Global-WAN

(G-WAN)

v2.1.20 for Linux

(tested with Ubuntu 8.10+ 32-bit and Debian 5.0.6 AMD64)*

(*): G-WAN needs the 32-bit ia32 libraries on AMD64 Linux platforms:
apt-get -y install ia32-libs

User's manual

"Simplicity is the ultimate sophistication."
(Leonardo da Vinci, 1452-1519)

"Complexity is the enemy of security."
(Bruce Schneier, 1963-)

"The price of reliability is the pursuit of the utmost simplicity."
(Sir Charles Antony Richard Hoare, 1934-)

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94.230.210.136

This is the IP address used by http://gwan.ch/.

DNS is (illegally) hijacked by the guardians of the temple to censor anything that can challenge established interests, see http://gwan.ch/en_dns.html. By knowing the server IP address you will still be able to reach the Web site – even if its DNS records are hijacked again (it happened twice since June 2009).

This manual is therefore a good place to store this useful information.

Who makes G-WAN and Why?

I started to code in year 1979, and worked almost always on DOS/WINDOWS. In year 1998, I founded TWD Industries to market Remote-Anything (RA), a desktop-sharing tool.

RA (~100 KB) was portable, easier to use and to deploy, faster, safer and more stable than SYMANTEC *"pcAnywhere"* (53% of the market). RA did so well (in 138 countries) that SYMANTEC *"Norton Antivirus"* (87% of the market at the time) started to delete RA, claiming that it was an unfortunate (but constant) string of *"accidental false-alerts"*.

TWD responded with the Directory Server (DS), which allowed people to deploy RA on a WAN without having to configure their firewalls and routers. By waving the costs of large-scale deployments, RA became uniquely useful to *very important* Windows users.

That's when MICROSOFT killed RA with *"Windows Anti-Spyware"* / *"Windows Defender"*. The MICROSOFT Virus Information alliance (VIA), where antivirus vendors are paid by MICROSOFT, swiftly joined forces to delete RA, then subtly rated *"not-a-virus"*.

We sued FORTINET, SOPHOS, SYMANTEC and TREND MICRO. The Court fined us, stating that it is *"perfectly legitimate"* for antivirus vendors to delete a competitor's product – *without providing any technical reason for doing so*. So much for *"Fair Competition"*, "*Free and Open Markets"* and... the (famous 'three strikes') *"Justice"* department.

Then, we sued large French RA pirate users (OPAC: a government agency, FINAMA bank, GROUPAMA insurance, MAF AGROBOTIC: an industry world leader, SCRIBA: a MICROSOFT partner) for a total of 1.2 billion euro (bare retail price of the RA and DS counterfeit licenses officially seized at their headquarters – *without any damages*).

The French Police, judges and prosecutors have scuppered *all* those cases by silently *removing* the officially seized evidences from case records: *one month after the seizure*, FINAMA secretly gave the Police (an unofficial) affidavit made *at a different place.* Unsurprisingly, it claimed that FINAMA never used RA. But this document also invoked "*bank secrecy"* to ask the Police to (illegally) replace the official bailiff affidavit exposing the fraud by the fake affidavit. The Police did it. And the General Prosecutor of Paris covered the Police when we denounced this criminal activity (called forfeiture by the law).

Authorities are the puppets of those big companies who have the power to rewrite history – *and they routinely do it* because *" impunity: wealth "* (Ambrose Bierce).

While corruption is successful at preserving the interest of actively lobbying incumbents, it is ravaging this other kind of business *busy at solving real-life end-users' problems*.

G-WAN will bring TWD back to life – by giving end-users what the lobbyists don't.
Unlike Windows, Linux is virus-free, fast – and welcoming innovation, not fighting it.
And G-WAN is free for all, sparing *"Justice"* the hurdle of having to break the law.

Summary

G-WAN's main design spirit is "*simplicity rules*". Computers hate complexity almost as much as humans do. G-WAN makes them all a favor in this matter: to try G-WAN, just uncompress the archive and execute ./gwan. Try that with another application server.

This document consists in three chapters (and an annexe):

I. Web server,
II. Dynamic contents,
III. Extending the joy.
A. Why is G-WAN so much faster than all others?
B. A candid review of Java, C# and PHP.
C. What about Google Go?

Epilogue: Technology's Value – for *Who?*

G-WAN offers a stable, safe and fast web server designed to scale *as well as possible* with the many small GET/POST HTTP requests typically used by the Web (studies show that 90% of all served contents are under 100 KB).

The G-WAN HTTP server is *provably safer* than others for at least two reasons:

– it contains thousand times less lines of code (which also means less bugs);
– HTTP parsing works without libraries and buffer copies (no more exploits).

These unusual choices also make G-WAN unusually more efficient.

G-WAN is fast with large files, but, *with static contents*, it can only really shine with small files: web servers don't *receive* or *send* data: operating systems do it. So, if you serve a 1 MB file, the CPU time used by G-WAN is negligible compared to the time used by the system to send data on the network. Small files (and HTTP keep-alives), *like dynamic contents*, let G-WAN make the difference because *G-WAN does a larger part of the work*.

Web servers only *parse* client requests and *build* replies. And G-WAN does it properly. As a result, G-WAN works seamlessly under loads that cause others to stop responding.

G-WAN fuels the http://gwan.ch/ Web site since its fist public release on June 30th, 2009. Since then, *no vulnerability was found* – despite constant (and sometimes clever) attacks.

If you find a security problem then send me the details so I can take action without delay.

All contributions will receive full credits on G-WAN's Web site. And because the only goal pursued here is to make progress, you can count on a prompt reply.

I. The web server

Installation and configuration

To install G-WAN, download it from gwan.ch, copy the compressed archive in a folder of your disk (like /home/username/gwan), decompress it and run the *gwan* program.

> To configure Linux in order to *let* G-WAN run at full speed then read http://gwan.ch/source/ab.c.txt (I.e.: 'sudo gwan' to let G-WAN use all CPUs/Cores)

Decompressing the archive will create the following sub-directories (only the `www` sub-folder is mandatory, all other folders are optional):

```
/ gwan / 0.0.0.0_8080 / #0.0.0.0 / www        for HTML and image files
   |           |         |      / logs       for log files
   |  listening on this   |      / libraries  for Libraries (Chapter 3)
   |  interface (any) and |      / handlers   for Handlers  (Chapter 3)
   |  port number 8080    |      / csp        for C scripts (Chapter 2)
   |                      |      / cert       for SSL certificates
   |                      |
   |               Host name (like domain.com)
where the gwan     or IP address (like 192.168.2.4)
executable is      (one "#"-prefixed root host and
located            several "$"-prefixed virtual hosts)
```

To test the server, run G-WAN and enter the following URL in a web browser: http://127.0.0.1:8080/

By default, G-WAN listens on the 8080 non-privileged port, on *all* interfaces (0.0.0.0).

For each G-WAN *listener* tied to an interface and port, you will define one single *root host* and, optionally, one or several additional *virtual hosts*:

```
listener 1: / gwan / 192.168.2.4_80  / #trustleap.ch       (root host)
                                     / $forum.trustleap.ch (virtual host)
                                     / $gwan.ch            (virtual host)

listener 2: / gwan / 192.168.4.8_80  / #trustleap.com      (root host)
                                     / $gwan.com           (virtual host)
```

A *listener* receives incoming connections on a given network interface and port number.

A *root or virtual host* defines a Web site attached to a listener.

Many virtual hosts can be attached to a single listener. The listener finds which virtual host it must serve by looking at the 'Host' HTTP header (required by HTTP/1.1).

If such an HTTP header is not found (or not specified by a HTTP0.9/1.0 client) then the "#"-prefixed *root host* of the corresponding listener is used (as HTTP/1.1 clients *must* specify the Host header, G-WAN will return the HTTP error 400 if none is found).

Why not use configuration files, like all other HTTP servers? A single source of information (vs. configuration files *and* directory names) prevents unnecessary inconsistencies and errors – and spares you the need to become a *specialist*.

Host Aliases

An alias lets you assign additional domain names to an existing (root or virtual) host. Like for other hosts, you just have to create a folder – but its contents (if any) are ignored:

```
/ gwan / 192.168.2.4_80 / #gwan.ch                (root host)
                        / #gwan.ch:gwan.com       (alias)
                        / #gwan.ch:trustleap.ch   (alias)
                        / #gwan.ch:trustleap.com  (alias)
```

And, to define an alias for a virtual host:

```
/ gwan / 192.168.2.4_80 / #gwan.ch                      (root host)
                        / $forum.gwan.ch                (virtual host)
                        / $forum.gwan.ch:forum.gwan.com (alias)
```

An alias uses the following syntax: real_host **:** alias_host

If you do the above, you will not be able to reach contents from the IP address that has been assigned to all those domain names: G-WAN will always reply “404: Not found” – even if you setup an alias called #gwan.ch:94.230.210.136. That is because IP addresses are not valid host HTTP headers.

If you want to let G-WAN reach your Web site from its IP address, you have do this:

```
/ gwan / 192.168.2.4_80 / #94.230.210.136               (root host)
                        / #94.230.210.136:gwan.ch       (alias)
                        / #94.230.210.136:gwan.com      (alias)
                        / #94.230.210.136:trustleap.ch  (alias)
                        / #94.230.210.136:trustleap.com (alias)
```

HTTP Authentication

G-WAN supports the BASIC and DIGEST HTTP authorization schemes (RFC 2617).

To assign passwords to users and URIs we need a configuration file (sorry for that) stored in the directory of each root/virtual host (like #94.230.210.136/**acl.json**):

```
“acl”: {
“roles”: [
    {“name”:”admin”,    “description”:”full-access to all”},
    {“name”:”guest”,    “description”:”restricted-access to all”}
]
“rights”: [
    {“uri”:”/csp?auth_digest”,    “auth”:”DIGEST”,    “method”:”*”,        “role”:”admin”},
    {“uri”:”/csp?auth_basic”,     “auth”:”*”,         “method”:”GET”,     “role”:”guest”}
]
```

```
“users”: [
    {“name”:”paul”,  “role”:”admin”,   “HA1”:”a34b...78d1”},
    {“name”:”tom”,   “role”:”guest”,   “HA1”:”962f...eb51”}
]
}
```

“**roles**” are profiles associated with “**users**” to define “**rights**”: who can access an “**uri**”, using which HTTP authorization method (BASIC, DIGEST) and HTTP request method (GET/POST/PUT, etc.). A star character (wildcard) allows any method.

The “HA1” field is the RFC 2617-defined MD5(user:uri:password) hash.

C scripts can access this file to add, update or remove users, see the auth.c sample.

You can define access rights for different applications by defining dedicated “roles” and by associating any related “uri” to the dedicated “roles”:

- Application: shopping
  - “shop_admin”
  - “shop_guest”

- Application: accounting
  - “accnt_admin”
  - “accnt_guest”

To keep things simple, it may help to reduce the number of Web applications used on a single root or virtual host (use sub-domain DNS entries like forum.gwan.com).

Do not use DIGEST for anything of value: reading RFC 2617, it is evident that its design (Verisign and Microsoft, 1999) was purposely flawed in order to sell (Verisign) SSL certificates that delegate the whole security chain to... Verisign (Certificate Authority) and Microsoft (the CA repository, in charge of CA queries and CA validation).

There is obvious room for something safer than DIGEST (SSL does not make it safer).

Log files

G-WAN can use traditional (Apache-like) log files. To activate this feature, just create a sub-folder called /logs for the virtual hosts of your choice. Log files will not be generated/updated if the folder does not exist (or is renamed to, say, “/_logs”).

There are three different kinds of log files:

- `gwan.log` reports global events: startup/shut-down and script loading errors;
- `error.log` reports HTTP errors on a per virtual host basis;
- `access.log` reports all HTTP requests (and errors) for a virtual host.

G-WAN’s performances are only slightly lower when log files are enabled. The difference small but is noticeable in benchmarks and negligible for real-life use.

Note: You have to stop and restart G-WAN to apply your log files changes.

G-WAN log files are automatically rotated daily at 0:00 (GMT) in order to make it easier to archive, trace and analyze them. Each file is renamed as follows:

- `gwan.log => gwan_yyyy-mm-dd.log`
- `error.log => error_yyyy-mm-dd.log`
- `access.log => access_yyyy-mm-dd.log`

Where yyyy represents yesterday's year, mm the month and dd the day.

A daily HTML report is also saved in the /logs folder to report a summary of G-WAN's internal performance counters such as uptime, in/out traffic, RAM levels, number of connections, HTTP requests, script requests, HTTP errors, script errors, abnormal timeouts (attacks), etc. (if you don't see them, check your directory permissions or use 'sudo gwan' to let G-WAN create the files).

G-WAN's internal performance counters are also available from C scripts (Chapter III), allowing your C scripts to log additional events under particular circumstances.

Command-line options

```
gwan [ -b  |  -d  |  -r  |  -k ]   [ argument ]
```

`-b` disable the Denial of Service shield (for maximum raw performances);

`-v` display the version number and build date;

`-d` daemon mode: gwan will still run after user logged off, but no longer output text in the terminal. Another 'angel' instance of gwan is run to restart gwan if it stopped (this feature is enabled on http://gwan.ch/ since June 30th 2009 but has never been triggered so far);

You can specify a group and/or user to dump root privileges:

```
gwan -d:group:user
gwan -d:group
gwan -d::user
```

If you can't reach some files (HTML pages, image, CSS files, C scripts) then check the permissions applied to your folders (the user account you use must be allowed to reach those files – I use the `0644` permission mask and the account '`www-data`' to run gwan with '`root`' as the owner of data files): `sudo ./gwan -d:www-data:www-data`

`-r` run the specified C script and exit (no signal handler are installed: a crash will stop this new instance of gwan which is not acting as a server); This is useful

to run arbitrary C source code (not related to G-WAN): `./gwan -r ab.c` (to run the http://gwan.ch/source/ab.c.txt test);

`-k` gracefully stop all running gwan processes (useful to stop gwan when it is running as a daemon, see option -d).

gwan uses the `Gwan_12345.pid` (parent) and `gwan_23456.pid` (child) files to find the processes to kill. If they don't exist or are not reachable then gwan will say: "no gwan instance found" and it will fail to stop the running daemon.

In that case, kill the gwan processes by using: `sudo killall -9 gwan`

Only one of these options at a time can be used on the command line.

Web Site Optimization (HTML, CSS, Javascript, and pictures)

Before HTTP compression, comments and blanks can be waved from HTML, CSS and JS files to reduce their size. But modifying files requires write access and makes them difficult to read, forcing people to use two copies: one for edition and one for production.

There is a better way: G-WAN does it on-the-fly when it loads files from disks. In CSS files, G-WAN also complements image links (for those many tiny icons that are < 1024 bytes in size) with "Data URI" base64-encoded images (RFC 2397):

```
// In the CSS file:
.extern { background:url("../imgs/extern.gif") no-repeat right; }
becomes (the url link is kept for the inept MS Internet Explorer):
.extern { background:url(...)
         *background:url("../imgs/extern.gif") no-repeat right; }

// In the HTML file, both are invoked as follows:
<a class="extern" href="http://gwan.ch/">gwan.ch</a>
```

Merging icons into CSS file(s) eliminates many connections because CSS files are *cached* by Internet browsers.

We can also save connections by grouping larger images (> 1024 bytes) in a single file. To get higher compression rates, group them **horizontally** and **by color set** (so they can share the same palette). The file "loan_lan.png" contains 4 loan pictures:

```
// In the CSS file:
.clip  { position: absolute; top: 0; left: 0; }
.clipw { position: relative; }

.loan_1 { clip:rect(0 437px 185px     0); } // rect(y1, x2, y2, x1)
.loan_10{ clip:rect(0 874px 185px 437px); left: -437px; } // etc.

// In the HTML file, absolute position on a page:
<img src="imgs/loan_lan.png" alt="Loan" class="clip loan_1">

// In the HTML file, relative positioning (following text flow):
```

```
<div class="clipw" style="height: 185px; width: 437px;">
   <img src="imgs/loan_lan.png" alt="Loan" class="clip loan_1">
</div>
```

See how http://gwan.ch/imgs/loan_lan.png is used in http://gwan.ch/imgs/style.css and http://gwan.ch/index.html.

Those two methods have reduced the number of request sent to G-WAN from 20 to 5 for the http://gwan.ch/index.html page, increasing the capacity of the server by a factor 4.

GIF has a low overhead and should be used for icons and other small images. PNG works better for larger images because it compresses better but drags more fat. The JPG format should be used with real-world photos.

Always reduce the number of colors to the smallest possible power of two (2, 4, 8, etc.) that respects your image palette: doing so will significantly reduce the file size.

Supported HTTP features

Protocols HTTPS (SSLv2, SSLv3, TLS 1.1 + the TLS 1.2 “server_name” extension or Server Name Indication, see RFC 3546 and 4366), HTTP/0.9, HTTP/1.0, and HTTP/1.1

Methods GET, HEAD, POST (application/x-www-form-urlencoded), PUT, DELETE, OPTIONS (a request can be 4-KB long)

Encodings entity, gzip, deflate (encodings are already parsed for handlers / servlets)

Conditions: If-[Un]Modified-Since, If-None-Match, If-Not-Match (Etags), If-Range (byte ranges only)

Authorization: BASIC and DIGEST, with manual and automatic session support, see the session.c and auth.c samples

Others HTTP and servlets caches updated in real-time, directory listings, HTTP compression (deflate, RFC 1950 and gzip, RFC 1952)

Supported MIME types

```
“xls”,    ”application/excel”
“tgz”,    ”application/x-tar-gz”
“tar”,    ”application/x-tar”
“gz”,     ”application/x-gunzip”
“bz2”,    ”application/x-bzip2”
“arj”,    ”application/x-arj-compressed”
“rar”,    ”application/x-arj-compressed”
“mp3”,    ”audio/mpeg”
“wav”,    ”audio/wav”
“avi”,    ”video/x-msvideo”
“mov”,    ”video/quicktime”
“flv”,    ”video/x-flv”
```

```
“mng”,    ”video/x-mng”
“mpeg”,   ”video/mpeg”
“mpg”,    ”video/mpeg”
“asx”,    ”video/x-ms-asf”
“wmv”,    ”video/x-ms-wmv”
“bin”,    ”application/octet-stream”
“exe”,    ”application/octet-stream”
“dll”,    ”application/octet-stream”
“swf”,    ”application/x-shockwave-flash”
“der”,    ”application/x-x509-ca-cert”
“pem”,    ”application/x-x509-ca-cert”
“crt”,    ”application/x-x509-ca-cert”
“ps”,     ”application/postscript”
“eps”,    ”application/postscript”
“ai”,     ”application/postscript”
“js”,     ”application/x-javascript”
“xml”,    ”application/xml”
“json”,   ”application/json”
“atom”,   ”application/atom+xml”
“rss”,    ”application/rss+xml”
“rtf”,    ”text/richtext”
“txt”,    ”text/plain”
“zip”,    ”application/octet-stream”
“pdf”,    ”application/pdf”
“tif”,    ”image/tiff”
“ico”,    ”image/x-icon”
“bmp”,    ”image/x-ms-bmp”
“svg”,    ”image/svg+xml”
“css”,    ”text/css”
“jpeg”,   ”image/jpeg”
“jpg”,    ”image/jpeg”
“png”,    ”image/png”
“gif”,    ”image/gif”
“shtm”,   ”text/html”
“shtml”,  ”text/html”
“html”,   ”text/html”
“htm”,    ”text/html”
```

As this list is hard-coded you cannot add MIME types in G-WAN version 1.x but I will add any type that makes sense if users ask for it.

Updating static contents

When you need to add or update documents located in the `www` directory you can do so without stopping G-WAN (all cached files are updated in real-time).

Updating C servlets

When you need to add or update servlets located in the `csp` directory you can do so without stopping G-WAN (all cached files are updated in real-time).

Default HTML CSS style sheet and HTTP Errors CSS style

To personalize the HTTP default style sheet (used by directory listings), you have to make your CSS style available under `/www/imgs/style.css`.

To personalize the HTTP error style, you have to create a CSS style sheet and make it available under `/www/imgs/errors.css`.

While G-WAN is supporting all the HTTP error codes (that's useful for servlets), only a subset is relevant for the server (like 404, Not found):

```
"100 Continue"
"101 Switching Protocols"
"102 HTTP Processing"

"200 OK"
"201 Created"
"202 Accepted"
"203 Non-Authoritative Information"
"204 No Content"
"205 Reset Content"
"206 Partial Content"
"207 Webdav Multi-status"

"300 Multiple Choices"
"301 Moved Permanently"
"302 Found"
"303 See Other"
"304 Not Modified"
"305 Use Proxy"
"307 Temporary Redirect"

"400 Bad Request"
"401 Unauthorized"
"402 Payment Required"
"403 Forbidden"
"404 Not Found"
"405 Method Not Allowed"
"406 No Acceptable"
"407 Proxy Authentication Required"
"408 Request Time-out"
"409 Conflict"
"410 Gone"
"411 Length Required"
"412 Precondition Failed"
"413 Request Entity Too Large"
"414 Request-URI Too Large"
"415 Unsupported Media Type"
"416 Requested range not satisfiable"
"417 Expectation Failed"
"422 Unprocessable Entity"
"423 Locked"
"424 Failed Dependency"
```

```
“425 No Matching Vhost”
“426 Upgrade Required”
“449 Retry With Appropriate Action”

“500 Internal Server Error”
“501 Not Supported”
“502 Bad Gateway”
“503 Service Unavailable”
“504 Gateway Time-out”
“505 HTTP Version not supported”
“506 Variant also varies”
“507 Insufficient Storage”
“510 Not Extended”
```

If you use custom error codes after `600` you will have to supply their description.

Disabling Directory Listing

To disable directory listing, you can define the `DIR_LISTING` value in the Maintenance script (see Chapter III).

You can also copy an `index.html` file in the specific directories that you want visitors not to browse. G-WAN only lists files in those directories that miss such an `index.html` file.

II. Dynamic contents

Servers need *scripts* for rapid-development and *compiled filters* for raw speed. G-WAN's ANSI C *scripts* do both – with compiled code performances.

How many languages do you need to learn if one of them works better than all? C made Unix, Windows, games, PDF viewers, Web browsers. C servlets will be limited by your sole imagination. C survived 40 years for a reason: it fits the task.

> *"By using C, applications that previously had required big machines could be executed on small ones, like the 8080."* (Thomas Plum, 1976)
>
> In 2010, *34 years later*, nothing has changed: C will let you do more processing with less money (using a bunch of servers instead of a server farm).
>
> If you are a student, C offers more free source code than any other. Plus, C is *easier to learn* (32 keywords, 146 functions), *faster* and *more powerful* than all others.
>
> If you are an established business, ANSI C is *bug-free* and, unlike those more 'modern' languages (like, say, C++), it never required you to rewrite your code after a committee decided that the previous specifications were, ahem, 'inadequate' (sic).
>
> Java and .Net fans will argue that C lacks "innovations" like *garbage collection* or *error recovery*, and that the potential misuse of *C pointers* are a serious security issue. G-WAN's memory pools, dynamic buffers and graceful crash handling just make these issues *irrelevant* (while making C even faster, not slower).

Assuming that G-WAN is installed and running, if you look at the files located in the `/csp` directory, you will see C source code files (the "servlets"). C servlets are executed by G-WAN when clients request the corresponding URL: http://127.0.0.1/csp?bench

The server will return the `bench.c` "reply" dynamic buffer to the client that sent this query.

Your first C servlet: "301 moved permanently"

Redirecting users is useful after you moved or deleted the previous URL on your server. All the information necessary for a redirect is in the headers. The body of the response is typically empty, but one is created here to see how to proceed:

```
int main(int argc, char *argv[])
{
   xbuf_t *reply = get_reply(argv); // pointer on server reply buffer

   xbuf_xcat(reply,
             "HTTP/1.1 301 Moved Permanently\r\n"
             "Content-type: text/html\r\n"
             "Location: new.html\r\n\r\n"
             "<html><head><title>Redirect</title></head>"
             "<body>Click <a href=\"new.html\">here</a>"
             ".</body></html>");
```

```
    return 301; // return an HTTP code (301:'Moved')
}
```

The function `xbuf_xcat()` works like `sprintf()` and lets you write the reply that the server will send to the client (without worrying about the length of the buffer).

Your "reply" buffer can contain HTTP headers only, or just HTML code and no headers, or both headers and HTML. When HTTP headers are missing, the server creates headers to match your `main()`'s return code (the HTTP status code).

All the standard HTTP status codes are supported but if you use your own custom codes (in the `600+` range) then the server can't imagine their purpose so you will have to explicitly define headers and an HTML message (if you target human clients).

The following example (without headers) is equivalent to the previous example (which explicitly defined response headers):

```
int main(int argc, char *argv[])
{
    xbuf_t *reply = get_reply(argv); // pointer on server reply buffer

    static char szURI[] = "new.html"; // new location
    xbuf_xcat(reply,
              "<html><head><title>Redirect</title></head>"
              "<body>Click <a href=\"%s\">here</a>.</body></html>",
              szURI);

    return 301; // return an HTTP code (301:'Moved')
}
```

A servlet can use this auto-completion feature to reduce the code to its simplest expression (for example, to filter connections per IP address, CIDR, or country):

```
int main() // status code 401 means 'Unauthorized'
{
    …           // do whatever you need to filter connections
    Return 401; // gwan uses '401' to build headers and an HTML reply
}
```

Today, either your servlets will define all the headers or you will expect the server to do it all for you. Environment variables (like an up-to-date HTTP date stamp) are available to make it easier to quickly build HTTP headers.

Other dynamic buffer routines will help you in the task of building a reply.

Note: To send something else than HTML (like a PNG or an XML document), you MUST explicitly define HTTP headers (servlet examples are provided) *or,* you HAVE to return an invalid HTTP status code (see below).

Sending non-HTTP Replies (JSON, etc.)

A servlet may need to talk to a client without HTTP headers. Here, G-WAN's HTTP headers automatic completion (based on the HTTP status code) is a nuisance.

To prevent HTTP headers automatic completion, just make your servlets return an *invalid* HTTP status code in the 1-99 range (inclusive).

By doing so, you can send whatever you wish, and G-WAN will not interfere.

Dynamic buffers

Dynamic buffers, like memory pools, are an efficient way to reduce the burden of memory management for high-performance programs. They are also convenient: servlets can just fill dynamic buffers without having to care about size, alignment, allocation lifetime, locks or heap fragmentation.

They are also immensely safer: you can't overflow dynamic buffers (unless you are using all the memory available on a machine) and 'bad' pointers are more likely to point to legal memory areas – the kind that will not cause a crash.

Each C servlet has a "reply" `xbuffer` aimed at sending information to clients.

But it may also be useful to create additional dynamic buffers in your servlets (to load an HTML template file, or to get the reply of a query sent to a web server).

You are expected to call `xbuf_free()` to release any dynamic buffer that you have created (but you should never free the server "reply" buffer).

`xbuf_reset()`	(re)initiatize a dynamic buffer (without freeing memory)
`xbuf_frfile()`	load a file, and store its contents in a dynamic buffer
`xbuf_tofile()`	save the dynamic buffer in a file
`xbuf_frurl()`	make an HTTP request, and store the result in a dynamic buffer
`xbuf_cat()`	like strcat(), but in a dynamic buffer rather than a string
`xbuf_ncat()`	like strncat(), but it also copies binary data in the specified buffer
`xbuf_xcat()`	formatted strcat() (a la sprintf) in the specified dynamic buffer
`xbuf_insert()`	insert bytes at a given position in the buffer
`xbuf_delete()`	delete bytes at a given position in the buffer
`xbuf_getln()`	get an LF-terminated text line from a buffer
`xbuf_findstr()`	find a given string into the buffer
`xbuf_repl()`	replace a string by another string in a buffer
`xbuf_replfrto()`	like the call above, but from/to given pointers in the buffer
`xbuf_free()`	release the memory previously allocated for a dynamic buffer

The servlet samples (`/csp` folder) demonstrate the syntax of all those functions.

But sending information is only half of the job: often, you will also need to get information sent by the client (via `GET` or `POST` HTTP requests).

Getting GET/POST parameters

G-WAN transparently processes GET and POST in the very same way to let you access parameters with the same code (via the get_arg() call), but you can also walk main()'s argv[] the 'hard' way (see the argv.c sample):

```
unsigned int i = 0;
while(i < argc)
{
    xbuf_xcat(reply, "argv[%u] '%s'<br>", i, argv[i]);
    i++;
}
```

Please refer to the csp/contact.c, csp/loan.c and csp/argv.c samples.

You can invoke those samples as follows:
http://127.0.0.1/csp?contact

Getting server "environment" variables

Traditional 'environment' variables are available to servlets. G-WAN variables, like the current HTTP date/time are also available: the work is already done by the server.

```
REQUEST          // char*  // "GET / HTTP/1.1\r\n..."
REQUEST_METHOD   // int    // 1=GET, 2=HEAD, 3=PUT, 4=POST
QUERY_STRING     // char*  // Request URL after '?'
CONTENT_TYPE     // int    // 1="x-www-form-urlencoded"
CONTENT_LENGTH   // int    // body length provided by client
SESSION_ID       // int    // 12345678 (range: 0-4294967295)
AUTH_TYPE        // int    // not implemented yet
REMOTE_ADDR      // char*  // "192.168.54.128"
REMOTE_PORT      // int    // 1460 (normal range: 1024-65535)
REMOTE_PROTOCOL  // int    // ((HTTP_major*1000)+HTTP_minor)
REMOTE_USER      // char*  // not implemented yet
USER_AGENT       // char*  // "Mozilla ... Firefox"
SERVER_SOFTWARE  // char*  // "G-WAN/1.0.2"
SERVER_NAME      // char*  // "domain.com"
SERVER_ADDR      // char*  // "192.168.10.14"
SERVER_PORT      // int    // 80 (443, 8080, etc.)
SERVER_DATE      // char*  // "Tue, 06 Jan 2009 06:12:20 GMT"
SERVER_PROTOCOL  // int    // ((HTTP_major*1000)+HTTP_minor)
WWW_ROOT         // char*  // the HTML pages root folder
CSP_ROOT         // char*  // the csp .C files folder
FNT_ROOT         // char*  // the fonts folder

DOWNLOAD_SPEED   // int*   // a multiple of the default 4,096 bytes/sec.
```

DOWNLOAD_SPEED lets you calm G-WAN's enthusiasm at slamming the door on the face of unpolite visitors, cutting connections that do not send or receive data sufficiently quickly.

The default (fair?) value is 4,096 bytes per second. If you feel that it is acceptable for clients to be slower, set DOWNLOAD_SPEED to an integer value > 1 (like 2, 3, 10...):

```
int *pDN_SPEED = 0;
get_env(argv, HTTP_CODE, &pDN_SPEED);
```

```
if(pDN_SPEED) // check that we got a pointer
   *pDN_SPEED = 2; // allow 2,048 bytes per second
```

If you don't trust all your visitors but would like a more permissive policy for a privileged group of users then you can use a G-WAN Handler to apply this option on a per case basis (by CIDR, IP address, authentication, etc.).

Servlets can also access G-WAN's internal performance counters:

```
CC_BYTES_IN      // unsigned long long (unsigned __int64 on Windows)
CC_BYTES_OUT     // unsigned long long (unsigned __int64 on Windows)
CC_BYTES_INDAY   // unsigned long long (unsigned __int64 on Windows)
CC_BYTES_OUTDAY  // unsigned long long (unsigned __int64 on Windows)
CC_ACCEPTED      // unsigned int  // total number of TCP connections
CC_CLOSED        // unsigned int  // total number of TCP connections
CC_REQUESTS      // unsigned int  // total number of requests
CC_HTTP_REQ      // unsigned int  // number of HTTP requests
CC_CACHE_MISS    // unsigned int  // requests not satisfied by the cache
CC_ACPT_TMO      // unsigned int  // attack: connection without request
CC_READ_TMO      // unsigned int  // attack: partial request received
CC_SLOW_TMO      // unsigned int  // attack: request sent too slowly
CC_SEND_TMO      // unsigned int  // attack: reply fetched too slowly
CC_CSP_REQ       // unsigned int  // number of Servlet requests
CC_STAT_REQ      // unsigned int  // number of Statistics requests
CC_HTTP_ERR      // unsigned int  // number of HTTP errors
CC_EXCEPTIONS    // unsigned int  // number of Servlet faults

US_HANDLER_DATA  // get a pointer to Listener-wide persistent data
US_VHOST_DATA    // get a pointer to a Virtual-Host persistent data
```

Template Engines

Web development frameworks inevitably come with a template system. C#, Java and PHP mix scripting, variables and HTML (each using a different proprietary syntax) to achieve "*independence between the application user interface and the application logic*".

The G-WAN `contact.c` sample is using an HTML template form with HTML comments to embed C script variables in the presentation layer:

```
<p><!--time--><br><!--ip--><br></p>
```

This choice has several advantages:

- the variable remains invisible until it is used (it's an HTML comment);
- the syntax is completely standard (that's not another patent mine-field);
- any other framework could use the same syntax overnight (openness);
- there is no limit about what you can put in such a variable (*you* decide).

Keeping it simple has some value.

Using Persistence Pointers

Servlets and Handlers can use persistence to store data tuples, a socket connected to a database server or another application server, etc.:

```
// get the Virtual Host persistent pointer
char *ptr = get_env(argv, US_VHOST_DATA, 0);

// just an example of what can be done
typedef struct hive_s
{
   void *my_whatever;
   void *my_list_or_tree;
   void *my_sql_persistent_connection;
} hive_t;

if(!ptr) // if the pointer has never been used, attach our structure
   ptr = (void*)malloc(sizeof(hive_t));

if(ptr)
   ptr->my_whatever = strdup("I want to remember this");
```

To store more than a single buffer, the persistence pointer can host linked-lists, trees, in-memory SQLite tables, memcached entries, etc.

To let you chose the most efficient tool for your needs, G-WAN just provides a pointer. If it is not used then it will not consume memory.

See `handlers/main.c` to see how to use `US_HANDLER_DATA` with a G-WAN Handler .
See `csp/contact.c` to see how to query other variables with `get_env()`.

Making Blocking BSD Socket Calls Run Asynchronously

Web frameworks are either blocking (performing poorly by stacking hundreds of threads) or asynchronous (and difficult to use because everything must be a state-machine).

> To perform and scale one must avoid blocking a server. Using many blocking threads is not as efficient as using true asynchronous calls (because of the threading overhead: more memory used by each thread, context switches, etc.).

Client connections are difficult to use with asynchronous servers because they have to re-use the HTTP server internal state-machine (and doing this requires clunky interfaces, just look at how difficult writing Nginx modules can be).

G-WAN lets you write ***procedural code*** using blocking BSD socket calls like `connect()`, `recv()` or `send()` – while behind the scene they run asynchronously.

With this feature, C scripts can process network events without waiting for them to complete. Without it, the **latency** of **database servers** or of other back-end **application servers** uselessly blocks an HTTP server (or reverse-proxy) like G-WAN.

And it works *transparently* with **existing TCP-based network libraries** like `libCURL`, `OpenSSL` or the `mySQL / PostgreSQL` client ANSI C libraries.

Of course, G-WAN´s `xbuf_frurl()` HTTP client (see `get_headers.c`, `request.c` or `attack.c`) is taking advantage of it to let you query remote servers without ever blocking G-WAN's threads.

Putting it all together

The `/csp/loan.c` sample uses `AJAX` to process a form without reloading the whole HTML page. When users press the 'Calculate' button, the loan is displayed in the same HTML form used to gather data entered by the end-user.

This example can be used as the basis of more complex Web 2.0 applications (G-WAN already issues session ids, see `get_env()` and `SESSION_ID`, and SQL libraries provide persistence for session handling):

```
Dear Philippe Martin, your loan goes as follows:
```

LOAN	DETAILS
Amount	10,000.00
Rate	3.50%
Term	1 year(s)
Cost	190.60 (1.91%)

YEAR 1				
MONTH	PAYMENT	INTEREST	PRINCIPAL	BALANCE
January	849.22	29.17	820.05	9,179.95
February	849.22	26.77	822.44	8,357.51
March	849.22	24.38	824.84	7,532.67
April	849.22	21.97	827.25	6,705.42
May	849.22	19.56	829.66	5,875.76
June	849.22	17.14	832.08	5,043.69
July	849.22	14.71	834.51	4,209.18
August	849.22	12.28	836.94	3,372.24
September	849.22	9.84	839.38	2,532.86
October	849.22	7.39	841.83	1,691.03
November	849.22	4.93	844.28	846.75
December	846.75	2.47	844.28	0.00

```
This page was generated in 0.02 ms.
(on a 3GHz CPU 1 millisecond = 3,000,000 CPU clock cycles)
```

PHP, Perl, Python, Java and C# are orders of magnitude slower than G-WAN C servlets.

To benchmark a C servlet you have to measure the C script execution time (printed above) but also the server processing and reply time which can be calculated by Apache Benchmark with different concurrency loads (ab -c 10, 100, 500, 1000):

```
ab -n 1000000 -c 100 -t 1 -k -H "Accept-Encoding: gzip"
"http://10.10.2.4:80/csp?loan&name=Eva&amount=10000&rate=3.5&term=10"
```

Modifying the term (number of years) lets you control the volume of calculations, the length of the resulting HTML page, and verify how it scales with high concurrencies.

This dedicated test framework will help you to make benchmarks and generate charts:
http://gwan.ch/source/ab.c.txt

Additional functions

The portable G-WAN calls below (documented in `gwan.h`) are available from C servlets:

`cycles64()` get the CPU clock cycle counter's value (64-bit value)
`getms()` get the current time in milliseconds (64-bit value)
`getus()` get the current time in microseconds (64-bit value)

`s_time()` equivalent to time(0) (but much faster under Windows)
`s_gmtime()` equivalent to gmtime(); but faster (and thread-safe)
`s_asctime()` equivalent to asctime(); but faster (and thread-safe)
`s_localtime()` equivalent to localtime(); but faster (and thread-safe)

`time2rfc()` format an HTTP date string from a given time_t value
`rfc2time()` return a time_t value from an HTTP date string

`sw_init()` a good pseudo-random numbers generator sw_rand()
`hw_init()` a true hardware random numbers generator hw_rand()

`get_arg()` get GET/POST application/x-www-form-urlencoded parameters
`get_env()` get G-WAN's "environment" variables

`url_encode()` encode an URL so you can use it
`escape_html()` encode a buffer so you can use it in HTML
`unescape_html()` decode a buffer
`html2txt()` remove all HTML tags from a buffer

`s_snprintf()` like the libc call, but with more tricks (all used by `xbuf_xcat`):

`%b` binary conversion (use `%llb` for 64-bit integers)
`%b` 8 => "1000"

`%B` encode a null-terminated string with base64
`%-B` decode a base64 null-terminated string
`%12B` encode a 12-byte binary buffer (null bytes do not stop encoding)

`%C` generate a string of n times the specified character

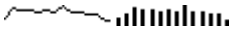
`%3C` 'A' => "AAA"

`%k` 1024 => "1 KB" (byte, KB, MB, GB... formatter; use `%llk` for 64-bit integers)

`gif_build()` build an in-memory GIF from a raw bitmap; see `fractal.c` and `chart.c`
`gif_parse()` parse an in-memory GIF from a buffer; see the `chart.c` sample

`dr_line()` raw bitmap drawing primitives, see `gwan.h`
`dr_circle()`
`dr_rect()`

`dr_chart()` draw area/bar/dot/line/pie/ring charts, see the `chart.c` sample

It can also draw sparklines: 

`md5()` to calculate MD5 hash values
`sha1()` to calculate SHA1 hash values
`sha2()` to calculate SHA2 hash values

`crc32()` to calculate CRC32 checksums
`adler32()` to calculate Adler32 checksums

`aes_init()` to setup an encryption key (use `hw_rand()`)
`aes_enc()` to encrypt data with the U.S. NIST FIPS PUB 197 standard (2001)

`gzip_cmp()` to compress data under the GZIP and ZLIB (deflate) standard formats
`lzjb_cmp()` to compress data very quickly
`lzjb_exp()` to decompress data very quickly

`cacheadd()` add (or update) a file or a buffer in G-WAN's memory cache
`cachedel()` delete a file or a buffer from G-WAN's memory cache

`sendemail()` send an email to an SMTP server (see the `contact.c` sample)

`jsn_frtext()` parse text to build a JSON tree
`jsn_totext()` export a JSON tree into text
`jsn_byindex()` search a value by its index in JSON tree
`jsn_byname()` search a value by its name in JSON tree
`jsn_byvalue()` search a value by its value in JSON tree
`jsn_add()` add data to a JSON tree
`jsn_del()` remove data from a JSON tree
`jsn_updt()` update data in a JSON tree
`jsn_free()` free the memory used by a JSON tree

Caching, Expires Header and “Pretty” URLs

Let’s say that you generate dynamic contents with a C servlet:
http://127.0.0.1/csp?servlet&arg1=123&arg2=456

But (a) you don’t want the same contents to be generated for each request, and (b) you want to make these contents available at a “pretty” URL (no “`/csp?servlet`”).

After you generate the page, just before calling return(200) in your code, insert the following code in your C servlet:

```
// note: no starting '/' in the virtual path
static char path[] = "tools/counter.html";  // a 'virtual' path
int expire = 0; // 0:never

// 200 is the HTTP status code returned by the server for this cached entry
// (play with redirections: ret = 301, or with cached JSON entries: ret = 1)
if(cacheadd(argv, path, reply->ptr, reply->len, 200, expire) < 0)
   error(); // out of memory

return 200; // return an HTTP code (200:'OK')
```

`'path'` is the “pretty” path (not the URL) that you want to use. `cacheadd()` will just update any existing cache entry.

Use a relevant file extension to let G-WAN pick a specific MIME type so that HTTP compression can be applied when needed (without extension, “`html/text`” is used).

The `expire` value can be 0 (never expire, staying cached until you delete it), or it can be the number of seconds before it will expire (60*60=3600 for a one-hour lifespan).

Expire lets you to put entries in the cache – and forget about them, but expire also lets G-WAN to generate relevant “`Expires:`“ and “`Cache-Control:`“ HTTP headers on your behalf (telling proxy servers and browsers to query G-WAN only when needed).

The expiration feature lets you define expiring links to a given resource for clients. See the cache0.c, cache1.c, cache2.c cache3.c and cache4.c samples.

HTTP Compression (gzip and deflate)

If a client supports gzip or deflate then servlet outputs that are > 100 bytes are compressed on the fly (compressing smaller buffers wastes resources).

G-WAN will not do it if your servlets add their own HTTP headers (allowing you to safely generate other kinds of documents than plain “text/html”, like images).

Note: gzip and deflate use the same (’deflate’ RFC 1951) compression method, but the gzip (RFC 1952) format is faster than the deflate (RFC 1950) format because the adler32 algorithm used by deflate is much slower than (any decent implementation of) the crc32 method used by gzip. Result: use gzip rather than deflate. You can also read those RFCs to see how much confusion rocket scientists can squeeze into a single page of text.

Scripts execution errors, crashes and debugging

At run time G-WAN signals syntax errors, undefined symbols, etc. in the terminal used to run gwan, before C servlets execute. This allows you to start G-WAN with servlets that (at least) compile and link.

G-WAN also “gracefully” handles C servlet crashes and reports where exactly in the C source code the fault happened (instead of stopping the server).

For example, if you let G-WAN run this code:

```
1. void crash() { *((int*)(0))=0xBADC0DE; } // write access violation
2. int  main () { crash(); return 200; }
```

G-WAN will tell you which line in your C source code file did it wrong:

```
Exception:       c0000005 Write Access Violation
Address:         06d3b413
Access Address:  00000000

Registers:       EAX=0badc0de CS=001b EIP=06d3b413 EFLGS=00010246
                 EBX=00000000 SS=0023 ESP=0166df34 EBP=0166df3c
                 ECX=00000000 DS=0023 ESI=00000104 FS=003b
                 EDX=0166fc58 ES=0023 EDI=0166f47c CS=001b

Call chain:(line) PgrmCntr(EIP) RetAddress FramePtr(EBP) StackPtr(ESP)
crash():     1      06d3b413      06d3b4a6   0166df3c      0166df34
main():      2      06d3b4a6      0042d1ea   0166df64      0166df34

Servlet: csp/crash.c
Query  : /csp?crash     (may be useful to reproduce the error)
Client : 127.0.0.1      (may be useful to identify recurring offenders)
```

Until you fix the code, G-WAN reports an “internal server error” (status 500).

G-WAN execution errors, crashes and debugging

When used in daemon mode, if a child dies the `gwan` parent process forks again to continue servicing clients. If there is a failure, it may be G-WAN (or something else), you need to know, and you must not have to search forever to find out.

The `/gwan/trace` file only lists the child start/stop status:

```
Fri, 28 Oct 2010 09:11:46 GMT: start
Fri, 28 Oct 2010 09:11:51 GMT: clean stop
```

If a child crashed, you will find a stack frames dump instead of a “`clean stop`”.

The `/gwan/gwan.log` file will also tell what happened before a new child was forked:

```
[Thu, 28 Oct 2010 10:25:16 GMT] * child normal exit(3)     exit code
```

```
[Sat, 28 Oct 2010 14:34:07 GMT] * child clean stop   Ctrl+C, gwan -k
[Sat, 28 Oct 2010 16:52:43 GMT] * child abort(11)       11 : SIGSEGV
```

The daily server HTML report also indicates how many forks took place, and lists the system, parent, and child uptimes:

```
System Uptime: 01 day(s) 00 month(s) 00 year(s) 12:32:44
Parent Uptime: 01 day(s) 00 month(s) 00 year(s) 10:40:40
Child  Uptime: 01 day(s) 00 month(s) 00 year(s) 10:40:40
fork: 1 (times parent started a child)
```

In daemon mode, if there is more than one fork then check `/gwan/trace`. If you have such a crash then contact me, I will do my best to help you find what caused the crash.

RESTFUL Web services

REST is a bunch of recommendations that aim to deliver stateless (and therefore scalable) Web services. The following suggestions are recurring:

– do not use query strings if possible (no `/csp?forum&topic=linking+issues`);
– use `GET` to fetch, `POST` to create, `PUT` to update, `DELETE` to erase data;
– keep all resources in a tree-like hierarchy (`/net/host/disk/dir/file`) ;
– keep URIs in lower-case (data can use upper-case);
– replace spaces by '_' (underscores);
– users must be able to bookmark all resources (so they can be cached too);
– resources must contain links to find more details about the resource: "`/products/412`" can contain the link "`/products/412/specifications`" ;
– use the "`Accept:`" HTTP header to let clients specify the format (xml, json, html...) they can use to read resources so your services can be more flexible;
– don't reply 404 for a partial path, reply with a parent or default resource;
– hide the server scripting technology (csp, jsp, php) so you can port applications to another language without changing the URLs.

Examples:

```
GET /csp?forum&listuser=Eva         (not RESTFUL: query, parameters)
GET /csp/forum/users/Eva            (OK: GET tree-like)

GET /csp/forum/interfaces/how_to_link_with_a_lib   (OK)

GET /csp?adduser&name=Robert         (not RESTFUL, use POST to create)

POST /csp/forum/users HTTP/1.1       (OK, use PUT to update data)
Host: gwan.ch
Content-Type: application/json
{ “user”: { “name”:”Eva” } }
```

As some vendors (like eBay) present APIs that they call “RESTFUL” and which are based on queries (?) and parameters (&), the concept is far from being strictly defined.

With (strict) RESTFUL URLs, it seems that you have first to test if the URL exists as a static content (like a directory). If none is found then you have to check if a servlet can match any part of the URL prefix before you report “404: Not found”.

Unless your server only serves dynamic contents, such a procedure is very inefficient.
This can be resolved by using:

– G-WAN Virtual Servers for each RESTFUL service like secure.host.com while host.com only serves non-RESTFUL services;

– You can also use a G-WAN Handler to rewrite URLs (and each Virtual Server can use a different Handler) in order to be truly RESTFUL;

– But the `/csp/` alias of `/csp?` makes your life easier. It lets G-WAN distinguish between static and dynamic contents and it removes the unwanted query.

Like for `GET /csp?hello`, make sure that `/csp/` starts your URL: `GET /csp/hello`

The rest is discipline: instead of using query parameters you will have to use a hierarchy (but no query) and attributes (instead of parameters) in your URLs:

```
GET /csp?loan&name=Eva&amount=10000&rate=3.5&term=10
```

would become something like:

```
GET /csp/loan/name/Eva/amount/10000/rate/3.5/term/10
```

Here, G-WAN cannot transparently parse ‘parameters’ like in a query because there is no explicit link between “`name`” and “`Eva`” or “`amount`” and “`10000`” in the syntax.

As REST does not completely exclude queries, we can use the best of both worlds:

```
GET /csp/loan/name=Eva/amount=10000/rate=3.5/term=10
```

G-WAN automatically parses parameters from this URL (like with a query) so you can continue using get_arg() with `REST` (instead of parsing it manually).

The only limitation with `/csp/` is that you cannot put your script in a `/gwan/csp/dir` sub-directory while `/csp?dir/loan` works fine. This is because if is hard to tell where the servlet path ends and where parameters start in `/csp/dir/loan/date/Lucy`

For `POST` and `PUT`, G-WAN can help by transparently parsing `JSON` entities in order to let you access data as usual with the `get_arg()` function.

Hierarchic `JSON` values will be addressed like this:

```
Content-Type: application/json
{ “user”: { “name”:”Eva” } }

char *name = “”;
get_arg(“user.name=”, &name, argv);
```

See the G-WAN JSON parser / renderer functions in the json.c sample.

Web Applications Security

Cross-site scripting, injection attacks or request forgery are made easy and having success for simple reasons which can easily be listed:

– the surface of vulnerability is expending with new Web browser features;
– web developers already have a job and just can't cope with these issues;
– fixing the whole stuff would severely harm the so-called 'advertising' business.

By identifying data flows, simple cryptographic tags would greatly limit the room for abuses in the “cool-features” area because servers could distinguish between clients (the good, the bad and the ugly) -even in a single aggregated flow.

More sophisticated users would find it priceless to be in a position to actually trust what transits on public networks (with today’s tools, this goal remains out of reach).

It is typically claimed that cryptography is weakened or avoided to preserve performances and scalability when securing content. This is mainly due to the fact that people reuse generic libraries instead of writing on-purpose code (like G-WAN).

A thing or two can also be done in this matter.

III. Extending the Joy

A development platform must let developers and third-parties extend its features. And it must be as easy to use as possible – both to save time and to avoid errors.

G-WAN works with:

- `Servlets` (to handle HTTP forms, query databases, etc.);
- `Handlers` (to filter, encode, authenticate, log, implement protocols, etc.);
- `Libraries` (to add new functions to Servlets and Handlers);
- `Applets` (on the client side) and an the optional Maintenance script.

A word about interfaces

Usually, plug-ins connect with the server through interfaces. They rely on formats that you have to learn, they are uselessly error-prone and complex – and they can even become obsolete and are replaced (it was the case for IBM Apache and Microsoft IIS).

For all those reasons, the best interface is none:

- `Servlets` copied into the /`csp` sub-folder will be used;
- `Handlers` copied into the `/handlers` sub-folder will be used;
- `Includes` copied into the `/include` sub-folder will be used;
- `Libraries` copied into the `/libraries` sub-folder will be used (#pragma link);
- `Fonts` copied into the `/fonts` sub-folder will be used;
- A `main.c` script copied into the `/gwan` folder will be used.

To disable a servlet/handler/library just delete or rename it extension (to *.cx, *.dlx -or anything else than the expected *.c and *.dll or *.so).

To disable any of these capabilities, remove (or rename) the `/csp` folder to completely disable servlets, the `/handlers` folder to completely disable Handlers, etc.

Servlets

Servlets let programmers build Web applications on the top of G-WAN.

Servlets let you build replies to client HTTP requests. A reply can be an HTML page, just HTTP headers, both, or a PNG image, an XML document, etc.

You do not have to stop and restart `gwan` to update modified servlets (or to load new ones). G-WAN does it on-the-fly.

Servlets are covered in Chapter II.

Handlers

Handlers are C scripts like servlets. But instead of just letting you build the reply of an HTTP request, they allow you to act at all the different stages of a connection:

(a) **after** the connection is **accepted**;

Use the client IP address to filter access to your server:

```
switch(ip_range) {
case x: return 0;    // close connection
case y: return 1;    // build reply based on created URL
case z: return 2;    // send reply provided in reply buffer
default: return 255; // continue normally with current data
}
```

(b) **after** data is **read** from the connections;

Here you can use G-WAN as a TCP server, controlling its behavior, decoding or altering a request, directly replying, etc.:

```
switch(choice) {
case x: return 0;    // close connection
case y: return 1;    // read more data from client
case z: return 2;    // send reply provided in reply buffer
default: return 255; // continue normally with current data
}
```

(c) **after** an HTTP request has been **parsed and validated**;

Here you can use G-WAN as a front-end server, and redirect or alter requests:

```
switch(choice) {
case x: return 0;    // close connection
case z: return 2;    // send reply provided in reply buffer
default: return 255; // continue normally with current data
}
```

(d) **before** the server reply is **sent** to the client;

You can encode the server reply before it is sent, or log the request with an alternate method (in selected cases for example), or stop HTTP keep-alives:

```
switch(choice) {
case z: return 0;    // close connection (before sending)
default: return 255; // continue normally with current data
}
```

Handlers have three entry points:

```
Int init(char *argv[], int argc);
int main(char *argv[], int argc);
int clean(char *argv[], int argc);
```

`init()` lets you define persistent data structures to hold white-lists or black-lists, etc.

`main()` is called for each server request and will do the job at each a/b/c/d step.

`clean()` is called by G-WAN when a virtual host (or the server) is closing. You can use it to free your persistent structures, save your custom counters on disk, etc.

There is a Handler sample called main.cxx located in your gwan/handlers folder. Just rename it to main.c to have it being used by G-WAN. It shows how to use the `US_HANDLER_DATA` persistence pointer.

Handlers can be used to to customize and extend G-WAN at will:

- `ip_acl.c` (filter incoming connections by IP addresses or CIDRs);
- `ip2geo.c` (filter or redirect incoming connections by country);
- `throttle.c` (limit the number of concurrent requests sent by a client);
- `url_wr.c` (rewrite URLs to hide servlets or to redirect to moved pages);
- `crypto.c` (decrypt HTTP requests and encrypt HTTP replies);
- `syslog.c` (log connections on a remote syslog server).

Handlers can even be used to implement other protocols like POP3, SMTP or IMAP, using G-WAN as a general-purpose socket server in addition to using it as a Web server (the less you have server processes installed and running, the less you will have maintenance and security troubles).

Handlers are defined on a per listener basis. They can't be defined on a per virtual host basis because when the before accept Handler is triggered the Host header has not yet been received (so we can't tell which virtual host should be served).

If you need to define specific handlers for a given Web site, just dedicate a listener for this Web site. You can define any number of IP addresses for a single machine, even with a single network interface, making it easy to create new listeners.

At the moment, only one handler can be defined per listener (a more elaborated mechanism will later wave this arbitrary limitation).

Libraries

Third-party (shared *.so or *.dll) Libraries are pre-compiled code used to extend the features made available to C servlets.

Sometimes, you may need to use closed-source resources (either for security: compiled code is harder to alter than source code, or for licensing reasons: the source code of a feature you really need is not available, or for convenience: features already available from the operating system).

G-WAN lets you use the Boutell GD library to create dynamic pictures, the GNU GSL library for scientific calculations, the Crypto library of your choice, and so on.

Two directives let you specify which libraries you want to use:

`#pragma include "[path]"`

lets you specify an additional path where #include files that you want to link with your servlet should be searched.

`#pragma link "[path]modulename[.ext]"`

lets you specify the (static or dynamic) libraries that you want to link with your servlet. It lets you link .c , .obj, .a/.lib and .so/.dll files (the `pragma link` order counts). By default, the extension is ".obj" if none is supplied.

Any open-source, commercial, system or custom-made shared library written in your favorite language can be used by G-WAN without modification nor dedicated interfaces. Start with `/lib` and `/usr/lib` (SQLite is already there).

Applets

Applets will be illustrated at a later date when real-life examples will be available.

The purpose of G-WAN applets is to give the client-side as much power as you can already find at the G-WAN server-side.

As the C language has full-access to the low-level resources of a machine, sand-boxing will be used to isolate the scope of Applets.

Maintenance Scripts

The maintenance script has no defined purpose: you decide what it will do.

If present in gwan's directory, the script called `main.c` will be executed until it elects to terminate (or until G-WAN is closed).

It can access G-WAN's internal structures and performance counters, like C servlets, but unlike servlets (or Handlers) it is not aimed at working on HTTP requests. The maintenance script is intended to sleep when it is idle, that is, most of the time.

You can use it, for example, to run external tasks, run other scripts, backup files, send alerts, etc. You can even use the maintenance script to run completely unrelated C programs by using a new G-WAN instance (`./gwan -r script.c`).

A fille called `main.cxx` is provided in the `gwan` folder. Just rename this maintenance script sample to `main.c` and it will show you how a maintenance script works.

Extending G-WAN further (PHP, Java, C#, C++, Python, Perl, Js, etc.)

You don't know, don't like or don't use ANSI C. Or you have a huge code-base in another language and you would like to use G-WAN with your favorite scripted or compiled language.

You can use a C Servlet or an Handler (after_read) to:

– redirect requests to another application server and then have G-WAN cache them,
– invoke compiled libraries (your compiled code invoked by your C script or Handler),
– call a script engine (via fastCGI, or any other interface).

As all other languages have been created in C you will not have trouble to interface C with whatever you need to use with C.

Just keep in mind that using external code will inevitably add overhead (slow-downs) and bugs to G-WAN.

The less you have layers of code, the safest (and fastest) your system will be.

G-WAN was created for this sole reason.

“Computing Science would benefit from more frequent analysis, critique, particularly self-critique. After all, thorough self-critique is the hallmark of any subject claiming to be a science.”

(Niklaus Wirth, *“Good Ideas, Through the Looking Glass”*, 2005)

1963, Ph.D. From the University of California at Berkeley

1965, Assistant Professor at Stanford University

1968, Professor at the Federal Institute of Technology (ETH) in Zurich

1982, Chairman of the Division of Computer Science at ETH Zurich

1984, ACM Turing Award Recipient
(for his programming languages: Euler, ALGOL-W, Modula, and Pascal)

A. Why is G-WAN so much faster than all others?

"What I find truly baffling are manuals -hundreds of pages long- that accompany software applications, programming languages, and operating systems. Unmistakably, they signal both a contorted design that lacks clear concepts and an intent to hook customers."
(Niklaus Wirth, "A Plea for Lean Software")

Niklaus Wirth has created applications, programming languages and operating systems. In *"On the composition of well-structured programs"* he wrote that *"our most important mental tool for coping with complexity is abstraction"*.

This is the part that Academia has messed with. "*Abstraction"* is a dangerous word as it does not tell which kind is desirable, nor how far the abstraction should be allowed to fly away from reality (the real world constraints, like gravity or temperature).

> Think *"big O"*. Having a way to classify the performances of algorithms is a good thing. But when the chosen metrics have nothing to do with the real world, then it is not surprising to be deceived by the results: not all arithmetic 'operations' have the same computational cost, and *"big O"* is completely ignoring realities like the wait state caused by reloading the CPU caches (this invisible 'operation' is largely dwarfing the cost of arithmetic 'operations').

Wirth wrote that we should not think *"in terms of computer instructions, bits, and 'logical words', but rather in terms and entities natural to the problem itself, abstracted in some suitable sense"*.

I would put a strong emphasis on *suitable* in *"suitable sense"*.

An abstraction should be a (preferably useful) verb. In our world, a high-level abstraction is something like 'list all A+ students'. In the world of computers a low-level abstraction is something like 'concatenate two character strings'.

So, there is a pyramid of abstractions, all laying on a large basis of low-level abstractions, with high-level abstractions on the higher floors.

And, if the basis is flawed because it is neglected (or purposely sabotaged), then you obviously cannot expect from the higher floors to do anything decently.

One major mistake I have seen all around is to oppose "coding" to "programming". Academics see the former as an uninteresting (and vulgar) low-level task left to a few embedded engineers (even the gaming industry, thanks to APIs and hardware lock-in, is no longer about "coding" any more) while the latter is, at least for Academia, the magnificent expression of human intelligence: creating ("big O") algorithms.

Too often, good algorithms are poorly implemented and ex-students make a poor choice of algorithms (they usually all make the same wrong choice – the one they were taught).

Some algorithms are better than others for a given task, so the favorite algorithm of a Master Thesis (that's rarely the simplest animal because old species have been discussed a long time ago) is not necessarily the one that your program needs.

Implementation ("coding"), as the 'low-level' basis of any abstraction, matters too.

> It matters so much that the only real way to achieve anything that works reasonably well is to hire serious coders to make the basis of any new system (whether abstractions are used or not, it makes no difference: the basis must be clean).
>
> Then, those who design the upper floors are merely 'users' of what has been done right in the first place. There's nothing wrong or offending at being an 'user'. But telling it this way, the way it is, redefines the priorities: first a strong basis, and then, the upper floors.

If you ignore this fundamental rule then you get something like MICROSOFT Windows. MICROSOFT, for various reasons (including the fact that hiring new graduates grants tax-breaks), has reached a point where Academia has become the only game in town.

The result is abstractions from bottom to top, made by people who have no idea about what "coding" means. Worse, they see the concept as a vestige of the past, obsolete, useless, while Intellectual Property (I.P.), like, say, patenting a smiley, is 'true' value.

This contempt for the value of reality is due to the most popular Academic in the abstraction area: Bjarne Stroustrup, a fervent and loyal MICROSOFT Windows user. Bjarne has spent his life corrupting the work of others: unlike C++, ANSI C never required to break initial specifications seen as "inadequate" a bit later. Twice, C++ programmers have had to rewrite all their code in order to make it compile with the new, "more appropriate", incompatible (but brand new and therefore brilliant) C++ official standard.

The curious will compare the number of characters of the C++ standard to the ANSI C standard (counting pages is irrelevant: the font size was reduced to cope with the '++').

But Bjarne did a wonderful job at promoting itself: the C++ language has decerebrated generations of CS students – despite a somewhat measured enthusiasm:

"C++ is an insult to the human brain."
(Niklaus Wirth)

"I invented the term Object-Oriented, and I can tell you I did not have C++ in mind."
(Alan Kay)

"There are only two things wrong with C++: The initial concept and the implementation."
(Bertrand Meyer)

And this is merely the opinion of well-educated Academics – Bjarne Stroustrup's peers.

History will report that too few Academic voices advocated for more common-sense. Reality may be a bit less politically correct – but that's what official history is for: painting ugly things with more acceptable colors.

So, now, why is G-WAN so much faster than all others?

The answer is simple: because Academia has (purposely) made generations of idiots. Wirth invited Academia – it's peers – to take the right direction and to shun corruption:

> *"Programs should be written for human readers as well as for computers. If this notion contradicts certain vested interests in the commercial world, it should at least find no resistance in academia."*
> (Niklaus Wirth, "A Plea for Lean Software")

The "vested interest" have made their way in public institutions, like justice and education:

> Cigarettes have been 'tuned' by Scientists with thousands of toxic chemicals to make smokers more severely addicted – and faster. So, cigarettes kill faster and nastier than tobacco alone, thanks to the marvels of Science.
>
> The U.S. Gov. fined the tobacco industry $130 billion for conspiring for decades to deceive the public about the dangers of their products. After intense lobbying, the sum of $130 billion has been cut to $10 billion.
>
> "T*he political people were pushing the buttons and ordering us to say what we said, and because of that, we failed to zealously represent the interests of the American public*" said the lawyer at Justice:
> http://www.washingtonpost.com/wp-dyn/content/article/2007/03/21/AR2007032102713_pf.html

Why proprietary (and technically inferior) Java or .Net are taught in public schools (a blatant promotion of private interests made at the expense of the taxpayer) while the (patent-free and technically superior) 40-year old C (used to build Java and .Net in the first place) is censored by Academia, the Guardian of The Temple of Knowledge?

If Science can happily kill for money, it can as well make sure that computers run much slower to help selling a few hundred millions more of them – every single year.

But abstractions (theory) and implementation (practice) are different by nature:

> *"Theory and practice sometimes clash. And when that happens, theory loses. Every single time."* (Linus Benedict Torvalds)

So, if you did not choose yet, it's still time to be on the right side. In a world crippled by a long-term crisis and capped CPU frequencies, efficiency will become fashionable again.

And, for most of us, using ultra-fast code will soon be the only possible way to do things.

“Survival, security, comfort, pleasure, novelty, understanding, contribution, love. True disinterested love can only come after we have visited all the other states. As long as we do not, we merely seek to find in others what we lack ourselves.”

(Pierre, G-WAN's author)

B. A candid review of Java, C# and PHP

We all have read that Java is 'the next step' of programming. C# has the same claim, which is not surprising since it is merely a copy of Java (just 4 times slower). PHP has a more exotic pedigree but has also heavily used 'copy & paste' in the R&D department.

I translated the `loan.c` G-WAN servlet from ANSI C (1972) into Java (1995), C# (2001) and PHP (1995). Here are my views on each language.

Claim #1: Portability

"Write once and execute anywhere", or so tells the slogan, *"because XYZ is portable"*. Java, C# and PHP are all written in *portable* C/C++. As a result, they are not more portable than C since a C compiler is necessary for any of them to exist in the first place.

Claim #2: Ease of use

The most bothering thing about Java, C# and PHP, is the fact that you have a hard time to find the API calls you need. Names are not following any coherent convention. The same goes for function arguments and their order. Plus, there are thousands of API calls (~6,000 for PHP) so you can search during hours to do the most basic task.

> Example: adding 'pretty thousands' to formatted numbers

ANSI C
```
char str[16];
sprintf(str, "a = %'.2f", amount);
```

Java
```
DecimalFormat df;
df = new DecimalFormat("0.00");
df.setGroupingUsed(true);
df.setGroupingSize(3);
PrintWriter m_out = response.getWriter();
m_out.printf("a = %s", df.format(amount));
```

C#
```
string str = "";
str += String.Format("{0:d}", amount);
```

PHP
```
$str .= sprintf("a = %s", number_format($amount, 2));
```

What's the point of creating an incompatible syntax if the new, so-called "easier to use" method is incredibly more complex and counter-intuitive than the 40-year old original?

Error reports come second. Java makes incredibly long reports for tiny things like missing punctuation – and despite the bloat, it does not always tell you what's wrong. C# is a superior nuisance as soon as you enter the 'exceptions' area (use a comma instead of a

point in locale-related data – and an exception will crash your program). PHP, well, let's be charitable with the less generously funded project.

Web application packaging is also high on the list. In fact, this is so confusing that experts from the vendors themselves have made (deadly) mistakes in this area when they sent to me their own 'enhanced' versions of my benchmarks: their code was never executed.

"Ease of use"? My foot. You can only agree with this claim if you don't know C.

Claim #3: Modern design

Let's look at the syntax. Modern languages surely do better than 40-year old C?

Example 1: source code comments

```
ANSI C    // this is a comment
Java      // this is a comment
C#        // this is a comment
PHP       //:: this is a comment ::
```

Example 2: if() or for() or while()

```
ANSI C    if(amount) ...
Java      if(amount != 0) ...
C#        if(amount != 0) ...
PHP       if($amount) :   ... endif
```

Example 3: multi-line litterals

```
ANSI C    char str[] = "this is a multi-line " "string";
Java      String str = "this is a multi-line " + "string";
C#        string str = "this is a multi-line " + "string";
PHP       $str .= "this is a multi-line " . "string";
```

Java and C# require an ending '+' for each intermediate line of a multi-line literal and are unable to understand implicit tests for a null value. Improvements, really?

PHP imposes a pointlessly complex syntax, borrowed from Pascal, or inherited from Java (which copied C) – but modified to become incompatible with the original. Other PHP requirements are genuine innovations, like its incredibly complex comments.

Where is the progress? I mean seriously? When you claim that your language is simpler, easier to use and to learn, shouldn't it be visible somewhere in the syntax itself if, as we have seen earlier, that's not the case with the design of the libraries?

Why is the syntax of the more recent programming languages (including the C++ pig) actually more complex than the syntax of ANSI C from which they are all derived?

The answer is simple: *"a contorted design is intented to hook customers".*

Claim #4: “C is difficult”

We have seen that the syntax of C is actually simpler. We have seen that the logic (if then else, while, for) is the same for all (copied from C). We have seen that the only real difference is in the huge (and incoherent) libraries offered by Java, C# and PHP.

But, like the languages themselves, those big libraries have been written in C. So the choice of the language matters less than how it is supposed to be used.

The main difference between C and Java, C# or PHP is the fact that C is not a monstrous collection of ready-to-push buttons (the C library only counts 146 functions): C’s 32 keywords let you build tailor-made buttons, good (libc) and bad ones (C#).

That’s what programming is all about: resolving problems.
Pressing buttons is not programming, that’s playing Lego.

Sure, not everyone wants to become an engineer – and playing Lego can be fun. But in this case, given the use of a similar logic (if then else, while, for), the choice of the language is secondary as compared to the availability of the ready-to-use features people need to resolve their problems.

Having a cleaner syntax, C merely lacks a wide collection of libraries available from a central repository to satisfy the needs of any given field (like, say, Web applications).

If BigCos did not do it, that’s because their agenda was about promoting their own solutions: patented (to exclude the competition) and overly complex (to lock-in users).

An unexpected event ruined their efforts: the CPU frequency halt – making room for C.

Claim #5: Security

Java, C# and PHP claim that the ANSI C language is “dangerous”. Go on secunia.com and search for Java, .Net or PHP – you will find dozens of critical security holes.

Compare this to the number of vulnerabilities found in ANSI C (for which the exact number of language implementation security holes is... zero).

Conclusion

Let’s sum it up. Java, C# and PHP are:

1. much less portable than ANSI C,
2. much less easy to learn than ANSI C,
3. much less coherent and concise than ANSI C,
4. much less innovating than ANSI C (they borrowed almost all from C),
5. much less secure than ANSI C.

And on the top of that Java, C# and PHP also:

– have bloated runtimes (PHP: 80 MB, Java: 100+ MB, C#: 200+ MB),

- are all orders of magnitude slower than ANSI C (C >> PHP >> Java >> C#),
- are constantly growing, becoming slower and more complex as time goes,
- are proprietary and locked by hundreds of patents (while ANSI C is free).

Sadly , all the claims of progress are just marketing hype – duly relayed by Academia.

In the light of these facts, we understand why the heavy hand of lobbying is necessary to push the 'modern' programming languages in public schools all over the World.

The drama is that these generations have been sacrificed: CS students are end-users of doomed 'technologies' designed to be as inefficient as possible to sell more hardware.

All went fine as long as the CPU frequency was hiding the facts. And today's global recession will not make it easy to "throw more hardware (and electricity) at the problem".

The opportunity is that there's now a bunch of vacant thrones: BigCos would have to throw away all their existing lines of products – and re-invent themselves to supplant the new incoming wild Darwinian creatures (Mother Nature hates gaps).

History shows that incumbents do not re-invent themselves: Micro-Soft did it to IBM. Incumbents want to make their confortable position last as long as possible.
Today is a good time for the new clunky World Leader to be ousted.

C. What about Google Go?

Another junk-language or a real innovation? Given its pedigree, I was curious to know.

First, Go lists more than 80 authors and more than 100 contributors. GOOGLE says that this is a “small project”. I wonder what resources GOOGLE assigns to large projects.

Second, Ken Thompson is a co-author. In 1984’s *“Reflections on Trusting Trust”*, he brilliantly demonstrated how source code audits can be made pointless. Ken created the B language in 1969. Dennis Ritchie created C in 1972. Both received the ACM Turing Award for having created Unix. The A+ league.

Should Go be called *“B, the return”* or rather *“B++”*? Not those two. Go’s syntax borrowed more from BCPL (B’s ancestor created in 1966 by Martin Richards) – than from B itself. So that would rather be *“BCPL++”* if we had to derive a name from its venerable roots.

Predictably, Go is not the average ‘modern’ language. Behind an apparent bareness Go is hardly hiding the impressive minds behind the gazillions of polished details, the clever choices and the libraries provided with this (prototype) language.

> But... there is a “but”. If you know asm (1950), COBOL (1959), and C (1972) then C++ (1983) looks more like COBOL than C because it is a “ready-to-wear” straight-jacket which is defeating the very idea of programming in the first place.

The usual argument is called “productivity” (learning curve, amount of code per developer, error avoidance or detection, complexity of the program, resulting software cost, maintenance cost, and relative developer costs vs. machines + energy costs).

But productivity is rarely achieved by its most enthusiastic promoters (see the review of C#, Java and PHP earlier in this document, and how C compares – about productivity).

If a language gives one or two ways to resolve a given problem, then developers will not make it wrong: they just have to copy & paste from the yellow-pages-thick online doc.

As a result, developers will all use the same stuff (good-bye innovation). As G-WAN illustrates it, innovation can leverage productivity by making developer tools simpler, cleaner, safer, smaller and much faster – which on the top of that waves the highest recurring costs (such as hardware, floor space and high energy consumption upgrades).

If you use Go, C++, C# or Java, you will use hidden mechanisms without wondering how they work. That’s the problem. When one limits what users can do, they are locked-in. That’s usually done by injecting libraries as part of the language core. C doesn’t do that: you can use any library you want – but you are not forced to use any.

C will beat Go’s advanced features – every single time – because C gives you this freedom of doing it right that Go denies to you. Trading efficiency for productivity is not needed: libraries can be made optional (rather than unavoidable).

Would it be a progress for Java, C# or PHP developers to switch to Go?

That might not be easy, but yes, Go is indisputably better than Java, C# or PHP.

Is Go superior to C?
Today, C is simpler, easier to learn, more powerful – and it does not limit you.

> Go is very close to be better than C – that would have been the case if its authors did not insist to impose their (necessarily limited) views as the only way to do things.
>
> Go has enough value by its own. It should not try to copy the defects of C++, Java, C# or PHP: Go can provide any library that its authors think might be useful but they should not build its core on it.
>
> Doing so means that nobody will be able to make Go fit specific needs without using another more flexible tool, like C. That's killing the language: coders will feel betrayed by being denied the right of doing things better than the actual design of Go.
>
> Libraries are more desirable because they widen the choice instead of restricting it.

So, what is the value of Go's advanced features? Go's design could shine instead of being tarnished by arbitrary choices (that will stay forever, bringing the language down instead of leveraging it), if, unlike C++, Go's advanced features were presented for what they are: libraries that people are free to use.

Please note that this opinion is based on what Go, a prototype, is today. Go's basis makes it the "better C" that Bjarne Stroustrup so miserably failed to deliver. It is still time to make Go become equally useful for the veteran as it already is for the Web developer.

To sum it up: be careful not to make nested general-purpose libraries the only way to do things in Go's core. This has already been done before Go, and C survived more than decently because of this too common flaw in the more 'modern' programming languages supposed to replace it.

> "A language that doesn't have everything is actually easier to program in than some that do." (Dennis M. Ritchie)

Being in charge of G-WAN, that's a lesson I should carefully apply to myself too.

It is just too easy to be wrong. What matters is not to be wrong for too long.

Epilogue: Technology's Value – for *Who?*

Open markets encourage competition and generate challengers who, by offering better solutions to consumers, replace less adequate incumbents.

At least, that's the way the theory is sold. In practice, if history is of any help to analyze the present, BigCos are constantly backed by government largesses (gold-plated contracts and legal leniency) – thanks to generous pay-back schemes called "lobbying":

> *"Schumpeter criticized the 'corruption eruption' in business (May 1st), but I wonder if we really are on such moral high ground. In foreign countries, businesses pay bribes; in America, they contribute to political campaign funds. That could be a distinction without a difference."*
> (Robert Kennedy, The Economist – May 27th 2010)

"Open markets", clearly, do not work. Or, to be fair with the theory: in practice, the theory is never applied to the *"too big to fail"* players, the rules being only relevant for you and me, those who pay the taxes that BigCos prefer to withdraw from the government budget (as an excuse, they know first-hand how government's money is mis-used).

Now, let's have a look at the results for consumers: we, taxpayers, are funding the governments which are funding BigCos. What is our compensation?

> Technology that is as inefficient as possible to control our ability to challenge BigCos, and as efficient as possible to brainwash and spy on us to protect the status-quo.

When a flawed system has for only goal to sustain itself (whatever it takes and at the cost of all) then it is time to reconsider the notion of patriotism we learned at school:

> *"A patriot must always be ready to defend his country against his government."* (Edward Abbey)

Therefore, if you are willing to become a challenger:

> *"Don't look at what the industry is doing, look at what they're not doing and focus on that. That's where the real disruptive technology comes from. "* (Alexei Erchak)

And, if you are a business or a consumer:

Vote with your wallet. Stop buying BigCo technology designed to lock-in you, to limit you, and to deceive you. Invest your energy (time, money) in projects where people contribute to advance progress that clearly benefits you.

The Believe-Nothing Religion

Defenders of the status-quo often claim that “liberty”, “peace” and “justice“ are just empty moral slogans used by challengers to get the support of the masses with the only goal of satisfying their own personal ambitions. And in their hands, that’s often the case.

By destroying people’s beliefs, they destroy theirs hopes and dignity, making them feel weak and unmotivated: *“why make efforts or be loyal to anyone if nothing makes sense in such a generally corrupted world?”*

> MICROSOFT for example, has often explained that it is sued by inferior players unable to compete with them (on a *“fair and open market”*, of course) – and that MICROSOFT is the leader only because *“it better serves the needs of consumers”*.
>
> They seriously state that there is no difference between challengers and incumbents – at least after challengers became incumbents, at which point challengers are also supposed to *“do whatever it takes”* to stay at the top of the pyramid.

Stating that everybody is animated by the burning desire to abuse others insidiously suggests that the Great Art of Deception is the only way to make progress.

Invalidating this affirmation is easy. Just look at *how* one is trying to make progress:

– is it with a systematic stream of lies and corruption to get more power on others?
– or is it by really serving better the needs of users to let us all make progress?

Legitimacy comes from indisputable merit. This is why they fight merit with so much rage.

When one is busy making things right, he has no time (and no desire) for anything else. This sane and fully-satisfactory exercise does something more to the practitioner:

The only way to do something right is to avoid cheating. We all become what we do:

> As an engineer (or champion) successfully forces the doors of new unexplored territories, he builds this self-confidence that fuels his motivation, pushing him further.
>
> Inversely, as cheaters improve their deception skills they also destroy their ability to do anything else correctly... forcing them to rely even more on treachery.

At the end of the game, champions deliver while cheaters leave myriads of victims. And because the “Justice” dept. is corrupt we all have to pay for their “high-fliers” lifestyle.

Moral of the story: the more you work, the better you become at the task.
And if this is useful to others then you will get the dividends of your efforts.

Feedback

Suggestions are welcome, but as my time is limited try to follow the guidelines below:

– most questions and suggestions are more appropriate on the Forum:

http://forum.trustleap.com/

but you can also use the feedback form available on http://gwan.ch/ to contact me directly, in which case:

– use a relevant subject in your email so we know what you want,

– please go straight to the point and give a *real-life* example,

– be kind: it's version 1 so there is obvious room for enhancements.

If many software vendors do not let you contact them (or do it in a way that defeats its purpose), there is a reason: this is a very time-consuming process.

The only way to keep this service available is to respect its constraints.

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>
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Suggested One Line Program Description

G-WAN is a Web Application Server with ‘edit & play’ C servlets

Suggested Description

G-WAN is a Web server and an application server with C servlets and the whole takes 100 KB of code in addition to be far faster than other available Web servers.

C servlets are ‘edit & play’ scripts that let you use the power of C with the convenience of scripts. G-WAN is free for all. Feel free to distribute it around you!

Requirements

G-WAN Requires Windows XP (or more recent), or Linux (Ubuntu 8.10+) 32-bit

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