Yaws - Yet Another Web Server

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Contents

1 Introduction **3**

1.1 Prerequisites 4

1.2 A tiny example 4

2 Compile, Install, Config and Run **6**

2.0.1 Compile and Install 6

2.0.2 Configure 7

3 Static content **10**

4 Dynamic content **11**

4.1 Introduction 11

4.2 EHTML 11

4.3 POSTs 16

4.3.1 Queries 16

4.3.2 Forms 16

4.4 POSTing files 17

5 Mode of operation **20**

5.1 On the fly compilation 20

5.2 Evaluating the Yaws Code 21

6 SSL **22**

7 Applications **23**

7.1 Login scenarios 23

7.1.1 The session server 23

7.1.2 Arg rewrite 25

7.1.3 Authenticating . . . 25
7.1.4 Database driven applications . . . 27
7.2 Appmods . . . 27
7.3 The opaque data . . . 28
7.4 Customizations . . . 29
7.4.1 404 File not found . . . 29
7.4.2 Crash messages . . . 30
7.5 Stream content . . . 30
7.6 All out/1 return values . . . 31

8 Debugging and Development **33**
8.1 Logs . . . 33

9 External scripts via CGI **34**

10 FastCGI **35**
10.1 The FastCGI Responder Role . . . 35
10.2 The FastCGI Authorizer Role . . . 36
10.3 The FastCGI Filter Role . . . 36
10.4 FastCGI Configuration . . . 36

11 Security **37**
11.1 WWW-Authenticate . . . 37

12 Embedded mode **39**
12.1 Creating Global and Server Configurations . . . 39
12.2 Starting Yaws in Embedded Mode . . . 40

13 The config file - yaws.conf **41**
13.1 Global Part . . . 41
13.2 Server Part . . . 42
13.3 Configuration Examples . . . 45

Chapter 1

Introduction

YAWS is an ERLANG web server. It's written in ERLANG and it uses ERLANG as its embedded language similar to PHP in Apache or Java in Tomcat.

The advantages of ERLANG as an embedded web page language as opposed to Java or PHP are many.

- Speed - Using ERLANG for both implementing the web server itself as well as embedded script language gives excellent dynamic page generation performance.
- Beauty - Well this is subjective
- Scalability - due to the light weight processes of ERLANG , YAWS is able to handle a very large number of concurrent connections

YAWS has a wide feature set, it supports:

1. HTTP 1.0 and HTTP 1.1
2. Static content page delivery
3. Dynamic content generation using embedded ERLANG code in the HTML pages
4. Common Log Format traffic logs
5. Virtual hosting with several servers on the same IP address
6. Multiple servers on multiple IP addresses.
7. HTTP tracing for debugging
8. An interactive interpreter environment in the Web server while developing and debugging the web site.

9. RAM caching of commonly accessed pages.
10. Full streaming capabilities of both up and down load of dynamically generated pages.
11. SSL
12. Support for WWW-Authenticated pages.
13. Support API for cookie based sessions.
14. Application Modules where virtual directory hierarchies can be made.
15. Embedded mode

1.1 Prerequisites

This document requires that the reader:

- Is well acquainted with the ERLANG programming language
- Understands basic Web technologies.

1.2 A tiny example

We introduce YAWS by help of a tiny example. The web server YAWS serves and delivers static content pages similar to any old web server, except that YAWS does this much faster than most web servers. It's the dynamic pages that makes YAWS interesting. Any page with the suffix ".yaws" is considered a dynamic YAWS page. A YAWS page can contain embedded ERLANG snippets that are executed while the page is being delivered to the WWW browser.

Example 1.1 is the HTML code for a small YAWS page.

```
<html>

<p> First paragraph

<erl>
out(Arg) ->
    {html, "<p>This string gets inserted into HTML document dynamically"}.
</erl>

<p> And here is some more HTML code

</html>
```

Figure 1.1: Example 1.1

It illustrates the basic idea behind YAWS . The HTML code can contain <erl> and </erl> tags and inside these tags an ERLANG function called `out/1` gets called and the output of that function is inserted into the HTML document, dynamically.

It is possible to have several chunks of HTML code together with several chunks of ERLANG code in the same YAWS page.

The `Arg` argument supplied to the automatically invoked `out/1` function is an ERLANG record that contains various data which is interesting when generating dynamic pages. For example the HTTP headers which were sent from the WWW client, the actual TCP/IP socket leading to the WWW client. This will be elaborated on throughly in later chapters.

The `out/1` function returned the tuple `{html, String}` and `String` gets inserted into the HTML output. There are number of different return values that can be returned from the `out/1` function in order to control the behavior and output from the YAWS web server.

Chapter 2

Compile, Install, Config and Run

This chapter is more of a "Getting started" guide than a full description of the YAWS configuration. YAWS is hosted on Sourceforge at `http://sourceforge.net/projects/erlyaws/`. This is where the source code resides in a CVS repository and the latest unreleased version is available through anonymous CVS through the following commands:

```
# export CVS_RSH=ssh
# export CVSROOT=:pserver:anonymous@cvs.erlyaws.sourceforge.net:/cvsroot/erlyaws
# cvs  login
# cvs -z3 co .
```

Released version of YAWS are available either at the Sourceforge site or at `http://yaws.hyber.org/download`.

2.0.1 Compile and Install

To compile and install a YAWS release one of the prerequisites is a properly installed ERLANG system. YAWS runs on ERLANG releases OTP R8 and later. Get ERLANG from `http://www.erlang.org/`

Compile and install is straight forward:

```
# cd /usr/local/src
# tar xfz yaws-X.XX.tar.gz
# cd yaws
# ./configure && make
# make install
```

The make command will compile the YAWS web server with the `erlc` compiler found by the configure script.

- `make install` - will install the executable called `yaws` in `/usr/local/bin/` and a working configuration file in `/etc/yaws.conf`

- `make local_install` - will install the executable in `$HOME/bin` and a working configuration file in `$HOME/yaws.conf`

While developing a YAWS site, it's typically most convenient to use the local_install and run YAWS as a non-privileged user.

2.0.2 Configure

Let's take a look at the config file that gets written to $HOME after a local_install.

```
# first we have a set of globals

logdir = .
ebin_dir = /home/klacke/yaws/yaws/examples/ebin
include_dir = /home/klacke/yaws/yaws/examples/include

# and then a set of servers

<server localhost>
        port = 8000
        listen = 127.0.0.1
        docroot = /home/klacke/yaws/yaws/scripts/../www
</server>
```

Figure 2.1: Minimal Local Configuration

The configuration consists of an initial set of global variables that are valid for all defined servers.

The only global directive we need to care about for now is the logdir. YAWS produces a number of log files and they will - using the Configuration from Figure 2.1 - end up in the current working directory. We start YAWS interactively as

```
# ~/bin/yaws -i
Erlang (BEAM) emulator version 5.1.2.b2 [source]

Eshell V5.1.2.b2  (abort with ^G)
1>
=INFO REPORT==== 30-Oct-2002::01:38:22 ===
Using config file /home/klacke/yaws.conf
=INFO REPORT==== 30-Oct-2002::01:38:22 ===
Listening to 127.0.0.1:8000 for servers ["localhost:8000"]

1>
```

By starting YAWS in interactive mode (using the command switch *-i* we get a regular ERLANG prompt. This is most convenient when developing YAWS /http pages. For example we:

- Can dynamically compile and load optional helper modules we need.
- Get all the crash and error reports written directly to the terminal.

The configuration in Example 2.1 defined one HTTP server on address 127.0.0.1:8000 called "localhost". It is important to understand the difference between the name and the address of a server. The name is the expected value in the client Host: header. That is typically the same as the fully qualified DNS name of the server whereas the address is the actual IP address of the server.

Since YAWS support virtual hosting with several servers on the same IP address, this matters.

Nevertheless, our server listens to *127.0.0.1:8000* and has the name "localhost", thus the correct URL for this server is *http://localhost:8000*.

The document root (docroot) for the server is set to the www directory in the YAWS source code distribution. This directory contains a bunch of examples and we should be able to run all those example now on the URL *http://localhost:8000*.

Instead of editing and adding files in the YAWS www directory, we create yet another server on the same IP address but a different port number - and in particular a different document root where we can add our own files.

```
# mkdir ~/test
# mkdir ~/test/logs
```

Now change the config so it looks like this:

```
logdir = /home/klacke/test/logs
ebin_dir = /home/klacke/test
include_dir = /home/klacke/test

<server localhost>
        port = 8000
        listen = 127.0.0.1
        docroot = /home/klacke/yaws/yaws/www
</server>

<server localhost>
        port = 8001
        listen = 127.0.0.1
        docroot = /home/klacke/test
</server>
```

We define two servers, one being the original default and a new pointing to a document root in our home directory.

We can now start to add static content in the form of HTML pages, dynamic content in the form of .yaws pages or ERLANG .beam code that can be used to generate the dynamic content.

The load path will be set so that beam code in the directory `~/test` will be automatically loaded when referenced.

It is best to run YAWS interactively while developing the site. In order to start the YAWS as a daemon, we give the flags:

```
# yaws -D --heart
```

The *-D* or *–daemon* flags instructs YAWS to run as a daemon and the *–heart* flag will start a heartbeat program called heart which restarts the daemon if it should crash or if it stops responding to a regular heartbeat. By default, heart will restart the daemon unless it has already restarted 5 times in 60 seconds or less, in which case it considers the situation fatal and refuses to restart the daemon again. The *-heart-restart=C,T* flag changes the default 5 restarts in 60 seconds to *C* restarts in *T* seconds. For infinite restarts, set both *C* and *T* to 0. This flag also enables the *–heart* flag.

Once started in daemon mode, we have very limited ways of interacting with the daemon. It is possible to query the daemon using:

```
# yaws -S
```

This command produces a simple printout of Uptime and number of hits for each configured server.

If we change the configuration, we can HUP the daemon using the command:

```
# yaws -h
```

This will force the daemon to reread the configuration file.

Chapter 3

Static content

YAWS acts very much like any regular web server while delivering static pages. By default YAWS will cache static content in RAM. The caching behavior is controlled by a number of global configuration directives. Since the RAM caching occupies memory, it may be interesting to tweak the default values for the caching directives or even to turn it off completely.

The following configuration directives control the caching behavior

- *max_num_cached_files = Integer* YAWS will cache small files such as commonly accessed GIF images in RAM. This directive sets a maximum number on the number of cached files. The default value is 400.
- *max_num_cached_bytes = Integer* This directive controls the total amount of RAM which can maximally be used for cached RAM files. The default value is 1000000, 1 megabyte.
- *max_size_cached_file = Integer*

  This directive sets a maximum size on the files that are RAM cached by YAWS . The default value i 8000, 8 batters.

It may be considered to be confusing, but the numbers specified in the above mentioned cache directives are local to each server. Thus if we have specified `max_num_cached_bytes = 1000000` and have defined 3 servers, we may actually use $3 * 1000000$ bytes.

Chapter 4

Dynamic content

Dynamic content is what YAWS is about. Most web servers are designed with HTTP and static content in mind whereas YAWS is designed for dynamic pages from the start. Most large sites on the Web today make heavy use of dynamic pages.

4.1 Introduction

When the client GETs a page that has a .yaws suffix, the YAWS server will read that page from the hard disk and divide it in parts that consist of HTML code and ERLANG code. Each chunk of ERLANG code will be compiled into a module. The chunk of ERLANG code must contain a function `out/1`. If it doesn't the YAWS server will insert a proper error message into the generated HTML output.

When the YAWS server ships a .yaws page it will process it chunk by chunk through the .yaws file. If it is HTML code, the server will ship that as is, whereas if it is ERLANG code, the YAWS server will invoke the `out/1` function in that code and insert the output of that `out/1` function into the stream of HTML that is being shipped to the client.

YAWS will (of course) cache the result of the compilation and the next time a client requests the same .yaws page YAWS will be able to invoke the already compiled modules directly.

4.2 EHTML

There are two ways to make the `out/1` function generate HTML output. The first and most easy to understand is by returning a tuple `{html, String}` where `String` then is regular HTML data (possibly as a deep list of strings and/or binaries) which will simply be inserted into the output stream. An example:

```
<html>
<h1> Example 1 </h1>

<erl>
out(A) ->
    Headers = A#arg.headers,
    {html, io_lib:format("You say that you're running ~p",
```

```
                        [Headers#headers.user_agent])}.

</erl>

</html>
```

The second way to generate output is by returning a tuple `{ehtml, EHTML}`. The term `EHTML` must adhere to the following structure:

$EHTML = [EHTML] | \{TAG, Attrs, Body\} | \{TAG, Attrs\} | \{TAG\} | binary() | character()$

$TAG = atom()$

$Attrs = [\{HtmlAttribute, Value\}]$

$HtmlAttribute = atom()$

$Value = string() | atom()$

$Body = EHTML$

We give an example to show what we mean: The tuple

```
{ehtml, {table, [{bgcolor, grey}],
         [
          {tr, [],
           [
            {td, [], "1"},
            {td, [], "2"},
            {td, [], "3"}
           ]
          },
          {tr, [],
           [{td, [{colspan, "3"}], "444"}]}]}}.
```

Would be expanded into the following HTML code

```
<table bgcolor="grey">
  <tr>
    <td> 1 </td
    <td> 2 </td>
    <td> 3 </td>
  </tr>
  <tr>
    <td colspan="3"> 444 </td>
  </tr>
</table>
```

At a first glance it may appears as if the HTML code is more beautiful than the ERLANG tuple. That may very well be the case from a purely aesthetic point of view. However the ERLANG code has the advantage

of being perfectly indented by editors that have syntax support for ERLANG (read Emacs). Furthermore, the ERLANG code is easier to manipulate from an ERLANG program.

As an example of some more interesting ehtml we could have an `out/1` function that prints some of the HTTP headers.

In the www directory of the YAWS source code distribution we have a file called `arg.yaws`. The file demonstrates the Arg #arg record parameter which is passed to the `out/1` function.

But before we discuss that code, we describe the Arg record in detail.

Here is the `yaws_api.hrl` file which is in included by default in all YAWS files. The #arg record contains many fields that are useful when processing HTTP request dynamically. We have access to basically all the information which associated to the client request such as:

- The actual socket leading back to the HTTP client
- All the HTTP headers - parsed into a #headers record.
- The HTTP request - parsed into a #http_request record
- clidata - Data which is POSTed by the client
- querydata - This is the remainder of the URL following the first occurrence of a ? character - if any.
- docroot - The absolute path to the docroot of the virtual server that is processing the request.

```
-record(arg, {
          clisock,        %% the socket leading to the peer client
          client_ip_port, %% {ClientIp, ClientPort} tuple
          headers,        %% headers
          req,            %% request
          clidata,        %% The client data (as a binary in POST requests)
          server_path,    %% The normalized server path
          querydata,      %% Was the URL on the form of ...?query (GET reqs)
          appmoddata,     %% the remainder of the path leading up to the querey
          docroot,        %% where's the data
          docroot_mount,  %% virtual directory e.g /myapp/ that the docroot
                          %%  refers to.
          fullpath,       %% full path to yaws file
          cont,           %% Continuation for chunked multipart uploads
          state,          %% State for use by users of the out/1 callback
          pid,            %% pid of the yaws worker process
          opaque,         %% useful to pass static data
          appmod_prepath, %% path in front of: <appmod><appmoddata>
          prepath,        %% Path prior to 'dynamic' segment of URI.
                          %%  ie http://some.host/<prepath>/<script-point>/d/e
                          %% where <script-point> is an appmod mount point,
                          %% or .yaws,.php,.cgi,.fcgi etc script file.
          pathinfo        %% Set to 'd/e' when calling c.yaws for the request
```

```
                        %% http://some.host/a/b/c.yaws/d/e
        }).


-record(http_request, {method,
                       path,
                       version}).


-record(headers, {
          connection,
          accept,
          host,
          if_modified_since,
          if_match,
          if_none_match,
          if_range,
          if_unmodified_since,
          range,
          referer,
          user_agent,
          accept_ranges,
          cookie = [],
          keep_alive,
          location,
          content_length,
          content_type,
          content_encoding,
          authorization,
          transfer_encoding,
          other = []   %% misc other headers
         }).
```

There are a number of *advanced* fields in the #arg record such as `appmod`, `opaque` that will be discussed in later chapters.

Now, we show some code which displays the content of the Arg #arg record. The code is available in yaws/www/arg.yaws and after a a `local_install` a request to *http://localhost:8000/arg.yaws* will run the code.

```
<html>

<h2> The Arg </h2>

<p>This page displays the Arg #argument structure
supplied to the out/1 function.
```

```
<erl>


out(A) ->
    Req = A#arg.req,
    H = yaws_api:reformat_header(A#arg.headers),
    {ehtml,
     [{h4,[], "The headers passed to us were:"},
      {hr},
      {ol, [],lists:map(fun(S) -> {li,[], {p,[],S}} end,H)},

      {h4, [], "The request"},
      {ul,[],
       [{li,[], f("method: ~s",  [Req#http_request.method])},
        {li,[], f("path: ~p",    [Req#http_request.path])},
        {li,[], f("version: ~p", [Req#http_request.version])}]},

      {hr},
      {h4, [], "Other items"},
      {ul,[],
       [{li,[], f("clisock from: ~p", [inet:peername(A#arg.clisock)])},
        {li,[], f("docroot: ~s",      [A#arg.docroot])},
        {li,[], f("fullpath: ~s",     [A#arg.fullpath])}]},
      {hr},
      {h4, [], "Parsed query data"},
      {pre,[], f("~p", [yaws_api:parse_query(A)])},
      {hr},
      {h4,[], "Parsed POST data "},
      {pre,[],  f("~p", [yaws_api:parse_post(A)])}]}.

</erl>

</html>
```

The code utilizes 4 functions from the `yaws_api` module. `yaws_api` is a general purpose www api module that contains various functions that are handy while developing YAWS code. We will see many more of those functions during the examples in the following chapters.

The functions used are:

- `yaws_api:f/2` alias for `io_lib:format/2`. The `f/2` function is automatically `-included` in all YAWS code.
- `yaws_api:reformat_header/1` — This function takes the #headers record and unparses it, that is reproduces regular text.
- `yaws_api:parse_query/1` — The topic of next section.

- `yaws_api:parse_post/1` — Ditto.

4.3 POSTs

4.3.1 Queries

The user can supply data to the server in many ways. The most common is to give the data in the actual URL. If we invoke:

```
GET http://localhost:8000/arg.yaws?kalle=duck&goofy=unknown
```

we pass two parameters to the *arg.yaws* page. That data is URL-encoded by the browser and the server can retrieve the data by looking at the remainder of the URL following the ? character. If we invoke the `arg.yaws` page with the above mentioned URL we get as the result of `yaws_parse_query/1`:

$kalle = duck$

$goofy = unknown$

In ERLANG terminology, the call `yaws_api:parse_query(Arg)` returns the list:

```
[{kalle, "duck"}, {goofy, "unknown"}]
```

Note that the first element is transformed into an atom, whereas the value is still a string.

hence, a web page can contain URLs with a query and thus pass data to the web server. This scheme works both with GET and POST requests. It is the easiest way to pass data to the Web server since no FORM is required in the web page.

4.3.2 Forms

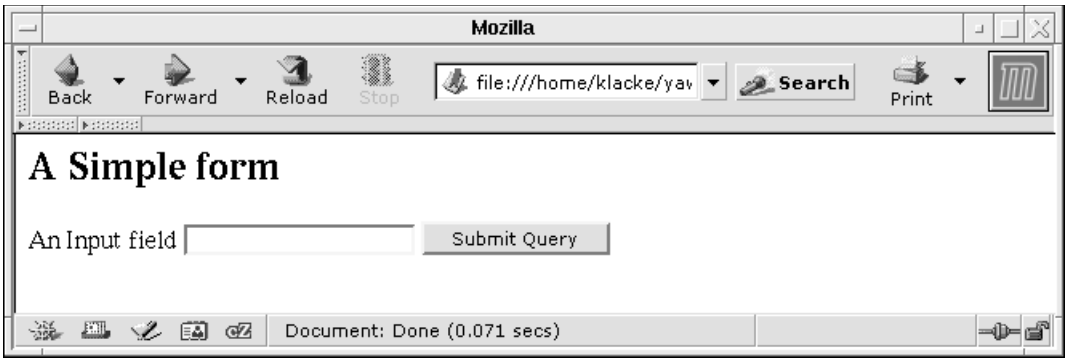
In order to POST data a FORM is required, say that we have a page called `form.yaws` that contain the following code:

```
<html>
<form action="/post_form.yaws"
      method="post"

<p> A Input field
<input name="xyz" type="text">
<input type="submit">
</form>
</html>
```

This will produce a page with a simple input field and a Submit button.

If we enter something - say “Hello there “ - in the input field and click the Submit button the client will request the page indicated in the “action” attribute, namely `post_form.yaws`.

If that YAWS page has the following code:




```
out(A) ->
   L = yaws_api:parse_post(A),
   {html, f("~p", [L])}
```

The user will see the output

```
[{xyz, "Hello there"}]
```

The differences between using the query part of the URL and a form are the following:

- Using the query arg only works in GET request. We parse the query argument with the function `yaws_api:parse_query(Arg)`
- If we use a form and POST the user data the client will transmit the user data in the body of the request. That is - the client sends a request to get the page using the POST method and it then attaches the user data - encoded - into the body of the request.

  A POST request can have a query part in its URL as well as user data in the body.

4.4 POSTing files

It is possible to upload files from the client to the server by means of POST. We indicate this in the form by telling the browser that we want a different encoding. Here is an example form that does this:

```
out(A) ->
    Form =
        {form, [{enctype, "multipart/form-data"},
                {method, post},
                {action, "file_upload_form.yaws"}],
                [{input, [{type, submit}, {value, "Upload"}]},
                 {input, [{type,file}, {width, "50"}, {name, foo}]}]},
    {ehtml, {html,[], [{h2,[], "A simple file upload page"},
                       Form]}}.
```

As shown in the figure, the page delivers the entire HTML page with enclosing `html` markers.

The user gets an option to browse the local host for a file or the user can explicitly fill in the file name in the input field. The file browsing part is automatically taken care of by the browser.

The action field in the form states that the client shall POST to a page called `file_upload_form.yaws`. This page will get the contents of the file in the body of the POST message. To read it, we use the `yaws_multipart` module, which provides the following capabilities:

1. It reads all parameters — files uploaded and other simple parameters.
2. It takes a few options to help file uploads. Specifically:
   (a) `{max_file_size, MaxBytes}`: if the file size in bytes exceeds `MaxBytes`, return an error
   (b) `no_temp_file`: read the uploaded file into memory without any temp files
   (c) `{temp_file,FullFilePath}`: specify `FullFilePath` for the temp file; if not given, a unique file name is generated
   (d) `{temp_dir, TempDir}`: specify `TempDir` as the directory to store the uploaded temp file; if this option is not provided, then by default an OS-specific temp directory such as "/tmp" is used

Just call `yaws_multipart:read_multipart_form` from your `out/1` function and it'll return a tuple with the first element set to one of these three atoms:

- `get_more`: more data needs to be read; return this tuple directly to YAWS from your `out/1` function and it will call your `out/1` function again when it has read more POST data, at which point you must call `read_multipart_form` again
- `done`: multipart form reading is complete; a `dict` full of parameters is returned
- `error`: an error occurred

The `dict` returned with `done` allows you to query it for parameters by name. For file upload parameters, it returns one of the following lists:

```
[{filename, "name of the uploaded file as entered on the form"},
 {value, Contents_of_the_file_all_in_memory} | _T]
```

or:

```
[{filename, "name of the uploaded file as entered on the form"},
 {temp_file, "full pathname of the temp file"} | _T]
```

Some multipart/form messages also include headers such as `Content-Type` and `Content-Transfer-Encoding` for different subparts of the message. If these headers are present in any subpart of a multipart/form message, they're also included in that subpart's parameter list, like this:

```
[{filename, "name of the uploaded file as entered on the form"},
 {value, Contents_of_the_file_all_in_memory},
 {content_type, "image/png"} | _T]
```

Note that for the temporary file case, it's your responsibility to delete the file when you're done with it.

Here's an example:

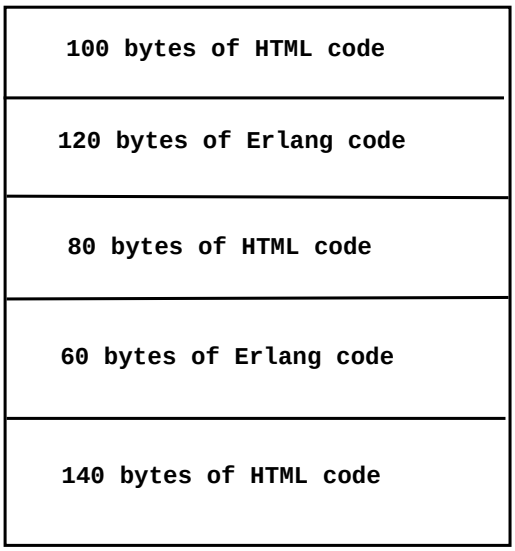
```
-module(my_yaws_controller).
-export([out/1]).

out(Arg) ->
    Options = [no_temp_file],
    case yaws_multipart:read_multipart_form(Arg, Options) of
        {done, Params} ->
            io:format("Params : ~p~n", [Params]),
            {ok, [{filename, FileName},{value,FileContent}|_]} =
                dict:find("my_file", Params),
            AnotherParam = dict:find("another_param", Params);
        %% do something with FileName, FileContent and AnotherParam
        {error, Reason} ->
            io:format("Error reading multipart form: ~s~n", [Reason]);
        Other -> Other
    end.
```

Chapter 5

Mode of operation

5.1 On the fly compilation

When the client requests a YAWS page, YAWS will look in its caches (there is one cache per virtual server) to see if it finds the requested page in the cache. If YAWS doesn't find the page in the cache, it will compile the page. This only happens the first time a page is requested. Say that the page is 400 bytes big and has the following layout:



The YAWS server will then parse the file and produce a structure which makes it possible to deliver the page in a readily fashion the next time the same page is requested.

When shipping the page it will

1. Ship the first 100 bytes from the file
2. Evaluate the first ERLANG chunk in the file and ship the output from the `out/1` function in that chunk. It will also jump ahead in the file and skip 120 bytes.
3. Ship 80 bytes of HTML code

4. Again evaluate an ERLANG chunk, this time the second and jump ahead 60 bytes in the file.
5. And finally ship 140 bytes of HTML code to the client

YAWS writes the source output of the compilation into a directory `/tmp/yaws/$UID`. The beam files are never written to a file. Sometimes it can be useful to look at the generated source code files, for example if the YAWS /ERLANG code contains a compilation error which is hard to understand.

5.2 Evaluating the Yaws Code

All client requests will execute in their own ERLANG process. For each group of virtual hosts on the same IP:PORT pair one ERLANG process listens for incoming requests.

This process spawns acceptor processes for each incoming request. Each acceptor process reads and parses all the HTTP headers from the client. It then looks at the Host: header to figure out which virtual server to use, i.e. which docroot to use for this particular request. If the Host: header doesn't match any server from *yaws.conf* with that IP:PORT pair, the first one from *yaws.conf* is chosen.

By default YAWS will not ship any data at all to the client while evaluating a YAWS page. The headers as well as the generated content are accumulated and not shipped to the client until the entire page has been processed.

Chapter 6

SSL

SSL - Secure Socket Layer is a protocol used on the Web for delivering encrypted pages to the WWW client. SSL is widely deployed on the Internet and virtually all bank transactions as well as all on-line shopping today is done with SSL encryption. There are many good sources on the net that describes SSL in detail - and I will not try to do that here. There is for example a good document at: `http://www.tldp.org/HOWTO/SSL-Certificates-HOWTO/` which describes how to manage certificates and keys.

In order to run an SSL server we must have a certificate. Either we can create a so called self-signed certificate ourselves or buy a certificate from one of the many CA's (Certificate Authority's) on the net. YAWS use the otp interface to openssl.

To setup a YAWS server with SSL we could have a *yaws.conf* file that looks like:

```
 logdir = /var/log/yaws

<server www.funky.org>
               port = 443
               listen = 192.168.128.32
               docroot = /var/yaws/www.funky.org
               <ssl>
                  keyfile = /etc/funky.key
                  certfile = /etc/funky.cert
                  password = gazonk
               </ssl>
       </server>
```

This is the easiest possible SSL configuration. The configuration refers to a certificate file and a key file. The certificate file must contain the name "www.funky.org" as it "Common Name".

The keyfile is the private key file and it is encrypted using the password "gazonk".

Chapter 7

Applications

YAWS is well suited for Web applications. In this chapter we will describe a number of application templates. Code and strategies that can be used to build Web applications.

There are several ways of starting applications from YAWS .

- The first and most easy variant is to specify the `-r Module` flag to the YAWS startup script. This will `apply(Module,start,[])`
- We can also specify runmods in the *yaws.conf* file. It is possible to have several modules specified if want the same YAWS server to run several different applications.

```
runmod = myapp
runmod = app_number2
```

- It is also possible to do it the other way around, let the main application start YAWS . We call this embedded mode and that will be discussed in a later chapter,

7.1 Login scenarios

Many Web applications require the user to login. Once the user has logged in the server sets a Cookie and then the user will be identified by help of the cookie in subsequent requests.

7.1.1 The session server

The cookie is passed in the headers and is available to the YAWS programmer in the Arg #arg record. The YAWS session server can help us to maintain a state for a user while the user is logged in to the application. The session server has the following 5 api functions to aid us:

1. `yaws_api:new_cookie_session(Opaque)` This function initiates a new cookie based session. The Opaque data is typically some application specific structure which makes it possible for the application to read a user state, or it can be the actual user state itself.

2. `yaws_api:cookieval_to_opaque(Cookie)` This function maps a cookie to a session.
3. `yaws_api:replace_cookie_session(Cookie, NewOpaque)` Replace the Opaque user state in the session server.
4. `yaws_api:delete_cookie_session(Cookie)` This function should typically be called when the user logs out or when our web application decides to auto logout the user.

All cookie based applications are different but they have some things in common. In the example that follow we assume the existence of a function `myapp:auth(UserName, Passwd)` and it returns `ok` or `{error, Reason}`.

Furthermore - let's have a record:

```
-record(session, {user,
                  passwd,
                  udata = []}).
```

The following function is a good template function to check the cookie.

```
get_cookie_val(CookieName, Arg) ->
    H = Arg#arg.headers,
    yaws_api:find_cookie_val(CookieName, H#headers.cookie).
```

```
check_cookie(A, CookieName) ->
    case get_cookie_val(CookieName, A) of
        []  ->
            {error, "not logged in"};
        Cookie ->
            yaws_api:cookieval_to_opaque(Cookie)
    end.
```

So what we need to do is the following: We want to check all requests and make sure the the session_server has our cookie registered as an active session.

If a request comes in without a working cookie we want to present a login page instead of the page the user requested.

Another quirky issue is that the pages necessary for display of the login page must be shipped without checking the cookie.

7.1.2 Arg rewrite

In this section we describe a feature whereby the user is allowed to rewrite the Arg at an early stage in the YAWS server. We do that by specifying an `arg_rewrite_mod` in the *yaws.conf* file.

```
arg_rewrite_mod = myapp
```

Then in the `myapp` module we have:

```
arg_rewrite(Arg) ->
    OurCookieName = "myapp_sid"
    case check_cookie(A, OurCookieName) of
        {error, _} ->
            do_rewrite(Arg);
        {ok, _Session} ->
            %return Arg untouched
            Arg
    end.

%% these pages must be shippable without a good cookie
login_pages() ->
    ["/banner.gif", "/login.yaws", "/post_login.yaws"].

do_rewrite(Arg) ->
    Req = Arg#arg.req,
    {abs_path, Path} = Req#http_request.path,
    case lists:member(Path, login_pages()) of
        true ->
            Arg;
        false ->
            Arg#arg{req = Req#http_request{path = {abs_path, "/login.yaws"}},
                    state =  {abs_path, Path}}
    end.
```

Our arg rewrite function lets all Args go through untouched that either have a good cookie or belong to a set of predefined pages that are acceptable to get without being logged in. If we decode that the user must log in, we change the path of the request, thereby making the YAWS server ship a login page instead of the page the user requested. We also set the original path in the Arg state argument so that the login page can redirect the user to the original page - once the login procedure is finished.

7.1.3 Authenticating

Now we're approaching the `login.yaws` page, the page that displays the login prompt to the user. The login page consists of two parts, one part that displays the login data as a form and one form processing page that reads the data the user entered in the login fields and performs the actual authentication.

The login page performs a tiny well known Web trick where it passes the original URL request in a hidden field in the login page and thereby passing that information to the form processing page.

The page `login.yaws`:

```
<erl>

out(A) ->
    {ehtml,
     {html,[],
      [{h2, [], "Login page"},
       {hr},
       {form, [{action,"/login_post.yaws"},
               {method,post}],

        [{p,[], "Username"}, {input, [{type,text},{name,uname}]},
         {p,[],"Password"},  {input, [{type,password},{name,passwd}]},
         {input, [{type,submit},{value,"Login"}]},
         {input, [{type,hidden},{name,url},
                  {value, A#arg.state}]}]}]}}.

</erl>
```

The form processing page which gets the POST data from the code above looks like:

```
<erl>

-include("myapp.hrl").
%% we have the session record there
%% we must set the include_path in the yaws.conf file
%% in order for the compiler to find that file

kv(K,L) ->
    {value, {K, V}} = lists:keysearch(K,1,L),
    V.

out(A) ->
    L = yaws_api:parse_post(A),
    User = kv(user, L),
    Pwd =  kv(passwd, L),
    case myapp:auth(User, Pwd) of
        ok ->
            S = #session{user = User,
                         passwd = Pwd,
                         udata = []},
            %% Now register the session to the session server
```

```
            Cookie = yaws_api:new_cookie_session(S),
            [{redirect_local, kv(url, L)},
              yaws_api:setcookie("myapp_sid",Cookie)]
        Err ->
            {ehtml,
             {html, [],
              {p, [], f("Bad login: ~p",[Err])}}}
    end.

</erl>
```

The function returns a list of two new previously not discussed return values: Instead of returning HTML output as in `{html, Str}` or `{ehtml,Term}` we return a list of two new values. There are many different possible return values from the `out/1` function and they will all be described later.

1. The tuple `{redirect_local, Path}`. This particular redirect return value will make the YAWS web server return a 302 redirect to the specified Path. Optionally a different status code can be supplied which will be used in place of 302, eg `{redirect_local, Path, 307}`.
2. `yaws_api:setcookie("myapp_sid",Cookie)` generates a `Set-Cookie` header

Now if we put all this together we have a full blown cookie based login system. The last thing we did in the form processing code was to register the session with the session server thereby letting any future requests go straight through the `Arg` rewriter.

This way both YAWS pages as well as all or some static content is protected by the cookie login code.

7.1.4 Database driven applications

We can use code similar to the code in the previous section to associate a user session to entries in a database. Mnesia fits perfectly together with YAWS and keeping user persistent state in Mnesia is both easy and convenient.

Once the user has logged in we can typically use the user name as key into the database. We can mix ram_tables and disc_tables to our liking. The Mnesia database must be initialized by means of `create_table/2` before it can be used. This is typically done while installing the web application on a machine.

Another option is to let the application check that Mnesia is initialized whenever the application starts.

If we don't want or need to use Mnesia, it's of course possible to use a simple `dets` file or a text file as well.

7.2 Appmods

Appmods is mechanism to invoke different applications based upon the URL. A URL - as presented to the web server in a request - has a path part and a query part.

It is possible to install several appmods in the *yaws.conf* file as:

```
appmods = foo myapp
```

Now, if the user requests a URL where any component in the directory path is an appmod, the parsing of the URL will terminate there and instead of reading the actual file from the disk, YAWS will invoke the appmod with the remainder of the path inserted into `Arg#arg.appmoddata`.

Say the user requests the URL *http://www.funky.org/myapp/xx/bar.html*. YAWS will not ship the file `bar.html` to the client, instead it will invoke `myapp:out(Arg)` with `Arg#arg.appmoddata` set to the string `xx/bar.html`. Any optional query data - that is data that follows the first "?" character in the URL - is removed from the path and passed as `Arg#arg.querydata`.

Appmods can be used to run applications on a server. All requests to the server that has an appmod in the URL will be handled by that application. If the application decides that it want to ship a page from the disk to the client, it can return the tuple `{page, Path}`. This return value will make YAWS read the page from the disk, possibly add the page to it's cache of commonly accessed pages and ship it back to the client.

The `{page, Path}` return value is equivalent to a redirect, but it removes an extra round trip - and is thus faster.

Appmods can also be used to fake entire directory hierarchies that doesn't exists on the disk.

7.3 The opaque data

Sometimes an application needs application specific data such as the location of its data files or whatever. There exists a mechanism to pass application specific configuration data from the YAWS server to the application.

When configuring a server we have an opaque field in the configuration file that can be used for this purpose. Say that we have the following fields in the config file:

```
<server foo>
    listen = 192.168.128.44
    <opaque>
        foo = bar
        somefile = /var/myapp/db
        myname = hyber
    </opaque>
</server>
```

This will create a normal server that listens to the specified IP address. An application has access to the opaque data that was specified in that particular server through `Arg#arg.opaque`

If we have the opaque data specified above, the Arg opaque field will have the value:

```
[{foo, "bar"},
 {somefile, "/var/myapp/db"},
```

```
 {myname, "hyber"}
]
```

7.4 Customizations

When actually deploying an application at a live site, some of the standard YAWS behaviors are not acceptable. Many sites want to customize the web server behavior when a client requests a page that doesn't exists on the web server. The standard YAWS behavior is to reply with status code 404 and a message explaining that the page doesn't exist.

Similarly, when YAWS code crashes, the Reason for the crash is displayed in the Web browser. This is very convenient while developing a sit but not acceptable in production.

7.4.1 404 File not found

We can install a special handler for 404 messages. We do that by specifying a `errormod_404` in the *yaws.conf* file.

If we have:

```
<server foo>
  ..
  ..
  ..
  errormod_404 = myapp

</server>
```

When YAWS gets a request for a file that doesn't exists on the hard disk, it invokes the errormod_404 module to generate both the status code as well as the content of the message.

`Module:out404(Arg, GC, SC)` will be invoked by YAWS . The arguments are

- Arg is a #arg record
- GC is a #gconf record (defined in yaws.hrl)
- SC is a #sconf record (defined in yaws.hrl)

The function can and must do the same things that a normal `out/1` does.

7.4.2 Crash messages

We use a similar technique for generating the crash messages, we install a module in the *yaws.conf* file and let that module generate the crash message. We have:

```
errormod_crash = Module
```

The default is to display the entire formated crash message in the browser. This is good for debugging but not in production.

The function `Module:crashmsg(Arg, SC, Str)` will be called. The Str is the real crash message formated as a string.

7.5 Stream content

If the `out/1` function returns the tuple `{content, MimeType, Content}` YAWS will ship that data to the Client. This way we can deliver dynamically generated content to the client which is of a different mime type than "text/html".

If the generated file is very large and it not possible to generate the entire file, we can return the value: `{streamcontent, MimeType, FirstChunk}` which delivers data back to the client using HTTP chunked transfer (see RFC 2616 section 3.6.1) and then from a different ERLANG process deliver the remaining chunks by using the functions:

1. `yaws_api:stream_chunk_deliver(YawsPid, Data)` where the `YawsPid` is the process id of the YAWS worker process. That pid is available in `Arg#arg.pid`.
2. `stream_chunk_end(YawsPid)` This function must be called to indicate the end of the stream.

A streaming alternative is also available for applications that need a more direct way to deliver data to clients, such as those dealing with data too large to buffer in memory but not wishing to use chunked transfer, or applications that use long-polling (Comet) techniques that require them to hold client connections open for extended periods. For these situations we can return the value: `{streamcontent_from_pid, MimeType, Pid}` to tell YAWS that we wish to deliver data of mime type `MimeType` to the client from process `Pid`. In this case, YAWS will prepare the socket for delivery from `Pid` and then send one of the following messages to `Pid`:

- `{ok, YawsPid}` tells `Pid` that it is now OK to proceed with sending data back to the client using the socket. The socket is accessible as `Arg#arg.clisock`.
- `{discard, YawsPid}` informs `Pid` that it should not attempt to use the socket, typically because the requested HTTP method requires no response body.

We call one of the following functions to send data:

- `yaws_api:stream_process_deliver(Socket, IoList)` sends data `IoList` using socket `Socket` without chunking the data.

- `yaws_api:stream_process_deliver_chunk(Socket, IoList)` sends data `IoList` using socket `Socket` but converts the data into chunked transfer form before sending it.

Pids using chunked transfer must indicate the end of their transfer by calling the following function:

- `yaws_api:stream_process_deliver_final_chunk(Socket, IoList)`

which delivers a special HTTP chunk to mark the end of the data transfer to the client.

Finally, `Pid` must always call `yaws_api:stream_process_end(Socket, YawsPid)` when it finishes sending data or when it receives the `{discard, YawsPid}` message from YAWS — this is required to inform YAWS that `Pid` has finished with the socket and will not use it directly anymore. If the application has to close the socket while it's in control of it, though, it must pass the atom `closed` as the first argument to `yaws_api:stream_process_end` in place of the socket to inform YAWS that the socket has been closed and it should no longer attempt to use it.

Applications using `streamcontent_from_pid` wanting to avoid chunked transfer encoding for their streams should be sure to include a setting for the `Content-Length` header in their `out/1` return value. YAWS automatically sets the `Transfer-Encoding` header to `chunked` if it does not detect a `Content-Length` header.

7.6 All out/1 return values

- `{html, DeepList}` This assumes that DeepList is formatted HTML code. The code will be inserted in the page.
- `{ehtml, Term}` This will transform the ERLANG term Term into a stream of HTML content.
- `{content, MimeType, Content}` This function will make the web server generate different content than HTML. This return value is only allowed in a YAWS file which has only one <erl> </erl> part and no html parts at all.
- `{streamcontent, MimeType, FirstChunk}` This return value plays the same role as the `content` return value above. However it makes it possible to stream data to the client using HTTP chunked transfer if the YAWS code doesn't have access to all the data in one go. (Typically if a file is very large or if data arrives from back end servers on the network.)
- `{streamcontent_from_pid, MimeType, Pid}` This return value is similar to the `streamcontent` return value above. However it makes it possible to stream data to the client directly from an application process to the socket. This approach can be useful for applications that employ long-polling (Comet) techniques, for example, and for applications wanting to avoid buffering data or avoid HTTP chunked mode transfer for streamed data.
- `{header, H}` Accumulates a HTTP header. Used by for example the `yaws_api:setcookie/2-6` function.
- `{allheaders, HeaderList}` Will clear all previously accumulated headers and replace them.
- `{status, Code}` Will set another HTTP status code than 200.
- `break` Will stop processing of any consecutive chunks of erl or html code in the YAWS file.

- `ok` Do nothing.
- `{redirect, Url}` Erase all previous headers and accumulate a single Location header. Set the status code.
- `{redirect, Url, Status}` Same as redirect above with the additional option of supplying the status code. The default for a redirect is 302 but 301, 303 and 307 are also valid redirect status codes.
- `{redirect_local, Path}` Does a redirect to the same Scheme://Host:Port/Path in which we are currently executing. Path can be either be the path directly (equivalent to `abs_path`), or one of `{{abs_path, Path}` or `{{rel_path, RelativePath}}`
- `{redirect_local, Path, Status}` Same as `redirect_local` above with the additional option of supplying the status code. The default for a redirect is 302 but 301, 303 and 307 are also valid redirect status codes.
- `{get_more, Cont, State}` When we are receiving large POSTs we can return this value and be invoked again when more Data arrives.
- `{page, Page}` Make YAWS return a different page than the one being requested.
- `{page, {Options, Page}}`

  Like the above, but supplying an additional deep list of options. For now, the only type of option is `{header, H}` with the effect of accumulating the HTTP header `H` for page `Page`.
- `[ListOfValues]`

  It is possible to return a list of the above defined return values. Any occurrence of `stream_content`, `get_more`, or `page` in this list is legal only if it is the last position of the list.

Chapter 8

Debugging and Development

YAWS has excellent debugging capabilities. First and foremost we have the ability to run the web server in interactive mode by means of the command line switch `-i`

This gives us a regular ERLANG command line prompt and we can use that prompt to compile helper code or reload helper code. Furthermore all error messages are displayed there. If a .yaws page producees any regular ERLANG io, that output will be displayed at the ERLANG prompt - assuming that we are running in interactive mode.

If we give the command line switch `-d` we get some additional error messages. Also YAWS does some additional checking of user supplied data such as headers.

8.1 Logs

YAWS produces various logs. All log files are written into the YAWS logdir directory. This directory is specified in the config file.

We have the following log files:

- The access log. Access logging is turn on or off per server in the *yaws.conf* file. If access_log is turned on for a server, YAWS will produce a log in Common Access Log Format called *HostName:PortNumber.access*
- *report.log* This file contains all error and crash messages for all virtual servers in the same file.
- *trace.traffic* and *trace.http* The two command line flags `-t` and `-T` tells YAWS to trace all traffic or just all HTTP messages and write them to a file.

Chapter 9

External scripts via CGI

YAWS can also interface to external programs generating dynamic content via the Common Gateway Interface (CGI). This has to be explicitly enabled for a virtual host by listing `cgi` in the `allowed_scripts` line in the configuration file. Any request for a page ending in `.cgi` (or `.CGI`) will then result in trying to execute the corresponding file.

If you have a Php executable compiled for using CGI in the `PATH` of the YAWS server, you can enable Php support by adding `php` to `allowed_scripts`. Requests for pages ending in `.php` will then result in YAWS executing `php` (configurable via `php_exe_path`) and passing the name of the corresponding file to it via the appropriate environment variable.

These ways of calling CGI scripts are also available to `.yaws` scripts and appmods via the functions `yaws_api:call_cgi/2` and `yaws_api:call_cgi/3`. This makes it possible to write wrappers for CGI programs, irrespective of the value of `allowed_scripts`.

The author of this YAWS feature uses it for self-written CGI programs as well as for using a standard CGI package. You should not be surprised however, should some scripts not work as expected due to an incomplete or incorrect implementation of certain CGI meta-variables. The author of this feature is interested in hearing about your experiences with it. He can be contacted at `carsten@codimi.de`.

Chapter 10

FastCGI

YAWS supports the responder role and the authorizer role of the FastCGI protocol. See `www.fastcgi.com` for details on the FastCGI protocol.

The benefits of using FastCGI include:

1. Unlike CGI, it is not necessary to spawn a new process for every request; the application server can handle multiple requests in a single process.
2. The fact that the application server can run on a different computer benefits scalability and security.
3. The application server can be written in any language for which a FastCGI library is available. Existing applications which have been written for other web servers can be used with YAWS .
4. FastCGI can also be used to implement external authentication servers (in addition to generating dynamic content).

Support for FastCGI was added to YAWS by Bruno Rijsman (`brunorijsman@hotmail.com`).

10.1 The FastCGI Responder Role

The FastCGI responder role allows YAWS to communicate with an application server running on a different (or on the same) computer to generate dynamic content.

The FastCGI protocol (which runs over TCP) is used to send the request information from YAWS to the application server and to send the response information (e.g. the generated dynamic content) from the application server back to YAWS .

FastCGI responders can be invoked in two ways:

1. By including `fcgi` in the `allowed_scripts` line in the configuration file (note that the default value for `allowed_scripts` includes `fcgi`).

   In this case a request for any resource with the `.fcgi` extension will result in a FastCGI call to the application server to dynamically generate the content.

   Note: the YAWS server will only call the application server if a file corresponding to the resource name (i.e. a file with the `.fcgi` extension) exists locally on the YAWS server. The contents of that file are not relevant.

2. By creating an appmod which calls `yaws_api:call_fcgi_responder`. See the `yaws_api (5)` man page for details.

10.2 The FastCGI Authorizer Role

The FastCGI authorizer role allows YAWS to communicate with an authentication server to authenticate requests.

The FastCGI protocol is used to send the request information from YAWS to the authentication server and the authentication respone back from the authentication server to YAWS .

If access is allowed, YAWS processing of the request proceeds normally.

If access is denied, the authentication server provides the response which is sent back to the client. This is typically a not authorized response or a redirect to a login page.

FastCGI authorizers are invoked by creating an appmod which calls `yaws_api:call_fcgi_authorizer`. See the `yaws_api (5)` man page for details.

10.3 The FastCGI Filter Role

FastCGI defines a third role, the filter role, which YAWS does not currently support.

10.4 FastCGI Configuration

The following commands in the `yaws.conf` file control the operation of FastCGI.

If you use FastCGI, you *must* include the `fcgi_app_server` setting in the configuration file to specify the host name (or IP address) and TCP port of the FastCGI application server.

You may include the `fcgi_trace_protocol` setting to enable or disable tracing of FastCGI protocol messages. This is useful for debugging.

You may include the `fcgi_log_app_error` setting to enable or disable logging application errors (any output to stderr and non-zero exit codes).

You may include the `extra_cgi_vars` command to pass additional environment variables to the application.

Chapter 11

Security

YAWS is of course susceptible to intrusions. YAWS has the ability to run under a different user than root - Assuming we need to listen to privileged port numbers. Running as root is generally a bad idea.

Intrusions can happen basically at all places in YAWS code where the YAWS code calls either the BIF `open_port` or when YAWS code does calls to `os:cmd/1`.

Both `open_port` and `os:cmd/1` invoke the `/bin/sh` interpreter to execute its commands. If the commands are nastily crafted bad things can easily happen.

All data that is passed to these two function must be carefully checked.

Since YAWS is written in ERLANG a large class of cracks are eliminated since it is not possible to perform any buffer overrun cracks on a YAWS server. This is very good.

Another possible point of entry to the system is by providing a URL which takes the client out from the docroot. This should not be possible - and the impossibility relies on the correctness of the URL parsing code in YAWS .

11.1 WWW-Authenticate

YAWS has support for WWW-Authentication. WWW-Authenticate is a standard HTTP scheme for the basic protection of files with a username and password. When a client browser wants a protected file, it must send a "Authenticate: username:password" header in the request. Note that this is plain text. If there is no such header or the username and password is invalid the server will respond with status code 401 and the realm. Browsers will then tell the user that a username and password is needed for "realm", and will resend the request after the user enters the information.

WWW-Authentication is configured in the *yaws.conf* file, in as many <*auth*> directives as you desire:

```
<server foo>
  docroot = /var/yaws/www/

..
..
```

```
  <auth>
    realm = secretpage
    dir   = /protected
    dir   = /anotherdir
    user  = klacke:gazonk
    user  = jonny:xyz
    user  = ronny:12r8uyp09jksfdge4
  </auth>
</server>
```

YAWS will require one of the given username:password pairs for all files in the */protected* and */anotherdir* directories. Note that these directories are specified as a server path, that is, the filesystem path that is actually protected here is */var/yaws/www/protected*

Chapter 12

Embedded mode

YAWS is a normal OTP application. It is possible to integrate YAWS into another - larger - application. The YAWS source tree must be integrated into the larger applications build environment. YAWS is then simply started by `application:start()` from the larger applications boot script, or the YAWS components needed for the larger application can be started individually under the application's supervisor(s).

By default YAWS reads its configuration data from a config file, the default is "/etc/yaws.conf". If YAWS is integrated into a larger application, however, that application typically has its configuration data kept at some other centralized place. Sometimes we may not even have a file system to read the configuration from if we run a small embedded system.

YAWS reads its application environment. If the environment key `embedded` is set to t`true`, YAWS starts in embedded mode. Once started it must be fed a configuration, and that can be done after YAWS has started by means of the function `yaws_api:setconf/2`.

It is possible to call `setconf/2` several times to force YAWS to reread the configuration.

12.1 Creating Global and Server Configurations

The `yaws_api:setconf/2` function mentioned in the previous section takes two arguments:

- a `#gconf` record instance, specifying global YAWS configuration
- a list of lists of `#sconf` record instances, each specifying configuration for a particular server instance

These record types are specified in `yaws.hrl`, which is not normally intended for inclusion by applications. Instead, YAWS provides the `yaws_api:embedded_start_conf/1,2,3,4` functions that allow embedded mode applications to specify configuration data using property lists (lists of `\{key, value\}` pairs).

The `yaws_api:embedded_start_conf` functions all return a tuple containing the following four items:

- the atom `ok`.
- a list of lists of `#sconf` record instances. This variable is intended to be passed directly to `yaws_api:setconf/2` as its second argument.

- a `#gconf` record instance. This variable is intended to be passed directly to `yaws_api:setconf/2` as its first argument.
- a list of supervisor child specification for the YAWS components the embedded mode application's configuration specified should be started. This allows embedded mode applications to start YAWS under its own supervisors.

Note that `yaws_api:embedded_start_conf` does not actually start any servers, but rather it only returns the configuration information and child specifications needed for the embedded mode application to start and configure YAWS itself.

12.2 Starting Yaws in Embedded Mode

An embedded mode application can start YAWS in one of two ways:

- It can call `yaws_api:embedded_start_conf` to obtain configuration and YAWS startup information as described in the previous section, start YAWS under its own supervisors, and then pass the global and server configuration settings to `yaws_api:setconf/2`.
- It can call `yaws:start_embedded/1,2,3,4`, each of which takes exactly the same arguments as the corresponding `yaws_api:embedded_start_conf/1,2,3,4` function. Instead of just returning start and configuration information, however, `yaws:start_embedded` also starts and configures YAWS , which can be more convenient but does not allow the embedded mode application any supervision control over YAWS .

Both of these functions take care of setting the environment key `embedded` to `true`. Neither approach requires any special settings in the embedded mode application's `.app` file nor any special command-line switches to the ERLANG runtime.

For an example of how to use `yaws_api:embedded_start_conf` along with `yaws_api:setconf`, please see the files `www/ybed_sup.erl` and `www/ybed.erl` in the YAWS distribution.

Chapter 13

The config file - yaws.conf

In this section we provide a complete listing of all possible configuration file options. The configuration contains two distinct parts: a global part which affects all the virtual hosts and a server part where options for each virtual host is supplied.

13.1 Global Part

- `logdir = Directory` - All YAWS logs will be written to files in this directory. There are several different log files written by YAWS .
  - report.log - this is a text file that contains all error logger printouts from YAWS .
  - Host.access - for each virtual host served by YAWS , a file Host.access will be written which contains an access log in Common Log Format.
  - trace.http - this file contains the HTTP trace if that is enabled
  - trace.traffic - this file contains the traffic trace if that is enabled
- `ebin_dir = Directory` - This directive adds Directory to the ERLANG search path. It is possible to have several of these command in the configuration file.
- `include_dir = Directory` - This directive adds Directory to the path of directories where the ERLANG compiler searches for include files. We need to use this if we want to include .hrl files in our YAWS ERLANG code.
- `max_num_cached_files = Integer` - YAWS will cache small files such as commonly accessed GIF images in RAM. This directive sets a maximum number on the number of cached files. The default value is 400.
- `max_num_cached_bytes = Integer` - This directive controls the total amount of RAM which can maximally be used for cached RAM files. The default value is 1000000, 1 megabyte.
- `max_size_cached_file = Integer` - This directive sets a maximum size on the files that are RAM cached by YAWS . The default value is 8000, 8 kBytes.

- `cache_refresh_secs = Integer` - The RAM cache is used to serve pages that sit in the cache. An entry sits in cache at most cache_refresh_secs number of seconds. The default is 30. This means that when the content is updated under the docroot, that change doesn't show until 30 seconds have passed. While developing a YAWS site, it may be convenient to set this value to 0. If the debug flag (-d) is passed to the YAWS start script, this value is automatically set to 0.

- `max_connections = nolimit | Integer` - This value controls the maximum number of connections from HTTP clients into the server. This is implemented by closing the last socket if the threshold is reached.

- `keepalive_maxuses = nolimit | Integer` - Normally, YAWS does not restrict the number of times a connection is kept alive using keepalive. Setting this parameter to an integer `X` will ensure that connections are closed once they have been used `X` times. This can be a useful to guard against long-running connections collecting too much garbage in the ERLANG VM.

- `keepalive_timeout = Integer | infinity` - If the HTTP session will be kept alive (i.e., not immediately closed) it will close after the specified number of milliseconds unless a new request is received in that time. The default value is 30000. The value `infinity` is legal but not recommended.

- `trace = traffic | http` - This enables traffic or http tracing. Tracing is also possible to enable with a command line flag to YAWS .

- `username = User` - When YAWS is run as root, it can be configured to change userid once it has created the necessary listen sockets on privilged ports.

- `subconfig = File` - Load specified config file.

- `subconfigdir = Directory` - Load all config file in specified directory.

13.2 Server Part

YAWS can virthost several web servers on the same IP address as well as several web servers on different IP addresses. The only limitation here is that there can be only one server with SSL enabled per each individual IP address. Each virtual host is defined within a matching pair of `<server ServerName>` and `</server>`. The `ServerName` will be the name of the web server.

The following directives are allowed inside a server definition.

- `port = Port` - This makes the server listen on Port.

- `listen = IpAddress` - This makes the server listen on `IpAddress` when virthosting several servers on the same IP/port address, if the browser doesn't send a Host: field, YAWS will pick the first server specified in the config file.

- `listen_backlog = Integer` - This sets the TCP listen backlog for the server to define the maximum length the queue of pending connections may grow to. The default is the same as the default provided by `gen_tcp:listen/2`, which is 5.

- `rport = Port` This forces all local redirects issued by the server to go to Port. This is useful when YAWS listens to a port which is different from the port that the user connects to. For example, running YAWS as a non-privileged user makes it impossible to listen to port 80, since that port can only be opened by a privileged user. Instead YAWS listens to a high port number port, 8000, and iptables are used to redirect traffic to port 80 to port 8000 (most NAT:ing firewalls will also do this for you).

- `rscheme = http | https` This forces all local redirects issued by the server to use this method. This is useful when an SSL off-loader, or stunnel, is used in front of YAWS .

- `access_log = true | false` Setting this directive to false turns of traffic logging for this virtual server. The default value is true.

- `docroot = Directory` - This makes the server serve all its content from Directory.

- `auth_skip_docroot = true | false` - If true, the docroot will not be searched for `.yaws_auth` files. This is useful when the docroot is quite large and the time to search it is prohibitive when YAWS starts up. Defaults to false.

- `partial_post_size = Integer` - When a YAWS file receives large POSTs, the amount of data received in each chunk is determined by the this parameter. The default value is 10240.

- `tilde_expand = true|false` - If this value is set to false YAWS will never do tilde expansion. Tilde expansion takes a URL of the form `http://www.foo.com/~username` and changes it into a request where the docroot for that particular request is set to the directory `~username/public_html/`. The default value is false.

- `allowed_scripts = [ListOfSuffixes]` - The allowed script types for this server. Recognized are 'yaws', 'cgi', 'php'. Default is `allowed_scripts = yaws`.

- `appmods = [ListOfModuleNames]` - If any the names in `ListOfModuleNames` appear as components in the path for a request, the path request parsing will terminate and that module will be called.

  Assume for example that we have the URL `http://www.hyber.org/myapp/foo/bar/baz?user=joe` while we have the module `foo` defined as an appmod, the function `foo:out(Arg)` will be invoked instead of searching the file systems below the point `foo`.

  The `Arg` argument will have the missing path part supplied in its `appmoddata` field.

- `php_exe_path = Path` - The name of (and possibly path to) the php executable used to interpret php scripts (if allowed). Default is `php_exe_path = php`.

- `phpfcgi = HostPortSpec` - The host and port of a PHP FCGI server for interpreting `.php` files. If specified, it overrides the `php_exe_path` setting. For all servers where `phpfcgi` is not specified, the binary specified by `php_exe_path` is invoked as normal CGI.

- `fcgi_app_server = HostPortSpec` - The hostname (or IP address) and TCP port of a FastCGI application server. This is separate from the `phpfcgi` setting and is used for normal FCGI applications. Because they're separate, both `fcgi_app_server` and `phpfcgi` can be set for the same server to allow it to serve both `.fcgi` and `.php` files.

- `fcgi_trace_protocol = true | false` - Enable or disable tracing of FastCGI protocol messages. This is useful for debugging.

- `fcgi_log_app_error = true | false` - Enable or disable logging FCGI application errors (any output to stderr and non-zero exit codes).
- `errormod_404 = Module` - It is possible to set a special module that handles 404 Not Found messages.

  The function `Module:out404(Arg, GC, SC)` will be invoked. The arguments are

  `Arg` is an `arg{}` record

  `GC` is a `gconf{}` record (defined in yaws.hrl)

  `SC` is a `sconf{}` record (defined in yaws.hrl)

  The function can and must do the same things that a normal `out/1` does.
- `errormod_crash = Module` - It is possible to set a special module that handles the HTML generation of server crash messages. The default is to display the entire formated crash message in the browser. This is good for debugging but not in production.

  The function `Module:crashmsg(Arg, SC, Str)` will be called. The `Str` is the real crash message formatted as a string.
- `arg_rewrite_mod = Module` - It is possible to install a module that rewrites all the Arg arg records at an early stage in the YAWS server. This can be used to do various things such as checking a cookie, rewriting paths etc.
- `<ssl> .... </ssl>` This begins and ends an SSL configuration for this server.
  - `keyfile = File` - Specifies which file contains the private key for the certificate.
  - `certfile = File` - Specifies which file contains the certificate for the server.
  - `cacertfile = File` File If the server is setup to require client certificates. This file needs to contain all the certificates of the acceptable signers for the client certs.
  - `verify = 1 | 2 | 3` Specifies the level of verification the server does on client certs. 1 means nothing , 2 means the the server will ask the client for a cert but not fail if the client doesn't supply a client cert, 3 means that the server requires the client to supply a client cert.
  - `depth = Int` Specifies the depth of certificate chains the server is prepared to follow when verifying client certs.
  - `password = String` - String If the private key is encrypted on disk, this password is the 3des key to decrypt it.
  - c`ciphers = String` This string specifies the ssl cipher string. The syntax of the ssl cipher string is a little horrible sub language of its own. It is documented in the ssl man page for "ciphers".
  - `</ssl>` Ends an SSL definition
- `<auth> ... </auth>` Defines an auth structure. The following items are allowed within a matching pair of <auth> and </auth> delimiters.
  - `dir = Dir` Makes Dir to be controlled bu WWW-authenticate headers. In order for a user to have access to WWW-Authenticate controlled directory, the user must supply a password.
  - `realm = Realm` In the directory defined here, the WWW-Authenticate Realm is set to this value.

- `user = User:Password` Inside this directory, the user User has access if the user supplies the password Password in the pop up dialog presented by the browser. We can obviously have several of these value inside a single <auth> </auth> pair.
- `</auth>` Ends an auth definition

13.3 Configuration Examples

The following example defines a single server on port 80.

```
logdir = /var/log/yaws
<server www.mydomain.org>
        port = 80
        listen = 192.168.128.31
        docroot = /var/yaws/www
</server>
```

And this example shows a similar setup but two webÂ servers on the same IP address

```
logdir = /var/log/yaws
<server www.mydomain.org>
        port = 80
        listen = 192.168.128.31
        docroot = /var/yaws/www
</server>

<server www.funky.org>
        port = 80
        listen = 192.168.128.31
        docroot = /var/yaws/www_funky_org
</server>
```

When there are several virtual hosts defined for the same IP number and port, and an HTTP request arrives with a Host field that does not match any defined virtual host, then the one which defined “first” in the file is chosen.

An example with www-authenticate and no access logging at all.

```
logdir = /var/log/yaws
<server www.mydomain.org>
        port = 80
        listen = 192.168.128.31
        docroot = /var/yaws/www
        access_log = false
```

```
        <auth>
            dir = /var/yaws/www/secret
            realm = foobar
            user = jonny:verysecretpwd
            user = benny:thequestion
            user = ronny:havinganamethatendswithy
        </auth>

</server>
```

And finally a slightly more complex example with two servers on the same IP, and one ssl server on a different IP.

The `is_default` is used to select the funky server if someone types in for example http://192.168.128.31/ in his/her browser.

```
logdir = /var/log/yaws
max_num_cached_files = 8000
max_num_cached_bytes = 6000000

<server www.mydomain.org>
        port = 80
        listen = 192.168.128.31
        docroot = /var/yaws/www
</server>

<server www.funky.org>
        port = 80
        is_default = true
        listen = 192.168.128.31
        docroot = /var/yaws/www_funky_org
</server>

<server www.funky.org>
        port = 443
        listen = 192.168.128.32
        docroot = /var/yaws/www_funky_org
        <ssl>
           keyfile = /etc/funky.key
           certfile = /etc/funky.cert
           password = gazonk
        </ssl>
</server>
```