nomad

User Manual

version 2.3

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Introduction

nomad is an agile network intelligence application used to maximize backhaul network utilization, to achieve cost and time savings throughout the network life-cycle. Its layers of complex coding and algorithms collect and analyze network data from multiple technologies/equipment in real-time. **nomad** uses this data to generate easily-digestible, measurable and actionable information and KPIs, to reveal network inefficiencies and allow quick troubleshooting. Its architecture makes it cost-effective, easy to deploy and scalable.

nomad is designed to be intuitive and easy-to-use. This User Manual explains important concepts, menus, dashboards and configuration options to allow you to get maximum use out of the application from the go.

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Preface

This User Manual is intended for network operators, administrators and managers, providing detailed information and graphics, designed to give the user complete knowledge about **nomad's** structure, components and interfaces.

- Network concepts and conventions
- Network equipment types
- Data communication network (DCN)

This User Manual allows users to achieve the following:

- Understand the data structure
- Use administration functions to configure the data collection, configure the network inventory and system management
- Use the **nomad** interface to configure and display various network data and reports for the different modules

This User Manual is laid out sequentially, mirroring the processes a user would usually do with **nomad**, from start to finish. The exception here is the 'modules' chapter, which lists all available **nomad** modules. Not all of these modules may be installed on the user's **nomad** instance.

Chapter 1 lists the recommended hardware configuration, depending on the type of installation and the size of the user network and can be used as a guide for scalability.

Chapter 2 introduces the Data Integration concept, needed to understand the way data is retrieved and displayed within **nomad.**

Chapter 3 shows how to use the **nomad** interface, addressing how to log-in and log-out, the general architecture and components and how to display and handle the number of different reports **nomad** produces.

Chapter 4 addresses the administrative side of **nomad**, giving details on how to collect the network inventory, integrate new data sources, configure the data collection and manage different schedule processes and configure system server settings.

Chapter 5 gives a detailed breakdown of each module available within **nomad**, providing a description, supported equipment list and the various reports specific to each module.

It is recommended to read every chapter of this User Manual before beginning to use **nomad** so that the user has complete control and confidence in what they are doing, to understand the information shown and to reduce the risk of any adverse events. Some data in **nomad**, once changed, cannot be unchanged.

To navigate to specific chapters or sections within this user guide, users can click on the appropriate link within the Contents pages. It is also possible to search within the document to find specific information.

Measurements, Conventions and Abbreviations

A number of conventions are used in **nomad**, these are explained below:

KHz - Gigahertz
Used to measure such parameters as frequency
GHz - Gigahertz
Used to measure such parameters as frequency band
kbps - kilobits per second
Used to measure such parameters as link capacity
dBm- decibel milliwatt
Used to measure such parameters as signal level

Aggregation functions:

- **MIN - Minimum:** corresponds to the lowest value in a dataset
- **MAX - Maximum:** corresponds to the highest value in a dataset
- **AVG - Average:** corresponds to the average value in a dataset
- **SUM - Sum:** corresponds to the sum of all values in a dataset

Coordinates
The longitude and latitude coordinates must be in the format 'EPSG:4326' so the sites can be properly displayed in the map.

Local and Remote Ports
Topological link names are built as a concatenation of each end port's name as follows: *Local-Remote*.

"Local" corresponds to the port on the left-side of the link name, also called near-end. "Local" is sometimes referred to as "A" in grids and charts.

"Remote" corresponds to the port on the right-side of the link name, also called far-end. "Remote" is sometimes referred to as "Z" in grids and charts.

1. Hardware Requirements

Demo Versions & Small Networks

For demo versions, running with less than 250 managed elements, a simple laptop/desktop is enough. The following configuration is recommended:

1 CPUs (x86_64, Quad Core, >= 2,5 GHz)
RAM >= 4 GB
Disks: min. 20GB total usable space
>= 1x Gbit-Ethernet
Operating System: Windows 7 64-bit or Linux

Production Servers

For production, we recommend professional racked hardware.

Network up to 1000 Managed Elements

1 CPUs (x86_64, Quad Core, >= 2,5 GHz)
RAM >= 8 GB
Professional hardware raid controller with RAID5 support and battery backed cache
Disks: min. 200GB total usable space with RAID5, fast access rates
>= 1x Gbit-Ethernet
Operating System: Linux

Network up to 3000 Managed Elements

2 CPUs (x86_64, Quad Core, >= 2,5 GHz)
RAM >= 12 GB
Professional hardware raid controller with RAID5 support and battery backed cache
Disks: min. 500GB total usable space with RAID5, fast access rates
>= 1x Gbit-Ethernet (or more depending on IP configuration)
Operating System: Linux

Network up to 6000 Managed Elements

2 CPUs (x86_64, Quad Core, >= 2,5 GHz)
RAM >= 24 GB
Professional hardware raid controller with RAID5 support and battery backed cache
Disks: min 1TB total usable space with RAID5, fast access rates
>= 2x Gbit-Ethernet (or more depending on IP configuration)
Operating System: Linux

2. nomad Data Integration

Concept

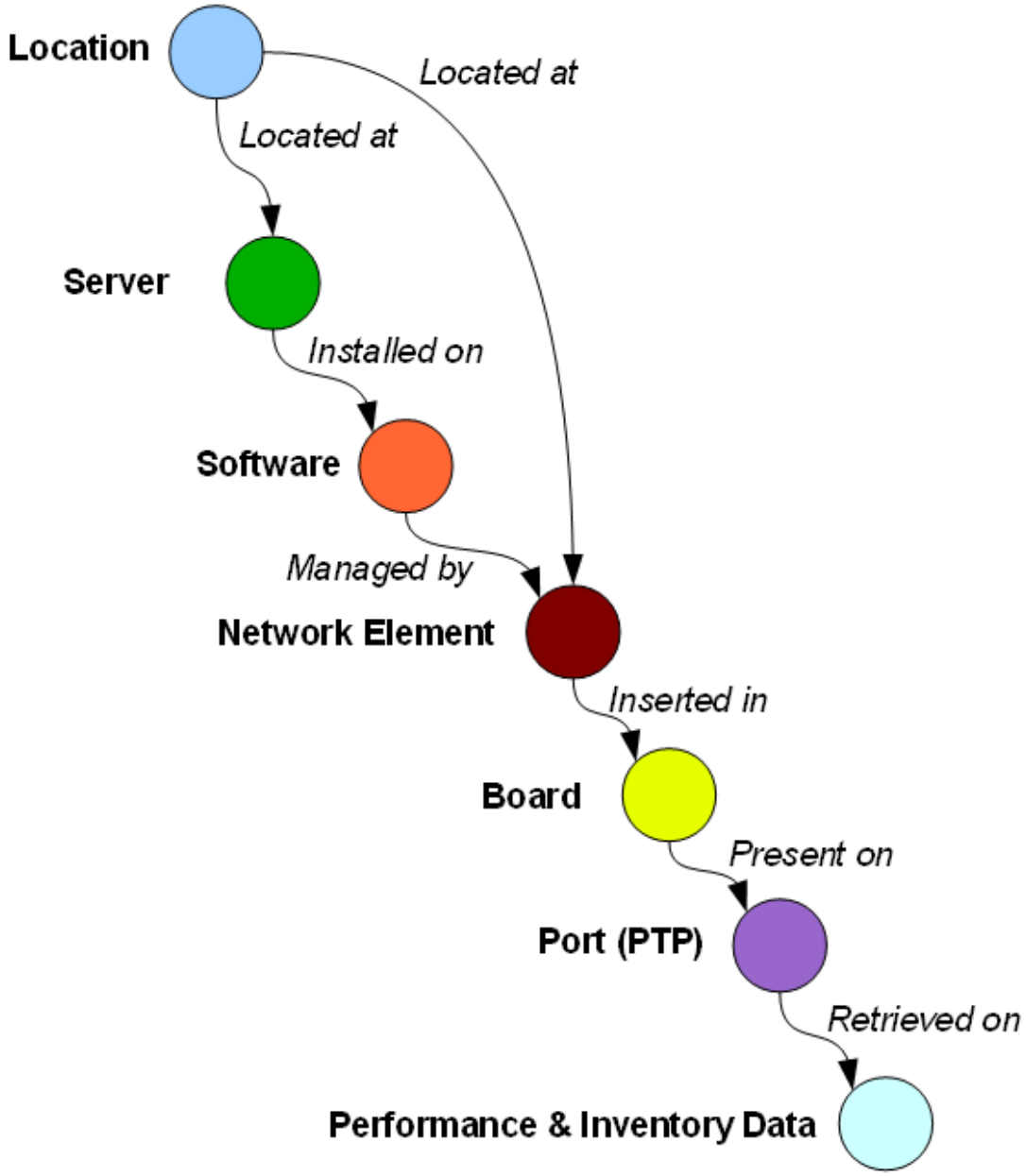
Data Structure

nomad uses a generic data structure in order to store network-related data. This data structure implies that the following information is initially set in **nomad**:

At least one site/location

At least one network manager (i.e. NMS - Software). Even if there is no NMS in the network, one has to be declared in order to match **nomad's** data structure (**nomad** can be declared as NMS).

The following figure represents **nomad's** data structure:



A **Location** represents a Geographical Site.
A **Server** is the physical machine on which the NMS **Software** is installed. It also has an IP Address and is located in a Location.
Software manages **Managed Elements**. It's installed on a **Server**. (i.e. NMS)
A **Managed Element** is managed by a Software and located in a Location.
A **Board** is inserted on a network element and contains **Ports**. Please note that for equipment without boards, "virtual" boards are created automatically in **nomad** .
A **Port** or **PTP** is present on a **board**. This can be an Ethernet port, an E1 port, radio port, etc.
Topological Links (i.e. microwave radio links, SDH physical connections, etc) are linking two ports.
Performance and Inventory Data is retrieved or measured on a port or PTP.

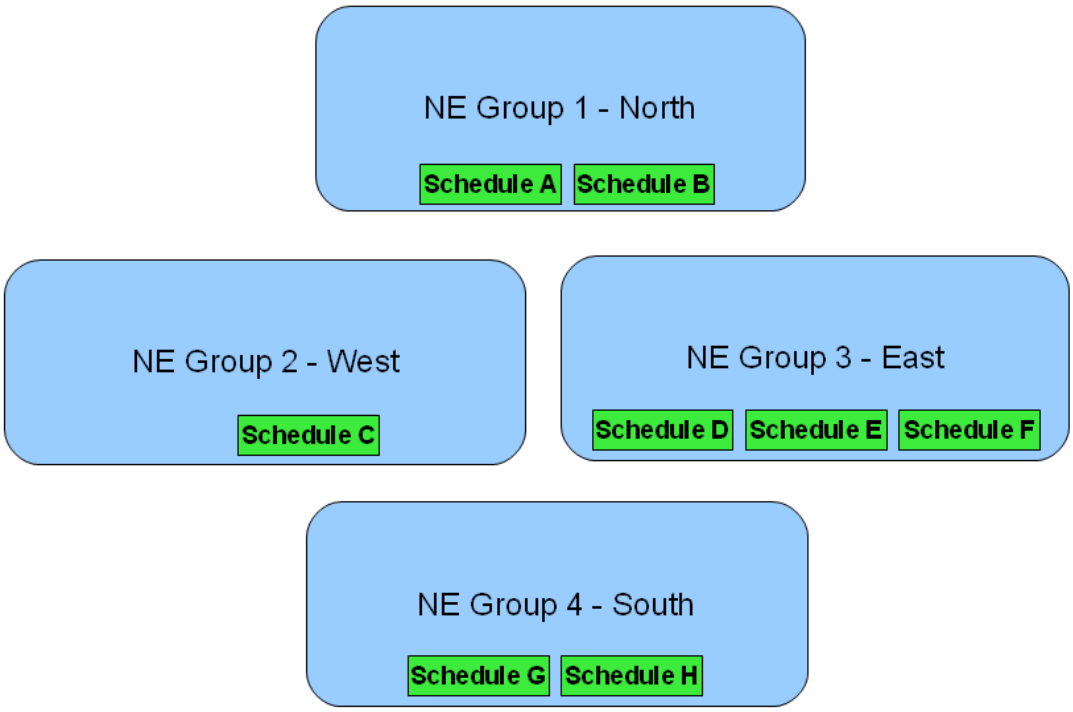
Groups and Schedules

nomad data collection architecture is designed to handle the collection of large amounts of data in large networks. The data is retrieved through the data communication network (DCN) which has a limited and variable bandwidth. In order to keep within the DCN bandwidth constraints **nomad** data collection is sectioned in **schedules**, each collecting a certain type of data (i.e. inventory, performance) for a definite **group** of managed elements.

According to the DCN topology, groups and schedules can be defined to provide the best data collection out of the available DCN bandwidth.

Data collection SCHEDULES are the unique way to collect data from the network and to display the data in nomad reports.

The following picture shows an example of a regional group definition. There are plenty of possibilities for group creation, the most common rules for the group creation include the following: regional based, OSPF area based, equipment type based, etc.



Managed Elements Groups: Existing groups can be displayed from the menu: *Administration -> Data Integration -> Managed Elements Groups.*

Schedules: Existing schedules can be displayed from the menu: *Administration -> Data Integration -> Process Manager*. The process manager also displays currently running schedules.

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3. nomad User Interface

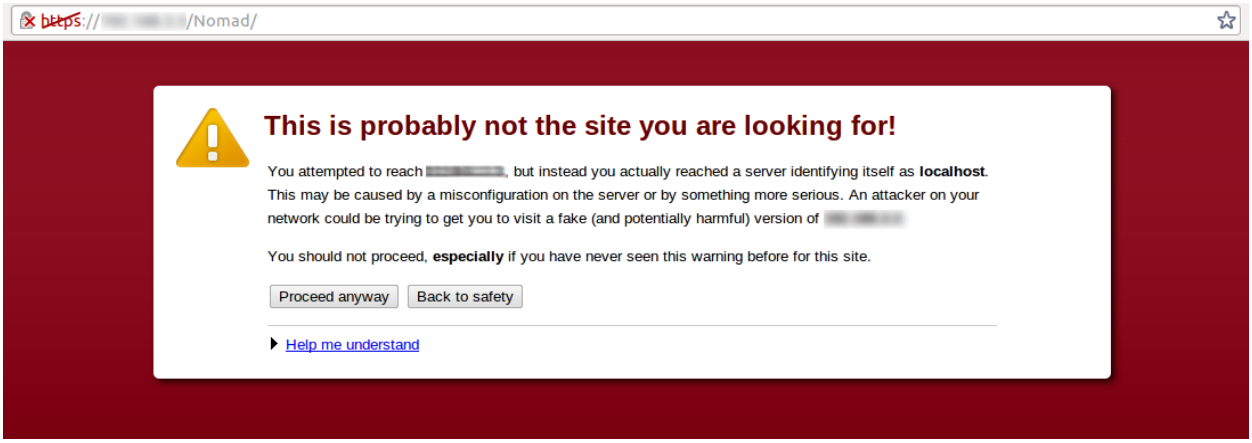
Login to nomad

nomad user-interface is a secure web-interface using HTTPS. You need a modern standard-compliant web-browser to access **nomad** user interface (Chrome is **highly** recommended).

nomad user-interface can be accessed with the following URL:

https://{yourConfiguredIP}/Nomad

HTTPS requires that the certificate is accepted by the browser for **nomad** server. Depending on the browser you use, you may get a warning. Simply ignore the browser warning and accept the certificate to access **nomad** login page.

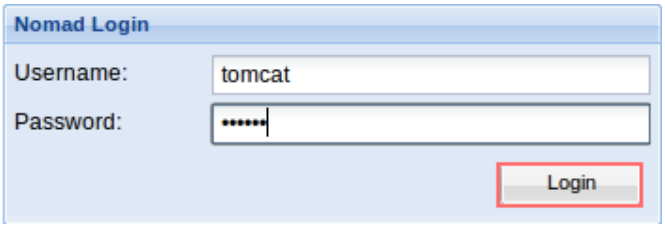


Certificate Warning Chrome

In Google Chrome, simply click on "Proceed Anyway".

In Mozilla Firefox, simply click on "Or you can add an exception" to add and confirm the exception.

After accepting the certificate you will be redirected to the login Page.



Login Screen

Default login credentials are:

Username: tomcat
Password: tomcat

You are now successfully logged in!

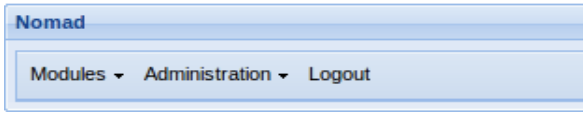
General Architecture

Controls

nomad is controlled purely by the mouse. Left-click performs all of the **nomad** operations, there are no right-click options. Occasionally, for example on the Map, the mouse wheel may be used to zoom in/out.

Main Menu

The main menu is divided into three categories: Modules, Administration and Logout.



nomad main menu

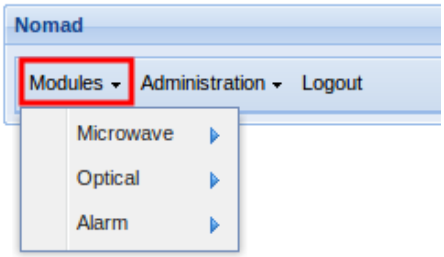
Modules provides the network data visualization and analysis.

Administration is necessary to configure **nomad** (schedules, inventory, networking).

The **Logout** button performs a straightforward logout function: when clicked, the user will exit **nomad**. To start **nomad** again, the user must login again.

Modules

This menu provides the data visualization and analysis for the different modules that the user has purchased. Currently there are three different modules: Microwave, Optical and Alarm.



nomad Modules menu

Administration

This menu provides **nomad** configuration of the network inventory, the data retrieval schedules and the **nomad** server configuration.

Reports

The reports are graphical components that display the data requested by the user and, in a few cases, also allow the user to edit data. These reports are displayed once the user clicks on an option in the menu. The

displayed reports are a list of graphical widgets such as grids, charts, a map, a tab panel or a time series chart.

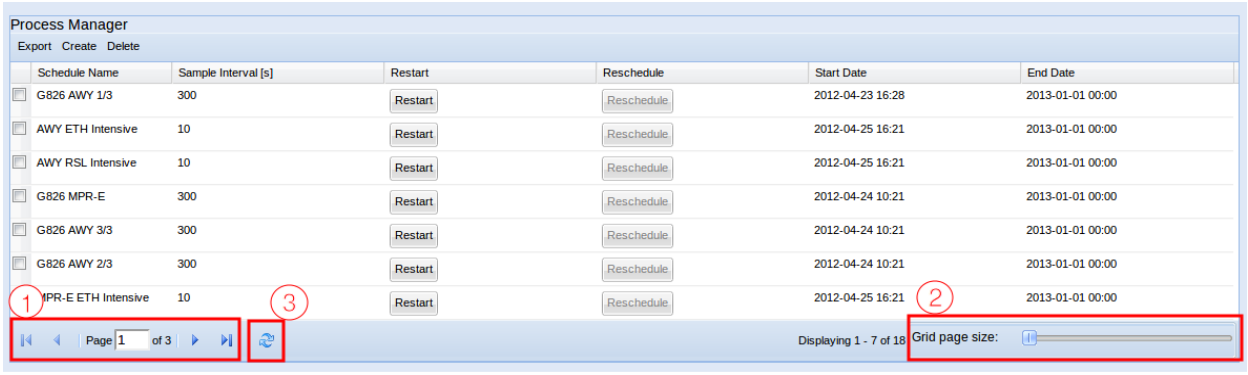
Grids

Grids are the main component to display data to the user. All the grids in **nomad** have common behavior and actions.

Pagination

The grids show a fixed amount of data rows and the user should move through pages to visualize all the contents. To do that the user has to click on the page arrows to switch the page.

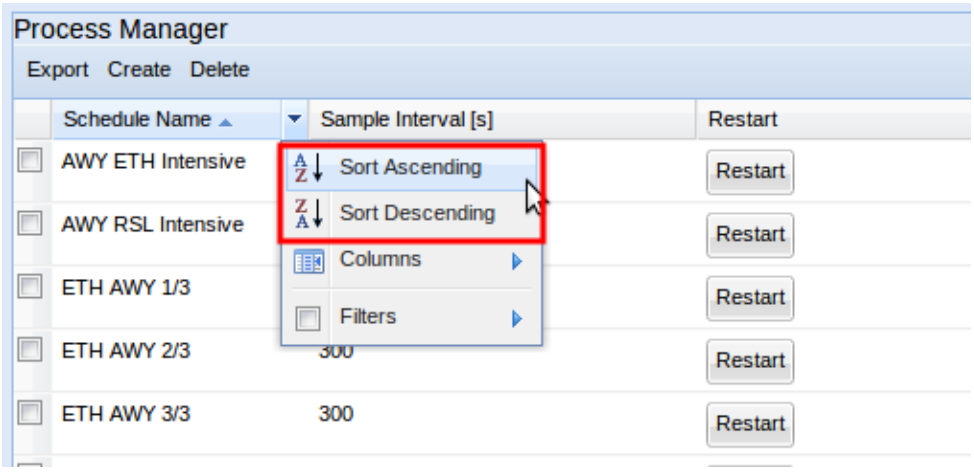
In the image below there are three grid components. In red: the component (1) allows the user to navigate through the pages of the grid; the component (2) allows the user to change the size of the page. To see an effective change of the page size it is also necessary to refresh the page clicking on the refresh button, component (3).



nomad Grid example

Sorting

The user can also sort the grid according to one of its columns by clicking on the header of that column. It is also possible to sort the grid by clicking on the right end of the column header and selecting 'Sort Ascending' or 'Sort Descending'.

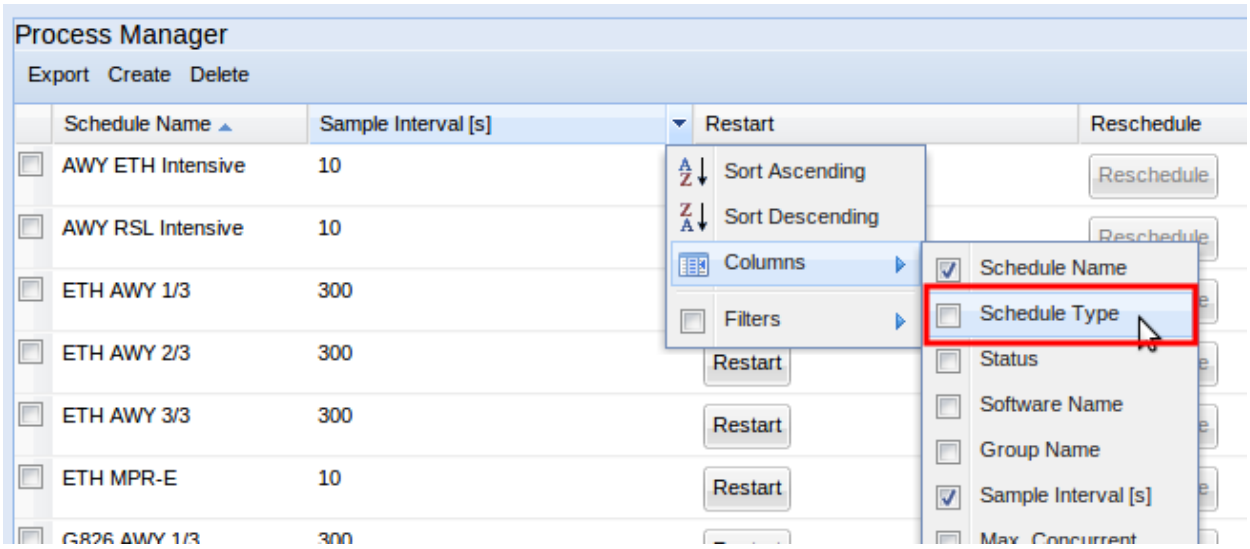


nomad Grid column sorting

Column Hiding

Some grids may have a large number of columns. Depending on the user's screen and resolution, the grid may be difficult to work with due to the amount of information shown. Hiding columns will improve the readability of the grid.

To hide a column in the grid the user must click on the right side of one of the headers of the grid and then deselect the column the user wants to hide.

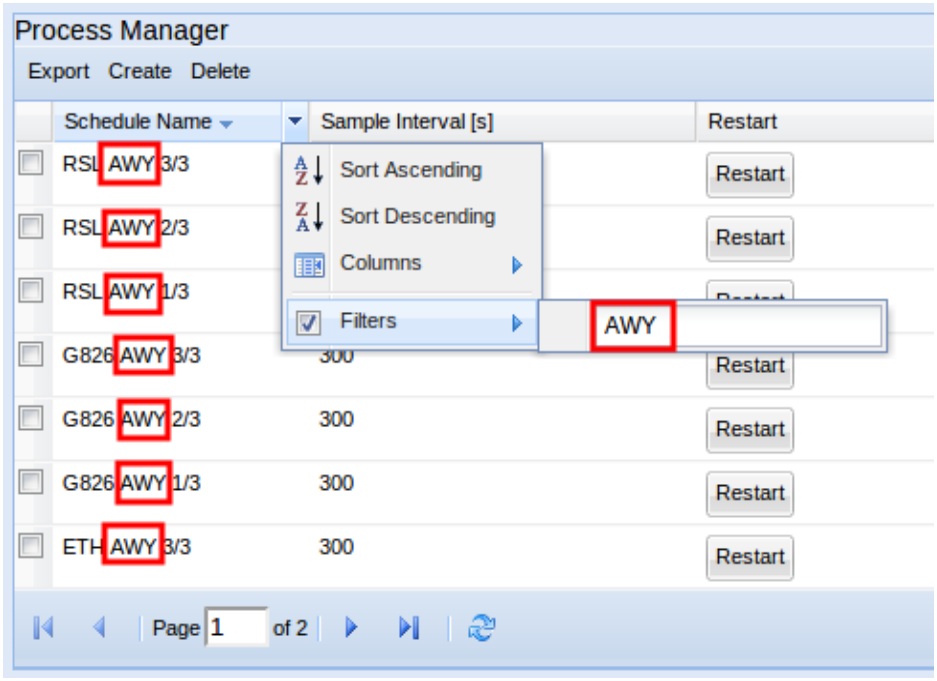


nomad Grid column hiding

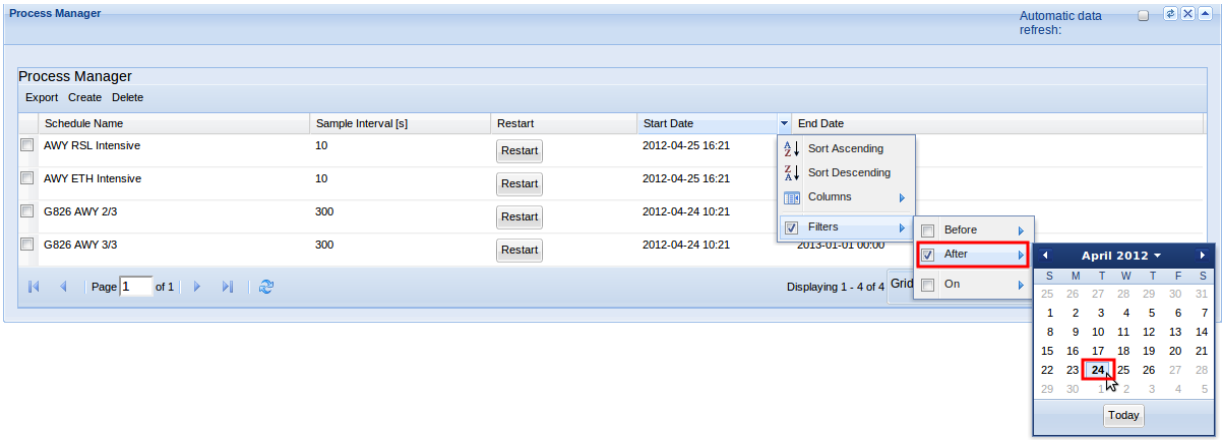
Filtering

To filter the grid according to the value of a column it is necessary to click on the right side of the column the user wants to filter. Then the user can select the 'Filters' option and then insert the values for the selection. There are three kinds of filters according to the column type: text, date and number.

Text filtering: for this kind of filtering the user can insert in the filtering field the text that is searched for in the column.



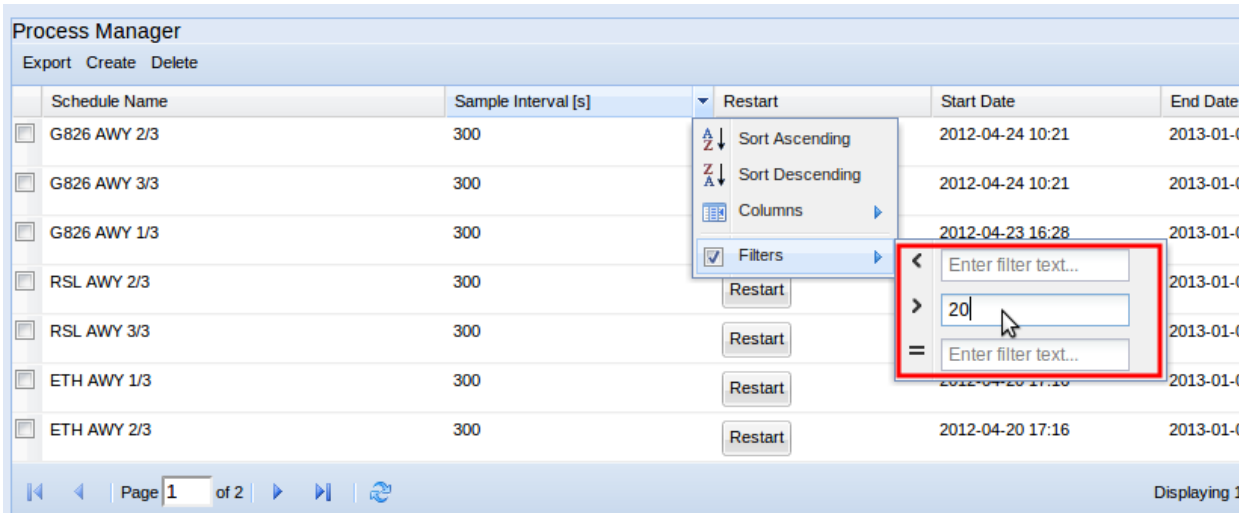
Date filtering: there are three kinds of date filters ('before', 'after' and 'on') that can be applied to dates. It is important to know that the date filters have a precision of days.



nomad Grid date column filtering

Note: In the image above it can be seen that the selected dates are those after 24-4-2012 00:00 A.M.

Number filtering: there are three kinds of numerical filters (less than, greater than and equal to).



nomad Grid numerical column filtering

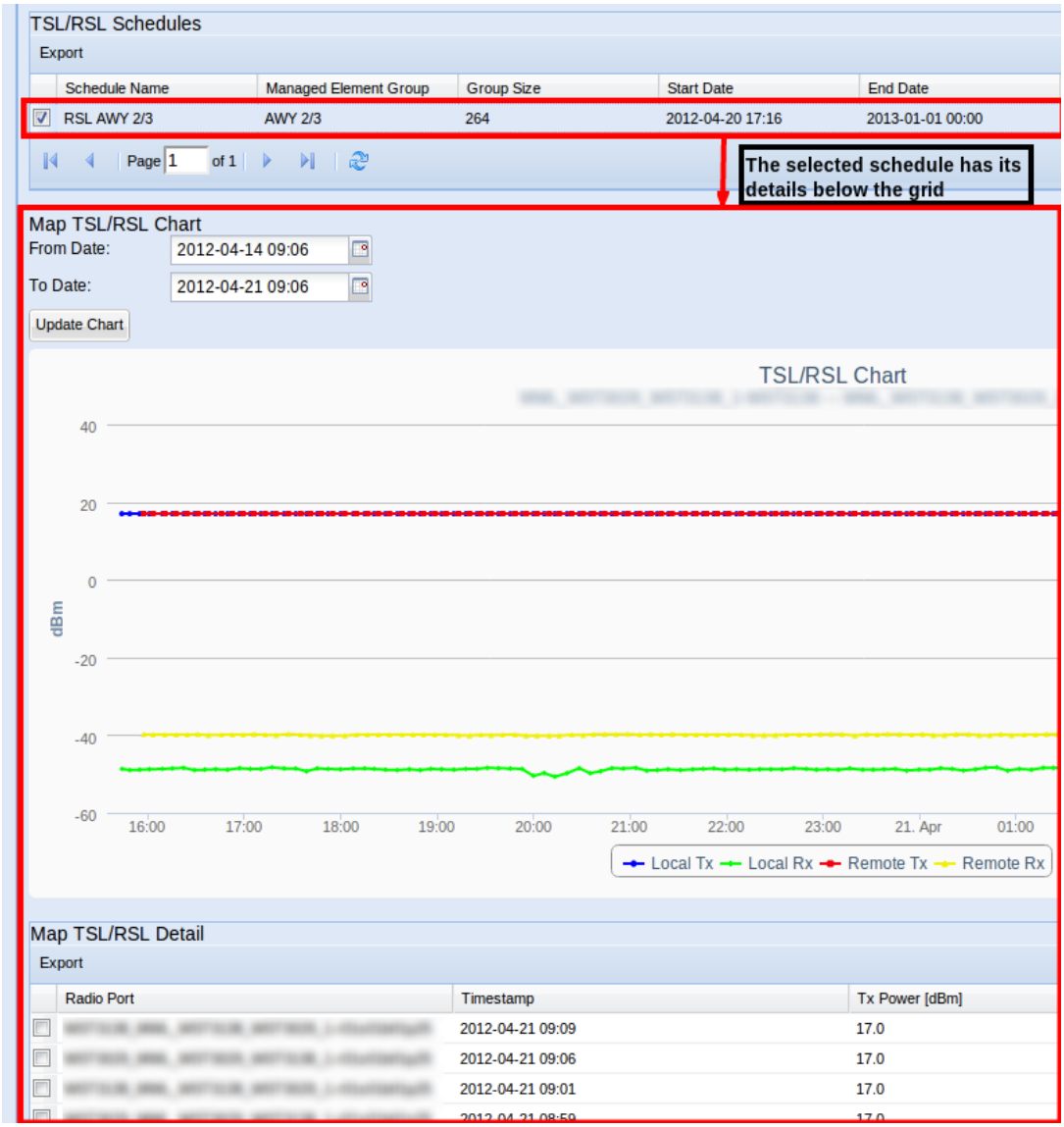
Selection

There are three kinds of row selection in grids: no selection, single selection and multiple selection. When a row is selected the user can perform the following actions:

Show new graphical components displaying the detail of that row. For most grids, when one or several rows are selected, **nomad** will show new components (charts, grids, maps...) with the detail of that row.

If the grid is editable, the user can delete it by clicking on the 'Delete' button.

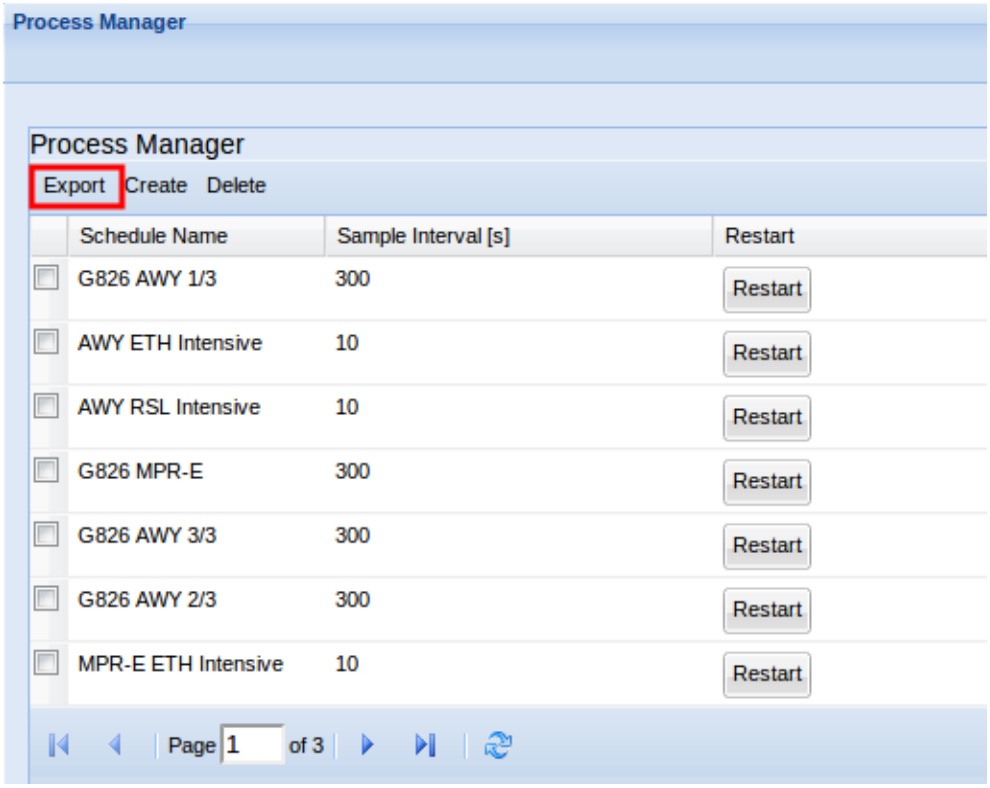
If the grid is editable, selected rows may be inserted in relation with other elements. For example, a grid of Managed Elements can be selected to be added to Managed Elements Groups.



The time series graph below the grid is the detail of the selected schedule of that grid.

Export

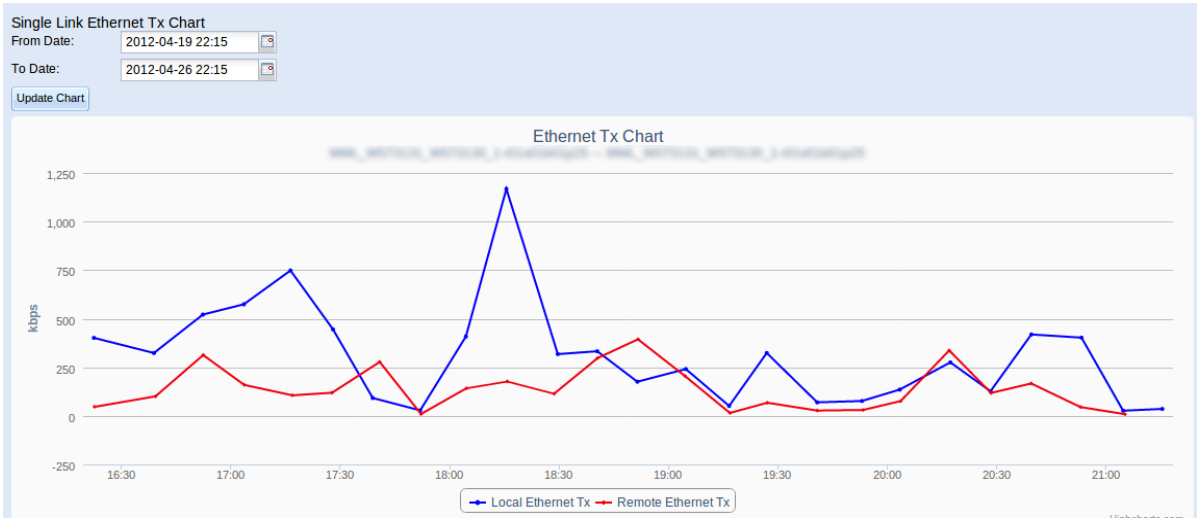
Every grid can be exported as a spreadsheet (Microsoft Excel format). This export will include the information of all the pages inside the grid. To request the export the user must click on the 'Export' button located at the top left of the grid.



nomad grids - Export button

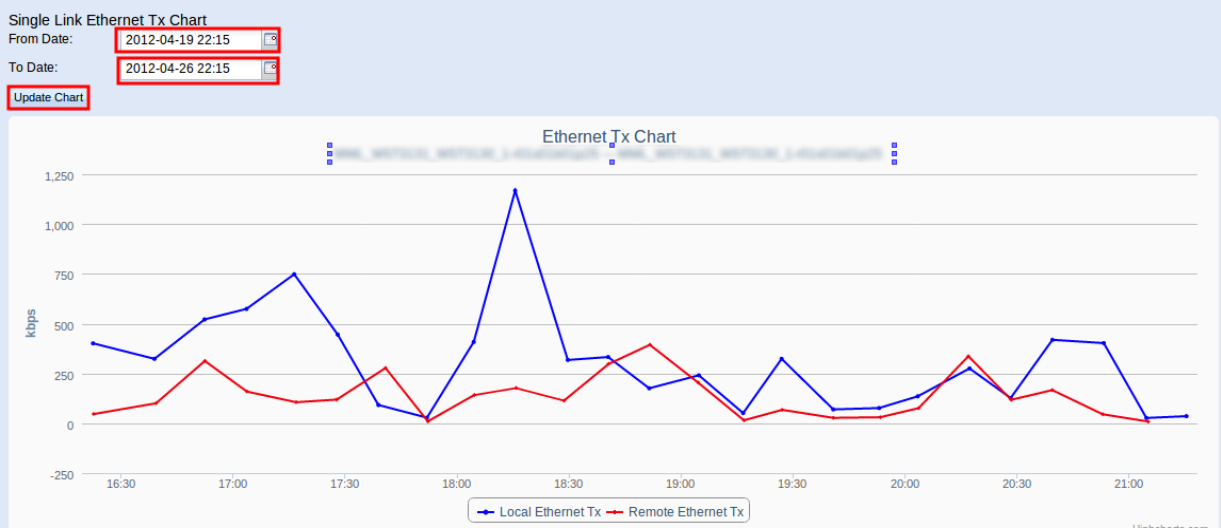
Time Series Charts

Time Series Charts are graphical components that show a set of time series for a certain time range. Usually, these time series are performance data from a previously selected link (a link from a row in a grid or a link from a map).



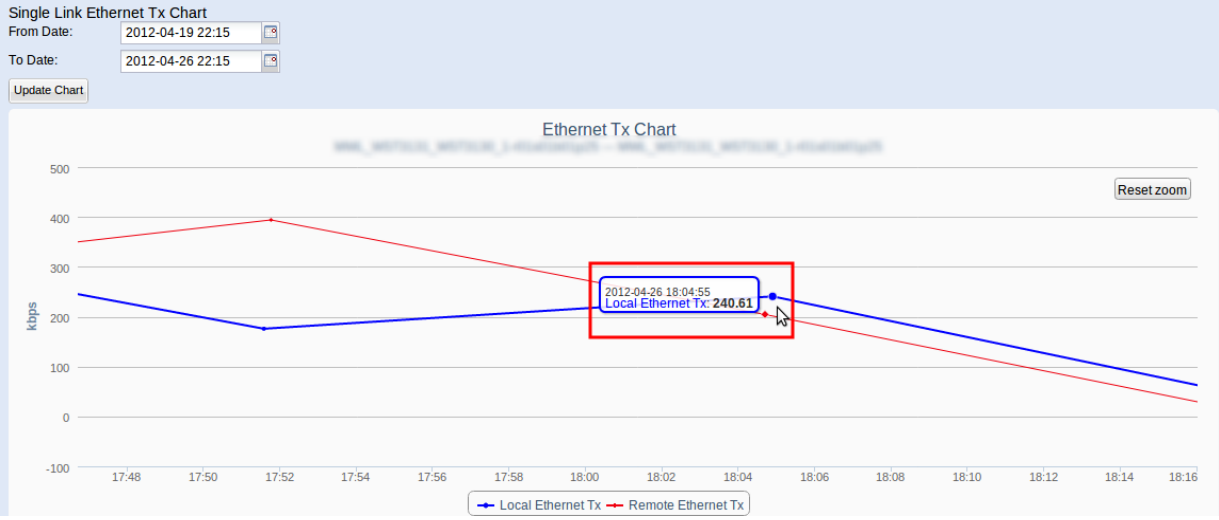
nomad Time series chart example

When a link or any other element is selected and generates a Time Series Chart, this chart has a predefined time range. The user can change this time range by modifying the '*From Date*' and '*To Date*' and then clicking the '*Update Chart*' button.



nomad Date selection for Time series chart example

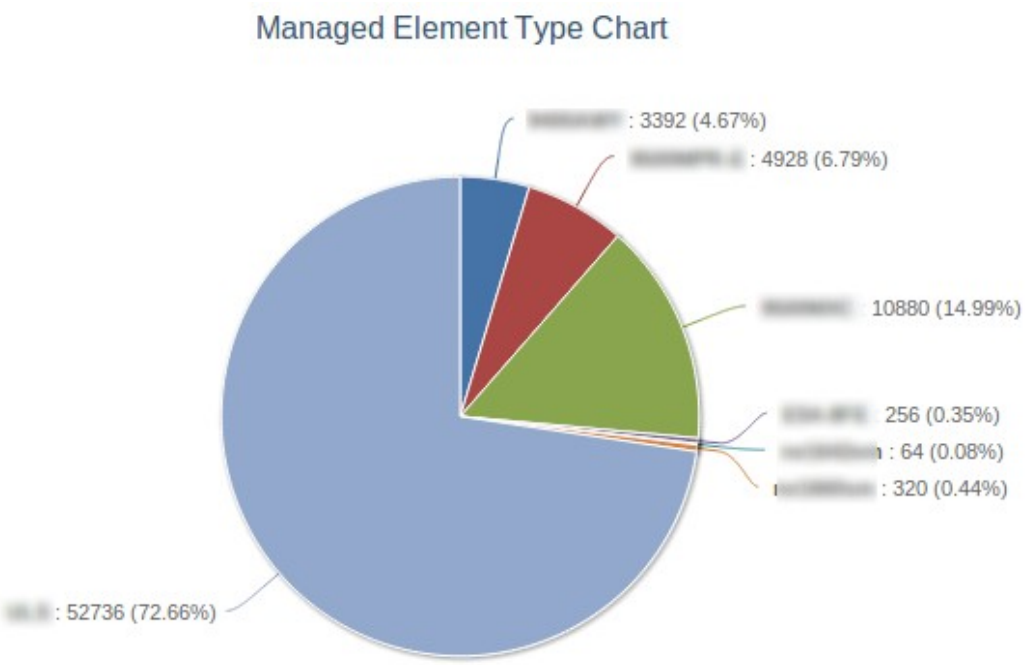
The user can also zoom-in on the Time Series Chart by selecting a time range in the chart using the mouse (drag-and-drop). Furthermore, if the user wants to see the detail of a data point (the date it was collected and the result) the user should move the mouse pointer to that chart point. Then **nomad** will automatically show a dialog with the detail of that point.



nomad Sample selection for Time series chart example

Pie Charts

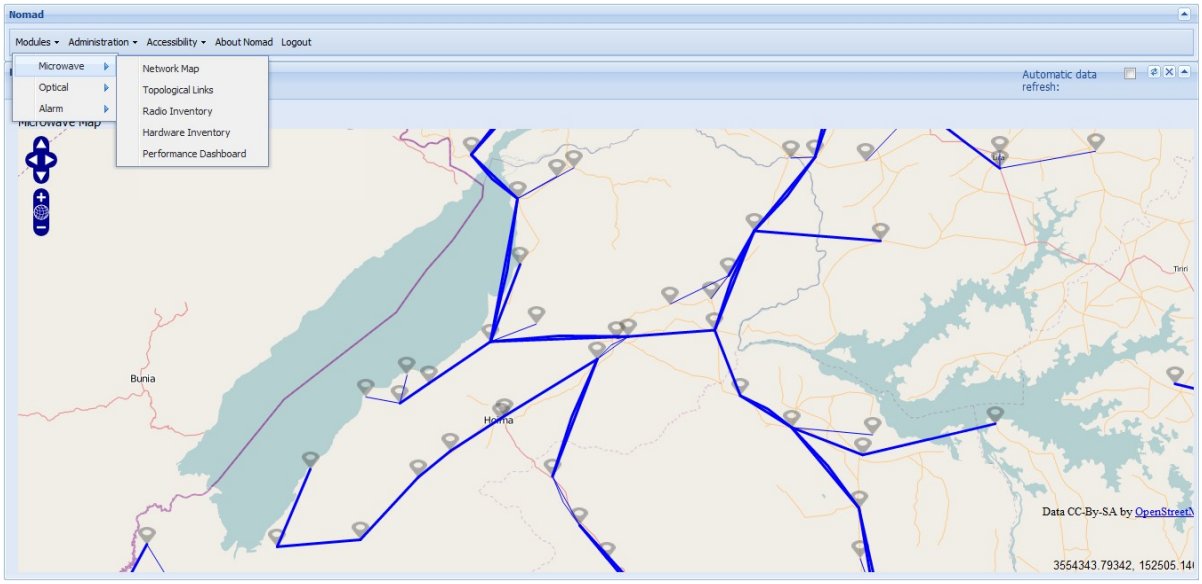
A Pie Chart is a circular chart divided into sectors, each showing the relative size of each value. It graphically represents the split in quantity of values of a certain parameter including the corresponding percentage.



nomad Pie Chart example

Map

The Map is a graphical component that displays geographical information of locations (sites) and links between the Managed Elements located at those locations.



nomad Microwave Network Map

The user can navigate using drag-and-drop and also zoom in and zoom out using the mouse wheel.

When there is more than one link between the same two sites, the links are displayed as different paths between those two sites.

If the user hovers on one of the links, its width will be increased and the map will show the location name of its two end ports. If the user clicks on a link, that link will be painted in purple to let the user know that that is the particular link displayed in detail. The detail of a link is displayed by one or more graphical components that show information related to that link (performance, alarms).

The tiles of the map are retrieved from **nomad** server. This means that no tiles are retrieved from the Internet therefore it is possible to deploy **nomad** and use the map in a network without Internet access.

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4. nomad Administration

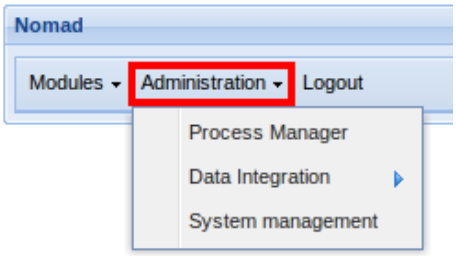
Administration

The administration menu contains the following configuration menus:

Process Manager: allows the user to configure the data collection (i.e. schedules)

Data Integration: submenus here allow the user to configure the network inventory as well as the managed element groups for the schedules.

System Management: configuration of **nomad** server networking, time zone and licence.

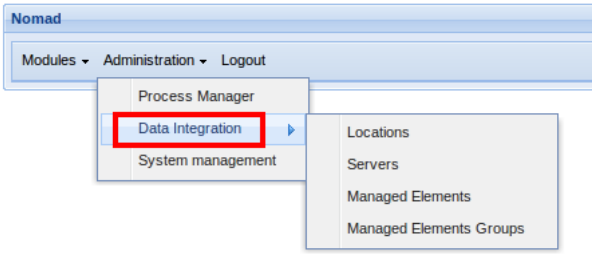


nomad Administration menu

Data Integration

Note: It is important to have read and understood **nomad** data integration concepts explained in Chapter 2.

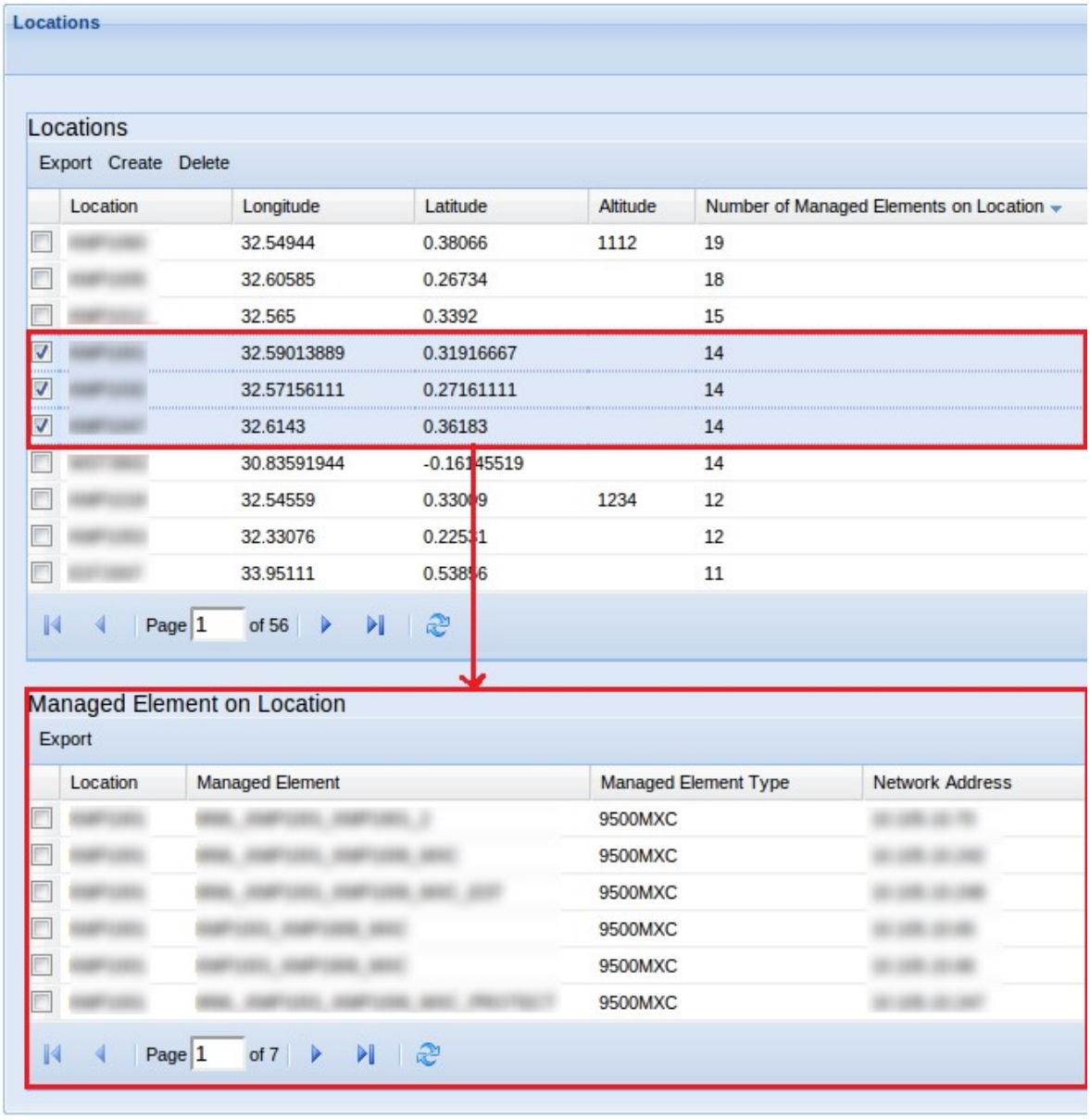
This menu option contains the following configuration submenus: *Locations*, *Servers*, *Managed Elements* and *Managed Elements Groups.*



nomad Data Integration menu

Locations

This configuration menu allows the user to display, add and delete locations, as well as to display the different managed element in the different locations. The main grid displays the different locations that are stored in **nomad**. New locations can be added and removed by clicking the 'Create' and 'Delete' buttons on the top of the grid. If the user selects one or more locations **nomad** will display the managed elements in the selected locations in a new grid, below the Locations grid.



nomad Locations dashboard

To create a new Location the user should click the button 'Create'. If the user wants to remove one or more Location then the user should select the Locations to remove and then click the 'Delete' button.
The longitude and latitude coordinates must be in the format 'EPSG:4326' so that the sites can be properly displayed in the map.

Note: Location names are usually automatically retrieved from the network management system, albeit without geo-coordinates.

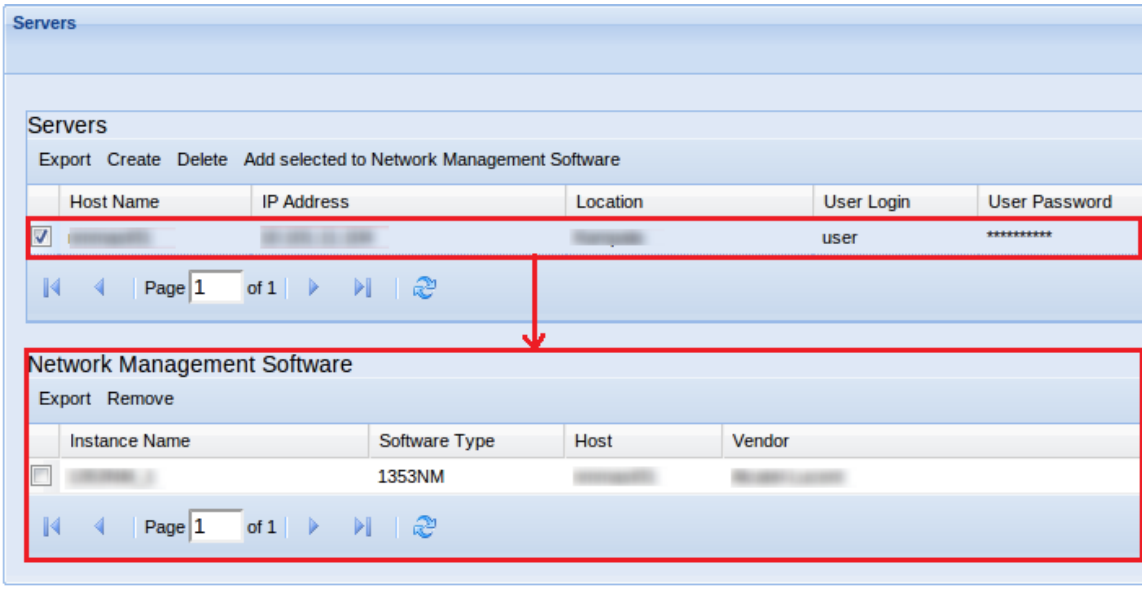
Note: The geographic representation of the network topology requires the location coordinates to be loaded into **nomad**. This can be done during the installation; location coordinates can be loaded from a spreadsheet for all locations in the network. It is also possible to add and edit coordinates in the Location grid (*Administration->Data Integration->Locations*).

ATTENTION: DELETING A LOCATION WILL DELETE ALL THE MANAGED ELEMENTS INSIDE AND ALSO ERASE ALL DATA COLLECTED FOR THOSE MANAGED ELEMENTS!

Servers

This menu has a list of servers registered in **nomad** that have one or more Network Management Systems (NMS) installed. The user can create and remove new servers, as well as add NMSs to the servers. **nomad** uses the NMSs to retrieve the information about the managed elements and their locations in the network. **nomad** retrieves that information by running the schedule type 'NMS Synchronization'. The configuration of schedules is explained later in this user manual (see Process Manager).

It is important to note that **nomad** requires at least one NMS. In case there is no NMS in the network it is necessary to add **nomad** as the NMS and also the server where it is running.



nomad Servers dashboard

To create a new Server the user should click the button 'Create'. If the user wants to remove one or more servers then the user should select the servers to remove and then click the button 'Delete'.
If the user wants to remove a Network Management Software from a Server the user should select the server to modify. Then, the user should select the Network Management Software the user wants to remove in the grid below (the one that displays Network Management Software). Finally, the user should click the button 'Remove' to remove it from the server.
To add new Network Management Software to a server the user should first select the server the user wants to modify. Then the user has to click the button 'Add selected to Network Management Software'. Finally, the user has to select the Network Management Software to insert and click the 'OK' button.

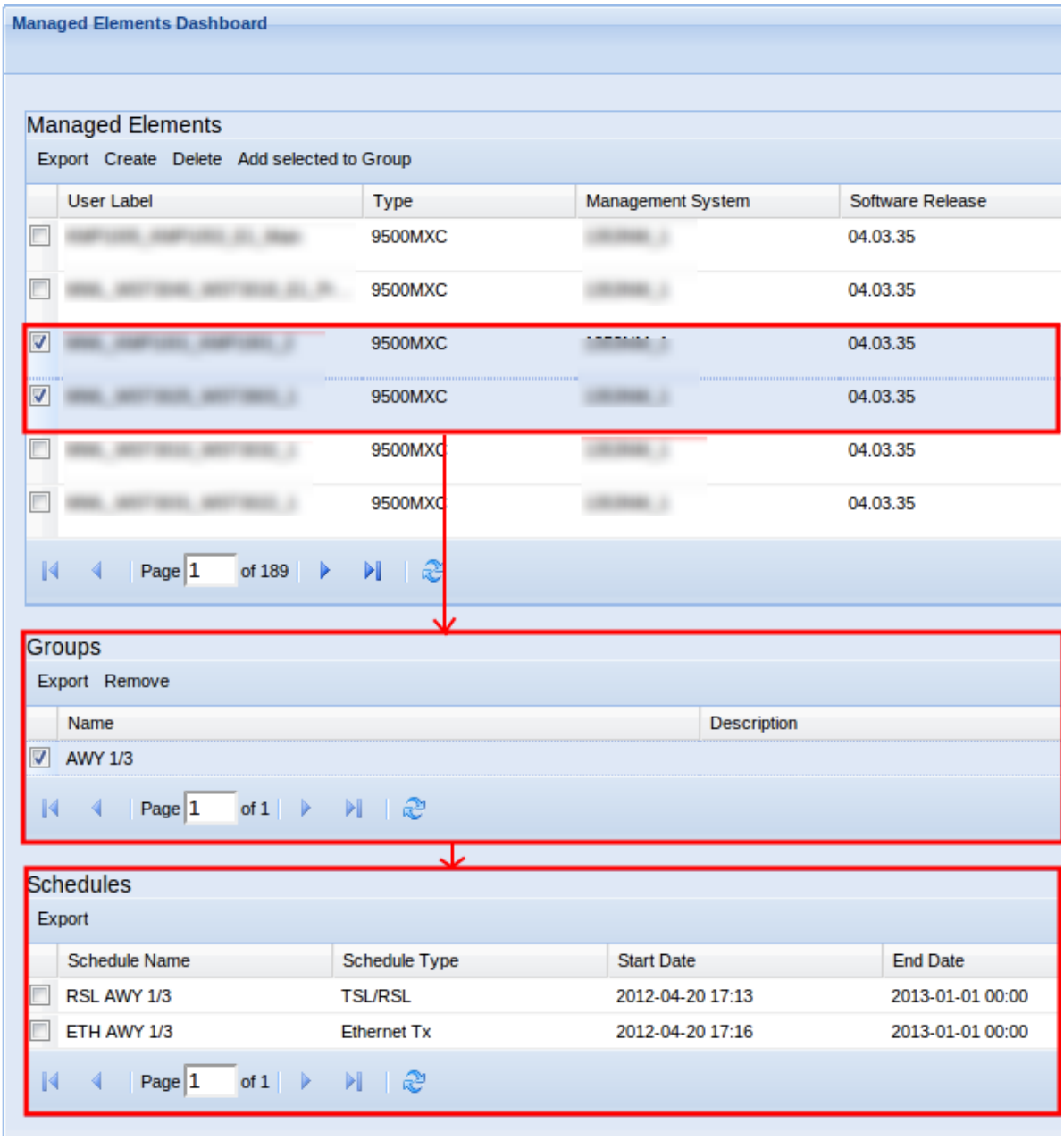
Managed Elements

This configuration menu allows the user to display and edit the Managed Elements in **nomad**. Managed elements are usually automatically retrieved from the network management system, using an 'NMS Synchronization' schedule. However, the user can also create and delete Managed Elements directly in **nomad.**

Note: The data collection in **nomad** is based on managed elements groups and schedules. See Chapter *2. nomad Data Integration* for the data collection concepts.

Display Managed Elements Groups and Schedules

This configuration menu allows the user to first display a grid with all the Managed Elements. Selecting a Managed Element displays a grid below showing the groups to which the selected Managed Elements belong. If the user selects one or more groups **nomad** will generate a grid below with the information about the schedules that retrieve information for the selected groups.



nomad Managed Elements dashboard

Add and delete Managed Elements

To create a new Managed Element the user should click the 'Create' button. If the user wants to delete one or more Managed Elements then the user should select the Managed Elements to delete and finally click the button 'Delete'.

WARNING: IF THE USER REMOVES A MANAGED ELEMENT, ALL OF ITS PTPs, BOARDS AND COLLECTED DATA WILL BE REMOVED.

Note: The user should take into account that **nomad** uses the term 'Delete' to remove elements from the database, although it uses the term 'Remove' to remove relations between elements (for example, the relation between Managed Element and Managed Element Group).

Ping Managed Element

In the Managed Element grid there is a column labeled ‘Ping’ that allows the user to Ping the Managed Element from **nomad**.

Add Managed Elements to Groups

To include one or several Managed Elements in a Group the user should first select the Managed Elements the user wants to insert in a Managed Element Group. Then the user has to click the button ‘Add selected to Group’. Finally, the user has to select the Managed Element Group to insert and click the ‘OK’ button.

Remove Managed Elements from Groups

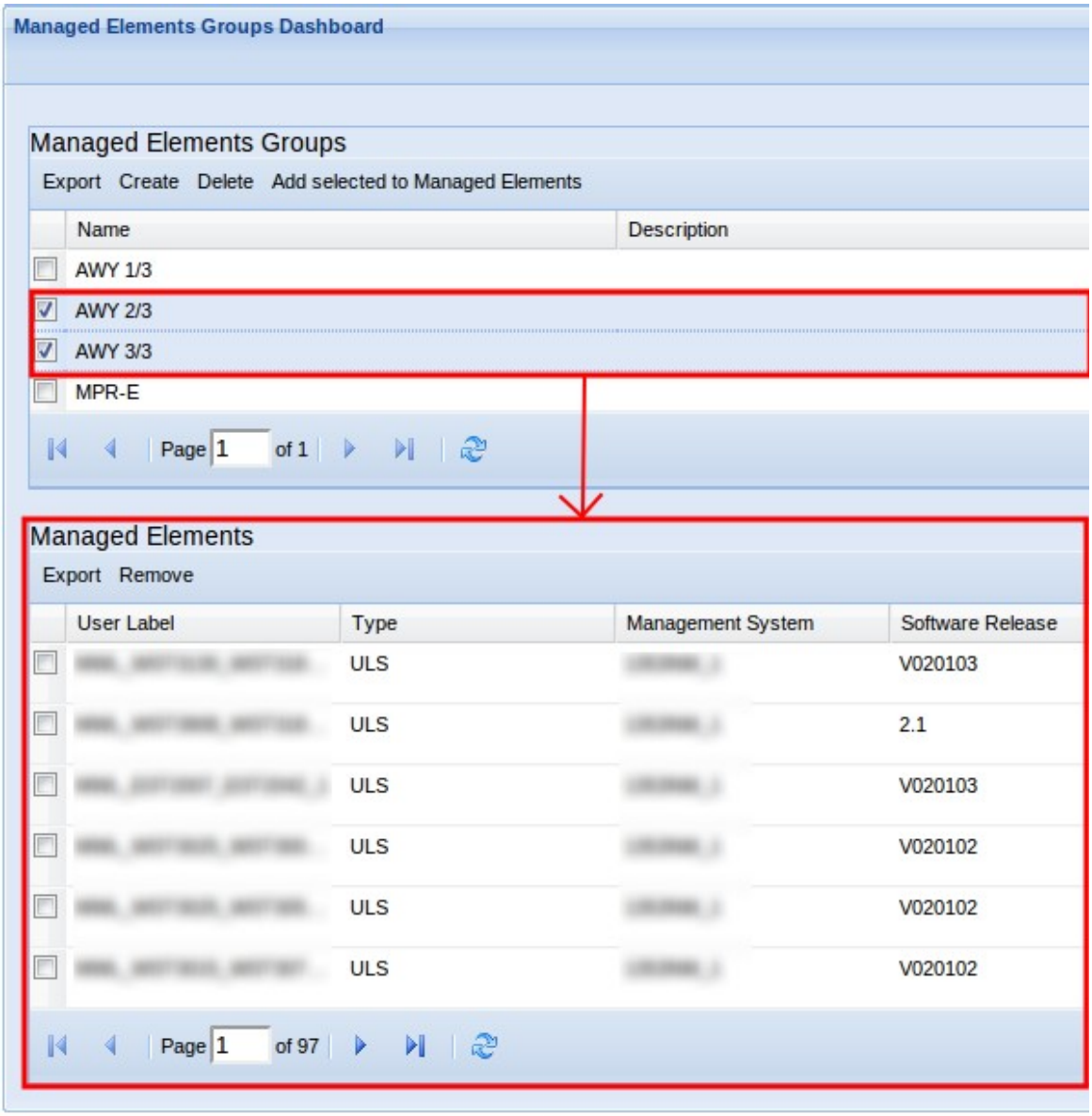
To remove one or several Managed Elements from a Group the user should first select the Managed Elements to be removed. Then, the user has to select the Managed Elements Groups the user wants the elements to be removed from, in the grid below (the one that displays Managed Elements Groups). Finally, the user should click the button ‘Remove’ to remove the elements from the selected Managed Element Groups.

WARNING: IF THE USER REMOVES A MANAGED ELEMENT GROUP ALL ITS SCHEDULES AND THE DATA RETRIEVED BY THESE SCHEDULES WILL BE REMOVED.

Managed Elements Groups

Display Managed Elements Groups

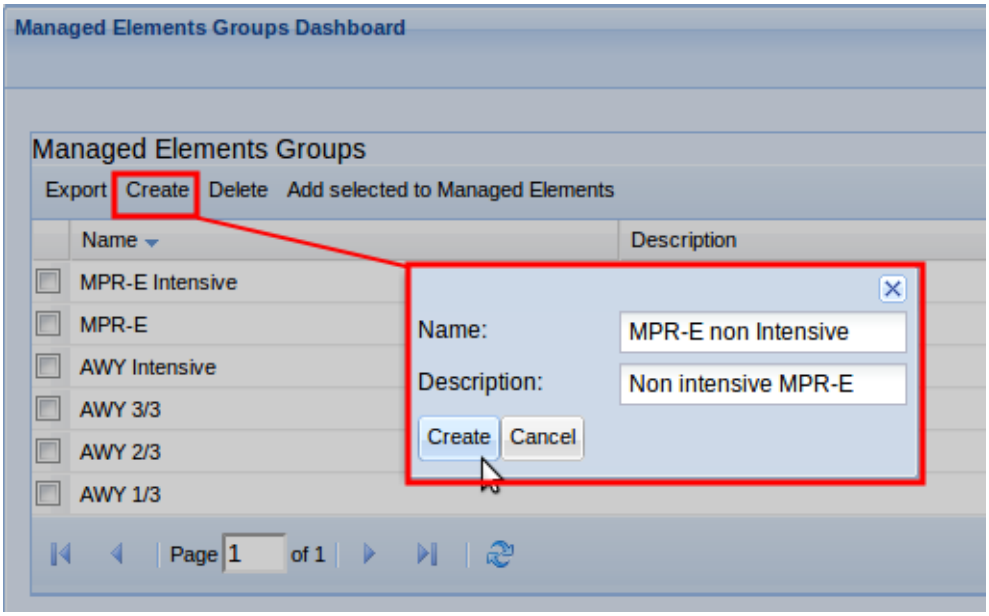
This configuration menu allows the user to first display a grid with all the Managed Elements Groups. As explained above, the Managed Elements Groups are sets of Managed Elements that are used by schedules to identify which Managed Elements to collect data from.



nomad Managed Elements Groups dashboard

Add and Remove Managed Elements Groups

To create new Managed Elements Group the user should click the button 'Create'. If the user wants to delete one or more Managed Element Groups then the user should select the managed groups to delete and then click the button 'Delete'.



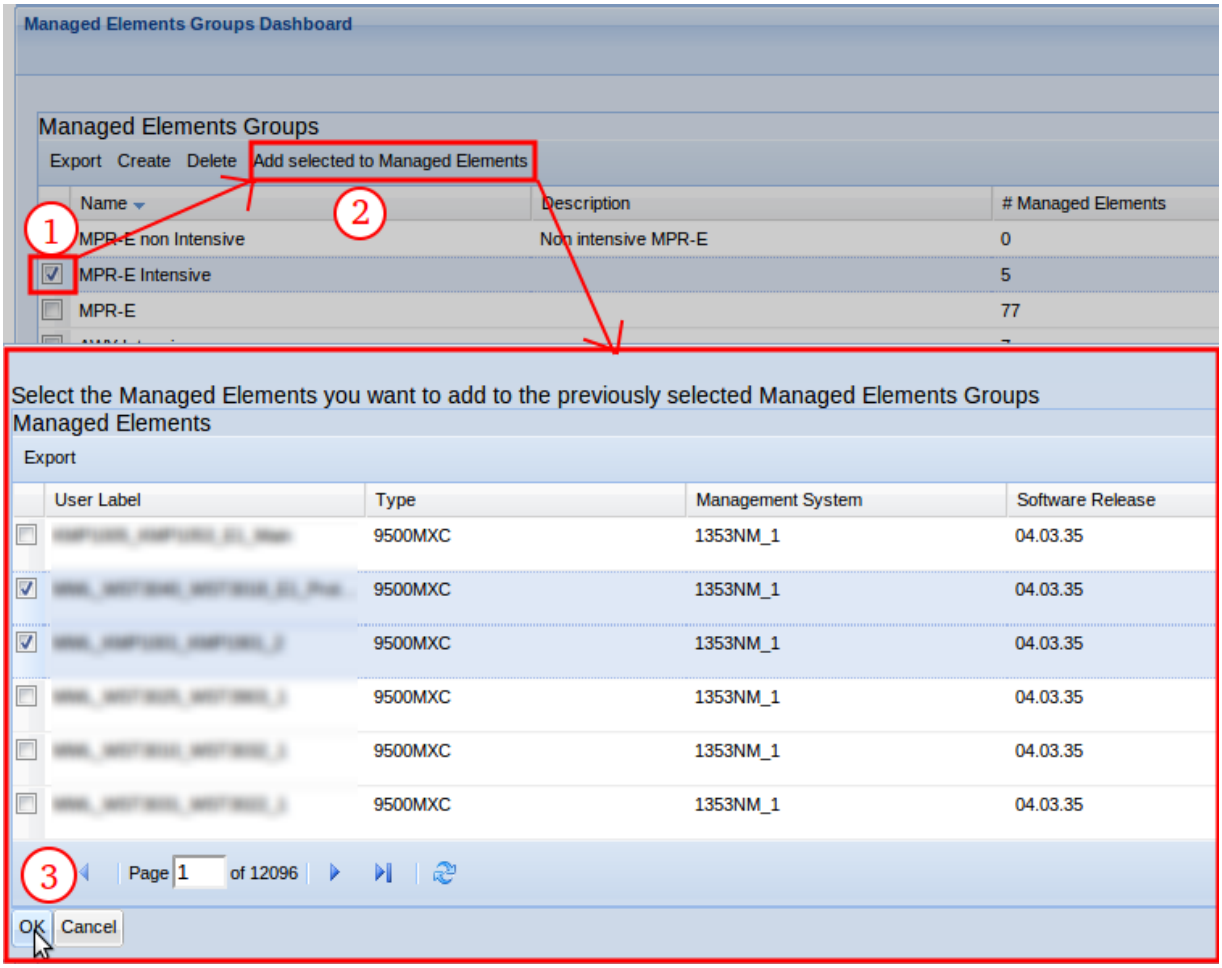
Managed Elements Group creation

ATTENTION: DELETING A MANAGED ELEMENT WILL ERASE ALL DATA COLLECTED FOR THAT MANAGED ELEMENT!

Managed Elements of Managed Element Groups

When the user selects a Managed Elements Group, **nomad** displays below the Managed Elements contained in that Group. The user can add and remove Managed Elements from the Managed Elements Groups.

If the user wants to remove Managed Elements from a Managed Elements Group, the user should select the Managed Element Group to modify. Then, the user has to select the Managed Elements the user wants to remove in the grid below (the one that displays Managed Elements). Finally, the user has to click the button 'Remove' to remove them from the Managed Element Group.
To add new Managed Elements to the Managed Elements Groups the user should first select the Managed Elements Groups the user wants to modify (1). Then, the user has to click the button 'Add selected to Manage Elements' (2). Finally, the user has to select the Managed Elements to insert and click the 'OK' button (3).



Insertion of two Managed Elements into a Group example

Note: the Managed Element Group names should be as meaningful as possible in order to identify groups quickly in the future.

Note: It is recommended to stop and delete all schedules of a group before deleting it.

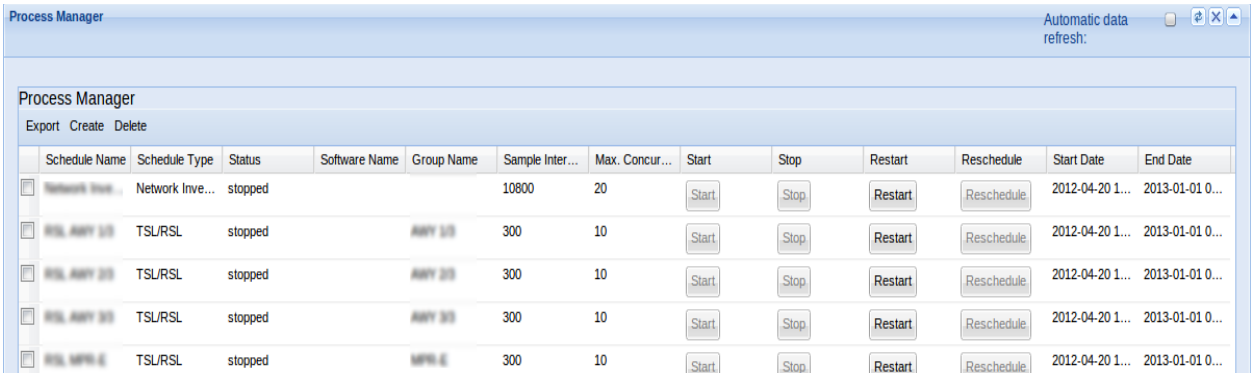
Note: Inventory data collection schedules apply to the whole network or to a sub-network managed by a given NMS. For that reason, there are specific network element groups in **nomad**:

Whole Network Group: contains all managed elements currently in **nomad**.
NMS Group: contains all managed elements managed under the selected NMS (i.e. 1353NM).

These groups can only be used for inventory schedules. Inventory data collection schedules run forever until they are stopped by the user. You can control the recurrence of the data collection using the Interval parameter. The inventory schedule will run and then wait for the duration of the Interval period before starting again.

Process Manager

The Process Manager is used to monitor and control server side processes. **This is the unique control panel to follow the execution of data collection processes, also called schedules.** It is important that the user fully understands the **nomad** data retrieval system explained in Chapter *4. nomad Administration*
To open the process manager click in *Administration -> Process Manager*.



nomad Process Manager

This panel lists all - running or completed - data collection processes, or so-called schedules. The table provides all relevant information on the active schedules. Each column is explained below:

Schedule Name: meaningful name that easily identifies the schedule
Schedule Type: defines the measure to retrieve from the network. There are three schedule types:
Software Name: this field only applies if the schedule type is "NMS Synchronization". The value of the field is the name of the NMS from which the "NMS Synchronization" schedule should retrieve data.
Group Name: group of managed elements that will provide the measurement information
Sample Interval (in seconds): the number of seconds that the schedule should wait between two consecutive data retrievals.
Max. Concurrent: the number of network elements to process concurrently in the group.
Start Date: the date when the schedule will start to retrieve information.
End Date: the date when the schedule will stop the information retrieval.

Note: Inventory schedules do not stop automatically (End Date is ignored). The only way to stop an inventory schedule is in the process manager, clicking on 'Stop'.

Note: A schedule and its corresponding data can be permanently removed from **nomad** by a simple click on 'Remove' on the Schedules Group report. All data collected during that particular schedule will be erased permanently and won't be available in reports anymore.

ATTENTION: Be aware that too short an interval could overload the DCN! Be aware that too many concurrent data collections could overload the DCN!

ATTENTION: DELETING A SCHEDULE WILL REMOVE ALL DATA ATTACHED TO IT. IT WILL NO LONGER BE POSSIBLE TO DISPLAY RELATED DATA IN ANY REPORT.

Network Schedule Types

Network Inventory

The Network Inventory schedule type performs the topology discovery and collects hardware and radio inventory data.
Inventory data collection schedules apply to the whole network or to a sub-network managed by a given NMS. For that reason, there are specific network element groups in **nomad**:

Whole Network Group: contains all network elements currently in **nomad**.
NMS Group: contains all network elements managed under the selected NMS (i.e. 1353NM).

Note: These groups can only be used for inventory schedules. Inventory data collection schedules runs forever until they are stopped by the user. You can control the recurrence of the data collection using the Interval parameter. The inventory schedule will run and then wait for the Interval period before starting again.

Note: Inventory schedules do not stop automatically (End Date is ignored). The only way to stop an inventory schedule is in the process manager (See chapter 6).

Note: The data collection is concurrent for as many network elements as specified in the schedule properties (i.e. Concurrent Max Requests).

NMS Synchronization

This type of schedule regularly retrieves managed elements details and location information from the NMSs registered in **nomad** (i.e. Software).
The NMS involved in the data retrieval is the one selected in the field "Software Name". This schedule can be configured to run for the whole network, i.e. synchronize all NMS, or for a given NMS.

Note: the NMS must be preliminarily declared in **nomad** under *Administration -> Data Integration -> Servers*

The NMS Synchronization schedule type ensures that the NMS and **nomad** are aligned, for the following information:

Location/site names
Managed element types
Managed element user labels
Managed element IP addresses

Supported Network Management Systems:

- Alcatel-Lucent 1350OMS-EML (i.e. 1353NM)
- Alcatel-Lucent 5620SAM, through SAM-O northbound interface

Performance Schedules

Performance data collection schedules run on a specific group of managed elements. Data is collected concurrently (i.e. Concurrent Max Request parameter) for a definite period of time (i.e. from Start Date to End Date). Performance counters are retrieved at a regularity defined by the Interval parameter.

The performance schedules are of the following types.

TSL/RSL Schedule

This schedule type retrieves Transmit and Receive Signal Levels (TSL / RSL) instant values of all radio ports available on all Managed Elements in the group.

Ethernet Tx Schedule

This schedule type retrieves capacity usage instant values of all radio ports available on all Managed Elements in the group.

G.826 History Schedule

This schedule type retrieves 15 minute history G.826 counters of all radio ports available on all Managed Elements in the group:

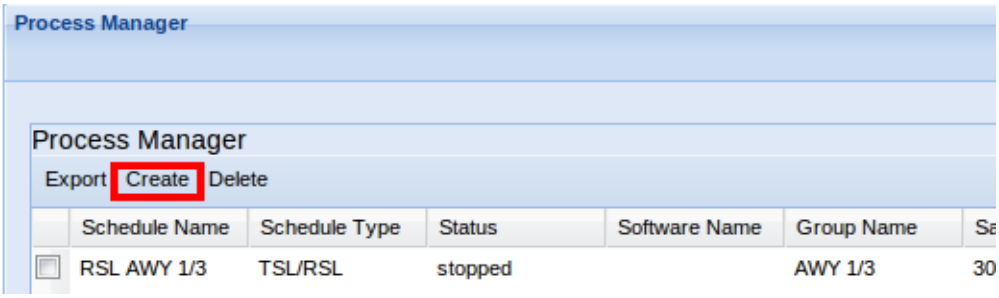
- Errored Seconds (ES)
- Severely Errored Second (SES)

- Unavailable Seconds (UAS)
- Background Block Error (BBE)

Note: The G.826 History schedule collects 15 minute history data from the managed elements. The interval specified as parameter of the schedule corresponds to a period for which the 15 minute counters should be fetched (i.e. 84600 = once a day, 3600 = once per hour). All available counters are retrieved for the last 2 periods each time. For example, if the interval is set to 3600 (i.e. every 1 hour), every hour **nomad** will retrieve the 15 minute counters for the last 2 hours.

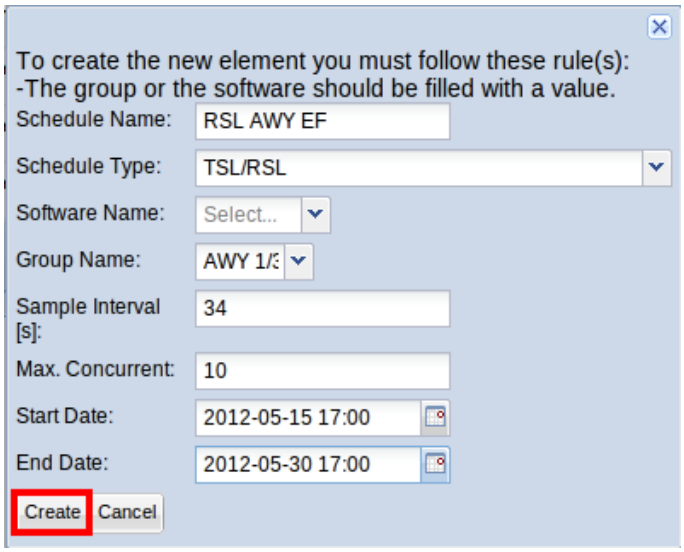
Creation of data collection schedules

The first step to create a schedule for data collection is to press the button "Create" in the menu bar of the "Process Manager" grid.



nomad Process Manager 'Create' button

Once the user clicks on this button, **nomad** displays a dialog where the user can introduce the data for the new schedule.



nomad Schedule creation dialog

Finally, the user must press the 'Create' button so that **nomad** can add this new schedule.

ATTENTION: Be aware that too short Sample Intervals could overload the DCN! Be aware that too many concurrent data collections could overload the DCN!

Schedule Actions

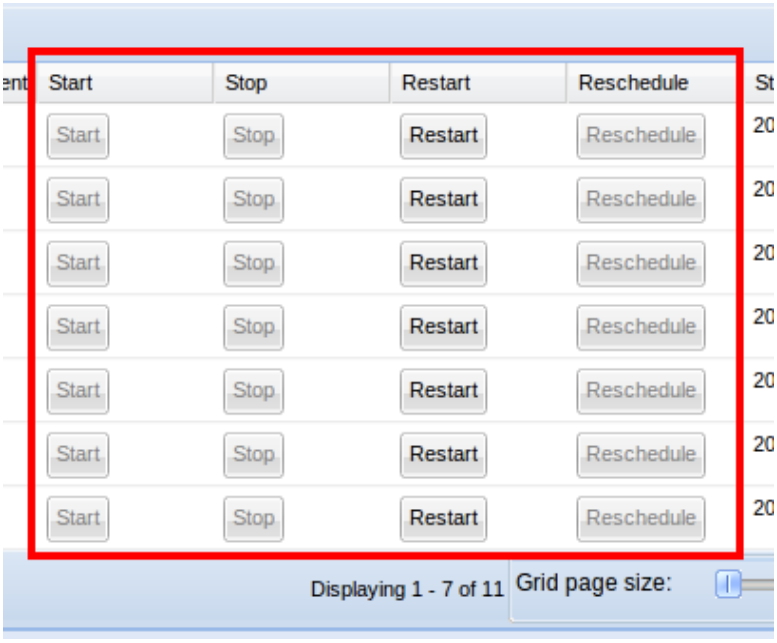
Once the schedules are created, the user can manage them by executing one of the following actions:

Start: changes the start date to the current date and starts the schedule.

Stop: stops the schedule.

Restart: stops the schedule and starts it again

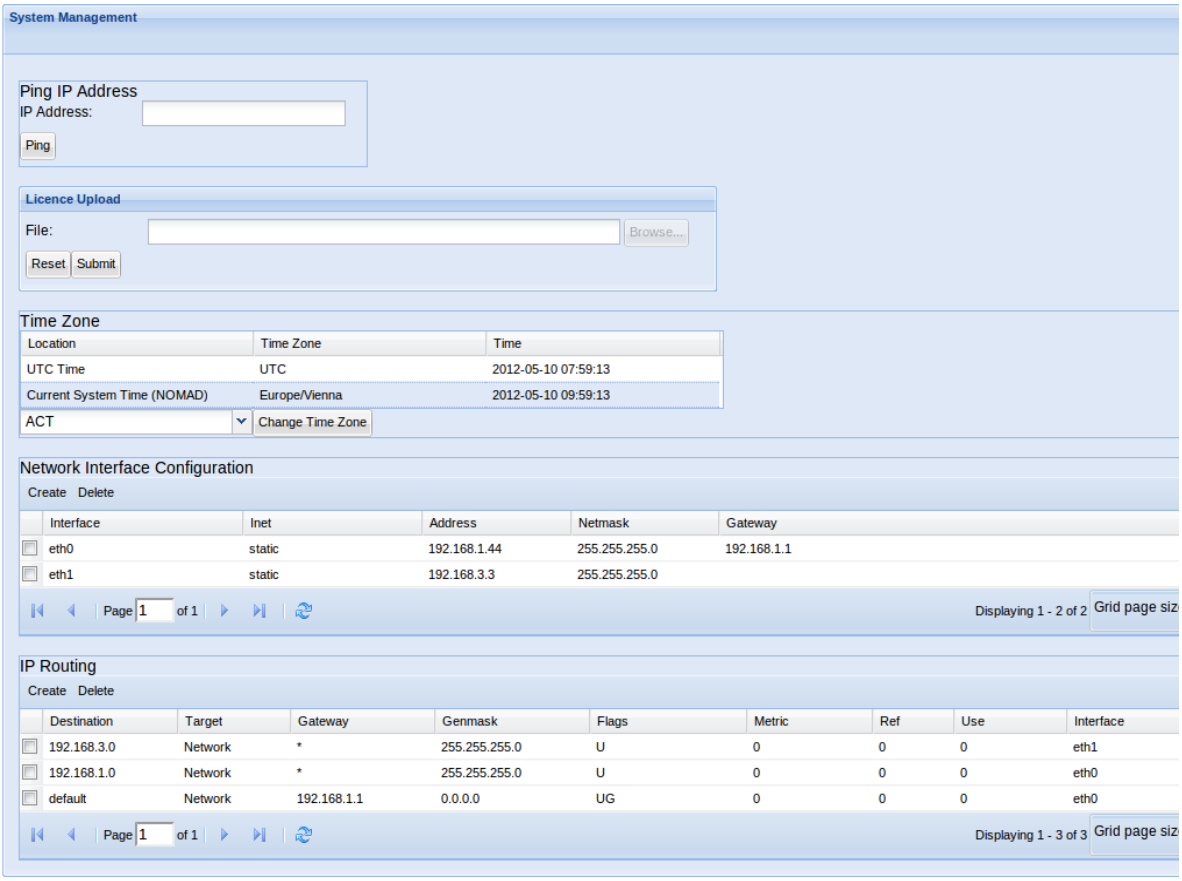
Reschedule: sets the start date of the schedule to the current date and changes the end date to fit the previous time interval.



nomad Schedule actions from Schedules grid

NOMAD System Management

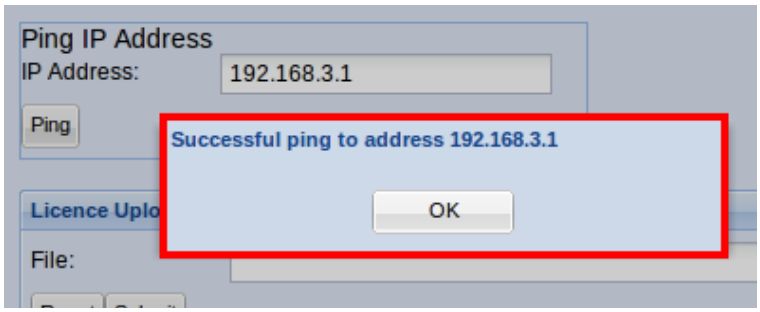
The system manager allows the user to do the following administrative tasks: ping an IP, upload a licence file, change the time zone of the server, change the network interface configuration and change the routing table.



System Management

Ping IP Address

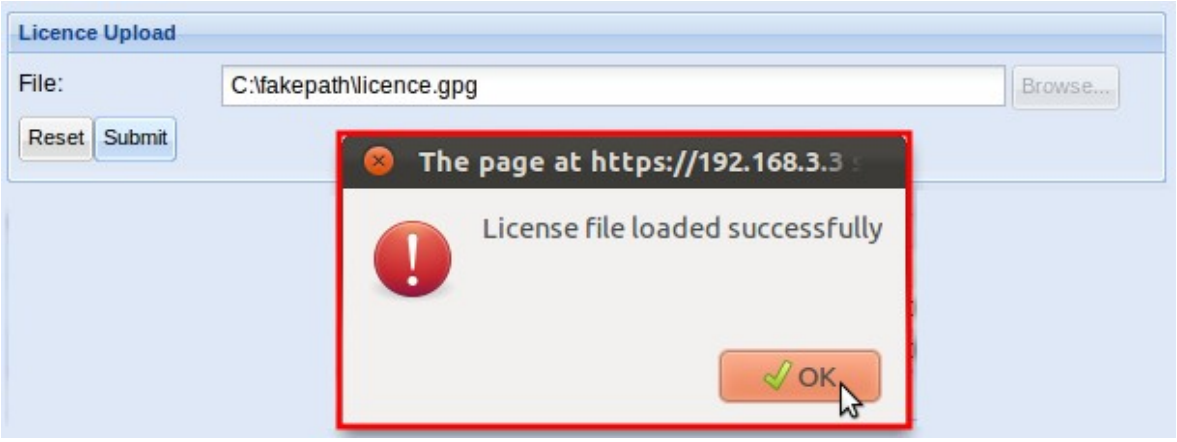
To check if a managed element can be reached by **nomad**, the user can introduce the IP address of that managed element in the "IP Address" field and then click the "Ping" Button. **nomad** will notify the user whether the ping request was successful or not.



nomad successful Ping call

License Upload

When the user receives the purchased **nomad** license it is mandatory to upload it in **nomad**. The license uploading is a classical web uploading mechanism in which the user first clicks on the "Browse" button to select the license file and then clicks on the "Submit" button to send the license.

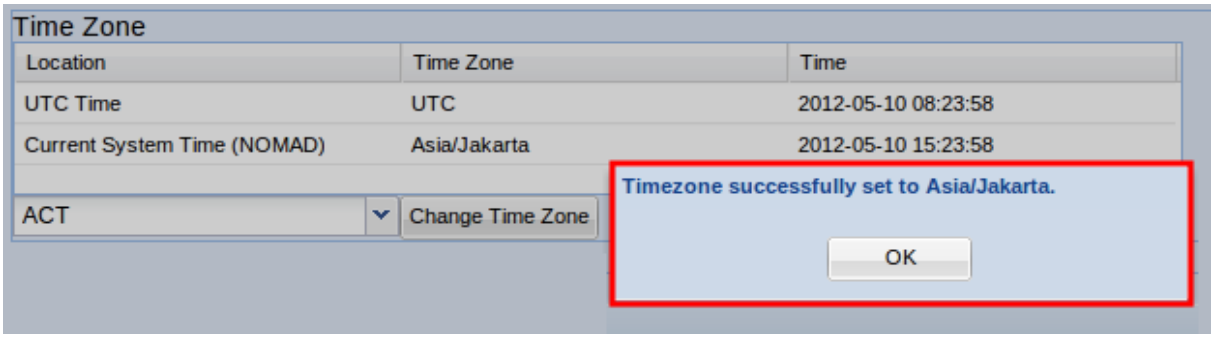


nomad Upload License

Time Zone

This component allows the user to change the time zone of **nomad**. It is important to know that the dates used in the data collection schedules are in the time zone of **nomad**.

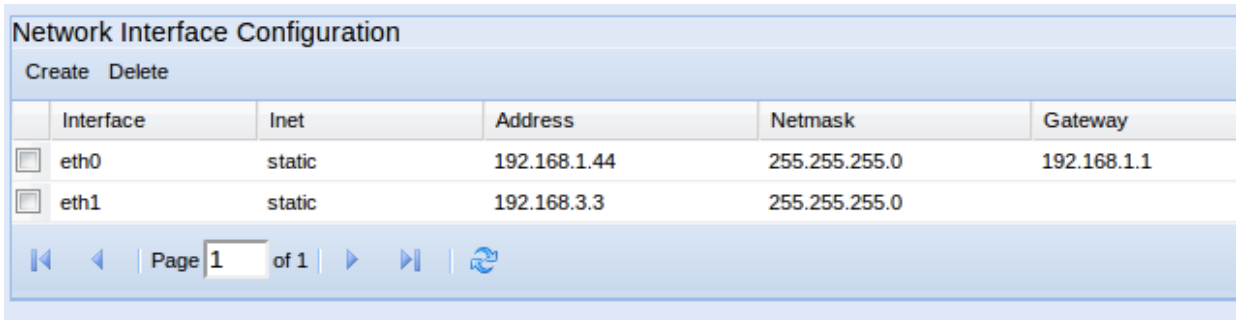
To change the time zone the user should select the new time zone in the combo box below the grid, click on the button 'Change Time Zone' and select the appropriate option.



nomad Time Zone change dialog

Network Interface Configuration

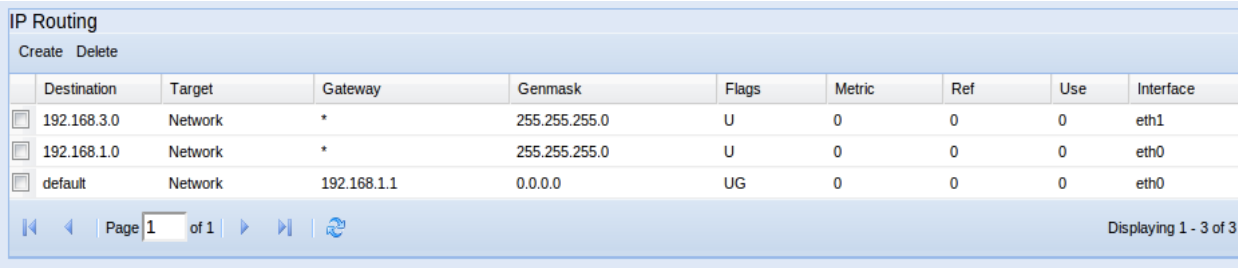
This configuration menu provides a graphical method to modify **nomad** network interface configuration. The user can create new interface configurations, delete them and also modify the existing ones. It is important to know that when there is a change in the grid, the networking services of **nomad** server are restarted.



nomad Network Interface grid

IP Routing

This provides a graphical method to modify the routing table of **nomad**. To modify IP routing the user must add or delete routes. It is not possible to edit existing routes.



nomad IP Routing table as a grid

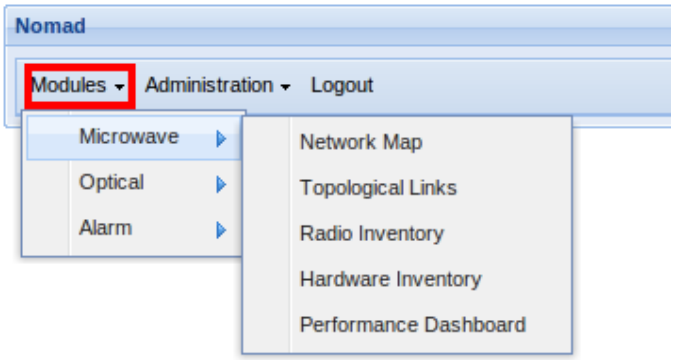
5. nomad Modules & Reports

nomad modular architecture allows a flexible configuration of both the data collection and the reports. A module is a set of data collection capabilities and reports focusing on a particular entity: specific parameters, technology, etc. The following modules are available:

- Microwave Networks
  - M001 - Network Representation & Topology Discovery
  - M002 - Radio Inventory
  - M003 - Tx, Rx Power Monitoring
  - M004 - Capacity & Ethernet Usage
  - M005 - G.826 Performance Monitoring
  - M008 - Adaptive Modulation Monitoring
  - M009 - Hardware Inventory

Microwave Networks

This chapter of the user manual focuses on the Microwave modules which are available through the menu *Modules->Microwave.*



nomad Microwave Networks sub-menu

M001 - Representation & Topology Discovery

Description

This module provides the automatic discovery of the microwave network topology and its representation on a map. The geographic representation is offline (no Internet connection requirement): all map tiles are downloaded to **nomad** during installation.

The topology discovery is an algorithm which discovers the radio link connections between managed elements from a list of IP addresses. The list of IP addresses can be retrieved from the NMS or loaded from a spreadsheet into **nomad**. There is also the possibility to add managed elements directly through the **nomad** user-interface.

Supported Equipment

Network Management Systems:

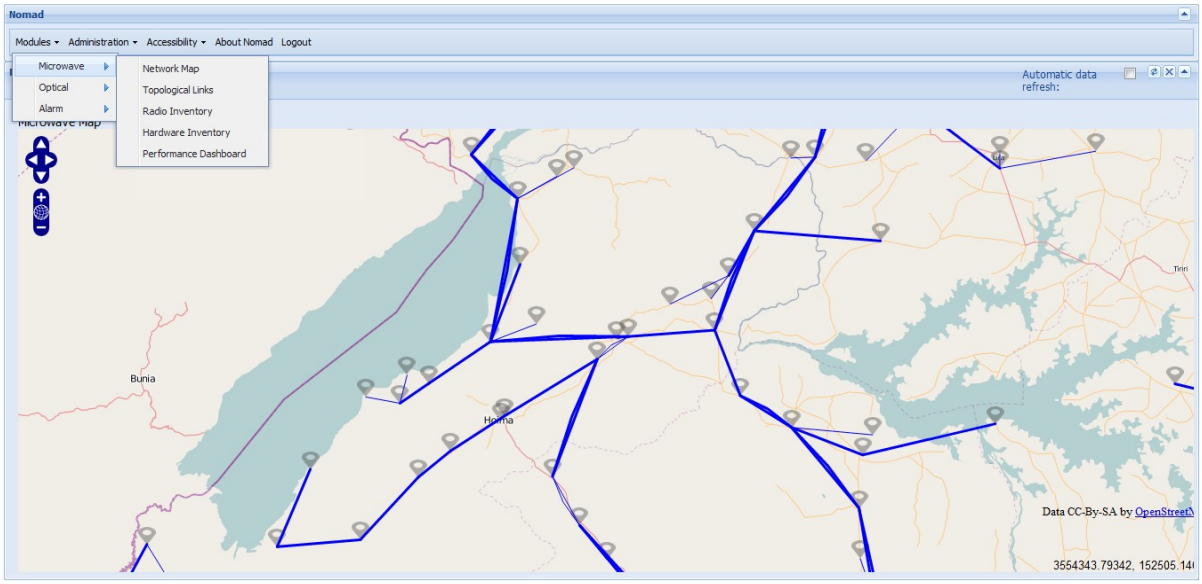
- Alcatel-Lucent 1350-OMS-EML (i.e. 1353NM)
- 5620SAM through SAM-O northbound interface

Network Elements:

- 9400AWY
- 9500MXC
- 9500MPR (MSS4/8)

Reports

The discovered network topology is represented on the map which can be displayed from the menu: *Modules->Microwave->Network Map*. Protected links (1+1) are represented by a bolder line whereas 1+0 links are represented with a simple line.



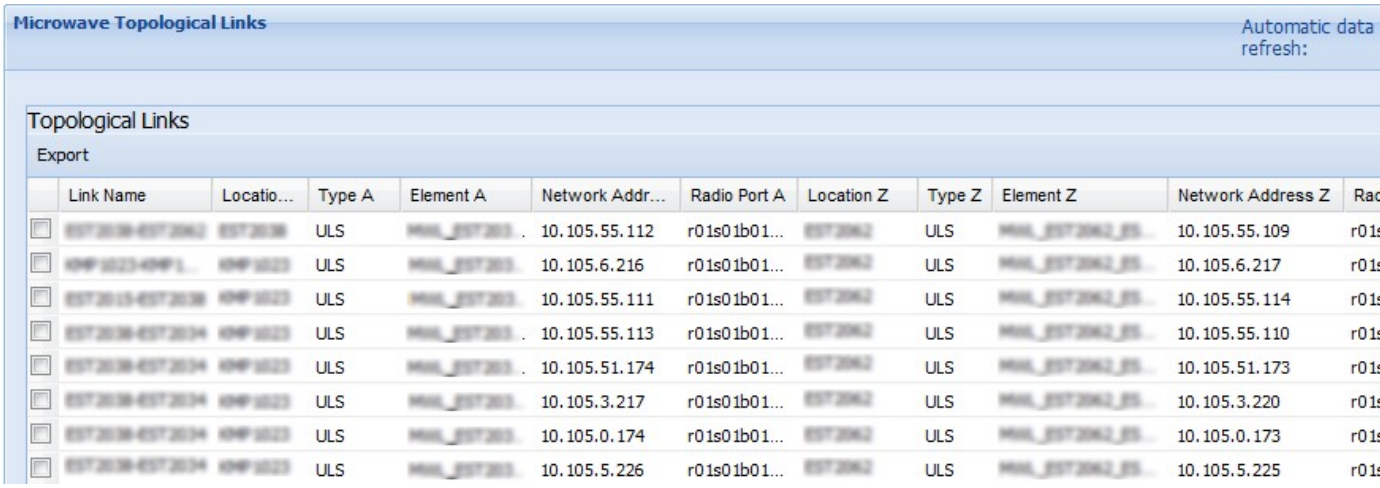
nomad Network Map

If the user clicks on a link, **nomad** will display below the map a tab panel with different technologies: *TSL/RSL*, *G.826*, *Capacity Dashboard*, *Ethernet Tx* and *Adaptive Modulation*. For each technology, the dashboard shows in a grid the different schedules it has. If the user selects one or more schedules, the dashboard will provide its performance details. The performance measures are graphs and grids with the information that has been retrieved and computed by **nomad**. The charts allow the user to select the range of data to display. Furthermore, the grids allow the user to filter and sort the measures.

Note: The geographic representation of the network topology requires the location coordinates to be loaded into **nomad**. This can be done during the installation; location coordinates can be loaded from a spreadsheet for all locations in the network. It is also possible to add and edit coordinates in the Location report (*Administration->Data Integration->Locations*), see *Chapter 4. nomad Administration -> Data Integration -> Locations*.

Beside the representation of the microwave network on the map, this module also provides a microwave link connections report listing all radio links discovered including equipment label and types, radio ports on both ends and location names.

This report can be displayed or exported from the menu, selecting *Modules->Microwave->Topological Links.*



Link Name	Locatio...	Type A	Element A	Network Addr...	Radio Port A	Location Z	Type Z	Element Z	Network Address Z	Rad
[redacted]	[redacted]	ULS	[redacted]	10.105.55.112	r01s01b01...	[redacted]	ULS	[redacted]	10.105.55.109	r01s
[redacted]	[redacted]	ULS	[redacted]	10.105.6.216	r01s01b01...	[redacted]	ULS	[redacted]	10.105.6.217	r01s
[redacted]	[redacted]	ULS	[redacted]	10.105.55.111	r01s01b01...	[redacted]	ULS	[redacted]	10.105.55.114	r01s
[redacted]	[redacted]	ULS	[redacted]	10.105.55.113	r01s01b01...	[redacted]	ULS	[redacted]	10.105.55.110	r01s
[redacted]	[redacted]	ULS	[redacted]	10.105.51.174	r01s01b01...	[redacted]	ULS	[redacted]	10.105.51.173	r01s
[redacted]	[redacted]	ULS	[redacted]	10.105.3.217	r01s01b01...	[redacted]	ULS	[redacted]	10.105.3.220	r01s
[redacted]	[redacted]	ULS	[redacted]	10.105.0.174	r01s01b01...	[redacted]	ULS	[redacted]	10.105.0.173	r01s
[redacted]	[redacted]	ULS	[redacted]	10.105.5.226	r01s01b01...	[redacted]	ULS	[redacted]	10.105.5.225	r01s

nomad Topological Links Report

The link name is built as a concatenation of the location names of both ends of the link.

M002 - Radio Inventory

Description

This module provides a complete inventory of radio parameters in the microwave network. Frequencies, modulation schemes, protection schemes, link capacity are collected and reported for every microwave radio link in the network.

Corresponding data collection schedule type: *Network Inventory*

Supported Equipment

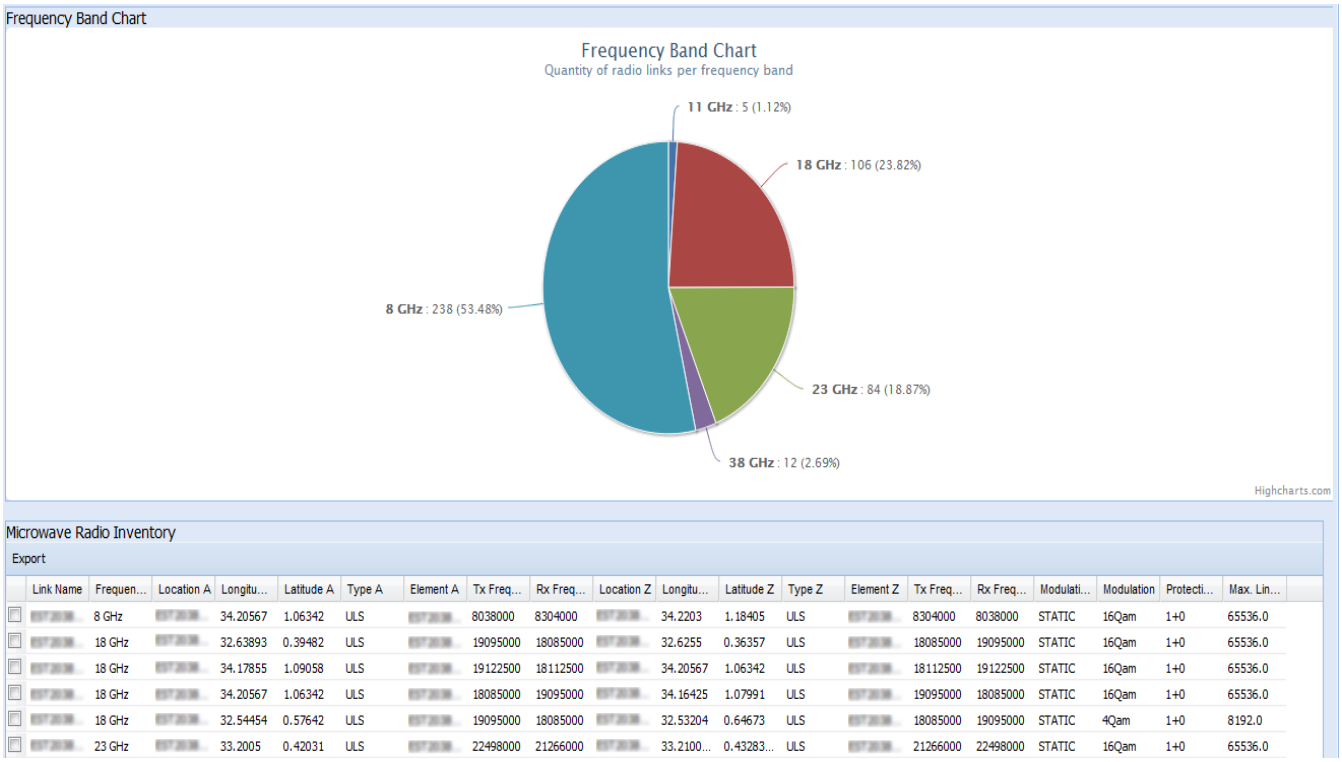
Managed Elements:

- 9400AWY
- 9500MXC
- 9500MPR (MSS4/8)

Reports

The full radio inventory report can be displayed or exported from the menu *Modules->Microwave->Radio Inventory*. It is composed of a grid and a chart representing the number of radio links per frequency band. The grid contains a row for each radio link in the network with radio parameters and site details:

- Link name
- Site A and Z (near- and far-end)
    - Location name
    - Location coordinates (longitude, latitude)
    - Equipment name and type
    - Tx and Rx frequencies in KHz
- Frequency band
- Modulation type (static or adaptive)
- Modulation scheme
- Protection Scheme
- Link Max Capacity in kpbs



Link Name	Frequen...	Location A	Longitu...	Latitude A	Type A	Element A	Tx Freq...	Rx Freq...	Location Z	Longitu...	Latitude Z	Type Z	Element Z	Tx Freq...	Rx Freq...	Modulati...	Modulation	Protecti...	Max. Lin...
	8 GHz		34.20567	1.06342	ULS		8038000	8304000		34.2203	1.18405	ULS		8304000	8038000	STATIC	16Qam	1+0	65536.0
	18 GHz		32.63893	0.39482	ULS		19095000	18085000		32.6255	0.36357	ULS		18085000	19095000	STATIC	16Qam	1+0	65536.0
	18 GHz		34.17855	1.09058	ULS		19122500	18112500		34.20567	1.06342	ULS		18112500	19122500	STATIC	16Qam	1+0	65536.0
	18 GHz		34.20567	1.06342	ULS		18085000	19095000		34.16425	1.07991	ULS		19095000	18085000	STATIC	16Qam	1+0	65536.0
	18 GHz		32.54454	0.57642	ULS		19095000	18085000		32.53204	0.64673	ULS		18085000	19095000	STATIC	4Qam	1+0	8192.0
	23 GHz		33.2005	0.42031	ULS		22498000	21266000		33.2100...	0.43283...	ULS		21266000	22498000	STATIC	16Qam	1+0	65536.0

nomad Microwave Radio Inventory Report

M003 - Tx, Rx Power Monitoring

Description

This module provides capabilities to monitor microwave link transmit and receive power, also known as Transmit and Received Signal Level (TSL/RSL), for the whole network. The RSL data collection schedule allows detailed measurements collections (sampling time in the order of a few seconds) which are then represented in the report along time. In case of protected links, both main and spare are considered and represented in the reports.

Corresponding data collection schedule type: TSL/*RSL*

Supported Equipment

Network Elements:

- 9400AWY
- 9500MXC
- 9500MPR (MSS4/8)
- 9500MPR (MSS1C) as of Rel. 3.4

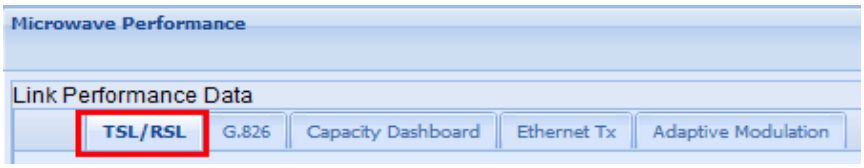
Reports

There are two different TSL/RSL reports available in **nomad**:

- **Multi-link TSL/RSL Report**: lists Tx and Rx power measurements for several radio links in the same report, indicating the maximum, minimum and average values in the measurement interval. This is particularly useful to display data for several schedules at once.

- **Single-link Report**: plots TSL/RSL measurements for a single radio link including a chart and a grid containing all measurements in the time-interval.

The TSL/RSL reports can be displayed and exported directly from the map with a click on a link or from the "TSL/RSL" tab of the performance dashboard: *Modules->Microwave->Performance Dashboard.*



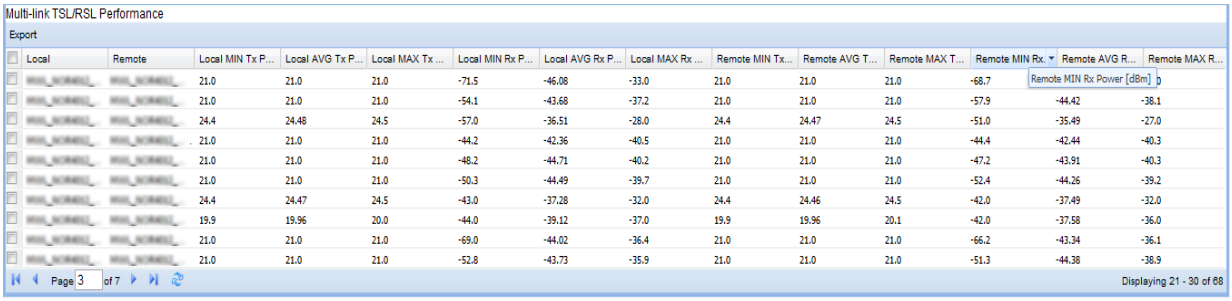
nomad Performance Dashboard - TSL/RSL Tab

TSL/RSL Multi-Link Report

This report provides Tx and Rx power measurements on both ends of each link included in the schedules (and corresponding groups) selected in the first grid of the report. The time spans are as the selected schedules are due to last for.

Power values are in dBm and represented in a table with one row per radio link.

The ends of the link are referred to as "Local" and "Remote". Aggregated values (min/max/avg) over the schedule duration are available for both local and remote ends.



nomad Multi-Link TSL/RSL Report

In order to have further details, it is possible to ***drill-down*** to the single-link report including a chart and detailed measures. To do so select a link (i.e. a row).

TSL/RSL Single-Link Report

This report provides a detailed representation of the Tx and Rx power measurements on both ends of the selected link.

Power values are expressed in dBm.

The single-link TSL/RSL report is composed of a grid and a chart. The chart provides Tx and Rx power measurements along the time for both ends of the link (i.e. local and remote). It is possible to zoom in and out on the chart simply selecting a time interval with the mouse. The 'reset' button resets the initial scale of the chart. Series can be enabled or disabled simply clicking on the series name.

Per default, the chart displays the data for the last seven (7) days starting from the latest available measurement. This time interval can be adjusted using the time selection boxes (i.e. 'From Date' and 'To Date') in the top left-hand corner of the chart and pressing the 'Update Chart' button.

The grid contains every measurement in the time interval for both local and remote radio ports.

nomad TSL/RSL Single-Link Report

M004 - Capacity & Ethernet Usage

Description

This module enables the monitoring of the link capacity and particularly Ethernet capacity usage on the radio link for a single Managed Element a group of elements.
This module provides a unique insight into the real capacity usage - both TDM and Ethernet capacities - along the time of the whole microwave network. It is particularly useful to prevent congestions, forecast capacity upgrades and understand Ethernet traffic trends (transmit rate, peak times, congested links, etc).

The following parameters are available per radio link:

- **Total link capacity** in kbps
- **TDM capacity** in kbps
- **Available capacity for Ethernet traffic** in kbps
- **Ethernet Tx Transmit Rate** in kbps on both directions
- **Ethernet Throughput** in % of the bandwidth available for Ethernet currently used
- **Ethernet frame discarded rate** in % of total transmitted frames
- **Total Transmitted Octets (TTO)** incremental counter in Tx direction on the radio
- **Total Transmitted Frames (TTF)** incremental counter in Tx direction on the radio
- **Total Discarded Frames (TDF)** incremental counter in Tx direction on the radio

Corresponding data collection schedule type: *Ethernet Tx*

Supported Equipment

Managed Elements:

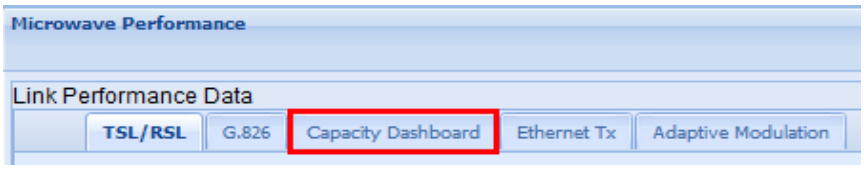
- 9400AWY
- 9500MPR (MSS4/8)
- 9500MPR (MSS1C) as of Rel. 4.0

Reports

There are two different types of capacity reports available in **nomad** :

- **Multi-link Report**: lists the above capacity parameters for multiple radio links in the same report, indicating the maximum, minimum and average values in the measurement interval. This is particularly useful to display data for several schedules at once.
- **Single-link Report**: plots capacity measurements for a single radio link including charts and a grid containing all measurements in the time-interval.

The Capacity Usage reports can be displayed and exported directly from the map with a click on a link or from the "Capacity Dashboard" tab of the performance dashboard: *Modules->Microwave->Performance Dashboard.*



nomad Performance Dashboard - Capacity Dashboard Tab

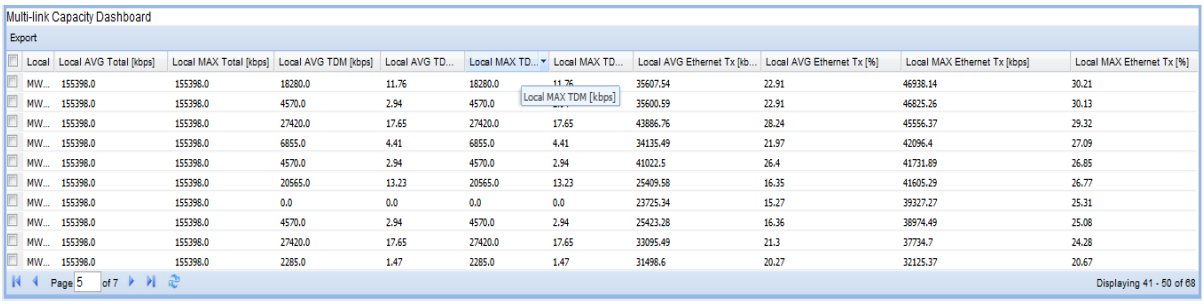
Capacity Dashboard Multi-Link Report

This report provides a unique view of the total capacity usage of each radio link included in the schedules (and corresponding groups) selected in the first grid of the report. The time spans are as the selected schedules are due to last for.

The ends of the link are referred as "Local" and "Remote". Aggregated values (min/max/avg) over the schedule duration are available for both local and remote ends.

The report contains the following capacity figures, for **both local and remote ends** of the radio links:

- Total link capacity in kbps
- Ethernet transmit rate on the link in kbps
- TDM capacity on the link in kbps



nomad Multi-Link Capacity Dashboard

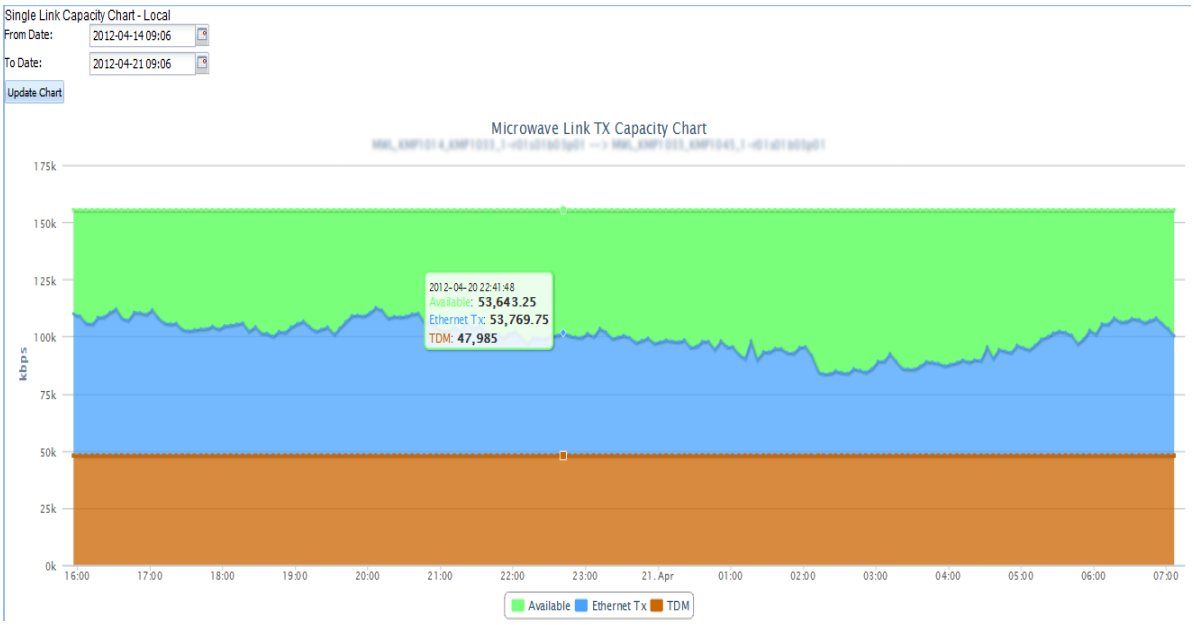
In order to get further details, it is possible to ***drill-down*** to the single-link report including a chart and detailed measures. To do so, select a link (i.e. a row).

Capacity Dashboard Single-Link Report

The single-link capacity dashboard report is composed of a grid and a chart. The chart provides a stacked-area representation of the capacity usage of the radio link. The total link capacity over the time is composed of the TDM capacity (brown), the Ethernet capacity (blue) and the remaining available capacity (green). This chart is available for both ends of the link (i.e. local and remote). It is possible to zoom in and out on the chart simply selecting a time interval with the mouse. The "reset" button resets to the initial scale of the chart. Series can be enabled or disabled by simply clicking on the series name.

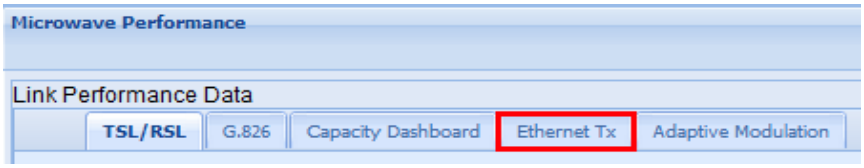
Per default, the chart displays the data for the last seven (7) days starting from the latest available measurement. This time interval can be adjusted using the time selection boxes (i.e. "From Date" and "To Date") in the top left-hand corner of the chart and pressing the "Update Chart" button.

The grid contains all capacity values in the time interval for both local and remote radio ports.



nomad Capacity Dashboard Single-Link

The **Ethernet Tx reports** can be displayed and exported directly from the map with a click on a link or from the "Ethernet Tx" tab of the performance dashboard: *Modules->Microwave->Performance Dashboard.*



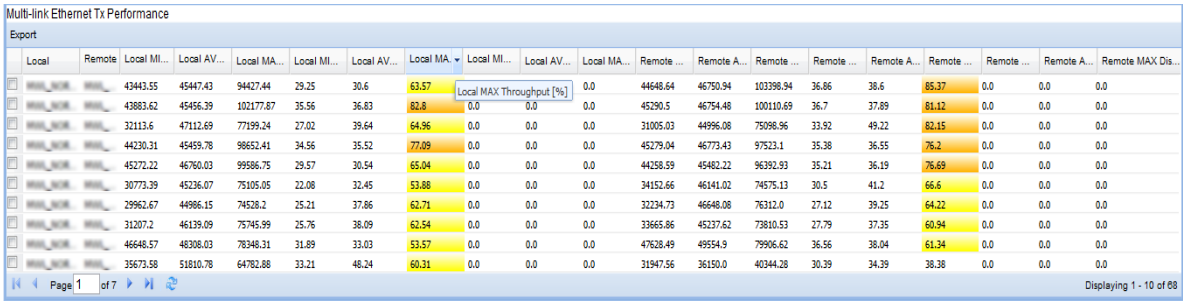
nomad Performance Dashboard - Ethernet Tab

Ethernet Multi-Link Report

This report provides a detailed view of the Ethernet usage of each radio link included in the schedules (and corresponding groups) selected in the first grid of the report. The time spans are as the selected schedules are due to last for.

The ends of the link are referred as “Local” and “Remote”. Aggregated values (min/max/avg) over the schedule duration are available for both local and remote ends.
The report contains the following fields, for both local and remote ends of the radio links:

- Total Transmitted Octets (TTO), incremental counter in Tx direction on the radio
- Total Transmitted Frames (TTF), incremental counter in Tx direction on the radio
- Total Discarded Frames (TDF), incremental counter in Tx direction on the radio
- Ethernet transmit rate in kbps, built on TTO (total transmitted octets) counters and sampled at a time defined in the data collection schedule
- Ethernet Throughput in %. This elaborated counter provides the percentage of the available bandwidth for Ethernet really used for Ethernet traffic in Tx direction. The reference is the bandwidth available for Ethernet traffic.
- Ethernet discarded frame ratio (in %) gives the percentage of Ethernet frames which are discarded against the total number of transmitted frames. This is also an elaborated counter built upon total discarded frames (TDF) and total transmitted frames (TTF) counters.



nomad Multi-Link Ethernet Tx Report

Conditional formatting is enabled on this report:

- Ethernet Throughput:
  - Yellow if > 50%
  - Orange if > 80%
  - Red if > 90%
- Ethernet Discarded Ratio:
  - Red if > 0%

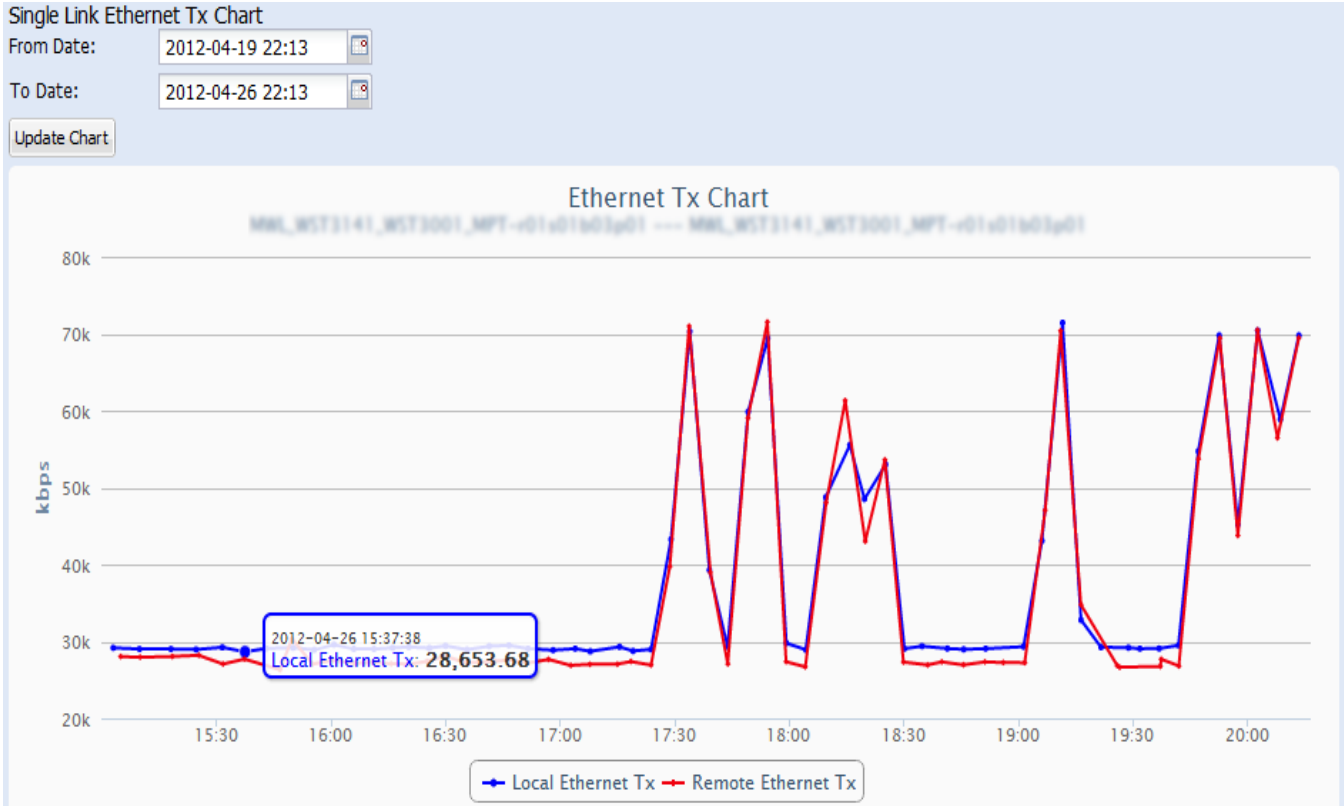
In order to get further details, it is possible to ***drill-down*** to the single-link report including a chart and detailed measures. To do so, select a link (i.e. a row).

Ethernet Single-Link Report

The single-link Ethernet Tx report is composed of a grid and a chart. The chart provides Ethernet Tx Transmit rate along the time for both ends of the link (i.e. local and remote). It is possible to zoom in and out on the chart simply selecting a time interval with the mouse. The “reset” button resets the initial scale of the chart. Series can be enabled or disabled simply clicking on the series name.

Per default, the chart displays the data for the last seven (7) days starting from the latest available measurement. This time interval can be adjusted using the time selection boxes (i.e. “From Date” and “To Date”) in the top left-hand corner of the chart and pressing the “Update Chart” button.

The grid contains all Ethernet Tx Transmit rate values in the time interval for both local and remote radio ports.



nomad Ethernet Tx Single-Link Report

M005 - G.826 Performance Monitoring

Description

This module gathers the ITU G.826 performance measurements aggregated over 15 minute or 1 day periods for the whole network in one single report. ITU G.826 counters are retrieved for both ends of each radio link included in the schedule (and corresponding group) selected in the first grid of the report. The time spans are as the selected schedules are due to last for.

The following G.826

- Errored Seconds (ES)
- Severely Errored Second (SES)
- Unavailable Seconds (UAS)
- Background Block Error (BBE)

Corresponding data collection schedule type: *G.826 History*

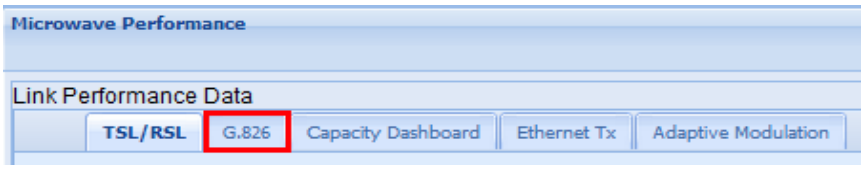
Supported Equipment

Network elements:

- 9400AWY
- 9500MXC
- 9500MPR

Report

The **G.826 report** can be displayed and exported directly from the map with a click on a link or from the "G.826" tab of the performance dashboard: *Modules->Microwave->Performance Dashboard.*



nomad Performance Dashboard - G.826 Tab

G.826 Multi-Link Report

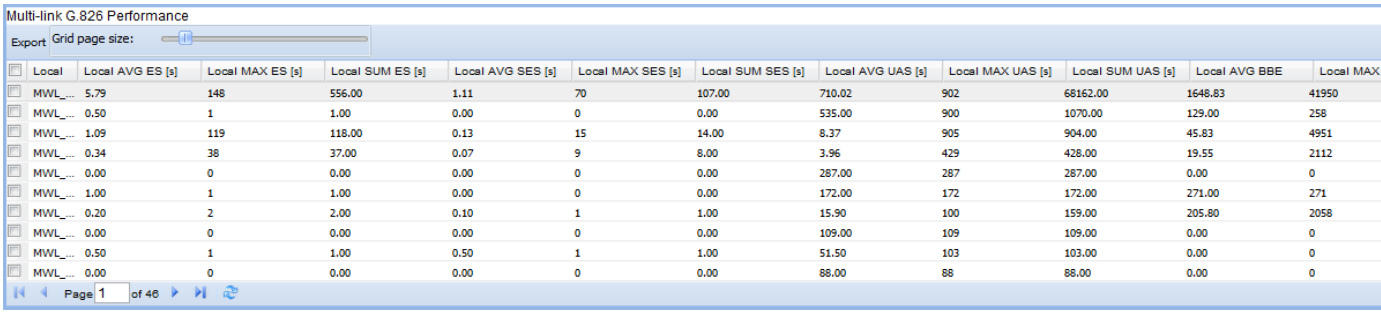
This report provides G.826 15 minute measurements of each radio link included in the schedules (and corresponding groups) selected in the first grid of the report. The time spans are as the selected schedules are due to last for.

The ends of the link are referred as "Local" and "Remote". Aggregated values (min/max/avg/sum) over the schedule duration are available for both local and remote ends.

The report contains the following fields, for both local and remote ends of the radio links:

- Errored Seconds (ES)
- Severely Errored Second (SES)
- Unavailable Seconds (UAS)
- Background Block Error (BBE)

Note: In case no error occurs on a link for 15 minutes, no counter is retrieved.



nomad G.826 Multi-Link report

M008 - Adaptive Modulation

Description

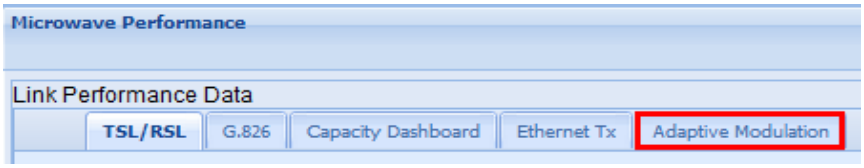
This module allows the monitoring of the adaptive modulation along the time for all the microwave links in the network. It provides for 15 minute intervals the usage of each modulation scheme in milliseconds, for each radio link.

Supported Equipment

Managed Elements: 9500MPR (MSS4/8)

Reports

The **adaptive modulation report** can be displayed and exported directly from the map with a click on a link or from the "Adaptive Modulation" tab of the performance dashboard: *Modules->Microwave->Performance Dashboard.*



nomad Performance Dashboard - Adaptive Modulation Tab

Adaptive Modulation Multi-Link Report

This report provides for 15 minute intervals the usage of each modulation scheme in milliseconds, for each radio link included in the schedules (and corresponding groups) selected in the first grid of the report. The time spans are as the selected schedules are due to last for.

The ends of the link are referred to as “Local” and “Remote”.

M009 - Hardware Inventory

Description

This module provides a full network microwave equipment inventory report which contains, for each equipment: part numbers, serial numbers and software release number of every hardware item present in the equipment, including outdoor units (ODU). Licenses are also retrieved for each managed element.
Inventory data is collected from every network element and grouped in one single report for the whole network. This is particularly interesting for large scale inventory tasks such as warranty, spare parts and phase-out management.

Supported Equipment

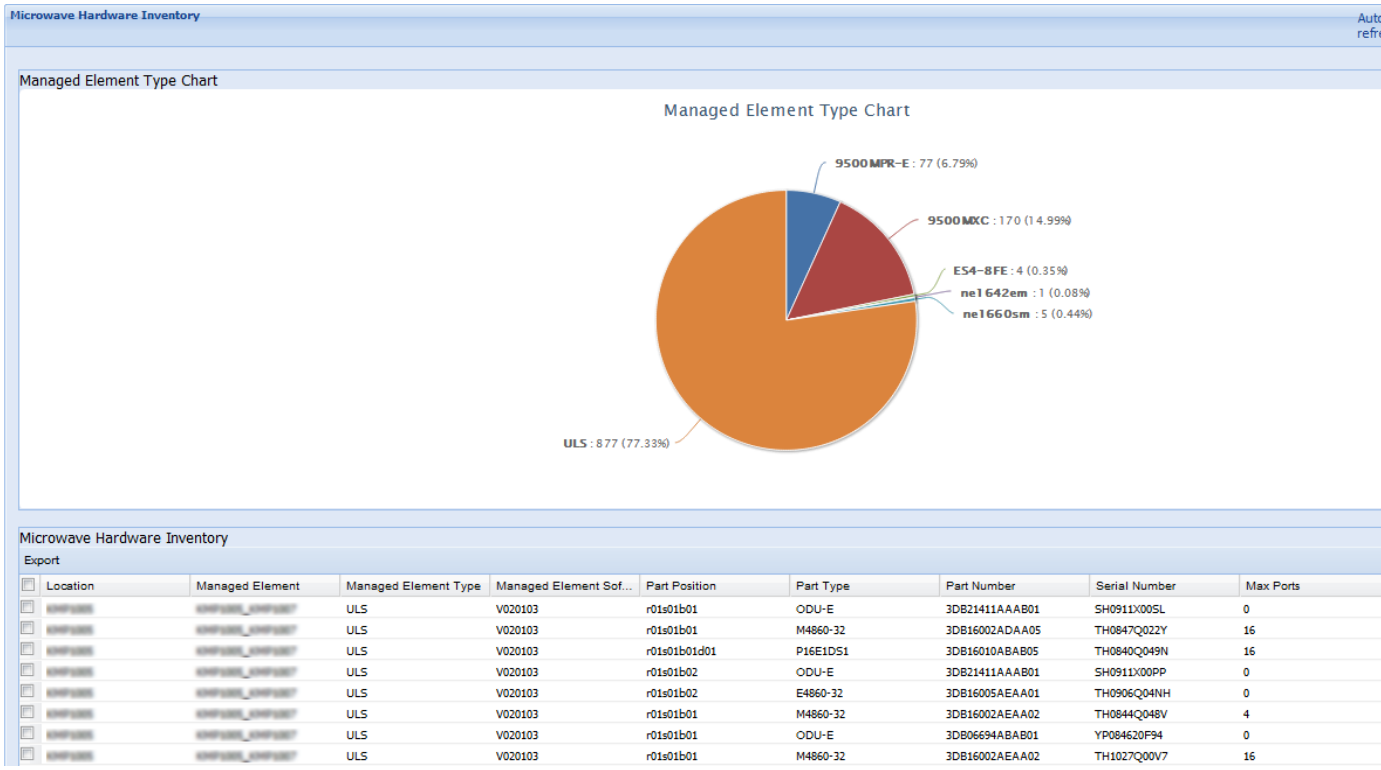
Managed Elements:

- 9400AWY
- 9500MXC
- 9500MPR (MSS4/8)

Report

The full hardware inventory report can be displayed or exported from the menu *Modules->Microwave->Hardware Inventory*. It is composed of a grid and a chart representing the split of managed elements by types. The grid contains a row for each hardware item in the network, grouped by managed element, with the following parameters:

- Location of the Managed Element the item belongs to
- Information on the Managed Element the item belongs to
  - User label
  - Type
  - Software release
- Item position in the Managed Element
- Item part number
- Item unique serial number
- Item type
- For items which are E1 boards, the report also contains the number of E1 ports on the board and the number of these ports which are enabled (i.e. “used”).



Location	Managed Element	Managed Element Type	Managed Element Sof...	Part Position	Part Type	Part Number	Serial Number	Max Ports
[redacted]	[redacted]	ULS	V020103	r01s01b01	ODU-E	3DB21411AAAB01	SH0911X005L	0
[redacted]	[redacted]	ULS	V020103	r01s01b01	M4860-32	3DB16002ADAA05	TH0847Q022Y	16
[redacted]	[redacted]	ULS	V020103	r01s01b01d01	P16E1DS1	3DB16010ABAB05	TH0840Q049N	16
[redacted]	[redacted]	ULS	V020103	r01s01b02	ODU-E	3DB21411AAAB01	SH0911X00PP	0
[redacted]	[redacted]	ULS	V020103	r01s01b02	E4860-32	3DB16005AEAA01	TH0906Q04NH	0
[redacted]	[redacted]	ULS	V020103	r01s01b01	M4860-32	3DB16002AEAA02	TH0844Q048V	4
[redacted]	[redacted]	ULS	V020103	r01s01b01	ODU-E	3DB06694ABAB01	YP084620F94	0
[redacted]	[redacted]	ULS	V020103	r01s01b01	M4860-32	3DB16002AEAA02	TH1027Q00V7	16

nomad Microwave Hardware Inventory Report

Oghmasys IT Services GmbH, Gentzgasse 72/27, 1180 Vienna UID: ATU62104403 Registered no. FN 268554 h

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