Fluentd vs. Logstash

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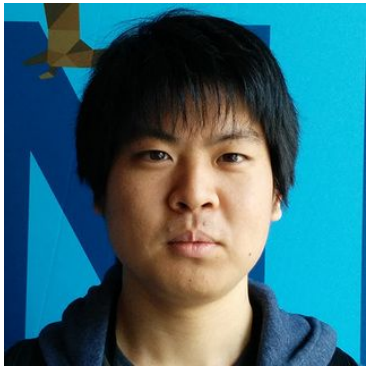
About Me

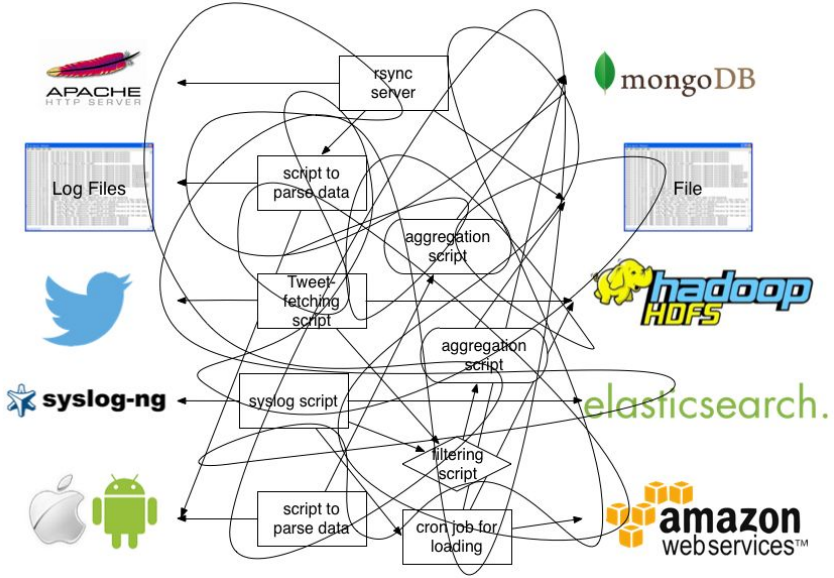
- Masaki MATSUSHITA
- Software Engineer at 

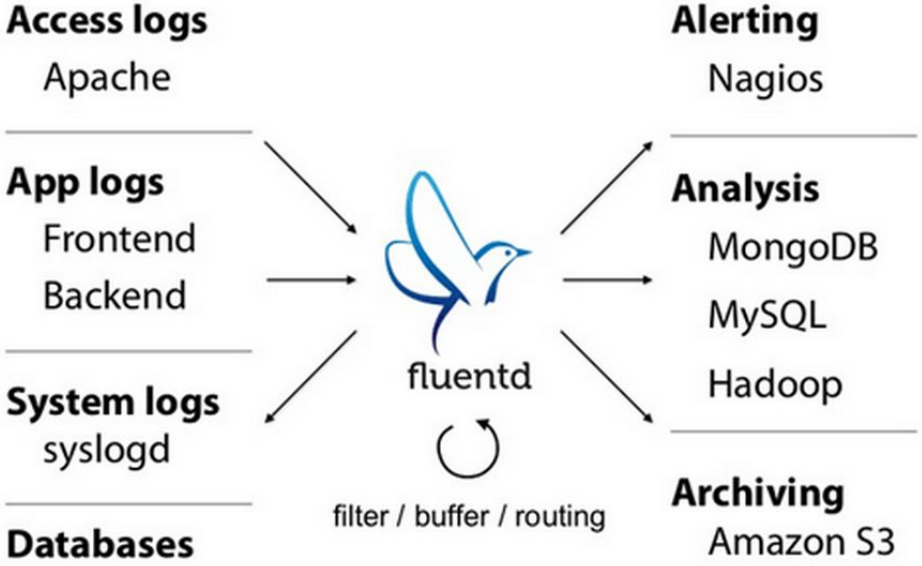
  - We are providing Internet access here!
- Github: mmasaki Twitter: @_mmasaki
- 16 Commits in Liberty
  - Trove, oslo_log, oslo_config
- CRuby Commiter
  - 100+ commits for performance improvement



What are Log Collectors?

- Provide pluggable and unified logging layer



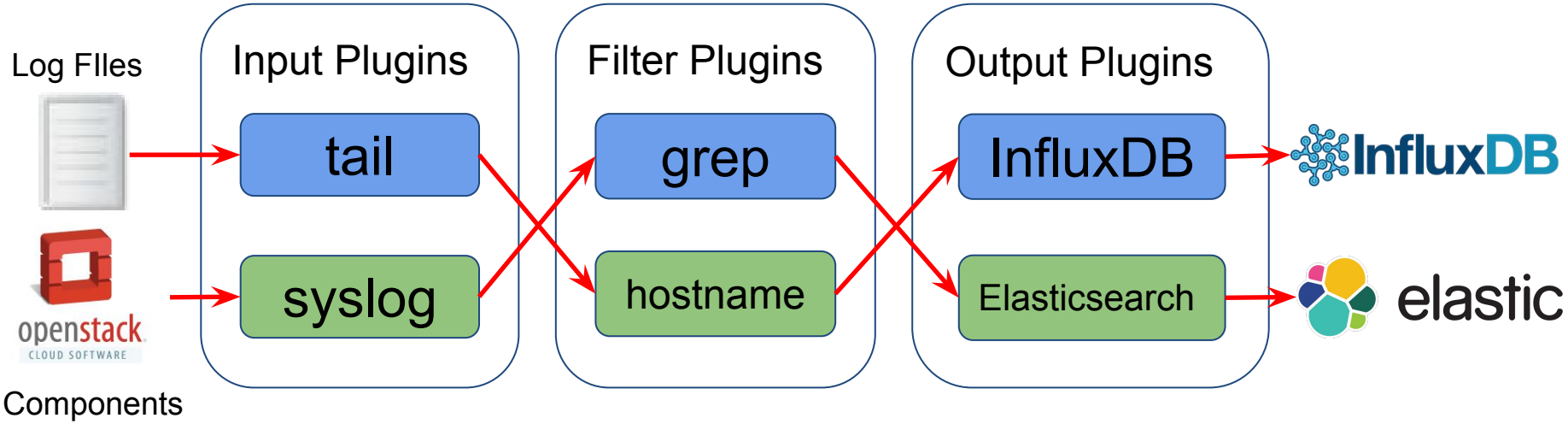


Without Log Collectors → With Log Collectors

Images from http://fluentd.org/

Input, Filter and Output

- They are implemented as plugins
- Can be replaced easily



Two Popular Log Collectors

- Fluentd
  - Written in CRuby
  - Used in Kubernetes
  - Maintained by Treasure Data Inc.
- Logstash
  - Written in JRuby
  - Maintained by elastic.co
- They have similar features
- Which one is better for you?

Agenda

- Comparisons
  - Configuration
  - Supported Plugins
  - Performance
  - Transport Protocol
- Integrate OpenStack with Fluentd/Logstash
  - Considering High Availability

Configuration: Fluentd

- Every inputs are tagged
- Logs will be routed by tag

nova-api.log
(tag: openstack.nova)

cinder-api.log
(tag: openstack.cinder)

fluentd

Filter/**Route**

<match openstack.nova>

elastic

<match openstack.cinder>

Fluentd Configuration: Input

- Every inputs will be tagged

```
<source>
  @type tail
  path /var/log/nova/nova-api.log
  tag openstack.nova
</source>
```

Example of tailing nova-api log

Fluentd Configuration: Output

```
<match openstack.nova> # nova related logs
  @type elasticsearch
  host example.com
</match>

<match openstack.*> # all other OpenStack related logs
  @type influxdb
  # ...
</match>
```

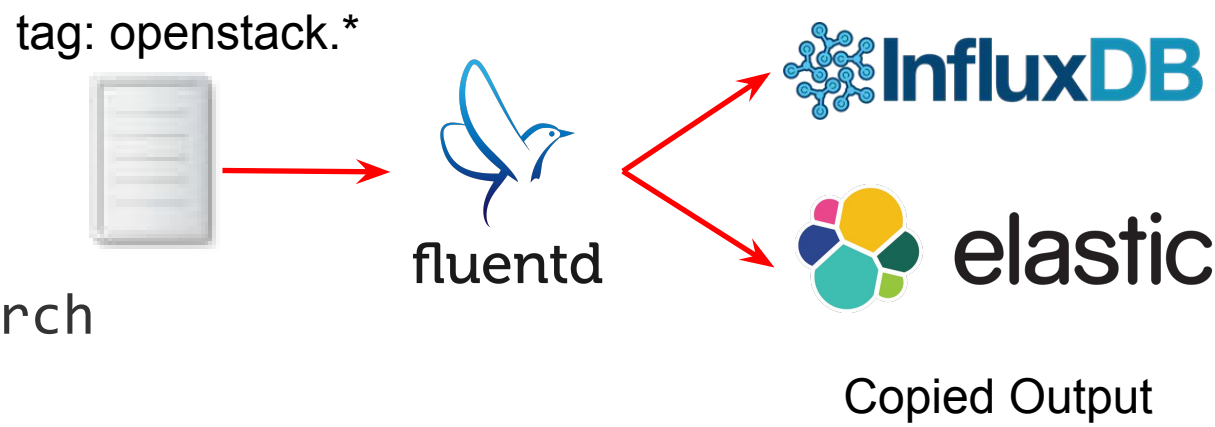
Routed by tag
(First match is priority)

Wildcards can be used

Fluentd Configuration: Copy

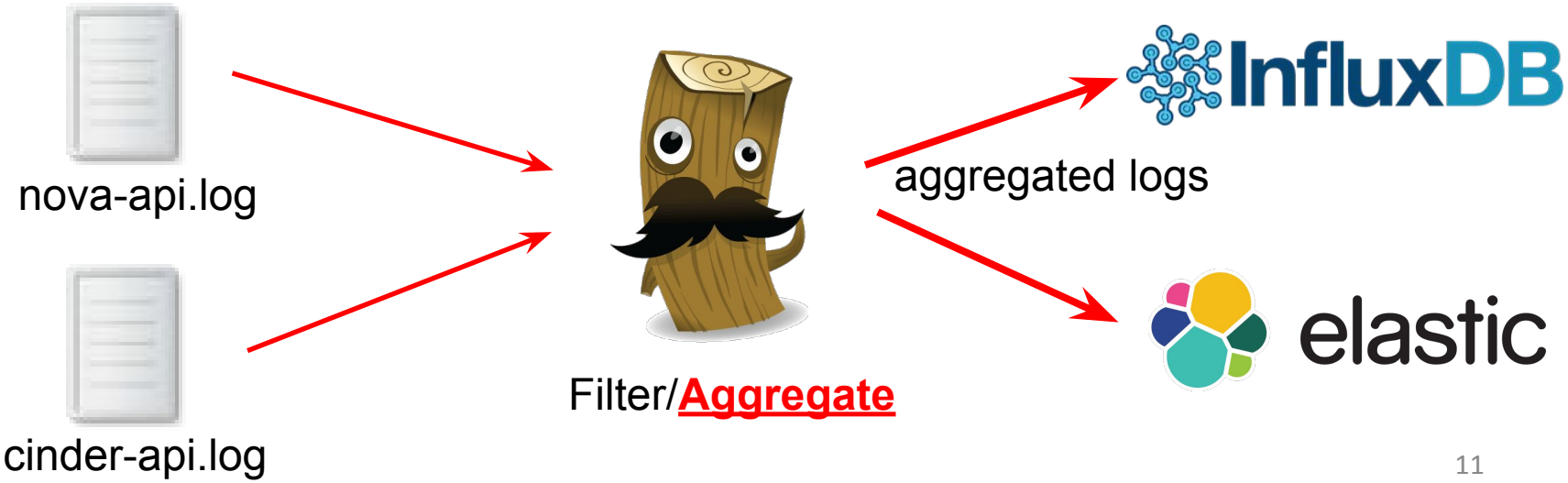
```
<match openstack.*>
  @type copy
  <store>
    @type influxdb
  </store>
  <store>
    @type elasticsearch
  </store>
</match>
```

Copy plugin enables multiple outputs for a tag



Logstash Configuration

- No tags
- All inputs will be aggregated
- Logs will be scattered to outputs

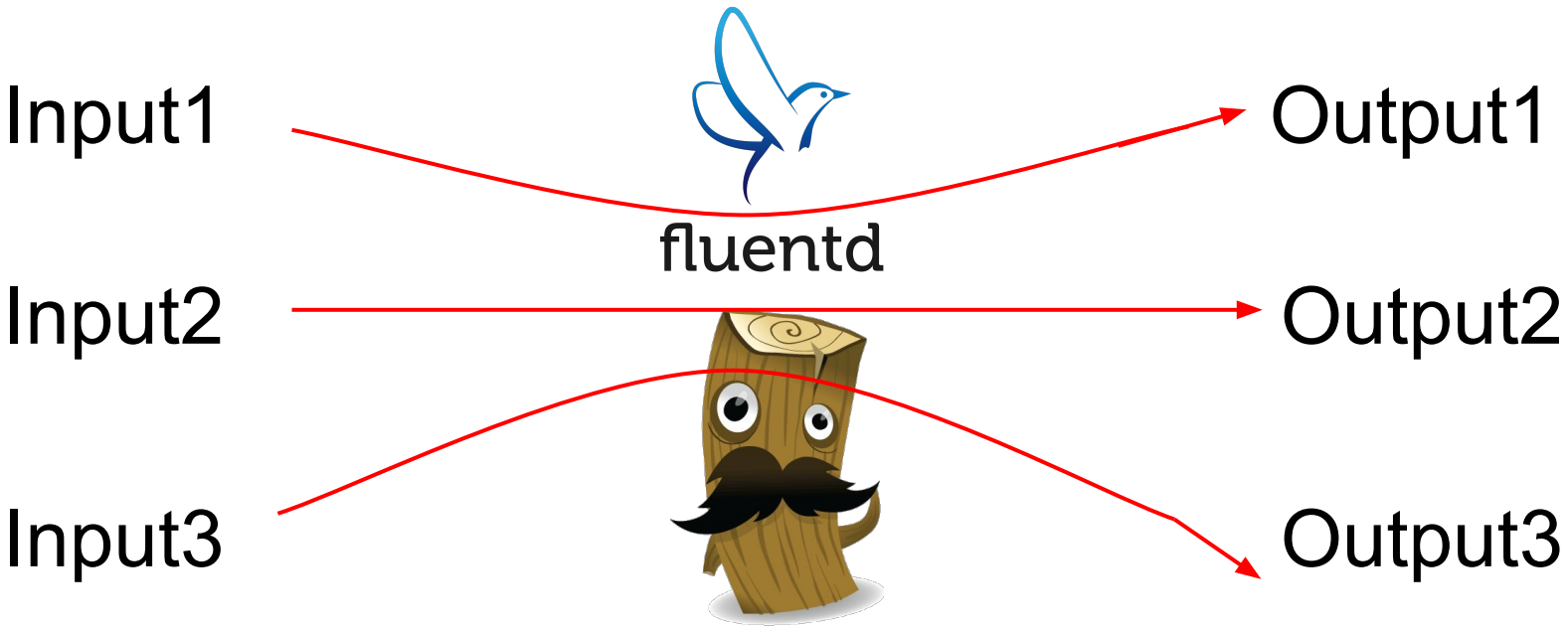


Logstash Configuration

```
input {
    file { path => “/var/log/nova/*.log” }
    file { path => “/var/log/cinder/*.log” }
}
output {
    elasticsearch { hosts => [“example.com”] }
    influxdb { host => “example.com”... }
}
```

Case 1: Separated Streams

- Handle multiple streams separately



Case 1: Separated Streams

Fluentd: Simple matching by tag

```
<match input.input1>
  @type output1
</match>

<match input.input2>
  @type output2
</match>

<match input.input3>
  @type output3
</match>
```

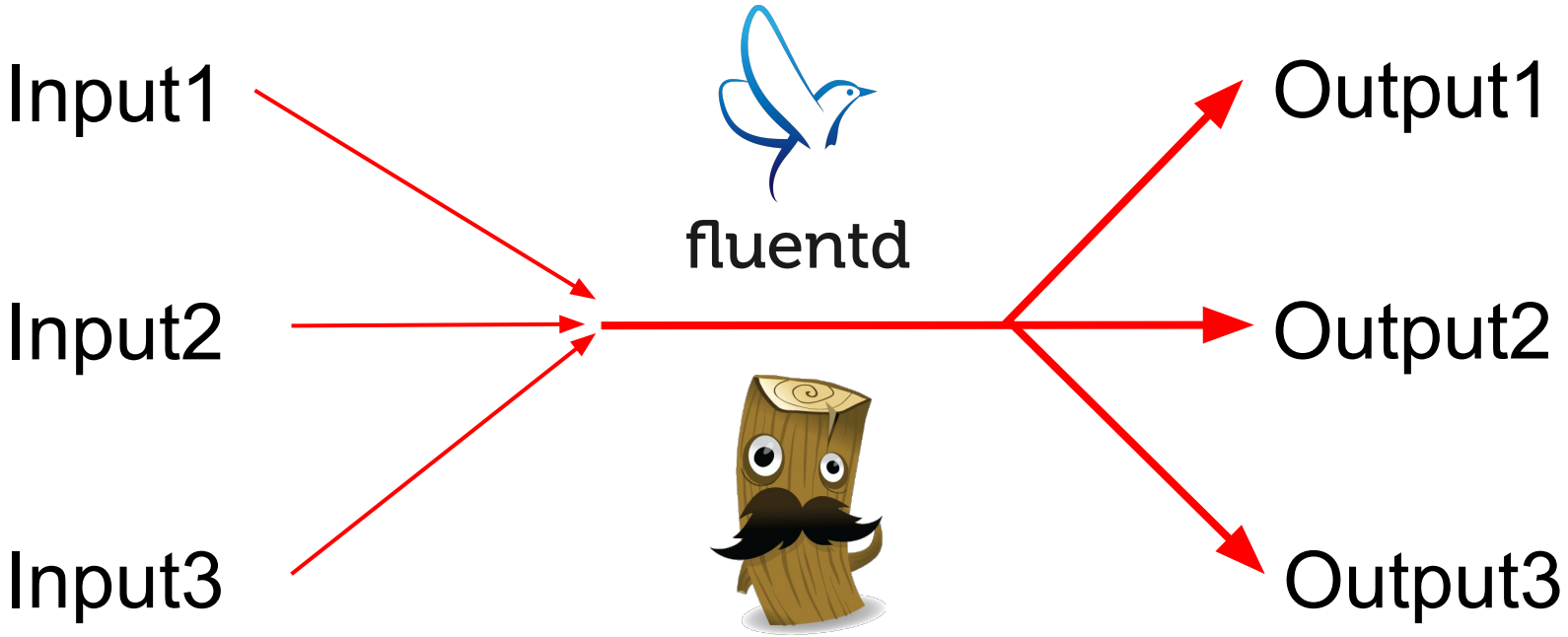
Logstash: Conditional Outputs

```
output {
  if [type] == “input1” {
    output1 {}
  } else if [type] == “input2” {
    output2 {}
  } else if [type] == “input3” {
    output3 {}
  }
}
```

Need to split aggregated logs

Case 2: Aggregated Streams

- Streams will be aggregated and scattered



Case 2: Aggregated Streams

Fluentd: Copy plugins is needed

```
<match input.*>
  @type copy
  <store>
    @type output1
  </store>
  <store>
    @type output2
  </store>
  <store>
    @type output3
  </store>
</match>
```

Logstash: Quite simple

```
output {
  output1 {}
  output2 {}
  output3 {}
}
```

Configuration

- Fluentd
  - Routed by simple tag matching
  - Suited to handle log streams separately
- Logstash
  - Logs are aggregated
  - Suited to handle logs in gather-scatter style

Plugins

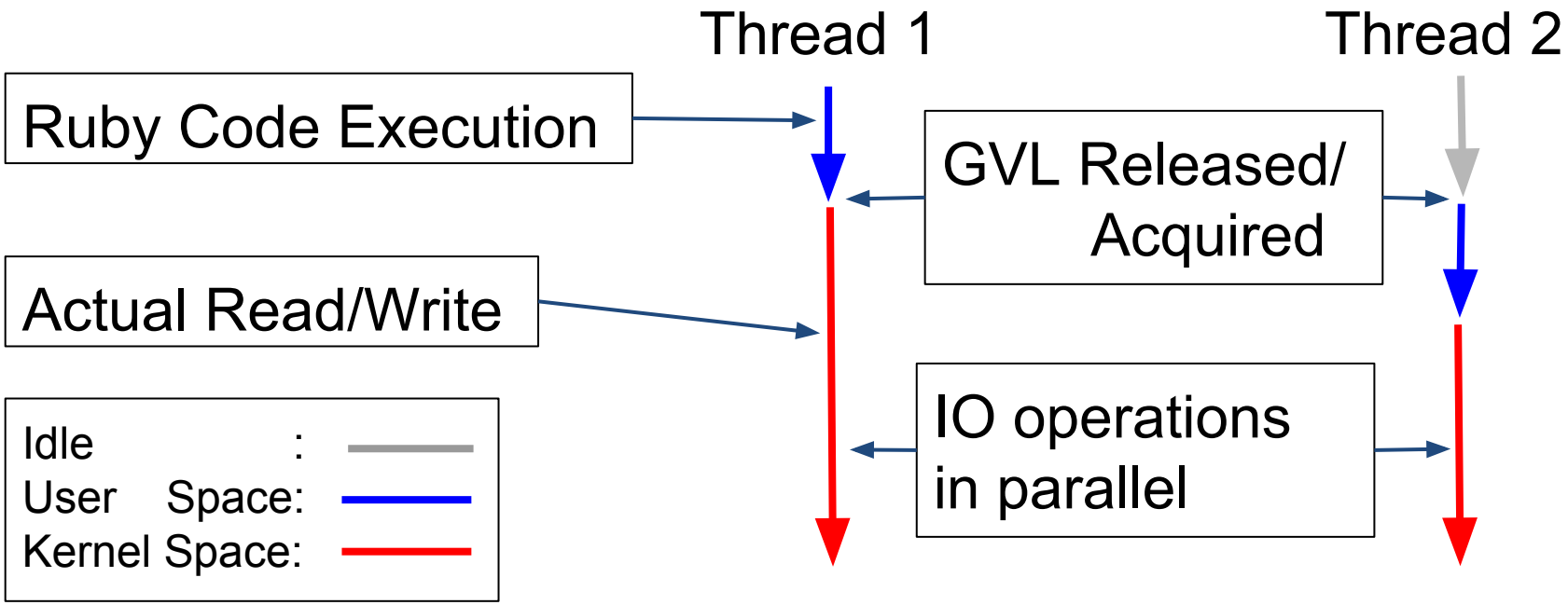
- Both provide many plugins
  - Fluentd: 300+, Logstash: 200+
- Popular plugins are bundled with Logstash
  - They are maintained by the Logstash project
- Fluentd contains only minimal plugins
  - Most plugins are maintained by individuals
- Plugins can be installed easily by one command

Performance

- Depends on circumstances
- More than enough for OpenStack logs
  - Both can handle 10000+ logs/s
- Applying heavy filters is not a good idea
- CRuby is slow because of GVL?
  - GVL: Global VM (Interpreter) Lock
  - It’s not true for IO bound loads

GVL on IO bound loads

- IO operation can be performed in parallel

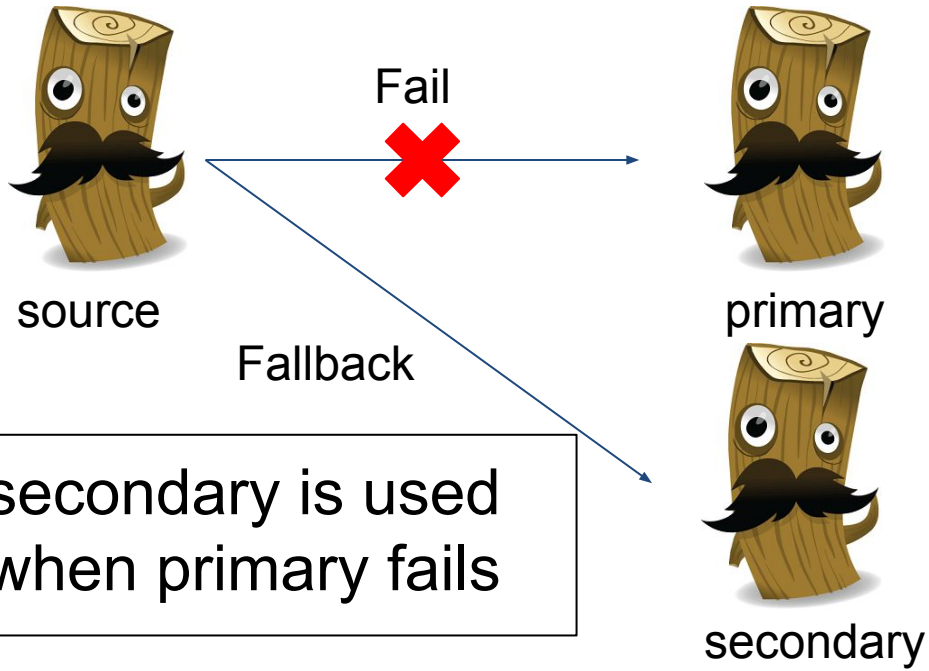


Transport Protocol

- Both collectors have their own transport protocol.
  - Failure Detection and Fallback
- Logstash: Lumberjack protocol
  - Active-Standby only
- Fluentd: forward protocol
  - Active-Active (Load Balancing), Active-Standby
  - Some additional features

Logstash Transport: lumberjack

- Active-Standby

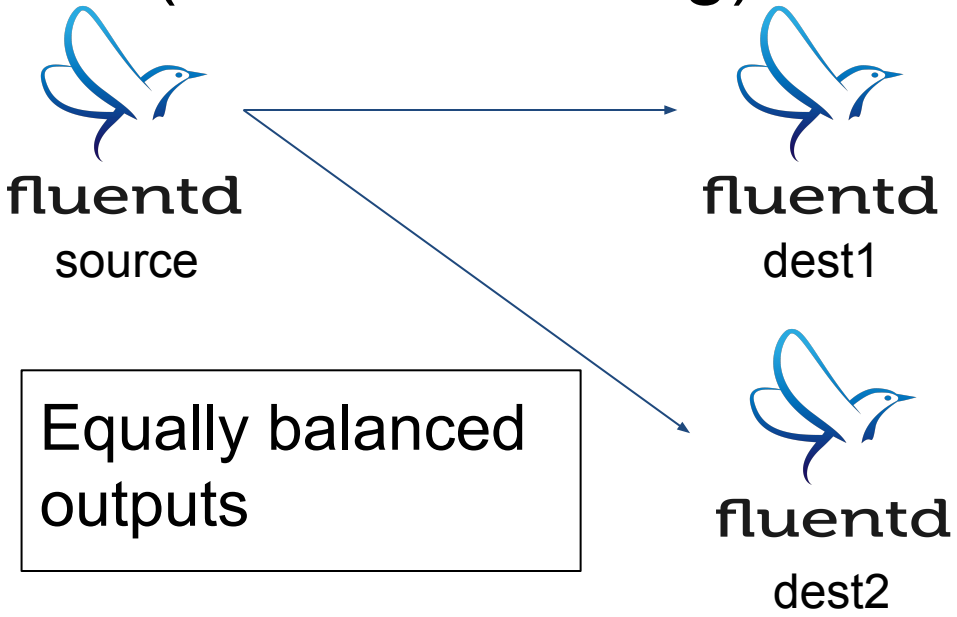


secondary is used when primary fails

```
lumberjack { #config@source
  hosts => [
    “primary”,
    “secondary”
  ]
  port => 1234
  ssl_certificate => …
}
```

Fluentd Transport: forward

- Active-Active (Load Balancing)

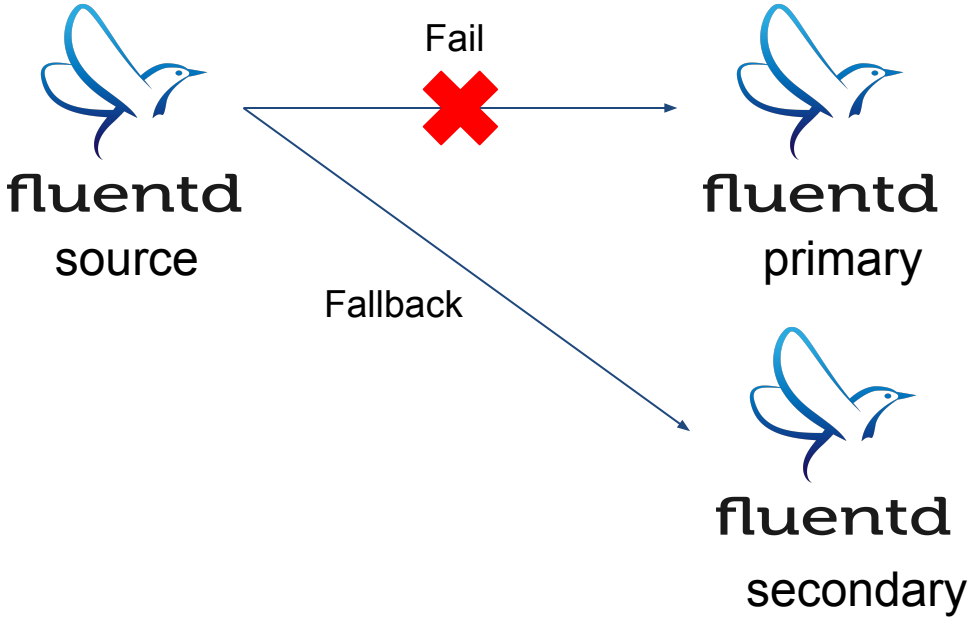


Equally balanced outputs

```
<match openstack.*>
  type forward
  <server>
    host dest1
  </server>
  <server>
    host dest2
  </server>
</match>
```

Fluentd Transport: forward

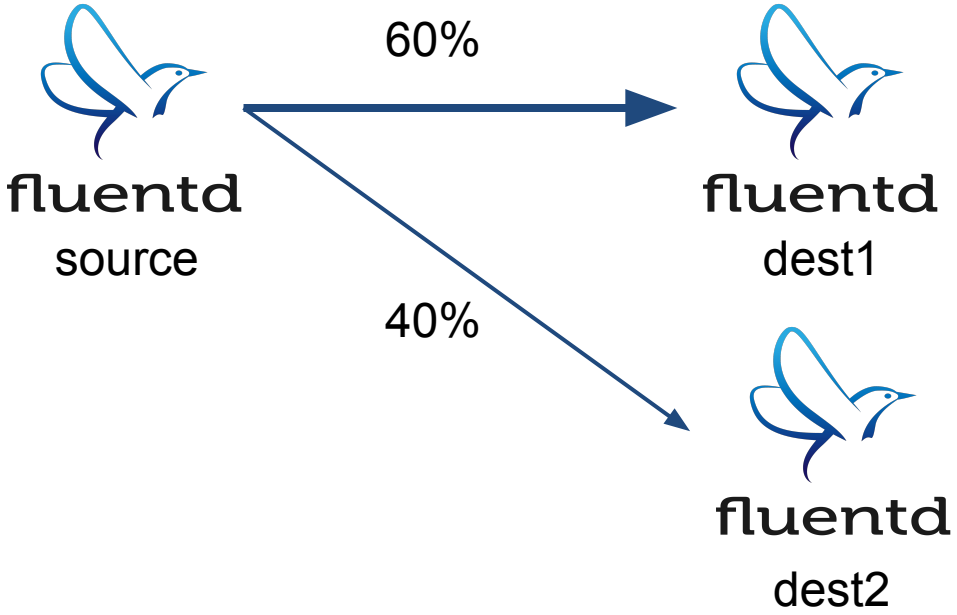
- Active-Standby




```
<match openstack.*>
  type forward
  <server>
    host primary
  </server>
  <server>
    host secondary
    standby
  </server>
</match>
```

Fluentd Transport: forward

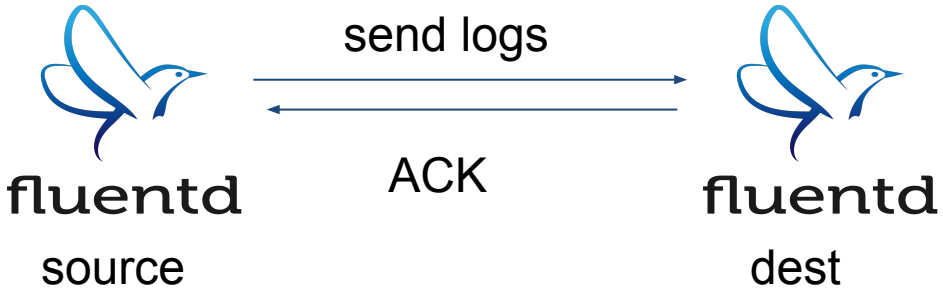
- Weighted Load Balancing




```
<match openstack.*>
  type forward
  <server>
    host dest1
    weight 60
  </server>
  <server>
    host dest2
    weight 40
  </server>
</match>
```

Fluentd Transport: forward

- At-least-one Semantics (may affect performance)



Logs are re-transmitted until ACK is received

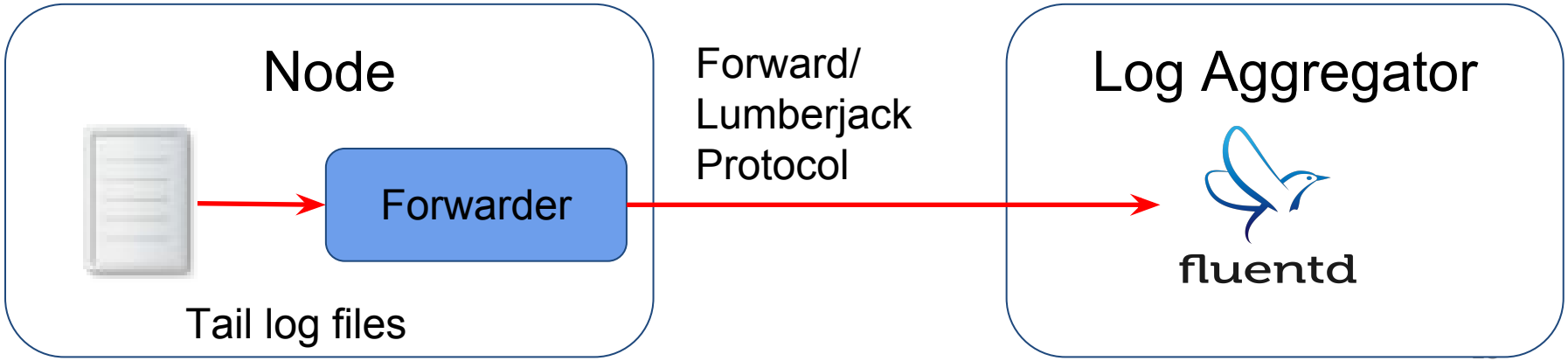
```
<match openstack.*>
  type forward
  require_ack_response
  <server>
    host dest
  </server>
</match>
```

Transport Protocol

- Both can be configured as Active-Standby mode.
- Fluentd has great features:
  - Active-Active Mode (Load Balancing)
  - At-least-one Semantics
  - Weighted Load Balancing

Forwarders

- Fluentd/Logstash have their own “forwarders”
  - Lightweight implementation written in Golang
  - Low memory consumption
  - One binary: Less dependent and easy to install



Forwarders: Config Example

fluentd-forwarder:

```
[fluentd-forwarder]
to = fluent://fluentd1:24224
to = fluent://fluentd2:24224
```

logstash-forwarder:

```
"network": {
  "servers": [
    "logstash1:5043",
    "logstash2:5043"
  ]
}
```

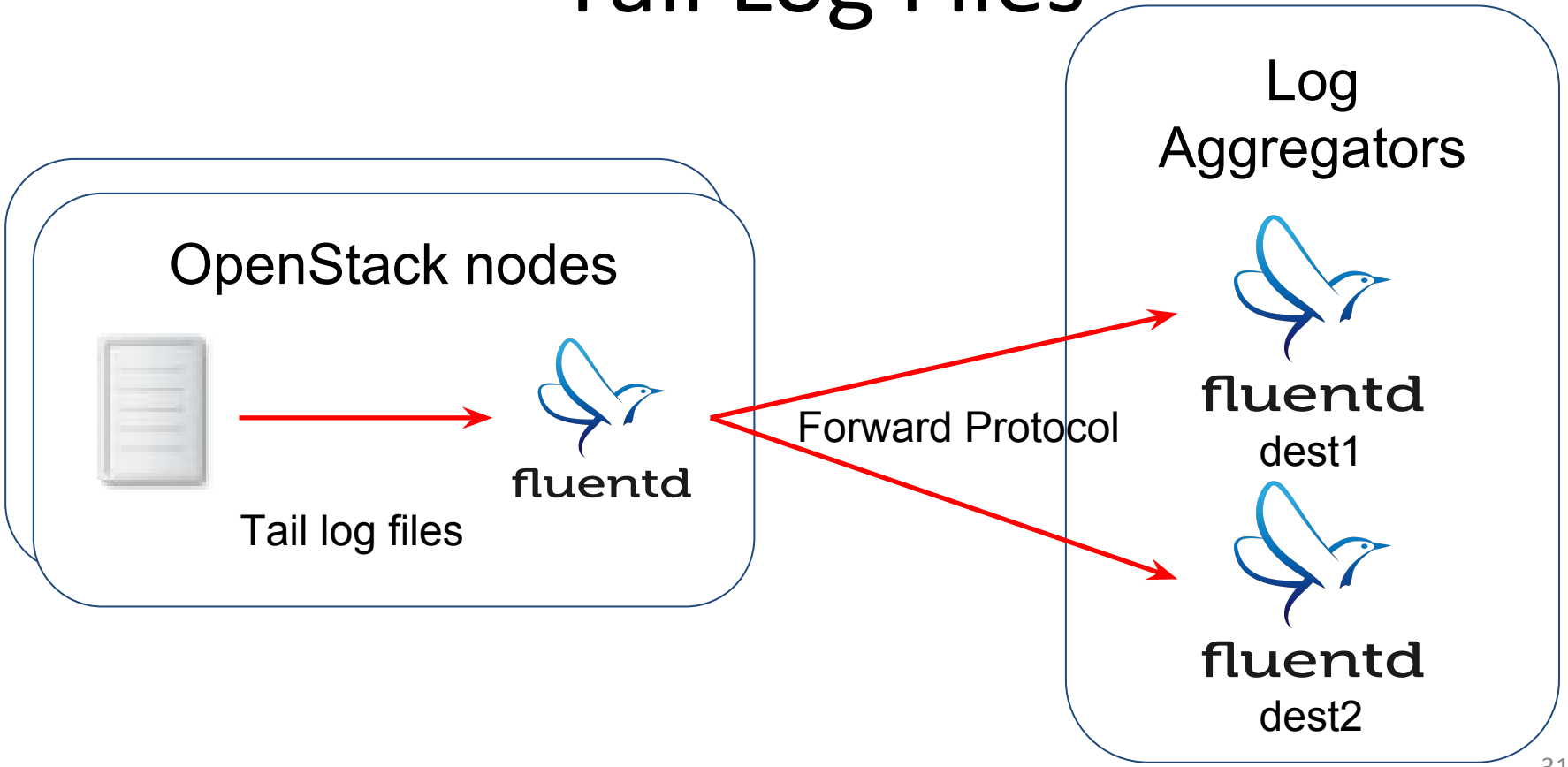
Always send logs to both servers.

Pick one active server and send logs only to it.
Fallback to another server on failure.

Integration with OpenStack

- Tail log files by local Fluentd/Logstash
  - must parse many form of log files
- Rsyslog
  - installed by default in most distribution
  - can receive logs in JSON format
- Direct output from oslo_log
  - oslo_log: logging library used by components
  - Logging without any parsing

Tail Log Files



Tail Log Files

- Must handle many log files…

syslog	nova/nova-api.log
kern.log	nova/nova-conductor.log
apache2/access.log	nova/nova-consoleauth.log
apache2/error.log	nova/nova-manage.log
	nova/nova-novncproxy.log
keystone/keystone-all.log	nova/nova-scheduler.log
keystone/keystone-manage.log	
keystone/keystone.log	mysql/error.log
	mysql/mysql-slow.log
cinder/cinder-api.log	mysql.log
cinder/cinder-scheduler.log	mysql.err
neutron/neutron-server.log	nova/nova-compute.log
neutron/neutron-server.log	nova/nova-manage.log...

Tail Log Files

- But you can use wildcard

Fluentd:

```
<source>
  type tail
  path /var/log/nova/*.log
  tag openstack.nova
</source>
```

Logstash:

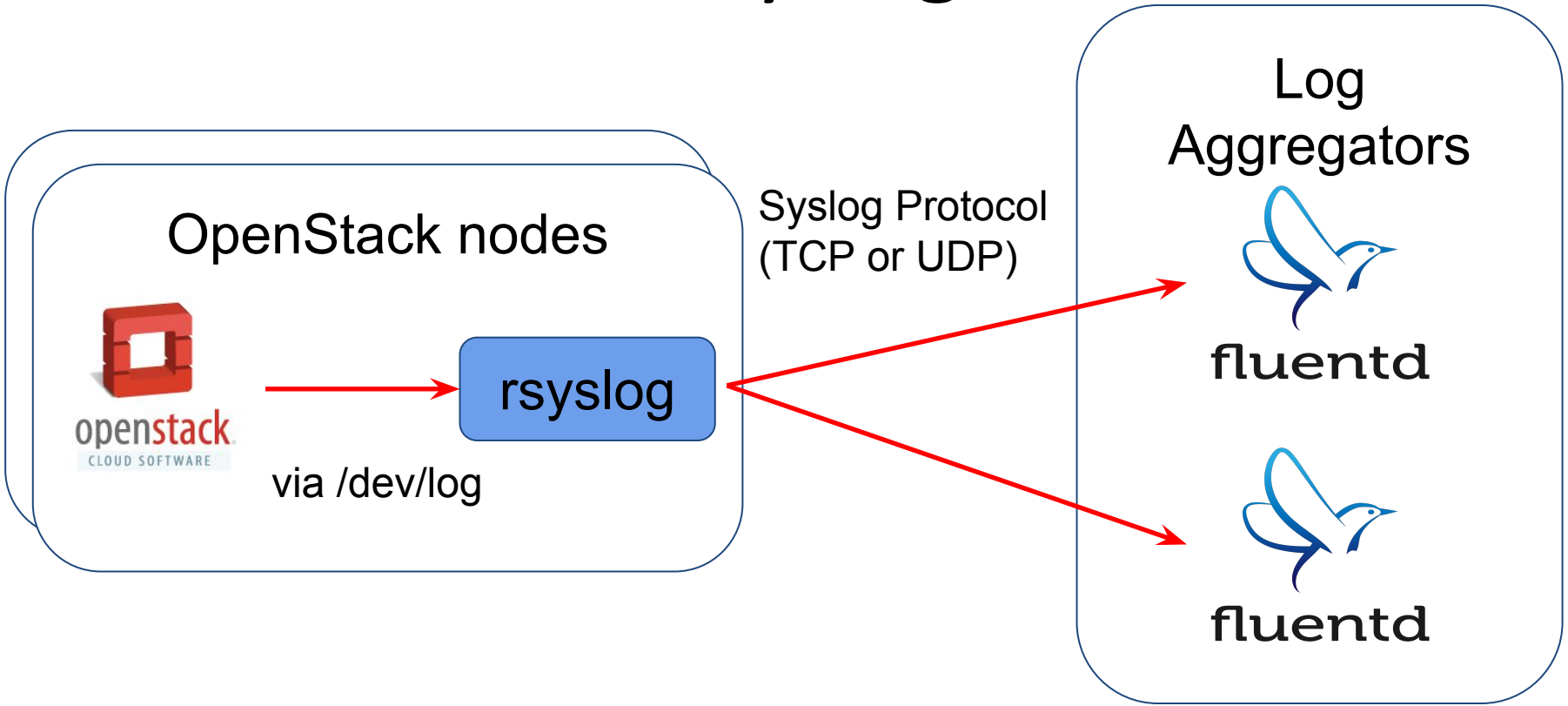
```
input {
  file {
    path => ["/var/log/nova/*.log"]
  }
}
```

Parse Text Log

- Welcome to regular expression hell!

```
<source>
  type tail # or syslog
  path /var/log/nova/nova-api.log
  format /^(?<asctime>.+) (?<process>\d+) (?<loglevel>\w+) (?
<objname>\S+)( \[(-|(?<request_id>.+?) (?<user_identity>.+))\])?
((?<remote>\S*) "(?<method>\S+) (?<path>[^\"]*) \S*?" status: (?
<code>\d*) len: (?<size>\d*) time: (?<res_time>\S)|(?<message>.
*))/
</source>
```

Rsyslog


OpenStack nodes
openstack
CLOUD SOFTWARE
rsyslog
via /dev/log
Syslog Protocol
(TCP or UDP)
Log
Aggregators
fluentd
fluentd

Rsyslog: Logging.conf

- Logging Configuration in detail
- Handler: Syslog, Formatter: JSON

```
# /etc/{nova,cinder…}/logging.conf
[handler_syslog]
class = handlers.SysLogHandler
args = ('/dev/log', handlers.SysLogHandler.LOG_LOCAL1)
formatter = json

[formatter_json]
class = oslo_log.formatters.JSONFormatter
```

Example Output: JSONFormatter


```
{
  "levelname": "INFO",
  "funcname": "start",
  "message": "Starting conductor node (version 13.0.0)",
  "msg": "Starting %(topic)s node (version %(version)s)",
  "asctime": "2015-09-29 18:29:57,690",
  "relative_created": 2454.8499584198,
  "process": 25204,
  "created": 1443518997.690932,
  "thread": 140119466896752,
  "name": "nova.service",
  "process_name": "MainProcess",
  "thread_name": "GreenThread-1",
  ...
```

Syslog Facilities

- Assignment of local0..7 Facilities for components
- Logs are tagged as like “syslog.local0” in Fluentd
- Example:
  - local0: Keystone
  - local1: Nova
  - local2: Cinder
  - local3: Neutron
  - local4: Glance

Rsyslog: Config@OpenStack nodes

- Active-Standby Configuration

```
# /etc/rsyslog.d/rsyslog.conf
user.* @@primary:5140
$ActionExecOnlyWhenPreviousIsSuspended on
&@@secondary:5140
```

Rsyslog: Config@Aggregator

Fluentd:

```
<source>
  type syslog
  port 5140
  protocol_type tcp
  format json
  tag syslog
</source>
```

Logstash:

```
input {
  syslog {
    codec => json
    port => 5140
  }
}
```

Listen on both TCP and UDP

Specify TCP or UDP

Rsyslog: Config@Aggregator

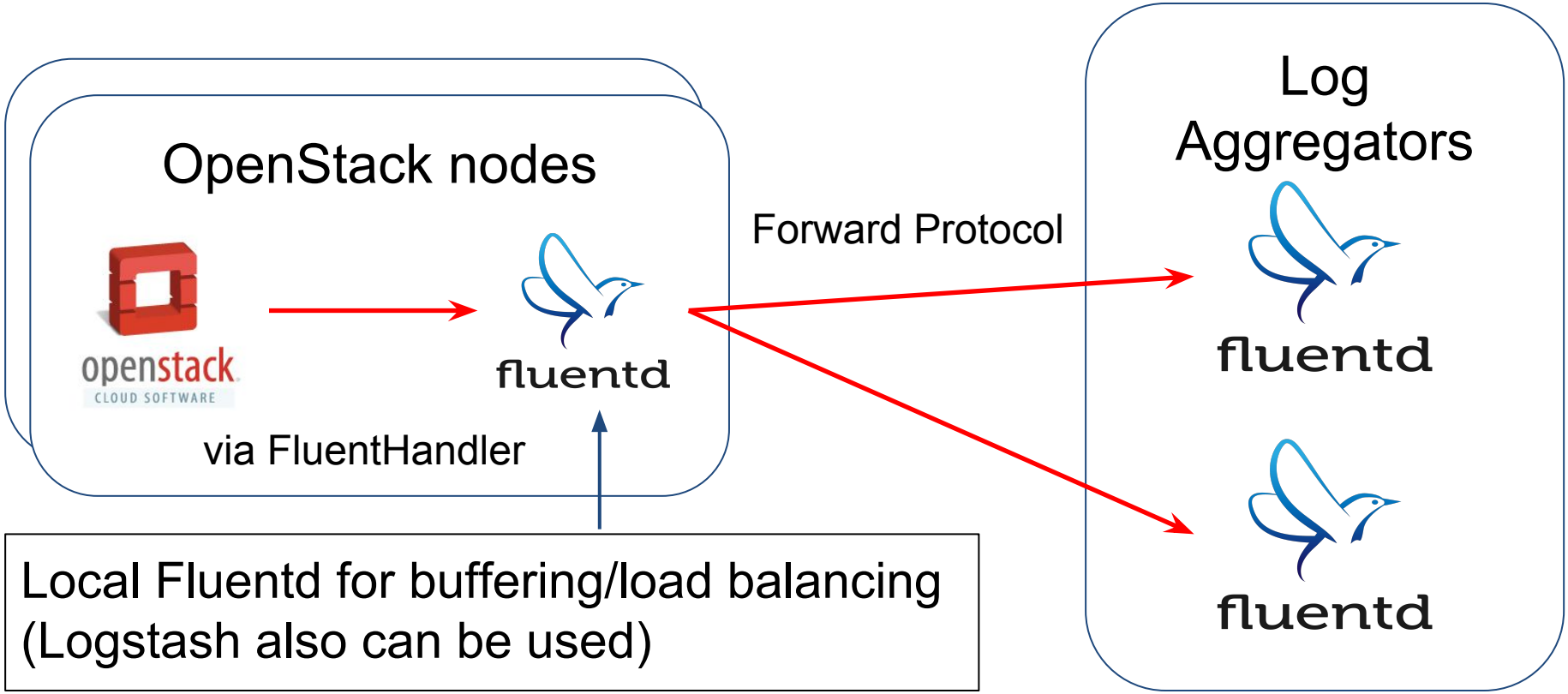
Fluentd:

```
<source>
  type syslog
  port 5140
  protocol_type tcp
  format json
  tag syslog
</source>
```

Logstash:

```
input {
  syslog {
    codec => json
    port => 5140
  }
}
```

Direct output from oslo_log



Direct output from oslo_log

```
# logging.conf:
[handler_fluent]
class = fluent.handler.FluentHandler # fluent-logger
formatter = fluent
args = (’openstack.nova', 'localhost', 24224)

[formatter_fluent]
class = fluent.handler.FluentFormatter # our Blueprint
```

Format logs as Dictionary

Our BP in oslo_log: FluentFormatter


```
{
  "hostname":"allinone-vivid",
  "extra":{"project":"unknown","version":"unknown"},
  "process_name":"MainProcess",
  "module":"wsgi",
  "message":"(4132) wsgi starting up on http://0.0.0.0:8774/",
  "filename":"wsgi.py",
  "name":"nova.osapi_compute.wsgi.server",
  "level":"INFO",
  "traceback":null,
  "funcname":"server",
  "time":"2015-10-15 10:09:12,255"
}
```


Don’t need to parse!

Conclusion

- Log Handling
  - Fluentd: Logs are distinguished by tag
  - Logstash: No tags. Logs are aggregated
- Transport Protocol
  - Both supports active-standby mode
  - Fluentd supports some additional features
    - Client-side load balancing (Active-Active)
    - At-least-one semantics
    - Weighted load balancing

Conclusion

- Integration with OpenStack
  - Tail log files: regular expression hell
  - Rsyslog: No agents are needed
  - Direct output from oslo_log w/o any parsing
  - Review is welcome for our Blueprint (oslo_log: fluent-formatter)

Thank you!

Please visit our booth!

Robot Racing over WebRTC! →