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1. ANNEXURE

1.1 Introduction

This documents is supporting document, while installing Zipkin and ELK you may find reference.

2. Document Tracing Zipkin

2.1 Installation of Zipkin

2.1.1 Download and Running

Zipkin works as an independent application and it can be downloaded as a runnable jar from the official website of Zipkin : <https://zipkin.io/>. The latest version of Zipkin needs a Java version above 8.

The direct download link of jar is as follows:

https://search.maven.org/remote_content?g=io.zipkin&a=zipkin-server&v=LATEST&c=exec

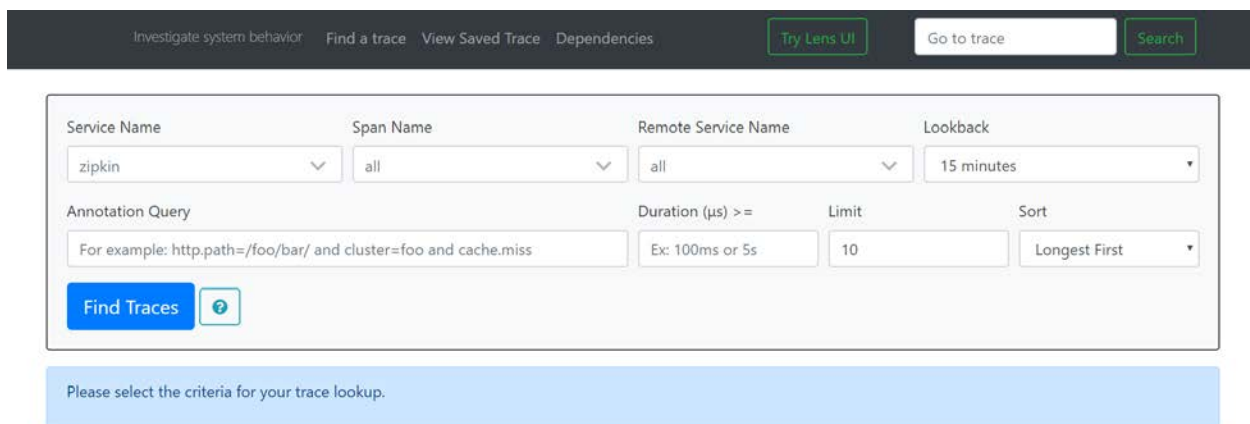
The downloaded jar can be executed using the `java -jar JAR_NAME` command.

The configuration of Zipkin can be done environment variables. The port of the Zipkin can be set using `QUERY_PORT` environment variable.

The application starts on the port number assigned for `QUERY_PORT` environment variable or its default value of 9411. The web UI of Zipkin can be accessed at <http://localhost:PORT>.

2.2 Zipkin User Interface

The basic layout of Zipkin looks as follows



The screenshot shows the Zipkin user interface search form. At the top, there are navigation links: "Investigate system behavior", "Find a trace", "View Saved Trace", and "Dependencies". To the right, there are buttons for "Try Lens UI", "Go to trace", and "Search". The main search form has four dropdown menus: "Service Name" (set to "zipkin"), "Span Name" (set to "all"), "Remote Service Name" (set to "all"), and "Lookback" (set to "15 minutes"). Below these are three input fields: "Annotation Query" (with a placeholder "For example: http.path=/foo/bar/ and cluster=foo and cache.miss"), "Duration (µs) >=" (with a placeholder "Ex: 100ms or 5s"), and "Limit" (set to "10"). There is also a "Sort" dropdown menu set to "Longest First". A blue "Find Traces" button with a help icon is at the bottom left. A light blue banner at the bottom says "Please select the criteria for your trace lookup."

We can find the traces of required api calls and services using the above search options given in the user interface. The search options given in the user interface are self-explanatory and there is another UI option (Try Lens UI). It's given a different user interface with same functionality.

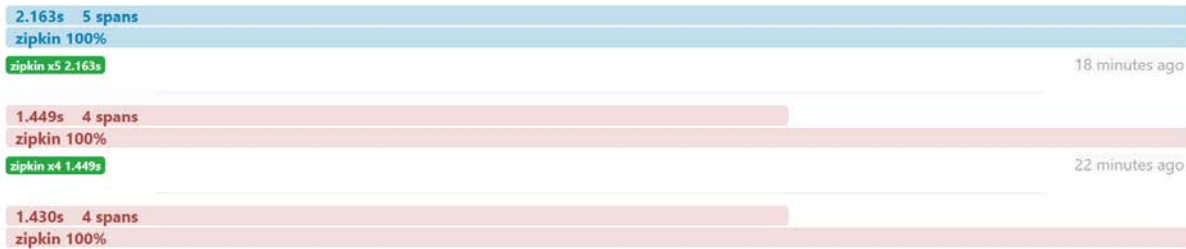
Service Name: zipkin | Span Name: all | Remote Service Name: all | Lookback: 1 hour

Annotation Query: For example: http.path=/foo/bar/ and cluster=foo and cache.miss

Duration (µs) >=: Ex: 100ms or 5s | Limit: 10 | Sort: Longest First

Find Traces ⓘ

Showing: 4 of 4 | Services: zipkin | **JSON** ⬇



The list of the traces can be seen like the above screen. Some error API calls are made to showcase how to track errors. The blue listings show the successful API hits and the red listings indicate errors. Each block indicates a single trace in the listings.

Opening an individual trace shows the below shown screen.

Investigate system behavior | Find a trace | View Saved Trace | Dependencies | **Try Lens UI** | Go to trace | Search

Duration: 2.163s | Services: 1 | Depth: 3 | Total Spans: 4 | **JSON** ⬇

Expand All | **Collapse All**

zipkin x4

Services	Start	End	Duration	Annotations
zipkin	-2.163s	http/api1	432.639ms	
zipkin	-1.001s	api1		
zipkin	1.068s	http/api2		
zipkin	1.001s	api2		

The above shown image describes the time taken for each block. There are 2 custom spans created inside 2 service calls, so there are total of 4 blocks. The time taken for individual block can be seen above. Clicking an individual block shows the following details.

Date Time	Relative Time	Annotation	Address
9/10/2019, 4:11:23 PM		Server Start	10.184.89.16:8080 (zipkin)
9/10/2019, 4:11:25 PM	2.163s	Server Finish	10.184.89.16:8080 (zipkin)

Key	Value
http.host	localhost
http.method	GET
http.path	/api1
http.status_code	200
http.url	http://localhost:8080/api1
mvc.controller.class	Controller
mvc.controller.method	api1
spring.instance_id	eswarperabathini.in.oracle.com:Zipkin

Show IDs

tracelid	9d63642d72ab6f9f
spanid	9d63642d72ab6f9f

The details of the specific span block are shown above and the logging events can also be seen in the Zipkin UI as small circular blocks. An example of error log is shown below.

Investigate system behavior Find a trace View Saved Trace Dependencies Try Lens UI Go to trace Search

Duration: 1.026s Services: 1 Depth: 2 Total Spans: 3 JSON

Expand All Collapse All zipkin x3

Services

zipkin	-1.026s : http/api1	205.134ms	410.267ms	615.401ms	820.534ms	1.026s
zipkin	-1.001s : api1					0
zipkin						8ms

Clicking on the error portion gives the clear detail about the error and where the error has arised. AN example is shown below.

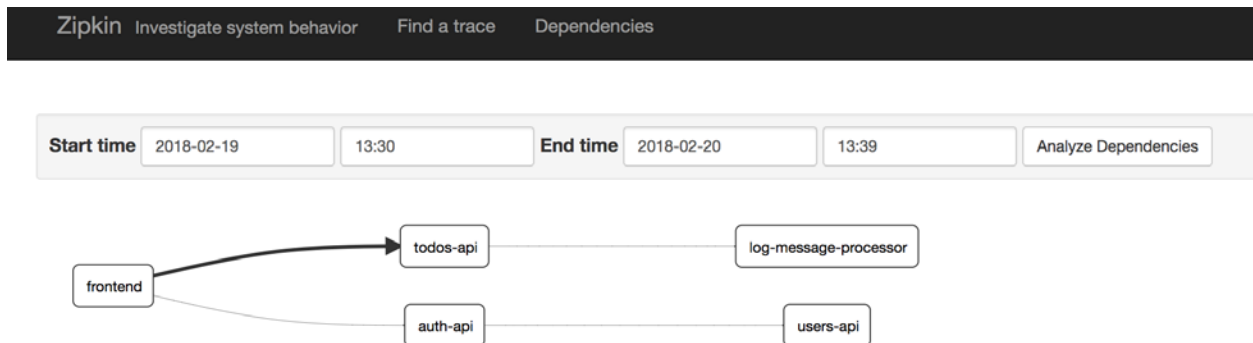
Services: zipkin

Date Time	Relative Time	Annotation	Address
9/11/2019, 6:09:01 PM		Server Start	10.184.89.16:8080 (zipkin)
9/11/2019, 6:09:02 PM	1.026s	Server Finish	10.184.89.16:8080 (zipkin)

Key	Value
error	Request processing failed; nested exception is org.springframework.web.client.HttpServerErrorException: 500 null
http.host	localhost
http.method	GET
http.path	/api1
http.status_code	500
http.url	http://localhost:8080/api1
mvc.controller.class	BasicErrorController
mvc.controller.method	errorHtml
spring.instance_id	eswarperabathini.in.oracle.com:Zipkin

If the Lens UI is used in Zipkin, the above screen shots are not applicable, but are relatable to the Lens UI as well.

Traces of the application can be found using Traceld, which can be found in the debug logs of the deployment when spring-cloud-sleuth is included in the dependencies (Included in spring-cloud-starter-zipkin dependency). Clicking the dependency tab gives the dependency graph info between micro-services. An example dependency graph is shown below.



3. Monitoring ELK

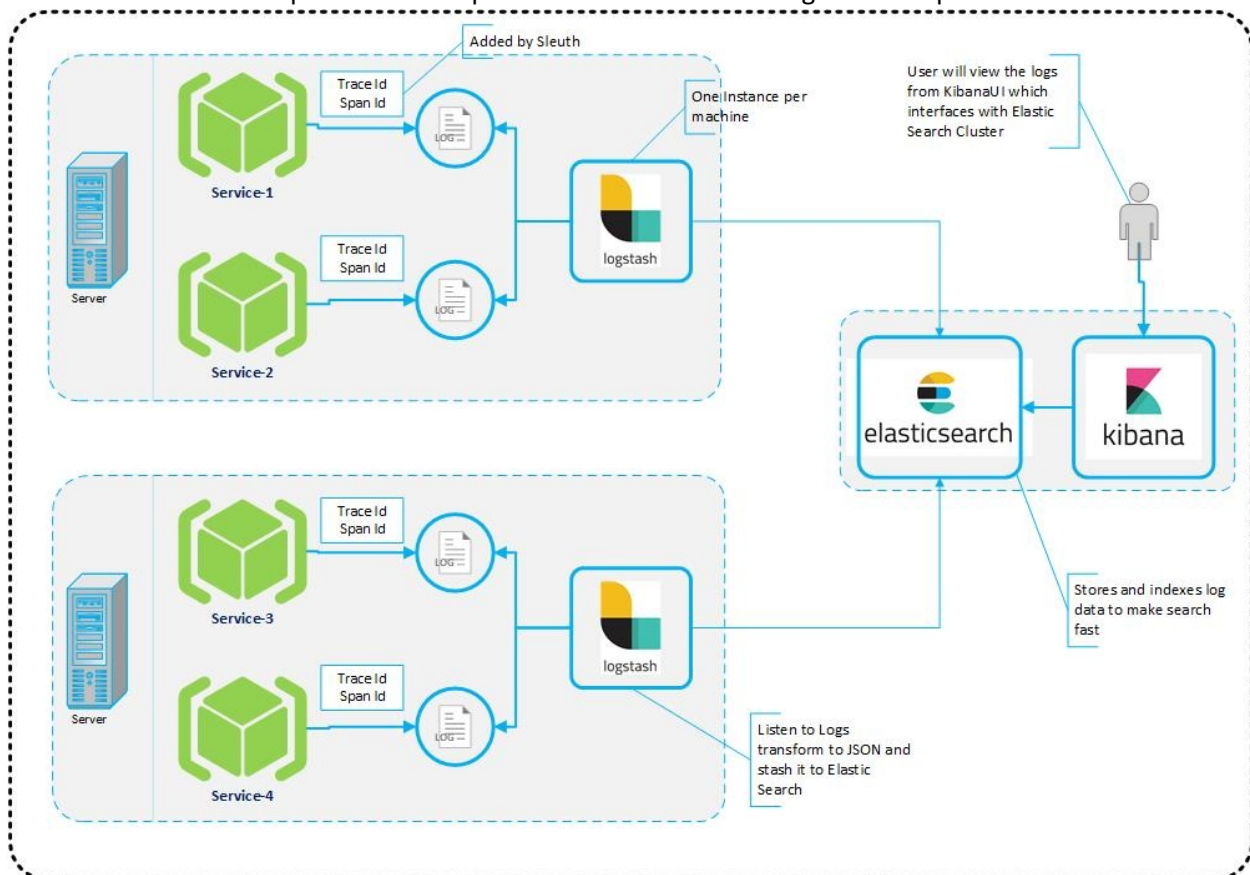
3.1 Introduction

ELK Stack was a collection of three open-source products — Elasticsearch, Logstash, and Kibana. Elasticsearch is an open source, full-text search and analysis engine, based on the Apache Lucene search engine. Logstash is a log aggregator that collects data from various input sources, executes different transformations and enhancements and then ships the data to various supported output destinations. Kibana is a visualization layer that works on top of Elasticsearch, providing users with the ability to analyze and visualize the data.

Together, these different components are most commonly used for monitoring, troubleshooting and securing IT environments. Logstash take care of data collection and processing, Elasticsearch indexes and stores the data, and Kibana provides a user interface for querying the data and visualizing it.

3.2 Architecture

The below architecture provides a comprehensive solution handling all the required facets



Spring cloud Sleuth also provides additional functionality to keep trace of the application calls by providing us a way to create intermediate logging events. So Spring Cloud Sleuth dependency must be added to applications.

3.3 Installing & Configuring ELK

To install and configure ELK Stack, make sure the versions of the 3 software are same. Download the latest version of

1. Logstash
2. Elastic Search
3. Kibana

The installation guides are given below.

1. Logstash : <https://www.elastic.co/guide/en/logstash/current/installing-logstash.html>
2. Elastic Search : <https://www.elastic.co/guide/en/elasticsearch/reference/current/install-elasticsearch.html>
3. Kibana : <https://www.elastic.co/guide/en/kibana/current/install.html>

Follow the process below after completing the download process of ELK.

3.3.1 Setup

3.3.1.1 Start ElasticSearch

1. Go to Elasticsearch root folder and use nohup to start the Elasticsearch process as below:

```
> nohup ./bin/elasticsearch
```

3.3.1.2 Setup Logstash and start

1. Create a new **logstash.conf** file that provides the required file parsing and integration to Elasticsearch

logstatsh.conf:

```
#Point to the application logs
input {
  file {
    type => "java"
    path => "/scratch/app/work_area/app_Logs/*.Log"
    codec => multiline {
      pattern => "%{YEAR}-%{MONTHNUM}-%{MONTHDAY} %{TIME}.*"
      negate => "true"
      what => "previous"
    }
  }
}
#Provide the parsing logic to transform Logs into JSON
filter {
```

```

#If log line contains tab character followed by 'at' then we will tag
that entry as stacktrace
if [message] =~ "\tat" {
  grok {
    match => ["message", "^(\\tat)"]
    add_tag => ["stacktrace"]
  }
}

#Grokking Spring Boot's default log format
grok {
  match => [ "message",
    "(?<timestamp>%{YEAR}-%{MONTHNUM}-%{MONTHDAY}
%{TIME}) %{LOGLEVEL:level} %{NUMBER:pid} --- \[(?<thread>[A-Za-z0-9-]+)\]
[A-Za-z0-9.]*\.(?<class>[A-Za-z0-9#_]+)\s*:\s+(?<Logmessage>.*)",
    "message",
    "(?<timestamp>%{YEAR}-%{MONTHNUM}-%{MONTHDAY}
%{TIME}) %{LOGLEVEL:level} %{NUMBER:pid} --- .+? :\s+(?<Logmessage>.*)"
  ]
}

# pattern matching Logback pattern
grok {
  match =>
{ "message" => "%{TIMESTAMP_ISO8601:timestamp}\s+%{LOGLEVEL:severity}\s+\[
%{DATA:service},%{DATA:trace},%{DATA:span},%{DATA:exportable}\]\s+\[%{DATA
:environment}\]\s+\[%{DATA:tenant}\]\s+\[%{DATA:user}\]\s+\[%{DATA:branch}
\]\s+%{DATA:pid}\s+---
\s+\[%{DATA:thread}\]\s+%{DATA:class}\s+:\s+%{GREEDYDATA:rest}" }
}

#Parsing out timestamps which are in timestamp field thanks to previous
grok section
date {
  match => [ "timestamp" , "yyyy-MM-dd HH:mm:ss.SSS" ]
}
}

#Ingest logs to Elasticsearch
output {
  elasticsearch { hosts => ["localhost:9200"] }
  stdout { codec => rubydebug }
}
}

```

2. Start Logstash process

```
>nohup ./bin/logstash -f logstash.conf
```

3.3.1.3 Setup Kibana and start

1. Go to the **kibana.yml** available under <kibana_setup_folder>/config and modify the file to include the below:

```
#Uncomment the below line and update the IP address to your host machine IP.  
server.host: "xx.xxx.xxx.xx"  
#Provide the elasticsearch url. If this is running on the same machine  
then you can use the below config as is  
elasticsearch.url: "http://localhost:9200"
```

2. Start Kibana process using the below command:

```
>nohup ./bin/kibana
```

A view of the Kibana dashboard is given below:



The screenshot shows the Kibana dashboard interface. On the left is a sidebar with navigation options: Discover, Visualize, Dashboard, Timelion, Dev Tools, and Management. The main area displays a table of log entries with columns for Time, service, environment, tenant, user, branch, trace, span, and message. The table contains five rows of log data, each representing a different service call or response.

Time	service	environment	tenant	user	branch	trace	span	message
July 11th 2018, 13:31:22.017	book-service	DEV	CITI	TestUser	TestBranch	b65cf8dc98bcaea9	b65cf8dc98bcaea9	2018-07-11 13:31:22.017 INFO [book-service,b65cf8dc98bcaea9,b65cf8dc98bcaea9,true] [DEV] [CITI] [TestUser] [TestBranch] 21656 --- [10-8083-exec-10] c.s.c.d.b.BookServiceApplication : Ratings found, set ratings for the given book
July 11th 2018, 13:31:22.017	book-service	DEV	CITI	TestUser	TestBranch	b65cf8dc98bcaea9	b65cf8dc98bcaea9	2018-07-11 13:31:22.017 INFO [book-service,b65cf8dc98bcaea9,b65cf8dc98bcaea9,true] [DEV] [CITI] [TestUser] [TestBranch] 21656 --- [10-8083-exec-10] c.s.c.d.b.BookServiceApplication : Returning book details
July 11th 2018, 13:31:22.014	rating-service	DEV	CITI	TestUser	TestBranch	b65cf8dc98bcaea9	851c7433a448b30f	2018-07-11 13:31:22.014 INFO [rating-service,b65cf8dc98bcaea9,851c7433a448b30f,true] [DEV] [CITI] [TestUser] [TestBranch] 15224 --- [nio-8084-exec-7] c.s.c.d.r.RatingsServiceApplication : Finding ratings for book id:1
July 11th 2018, 13:31:22.005	book-service	DEV	CITI	TestUser	TestBranch	b65cf8dc98bcaea9	b65cf8dc98bcaea9	2018-07-11 13:31:22.005 INFO [book-service,b65cf8dc98bcaea9,b65cf8dc98bcaea9,true] [DEV] [CITI] [TestUser] [TestBranch] 21656 --- [10-8083-exec-10] c.s.c.d.b.BookServiceApplication : Fetching ratings for the book
July 11th 2018, 13:31:22.004	book-service	DEV	CITI	TestUser	TestBranch	b65cf8dc98bcaea9	b65cf8dc98bcaea9	2018-07-11 13:31:22.004 INFO [book-service,b65cf8dc98bcaea9,b65cf8dc98bcaea9,true] [DEV] [CITI] [TestUser] [TestBranch] 21656 --- [10-8083-exec-10] c.s.c.d.b.BookServiceApplication : Call to findBook with id:1