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1 Introduction

BIND, the most frequently used DNS server, normally keeps its zone data in zone files. This approach becomes inconvenient when the number of zones grows beyond a certain limit. When this happens, the obvious solution is to move all data to a database and make named read it from there. Recent versions of BIND include dynamically loadable zones (DLZ) feature\(^1\), which makes it possible to use such databases directly. However, DLZ has problems of its own, one of them being that it is unable to propagate glue records\(^2\).

The nssync utility provides an alternative solution, which makes it possible to keep your zone data in an SQL\(^3\) database without using DLZ and with glue records working.

It does so by periodically polling the database to determine which data have changed recently and converting the database into BIND zone files.

---


\(^3\) As of version 1.1.91 only MySQL is supported.
2 Overview

The `nssync` utility is normally started periodically from crontab. Upon startup it reads its configuration file, which supplies the necessary program settings. Then, if the settings require so, it verifies that no other copy of the `nssync` is already running. Further on, it parses the `named` configuration file `named.conf` to determine several settings needed for its further operation, in particular, the value of the `directory` statement in the `options` block.

Once these preliminary operations are over, `nssync` starts its main task. Its configuration file defines, among other data, one or more `synchronization blocks`. Each such block defines SQL statements which return information about DNS zones as well as the location of `named` configuration file where the `zone` statements for these zones are to be stored (it is supposed that this file is included somewhere in the main `named.conf` file). For each synchronization block, the utility retrieves the zone data from the database and formats them into separate zone files. Each of these files is then compared to an already existing one (locations of the zone files are defined in the synchronization block they pertain to). If the files differ, new zone file replaces the old one and a flag is set indicating that the `named` daemon needs to be restarted in order to read new configuration.

When this stage is finished, `nssync` reloads the name server (if required) and exits.

Several command line options can be supplied in order to modify the program’s behavior. In particular, it is possible to check the configuration file syntax or even instruct the utility to do everything, except modifying the zone files (a so-called `dry-run mode`). This allows you to debug your configuration before actually starting using `nssync`. 
3 Configuration File

Nssync reads its settings from a configuration file nssync.conf located normally in the system configuration directory (usually /etc or /usr/local/etc, depending on compile-time options).

This chapter describes the syntax of that file in general. The chapter that follows describes the nssync-specific settings in detail.

The configuration file consists of statements and comments.

There are three classes of lexical tokens: keywords, values, and separators. Blanks, tabs, newlines and comments, collectively called white space are ignored except as they serve to separate tokens. Some white space is required to separate otherwise adjacent keywords and values.

3.1 Comments

Comments may appear anywhere where white space may appear in the configuration file. There are two kinds of comments: single-line and multi-line comments. Single-line comments start with ‘#’ or ‘//’ and continue to the end of the line:

    # This is a comment
    // This too is a comment

Multi-line or C-style comments start with the two characters ‘/*’ (slash, star) and continue until the first occurrence of ‘*/’ (star, slash).

Multi-line comments cannot be nested. However, single-line comments may well appear within multi-line ones.

3.2 Pragmatic Comments

Pragmatic comments are similar to usual single-line comments, except that they cause some changes in the way the configuration is parsed. Pragmatic comments begin with a ‘#’ sign and end with the next physical newline character.

    #include <file>
    #include file

Include the contents of the file file. If file is an absolute file name, both forms are equivalent. Otherwise, the form with angle brackets searches for the file in the include search path, while the second one looks for it in the current working directory first, and, if not found there, in the include search path.

The default include search path is:

1. prefix/share/nssync/1.1.91/include
2. prefix/share/nssync/include

where prefix is the installation prefix.
#include_once <file>
#include_once file
Same as #include, except that, if the file has already been included, it will not be included again.

#line num
#line num "file"
This line causes the parser to believe, for purposes of error diagnostics, that the line number of the next source line is given by num and the current input file is named by file. If the latter is absent, the remembered file name does not change.

# num "file"
This is a special form of #line statement, understood for compatibility with the C preprocessor.

In fact, these statements provide a rudimentary preprocessing features. For more sophisticated ways to modify configuration before parsing, see Section 3.4 [Preprocessor], page 8.

3.3 Statements
A simple statement consists of a keyword and value separated by any amount of whitespace. Simple statement is terminated with a semicolon (‘;’).

The following is a simple statement:

standalone yes;
pidfile /var/run/slb.pid;

A keyword begins with a letter and may contain letters, decimal digits, underscores (‘_’) and dashes (‘-’). Examples of keywords are: ‘expression’, ‘output-file’.

A value can be one of the following:

number A number is a sequence of decimal digits.

boolean A boolean value is one of the following: ‘yes’, ‘true’, ‘t’ or ‘1’, meaning true, and ‘no’, ‘false’, ‘nil’, ‘0’ meaning false.

unquoted string
An unquoted string may contain letters, digits, and any of the following characters: ‘_’, ‘-’, '.', '/', '@', '*', ':'.

quoted string
A quoted string is any sequence of characters enclosed in double-quotes (‘"’). A backslash appearing within a quoted string introduces an escape sequence, which is replaced with a single character according to the following rules:
Sequence          Replaced with
\a               Audible bell character (ASCII 7)
\b               Backspace character (ASCII 8)
\f               Form-feed character (ASCII 12)
\n               Newline character (ASCII 10)
\r               Carriage return character (ASCII 13)
\t               Horizontal tabulation character (ASCII 9)
\v               Vertical tabulation character (ASCII 11)
\\              A single backslash (\)
\"              A double-quote.

Table 3.1: Backslash escapes

In addition, the sequence '\newline' is removed from the string. This allows to split long strings over several physical lines, e.g.:

"a long string may be\nsplit over several lines"

If the character following a backslash is not one of those specified above, the backslash is ignored and a warning is issued.

Two or more adjacent quoted strings are concatenated, which gives another way to split long strings over several lines to improve readability. The following fragment produces the same result as the example above:

"a long string may be"
" split over several lines"

Here-document

A here-document is a special construct that allows to introduce strings of text containing embedded newlines.

The '<<word' construct instructs the parser to read all the following lines up to the line containing only word, with possible trailing blanks. Any lines thus read are concatenated together into a single string. For example:

<<EOT
A multiline string
EOT

The body of a here-document is interpreted the same way as a double-quoted string, unless word is preceded by a backslash (e.g. '<<\EOT') or enclosed in double-quotes, in which case the text is read as is, without interpretation of escape sequences.

If word is prefixed with - (a dash), then all leading tab characters are stripped from input lines and the line containing word. Fur-
thermore, if - is followed by a single space, all leading whitespace is stripped from them. This allows to indent here-documents in a natural fashion. For example:

```
<<- TEXT
    The leading whitespace will be
    ignored when reading these lines.
TEXT
```

It is important that the terminating delimiter be the only token on its line. The only exception to this rule is allowed if a here-document appears as the last element of a statement. In this case a semicolon can be placed on the same line with its terminating delimiter, as in:

```
help-text <<-EOT
    A sample help text.
EOT;
```

list

A list is a comma-separated list of values. Lists are enclosed in parentheses. The following example shows a statement whose value is a list of strings:

```
alias (test,null);
```

In any case where a list is appropriate, a single value is allowed without being a member of a list: it is equivalent to a list with a single member. This means that, e.g.

```
alias test;
```

is equivalent to

```
alias (test);
```

A block statement introduces a logical group of statements. It consists of a keyword, followed by an optional value, and a sequence of statements enclosed in curly braces, as shown in the example below:

```
server srv1 {
    host 10.0.0.1;
    community "foo";
}
```

The closing curly brace may be followed by a semicolon, although this is not required.

### 3.4 Preprocessor

Before actual parsing, the configuration file is preprocessed. The built-in preprocessor handles only file inclusion and `#line` statements (see Section 3.2 [Pragmatic Comments], page 5), while the rest of traditional preprocessing facilities, such as macro expansion, is supported via `m4`, which serves as external preprocessor.

The detailed description of `m4` facilities lies far beyond the scope of this document. You will find a complete user manual in Section “GNU M4” in
**GNU M4 macro processor.** For the rest of this subsection we assume the reader is sufficiently acquainted with m4 macro processor.

The external preprocessor is invoked with `-s` flag, which instructs it to include line synchronization information in its output. This information is then used by the parser to display meaningful diagnostic.

An initial set of macro definitions is supplied by the `pp-setup` file, located in `prefix/share/nssync/1.1.91/include` directory.

The default `pp-setup` file renames all m4 built-in macro names so they all start with the prefix `m4_`. This is similar to GNU m4 `--prefix-builtin` option, but has an advantage that it works with non-GNU m4 implementations as well.
4 Nssync Configuration

4.1 General Settings

These settings modify the behavior of nssync as a whole.

**pidfile file**

At startup, check if file already exists and is owned by an existing process. Exit if so. Use this statement to avoid accidentally running two copies of nssync simultaneously.

**tempdir dir**

Sets the name for the temporary directory. This is a directory where nssync creates temporary zone files. The argument must point to an existing directory.

**check-ns bool**

If set to true, nssync will check the list of NS servers prior to creating a zone file. The file will be created only if IPv4 address of one of the servers matches one of the IP addresses of the host on which nssync is run.

**named-conf file**

Defines the full pathname of the named configuration file. Default is /etc/named.conf.

**bind-include-path list**

Sets include search path for include directives found in BIND configuration. The argument is either a single directory or a list of directories (see Section 3.3 [Statements], page 6).

**zonefile-pattern pat**

Defines the pattern for zone file names. The name of each zone file is created by expanding variable references in the pat argument. The following variable references are defined:

- $zone
- ${zone} Name of the zone, without the trailing dot.
- $synctag
- ${synctag} Zone synchronization tag (see Section 4.3 [Synchronization Block], page 13).

Both notations (with and without braces) are equivalent. The notation with curly braces should be used if the reference is immediately followed by a letter.

The default zone file pattern is ‘$zone.$synctag’.
zone-conf pat
  [Configuration]
  Defines the pattern for zone configuration file, i.e. a file containing zone statements.
  The handling of pat is similar to that in zonefile-pattern, except that only the ‘$synctag’ reference is defined.

compare-command cmd
  [Configuration]
  Defines a command to be used for comparing two zone files. The cmd must be a command taking two files as its arguments and returning 0 if they are the same or non-zero if they differ. Nssync uses this command to determine whether a particular zone has changed. The following variable references are expanded in cmd:

  $oldfile
  ${oldfile}  Old zone file.

  $newfile
  ${newfile}  New zone file.

  The default compare-command value is:
  
  
  cmp $oldfile $newfile > /dev/null

reload-command cmd
  [Configuration]
  Defines a command to reload the nameserver. The default is ‘/usr/sbin/rndc reload’.

4.2 SQL Access

The following statements define the database server and the database to use:

host hostname[:port-or-socket]
  [Configuration]
  Defines the SQL server IP and port. The hostname can be either the server IP address or its hostname. The port-or-socket part, if supplied, can be either the number of TCP port to use instead of the default 3306 or the full pathname of the UNIX socket. In the latter case hostname is effectively ignored.

database name
  [Configuration]
  Sets the database name.

ssl-ca file
  [Configuration]
  Defines the name of the Certificate Authority (CA) file.

  There are two ways to supply database access credentials. The simplest one is by using user and password statements:

user name
  [Configuration]
  Sets SQL user name.
password arg

Sets SQL user password.

The drawback of this approach is that the password appears in plaintext, which means the permissions of the \texttt{nssync.conf} file must be tightened so as to avoid its compromise.

The following two statements provide an alternative, more safe and flexible way of setting access credentials:

\begin{verbatim}
sql-config-file file
Read MySQL configuration from the \texttt{option file file}. See Section “option-files” in \texttt{MySQL Manual}, for a description of MySQL option file format.

sql-config-group name
Read the named group from the SQL configuration file.
\end{verbatim}

To illustrate their use, suppose your \texttt{nssync.conf} file contains the following:

\begin{verbatim}
sql-config-file /etc/nssync.my;
sql-config-group nssync;
\end{verbatim}

The the \texttt{/etc/nssync.my} will contain the actual SQL access configuration, which can look as in the example below:

\begin{verbatim}
[nssync]
socket = /var/db/mysql.sock
database = dns
user = root
pass = guessme
\end{verbatim}

\begin{verbatim}
slave-status-file file
Use this statement if \texttt{nssync} reads data from a slave database. It allows you to avoid recreating zone files if the database information has not changed since the previous run.

If this statement is present, \texttt{nssync} will save the state of the SQL slave in \texttt{file}. Upon startup, it will read these data and compare them with the current state. If they are the same, it will exit immediately.
\end{verbatim}

\section{4.3 Synchronization Block}

A \textit{synchronization block} defines a set of zones to be synchronized from the database and configures SQL statements which return the zone data. This set is identified by \textit{synchronization tag}, supplied as the argument to the \texttt{sync} statement:

\begin{verbatim}
# Define a synchronization block.
sync tag {
    # zone configuration file
    zone-conf pat;
    # pattern for new zone file names
\end{verbatim}
zonefile-pattern pat;
# add these statements to each generated zone file
add-statements text;
# a query for retrieving SOA records
soa-query string;
# a query for retrieving NS and similar records
ns-query string;
# a query for retrieving the rest of RRs
rr-query string;
# a query for retrieving RRs from reverse delegation zones
rev-rr-query string;
}

Statements within the sync block configure the zones:

zone-conf pat                  [Configuration]
Defines the pattern for the name of zone configuration file for zones in this
synchronization block. If not supplied, the global zone-conf statement
will be used instead (see [zone-conf], page 12).

zonefile-pattern pat           [Configuration]
Defines the pattern for zone file names. If not supplied, the global
zonefile-pattern statement will be used instead (see [zonefile-pattern],
page 11).

add-statements text            [Configuration]
Append text to each generated zone statement. For example, the follow-
ing can be used to redefine forwarders and query ACLs for zones in this
synchronization block:

```
add-statements "<<EOT
  forwarders { /* empty */ };  
  allow-query { local-query-only; }; 
EOT;
```

Notice the use of the here-document construct.

The following statements define which zones pertain to this particular
synchronization block:

soa-query string               [Configuration]
A query for retrieving SOA records.

ns-query string                [Configuration]
A query for retrieving NS and similar records. Use the '$zone' reference
for the zone name.

rr-query string                [Configuration]
A query for retrieving the rest of RRs. Use the '$zone' reference for the
zone name.
rev-rr-query string

A query for retrieving RRs from reverse delegation zones. Use the `$zone` reference for the zone name.

Here is an example of a working sync directive:

```plaintext
sync external {
    zone-conf "/var/namedb/nssync/zones.external";
    zonefile-pattern "/var/namedb/external/db.$zone";
    
    soa-query "select zone, ttl, type, data, resp_person, "
                "serial, refresh, retry, expire, minimum "
                "from dns_soa where type='SOA' "
                "and view='external' order by zone";
    
    ns-query "select ttl, type, data "
              "from dns_soa where zone='$zone' "
              "and type<>'SOA' and view='external'";
    
    rr-query "select host, ttl, type, mx_priority, "
                "case when type='TXT' then "
                "concat('"', data, '"') "
                "else data end "
                "from dns_records "
                "where zone='$zone' and view='external' "
                "order by 1";
    
    rev-rr-query "select host, ttl, type, mx_priority, "
                 "case when type='TXT' then "
                 "concat('"', data, '"') "
                 "else data end "
                 "from dns_records "
                 "where zone='$zone' and view='external' "
                 "order by cast(host as unsigned)";
}
```
5 Invocation

The \texttt{nssync} is normally invoked periodically from a crontab, e.g.:\footnote{Chapter 6 [Exit Codes], page 19.}

\begin{verbatim}
*/5  *  *  *  *  /usr/sbin/nssync | \ 
/usr/bin/logger -t nssync -p local1.err
\end{verbatim}

The following table summarizes available command line options:

\begin{itemize}
  \item \texttt{-E} Preprocess configuration file and exit.
  \item \texttt{-c file}
  \item \texttt{--config-file=file} Use \texttt{file} instead of the default configuration file.
  \item \texttt{-f}
  \item \texttt{--force} Proceed even if slave status has not changed (see \texttt{[slave-status-file]}, page 13).
  \item \texttt{-n}
  \item \texttt{--dry-run} Do nothing, print almost everything; implies \texttt{--debug --stderr}. Use additional \texttt{--debug} options to get even more info.
  \item \texttt{-t}
  \item \texttt{--lint} Parse configuration file and exit. The return status is 0 if the syntax is OK, and 78 if errors were detected (see \texttt{Chapter 6 [Exit Codes]}, page 19).
  \item \texttt{-D symbol=value}
  \item \texttt{--define=symbol[=value]} Define a preprocessor symbol.
  \item \texttt{-I dir}
  \item \texttt{--include-directory=dir} Add include directory.
  \item \texttt{--no-preprocessor} Disable preprocessing.
  \item \texttt{--preprocessor=command} Use \texttt{command} instead of the default preprocessor.
  \item \texttt{-d}
  \item \texttt{--debug} Increase debug level.
  \item \texttt{-X}
  \item \texttt{--debug-lexer} Debug configuration file lexer.
  \item \texttt{-x}
  \item \texttt{--debug-parser} Debug configuration file parser.
\end{itemize}
--config-help
    Show configuration file summary

-V
--version
    Print program version.

-h
--help
    Give this help list.
--usage
    Give a short usage message.
6 Exit Codes

Apart from issuing a descriptive error message, *nssync* attempts to indicate the reason of its termination by its error code. As usual, a zero exit code indicates normal termination. The table below summarizes all possible error codes. For each error code, it indicates its decimal value and its symbolic name from *include/sysexits.h* (if available).

<table>
<thead>
<tr>
<th>Code</th>
<th>Symbolic Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>EX_OK</td>
<td>Program terminated correctly.</td>
</tr>
<tr>
<td>64</td>
<td>EX_USAGE</td>
<td>The program was invoked incorrectly, e.g. an invalid option was given, or an erroneous argument was supplied to an option.</td>
</tr>
<tr>
<td>69</td>
<td>EX_UNAVAILABLE</td>
<td>The program exited due to some error not otherwise described in this table.</td>
</tr>
<tr>
<td>70</td>
<td>EXSOFTWARE</td>
<td>Some internal software error occurred.</td>
</tr>
<tr>
<td>78</td>
<td>EX_CONFIG</td>
<td>An error in the configuration file was detected.</td>
</tr>
</tbody>
</table>
7 How to Report a Bug

Email bug reports to gray+nssync@gnu.org.ua. Please include a detailed description of the bug and information about the conditions under which it occurs, so we can reproduce it. To facilitate the task, the following list shows the basic set of information that is needed in order to find the bug:

- Package version you use.
- A detailed description of the bug.
- Conditions under which the bug appears.
- It is often helpful to send the contents of config.log file along with your bug report. This file is created after running ./configure in the nssync source root directory.
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Version 1.3, 3 November 2008
http://fsf.org/

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Concept Index

This is a general index of all issues discussed in this manual.

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