

YAZ proxy User's Guide and Reference

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by Mike Taylor and Adam Dickmeiss

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YAZ proxy (<http://www.indexdata.dk/yazproxy/>) is a powerful general purpose Z39.50/SRW/SRU proxy.

This manual covers version 1.0.1.

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Chapter 1. Introduction

The YAZ Proxy (<http://www.indexdata.dk/yazproxy/>) is highly configurable and can be used in a number of different applications, ranging from debugging Z39.50-based applications and protecting overworked servers, to improving the performance of stateless WWW/Z39.50 gateways. Among other features, it includes:

- SRW/SRU (<http://www.loc.gov/z3950/agency/zing/srw/>) server function, to allow any Z39.50 server to also support the ZiNG (<http://www.loc.gov/z3950/agency/zing/>) protocols
- Load balancing across multiple backend servers
- Session-sharing and pre-initialization to improve performance in servers with expensive session initialization
- Configurable request filtering, to keep bad requests from reaching the server
- XML (<http://www.w3.org/XML/>) support -- MARC records can be converted to MARCXML (<http://www.loc.gov/standards/marcxml/>), and XSLT (<http://www.w3.org/TR/xslt>)-transformations allow the proxy to support arbitrary retrieval schemas in XML
- Load governor function limits requests from aggressive batch-mode clients
- Configurable logging
- Efficient multiplexing software enables small memory footprint and very high performance

Licensing

The proxy application and the proxy library is covered by the GPL.

Support

Configuration and installation assistance and ongoing support is available for the YAZ Proxy. For further information about support or licensing options, please contact David Dorman in the US (dorman at indexdata.com, 860-346-1237 or toll free 866-489-1568) or Sebastian Hammer in Denmark (quinn a indexdata.com, or +45 3341 0100)

Chapter 2. Installation

You need a C++ compiler to compile and use YAZ proxy. The software was implemented using GCC (<http://gcc.gnu.org/>) so we know that works well with YAZ proxy. From time to time the software has been compiled on Windows using Visual C++. Other compilers should work too. Let us know of portability problems, etc. with your system.

YAZ proxy is built on top of the YAZ (<http://indexdata.dk/yaz/>) and YAZ++ (<http://indexdata.dk/yazplusplus/>) toolkits. You need to install these first. For some platforms there are binary packages available for YAZ/YAZ++.

We also highly recommend that libxml2 (<http://xmlsoft.org/>) and libXSLT (<http://xmlsoft.org/XSLT/>) are installed. YAZ must be configured with libxml2 support. If not, SRW/SRU (<http://www.loc.gov/z3950/agency/zing/srw/>) is not supported. The YAZ Proxy uses libXSLT for record conversions via XSLT.

YAZ proxy may also use USEMARCON to convert between MARC formats. This is useful if you want the proxy to offer more MARC record types than the backend target supports. Get USEMARCON from: British Library USEMARCON page (<http://www.bl.uk/services/bibliographic/usemarcon.html>).

Building on Unix

On UNIX, the software is compiled as follows:

```
$ ./configure
$ make
$ su
# make install
```

You can supply options for the `configure` script. The most useful ones are:

`--prefix directory`

Specifies installation prefix. By default `/usr/local` is used.

`--with-yazpp directory`

Specifies the location of `yaz++-config`. The `yaz++-config` program is generated in the source directory of YAZ++ as well as the binaries directory when YAZ++ is installed (via `make install`).

If you don't supply this option, `configure` will look for `yaz++-config` in directories of the `PATH` environment - which is nearly always what you want.

`--with-xslt directory`

Specifies prefix for libXSLT (and libxml2). `configure` must be able to locate **xslt-config** in `PREFIX/bin`. If this option is omitted, `configure` looks for **xslt-config** in the current `PATH`.

`--with-usemarcon directory`

Specifies USEMARCON installation prefix. configure must be able to locate **usemarcon-config** in PREFIX/bin. If this option is omitted, configure looks for **usemarcon-config** in the current PATH.

For the whole list of configure options, refer to the help: `./configure --help`.

Configure uses GCC's C/C++ compiler if available. To specify another compiler, set CXX. To use other compiler flags, specify CXXFLAGS. For example, to use CC with debugging do:

```
CXXFLAGS="-g" CXX=CC ./configure
```

This is what you have after successful compilation:

`src/yazproxy`

The YAZ Proxy program. It gets installed in your binaries directory (*prefix/bin*).

`src/libyazproxy.la`

The YAZ proxy library. This library gets installed in the libraries directory (*prefix/lib*).

`include/yazproxy/*.h`

C++ header files, which you'll need for YAZ proxy development. All these are installed in the header files area (*prefix/include/yazproxy*).

`etc`

Various files such as configuration files, XSLT files, CQL to RPN conversion files, a sample start/stop control script `yazproxyctl.sh` that can be used as template for an `/etc/init.d` script. These files are installed in the YAZ proxy's data area (*prefix/share/yazproxy*).

Building on Windows

YAZ++ is shipped with "makefiles" for the NMAKE tool that comes with Microsoft Visual Studio (<http://msdn.microsoft.com/vstudio/>). Version 6 and .NET has been tested. We expect that YAZ++ compiles with version 5 as well.

Note: The YAZ proxy has never been used in production on Windows. Although it compiles and runs, doesn't mean it scale on that platform. Furthermore the YAZ proxy currently doesn't run as a Service - only as a Console application.

Start a command prompt and switch the sub directory WIN where the file `makefile` is located.

Customize the installation by editing the `makefile` file (for example by using notepad). The following summarizes the most important settings in that file:

DEBUG

If set to 1, the software is compiled with debugging libraries (code generation is multi-threaded debug DLL). If set to 0, the software is compiled with release libraries (code generation is multi-threaded DLL).

YAZ_DIR

This must be set to the home of the YAZ source directory.

YAZPP_DIR

This must be set to the home of the YAZ++ source directory.

HAVE_XSLT, LIBXSLT_DIR

If HAVE_LIBXSLT is set to 1, the proxy is compiled with XSLT and XML support. In this configuration, set LIBXSLT_DIR to the libXSLT (<http://www.xmlsoft.org/>) source directory.

Note: If you enable libXSLT you have to enable libxml2 and its sub components zlib and iconv as well.

Windows versions of libXSLT, libxml2, zlib and iconv can be found here (<http://www.zlatkovic.com/libxml.en.html>).

HAVE_ICONV, ICONV_DIR

If HAVE_ICONV is set to 1, the proxy is compiled with iconv support. In this configuration, set ICONV_DIR to the iconv source directory.

HAVE_LIBXML2, LIBXML2_DIR

If HAVE_LIBXML2 is set to 1, the proxy is compiled with XML support. In this configuration, set LIBXML2_DIR to the libxml2 (<http://www.xmlsoft.org/>) source directory and ZLIB_DIR to the zlib directory.

Note: YAZ++ is not using ZLIB. But libxml2 is.

When satisfied with the settings in the makefile, type

```
nmake
```

Tip: If the `nmake` command is not found on your system you probably haven't defined the environment variables required to use that tool. To fix that, find and run the batch file `vcvars32.bat`. You need to run it from within the command prompt or set the environment variables "globally"; otherwise it doesn't work.

If you wish to recompile YAZ++ - for example if you modify settings in the `makefile` you can delete object files, etc by running.

```
nmake clean
```

The following files are generated upon successful compilation:

```
bin/yazproxy.dll
```

YAZ proxy DLL.

```
lib/yazproxy.lib
```

Import library for `yazproxy.dll`.

```
bin/yazproxy.exe
```

YAZ proxy. It's a WIN32 console application.

Chapter 3. Using YAZ proxy

As mentioned in the introduction the YAZ proxy has many uses. This chapter includes a few examples.

The YAZ Proxy is useful for debugging SRW/SRU/Z39.50 software, logging APDUs, redirecting Z39.50 packages through firewalls, etc. Furthermore, it offers facilities that often boost performance for connection-less Z39.50 clients such as web gateways.

Unlike most other server software, the proxy runs single-threaded, single-process. Every I/O operation is non-blocking so it is very lightweight and extremely fast. It does not store any state information on the hard drive, except any log files you ask for.

Example 3-1. Using the Proxy to Log APDUs

Suppose you use a commercial Z39.50 client for which you do not have source code, and it's not behaving how you think it should when running against some specific server that you have no control over. One way to diagnose the problem is to find out what packets (APDUs) are being sent and received, but not all client applications have facilities to do APDU logging.

No problem. Run the proxy on a friendly machine, get it to log APDUs, and point the errant client at the proxy instead of directly at the server that's causing it problems.

Suppose the server is running on `foo.bar.com`, port 18398. Run the proxy on the machine of your choice, say `your.company.com` like this:

```
yazproxy -a - -t tcp:foo.bar.com:18398 tcp:@:9000
```

(The `-a -` option requests APDU logging on standard output, `-t tcp:foo.bar.com:18398` specifies where the backend target is, and `tcp:@:9000` tells the proxy to listen on port 9000 and accept connections from any machine.)

Now change your client application's configuration so that instead of connecting to `foo.bar.com` port 18398, it connects to `your.company.com` port 9000, and start it up. It will work exactly as usual, but all the packets will be sent via the proxy, which will generate a log like this:

```
decode choice
initRequest {
    referenceId OCTETSTRING(len=4) 69 6E 69 74
    protocolVersion BITSTRING(len=1)
    options BITSTRING(len=2)
    preferredMessageSize 1048576
    maximumRecordSize 1048576
    implementationId 'Mike Taylor (id=169)'
    implementationName 'Net::Z3950.pm (Perl)'
    implementationVersion '0.31'
}
encode choice
initResponse {
    referenceId OCTETSTRING(len=4) 69 6E 69 74
    protocolVersion BITSTRING(len=1)
    options BITSTRING(len=2)
    preferredMessageSize 1048576
    maximumRecordSize 1048576
```

```

    result TRUE
    implementationId '81'
    implementationName 'GFS/YAZ / Zebra Information Server'
    implementationVersion 'YAZ 1.9.1 / Zebra 1.3.3'
  }
  decode choice
  searchRequest {
    referenceId OCTETSTRING(len=1) 30
    smallSetUpperBound 0
    largeSetLowerBound 1
    mediumSetPresentNumber 0
    replaceIndicator TRUE
    resultSetName 'default'
    databaseNames {
      'gils'
    }
    {
      smallSetElementSetNames choice
      generic 'F'
    }
    {
      mediumSetElementSetNames choice
      generic 'B'
    }
  }
  preferredRecordSyntax OID: 1 2 840 10003 5 10
  {
    query choice
    type_1 {
      attributeSetId OID: 1 2 840 10003 3 1
      RPNStructure choice
      {
        simple choice
        attributesPlusTerm {
          attributes {
          }
          term choice
          general OCTETSTRING(len=7) 6D 69 6E 65 72 61 6C
        }
      }
    }
  }
}

```

Example 3-2. Using a configuration file

In Example 3-1 the default backend server was specified by a command line option. The same proxy behavior can be achieved by creating a configuration with the following contents:

```

<?xml version="1.0"?>
<proxy xmlns="http://indexdata.dk/yazproxy/schema/0.9/">
  <target name="foo" default="1">

```

```

        <url>foo.bar.com:18398</url>
        <log>client-apdu</log>
    </target>
    <target name="*">
    </target>
</proxy>

```

The proxy is started with

```
yazproxy -c config.xml @:9000
```

The last target section is used for all servers except foo. Had the the last section been omitted, then *only* foo could be reached via the proxy.

Example 3-3. Offering SRW/SRU/Z39.50 service

In order to offer SRW/SRU service we must be specify sufficient information to allow the proxy to convert from SRW/SRU to Z39.50. This involves translating CQL queries to Type-1 (also called RPN/PQF), since most Z39.50 servers do not support CQL. The conversion is specified by the `cql2rpn` element.

We must also ensure that the server can return at least one kind of XML record (Dublin-Core recommended).

An explain record for the SRW/SRU service must also be created.

The following is a relatively simple configuration file for such a service. This service lives on `indexdata.dk`, port 9000. The database is `gils`. The backend server is also `indexdata.dk` (port 210) as given by `url`.

The server may return USMARC/MARC21 (Z39.50/SRW/SRU) and MARCXML (SRW/SRU only) as specified by the syntax elements.

```

<?xml version="1.0"?>
<!-- $Id: using.xml,v 1.6 2005/03/14 13:16:03 adam Exp $ -->
<proxy xmlns="http://indexdata.dk/yazproxy/schema/0.9/">
  <target name="bagel">
    <url>indexdata.dk</url>
    <target-timeout>240</target-timeout>
    <client-timeout>180</client-timeout>
    <attribute type="1" value="1-11,13-1016"/>
    <attribute type="1" value="*" error="114"/>
    <syntax type="usmarc"/>
    <syntax type="none"/>
    <syntax type="xml" marcxml="1"
      identifier="info:srw/schema/1/marcxml-v1.1" >
      <name>marcxml</name>
    </syntax>
    <syntax type="*" error="238"/>
  <preinit>0</preinit>

```

```

<explain xmlns="http://explain.z3950.org/dtd/2.0/">
  <serverInfo>
    <host>indexdata.dk</host>
    <port>9000</port>
    <database>gils</database>
  </serverInfo>
</explain>
<cql2rpn>pqf.properties</cql2rpn>
</target>
</proxy>

```

The conversion from CQL to RPN is specified by a file whose name, relative to the working directory, is given in the `cql2rpn` element. A complete Bath/DC conversion file, `pqf.properties` is provided as part of the `yazproxy` distribution in the `etc` subdirectory.

Explain information is embedded in the configuration file. Note that in this example, only a few mandatory explain elements are specified. A well-behaving server should describe index sets, indexes, record schemas as well.

Chapter 4. Proxy Reference

Operating Environment

The YAZ proxy is a console program. After startup it spawns a child process (except on Windows or if option -X is given). The child process is the core of the proxy and it handles all communication with clients and servers. The parent process will restart the child process if it dies unexpectedly and report the reason. For options for YAZ proxy, see the Section called *Proxy Usage (man page)*.

As an option, the proxy may change user identity to a less privileged user.

Choosing the Backend Server

When the proxy receives a Z39.50 Initialize Request from a Z39.50 client, it determines the backend server by the following rules:

1. If the `InitializeRequest` PDU from the client includes an `otherInfo` element with OID `1.2.840.10003.10.1000.81.1`, then the contents of that element specify the server to be used, in the usual YAZ address format (typically `tcp:hostname:port`) as described in the Addresses section of the YAZ manual (<http://www.indexdata.dk/yaz/doc/comstack.addresses.tkl>).
2. Otherwise, the Proxy uses the default server, if one was specified in the proxy configuration file. See the Section called *target*.
3. Otherwise, the Proxy uses the default server, if one was specified on the command-line with the `-t` option.
4. Otherwise, the proxy closes the connection with the client.

If the proxy receives an SRW/SRU request, the following rules are used.

1. If default target has Explain information with a `database` that matches the path of the HTTP request of SRW/SRU that backend server is used for SRW/SRU operation.
2. Otherwise the service will return HTTP 404 (Not found).

Note: We know it is stupid to only check for explain in default target. It means that it is only possible to offer one SRW/SRU server. We expect to improve that in the next version of the YAZ proxy.

Keep-alive Facility

The keep-alive is a facility where the proxy keeps the connection to the backend server - even if the client closes the connection to the proxy.

If a new or another client connects to the proxy again and requests the same backend it will be reassigned to this backend. In this case, the proxy sends an initialize response directly to the client and an initialize handshake with the backend is omitted.

When a client reconnects, query and record caching works better, if the proxy assigns it to the same backend as before. And the result set (if any) is re-used. To achieve this, Index Data defined a session cookie which identifies the backend session.

The cookie is defined by the client and is sent as part of the Initialize Request and passed in an `otherInfo` element with `OID 1.2.840.10003.10.1000.81.2`.

Clients that do not send a cookie as part of the initialize request may still better performance, since the init handshake is saved.

Refer to the Section called *keepalive* on how to setup configuration parameters for keepalive.

Query Caching

Simple stateless clients often send identical Z39.50 searches in a relatively short period of time (e.g. in order to produce a results-list page, the next page, a single full-record, etc). And for many targets, it's much more expensive to produce a new result set than to reuse an existing one.

The proxy tries to solve that by remembering the last query for each backend target, so that if an identical query is received next, it is turned into Present Requests rather than new Search Requests.

Note: In a future we release will probably allows for an arbitrary-sized cache for targets supporting named result sets.

You can enable/disable query caching using option -o.

Record Caching

As an option, the proxy may also cache result set records for the last search. The proxy takes into account the Record Syntax and CompSpec. The CompSpec includes simple element set names as well. By default the cache is 200000 bytes per session.

Query Validation

The Proxy may also be configured to trap particular attributes in Type-1 queries and send Bib-1 diagnostics back to the client without even consulting the backend target. This facility may be useful if a target does not properly issue diagnostics when unsupported attributes are send to it.

Record Syntax Validation

The proxy may be configured to accept, reject or convert records. When accepted, the target passes search/present requests to the backend target under the assumption that the target can honor the request (In fact it may not do that). When a record is rejected because the record syntax is "unsupported" the proxy returns a diagnostic to the client. Finally, the proxy may convert records.

The proxy can convert from MARC to MARCXML and thereby offer an XML version of any MARC record as long as it is ISO2709 encoded. If the proxy is compiled with libXSLT support it can also perform XSLT on XML.

Other Optimizations

We've had some plans to support global caching of result set records, but this has not yet been implemented.

Proxy Configuration File

The Proxy may read a configuration file using option `-c` followed by the filename of a config file.

The config file is XML based. The YAZ proxy must be compiled with libxml2 (<http://www.xmlsoft.org/>) and libXSLT (<http://xmlsoft.org/XSLT/>) support in order for the config file facility to be enabled.

See the Section called *YAZ Proxy Configuration Schema* for an XML schema for the configuration.

Tip: To check for a config file to be well-formed, the `yazproxy` may be invoked without specifying a listening port, i.e.

```
yazproxy -c myconfig.xml
```

If this does not produce errors, the file is well-formed.

Proxy Configuration Header

The proxy config file must have a root element called `proxy` and scoped within namespace `xmlns="http://indexdata.dk/yazproxy/schema/0.8/"`. All information except an optional XML header must be stored within the `proxy` element.

```
<?xml version="1.0"?>
<proxy xmlns="http://indexdata.dk/yazproxy/schema/0.8/">
  <!-- content here .. -->
</proxy>
```


target

The element `target` which may be repeated zero or more times with parent element `proxy` contains information about each backend target. The `target` element have two attributes: `name` which holds the logical name of the backend target (required) and `default` (optional) which (when given) specifies that the backend target is the default target - equivalent to command line option `-t`.

```
<?xml version="1.0"?>
<proxy xmlns="http://indexdata.dk/yazproxy/schema/0.8/">
  <target name="server1" default="1">
    <!-- description of server1 .. -->
  </target>
  <target name="server2">
    <!-- description of server2 .. -->
  </target>
</proxy>
```

url

The `url` which may be repeated one or more times should be the child of the `target` element. The CDATA of `url` is the Z-URL of the backend.

Multiple `url` element may be used. In that case, then a client initiates a session, the proxy chooses the URL with the lowest number of active sessions, thereby distributing the load. It is assumed that each URL represents the same database (data).

target-timeout

The element `target-timeout` is the child of element `target` and specifies the amount in seconds before a target session is shut down.

This can also be specified on the command line by using option `-T`. Refer to **OPTIONS** in the Section called *Proxy Usage (man page)*.

client-timeout

The element `client-timeout` is the child of element `target` and specifies the amount in seconds before a client session is shut down.

This can also be specified on the command line by using option `-i`. Refer to **OPTIONS** in the Section called *Proxy Usage (man page)*.

keepalive

The `keepalive` element holds information about the keepalive Z39.50 sessions. Keepalive sessions are proxy-to-backend sessions that is no longer associated with a client session.

The `keepalive` element which is the child of the `target` holds two elements: `bandwidth` and `pdu`. The `bandwidth` is the maximum total bytes transferred to/from the target. If a target session exceeds this limit, it is shut down (and no longer kept alive). The `pdu` is the maximum number of requests sent to the target. If a target session exceeds this limit, it is shut down. The idea of these two limits is that avoid very long sessions that use resources in a backend (that leaks!).

The following sets maximum number of bytes transferred in a target session to 1 MB and maximum of requests to 400.

```
<keepalive>
  <bandwidth>1048576</bandwidth>
  <retrieve>400</retrieve>
</keepalive>
```

limit

The `limit` section specifies bandwidth/pdu requests limits for an active session. The proxy records bandwidth/pdu requests during the last 60 seconds (1 minute). The `limit` may include the elements `bandwidth`, `pdu`, and `retrieve`. The `bandwidth` measures the number of bytes transferred within the last minute. The `pdu` is the number of requests in the last minute. The `retrieve` holds the maximum records to be retrieved in one Present Request.

If a bandwidth/pdu limit is reached the proxy will postpone the requests to the target and wait one or more seconds. The idea of the limit is to ensure that clients that downloads hundreds or thousands of records do not hurt other users.

The following sets maximum number of bytes transferred per minute to 500Kbytes and maximum number of requests to 40.

```
<limit>
  <bandwidth>524288</bandwidth>
  <retrieve>40</retrieve>
</limit>
```

Note: Typically the limits for keepalive are much higher than those for session minute average.

attribute

The `attribute` element specifies accept or reject or a particular attribute type, value pair. Well-behaving targets will reject unsupported attributes on their own. This feature is useful for targets that do not gracefully handle unsupported attributes.

Attribute elements may be repeated. The proxy inspects the attribute specifications in the order as specified in the configuration file. When a given attribute specification matches a given attribute list in a query, the proxy takes appropriate action (reject, accept).

If no attribute specifications matches the attribute list in a query, it is accepted.

The `attribute` element has two required attributes: `type` which is the Attribute Type-1 type, and `value` which is the Attribute Type-1 value. The special value/type `*` matches any attribute type/value. A value may also be specified as a list with each value separated by comma, a value may also be specified as a list: low value - dash - high value.

If attribute `error` is given, that holds a Bib-1 diagnostic which is sent to the client if the particular type, value is part of a query.

If attribute `error` is not given, the attribute type, value is accepted and passed to the backend target.

A target that supports use attributes 1,4, 1000 through 1003 and no other use attributes, could use the following rules:

```
<attribute type="1" value="1,4,1000-1003"/>
<attribute type="1" value="*" error="114"/>
```

syntax

The `syntax` element specifies accept or reject or a particular record syntax request from the client.

The `syntax` has one required attribute: `type` which is the Preferred Record Syntax.

If attribute `error` is given, that holds a Bib-1 diagnostic which is sent to the client if the particular record syntax is part of a present - or search request.

If attribute `error` is not given, the record syntax is accepted and passed to the backend target.

If attribute `marcxml` is given, the proxy will perform MARC21 to MARCXML conversion. In this case the `type` should be XML. The proxy will use preferred record syntax USMARC/MARC21 or `backendtype` (if given) against the backend target.

If attribute `backendtype` is given, that holds the record syntax to be transmitted to backend.

If attribute `stylesheet` is given, the proxy will convert XML record from server via XSLT. It is important that the content from server is XML. If used in conjunction with attribute `marcxml` the MARC to MARCXML conversion takes place before the XSLT conversion takes place.

If attribute `identifier` is given that is the SRW/SRU record schema identifier for the resulting output record (after MARCXML and/or XSLT conversion).

If sub element `title` is given (as child element of `syntax`, then that is the official SRW/SRU name of the resulting record schema.

If sub element name is given that is an alias for the record schema identifier. Multiple names may be specified.

Example 4-1. MARCXML conversion

To accept USMARC and offer MARCXML XML plus Dublin Core (via XSLT conversion) but the following configuration could be used:

```
<proxy>
<target name="mytarget">
  ..
<syntax type="usmarc"/>
<syntax type="xml" marcxml="1"
  identifier="info:srw/schema/1/marcxml-v1.1"
  <title>MARCXML<title>
  <name>marcxml<name>
</syntax>
<syntax type="xml" marcxml="1" stylesheet="MARC21slim2SRWDC.xsl"
  identifier="info:srw/schema/1/dc-v1.1">
  <title>Dublin Core<title>
  <name>dc<name>
</syntax>
<syntax type="*" error="238"/>
  ..
</target>
</proxy>
```

explain

The explain element includes Explain information for SRW/SRU about the server in the target section. This information must have a serverInfo element with a database that this target must be available as (URL path). For example,

```
<explain xmlns="http://explain.z3950.org/dtd/2.0/">
  <serverInfo>
    <host>myhost.org</host>
    <port>8000</port>
    <database>mydatabase</database>
  </serverInfo>
  <!-- remaining Explain stuff -->
</explain>
```

In the above case, the SRW/SRU service is available as `http://myhost.org:8000/mydatabase`.

cql2rpn

The content of the `cql2rpn` element specifies the path from the working directory to a CQL-to-RPN conversion file for the server in the target section. This element is required for SRW/SRU searches to operate against Z39.50 servers that don't support CQL. Most Z39.50 servers only support Type-1/RPN so this is usually required.

See YAZ documentation for more information about the CQL to PQF (<http://indexdata.dk/yaz/doc/tools.tkl#tools.cql.pqf>) conversion. See also the `pqf.properties` in the `etc` (or `prefix/share/yazproxy`) directory of the YAZ proxy distribution.

preinit

The element `preinit` is the child of element `target` and specifies the number of spare connection to a target. By default no spare connection are created by the proxy. If the proxy uses a target exclusive or a lot, the `preinit` session will ensure that target sessions have been made before the client makes a connection and will therefore reduce the connect-init handshake dramatically. Never set this to more than 5.

max-clients

The element `max-clients` is the child of element `proxy` and specifies the total number of allowed connections to targets (all targets). If this limit is reached the proxy will close the least recently used connection.

Note, that many Unix systems impose a system on the number of open files allowed in a single process, typically in the range 256 (Solaris) to 1024 (Linux). The proxy uses 2 sockets per session + a few files for logging. As a rule of thumb, ensure that $2 * \text{max-clients} + 5$ can be opened by the proxy process.

Tip: Using the `bash` (<http://www.gnu.org/software/bash/bash.html>) shell, you can set the limit with `ulimit -nno`. Use `ulimit -a` to display limits.

log

The element `log` is the child of element `proxy` and specifies what to be logged by the proxy.

Specify the log file with command-line option `-l`.

The text of the `log` element is a sequence of options separated by white space. See the table below:

Table 4-1. Logging options

Option	Description
--------	-------------

Option	Description
<code>client-apdu</code>	Log APDUs as reported by YAZ for the communication between the client and the proxy. This facility is equivalent to the APDU logging that happens when using option <code>-a</code> , however this tells the proxy to log in the same file as given by <code>-l</code> .
<code>server-apdu</code>	Log APDUs as reported by YAZ for the communication between the proxy and the server (backend).
<code>clients-requests</code>	Log a brief description about requests transferred between the client and the proxy. The name of the request and the size of the APDU is logged.
<code>server-requests</code>	Log a brief description about requests transferred between the proxy and the server (backend). The name of the request and the size of the APDU is logged.

To log communication in details between the proxy and the backend, the following configuration could be used:

```
<target name="mytarget">
  <log>server-apdu server-requests</log>
</target>
```

Proxy Usage (man page)

yazproxy

Name

`yazproxy` — The YAZ toolkit's transparent Z39.50/SRW/SRU proxy

Synopsis

```
yazproxy [-a filename] [-l filename] [-m num] [-v level] [-t target] [-o level] [-i seconds] [-T seconds] [-p pidfile] [-u userid] [-c config] {host:port}
```

DESCRIPTION

yazproxy is a proxy that accepts connections from Z39.50/SRW/SRU clients and contacts a Z39.50 backend. The listening port must be specified on the command-line. **inetd** operation is not supported. The *host:port* argument specifies host address to listen to, and the port to listen on. Use the host @ to listen for connections coming from any address.

yazproxy can be configured using command-line options or a configuration file. Configuration file options override values specified on the command-line.

yazproxy rereads its configuration file and reopens log files when it receives the hangup signal, SIGHUP.

OPTIONS

-a filename

Specifies the name of a file to which to write a log of the APDUs (protocol packets) that pass through the proxy. The special filename - may be used to indicate standard output.

-l filename

Specifies the name of a file to which to write a log of the YAZ proxy activity. This uses the logging facility as provided by the YAZ toolkit. If this options is omitted, the output directed to stderr.

-m num

Specifies the maximum number of connections to be cached [default 50].

-v level

Sets the logging level. *level* is a comma-separated list of members of the set {fatal,debug,warn,log,malloc,all,none}.

-t target

Specifies the default backend target to use when a client connects that does not explicitly specify a target in its `initRequest`.

-o level

Sets level for optimization. Use zero to disable; non-zero to enable. Handling for this is not fully implemented; we will probably use a bit mask to enable/disable specific features. By default optimization is enabled (value 1).

-i seconds

Specifies in seconds the idle time for communication between client and proxy. If a connection is inactive for this long it will be closed. Default: 600 seconds (10 minutes).

-T seconds

Specifies in seconds the idle time for communication between proxy and backend target. If a connection is inactive for this long it will be closed. Default: 600 seconds (10 minutes).

`-p pidfile`

When specified, yazproxy will create *pidfile* with the process ID of the proxy. The pidfile will be generated before the process changes identity (see option `-u`).

`-u userid`

When specified, yazproxy will change identity to the user ID specified, just after the proxy has started listening to a possibly privileged port and after the PID file has been created if specified by option `-u`.

`-c config`

Specifies config filename. Configuration is in XML and is only supported if the YAZ proxy is compiled with libxml2.

EXAMPLES

The following command starts the proxy, listening on port 9000, with its default backend target set to Index Data's test server:

```
$ yazproxy -t indexdata.dk:210 @:9000
```

You can connect to the proxy via yaz-client as follows:

```
$ ./yaz-client localhost:9000/gils
Connecting...OK.
Sent initrequest.
Connection accepted by v3 target.
ID      : 81
Name    : Zebra Information Server/GFS/YAZ (YAZ Proxy)
Version: Zebra 1.3.15/1.23/2.0.19
Options: search present delSet scan sort extendedServices namedResultSets
Elapsed: 0.152108
Z> f computer
Sent searchRequest.
Received SearchResponse.
Search was a success.
Number of hits: 3, setno 1
SearchResult-1: computer(3)
records returned: 0
Elapsed: 0.172533
```

The YAZ command-line client, **yaz-client**, allows you to set the proxy address by specifying option `-p`. In that case, the actual backend target is specified as part of the Initialize Request.

Suppose the proxy running on localhost, port 9000. To connect to British Library's server at blpcz.bl.uk:21021 use:

```
yaz-client -p localhost:9000 blpcz.bl.uk:21021/BLPC-ALL
```


OtherInformation Encoding

The proxy uses the OtherInformation definition to carry information about the target address and cookie.

```
OtherInformation ::= [201] IMPLICIT SEQUENCE OF SEQUENCE{
  category          [1] IMPLICIT InfoCategory OPTIONAL,
  information        CHOICE{
    characterInfo    [2] IMPLICIT InternationalString,
    binaryInfo       [3] IMPLICIT OCTET STRING,
    externallyDefinedInfo [4] IMPLICIT EXTERNAL,
    oid              [5] IMPLICIT OBJECT IDENTIFIER}}
--
InfoCategory ::= SEQUENCE{
  categoryTypeId [1] IMPLICIT OBJECT IDENTIFIER OPTIONAL,
  categoryValue  [2] IMPLICIT INTEGER}
```

The categoryTypeId is either OID 1.2.840.10003.10.1000.81.1, 1.2.840.10003.10.1000.81.2 for proxy target and proxy cookie respectively. The integer element category is set to 0. The value proxy and cookie is stored in element characterInfo of the information choice.

YAZ Proxy Configuration Schema

Here an XML Schema for the YAZ proxy configuration file. The schema, yazproxy.xsd is located in sub directory etc of the distribution.

```
<?xml version="1.0"?>
<!-- XML Schema for YAZ proxy config file.
      $Id: reference.xml,v 1.11 2005/03/14 13:15:39 adam Exp $
-->
<xs:schema
  xmlns:xs="http://www.w3.org/2001/XMLSchema"
  xmlns:exp="http://explain.z3950.org/dtd/2.0/"
  xmlns="http://indexdata.dk/yazproxy/schema/0.9/"
  targetNamespace="http://indexdata.dk/yazproxy/schema/0.9/"
  >
  <xs:import namespace="http://explain.z3950.org/dtd/2.0/"
    schemaLocation="zeerex-2.0.xsd"/>
  <xs:element name="proxy">
    <xs:complexType>
      <xs:sequence>
        <xs:element ref="target" minOccurs="0" maxOccurs="unbounded"/>
        <xs:element ref="max-clients" minOccurs="0"/>
        <xs:element ref="log" minOccurs="0"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
</xs:schema>
```

```

    <xs:element ref="module" minOccurs="0"/>
  </xs:sequence>
</xs:complexType>
</xs:element>

<xs:element name="target">
  <xs:complexType>
    <xs:sequence>
      <xs:element ref="url" minOccurs="0" maxOccurs="unbounded"/>
      <xs:element ref="target-timeout" minOccurs="0"/>
      <xs:element ref="client-timeout" minOccurs="0"/>
      <xs:element ref="keepalive" minOccurs="0"/>
      <xs:element ref="limit" minOccurs="0"/>
      <xs:element ref="attribute" minOccurs="0" maxOccurs="unbounded"/>
      <xs:element ref="syntax" minOccurs="0" maxOccurs="unbounded"/>
      <xs:element ref="preinit" minOccurs="0"/>
      <xs:element ref="exp:explain" minOccurs="0"/>
      <xs:element ref="cql2rpn" minOccurs="0"/>
      <xs:element ref="target-authentication" minOccurs="0"/>
      <xs:element ref="client-authentication" minOccurs="0"/>
      <xs:element ref="negotiation-charset" minOccurs="0"/>
      <xs:element ref="negotiation-lang" minOccurs="0"/>
    </xs:sequence>
    <xs:attribute name="default" type="xs:string" use="optional"/>
    <xs:attribute name="name" type="xs:string"/>
    <xs:attribute name="database" type="xs:string"/>
  </xs:complexType>
</xs:element>

<xs:element name="url" type="xs:string"/>
<xs:element name="target-timeout" type="xs:integer"/>
<xs:element name="client-timeout" type="xs:integer"/>
<xs:element name="bandwidth" type="xs:integer"/>
<xs:element name="pdu" type="xs:integer"/>
<xs:element name="retrieve" type="xs:integer"/>
<xs:element name="preinit" type="xs:integer"/>
<xs:element name="cql2rpn" type="xs:string"/>
<xs:element name="target-authentication">
  <xs:complexType>
    <xs:simpleContent>
      <xs:extension base="xs:string">
        <xs:attribute name="type" type="xs:string"/>
      </xs:extension>
    </xs:simpleContent>
  </xs:complexType>
</xs:element>

<xs:element name="client-authentication">
  <xs:complexType>
    <xs:simpleContent>
      <xs:extension base="xs:string">
        <xs:attribute name="module" type="xs:string"/>
        <xs:attribute name="args" type="xs:string"/>
      </xs:extension>
    </xs:simpleContent>
  </xs:complexType>
</xs:element>

```

```

        </xs:extension>
    </xs:simpleContent>
</xs:complexType>
</xs:element>

<xs:element name="negotiation-charset" type="xs:string"/>
<xs:element name="negotiation-lang" type="xs:string"/>

<xs:element name="keepalive">
    <xs:complexType>
        <xs:sequence>
            <xs:element ref="bandwidth" minOccurs="0"/>
            <xs:element ref="pdu" minOccurs="0"/>
        </xs:sequence>
    </xs:complexType>
</xs:element>
<xs:element name="limit">
    <xs:complexType>
        <xs:sequence>
            <xs:element ref="bandwidth" minOccurs="0"/>
            <xs:element ref="pdu" minOccurs="0"/>
            <xs:element ref="retrieve" minOccurs="0"/>
        </xs:sequence>
    </xs:complexType>
</xs:element>

<xs:element name="attribute">
    <xs:complexType>
        <xs:attribute name="type" type="xs:string"/>
        <xs:attribute name="value" type="xs:string"/>
        <xs:attribute name="error" type="xs:integer"/>
    </xs:complexType>
</xs:element>

<xs:element name="syntax">
    <xs:complexType>
        <xs:sequence>
            <xs:element ref="title" minOccurs="0"/>
            <xs:element ref="name" minOccurs="0" maxOccurs="unbounded"/>
        </xs:sequence>
        <xs:attribute name="error" type="xs:string" />
        <xs:attribute name="type" type="xs:string" />
        <xs:attribute name="marcxml" type="xs:string" />
        <xs:attribute name="identifier" type="xs:string" />
        <xs:attribute name="stylesheet" type="xs:string" />
        <xs:attribute name="backendtype" type="xs:string" />
        <xs:attribute name="backendcharset" type="xs:string" />
        <xs:attribute name="usemarconstage1" type="xs:string" />
        <xs:attribute name="usemarconstage2" type="xs:string" />
    </xs:complexType>
</xs:element>

<xs:element name="title" type="xs:string"/>

```

```
<xs:element name="name" type="xs:string"/>

<xs:element name="max-clients" type="xs:integer"/>
<xs:element name="log" type="xs:string"/>
<xs:element name="module" type="xs:string"/>

</xs:schema>
```

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