ELK log analysis

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Tutorial VMs

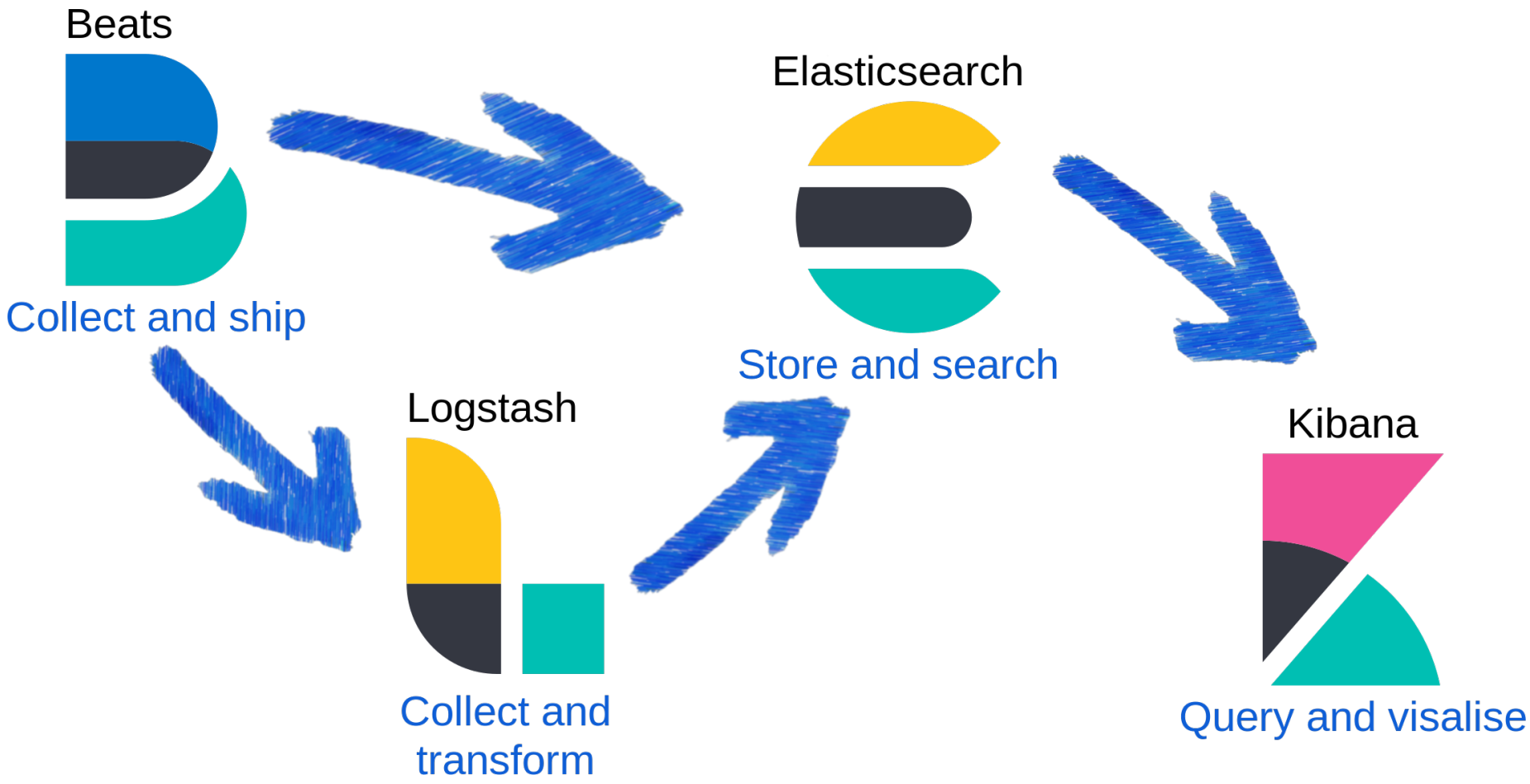
- Each participant has 3 VMs for tutorial
  - One has a public access and is used as access point to the rest
    - Hostname is *elk-X-a* (for rest of tutorial “node A” or just “A”)*
    - DNS address is elk-X-a.scc.kit.edu
  - Other two are accessible only through first one
    - Hostnames *elk-X-b* and *elk-X-c* (nodes B & C)*
  - Each VM has 8GB RAM, 2 CPU cores with 60GB of HDD
  - Most of tasks involve all 3 VMs unless specified

* “X” stands for instance number

Tutorial VMs

- Nodes B & C are accessible only through node A
  - You can use -o ProxyJump=nodeA on ssh cli
  - Use name and password you got for first login
  - It is suggested to add your ssh public key to *~/.ssh/authorized_keys* of the root user on all machines
    - sudo sh -c "echo ‘<ssh-public-key>’ > /root/.ssh/authorized_keys"
    - Feel free to install your favourite text editor
      - eg. # yum -y install nano

ELK architecture



Outline of tutorial

- Repository setup
- Elasticsearch cluster setup and basics
- Filebeat installation and configuration
- Kibana setup with basic security
- Logstash and Filebeat stack setup
- Log data transformation with Logstash (basic to advanced)
- Kibana visualizations of the data

Materials on https://git.io/fjNBe

Repository setup

Create file */etc/yum.repos.d/elasticsearch.repo* with following content

```
[elasticsearch-7.x]
name=Elasticsearch repository for 7.x packages
baseurl=https://artifacts.elastic.co/packages/7.x/yum
gpgcheck=1
gpgkey=https://artifacts.elastic.co/GPG-KEY-elasticsearch
enabled=1
autorefresh=1
type=rpm-md
```

* You can also “curl” it from materials on github

```
# curl -L https://git.io/fjNeQ > /etc/yum.repos.d/elasticsearch.repo
```

Elasticsearch setup

- Install elasticsearch package
  - `# yum install elasticsearch`
  - You will need to confirm downloaded gpg-key (or use -y switch)
- Edit service for memlock
  - # systemctl edit elasticsearch (elasticsearch/mem_lock.conf)

```
[Service]
LimitMEMLOCK=infinity
```

Elasticsearch setup
elasticsearch.yml

- Edit */etc/elasticsearch/elasticsearch.yml*
  - cluster
    - name to anything you like – eg. gks2019
    - initial_master_nodes: [all nodes]
  - discovery:
    - seed_hosts: list of master node (all nodes here)
  - bootstrap.memory_lock: true (only uncomment)

Elasticsearch setup
elasticsearch.yml

- Edit */etc/elasticsearch/elasticsearch.yml*
  - network.host: “::0”
  - node:
    - name: unique for each node (eg. host name)
    - attr.rack: can be used to customize data allocation
      - Not used during tutorial
    - data: true
    - master: true

Example config at [elasticsearch/elasticsearch.yml]

Elasticsearch setup finish

- Edit */etc/elasticsearch/jvm.options*
  - -Xms & -Xmx
    - To ½ of RAM but no more than 30GB
    - Details: Heap size
- Reload systemctl & start service
  - # systemctl daemon-reload && systemctl start elasticsearch
- Finally check cluster state:
  - # curl -s 'localhost:9200/_cluster/health?pretty'

Kibana & httpd setup
Without TLS

Do this on publicly accessible node only (node A)

- Install packages
  - # yum -y install httpd kibana
- curl following files
  - kibana/httpasswd.users → */etc/httpd*
  - kibana/http-kibana.conf → */etc/httpd/conf.d*

Kibana & httpd setup
With TLS

Do this on publicly accessible node only (node A)

- Install packages
  - # yum -y install httpd kibana mod_ssl
- curl following files
  - kibana/httpasswd.users → */etc/httpd*
  - kibana/https-kibana.conf → */etc/httpd/conf.d*
  - kibana/create_cert.sh → */anywhere/you/like/it*
- Run create_cert.sh (creates self-signed ssl certificate)
  - sh create_cert.sh

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Kibana & httpd setup

- Start httpd
  - # systemctl start httpd
- Edit /etc/kibana/kibana.yml (example kibana/kibana.yml)
  - server.host: localhost
- Start kibana
  - # systemctl start kibana
- Connect to kibana in web browser
  - User is kibana and password is kibanakibana (you can change this)

Logstash setup

Do this on the non-public nodes only (nodes B & C)

- Install logstash (requires java)
  - # yum -y install logstash java-11-openjdk-devel
- Edit /etc/logstash/logstash.yml
  - xpack.monitoring.enabled: true
  - xpack.monitoring.elasticsearch.hosts: list of Elasticsearch hosts
    - In format http://host:port
    - Feature not available in *-oss versions

Logstash setup
Tutorial only

- Edit logstash service so it is run as root
- Used only during tutorial, not advised in production

```
[Service]

User=root

group=root
```

Logstash
logstash.conf

- /etc/logstash/conf.d/logstash.conf
  - Main config file describing input transformations
  - Basic structure:
    - Input definitions
      - What to process
    - Filter definitions
      - How to process it
    - Output definitions
      - Where to send it

Logstash logstash.conf/input

- Input describes data source
- Supports lot of different plugins
  - File, beats, elasticsearch, exec, and many more

```
input {
        beats {
                port                    => 5044
                host                    => "::"
        }
        file {
                path                    => "/tmp/test-file"
                type                    => "test"
                start_position          => "beginning"
        }
}
```

Logstash logstash.conf/output

- Output describes where you want to store transformed data
- Many different plugins
  - file
  - elasticsearch
  - email
  - many more

```
output {
        stdout {
                codec     => rubydebug { metadata => true }
        }
        if [type] == "test" {
                file {
                        path                    => "/tmp/test.out"
                        file_mode               => 0644
                        flush_interval          => 0
                }
        }
        else {
                elasticsearch {
                        hosts                   =>   [  "elk-X-a:9200",
                                                "elk-X-b:9200", "elk-X-c:9200"]
                }
        }
}
```

Logstash
logstash.conf/filter

- Filter config is the main part of data transformation work
- Lots of filters to apply to data
  - date – date and time processing
  - kv – key and value parsing
  - mutate – transform already known data
  - grok – swiss army filter for logstash
  - ruby – when even grok is not enough
  - many other

Logstash
logstash.conf/filter

We will get to filters after we setup filebeat to ship data

- Now just a small demo
  - Add example filter to config file
  - Run logstash in foreground /usr/share/logstash/bin/logstash "--path.settings" "/etc/logstash"

```
filter {
        if [type] == "test" {
                mutate {
                        uppercase           =>
[ "message" ]
                }
        }
}
```

Filebeat setup

- Install filebeat
  - # yum -y install filebeat
- Edit /etc/filebeat/filebeat.yml
  - Backup old file and create new
  - This is only to test connection and to see what filebeat does
  - Do only on one node

```
filebeat:
  inputs:
    - type: log
      paths:
        - /var/log/messages
      fields:
        type: test
      fields_under_root: true
output:
  logstash:
    hosts:
      - "nodeB:5044"
```

filebeat/test.yml

Filebeat setup

- Start logstash in foreground (nodeB)
  - # /usr/share/logstash/bin/logstash "--path.settings" "/etc/logstash"
- Start filebeat (node with configured test instance)
  - # systemctl start filebeat
- Observe sent events
- Stop filebeat
  - # systemctl stop filebeat

logstash/sample_filebeat_event.txt

Now some more serious work
Collect log sources

- Stop any running logstash
- Look into /var/log on all machines
- Create /etc/filebeat/filebeat.yml
  - Try to collect all interesting log files on system
  - You need to take a look into files (eg. with less)
  - Add custom field to every log type you find, so you can sort it out afterwards

Now some more serious work
Multiline events

- Try to determine if there are any events over more lines
  - You can join them with filebeat
  - This appends all lines starting with whitespace to a line that does not start with one
  - More on multiline

```
multiline:
  pattern: '^\s+'
  negate: true
  match: before
```

Now some more serious work

- Start all filebeat instances on all machines when you feel ready
- Now we need to analyze events which will be shipped to logstash
- We know what data will be filebeat adding to events from our sample event

```
{
        "input" => {
       "type" => "log"
   },
       "agent" => {
          "hostname" => "elk-X-b",
                "id" => "ca9d2d29-b991-43b5-91e9-c360b1f1dd56",
       "ephemeral_id" => "e7267066-5020-43eb-b874-e0891db70fd6",
              "type" => "filebeat",

[ ….. AND SO ON …. ]
```

Now some more serious work
Sample event usable fields

- Agent
  - Hostname
- @metadata
  - beat
- Message !!!
- @timestamp (time when event was collected)
- Any custom field (eg. type)

Aug 25 17:12:21 elk-X-a sshd[10623]: Accepted publickey for root from 10.0.0.1 port 32816 ssh2: RSA SHA256:Eq+vWr09lautVQ2BB5vG0Uze0BiJmPt0IQtrYbCag38

Event analysis
Ssh login (secure log)

Aug 25 17:12:21 elk-X-a sshd[10623]: Accepted publickey for root from 10.0.0.1 port 32816 ssh2: RSA SHA256:Eq+vWr09lautVQ2BB5vG0Uze0BiJmPt0lQtrYbCag38

- Date and time
- Hostname
- Program
- Event
  - What, For, From, With

How to get info into ES

- We will need two filters to get data into ES right
- Grok
- Date
- With grok we will get data from event into searchable fields
- With date we will set right @timestampt to event

Grok

- Grok works as a powerful regex matching tool
- It has many built in patterns to use
- We will be using only basic patterns to demonstrate how to build your own

Aug 25 17:12:21 elk-X-a sshd[10623]: Accepted publickey for root from 10.0.0.1 port 32816 ssh2: RSA SHA256:Eq+vWr09lautVQ2BB5vG0Uze0BiJmPt0IQtrYbCag38

%{SYSLOGTIMESTAMP:[@metadata][date]} %{SYSLOGHOST:host} %{SYSLOGPROG}: %{GREEDYDATA} for %{WORD:user} from %{SYSLOGHOST:remote_host} port %{NUMBER:port} %{GREEDYDATA}: %{WORD:key_type} %{NOTSPACE:hash_algo}:%{NOTSPACE:key_hash}

Date

- Now we have [@metadata][date] thanks to grok
- Date plugin is straightforward
- Timezone is by default same as logstash host have

```
date {
      match    => [
            "[@metadata][timestamp]",
            "MMM dd yyyy HH:mm:ss",
            "MMM  d yyyy HH:mm:ss"
      ]
}
```

Grok part 2

- The pattern we built before will match only secure logs about ssh logins
- Other lines will fail and timestamp will not be updated
- Try to prepare other grok pattern to match also different lines
- Grok tries patterns one after another until it matches or have no more patterns
- Handy tool for grok debugging https://grokdebug.herokuapp.com/
  - Also part of kibana

Aug 25 16:06:58 elk-X-a sshd[1829]: pam_unix(sshd:session): session opened for user root by (uid=0)

Kibana

Here we will try live demo on data we have already collected.

Other logs to train on

You will find other logs to train on in logs directory in materials.

You can reach me on github or send me an email

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Thank you for your attention

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