Collect distributed application logging

using Fluentd (EFK stack)

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Software geek, hands on
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Some stuff about me...

- Mostly doing cloud related stuff
    - Java, Groovy, Scala, Spring Boot, IOT, AWS, Terraform, Infrastructure
- Enjoying the good things
- Chef leuke dingen doen == “trying out cool and new stuff”
- Currently involved in a big IOT project
- Wannabe chef, movie & Netflix addict

Agenda

- Logging
- Distributed Logging
- Fluentd Overview including demo’s:
    - Run Fluentd
    - Capture input from docker container
    - Capture HTTP access logs
    - Capture HTTP access logs and store in MongoDB
    - Capture HTTP access logs and store in EFK stack
    - Capture SpringBoot logs and store in EFK stack including in_tail
    - HA Setup

Logging

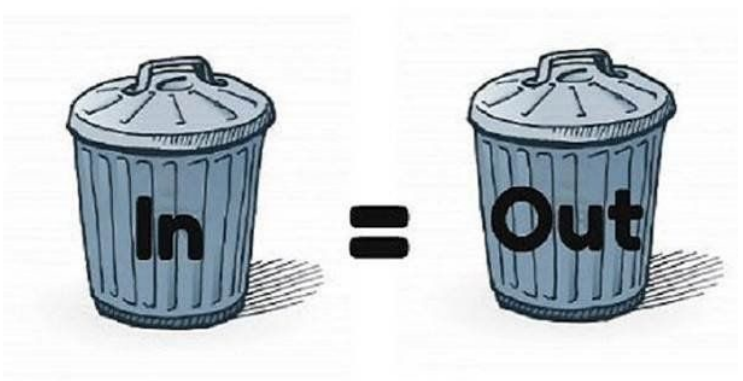
Generate › Collect › Transport › Store › Analyze › Alert

- Providing useful information, seems hard!

- Common Log Formats
  - W3C, Common Log Format, Combined Log Format
  - used for:
    - Proxy & Web Servers

- Agree upon Application Log Formats
  - Do not forget -> Log levels!

- Data security
  - Do not log passwords or privacy related data



Some seriously useful log message :)

- “No need to log, we know what is happening”
- “Something happened not sure what”
- “Empty log message”
- “Lots of sh*t happing”
- “It works b****”
- **<u>“How did we end up here?”</u>**
- **<u>“Okay i am getting tired of this error message”</u>**
- “Does this work?”
- “We hit a bug, still figuring out what”
- **<u>“Call 911 we have a problem”</u>**

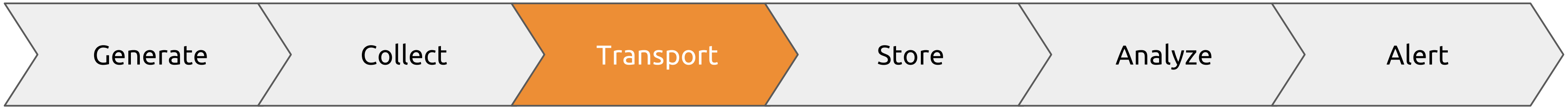
Logging considerations

- Logging means more code
- Logging is not free
- Consider feedback to the UI instead of logging
- **<u>The more you log, the less you can find</u>**
- Consider to log only the most evil scenarios (log exceptions)
- Agree on levels like FATAL, ERROR, WARN, DEBUG, INFO, TRACE …

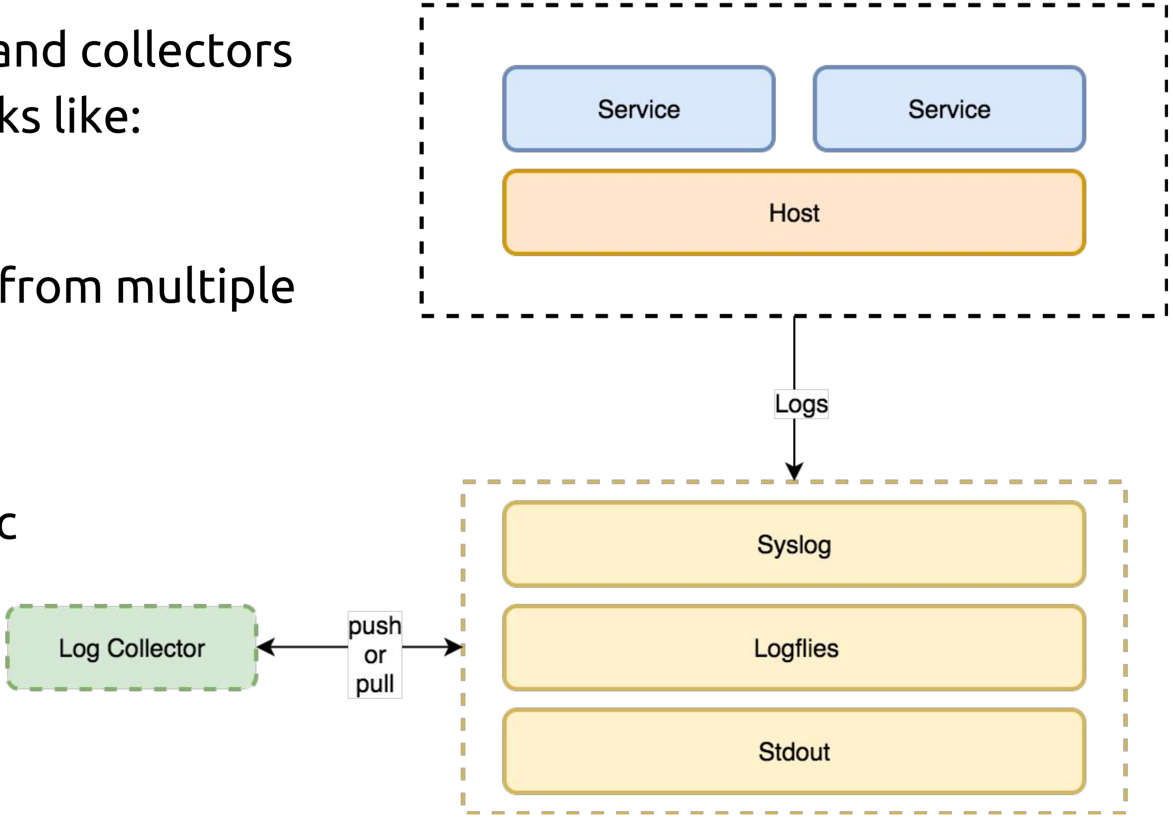
Generate → **Collect** → Transport → Store → Analyze → Alert

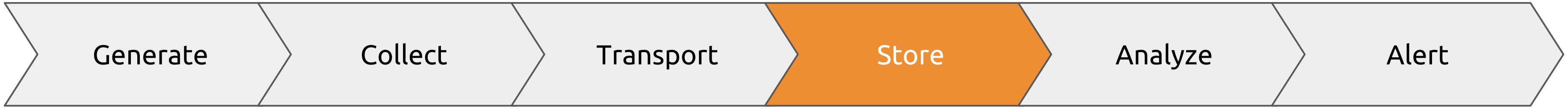
- Syslog / Syslog-ng
- Files -> multiple places (/var/log)
  - Near realtime replication to remote destinations
- Stdout
  - Normally goes to /dev/null

In container based environments logging to “Stdout” has the preference

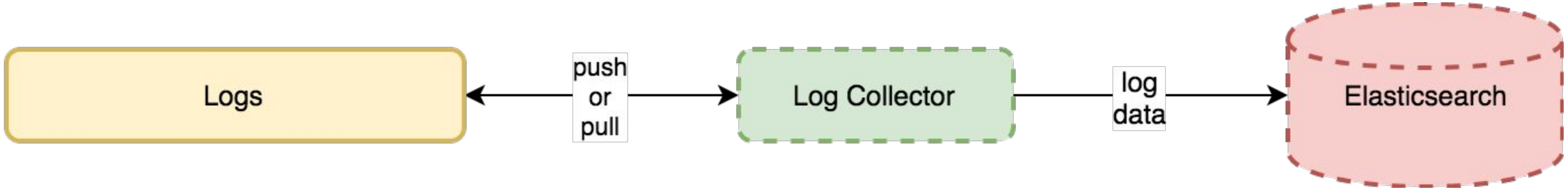


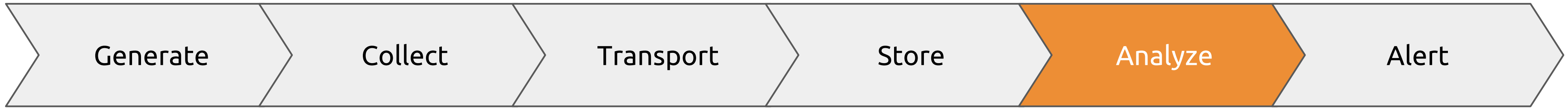
- Specialized transporters and collectors available using frameworks like:
  - Logstash, Flume, Fluentd
- Accumulate data coming from multiple hosts / services
  - Multiple input sources
- Optimized network traffic
  - Pull / Push



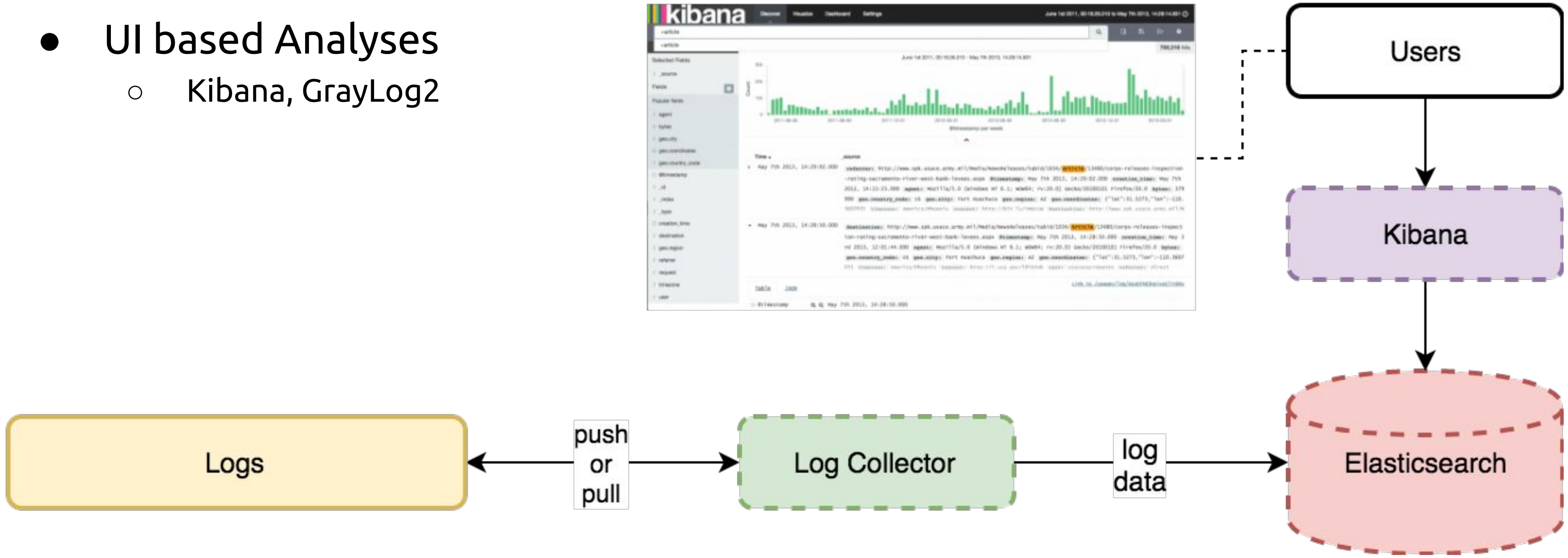


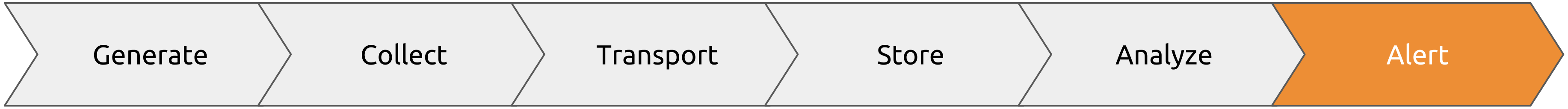
- Where should it be stored?
  - Short vs Long term
  - Associated costs
  - Speed of data ingestion & retrieval
  - Data access policies (who needs access)
- Example storage options:
  - S3, Glacier, Tape backup
  - HDFS, Cassandra, MongoDB or ElasticSearch





- Batch processing of log data
  - HDFS, Hive, PIG → MapReduce Jobs
- UI based Analyses
  - Kibana, GrayLog2





- Based on patterns or “calculated” metrics → send out events
    - Trigger alert and send notifications

- Logging != Monitoring
    - Logging -> recording to diagnose a system

```
127.0.0.1 - frank [10/Oct/2000:13:55:36 -0700] "GET /apache_pb.gif HTTP/1.0" 200 2326
```

    - Monitoring -> observation, checking and recording

```
http_requests_total{method="post",code="200"} 1027 1395066363000
```

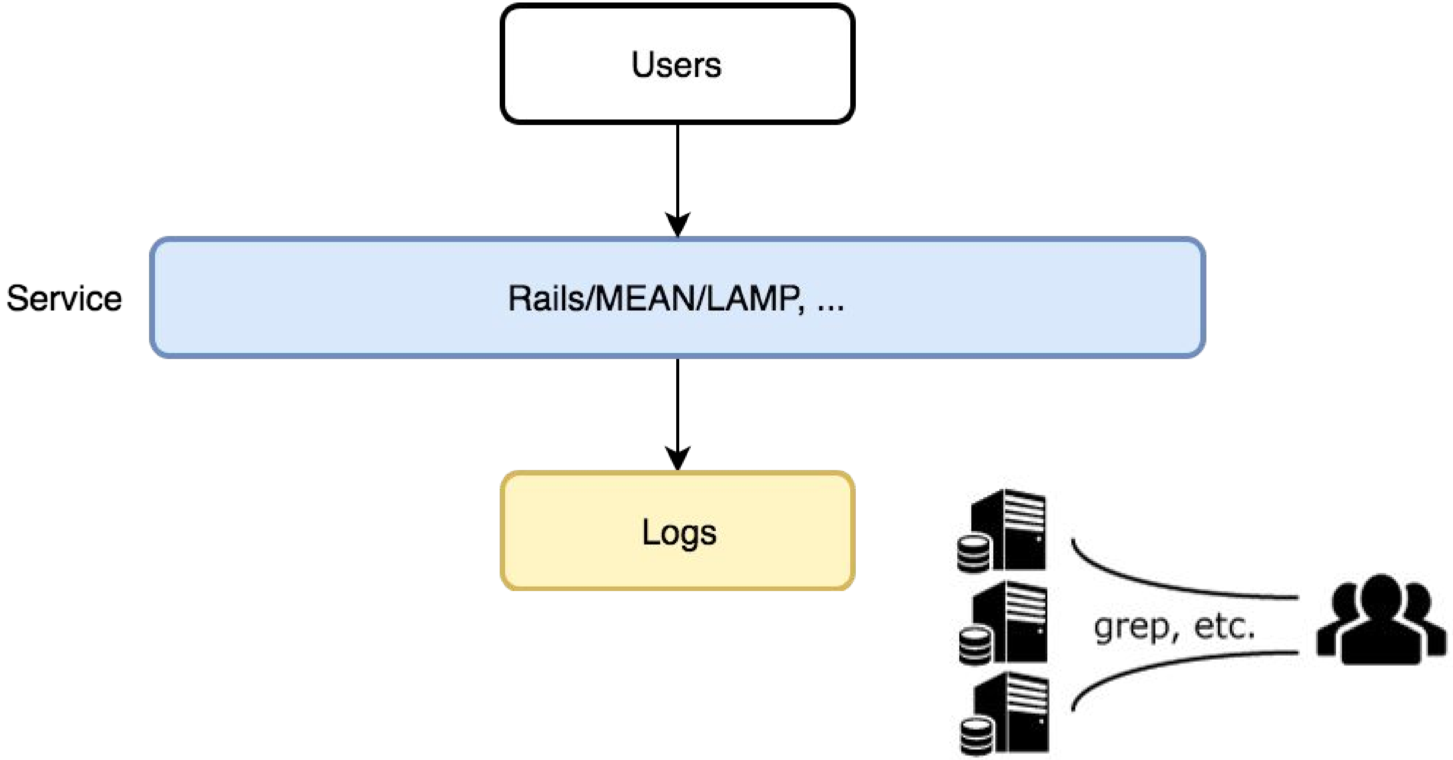
“In a containerized world, we must think differently about logging.”

Label data at the source

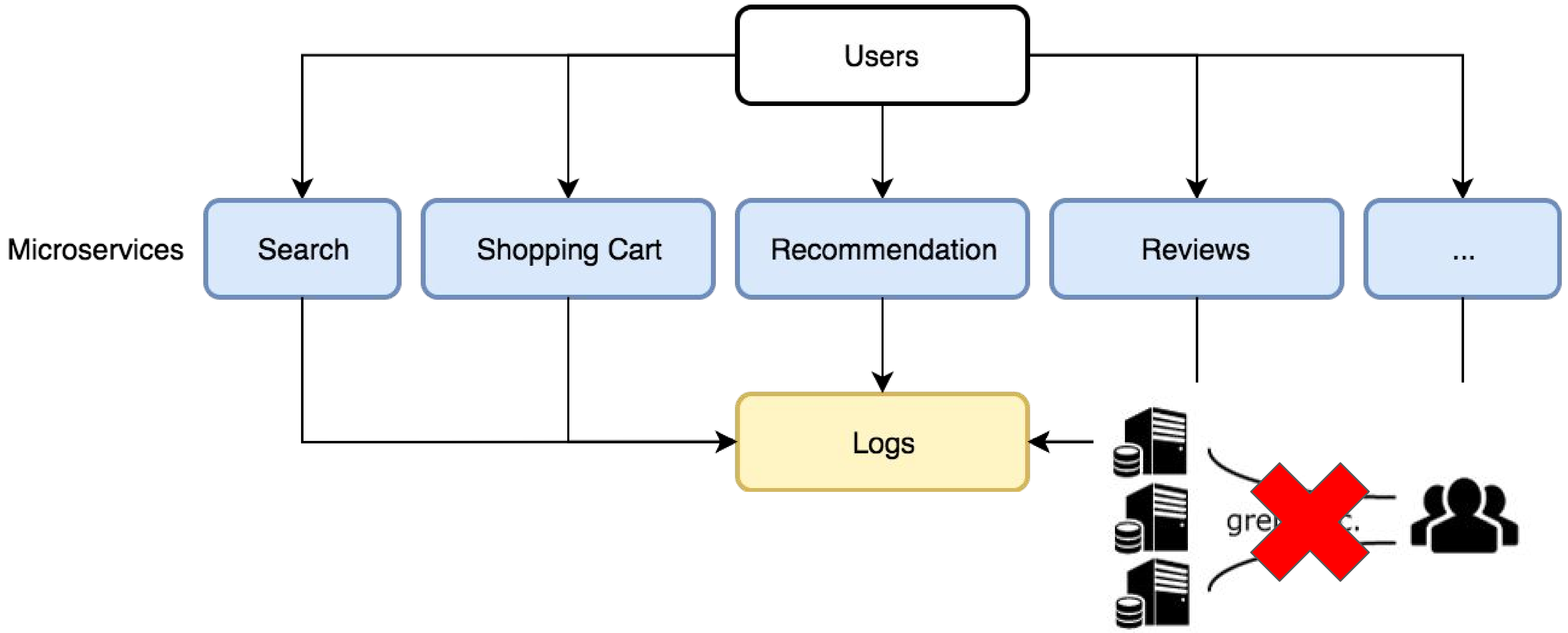
Push data and parse it as soon as possible

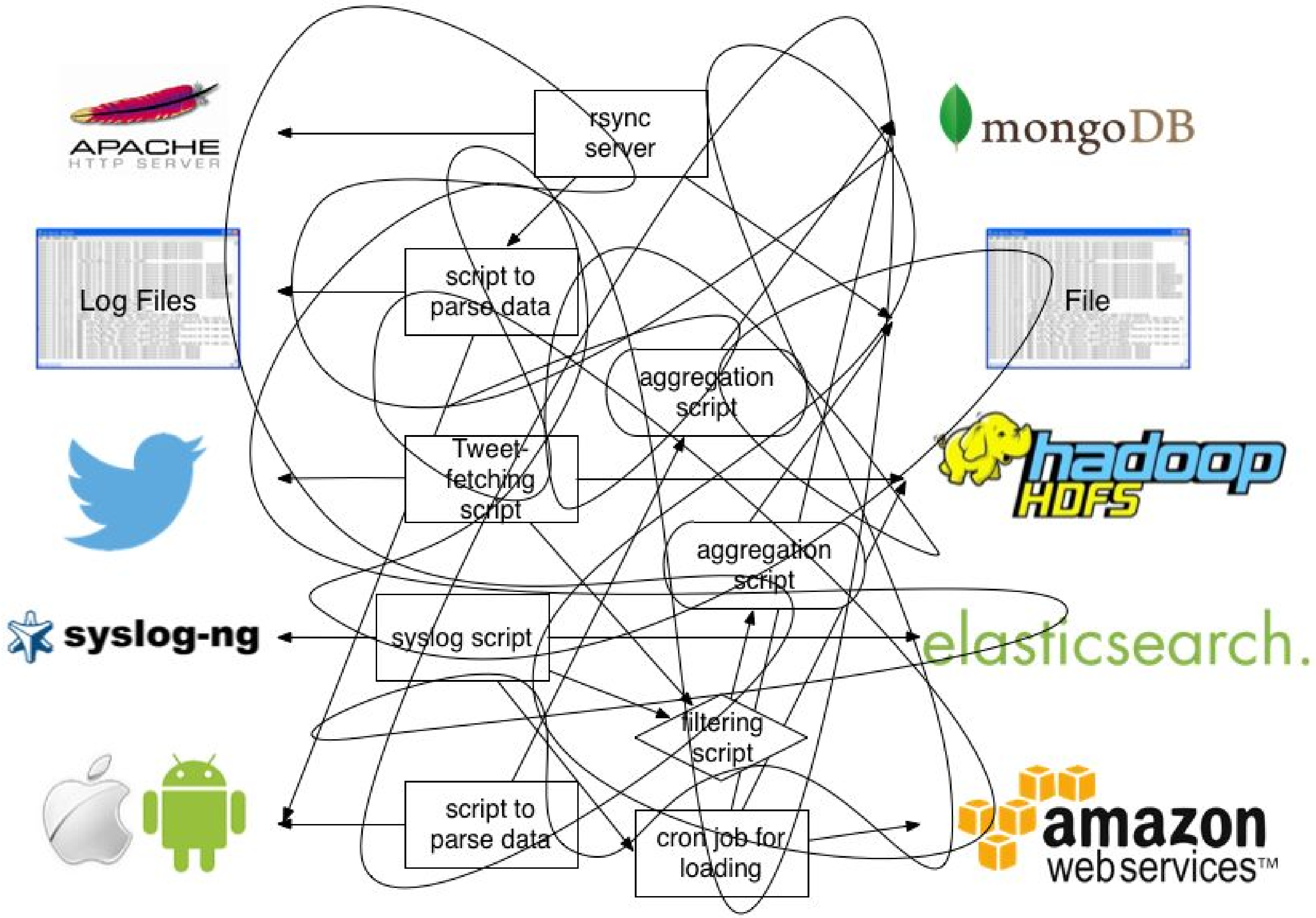
Distributed Logging

Logging

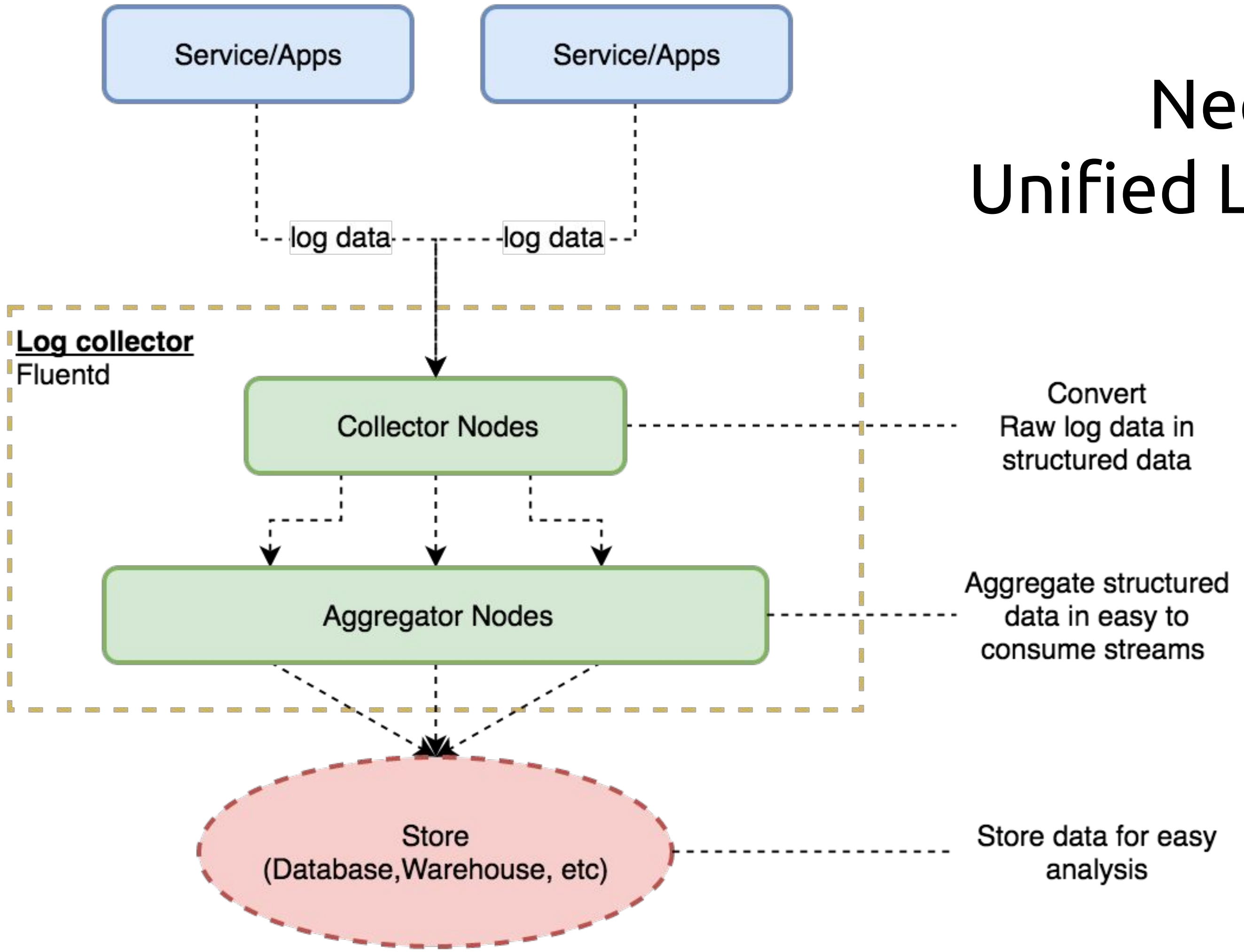


Distributed Logging

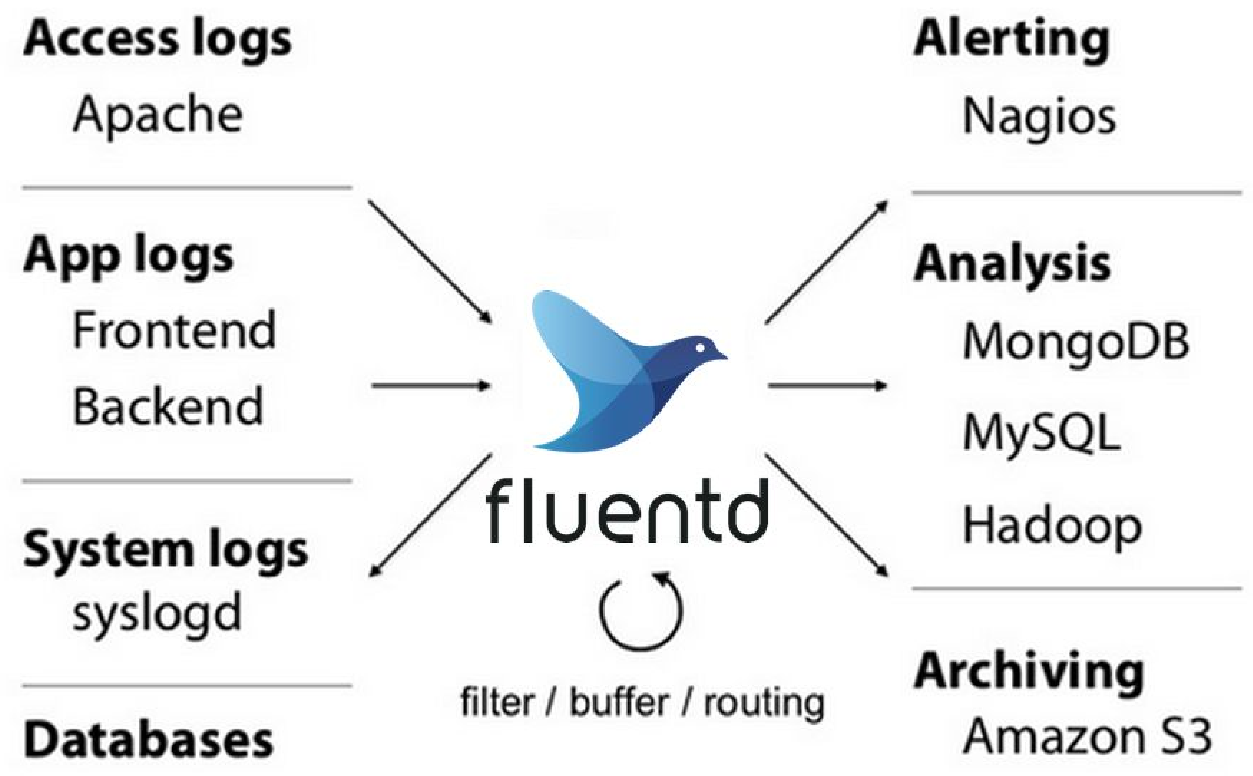



APACHE HTTP SERVER
rsync server
mongoDB
Log Files
script to parse data
File
aggregation script
Tweet-fetching script
hadoop HDFS
aggregation script
syslog-ng
syslog script
elasticsearch.
filtering script
script to parse data
cron job for loading
amazon web services™

Need for a Unified Logging Layer

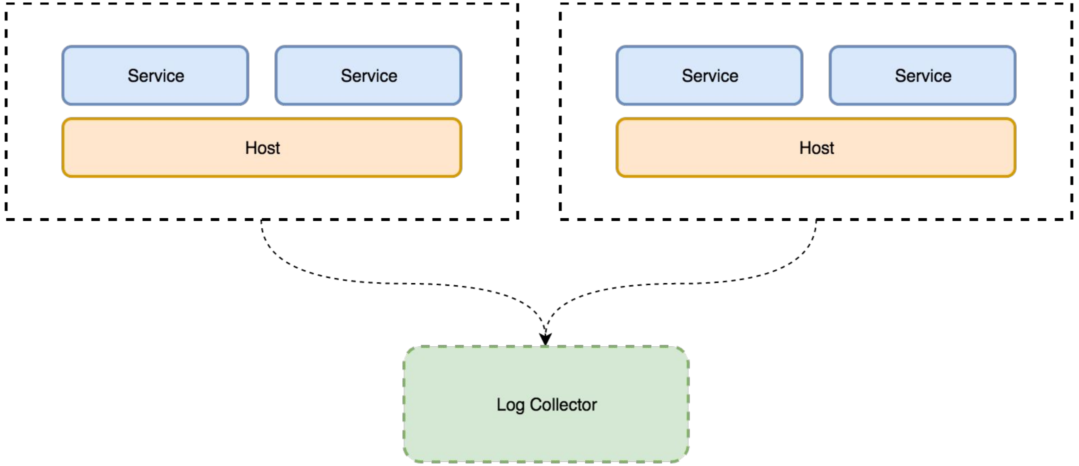


Fluentd Overview


Access logs
Apache
App logs
Frontend
Backend
System logs
syslogd
Databases
fluentd
filter / buffer / routing
Alerting
Nagios
Analysis
MongoDB
MySQL
Hadoop
Archiving
Amazon S3

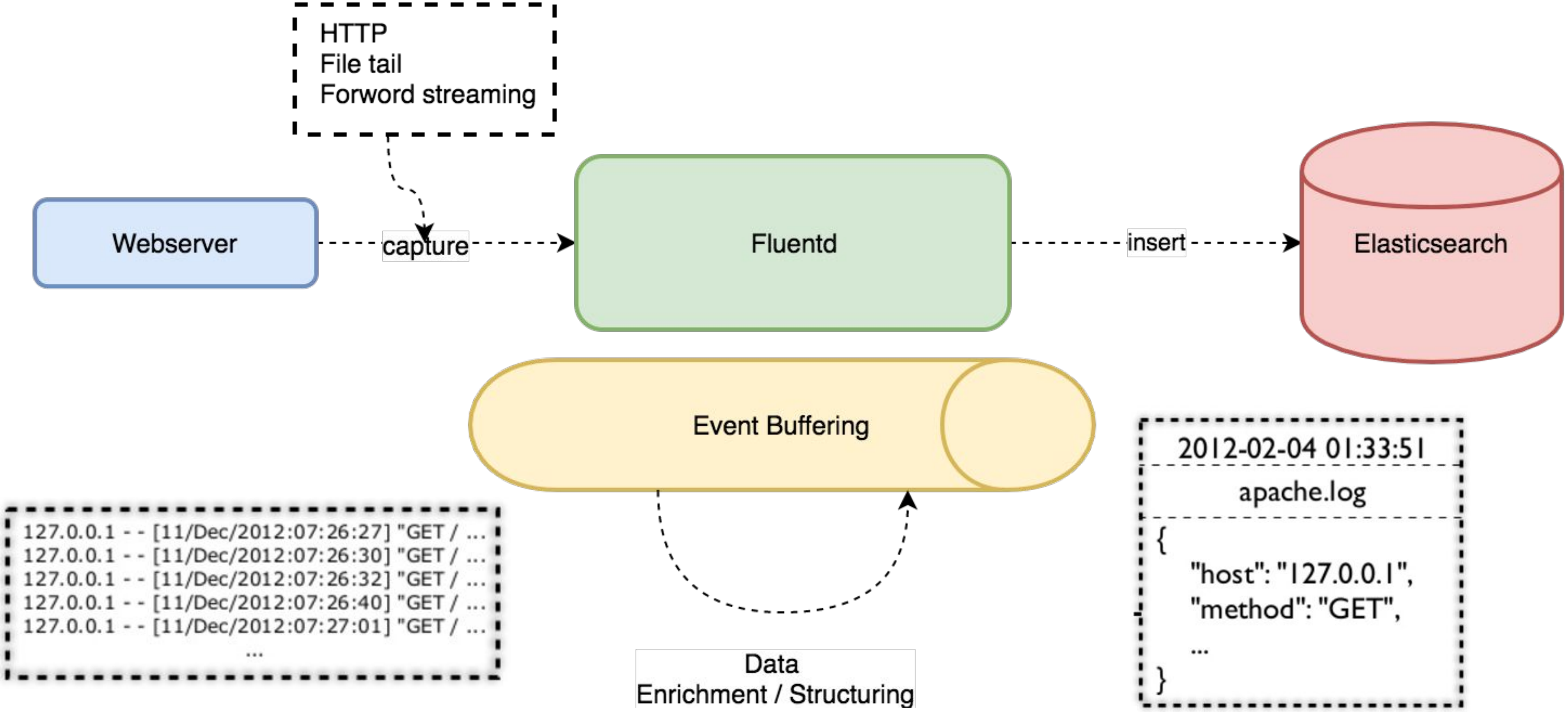
Fluentd

- Open source log collector written in Ruby
- Reliable, scalable and easy to extend
    - Pluggable architecture
    - Rubygem ecosystem for plugins
- Reliable log forwarding



fluentd

Example

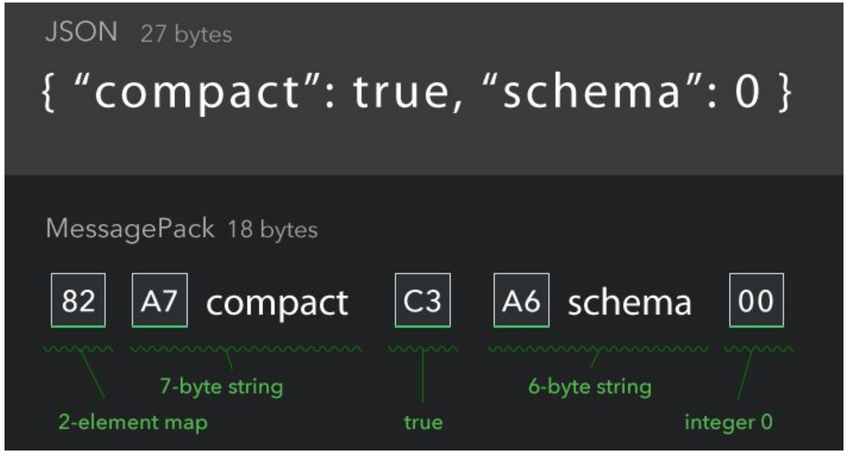


```
127.0.0.1 - - [11/Dec/2012:07:26:27] "GET / ...
127.0.0.1 - - [11/Dec/2012:07:26:30] "GET / ...
127.0.0.1 - - [11/Dec/2012:07:26:32] "GET / ...
127.0.0.1 - - [11/Dec/2012:07:26:40] "GET / ...
127.0.0.1 - - [11/Dec/2012:07:27:01] "GET / ...
...
```

```
{
    "host": "127.0.0.1",
    "method": "GET",
    ...
}
```

Event structure

- Tag
  - Where an event comes from, used for message routing
- Time
  - When an event happens, Epoch time
  - Parsed time coming from the datasource
- Record
  - Actual log content being a JSON object
  - Internally MessagePack

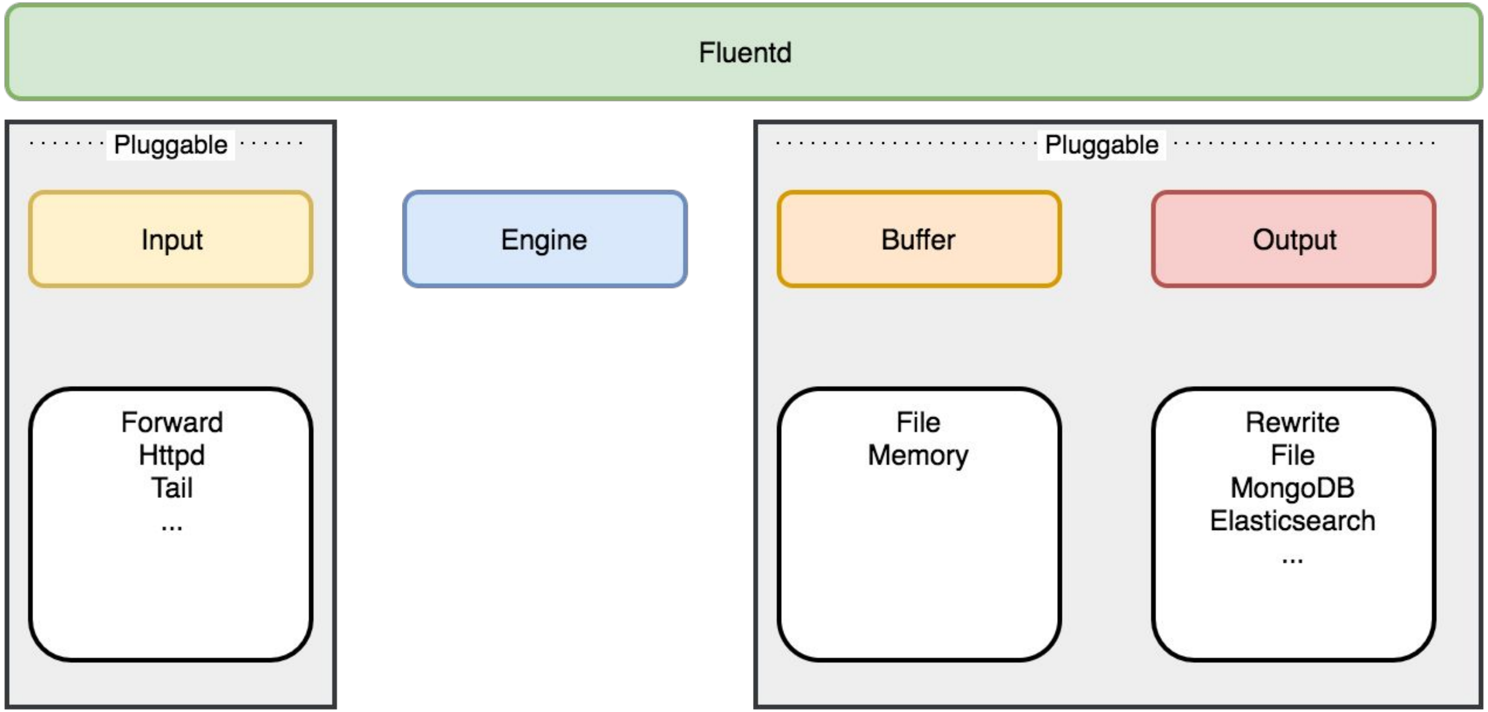


Event example

```
192.168.0.1 - - [28/Feb/2013:12:00:00 +0900] "GET / HTTP/1.1" 200 777
```

```
tag:: apache.access # set by configuration
time: 1362020400   # 28/Feb/2013:12:00:00 +0900
record: {"user":"-","method":"GET","code":200,"size":777,"host":"192.168.0.1","path":"/"}
```

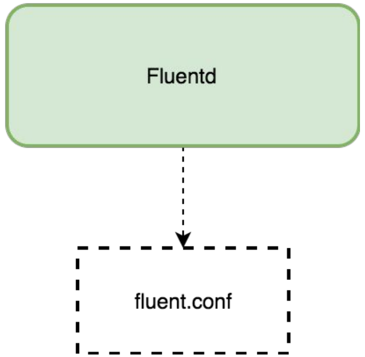
Pluggable Architecture



http://www.fluentd.org/plugins

Configuration

- Driven by a simple text based configuration file
  - fluent.conf



`<source><source/>` → Tell where the data comes from (input)

`<match></match>` → Tell fluentd what to do (output)

`<filter></filter>` → Event processing pipeline

`<label></label>` → Groups filter and output for internal routing

```
source -> filter 1 -> ... -> filter N -> output
```

```
# receive events via HTTP
<source>
  @type http
  port 9880
</source>
```

```
# read logs from a file
<source>
  @type tail
  path /var/log/httpd.log
  format apache
  tag apache.access
</source>
```

```
# save alerts to a file
<match alert.**>
  @type file
  path /var/log/fluent/alerts
</match>
```

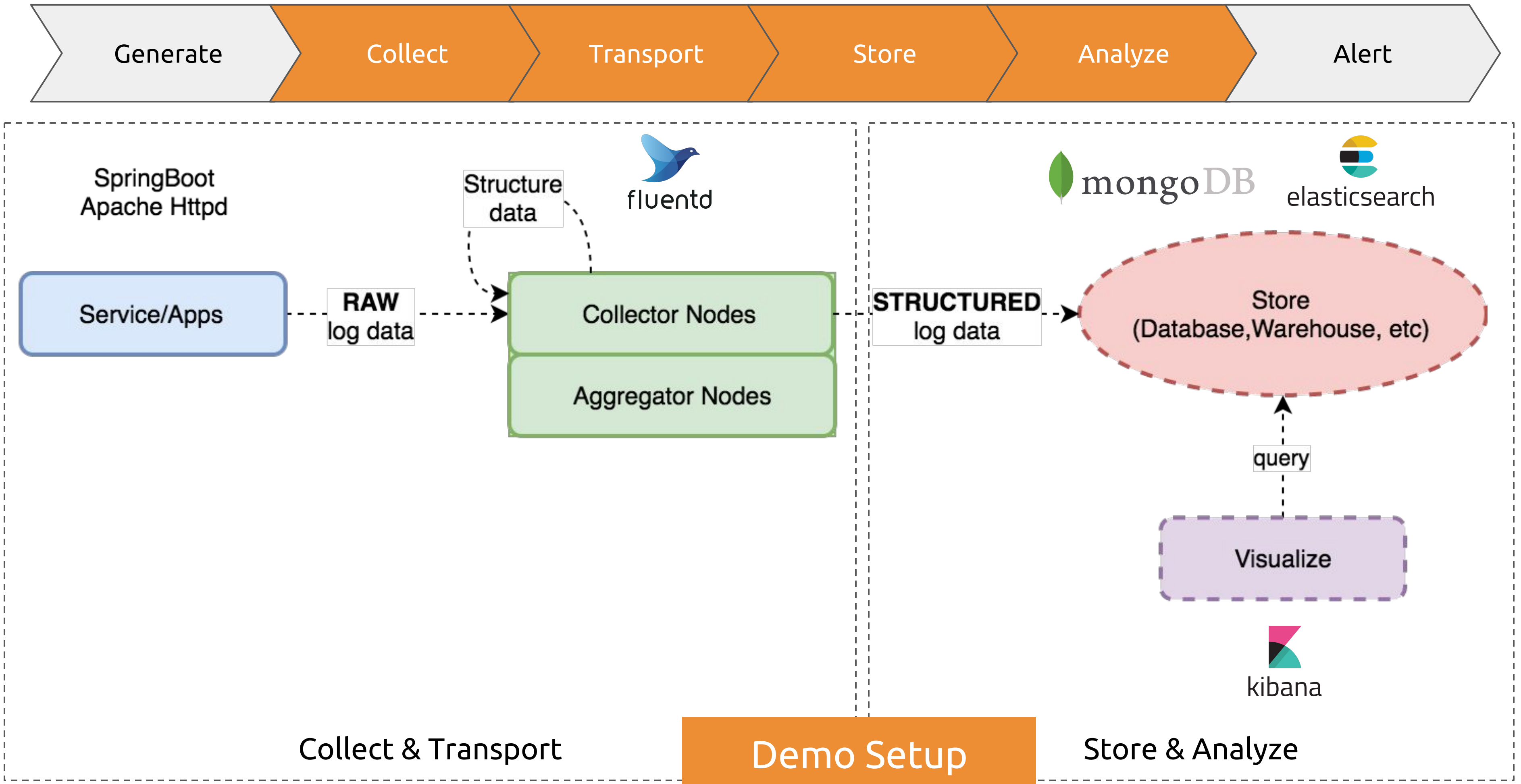
```
# save access logs to MongoDB
<match apache.access>
  @type mongo
  database apache
  collection log
</match>
```

```
# forward other logs to servers
<match **>
  type forward
  <server>
    host 192.168.0.11
    weight 20
  </server>
  <server>
    host 192.168.0.12
    weight 60
  </server>
</match>
```

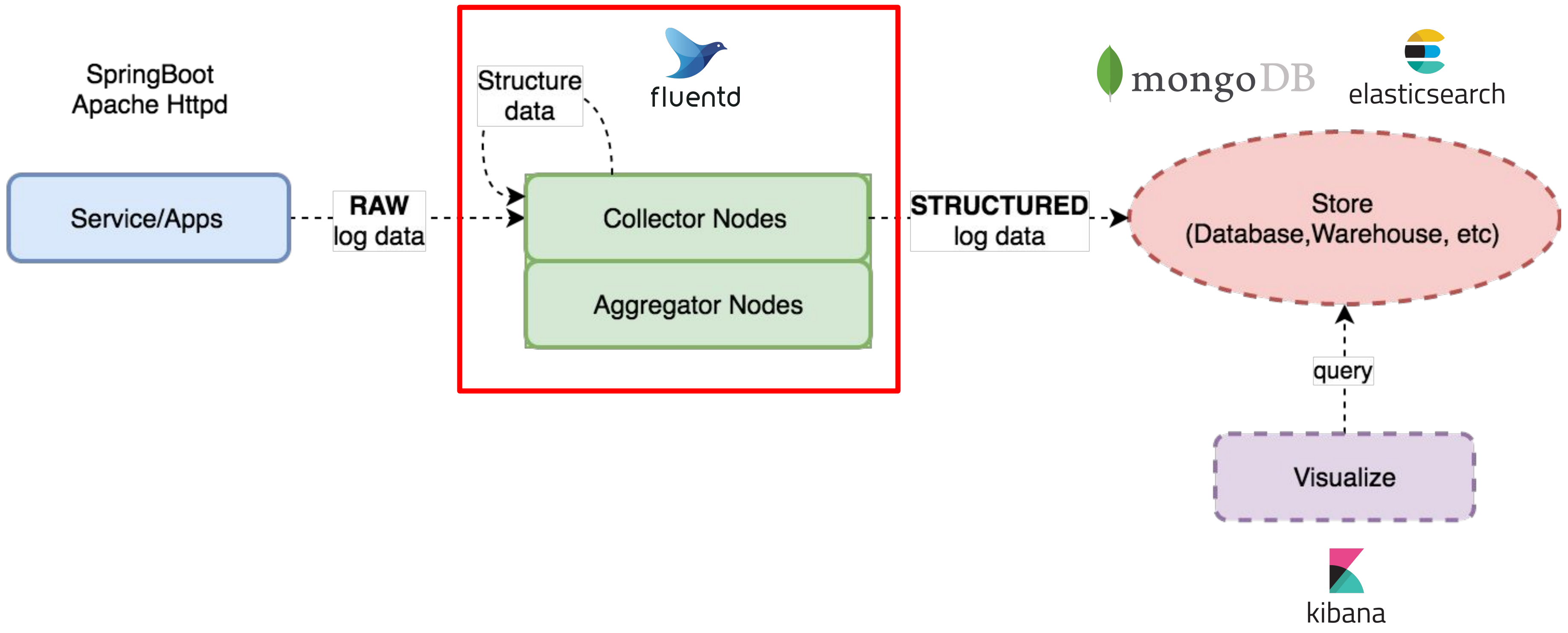
```
# add a field to an event
<filter myapp.access>
  @type record_transformer
  <record>
    host_param "#{Socket.gethostname}"
  </record>
</filter>
```

```
# grouping and internal routing
<source>
  @type forward
  port 24224
  bind 0.0.0.0
  @label @SYSTEM
</source>
<label @SYSTEM>
  <filter var.log.middleware.**>
    @type grep
    # ...
  </filter>
  <match **>
    @type s3
    # ...
  </match>
</label>
```

Demo Setup


Generate
Collect
Transport
Store
Analyze
Alert
SpringBoot
Apache Httpd
Service/Apps
RAW
log data
Structure
data
fluentd
Collector Nodes
Aggregator Nodes
STRUCTURED
log data
mongoDB
elasticsearch
Store
(Database,Warehouse, etc)
query
Visualize
kibana
Collect & Transport
Store & Analyze

Demo: Run Fluentd

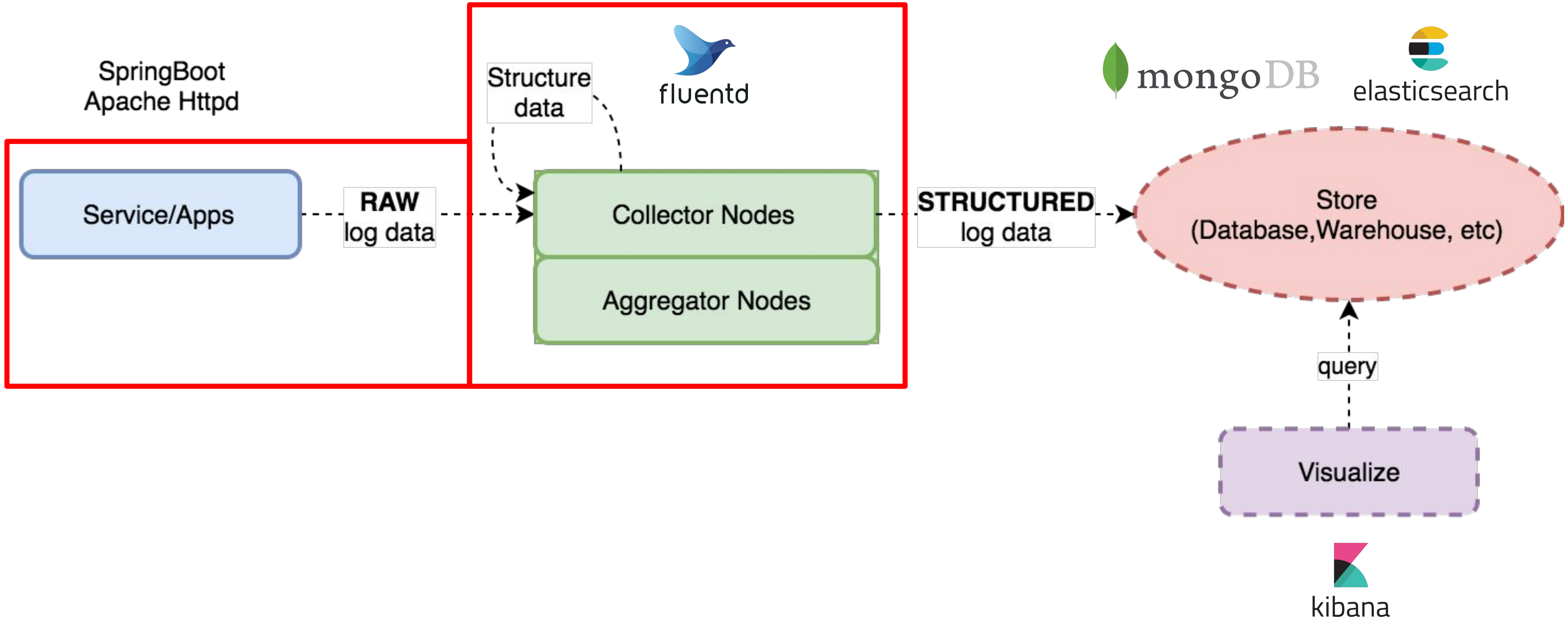


```
# file: docker-compose.yml
version: '2'
services:

  fluentd:
    container_name: fluentd
    image: fluentd-demo                  → Docker image used for fluentd (container the plugins)
    volumes:
      - $PWD/:/fluentd/etc               → Mounting local filesystem that contains the config file
    ports:
      - "24220:24220"                    → portmapping 24220 on host to 24220 in Docker container
```

```
# file: fluent.conf
# monitoring agent:
#   check http://localhost:24220/api/plugins.json for healthcheck
<source>
  @type monitor_agent
  port 24220                                  → Run the monitor agent on port 24220
  bind 0.0.0.0                                → Bind to all network interfaces
</source>
```

<u>Demo</u>

Demo: Capture input from Docker container

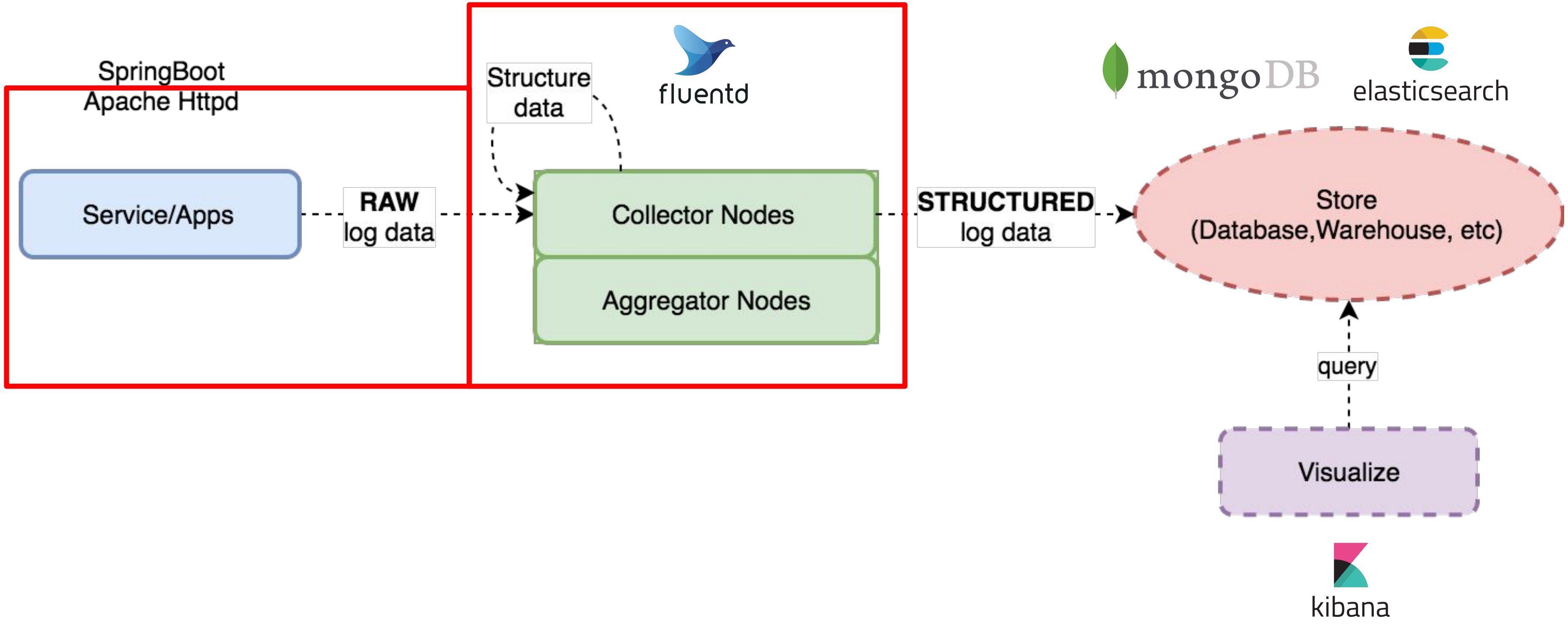


```
# file: docker-compose.yml
version: '2'
services:

  fluentd:
    container_name: fluentd
    # code intentionally omitted

  echo:
    container_name: echo
    image: debian
    command: bash -c 'for((i=1;i<=1000;i+=1)); do echo -e "Welcome $${i} times"; sleep 2; done;'
    links:
      - fluentd
    logging:
      driver: "fluentd"                   → Use the fluentd logging driver
      options:
        fluentd-address: localhost:24224  → Where can we find fluentd?
        tag: echo                         → Tag used for event routing
```

```
# file: fluent.conf
# input forward plugin
<source>
  @type forward                           → Bind to all network interfaces
  port 24224                              → Run the in_forward plugin on port 24220
  bind 0.0.0.0                            → Bind to all network interfaces
</source>
```

Demo

Demo: Capture HTTP Access Logs



```
# file: docker-compose.yml
version: '2'
services:

  fluentd:
    container_name: fluentd
    # code intentionally omitted

  httpd:
    container_name: httpd
    image: httpd-demo
    ports:
      - "80:80"                                → Run our Http server on port 80 serving “/”
    links:
      - fluentd
     logging:
       driver: "fluentd"                        → Use the fluentd logging driver
       options:
         fluentd-address: localhost:24224 → Where can we find fluentd?
         tag: httpd.access                      → Tag used for event routing
```

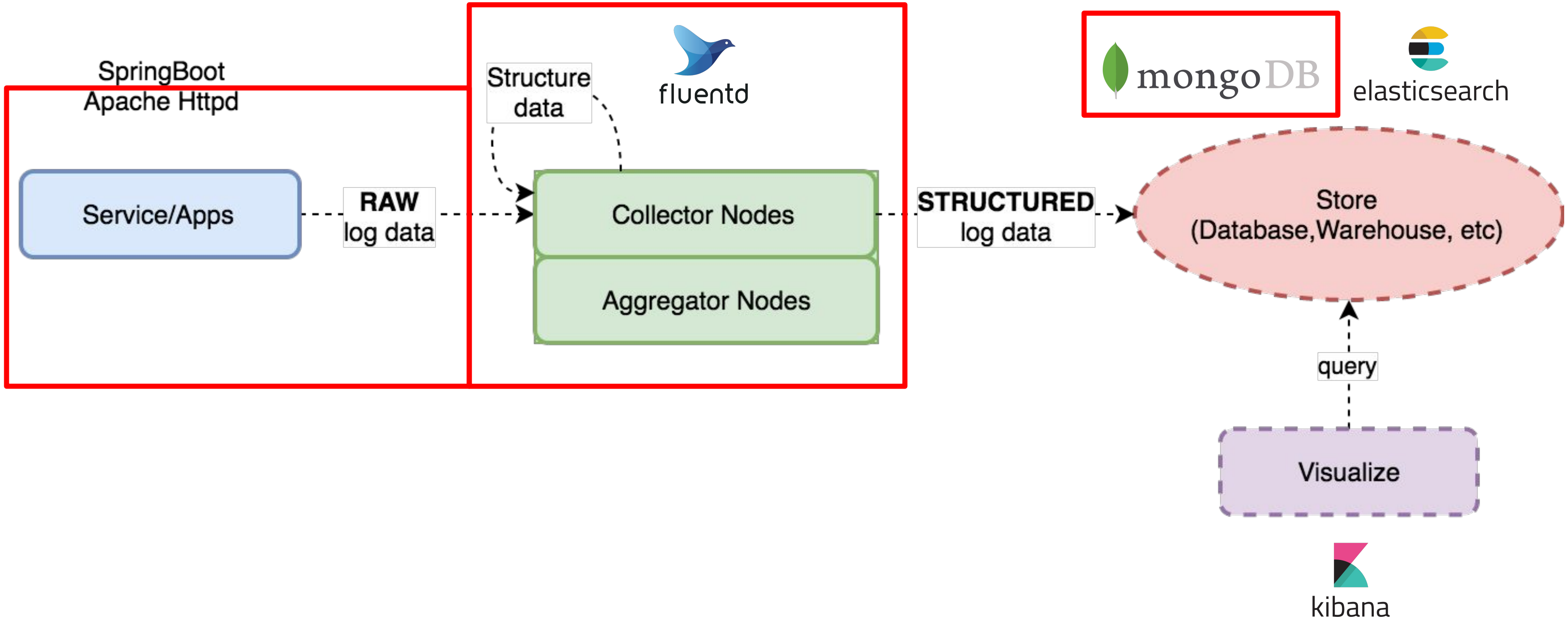
You get the idea :)

match order

```
# file: fluent.conf
# input forward plugin
<source>
  @type forward                     → Bind to all network interfaces
  port 24224                        → Run the in_forward plugin on port 24220
  bind 0.0.0.0                      → Bind to all network interfaces
</source>

# filter httd access logs
<filter httpd.access>               → Notice the filter tag! *, *.*, **, {a.b,a.*,a.*.b}, ...
  @type parser                      → Parse the data and create fields using the regex pattern
  format /^some regex pattern$/
  # code intentionally omitted
</filter>

# match all and print
<match **>
  @type stdout
</match>
```

Demo

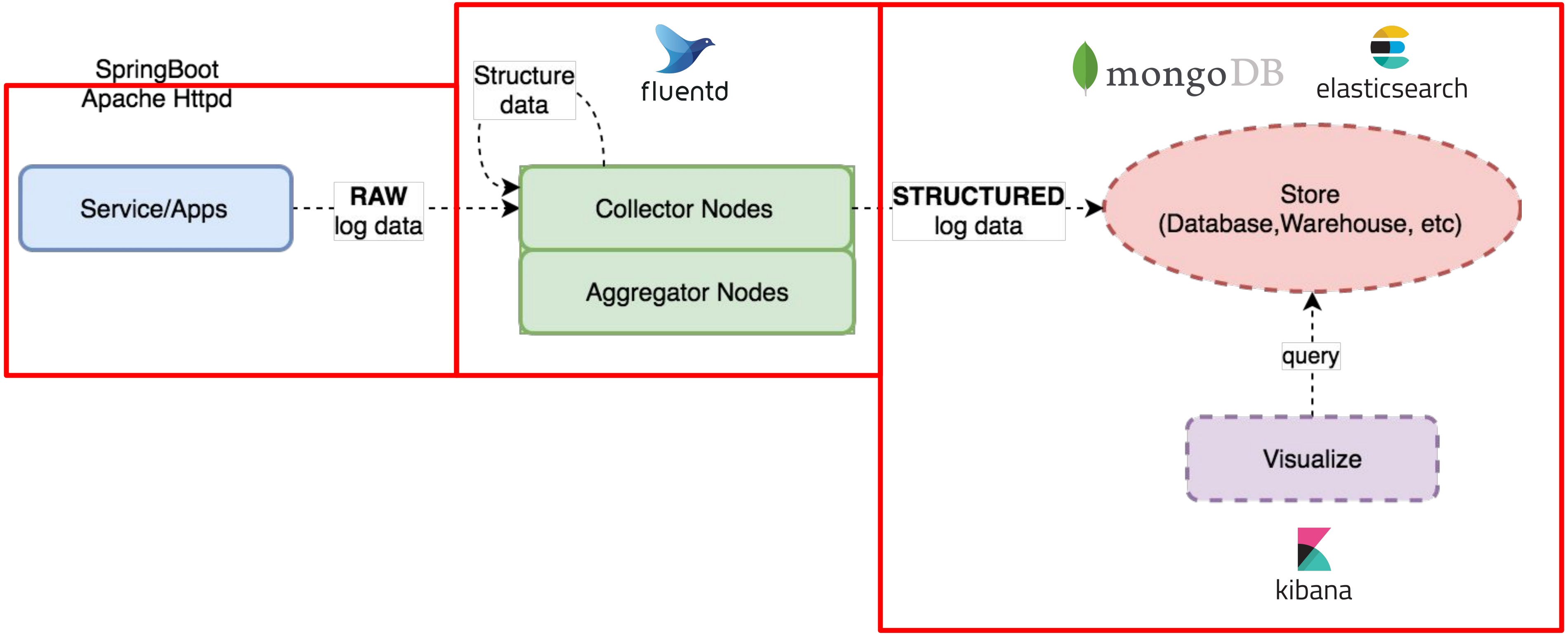
Demo: Capture HTTP Access Logs -> MongoDB



```
# file: fluent.conf
# code intentionally omitted
<match httpd.access>
  @type copy                              → Copy to multiple destinations
  <store>
    @type stdout                          → Console output
  </store>
  <store>
    @type mongo                           → MongoDB output
    host mongodb
    port 27017
    database fluentd
    collection test
    flush_interval 5s
    include_time_key true
  </store>
</match>
```

Demo

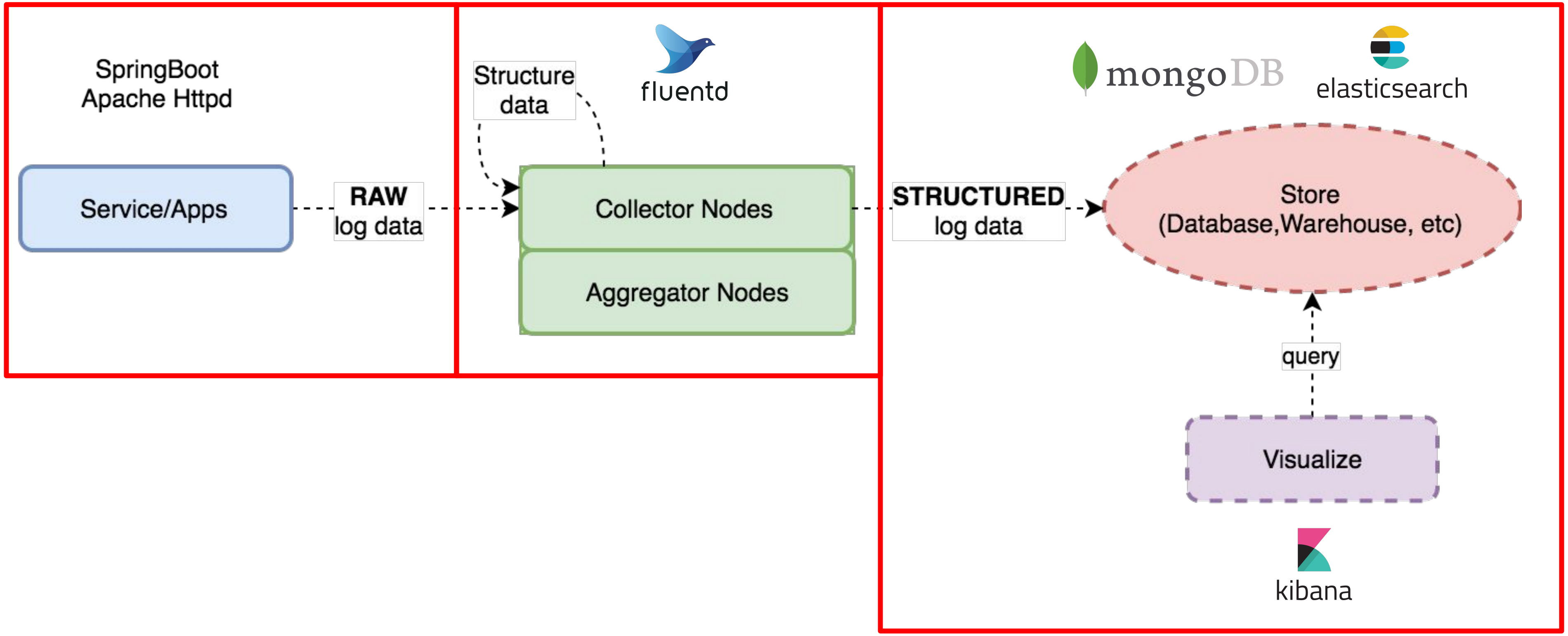
Demo: Capture HTTP Access Logs -> ELK stack



```
# file: fluent.conf
# code intentionally omitted
<match httpd.access>
  @type copy                                    → Copy to multiple destinations
  <store>
    @type stdout                                → Console output
  </store>
  <store>
    @type elasticsearch                         → Elasticsearch output
    host elasticsearch
    port 9200
    flush_interval 5
    logstash_format true
    include_tag_key true
  </store>
  <store>
    @type file
    path /fluentd/etc/logs/                     → File output
  </store>
</match>
```

Demo

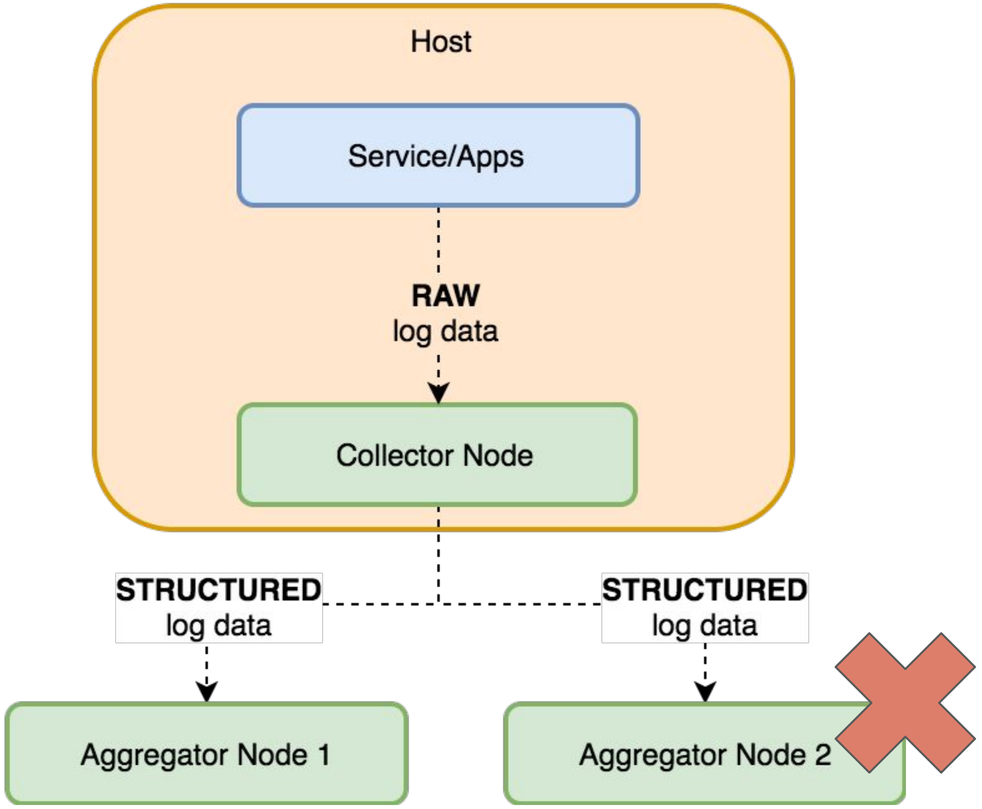
Demo: Capture Spring Boot Logs



```
# file: fluent.conf
# code intentionally omitted
<filter springboot.**>
  @type parser
  key_name log
  reserve_data true
  reserve_time true
  <parse>
    @type grok
    grok_failure_key grokfailure
    <grok>                                        → Parsing done based on GROK Patterns
      pattern %{TIMESTAMP_ISO8601:time_stamp}%{SPACE}%{LOGLEVEL:log_level}...*)
     </grok>
   </parse>
</filter>
```

Demo

Demo: HA Setup



Demo

https://github.com/mpas/collect-distributed-application-logging-using-fluentd-efk-stack

That's a wrap!

Question?

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Software geek, hands on
Developer/Architect/DevOps Engineer

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