER.TYPE	Qualifier Designates the encryption protocol used by the client.
REQ.SSL.CLIENT.CIPHER.BITS	Qualifier Designates the number of bits used by the client's SSL key.
REQ.SSL.CLIENT.SSL.VERSION	Qualifier Designates the SSL version that the client is using.
REQ.TCP	Protocol Operates on incoming TCP packets.

Expression Element	Definition
REQ.TCP.SOURCEPORT	Qualifier Designates the source port of the incoming packet.
REQ.TCP.DESTPORT	Qualifier Designates the destination port of the incoming packet.
REQ.IP	Protocol Operates on incoming IP packets.
REQ.IP.SOURCEIP	Qualifier Designates the source IP of the incoming packet.
REQ.IP.DESTIP	Qualifier Designates the destination IP of the incoming packet.
RES	Flow Type Operates on outgoing (or response) packets.
RES.HTTP	Protocol Operates on HTTP responses.
RES.HTTP.VERSION	Qualifier Designates the HTTP version.
RES.HTTP.HEADER	Qualifier Designates the HTTP header.
RES.HTTP.STATUSCODE	Qualifier Designates the status code of the HTTP response.
RES.TCP	Protocol Operates on incoming TCP packets.
RES.TCP.SOURCEPORT	Qualifier Designates the source port of the outgoing packet.
RES.TCP.DESTPORT	Qualifier Designates the destination port of the outgoing packet.
RES.IP	Protocol Operates on outgoing IP packets.

Expression Element	Definition
RES.IP.SOURCEIP	Qualifier Designates the source IP of the outgoing packet. This can be in IPv4 or IPv6 format. For example: `add expr exp3 “sourceip == 10.102.32.123 –netmask 255.255.255.0 && destip == 2001::23/120”.`
RES.IP.DESTIP	Qualifier Designates the destination IP of the outgoing packet.

Client Security Expressions

Actual Expression	Definition
CLIENT.APPLICATION.AV({*NAME*}.VERSION == {*VERSION*}	Checks whether the client is running the designated anti-virus program and version.
CLIENT.APPLICATION.AV({*NAME*}.VERSION != {*VERSION*}	Checks whether the client is not running the designated anti-virus program and version.
CLIENT.APPLICATION.PF({*NAME*}.VERSION == {*VERSION*}	Checks whether the client is running the designated personal firewall program and version.
CLIENT.APPLICATION.PF({*NAME*}.VERSION != {*VERSION*}	Checks whether the client is not running the designated personal firewall program and version.
CLIENT.APPLICATION.IS({*NAME*}.VERSION == {*VERSION*}	Checks whether the client is running the designated internet security program and version.
CLIENT.APPLICATION.IS({*NAME*}.VERSION != {*VERSION*}	Checks whether the client is not running the designated internet security program and version.
CLIENT.APPLICATION.AS({*NAME*}.VERSION == {*VERSION*}	Checks whether the client is running the designated anti-spam program and version.
CLIENT.APPLICATION.AS({*NAME*}.VERSION != {*VERSION*}	Checks whether the client is not running the designated anti-spam program and version.

Network-Based Expressions

Expression	Definition
REQ	Flow Type. Operates on incoming, or request, packets.
REQ.VLANID	Qualifier. Operates on the virtual LAN (VLAN) ID.
REQ.INTERFACE.ID	Qualifier. Operates on the ID of the designated NetScaler interface.
REQ.INTERFACE.RXTHROUGHPUT	Qualifier. Operates on the raw received packet throughput of the designated NetScaler interface.
REQ.INTERFACE.TXTHROUGHPUT	Qualifier. Operates on the raw transmitted packet throughput of the designated NetScaler interface.
REQ.INTERFACE.RXTXTHROUGHPUT	Qualifier. Operates on the raw received and transmitted packet throughput of the designated NetScaler interface.
REQ.ETHER.SOURCEMAC	Qualifier. Operates on the source MAC address.
REQ.ETHER.DESTMAC	Qualifier. Operates on the destination MAC address.
RES	Flow Type. Operates on outgoing (or response) packets.
RES.VLANID	Qualifier. Operates on the virtual LAN (VLAN) ID.
RES.INTERFACE.ID	Qualifier. Operates on the ID of the designated NetScaler interface.
RES.INTERFACE.RXTHROUGHPUT	Qualifier. Operates on the raw received packet throughput of the designated NetScaler interface.
RES.INTERFACE.TXTHROUGHPUT	Qualifier. Operates on the raw transmitted packet throughput of the designated NetScaler interface.

Expression	Definition
RES.INTERFACE.RXTXTHROUGHPUT	Qualifier. Operates on the raw received and transmitted packet throughput of the designated NetScaler interface.
RES.ETHER.SOURCEMAC	Qualifier. Operates on the source MAC address.
RES.ETHER.DESTMAC	Qualifier. Operates on the destination MAC address.

Date/Time Expressions

Expression	Definition
TIME	Qualifier. Operates on the date and time of day, GMT.
DATE	Qualifier. Operates on the date, GMT.
DAYOFWEEK	Operates on the specified day in the week, GMT.

File System Expressions

You can specify file system expressions in authorization policies for users and groups who access file sharing through the Access Gateway file transfer utility (the VPN portal). These expressions work with the Access Gateway's file transfer authorization feature to control user access to file servers, folders, and files. For example, you can use these expressions in authorization policies to control access based on file type and size.

Expression	Definition
FS.COMMAND	Qualifier. Operates on a file system command. The user can issue multiple commands on a file transfer portal. (For example, `ls` to list files or `mkdir` to create a directory). This expression returns the current action that the user is taking. Possible values: `Neighbor`, `login`, `ls`, `get`, `put`, `rename`, `mkdir`, `rmdir`, `del`, `logout`, `any`. Following is an example: `Add authorization policy pol1 “fs.command eq login && (fs.user eq administrator || fs.serverip eq 10.102.88.221 –netmask 255.255.255.252)” allow`
FS.USER	Returns the user who is logged on to the file system.
FS.SERVER	Returns the host name of the target server. In the following example, the string `win2k3-88-22` is the server name: `fs.server eq win2k3-88-221`
FS.SERVERIP	Returns the IP address of the target server.
FS.SERVICE	Returns a shared root directory on the file server. If a particular folder is exposed as shared, a user can directly log on to the specified first level folder. This first level folder is called a service. For example, in the path \\hostname\SERVICEX\ETC, SERVICEX is the service. As another example, if a user accesses the file \\hostname\service1\dir1\file1.doc, `FS.SERVICE` will return `service1`. Following is an example: `fs.service notcontains New`
FS.DOMAIN	Returns the domain name of the target server.
FS.PATH	Returns the complete path of the file being accessed. For example, if a user accesses the file \\hostname\service1\dir1\file1.doc, `FS.PATH` will return `\service\dir1\file1.doc`. Following is an example: `fs.path notcontains SSL`
FS.FILE	Returns the name of the file being accessed. For example, if a user accesses the file \\hostname\service1\dir1\file1.doc, `FS.FILE` will return `file1.doc`.

Expression	Definition
FS.DIR	Returns the directory being accessed. For example, if a user accesses the file \\hostname\service1\dir1\file1.doc, `FS.DIR` will return `\service\dir1`.
FS.FILE.ACCESSTIME	Returns the time at which the file was last accessed. This is one of several options that provide you with granular control over actions that the user performs. (See the following entries in this table.)
FS.FILE.CREATETIME	Returns the time at which the file was created.
FS.FILE.MODIFYTIME	Returns the time at which the file was edited.
FS.FILE.WRITETIME	Returns the time of the most recent change in the status of the file.
FS.FILE.SIZE	Returns the file size.
FS.DIR.ACCESSTIME	Returns the time at which the directory was last accessed.
FS.DIR.CREATETIME	Returns the time at which the directory was created.
FS.DIR.MODIFYTIME	Returns the time at which the directory was last modified.
FS.DIR.WRITETIME	Returns the time at which the directory status last changed.

Note: File system expressions do not support regular expressions.

Built-In Named Expressions (General)

Expression	Definition
ns_all_apps_ncomp	Tests for connections with destination ports between 0 and 65535. In other words, tests for all applications.
ns_cachecontrol_nocache	Tests for connections with an HTTP Cache-Control header that contains the value “no-cache”.
ns_cachecontrol_nostore	Tests for connections with an HTTP Cache-Control header that contains the value “no-store”.

Expression	**Definition**
ns_cmpclient	Tests the client to determine if it accepts compressed content.
ns_content_type	Tests for connections with an HTTP Content-Type header that contains “text”.
ns_css	Tests for connections with an HTTP Content-Type header that contains “text/css”.
ns_ext_asp	Tests for HTTP connections to any URL that contains the string `.asp`—in other words, any connection to an active server page (ASP).
ns_ext_cfm	Tests for HTTP connections to any URL that contains the string `.cfm`
ns_ext_cgi	Tests for HTTP connections to any URL that contains the string `.cgi`—in other words, any connection to a common gateway interface (CGI) script.
ns_ext_ex	Tests for HTTP connections to any URL that contains the string `.ex`
ns_ext_exe	Tests for HTTP connections to any URL that contains the string `.exe`—in other words, any connection to a executable file.
ns_ext_htx	Tests for HTTP connections to any URL that contains the string `.htx`
ns_ext_not_gif	Tests for HTTP connections to any URL that does not contain the string `.gif`—in other words, any connection to a URL that is not a GIF image.
ns_ext_not_jpeg	Tests for HTTP connections to any URL that does not contain the string `.jpeg`—in other words, any connection to a URL that is not a JPEG image.
ns_ext_shtml	Tests for HTTP connections to any URL that contains the string `.shtml`—in other words, any connection to a server-parsed HTML page.
ns_false	Always returns a value of FALSE.

Expression	Definition
ns_farclient	Client is in a different geographical region from the NetScaler, as determined by the geographical region in the client's IP address. The following regions are predefined: • 192.0.0.0 – 193.255.255.255: Multi-regional • 194.0.0.0 – 195.255.255.255: European Union • 196.0.0.0 – 197.255.255.255: Other1 • 198.0.0.0 – 199.255.255.255: North America • 200.0.0.0 – 201.255.255.255: Central and South America • 202.0.0.0 – 203.255.255.255: Pacific Rim • 204.0.0.0 – 205.255.255.255: Other2 • 206.0.0.0 – 207.255.255.255: Other3
ns_header_cookie	Tests for HTTP connections that contain a Cookie header
ns_header_pragma	Tests for HTTP connections that contain a `Pragma: no-cache` header.
ns_mozilla_47	Tests for HTTP connections whose User-Agent header contains the string `Mozilla/4.7`—in other words, any connection from a client using the Mozilla 4.7 web browser.
ns_msexcel	Tests for HTTP connections whose Content-Type header contains the string `application/vnd.msexcel`—in other words, any connection transmitting a Microsoft Excel spreadsheet.
ns_msie	Tests for HTTP connections whose User-Agent header contains the string `MSIE`—in other words, any connection from a client using any version of the Internet Explorer web browser.
ns_msppt	Tests for HTTP connections whose Content-Type header contains the string `application/vnd.ms-powerpoint`—in other words, any connection transmitting a Microsoft PowerPoint file.
ns_msword	Tests for HTTP connections whose Content-Type header contains the string `application/vnd.msword`—in other words, any connection transmitting a Microsoft Word file.
ns_non_get	Tests for HTTP connections that use any HTTP method except for GET.
ns_slowclient	Returns TRUE if the average round trip time between the client and the NetScaler is more than 80 milliseconds.
ns_true	Returns TRUE for all traffic.
ns_url_path_bin	Tests the URL path to see if it points to the /bin/ directory.

Expression	Definition
ns_url_path_cgibin	Tests the URL path to see if it points to the CGI-BIN directory.
ns_url_path_exec	Tests the URL path to see if it points to the /exec/ directory.
ns_url_tokens	Tests for the presence of URL tokens.
ns_xmldata	Tests for the presence of XML data.

Built-In Named Expressions (Anti-Virus)

Expression	Definition
McAfee Virus Scan 11	Tests to determine whether the client is running the latest version of McAfee VirusScan.
Mcafee Antivirus	Tests to determine whether the client is running any version of McAfee Antivirus.
Symantec AntiVirus 10 (with Updated Definition File)	Tests to determine whether the client is running the most current version of Symantec AntiVirus.
Symantec AntiVirus 6.0	Tests to determine whether the client is running Symantec AntiVirus 6.0.
Symantec AntiVirus 7.5	Tests to determine whether the client is running Symantec AntiVirus 7.5.
TrendMicro OfficeScan 7.3	Tests to determine whether the client is running Trend Microsystems' OfficeScan, version 7.3.
TrendMicro AntiVirus 11.25	Tests to determine whether the client is running Trend Microsystems' AntiVirus, version 11.25.
Sophos Antivirus 4	Tests to determine whether the client is running Sophos Antivirus, version 4.
Sophos Antivirus 5	Tests to determine whether the client is running Sophos Antivirus, version 5.
Sophos Antivirus 6	Tests to determine whether the client is running Sophos Antivirus, version 6.

Built-In Named Expressions (Personal Firewall)

Expression	Definition
TrendMicro OfficeScan 7.3	Tests to determine whether the client is running Trend Microsystems' OfficeScan, version 7.3.

Expression	Definition
Sygate Personal Firewall 5.6	Tests to determine whether the client is running the Sygate Personal Firewall, version 5.6.
ZoneAlarm Personal Firewall 6.5	Tests to determine whether the client is running the ZoneAlarm Personal Firewall, version 6.5.

Built-In Named Expressions (Client Security)

Expression	Definition
Norton Internet Security	Tests to determine whether the client is running any version of Norton Internet Security.

Summary Examples of Advanced Expressions and Policies

The following table provides examples of advanced expressions that you can use as the basis for your own advanced expressions.

Examples of Advanced Expressions

Expression Type	Sample Expressions

Look at the method used in the HTTP request.	`http.req.method.eq(post)`
	`http.req.method.eq(get)`

Check the Cache-Control or Pragma header value in an HTTP request (`req`) or response (`res`).	`http.req.header("Cache-Control").contains("no-store")`
	`http.req.header("Cache-Control").contains("no-cache")`
	`http.req.header("Pragma").contains("no-cache")`
	`http.res.header("Cache-Control").contains("private")`
	`http.res.header("Cache-Control").contains("public")`
	`http.res.header("Cache-Control").contains("must-revalidate")`
	`http.res.header("Cache-Control").contains("proxy-revalidate")`
	`http.res.header("Cache-Control").contains("max-age")`

Check for the presence of a header in a request (`req`) or response (`res`).	`http.req.header("myHeader").exists`
	`http.res.header("myHeader").exists`

Examples of Advanced Expressions

Expression Type	Sample Expressions

Look for a particular file type in an HTTP request based on the file extension.	`http.req.url.contains(".html")`
	`http.req.url.contains(".cgi")`
	`http.req.url.contains(".asp")`
	`http.req.url.contains(".exe")`
	`http.req.url.contains(".cfm")`
	`http.req.url.contains(".ex")`
	`http.req.url.contains(".shtml")`
	`http.req.url.contains(".htx")`
	`http.req.url.contains("/cgi-bin/")`
	`http.req.url.contains("/exec/")`
	`http.req.url.contains("/bin/")`

Look for anything that is other than a particular file type in an HTTP request.	`http.req.url.contains(".gif").not`
	`http.req.url.contains(".jpeg").not`

Check the type of file that is being sent in an HTTP response based on the Content-Type header.	`http.res.header("Content-Type").contains("text")`
	`http.res.header("Content-Type").contains("application/msword")`
	`http.res.header("Content-Type").contains("vnd.ms-excel")`
	`http.res.header("Content-Type").contains("application/vnd.ms-powerpoint")`
	`http.res.header("Content-Type").contains("text/css")`
	`http.res.header("Content-Type").contains("text/xml")`
	`http.res.header("Content-Type").contains("image/")`

Check whether this response contains an expiration header.	`http.res.header("Expires").exists`
Check for a Set-Cookie header in a response	`http.res.header("Set-Cookie").exists`

Check the agent that sent the response.	`http.res.header("User-Agent").contains("Mozilla/4.7")`
	`http.res.header("User-Agent").contains("MSIE")`

Examples of Advanced Expressions

Expression Type	**Sample Expressions**
Check if the first 1024 bytes of the body of a request starts with the string “some text”.	`http.req.body(1024).contains("some text")`

The following table shows examples of policy configurations and bindings for commonly-used functions.

Examples of Advanced Expressions and Policies

Purpose	**Example**

Use the Rewrite feature to replace occurrences of http:// with https:// in the body of an HTTP response.	`add rewrite action httpRewriteAction replace_all http.res.body(50000) "\"https://\"" -pattern http://`
	
	 `add rewrite policy demo_rep34312 "http.res.body(50000).contains(\"http://\")" httpRewriteAction`

Replace all occurrences of “abcd” with “1234”.	`add rewrite action abcdTo1234Action replace_all "http.req.body(1000)" "\"1234\"" -pattern abcd`
	
	 `add rewrite policy abcdTo1234Policy "http.req.body(1000).contains(\"abcd\")" abcdTo1234Action`
	
	 `bind rewrite global abcdTo1234Policy 100 END -type REQ_OVERRIDE`

Downgrade the HTTP version to 1.0 to prevent the server from chunking HTTP responses.	`add rewrite action downgradeTo1.0Action replace http.req.version.minor "\"0\""`
	
	 `add rewrite policy downgradeTo1.0Policy "http.req.version.minor.eq(1)" downgradeTo1.0Action`
	
	 `bind lb vserver myLBVserver -policyName downgradeTo1.0Policy -priority 100 -gotoPriorityExpression NEXT -type REQUEST`

Remove references to the HTTP or HTTPS protocol in all responses, so that if the user's connection is HTTP, the link is opened by using HTTP, and if the user's connection is HTTPS, the link is opened by using HTTPS.	`add rewrite action remove_http_https replace_all "http.res.body(1000000).set_text_mode(ignorecase)" "\"//\"" -pattern "re~https?://|HTTPS?://~"`
	
	 `add rewrite policy remove_http_https true remove_http_https`
	
	 `bind lb vserver test_vsvr -policyName remove_http_https -priority 20 -gotoPriorityExpression NEXT -type RESPONSE`

Examples of Advanced Expressions and Policies

Purpose	**Example**

Rewrite instances of http:// to https:// in all URLs.
 	
This policy uses Responder functionality.
	`add responder action httpToHttpsAction redirect "\"https://\" + http.req.hostname + http.req.url" -bypassSafetyCheck YES`
	
	`add responder policy httpToHttpsPolicy "!CLIENT.SSL.IS_SSL" httpToHttpsAction`
	
	`bind responder global httpToHttpsPolicy 1 END -type OVERRIDE`

Modify a URL to redirect from URL A to URL B. In this example, “file5.html” is appended to the path.
 	
This policy uses Responder functionality.
	`add responder action appendFile5Action redirect "\"http://\" + http.req.hostname + http.req.url + \"/file5.html\"" -bypassSafetyCheck YES`
	
	`add responder policy appendFile5Policy "http.req.url.eq(\"/testsite\")" appendFile5Action`
	
	`bind responder global appendFile5Policy 1 END -type OVERRIDE`

Redirect an external URL to an internal URL.	`add rewrite action act_external_to_internal REPLACE 'http.req.hostname.server' '"www.my.host.com"'`
	
	`add rewrite policy pol_external_to_internal 'http.req.hostname.server.eq("www.external.host.com")' act_external_to_internal`
	
	`bind rewrite global pol_external_to_internal 100 END -type REQ_OVERRIDE`

Redirect requests to www.example.com that have a query string to www.Web*n*.example.com. The value *n* is derived from a server parameter in the query string, for example, `server=5`.	`add rewrite action act_redirect_query REPLACE q#http.req.header("Host").before_str(".example.com")' '"Web" + http.req.url.query.value("server")#`
	
	`add rewrite policy pol_redirect_query q#http.req.header("Host").eq("www.example.com") && http.req.url.contains("?")' act_redirect_query#`

Examples of Advanced Expressions and Policies

Purpose	**Example**

Limit the number of requests per second from a URL.	`add ns limitSelector ip_limit_selector http.req.url "client.ip.src"`
	
	`add ns limitIdentifier ip_limit_identifier -threshold 4 -timeSlice 3600 -mode request_rate -limitType smooth -selectorName ip_limit_selector`
	
	`add responder action my_Web_site_redirect_action redirect "\"http://www.mycompany.com/\""`
	
	`add responder policy ip_limit_responder_policy "http.req.url.contains(\"myasp.asp\") && sys.check_limit(\"ip_limit_identifier\")" my_Web_site_redirect_action`
	
	`bind responder global ip_limit_responder_policy 100 END -type default`

Check the client IP address but pass a request through unchanged	`add rewrite policy check_client_ip_policy 'HTTP.REQ.HEADER("x-forwarded-for").EXISTS || HTTP.REQ.HEADER("client-ip").EXISTS' NOREWRITE`
	
	`bind rewrite global check_client_ip_policy 100 END`

Examples of Advanced Expressions and Policies

Purpose	**Example**

Remove old headers from a request and insert an NS-Client header	`add rewrite action del_x_forwarded_for delete_http_header x-forwarded-for`
	
	`add rewrite action del_client_ip delete_http_header client-ip`
	
	`add rewrite policy check_x_forwarded_for_policy 'HTTP.REQ.HEADER("x-forwarded-for").EXISTS' del_x_forwarded_for`
	
	`add rewrite policy check_client_ip_policy 'HTTP.REQ.HEADER("client-ip").EXISTS' del_client_ip`
	
	`add rewrite action insert_ns_client_header insert_http_header NS-Client 'CLIENT.IP.SRC'`
	
	`add rewrite policy insert_ns_client_policy 'HTTP.REQ.HEADER("x-forwarded-for").EXISTS || HTTP.REQ.HEADER("client-ip").EXISTS' insert_ns_client_header`
	
	`bind rewrite global check_x_forwarded_for_policy 100 200`
	
	`bind rewrite global check_client_ip_policy 200 300`
	
	`bind rewrite global insert_ns_client_policy 300 END`

Examples of Advanced Expressions and Policies

Purpose	Example

Remove old headers from a request, insert an NS-Client header, and then modify the “insert header” action so that the value of the inserted header contains the client IP values from the old headers and the NetScaler’s connection IP address.
 	
Note that this example repeats the previous example, with the exception of the final `set rewrite action`.
	`add rewrite action del_x_forwarded_for delete_http_header x-forwarded-for`
	
	`add rewrite action del_client_ip delete_http_header client-ip`
	
	`add rewrite policy check_x_forwarded_for_policy 'HTTP.REQ.HEADER("x-forwarded-for").EXISTS' del_x_forwarded_for`
	
	`add rewrite policy check_client_ip_policy 'HTTP.REQ.HEADER("client-ip").EXISTS' del_client_ip`
	
	`add rewrite action insert_ns_client_header insert_http_header NS-Client 'CLIENT.IP.SRC'`
	
	`add rewrite policy insert_ns_client_policy 'HTTP.REQ.HEADER("x-forwarded-for").EXISTS || HTTP.REQ.HEADER("client-ip").EXISTS' insert_ns_client_header`
	
	`bind rewrite global check_x_forwarded_for_policy 100 200`
	
	`bind rewrite global check_client_ip_policy 200 300`
	
	`bind rewrite global insert_ns_client_policy 300 END`
	
	`set rewrite action insert_ns_client_header -stringBuilderExpr 'HTTP.REQ.HEADER("x-forwarded-for").VALUE(0) + " " + HTTP.REQ.HEADER("client-ip").VALUE(0) + " " + CLIENT.IP.SRC' -bypassSafetyCheck YES`

Tutorial Examples of Advanced Policies for Rewrite

With the rewrite feature, you can modify any part of an HTTP header, and, for responses, you can modify the HTTP body. You can use this feature to accomplish a number of useful tasks, such as removing unnecessary HTTP headers, masking internal URLs, redirecting Web pages, and redirecting queries or keywords.

In the following examples, you first create a rewrite action and a rewrite policy. Then you bind the policy globally.

In This Appendix

Redirecting an External URL to an Internal URL

Redirecting a Query

Redirecting HTTP to HTTPS

Removing Unwanted Headers

Reducing Web Server Redirects

Masking the Server Header

Redirecting an External URL to an Internal URL

This example describes how to create a Rewrite action and Rewrite policy that redirects an external URL to an internal URL. You create an action, called act_external_to_internal, that performs the rewrite. Then you create a policy called pol_external_to_internal

To redirect an external URL to an internal URL by using the command line

To create the rewrite action, at the NetScaler command prompt, type:

```
add rewrite action act_external_to_internal REPLACE
'http.req.hostname.server'
'"host_name_of_internal_Web_server"'
```

To create the rewrite policy, at the NetScaler command prompt, type:

```
add rewrite policy pol_external_to_internal
'http.req.hostname.server.eq("host_name_of_external_Web_server
")' act_external_to_internal
```

Bind the policy globally.

To redirect an external URL to an internal URL by using the configuration utility

1. In the navigation pane, expand **Rewrite**, and then click **Actions**.
2. In the details pane, click **Add**.
3. In the Create Rewrite Action dialog box, enter the name **`act_external_to_internal`**.
4. To replace the HTTP server hostname with the internal server name, choose **Replace** from the **Type** list box.
5. In the **Header Name** field, type **Host**.
6. In the **String expression for replacement text** field, type the internal hostname of your Web server.
7. Click **Create** and then click **Close**.
8. In the navigation pane, click **Policies**.
9. In the details pane, click **Add**.
10. In the Name field, type **pol_external_to_internal**. This policy will detect connections to the Web server.
11. In the **Action** drop-down menu, choose the action **act_external_to_internal**.
12. In the **Expression** editor, construct the following expression:

    ```
    HTTP.REQ.HOSTNAME.SERVER.EQ("www.example.com")
    ```
13. Bind your new policy globally.

Redirecting a Query

This example describes how to create a Rewrite action and Rewrite policy that redirects a query to the proper URL. The example assumes that the request contains a Host header set to **`www.example.com`** and a GET method with the string /**`query.cgi?server=5`**. The redirect extracts the domain name from the host header and the number from the query string, and redirects the user's query to the server **`Web5.example.com`**, where the rest of the user's query is processed.

Note: Although the following commands appears on multiple lines, you should enter them on a single line without line breaks.

To redirect a query to the appropriate URL using the command line

1. To create a Rewrite action named **`act_redirect_query`** that replaces the HTTP server hostname with the internal server name, type:

```
add rewrite action act_redirect_query REPLACE
q#http.req.header("Host").before_str(".example.com")' '"Web" +
http.req.url.query.value("server")#
```

2. To create a Rewrite policy named **`pol_redirect_query`**, type the following commands at the NetScaler command prompt.. This policy detects connections, to the Web server, that contain a query string. Do not apply this policy to connections that do not contain a query string:

```
add rewrite policy pol_redirect_query
q#http.req.header("Host").eq("www.example.com") &&
http.req.url.contains("?")' act_redirect_query#
```

3. Bind your new policy globally.

   Since this Rewrite policy is highly specific and should be run before any other Rewrite policies, it is advisable to assign it a high priority. If you assign it a priority of 1, it will be evaluated first.

Redirecting HTTP to HTTPS

This example describes how to rewrite Web server responses to find all URLs that begin with the string “http” and replace that string with “https”. You can use this to avoid having to update Web pages after moving a server from HTTP to HTTPS.

To redirect HTTP URLs to HTTPS by using the command line

1. To create a Rewrite action named **`act_replace_http_with_https`** that replaces all instances of the string “http” with the string “https”, at the NetScaler command prompt, type:

   ```
   add rewrite action act_replace_http_with_https replace_all
   'http.res.body(100)' '"https"' -pattern http
   ```

2. To create a Rewrite policy named **`pol_replace_http_with_https`** that detects connections to the Web server, at the NetScaler command prompt, type:

   ```
   add rewrite policy pol_replace_http_with_https TRUE
   replace_https NOREWRITE
   ```

3. Bind your new policy globally.

Removing Unwanted Headers

This example explains how to use a Rewrite policy to remove unwanted headers. Specifically, the example shows how to remove the following headers:

- **Accept Encoding header.** Removing the Accept Encoding header from HTTP responses prevents compression of the response.
- **Content Location header.** Removing the Content Location header from HTTP responses prevents your server from providing a hacker with information that might allow a security breach.

To delete headers from HTTP responses, you create a rewrite action and a rewrite policy, and you bind the policy globally.

To create the appropriate Rewrite action by using the NetScaler command line

At the NetScaler command prompt, type one of the following commands to either remove the Accept Encoding header and prevent response compression or remove the Content Location header:

```
add rewrite action "act_remove-ae" delete_http_header
"Accept-Encoding"
```

```
add rewrite action "act_remove-cl" delete_http_header
"Content-Location"
```

To create the appropriate Rewrite policy by using the NetScaler command line

At the NetScaler command prompt, type one of the following commands to remove either the Accept Encoding header or the Content Location header:

```
add rewrite policy "pol_remove-ae" true "act_remove-ae"

add rewrite policy "pol_remove-cl" true "act_remove-cl"
```

To bind the policy globally by using the NetScaler command line

At the NetScaler command prompt, type one of the following commands, as appropriate, to globally bind the policy that you have created:

```
bind rewrite global pol_remove_ae 100

bind rewrite global pol_remove_cl 200
```

Reducing Web Server Redirects

This example explains how to use a Rewrite policy to modify connections to your home page and other URLs that end with a forward slash (/) to the default index page for your server, preventing redirects and reducing load on your server.

To modify directory-level HTTP requests to include the default home page by using the command line

1. To create a Rewrite action named **`action-default-homepage`** that modifies URLs that end in a forward slash to include the default home page **`index.html`**, type:

   ```
   add rewrite action "action-default-homepage" replace
   q#http.req.url.path "/" "/index.html"#
   ```

2. To create a Rewrite policy named **`policy-default-homepage`** that detects connections to your home page and applies your new action, type:

   ```
   add rewrite policy "policy-default-homepage"
   q#http.req.url.path.EQ("/") "action-default-homepage"#
   ```

3. Globally bind your new policy to put it into effect.

Masking the Server Header

This example explains how to use a Rewrite policy to mask the information in the Server header in HTTP responses from your Web server. That header contains information that hackers can use to compromise your Web site. While masking the header will not prevent a skilled hacker from finding out information about your server, it will make hacking your Web server more difficult and encourage hackers to choose less well protected targets.

To mask the Server header in responses from the command line

1. To create a Rewrite action named **`act_mask-server`** that replaces the contents of the Server header with an uninformative string, type:

```
add rewrite action "act_mask-server" replace
"http.RES.HEADER(\"Server\")" "\"Web Server 1.0\""
```

2. To create a Rewrite policy named **`pol_mask-server`** that detects all connections, type:

   ```
   add rewrite policy "pol_mask-server" true "act_mask-server"
   ```

3. Globally bind your new policy to put it into effect.

Tutorial Examples of Classic Policies

Following are useful examples of classic policy configuration for certain NetScaler features such as Access Gateway, Application Firewall, and SSL.

In This Appendix

Access Gateway Policy to Check for a Valid Client Certificate

Application Firewall Policy to Protect a Shopping Cart Application

Application Firewall Policy to Protect Scripted Web Pages

DNS Policy to Drop Packets from Specific IPs

SSL Policy to Require Valid Client Certificates

Access Gateway Policy to Check for a Valid Client Certificate

The following policies enable the NetScaler to ensure that a client presents a valid certificate before establishing a connection to a company's SSL VPN.

To check for a valid client certificate by using the NetScaler command line

1. At a NetScaler command prompt, create an Access Gateway profile named **`act_current_client_cert`** that requires that users have a current client certificate to establish an SSL connection with the Access Gateway or NetScaler.

   ```
   add ssl action act_current_client_cert-clientAuth DOCLIENTAUTH
   -clientCert ENABLED -certHeader
   "header_of_client_certificate_issued_by_your_company"
   -clientCertNotBefore ENABLED -certNotBeforeHeader "Mon, 01 Jan
   2007 00:00:00 GMT"
   ```

2. To create an SSL policy named **`client_cert_policy`** that detects connections to the Web server that contain a query string, type:

```
add ssl policy client_cert_policy
'REQ.SSL.CLIENT.CERT.VALIDFROM >= "Mon, 01 Jan 2008 00:00:00
GMT"' act_block_ssl
```

3. Globally bind your new policy to put it into effect.

   Since this SSL policy should apply to any user's SSL connection unless a more specific SSL policy applies, you may want to assign a large priority value. For example, if you assign it a priority of one thousand (1000), that should ensure that other SSL policies are evaluated first, meaning that this policy will apply only to connections that do not match more specific policy criteria.

Application Firewall Policy to Protect a Shopping Cart Application

Shopping cart applications handle sensitive customer information, for example, credit card numbers and expiration dates, and they access back-end database servers. Many shopping cart applications also use legacy CGI scripts, which can contain security flaws that were unknown at the time they were written, but are now known to hackers and identity thieves.

A shopping cart application is particularly vulnerable to the following attacks:

- **Cookie tampering.** If a shopping cart application uses cookies, and does not perform the appropriate checks on the cookies that users return to the application, an attacker could modify a cookie and gain access to the shopping cart application under another user's credentials. Once logged on as that user, the attacker could obtain sensitive private information about the legitimate user or place orders using the legitimate user's account.
- **SQL injection.** A shopping cart application normally accesses a back-end database server. Unless the application performs the appropriate safety checks on the data users return in the form fields of its Web forms before it passes that information on to the SQL database, an attacker can use a Web form to inject unauthorized SQL commands into the database server. Attackers normally use this type of attack to obtain sensitive private information from the database or modify information in the database.

The following configuration will protect a shopping cart application against these and other attacks.

To protect a shopping cart application by using the configuration utility

1. In the navigation pane, expand **Application Firewall**, click **Profiles**, and then click Add.

2. In the **Create Application Firewall Profile** dialog box, in the Profile Name field, enter **shopping_cart**.
3. In the Profile Type drop-down list, select **Web Application**.
4. In the Configure Select **Advanced** defaults.
5. Click **Create** and then click **Close**.
6. In the details view, double-click the new profile.
7. In the **Configure Web Application Profile** dialog box, configure your new profile as described below:

   A. Click the **Checks** tab, double-click the **Start URL** check, and in the **Modify Start URL Check** dialog box, click the **General** tab and disable blocking, and enable learning, logging, statistics, and URL closure. Click **OK** and then click **Close**.

      Note that if you are using the command line, you configure these settings by typing the following at the prompt, and pressing Enter:

      ```
      set appfw profile shopping_cart -startURLAction LEARN LOG
      STATS -startURLClosure ON
      ```

   B. For the **Cookie Consistency** check and **Form Field Consistency** checks, disable blocking, and enable learning, logging, statistics, using a similar method to the **Modify Start URL Check** configuration.

      If you are using the command line, you configure these settings by typing the following commands:

      ```
      set appfw profile shopping_cart -cookieConsistencyAction
      LEARN LOG STATS

      set appfw profile shopping_cart -fieldConsistencyAction
      LEARN LOG STATS
      ```

   C. For the SQL Injection check, disable blocking, and enable learning, logging, statistics, and transformation of special characters in the **Modify SQL Injection Check** dialog box, **General** tab, **Check Actions** section.

      If you are using the command line, you configure these settings by typing the following at the prompt, and pressing Enter:

      ```
      set appfw profile shopping_cart -SQLInjectionAction LEARN
      LOG STATS -SQLInjectionTransformSpecialChars ON
      ```

D. For the Credit Card check, disable blocking; enable logging, statistics, and masking of credit card numbers; and enable protection for those credit cards you accept as forms of payment.

- If you are using the configuration utility, you configure blocking, logging, statistics, and masking (or *x-out*) in the Modify Credit Card Check dialog box, General tab, Check Actions section. You configure protection for specific credit cards in the Settings tab of the same dialog box.

- If you are using the command line, you configure these settings by typing the following at the prompt, and pressing Enter:

```
set appfw profile shopping_cart -creditCardAction LOG
STATS -creditCardXOut ON -creditCard <name> [<name>...]
```

For <name> you substitute the name of the credit card you want to protect. For Visa, you substitute **`VISA`**. For Master Card, you substitute **`MasterCard`**. For American Express, you substitute **`Amex`**. For Discover, you substitute **`Discover`**. For Diners Club, you substitute **`DinersClub`**. For JCB, you substitute **`JCB`**.

8. Create a policy named **`shopping_cart`** that detects connections to your shopping cart application and applies the **`shopping_cart`** profile to those connections.

To detect connections to the shopping cart, you examine the URL of incoming connections. If you host your shopping cart application on a separate host (a wise measure for security and other reasons), you can simply look for the presence of that host in the URL. If you host your shopping cart in a directory on a host that handles other traffic, as well, you must determine that the connection is going to the appropriate directory and/or HTML page.

The process for detecting either of these is the same; you create a policy based on the following expression, and substitute the proper host or URL for <string>.

```
REQ.HTTP.HEADER URL CONTAINS <string>
```

- If you are using the configuration utility, you navigate to the Application Firewall Policies page, click the Add... button to add a new policy, and follow the policy creation process described in “To create a policy with classic expressions using the configuration utility” beginning on page 201 and following.

- If you are using the command line, you type the following command at the prompt and press Enter:

```
add appfw policy shopping_cart "REQ.HTTP.HEADER URL
CONTAINS <string>" shopping_cart
```

9. Globally bind your new policy to put it into effect.

   Since you want to ensure that this policy will match all connections to the shopping cart, and not be preempted by another more general policy, you should assign a high priority to it. If you assign one (1) as the priority, no other policy can preempt this one.

Application Firewall Policy to Protect Scripted Web Pages

Web pages with embedded scripts, especially legacy Javascripts, often violate the "same origin rule," which does not allow scripts to access or modify content on any server but the server where they are located. This security vulnerability is called *cross-site scripting*. The Application Firewall Cross-Site Scripting rule normally filters out requests that contain cross-site scripting.

Unfortunately, this can cause Web pages with older Javascripts to stop functioning, even when your system administrator has checked those scripts and knows that they are safe. The example below explains how to configure the Application Firewall to allow cross-site scripting in Web pages from trusted sources without disabling this important filter for the rest of your Web sites.

To protect Web pages with cross-site scripting by using the NetScaler command line

1. At the NetScaler command line, to create an advanced profile, type:

   ```
   add appfw profile pr_xssokay -defaults advanced
   ```

2. To configure the profile, type:

   ```
   set appfw profile pr_xssokay
        -startURLAction NONE
        -startURLClosure OFF
        -cookieConsistencyAction LEARN LOG STATS
        -fieldConsistencyAction LEARN LOG STATS
        -crossSiteScriptingAction LEARN LOG STATS$"
   ```

3. Create a policy that detects connections to your scripted Web pages and applies the **`pr_xssokay`** profile, type:

   ```
   add appfw policy pol_xssokay "REQ.HTTP.HEADER URL CONTAINS
   ^\.pl\?$ || REQ.HTTP.HEADER URL CONTAINS ^\.js$" pr_xssokay
   ```

4. Globally bind the policy.

To protect Web pages with cross-site scripting by using the configuration utility

1. In the navigation pane, expand **Application Firewall**, and then click **Profiles**.
2. In the details view, click Add.
3. In the **Create Application Firewall Profile** dialog box, create a Web Application profile with advanced defaults and name it **`pr_xssokay`**. Click **Create** and then click **Close**.
4. In the details view, click the profile, click **Open**, and in the **Configure Web Application Profile** dialog box, configure the **`pr_xssokay`** profile as shown below.
   - Start URL Check: Clear all actions.
   - Cookie Consistency Check: Disable blocking.
   - Form Field Consistency Check: Disable blocking.
   - Cross-Site Scripting Check: Disable blocking.

   This should prevent blocking of legitimate requests involving Web pages with cross-site scripting that you know are nonetheless safe.
5. Click **Policies**, and then click **Add**.
6. In the **Create Application Firewall Policy** dialog box, create a policy that detects connections to your scripted Web pages and applies the **`pr_xssokay`** profile:
   - Policy name: **`pol_xssokay`**
   - Associated profile: **`pr_xssokay`**
   - Policy expression: **`"REQ.HTTP.HEADER URL CONTAINS ^\.pl\?$ || REQ.HTTP.HEADER URL CONTAINS ^\.js$"`**
7. Globally bind your new policy to put it into effect.

DNS Policy to Drop Packets from Specific IPs

The following example describes how to create a DNS action and DNS policy that detects connections from unwanted IPs or networks, such as those used in a DDOS attack, and drops all packets from those locations. The example shows networks within the IANA reserved IP block **`192.168.0.0/16`**. A hostile network will normally be on publicly routable IPs.

To drop packets from specific IPs by using the NetScaler command line

1. To create a DNS policy named **`pol_ddos_drop`** that detects connections from hostile networks and drops those packets, type:

   ```
   add dns policy pol_ddos_drop
   'client.ip.src.in_subnet(192.168.253.128/25) ||
   client.ip.src.in_subnet(192.168.254.32/27)' -drop YES'
   ```

   For the example networks in the **`192.168.0.0/16`** range, you substitute the IP and netmask in **`###.###.###.###/##`** format of each network you want to block. You can include as many networks as you want, separating each **`CLIENT.IP.SRC.IN_SUBNET(###.###.###.###./##)`** command with the **`OR`** operator.

2. Globally bind your new policy to put it into effect.

SSL Policy to Require Valid Client Certificates

The following example shows an SSL policy that checks the user's client certificate validity before initiating an SSL connection with a client.

To block connections from users with expired client certificates

1. Log on to the NetScaler command line.

   If you are using the GUI, navigate to the SSL Policies page, then in the Data area, click the Actions tab.

2. Create an SSL action named **`act_current_client_cert`** that requires that users have a current client certificate to establish an SSL connection with the NetScaler.

   ```
   add ssl action act_current_client_cert-clientAuth DOCLIENTAUTH
   -clientCert ENABLED -certHeader "clientCertificateHeader"
   -clientCertNotBefore ENABLED -certNotBeforeHeader "Mon, 01 Jan
   2007 00:00:00 GMT"
   ```

3. Create an SSL policy named **`pol_current_client_cert`** that detects connections to the Web server that contain a query string.

   ```
   add ssl policy pol_current_ client_cert
   'REQ.SSL.CLIENT.CERT.VALIDFROM >= "Mon, 01 Jan 2007 00:00:00
   GMT"' act_block_ssl
   ```

4. Bind your new policy globally.

   Since this SSL policy should apply to any user’s SSL connection unless a more specific SSL policy applies, you may want to assign it a low priority. If you assign it a priority of one thousand (1000), that should ensure that other SSL policies are evaluated first, meaning that this policy will apply only to connections that do not match more specific policy criteria.

Migration of Apache mod_rewrite Rules to Advanced Policies

The Apache HTTP Server provides an engine known as mod_rewrite for rewriting HTTP request URLs. If you migrate the mod_rewrite rules from Apache to the NetScaler, you boost back-end server performance. In addition, because the NetScaler typically load balances multiple (sometimes thousands of) Web servers, after migrating the rules to the NetScaler you will have a single point of control for these rules.

This appendix provides examples of mod_rewrite functions, and translations of these functions into Rewrite and Responder policies on the NetScaler.

In This Appendix

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Converting URL Variations into Canonical URLs

On some Web servers you can have multiple URLs for a resource. Although the canonical URLs should be used and distributed, other URLs can exist as shortcuts or internal URLs. You can make sure that users see the canonical URL regardless of the URL used to make an initial request.

In the following examples, the URL /~user is converted to /u/user.

Apache mod_rewrite solution for converting a URL

```
RewriteRule   ^/~([^/]+)/?(.*)    /u/$1/$2[R]
```

NetScaler solution for converting a URL

```
add responder action act1 redirect '"/u/"+HTTP.REQ.URL.AFTER_STR("/
~")' -bypassSafetyCheck yes

add responder policy pol1 'HTTP.REQ.URL.STARTSWITH("/~") &&
HTTP.REQ.URL.LENGTH.GT(2)' act1

bind responder global pol1 100
```

Converting Host Name Variations to Canonical Host Names

You can enforce the use of a particular host name for reaching a site. For example, you can enforce the use of www.example.com instead of example.com.

Apache mod_rewrite solution for enforcing a particular host name for sites running on a port other than 80

```
RewriteCond %{HTTP_HOST}   !^www.example.com

RewriteCond %{HTTP_HOST}   !^$

RewriteCond %{SERVER_PORT} !^80$

RewriteRule ^/(.*)        http://www.example.com:%{SERVER_PORT}/$1
[L,R]
```

Apache mod_rewrite solution for enforcing a particular host name for sites running on port 80

```
RewriteCond %{HTTP_HOST}   !^www.example.com

RewriteCond %{HTTP_HOST}   !^$

RewriteRule ^/(.*)         http://www.example.com/$1 [L,R]
```

NetScaler solution for enforcing a particular host name for sites running on a port other than 80

```
add responder action act1 redirect '"http://
www.example.com:"+CLIENT.TCP.DSTPORT+HTTP.REQ.URL'
-bypassSafetyCheck yes
```

```
add responder policy pol1
'!HTTP.REQ.HOSTNAME.CONTAINS("www.example.com")&&!HTTP.REQ.HOSTNAME
.EQ("")&&!HTTP.REQ.HOSTNAME.PORT.EQ(80)&&HTTP.REQ.HOSTNAME.CONTAINS
("example.com")' act1
```

```
bind responder global pol1 100 END
```

NetScaler solution for enforcing a particular host name for sites running on port 80

```
add responder action act1 redirect '"http://
www.example.com"+HTTP.REQ.URL' -bypassSafetyCheck yes
```

```
add responder policy pol1
'!HTTP.REQ.HOSTNAME.CONTAINS("www.example.com")&&!HTTP.REQ.HOSTNAME
.EQ("")&&HTTP.REQ.HOSTNAME.PORT.EQ(80)&&HTTP.REQ.HOSTNAME.CONTAINS(
"example.com")' act1
```

```
bind responder global  pol1 100 END
```

Moving a Document Root

Usually the document root of a Web server is based on the URL “/”. However, the document root can be any directory. You can redirect traffic to the document root if it changes from the top-level “/” directory to another directory.

In the following examples, you change the document root from / to /e/www. The first two examples simply replace one string with another. The third example is more universal because, along with replacing the root directory, it preserves the rest of the URL (the path and query string), for example, redirecting /example/file.html to /e/www/example/file.html.

Apache mod_rewrite solution for moving the document root

```
RewriteEngine on
```

```
RewriteRule   ^/$  /e/www/  [R]
```

NetScaler solution for moving the document root

```
add responder action act1 redirect '"/e/www/"' -bypassSafetyCheck
yes
```

```
add responder policy pol1 'HTTP.REQ.URL.EQ("/")' act1
```

```
bind responder global pol1 100
```

NetScaler solution for moving the document root and appending path information to the request

```
add responder action act1 redirect '"/e/www"+HTTP.REQ.URL'
-bypassSafetyCheck yes
```

```
add responder policy pol1 '!HTTP.REQ.URL.STARTSWITH("/e/www/")'
act1
```

```
bind responder global pol1 100 END
```

Moving Home Directories to a New Web Server

You may want to redirect requests that are sent to home directories on a Web server to a different Web server. For example, if a new Web server is replacing an old one over time, as you migrate home directories to the new location you need to redirect requests for the migrated home directories to the new Web server.

In the following examples, the host name for the new Web server is newserver.

Apache mod_rewrite solution for redirecting to another Web server

```
RewriteRule   ^/(.+)  http://newserver/$1     [R,L]
```

NetScaler solution for redirecting to another Web server (method 1)

```
add responder  action act1 redirect '"http://
newserver"+HTTP.REQ.URL' -bypassSafetyCheck yes
```

```
add responder policy pol1 'HTTP.REQ.URL.REGEX_MATCH(re#^/(.+)#)'
act1
```

```
bind responder global pol1 100 END
```

NetScaler solution for redirecting to another Web server (method 2)

```
add responder  action act1 redirect '"http://
newserver"+HTTP.REQ.URL' -bypassSafetyCheck yes
```

```
add responder policy pol1 'HTTP.REQ.URL.LENGTH.GT(1)' act1
```

```
bind responder global pol1 100 END
```

Working with Structured Home Directories

Typically, a site with thousands of users has a structured home directory layout. For example, each home directory may reside under a subdirectory that is named using the first character of the user name. For example, the home directory for jsmith (/~jsmith/anypath) might be /home/j/smith/.www/anypath, and the home directory for rvalveti (/~rvalveti/anypath) might be /home/r/rvalveti/.www/ anypath.

The following examples redirect requests to the home directory.

Apache mod_rewrite solution for structured home directories

```
RewriteRule   ^/~(([a-z])[a-z0-9]+)(.*)  /home/$2/$1/.www$3
```

NetScaler solution for structured home directories

```
add rewrite action act1 replace 'HTTP.REQ.URL'  '"/home/"+
HTTP.REQ.URL.AFTER_STR("~").PREFIX(1)+"/"+
HTTP.REQ.URL.AFTER_STR("~").BEFORE_STR("/")+"/
.www"+HTTP.REQ.URL.SKIP(\'/\',1)'  -bypassSafetyCheck yes

add rewrite policy pol1  'HTTP.REQ.URL.PATH.STARTSWITH("/~")' act1

bind rewrite global pol1 100
```

Redirecting Invalid URLs to Other Web Servers

If a URL is not valid, it should be redirected to another Web server. For example, you should redirect to another Web server if a file that is named in a URL does not exist on the server that is named in the URL.

On Apache, you can perform this check using mod_rewrite. On the NetScaler, an HTTP callout can check for a file on a server by running a script on the server. In the following NetScaler examples, a script named file_check.cgi processes the URL and uses this information to check for the presence of the target file on the server. The script returns TRUE or FALSE, and the NetScaler uses the value that the script returns to validate the policy.

In addition to performing the redirection, the NetScaler can add custom headers or, as in the second NetScaler example, it can add text in the response body.

Apache mod_rewrite solution for redirection if a URL is wrong

```
RewriteCond   /your/docroot/%{REQUEST_FILENAME} !-f

RewriteRule   ^(.+)      http://webserverB.com/$1 [R]
```

NetScaler solution for redirection if a URL is wrong (method 1)

```
add HTTPCallout Call

set policy httpCallout Call -IPAddress 10.102.59.101 -port 80
-hostExpr '"10.102.59.101"' -returnType BOOL -ResultExpr
'HTTP.RES.BODY(100).CONTAINS("True")'  -urlStemExpr '"/cgi-bin/
file_check.cgi"'   -parameters query=http.req.url.path -headers
Name("ddd")

add responder action act1 redirect '"http://
webserverB.com"+HTTP.REQ.URL' -bypassSafetyCheck yes
```

```
add responder policy pol1 '!HTTP.REQ.HEADER("Name").EXISTS  &&
!SYS.HTTP_CALLOUT(call)' act1
```

```
bind responder global pol1 100
```

NetScaler solution for redirection if a URL is wrong (method 2)

```
add HTTPCallout Call
```

```
set policy httpCallout Call -IPAddress 10.102.59.101 -port 80
-hostExpr '"10.102.59.101"' -returnType BOOL -ResultExpr
'HTTP.RES.BODY(100).CONTAINS("True")'  -urlStemExpr '"/cgi-bin/
file_check.cgi"'   -parameters query=http.req.url.path -headers
Name("ddd")
```

```
add responder  action act1 respondwith  '"HTTP/1.1 302 Moved
Temporarily\r\nLocation: http://
webserverB.com"+HTTP.REQ.URL+"\r\n\r\nHTTPCallout Used"'
-bypassSafetyCheck yes
```

```
add responder policy pol1 '!HTTP.REQ.HEADER("Name").EXISTS  &&
!SYS.HTTP_CALLOUT(call)' act1
```

```
bind responder global pol1 100
```

Rewriting a URL Based on Time

You can rewrite a URL based on the time. The following examples change a request for example.html to example.day.html or example.night.html, depending on the time of day.

Apache mod_rewrite solution for rewriting a URL based on the time

```
RewriteCond   %{TIME_HOUR}%{TIME_MIN} >0700

RewriteCond   %{TIME_HOUR}%{TIME_MIN} <1900

RewriteRule   ^example\.html$ example.day.html [L]

RewriteRule   ^example\.html$ example.night.html
```

NetScaler solution for rewriting a URL based on the time

```
add rewrite action act1 insert_before
'HTTP.REQ.URL.PATH.SUFFIX(\'.\',0)' '"day."'
```

```
add rewrite action act2  insert_before
'HTTP.REQ.URL.PATH.SUFFIX(\'.\',0)' '"night."'
```

```
add rewrite  policy pol1 'SYS.TIME.WITHIN(LOCAL 07h 00m,LOCAL 18h
59m)' act1
```

```
add rewrite policy pol2 'true'  act2
```

```
bind rewrite global pol1 101
```

```
bind rewrite global pol2 102
```

Redirecting to a New File Name (Invisible to the User)

If you rename a Web page, you can continue to support the old URL for backward compatibility while preventing users from recognizing that the page was renamed.

In the first two of the following examples, the base directory is /~quux/. The third example accommodates any base directory and the presence of query strings in the URL.

Apache mod_rewrite solution for managing a file name change in a fixed location

```
RewriteEngine  on

RewriteBase    /~quux/

RewriteRule    ^foo\.html$  bar.html
```

NetScaler solution for managing a file name change in a fixed location

```
add rewrite action act1 replace 'HTTP.REQ.URL.AFTER_STR("/
~quux").SUBSTR("foo.html")' '"bar.html"'

add rewrite policy pol1 'HTTP.REQ.URL.ENDSWITH("/~quux/foo.html")'
act1

bind rewrite global pol1 100
```

NetScaler solution for managing a file name change regardless of the base directory or query strings in the URL

```
add rewrite action act1 replace 'HTTP.REQ.URL.PATH.SUFFIX(\'/\',0)'
'"bar.html"'

Add rewrite policy pol1 'HTTP.REQ.URL.PATH.CONTAINS("foo.html")'
act1

Bind rewrite global pol1 100
```

Redirecting to New File Name (User-Visible URL)

If you rename a Web page, you may want to continue to support the old URL for backward compatibility and allow users to see that the page was renamed by changing the URL that is displayed in the browser.

In the first two of the following examples, redirection occurs when the base directory is /~quux/. The third example accommodates any base directory and the presence of query strings in the URL.

Apache mod_rewrite solution for changing the file name and the URL displayed in the browser

```
RewriteEngine on

RewriteBase    /~quux/

RewriteRule    ^old\.html$ new.html  [R]
```

NetScaler solution for changing the file name and the URL displayed in the browser

```
add responder action act1 redirect
'HTTP.REQ.URL.BEFORE_STR("foo.html")+"new.html"' -bypassSafetyCheck
yes

add responder policy pol1 'HTTP.REQ.URL.ENDSWITH("/~quux/
old.html")' act1

bind responder global pol1 100
```

NetScaler solution for changing the file name and the URL displayed in the browser regardless of the base directory or query strings in the URL

```
add responder action act1 redirect
'HTTP.REQ.URL.PATH.BEFORE_STR("old.html")+"new.html"+HTTP.REQ.URL.A
FTER_STR("old.html")' -bypassSafetyCheck yes

add responder policy pol1 'HTTP.REQ.URL.PATH.CONTAINS("old.html")'
act1

bind responder global pol1 100
```

Accommodating Browser Dependent Content

To accommodate browser-specific limitations—at least for important top-level pages—it is sometimes necessary to set restrictions on the browser type and version. For example, you might want to set a maximum version for the latest Netscape variants, a minimum version for Lynx browsers, and an average feature version for all others.

The following examples act on the HTTP header "User-Agent", such that if this header begins with "Mozilla/3", the page MyPage.html is rewritten to MyPage.NS.html. If the browser is "Lynx" or "Mozilla" version 1 or 2, the URL becomes MyPage.20.html. All other browsers receive page MyPage.32.html.

Apache mod_rewrite solution for browser-specific settings

```
RewriteCond %{HTTP_USER_AGENT}  ^Mozilla/3.*

RewriteRule ^MyPage\.html$ MyPage.NS.html [L]

RewriteCond %{HTTP_USER_AGENT}  ^Lynx/.* [OR]

RewriteCond %{HTTP_USER_AGENT}  ^Mozilla/[12].*
```

```
RewriteRule ^MyPage\.html$ MyPage.20.html [L]

RewriteRule ^fMyPage\.html$ MyPage.32.html [L]
```

NetScaler solution for browser-specific settings

```
add patset pat1

bind patset pat1 Mozilla/1

bind Patset pat1 Mozilla/2

bind patset pat1 Lynx

bind Patset pat1 Mozilla/3

add rewrite action act1 insert_before 'HTTP.REQ.URL.SUFFIX' '"NS."'

add rewrite action act2 insert_before 'HTTP.REQ.URL.SUFFIX' '"20."'

add rewrite action act3 insert_before 'HTTP.REQ.URL.SUFFIX' '"32."'

add rewrite policy pol1
'HTTP.REQ.HEADER("User-Agent").STARTSWITH_INDEX("pat1").EQ(4)' act1

add rewrite policy pol2
'HTTP.REQ.HEADER("User-Agent").STARTSWITH_INDEX("pat1").BETWEEN(1,3
)' act2

add rewrite policy pol3
'!HTTP.REQ.HEADER("User-Agent").STARTSWITH_ANY("pat1")' act3

bind rewrite global pol1 101 END

bind rewrite global pol2 102 END

bind rewrite global pol3 103 END
```

Blocking Access by Robots

You can block a robot from retrieving pages from a specific directory or a set of directories to ease up the traffic to and from these directories. You can restrict access based on the specific location or you can block requests based on information in User-Agent HTTP headers.

In the following examples, the Web location to be blocked is /~quux/foo/arc/, the IP addresses to be blocked are 123.45.67.8 and 123.45.67.9, and the robot's name is NameOfBadRobot.

Apache mod_rewrite solution for blocking a path and a User-Agent header

```
RewriteCond %{HTTP_USER_AGENT}   ^NameOfBadRobot.*

RewriteCond %{REMOTE_ADDR}       ^123\.45\.67\.[8-9]$

RewriteRule ^/~quux/foo/arc/.+   -   [F]
```

NetScaler solution for blocking a path and a User-Agent header

```
add responder action act1 respondwith '"HTTP/1.1 403
Forbidden\r\n\r\n"'
```

```
add responder policy pol1
'HTTP.REQ.HEADER("User_Agent").STARTSWITH("NameOfBadRobot")&&CLIENT
.IP.SRC.EQ(123.45.67.8)&&CLIENT.IP.SRC.EQ(123.45.67.9) &&
HTTP.REQ.URL.STARTSWITH("/~quux/foo/arc")' act1
```

```
bind responder global pol1 100
```

Blocking Access to Inline Images

If you find people frequently going to your server to copy inline graphics for their own use (and generating unnecessary traffic), you may want to restrict the browser's ability to send an HTTP Referer header.

In the following example, the graphics are located in http://www.quux-corp.de/~quux/.

Apache mod_rewrite solution for blocking access to an inline image

```
RewriteCond %{HTTP_REFERER} !^$

RewriteCond %{HTTP_REFERER} !^http://www.quux-corp.de/~quux/.*$

RewriteRule .*\.gif$ - [F]
```

NetScaler solution for blocking access to an inline image

```
add patset pat1

bind patset pat1 .gif

bind patset pat1 .jpeg

add responder action act1 respondwith '"HTTP/1.1 403
Forbidden\r\n\r\n"'

add responder policy pol1 '!HTTP.REQ.HEADER("Referer").EQ("") &&
!HTTP.REQ.HEADER("Referer").STARTSWITH("http://www.quux-corp.de/
~quux/")&&HTTP.REQ.URL.ENDSWITH_ANY("pat1")' act1

bind responder global pol1 100
```

Creating Extensionless Links

To prevent users from knowing application or script details on the server side, you can hide file extensions from users. To do this, you may want to support extensionless links. You can achieve this behavior by using rewrite rules to add an extension to all requests, or to selectively add extensions to requests.

The first two of the following examples show adding an extension to all request URLs. In the last example, one of two file extensions is added. Note that in the last example, the mod_rewrite module can easily find the file extension because this module resides on the Web server. In contrast, the NetScaler must invoke an HTTP callout to check the extension of the requested file on the Web server. Based on the callout response, the NetScaler adds the .html or .php extension to the request URL.

Note: In the second NetScaler example, an HTTP callout is used to query a script named file_check.cgi hosted on the server. This script checks whether the argument that is provided in the callout is a valid file name.

Apache mod_rewrite solution for adding a .php extension to all requests

```
RewriteRule ^/?([a-z]+)$ $1.php [L]
```

NetScaler policy for adding a .php extension to all requests

```
add rewrite action act1 insert_after 'HTTP.REQ.URL' '".php"'

add rewrite policy pol1 'HTTP.REQ.URL.PATH.REGEX_MATCH(re#^/
([a-z]+)$#)' act1

bind rewrite global pol1 100
```

Apache mod_rewrite solution for adding either .html or .php extensions to requests

```
RewriteCond %{REQUEST_FILENAME}.php -f

RewriteRule ^/?([a-zA-Z0-9]+)$ $1.php [L]

RewriteCond %{REQUEST_FILENAME}.html –f

RewriteRule ^/?([a-zA-Z0-9]+)$ $1.html [L]
```

NetScaler policy for adding either .html or .php extensions to requests

```
add HTTPCallout Call_html

add HTTPCallout Call_php

set policy httpCallout Call_html -IPAddress 10.102.59.101 -port 80
-hostExpr '"10.102.59.101"' -returnType BOOL -ResultExpr
'HTTP.RES.BODY(100).CONTAINS("True")'  -urlStemExpr '"/cgi-bin/
file_check.cgi"'   -parameters query=http.req.url+".html"

set policy httpCallout Call_php -IPAddress 10.102.59.101 -port 80
-hostExpr '"10.102.59.101"' -returnType BOOL -ResultExpr
'HTTP.RES.BODY(100).CONTAINS("True")'  -urlStemExpr '"/cgi-bin/
file_check.cgi"' -parameters query=http.req.url+".php"

add patset pat1
```

```
bind patset pat1 .html

bind patset pat1 .php

bind patset pat1 .asp

bind patset pat1 .cgi

add rewrite  action act1 insert_after 'HTTP.REQ.URL.PATH'
'".html"'

add rewrite  action act2 insert_after "HTTP.REQ.URL.PATH"  '".php"'

add rewrite policy pol1 '!HTTP.REQ.URL.CONTAINS_ANY("pat1") &&
SYS.HTTP_CALLOUT(Call_html)' act1

add rewrite policy pol2 '!HTTP.REQ.URL.CONTAINS_ANY("pat1") &&
SYS.HTTP_CALLOUT(Call_php)' act2

bind rewrite global pol1 100 END

bind rewrite global pol2 101 END
```

Redirecting a Working URI to a New Format

Suppose that you have a set of working URLs that resemble the following:

```
/index.php?id=nnnn
```

To change these URLs to `/nnnn` and make sure that search engines update their indexes to the new URI format, you need to do the following:

- Redirect the old URIs to the new ones so that search engines update their indexes.
- Rewrite the new URI back to the old one so that the index.php script runs correctly.

To accomplish this, you can insert marker code into the query string (making sure that the marker code is not seen by visitors), and then removing the marker code for the index.php script.

The following examples redirect from an old link to a new format only if a marker is not present in the query string. The link that uses the new format is re-written back to the old format, and a marker is added to the query string.

Apache mod_rewrite solution

```
RewriteCond %{QUERY_STRING} !marker

RewriteCond %{QUERY_STRING} id=([-a-zA-Z0-9_+]+)

RewriteRule ^/?index\.php$ %1? [R,L]

RewriteRule ^/?([-a-zA-Z0-9_+]+)$  index.php?marker&id=$1 [L]
```

NetScaler solution

```
add responder action act_redirect redirect
'HTTP.REQ.URL.PATH.BEFORE_STR("index.php")+HTTP.REQ.URL.QUERY.VALUE
("id")' -bypassSafetyCheck yes

add responder policy pol_redirect
'!HTTP.REQ.URL.QUERY.CONTAINS("marker")&&
HTTP.REQ.URL.QUERY.VALUE("id").REGEX_MATCH(re/[-a-zA-Z0-9_+]+/) &&
HTTP.REQ.URL.PATH.CONTAINS("index.php")' act_redirect

bind responder global pol_redirect 100 END

add rewrite action act1 replace 'HTTP.REQ.URL.PATH.SUFFIX(\'/\',0)'
'"index.phpmarker&id="+HTTP.REQ.URL.PATH.SUFFIX(\'/\',0)'
-bypassSafetyCheck yes

add rewrite policy pol1 '!HTTP.REQ.URL.QUERY.CONTAINS("marker")'
act1

bind rewrite global pol1 100 END
```

Ensuring That a Secure Server Is Used for Selected Pages

To make sure that only secure servers are used for selected Web pages, you can use the following Apache mod_rewrite code or NetScaler Responder policies.

Apache mod_rewrite solution

```
RewriteCond %{SERVER_PORT} !^443$

RewriteRule ^/?(page1|page2|page3|page4|page5)$  https://
www.example.com/%1 [R,L]
```

NetScaler solution using regular expressions

```
add responder action res_redirect redirect  '"https://
www.example.com"+HTTP.REQ.URL' -bypassSafetyCheck yes

add responder policy pol_redirect
'!CLIENT.TCP.DSTPORT.EQ(443)&&HTTP.REQ.URL.REGEX_MATCH(re/
page[1-5]/)'  res_redirect

bind responder global pol_redirect 100 END
```

NetScaler solution using pattern sets

```
add patset pat1

bind patset pat1 page1

bind patset pat1 page2

bind patset pat1 page3
bind patset pat1 page4

bind patset pat1 page5

add responder action res_redirect redirect  '"https://
www.example.com"+HTTP.REQ.URL' -bypassSafetyCheck yes

add responder policy pol_redirect
'!CLIENT.TCP.DSTPORT.EQ(443)&&HTTP.REQ.URL.CONTAINS_ANY("pat1")'
res_redirect

bind responder global pol_redirect 100 END
```

New Advanced Expression Operators in This Release

NetScaler 9.2 supports new advanced expression operators for extracting and evaluating numeric data, text, HTTP data, XML and JSON data, and user groups. NetScaler 9.2 also supports new operators and methods for the CLIENT and ipv6 expression prefixes.

In This Appendix

Operators for Extracting and Evaluating Numeric Data

Operators for Extracting and Evaluating Text

Operators for Extracting and Evaluating HTTP Data

Operators for the CLIENT and ipv6 Expression Prefixes

XPath and JSON Operators for Evaluating XML and JSON Data

Operators for Evaluating Groups to Which a User Belongs

Operators for Extracting and Evaluating Numeric Data

The following operators have been introduced for extracting and evaluating numeric data.

New Operators for Extracting and Evaluating Numeric Data

Operators	**Operation**
number.NE(i)	Determine whether a given number is equal to the argument.
number.TYPECAST_DOUBLE_AT	Transform an integer to a double-precision floating-point number.
number.TYPECAST_IP_ADDRESS_AT	Transform an integer to the format of an IP address.

New Operators for Extracting and Evaluating Numeric Data

Operators	**Operation**
number.TYPECAST_TIME_AT and operators of the format "*number*.TYPECAST_TIME_AT.<operator>." For example, *number*.TYPECAST_TIME_AT.DAY, *number*.TYPECAST_TIME_AT.BETWEEN(*time1*, *time2*), and *number*.TYPECAST_TIME_AT.EQ(*t*).	Transform, extract, and evaluate time values.
Operators of the format "*double*.<operator>." For example, *double*.ADD (*i*), *double*.BETWEEN(*i*, *j*), and *double*.DIV(*i*).	Extract and evaluate double-precision floating-point numeric data.

Operators for Extracting and Evaluating Text

The following operators have been introduced for extracting and evaluating text.

New Operators for Evaluating Text

Operators	**Operation**
EXTEND(*m*,*n*)	Extend the scope of the search by a specified number of bytes on both sides of a pattern match.
text.GET_SIGNED16(*n*, *endianness*), *text*.GET_SIGNED32(*n*, *endianness*), *text*.GET_SIGNED8(*n*), *text*.GET_UNSIGNED16(*n*, *endianness*), and *text*.GET_UNSIGNED8(*n*)	Extract a series of bytes that represent a sequence of 8, 16, or 32 bit integers (signed or unsigned), and the extract the *n*th integer from the sequence.
text.SUBSTR_ANY(*patset_name*)	Select a sub-string that matches a string in the given pattern set.
text.SET_TEXT_MODE(PLUS_AS_SPACE | NO_PLUS_AS_SPACE), *text*.SET_TEXT_MODE(BACKSLASH_ENCODED | NO_BACKSLASH_ENCODED), and *text*.SET_TEXT_MODE(BAD_ENCODE_RAISE_UNDEF | NO_BAD_ENCODE_RAISE_UNDEF)	Set the mode of a text object.
.B64DECODE and .B64ENCODE	Encode and decode text by using the Base64 encoding algorithm.
.HASH	Convert text to a hash value.

Operators for Extracting and Evaluating HTTP Data

The following operators have been introduced for extracting and evaluating HTTP data.

New Operators for Extracting and Evaluating HTTP data

Operators	**Operation**
HTTP.REQ.IS_NTLM_OR_NEGOTIATE	Determine whether a request is a part of an NTLM or NEGOTIATE connection.
HTTP.REQ.USER	Extract the AAA user associated with the current HTTP transaction.
HTTP.REQ.USER.PASSWD	Returns the password of the user.
HTTP.REQ.USER.NAME	Extract the name of the user.
HTTP.REQ.USER.IS_MEMBER_OF(group_name)	Determine whether the current user is a member of a given group.

Operators for the CLIENT and *ipv6* Expression Prefixes

The following operators and methods have been introduced for the CLIENT and IPv6 expression prefixes.

Operators for CLIENT and ipv6 Expression Prefixes

Operators	**Operation**
CLIENT.SSL.CLIENT_CERT.TO_PEM	Retrieve the SSL certificate in binary format.
CLIENT.SSL.CIPHER_NAME	Extract the SSL cipher name.
CLIENT.UDP.RADIUS, CLIENT.UDP.RADIUS.ATTR_TYPE(i), and CLIENT.UDP.RADIUS.USERNAME	Extract RADIUS data
IPV6 ADDRESS VALUE.SUBNET(n)	Extract the IPV6 address after applying the subnet mask.

XPath and JSON Operators for Evaluating XML and JSON Data

The following operators have been introduced for evaluating XML and JSON text.

XPath and JSON Operators for Evaluating XML and JSON Text

Operators	**Operations**
Operators of the format *text*.XPATH(xpathex)	Evaluate XML text.
Operators of the format *text*.XPATH_JSON(xpathex)	Evaluate JSON text.

Operators for Evaluating Groups to Which a User Belongs

The following operators have been introduced for retrieving the internal and external groups to which a user belongs.

Operators for Evaluating Groups to Which a User Belongs

Operators	**Operations**
HTTP.REQ.USER.EXTERNAL_GROUPS, HTTP.REQ.USER.EXTERNAL_GROUPS.IGNORE_EMPTY_ELEMENTS, HTTP.REQ.USER.EXTERNAL_GROUPS(sep), and HTTP.REQ.USER.EXTERNAL_GROUPS.IGNORE_EMPTY_ELEMENTS	Return a list of the external groups to which a user belongs.
HTTP.REQ.USER.GROUPS, HTTP.REQ.USER.GROUPS.IGNORE_EMPTY_ELEMENTS, HTTP.REQ.USER.GROUPS(sep), and HTTP.REQ.USER.GROUPS.IGNORE_EMPTY_ELEMENTS	Return a list of the internal and external groups to which a user belongs
HTTP.REQ.USER.INTERNAL_GROUPS, HTTP.REQ.USER.INTERNAL_GROUPS.IGNORE_EMPTY_ELEMENTS, HTTP.REQ.USER.INTERNAL_GROUPS(sep), and HTTP.REQ.USER.INTERNAL_GROUPS.IGNORE_EMPTY_ELEMENTS	Return a list of the internal groups to which a user belongs

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