# The logstash Book

## Log management made easy

James Turnbull

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James Turnbull

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# Chapter 1

# Shipping Events

Our log management project is going well. We've got some of our Syslog messages centralized and searchable but we've hit a snag. We've discovered some hosts and devices in our environment that can't be managed with an agent. There are a few different devices that all have varying reasons for not being able to run the agent:

- Small virtual machine with limited memory insufficient to run an agent.
- Some embedded devices and appliances without the ability to install software and hence run the agent.
- Some outsourced managed hosts where you can't install software of your own.

So to address these hosts we're going to make a slight digression in our project and look at alternatives to running an agent and getting events to our central Logstash server.

We're going to look at using Syslog, the traditional Linux/Unix logging framework, for sending events to Logstash.

We're also going to explore the Filebeat log forwarding agent, part of the Beats family of collection tools, which also include Network data, Metrics and Windows

Event Log data. We first saw Filebeat in Chapter 3 but we're going to dive a bit deeper into its capabilities.

## Using Syslog

The easiest way we can get our recalcitrant devices to log to Logstash is using a more traditional logging method: Syslog. Instead of using an agent to send our logs we can enable existing Syslog daemons or services to do it for us.

To do this we're going to configure our central Logstash server to receive Syslog messages and then configure Syslog on the remote hosts to send to it. We're also going to show you how to configure a variety of Syslog services.

### A quick introduction to Syslog

Syslog is one of the original standards for computer logging. It was designed by Eric Allman as part of Sendmail and has grown to support logging from a variety of platforms and applications. It has become the default mechanism for logging on Unix and Unix-like systems like Linux and is heavily used by applications running on these platforms as well as printers and networking devices like routers, switches and firewalls.

As a result of its ubiquity on these types of platforms it's a commonly used means to centralize logs from disparate sources. Each message generated by Syslog (and there are variations between platforms) is roughly structured like so:

**Listing 1.1: A Syslog message**

```
Dec 15 14:29:31 joker systemd-logind[2113]: New session 31581 of
 user bob.
```

They consist of a timestamp, the host that generated the message (here `joker`), the process and process ID (PID) that generated the message and the content of the message.

Messages also have metadata attached to them in the form of facilities and severities. Messages refer to a facility like:

- AUTH
- KERN
- MAIL
- etcetera

The facility specifies the type of message generated, for example messages from the `AUTH` facility usually relate to security or authorization, the `KERN` facility are usually kernel messages or the `MAIL` facility usually indicates it was generated by a mail subsystem or application. There are a wide variety of facilities including custom facilities, prefixed with `LOCAL` and a digit: `LOCAL0` to `LOCAL7`, that you can use for your own messages.

Messages also have a severity assigned, for example `EMERGENCY`, `ALERT`, and `CRITICAL`, ranging down to `NOTICE`, `INFO` and `DEBUG`.

---

**TIP** You can find more details on Syslog here.

---

## Configuring Logstash for Syslog

Configuring Logstash to receive Syslog messages is really easy. All we need to do is add the `syslog` input plugin to our central server's `/etc/logstash/conf.d/central.conf` configuration file. Let's do that now:

**Listing 1.2: Adding the ‘syslog‘ input**

```
input {
  beats {
    port => 5044
  }
  syslog {
    type => syslog
    port => 5514
  }
}
output {
  stdout { }
  elasticsearch { }
}
```

You can see that in addition to our `beats` input we've now got `syslog` enabled and we've specified two options:

**Listing 1.3: The ‘syslog‘ input**

```
syslog {
  type => syslog
  port => 5514
}
```

The first option, `type`, tells Logstash to label incoming events as `syslog` to help us to manage, filter and output these events. The second option, `port`, opens port 5514 for both TCP and UDP and listens for Syslog messages. By default most Syslog servers can use either TCP or UDP to send Syslog messages and when being used to centralize Syslog messages they generally listen on port 514. Indeed, if not specified, the `port` option defaults to 514. We've chosen a different port here to separate out Logstash traffic from any existing Syslog traffic flows you might

have. Additionally, since we didn't specify an interface (which we could do using the `host` option) the `syslog` plugin will bind to `0.0.0.0` or all interfaces.

**TIP** You can find the full list of options for the `syslog` input plugin here.

Now, if we restart our Logstash agent, we should have a Syslog listener running on our central server.

**Listing 1.4: Restarting the Logstash server**

```
$ sudo service logstash restart
```

You should see in your `/var/log/logstash/logstash.log` log file some lines indicating the `syslog` input plugin has started:

**Listing 1.5: Syslog input startup output**

```
{:message=>"Starting syslog udp listener", :address=>"
0.0.0.0:5514", :level=>:info}
{:message=>"Starting syslog tcp listener", :address=>"
0.0.0.0:5514", :level=>:info}
```

**NOTE** To ensure connectivity you will need make sure any host or intervening network firewalls allow connections on TCP and UDP between hosts sending Syslog messages and the central server on port 5514.

## Configuring Syslog on remote agents

There are a wide variety of hosts and devices we need to configure to send Syslog messages to our Logstash central server. Some will be configurable by simply specifying the target host and port, for example many appliances or managed devices. In their case we'd specify the hostname or IP address of our central server and the requisite port number.

*Central server*

- Hostname: smoker.example.com
- IP Address: 10.0.0.1
- Syslog port: 5514

In other cases our host might require its Syslog daemon or service to be specifically configured. We're going to look at how to configure three of the typically used Syslog daemons to send messages to Logstash:

- RSyslog
- Syslog-NG
- Syslogd

We're not going to go into great detail about how each of these Syslog servers works but rather focus on how to send Syslog messages to Logstash. Nor are we going to secure the connections. The `syslog` input and the Syslog servers will be receiving and sending messages unencrypted and unauthenticated.

Assuming we've configured all of these Syslog servers our final environment might look something like:

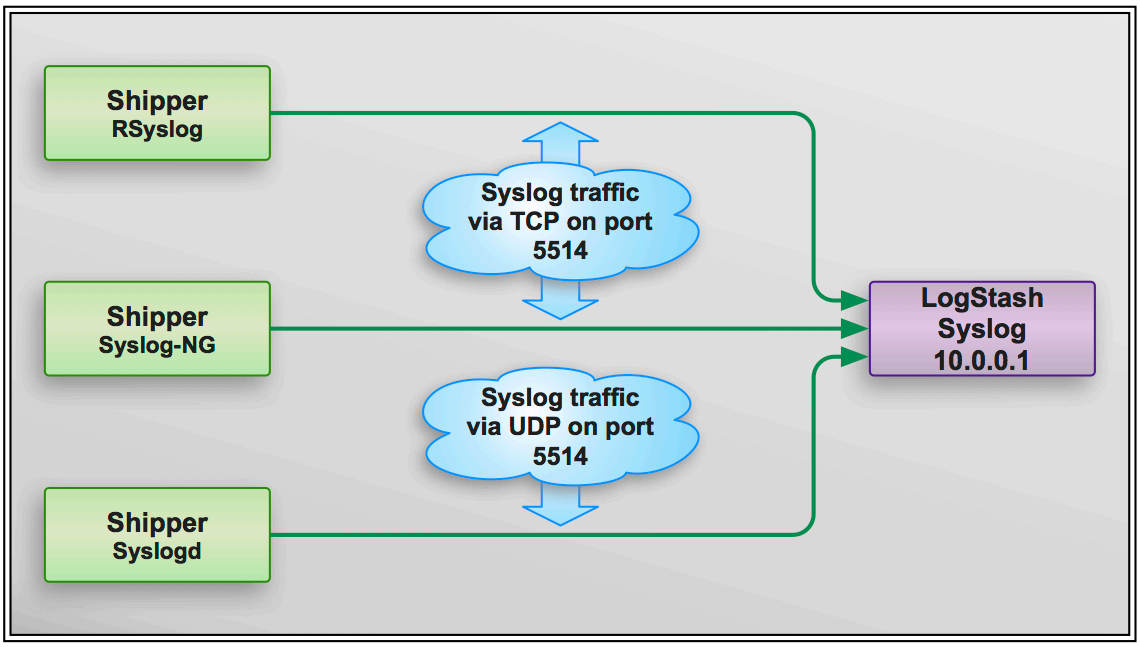


Figure 1.1: Syslog shipping to Logstash

**WARNING** As I mentioned above Syslog has some variations between platforms. The Logstash `syslog` input plugin supports RFC3164 style syslog with the exception that the date format can either be in the RFC3164 style or in ISO8601. If your Syslog output isn't compliant with RFC3164 then this plugin will probably not work. We'll look at custom filtering in Chapter 5 that may help parse your specific Syslog variant.

### Configuring RSyslog

The RSyslog daemon has become popular on many distributions, indeed it has become the default Syslog daemon on recent versions of Ubuntu, CentOS, Fedora, Debian, openSuSE and others. It can process log files, handle local Syslog and

comes with a modular plug-in system.

---

**TIP** In addition to supporting Syslog output Logstash also supports the RSyslog specific RELP protocol.

---

We're going to add Syslog message forwarding to our RSyslog configuration file, usually `/etc/rsyslog.conf` (or on some platforms inside the `/etc/rsyslog.d/` directory). To do so we're going to add the following line to the end of our `/etc/rsyslog.conf` file:

**Listing 1.6: Configuring RSyslog for Logstash**

```
*.* @@smoker.example.com:5514
```

---

**NOTE** If you specify the hostname, here `smoker.example.com`, your host will need to be able to resolve it via DNS.

---

This tells RSyslog to send all messages using `*.*`, which indicates all facilities and priorities. You can specify one or more facilities or priorities if you wish, for example:

**Listing 1.7: Specifying RSyslog facilities or priorities**

```
mail.* @@smoker.example.com:5514
*.emerg @@joker.example.com:5514
```

The first line would send all `mail` facility messages to our `smoker` host and the second would send all messages of `emerg` priority to the host `joker`.

The `@@` tells RSyslog to use TCP to send the messages. Specifying a single `@` uses UDP as a transport.

**TIP** I would strongly recommend using the more reliable and resilient TCP protocol to send your Syslog messages.

If we then restart the RSyslog daemon, like so:

**Listing 1.8: Restarting RSyslog**

```
$ sudo /etc/init.d/rsyslog restart
```

Our host will now be sending all the messages collected by RSyslog to our central Logstash server.

### The RSyslog imfile module

One of RSyslog's modules provides another method of sending log entries from RSyslog. You can use the imfile module to transmit the contents of files on the

host via Syslog. The `imfile` module works much like Logstash's `file` input and supports file rotation and tracks the currently processed entry in the file.

To send a specific file via RSyslog we need to enable the `imfile` module and then specify the file to be processed. Let's update our `/etc/rsyslog.conf` file (or if your platform supports the `/etc/rsyslog.d` directory then you can create a file-specific configuration file in that directory).

**Listing 1.9: Monitoring files with the imfile module**

```
module(load="imfile" PollingInterval="10")

input(type="imfile"
      File="/var/log/riemann/riemann.log"
      Tag="riemann")
```

The first line loads the `imfile` module and sets the polling internal for events to 10 seconds. It only needs to be specified once in your configuration.

The next block specifies the file from which to collect events. It has a `type` of `imfile`, telling RSyslog to use the `imfile` module. The `File` attribute specifies the name of the file to poll. The `File` attribute also supports wildcards.

**Listing 1.10: Monitoring files with an imfile wildcard**

```
input(type="imfile"
      File="/var/log/riemann/*.log"
      Tag="riemann")
```

This would collect all events from all files in the `/var/log/riemann` directory with a suffix of `.log`.

Lastly, the `Tag` attribute tags these messages in RSyslog with a tag of `riemann`.

Now, once you've restarted RSyslog, it will be monitoring this file and sending any new lines via Syslog to our Logstash instance (assuming we've configured RSyslog as suggested in the previous section).

---

**TIP** You can find the full RSyslog documentation here.

---

### Configuring Syslog-NG

Whilst largely replaced in modern distributions by RSyslog, there are still a lot of platforms that use Syslog-NG including Gentoo, FreeBSD, Arch Linux and HP UX. Like RSyslog, Syslog-NG is a fully featured Syslog server but its configuration is a bit more substantial than what we needed for RSyslog.

Syslog-NG configuration comes in four types:

- `source` statements - where log messages come from.
- `destination` statements - where to send log messages.
- `filter` statements - how to filter or process log messages.
- `log` statements - actions that combine source, destination and filter statements.

Let's look inside an existing Syslog-NG configuration. Its configuration file is usually `/etc/syslog-ng.conf` or `/etc/syslog-ng/syslog-ng.conf`. You'll usually find a line something like this inside:

**Listing 1.11: Syslog-NG s_src source statement**

```
source s_src { unix-dgram("/dev/log"); internal(); file("/proc/
kmsg" program_override("kernel"));
};
```

This basic `source` statement collects Syslog messages from the host, kernel messages and any internal messages to Syslog-NG. This is usually the default `source` on most distributions and platforms. If you don't see this `source` your Syslog-NG server may not be collecting Syslog messages and you should validate its configuration. You may also see additional `source` statements, for example collecting messages via the network from other hosts.

We then need to define a new `destination` for our Logstash server. We do this with a line like so:

**Listing 1.12: New Syslog-NG destination**

```
destination d_logstash { tcp("10.0.0.1" port(5144)); };
```

This tells Syslog-NG to send messages to IP address `10.0.0.1` on port 5144 via TCP. If you have domain name resolution you could instead specify our Logstash server's host name.

Lastly, we will need to specify a `log` action to combine our `source` or sources and our `destination`

**Listing 1.13: New Syslog-NG log action**

```
log { source(s_src); destination(d_logstash); };
```

This will send all Syslog messages from the `s_src` source to the `d_logstash` destination which is our central Logstash server.

To enable the message transmission you'll need to restart Syslog-NG like so:

**Listing 1.14: Restarting Syslog-NG**

```
$ sudo /etc/init.d/syslog-ng restart
```

**TIP** You can find the full Syslog-NG documentation here.

### Configuring Syslogd

The last Syslog variant we're going to look at configuring is the older style Syslogd. While less common it's still frequently seen on older distribution versions and especially in the more traditional Unix platforms.

**TIP** This includes many of the *BSD-based platforms including OSX.

Configuring Syslogd to send on messages is very simple. Simply find your Syslogd

configuration file, usually `/etc/syslog.conf` and add the following line at the end of the file:

**Listing 1.15: Configuring Syslogd for Logstash**

```
*.* @smoker.example.com:5514
```

**TIP** You can find more details about Syslogd configuration here.

This will send all messages to the host `smoker.example.com` on UDP port 5514. It is important to note that Syslogd generally does not support sending messages via TCP. This may be a problem for you given UDP is a somewhat unreliable protocol: there is absolutely no guarantee that the datagram will be delivered to the destination host when using UDP. Failure rates are typically low but for certain types of data including log events losing them is potentially problematic. You should take this into consideration when using Syslogd and if possible upgrade to a more fully featured Syslog server like Syslog-NG or RSyslog.

Once you've configured the Syslogd you'll need to restart the daemon, for example:

**Listing 1.16: Restarting Syslogd**

```
$ sudo /etc/init.d/syslogd restart
```

### Other Syslog daemons

There are a variety of other Syslog daemons including several for Microsoft Windows. If you need to configure these then please see their documentation.

- Snare for Windows
- KiwiSyslog
- Syslog-Win32
- Cisco devices
- Checkpoint
- Juniper
- F5 BigIP
- HP Jet Direct

---

**WARNING** Remember not all of these devices will produce RFC-compliant Syslog output and may not work with the `syslog` input. We'll look at custom filtering in Chapter 5 that may assist in working with your Syslog variant. This blog post on Syslog parsing might also interest.

---

### Testing with logger

Most Unix and Unix-like platforms come with a handy utility called `logger`. It generates Syslog messages that allow you to easily test if your Syslog configuration is working. You can use it like so:

**Listing 1.17: Testing with logger**

```
$ logger "This is a syslog message"
```

This will generate a message from the `user` facility of the priority `notice` (`user.notice`) and send it to your Syslog process.

**TIP** You can see full options to change the facility and priority of logger messages here.

Assuming everything is set up and functioning you should see the resulting log event appear on your Logstash server:

**Listing 1.18: Logstash log event from Syslog**

```
{
  "host" => "joker.example.com",
  "priority" => 13,
  "timestamp" => "Dec 17 16:00:35",
  "logsource" => "joker.example.com",
  "program" => "bob",
  "pid" => "23262",
  "message" =>"This is a syslog message",
  "severity" => 5,
  "facility" => 1,
  "facility_label" => "user-level",
  "severity_label" => "Notice",
  "@timestamp" => "2012-12-17T16:00:35.000Z",
  "@version => "1",
  "message" => "<13>Dec 17 16:00:35 joker.example.com bob[23262]:
 This is a syslog message",
  "type" => "syslog"
}
```

## Filebeat

Filebeat is a lightweight, open source shipper for logs. It replaces the legacy Logstash Forwarder or Lumberjack. It can tail logs, manages log rotation and can send log data on to Logstash or even directly to Elasticsearch.

Filebeat is part of a larger collection of data shipping tools called Beats. There are several other Beats in development, including community contributions, for monitoring things like Docker and Nginx. Beats are licensed with the Apache 2.0 license and written in Golang.

**TIP** There's also a Windows Event Log beat called Winlogbeat if you're collecting logs on Microsoft Windows.

We first saw Filebeat in Chapter 3 but let's dive in a bit more.

## Configure Filebeat on our central server

Let's first revisit our configuration on our central server to receive data from Filebeat. To do this we use the input plugin called `beats` we introduced in Chapter 3. We should be able to see our `beats` plugin in our `central.conf` configuration file.

**Listing 1.19: The beats input**

```
input {
  syslog {
    type => syslog
    port => 5514
  }
  beats {
    port => 5044
  }
}
output {
  stdout { }
  elasticsearch { }
}
```

Remember we added the `beats` plugin and specified one option: `port`. The `port` option controls which port Logstash will receive logs from, here `5044`.

**TIP** You can find the full documentation for the `beats` input on the Elastic site.

## Installing Filebeat on the remote host

Now let's look at downloading and installing Filebeat on a remote agent. We're going to choose a new Ubuntu host called `gangsteroflove.example.com`. This is the elongated explanation and deep dive into Filebeat that we didn't take in Chapter 3. It'll also show us an install on an Ubuntu host.

We can install Filebeat as a package via Apt. It's also available as an RPM, a tarball or a Windows executable installer from the Elastic.com download site.

Let's start by adding the appropriate GPG key for validating the packages.

**Listing 1.20: Adding the Elasticsearch GPG key**

```
$ wget -O - https://artifacts.elastic.co/GPG-KEY-elasticsearch |
 sudo apt-key add -
```

You may also need the `apt-transport-https` package.

**Listing 1.21: Installing apt-transport-https**

```
$ sudo apt-get install apt-transport-https
```

Now let's add the APT repository configuration.

**Listing 1.22: Adding the Elastic APT repository**

```
$ echo "deb https://artifacts.elastic.co/packages/5.x/apt stable
 main" | sudo tee -a /etc/apt/sources.list.d/elastic-5.x.list
```

**TIP** If we were running on a Red Hat or a derivative we would install the appropriate Yum repository.

We then run an `apt-get update` to refresh our package list.

**Listing 1.23: Updating the package list**

```
$ sudo apt-get update
```

And finally we can install Filebeat itself.

**Listing 1.24: Installing Filebeat via apt-get**

```
$ sudo apt-get install filebeat
```

After installation you can see that an example configuration file, `filebeat.yml`, has been created in the `/etc/filebeat` directory.

## Configuring Filebeat

Filebeat is configured via a YAML file called `filebeat.yml`, located in the `/etc/filebeat` directory. Filebeat comes with a commented example file that explains all of Filebeat's local options. Let's skip this file and create our own file now.

**Listing 1.25: Our new filebeat.yml file**

```
filebeat.prospectors:
- input_type: log
  paths:
    - /var/log/*.log
  input_type: log
  document_type: syslog
  registry: /var/lib/filebeat/registry
output.logstash:
  hosts: ["10.0.0.1:5044"]
logging.to_files: true
logging.files:
  path: /var/log/filebeat
  name: filebeat
  rotateeverybytes: 10485760
```

The `filebeat.yml` file is divided into stanzas. The most relevant to us are `prospectors`, `output` and `logging`.

### Prospectors

The `prospectors` tells Filebeat what files to gather logs from and the `output` tells Filebeat where to send those files. The last stanza, `logging`, controls Filebeat's own logging. Let's look at each in turn now, starting with `prospectors`.

**Listing 1.26: The prospectors section**

```
filebeat.prospectors:

- input_type: log
  paths:
    - /var/log/*.log
  document_type: syslog
  registry: /var/lib/filebeat/registry
```

Each stanza, marked with a `paths` statement, represents a file or collection of files you want to "prospect". Here we've grabbed all of the files ending in `*.log` in the `/var/log` directory. The `input_type` controls what sort of file is being read, here a standard log file. You can also use this setting to read from `STDIN`. The last option, `document_type`, controls the value of the `type` field in Logstash. The default is `log` but we've updated it to `syslog` so we can distinguish where our logs are coming from. The last option, `registry`, records file offsets and we'll talk more about it in a moment.

To match files and directories, Filebeat supports all Golang-style globs. For example, we could also get everything in subdirectories too with a glob.

**Listing 1.27: The prospectors section**

```
filebeat.prospectors:

- input_type: log
  paths:
    - /var/log/*/*.log
. . .
```

Or multiple sets of paths like so:

**Listing 1.28: The prospectors section**

```
filebeat.prospectors:

- input_type: log
  paths:
    - /var/log/*/*.log
    - /opt/application/logs/*.log
. . .
```

Filebeat will grab all files ending in `*.log` from both these paths.

Filebeat will also take care of log rotation. It recognizes when a file has been rotated and grabs the new file. Filebeat also handles tracking progress reading a file. When Filebeat reads a file it will mark its current read position in the file in a catalogue called a registry. The default registry, which we've defined using the `registry` option, is at `/var/lib/filebeat/registry`. Let's look inside that file.

**Listing 1.29: The /var/lib/filebeat/registry file**

```
{"/var/log/auth.log":{"source":"/var/log/auth.log","offset"
:956674,"FileStateOS":{"inode":1180057,"device":64769}},"/var/
log/dpkg.log":{"source":"/var/log/dpkg.log","offset":23515,"
FileStateOS":{"inode":1180391,"device":64769}},"/var/log/kern.
log":{"source":"/var/log/kern.log","offset":54270249,"
FileStateOS":{"inode":1180046,"device":64769}}}
```

We see a list of files that Filebeat is collecting logs from and their current offset. If we were to restart Filebeat then it would check the `registry` file and resume collecting logs from those offsets. This stops duplicate logs being sent or Filebeat restarting logging from the start of a file rather than the current point. If you need to reset the registry you can just delete the `/var/lib/filebeat/registry` file.

### Tags and fields

Filebeat also offers us the ability to add fields and tags to our log events. Let's start with adding some tags to our events. To do this we specify an array of tags using the `tags` option.

**Listing 1.30: Adding tags to a prospector**

```
filebeat.prospectors:

- input_type: log
  tags: [ "this", "is", "a", "tag" ]
  paths:
    - /var/log/*/*.log
. . .
```

This would add the tags `this`, `is`, `a`, `tag` to each event that this prospector collects.

We can also add fields to each event using the `fields` option.

**Listing 1.31: Adding tags to a prospector**

```
filebeat.prospectors:

- input_type: log
  fields:
    dc: nj
  fields_under_root: true
  paths:
    - /var/log/*/*.log
. . .
```

This would add a field entitled `dc` with a value of `nj` to the event. The `fields_under_root` option controls where in the event the field is added. If you

specify `true` then the field will be at the root of the event. If set to `false` then it'll be located underneath a field called `fields`.

### Filebeat outputs

Now we've defined where we want to collect logs from we now need to define where to send those logs. Filebeat can send log entries from the host to Logstash or even directly to Elasticsearch. It does that in the `output` stanza. Let's look at our `output` stanza now.

**Listing 1.32: The Filebeat output stanza**

```
output.logstash:
  hosts: ["10.0.0.1:5044"]
```

We've defined an output type of `logstash` and specified the `hosts` option. This tells Filebeat to connect to a Logstash server. The `hosts` option is an array that can contain one or more Logstash hosts running the `beats` input plugin. In our case we're connecting to the Logstash host at `10.0.0.1` on port `5044`.

Lastly, we want Filebeat to log some information about what it is doing. To handle this we configure the `logging` stanza.

**Listing 1.33: The Filebeat logging stanza**

```
logging.to_files: true
logging.files:
  path: /var/log/filebeat
  name: filebeat
  rotateeverybytes: 10485760
```

Here we've configured the `to_files` option to `true` to tell Filebeat to log to a file. We could also log to Syslog or `STDOUT`. We've then told Filebeat where to log, inside the `files` block. We have given Filebeat a `path`, `/var/log/filebeat`, the `name` of the file to log to and controlled when the file will rotate, when it fills up to `rotateeverybytes` of `10485760` or 10Mb.

---

**TIP** Filebeat is hugely configurable. You can send data with TLS, control network and transport options like back-off and manage how files are handled when they rotate. Amongst many other settings. You'll find the commented `filebeat.yml` example file very useful for exploring settings and further documentation is available in the Filebeat documentation.

---

To start the Filebeat service we can use the `service` command.

**Listing 1.34: Starting the Filebeat service**

```
$ sudo service filebeat start
```

And ensure it's enabled at boot.

**Listing 1.35: Starting Filebeat at boot**

```
$ sudo systemctl enable filebeat
```

If we now check out Logstash server we should see log entries arriving from our Filebeat service with a type of `syslog` from every Syslog log file in the `/var/log/` directory. We can then use the type field to route and process those logs.

## Other log shippers

If the shippers in this chapter don't suit your purposes there are also several other shippers that might work for you. Most of these are legacy and largely unmaintained so please take care.

### Log-Courier

The Log-Courier project is a Logstash shipper. It's lightweight and written in Go. It's focus is on log event integrity and efficiency.

### Beaver

The Beaver project is another Logstash shipper. Beaver is written in Python and available via PIP.

**Listing 1.36: Installing Beaver**

```
$ pip install beaver
```

Beaver supports sending events via the Redis, `STDIN`, or zeroMQ. Events are sent in Logstash's `json` codec.

**TIP** This is an excellent blog post explaining how to get started with Beaver and Logstash.

### Woodchuck

Another potential shipping option is Woodchuck. It's designed to be lightweight and is written in Ruby and deployable as a RubyGem. It currently only supports outputting events as Redis (to be received by Logstash's `redis` input) but plans include ZeroMQ and TCP output support. It has not been recently updated.

### Others

- Syslog-shipper
- Remote_syslog
- Message::Passing

## Summary

We've now got some of the recalcitrant hosts into our logging infrastructure via some of the methods we've learnt about in this chapter: Syslog, Filebeat or some of the other log shippers.

That should put our log management project back on track and we can now look at adding some new log sources to our Logstash infrastructure.

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**Thanks! I hope you enjoyed the book.**



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