# NXLOG Community Edition Reference Manual for v2.8.1248

Ed. v2.8.1248

# Contents

# Chapter 1

# Introduction

## 1.1 Overview

Today's IT infrasturcture can be very demanding in terms of event logs. Hundreds of different devices, applications, appliances produce vast amounts of event log messages. These must be handled in real time, forwarded or stored in a central location after filtering, message classification, correlation and other typical log processing tasks. In most organizations these tasks are solved by connecting a dozen different scripts and programs which all have their custom format and configuration. nxlog is a high-performance multi-platform log management solution aimed at solving these tasks and doing it all in one place.

nxlog can work in a heterogenous environment collecting event logs from thousands of different sources in many formats. nxlog can accept event logs from tcp, udp, file, database and various other sources in different formats such as syslog, windows event log etc. It can perform log rewrite, correlation, alerting, pattern matching, execute scheduled jobs, or even log rotation. It was designed to be able to fully utilize todays multi-core CPU systems. Its multi-threaded architecture enables input, log processing and output tasks to be executed in parallel. Using a high-performance I/O layer it is capable of handling thousands of simultaneous client connections and process log volumes above the 100.000 EPS range. nxlog tries hard to minimize loosing log messages, it does not drop any unless instructed to. It can process input sources in a prioritized order, meaning that a higher priority source will be always processed before others. This can further help avoiding UDP message loss for example. In case of network congestion or other log transmission problems, nxlog can buffer messages on the disk or in memory. Using loadable modules it supports different input sources and log formats, not only limited to syslog but windows event log, audit logs or even custom binary application logs. It is possible to further extend its functionality by using custom loadable modules similarly to the Apache Web server. In addition to the online log processing mode it can be used to process logs in batch mode in an offline fashion. A powerful configuration language with an Apache style configuration file syntax enables it to rewrite logs, send alerts, execute external scripts or do virtually anything based on any criteria specified using the nxlog configuration language.

## 1.2 Features

### 1.2.1 Multiplatform

nxlog is built to utilize the Apache Portable Runtime Library (libapr), the same solid foundation as the Apache Webserver is built on which enables nxlog to run on many different operating systems including different Unix flavors (Linux, HP-UX, Solaris, *BSD etc). It compiles and runs as a native Windows application without requiring the CygWin libraries on Microsoft Windows platforms.

### 1.2.2 Modular architecture

nxlog has a lightweight modular architecture, pluggable modules are available to provide different features and functions similarly to the Apache HTTP server. Log format parsers, transmission protocol handlers, database handlers and nxlog language extensions are such modules. A module is only loaded if it is necessary, this helps reduce memory as well. The core of nxlog only contains

code to handle files and sockets in addition to the configuration parser and the lightweight built-in language engine. All transport protocol handlers, format parsers (such as syslog) etc reside in modules. Modules have a common API, developers can easily write new modules and extend the functionality of nxlog.

### 1.2.3 Client-server mode

nxlog can act as a client and/or a server. It can collect logs from local files and the operating system then forward it to to a remote server. It can accept connections and receive logs over the network then write these to a database or files or forward it further. It all depends how it is configured.

### 1.2.4 Log message sources and destinations

In addition to reading from and writing to log files, nxlog supports different protocols on the network and transport layer such as TCP, UDP, TLS/SSL and Unix Domain Socket. It can both read and write from such sources and can convert between then, read input from an UDP socket and send out in TCP for example.

Many database servers are supported (PostgreSQL, MySQL, Oracle, MsSQL, SqlLite, Sybase, etc) through database input and output modules so that log messages or data extracted from log messages can be stored or read from a database.

### 1.2.5 Importance of security

On unix systems nxlog can be instructed to run as a normal user by dorpping its root privileges. Modules requiring special privileges (e.g. kernel, tcp port bind below 1024) use Linux capabilites and do not require it to be running as root.

To secure data and event logs, nxlog provides TLS/SSL transport so that messages cannot be intercepted and/or altered during transmission.

### 1.2.6 Scalable multi-threaded architecture

Using an event based architecture, tasks within nxlog are processed in a parallel fashion. Non-blocking I/O is used wherever possible and a worker thread pool takes care of handling ready to be processed log messages. Reading input, writing output and log processing (parsing, pattern matching, etc) are all handled in parallel. For example when single threaded syslog daemons block trying to write output to a file or database, UDP input will be lost. The multi-threaded architecture of nxlog not only avoids this problem but enables to fully utilize today's multi-core and multi-processor systems for maximum throughput.

### 1.2.7 High performance I/O

Traditional POSIX systems provide the select(2) and/or poll(2) system calls to monitor file descriptors, unfortunately using these methods is not scalable. Modern operating systems have some I/O readiness notification API to enable handling a large number of open files and network connections simultaneously. nxlog is capable of using these high-performance I/O readieness notification APIs and can handle thousands of simultaneous network connections. Together with its massively multi-threaded architecture, this enables nxlog to process log messages from thousands of simultaneous network connections above the hundred thousand event per second (EPS) range.

### 1.2.8 Message buffering

When write blocks on the sending side, because of a network trouble for example, nxlog will throttle back on the input side using flow control. In some cases it is preferable that the logs are continued to be read on the input side, to avoid dropping UDP syslog messages for example. There is a module avalable which makes it possible to buffer log messages to disk and/or memory. When the problems are solved and the system is back in order and can send out messages faster then being received, then the buffer is automatically emptied. Together with the nxlog language it is also possible to do conditional buffering based on different parameters (time or system load for example).

### 1.2.9 Prioritized processing

Not all log sources are always equally important. Some systems send critical logs which should be processed at a higher priority than others. nxlog supports assigning priorites to log routes, this ensures that higher priority log messages are dealt with (read, processed and written/sent out) first, only then are the messages with lower priorities handled. For example this can help avoiding the situation where a TCP input can overload the system leading to dropped incoming UDP syslog messages.

### 1.2.10 Avoiding lost messages

Built-in flow control ensures that nxlog does not drop log messages and you will not see any logs such as the following:

```
Dec 18 18:42:42 server syslog-ng[1234]: STATS: dropped 42
```

Though nxlog can be explicitly instructed to drop log messages depending on certain conditions in order to avoid a possible resource exhaustion or filter out unwanted messages.

UDP syslog is a typical case where a message can be lost due to the nature of the UDP protocol. If the kernel buffer becomes full because it is not read, the operating system will drop any further received UDP messages. If a log processing system is busy processing logs, reading from TCP and UDP and writing to database or disk, the kernel UDP buffer can fill quickly. Utilizing the above mentioned parallel processing, buffering and I/O prioritization features it is possible to greatly reduce losing UDP syslog messages. Of course using TCP can help avoiding message loss, unfortunately there are many archaic devices which only support UDP syslog.

### 1.2.11 Apache-style configuration syntax

nxlog uses Apache style configuration file syntax. This format is in use by many other popular system daemons and tools as it is easy to read and/or generate by both humans and scripts.

### 1.2.12 Built-in config language

A built-in configuration language enables administrators to create complex rules, format or rewrite messages or execute some action. Using this language it is possible to do virtually anything without the need to forward messages to an external script. Loadable modules can register their own procedures and functions to further extend the capabilities of the nxlog language.

Perl is a highly popular language in solving log processing tasks. The built-in nxlog language is very similar in syntax to Perl. In addition to the normal operations it supports polymorphic functions and procedures, regular expressions with captured substrings. It should be fairly trivial to write and understand by people experienced in Perl programming unlike some macro based configuration languages found in other solutions.

### 1.2.13 Scheduled tasks

nxlog has a built-in scheduler similar to cron, but with more advanced capabilities to specify the timings. Using this feature, administrators can automate tasks such as log rotation or system health check from within nxlog without having to use external scheduler tools. Each module can schedule any number of actions to be executed through the built-in nxlog language.

### 1.2.14 Log rotation

Log files can be rotated by size or time without the need of external log rotation tools. Log rotation can also be scheduled in order to guarantee timely file rotation.

The file input reader module supports external log-rotation scripts, it can detect when an input file was moved/renamed and will reopen its input. Similarly, the file output writer module can also monitor when the file being written to is rotated and will reopen its original output. This way it is possible to keep using external log rotation tools without the need to migrate to the built-in log rotation.

### 1.2.15 Different log message formats

Nxlog supports both the older legacy syslog format (RFC 3164) and the newer IETF Syslog standard (RFC 5424) and it can also produce syslog in the Snare Agent format. nxlog is not only a syslog daemon but can handle many other protocols and log file formats such as Windows Event Log, Checkpoint logs through LEA, OS audit logs, log message data in comma separated (CSV) format or delimited, GELF, JSON, XML or custom application logs. It can parse and generate most of these formats as well. It is only a matter of selecting the appropriate log format parser. Log format parsers are also provided by loadable modules, nxlog will only use parsers which are configured and required for its log processing. For example if the log processing task does not deal with any syslog data, then there is no need to load the syslog module at all.

Using regular expressions and string operation functions of the built-in nxlog language, any data can be extracted from log messages and can be converted to any format required. It is possible to configure nxlog in such a way that it reads log messages in one format then converts it internally to a different one and sends the output to another destination enabling on-the-fly log conversion. For example it is possible to convert Windows Event Log to syslog on a Windows host and send it to a central syslog server.

By using log format parser functions, nxlog can handle multi-line log messages (such as the Apache Tomcat log) or even custom binary formats. A special nxlog message format can preserve the parsed fields of log messages and transfer these across the network or store in files which alleviates the need to parse the messages again at the reception without loosing any information.

### 1.2.16 Advanced message processing capabilites

In addition to the features provided by the above mentioned built-in nxlog language, using additional modules nxlog is capable to solve all tasks related to log message processing such as message classification, event correlation, pattern matching, message filtering, rewrite, conditional alerting etc.

### 1.2.17 Offline processing mode

Sometimes messages need to be processed in an offline fashion, convert log files to another format, filter out messages or load files into a database for log analysis purposes. nxlog can also work in an offline mode when it processes log messages until there is no more input and then exits, so it is possible to do batch processing tasks with it as well.

It is an important factor that in offline mode the time of the event and the current time are not the same and are not even close. Many log processing tools assume the event time to be the current time, thus making offline processing impossible. Due to network problems and buffering it is possible that log messages are not received instantly but with some delay. Making decisions based on event reception time instead of the timestamp provided in the message is a big mistake and can lead to false alarms in event correlation engines for example. By using the event time available in messages, nxlog can work properly in both offline and online mode with log messages. This is escpecially important to be able to do proper time based event correlation in real-time and in offline mode as well.

### 1.2.18 Character set and i18n support

Log messages can be emitted in different languages and character sets. It is also a common problem that the messages use different character sets even for one language. For example Microsoft Windows systems use the UTF-16 character set, other systems can create messages using the UTF-8 encoding. UTF-8 has become a standard on Unix systems, yet some legacy applications and system settings create log messages using another codepage, for example latin-2 or ISO-8859-2 in Eastern Europe or EUC-JP in Japan.

Comparing two strings in different character sets can likely fail. Also some database engines only support storing text data in one character set only, trying to insert text in a different character set can result in an error and data loss. It is a good practice to normalize logs to a common character set such as UTF-8 in order to overcome these problems.

nxlog supports explicit character set conversion from one character set to another. In addition it can also detect the character set of a string and convert it to a specific character set. Using charset autodetection, nxlog is capable of normalizing log messages which can contain strings in mixed character sets even without knowing the exact encoding of the source log message.

# Chapter 2

# Installation and quickstart

This chapter will guide to quickly get nxlog set up and running.

## 2.1 Microsoft Windows

**Install the MSI pacakge** Run the nxlog installer using the MSI package, accept the license agreement and click finish.

**Edit nxlog.conf** The nxlog configuration file `nxlog.conf` is put under `C:\Program Files\nxlog\conf` or `C:\Program Files (x86)\nxlog\conf` on 64bit architectures. Using a text editor such as notepad.exe, open `nxlog.conf`.

**Verify the ROOT path in nxlog.conf** The windows installer uses the `C:\Program Files\nxlog` directory for the installation. On 64bit machines this is `C:\Program Files (x86)\nxlog`. We refer to this as the `ROOT` path. Please verify the `nxlog.conf` configuration file and use the appropriate ROOT path:

```
define ROOT C:\Program Files\nxlog
 or
define ROOT C:\Program Files (x86)\nxlog
```

**Configure nxlog** The most common use-case for nxlog on windows is to collect logs from the EventLog subsystem and forward it over the network. Here is a simple configuration which reads the EventLog and forwards it over UDP in the SNARE agent format.

```
<Extension syslog>
    Module      xm_syslog
</Extension>

<Input internal>
    Module      im_internal
</Input>

<Input eventlog>
    Module      im_msvistalog
</Input>

<Output out>
    Module      om_udp
    Host        192.168.1.1
    Port        514
    Exec        to_syslog_snare();
</Output>

<Route 1>
```

```
    Path        eventlog, internal => out
</Route>
```

There are endless configurations for Windows systems depending on what to collect and how to send or store. Please read the relevant chapters from this manual:

Reading and receiving logs
Processing logs
Forwarding and storing logs

**Start nxlog** nxlog can be started using the following methods:

Start the Service Manager, find 'nxlog' in the list. Select it and start the service.
Double-click on `nxlog.exe`.

**Check the logs** The default configuration instructs nxlog to write its own logs to the file located at `C:\Program Files\nxlog\data\nxlog.log` or `C:\Program Files (x86)\nxlog\data\nxlog.log`. Open it with notepad.exe and check for errors. Note that some text editors (such as wordpad) need exclusive locking and will refuse to open the log file while nxlog is running.

## 2.2 GNU/Linux

### 2.2.1 Installing from DEB packages (Debian, Ubuntu)

**Install the dependencies first** To list the dependencies, use the following command:

```
dpkg-deb -f nxlog_1.4.581_amd64.deb Depends
```

Then make sure all listed dependencies are installed. Alternatively you can run **apt-get install -f** after trying to install the package with dpkg and getting an error due to the missing dependencies.

**Install the deb package** To install the deb package, issue the following command as root:

```
dpkg -i nxlog_1.4.581_amd64.deb
```

### 2.2.2 Installing from RPM packages (CentOS, RedHat)

Install the rpm package with the following command:

```
rpm -ivh nxlog-1.4.581-1.x86_64.rpm
```

### 2.2.3 Configuring nxlog on GNU/Linux

After the package is installed check and edit the configuration file located at `/etc/nxlog/nxlog.conf`. It contains an example configuration which you will likely want to modify to suit your needs. Please read the relevant chapters from this manual on how to configure nxlog:

Reading and receiving logs
Processing logs
Forwarding and storing logs

# Chapter 3

# Architecture and concepts

## 3.1 History

For a few years we have been using a modified version of msyslog. It is also capable of using plugins for different inputs and outputs. Unfortunately, like many other syslog implementations, it was based on the BSD syslog with a single threaded architecture. Since it was a syslog daemon, everything had to be converted to syslog. We soon realized that something better is needed with the features required by a modern logging solution.

We started looking for other solutions. There were a few possible alternatives to msyslog with some nice features (e.g. rsyslog, syslog-ng, etc), but none of them qualified. Most of them were still single threaded, syslog oriented without native support for MS Windows, in addition to awkward configuration syntax, ugly source-code and so on. So I decided that it would be easier for us on the long term to design and write nxlog from scratch instead of hacking something else. Thus nxlog was born in 2009 and has been a closed source product heavily used in several production deployments since. The source code of NXLOG Community Edition was released in November 2011.

## 3.2 Concepts

Most log processing solutions are built around the same concept. The input is read from a source, then the log messages are processed. Finally output is written or sent to a sink in other terminology.

When an event occurs in an application or a device, depending on its configuration a log message is emitted. This is usually referred to as an "event log" or "log message". These log messages can have different formats and can be transmitted over different protocols depending on the actual implementation.

There is one thing common in all event log messages. All contain important data such as user names, IP addresses, application names, etc. This way an event can be represented as a list of key-value pairs which we call a "field". The name of the field is the key and the field data is the value. In another terminology this meta-data is sometimes referred to as event property or message tag. The following example illustrates a syslog message:

```
<30>Nov 21 11:40:27 log4ensics sshd[26459]: Accepted publickey for log4ensics from ↩
    192.168.1.1 port 41193 ssh2
```

The fields extracted from this message are as follows:

```
AuthMethod              publickey
SourceIPAddress         192.168.1.1
AccountName             log4ensics
SyslogFacility          DAEMON
SyslogSeverity          INFO
Severity                INFO
EventTime               2009-11-21 11:40:27.0
Hostname                log4ensics
```

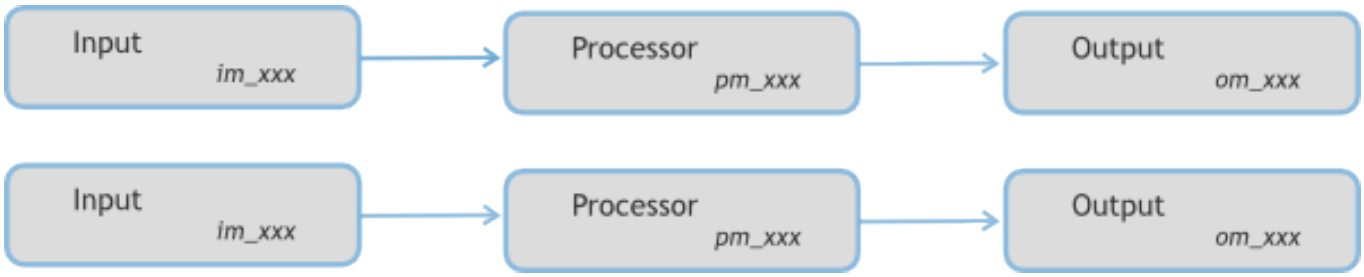
```
ProcessID               26459
SourceName              sshd
Message                 Accepted publickey for log4ensics from 192.168.1.1 port 41193 ssh2
```

nxlog will try to use the Common Event Expression standard for the field names once the standard is stable.

nxlog has a special field, $raw_event. This field is handled by the transport (UDP, TCP, File, etc) modules to read input into and write output from it. This field is also used later to parse the log message into further fields by various functions, procedures and modules.

## 3.3 Architecture

By utilizing loadable modules, the plugin architecture of nxlog allows it to read data from any kind of input, parse and convert the format of the messages and then send it to any kind of output. Different input, processor and output modules can be used at the same time to cover all the requirements of the logging environment. The following figure illustrates the flow of log messages using this architecture.




*Architecture*

The core of nxlog is responsible for parsing the configuration file, montitoring files and sockets, and managing internal events. It has an event based architecture, all modules can dispatch events to the core. The nxlog core will take care of the event and will optionally pass it to a module for processing. nxlog is a multi-threaded application, the main thread is responsible for monitoring files and sockets. These are added to the core by the different input and output modules. There is a dedicated thread handling internal events. It sleeps until the next event is to be processed then wakes up and dispatches the event to a worker thread. nxlog implements a worker thread-pool model. Worker threads receive an event which must be processed immediately. This way the nxlog core can centrally control all events and the order of their execution making prioritized processing possible. Modules which handle sockets or files are written to use non-blocking I/O in order to ensure that the worker threads never block. The files and sockets monitored by the main thread also dispatch events which are then delegated to the workers. Each event belonging to the same module is executed in sequential order, not concurrently. This ensures that message order is kept and gives a great benefit of not having to deal with concurrency issues in modules. Yet the modules (worker threads) run concurrently, thus the global log processing flow is greatly parallelized.

When an input module receives data, it creates an internal representation of the log message which is basically a structure containing the raw event data and any optional fields. This log message is then pushed to the queue of the next module in the route and an internal event is generated to signal the availability of the data. The next module after the input module in a route can be either a processor module or an output module. Actually an input or output module can also process data through built in code or using the nxlog language execution framework. The only difference is that processor modules are run in another worker thread, thus parallelizng log processing even more. Considering that processor modules can also be chained, this can efficiently distribute work among multiple CPUs or CPU cores in the system.

# Chapter 4

# Configuration

nxlog uses Apache-style configuration files. The configuration file is loaded from its default location or it can be explicitly specified with the `-c` command line argument.

The config file is made up of blocks and directives. Blocks are similar to xml tags containing multiple directives. Directive names are case insensitive but arguments are not always. A directive and its argument must be specified on the same line. Values spanning multiple lines must have the newline escaped with the backslash "\". A typical case for this is the Exec directive. Blank lines are ignored.

Lines starting with the hashmark "#" are comments and are ignored.

The configuration file can be logically divided into three parts: global parameters, module definitions and their configuration and routes which link the modules together according to the data flow required.

## 4.1 File inclusion

Using the 'include' directive it is possible to specify a file which will be included in the current config file. Special care must be taken when specifing files with relative filenames. The SpoolDir directive will only take effect after the configuration was parsed, so relative paths specified with the 'include' directive are relative to the working directory where nxlog was started from.

The include directive also supports wildcarded file names (e.g. `*.conf`) so that it is possible to include a set of files within a directory without the need to explicitly list all.

**Example 4.1** File inclusion example

```
include modules/module1.conf
```

**Example 4.2** Config file inclusion with wildcards

```
include /etc/nxlog.d/*.conf
```

## 4.2 Constant and macro definitions

Defines are useful if there are many instances in the code where the same value must be used, directory or host names are typical cases. In such cases the value can be configured with a single definition. This can be used to not only define constants but any string like code snippets or parser rules.

An nxlog define works similarly as in C where the preprocessor substitutes the value in places where the macro is used, i.e. the nxlog configuration parser will first replace all occurences of the defined name with its value, only after this substitution will the configuration check occur.

**Example 4.3** Example for using defines

```
define BASEDIR /var/log
define IGNORE_DEBUG if $raw_event =~ /debug/ drop();

<Input messages>
    Module      im_file
    File        '%BASEDIR%/messages'
</Input>

<Input proftpd>
    Module      im_file
    File        '%BASEDIR%/proftpd.log'
    Exec        %IGNORE_DEBUG%
</Input>
```

The following example shows an incorrect use if the define directive. After substitution the `drop()` procedure will be always executed, only the warning message is emitted conditionally.

**Example 4.4** Incorrect use of a define

```
define ACTION log_warning("dropping message"); drop();

<Input messages>
    Module      im_file
    File        '/var/log/messages'
    Exec        if $raw_event =~ /dropme/ %ACTION%
</Input>
```

To avoid this problem, the defined action should be one code block, i.e. it should be enclosed within curly braces:

```
define ACTION { log_warning("dropping message"); drop(); }
```

## 4.3 Global directives

**ModuleDir** By default the nxlog binaries have a compiled-in value for the directory to search for loadable modules. This can be overrridden with this directive. The module directory contains subdirectories for each module type (extension, input, output, processor) and the module binaries are located in those.

**PidFile** Under Unix operating systems nxlog writes a pid file as other system daemons do. The default value can be overridden with this directive in case multiple daemon instances need to be running. This directive has no effect on MS Windows or with the nxlog-processor.

**LogFile** nxlog will write its internal log to this file. If this directive is not specified, self logging is disabled. Not that the im_internal module can be also used to direct internal log messages to files or different output destinations, but this does not support loglevel below 'info'. This LogFile directive is especially usefull for debugging.

**LogLevel** This directive has five possible values: CRITICAL, ERROR, WARNING, INFO, DEBUG It will set the logging level used for LogFile and the standard output if nxlog is started in the forground. By default the LogLevel is INFO.

**SuppressRepeatingLogs** Under some circumstances it is possible for nxlog to generate an extreme amount of internal logs consisting of the same message due to a misconfiguration or software bug. This can lead to an extreme usage of disk space by LogFile and nxlog can quickly fill up the disk. With this directive nxlog will write at most 2 lines per second if the same message is generated successively by emitting 'last message repeated x times' will suppress these messages. This directive takes a boolean value (TRUE or FALSE). If this directive is not specified in the config file, it defaults to TRUE, i.e. repeating message suppression is enabled.

**NoCache** Some modules save data to a cache file which is persisted across a shutdown/restart. Modules such as im_file will save the file position in order to be able to continue reading from the same position where it left off after a restart. This caching mechanism can be explicitely turned off with this directive, this is mostly useful with the nxlog-processor in offline mode. This directive takes a boolean value (TRUE or FALSE). If this directive is not specified in the config file, it defaults to FALSE, i.e. caching is enabled.

**CacheDir** This directive specifies a directory where the cache file called `configcache.dat` should be written to. This directive has a compiled-in value which is used by default.

**User** nxlog will drop to user specified with this directive. This is useful if nxlog needs privileged access to some system resources such as kernel messages or port bind below 1024. On Linux systems it will use capabilites to be able to access these resources. In this case nxlog must be started as root. The user can be specified by name or by numeric id. This directive has no effect on MS Windows or with the nxlog-processor.

**Group** Similar to User, nxlog will set the group ID to be running under. The group can be specified by name or by numeric id. This directive has no effect on MS Windows or with the nxlog-processor.

**RootDir** nxlog will set its root directory to the value specified with this directive. If SpoolDir is also set, this will be relative to the value of RootDir, i.e. chroot() is called first. This directive has no effect on MS Windows or with the nxlog-processor.

**SpoolDir** nxlog will change its working directory to the value specified with this directive. This is useful with files created through relative filenames, e.g. with om_file and in case of core dumps. This directive has no effect with the nxlog-processor.

**Threads** This optional directive specifies the number of worker threads to use. The number of the worker threads is calculated and set to an optimal value if this directive is not defined. You should not set this unless you know what you are doing.

**FlowControl** This optional boolean directive specifies whether all input and processor modules should use flow-control. This defaults to TRUE. See the description of the module level FlowControl directive for more information.

**NoFreeOnExit** This directive has only a debugging purpuse. When set to TRUE, nxlog will not free module resources on exit. Otherwise valgrind is unable to show proper stack trace locations in module function calls. The default value is FALSE if not specified.

**IgnoreErrors** If set to FALSE, nxlog will stop if it encounters a problem with the configuration file such as an invalid module directive or if there are other problems which would prevent all modules functioning correctly. If set to TRUE, nxlog will start after logging the problem. The default value is TRUE if the directive is not specified.

**Panic** A panic condition is a critical state which usually indicates a bug. Assertions are used in nxlog code for checking conditions where the code will not work unless the asserted condition is satisfied. Failing assertions result in a panic and these also suggest a bug in the code. A typical case is checking for NULL pointers before pointer dereference. Assertions have also a security value. This directive can take three different values: HARD, SOFT or OFF. HARD will cause an abort in case the assertion fails. This is how most C based programs work. SOFT will cause an exception to be thrown at the place of the panic/assertion. In case of NULL pointer checks this is identical to a NullPointerException in Java. It is possible that nxlog can recover from exceptions and can continue to process log messages, or at least the other modules can. In case of assertion failure the location and the condition is printed at CRITICAL loglevel in HARD mode and ERROR loglevel in SOFT mode. If Panic is set to OFF, the failing condition is only printed in the logs but the execution will continue on the normal code path. Most of the time this will result in a segmentation fault or other undefined behavior, though there can be a case where turning off a buggy assertion or panic lurking somewhere in the code will solve the problems caused by it in HARD/SOFT mode. The default value for Panic is SOFT.

## 4.4 Modules

nxlog will only load modules which are used and specified in the configuration file. The followin is a skeleton config block for an input module:

```
<Input instancename>
    Module      im_module
    ...
</Input>
```

The instance name must be unique, can contain only the characters [a-zA-Z0-9_-]. The inctance name is referenced from the route definition as well as the Processors directive. Four types of modules exist in nxlog, these must be decalred with the Input, Processor, Output and Extension tags.

### 4.4.1 Common module directives

The following directives are common in all modules.

#### 4.4.1.1 Module

This directive is mandatory as it specifies which loadable binary should be loaded. The module binary has a .so extension on Unix and a .dll on MS Windows platforms and resides under the ModuleDir location. All module binary names are prefixed with either im_, pm_, om_, xm_. These stand for input module, processor module, output module and extension module.

It is possible that multiple instances use the same loadable binary. In this case the binary is only loaded once but instantiated multiple times. Different module instances may have different configuration.

#### 4.4.1.2 FlowControl

This optional boolean directive specifies whether the module should be using flow-control. This can be used only in *Input* and *Processor* modules. Flow-control is enabled by default if this directive is not sepcified. This module-level directive can be used to override the global FlowControl directive.

When flow-control is in effect, a module (input or processor) which tries to forward log data to the next module in the route will be suspended if the next module cannot accept more data. For example if a network module (e.g. om_tcp) cannot forward logs because of a network error, the proceeding module in the route will be paused. When flow-control is disabled, the module will drop the log record if the queue of the next module in the route is full.

Disabling flow-control can be also useful when more output modules are configured to store or forward log data. When flow-control is enabled, the output modules will only store/forward log data if all outputs are functional. Consider the case when log data is stored in a file using om_file and also forwarded over the network using om_tcp. When flow-control is enabled, a network disconnection will make the data flow stall and log data will not be written into the local file either. With flow-control disabled, nxlog will write log data to the file and will drop messages that the om_tcp network module cannot forward.

---

**Note**
It is recommended to disable FlowControl when the im_uds module is used to collect local syslog from the `/dev/log` unix domain socket. Otherwise the syslog() system call will block in all programs which are trying to write to the system log if the Output queue becomes full and this will result in an unresponsive system.

---

#### 4.4.1.3 Schedule

The Schedule block can be used to execute periodic jobs such as log rotation or any other task. Scheduled jobs have the same priority as the module. The schedule block has the following directives:

**When** This directive takes a value similar to a crontab entry which consists of five space separated definitions for minute, hour, day, month and weekday. See the crontab(5) manual for the field definitions. It supports lists as comma separated values and/or ranges. Step values are also supported with the slash. Month and week days are not supported, these must be defined with numeric values. The following extensions are also supported:

```
@yearly        Run once a year, "0 0 1 1 *".
@annually      (same as @yearly)
@monthly       Run once a month, "0 0 1 * *".
@weekly        Run once a week, "0 0 * * 0".
@daily         Run once a day, "0 0 * * *".
@midnight      (same as @daily)
@hourly        Run once an hour, "0 * * * *".
```

**Every** In addition to the crontab format it is possible to schedule execution at periodic intervals. With the crontab format it is not possible to run jobs every five days for example, this directive enables it in a simple way. It takes an integer value with an optional unit. The unit can be one of the following: sec, min, hour, day, week. If the unit is not specified, the value is assumed to be in seconds.

**First** This directive sets the first execution time. If the value is in the past, the next execution time is calculated as if nxlog has been running since and jobs will not be run to make up the missed events in the past. The directive takes a datetime literal value.

**Exec** The Exec directive takes one or more nxlog statement. This is the code which is actually being scheduled. Multiple Exec directives can be specified within one Schedule block, so this behaves the same as the Exec directive of the modules. See that for more details. Note that it is not possible to use fields in statements here because execution is not triggered by log messages.

**Example 4.5** Two scheduled jobs in the context of the im_tcp module

```
<Input in>
    Module  im_tcp
    Port  2345

    <Schedule>
  Every 1 sec
  First   2010-12-17 00:19:06
  Exec  log_info("scheduled execution at " + now());
    </Schedule>

    <Schedule>
  When  1 */2 2-4 * *
  Exec  log_info("scheduled execution at " + now());
    </Schedule>
</Input>

<Output out>
    Module  om_file
    File  "tmp/output"
</Output>

<Route 1>
    Path  in => out
</Route>
```

#### 4.4.1.4 Exec

The Exec directive contains statements in the nxlog language which are executed when a module receives a log message. This directive is available in all input, processor and output modules. It is not available in extension modules because these don't handle log messages directly. More than one Exec may be specified. In this case these are executed in the order of appearance. Due to the limitations of the apache configuration file format, each directive must be one line unless it contains a trailing backslash "\" character.

**Example 4.6** Exec statement spanning multiple lines

```
Exec  if $Message =~ /something interesting/       \
           log_info("found something interesting");         \
        else                                                \
           log_debug("found nothing interesting");
```

**Example 4.7** Equivalent use of statements in Exec

```
Exec  log_info("first"); \
        log_info("second");
# The above is the same as the following:
Exec  log_info("first");
Exec    log_info("second");
```

**Note**
You cannot split the lines in the first example as the exec directive must contain a full statement. It is only possible to split the Exec arguments if it contains multiple statements as in the second example above.

#### 4.4.1.5 Processors

The 'Processors' directive has been obsoleted and is no longer available.

#### 4.4.1.6 InputType

This directive specifies the name of the registered input reader function to be used for parsing raw events from input data. Names are treated case insensitively.

This is a common directive only for stream oriented input modules: im_file, im_exec, im_ssl, im_tcp, im_udp, im_uds. Note that im_udp may only work properly if log messages do not span multiple packets and log messages are within the UDP message size limit. Otherwise the loss of a packet may lead to parse errors.

These modules work by filling an input buffer with data read from the source. If the read operation was successfull (i.e. there was data coming from the source), the module calls the specified callback function. If this is not explicitly specified, it will use the module default.

Modules may provide custom input reader functions. Once these are registered into the nxlog core, the modules listed above will be capable of using these. This makes it easier to implement custom protocols because these can be developed without the need of taking care about the transport layer.

The following input reader functions are provided by the nxlog core:

**LineBased** The input is assumed to contain log messages separated by newlines. Thus if an LF (\n) or CRLF (\r\n) is found, the function considers that it has reached the end of the log message.

**Dgram** Once the buffer is filled with data, it is considered to be one log message. This is the default for the im_udp input module, since UDP syslog messages arrive in separate packets.

**Binary** The input is parsed in the nxlog binary format which is capable of preserving parsed fields of the log messages. The LineBased reader is capable of automatically detecting log messages in the Binary nxlog format, it is only recommended to configure InputType to Binary if no compatibility with other logging software is required.

**Example 4.8** TCP input assuming nxlog format

```
<Input in>
    Module  im_tcp
    Port  2345
    InputType Binary
</Input>

<Output out>
    Module  om_file
    File  "tmp/output"
</Output>

<Route 1>
    Path  in => out
</Route>
```

#### 4.4.1.7 OutputType

This directive specifies the name of the registered output writer function to be used for formatting raw events when sending to different destinations. Names are treated case insensitively.

This is a common directive only for stream oriented output modules: om_file, om_exec, om_ssl, om_tcp, om_udp, om_uds.

These modules work by filling the output buffer with data to be written to the destination. The specified callback function is called before the write operation. If this is not explicitly specified, it will use the module default.

Modules may provide custom output formatter functions. Once these are registered into the nxlog core, the modules listed above will be capable of using these. This makes it easier to implement custom protocols because these can be developed without the need to take care about the transport layer.

The following output writer functions are provided by the nxlog core:

**LineBased** The output will contain log messages separated by newlines (CRLF).

**Dgram** Once the buffer is filled with data, it is considered to be one log message. This is the default for the om_udp output module, since UDP syslog messages are sent in separate packets.

**Binary** The output is written in the nxlog binary format which is capable of preserving parsed fields of the log messages.

**Example 4.9** TCP output sending messages in nxlog format

```
<Input in>
    Module  im_file
    File  "tmp/input"
</Input>

<Output out>
    Module  om_tcp
    Port  2345
    Host  localhost
    OutputType  Binary
</Output>

<Route 1>
    Path  in => out
</Route>
```

## 4.5 Routes

Routes define the flow and processing order of the log messages. The route must have a name and a Path. The name is specified similarly to the instance name in a module block.

**Example 4.10** Route block

```
<Route example>
    Path  in1, in2 => proc => out1, out2
</Route>
```

### 4.5.1 Priority

This directive is optional. It takes an integer value as a parameter, its value must be in the range of 1-100. It defaults to 10 if it is not explicitly specified. Log messages in routes with a lower priority value will be processed before others.

Actually this value is assigned to each module part of the route. The internal events of the modules are processed in priority order by the nxlog engine, thus modules of a route with a lower priority value (higher priority) will process log messages first.

This directive can be especially usefull to minimize syslog UDP message loss for example.

**Example 4.11** Prioritized processing

```
<Input tcpin>
    Module  im_tcp
    Host  localhost
    Port  514
</Input>

<Input udpin>
    Module  im_udp
    Host  localhost
    Port  514
</Input>

<Output tcpfile>
    Module  om_file
    File  "/var/log/tcp.log"
</Output>

<Output udpfile>
    Module  om_file
    File  "/var/log/udp.log"
</Output>

<Route udp>
    Priority  1
    Path  udpin => udpfile
</Route>

<Route tcp>
    Priority  2
    Path  tcpin => tcpfile
</Route>
```

### 4.5.2 Path

The Path directive is where the data flow is defined. First the instance name of input modules are specified. If more than one input reads log messages which fed data into the route, then these must be separated by a comma. Input modules are followed by an arrow "=>" sign. Either processor modules or output modules follow. Processor modules must be separated by arrows, not commas, because they receive log messages in order, unlike input and output modules which work in parallel. Output modules are separated by commas. The syntax for the PATH directive is illustrated by the following:

```
Path  INPUT1[, INPUT2...] => [PROCESSOR1 [=> PROCESSOR2...] =>] OUTPUT1[, OUTPUT2...]
```

The Path must contain at least an input and an output module. The following example shows different routes.

**Example 4.12** Different routes

```
<Input in1>
    Module  im_null
</Input>

<Input in2>
    Module  im_null
</Input>

<Processor p1>
    Module  pm_null
</Processor>

<Processor p2>
    Module  pm_null
</Processor>

<Output out1>
    Module  om_null
</Output>

<Output out2>
    Module  om_null
</Output>

<Route 1>
    # no processor modules
    Path  in1 => out1
</Route>

<Route 2>
    # one processor module
    Path  in1 => p1 => out1
</Route>

<Route 3>
    # multiple modules
    Path  in1, in2 => p1 => p2 => out1, out2
</Route>
```

# Chapter 5

# Language

The nxlog core contains support for using a built-in interpreted language. This language can be used to make complex decisions or build expressions in the nxlog configuration file. The code written in the nxlog language is similar to Perl which is a common tool for developers and administrators to solve log processing tasks. When nxlog starts and reads its configuration file, directives containing nxlog language code are parsed and compiled into a pseudo-code. If a syntax error is found, nxlog will print the error. The pseudo-code is then evaluated at run-time, similarly to other interpreted languages.

The nxlog language can be used in two ways. Some module directives (e.g. file names) require a value, for these expressions can be used if supported by the module. Other directives such as Exec take a statement or statements as argument.

In addition to the built-in functions and procedures provided by the nxlog core, modules can register additional functions and procedures. This enables developers to extend the language through loadable modules so that additional processing features can be executed such as message formatters and parsers or data lookup functions.

Due to the simplicity of the language there is no error handling (except for function return values) available to the administrator. If an error occurs during the execution of the nxlog pseudo-code, usually the error is printed in the nxlog logs. If an error occurs during log message processing it is also possible for the message to be dropped. In case sophisticated error handling or more complex processing is a requirement, the message processing can be implemented in an external script or program, in a dedicated nxlog module or in perl via the xm_perl module.

## 5.1 Types

The nxlog language is a typed language, this allows stricter syntax checking when parsing the configuration while trying to enforce type-safety. Though fields and some functions can return values with a type which can only be determined at run-time. The language provides only simple types, complex types such as arrays and hashes (associative arrays) are not supported. See xm_perl if you require such complex processing rules. The language also supports the undefined value similarly to Perl. The following types are provided by the nxlog language:

**Unknown** This is a special type for values where the type cannot be determined at compile time and for values which are uninitialized. The undef literal and fields without a value have also an unknown type. The unknown type can be also thought of as 'any' in case of function and procedure api declarations.

**Boolean** A boolean value which is either TRUE, FALSE or undefined. Note that an undefined boolean is not the same as a FALSE value.

**Integer** An integer which can hold a signed 64 bit value in addition to the undefined value. Floating point values are not supported.

**String** A string is an array of characters in any character set. The binary type should be used for values where the NUL byte can also occur. An undefined string is not the same as an empty string. Strings have a limited length to prevent resource exhaustion problems, this is a compile-time value currently set to 1M.

**Datetime** A datetime holds a microsecond value elapsed since the Epoch and is always stored in UTC/GMT.

**IPv4 Address** Stores a dotted quad IPv4 address in an internal format (integer).

**IPv6 Address** Stores an IPv6 address in an internal format.

**Regular expression** A regular expression can only be used with the =~ or !~ operators.

**Binary** This type can hold an array of bytes.

**Variadic arguments** This is a special type only used in function and procedure api declarations to indicate variadic arguments.

## 5.2 Expressions

Expressions are a subset of the nxlog languge. Some module directives take an expression as a parameter which is then dynamically evaluated at run-time to a value. Expressions can also be used in statements.

The following language elements are expressions: literals, fields, binary and unary operations, functions. In addition, brackets can be used around expressions as shown in the example below. Brackets can also help in writing more readable code.

**Example 5.1** Using brackets around expressions

```
if 1 + 1 == (1 + 1) log_info("2");
if (1 + 1) == (1 + 1) log_info("2");
if ((1 + 1) == (1 + 1)) log_info("2");
```

### 5.2.1 Literals

A literal is a representation of a fixed value. A literal is an expression.

**Undef** The undef literal has an unknown type. It can be also used in an assignment to unset a value of a field, for example:

**Example 5.2** Unsetting a value of a field

```
$ProcessID = undef;
```

**Boolean** A boolean literal is either TRUE or FALSE. It is case insensitive, so True, False, true, false are also valid.

**Integer** An integer starts with a minus "-" sign if it is negative. The "0X" or "0x" prepended modifier means a hexadecimal notation. The "K", "M" and "G" modifiers are also supported which can be appended to mean Kilo (1024), Mega (1024^2) and Giga (1024^3).

**Example 5.3** Setting an integer value

```
$Limit = 42M;
```

**String** String literals are quoted characters using either single or double quotes. String literals specified with double quotes can contain the following escape sequences.

**** The backslash (\) character.

**\"** The double quote (") character.

**\n** Line feed (LF).

**\r** Carriage return (CR).

**\t** Horizontal tab.

**\b** Audible bell.

**\xXX** A single byte in the form of a two digit hexadecimal number. For example the line-feed character can also be expressed as `\x0A`.

**Note**
String literals in single quotes do not process the escape sequences. `"\n"` is a single character (LF) while `'\n'` is two characters. The following comparison is FALSE for this reason:

```
"\n" == '\n'
```

Extra care should be taken with the backslash when using double quoted string literals to specify file paths on windows. See this note for the file directive of im_file about the possible complications.

**Example 5.4** Setting a string value

```
$Message = "Test message";
```

**Regular expression** Regular expressions must be quoted with slashes as in Perl. Captured substrings are accessible through a numeric reference such as $1. The full subject string is placed into $0.

**Example 5.5** A regular expression match operation

```
if $Message =~ /^Test (\S+)/ log_info("captured: " + $1);
```

**Datetime** The datetime literal is an unquoted representation of a time value expressing local time in the format of YYYY-MM-DD hh:mm:ss

**Example 5.6** Setting a datetime value

```
$EventTime = 2000-01-02 03:04:05;
```

**IPv4 Address** An IPv4 literal value is expressed in dotted quad notation such as `192.168.1.1`.

**IPv6 Address** An IPv6 literal value is expressed by 8 groups of 16-bit hexadecimal values separated by colons (:) such as `2001:0db8:85a3:0000:0000:8a2e:0370:7334`.

### 5.2.2 Fields

A log message can be broken up into fields by parsers or is already emitted as a list of fields as discussed earlier. The field has a name and in the nxlog language it is represented with the dollar "$" sign prepended to the name of the field, similarly to Perl's scalar variables. The name of the field is allowed to have the following characters:

```
[[:alpha:]_][[:alnum:]\._]*
```

A field which does not exist has an unknown type. A field is an expression which evaluates to a value. Fields are only available in an evaluation context which is triggered by a log message. For example using a value of a field in the Exec directive of a schedule block will result in a run-time error because this scheduled execution is not triggered by a log message. Fields are passed along the route and are available in each successive module in the chain. Eventually the output module is responsible for writing these. Stream oriented modules emit the data contained in $raw_event unless OutputType is set to something else (i.e. Binary).

### 5.2.3 Operations

Similarly to other programming languages and especially Perl, the nxlog language has unary and binary operations which are expressions and evaluate to a value.

#### 5.2.3.1 Unary operations

Unary operations work with a single operand. Currently the following unary operations are available. It is possible to use brackets around the operand to which makes it look like a function call as in this example.

**not** The 'not' operator expects a boolean value. It will evaluate to undef if the value is undefined. If it receives an unknown value which evaluates to a non-boolean, it will result in a run-time execution error.

**Example 5.7** Typical use of the 'not' operand

```
if not $success log_error("failure");
```

**-** The unary negation operator before an integer is very similar to a negative integer, except that two or more minus "-" signs are not valid for an integer literal.

**Example 5.8** Unary negation

```
if - -1 != 1 log_error("this should never be printed");
```

**defined** The defined operation will evaluate to TRUE if the operand is defined, otherwise it is FALSE.

**Example 5.9** Use of the unary 'defined' operation

```
if defined 1 log_info("1");
if defined(2) log_info("2");
if defined undef log_info("never printed");
```

#### 5.2.3.2 Binary operations

Binary operations work with two operands and evaluate to a value. The type of the evaluated value depends on the type of the operands. Execution might result in a run-time error if the type of the operands are unknown at compile time and evaluate to types which are incompatible with the binary operation. The operations are described with the following syntax:

```
TYPE_OF_LEFT_OPERAND BINARY_OPERATION TYPE_OF_RIGHT_OPERAND = TYPE_OF_EVALUATED_VALUE
```

Below is a list of currently supported binary operations.

**=~** This is the regular expression match operation as in Perl. The PCRE engine is used to to execute the regular expressions. This operation takes a string and a regexp operand and evaluates to a boolean value which will be TRUE if the regular expression matches the subject string. Captured substrings are accessible through a numeric reference such as $1. The full subject string is placed into $0.

**string =~ regexp = boolean**

**regexp =~ string = boolean**

**Example 5.10** Regular expression based string matching

```
if $Message =~ /^Test message/ log_info("matched");
```

Regexp based string substitution is also supported with the *s///* operator.

The following regular expression modiers are supported:

**g** The */g* modifier can be used for global replacement.

**Example 5.11** Replace whitespace occurences

```
if $SourceName =~ s/\s/_/g log_info("removed all whitespace in SourceName");
```

**s** The **.** normally matches any character except newline. The */s* modifier can be used to have the **.** match all characters including line terminator characters (LF and CRLF).

**Example 5.12** Dot matches all characters

```
if $Message =~ /failure/s log_info("failure string present in the message");
```

**m** The */m* modifier can be used to treat the string as multiple lines, i.e. ^ and *$* match newlines within data.

**i** The */i* modifier does case insensitive matching.

Variables and captured substring references cannot be used inside the requlr expression or the regexp substitution operator, these will be treated literally as is.

**!~** This is the opposite of =~, the expression will evaluate to TRUE if the regular expresion does not match on the subject string. It can be also written as not LEFT_OPERAND =~ RIGHT_OPERAND

**string !~ regexp = boolean**

**regexp !~ string = boolean**

The *s///* substitution operator is also supported.

**Example 5.13** Regular expression based string matching

```
if $Message !~ /^Test message/ log_info("didn't match");
```

**==** This operator compares two values for equality. Comparing a defined value with an undefined results in undef!

**undef == undef = TRUE**

**string == string = boolean**

**integer == integer = boolean**

**boolean == boolean = boolean**

**datetime == datetime = boolean**

**Example 5.14** Comparing integers

```
if $SeverityValue == 1 log_info("severity is one");
```

**!=** This operator compares two values for inequality. Comparing a defined value with an undefined results in undef!

**undef != undef = FALSE**

**string != string = boolean**

**integer != integer = boolean**

**boolean != boolean = boolean**

**datetime != datetime = boolean**

**Example 5.15** Comparing for inequality

```
if $SeverityValue != 1 log_info("severity is not one");
```

**<** This operation will evaluate to TRUE if the left operand is less than the operand on the right, FALSE otherwise. Comparing a defined value with an undefined results in undef!

**integer < integer = boolean**

**datetime < datetime = boolean**

**Example 5.16** Less

```
if $SeverityValue < 1 log_info("severity is less than one");
```

**<=** This operation will evaluate to TRUE if the left operand is less than or equal to the operand on the right, FALSE otherwise. Comparing a defined value with an undefined results in undef!

**integer <= integer = boolean**

**datetime <= datetime = boolean**

**Example 5.17** Less or equal

```
if $SeverityValue < 1 log_info("severity is less than or equal to one");
```

**>**

**integer > integer = boolean**

**datetime > datetime = boolean**

**Example 5.18** Greater

```
if $SeverityValue > 1 log_info("severity is greater than one");
```

**>=**

**integer >= integer = boolean**

**datetime >= datetime = boolean**

**Example 5.19** Greater or equal

```
if $SeverityValue >= 1 log_info("severity is greater than or equal to one");
```

**and** This is the boolean 'and' operation which evaluates to TRUE if and only if both operands are TRUE. The operation will evaluate to undef if either operand is undefined.

**boolean and boolean = boolean**

**Example 5.20** And operation

```
if $SeverityValue == 1 and $FacilityValue == 2 log_info("1 and 2");
```

**or** This is the boolean 'and' operation which evaluates to TRUE if either operand is TRUE. The operation will evaluate to undef if both operands are undefined.

**boolean or boolean = boolean**

**Example 5.21** Or

```
if $SeverityValue == 1 or $SeverityValue == 2 log_info("1 or 2");
```

**+** This operation will result in an integer if both operands are integers. If either operand is a string, the result will be a string where non-string typed values are converted to a string. In this case it acts as a concatenation operator (which is the dot "." operator in Perl). Adding an undefined value to a non-string will result in undef.

**integer + integer = integer**

**string + undef = string**

**undef + string = string**

**undef + undef = undef**

**string + string = string** Concatenate two strings.

**datetime + integer = datetime** Add the number of seconds in the right value to the datetime stored in the left value.

**integer + datetime = datetime** Add the number of seconds in the left value to the datetime stored in the right value.

**Example 5.22** Concatenation

```
if 1 + "a" == "1a" log_info("this will be printed");
```

**-** Subtraction. The result will be undef if either operand is undefined.

**integer - integer = integer** Subtract two integers.

**datetime - datetime = integer** Subtract two datetime types. The result is the difference between to two expressed in microseconds.

**datetime - integer = datetime** Subtract the number of seconds from the datetime stored in the left value.

**Example 5.23** Subtraction

```
if 4 - 1 == 3 log_info("four minus one is three");
```

***** Multiply an integer with another. The result will be undef if either operand is undefined.

**integer * integer = integer**

**Example 5.24** Multiplication

```
if 4 * 2 == 8 log_info("four times two is eight");
```

**/** Divide an integer with another. The result will be undef if either operand is undefined. Since the result is an integer, fractional parts are lost.

**integer / integer = integer**

**Example 5.25** Division

```
if 9 / 4 == 2 log_info("9 divided by 4 is 2");
```

**%** This is the modulo operation. Divides an integer with another and returns the remainder. The result will be undef if either operand is undefined.

**integer % integer = integer**

**Example 5.26** Modulo

```
if 3 % 2 == 1 log_info("three mod two is one");
```

### 5.2.4 Functions

A function is an expression which always returns a value. A function cannot be used without using its return value. In contrast to procedures, a function never modifies its arguments, the state of the nxlog engine or the state of a module. Functions can be polymorphic, the same function can take different arguments. Some functions also support variadic arguments denoted by the varargs argument type. See the list of available functions.

**Example 5.27** Function call

```
$current.time = now();
if now() > 2000-01-01 00:00:00 log_info("we are in the 21st century");
```

## 5.3 Statements

Directives such as Exec take a statement as argument. After a statement is evaluated, usually the result will be a change in the state of the nxlog engine, the state of a module or the log message. A statement is terminated by a semicolon ";". Multiple statements can be specified and these will be evaluated and executed in order. The following elements can be used in statements. There is no loop operation (for, while) in the nxlog language.

### 5.3.1 Assignment

The assignment operation "=" loads the value from the expression evaluated on the right into a field on the left.

**Example 5.28** Assignment

```
$event.rcvd = now();
```

### 5.3.2 Block

A block consists of one or more statements within curly braces "{}". This is typically used with conditional statements as in the example below.

**Example 5.29** Conditional statement block

```
if now() > 2000-01-01 00:00:00
{
   log_info("we are in the");
   log_info("21st century");
}
```

### 5.3.3 Procedures

Though both functions can take arguments, procedures are the opposite of function calls. Procedures never return a value, thus these can be used as statements. A procedure can modify its argument if it is a field, or it can modify the state of the nxlog engine, the state of a module or the log message. Procedures can also be polymorphic, the same procedure can take different arguments. Some procedures also support variadic arguments denoted by the varargs argument type. See the list of available procedures.

**Example 5.30** Procedure call

```
log_info("this is a procedure call");
```

### 5.3.4 If-Else

A conditional statement starts with the "if" keyword followed by a boolean expression and a statement. The "else" with another statement is optional. Brackets around the expression are also optional.

**Example 5.31** Conditional statements

```
if now() > 2000-01-01 00:00:00 log_info("we are in the 21st century");

# same as above but with brackets
if ( now() > 2000-01-01 00:00:00 ) log_info("we are in the 21st century");

# conditional statement block
if now() > 2000-01-01 00:00:00
{
   log_info("we are in the 21st century");
}

# conditional statement block with an else branch
if now() > 2000-01-01 00:00:00
{
   log_info("we are in the 21st century");
}
else log_info("we are not yet in the 21st century");
```

Simliarly to Perl, the nxlog language doesn't have a switch statement. This can be accomplished by the appropriate use of conditional if-else statements as in the example below.

**Example 5.32** Emulating switch with if-else

```
if ( $value == 1 )
   log_info("1");
else if ( $value == 2 )
   log_info("2");
else if ( $value == 3 )
   log_info("3");
else
   log_info("default");
```

**Note**
The Perl shorthand "elsif" is not supported. There is no "unless" either.

## 5.4 Variables

Fields are not persistent because the scope of these is the log message itself, though fields can be used for storing temporary data during the processing of one log message or to pass values across modules along the route. Unfortunately if we need to store some value persistently, for example to set a state on a condition, then the fields cannot be used.

The nxlog engine supports module variables for this purpose. A module variable is referenced by a string value. A module variable can only be accessed from the same module due to concurrency reasons. A module variable with the same name is a different variable when referenced from another module. A module variable can be created with an expiry value or it can have an infinite lifetime. If a variable is created with a lifetime, it will be destroyed automatically when the lifetime expires. This can be also used as a means of a garbage collection method, or it can reset the value of the variable automatically. The module variables can store values of any type. Module variables are supported by all modules automatically. See create_var(), delete_var(), set_var() and get_var() for using module variables.

**Example 5.33** Simple event correlation using module variables

If the number of login failures exceeds 3 within 45 seconds, then we generate an internal log message.

```
if $Message =~ /login failure/
{
   if not defined get_var('login_failures')
   { # create the variable if it doesn't exist
       create_var('login_failures', 45);
       set_var('login_failures', 1);
   }
   else
   { # increase the variable and check if it is over the limit
       set_var('login_failures', get_var('login_failures') + 1);
       if get_var('login_failures') >= 3
           log_warning("3 or more login failures detected within 45 seconds");
   }
}
```

Note that this method is a bad example for this task, becuase the lifetime of the variable is not affected by set_var(). For example if there is one login failure at time 0s, then three login failures at 45s, 46s and 47sec, then this algorithm will not be able to detect this, because the variable will be automatically cleared at 45s, and the last three login failures are not noticed even though they happened within 3 seconds. Also note that this method can only work in real time because the timing is not based on values available in the log message, though this can be reprogrammed by storing the event time in another variable.

## 5.5 Statistical counters

Statistical counters are similar to variables but these only support integers. The difference is that statistical counters can use different algorithms to recalculate their value every time they are updated or read. A statistical counter can be created with the create_stat() procedure calls. The following types are available for statistical counters:

**COUNT** This will aggregate the values added, so the value of the counter will increase if only positive integers are added until the counter is destroyed, or indefinitely if the counter has no expiry.

**COUNTMIN** This will calculate the minimum value of the counter.

**COUNTMAX** This will calculate the maximum value of the counter.

**AVG** This algorithm calculates the average over the specified interval.

**AVGMIN** This algorithm calculates the average over the specified interval and the value of the counter is always the lowest which was ever calculated during the lifetime of the counter.

**AVGMAX** Similar to AVGMIN but returns the highest value calculated during the lifetime of the counter.

**RATE** This calculates the value over the specified interval, can be used to calculate events per second (EPS) values.

**RATEMIN** Will return the lowest rate calculated during the lifetime of the counter.

**RATEMAX** Will return the highest rate calculated during the lifetime of the counter.

**GRAD** This calculates the change of the rate of the counter over the specified interval, which is the gradient.

**GRADMIN** Lowest gradient calculated during the lifetime of the counter.

**GRADMAX** Highest gradient calculated during the lifetime of the counter.

A statistical counter will only return a value if the time specified in the interval argument has elapsed since it was created. Statistical counters can be also created with a lifetime. When they expire, they will be destoryed similarly to module variables.

After a statistical counter is created, it can be updated with the add_stat() procedure call. The value of the counter can be read with the get_stat() function call. The value of the statistical counter is recalculated during these calls, but it does never happen automatically in a timed fashion, so this can lead to slight distortion of the calculated value if the add and read operations are infrequent.

Another feature of statistical counters is that it is possible to specify a time value both during creation, update and read making offline log processing possible.

**Example 5.34** Simple event correlation using statistical counters

If the number of login failures exceeds 3 within 45 seconds, then we generate an internal log message. This accomplishes the exact same task as our previous algorithm did with module variables, except that this is a lot simpler. In addition, this method is more precise, because it uses the timestamp from the log message instead of relying on the current time, so it is possible to use this for offline log analysis as well.

```
if $Message =~ /login failure/
{
   # create will no do anything if the counter already exists
   create_stat('login_failures', 'RATE', 45, $EventTime);
   add_stat('login_failures', 1, $EventTime);
   if get_stat('login_failures', $EventTime) >= 3
      log_warning("3 or more login failures detected within 45 seconds");
}
```

Note that this is still not perfect because the time window used in the rate calculation does not shift, so the problem described in our previous example also affects this version and it is possible that this algorith does not work in some situations.

## 5.6 List of available functions and procedures

### 5.6.1 Functions and procedures exported by core

#### 5.6.1.1 Functions exported by core

**`string lc(string arg);`**

**description** Convert a string to lower case.

**arguments**

**arg** type: string

**return type** string

**`string uc(string arg);`**

**description** Convert a string to upper case.

**arguments**

**arg** type: string

**return type** string

```
datetime now();
```

**description** Return the current time.

**return type** datetime

```
string type(unknown arg);
```

**description** Returns the type of a variable. Can be "boolean", "integer", "string", "datetime", "ip4addr", "ip6addr", "regexp", "binary". For values with the unknown type, it returns undef.

**arguments**

**arg** type: unknown

**return type** string

```
integer microsecond(datetime datetime);
```

**description** Return the microsecond part from the time value.

**arguments**

**datetime** type: datetime

**return type** integer

```
integer second(datetime datetime);
```

**description** Return the second part from the time value.

**arguments**

**datetime** type: datetime

**return type** integer

```
integer minute(datetime datetime);
```

**description** Return the minute part from the time value.

**arguments**

**datetime** type: datetime

**return type** integer

```
integer hour(datetime datetime);
```

**description** Return the hour part from the time value.

**arguments**

**datetime** type: datetime

**return type** integer

```
integer day(datetime datetime);
```

**description** Return the day part from the time value.

**arguments**

**datetime** type: datetime

**return type** integer

```
integer month(datetime datetime);
```

**description** Return the month part from the datetime value.

**arguments**

**datetime** type: datetime

**return type** integer

```
integer year(datetime datetime);
```

**description** Return the year part from the datetime value.

**arguments**

**datetime** type: datetime

**return type** integer

```
datetime fix_year(datetime datetime);
```

**description** Set year value to current in a datetime which was parsed with a missing year such as BSD syslog or cisco timestamps.

**arguments**

**datetime** type: datetime

**return type** datetime

```
integer dayofweek(datetime datetime);
```

**description** The number of days since Sunday in the range of 0-6.

**arguments**

**datetime** type: datetime

**return type** integer

```
integer dayofyear(datetime datetime);
```

**description** Return the day number of the year in the range of 1-366.

**arguments**

**datetime** type: datetime

**return type** integer

```
string string(unknown arg);
```

**description** Convert the argument to string.

**arguments**

**arg** type: unknown

**return type** string

```
integer integer(unknown arg);
```

**description** Parse and convert the string argument to an integer. For datetime type it returns the number of microseconds since epoh

**arguments**

**arg** type: unknown

**return type** integer

```
datetime datetime(integer arg);
```

**description** Convert the integer argument expressing the number of microseconds since epoch to datetime.

**arguments**

**arg** type: integer

**return type** datetime

```
datetime parsedate(string arg);
```

**description** Parse a datetime argument. Returns an undefined datetime type if it cannot parse the argument so that the user can fix the error, e.g. $EventTime = parsedate($somestring); if not defined($EventTime) $EventTime = now();

**arguments**

**arg** type: string

**return type** datetime

```
string strftime(datetime datetime, string fmt);
```

**description** Convert a datetime to a string with the given format. See the manual of strftime(3) for the format specification.

**arguments**

**datetime** type: datetime

**fmt** type: string

**return type** string

```
datetime strptime(string input, string fmt);
```

**description** Convert a string to a datetime with the given format. See the manual of strptime(3) for the format specification.

**arguments**

**input** type: string

**fmt** type: string

**return type** datetime

```
string hostname();
```

**description** Return the hostname (short form).

**return type** string

```
string hostname_fqdn();
```

**description** Return the FQDN hostname. This function will return the short form if the FQDN hostname cannot be determined.

**return type** string

```
ip4addr host_ip();
```

**description** Return the first non-loopback IP address the hostname resolves to.

**return type** ip4addr

```
ip4addr host_ip(integer nth);
```

**description** Return the nth non-loopback IP address the hostname resolves to. The nth argument starts from 1.

**arguments**

**nth** type: integer

**return type** ip4addr

```
unknown get_var(string varname);
```

**description** Return the value of the variable or undef if it doesn't exist.

**arguments**

**varname** type: string

**return type** unknown

```
integer get_stat(string statname);
```

**description** Return the value of the statistical counter or undef if it doesn't exist.

**arguments**

**statname** type: string

**return type** integer

```
integer get_stat(string statname, datetime time);
```

**description** Return the value of the statistical counter or undef if it doesn't exist. The time argument specifies the current time.

**arguments**

**statname** type: string
**time** type: datetime

**return type** integer

```
ip4addr ip4addr(integer arg);
```

**description** Convert the integer argument to an ip4addr type.

**arguments**

**arg** type: integer

**return type** ip4addr

```
ip4addr ip4addr(integer arg, boolean ntoa);
```

**description** Convert the integer argument to an ip4addr type. If 'ntoa' is set to true, the integer is assumed to be in network byte order. Instead of '1.2.3.4' the result will be '4.3.2.1'.

**arguments**

**arg** type: integer
**ntoa** type: boolean

**return type** ip4addr

```
string substr(string src, integer from);
```

**description** Return the string starting at the byte offset specified in 'from'.

**arguments**

**src** type: string
**from** type: integer

**return type** string

```
string substr(string src, integer from, integer to);
```

**description** Return a substring specified with the starting and ending positions as byte offsets from the beginning of the string.

**arguments**

**src** type: string
**from** type: integer
**to** type: integer

**return type** string

```
string replace(string subject, string src, string dst);
```

**description** Replace all occurences of 'src' with 'dst' in the 'subject' string.

**arguments**

**subject** type: string
**src** type: string
**dst** type: string

**return type** string

```
string replace(string subject, string src, string dst, integer count);
```

**description** Replace 'count' number occurences of 'src' with 'dst' in the 'subject' string.

**arguments**

**subject** type: string
**src** type: string
**dst** type: string
**count** type: integer

**return type** string

```
integer size(string str);
```

**description** Return the size of the string 'str' in bytes.

**arguments**

**str** type: string

**return type** integer

```
boolean dropped();
```

**description** Return TRUE if the currently processed event has been already dropped.

**return type** boolean

#### 5.6.1.2 Procedures exported by core

```
log_debug(unknown arg, varargs args);
```

**description** Print the argument(s) at DEBUG log level.

**arguments**

**arg** type: unknown
**args** type: varargs

```
debug(unknown arg, varargs args);
```

**description** Print the argument(s) at DEBUG log level. Same as log_debug().

**arguments**

**arg** type: unknown
**args** type: varargs

```
log_info(unknown arg, varargs args);
```

**description** Print the argument(s) at INFO log level.

**arguments**

**arg** type: unknown
**args** type: varargs

```
log_warning(unknown arg, varargs args);
```

**description** Print the argument(s) at WARNING log level.

**arguments**

**arg** type: unknown
**args** type: varargs

```
log_error(unknown arg, varargs args);
```

**description** Print the argument(s) at ERROR log level.

**arguments**

**arg** type: unknown

**args** type: varargs

```
delete(unknown arg);
```

**description** Delete the field from the event, i.e. delete($field). Note that doing '$field = undef' is not the same, though after both operations the field will be undefined.

**arguments**

**arg** type: unknown

```
create_var(string varname);
```

**description** Create a module variable with the specified name. The variable will be created with an infinite lifetime.

**arguments**

**varname** type: string

```
create_var(string varname, integer lifetime);
```

**description** Create a module variable with the specified name with the lifetime given in seconds. If the lifetime expires, the variable is deleted automatically and get_var(name) will return undef.

**arguments**

**varname** type: string
**lifetime** type: integer

```
create_var(string varname, datetime expiry);
```

**description** Create a module variable with the specified name. Expiry specifies when the variable should be deleted automatically.

**arguments**

**varname** type: string
**expiry** type: datetime

```
delete_var(string varname);
```

**description** Delete the module variable with the specified name if it exists.

**arguments**

**varname** type: string

```
set_var(string varname, unknown value);
```

**description** Set a value of a module variable. If the variable does not exist, it will be created with an infinite lifetime.

**arguments**

**varname** type: string
**value** type: unknown

```
create_stat(string statname, string type);
```

**description** Create a module statistical counter with the specified name using the current time. The statistical counter will be created with an infinite lifetime. The type argument can be any of the following to select the required algorithm for calculating the value of the statistical counter: COUNT, COUNTMIN, COUNTMAX AVG, AVGMIN, AVGMAX, RATE, RATEMIN, RATEMAX, GRAD, GRADMIN, GRADMAX. See the statistical counters section for the description of these. This procedure with two parameters can only be used with COUNT, otherwise the interval parameter must be specified.

**arguments**

**statname** type: string
**type** type: string

```
create_stat(string statname, string type, integer interval);
```

**description** Create a module statistical counter with the specified name to be calculated over 'interval' seconds and using the current time. The statistical counter will be created with an infinite lifetime.

**arguments**

**statname** type: string
**type** type: string
**interval** type: integer

```
create_stat(string statname, string type, integer interval, datetime time);
```

**description** Create a module statistical counter with the specified name to be calculated over 'interval' seconds and the time value specified in the argument named 'time'. The statistical counter will be created with an infinite lifetime.

**arguments**

**statname** type: string
**type** type: string
**interval** type: integer
**time** type: datetime

```
create_stat(string statname, string type, integer interval, datetime time, integer lifetim
```

**description** Create a module statistical counter with the specified name to be calculated over 'interval' seconds and the time value specified in the argument named 'time'. The statistical counter will expire after 'lifetime' seconds.

**arguments**

**statname** type: string
**type** type: string
**interval** type: integer
**time** type: datetime
**lifetime** type: integer

```
create_stat(string statname, string type, integer interval, datetime time, datetime expiry
```

**description** Create a module statistical counter with the specified name to be calculated over 'interval' seconds and the time value specified in the argument named 'time'. The statistical counter will expire at 'expiry'.

**arguments**

**statname** type: string
**type** type: string
**interval** type: integer
**time** type: datetime
**expiry** type: datetime

```
add_stat(string statname, integer value);
```

**description** Add 'value' to the statistical counter using the current time.

**arguments**

**statname** type: string
**value** type: integer

```
add_stat(string statname, integer value, datetime time);
```

**description** Add 'value' to the statistical counter using the time specified in the argument named 'time'.

**arguments**

**statname** type: string
**value** type: integer

**time** type: datetime

`sleep(integer interval);`

**description** Sleep the specified number of microseconds. This procedure is provided for testing purposes mostly. It can be used as a poor man's rate limiting tool, though its use is not recommended.

**arguments**

**interval** type: integer

`drop();`

**description** Drop the currently processed event's log and don't execute further statements.

`rename_field(string old, string new);`

**description** Rename a field.

**arguments**

**old** type: string

**new** type: string

`reroute(string routename);`

**description** Move the currently processed event data to the route specified in the argument. The event data will enter the route as if it was received by an input module there.

**arguments**

**routename** type: string

`add_to_route(string routename);`

**description** Copy the currently processed event data to the the route specified in the argument. This procedure makes a copy of the data and the original will be processed normally.

**arguments**

**routename** type: string

### 5.6.2 Functions and procedures exported by modules

**xm_syslog** Functions and procedures exported by xm_syslog

**om_file** Functions and procedures exported by om_file

# Chapter 6

# Modules

nxlog uses loadable modules similarly to the Apache HTTP server, these are also called as plugins in another terminology. There are four types of modules: extension, input, processor and output modules. This chapter deals with the features and configuration of each specific module. General concepts about configuring modules were discussed in the Configuration chapter earlier.

## 6.1 Extension modules

Extension modules do not process log messages directly, and for this reason their instances cannot be part of a route. These modules can enhance the features of nxlog in different ways such as exporting new functions and procedures, registering additional I/O reader and writer functions to be used with modules supporting the OutputType and InputType directives. Also there are many possibilities to hook an extension module into the nxlog engine, the following modules will illustrate this.

### 6.1.1 CSV (xm_csv)

This module provides functions and procedures to process data formatted as comma separated values (CSV) and allows to convert to CSV and parse CSV into fields.

The pm_transformer module also provides a simple interface to parse and generate CSV lines, but with the API this xm_csv module exports to the nxlog language, it is possible to solve a lot more complex tasks involving CSV formatted data.

---

**Note**
It is possible to use more than one xm_csv module instance with different options in order to support different CSV formats at the same time. For this reason, functions and procedures exported by the module are public and must be referenced by the module instance name.

---

#### 6.1.1.1 Configuration

In addition to the common module directives, the following can be used to configure the xm_csv module instance.

**QuoteChar** This optional directive takes a single character (see below) as argument to specify the quote character used to enclose fields. If QuoteOptional is TRUE, then only string type fields are quoted. If this directive is not specified, the default quote character is the double-quote character (").

**EscapeChar** This optional directive takes a single character (see below) as argument to specify the escape character used to escape special characters. The escape character is used to prefix the following characters: the escape character itself, the quote character and the delimiter character. If EscapeControl is TRUE, the \n, \r, \t, \b (newline, carriage-return, tab, backspace) control characters are also escaped. If this directive is not specified, the default escape character is the backslash character (\).

**Delimiter** This optional directive takes a single character (see below) as argument to specify the delimiter character used to separate fields. If this directive is not specified, the default escape character is the comma character (,). Note that there is no delimiter after the last field.

**QuoteOptional** This directive has been deprecated in favor of QuoteMethod, please use that instead.

**QuoteMethod** This optional directive can take the following values:

**String** Only string type fields will be quoted. Has the same effect as QuoteOptional set to *TRUE*. This is the default behavior if the QuoteMethod directive is not specified.

**All** All fields will be quoted.

**None** Nothing will be quoted. This can be problematic if the field value (typically text that can contain any character) can contain the delimiter character. Make sure that this is escaped or replaced with something else.

Note that this directive only effects CSV generation when using to_csv(). The CSV parser can automatically detect the quotation.

**EscapeControl** If this optional boolean directive is set to TRUE, control characters are also escaped. See the EscapeChar directive for details. If this directive is not specified, control characters are escaped by default. Note that this is necessary in order to allow single line CSV field lists which contain line-breaks.

**Fields** This is a comma separated list of fields which will be filled from the input parsed. Field names with or without the dollar sign "$" are also accepted. This directive is mandatory. The fields will be stored as strings by default unless their type is explicitely specified with the FieldTypes directive.

**FieldTypes** This optional directive specifies the list of types corresponding to the field names defined in Fields. If specified, the number of types must match the number of field names specified with Fields. If this directive is omitted, all fields will be stored as strings. This directive has no effect on the fields-to-csv conversion.

**UndefValue** This optional directive specifies a string which will be treated as an undefined value. This is particularly useful when parsing the W3C format where the dash "-" marks an omitted field.

#### 6.1.1.1.1 Specifying characters for quote, escape and delimiter

The QuoteChar, EscapeChar and Delimiter can be specified in different ways, mainly due to the nature of the config file format. As of this writing, the module does not support multi character strings for these parameters.

**Unquoted single character** Printable characters can be specified as an unquoted character, except for the backslash '\'. Example:

```
Delimiter ;
```

**Control characters** The following non-printable characters can be specified with escape sequences:

**\a** audible alert (bell)

**\b** backspace

**\t** horizontal tab

**\n** newline

**\v** vertical tab

**\f** formfeed

**\r** carriage return

To use TAB delimiting:

```
Delimiter \t
```

**A character in single quotes** The config parser strips whitespace, so it is not possible to define space as the delimiter unless it is enclosed within quotes:

```
Delimiter ' '
```

Printable characters can also be enclosed:

```
Delimiter ';'
```

The backslash can be specified when enclosed within quotes:

```
Delimiter '\'
```

**A character in double quotes** Double quotes can be used similarly to single quotes:

```
Delimiter " "
```

The backslash can be specified when enclosed within double quotes:

```
Delimiter "\"
```

#### 6.1.1.2 Functions and procedures exported by xm_csv

##### 6.1.1.2.1 Functions exported by xm_csv

**`string to_csv();`**

**description** Convert the specified fields to a single CSV formatted string.

**return type** string

##### 6.1.1.2.2 Procedures exported by xm_csv

**`parse_csv();`**

**description** Parse the raw_event field as csv input

**`parse_csv(string source);`**

**description** Parse the given string as CSV format

**arguments**

**source** type: string

**`to_csv();`**

**description** Format the specified fields as CSV and put it into the 'raw_event' field.

#### 6.1.1.3 Configuration examples

**Example 6.1** Complex CSV format conversion

This example illustrates the power of nxlog and the xm_csv module. It shows that not only can the module parse and create CSV formatted input and output, but using multiple xm_csv modules it is possible to reorder, add, remove or modify fields and output these in a different CSV format.

```
<Extension csv1>
    Module      xm_csv
    Fields  $id, $name, $number
    FieldTypes  integer, string, integer
    Delimiter ,
</Extension>

<Extension csv2>
    Module      xm_csv
    Fields  $id, $number, $name, $date
    Delimiter ;
</Extension>

<Input filein>
    Module  im_file
    File  "tmp/input"
    Exec  csv1->parse_csv(); \
        $date = now(); \
                if not defined $number $number = 0; \
                csv2->to_csv();
</Input>

<Output fileout>
    Module  om_file
    File  "tmp/output"
</Output>

<Route 1>
    Path  filein => fileout
</Route>
```

Samples for the input and output files processed by the above config are shown below.

```
1, "John K.", 42
2, "Joe F.", 43
```

```
1;42;"John K.";2011-01-15 23:45:20
2;43;"Joe F.";2011-01-15 23:45:20
```

### 6.1.2 JSON (xm_json)

This module provides functions and procedures to process data formatted as JSON and allows to convert to JSON and parse JSON into fields.

#### 6.1.2.1 Configuration

The module does not have any module specific configuration directives.

#### 6.1.2.2 Functions and procedures exported by xm_json

##### 6.1.2.2.1 Functions exported by xm_json

```
string to_json();
```

**description** Converts the fields to JSON and returns it as a string value. Fields having a leading dot (.) or underscore (_) and the 'raw_event' will be automatically excluded.

**return type** string

##### 6.1.2.2.2 Procedures exported by xm_json

```
parse_json();
```

**description** Parse the raw_event field as json input

```
parse_json(string source);
```

**description** Parse the given string as JSON format

**arguments**

**source** type: string

```
to_json();
```

**description** Convert the fields to JSON and put this into the 'raw_event' field. Fields having a leading dot (.) or underscore (_) and the 'raw_event' will be automatically excluded.

#### 6.1.2.3 Configuration examples

**Example 6.2** Syslog to JSON format conversion

The following configuration accepts syslog (both legacy and RFC5424) and converts it to JSON.

```
<Extension syslog>
    Module  xm_syslog
</Extension>

<Extension json>
    Module  xm_json
</Extension>

<Input in>
    Module  im_tcp
    Port  1514
    Host  0.0.0.0
    Exec  parse_syslog(); to_json();
</Input>

<Output out>
    Module  om_file
    File  "/var/log/json.txt"
</Output>

<Route r>
    Path  in => out
</Route>
```

A sample is shown for the input and its corresponding output:

```
<30>Sep 30 15:45:43 host44.localdomain.hu acpid: 1 client rule loaded
```

```
{"MessageSourceAddress":"127.0.0.1","EventReceivedTime":"2011-03-08 14:22:41"," ↩
    SyslogFacilityValue":1,\
"SyslogFacility":"DAEMON","SyslogSeverityValue":5,"SyslogSeverity":"INFO","SeverityValue ↩
    ":2,"Severity":"INFO",\
"Hostname":"host44.localdomain.hu","EventTime":"2011-09-30 14:45:43","SourceName":"acpid"," ↩
    Message":"1 client rule loaded "}
```

**Example 6.3** Converting Windows EventLog to Syslog encapsulated JSON

The following configuration reads the Windows EventLog and converts it into the legacy syslog format where the message part contains the fields in JSON.

```
<Extension syslog>
    Module      xm_syslog
</Extension>

<Extension json>
    Module      xm_json
</Extension>

<Input in>
    Module      im_msvistalog
    Exec        $Message = to_json(); to_syslog_bsd();
</Input>

<Output out>
    Module      om_tcp
    Host        192.168.1.1
    Port        1514
</Output>


<Route r>
    Path        in => out
</Route>
```

A sample output is shown:

```
<14>Mar  8 14:40:11 WIN-OUNNPISDHIG Service_Control_Manager: {"EventTime":"2012-03-08  ↩
    14:40:11","EventTimeWritten":"2012-03-08 14:40:11",\
"Hostname":"WIN-OUNNPISDHIG","EventType":"INFO","SeverityValue":2,"Severity":"INFO"," ↩
    SourceName":"Service Control Manager",\
"FileName":"System","EventID":7036,"CategoryNumber":0,"RecordNumber":6788,"Message":"The  ↩
    nxlog service entered the running state. ",\
"EventReceivedTime":"2012-03-08 14:40:12"}
```

### 6.1.3 XML (xm_xml)

This module provides functions and procedures to process data formatted as Extensible Markup Language (XML) and allows to convert to XML and parse XML into fields.

#### 6.1.3.1 Configuration

The module does not have any module specific configuration directives.

#### 6.1.3.2 Functions and procedures exported by xm_xml

##### 6.1.3.2.1 Functions exported by xm_xml

**`string to_xml();`**

**description** Converts the fields to XML and returns it as a string value. Fields having a leading dot (.) or underscore (_) and the 'raw_event' will be automatically excluded.

**return type** string

#### 6.1.3.2.2 Procedures exported by xm_xml

**`parse_xml();`**

**description** Parse the raw_event field as xml input

**`parse_xml(string source);`**

**description** Parse the given string as XML format

**arguments**

**source** type: string

**`to_xml();`**

**description** Convert the fields to XML and put this into the 'raw_event' field. Fields having a leading dot (.) or underscore (_) and the 'raw_event' will be automatically excluded.

### 6.1.3.3 Configuration examples

**Example 6.4** Syslog to XML format conversion

The following configuration accepts Syslog (both legacy and RFC5424) and converts it to XML.

```
<Extension syslog>
    Module  xm_syslog
</Extension>

<Extension xml>
    Module  xm_xml
</Extension>

<Input in>
    Module  im_tcp
    Port  1514
    Host  0.0.0.0
    Exec  parse_syslog(); to_xml();
</Input>

<Output out>
    Module  om_file
    File  "/var/log/log.xml"
</Output>

<Route r>
    Path  in => out
</Route>
```

A sample is shown for the input and its corresponding output:

```
<30>Sep 30 15:45:43 host44.localdomain.hu acpid: 1 client rule loaded
```

```
<Event><MessageSourceAddress>127.0.0.1</MessageSourceAddress><EventReceivedTime>2012-03-08 ↩
    15:05:39</EventReceivedTime>\
<SyslogFacilityValue>3</SyslogFacilityValue><SyslogFacility>DAEMON</SyslogFacility>< ↩
    SyslogSeverityValue>6</SyslogSeverityValue>\
<SyslogSeverity>INFO</SyslogSeverity><SeverityValue>2</SeverityValue><Severity>INFO</ ↩
    Severity><Hostname>host44.localdomain.hu</Hostname>\
<EventTime>2012-09-30 15:45:43</EventTime><SourceName>acpid</SourceName><Message>1 client ↩
    rule loaded</Message></Event>
```

**Example 6.5** Converting Windows EventLog to Syslog encapsulated XML

The following configuration reads the Windows EventLog and converts it into the legacy syslog format where the message part contains the fields in XML.

```
<Extension syslog>
    Module      xm_syslog
</Extension>

<Extension xml>
    Module      xm_xml
</Extension>

<Input in>
    Module      im_msvistalog
    Exec        $Message = to_xml(); to_syslog_bsd();
</Input>

<Output out>
    Module      om_tcp
    Host        192.168.1.1
    Port        1514
</Output>


<Route r>
    Path        in => out
</Route>
```

A sample output is shown:

```
<14>Mar  8 15:12:12 WIN-OUNNPISDHIG Service_Control_Manager: <Event><EventTime>2012-03-08  ↩
    15:12:12</EventTime>\
<EventTimeWritten>2012-03-08 15:12:12</EventTimeWritten><Hostname>WIN-OUNNPISDHIG</Hostname ↩
    ><EventType>INFO</EventType>\
<SeverityValue>2</SeverityValue><Severity>INFO</Severity><SourceName>Service Control  ↩
    Manager</SourceName>\
<FileName>System</FileName><EventID>7036</EventID><CategoryNumber>0</CategoryNumber>< ↩
    RecordNumber>6791</RecordNumber>\
<Message>The nxlog service entered the running state. </Message><EventReceivedTime ↩
    >2012-03-08 15:12:14</EventReceivedTime></Event>
```

### 6.1.4 Key-value pairs (xm_kvp)

This module provides functions and procedures to process data formatted as key-value pairs (KVPs), also commonly called as name-value pairs. The module can both parse and generate data formatted as key-value pairs.

It is quite common to have a different set of keys in each log line in the form of key-value formatted messages. Extracting values from such logs using regular expressions can be quite cumbersome. The xm_kvp extension module solves this problem by automating this process.

Log messages containing key-value pairs typically look like the following:

```
key1: value1, key2: value2, key42: value42
key1="value 1"; key2="value 2"
Application=smtp, Event='Protocol Conversation', status='Client Request', ClientRequest=' ↩
    HELO 1.2.3.4'
```

I.e. keys are usually separated from the value using an equal sign (=) or the colon (:) and the key-value pairs are delimited with a comma (,), semicolon (;) or space. In addition, values and keys may be quoted and can contain escaping. The module will try to guess the format or this can be explicitly specified using the configuration directives listed below.

**Note**
It is possible to use more than one xm_kvp module instance with different options in order to support different KVP formats at the same time. For this reason, functions and procedures exported by the module are public and must be referenced by the module instance name.

#### 6.1.4.1 Configuration

In addition to the common module directives, the following can be used to configure the xm_kvp module instance.

**KeyQuoteChar** This optional directive takes a single character (see below) as argument to specify the quote character used to enclose key names. If this directive is not specified, the module will accept keys quoted in single and double quotes in addition to unquoted keys.

**ValueQuoteChar** This optional directive takes a single character (see below) as argument to specify the quote character used to enclose values. If this directive is not specified, the module will accept keys quoted in single and double quotes in addition to unquoted values. Normally, but not neccessarily, quotation is used when the value contains space and or the KVDelimiter character.

**EscapeChar** This optional directive takes a single character (see below) as argument to specify the escape character used to escape special characters. The escape character is used to prefix the following characters: the EscapeChar itself and the KeyQuoteChar or the ValueQuoteChar. If EscapeControl is TRUE, the \n, \r, \t, \b (newline, carriage-return, tab, backspace) control characters are also escaped. If this directive is not specified, the default escape character is the backslash character (\).

**KVDelimiter** This optional directive takes a single character (see below) as argument to specify the delimiter character used to separate the key from the value. If this directive is not specified, the module will try to guess the delimiter used which can be either a colon (:) or the equal-sign (=).

**KVPDelimiter** This optional directive takes a single character (see below) as argument to specify the delimiter character used to separate the key-value pairs. If this directive is not specified, the module will try to guess the delimiter used which can be either a comma (,) semicolon (;) or the space.

**EscapeControl** If this optional boolean directive is set to TRUE, control characters are also escaped. See the EscapeChar directive for details. If this directive is not specified, control characters are escaped by default. Note that this is necessary in order to allow single line KVP field lists which contain line-breaks.

##### 6.1.4.1.1 Specifying characters for quote, escape and delimiter

The ValueQuoteChar, KeyQuoteChar, EscapeChar, KVDelimiter and KVPDelimiter can be specified in different ways, mainly due to the nature of the config file format. As of this writing, the module does not support multi character strings for these parameters.

**Unquoted single character** Printable characters can be specified as an unquoted character, except for the backslash '\'. Example:

```
Delimiter ;
```

**Control characters** The following non-printable characters can be specified with escape sequences:

**\a** audible alert (bell)

**\b** backspace

**\t** horizontal tab

**\n** newline

**\v** vertical tab

**\f** formfeed

**\r** carriage return

To use TAB delimiting:

```
KVPDelimiter \t
```

**A character in single quotes** The config parser strips whitespace, so it is not possible to define space as the delimiter unless it is enclosed within quotes:

```
KVPDelimiter ' '
```

Printable characters can also be enclosed:

```
KVPDelimiter ';'
```

The backslash can be specified when enclosed within quotes:

```
EscapeChar '\'
```

**A character in double quotes** Double quotes can be used similarly to single quotes:

```
KVPDelimiter " "
```

The backslash can be specified when enclosed within double quotes:

```
EscapeChar "\"
```

#### 6.1.4.2 Functions and procedures exported by xm_kvp

##### 6.1.4.2.1 Functions exported by xm_kvp

**`string to_kvp();`**

**description** Convert the internal fields to a single KVP formatted string.

**return type** string

##### 6.1.4.2.2 Procedures exported by xm_kvp

**`parse_kvp();`**

**description** Parse the raw_event field as key-value pairs and populate the internal fields using the key names.

**`parse_kvp(string source);`**

**description** Parse the given string key-value pairs and populate the internal fields using the key names.

**arguments**

**source** type: string

**`to_kvp();`**

**description** Format the internal fields as KVP and put this into the 'raw_event' field.

**`reset_kvp();`**

**description** Reset the kvp parser so that the autodetected KeyQuoteChar, ValueQouteChar, KVDelimiter and KVPDelimiter characters can be detected again.

#### 6.1.4.3 Configuration examples

The following examples show various use-cases for parsing KVPs either embedded in another encapsulating format (e.g. syslog) or simply on their own. To do something with the logs we convert these to JSON , though obviously there are dozens of other options. These examples use files for input and output, this can be also changed to use UDP syslog or some other protocol.

**Example 6.6** Simple KVP parsing

The following two lines of input illustrate a simple KVP format where each line consists of various keys and values assigned to them.

```
Name=John, Age=42, Weight=84, Height=142
Name=Mike, Weight=64, Age=24, Pet=dog, Height=172
```

To process this input we use the following configuration that will ignore lines starting with a hash (#) and parses others as key value pairs. The parsed fields can be used in nxlog expressions. In this example we insert a new field named $Overweight and set its value to TRUE if the conditions are met. Finally a few automatically added fields are removed and the log is then converted to JSON.

```
<Extension kvp>
    Module       xm_kvp
    KVPDelimiter ,
    KVDelimiter  =
    EscapeChar   \\
</Extension>

<Extension json>
    Module       xm_json
</Extension>

<Input in>
    Module       im_file
    File         "modules/extension/kvp/xm_kvp5.in"
    SavePos      FALSE
    ReadFromLast FALSE
    Exec         if $raw_event =~ /^#/ drop(); \
                 else \
                 { \
                   kvp->parse_kvp(); \
                   delete($EventReceivedTime); \
                   delete($SourceModuleName); \
                   delete($SourceModuleType); \
                   if ( integer($Weight) > integer($Height) - 100 ) $Overweight = TRUE; \
                   to_json();\
                 }
</Input>

<Output out>
    Module       om_file
    File         'tmp/output'
</Output>

<Route 1>
    Path         in => out
</Route>
```

The output produced by the above configuration is as follows:

```
{"Name":"John","Age":"42","Weight":"84","Height":"142","Overweight":true}
{"Name":"Mike","Weight":"64","Age":"24","Pet":"dog","Height":"172"}
```

**Example 6.7** Parsing KVPs in Cisco ACS syslog

The following line is from a Cisco ACS source:

```
<38>Oct 16 21:01:29 10.0.1.1 CisACS_02_FailedAuth 1k1fg93nk 1 0 Message-Type=Authen failed, ↩
    User-Name=John,NAS-IP-Address=10.0.1.2,AAA Server=acs01
<38>Oct 16 21:01:31 10.0.1.1 CisACS_02_FailedAuth 2k1fg63nk 1 0 Message-Type=Authen failed, ↩
    User-Name=Foo,NAS-IP-Address=10.0.1.2,AAA Server=acs01
```

The format is syslog which contains a set of values present in each record such as the category name and an additional set of KVPs. The following configuration can be used to process this and convert it to JSON:

```
<Extension json>
    Module      xm_json
</Extension>

<Extension syslog>
    Module      xm_syslog
</Extension>

<Extension kvp>
    Module      xm_kvp
    KVDelimiter =
    KVPDelimiter ,
</Extension>

<Input in>
    Module  im_file
    SavePos     FALSE
    ReadFromLast FALSE
    File        "modules/extension/kvp/cisco_acs.in"
    Exec  parse_syslog_bsd();
    Exec  if ( $Message =~ /^CisACS_(\d\d)_(\S+) (\S+) (\d+) (\d+) (.*)$/ ) \
                { \
                   $ACSCategoryNumber = $1; \
                   $ACSCategoryName = $2; \
                   $ACSMessageId = $3; \
                   $ACSTotalSegments = $4; \
                   $ACSSegmentNumber = $5; \
                   $Message = $6; \
                   kvp->parse_kvp($Message); \
                } \
                else log_warning("does not match: " + to_json());
</Input>

<Output out>
    Module  om_file
    File  "tmp/output"
    Exec  delete($EventReceivedTime);
    Exec  to_json();
</Output>

<Route 1>
    Path  in => out
</Route>
```

The converted JSON result is shown below:

```
{"SourceModuleName":"in","SourceModuleType":"im_file","SyslogFacilityValue":4," ↩
    SyslogFacility":"AUTH","SyslogSeverityValue":6,"SyslogSeverity":"INFO","SeverityValue ↩
    ":2,"Severity":"INFO","Hostname":"10.0.1.1","EventTime":"2014-10-16 21:01:29","Message ↩
    ":"Message-Type=Authen failed,User-Name=John,NAS-IP-Address=10.0.1.2,AAA Server=acs01"," ↩
    ACSCategoryNumber":"02","ACSCategoryName":"FailedAuth","ACSMessageId":"1k1fg93nk"," ↩
    ACSTotalSegments":"1","ACSSegmentNumber":"0","Message-Type":"Authen failed","User-Name ↩
    ":"John","NAS-IP-Address":"10.0.1.2","AAA Server":"acs01"}
{"SourceModuleName":"in","SourceModuleType":"im_file","SyslogFacilityValue":4," ↩
    SyslogFacility":"AUTH","SyslogSeverityValue":6,"SyslogSeverity":"INFO","SeverityValue ↩
    ":2,"Severity":"INFO","Hostname":"10.0.1.1","EventTime":"2014-10-16 21:01:31","Message ↩
    ":"Message-Type=Authen failed,User-Name=Foo,NAS-IP-Address=10.0.1.2,AAA Server=acs01"," ↩
```

**Example 6.8** Parsing KVPs in Sidewinder logs

The following line is from a Sidewinder log source:

```
date="May 5 14:34:40 2009 MDT",fac=f_mail_filter,area=a_kmvfilter,type=t_mimevirus_reject, ↩
    pri=p_major,pid=10174,ruid=0,euid=0,pgid=10174,logid=0,cmd=kmvfilter,domain=MMF1,edomain ↩
    =MMF1,message_id=(null),srcip=66.74.184.9,mail_sender=<habuzeid6@...>,virus_name=W32/ ↩
    Netsky.c@MM!zip,reason="Message scan detected a Virus in msg Unknown, message being  ↩
    Discarded, and not quarantined"
```

This can be parsed and converted to JSON with the following configuration:

```
<Extension kvp>
    Module  xm_kvp
    KVPDelimiter ,
    KVDelimiter =
    EscapeChar \\
    ValueQouteChar "
</Extension>

<Extension json>
    Module  xm_json
</Extension>

<Input in>
    Module  im_file
    File  "modules/extension/kvp/sidewinder.in"
    SavePos FALSE
    ReadFromLast FALSE
    Exec  kvp->parse_kvp(); delete($EventReceivedTime); to_json();
</Input>

<Output out>
    Module  om_file
    File  'tmp/output'
</Output>

<Route 1>
    Path  in => out
</Route>
```

The converted JSON result is shown below:

```
{"SourceModuleName":"in","SourceModuleType":"im_file","date":"May 5 14:34:40 2009 MDT","fac ↩
    ":"f_mail_filter","area":"a_kmvfilter","type":"t_mimevirus_reject","pri":"p_major","pid ↩
    ":"10174","ruid":"0","euid":"0","pgid":"10174","logid":"0","cmd":"kmvfilter","domain":" ↩
    MMF1","edomain":"MMF1","message_id":"(null)","srcip":"66.74.184.9","mail_sender":"< ↩
    habuzeid6@...>","virus_name":"W32/Netsky.c@MM!zip","reason":"Message scan detected a  ↩
    Virus in msg Unknown, message being Discarded, and not quarantined"}
```

**Example 6.9** Parsing URL request parameters in Apache access logs

URLs in HTTP requests frequently contain URL parameters which are a special kind of key-value pairs delimited by the ampersand (&). Here is an example of two HTTP requests logged by the Apache web server in the Combined Log Format:

```
192.168.1.1 - foo [11/Jun/2013:15:44:34 +0200] "GET /do?action=view&obj_id=2 HTTP/1.1" 200 ↩
    1514 "https://localhost" "Mozilla/5.0 (X11; Linux x86_64; rv:17.0) Gecko/17.0 Firefox ↩
    /17.0"
192.168.1.1 - - [11/Jun/2013:15:44:44 +0200] "GET /do?action=delete&obj_id=42 HTTP/1.1" 401 ↩
     788 "https://localhost" "Mozilla/5.0 (X11; Linux x86_64; rv:17.0) Gecko/17.0 Firefox ↩
    /17.0"
```

The following configuration file parses the access log and extracts all the fields. In this case the request parameters are extracted into the *HTTPParams* field using a regular expression. This field is then further parsed using the KVP parser. At the end of the processing all fields are converted to the KVP format using the to_kvp() procedure of the *kvp2* instance.

```
<Extension kvp>
    Module  xm_kvp
    KVPDelimiter &
    KVDelimiter =
</Extension>

<Extension kvp2>
    Module  xm_kvp
    KVPDelimiter ;
    KVDelimiter =
</Extension>

<Input in>
    Module  im_file
    File  "modules/extension/kvp/apache_url.in"
    SavePos FALSE
    ReadFromLast FALSE
    Exec    if $raw_event =~ /^(\S+) (\S+) (\S+) \[([^\]]+)\] \"(\S+) (.+) HTTP.\d\.\d\" (\ ↩
        d+) (\d+) \"([^\"]+)\" \"([^\"]+)\"/\
                { \
                  $Hostname = $1; \
                  if $3 != '-' $AccountName = $3; \
                  $EventTime = parsedate($4); \
                  $HTTPMethod = $5; \
                  $HTTPURL = $6; \
                  $HTTPResponseStatus = $7; \
                  $FileSize = $8; \
                  $HTTPReferer = $9; \
                  $HTTPUserAgent = $10; \
                  if $HTTPURL =~ /\?(.+)/ { $HTTPParams = $1; } \
                  kvp->parse_kvp($HTTPParams); \
                  delete($EventReceivedTime); \
                  kvp2->to_kvp(); \
                }
</Input>

<Output out>
    Module  om_file
    File  'tmp/output'
</Output>

<Route 1>
    Path  in => out
</Route>
```

The two request parameters *action* and *obj_id* then appear at the end of the KVP formated lines.

```
SourceModuleName=in;SourceModuleType=im_file;Hostname=192.168.1.1;AccountName=foo;EventTime ↩
    =2013-06-11 15:44:34;HTTPMethod=GET;HTTPURL=/do?action=view&obj_id=2;HTTPResponseStatus ↩
    =200;FileSize=1514;HTTPReferer=https://localhost;HTTPUserAgent='Mozilla/5.0 (X11; Linux  ↩
    x86_64; rv:17.0) Gecko/17.0 Firefox/17.0';HTTPParams=action=view&obj_id=2;action=view; ↩
    obj_id=2;
SourceModuleName=in;SourceModuleType=im_file;Hostname=192.168.1.1;EventTime=2013-06-11  ↩
```

### 6.1.5 GELF (xm_gelf)

This module provides an output writer function which can be used to generate output in Graylog Extended Log Format (GELF) and feed that into Graylog2 or GELF compliant tools.

The advantage of using this module over syslog (e.g. Snare Agent and others) is that the GELF format contains structured data in JSON and makes the fields available to analysis. This is especially convenient with sources such as the Windows EventLog which already generate logs in a structured format.

The GELF output generated by this module includes all fields, except the following:

The 'raw_event' field.
Fields starting with a leading dot (.).
Fields starting with a leading underscore (_).

In order to make nxlog output GELF formatted data, the following needs to be done:

1. Make sure the xm_gelf module is loaded:

```
<Extension gelf>
    Module      xm_gelf
</Extension>
```

2. Set the OutputType to GELF in your output module (which is om_udp):

```
    OutputType  GELF
```

#### 6.1.5.1 Configuration

The module does not have any module specific configuration directives.

#### 6.1.5.2 Configuration examples

**Example 6.10** Sending Windows EventLog to Graylog2 in GELF

The following configuration reads the Windows EventLog and sends it to the Graylog2 server in GELF format.

```
<Extension gelf>
    Module      xm_gelf
</Extension>

<Input in>
    # Use 'im_mseventlog' for Windows XP, 2000 and 2003
    Module      im_msvistalog
# Uncomment the following to collect specific event logs only
#    Query       <QueryList>\
#                    <Query Id="0">\
#                        <Select Path="Application">*</Select>\
#                        <Select Path="System">*</Select>\
#                        <Select Path="Security">*</Select>\
#                    </Query>\
#                </QueryList>
</Input>

<Output out>
    Module      om_udp
    Host        192.168.1.1
    Port        12201
    OutputType  GELF
</Output>

<Route r>
    Path        in => out
</Route>
```

**Example 6.11** Forwarding custom log files to Graylog2 in GELF

You may want to collect custom application logs and send it out in the GELF format. See the following example about setting the common and custom fields to make the data more useful for the other end.

```
<Extension gelf>
    Module  xm_gelf
</Extension>

<Input in>
    Module  im_file
    File  "/var/log/app*.log"

    # Set the $EventTime field usually found in the logs by extracting it with a regexp.
    # If this is not set, the current system time will be used which might be a little off.
    Exec  if $raw_event =~ /(\d\d\d\d\-\d\d-\d\d \d\d:\d\d:\d\d)/ $EventTime = parsedate($1 ↩
        );

    # Explicitly set the Hostname. This defaults to the system's hostname if unset.
    Exec  $Hostname = 'myhost';

    # Now set the severity level to something custom. This defaults to 'INFO' if unset.
    # We can use the following numeric values here which are the standard syslog values:
    # ALERT: 1, CRITICAL: 2, ERROR: 3, WARNING: 4, NOTICE: 5, INFO: 6, DEBUG: 7
    Exec  if $raw_event =~ /ERROR/ $SyslogSeverityValue = 3; \
                else $SyslogSeverityValue = 6;

    # Set a field to contain the name of the source file
    Exec  $FileName = file_name();

    # To set a custom message, use the $Message field. The $raw_event field is used if  ↩
        $Message is unset.
    Exec  if $raw_event =~ /something important/ $Message = 'IMPORTANT!! ' + $raw_event;

    # Set the SourceName (facility field in GELF), will default to 'NXLOG' if unset.
    Exec  $SourceName = 'myapp';
</Input>

<Output out>
    Module  om_udp
    Host  192.168.1.1
    Port  12201
    OutputType  GELF
</Output>

<Route r>
    Path  in => out
</Route>
```

**Example 6.12** Parsing a CSV file and sending it to Graylog2 in GELF

Using the following config file nxlog will read a CSV file containing 3 fields and forwards it in GELF so that the fields will be available on the server.

```
<Extension gelf>
    Module  xm_gelf
</Extension>

<Extension csv>
    Module  xm_csv
    Fields      $name, $number, $location
    FieldTypes  string, integer, string
    Delimiter   ,
</Extension>

<Input in>
    Module  im_file
    File  "/var/log/app/csv.log"
    Exec        csv->parse_csv();
</Input>

<Output out>
    Module  om_udp
    Host  192.168.1.1
    Port  12201
    OutputType  GELF
</Output>

<Route r>
    Path  in => out
</Route>
```

### 6.1.6 Character set conversion (xm_charconv)

This module provides functions and procedures to convert strings between different character sets (codepages). Reasons for the existence of this module are outlined in the Character set and i18n support section.

The convert_fields() procedure and the convert() function supports all encodings available to iconv. See **iconv -l** for a list of encoding names.

#### 6.1.6.1 Configuration

In addition to the common module directives, the following can be used to configure the xm_charconv module instance.

**AutodetectCharsets** This optional directive takes a comma separated list of character set names. When 'auto' is specified as the source encoding for convert() or convert_fields(), these charsets will be tried for conversion.

#### 6.1.6.2 Functions and procedures exported by xm_charconv

##### 6.1.6.2.1 Functions exported by xm_charconv

```
string convert(string source, string srcencoding, string dstencoding);
```

**description** This function converts the source string to the encoding specified in 'dstencoding' from 'srcencoding'. 'srcencoding' can be 'auto' to request auto detection.

**arguments**

**source** type: string
**srcencoding** type: string
**dstencoding** type: string

**return type** string

#### 6.1.6.2.2 Procedures exported by xm_charconv

```
convert_fields(string srcencoding, string dstencoding);
```

**description** Convert all string type fields of a log message from 'srcencoding' to 'dstencoding'. 'srcencoding' can be "auto" to request auto detection.

**arguments**

**srcencoding** type: string
**dstencoding** type: string

### 6.1.6.3 Configuration examples

This configuration shows an example of character set autodetection. The input file can contain differently encoded lines and using autodetection the module normalizes output to utf-8.

**Example 6.13** Character set autodetection of various input encodings

```
<Extension charconv>
    Module      xm_charconv
    AutodetectCharsets utf-8, euc-jp, utf-16, utf-32, iso8859-2
</Extension>

<Input filein>
    Module  im_file
    File  "tmp/input"
    Exec  convert_fields("AUTO", "utf-8");
</Input>

<Output fileout>
    Module  om_file
    File  "tmp/output"
</Output>

<Route 1>
    Path  filein => fileout
</Route>
```

## 6.1.7 File operations (xm_fileop)

This module provides functions and procedures to manipulate files. Coupled with a Schedule block, this allows to implement various log rotation and retention policies, e.g.:

- log file retention based on file size,
- log file retention based on file age,
- cyclic log file rotation and retention.

**Note**
Rotating, renaming or removing the file written by om_file is also supported with the help of the reopen procedure.

#### 6.1.7.1 Configuration

The module does not have any module specific configuration directives.

#### 6.1.7.2 Functions and procedures exported by xm_fileop

##### 6.1.7.2.1 Functions exported by xm_fileop

```
string file_read(string file);
```

**description** Return the contents of the file as a string value. On error undef is returned and an error is logged.

**arguments**

**file** type: string

**return type** string

```
boolean file_exists(string file);
```

**description** Return TRUE if the file exists and is a regular file.

**arguments**

**file** type: string

**return type** boolean

```
string file_basename(string file);
```

**description** Strip the directory name from the full file path. basename('/var/log/app.log') will return 'app.log'.

**arguments**

**file** type: string

**return type** string

```
string file_dirname(string file);
```

**description** Return the directory name of the full file file path. basename('/var/log/app.log') will return '/var/log'. Returns an empty string if 'file' does not contain any directory separators.

**arguments**

**file** type: string

**return type** string

```
datetime file_mtime(string file);
```

**description** Return the last modification time of the file. On error undef is returned and an error is logged.

**arguments**

**file** type: string

**return type** datetime

```
datetime file_ctime(string file);
```

**description** Return the creation or inode-changed time of the file. On error undef is returned and an error is logged.

**arguments**

**file** type: string

**return type** datetime

```
string file_type(string file);
```

**description** Return the type of the file. The following string values can be returned: FILE, DIR, CHAR, BLOCK, PIPE, LINK, SOCKET, UNKNOWN. On error undef is returned and an error is logged.

**arguments**

**file** type: string

**return type** string

```
integer file_size(string file);
```

**description** Return the size of the file. On error undef is returned and an error is logged.

**arguments**

**file** type: string

**return type** integer

```
integer file_inode(string file);
```

**description** Return the inode number of the file. On error undef is returned and an error is logged.

**arguments**

**file** type: string

**return type** integer

```
string dir_temp_get();
```

**description** Return the name of a directory suitable as a temporary storage location.

**return type** string

```
boolean dir_exists(string path);
```

**description** Return TRUE if the 'path' exists and is a directory. On error undef is returned and an error is logged.

**arguments**

**path** type: string

**return type** boolean

#### 6.1.7.2.2 Procedures exported by xm_fileop

```
file_cycle(string file);
```

**description** Do a cyclic rotation on 'file'. 'file' will be moved to "'file'.1". If "'file'.1" already exists it will be moved to "'file'.2" and so on. This procedure will reopen the LogFile if this is cycled. An error is logged if the operation fails.

**arguments**

**file** type: string

```
file_cycle(string file, integer max);
```

**description** Do a cyclic rotation on 'file'. 'file' will be moved to "'file'.1". If "'file'.1" already exists it will be moved to "'file'.2" and so on. 'max' specifies the maximum number of files to keep. E.g. if 'max' is 5, "'file'.6" will be deleted. This procedure will reopen the LogFile if this is cycled. An error is logged if the operation fails.

**arguments**

**file** type: string

**max** type: integer

```
file_rename(string old, string new);
```

**description** Rename the file 'old' to 'new'. If the file 'new' exists, it will be overwritten. Moving files or directories across devices may not be possible. This procedure will reopen the LogFile if this is renamed. An error is logged if the operation fails.

**arguments**

**old** type: string

**new** type: string

```
file_copy(string src, string dst);
```

**description** Copy the file 'src' to 'dst'. If file 'dst' already exists, its contents will be overwritten. An error is logged if the operation fails.

**arguments**

**src** type: string

**dst** type: string

```
file_remove(string file);
```

**description** Remove the file 'file'. It is possible to specify a wildcard in filenames (but not in the path). If you use backslash as the directory separator with wildcards, make sure to escape this (e.g. 'C:\\test*.log'). This procedure will reopen the LogFile if this is removed. An error is logged if the operation fails.

**arguments**

**file** type: string

```
file_remove(string file, datetime older);
```

**description** Remove the file 'file' if its creation time is older than the value specified in 'older'. It is possible to specify a wildcard in filenames (but not in the path). If you use backslash as the directory separator with wildcards, make sure to escape this (e.g. 'C:\\test*.log'). This procedure will reopen the LogFile if this is removed. An error is logged if the operation fails.

**arguments**

**file** type: string

**older** type: datetime

```
file_link(string src, string dst);
```

**description** Create a hardlink from 'src' to 'dst'. An error is logged if the operation fails.

**arguments**

**src** type: string

**dst** type: string

```
file_append(string src, string dst);
```

**description** Append the contents of the file 'src' to 'dst'. 'dst' will be created if it does not exist. An error is logged if the operation fails.

**arguments**

**src** type: string

**dst** type: string

```
file_write(string file, string value);
```

**description** Write value into 'file'. 'file' will be created if it does not exist. An error is logged if the operation fails.

**arguments**

**file** type: string

**value** type: string

```
file_truncate(string file);
```

**description** Truncate the file to zero length. If 'file' does not exist, it will be created. An error is logged if the operation fails.

**arguments**

**file** type: string

```
file_truncate(string file, integer offset);
```

**description** Truncate the file to the size specified in 'offset'. If 'file' does not exist, it will be created. An error is logged if the operation fails.

**arguments**

**file** type: string

**offset** type: integer

```
file_chown(string file, integer uid, integer gid);
```

**description** Change file ownership. This function is only implemented on POSIX systems where chown() is available in the underlying OS. An error is logged if the operation fails.

**arguments**

**file** type: string

**uid** type: integer

**gid** type: integer

```
file_chown(string file, string user, string group);
```

**description** Change file ownership. This function is only implemented on POSIX systems where chown() is available in the underlying OS. An error is logged if the operation fails.

**arguments**

**file** type: string

**user** type: string

**group** type: string

```
file_chmod(string file, integer mode);
```

**description** Change file permission. This function is only implemented on POSIX systems where chmod() is available in the underlying OS. An error is logged if the operation fails.

**arguments**

**file** type: string

**mode** type: integer

```
file_touch(string file);
```

**description** Update the last modification time of 'file' or create it if 'file' does not exist. An error is logged if the operation fails.

**arguments**

**file** type: string

```
dir_make(string path);
```

**description** Create a directory recursively (i.e. as 'mkdir -p'). It succeeds if the directory already exists. An error is logged if the operation fails.

**arguments**

**path** type: string

```
dir_remove(string file);
```

**description** Remove the directory from the filesystem.

**arguments**

**file** type: string

#### 6.1.7.3 Configuration examples

**Example 6.14** Rotation of the internal LogFile

This example shows how to rotate the internal logfile based on time and size.

```
#define LOGFILE C:\Program Files\nxlog\data\nxlog.log
define LOGFILE /var/log/nxlog/nxlog.log

<Extension fileop>
    Module      xm_fileop

    # Check the size of our log file every hour and rotate if it is larger than 1Mb
    <Schedule>
        Every   1 hour
        Exec    if (file_size('%LOGFILE%') >= 1M) file_cycle('%LOGFILE%', 2);
    </Schedule>

    # Rotate our log file every week on sunday at midnight
    <Schedule>
        When    @weekly
        Exec    file_cycle('%LOGFILE%', 2);
    </Schedule>
</Extension>
```

### 6.1.8 Multi-line message parser (xm_multiline)

Multi-line messages such as exception logs and stack traces are quite common in logs. Unfortunately when the log messages are stored in files or forwarded over the network without any encapsulation, the newline character present in messages spanning multiple lines confuse simple linebased parsers which treat every line as a separate event.

Multi-line events have one or more of the following properties:

- The first line has a header (e.g. timestamp + severity).
- The first line has a header and there is closing character sequence marking the end.
- The line count in the message can be variable (one or more) or the message can have a fixed line count.

This information allows the message to be reconstructed, i.e. lines to be concatenated which belong to a single event. This is how the xm_multiline module can join together multiple lines into a single message.

The name of the xm_multiline module instance can be used by input modules as the input reader specified with the InputType directive. For each input source a separate context is maintained by the module so that multi-line messages coming from several simultaneous sources can be still correctly processed. An input source is a file for im_file (with wildcards it is one source for each file), a connection for im_ssl and im_tcp. Unfortunately im_udp uses a single socket and is treated as a single source even if multiple UDP (e.g. syslog) senders are forwarding logs to it.

**Note**
By using module variables it is possible to accomplish the same what this module does. The advantages of using this module over module variables are the following:

- Processes messages more efficiently.
- It yields a more readable configuration.
- Module event counters are correctly updated (i.e. one increment for one multi-line message and not per line).
- It works on message source level (each file for a wildcarded im_file module instance and each tcp connection for an im_tcp/im_ssl instance) and not on module instance level.

#### 6.1.8.1 Configuration

The following directives can be used to configure the xm_multiline module instance:

**HeaderLine** This directive takes a string or a regular expression literal. This will be matched against each line. When the match is successful, the successive lines are appended until the next header line is read. This directive is mandatory unless FixedLineCount is used.

> **Note**
> Until there is a new header read, the previous message is stored in the buffers because the module does not know where the message ends. The im_file module will forcibly flush this buffer after the configured PollInterval timeout. If this behaviour is unacceptable, consider using some kind of an encapsulation method (JSON, XML, RFC5425, etc) or use and end marker with EndLine if possible.

**EndLine** This is similar to the HeaderLine directive. This optional directive also takes a string or a regular expression literal to be matched against each line. When the match is successful the message is considered complete and is emitted.

**FixedLineCount** This directive takes a positive integer number defining the number of lines to concatenate. This is mostly useful with log messages spanning a fixed number of lines. When this number is defined, the module knows where the event message ends, thus it does not suffer from the problem described above.

**Exec** This directive is almost identical to the behavior of the Exec directive used by the other modules with the following differences:

- Each line is passed in $raw_event as it is read. The line includes the line terminator.
- Other fields cannot be used. If you want to store captured strings from regular expression based matching in fields, you cannot do it here.

This is mostly useful for filtering out some lines with the drop() procedure or rewriting them.

#### 6.1.8.2 Configuration examples

**Example 6.15** Parsing multi-line XML logs and converting to JSON

XML is commonly formatted as indented multi-line to make it more readable. In the following configuration file we use the HeaderLine together with the HeaderLine directive to parse the events which are converted to JSON after some slight normalization.

```
<Extension multiline>
    Module  xm_multiline
    HeaderLine  /^<event>/
    EndLine /^</event>/
</Extension>

<Extension xmlparser>
    Module  xm_xml
</Extension>

<Extension json>
    Module  xm_json
</Extension>

<Input in>
    Module  im_file
    File  "modules/extension/multiline/xm_multiline5.in"
    SavePos FALSE
    ReadFromLast FALSE
    InputType multiline
    # Discard everything that doesn't seem to be an xml event
    Exec  if $raw_event !~ /^<event>/ drop();
    # Parse the xml event
    Exec        parse_xml();
    # Rewrite some fields
    Exec        $EventTime = parsedate($timestamp); delete($timestamp); delete( ↩
        $EventReceivedTime);
    # Convert to JSON
    Exec        to_json();
</Input>

<Output out>
    Module  om_file
    File  'tmp/output'
</Output>

<Route 1>
    Path  in => out
</Route>
```

An input sample:

```
<?xml version="1.0" encoding="UTF-8">
<event>
  <timestamp>2012-11-23 23:00:00</timestamp>
  <severity>ERROR</severity>
  <message>
    Something bad happened.
    Please check the system.
  </message>
</event>
<event>
  <timestamp>2012-11-23 23:00:12</timestamp>
  <severity>INFO</severity>
  <message>
   System state is now back to normal.
  </message>
</event>
```

The following output is produced:

**Example 6.16** Parsing DICOM logs

Each log message has a header (TIMESTAMP INTEGER SEVERITY) which is used as the message boundary. A regular expression is defined for this using the HeaderLine directive. Each log message is prepended with an additional line containing dashes and is output into a file.

```
<Extension dicom-multi>
    Module  xm_multiline
    HeaderLine  /^\d\d\d\d-\d\d-\d\d\d\d:\d\d:\d\d\.\d+\s+\d+\s+\S+\s+/
</Extension>

<Input in>
    Module  im_file
    File  "modules/extension/multiline/xm_multiline4.in"
    SavePos FALSE
    ReadFromLast FALSE
    InputType dicom-multi
</Input>

<Output out>
    Module  om_file
    File  'tmp/output'
    Exec  $raw_event = "--------------------------------------\n" + $raw_event;
</Output>

<Route 1>
    Path  in => out
</Route>
```

An input sample:

```
2011-12-1512:22:51.000000  4296   INFO   Association Request Parameteres:
Our Implementation Class UID:    2.16.124.113543.6021.2
Our Implementation Version Name: RZDCX_2_0_1_8
Their Implementation Class UID:
Their Implementation Version Name:
Application Context Name:    1.2.840.10008.3.1.1.1
Requested Extended Negotiation: none
Accepted Extended Negotiation: none
2011-12-1512:22:51.000000  4296   DEBUG  Constructing Associate RQ PDU
2011-12-1512:22:51.000000  4296   DEBUG  WriteToConnection, length: 310, bytes written:  ↩
    310, loop no: 1
2011-12-1512:22:51.015000  4296   DEBUG  PDU Type: Associate Accept, PDU Length: 216 + 6  ↩
    bytes PDU header
  02  00  00  00  00  d8  00  01  00  00  50  41  43  53  20  20
  20  20  20  20  20  20  20  20  20  20  52  5a  44  43  58  20
  20  20  20  20  20  20  20  20  20  20  00  00  00  00  00  00
2011-12-1512:22:51.031000  4296   DEBUG  DIMSE sendDcmDataset: sending 146 bytes
```

The following output is produced:

```
--------------------------------------
2011-12-1512:22:51.000000  4296   INFO   Association Request Parameteres:
Our Implementation Class UID:    2.16.124.113543.6021.2
Our Implementation Version Name: RZDCX_2_0_1_8
Their Implementation Class UID:
Their Implementation Version Name:
Application Context Name:    1.2.840.10008.3.1.1.1
Requested Extended Negotiation: none
Accepted Extended Negotiation: none
--------------------------------------
2011-12-1512:22:51.000000  4296   DEBUG  Constructing Associate RQ PDU
--------------------------------------
2011-12-1512:22:51.000000  4296   DEBUG  WriteToConnection, length: 310, bytes written:  ↩
    310, loop no: 1
======================================
2011-12-1512:22:51.015000  4296   DEBUG  PDU Type: Associate Accept, PDU Length: 216 + 6  ↩
    bytes PDU header
  02  00  00  00  00  d8  00  01  00  00  50  41  43  53  20  20
```

**Example 6.17** Multi-line messages with a fixed string header

The following configuration will process messages having a fixed string header containing dashes. Each event is then prepended with a sharp (#) and is output to a file.

```
<Extension multiline>
    Module  xm_multiline
    HeaderLine  "---------------"
</Extension>

<Input in>
    Module  im_file
    File  "modules/extension/multiline/xm_multiline1.in"
    SavePos FALSE
    ReadFromLast FALSE
    InputType multiline
    Exec        $raw_event = "#" + $raw_event;
</Input>

<Output out>
    Module  om_file
    File  'tmp/output'
</Output>

<Route 1>
    Path  in => out
</Route>
```

An input sample:

```
---------------
1
---------------
1
2
---------------
aaaaaaaaaaaaaaaaaaaaaaaaaaaaa
bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb
ccccccccccccccccccccccccccccccccccc
dddd
---------------
```

The following output is produced:

```
#---------------
1
#---------------
1
2
#---------------
aaaaaaaaaaaaaaaaaaaaaaaaaaaaa
bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb
ccccccccccccccccccccccccccccccccccc
dddd
#---------------
```

**Example 6.18** Multi-line messages with fixed line count

The following configuration will process messages having a fixed line count of 4. Lines containing only whitespace are ignored and removed. Each event is then prepended with a sharp (#) and is output to a file.

```
<Extension multiline>
    Module  xm_multiline
    FixedLineCount 4
    Exec  if $raw_event =~ /^\s*$/ drop();
</Extension>

<Input in>
    Module  im_file
    File  "modules/extension/multiline/xm_multiline2.in"
    SavePos FALSE
    ReadFromLast FALSE
    InputType multiline
</Input>

<Output out>
    Module  om_file
    File  'tmp/output'
    Exec  $raw_event = "#" + $raw_event;
</Output>

<Route 1>
    Path  in => out
</Route>
```

An input sample:

```
1
2
3
4
1asd

2asdassad
3ewrwerew
4xcbccvbc

1dsfsdfsd
2sfsdfsdrewrwe

3sdfsdfsew
4werwerwrwe
```

The following output is produced:

```
#1
2
3
4
#1asd
2asdassad
3ewrwerew
4xcbccvbc
#1dsfsdfsd
2sfsdfsdrewrwe
3sdfsdfsew
4werwerwrwe
```

**Example 6.19** Multi-line messages with a syslog header

Multi-line messages are frequently logged over syslog and they end up in log files. Unfortunately from the result it looks that each line is one event with its own syslog header. It can be a common requirement to merge these back into a single event message. The following configuration does just that. It strips the syslog header from the netstat output stored as a traditional syslog formatted file and each message is then printed again with a line of dashes used as a separator.

```
<Extension syslog>
    Module  xm_syslog
</Extension>

<Extension netstat>
    Module  xm_multiline
    FixedLineCount 4
    Exec  parse_syslog_bsd(); $raw_event = $Message + "\n";
</Extension>

<Input in>
    Module  im_file
    File  "modules/extension/multiline/xm_multiline3.in"
    SavePos FALSE
    ReadFromLast FALSE
    InputType netstat
</Input>

<Output out>
    Module  om_file
    File  'tmp/output'
    Exec  $raw_event =  ↩
        "--------------------------------------------------------------------------------\ ↩
        n" + $raw_event;
</Output>

<Route 1>
    Path  in => out
</Route>
```

An input sample:

```
Nov 21 11:40:27 hostname app[26459]: Iface   MTU Met   RX-OK RX-ERR RX-DRP RX-OVR    TX-OK  ↩
    TX-ERR TX-DRP TX-OVR Flg
Nov 21 11:40:27 hostname app[26459]: eth2       1500 0  16936814      0      0 0       ↩
    30486067      0      8      0 BMRU
Nov 21 11:40:27 hostname app[26459]: lo        16436 0  277217234      0      0 0       ↩
    277217234      0      0      0 LRU
Nov 21 11:40:27 hostname app[26459]: tun0       1500 0    316943      0      0 0         ↩
    368642      0      0      0 MOPRU
Nov 21 11:40:28 hostname app[26459]: Iface   MTU Met   RX-OK RX-ERR RX-DRP RX-OVR    TX-OK  ↩
    TX-ERR TX-DRP TX-OVR Flg
Nov 21 11:40:28 hostname app[26459]: eth2       1500 0  16945117      0      0 0       ↩
    30493583      0      8      0 BMRU
Nov 21 11:40:28 hostname app[26459]: lo        16436 0  277217234      0      0 0       ↩
    277217234      0      0      0 LRU
Nov 21 11:40:28 hostname app[26459]: tun0       1500 0    316943      0      0 0         ↩
    368642      0      0      0 MOPRU
Nov 21 11:40:29 hostname app[26459]: Iface   MTU Met   RX-OK RX-ERR RX-DRP RX-OVR    TX-OK  ↩
    TX-ERR TX-DRP TX-OVR Flg
Nov 21 11:40:29 hostname app[26459]: eth2       1500 0  16945270      0      0 0       ↩
    30493735      0      8      0 BMRU
Nov 21 11:40:29 hostname app[26459]: lo        16436 0  277217234      0      0 0       ↩
    277217234      0      0      0 LRU
Nov 21 11:40:29 hostname app[26459]: tun0       1500 0    316943      0      0 0         ↩
    368642      0      0      0 MOPRU
```

The following output is produced:

```
--------------------------------------------------------------------------------
Iface   MTU Met   RX-OK RX-ERR RX-DRP RX-OVR    TX-OK TX-ERR TX-DRP TX-OVR Flg
eth2       1500 0  16936814      0      0 0      30486067      0      8      0 BMRU
```

### 6.1.9 Syslog (xm_syslog)

This module provides support for the archaic BSD Syslog protocol as defined in RFC 3164 and the current IETF standard defined by RFC 5424-5426. This is achieved by exporting functions and procedures usable from the nxlog language. The transport is handled by the respective input and output modules (i.e. im_udp), this module only provides a parser and helper functions to create syslog messages and handle facility and severity values.

The older but still widespread BSD syslog standard defines both the format and the transport protocol in RFC 3164. The transport protocol is UDP, but to provide reliability and security, this line based format is also commonly transferred over TCP and SSL. There is a newer standard defined in RFC 5424 also known as the IETF syslog format which obsolotes the BSD syslog format. This format overcomes most of the limitations of the old BSD syslog and allows multi-line messages and proper timestamps. The transport method is defined in RFC 5426 for UDP and RFC 5425 for TLS/SSL.

Because the IETF Syslog format supports multi-line messages, RFC 5425 defines a special format to encapsulate these by prepending the payload size in ASCII to the IETF syslog message. Messages tranferred in UDP packets are self-contained and do not need this additional framing. The following input reader and output writer functions are provided by the xm_syslog module to support this TLS transport defined in RFC 5425. While RFC 5425 explicitly defines that the TLS network transport protocol is to be used, pure TCP may be used if security is not a requirement. Syslog messages can be also persisted to files with this framing format using these functions.

**InputType Syslog_TLS** This input reader function parses the payload size and then reads the message according to this value. It is required to support Syslog TLS transport defined in RFC 5425.

**OutputType Syslog_TLS** This output writer function prepends the payload size to the message. It is required to support Syslog TLS transport defined in RFC 5425.

---

**Note**
The *Syslog_TLS* InputType/OutputType can work with any input/output such as im_tcp or im_file and it does not depend on SSL transport at all. The name *Syslog_TLS* is a little misleading, it was chosen to refer to the octet-framing method described in RFC 5425 used for TLS transport.

---

---

**Note**
The pm_transformer module can also parse and create BSD and IETF syslog messages but using the functions and procedures provided by this module makes it possible to solve more complex tasks which pm_transformer is not capable of on its own.

---

Structured data in IETF syslog messages is parsed and put into nxlog fields. The SD-ID will be prepended to the field name with a dot unless it is 'NXLOG@XXXX'. Consider the following syslog message:

```
<30>1 2011-12-04T21:16:10.000000+02:00 host app procid msgid [exampleSDID@32473 eventSource ↩
    ="Application" eventID="1011"] Message part
```

After this IETF formatted syslog message is parsed with parse_syslog_ietf(), there will be two additional fields: $exampleSDID.eventID and $exampleSDID.eventSource. When SD-ID is NXLOG, the field name will be the same as the SD-PARAM name. The two additional fields extracted from the structured data part of the following IETF syslog message are $eventID and $eventSource:

```
<30>1 2011-12-04T21:16:10.000000+02:00 host app procid msgid [NXLOG@32473 eventSource=" ↩
    Application" eventID="1011"] Message part
```

All fields parsed from the structured data part are strings.

#### 6.1.9.1 Configuration

In addition to the common module directives, the following can be used to configure the xm_syslog module instance.

**SnareDelimiter** This optional directive takes a single character as argument to specify the delimiter character used to separate fields when using the to_syslog_snare() procedure. The character specification works the same way as with the xm_csv module. If this directive is not specified, the default escape character is the tab character (\t). In latter versions of Snare4 this has changed to #, so you can use this configuration directive to specify an alternative delimiter. Note that there is no delimiter after the last field.

**SnareReplacement** This optional directive takes a single character as argument to specify the replacement character substituted in place of any occurences of the delimiter character inside the $Message field when invoking the to_syslog_snare() procedure. The character specification works the same way as with the xm_csv module. If this directive is not specified, the default replacement character is space.

**IETFTimestampInGMT** This optional boolean directive can be used to format the timestamps produced by to_syslog_ietf() in GMT instead of local time. This defaults to FALSE so that local time is used by default with a timezone indicator.

#### 6.1.9.2 Functions and procedures exported by xm_syslog

##### 6.1.9.2.1 Functions exported by xm_syslog

```
integer syslog_facility_value(string arg);
```

**description** Convert a syslog facility string to an integer

**arguments**

**arg** type: string

**return type** integer

```
string syslog_facility_string(integer arg);
```

**description** Convert a syslog facility value to a string

**arguments**

**arg** type: integer

**return type** string

```
integer syslog_severity_value(string arg);
```

**description** Convert a syslog severity string to an integer

**arguments**

**arg** type: string

**return type** integer

```
string syslog_severity_string(integer arg);
```

**description** Convert a syslog severity value to a string

**arguments**

**arg** type: integer

**return type** string

##### 6.1.9.2.2 Procedures exported by xm_syslog

```
parse_syslog();
```

**description** Parse the raw_event field as either BSD Syslog (RFC3164) or IETF Syslog (RFC5424) format

```
parse_syslog(string source);
```

**description** Parse the given string as either BSD Syslog (RFC3164) or IETF Syslog (RFC5424) format

**arguments**

**source** type: string

```
parse_syslog_bsd();
```

**description** Parse the raw_event field as BSD Syslog (RFC3164) format

```
parse_syslog_bsd(string source);
```

**description** Parse the given string as BSD Syslog (RFC3164) format

**arguments**

**source** type: string

```
parse_syslog_ietf();
```

**description** Parse the raw_event field as IETF Syslog (RFC5424) format

```
parse_syslog_ietf(string source);
```

**description** Parse the given string as IETF Syslog (RFC5424) format

**arguments**

**source** type: string

```
to_syslog_bsd();
```

**description** Create a BSD Syslog formatted log message in $raw_event from the fields of the event. The fields that are used to construct the $raw_event field are $EventTime, $Hostname, $SourceName, $ProcessID, $Message or $raw_event, $SyslogSeverity or $SyslogSeverityValue or $Severity or $SeverityValue, $SyslogFacility or $SyslogFacilityValue. If the fields are not present, a sensible default is used.

```
to_syslog_ietf();
```

**description** Create an IETF Syslog (RFC5424) formatted log message in $raw_event from the fields of the event. The fields that are used to construct the $raw_event field are $EventTime, $Hostname, $SourceName, $ProcessID, $Message or $raw_event, $SyslogSeverity or $SyslogSeverityValue or $Severity or $SeverityValue, $SyslogFacility or $SyslogFacilityValue. If the fields are not present, a sensible default is used.

```
to_syslog_snare();
```

**description** Create a SNARE Syslog formatted log message in $raw_event. Uses the following fields to construct $raw_event: $EventTime, $Hostname, $SeverityValue, $FileName, $EventID, $SourceName, $AccountName, $AccountType, $EventType, $Category, $Message.

#### 6.1.9.3 Fields generated by xm_syslog

The following fields are set by xm_syslog:

**$raw_event** Type string
Will be set to a syslog formatted string after to_syslog_bsd() or to_syslog_ietf() is called.

**$Message** Type string
The message part of the syslog line, filled after parse_syslog_bsd() or parse_syslog_ietf() is called.

**$SyslogSeverityValue** Type integer
The severity part of the syslog line, filled after parse_syslog_bsd() or parse_syslog_ietf() is called. The default severity is 5 (="notice").

**$SyslogSeverity** Type string
The severity part of the syslog line, filled after parse_syslog_bsd() or parse_syslog_ietf() is called. The default severity is "notice".

**$SeverityValue** Type integer
Normalized severity number of the event.

**$Severity** Type string
Normalized severity name of the event.

**$SyslogFacilityValue** Type integer
The facility part of the syslog line, filled after parse_syslog_bsd() or parse_syslog_ietf() is called. The default facility is 1 (="user").

**$SyslogFacility** Type string
The facility part of the syslog line, filled after parse_syslog_bsd() or parse_syslog_ietf() is called. The default facility is "user".

**$EventTime** Type datetime
Will be set to the timestamp found in the syslog message after parse_syslog_bsd() or parse_syslog_ietf() is called. If the year value is missing, it is set to the current year.

**$Hostname** Type string
The hostname part of the syslog line, filled after parse_syslog_bsd() or parse_syslog_ietf() is called.

**$SourceName** Type string
The application/program part of the syslog line, filled after parse_syslog_bsd() or parse_syslog_ietf() is called.

**$MessageID** Type string
The MSGID part of the syslog message, filled after parse_syslog_ietf() is called.

**$ProcessID** Type string
The process id in the syslog line, filled after parse_syslog_bsd() or parse_syslog_ietf() is called.

#### 6.1.9.4 Configuration examples

**Example 6.20** Sending a file as BSD syslog over UDP

To send logs out in BSD syslog format over udp which are collected from files, use the to_syslog_bsd() procedure coupled with the om_udp module as in the following example.

```
<Extension syslog>
    Module  xm_syslog
</Extension>

<Input in>
    Module  im_file

    # We monitor all files matching the wildcard.
    # Every line is read into the $raw_event field.
    File  "/var/log/app*.log"

    # Set the $EventTime field usually found in the logs by extracting it with a regexp.
    # If this is not set, the current system time will be used which might be a little off.
    Exec  if $raw_event =~ /(\d\d\d\d\-\d\d-\d\d \d\d:\d\d:\d\d)/ $EventTime = parsedate($1 ↩
        );

    # Now set the severity to something custom. This defaults to 'INFO' if unset.
    Exec  if $raw_event =~ /ERROR/ $Severity = 'ERROR'; \
                else $Severity = 'INFO';

    # The facility can be also set, otherwise the default value is 'USER'.
    Exec  $SyslogFacility = 'AUDIT';

    # The SourceName field is called the TAG in RFC3164 terminology and is usually the  ↩
        process name.
    Exec  $SourceName = 'my_application';

    # It is also possible to rewrite the Hostname if you don't want to use the system's  ↩
        hostname.
    Exec  $Hostname = 'myhost';

    # The Message field is used if present, otherwise the current $raw_event is prepended  ↩
        with the
    # syslog headers.
    # You can do some modifications on the Message if required. Here we add the full path  ↩
        of the
    # source file to the end of message line.
    Exec  $Message = $raw_event + ' [' + file_name() + ']';

    # Now create our RFC3164 compliant syslog line using the fields set above and/or use  ↩
        sensible
    # defaults where possible. The result will be in $raw_event.
    Exec  to_syslog_bsd();
</Input>

<Output out>
    # This module just sends the contents of the $raw_event field to the destination  ↩
        defined here,
    # one UDP packet per message.
    Module  om_udp
    Host  192.168.1.42
    Port  1514
</Output>

<Route 66>
    Path  in => out
</Route>
```

**Example 6.21** Collecting BSD style syslog messages over UDP

To collect BSD style syslog messages over UDP, use the parse_syslog_bsd() procedure coupled with the im_udp module as in the following example.

```
<Extension syslog>
    Module  xm_syslog
</Extension>

<Input in>
    Module  im_udp
    Host  0.0.0.0
    Port  514
    Exec  parse_syslog_bsd();
</Input>

<Output out>
    Module  om_file
    File  "/var/log/logmsg.txt"
</Output>

<Route 1>
    Path  in => out
</Route>
```

**Example 6.22** Collecting IETF style syslog messages over UDP

To collect IETF style syslog messages over UDP as defined by RFC 5424 and RFC 5426, use the parse_syslog_ietf() procedure coupled with the im_udp module as in the following example. Note that the default port is 514 (as defined by RFC 5426), this is the same as for BSD syslog.

```
<Extension syslog>
    Module  xm_syslog
</Extension>

<Input in>
    Module  im_udp
    Host  0.0.0.0
    Port  514
    Exec  parse_syslog_ietf();
</Input>

<Output out>
    Module  om_file
    File  "/var/log/logmsg.txt"
</Output>

<Route 1>
    Path  in => out
</Route>
```

**Example 6.23** Collecting both IETF and BSD style syslog messages over the same UDP port

To collect IETF and BSD style syslog messages over UDP, use the parse_syslog() procedure coupled with the im_udp module as in the following example. This procedure is capable of detecting and parsing both syslog formats. Since 514 is the default UDP port number for both BSD and IETF syslog, this can be useful to collect both formats simultaneously. If you want to accept both formats on different ports then it makes sense to use the appropriate parsers as in the previous two examples.

```
<Extension syslog>
    Module  xm_syslog
</Extension>

<Input in>
    Module  im_udp
    Host  0.0.0.0
    Port  514
    Exec  parse_syslog();
</Input>

<Output out>
    Module  om_file
    File  "/var/log/logmsg.txt"
</Output>

<Route 1>
    Path  in => out
</Route>
```

**Example 6.24** Collecting IETF style syslog messages over TLS/SSL

To collect IETF style syslog messages over TLS/SSL as defined by RFC 5424 and RFC 5425, use the parse_syslog_ietf() procedure coupled with the im_ssl module as in the following example. Note that the default port is 6514 in this case (as defined by RFC 5425). The payload format parser is handled by the Syslog_TLS input reader.

```
<Extension syslog>
    Module  xm_syslog
</Extension>

<Input in>
    Module  im_ssl
    Host  localhost
    Port  6514
    CAFile  %CERTDIR%/ca.pem
    CertFile  %CERTDIR%/client-cert.pem
    CertKeyFile %CERTDIR%/client-key.pem
    KeyPass secret
    InputType Syslog_TLS
    Exec  parse_syslog_ietf();
</Input>

<Output out>
    Module  om_file
    File  "/var/log/logmsg.txt"
</Output>

<Route 1>
    Path  in => out
</Route>
```

**Example 6.25** Forwarding IETF syslog over TCP

The following configuration uses the to_syslog_ietf() procedure to convert input to IETF syslog and forward it over TCP:

```
<Extension syslog>
    Module  xm_syslog
</Extension>

<Input in>
    Module  im_file
    File  "/var/log/input.txt"
    Exec  $TestField = "test value"; $Message = $raw_event;
</Input>

<Output out>
    Module  om_tcp
    Host  127.0.0.1
    Port  1514
    Exec  to_syslog_ietf();
    OutputType  Syslog_TLS
</Output>

<Route 1>
    Path  in => out
</Route>
```

Because of the Syslog_TLS framing, the raw data sent over TCP will look like the following:

```
130 <13>1 2012-01-01T16:15:52.873750Z  - - - [NXLOG@14506 EventReceivedTime="2012-01-01  ↩
    17:15:52" TestField="test value"] test message
```

This example shows that all fields - except those which are filled by the syslog parser - are added to the structured data part.

**Example 6.26** Conditional rewrite of the syslog facility - version 1

```
<Extension syslog>
    Module  xm_syslog
</Extension>

<Input in>
    Module  im_udp
    Port  514
    Host  0.0.0.0
    Exec  parse_syslog_bsd();
</Input>

<Output fileout>
    Module  om_file
    File  "/var/log/logmsg.txt"
    Exec  if $Message =~ /error/ $SeverityValue = syslog_severity_value("error");
    Exec  to_syslog_bsd();
</Output>

<Route 1>
    Path  in => fileout
</Route>
```

**Example 6.27** Conditional rewrite of the syslog facility - version 2

The following example does almost the same thing as the previous example, except that the syslog parsing and rewrite is moved to a processor module and rewrite only occurs if the facility was modified. This can make it work faster on multi-core systems because the processor module runs in a separate thread. This method can also minimize UDP packet loss because the input module does not need to parse syslog messages and can process UDP packets faster.

```
<Extension syslog>
    Module  xm_syslog
</Extension>

<Input in>
    Module  im_udp
    Host  0.0.0.0
    Port  514
</Input>

<Processor rewrite>
    Module  pm_null
    Exec  parse_syslog_bsd();\
    if $Message =~ /error/ \
                {\
                  $SeverityValue = syslog_severity_value("error");\
                  to_syslog_bsd(); \
                }
</Processor>

<Output fileout>
    Module  om_file
    File  "/var/log/logmsg.txt"
</Output>

<Route 1>
    Path  in => rewrite => fileout
</Route>
```

### 6.1.10 External program execution (xm_exec)

This module provides two procedures which make it possible to execute external scripts or programs. The reason for providing these two procedures through this additional extension module is to keep the nxlog core small. A security advantage is that an administrator won't be able to execute arbitrarly scripts if this module is not loaded.

**Note**
The om_exec and im_exec modules also provide support for running external programs, though the purpose of these is to pipe data to and read data from programs. The procedures provided by the xm_exec module do not pipe log message data, these are intended for multiple invocations. Though data can be still passed to the executed script/program as command line arguments.

#### 6.1.10.1 Functions and procedures exported by xm_exec

##### 6.1.10.1.1 Procedures exported by xm_exec

**`exec(string command, varargs args);`**

**description** Execute the command passing it the supplied arguments and wait for it to terminate. The command is executed in the caller module's context. Note that the module calling this procedure will block until the process terminates. Use the exec_async() procedure to avoid this problem. All output written to STDOUT and STDERR by the spawned process is discarded.

**arguments**

**command** type: string

**args** type: varargs

```
exec_async(string command, varargs args);
```

**description** This procedure executes the command passing it the supplied arguments and does not wait for it to terminate.

**arguments**

**command** type: string

**args** type: varargs

#### 6.1.10.2 Configuration examples

**Example 6.28** nxlog acting as a cron daemon

```
<Extension exec>
    Module  xm_exec
    <Schedule>
  Every 1 sec
  Exec  exec_async("/bin/true");
    </Schedule>
</Extension>
```

**Example 6.29** Sending email alerts

```
<Extension exec>
    Module  xm_exec
</Extension>

<Input in>
    Module  im_tcp
    Host  0.0.0.0
    Port  1514
    Exec  if $raw_event =~ /alertcondition/ {  ↩
                                                    \
                  exec_async("/bin/sh", "-c", 'echo "' + $Hostname + '\n\nRawEvent:\n' +  ↩
                      $raw_event + \
                          '"|/usr/bin/mail -a "Content-Type: text/plain; charset=UTF-8" -s ↩
                               "ALERT" '  \
                          + 'user@domain.com' );  ↩
                                                                                  \
                }
</Input>

<Output out>
    Module  om_file
    File  "/var/log/messages"
</Output>

<Route r>
    Path  in => out
</Route>
```

For another example see this configuration for file rotation.

### 6.1.11 Perl (xm_perl)

This module makes it possible to execute perl code and process event data using the perl language via a built-in perl interpreter. The perl interpreter is only loaded if the module is declared in the configuration. While the nxlog language is already a powerful framework, it is not intended to be a full featured programming language. For example it does not provide lists, arrays, hashes and other features available in many high-level languages. Perl is widely used for log processing and it comes with a broad set of modules bundled or available from CPAN.

You can sometimes write faster code in C, but you can always write code faster in Perl. Code written in perl is also a lot safer because it is unlikely to crash. Exceptions in the perl code (croak/die) are handled properly and this will only result in an unfinished attempt at executing the log processing code but will not take down the whole nxlog process.

The module will parse the file specified in the PerlCode directive when nxlog and the module is started. This file should contain one or more methods which can be called from the Exec directive of any module which wants to do any log processing in perl. See the example below which illustrates the use of this module.

To acccess the fields and the event data from the perl code, you need to include the `Log::Nxlog` module. This exports the following methods:

**set_field_integer(event, key, value)** Sets the integer value in the field named 'key'.

**set_field_string(event, key, value)** Sets the string value in the field named 'key'.

**set_field_boolean(event, key, value)** Sets the boolean value in the field named 'key'.

**get_field(event, key)** Retreive the value associated with the field named 'key'. The method returns a scalar value if the key exist and the value is defined, otherwise it returns undef.

**delete_field(event, key)** Delete the value associated with the field named 'key'.

**field_type(event, key)** Return a string representing the type of the value associated with the field named 'key'.

**field_names(event)** Return a list of the field names contained in the event data. Can be used to iterate over all the fields.

**log_debug(msg)** Send the message in the argument to the internal logger on DEBUG loglevel. Does the same as the procedure named log_debug() in nxlog.

**log_info(msg)** Send the message in the argument to the internal logger on INFO loglevel. Does the same as the procedure named log_info() in nxlog.

**log_warning(msg)** Send the message in the argument to the internal logger on WARNING loglevel. Does the same as the procedure named log_warning() in nxlog.

**log_error(msg)** Send the message in the argument to the internal logger on ERROR loglevel. Does the same as the procedure named log_error() in nxlog.

You should be able to read the POD documentation contained in `Nxlog.pm` with **perldoc Log::Nxlog**.

#### 6.1.11.1 Configuration

The following directives can be used to configure the xm_perl module instance:

**PerlCode** This mandatory directive expects a file which contains valid perl code. This file is read and parsed by the perl interpreter. Methods defined in this file can be called with the call() procedure.

#### 6.1.11.2 Functions and procedures exported by xm_perl

##### 6.1.11.2.1 Procedures exported by xm_perl

```
call(string subroutine);
```

**description** Calls the perl subroutine provided in the first argument.

**arguments**

**subroutine** type: string

```
perl_call(string subroutine);
```

**description** Calls the perl subroutine provided in the first argument.

**arguments**

**subroutine** type: string

#### 6.1.11.3 Configuration examples

In this example logs are parsed as syslog then the data is passed to a perl method which does a GeoIP lookup on the source address of the incoming message.

**Example 6.30** Using the built-in perl interpreter

```
<Extension syslog>
    Module  xm_syslog
</Extension>

<Extension perl>
    Module  xm_perl
    PerlCode  modules/extension/perl/processlogs.pl
</Extension>

<Input in>
    Module  im_file
    File  'test.log'
    ReadFromLast FALSE
    SavePos FALSE
</Input>

<Output out>
    Module  om_file
    File  'tmp/output'
    # First we parse the input natively from nxlog
    Exec  parse_syslog_bsd();
    # Now call the 'process' subroutine defined in 'processlogs.pl'
    Exec  perl_call("process");
    # You can also invoke this public procedure 'call' in case
    # of multiple xm_perl instances like this:
    # Exec  perl->call("process");
</Output>

<Route 1>
    Path  in => out
</Route>
```

The contents of the `processlogs.pl` perl script is as follows:

```
use strict;
use warnings;

use Carp;
# FindBin is for adding a path to @INC, this not needed normally
use FindBin;
use lib "$FindBin::Bin/../../../../src/modules/extension/perl";

# Without Log::Nxlog you cannot access (read or modify) the event data
# so don't forget this:
use Log::Nxlog;

use Geo::IP;

my $geoip;

BEGIN
{
    # This will be called once when nxlog starts so you can use this to
    # initialize stuff here
    $geoip = Geo::IP->new(GEOIP_MEMORY_CACHE);
}


# this is the method which is invoked from 'Exec' for each event log
sub process
{
    # The event data is passed here when this method is invoked by the module
    my ( $event ) = @_;
```

```
    # We look up the county of the sender of the message
    my $msgsrcaddr = Log::Nxlog::get_field($event, 'MessageSourceAddress');
    if ( defined($msgsrcaddr) )
```

### 6.1.12 WTMP (xm_wtmp)

This module provides a parser function to process binary wtmp files. The module registers an parser function using the name of the extension module instance which can be used as the parameter of the InputType directive in input modules such as im_file.

#### 6.1.12.1 Configuration

The module does not have any module specific configuration directives.

#### 6.1.12.2 Configuration examples

**Example 6.31** WTMP to JSON format conversion

The following configuration accepts WTMP and converts it to JSON.

```
<Extension wtmp>
    Module    xm_wtmp
</Extension>

<Extension json>
    Module    xm_json
</Extension>

<Input in>
    Module    im_file
    File      '/var/log/wtmp'
    InputType wtmp
    Exec      to_json();
</Input>

<Output out>
    Module    om_file
    File      '/var/log/wtmp.txt'
</Output>

<Route processwtmp>
    Path      in => out
</Route>
```

The following is a sample output produced by the configuration above.

```
{"EventTime":"2013-10-01 09:39:59","AccountName":"root","Device":"pts/1",
 "LoginType":"login","EventReceivedTime":"2013-10-10 15:40:20",
 "SourceModuleName":"input","SourceModuleType":"im_file"}
{"EventTime":"2013-10-01 23:23:38","AccountName":"shutdown","Device":"no device",
 "LoginType":"shutdown","EventReceivedTime":"2013-10-11 10:58:00",
 "SourceModuleName":"input","SourceModuleType":"im_file"}
```

## 6.2 Input modules

Input modules are responsible for collecting event log data from various sources. The nxlog core will add a few fields in each input module, see the following section for the list of these.

### 6.2.1 Fields generated by core

The following fields are set by core:

**$raw_event** Type string
Filled with data received from stream modules (im_file, im_tcp, etc).

**$EventReceivedTime** Type datetime
Set to the time when the event is received. The value is not modified if the field already exists.

**$SourceModuleName** Type string
The name of the module instance is stored in this field for input modules. The value is not modified if the field already exists.

**$SourceModuleType** Type string
The type the module instance (such as 'im_file') is stored in this field for input modules. The value is not modified if the field already exists.

### 6.2.2 DBI (im_dbi)

FIXME

#### 6.2.2.1 Configuration examples

**Example 6.32** Reading from a MySQL database

```
<Input dbiin>
    Module  im_dbi
    SavePos TRUE
    Driver  mysql
    Option  host 127.0.0.1
    Option  username mysql
    Option  password mysql
    Option      dbname logdb
</Input>

<Output out>
    Module  om_file
    File  "tmp/output"
</Output>

<Route 1>
    Path  dbiin => out
</Route>
```

### 6.2.3 Program (im_exec)

This module will execute a program or script on startup and will read its standard output. It can be used to easily integrate with exotic log sources which can be read only with the help of scripts or programs.

#### 6.2.3.1 Configuration

In addition to the common module directives, the following can be used to configure the im_exec module instance.

**Command** This directive is mandatory. It specifies the name of the script/program to be executed.

**Arg** This is an optional parameter, multiple can be specified for each argument needed to pass to the Command. Note that specifying multiple arguments with one Arg directive separated with spaces will not work because the Command will receive it as one argument, so you will need to split them up.

**InputType** See the description about InputType in the global module config section.

**Restart** Restart the process if it exits. There is a 1 second delay before it is restarted in order not to DOS the system when a process is not behaving nicely. Looping should be implemented in the script itself, this directive is only to provide some safety against malfunctioning scripts and programs. This boolean directive defaults to FALSE.

#### 6.2.3.2 Configuration examples

**Example 6.33** Emulating im_file

```
<Input input>
    Module  im_exec
    Command /usr/bin/tail
    Arg   -f
    Arg   /var/log/messages
</Input>

<Output fileout>
    Module  om_file
    File  "tmp/output"
</Output>

<Route 1>
    Path  input => fileout
</Route>
```

This exact same configuration is not recommended for real use because im_file was designed to read log messages from files. This example only demonstrates the use of the im_exec module.

### 6.2.4 File (im_file)

This module can be used to read log messages from files. The file position can be persistently saved across restarts in order to avoid reading from the beginning again when nxlog is restarted. It also supports external rotation tools. When the module cannot read any more data from the file, it checks whether the opened file descriptor belongs to the same filename it opened originally. If the inodes differ, the module assumes the file was moved and reopens its input.

im_file uses a 1 second interval to monitor files for new messages. This method was implemented because polling a regular file is not supported on all platforms. If there is no more data to read, the module will sleep for 1 second.

By using wildcards, the module can read multiple files simultaneously and will open new files as they appear. It will also enter newly created directories if recursion is enabled.

**Note**
The module needs to scan the directory content in case of a wildcarded file monitoring. This can present a significant load if there are many files (hundreds or thousands) in the monitored directory. For this reason it is highly recommended to rotate files out of the monitored directory either using the built-in log rotation capabilities of nxlog or using external tools.

#### 6.2.4.1 Configuration

In addition to the common module directives, the following can be used to configure the im_file module instance.

**File** This mandatory directive specifies the name of the input file to open. It must be a string type expression. For relative filenames you should be aware that nxlog changes its working directory to '/' unless the global SpoolDir is set to something else. On Windows systems the directory separator is backslash. For compatibility reasons the forward slash '/' character

can be also used as the directory separator, but this only works for filenames which don't contain wildcards. If the filename is specified using wildcards, you should use backslash for the directory separator.

Wildcards are supported in filenames only, directory names in the path cannot be wildcarded. Wildcards are not regular expressions, these are patterns commonly used by unix shells to expand filenames which is also known as globbing.

**?** Matches a single character only.

***** Matches zero or more characters.

***** Matches the asterisk '*' character.

**\?** Matches the question mark '?' character.

**[...]** Used to specify a single character. If the first character of the class description is ^ or !, the sense of the description is reversed. The rest of the class description is a list of single characters or pairs of characters separated by -. Any of those characters can have a backslash in front of them, which is ignored; this lets you use the characters ] and - in the character class, as well as ^ and ! at the beginning.

---

**Note**

The backslash character '\' is used to escape the wildcard characters, unfortunately this is the same as the directory separator on Windows. Take this into account when specifying wildcarded filenames on this platform. Lets suppose that we have log files under the directory `C:\test` which need to be monitored. Specifying the wildcard `'C:\test\*.log'` will not match because '*' becomes a literal asterisk, thus it is treated as a non-wildcarded filename. For this reason the directory separator needs to be escaped, so the `'C:\test\\*.log'` will match our files. `'C:\\test\\*.log'` will also work. When specifying the filename using double quotes, this would became `"C:\\test\\\\*.log"` because the backslash is also used as an escape character inside double quoted string literals. Filenames on Windows systems are treated case-insensitively. Unix/Linux is case-sensitive.

---

**SavePos** This directive takes a boolean value of TRUE or FALSE and specifies whether the file position should be saved when nxlog exits. The file position will be read from the cache file file upon startup. The file position is saved by default if this directive is not specified in the configuration. Even if SavePos is enabled, it can be explicitly turned off with the NoCache directive.

**ReadFromLast** This optional directive takes a boolean value. If it is set to TRUE, it instructs the module to only read logs which arrived after nxlog was started in case the saved position could not be read (for example on first start). When SavePos is TRUE and a previously saved position value could be read, the module will resume reading from this saved position. If this is FALSE, the module will read all logs from the file. This can result in quite a lot of messages which is usually not the expected behaviour. If this directive is not specified, it defaults to TRUE.

**Recursive** This directive takes a boolean value of TRUE or FALSE and specifies whether input files should be searched recursively under subdirectories. The default value is TRUE. This option takes effect only if wildcards are used in the filename. For example if '/var/log/*.log' is specified in the File directive, then '/var/log/apache2/access.log' will also match. Because wildcards in directory names of the path are not supported, this directive makes it possible to read multiple files from different subdirectories with a single im_file module instance only.

**PollInterval** This directive specifies in seconds how frequently the module will check for new files and new log entries. If this directive is not specified it defaults to 1 second. Fractional seconds may be specified, i.e. to check twice every second you should set the following: `PollInterval 0.5`

**DirCheckInterval** This directive specifies in seconds how frequently the module will check the monitored directory for modifications to files and new files in case of a wildcarded File path. If this directive is not specified it defaults to double of the value of the PollInterval directive, i.e. it is 2 seconds if PollInterval isn't defined either. Fractional seconds may be specified. It is recommended to increase the default in case there are many files which cannot be rotated out and the nxlog process has a high CPU load.

**ActiveFiles** This directive specifies how many files nxlog will actively monitor at most. If there are modifications to more files in parallel than the value of this directive, then modifications to files above this limit will only get noticed after the DirCheckInterval, i.e. all data should be collected eventually. Typically there is only one or at most a couple log sources which actively append data to log files, the rest of the files are usually dormant after being rotated, so the default value of 10 should be sufficient in most cases. This directive is also only relevant in case of a wildcarded File path.

**RenameCheck** This directive takes a boolean value of TRUE or FALSE and specifies whether input files should be monitored for possible file rotation via renaming in order to avoid rereading the file contents. A file is considered to be rotated when nxlog detects a new file whose inode and size matches that of another watched file which has just been deleted. Note that this does not always work correctly and can yield false positives when a log file is deleted and another is added with the same size. The file system is likely to reuse to inode number of the deleted file and thus the module will falsely detect this as a rename/rotation. For this reason the default value of the RenameCheck directive is FALSE. When this directive is FALSE, renamed files are considered as new and the file contents will be reread.

> **Note**
> It is recommended to use a naming scheme for rotated files such that their name does not match the wildcard and are not monitored anymore after rotation instead of trying to solve the renaming issue by enabling this directive.

**CloseWhenIdle** This directive takes a boolean value of TRUE or FALSE and specifies whether open input files should be closed as soon as possible after there is no more data to read. Some applications request an exclusive lock on the log file written or rotated, this directive can possibly help if the application can/does retry to acquire the lock. This directive defaults to FALSE unless specified explicitly.

**InputType** See the description about InputType in the global module config section.

#### 6.2.4.2 Functions and procedures exported by im_file

##### 6.2.4.2.1 Functions exported by im_file

```
string file_name();
```

**description** Return the name of the file currently open which the log was read from.

**return type** string

#### 6.2.4.3 Configuration examples

**Example 6.34** Forwarding logs from a file to a remote host

```
<Input in>
    Module  im_file
    File  "/var/log/messages"
    SavePos TRUE
</Input>

<Output out>
    Module  om_tcp
    Host  192.168.1.1
    Port  514
</Output>

<Route 1>
    Path  in => out
</Route>
```

### 6.2.5 Internal (im_internal)

This module makes it possible to insert internal log messages of nxlog into a route. nxlog generates messages about error conditions, debugging messages, etc. In addition internal messages can be also generated from the nxlog language using the log_info(), log_warning() and log_error() procedure calls.

**Note**
Only messages with loglevel INFO and above are supported. Debug messages are ignored due to technical reasons. For debugging purposes the direct logging facility should be used, see the global LogFile and LogLevel directives.
One must be careful about the use of the im_internal module because it is easy to cause a message loop. For example consider the situation when the internal messages are sent to a database. If the database is experiencing errors which result in internal error messages then these are again routed to the database and this will trigger further error messages and is easy to see that this will result in a loop. In order to avoid a resource exhaustion, the im_internal module will drop its messages when the queue of next module in the route is full. It is recommended to always put the im_internal module instance in a separate route.

The im_internal does not have any module specific configuration directives in addition to the common module directives.

**Note**
If you require internal messages in syslog format, you need to explicitely convert them with pm_transformer or using the to_syslog_bsd() procedure of the xm_syslog module, because the $raw_event field is not generated in syslog format.

#### 6.2.5.1 Fields generated by im_internal

The following fields are set by im_internal:

**$raw_event** Type string
Will be set to the string passed to the log_info() and other log() procedures.

**$Message** Type string
Set to the same value as $raw_event.

**$SeverityValue** Type integer
Depending on the log level of the internal message, the syslog severity is set to the value corresponding to "debug", "info", "warning", "error" or "critical".

**$Severity** Type string
The severity name of the event.

**$EventTime** Type datetime
Will be set to the current time.

**$SourceName** Type string
Will be set to 'nxlog'.

**$ProcessID** Type integer
The field is filled with the process id of the nxlog process.

**$Hostname** Type string
The hostname where the log is produced

**$ErrorCode** Type integer
If an error is logged resulting from an OS error, this field contains the error number provided by the Apache portable runtime library.

#### 6.2.5.2 Configuration examples

**Example 6.35** Forwaring internal messages over syslog udp

```
<Extension syslog>
    Module      xm_syslog
</Extension>

<Input internal>
    Module  im_internal
</Input>

<Output out>
    Module  om_udp
    Host  192.168.1.1
    Port  514
    Exec  to_syslog_bsd();
</Output>

<Route internal>
    Path  internal => out
</Route>
```

### 6.2.6 Kernel (im_kernel)

This module can collect kernel log messages from the kernel log buffer. Currently this module works on linux only. On Linux the klogctl() system call is used for this purpose. In order to be able to read kernel logs, special privileges are required. For this reason nxlog needs to be started as root. Using the User and Group global directives nxlog can then drop its root privileges but it will keep the CAP_SYS_ADMIN capability to be able to read the kernel log buffer.

**Note**
Unfortunately it is not possible to read from the /proc/kmsg pseudo file for an unprivileged process even if the CAP_SYS_ADMIN capability is kept. For this reason the /proc/kmsg interface is not supported by the im_kernel module. The im_file module should work fine with the /proc/kmsg pseudo file if one wishes to collect kernel logs this way, though this will require nxlog to be running as root.

The kernel messages are emitted in the following form.

```
<[0-7]>Some message from the kernel.
```

**Note**
Kernel messages are valid BSD syslog messages but do not contain timestamp and hostname fields. These can be parsed with pm_transformer or using the parse_syslog_bsd() procedure of the xm_syslog module, this will set the timestamp and hostname fields.

#### 6.2.6.1 Configuration examples

**Example 6.36** Storing raw kernel logs into a file

```
# drop privileges after being started as root
User nxlog
Group nxlog

<Input kern>
    Module      im_kernel
</Input>

<Output fileout>
    Module      om_file
    File        "tmp/output"
</Output>

<Route 1>
    Path        kern => fileout
</Route>
```

### 6.2.7 Mark (im_mark)

Mark messages are used to indicate periodic activity in order to be assured that the logger is running in case there are no log messages coming in from other sources.

By default, without specifying any of the module specific directives, a log message is emitted every 30 minutes containing "-- MARK --".

**Note**
If you require mark messages in syslog format, you need to explicitely convert them with pm_transformer or using the to_syslog_bsd() procedure of the xm_syslog module, because the $raw_event field is not generated in syslog format.

**Note**
The functionality of the im_mark module can be also achieved using the Schedule block with a log_info("--MARK--") Exec statement which would insert the messages via the im_internal module into a route. Using a single module for this task can simplify and possibly make the configuration easier to understand. Just wanted to point out that "there is more than one way to do it" :)

#### 6.2.7.1 Configuration

In addition to the common module directives, the following can be used to configure the im_mark module instance.

**Mark** This optional directive can set the string for the mark message. If not specified, the default is "-- MARK --".

**MarkInterval** This optional directive sets the interval for mark messages in minutes. If not specified, the default value of 30 minutes is used.

#### 6.2.7.2 Fields generated by im_mark

The following fields are set by im_mark:

**$raw_event** Type string
Will be set to "-- MARK --" or the value defined with the Mark configuration directive.

**$Message** Type string
Set to the same value as $raw_event.

**$SeverityValue** Type integer
Its value will be set to 6 which is the "info" severity level.

**$Severity** Type string
The severity name of the event.

**$EventTime** Type datetime
Will be set to the current time.

**$SourceName** Type string
Will be set to 'nxlog'.

**$ProcessID** Type integer
The field is filled with the process id of the nxlog process.

#### 6.2.7.3 Configuration examples

**Example 6.37** Using the im_mark module

```
<Input mark>
    Module  im_mark
    MarkInterval 1
    Mark  -=| MARK |=-
</Input>

<Output fileout>
    Module  om_file
    File  "tmp/output"
</Output>

<Route 1>
    Path  mark => fileout
</Route>
```

### 6.2.8 MS EventLog for Windows XP/2000/2003 (im_mseventlog)

This module can be used to collect EventLog messages on Microsoft Windows platforms. The module looks up the available EventLog sources stored under the registry key "SYSTEM\\CurrentControlSet\\Services\\Eventlog" and will poll logs from each of these or only the sources defined with the Sources directive.

**Note**
Windows Vista, Windows 2008 and later use a new EventLog API which is not backward compatible. Messages in some events produced by sources in this new format cannot be resolved with the old API which is used by this module. If such an event is encountered, a Message similar to the following will be set:

```
The description for EventID XXXX from source SOURCE cannot be read by im_mseventlog  ↩
    because this does not support the newer WIN2008/Vista EventLog API.
```

Though the majority of event messages can be read with this module even on Windows 2008/Vista and later, it is recommended to use the im_msvistalog module instead.

**Note**
Strings are stored in dll and executable files and these need to be looked up by the module when reading eventlog messages. If a program (dll/exe) is already uninstalled and cannot be opened to look up the strings in the message, the following message will appear instead:

```
The description for EventID XXXX from source SOURCE cannot be found.
```

#### 6.2.8.1 Configuration

In addition to the common module directives, the following can be used to configure the im_mseventlog module instance.

**SavePos** This directive takes a boolean value of TRUE or FALSE and specifies whether the file position should be saved when nxlog exits. The file position will be read from the cache file upon startup. The file position is saved by default if this directive is not specified in the configuration. Even if SavePos is enabled, it can be explicitly turned off with the NoCache directive.

**ReadFromLast** This optional directive takes a boolean value. If it is set to TRUE, it instructs the module to only read logs which arrived after nxlog was started in case the saved position could not be read (for example on first start). When SavePos is TRUE and a previously saved position value could be read, the module will resume reading from this saved position. If this is FALSE, the module will read all logs from the EventLog. This can result in quite a lot of messages which is usually not the expected behaviour. If this directive is not specified, it defaults to TRUE.

**Sources** This optional directive takes a comma separated list of eventlog file names, such as 'Security, Application', to read only specific eventlog sources. If this directive is not specified, then all available eventlog sources are read (as listed in the registry). This directive should not be confused with the SourceName containted within the eventlog and it is not a list of such names. The value of this is stored in the FileName field.

**UTF8** This optional directive takes a boolean value. If it is set to TRUE, all strings will be converted to UTF-8 encoding. Internally this calls the convert_fields procedure. The xm_charconv module must be loaded for the character set conversoion to work. If this UTF8 directive is not defined, it defaults to TRUE, but conversion will only occur if the xm_charconv module is loaded, otherwise strings will be in the local codepage.

#### 6.2.8.2 Fields generated by im_mseventlog

The following fields are set by im_mseventlog:

**$raw_event** Type string
Contains the timestamp, hostname, severity and message from the event

**$Message** Type string
Contains the message from the event

**$EventTime** Type datetime
Will be set to the TimeGenerated field of the EventRecord.

**$EventTimeWritten** Type datetime
Will be set to the TimeWritten field of the EventRecord.

**$Hostname** Type string
The host or computer name field of the EventRecord.

**$SourceName** Type string
The event source which produced the event, this is the subsystem or application name.

**$EventID** Type integer
The event id of the EventRecord.

**$CategoryNumber** Type integer
The category number, stored as Category in the EventRecord.

**$Category** Type string
The category name resolved from CategoryNumber.

**$FileName** Type string
The logfile source (e.g. Security, Application) of the event.

**$AccountName** Type string
The username associated with the event.

**$AccountType** Type string
The type of the account. Possible values are: User, Group, Domain, Alias, Well Known Group, Deleted Account, Invalid, Unknown, Computer.

**$Domain** Type string
The domain name of the user.

**$SeverityValue** Type integer
Normalized severity number of the event.

**$Severity** Type string
Normalized severity name of the event.

**$EventType** Type string
The type of the event which is a string describing the severity. It takes the following values: "ERROR", "AUDIT_FAILURE", "AUDIT_SUCCESS", "INFO", "WARNING", "UNKNOWN"

**$RecordNumber** Type integer
The number of the event record.

#### 6.2.8.3 Configuration examples

**Example 6.38** Forwarding EventLogs from a windows machine to a remote host

```
<Input in>
    Module      im_mseventlog
</Input>

<Output out>
    Module      om_tcp
    Host        192.168.1.1
    Port        514
</Output>

<Route 1>
    Path        in => out
</Route>
```

### 6.2.9 MS EventLog for Windows 2008/Vista and later (im_msvistalog)

This module can be used to collect EventLog messages on Microsoft Windows platforms which support the newer EventLog API (also known as the Crimson Eventlog subsystem), namely Windows 2008/Vista and later. You can refer to the official Microsoft documentation about Event Logs. The module supports reading all System, Application and Custom events. It looks up the available channels and monitors events in each unless the Query and the Channel directives are explicitely defined. Event logs can be collected from remote servers over MS RPC (Note: Enterprise Edition only).

**Note**
This module will not work on Windows 2003 and earlier because Windows Vista, Windows 2008 and later use a new EventLog API which is not available in earlier Windows versions. If you need to collect EventLog messages on these platforms, you should use the im_mseventlog module instead.

**Note**
The Windows EventLog subsystem does not support subscriptions to Debug and Analytic channels, thus it is not possible to collect these type of events with this module.

In addition to the standard set of fields which are listed under the System section, event providers can define their own additional schema which enables logging additional data under the EventData section. The Security log makes use of this new feature and such additional fields can be seen as in the following XML snippet:

```
<EventData>
  <Data Name="SubjectUserSid">S-1-5-18</Data>
  <Data Name="SubjectUserName">WIN-OUNNPISDHIG$</Data>
  <Data Name="SubjectDomainName">WORKGROUP</Data>
  <Data Name="SubjectLogonId">0x3e7</Data>
  <Data Name="TargetUserSid">S-1-5-18</Data>
  <Data Name="TargetUserName">SYSTEM</Data>
  <Data Name="TargetDomainName">NT AUTHORITY</Data>
  <Data Name="TargetLogonId">0x3e7</Data>
  <Data Name="LogonType">5</Data>
  <Data Name="LogonProcessName">Advapi</Data>
  <Data Name="AuthenticationPackageName">Negotiate</Data>
  <Data Name="WorkstationName" />
  <Data Name="LogonGuid">{00000000-0000-0000-0000-000000000000}</Data>
  <Data Name="TransmittedServices">-</Data>
  <Data Name="LmPackageName">-</Data>
  <Data Name="KeyLength">0</Data>
  <Data Name="ProcessId">0x1dc</Data>
  <Data Name="ProcessName">C:\Windows\System32\services.exe</Data>
  <Data Name="IpAddress">-</Data>
  <Data Name="IpPort">-</Data>
</EventData>
```

nxlog can extract this data when fields are logged using this schema. The values will be available in the fields of the internal nxlog log structure. This is especially useful because there is no need to write pattern matching rules to extract this data from the message. These fields can be used in filtering rules, writing them into SQL tables or to trigger actions. Consider the following example which filters using the Exec directive:

```
<Input in>
    Module       im_msvistalog
    Exec         if ($TargetUserName == 'SYSTEM') OR ($EventType == 'VERBOSE') drop();
</Input>
```

#### 6.2.9.1 Configuration

In addition to the common module directives, the following can be used to configure the im_msvistalog module instance.

**SavePos** This directive takes a boolean value of TRUE or FALSE and specifies whether the file position should be saved when nxlog exits. The file position will be read from the cache file upon startup. The file position is saved by default if this directive is not specified in the configuration. Even if SavePos is enabled, it can be explicitly turned off with the NoCache directive.

**ReadFromLast** This optional directive takes a boolean value. If it is set to TRUE, it instructs the module to only read logs which arrived after nxlog was started in case the saved position could not be read (for example on first start). When SavePos is TRUE and a previously saved position value could be read, the module will resume reading from this saved position. If this is FALSE, the module will read all logs from the EventLog. This can result in quite a lot of messages which is usually not the expected behaviour. If this directive is not specified, it defaults to TRUE.

**Query** This directive specifies the query if one wishes to pull only specific eventlog sources. See the MSDN docs about Event Selection. Note that this directive needs a single-line parameter, so multi-line query XML should be specified with line continuation marks (\) as in the following example:

```
Query <QueryList>                                                \
        <Query Id='1'>                                           \
         <Select Path='Security'>*[Security/Level=4]</Select> \
        </Query>                                                 \
      </QueryList>
```

When the Query contains an XPath style expression, the Channel must also be specified. Otherwise if an XML Query is specified, the Channel should not be used.

**Channel** The name of the Channel to query. If not specified, the module will read from all sources defined in the registry. See the MSDN docs about Event Selection.

**PollInterval** This directive specifies in seconds how frequently the module will check for new events. If this directive is not specified it defaults to 1 second. Fractional seconds may be specified, i.e. to check twice every second you should set the following: `PollInterval 0.5`

#### 6.2.9.2 Fields generated by im_msvistalog

The following fields are set by im_msvistalog:

**$raw_event** Type string
Contains the EventTime, Hostname, Severity EventID and Message from the event.

**$Message** Type string
Contains the message from the event.

**$EventTime** Type datetime
Will be set to the EvtSystemTimeCreated field.

**$Hostname** Type string
Contains the EvtSystemComputer field.

**$SourceName** Type string
The event source which produced the event, this is the EvtSystemProviderName field.

**$EventID** Type integer
The event id as in EvtSystemEventID.

**$Task** Type integer
The task number as in EvtSystemTask.

**$Category** Type string
The category name resolved from Task.

**$Keywords** Type integer
The value of the Keywords field from EvtSystemKeywords.

**$Channel** Type string
The Channel (e.g. Security, Application) of the event source.

**$AccountName** Type string
The username associated with the event.

**$AccountType** Type string
The type of the account. Possible values are: User, Group, Domain, Alias, Well Known Group, Deleted Account, Invalid, Unknown, Computer.

**$Domain** Type string
The domain name of the user.

**$UserID** Type string
The SID which resolves to AccountName, stored in EvtSystemUserID.

**$SeverityValue** Type integer
Normalized severity number of the event.

**$Severity** Type string
Normalized severity name of the event (CRITICAL|ERROR|WARNING|INFO|DEBUG).

**$EventType** Type string
The type of the event which is a string describing the severity. This is translated to its string representation from EvtSystemLevel. It takes the following values: "CRITICAL", "ERROR", "AUDIT_FAILURE", "AUDIT_SUCCESS", "INFO", "WARNING", "VERBOSE"

**$ProviderGuid** Type string
The GUI of the event's provider as stored in EvtSystemProviderGuid. This corresponds to the name of the provider stored in the SourceName field.

**$Version** Type integer
The Version number of the event as in EvtSystemVersion.

**$OpcodeValue** Type integer
The Opcode number of the event as in EvtSystemOpcode.

**$Opcode** Type string
The opcode string resolved from OpcodeValue.

**$ActivityID** Type string
The ActivityID as stored in EvtSystemActivityID.

**$RelatedActivityID** Type string
The RelatedActivityID as stored in EvtSystemRelatedActivityID.

**$ProcessID** Type integer
The process identifier of the event producer as in EvtSystemProcessID.

**$ThreadID** Type integer
The thread identifier of the event producer as in EvtSystemThreadID.

**$RecordNumber** Type integer
The number of the event record.

#### 6.2.9.3 Configuration examples

**Example 6.39** Forwarding EventLogs from a windows machine to a remote host

```
<Input in>
    Module       im_msvistalog
    ReadFromLast TRUE
</Input>

<Output out>
    Module       om_tcp
    Host         192.168.1.1
    Port         514
</Output>

<Route 1>
    Path        in => out
</Route>
```

### 6.2.10 Null (im_null)

This module does not generate any input, so basically it does nothing. Yet it can be useful for creating a dummy route, testing purposes, and it can have Scheduled nxlog code execution as well, so it is not completely useless. This module does not have any module specific configuration directives. See this example for usage.

### 6.2.11 TLS/SSL (im_ssl)

The im_ssl module provides an SSL/TLS transport using the OpenSSL library beneath the surface. It behaves similarly to the im_tcp module, except that an SSL handshake is performed at connection time and the data is sent over a secure channel. Because log messages transferred over plain TCP can be eavasdropped or even altered with a man-in-the-middle attack, using the im_ssl module provides a secure log message transport.

#### 6.2.11.1 Configuration

In addition to the common module directives, the following can be used to configure the im_ssl module instance.

**Host** This specifies the IP address or a dns hostname which the module should listen on to accept connections.

**Port** This specifies the port number which the module will listen on for incoming conenctions.

**CertFile** This specifies the path of the certificate file to be used in the SSL handshake.

**CertKeyFile** This specifies the path of the certificate key file to be used in the SSL handshake.

**KeyPass** Optional password of the certificate key file defined in CertKeyFile. For passwordless private keys the directive is not needed.

**CAFile** This specifies the path of the certificate of the CA which will be used to check the certificate of the remote socket against.

**CADir** This specifies the path of CA certificates which will be used to check the certificate of the remote socket against. The cert file names in this directory must be in the OpenSSL hashed format.

**CRLFile** This specifies the path of the certificate revocation list (CRL) which will be used to check the certificate of the remote socket against.

**CRLDir** This specifies the path of certificate revocation lists (CRLs) which will be used to check the certificate of the remote socket against. The file names in this directory must be in the OpenSSL hashed format.

**RequireCert** This takes a boolean value of TRUE or FALSE and specifies whether the remote must present a certificate. If set to TRUE and there is no certificate presented during the handshake of the accepted connection, the connection will be refused. The default value is TRUE if this directive is not specified, meaning that all connections must use a certificate by default.

**AllowUntrusted** This takes a boolean value of TRUE or FALSE and specifies whether the remote connection should be allowed without certificate verification. If set to TRUE the remote will be able to connect with unknown and self-signed certificates. The default value is FALSE if this directive is not specified, meaning that all connections must present a trusted certificate by default.

**InputType** See the description about InputType in the global module config section.

#### 6.2.11.2 Fields generated by im_ssl

The following fields are set by im_ssl:

**$raw_event** Type string
Will be set to the string received.

**$MessageSourceAddress** Type string
Set to the IP address of the remote host.

#### 6.2.11.3 Configuration examples

**Example 6.40** Reading binary data forwarded from another nxlog agent

```
<Input ssl>
    Module  im_ssl
    Host  localhost
    Port  23456
    CAFile  %CERTDIR%/ca.pem
    CertFile  %CERTDIR%/client-cert.pem
    CertKeyFile %CERTDIR%/client-key.pem
    KeyPass secret
    InputType Binary
</Input>

<Output fileout>
    Module  om_file
    File  "tmp/output"
</Output>

<Route 1>
    Path  ssl => fileout
</Route>
```

### 6.2.12 TCP (im_tcp)

This module accepts TCP connections on the address and port specified in the configuration. It can handle multiple simultaneous connections. The TCP transfer protocol provides more reliable log transmission than UDP. If security is a concern, consider using the im_ssl module instead.

**Note**
There is no access control built in the module. If you need to deny some hosts connecting to the module's TCP port, you should use appropriate firewall rules for this purpose.

#### 6.2.12.1 Configuration

In addition to the common module directives, the following can be used to configure the im_tcp module instance.

**Host** This specifies the IP address or a dns hostname which the module should listen on to accept connections.

> **Note**
> Because of security reasons the default listen address is *localhost* if this directive is not specified (the *localhost* loopback address is not accessible from the outside). You will most probably want to send logs from remote hosts, so make sure that the address specified here is accessible. The any address *0.0.0.0* is commonly used here.

**Port** This specifies the port number which the module will listen on for incoming conenctions. The default port is 514 if this directive is not specified.

**InputType** See the description about InputType in the global module config section.

#### 6.2.12.2 Fields generated by im_tcp

The following fields are set by im_tcp:

**$raw_event** Type string
Will be set to the string received.

**$MessageSourceAddress** Type string
Set to the IP address of the remote host.

#### 6.2.12.3 Configuration examples

**Example 6.41** Using the im_tcp module

```
<Input in>
    Module  im_tcp
    Host  0.0.0.0
    Port  1514
</Input>

<Output out>
    Module  om_file
    File  "tmp/output"
</Output>

<Route r>
    Path  in => out
</Route>
```

### 6.2.13 UDP (im_udp)

This module accepts UDP datagrams on the address and port specified in the configuration. UDP is the transport protocol of the old BSD syslog standard as described in RFC 3164, so this module can be particularly useful to receive such messages from older devices which do not support other transports.

**Note**
There is no access control built in the module. If you need to deny some hosts sending logs to the module's UDP port, you should use appropriate firewall rules for this purpose.

**Note**
UDP packets can be dropped by the operating system because the protocol does not guarantee reliable message delivery. It is recommended to use the tcp or ssl transport modules instead if message loss is a concern.
Though nxlog was designed to minimize message loss even in the case of UDP, adjusting the kernel buffers could also help in avoiding UDP message loss on a loaded system. The Priority directive in the route block can also help in this situation.

For parsing syslog messages, take a look at the pm_transformer module or the parse_syslog_bsd() procedure of the xm_syslog.

#### 6.2.13.1 Configuration

In addition to the common module directives, the following can be used to configure the im_udp module instance.

**Host** This specifies the IP address or a dns hostname which the module should listen on to accept connections. The default address is "localhost" if this is not specified.

**Port** This specifies the port number which the module will listen on for incoming conenctions. The default port is 514 if this directive is not specified.

**SockBufSize** This optional directive sets the socket buffer size (SO_RCVBUF) to the value specified. Otherwise the OS defaults are used. If you are experiencing UDP packet loss at the kernel level, setting this to a high value (e.g. 150000000) may help. On Microsoft Windows systems the default socket buffer size is extremely low, using this option is highly recommended.

**InputType** See the description about InputType in the global module config section.

#### 6.2.13.2 Fields generated by im_udp

The following fields are set by im_udp:

**$raw_event** Type string
Will be set to the string received.

**$MessageSourceAddress** Type string
Set to the IP address of the remote host.

#### 6.2.13.3 Configuration examples

**Example 6.42** Using the im_udp module

```
<Input in>
    Module  im_udp
    Host  192.168.1.1
    Port  514
</Input>

<Output out>
    Module  om_file
    File  "tmp/output"
</Output>

<Route r>
    Path  in => out
</Route>
```

### 6.2.14 Unix Domain Socket (im_uds)

This module allows log messages to be received over a unix domain socket. Traditionally unix systems have a socket, typically /dev/log used by the system logger to accept messages from. Applications wishing to send messages to the system log use the syslog(3) system call.

**Note**
This module supports SOCK_DGRAM type sockets only. SOCK_STREAM type sockets may be supported in the future.

**Note**
It is recommended to disable FlowControl when this module is used to collect local syslog from the `/dev/log` unix domain socket. Otherwise the syslog() system call will block in all programs which are trying to write to the system log if the Output queue becomes full and this will result in an unresponsive system.

For parsing syslog messages, take a look at the pm_transformer module or the parse_syslog_bsd() procedure of the xm_syslog.

#### 6.2.14.1 Configuration

In addition to the common module directives, the following can be used to configure the im_uds module instance.

**UDS** This specifies the path of the unix domain socket. The default is /dev/log if this is not specified.

**InputType** See the description about InputType in the global module config section. This defaults to *dgram* if not specified because unix domain sockets are SOCK_DGRAM type on Linux and the module does not yet support SOCK_STREAM sockets.

#### 6.2.14.2 Configuration examples

**Example 6.43** Using the im_uds module

```
<Input unix>
    Module  im_uds
    uds   /dev/log
</Input>

<Output out>
    Module  om_file
    File  "/var/log/messages"
</Output>

<Route 1>
       Path unix => out
</Route>
```

## 6.3 Processor modules

### 6.3.1 Blocker (pm_blocker)

This module can block log messages and can be used to simulate when a route is blocked. When the module blocks the data flow, log messages are first accumulated in the buffers, and then the flow-control mechanism pauses the input modules. Using the block() procedure it is possibile to programatically stop or resume the data flow. It can be useful for real-world scenarios as well as testing. See the examples below. When the module starts, the blocking mode is disabled by default, i.e. it operate just like pm_null would.

#### 6.3.1.1 Functions and procedures exported by pm_blocker

##### 6.3.1.1.1 Functions exported by pm_blocker

```
boolean is_blocking();
```

**description** Return TRUE if the module is currently blocking the data flow, FALSE otherwise.

**return type** boolean

##### 6.3.1.1.2 Procedures exported by pm_blocker

```
block(boolean mode);
```

**description** When mode is TRUE, the module will block. You should call block(FALSE) from a schedule block or another module, otherwise it might not get invoked if the queue is already full.

**arguments**

**mode** type: boolean

#### 6.3.1.2 Configuration examples

**Example 6.44** Using the pm_blocker module

In this example we collect messages received over UDP and forward it to another host via TCP. The log data is forwarded during non-working hours between 19 pm and 8 am. During the other half of the day data is buffered on the disk to be sent out only after 19 pm.

```
<Input in>
    Module  im_udp
    Host  0.0.0.0
    Port  1514
</Input>

<Processor buffer>
    Module      pm_buffer
    # 100Mb disk buffer
    MaxSize 102400
    Type  disk
</Processor>

<Processor blocker>
    Module  pm_blocker
    <Schedule>
  When  0 8 * * *
  Exec  blocker->block(TRUE);
    </Schedule>
    <Schedule>
  When  0 19 * * *
  Exec  blocker->block(FALSE);
    </Schedule>
</Processor>

<Output out>
    Module  om_tcp
    Host  192.168.1.1
    Port  1514
</Output>

<Route 1>
    Path  in => buffer => blocker => out
</Route>
```

### 6.3.2 Buffer (pm_buffer)

Messages received over UDP may be dropped by the operating system unless packets are read from the message buffer fast enough. Some logging subsystems using a small circular buffer can also overwrite logs old logs in the buffer if it is not read, thus there is a chance of missing important log data. Such situations can lead to dropped or lost messages and other problems where buffering can help.

The pm_buffer module supports disk and memory based log message buffering. If both are required, multiple pm_buffer instances can be used with different settings. Because a memory buffer can be faster, though its size is limited, combining memory and disk based buffering can be a good idea in case buffering is frequently used.

The disk based buffering mode stores the log message data in chunks. When all the data is successfully forwarded from a chunk, it is then deleted in order to save disk space.

**Note**
Using pm_buffer is only recommended when there is a chance of message loss. The built-in flow-control in nxlog ensures that messages will not be read by the input module until the output side can send/store/forward. When reading from files (with im_file) or the Windows Eventlog (with im_mseventlog or im_msvistalog) it is rarely necessary to use the pm_buffer module unless there is a chance of log rotation (and thus a possibility of missing some data) while the output module (e.g. TCP or SSL) is being blocked.

#### 6.3.2.1 Configuration

In addition to the common module directives, the following can be used to configure the pm_buffer module instance.

**MaxSize** Specifies the size of the buffer in kilobytes. This paramater is mandatory.

**WarnLimit** Specifies an optional limit smaller than MaxSize which will trigger a warning message when reached. The log message will not be emitted again until the buffer size drops to half of WarnLimit and reaches it again in order to protect against a warning message flood.

**Type** Type can be either 'Mem' or 'Disk' to select memory or disk based buffering respectively.

**Directory** Name of the directory used to store the disk buffer file chunks. This is only valid with Type set to 'Disk' mode.

#### 6.3.2.2 Functions and procedures exported by pm_buffer

##### 6.3.2.2.1 Functions exported by pm_buffer

```
integer buffer_size();
```

**description** Return the size of the memory buffer in bytes.

**return type** integer

```
integer buffer_count();
```

**description** Return the number of log messages held in the memory buffer.

**return type** integer

#### 6.3.2.3 Configuration examples

**Example 6.45** Using a memory buffer to protect against udp message loss

```
<Input udp>
    Module  im_udp
    Host  0.0.0.0
    Port  514
</Input>

<Processor buffer>
    Module      pm_buffer
    # 1Mb buffer
    MaxSize 1024
    Type  Mem
    # warn at 512k
    WarnLimit 512
</Processor>

<Output tcp>
    Module  om_tcp
    Host  192.168.1.1
    Port  1514
</Output>

<Route 1>
    Path  udp => buffer => tcp
</Route>
```

### 6.3.3 Event correlator (pm_evcorr)

The pm_evcorr module provides event correlation functionality in addition to the already available nxlog language features such as variables and statistical counters which can be also used for event correlation purposes.

This module was greatly inspired by the Perl based correlation tool SEC. Some of the rules of the pm_evcorr module were designed to mimic those available in SEC. This module aims to be a better alternative to SEC with the following advantages:

- The correlation rules in SEC work with the current time. With pm_evcorr it is possible to specify a time field wich is used for elapsed time calculation making offline event correlation also possible.
- SEC uses regular expressions extensively which can become quite slow in case of many correlation rules. In contrast this module can correlate preprocessed messages using fields for example from the pattern matcher and the syslog parser without requiring the use of regular expressions (though these are also available for use by correlation rules). Thus testing conditions can be significantly faster when simple comparison is used instead of regular expression based pattern matching.
- This module was designed to operate on fields thus making it possible to correlate structured logs in addition to simple free-form log messages.
- Most importantly, this module is written in C and SEC is pure Perl which could have major performance benefits.

The rulesets of this module can use a context. A context is an expression which is evaluated during runtime to a value and the correlation rule is checked in the context of this value. For example if we wanted to count the number of failed logins per user and alert if the failed logins exceed 3 for the user, then we'd use the $AccountName as the context. There is a separate context storage is for each correlation rule instance. If you need global contexts accessible from all rule instances, take a look at module variables and statistical counters.

#### 6.3.3.1 Configuration

The pm_evcorr configuration contains correlation rules which are evaluated for each log message processed by the module. Currently there are five rule types supported by pm_evcorr: Simple, Suppressed, Pair, Absence and Thresholded. These rules are defined in config blocks. The order of the rules is important because the rules are evaluated in the order they are defined. For example a correlation rule can change a state, variable or field which can be then used by a later rule. File inclusion can be useful to move the correlation rules into a standalone file.

In addition to the common module directives, the following can be used to configure the pm_evcorr module instance.

**TimeField** Specifies the name of the field to use for calculating elapsed time such as 'EventTime'. The name of the field must be specified without the leading dollar "$" sign. If this parameter is not specified, the current time is assumed. This directive makes it possible to accurately correlate events based on the event time recorded in the logs and to do non real-time event correlation also.

**ContextCleanTime** When a Context is used in the correlation rules, these must be purged from memory after they are expired, otherwise using too many context values could result in a high memory usage. This optional directive specifies the interval between context cleanups in seconds. By default a 1 minute cleanup interval is used if any rules use a Context and this directive is not specified.

**Simple** This rule is essentially the same as the Exec directive supported by all modules. Because Execs are evaluated before the correlation rules, the Simple rule was also needed to be able to evaluate a statement as the other rules do, following the rule order. The Simple block has one directive also with the same name.

**Exec** One or more Exec directives must be specified which takes a statement as argument.

**Suppressed** This rule matches the given condition. If the condition evaluates to TRUE, the statement specified with the Exec directive is evaluated. The rule will then ignore any log messages for the time specified with Interval directive. For example this rule is useful to suppress creating many alerts in a short period when a condition is satisfied.

**Condition** This mandatory directive takes an expression as argument which must evaluate to a boolean value.

**Interval** This mandatory directive takes an integer argument specifying the number of seconds to ignore the condition. The TimeField directive is used to calculate time.

**Context** This optional directive specifies an expression to be used as the context. It must evaluate to a value. Most often a field is specified here.

**Exec** One or more Exec directives must be specified which takes a statement as argument.

**Pair** When TriggerCondition evaluates to TRUE, this rule type will wait Interval seconds for RequiredCondition to become TRUE, it then executes the statement(s) in the Exec directive(s).

**TriggerCondition** This mandatory directive takes an expression as argument which must evaluate to a boolean value.

**RequiredCondition** This mandatory directive takes an expression as argument which must evaluate to a boolean value. When this evaluates to TRUE after TriggerCondition evaluated to TRUE within Interval seconds, the statement(s) in the Exec directive(s) are executed.

**Interval** Thisdirective takes an integer argument specifying the number of seconds to wait for RequiredCondition to become TRUE. If this directive is 0 or not specified, the rule will wait indefinitely for RequiredCondition to become TRUE. The TimeField directive is used to calculate time.

**Context** This optional directive specifies an expression to be used as the context. It must evaluate to a value. Most often a field is specified here.

**Exec** One or more Exec directives must be specified which takes a statement as argument.

**Absence** This rule type does the opposite of Pair. When TriggerCondition evaluates to TRUE, this rule type will wait Interval seconds for RequiredCondition to become TRUE. If it does not become TRUE it then executes the statement(s) in the Exec directive(s).

**TriggerCondition** This mandatory directive takes an expression as argument which must evaluate to a boolean value.

**RequiredCondition** This mandatory directive takes an expression as argument which must evaluate to a boolean value. When this evaluates to TRUE after TriggerCondition evaluated to TRUE within Interval seconds, the statement(s) in the Exec directive(s) are NOT executed.

**Interval** This mandatory directive takes an integer argument specifying the number of seconds to wait for RequiredCondition to become TRUE. Its value must be greater than 0. The TimeField directive is used to calculate time.

**Context** This optional directive specifies an expression to be used as the context. It must evaluate to a value. Most often a field is specified here.

**Exec** One or more Exec directives must be specified which takes a statement as argument.

---

**Note**
The evaluation of this Exec is not triggered by a log event, thus it does not make sense to use log data related operations such as accessing fields.

---

**Thresholded** This rule will execute the statement(s) in the Exec directive(s) if the Condition evaluates to TRUE Threshold or more times during the Interval specified. The advantage of this rule over the use of statistical counters is that the time window is dynamic and shifts as log messages are processed. Thus the problem described in this example is not present with this rule.

**Condition** This mandatory directive takes an expression as argument which must evaluate to a boolean value.

**Interval** This mandatory directive takes an integer argument specifying a time window for Condition to become TRUE. Its value must be greater than 0. The TimeField directive is used to calculate time. This time window is dynamic, meaning that it will shift.

**Threshold** This mandatory directive takes an integer argument specifying the number of times Condition must evaluate to TRUE within the given time Interval. When the treshold is reached, the module executes the statement(s) in the Exec directive(s).

**Context** This optional directive specifies an expression to be used as the context. It must evaluate to a value. Most often a field is specified here.

**Exec** One or more Exec directives must be specified which takes a statement as argument.

**Stop** This rule will stop evaluating successive rules if the Condition evaluates to TRUE. The optional Exec directive will be evaluated in this case.

**Condition** This mandatory directive takes an expression as argument which must evaluate to a boolean value. When it evaluates to TRUE, the correlation rule engine will stop checking any further rules.

**Exec** One or more Exec directives can be specified which takes a statement as argument. This will be evaluated when the specified Condition is satisfied. This Exec directive is optional.

#### 6.3.3.2 Configuration examples

**Example 6.46** Correlation rules

This following configuration sample contains a rule for each type.

```
<Input in>
    Module  im_file
    File  "modules/processor/evcorr/testinput_evcorr2.txt"
    SavePos FALSE
    ReadFromLast FALSE
    Exec  if ($raw_event =~ /^(\d\d\d\d-\d\d-\d\d \d\d:\d\d:\d\d) (.+)/) {  \
                    $EventTime = parsedate($1);                             \
                    $Message = $2;                                          \
                    $raw_event = $Message;                                  \
                }
</Input>

<Input internal>
    Module  im_internal
    Exec  $raw_event = $Message;
    Exec  $EventTime = 2010-01-01 00:01:00;
</Input>

<Output out>
    Module  om_file
    File  'tmp/output'
</Output>

<Processor evcorr>
    Module     pm_evcorr
    TimeField    EventTime

    <Simple>
  Exec     if $Message =~ /^simple/ $raw_event = "got simple";
    </Simple>

    <Suppressed>
  # match input event and execute an action list, but ignore the following
      # matching events for the next t seconds.
        Condition  $Message =~ /^suppressed/
    Interval   30
    Exec     $raw_event = "suppressing..";
    </Suppressed>

    <Pair>
  # If TriggerCondition is true, wait Interval seconds for RequiredCondition to be true and ↩
       then do the Exec
      # If Interval is 0, there is no window on matching
        TriggerCondition  $Message =~ /^pair-first/
        RequiredCondition $Message =~ /^pair-second/
        Interval   30
        Exec     $raw_event = "got pair";
    </Pair>

    <Absence>
  # If TriggerCondition is true, wait Interval seconds for RequiredCondition to be true.
  # If RequiredCondition does not become true within the specified interval then do the  ↩
      Exec
  TriggerCondition  $Message =~ /^absence-trigger/
    RequiredCondition $Message =~ /^absence-required/
    Interval    10
    Exec      log_info("'absence-required' not received within 10 secs");
    </Absence>

    <Thresholded>
  # if the number of events exceeeds the given threshold within the interval do the Exec
      # Same as SingleWithThreshold in SEC
        Condition  $Message =~ /^thresholded/
        Threshold  3
```

### 6.3.4 Filter (pm_filter)

This is a simple module which forwards log messages if the specified condition is TRUE.

**Note**
This module has been obsoleted by the nxlog language because filtering is now possible in any module using the drop() procedure conditionally in the Exec directive.

**Example 6.47** Dropping messages conditionally

```
if $raw_event =~ /^Debug/ drop();
```

#### 6.3.4.1 Configuration

In addition to the common module directives, the following can be used to configure the pm_filter module instance.

**Condition** This mandatory directive takes an expression as argument which must evaluate to a boolean value. If the expression does not evaluate to TRUE, the log message is discarded.

#### 6.3.4.2 Configuration examples

**Example 6.48** Filtering messages

```
<Input unix>
    Module  im_uds
    uds   /dev/log
</Input>

<Processor filter>
    Module pm_filter
    Condition $raw_event =~ /failed/ or $raw_event =~ /error/
</Processor>

<Output out>
    Module  om_file
    File  "/var/log/error"
</Output>

<Route 1>
    Path unix => filter => out
</Route>
```

### 6.3.5 Message deduplicator (pm_norepeat)

This module can be used to filter out repeating messages. Similarly to syslog daemons, this module checks the previous message against the current. If they match, the current message is dropped. The module waits one second for duplicated messages to arrive. If duplicates are detected, the first message is forwarded, the rest is dropped and a message containing "last message repeated X times" is sent instead.

#### 6.3.5.1 Configuration

In addition to the common module directives, the following can be used to configure the pm_norepeat module instance.

**CheckFields** This optional directive takes a comma separated list of field names which are used to compare log messages. Only the fields listed here are compared, the others are ignored. For example the 'EventTime' field will be different in repeating messages, so this field should not be used in the comparison. If this directive is not specified, the default field to be checked is 'Message'.

#### 6.3.5.2 Fields generated by pm_norepeat

The following fields are set by pm_norepeat:

**$raw_event** Type string
Will be set to "last message repeated X times".

**$Message** Type string
Set to the same value as $raw_event.

**$SeverityValue** Type integer
Its value will be set to 6 which is the "info" severity level.

**$Severity** Type string
The severity name of the event.

**$EventTime** Type datetime
Will be set to the time of the last event or the current time if EventTime was not present in the last event.

**$SourceName** Type string
Will be set to 'nxlog'.

**$ProcessID** Type integer
The field is filled with the process id of the nxlog process.

#### 6.3.5.3 Configuration examples

**Example 6.49** Filtering out duplicated messages

```
<Input in>
    Module  im_uds
    UDS   /dev/log
</Input>

<Processor norepeat>
    Module  pm_norepeat
    CheckFields Hostname, SourceName, Message
</Processor>

<Output out>
    Module  om_file
    File  "/var/log/messages"
</Output>


<Route 1>
    Path  in => norepeat => out
</Route>
```

### 6.3.6 Null (pm_null)

This module does not do any special processing, so basically it does nothing. Though the Exec and the Schedule directive is available in this module just like in any other, thus it can be quite useful. This module does not have any module specific configuration directives. See this example for usage.

### 6.3.7 Pattern matcher (pm_pattern)

This module makes it possible to execute pattern matching efficiently using a pattern database file in XML format. Using this module is more efficient than having nxlog regular expression rules listed in Exec directives, because the pm_pattern module was designed in such a way that patterns need not to be matched linearly. In addition, the module does an automatic on-the-fly pattern reordering internally for further speed improvements and it has a feature which can be used to tag messages with additional fields useful for message classification. See the Pattern matching and message classification section for additional examples.

Regular expressions are the most widely used in pattern matching. Unfortunately using a large number of regular expression based patterns does not scale well, because these need to be evaluated linearly. There are other techniques such as the radix tree which solve the linearity problem, the drawback is that usually these require a special syntax for specifying patterns which users must learn. If the log message is already parsed and is not treated as single line of message, then it is possible to process only a subset of the patterns which partially solves the linearity problem. With the other performance improvement tricks employed within the pm_pattern module, its speed can compare to the other techniques such as a radix tree based pattern matcher. Yet the pm_pattern module can keep using regular expressions which all programmers and system administrators are familiar with and this also provides an easy migration of regexp patterns from other tools and already existing patterns.

Traditionally pattern matching on log messages has employed a technique where the log message was one string and the pattern (regular expression or radix tree based pattern) was executed against it. To match patterns against logs which contain structured data (such as the Windows EventLog), this structured data (the fields of the log) must be converted to a single string. This is a simple but inefficient method used by many tools.

The nxlog patterns defined in the XML pattern database file can contain more than one field, this allows multi-dimensional pattern matching. Thus with nxlog's pm_pattern module there is no need to convert all fields into a single string as it can work with multiple fields.

Patterns can be grouped together under pattern groups. Pattern groups serve an optimization purpose. The group can have an optional `matchfield` block which can check a condition. If the condtion (such as `$SourceName` matches `sshd`) is satisfied, the pm_pattern module will dive into the group and check each pattern against the log. If the pattern group's condition didn't match (i.e. `$SourceName` wasn't `sshd`), the module can thus skip all patterns in the group without having to check each pattern one by one.

When the pm_pattern module finds a matching pattern, the `PatternID` and `PatternName` fields are set on the log message. These can be used later in conditional processing and correlation rules for example.

---

**Note**

The pm_pattern module does not process all patterns. It exits after the first matching pattern is found. This means that at most one pattern can match a log message. You should avoid writing a pattern to be used with pm_pattern which can match a subset of logs that match another pattern. For example if you have two regular expression patterns `^\d+` and `^\d\d`, the second may be never matched because of the first. The internal order of patterns and pattern groups is changed dynamically by pm_pattern. Those patterns are placed and tried first which have the highest match count. Reasons for this operation mode are:

- Performance optimization,
- Setting the value of `$PatternID` would be problematic with multiple values because the language does not support arrays.

If you want a strictly linearly executing mattern matcher, you should use the Exec directive and write your rules there.

---

#### 6.3.7.1 Configuration

In addition to the common module directives, the following can be used to configure the pm_pattern module instance.

**PatternFile** This mandatory directive specifies the name of the pattern database file.

#### 6.3.7.2 Pattern database file

**Example 6.50** A simple pattern database

This pattern database contains two patterns to match ssh authentication messages. The patterns are under a group named *ssh* which checks whether the field *SourceName* is *sshd* and only tries to match the patterns if the logs are indeed from sshd. The patterns both extract *AuthMethod*, *AccountName* and *SourceIP4Address* from the log message when the pattern matches the log. Additionally *TaxonomyStatus* and *TaxonomyAction* are set. The second pattern utilizes the Exec block which is evaluated when the pattern matches.

**Note**
For this pattern to work, the logs must be parsed with parse_syslog() prior to feeding it to the pm_pattern module because it uses the *SourceName* and *Message* fields.

```
<?xml version='1.0' encoding='UTF-8'?>
<patterndb>
 <created>2010-01-01 01:02:03</created>
 <version>42</version>

 <group>
   <name>ssh</name>
   <id>42</id>
   <matchfield>
    <name>SourceName</name>
    <type>exact</type>
    <value>sshd</value>
   </matchfield>

   <pattern>
    <id>1</id>
    <name>ssh auth success</name>

    <matchfield>
     <name>SourceName</name>
     <type>exact</type>
     <value>sshd</value>
    </matchfield>

    <matchfield>
     <name>Message</name>
     <type>regexp</type>
        <!-- Accepted publickey for nxlogfan from 192.168.1.1 port 4242 ssh2 -->
     <value>^Accepted (\S+) for (\S+) from (\S+) port \d+ ssh2</value>
     <capturedfield>
  <name>AuthMethod</name>
  <type>string</type>
     </capturedfield>
     <capturedfield>
  <name>AccountName</name>
  <type>string</type>
     </capturedfield>
     <capturedfield>
  <name>SourceIP4Address</name>
        <type>string</type>
     </capturedfield>
    </matchfield>

    <set>
     <field>
       <name>TaxonomyStatus</name>
       <value>success</value>
       <type>string</type>
     </field>
     <field>
       <name>TaxonomyAction</name>
       <value>authenticate</value>
       <type>string</type>
```

#### 6.3.7.3 Fields generated by pm_pattern

The following fields are set by pm_pattern:

**$PatternID** Type integer
Set to the id number of the pattern which matched the message.

**$PatternName** Type string
Set to the name of the pattern which matched the message.

#### 6.3.7.4 Configuration examples

**Example 6.51** Using the pm_pattern module

```
<Extension syslog>
    Module      xm_syslog
</Extension>

<Input in>
    Module  im_uds
    UDS   /dev/log
    Exec  parse_syslog_bsd();
</Input>

<Processor pattern>
    Module  pm_pattern
    PatternFile /var/lib/nxlog/patterndb.xml
</Processor>

<Output out>
    Module  om_file
    File  "/var/log/messages"
</Output>

<Route 1>
    Path  in => pattern => out
</Route>
```

### 6.3.8 Message format converter (pm_transformer)

The pm_transformer module provides parsers for syslog (both legacy and the newer IETF standard), CSV, JSON and XML formatted data and can also convert between. This module is now obsoleted by the functions and procedures provided by the following modules:

xm_syslog
xm_csv
xm_json
xm_xml

Though using this pm_transformer module can be slightly faster than calling these procedures from an Exec directive.

#### 6.3.8.1 Configuration

In addition to the common module directives, the following can be used to configure the pm_transformer module instance.

**InputFormat** This directive specifies the input format of the $raw_event field so that it is further parsed into fields. If this directive is not specified, no parsing will be done.

**syslog_rfc3164** Input is parsed in bsd syslog format as defined by RFC 3164. This does the same as the parse_syslog_bsd() procedure.

**syslog_bsd** Same as syslog_rfc3164.

**syslog_rfc5424** Input is parsed in IETF syslog format as defined by RFC 5424. This does the same as the parse_syslog_ietf() procedure.

**syslog_ietf** Same as syslog_rfc5424.

**CSV** Input is parsed as a comma separated list of values. See xm_csv for similar functionality. The input fields must be defined defined by CSVInputFields

**XML** Input is parsed as XML. This does the same as the parse_xml() procedure.

**JSON** Input is parsed as JSON. This does the same as the parse_json() procedure.

**CSVInputFields** This is a comma separated list of fields which will be filled from the input parsed. The field names must have the dollar sign "$" prepended.

**CSVInputFieldTypes** This optional directive specifies the list of types corresponding to the field names defined in CSVInputFields. If specified, the number of types must match the number of field names specified with CSVInputFields. If this directive is omitted, all fields will be stored as strings. This directive has no effect on the fields-to-csv conversion.

**OutputFormat** This directive specifies the output transformation. If this directive is not specified, fields are not converted and $raw_event is left unmodified.

**syslog_rfc3164** Output in $raw_event is formatted in bsd syslog format as defined by RFC 3164. This does the same as the to_syslog_bsd() procedure.

**syslog_bsd** Same as syslog_rfc3164.

**syslog_rfc5424** Output in $raw_event is formatted in IETF syslog format as defined by RFC 5424. This does the same as the to_syslog_ietf() procedure.

**syslog_ietf** Same as syslog_rfc5424.

**syslog_snare** Output in $raw_event is formatted in SNARE syslog format. This does the same as the to_syslog_snare() procedure. This is to be used in conjunction with the im_mseventlog or im_msvistalog module to produce an output compatible with Snare Agent for Windows.

**CSV** Output in $raw_event is formatted as a comma separated list of values. See xm_csv for similar functionality.

**XML** Output in $raw_event is formatted in XML. This does the same as the to_xml() procedure.

**JSON** Output in $raw_event is formatted as JSON. This does the same as the to_json() procedure.

**CSVOutputFields** This is a comma separated list of message fields which are placed in the CSV lines. The field names must have the dollar sign "$" prepended.

#### 6.3.8.2 Configuration examples

**Example 6.52** Using the pm_transformer module

```
<Extension syslog>
    Module      xm_syslog
</Extension>

<Input filein>
    Module  im_file
    File  "tmp/input"
</Input>

<Processor transformer>
    Module  pm_transformer
    InputFormat syslog_rfc3164
#    OutputFormat syslog_rfc3164
    OutputFormat csv
    CSVOutputFields $facility, $severity, $timestamp, $hostname, $application, $pid,  ↩
        $message
</Processor>

<Output fileout>
    Module  om_file
    File  "tmp/output"
</Output>

<Route 1>
    Path  filein => transformer => fileout
</Route>
```

## 6.4 Output modules

### 6.4.1 Blocker (om_blocker)

This module serves testing purposes mostly. It will block log messages in order to simulate a blocked route. This can easily create a similar situation when a network transport output module such as om_tcp blocks because of a network problem. See the sleep() procedure which can delay log message output and can also help testing similar situations.

#### 6.4.1.1 Configuration examples

**Example 6.53** Testing buffering with the om_blocker module

```
<Input uds>
    Module  im_uds
    Uds   /dev/log
</Input>

<Processor buffer>
    Module  pm_buffer
    WarnLimit 512
    MaxSize 1024
    Type  Mem
</Processor>

<Output blocker>
    Module  om_blocker
</Output>

<Route 1>
    Path  uds => buffer => blocker
</Route>
```

### 6.4.2 DBI (om_dbi)

The om_dbi module utilizes the libdbi database abstraction library to enable storing logs in various database engines supported by the library such as MySQL, PostgreSQL, MSSQL, Sybase, Oracle, SQLite, Firebird. This module makes it possible to insert logs directly into an SQL database. You can specify the INSERT statement which will be executed for each log, this enables inserts into any table schema.

**Note**
The im_dbi and om_dbi modules support GNU/Linux only because of the libdbi library. The im_odbc and om_odbc modules provide native database access on Windows (available only in the NXLog Enterprise Edition).

**Note**
libdbi needs drivers to be able to access the database engines. These are in the libdbd-* packages on Debian and Ubuntu Linux. On Centos 5.6 there is a libdbi-drivers rpm package but this does seem to contain any driver binaries under /usr/lib64/dbd. The real driver for MySQL lives in libdbi-dbd-mysql. Same for PostgreSQL. Make sure you have these installed, otherwise you will get a libdbi driver initialization error.

#### 6.4.2.1 Configuration

In addition to the common module directives, the following can be used to configure the om_dbi module instance.

**Driver** This mandatory directive specifies the name of the libdbi driver which will be used to connect to the database. You will need to provide a DRIVER name here for which a loadable driver module exists under the name libdbdDRIVER.so (usually under /usr/lib/dbd/). The mysql driver is in the libdbdmysql.so file.

**SQL** This directive should specify the INSERT statement which is executed for each log message. The fields names (names with a $ sign) will be replaced with the value they contain. String types will be quoted.

**Option** This directive can be used to specify additional driver options such as the connection parameters. The manual of the libdbi driver should contain the available options which can be used here.

#### 6.4.2.2 Configuration examples

These two examples below are for the plain syslog fields. Depending on your requirements, you may want to store additional or other fields which were generated by parsers, regexp rules, the pm_pattern pattern matcher module or input modules. Notably the im_msvistalog and im_mseventlog modules generate different fields which you may want to store in an SQL database similarly to these examples.

**Example 6.54** Storing syslog in a PostgreSQL database

Below is a table schema which can be used to store syslog data.

```
CREATE TABLE log (
  id serial,
        timestamp timestamp  not null,
  hostname varchar(32) default NULL,
  facility varchar(10) default NULL,
  severity varchar(10) default NULL,
  application varchar(10) default NULL,
  message text,
  PRIMARY KEY (id)
);
```

And the config file:

```
<Extension syslog>
    Module  xm_syslog
</Extension>

<Input in>
    Module  im_tcp
    Port  1234
    Host  0.0.0.0
    Exec  parse_syslog_bsd();
</Input>

<Output dbi>
    Module  om_dbi
    SQL         INSERT INTO log (facility, severity, hostname, timestamp, application,  ↩
        message) \
                VALUES ($SyslogFacility, $SyslogSeverity, $Hostname, '$EventTime',  ↩
                    $SourceName, $Message)
    Driver  pgsql
    Option  host 127.0.0.1
    Option  username dbuser
    Option  password secret
    Option      dbname logdb
</Output>

<Route 1>
    Path  in => dbi
</Route>
```

**Example 6.55** Storing logs in a MySQL database

```
<Extension syslog>
    Module      xm_syslog
</Extension>

<Input in>
    Module  im_uds
    UDS   /dev/log
    Exec  parse_syslog_bsd();
</Input>

<Output dbi>
    Module  om_dbi
    SQL         INSERT INTO log (facility, severity, hostname, timestamp, application,  ↩
        message) \
                VALUES ($SyslogFacility, $SyslogSeverity, $Hostname, '$EventTime',  ↩
                    $SourceName, $Message)
    Driver  mysql
    Option  host 127.0.0.1
    Option  username mysql
    Option  password mysql
    Option      dbname logdb
</Output>

<Route 1>
    Path  in => dbi
</Route>
```

### 6.4.3 Program (om_exec)

This module will execute a program or script on startup and will write (pipe) the log data to the program's standard input. Unless OutputType is set to something else, only the contents of the $raw_event field are sent over the pipe. The execution of the program or script will terminate when the module is stopped, which usually happens when nxlogs exits and the pipe is closed.

**Note**
The program or script is started when nxlog start and must not exit until the module is stopped. To invoke a script for each log message, use xm_exec instead.

#### 6.4.3.1 Configuration

In addition to the common module directives, the following can be used to configure the om_exec module instance.

**Command** This directive is mandatory. It specifies the name of the script/program to be executed.

**Arg** This is an optional parameter, multiple can be specified for each argument needed to pass to the Command. Note that specifying multiple arguments with one Arg directive separated with spaces will not work because the Command will receive it as one argument, so you will need to split them up.

**OutputType** See the description about OutputType in the global module config section.

#### 6.4.3.2 Configuration examples

**Example 6.56** Piping logs to an external program

```
<Input in>
    Module  im_uds
    uds   /dev/log
</Input>

<Output out>
    Module  om_exec
    Command /usr/bin/someprog
    Arg   -
</Output>

<Route 1>
    Path  in => out
</Route>
```

This exact same configuration is not recommended for real use because im_file was designed to read log messages from files. This example only demonstrates the use of the om_exec module.

### 6.4.4 File (om_file)

This module can be used to write log messages to a file.

#### 6.4.4.1 Configuration

In addition to the common module directives, the following can be used to configure the om_file module instance.

**File** This mandatory directive specifies the name of the output file to open. It must be a string type expression. If the expression in the File directive is not a constant string (i.e. it contains functions, field names or operators), it will be evaluated before each event is written to the file (and after the Exec is evaluated). Note that the filename must be quoted to be a valid string literal unlike in other directives which take a filename argument. For relative filenames you should be aware that nxlog changes its working directory to '/' unless the global SpoolDir is set to something else.

Below are 3 different variations for specifying the same output file on a Windows system:

```
File 'C:\logs\logmsg.txt'
File "C:\\logs\\logmsg.txt"
File 'C:/logs/logmsg.txt'
```

**CreateDir** This optional directive takes a boolean value of TRUE or FALSE. If not specified, the default value is FALSE. If it is set to TRUE, the directory will be created if it doesn't exist before opening the file for writing.

**Truncate** This optional directive takes a boolean value of TRUE or FALSE. If set to TRUE, the file will be truncated before each write, meaning that only the most recent log message is saved. By default this is FALSE.

**Sync** This optional directive takes a boolean value of TRUE or FALSE. If set to TRUE, the file is synced after each log message, ensuring that it is really written to disk from the buffers. This can hurt performance, thus by default it is turned off.

**OutputType** See the description about OutputType in the global module config section.

#### 6.4.4.2 Functions and procedures exported by om_file

##### 6.4.4.2.1 Functions exported by om_file

**`string file_name();`**

**description** Return the name of the file currently open which was specified using the File directive. Note that this will be the old name if the file name changes dynamically. If you want the new name, use the expression you specified for the File directive instead of usng this function.

**return type** string

**`integer file_size();`**

**description** Return the size of the currently open output file in bytes. It will return undef if the file is not open. This can happend if 'File' is not a string literal expression and there was no log message.

**return type** integer

##### 6.4.4.2.2 Procedures exported by om_file

**`rotate_to(string filename);`**

**description** Rotate the current file to the filename specified. The module will then open the original file specified with the 'File' directive. Note that the rename(2) system call is used internally which does not support moving files across different devices on some platforms. If this is a problem, first rotate the file on the same device and then using the exec_async() procedure of the xm_exec module you can copy it to another device or file system or use the file_copy() procedure call provided by the xm_fileop module.

**arguments**

**filename** type: string

**`reopen();`**

**description** Reopen the File. This function should be called if the file has been removed or renamed e.g. with the file_cycle(), file_remove(), file_rename() functions of the xm_file module. This does not need to be called after rotate_to() because that reopens the file automatically.

#### 6.4.4.3 Configuration examples

**Example 6.57** Storing raw syslog messages into a file

```
<Input in>
    Module  im_uds
    UDS   /dev/log
</Input>

<Output out>
    Module  om_file
    File  "/var/log/messages"
</Output>

<Route 1>
    Path  in => out
</Route>
```

**Example 6.58** File rotation based on size

```
<Extension exec>
    Module  xm_exec
</Extension>

<Extension syslog>
    Module  xm_syslog
</Extension>

<Input in>
    Module  im_tcp
    Port  1514
    Host  0.0.0.0
    Exec  parse_syslog_bsd();
</Input>

<Output out>
    Module  om_file
    File  "tmp/output_" + $Hostname + "_" + month(now())
    Exec  if out->file_size() > 15M \
                { \
                   $newfile = "tmp/output_" + $Hostname + "_" + strftime(now(), "%Y%m%d%H%M ↩
                       %S"); \
                   out->rotate_to($newfile); \
                   exec_async("/bin/bzip2", $newfile); \
                }
</Output>

<Route 1>
    Path  in => out
</Route>
```

### 6.4.5 HTTP(s) (om_http)

This module will connect to the url specified in the configuration in either plain HTTP or HTTPS mode. Each event data is transferred in a single POST request. The module then waits for a response containing a successful status code (200, 201 or 202). It will reconnect and retry the delivery if the remote has closed the connection or a timeout is exceeded while waiting for the repsponse. This HTTP-level acknowledgement ensures that no messages are lost during transfer.

#### 6.4.5.1 Configuration

In addition to the common module directives, the following can be used to configure the om_http module instance.

**Url** This mandatory directive specifies the URL where the module should POST the event data. The module checks the url whether to operate in plain HTTP or HTTPS mode. It connects to the hostname specified in the url. If the port number is not explicitly indicated it defaults to 80 and 443 for HTTP and HTTPS respectively.

**HTTPSCertFile** This specifies the path of the certificate file to be used in the HTTPS handshake.

**HTTPSCertKeyFile** This specifies the path of the certificate key file to be used in the HTTPS handshake.

**HTTPSKeyPass** Optional password of the certificate key file defined in HTTPSCertKeyFile. For passwordless private keys the directive is not needed.

**HTTPSCAFile** This specifies the path of the certificate of the CA which will be used to check the certificate of the remote HTTPS server.

**HTTPSCADir** This specifies the path of CA certificates which will be used to check the certificate of the remote HTTPS server. The cert file names in this directory must be in the OpenSSL hashed format.

**HTTPSCRLFile** This specifies the path of the certificate revocation list (CRL) which will be used to check the certificate of the remote HTTPS server.

**HTTPSCRLDir** This specifies the path of certificate revocation lists (CRLs) which will be used to check the certificate of the remote HTTPS server. The file names in this directory must be in the OpenSSL hashed format.

**HTTPSAllowUntrusted** This takes a boolean value of TRUE or FALSE and specifies whether the connection should be allowed without certificate verification. If set to TRUE the connection will be allowed even if the remote HTTPS server presents unknown and self-signed certificates. The default value is FALSE if this directive is not specified, meaning that the remote end must present a trusted certificate by default.

**ContentType** Sets the Content-Type HTTP header to the string specified with this directive. The Content-Type is set to 'text/-plain' by default unless this directive is set.

#### 6.4.5.2 Functions and procedures exported by om_http

##### 6.4.5.2.1 Procedures exported by om_http

```
set_http_request_path(string path);
```

**description** Sets the path in the HTTP request to the string specified. This is useful if the URL is dynamic and parameters such as event id need to be included in the URL. Note that the string must be url encoded if it contains reserved characters.

**arguments**

**path** type: string

#### 6.4.5.3 Configuration examples

**Example 6.59** Sending logs over HTTPS

```
<Input in>
    Module    im_file
    File    'input.log'
    ReadFromLast  FALSE
</Input>

<Output out>
    Module    om_http
    URL     https://server:8080/
    HTTPSCertFile %CERTDIR%/client-cert.pem
    HTTPSCertKeyFile  %CERTDIR%/client-key.pem
    HTTPSCAFile   %CERTDIR%/ca.pem
    HTTPSAllowUntrusted FALSE
</Output>

<Route httpout>
    Path  in => out
</Route>
```

### 6.4.6 Null (om_null)

Log messages sent to the om_null module instance are discarded, this module does not write its output anywhere. It can be useful for creating a dummy route, testing purposes. It can have Scheduled nxlog code execution as well like any other module, so it is not completely useless. This module does not have any module specific configuration directives. See this example for usage.

### 6.4.7 TLS/SSL (om_ssl)

The om_ssl module provides an SSL/TLS transport using the OpenSSL library beneath the surface. It behaves similarly to the om_tcp module, except that an SSL handshake is performed at connection time and the data is received over a secure channel. Because log messages transferred over plain TCP can be eavasdropped or even altered with a man-in-the-middle attack, using the om_ssl module provides a secure log message transport.

#### 6.4.7.1 Configuration

In addition to the common module directives, the following can be used to configure the om_ssl module instance.

**Host** This specifies the IP address or a dns hostname where the module should connect to.

**Port** This specifies the port number where the module should connect to.

**Reconnect** This directive has been deprecated as of version 2.4. The module will try to reconnect automatically at increasing intervals on all errors.

**CertFile** This specifies the path of the certificate file to be used in the SSL handshake.

**CertKeyFile** This specifies the path of the certificate key file to be used in the SSL handshake.

**KeyPass** Optional password of the certificate key file defined in CertKeyFile. For passwordless private keys the directive is not needed.

**CAFile** This specifies the path of the certificate of the CA which will be used to check the certificate of the remote socket against.

**CADir** This specifies the path of CA certificates which will be used to check the certificate of the remote socket against. The cert file names in this directory must be in the OpenSSL hashed format.

**CRLFile** This specifies the path of the certificate revocation list (CRL) which will be used to check the certificate of the remote socket against.

**CRLDir** This specifies the path of certificate revocation lists (CRLs) which will be used to check the certificate of the remote socket against. The file names in this directory must be in the OpenSSL hashed format.

**AllowUntrusted** This takes a boolean value of TRUE or FALSE and specifies whether the connection should be allowed without certificate verification. If set to TRUE the connection will be allowed even if the remote server presents unknown and self-signed certificates. The default value is FALSE if this directive is not specified, meaning that the remote end must present a trusted certificate by default.

**OutputType** See the description about OutputType in the global module config section.

#### 6.4.7.2 Configuration examples

**Example 6.60** Writing nxlog binary data to another nxlog agent

```
<Input in>
    Module  im_uds
    UDS   tmp/socket
</Input>

<Output sslout>
    Module  om_ssl
    Host  localhost
    Port  23456
    CAFile  %CERTDIR%/ca.pem
    CertFile  %CERTDIR%/client-cert.pem
    CertKeyFile %CERTDIR%/client-key.pem
    KeyPass secret
    AllowUntrusted TRUE
    OutputType  Binary
</Output>


<Route 1>
    Path  in => sslout
</Route>
```

### 6.4.8 TCP (om_tcp)

This module initiates a TCP connection to a remote host and transfers log messages. The TCP transfer protocol provides more reliable log transmission than UDP. If security is a concern, consider using the om_ssl module instead.

#### 6.4.8.1 Configuration

In addition to the common module directives, the following can be used to configure the om_tcp module instance.

**Host** This mandatory directive specifies the IP address or a dns hostname where the module should connect to.

**Port** This specifies the port number where the module should connect to. The default port is 514 if this directive is not specified.

**Reconnect** This directive has been deprecated as of version 2.4. The module will try to reconnect automatically at increasing intervals on all errors.

**OutputType** See the description about OutputType in the global module config section.

#### 6.4.8.2 Configuration examples

**Example 6.61** Transferring raw logs over TCP

```
<Input in>
    Module  im_uds
    UDS   /dev/log
</Input>

<Output out>
    Module  om_tcp
    Host  192.168.1.1
    Port  1514
</Output>

<Route 1>
    Path  in => out
</Route>
```

### 6.4.9 UDP (om_udp)

This module sends log messages as UDP datagrams to the address and port specified in the configuration. UDP is the transport protocol of the old BSD syslog standard as described in RFC 3164, so this module can be particularly useful to send such messages to devices or syslog daemons which do not support other transports.

#### 6.4.9.1 Configuration

In addition to the common module directives, the following can be used to configure the om_udp module instance.

**Host** This mandatory directive specifies the IP address or a dns hostname which the module will send UDP datagrams to.

**Port** This specifies the port number which the module will send UDP packets to. The default port is 514 if this directive is not specified.

**SockBufSize** This optional directive sets the socket buffer size (SO_SNDBUF) to the value specified. Otherwise the OS defaults are used.

**OutputType** See the description about OutputType in the global module config section.

#### 6.4.9.2 Configuration examples

**Example 6.62** Sending raw syslog over udp

```
<Input in>
    Module  im_uds
    UDS   /dev/log
</Input>

<Output out>
    Module  om_udp
    Host  192.168.1.1
    Port  1514
</Output>

<Route 1>
    Path  in => out
</Route>
```

### 6.4.10 UDS (om_uds)

This module allows log messages to be sent to a unix domain socket. Traditionally unix systems have a socket, typically /dev/log used by the system logger to accept messages from. Applications wishing to send messages to the system log use the syslog(3) system call. nxlog can use this module to send log messages to the socket (=system logger) directly if another syslog daemon is in use.

**Note**
This module supports SOCK_DGRAM type sockets only. SOCK_STREAM type sockets will be supported in the future.

#### 6.4.10.1 Configuration

In addition to the common module directives, the following can be used to configure the om_uds module instance.

**UDS** This specifies the path of the unix domain socket. The default is /dev/log if this is not specified.

**OutputType** See the description about OutputType in the global module config section.

#### 6.4.10.2 Configuration examples

**Example 6.63** Using the om_uds module

```
<Extension syslog>
    Module  xm_syslog
</Extension>

<Input in>
    Module  im_file
    File  "/var/log/custom_app.log"
</Input>

<Output out>
    Module  om_uds
    # defaulting syslog fields and creating syslog output
    Exec  parse_syslog_bsd(); to_syslog_bsd();
    uds   /dev/log
</Output>

<Route 1>
       Path in => out
</Route>
```

# Chapter 7

# Offline log processing

## 7.1 nxlog-processor

The nxlog-processor tool is similar to the nxlog daemon, it uses the same configuration file. The difference is that it runs in foreground and will exit if there are no more log messages available from the input sources. The input sources are typically file and database sources. This tool is useful for offline log processing tasks such as loading a bunch of files into a database, converting between different formats (e.g. CSV and syslog), testing patterns, doing offline event correlation or HMAC message integrity checking.

FIXME manpage and usage

# Chapter 8

# Reading and receiving logs

This chapter deals with log sources such as operating systems, network, database, files, applications and special devices. Some of these log sources need a dedicated input module or a special parser to be able to read and interpret the log messages. A parser can be a dedicated module implementing the parser routines and exporting these to the nxlog core as procedures and functions such as the xm_syslog module. Alternatively parsers can be directly implemented in the nxlog language by constructs such as regular expressions using capturing or the other built-in functions and procedures available for string manipulation. Writing parsers in the nxlog language is especially useful if there is no dedicated parser module for the specific log source.

## 8.1 Operating Systems

This section provides information and examples about collecting system messages of various operating systems. OS specific applications are also discussed here. The following sources are not operating system specific but work on most supported platforms:

Network
Database
Files
External programs and scripts
Multi-platform applications

### 8.1.1 Microsoft Windows

#### 8.1.1.1 Windows EventLog

To collect log messages from the EventLog subsystem on Windows 2000 and 2003, use the im_mseventlog module. This will also work on later versions, but the im_msvistalog module is recommended for use on Windows 2008, Vista and later. See the im_mseventlog and im_msvistalog configuration examples.

#### 8.1.1.2 Microsoft SQL Server

Microsoft SQL Server stores its logs in UTF-16 encoding using a line-based format. It is recommended to normalize the encoding to UTF-8. The following config snipped will do that.

```
<Extension _charconv>
    Module      xm_charconv
</Extension>

<Input in>
    Module  im_file
```

```
    File  "C:\\MSSQL\\ERRORLOG"
    Exec  convert_fields('UCS-2LE','UTF-8'); if $raw_event == '' drop();
</Input>
```

As of this writing, the LineBased parser, the default InputType for im_file is not able to properly read the double-byte UTF-16 encoded files and will read an additional empty line (because of the double-byte CRLF). The above drop() call is intended to fix this. **convert_fields('UTF-16','UTF-8');** might also work instead of UCS-2LE.

#### 8.1.1.3 Microsoft IIS

Microsoft Internet Information Server supports different log file formats. Log files created by IIS are line-based and can be read with im_file.

```
<Input IIS>
  Module  im_file
  File  'C:\inetpub\logs\LogFiles\u_ex*'
</Input>
```

The above needs to be extended with appropriate parser rules if you want to parse the individual fields. See the following options depending on the format which is configured for your instance.

##### 8.1.1.3.1 W3C Extended Log File Format

See the W3C Extended Log File Format section in the Processing messages chapter, the W3C Extended Log File Format (IIS 6.0) docs and the W3C Extended Log File Examples (IIS 6.0).

##### 8.1.1.3.2 Microsoft IIS Format

The IIS format is line-based, fields are comma separated. It can be parsed with the help of the xm_csv module or with regular expressions.

##### 8.1.1.3.3 NCSA Common Log File Format

See the NCSA Common Log Format section in the Processing messages chapter.

##### 8.1.1.3.4 ODBC Logging

To read IIS logs from the ODBC datastore, use the im_odbc module.

### 8.1.2 GNU/Linux

**Kernel logs** The im_kernel module is dedicated to read the kernel log buffer.

**Local syslog** Local syslog is sent to the unix domain socket at /dev/log. The im_uds module should be used together with xm_syslog or pm_transformer.

### 8.1.3 Android

**Kernel logs** The Linux kernel log can be read with the im_kernel module.

**Android device logs** Android has a special in-kernel logging system. The im_android module can read this.

## 8.2 Network

This section provides information and examples about receiving log messages from the network over various protocols.

### 8.2.1 UDP

See im_udp.

### 8.2.2 TCP

See im_tcp.

### 8.2.3 TLS/SSL over TCP

See im_ssl.

### 8.2.4 Syslog

If you need to receive syslog over the network, the xm_syslog or pm_transformer module should be coupled with one of the network modules above. Syslog parsing is not even required if you only want to forward or store syslog as is.

## 8.3 Database

With special modules it is possible to read logs directly from database servers.

### 8.3.1 Using im_dbi

The im_dbi module can be used on POSIX systems where libdbi is available. See the im_dbi module documentation.

### 8.3.2 Using im_odbc

The im_odbc module can be used with ODBC compatible databases on Windows, Linux and Unix.

## 8.4 Files

The im_file module can be used to read logs from files. See Processing messages chapter about parsing various formats.

## 8.5 External programs and scripts

The im_exec module can be used to read logs from external programs and scripts over a pipe. See Processing messages chapter about parsing various formats.

## 8.6 Applications

This section provides information and examples about collecting log messages from various operating system independent (i.e. multi-platform) applications. Operating system applications are discussed in the previous section.

### 8.6.1 Apache HTTP Server

The Apache HTTP Server provides very comprehensive and flexible logging capabilities

#### 8.6.1.1 Error log

FIXME

#### 8.6.1.2 Access log - Common Log Format

See the NCSA Common Log Format section in the Processing messages chapter.

#### 8.6.1.3 Access log - Combined Log Format

See the NCSA Combined Log Format section in the Processing messages chapter.

### 8.6.2 Apache Tomcat and java application logs

Apache tomcat and java applications are very flexible and can be configured for different transports and formats.

Here is a log sample consisting of 3 events. The log message of the second event spans multiple lines.

```
2001-01-25 17:31:42,136 INFO [com.nxsec.somepackage.Class] - single line
2001-01-25 17:41:16,268 ERROR [com.nxsec.somepackage.Class] - Error retrieving names: ;  ↩
    nested exception is:
        java.net.ConnectException: Connection refused
AxisFault
 faultCode: {http://schemas.xmlsoap.org/soap/envelope/}Server.userException
 faultSubcode:
 faultString: java.net.ConnectException: Connection refused
 faultActor:
 faultNode:
 faultDetail:
        {http://xml.apache.org/axis/}stackTrace:java.net.ConnectException: Connection  ↩
            refused
2001-01-25 17:57:38,469 INFO [com.nxsec.somepackage.Class] - third log message
```

**Example 8.1** Parsing tomcat logs into fields

This can be very useful to filter messages by the emitting java class for example.

```
<Input log4j>
  Module  im_file
  File  "/var/log/tomcat6/catalina.out"
  Exec  if $raw_event =~ /^(\d{4}\-\d{2}\-\d{2} \d{2}\:\d{2}\:\d{2}),\d{3} (\S+) \[(\S+)\]  ↩
      \- (.*)/ \
          { \
        $log4j.time = parsedate($1); \
        $log4j.loglevel = $2; \
        $log4j.class = $3; \
        $log4j.msg = $4; \
          }
</Input>

<Output out>
  Module  om_null
</Output>

<Route tomcat>
    Path  log4j => out
</Route>
```

To parse and process multi-line messages such as the above, see the Dealing with multi-line messages section.

## 8.7 Devices

This section deals with special devices such as routers, firewalls, switches and other appliances.

### 8.7.1 Cisco

Cisco devices can be instructed to log over syslog. Unfortunately the lousy syslog RFC standards compliance and the different formats of cisco devices make it hard to have a universal cisco syslog parser. Some examples follow.

**Example 8.2** Cisco Secure Access Control Server

Refer to the Configuring Syslog Logging section in the Cisco Configuration Guide. An example syslog record from a Cisco ACS device looks like the following:

```
<38>Oct 16 21:01:29 10.0.1.1 CisACS_02_FailedAuth 1k1fg93nk 1 0 Message-Type=Authen failed, ↩
    User-Name=John,NAS-IP-Address=10.0.1.2,AAA Server=acs01
```

The following configuration file instructs nxlog to accept syslog messages on UDP port 1514. The payload is parsed as syslog and then the ACS specific fields are extracted. The output is written to a file in JSON format.

```
<Extension json>
    Module      xm_json
</Extension>

<Extension syslog>
    Module      xm_syslog
</Extension>

<Input in>
    Module  im_udp
    Host  0.0.0.0
    Port  1514
    Exec  parse_syslog_bsd();
    Exec  if ( $Message =~ /^CisACS_(\d\d)_(\S+) (\S+) (\d+) (\d+) (.*)$/ ) \
                { \
                   $ACSCategoryNumber = $1; \
                   $ACSCategoryName = $2; \
                   $ACSMessageId = $3; \
                   $ACSTotalSegments = $4; \
                   $ACSSegmentNumber = $5; \
                   $Message = $6; \
                   if ( $Message =~ /Message-Type=([^\,]+)/ ) { $ACSMessageType = $1; } \
                   if ( $Message =~ /User-Name=([^\,]+)/ ) { $AccountName = $1; } \
                   if ( $Message =~ /NAS-IP-Address=([^\,]+)/ ) { $ACSNASIPAddress = $1; } ↩
                       \
                   if ( $Message =~ /AAA Server=([^\,]+)/ ) { $ACSAAAServer = $1; } \
                }
#                if ( $Message =~ /^CisACS_(\d\d)_(\S+) (\S+) (\d+) (\d+) (.*)$/ ) { $ACSCategoryNumber = $1; $ACSCategoryName = $2; $ACSMessageId = $3; $ACSTotalSegments = $4; $ACSSegmentNumber = $5; $Message = $6; if ( $Message =~ /Message-Type=([^\,]+)/ ) { $ACSMessageType = $1; } if ( $Message =~ /User-Name=([^\,]+)/ ) { $AccountName = $1; } if ( $Message =~ /NAS-IP-Address=([^\,]+)/ ) { $ACSNASIPAddress = $1; } if ( $Message =~ /AAA Server=([^\,]+)/ ) { $ACSAAAServer = $1; } } else log_warning("does not match: " + to_json());

</Input>

<Output out>
    Module  om_file
    File  "tmp/output.txt"
    Exec  to_json();
</Output>

<Route 1>
    Path  in => out
</Route>
```

**Example 8.3** Cisco PIX and Cisco ASA

The PIX Log Message Format is described in the *Cisco PIX Firewall System Log Messages* document. An example syslog record from a Cisco ASA device looks like the following:

```
<38>Oct 12 2004 22:45:15 : %ASA-2-106006: Deny inbound UDP from 10.0.1.2/137 to  ↩
    10.0.1.1/137 on interface inside
```

The following configuration file instructs nxlog to accept syslog messages on UDP port 1514. The payload is parsed as syslog and then the ASA/PIX specific fields are extracted. The output is written to a file in JSON format.

**Note**
The variables can be extracted into fields with further parsing rules based on *CiscoMessageNumber*. See the System Log Messages for a complete list. If you intend to create parsing rules for a lot of message types, consider using the pm_pattern module.

```
<Extension json>
    Module      xm_json
</Extension>

<Extension syslgo>
    Module      xm_syslog
</Extension>

<Input in>
    Module  im_udp
    Host  0.0.0.0
    Port  1514
    Exec  parse_syslog_bsd();
    Exec  if ( $Message =~ /^\: \%(ASA|PIX)-(\d)-(\d\d\d\d\d\d)\: (.*)$/ ) \
                { \
                   $CiscoSeverityNumber = $2; \
                   $CiscoMessageNumber = $3; \
                   $Message = $4; \
                } \
                else log_warning("does not match: " + $raw_event);

</Input>

<Output out>
    Module  om_file
    File  "tmp/output.txt"
    Exec  to_json();
</Output>

<Route 1>
    Path  in => out
</Route>
```

### 8.7.2 Checkpoint

The im_checkpoint module can collect logs from Checkpoint devices over the OPSEC LEA protocol. (Note: available in the Enterprise Edition only).

# Chapter 9

# Processing logs

This chapter deals with various tasks that might be required after a log message is received by nxlog.

## 9.1 Parsing various formats

There are a couple standard log file formats in use by various applications such as web servers, firewalls, ftp servers etc. This section tries to give a hand by providing config snippets to parse these formats.

Data is parsed and processed in multiple steps. For stream based data (e.g. files, TCP, SSL) the input module must know the log message boundary in order to be able to read each message frame. The framing depends on the format. The most common type is line-based, where each log message is separated by a linebreak. Log messages may be separated by the header only such as multi-line messages (e.g. stack and exception traces in java). So the first step during message reception is to read the frames, i.e. the log messages. This task is done by the input reader functions which can be specified with the InputType directive. There are a couple built-in input reader functions, others may be registered by modules.

There may be additional parsing involved or required after a message is read. For example when a BSD syslog message is read, the message frame is read by the LineBased input reader. Then this message may be further parsed (i.e. to extract the hostname, date, severity) by modules (such as xm_syslog) or using nxlog language constructs in the Exec directive. This will result in nxlog message fields filled with value. There may be additional processing taken place to further tokenize or parse specific field contents (e.g. $Message) using regular expressions or the pm_pattern module.

### 9.1.1 W3C Extended Log File Format

See the specification draft of the format, it's not all that long. The important header line is the one which starts with `#Fields`. Using this information you can set up a parser rule to tokenize the fields using either xm_csv (as shown in the example below), pm_transformer or using regular expressions directly (similarly to how it's done in the Parsing apache logs in Combined Log Format example).

**Example 9.1** Parsing the W3C Extended Log File Format using xm_csv

Here is a sample log in this format which we need to parse:

```
#Version: 1.0
#Date: 2011-07-01 00:00:00
#Fields: date time cs-method cs-uri
2011-07-01 00:34:23 GET /foo/bar1.html
2011-07-01 12:21:16 GET /foo/bar2.html
2011-07-01 12:45:52 GET /foo/bar3.html
2011-07-01 12:57:34 GET /foo/bar4.html
```

The following configuration reads this file, tokenizes it with the csv parser. Header lines starting with a leading sharp (#) are ignored. The *EventTime* field is constructed from the *date* and *time* fields and is converted to a datetime type. Finally the fields are output as JSON into another file.

```
<Extension w3c>
    Module      xm_csv
    Fields  $date, $time, $HTTPMethod, $HTTPURL
    FieldTypes  string, string, string, string
    Delimiter ' '
    QuoteChar   '"'
    EscapeControl FALSE
    UndefValue  -
</Extension>

<Extension json>
    Module      xm_json
</Extension>

<Input in>
    Module  im_file
    File  "tmp/iis.log"
    ReadFromLast FALSE
    Exec  if $raw_event =~ /^#/ drop();                     \
                else                                            \
                {                                               \
                    w3c->parse_csv();                           \
                    $EventTime = parsedate($date + " " + $time); \
                }
</Input>

<Output out>
    Module  om_file
    Exec  $raw_event = to_json();
    File  "tmp/output.json"
</Output>

<Route 1>
    Path  in => out
</Route>
```

### 9.1.2 NCSA Common Log File Format

FIXME

### 9.1.3 NCSA Combined Log Format

**Example 9.2** Parsing apache logs in Combined Log Format

The following configuration shows an example for filtering access logs and only storing those related to the user 'john':

```
<Input access_log>
  Module  im_file
  File  "/var/log/apache2/access.log"
        Exec    if $raw_event =~ /^(\S+) (\S+) (\S+) \[([^\]]+)\] \"(\S+) (.+) HTTP.\d\.\d ↩
            \" (\d+) (\d+) \"([^\"]+)\" \"([^\"]+)\"/\
                { \
                  $Hostname = $1; \
                  if $3 != '-' $AccountName = $3; \
                  $EventTime = parsedate($4); \
                  $HTTPMethod = $5; \
                  $HTTPURL = $6; \
                  $HTTPResponseStatus = $7; \
                  $FileSize = $8; \
                  $HTTPReferer = $9; \
                  $HTTPUserAgent = $10; \
                }
</Input>

<Output out>
  Module  om_file
  File  '/var/log/john_access.log'
  Exec  if not (defined($AccountName) and ($AccountName == 'john')) drop();
</Output>

<Route apache>
    Path  access_log => out
</Route>
```

### 9.1.4 WebTrends Enhanced Log Format (WELF)

FIXME

### 9.1.5 Field delimited formats (CSV)

Comma, space, semicolon separated field list is a frequently used format. See the xm_csv and/or pm_transformer modules.

### 9.1.6 JSON

See the xm_json module about parsing structured data in JSON.

### 9.1.7 XML

See the xm_xml module about parsing structured data in XML.

## 9.2 Parsing date and time strings

The parsedate() function can be used to efficiently parse strings representing a date. See the Parsing apache logs in Combined Log Format example for sample usage.

The following formats are supported by `parsedate`:

**RFC 3164 date** Legacy syslog messages contain the date in this format which lacks the year. Example:

```
Sun 6 Nov 08:49:37
```

Unfortunately there are some deviations in some implementations, so the following are also recognized:

```
Sun 06 Nov 08:49:37
Sun  6 Nov 08:49:37
```

**RFC 1123** RFC 1123 compliant dates are also supported, including a couple others which are similar such as those defined in RFC 822, RFC 850 and RFC 1036. Here is the concrete list:

```
Sun, 06 Nov 1994 08:49:37 GMT  ; RFC 822, updated by RFC 1123
Sunday, 06-Nov-94 08:49:37 GMT ; RFC 850, obsoleted by RFC 1036
Sun Nov  6 08:49:37 1994       ; ANSI C's asctime() format
Sun, 6 Nov 1994 08:49:37 GMT   ; RFC 822, updated by RFC 1123
Sun, 06 Nov 94 08:49:37 GMT    ; RFC 822
Sun,  6 Nov 94 08:49:37 GMT    ; RFC 822
Sun, 6 Nov 94 08:49:37 GMT     ; RFC 822
Sun, 06 Nov 94 08:49 GMT       ; Unknown
Sun, 6 Nov 94 08:49 GMT        ; Unknown
Sun, 06 Nov 94 8:49:37 GMT     ; Unknown [Elm 70.85]
Sun, 6 Nov 94 8:49:37 GMT      ; Unknown [Elm 70.85]
Mon,  7 Jan 2002 07:21:22 GMT  ; Unknown [Postfix]
Sun, 06-Nov-1994 08:49:37 GMT  ; RFC 850 with four digit years
```

The above formats are recognized even without the leading day of week and without a timezone.

**Apache/NCSA date** This format can be found in Apache access logs (NCSA Combined Log Format) and possibly other sources. Example:

```
24/Aug/2009:16:08:57 +0200
```

**ISO and RFC 3339 date** nxlog can parse the ISO format with or without subsecond resolution, and with or without timezone information. It accepts either a comma (,) or a dot (.) in case there is sub-second resolution. Examples:

```
1977-09-06 01:02:03
1977-09-06 01:02:03.004
1977-09-06T01:02:03.004Z
1977-09-06T01:02:03.004+02:00
2011-5-29 0:3:21
2011-5-29 0:3:21+02:00
2011-5-29 0:3:21.004
2011-5-29 0:3:21.004+02:00
```

**CISCO syslog date** This is an RFC 3164 format with millisecond precision. Example:

```
Nov 3 14:50:30.403
Nov  3 14:50:30.403
Nov 03 14:50:30.403
```

The following format is also recognized (with or without millisecond precision):

```
Nov 3 2005 14:50:30.403
Nov  3 2005 14:50:30.403
Nov 03 2005 14:50:30.403
Nov 3 2005 14:50:30
Nov  3 2005 14:50:30
Nov 03 2005 14:50:30
```

**Windows timestamp format** Example:

```
20100426151354.537875-000
20100426151354.537875000
```

Dates without timezone information are treated as local time. The year will be set to 1970 for dates missing the year such as in the RFC 3164 date format. Use the fix_year() function to correct the year in such cases.

The parsedate() function returns an undefined datetime type. You should take care of checking the return value for errors as in the example below.

**Example 9.3** Using the parsedate() function

Since our regular expression is quite vague, it may match strings which are invalid. In this case parsedate() will return an undefined datetime value.

```
$raw_event = "2020-02-03 04:05:06 ......";
if $raw_event =~ /^(\S+)\s+(\S+)/
{
   $EventTime = parsedate($1 + " " + $2);
}
# making sure $EventTime doesn't stay empty
if not defined($EventTime) $EventTime = now();
```

If the above doesn't cut it, there is also strptime() to parse more exotic formats.

**Example 9.4** Parsing date and time from Exchange logs

The following example is from an Exchange log. The date and time are delimited by a tab (i.e. they are two distinct fields). Also it uses a non standard single digit format instead of fixed width with double digits:

```
2011-5-29 0:3:2 GMT ...
```

To parse this, we can use a regexp and strptime():

```
if $raw_event =~ /^(\d+-\d+-\d+\t\d+:\d+:\d+) GMT/ {
    $EventTime = strptime($1, '%Y-%m-%d%t%H:%M:%S');
}
```

## 9.3 Filtering messages

Message filtering is a process where only a subset of the messages is let through. Filtering is possible using regular expressions or other operators using any of the fields.

### 9.3.1 Using drop()

Use the drop() procedure to conditionally discard messages in an Exec directive.

```
<Input file>
    Module  im_file
    File  "/var/log/myapp/*.log"
    Exec  if not ($raw_event =~ /failed/ or $raw_event =~ /error/) drop();
</Input>

<Output out>
    Module  om_file
```

```
    File  "/var/log/myapp/errors.txt"
</Output>

<Route 1>
    Path file => => out
</Route>
```

### 9.3.2 Filtering through pm_filter

The other option is to use the pm_filter module as in the following example:

```
<Input unix>
    Module  im_uds
    uds   /dev/log
</Input>

<Processor filter>
    Module pm_filter
    Condition $raw_event =~ /failed/ or $raw_event =~ /error/
</Processor>

<Output out>
    Module  om_file
    File  "/var/log/error"
</Output>

<Route 1>
    Path unix => filter => out
</Route>
```

## 9.4 Dealing with multi-line messages

### 9.4.1 Using module variables

This example uses regular expressions and module variables to concatenate lines belonging to a single event.

**Example 9.5** Parsing multiline messages using module variables

```
<Input log4j>
  Module  im_file
  File  "/var/log/tomcat6/catalina.out"
  Exec  if $raw_event =~ /^\d{4}\-\d{2}\-\d{2} \d{2}\:\d{2}\:\d{2},\d{3} \S+ \[\S+\] \- .*/ ↩
      \
         { \
             if defined(get_var('saved')) \
                   { \
           $tmp = $raw_event; \
           $raw_event = get_var('saved'); \
           set_var('saved', $tmp); \
           $tmp = undef; \
           log_info($raw_event); \
        } \
        else \
        { \
      set_var('saved', $raw_event); \
      drop(); \
        } \
    } \
    else \
    { \
      set_var('saved', get_var('saved') + "\n" + $raw_event);\
      drop(); \
    }
</Input>

<Output out>
  Module  om_null
</Output>

<Route tomcat>
    Path  log4j => out
</Route>
```

Unfortunately this solution has a minor flaw. The log message of an event is only forwarded if a new log is read, otherwise it is kept in the 'saved' variable indefinitely.

### 9.4.2 Using xm_multiline

There is a dedicated extension module xm_multiline which makes it easier to deal with multi-line messages without the need to use module variables and write complex rules.

## 9.5 Alerting, calling external scripts and programs

There are a couple ways to invoke external scripts and pass data to them.

### 9.5.1 Sending all messages to an external program

Using the om_exec module, all messages can be piped to an external program or script which should be running until the module (or nxlog) is stopped.

### 9.5.2 Invoking a script or program for each message

The xm_exec module provides two procedure calls, exec() and exec_async(), to spawn an external script or program. See this file rotation example where bzip is executed to compress a logfile.

### 9.5.3 Alerting

Alerting is a process when a notification message is triggered if a certain condition is satisfied. Alerting can be implemented using one of the previous two modules. When using om_exec, the alerting script will receive all messages. The following example shows how to send an email using xm_exec when a regexp condition is met:

```
<Extension exec>
    Module  xm_exec
</Extension>

<Input in>
    Module  im_tcp
    Host  0.0.0.0
    Port  1514
    Exec  if $raw_event =~ /alertcondition/ {  ↩
                                                    \
                  exec_async("/bin/sh", "-c", 'echo "' + $Hostname + '\n\nRawEvent:\n' +  ↩
                      $raw_event + \
                          '"|/usr/bin/mail -a "Content-Type: text/plain; charset=UTF-8" -s ↩
                               "ALERT" '  \
                          + 'user@domain.com' );  ↩
                                                                                  \
              }
</Input>

<Output out>
    Module  om_file
    File  "/var/log/messages"
</Output>

<Route r>
    Path  in => out
</Route>
```

## 9.6 Rewriting and modifying messages

There are many ways to modify log messages. A simple method which does not always work is to modify the $raw_event field (in case of syslog) without parsing the message. This can be done with regular expressions using capturing, for example:

```
if $raw_event =~ /^(aaaa)(replaceME)(.+)/ $raw_event = $1 + 'replaceMENT' + $3;
```

The more complex method is to parse the message into fields, modify some fields and finally reconstruct the message from the fields. The conditional rewrite of the syslog facility example shows such a syslog message modification method.

## 9.7 Message format conversion

To convert between CSV formats, see this example.

The following example shows an nxlog configuration which receives IETF syslog over UDP and forwards in the old BSD syslog format over TCP:

```
<Extension syslog>
    Module  xm_syslog
</Extension>

<Input in>
    Module  im_udp
    Port  514
    Host  0.0.0.0
    Exec  parse_syslog_ietf(); to_syslog_bsd();
</Input>

<Output out>
    Module  om_tcp
    Host  1.2.3.4
    Port  1514
</Output>

<Route 1>
    Path  in => out
</Route>
```

Take a look at the pm_transformer module which can do format conversion.

The requirements and possibilities for format conversion are endless. It is possible to do this using the nxlog language, dedicated modules, functions and procedures. For special cases a processor or extension module can be crafted to achieve this.

## 9.8 Character set conversion

It is recommended to normalize logs to UTF-8. Even if you don't, there may be cases where you need to convert a string (a field) or the whole message to another character set. See th xm_charconv module which adds support for character set conversion.

## 9.9 Discarding messages

See the drop() procedure which can be invoked conditionally in the Exec directive. The Filtering messages section shows an example for using drop(). There is also om_null which could work in some situations.

## 9.10 Rate limiting

The poor man's tool for rate limiting is the sleep() procedure.

**Example 9.6** Using sleep for rate limiting

In the following example `sleep` is invoked with 500 microseconds. This means that the input module will be able to read at most 2000 messages per second.

```
<Input in>
    Module  im_tcp
    Host  0.0.0.0
    Port  1514
    Exec  sleep(500);
</Input>

<Output out>
    Module  om_null
</Output>

<Route r>
    Path  in => out
</Route>
```

While this is not very precise because the module can do additional processing which can add some to the total execution time, it gets fairly close.

**Note**
Be careful if you are planning to add rate limiting to a route which reads logs over UDP.

## 9.11 Buffering

Each input module has its own read buffer which is used to fill with data during a read on a socket or file. Each processor and output has a limited queue where the log messages are put by the preceeding module in the route. The default limit for these internal queues is 100. Nevertheless, for buffering bigger amount of data, the pm_buffer module can do disk and memory based buffering.

## 9.12 Pattern matching and message classification

Pattern matching is commonly used for message classification. When certain strings are detected in a log message, the message gets tagged with classifiers. Thus it is possible to query or take action on these type of messages via the classifier only.

### 9.12.1 Regular expressions in the Exec directive

The first option is to use the =~ operator in an Exec directive. The following code snippet shows an example for message classification.

**Example 9.7** Regular expression based message classification

When the contents of the Message field match against the regular expression, the `AccountName` and `AccountID` fields are filled with the appropriate values from the referenced captured substrings. Additionally the value `LoginEvent` is stored in the `Action` field.

```
if $Message =~ /^pam_unix\(sshd:session\): session opened for user (\S+) by \(uid=(\d+)\)/  ↩
    {
    $AccountName = $1;
    $AccountID = integer($2);
    $Action = 'LoginEvent';
}
```

### 9.12.2 Using pm_pattern

When there are a lot of patterns, writing these in the configuration file will make it bloated, ugly and is not as efficient as using the pm_pattern module. The above pattern matching rule can be defined in pm_pattern's XML format the following way which will accomplish the same.

```
<pattern>
   <id>42</id>
   <name>ssh_pam_session_opened</name>
   <description>ssh pam session opened</description>
   <matchfield>
      <name>Message</name>
      <type>REGEXP</type>
      <value>^pam_unix\(sshd:session\): session opened for user (\S+) by \(uid=(\d+)\)</ ↩
          value>
      <capturedfield>
         <name>AccountName</name>
         <type>STRING</type>
      </capturedfield>
      <capturedfield>
         <name>AccountID</name>
         <type>INTEGER</type>
      </capturedfield>
   </matchfield>
   <set>
      <field>
          <name>Action</name>
          <type>STRING</type>
          <value>LoginEvent</value>
      </field>
   </set>
</pattern>
```

## 9.13 Event correlation

It is possible to write correlation rules in the nxlog language using the builtin features such as the variables and statistical counters. While these are quite powerful, some cases cannot be detected with these, escpecially thoses conditions which require a sliding window.

A dedicated nxlog module, pm_evcorr is available for advanced correlation requirements. It has similar features as SEC and greatly enhances the correlation capabilites of nxlog.

## 9.14 Log rotation and retention

nxlog makes it possible to implement custom log rotation and retention policies for files written by nxlog and files written by other sources. The om_file and xm_fileop modules export various procedures which can be used for this purpose:

- rotate_to
- reopen
- file_cycle
- file_rename
- file_remove
- file_copy
- file_truncate

Should these native language construct be insufficient, it is always possible to call an exeternal script or program.

**Example 9.8** Rotation of the internal LogFile

This example shows how to rotate the internal logfile based on time and size.

```
#define LOGFILE C:\Program Files\nxlog\data\nxlog.log
define LOGFILE /var/log/nxlog/nxlog.log

<Extension fileop>
    Module      xm_fileop

    # Check the size of our log file every hour and rotate if it is larger than 1Mb
    <Schedule>
        Every   1 hour
        Exec    if (file_size('%LOGFILE%') >= 1M) file_cycle('%LOGFILE%', 2);
    </Schedule>

    # Rotate our log file every week on sunday at midnight
    <Schedule>
        When    @weekly
        Exec    file_cycle('%LOGFILE%', 2);
    </Schedule>
</Extension>
```

**Example 9.9** File rotation based on size

```
<Extension exec>
    Module  xm_exec
</Extension>

<Extension syslog>
    Module  xm_syslog
</Extension>

<Input in>
    Module  im_tcp
    Port  1514
    Host  0.0.0.0
    Exec  parse_syslog_bsd();
</Input>

<Output out>
    Module  om_file
    File  "tmp/output_" + $Hostname + "_" + month(now())
    Exec  if out->file_size() > 15M \
                { \
                   $newfile = "tmp/output_" + $Hostname + "_" + strftime(now(), "%Y%m%d%H%M ↩
                       %S"); \
                   out->rotate_to($newfile); \
                   exec_async("/bin/bzip2", $newfile); \
                }
</Output>

<Route 1>
    Path  in => out
</Route>
```

## 9.15 Explicit drop

nxlog does not drop messages voluntarily. The built-in flow control mechanism ensures that the input modules will pause until the output modules can write. This can be problematic in some situations when it is preferable to drop messages than to block. The following example illustrates the use of the drop() procedure used in conjunction with pm_buffer.

**Example 9.10** Explicitly dropping messages when the network module is blocked

In the following configuration we use two routes which send the input read from the UDP socket to two outputs, a file and a TCP destination. Without this setup when the TCP connection can transmit slower than the rate of incoming UDP packets or the TCP connetion is down, the whole chain (both routes) would be blocked which would result in dropped UDP packets. In this situation it is preferable to only drop log messages in the `tcp` route. In this route a pm_buffer module is used and the size of the buffer is checked. If the buffer size goes over a certain limit we assume that the TCP output is blocked (or sending too slow) and instruct to drop log messages using the drop() procedure. This way the UDP input will not get paused and all messages will be written to the output file regardless of the state of the TCP connection.

```
<Processor buffer>
  Module  pm_buffer
  WarnLimit 800
  MaxSize 1000
  Type  Mem
  Exec  if buffer_size() >= 80k drop();
</Processor>

<Input udpin>
  Module  im_udp
  Host  0.0.0.0
  Port  1514
</Input>

<Output tcpout>
  Module  om_tcp
  Host  192.168.1.1
  Port  1515
</Output>

<Output fileout>
  Module  om_file
  File  'out.txt'
</Output>

<Route tcp>
    Path  udpin => buffer => tcpout
</Route>
<Route file>
    Path  udpin => fileout
</Route>
```

# Chapter 10

# Forwarding and storing logs

This chapter deals with the output side, i.e. how to forward, send and store messages to various destinations.

## 10.1 Data format of the output

In addition to the transport protocol, the data format is an important factor. If the remote receiver cannot parse the message, it will likely discard or it may be just improperly processed.

**Syslog** There are two formats, the older BSD Syslog and the newer IETF syslog format as defined by RFC 3164 and RFC 5424. The transport protocol in syslog can be UDP, TCP or SSL. See the xm_syslog module about formatting and sending syslog messages to remote hosts over the network.

**Syslog SNARE** The SNARE agent format is a special format on top of BSD Syslog which is used and understood by several tools and log analyzer frontends. This format is most useful when forwaring Windows EventLog data, i.e. in conjunction with im_mseventlog and/or im_msvistalog. The to_syslog_snare procedure call can construct SNARE syslog formatted messages. The following example shows a configuration for reading the windows eventlog and forwarding it over UDP in the SNARE Agent format.

**Example 10.1** Forwarding EventLogs from a windows machine to a remote host in the SNARE Agent format

```
<Extension syslog>
    Module      xm_syslog
</Extension>

<Input in>
    Module      im_msvistalog
</Input>

<Output out>
    Module      om_udp
    Host        192.168.1.1
    Port        514
    Exec        to_syslog_snare();
</Output>

<Route 1>
    Path        in => out
</Route>
```

**NXLOG Binary format** The binary format is only understood by nxlog. All the fields are preserved when the data is sent in this format so there is no need to parse it again. You need to add this to the output module:

```
OutputType    Binary
```

And the receiver nxlog module should contain this:

```
InputType    Binary
```

**CSV** To send logs in CSV, use the xm_csv or the pm_transformer module.

**Graylog Extended Log Format (GELF)** The xm_gelf module can be used to generate GELF output.

**JSON** See the xm_json module docs about generating JSON output.

**XML** See the xm_xml module docs about generating XML output.

## 10.2 Forwarding over the network

The following network protocols can be used. There is a trade-off between speed, reliablilty, compatibility and security.

**UDP** To send logs in UDP packets, use the om_udp module.

**TCP** To send logs over TCP, use the om_tcp module.

**SSL/TLS** To send logs over a trusted secure SSL connection, use the om_ssl module.

## 10.3 Sending to sockets and files

**Files** To store logs in local files, use the om_file module.

**Piping to an external script or program** To send logs to an external program or script, use the om_exec module.

**Unix Domain Socket** To send logs to a unix domain socket, use the om_uds module.

## 10.4 Storing logs in a database

The om_dbi and om_odbc modules can be used to store logs in databases.

# Chapter 11

# Tips and tricks

This chapter addresses some common problems or log management requirements.

## 11.1 Detecting a dead agent or log source

It is a common requirement to be able to detect conditions when there are no log messages coming from a source. This usually indicates a problem with the log source, such as a broken network connection, server down or an application/system service is stuck. Usually this problem should be detected by monitoring tools (nagios, openview etc), but the absence of logs can be also a good reason to investigate such a situation.

---

**Note**
The im_mark module exists for a similar purpose. It can emit messages periodically in order to show that the system logger is not suffering problems.

---

The solution to this problem is the combined use of statistical counters and Scheduled checks. The input module can update a statistical counter configured to calculate events per hour for example. In the same input module a Schedule block is defined which checks the value of the statistical counter periodically. When the event rate is zero or drops below a certain limit, an appropriate action can be executed such as sending out an alert email or generating an internal warning message. Note that probably there are other ways to solve this issue and this method might not be the optimal for all situations.

**Example 11.1** Alerting on absence of log messages

The following configuration example creates a statistical counter in the context of the im_tcp module to calculate the number of events received per hour. The Schedule block within the context of the same module checks the value of the "msgrate" statistical counter and generates an internal error message when there were no logs received in the past hour.

```
<Input in>
    Module  im_tcp
    Port  2345
    Exec  create_stat("msgrate", "RATE", 3600); add_stat("msgrate", 1);

    <Schedule>
  Every 3600 sec
  Exec  create_stat("msgrate", "RATE", 10); add_stat("msgrate", 0);
  Exec  if defined get_stat("msgrate") and get_stat("msgrate") <= 1 \
    { \
        log_error("No messages received from the source!"); \
    }
    </Schedule>
</Input>

<Output out>
    Module  om_file
    File  "tmp/output"
</Output>

<Route 1>
    Path  in => out
</Route>
```

# Chapter 12

# Troubleshooting

According to Murphy, anything that can go wrong will go wrong. This chapter is to help diagnosing problems, be that configuration errors or possible bugs.

## 12.1 nxlog's internal logs

While nxlog is a tool to handle logs from external sources, it can and will emit logs about its own operations. These are essential to troubleshoot problems.

### 12.1.1 Check the contents of the LogFile

nxlog will log important events including errors and warnings into its logfile. So the first place to look for errors is the LogFile. If this directive is not specified in the configuration, you should add it.

---

**Note**
Some windows applications (e.g. wordpad) cannot open the logfile while nxlog is running because of exclusive file locking. Use a text file viewer which does not lock the file (e.g. notepad).

---

### 12.1.2 Injecting own logs into a route

Internal logs can be read as a log source with the im_internal module. This makes it possible to forward the internal logs over the network for example.

---

**Note**
This method will not work if the route which im_internal is part of is not functional. Logging with LogFile is more fault-tolerant and this is the recommended way for troubleshooting.

---

### 12.1.3 LogLevel

Internal logs are emitted only on LogLevel of INFO and above. It is possible to get detailed information about what nxlog is doing by setting LogLevel to DEBUG. This can produce an extreme amount of logs, it is recommended to enable this only for troubleshooting.

### 12.1.4 Running in foreground

When nxlog is running in foreground, it will emit logs to STDOUT and STDERR so the logs will be visible in the running terminal. This is the same log which is written to the LogFile. It can be started to run in foreground with **nxlog -f**.

### 12.1.5 Using log_info() in the Exec directive

Internal logs can be emitted from the configuration via the log_info() procedure call in the Exec directive. This can be extremely useful to print and debug message contents. Consider the following example:

```
<Input in>
    Module  im_udp
    Port  514
    Exec        if $raw_event =~ /keyword/ log_info("FOUND KEYWORD IN MSG: [" + $raw_event  ↩
        + "]");
</Input>
```

Anything which is printed with the log_info() and family of procedure calls will appear in LogFile, on the STDOUT/STDERR of nxlog in foreground mode and wil be emitted by im_internal.

## 12.2 Common problems

This section will list a couple problems which you are likely to run into.

### 12.2.1 Missing logdata

As discussed in the architecture chapter, logs are received by input modules, forwarded to the processor modules and finally handled by the output modules. When these modules handle a log message, the Exec directive is evaluated. There are a few situations when such statements can be evaluated but the required log is not available in the current context. When the so called logdata is not available in the current context, any dependent operation will fail and the evaluation of the Exec code will terminate. Most notably these operations are field assignments and function or procedure calls which access fields such as convert_fields(). Consider the following example.

**Example 12.1** Assignment after drop()

In this example the message is conditionally dropped. When the $raw_event field matches the keyword, the drop() operation is invoked which discards the log completely. If a subsequent statement follows which accesses the log, it will fail.

```
<Input in>
    Module  im_udp
    Port  514
    Exec        if $raw_event =~ /keyword/ drop(); $EventTime = now();
</Input>
```

In this case the following internal error log will be emitted:

```
missing logdata, assignment possibly after drop()
```

The following config snippet fixes the above error by correctly using conditional statements.

```
<Input in>
    Module  im_udp
    Port  514
    Exec        if $raw_event =~ /keyword/  \
                   drop();                  \
                else                        \
                   $EventTime = now();
</Input>
```

The "logdata will be missing" in the following cases:

Accessing a field or calling a procedure/function which needs the logdata after the drop() procedure.
Accessing a field or calling a procedure/function which needs the logdata from the Exec directive of a Schedule block. Since this sch

### 12.2.2 nxlog failed to start, cannot read configuration file

You may receive this error message in nxlog.log when nxlog fails to start:

```
nxlog failed to start: Invalid keyword: ÿþ# at C:\Program Files (x86)\nxlog\conf\nxlog.conf ↩
    :1
```

Some text editors may save the configuration file in UTF-16 or in UTF-8 with a BOM header. The configuration file must be encoded in ASCII or plain UTF-8, otherwise you will get this error. On windows using notepad.exe should work properly.

### 12.2.3 nxlog.log is in use by another application and cannot be accessed

You may receive this error message on Windows when trying to open the logfile (usually `nxlog.log`) with a text editor which uses exclusive locking. You can only open the log after nxlog is stopped. By using a text viewer or text editor which does not use exclusive locking (such as notepad.exe), you can open the logfile without the need to stop nxlog.

### 12.2.4 Connection refused when trying to connect to im_tcp or im_ssl

Make sure that you have no firewall blocking the connection. The interface address or the hostname which resolves to the interface address must be accessible from the outside. See the Host directive of im_tcp.

## 12.3 Debugging and dumping messages

When creating complex processing rules and configurations, you will most likely run into a problem and need to debug the stream of event log messages to see

- what has been received/read by the input(s),
- whether some required field exists and what its value is,
- if the parser is working correctly and populating the fields as it should,
- all the fields and their values contained in the event log after parsing.

The following configuration snippets show some examples how this can be done.

**Example 12.2** Writing the values of fields to an external file

The file_write() procedure provided by the xm_fileop module can be used to dump information into an external file.

```
<Extension fileop>
    Module      xm_fileop
</Extension>

<Extension syslog>
    Module      xm_syslog
</Extension>

<Input in>
    Module      im_tcp
    Host        0.0.0.0
    Port        1514
    Exec  parse_syslog_bsd();
    # Debug SyslogSeverity and Hostname fields
    Exec        file_write("/tmp/debug.txt", "Severity: " + $SyslogSeverity + ", Hostname:  ↩
        " + $Hostname);
</Input>

<Output out>
    Module      om_null
</Output>

<Route r>
    Path        in => out
</Route>
```

**Example 12.3** Writing the values of fields to the internal log

Using the log_info procedure the values can be sent to the internal log. This will be visible in the file defined with the LogFile global directive, in the input from the im_internal module and on standard output when running **nxlog** in foreground with the `-f` command line switch.

```
<Extension syslog>
    Module      xm_syslog
</Extension>

<Input in>
    Module      im_tcp
    Host        0.0.0.0
    Port        1514
    Exec  parse_syslog_bsd();
    # Debug SyslogSeverity and Hostname fields
    Exec        log_info("Severity: " + $SyslogSeverity + ", Hostname: " + $Hostname);
</Input>

<Output out>
    Module      om_null
</Output>

<Route r>
    Path        in => out
</Route>
```

**Example 12.4** Dumping all the fields

Using the to_json procedure provided by the xm_json module, all the fields can be dumped. If you prefer, you can use the to_xml procedure provided by the xm_xml module.

```
<Extension syslog>
    Module      xm_syslog
</Extension>

<Extension json>
    Module      xm_json
</Extension>

<Input in>
    Module      im_tcp
    Host        0.0.0.0
    Port        1514
    Exec  parse_syslog_bsd();
    # Dump $raw_event
    Exec  log_info("raw event is: " + $raw_event);
    # Dump fields in JSON
    Exec        log_info("Other fields are: " + to_json());
</Input>

<Output out>
    Module      om_null
</Output>

<Route r>
    Path        in => out
</Route>
```

This will produce the following output in the logs:

```
2012-05-18 13:11:35 INFO raw event is: <27>2010-10-12 12:49:06 host app[12345]: test  ↩
    message
2012-05-18 13:11:35 INFO Other fields are: {"MessageSourceAddress":"127.0.0.1"," ↩
    EventReceivedTime":"2012-05-18 13:11:35",
            "SourceModuleName":"in","SourceModuleType":"im_tcp","SyslogFacilityValue":3," ↩
                SyslogFacility":"DAEMON",
            "SyslogSeverityValue":3,"SyslogSeverity":"ERR","SeverityValue":4,"Severity":" ↩
                ERROR","Hostname":"host",
            "EventTime":"2010-10-12 12:49:06","SourceName":"app","ProcessID":"12345"," ↩
                Message":"test message"}
```

In some cases nxlog is already receiving some invalid data it cannot grok. To verify that indeed this is the case, use a network traffic analyzer such as wireshark or tcpdump.