The ELK Stack

Elastic Logging

Content

1. Log analysis	
2. The ELK stack	
3. Elasticsearch	Lab 1
4. Kibana phase 1	Lab 2
5. Beats	Lab 3
6. Kibana	Lab 4
7. Logstash & Filebeat	Lab 5
8. Enhanced Logstash	Lab 6
9. Kibana Custom Visualisations	Lab 7

Log analysis

What does it mean to analyse logs?

Log analysis

- Taken from Wikipedia
  - https://en.wikipedia.org/wiki/Log_analysis

> "In computer log management and intelligence, log analysis (or system and network log analysis) is an art and science seeking to make sense out of computer-generated records (also called log or audit trail records). The process of creating such records is called data logging."

Reasons

- Compliance with security policies
- Compliance with audit or regulation
- System troubleshooting
- Forensics (during investigations or in response to subpoena)
- Security incident response
- Understanding online user behavior
- Debugging production application issues

Many formats, many locations

- Logs come in many shapes and sizes
  - System logs
  - Application logs
  - Audit logs
  - Data feeds
  - Other sources
- Formats
  - Single line
  - Multiline
  - Mixed data
  - Organised

Disparate logging

- Logs are everywhere
- Why are they not centralised?
- One view to rule them all!
- Ability to obsfucate the data
  - Enable Devs to view production logs for live debugging
  - Enables support to perform more meaningful tasks

The ELK Stack

Centralise your view of logs and get what you need

What is ELK?

- Open source log and data viewing system
- Used for data analytics
  - So not just log files but any data you like
  - Can take inputs from many source
- Designed for big data storage and searching
  - Yes it is a noSQL database

- Further detail at
    - https://logz.io/learn/complete-guide-elk-stack/
    - https://qbox.io/blog/welcome-to-the-elk-stack-elasticsearch-logstash-kibana

The ELK stack

logstash

Broker

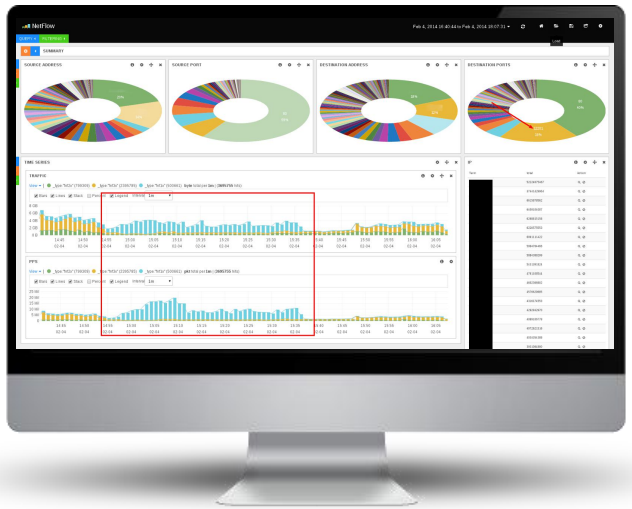
logstash

Cluster

elasticsearch

elasticsearch

elasticsearch



kibana

The heart of the system

- Elasticsearch
  - Big data store
  - Clusters for very large data and fast searching
- JSON API
- Adding data to Elasticsearch is called "Indexing"
  - POST or PUT methods
- Data can be searched using the GET method
- Data removal using the DELETE method

Indexing using the API

```
elk:~> curl -X PUT http://localhost:9200/app/instructors/2 \
-d '{
                "id":2,
                "firstname":"Steve",
                "lastname":"Shilling",
                "speciality":"Unix",
                "change_date":"2017-07-22 16:22:00"
}'

{
                "_index":"app",
                "_type":"instructors",
                "_id":"2",
                "_version":1,
                "result":"created",
                "_shards":{
                                "total":2,
                                "successful":1,
                                "failed":0
                },
                "created":true
}
```

Querying Elasticsearch

```
elk:~> curl -X GET http://localhost:9200/nstructors/2

{
        "_index":"app",
        "_type":"instructors",
        "_id":"2",
        "_version":2,
        "found":true,
        "_source":{
                "id":2,
                "firstname":"Steve",
                "lastname":"Shilling",
                "speciality":"Unix",
                "change_date":"2017-07-22 16:22:00"
        }
}
```


Using _search API

- curl -X GET http://localhost:9200/_search?q=steve
- curl -X GET http://localhost:9200/_search?q=firstname:steve
- curl -X GET http://localhost:9200/_search?q=change_date:2017*
- curl -X GET http://localhost:9200/_search?q=speciality:Uni?

- took: search time in milliseconds
- timed_out: If the search timed out
- shards: Lucene shards searched and success/fail rate
- hits: Actual results found and metadata

```
elk:~> curl -X GET http://localhost:9200/_search?q=steve

{
  "took":18,
  "timed_out":false,
  "_shards":{
    "total":11,
    "successful":11,
    "failed":0
  },
  "hits":{
    "total":1,
    "max_score":0.28488502,
    "hits":[{
      "_index":"app",
      "_type":"instructors",
      "_id":"2",
      "_score":0.28488502,
      "_source":{
        "id":2,
        "firstname":"Steve",
        "lastname":"Shilling",
        "speciality":"Unix",
        "change_date":"2017-07-22 16:22:00"
      }
    }]
  }
}
```

_search API with JSON

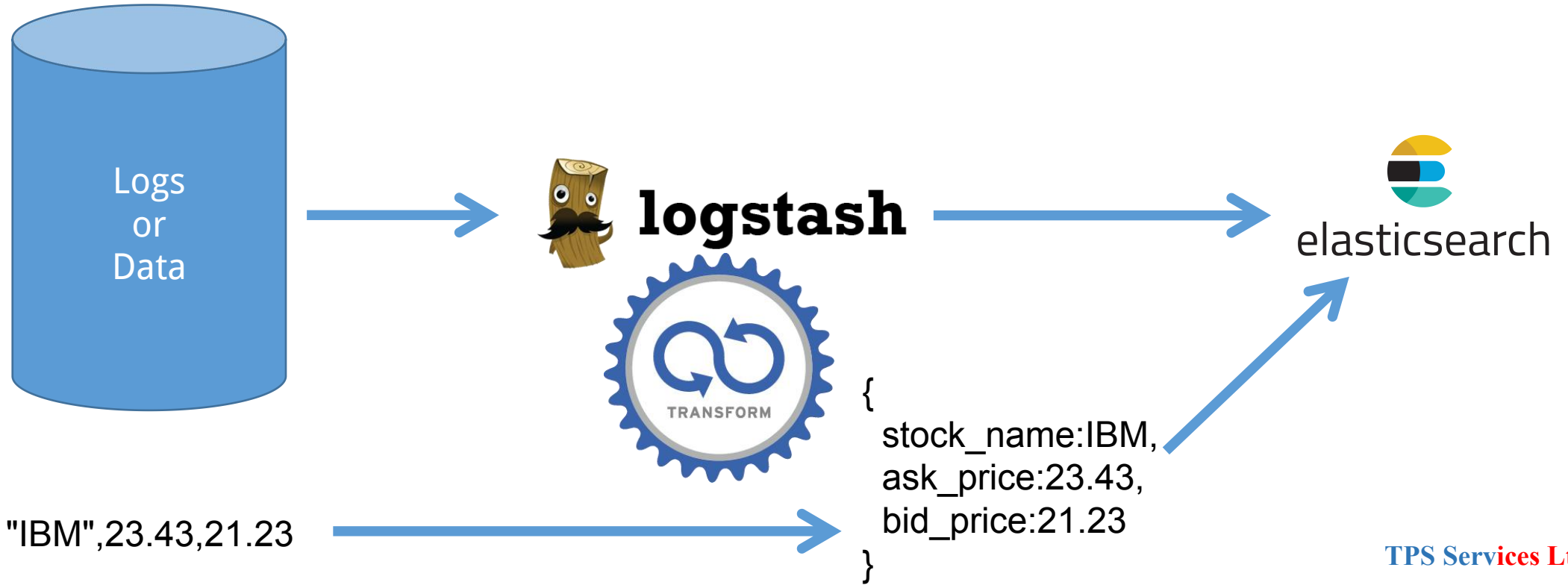
```
curl -X GET http://localhost:9200/_search \
-d '
{
  "query":{
    "match_phrase":{
      "speciality":"Unix"
    }
  }
}'
```

Data shipping

- Elasticsearch needs to be fed data
- Any JSON output can be collected by Elasticsearch
- Elastic make 2 products to help with logs and other data
  - Logstash
  - Beats

Logstash

- Server side data processing pipeline
  - https://www.elastic.co/products/logstash



Beats

- Lightweight processes for gathering common system data
  - Known applications and data formats
  - Log shipper for large enterprises
  - Sends to logstash server
    - Reduce load on Logstash servers and Elasticsearch cluster
- Extensible framework
  - Write your own
  - Use another from the community
    - https://www.elastic.co/guide/en/beats/libbeat/current/community-beats.html
- From Elastic
  - Filebeat, Metricbeat, Packetbeat, Winlogbeat, Heartbeat

Kibana

- The front end to the stack
- A web application for viewing, querying and analysis
- Capabilities
  - View raw data
  - Search raw data
  - Create charts for analysis

On with the show

- Now you know what ELK does
- Let's build and use it

Elastic Stack: Logging Lab 1

Installing, configuring and starting Elasticsearch

Installing Elasticsearch: Steps

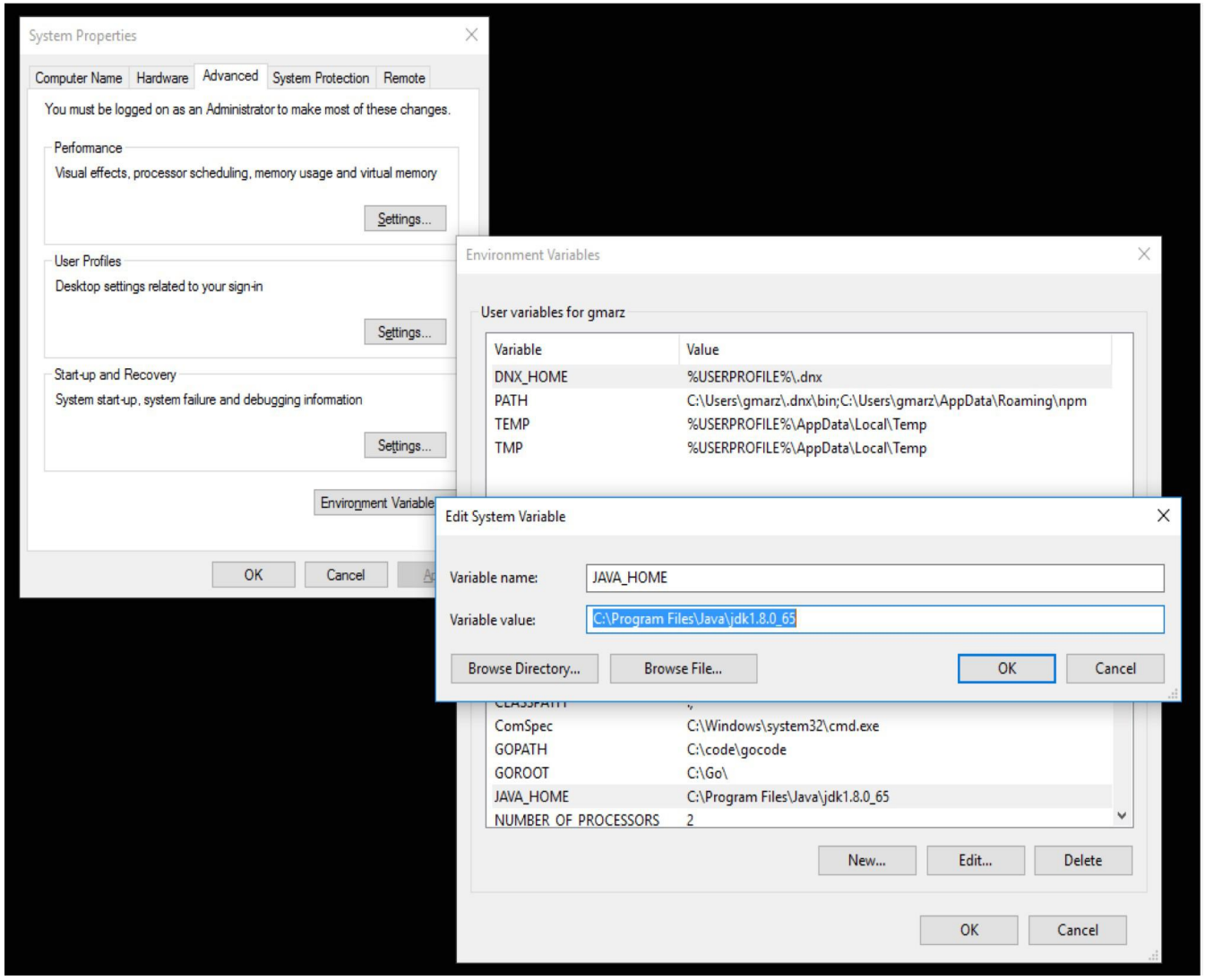
- Install Java
- Download Elasticsearch
- Install Elasticsearch
- Start Elasticsearch
- Test
- Configuring Elasticsearch

elasticsearch

Installing Java

- Elasticsearch is written in this language
  - http://www.oracle.com/technetwork/java/javase/downloads/index.html
- Linux can use the native Java packages (must be 1.8 or higher)
  - yum -y install java-1.8.0-openjdk
- Ensure JAVA_HOME variable is set
  - Most installations will do this
    - Although you may need to log out and back in for Windows
      - If it does not then see the following slide
    - On Linux if it does not set, or the wrong version;
      - /usr/bin/alternatives --config java

Set the Windows JAVA_HOME variable



Make sure you set the path that your JDK is at

Create A Workspace

- You will want to create a place to work out for this course.

```
# Mac or Linux:

elk:~> mkdir elkCourse
elk:~> cd elkCourse
elk:~/elkCourse>
```

```
# Windows
C:\Users\elk > mkdir elkCourse
C:\Users\elk > cd elkCourse
C:\Users\elk\elkCourse >
```


Download Elasticsearch

- For the latest version go to the elastic web site
  - www.elastic.co/downloads/elasticsearch
- Download the tar or zip files for better control
  - Location, and start up for different operating systems
- If you have administrator rights you can download the package
  - rpm = RedHat
  - deb = Debian/Ubuntu
  - msi = Microsoft

Installing Elasticsearch

- Package installations will do everything
  - Require Administrator rights to install
  - Will install as a service
    - RHEL = yum -y localinstall elasticsearch-5.5.0-x86_64.rpm
    - DEBIAN = dpkg -i elasticsearch-5.5.0-amd64.deb
- Using tar or zip will allow you to run it as a normal user
  - **Warning: It will fill up your disk quota!**
- Windows use a suitable unzip tool
- Linux use the tar command
  - tar xvf elasticsearch-5.5.0.tar.gz

Installing Elasticsearch

- For this course extract the file inside your elkCourse directory
  - e.g.

```
# Mac or Linux:

elk:~/elkCourse> tar xvf elasticsearch-5.5.0.tar.gz
elk:~/elkCourse> ls
elasticsearch-5.5.0
```


Starting Elasticsearch

- To start Elasticsearch as a user (and for this course)

```
# Windows:
C:\Users\elk\elkCourse> dir
elasticsearch-5.5.0
C:\Users\elk\elkCourse> cd elasticsearch-5.5.0
C:\Users\elk\elkCourse\elasticsearch-5.5.0> bin\elasticsearch.bat

# to quit Elasticsearch type ctrl-c, but don't quit now!
```

```
# Mac or Linux:
elk:~/elkCourse> ls
elasticsearch-5.5.0
elk:~/elkCourse> cd elasticsearch-5.5.0
elk:~/elkCourse/elasticsearch-5.5.0> bin/elasticsearch

# to quit Elasticsearch type ctrl-c, but don't quit now!
```

```
# Linux as a service:
elk:~/elkCourse> sudo service elasticsearch start
```

Testing Elasticsearch

- Check Elasticsearch is running
  - Point your web browser or curl http://localhost:9200


```
# Mac or Linux:
elk:~/elkCourse/elasticsearch-5.5.0> curl http://localhost:9200
{
 "name" : "logstash",
 "cluster_name" : "elasticsearch",
 "version" : {
  "number" : "2.0.0",
  "build_hash" : "de54438d6af8f9340d50c5c786151783ce7d6be5",
  "build_timestamp" : "2015-10-22T08:09:48Z",
  "build_snapshot" : false,
  "lucene_version" : "5.2.1"
 },
 "tagline" : "You Know, for Search"
}
```

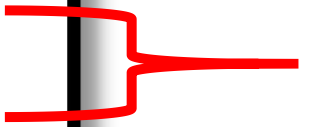
Configuring Elasticsearch

- Configured through YAML files
  - elasticsearch.yml
    - Define cluster names and nodes
    - Define log location
    - Specify which port to run on if you cannot use 9200
      - http.port: 9200
    - Define which NIC to run on
      - localhost is default
      - 0.0.0.0 for any network
      - network.host: 0.0.0.0
        - For version up to 6
        - network.host: _local_,_enp0s8:ipv4_
        - Also requires /etc/security/limits.conf to be changed to increase file descriptors
          - * hard nofile 65536

Checking changes

- Use netstat to ensure process is on required IPs and Ports

```
elk:~> netstat -tln
Active Internet connections (only servers)
Proto Recv-Q Send-Q Local Address           Foreign Address         State
tcp        0      0  0.0.0.0:22            0.0.0.0:*               LISTEN
tcp        0      0  127.0.0.1:25          0.0.0.0:*               LISTEN
tcp        0      0  0.0.0.0:55804         0.0.0.0:*               LISTEN
tcp        0      0  0.0.0.0:5601          0.0.0.0:*               LISTEN
tcp6       0      0  :::9200               :::*                    LISTEN
tcp6       0      0  :::9300               :::*                    LISTEN
tcp6       0      0  :::22                 :::*                    LISTEN
tcp6       0      0  ::1:25                :::*                    LISTEN
```



Elasticsearch running
All possible NICs
Ports 9200 and 9300

Congratulation

- You have completed Lab 1
- You have configure elasticsearch and tested it is ready
- Elasticsearch is now available to receive data

Installing Kibana Lab 2

Installing, configuring and starting Kibana

Installing Kibana: Steps

- Downloading Kibana
- Install Kibana
  - Optionally install "Sense" if using Kibana 4.x
- Start Kibana
- Restart Kibana
- Test
- Configuring Kibana

Downloading Kibana

- Download Kibana.
  - You may choose to do this course using Kibana 5 or 4.x.
  - If you are using Elasticsearch 2.x then you must use Kibana 4.x.
  - We recommend Kibana 5
- www.elastic.co/downloads/kibana
- Like with Elasticsearch you should choose your download type
  - Administrators use the O/S packages
  - Users/Developers use the WINDOWS or LINUX downloads
    - ZIP or TAR.GZ files

Installating kibana

- Package installations will do everything
  - Require Administrator rights to install
  - Will install as a service
    - RHEL = yum -y localinstall kibana-5.5.0-x86_64.rpm
    - DEBIAN = dpkg -i kibana-5.5.0-amd64.deb
- Using tar or zip will allow you to run it as a normal user
- Windows use a suitable unzip tool
- Linux use the tar command
  - tar xvf kibana-5.5.0-linux-x86_64.tar.gz

Installing Kibana

- For this course extract the file inside your elkCourse directory
  - e.g.

```
# Mac or Linux:

elk:~/elkCourse> tar xvf kibana-5.5.0-linux-x86_64.tar.gz
elk:~/elkCourse> ls
kibana-5.5.0-linux-x86_64
```


Starting Kibana

- To start Elasticsearch as a user (and for this course)

```
# Windows:
C:\Users\elk\elkCourse> dir
elasticsearch-5.5.0      kibana-5.5.0
C:\Users\elk\elkCourse> cd kibana-5.5.0
C:\Users\elk\elkCourse\kibana-5.5.0> bin\kibana.bat

# to quit Elasticsearch type ctrl-c, but don't quit now!
```

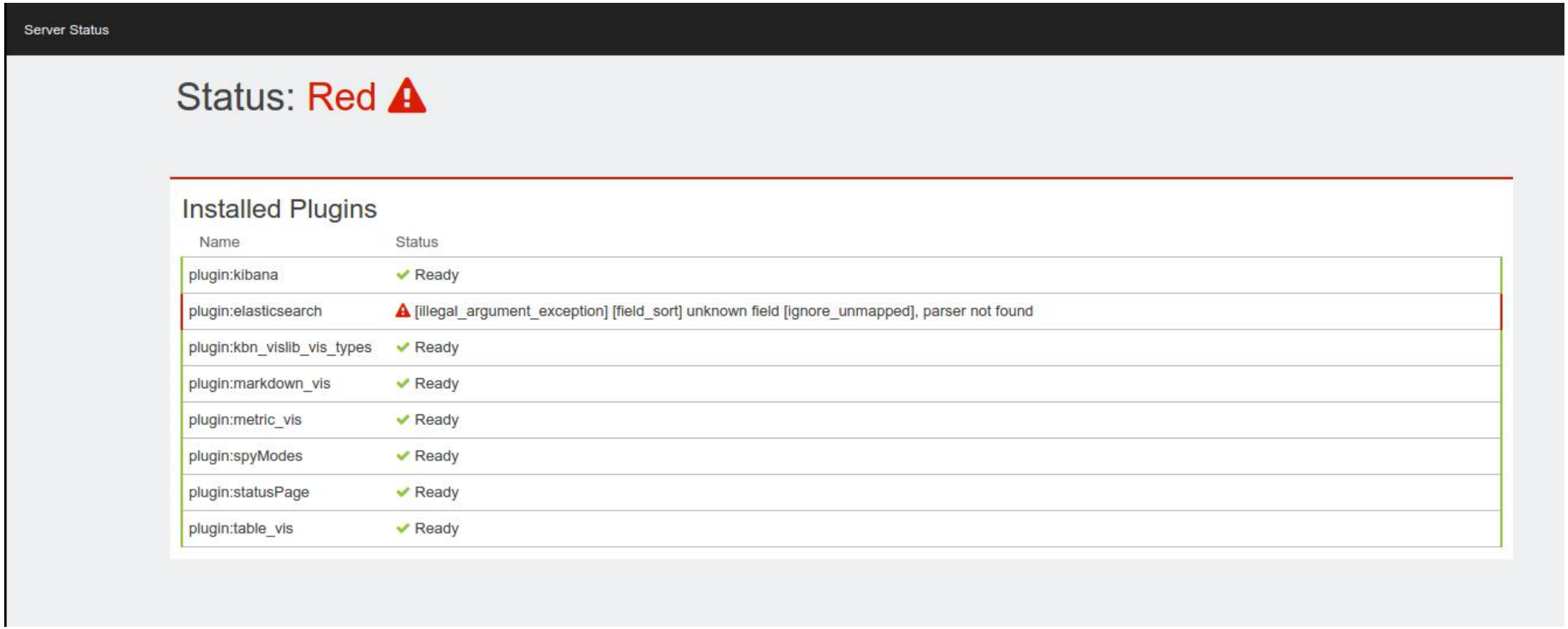
```
# Mac or Linux:
elk:~/elkCourse> ls
elasticsearch-5.5.0     kibana-5.5.0-linux-x86_64
elk:~/elkCourse> cd kibana-5.5.0-linux-x86_64
elk:~/elkCourse/kibana-5.5.0-linux-x86_64> bin/kibana

# to quit Elasticsearch type ctrl-c, but don't quit now!
```

```
# Linux as a service:
elk:~/elkCourse> sudo service kibana start
```

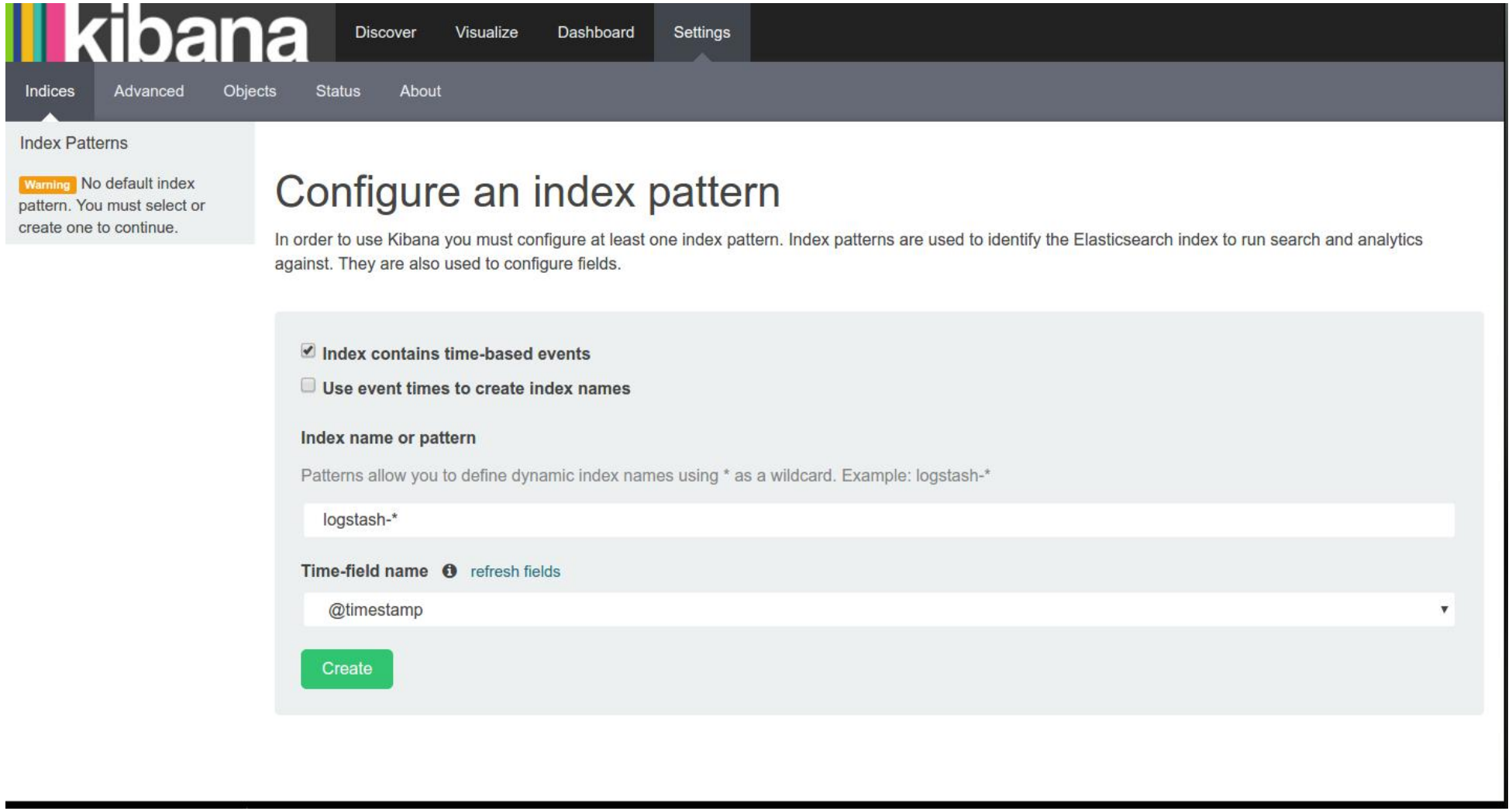
Kibana view

- Point your browser at your Kibana hosts port 5601
- http://localhost:5601

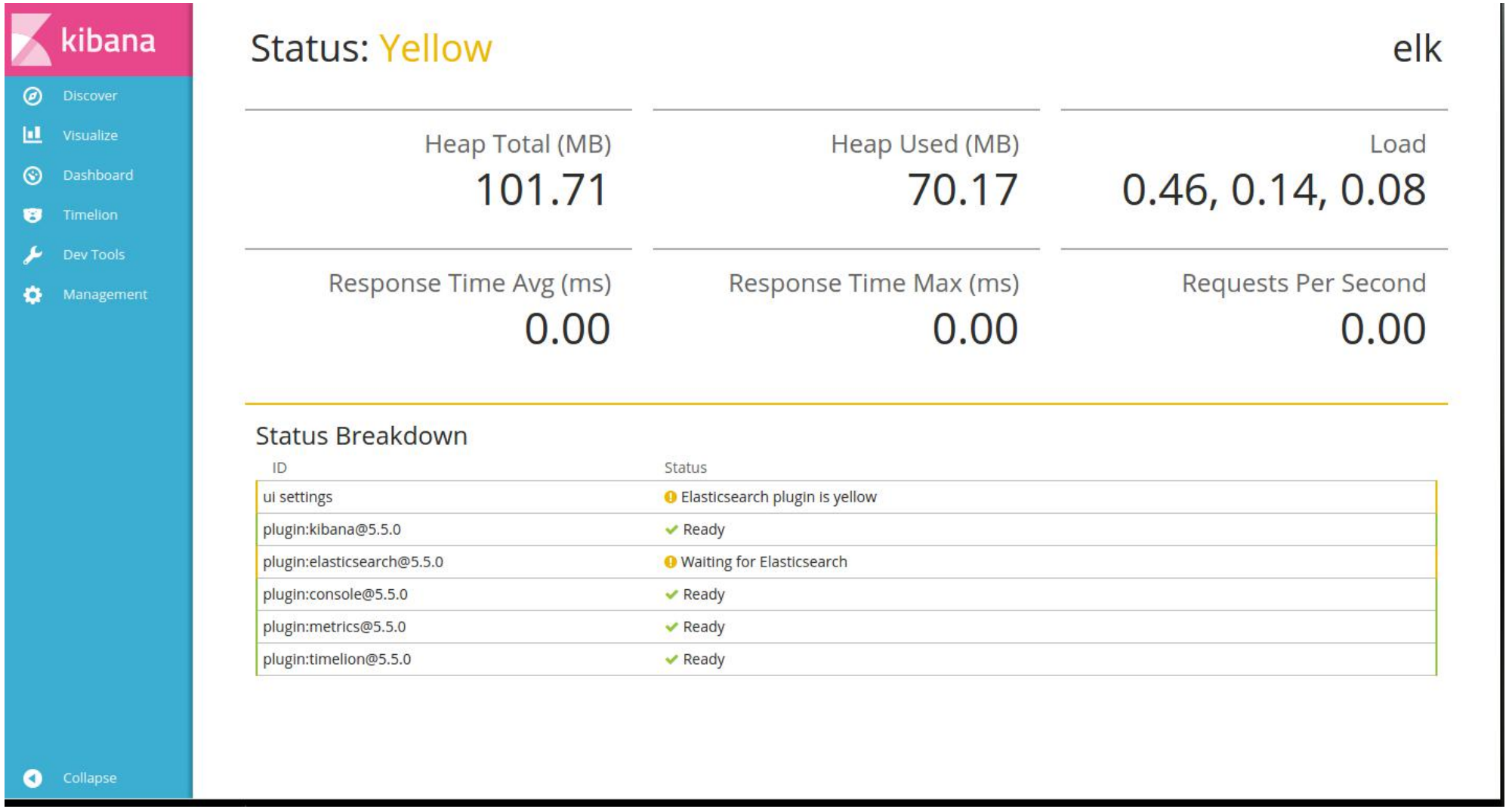
Version 4 configuration error



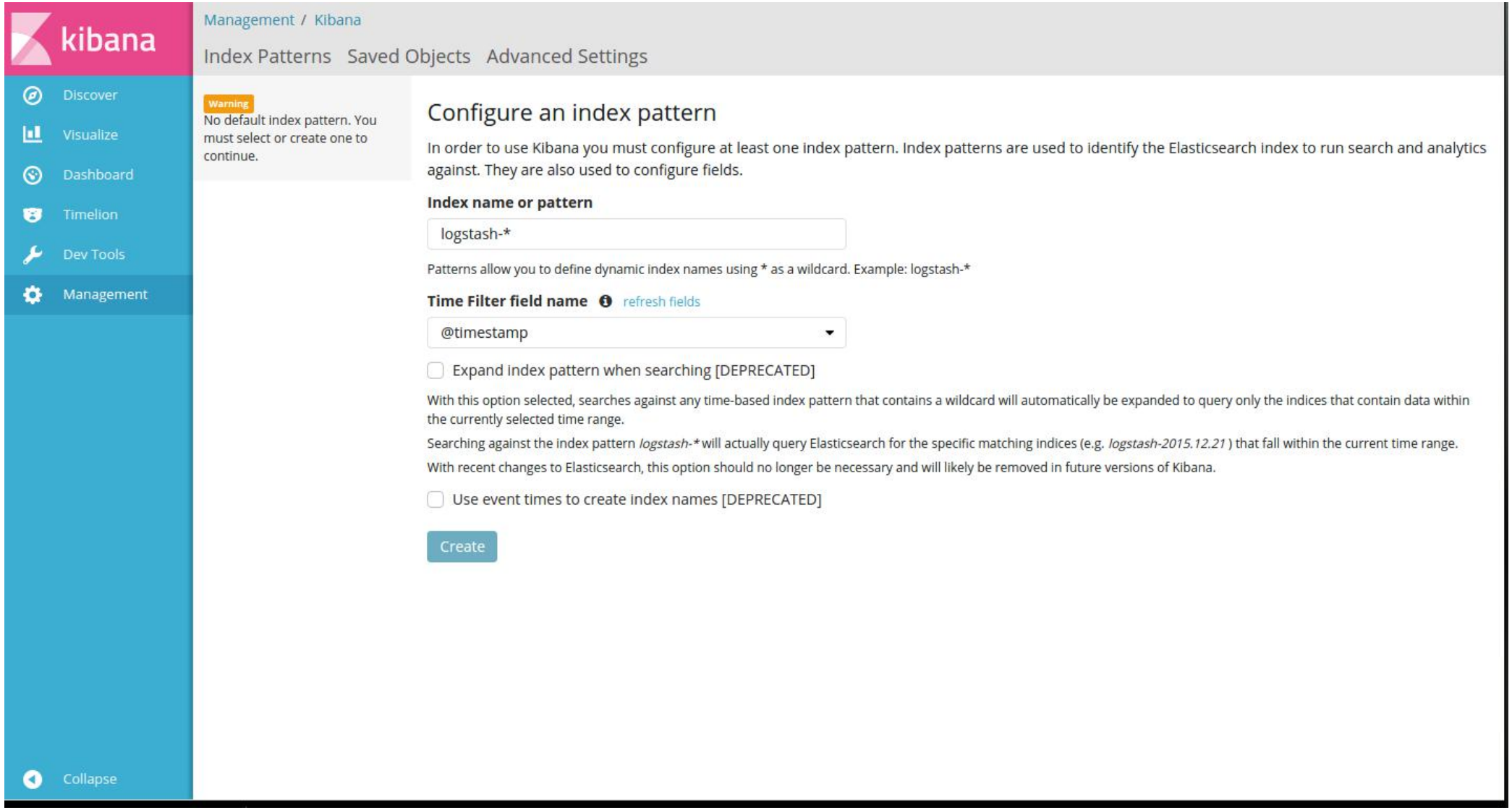
Version 4 working



Version 5 configuration error

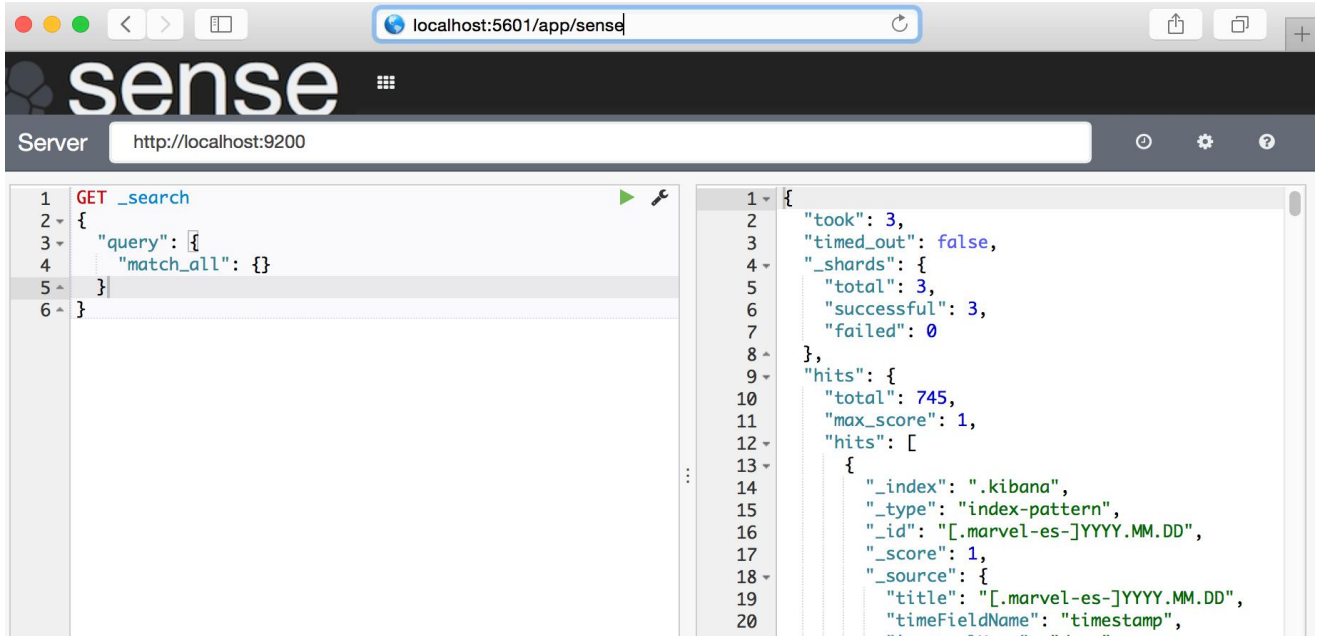


Version 5 working



Kibana AppSense

- App Sense allows you to view Elasticsearch API through Kibana
  - Make direct API JSON queries to Elasticsearch
  - It is a plugin so needs to be installed through Kibana
- Accessed by pointing web browser at;
  - http://localhost:5601/app/sense



Installing AppSense v4 Kibana

- Must be done from the command line
- Requires internet access to download plugin
- Use the command used to start Kibana with options

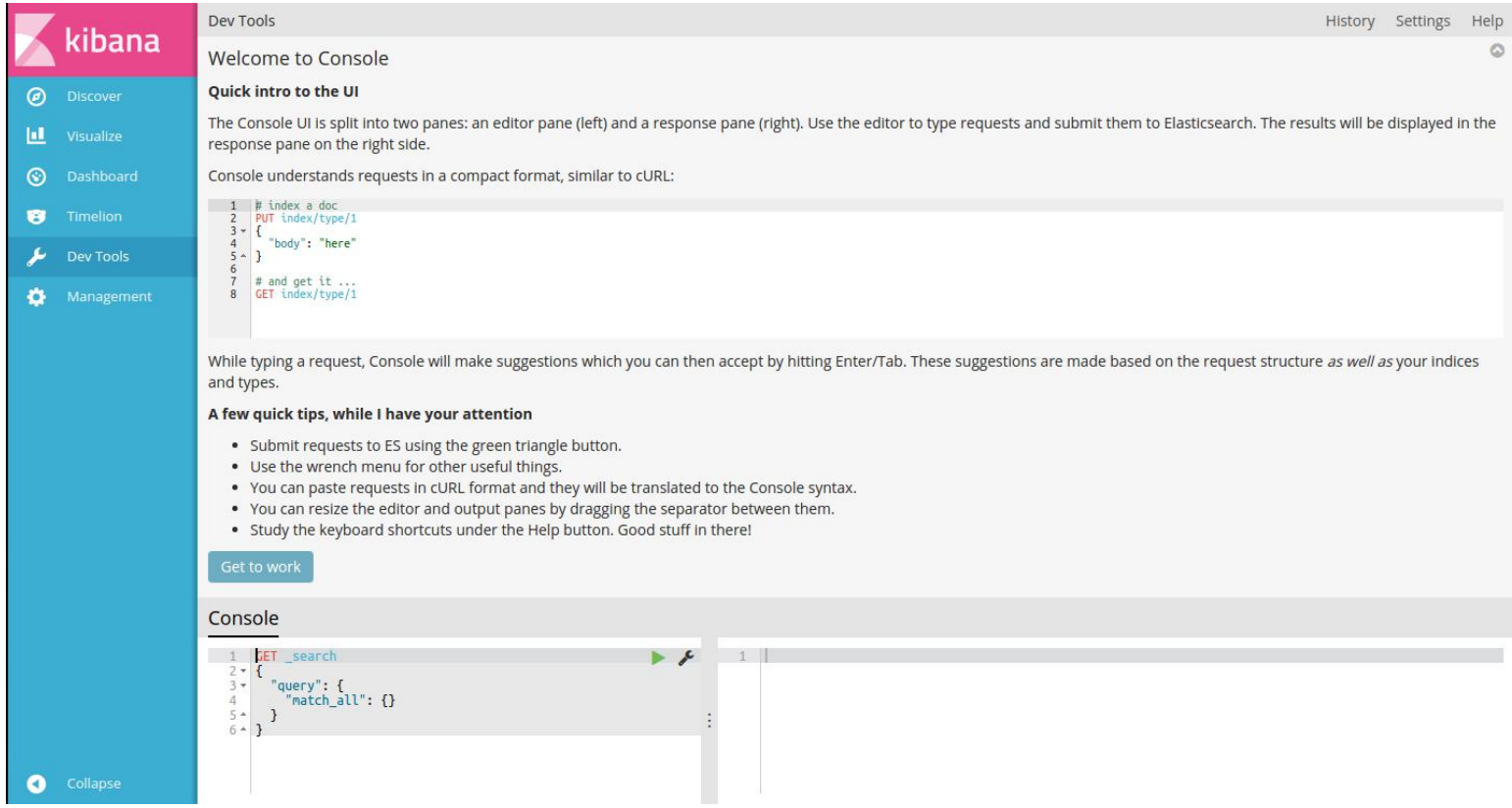
```
# Mac/Linux:

elk:~/elkCourse/kibana-4.4.0-linux-x86_64> bin/kibana plugin --install elastic/sense
```

```
# Windows:

C:\Users\elkCourse\kibana-4.4.0> bin\kibana.bat plugin --install elastic/sense
```

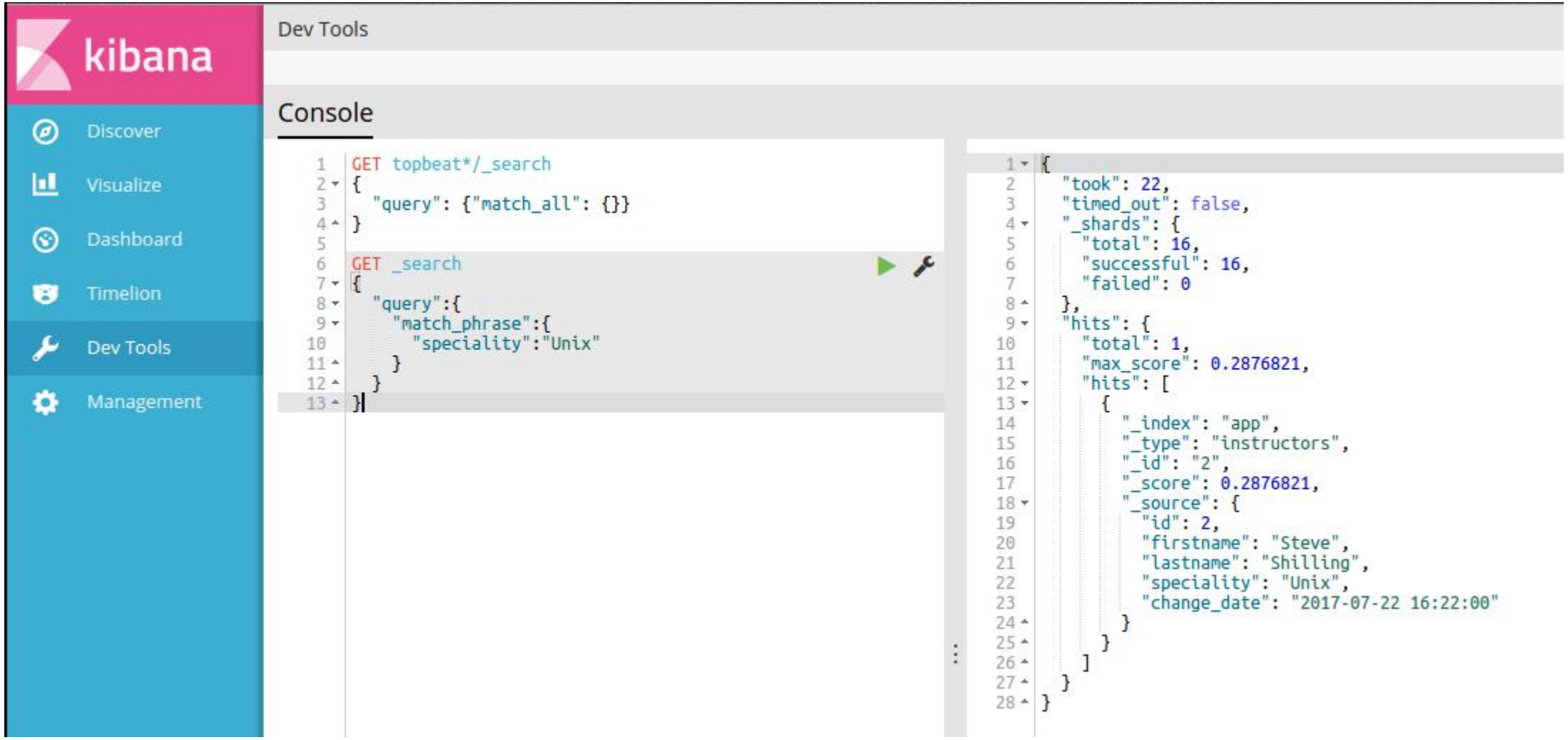
- Restart Kibana

Kibana 5 AppSense equivalent

- Version 5 has an Elasticsearch console built in
- Use the **Dev Tools** link in the left menu



Checking Kiband against Elasticsearch



Congratulation

- You have completed Lab 2
- Kibana will allow us to view data when it comes in

Beats Lab 3

Install, configure and start beats

Working with Beats

- Where to download
- Install Topbeat
- Configure Topbeat to send to Elasticsearch
- Start Topbeat
- Test
- View in Kibana

Downloading Beats

- Elastic created Beats
  - https://www.elastic.co/downloads/beats
- From other developers
  - https://www.elastic.co/guide/en/beats/libbeat/current/community-beats.html
  - Mostly Git repos
- Beats are written in GO
  - https://www.elastic.co/guide/en/beats/libbeat/current/new-beat.html

Install Topbeat

- Download from
  - www.elastic.co/downloads/beats/topbeat
- Unzip topbeat and place it in your ELK stack directory
- Before starting Topbeat we will need to configure it
  - Before doing that make a backup copy

```
# Mac/Linux:

elk:~/elkCourse/topbeat-1.3.1-x86_64> cp topbeat.yml topbeat.yml.orig
```

```
# Windows:

C:\Users\elkCourse\topbeat-1.3.1> copy topbeat.yml topbeat.yml.bak
```

Configure topbeat

- Open the **topbeat.yml** file in your favourite editor
- Edit the following entries in that file
  - Some of the items may need the # removed, some already set

```
input:
  # In seconds, defines how often to read server statistics
  period: 10

  # Regular expression to match the processes that are monitored
  procs: [".*"]

  # Statistics to collect (we are collecting all the explained  statistics)
  stats:
    system: true
    process: true
    filesystem: true

  shipper:
  # Tags make it easy  properties.
    tags: ["front-end","web-tier", "linux", "desktop"]
```


Configure topbeat shipper

- Name of the shipper
  - Default is the hostname
- Tags used to identify information from shippers
  - A way to group information together from servers
  - Or to identify a particular server

```
shipper:
# Tags make it easy  properties.
    tags: ["front-end","web-tier", "linux", "desktop"]
```


Configure topbeat where to go?

- Beats need to be told where to send their data
- Here we will send it directly to Elasticsearch

```
output:  elasticsearch:
    # add your ES host address
    hosts: ["localhost:9200"]

    # Optional protocol and basic auth credentials.
    #protocol: "https"
    #username: "admin"
    #password: "s3cr3t"
```


Configure topbeat to use template

- Use the template it ships with
- Defines the JSON to send as output

Starting topbeat

- Start the beat - let the data flow.....

```
# Mac OS, Linux
elk:~/elkCourse/topbeat-1.3.1-x86_64> ./topbeat -e -c topbeat.yml -d "elasticsearch"

# or if it must run with administrator privileges
elk:~/elkCourse/topbeat-1.3.1-x86_64> sudo ./topbeat -e -c topbeat.yml -d "elasticsearch"
```

```
# Windows
C:\Users\elk\elkCourse\topbeat> .\topbeat.exe -e -c topbeat.yml -d "elasticsearch"
```


Starting as a service

- Windows
  - Beats file comes with PowerShell installation script
    - install-service-topbeat.ps1
  - Also uninstall script too
    - uninstall-service-topbeat.ps1

- Linux
  - Create the relevant SVR4 init.d script or systemd control file

Example Linux /etc/init.d/topbeat script

```
#!/bin/bash
# description: topbeats service
# chkconfig: 35 99 99
case $1 in
	start)
		cd /opt/beats/topbeat*/bin
		nohup ./topbeat -e -c topbeat.yml -d "elasticsearch" >/var/log/topbeat.log 2>/var/log/topbeat.err &
		topbeatpid=$(ps -ef | grep topbeat | grep -v grep | awk '{print $2}')
		echo $topbeatpid >/var/run/topbeat.pid
		;;
	stop)
		kill $(cat /var/run/topbeat.pid)
		;;
	status)
		if ! ps -ef | grep topbeat | grep $(cat /var/run/topbeat.pid) | grep -v grep >/dev/null 2>&1
		then
			echo "Topbeat is running"
		else
			echo "Topbeat is not running"
		fi
		;;
esac
```

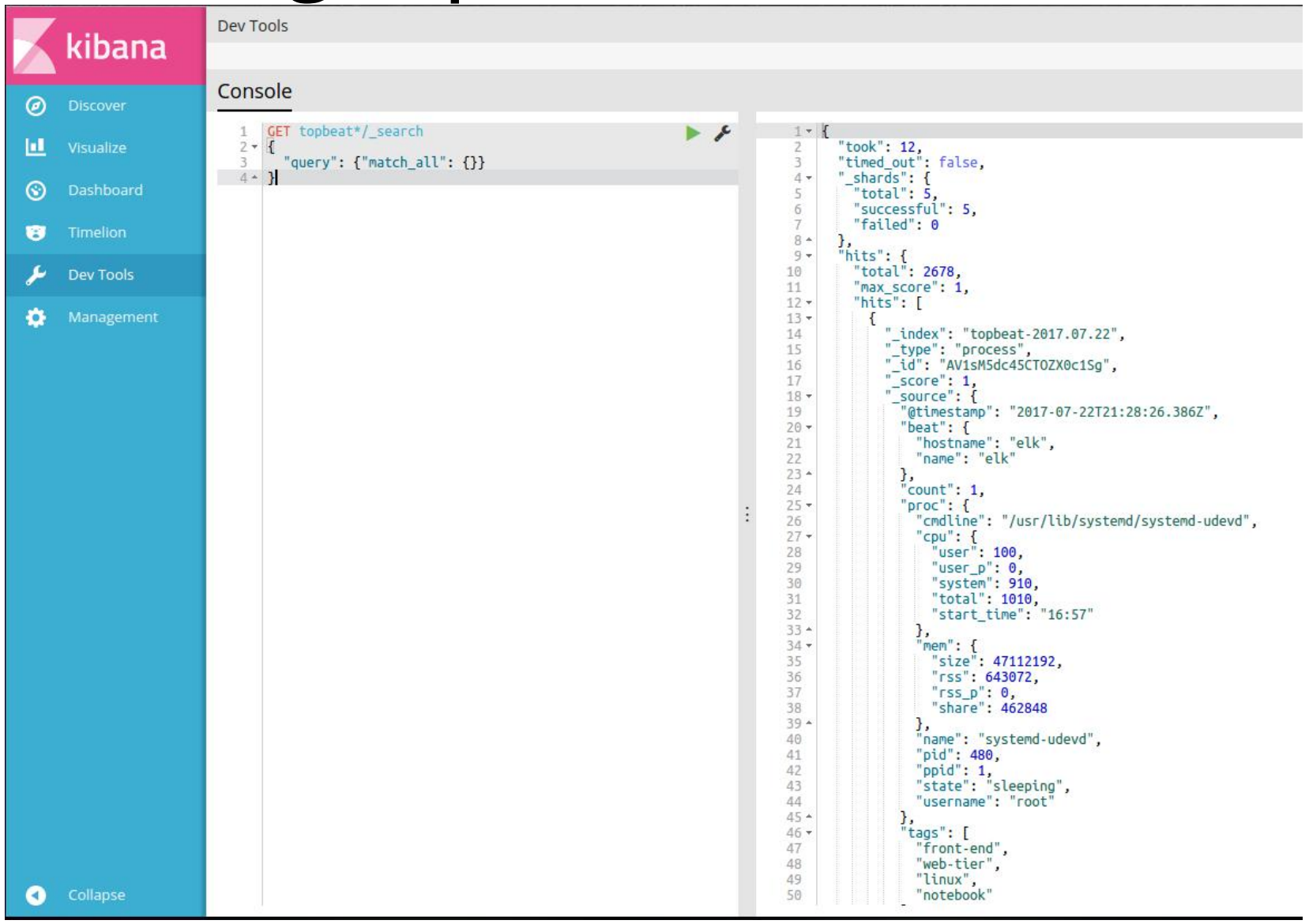
Systemd topbeat.service

```
# Filename: /usr/lib/systemd/system/topbeat.service

[Unit]
Description=Topbeat service script
After=syslog.target network.target

[Service]
Type=forking
PIDFile=/var/run/topbeat.pid
ExecStart=/opt/beats/topbeat/bin/topbeat -e -c /opt/beats/topbeat/bin/topbeat.yml -d "elasticsearch"
>/var/log/topbeat.log 2>/var/log/topbeat.err
ExecStop=kill $(cat /var/run/topbeat.pid)

[Install]
WantedBy=multi-user.target
```

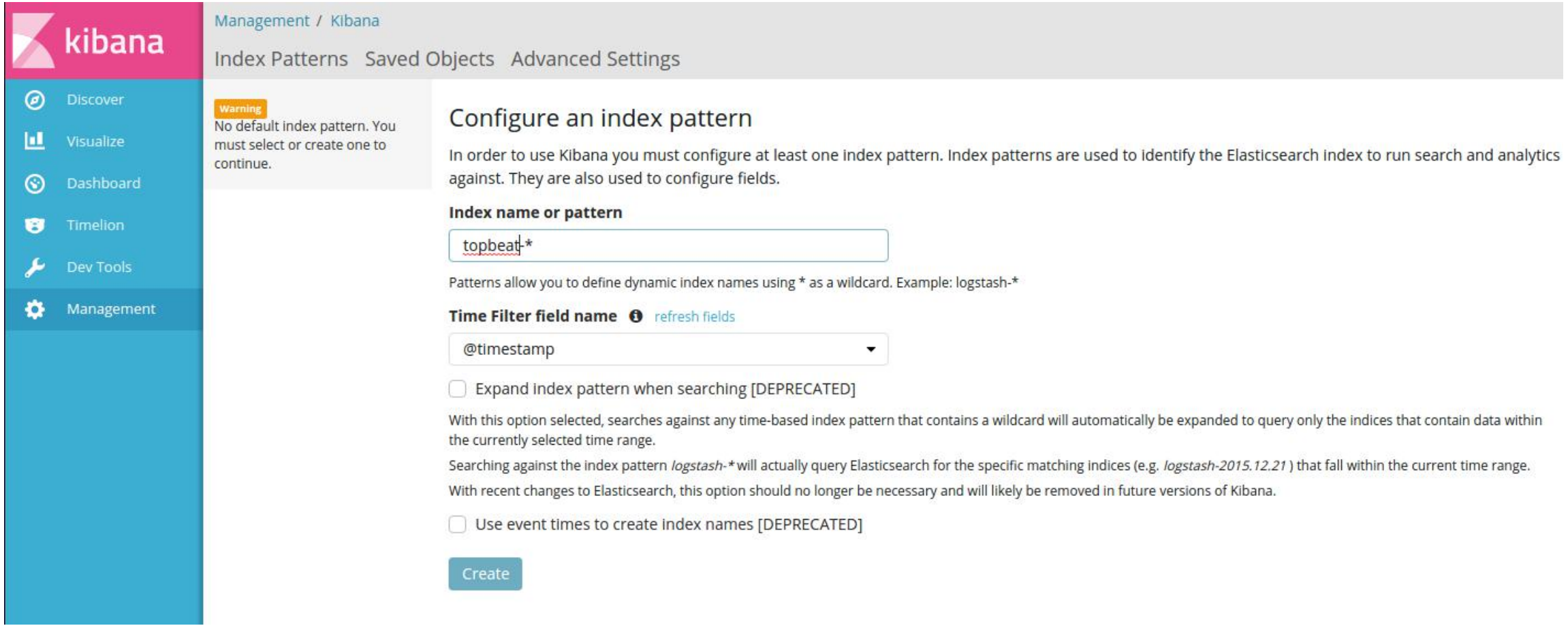
Checking Elasticsearch

```
elk:~> curl -X GET http://localhost:9200/topbeat*/_search -d '{"query": {"match_all": {}}}'


{"took":12,"timed_out":false,"_shards":{"total":5,"successful":5,"failed":0},"hits":{"total":2678,"max_score":1.0,"hits":[{"_index":"topbeat-2017.07.22","_type":"process","_id":"AV1sM5dc45CTOZX0c1Sg","_score":1.0,"_source":{"@timestamp":"2017-07-22T21:28:26.386Z","beat":{"hostname":"elk","name":"elk"},"count":1,"proc":{"cmdline":"/usr/lib/systemd/systemd-udevd","cpu":{"user":100,"user_p":0,"system":910,"total":1010,"start_time":"16:57"},"mem":{"size":47112192,"rss":643072,"rss_p":0,"share":462848},"name":"systemd-udevd","pid":480,"ppid":1,"state":"sleeping","username":"root"},"tags":["front-end","web-tier","linux","notebook"],"type":"process"}}, .....
```

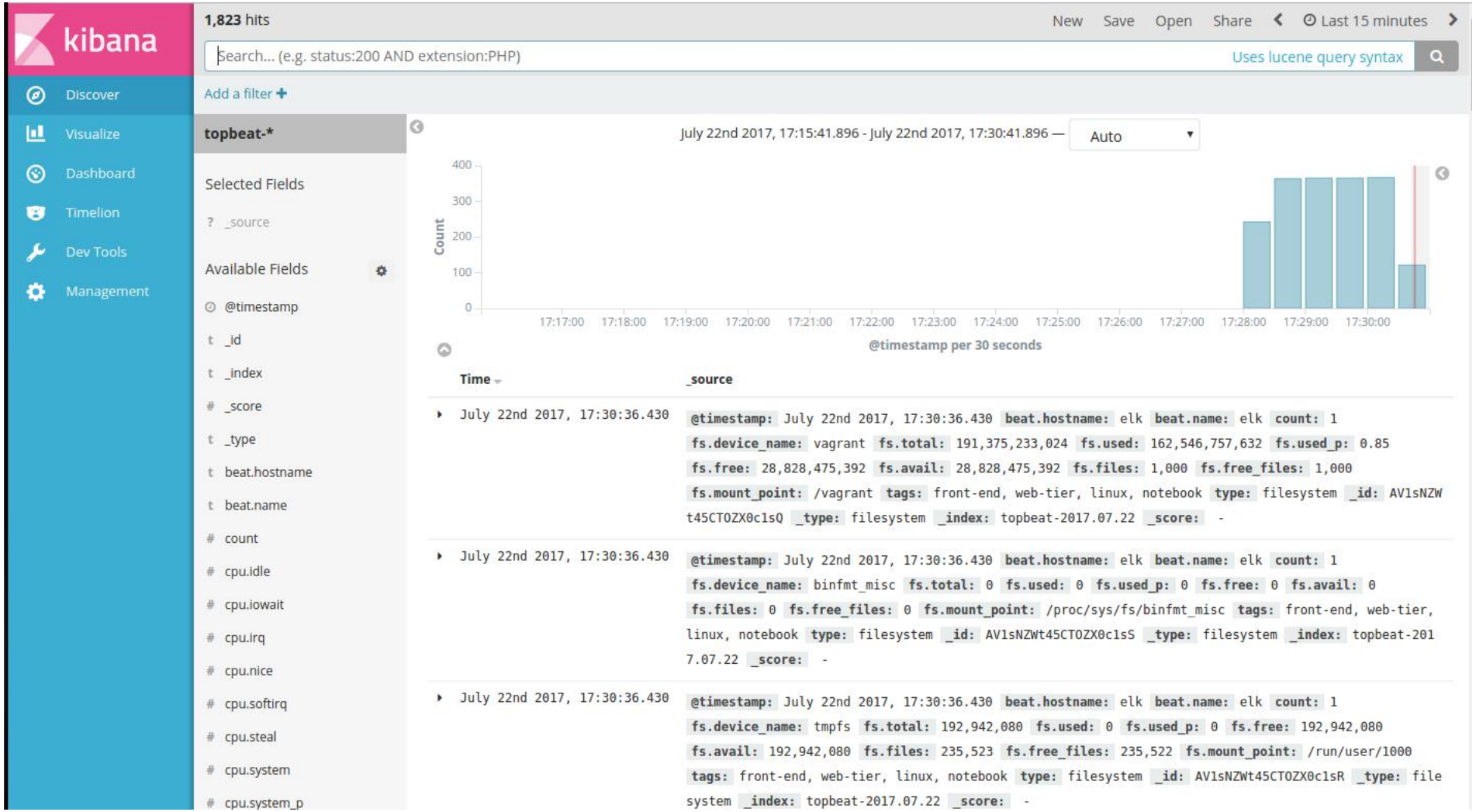
Checking topbeat in Kibana



Adding topbeat as an index



Viewing Topbeat data



Congratulation

- You have completed Lab 3
- Elasticsearch is now receiving data from a Beat
- Kibana is now showing us data
- Kibana has allowed us to query the data in Dev Tools
- Kibana has allowed us to create an index for the Beat

Kibana View Lab 4

Viewing Beats and using dashboards

Visualise your data

- Load Beats Dashboards
- Setup Index Pattern
- Explore Data In Kibana Discover
- Explore Topbeat Dashboard

Download and install dashboards

- View this link
  - https://www.elastic.co/guide/en/beats/libbeat/1.3/load-kibana-dashboards.html
  - A newer version
    - https://www.elastic.co/guide/en/kibana/current/dashboard.html
    - https://www.elastic.co/guide/en/beats/libbeat/5.5/import-dashboards.html#dashboards-archive-structure

```
# Mac OS, Linux
# grab the dashboards, unzip them and run the load script
#curl -L -O https://artifacts.elastic.co/downloads/beats/beats-dashboards/beats-dashboards-5.5.0.zip
elk:~> curl -L -O http://download.elastic.co/beats/dashboards/beats-dashboards-1.3.1.zip
elk:~> unzip beats-dashboards-1.3.1.zip
elk:~> cd beats-dashboards-1.3.1/
elk:~> ./load.sh
```

- Windows - See Website instructions:
  - https://www.elastic.co/guide/en/beats/libbeat/current/load-kibana-dashboards.html

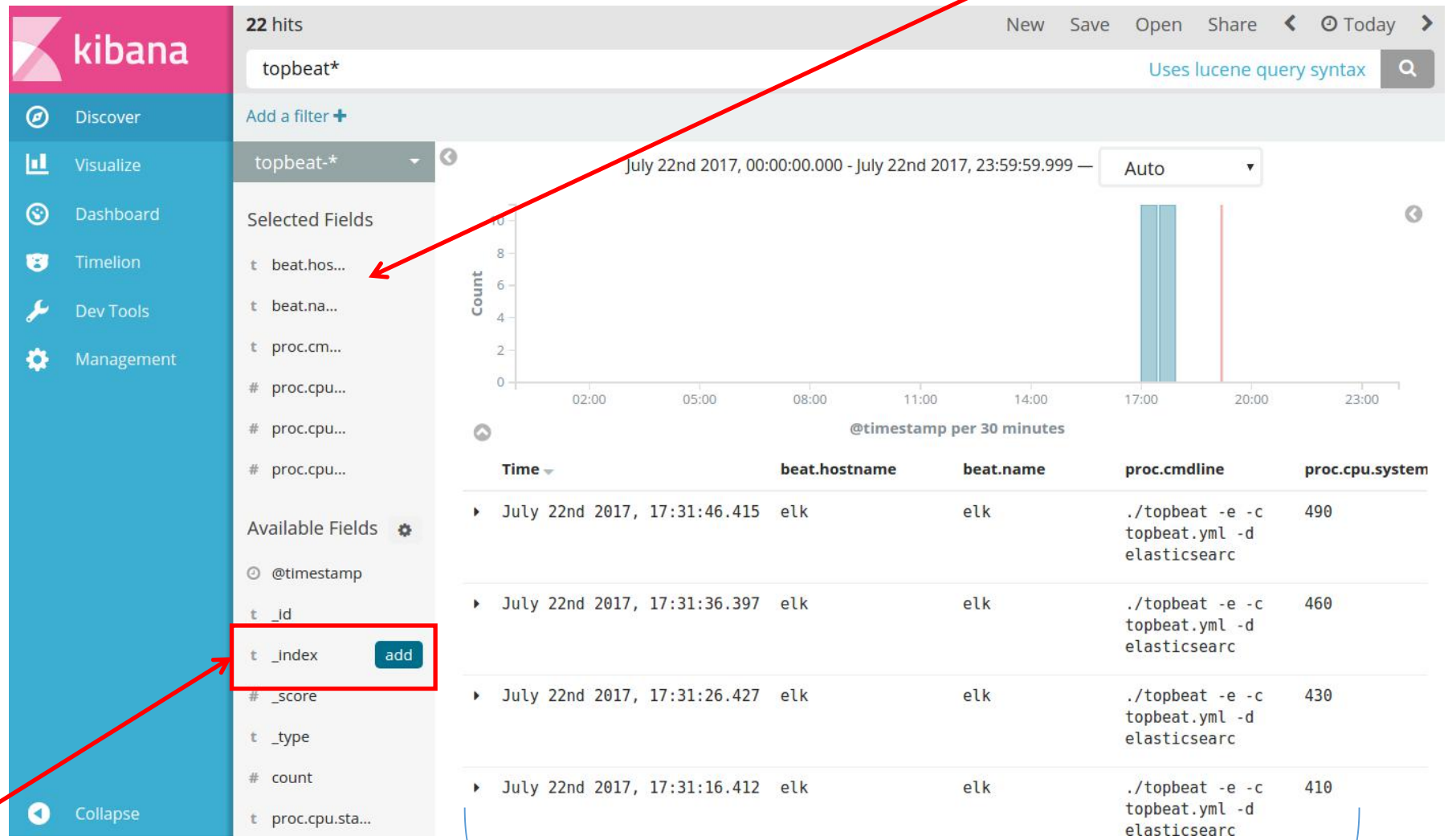
Viewing the data

2. Specify a valid range for data

1. Select Discover

3. Set index to search

Restricting data view

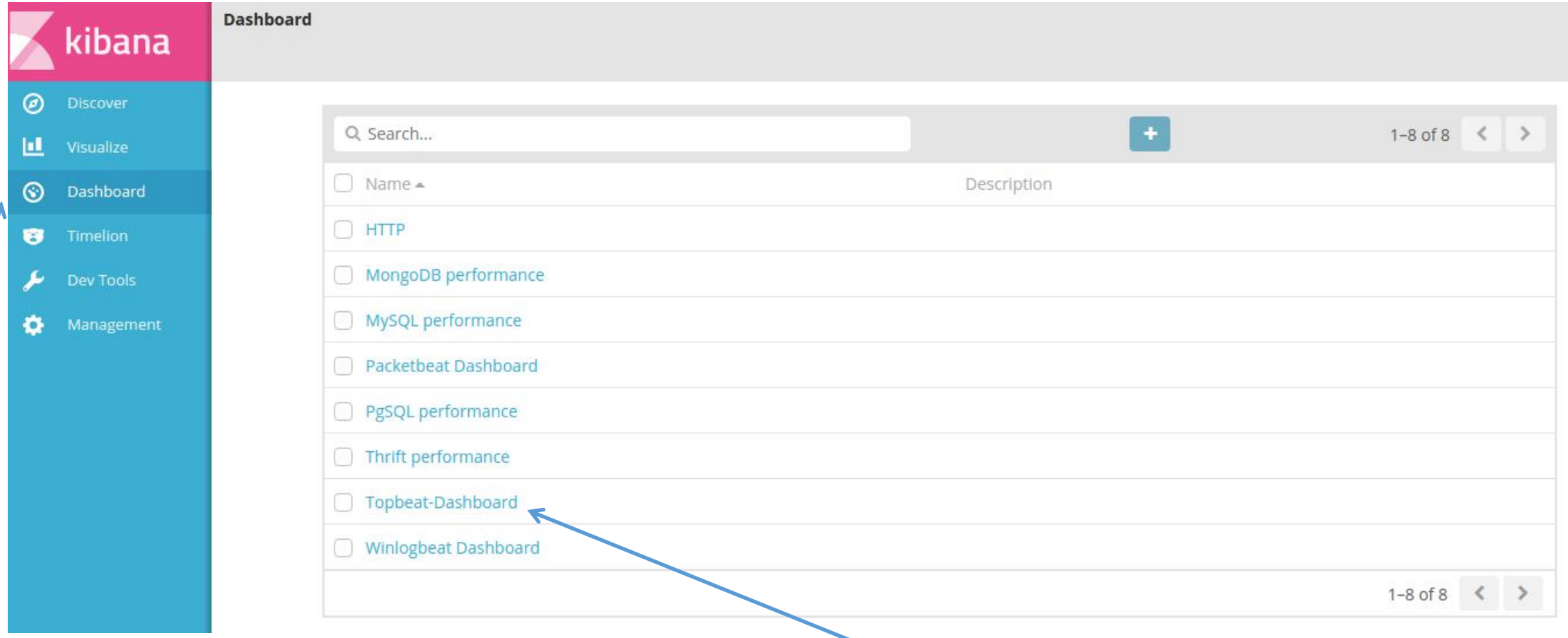


3. Remove columns from here

1. Click add to specify column

2. Columns show up here

Go to the Dashboards

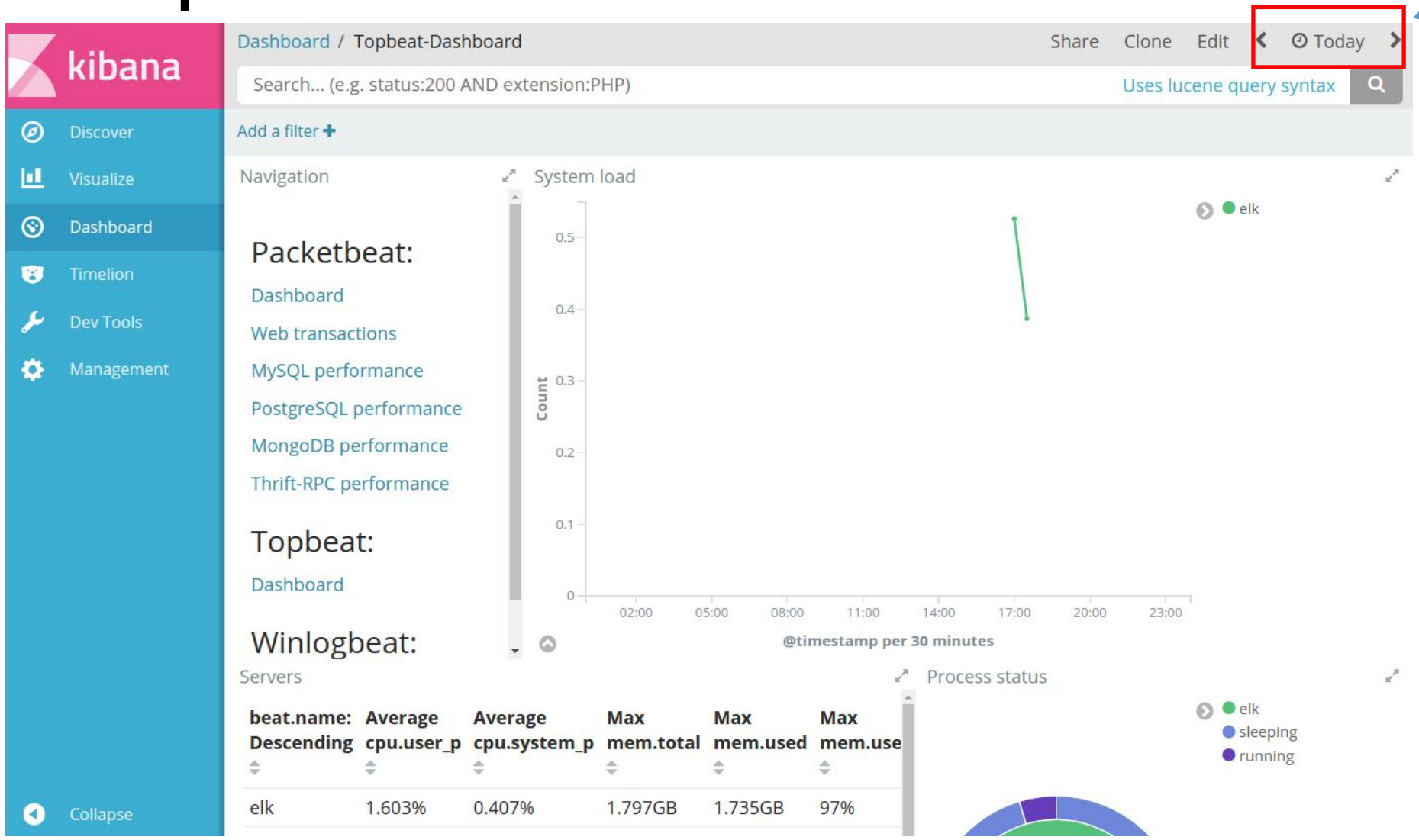


1. Select Dashboard

2. Select Topbeat-Dashboard

Topbeat-Dashboard

1. Specify a valid range for data

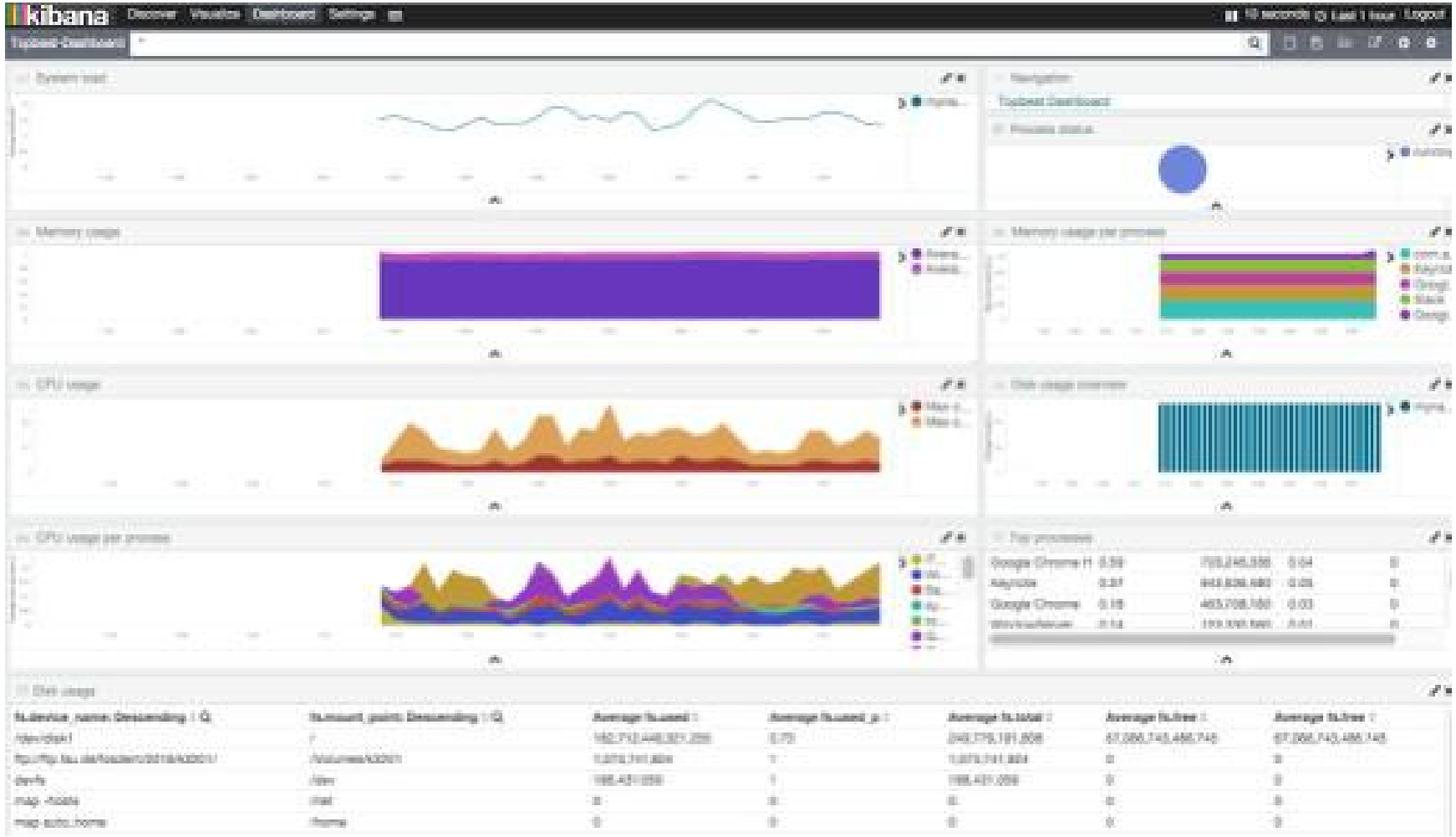


Explore Topbeat Dashboard

- To move visualizations
  - click in the header, drag and drop.
- To resize visualizations
  - click in the bottom-right corner, drag and drop.
- To remove visualizations
  - click on the X (top-right corner).
- Click, drag and drop inside a chart to drill down the time range.

Explore Topbeat Dashboard (2)

- Use the time-picker to set the time range
  - to 1 hour and the auto-refresh to 10 seconds.
- Click on the Topbeat Dashboard link
  - to reload default dashboard (you will lose unsaved changes).
- Save the modified dashboard with the same name
  - (overwrite) or with a new name (new dashboard).



Congratulation

- You have completed Lab 4
- You can now view and search data
- You can now load dashboards and modify them
- Now lets ingest log data

Logstash Lab 5

Installing, configuring and starting Filebeat and Logstash
Loading Apache log data

Logstash & Filebeat Logging: Steps

- Install Logstash
- Test Logstash
- Prepare Log Data
- Install Filebeat
- Test Filebeat
- Configure Logstash & Filebeat
- Ship Apache Log Data, Transform It, Load It

Download & Install Logstash

- Download Logstash.
  - www.elastic.co/downloads/logstash
- Ask your instructor for the Logdata.zip file.
- Put the following in your course directory
  - logstash_configs
  - log_data folders
- Unzip Logstash into your course directory
  - Open the "logstash_simple.conf" file in a text editor

- Look at the file configuration for logstash_simple.conf

logstash_simple.conf

- Start Logstash against this config

```
# use the standard input
input {
    stdin {}
}

# no filters  filter {}

# Just output to the terminal
output {
    stdout {
        codec => rubydebug
    }
}
```

Run logstash

- Logstash will start listening to port
  - 5044 as a listener
  - 9600 as an agent

```
elk:~> cd logstash-5.5.0/config
# We are here as it needs the log4j configuration too
elk:~> ../bin/logstash -f logstash_simple.conf
```

```
# Windows
C:\Users\elk\elkCourse\logstash> .\bin\logstash -f ..\logstash_configs\logstash_simple.conf
```


Logstash output

```
Sending Logstash's logs to /home/vagrant/logstash-5.5.0/logs which is now configured via log4j2.properties
[2017-07-22T23:34:57,887][INFO ][logstash.pipeline        ] Starting pipeline {"id"=>"main", "pipeline.workers"=>1,
"pipeline.batch.size"=>125, "pipeline.batch.delay"=>5, "pipeline.max_inflight"=>125}
[2017-07-22T23:34:57,956][INFO ][logstash.pipeline        ] Pipeline main started
The stdin plugin is now waiting for input:
```

Send Message To Logstash stdin Input

- With Logstash running against the logstash_simple.conf file, type some text in the terminal Logstash is running in:

```
# type "Hello world!" in the terminal
Hello world!

# you should see the following output
# notice: the "message" field has the input
# notice: the other fields are meta information fields
{
          "message" => "Hello world!",  "@version"     => "1",
   "@timestamp" => "2016-06-15T23:09:11.981Z",
                "host" => "your-host-name"
}
```

Using grok

- Change "logstash_simple.conf" to contain a grok filter as follows:

```
input {
   stdin {}
}

filter {
   grok {
      match => {
         "message" => '%{HTTPDATE:timestamp} %{IP:ip} <%{DATA:msg}>'
      }
   }
}

output {
   stdout {
      codec => rubydebug
   }
}
```

Restart logstash

- Any changes to logstash configuration files requires restart
  - Only the logstash service

```
# copy and paste the following in the terminal;
22/Mar/2016:16:38:00 -0700 183.60.215.50 <text at the end>
# you should see the following output
# notice: the <> plays an important part in the grok
# notice: there are 2 timestamp fields with 2 different values
{
                "msg" => "text at the end",
   "@timestamp" => 2017-07-22T23:56:05.596Z,
                 "ip" => "183.60.215.50",
        "@version" => "1",
                "host" => "elk",
         "message" => "22/Mar/2016:16:38:00 -0700 183.60.215.50 <text at the end>",
       "timestamp" => "22/Mar/2016:16:38:00 -0700"
}
```

Logstash is running

- Documents are being transformed
- Data coming from stdin and going to stdout

- Let's prepare a real log

Prepare Apache Log Data

- We want the log data to be relevant to the time you are taking this course.
  - This way we can use the Time Picker in Kibana with settings like "Last 30 Days".
  - Otherwise you would be stuck using "old" log data - and that's no fun!
- First, stop Logstash since we will use Logstash to create the log data for us using a prepared Logstash config file

```
# to stop the logstash execution there are two options
ctrl+C and then press enter
ctrl+D
```


Edit the log data

- Look inside the "log_data" directory provided to you.
- It should be in your "course" directory if you downloaded and extracted it there:

```
# list the log_data directory
~/course/log_data$ ls
convert_times.conf      original.log
```

Convert the data

```
# Mac/Linux
cat log_data/original.log | ../logstash-5.5.0/bin/logstash -f log_data/convert_times.conf

# Windows
type log_data/original.log | ..\logstash-5.5.0\bin\logstash -f log_data\convert_times.conf

# you will see this on your screen after Logstash starts running:
Settings: Default pipeline workers: 4
Pipeline main started
.....
.....
.....
# the dots show that the process is working
```

Verify conversion

- On completion you should see

```
.....
2017-07-23T00:07:21,263][WARN ][logstash.agent           ] stopping pipeline {:id=>"main"}
```

- Directory listing should have a new file called "access.log":

```
~/course/log_data$ ls
access.log    convert_times.conf    original.log
```


Log file is prepared

- Now we'll configure a beat to talk to logstash

Beats & Logstash

- All beats can be sent through logstash
- Logstash acts as a broker in this can
- Logstash can be on a different host to the Beat

Download & Install Filebeat

- Download Filebeat:
  - www.elastic.co/downloads/beats/filebeat

- Unzip Filebeat into your course directory
- Open the "filebeat.yml" file

- We will now go through some changes

Configure Filebeat input settings

- Read apache web server log file
- Let's change the log file paths

```
filebeat.prospectors:

- input_type: log
    - <path_to_home>/courseware/access.log
    # - /var/log/*.log
    # - c:\courseware\log_data\access.log
```


Configure the Filebeats shipper

- Setup to tag every document (log line) with the server properties

```
shipper:
# Tags make it easy  properties.
    tags: ["front-end","web-tier", "apache", "desktop"]
```

Configure Filebeats output

- Setup to send data to logstash running on your localhost

```
#------------------------- Elasticsearch output ------------------------------
#output.elasticsearch:
  # Array of hosts to connect to.
  #hosts: ["localhost:9200"]

  # Optional protocol and basic auth credentials.
  #protocol: "https"
  #username: "elastic"
  #password: "changeme"

#----------------------------- Logstash output --------------------------------
output.logstash:
  # The Logstash hosts
  hosts: ["localhost:5044"]
```

Examine logstash_stdout.conf

- If Logstash is currently running, stop it
- We will start it with a new config
- Open and examine the "logstash_configs/logstash_stdout.conf"

The input section

```
input {
  beats {
    host => "localhost"
    port => 5044
    congestion_threshold => 30
  }
}
```


Filter section

```
filter {
  grok {
    match => {
      "message" => '%{IPORHOST:clientip} %{USER:ident} %{USER:auth} \[%{HTTPDATE:timestamp}\] "%{WORD:verb}
%{DATA:request} HTTP/%{NUMBER:httpversion}" %{NUMBER:response:int} (?:-|%{NUMBER:bytes:int})
%{QS:referrer} %{QS:agent}'
    }
  }

  date {
    match => [ "timestamp", "dd/MMM/YYYY:HH:mm:ss Z" ]
    locale => en
    remove_field => timestamp
  }

  geoip {
    source => "clientip"
  }

  useragent {
    source => "agent"
    target => "useragent"
  }
}
```

Output section

```
output {
  stdout{ codec => rubydebug }
}
```

Start Logstash

- Against the logstash_stdout.conf
  - Working out of the "logstash" directory:

```
# Mac OS, Linux:
./bin/logstash -f ../courseware/logstash_configs/logstash_stdout.conf

# Windows:
.\bin\logstash -f ..\courseware\logstash_configs\logstash_stdout.conf

# you should see something like the following

Settings: Default pipeline workers: 4  Logstash startup completed
```


Run Filebeat

- Logstash is waiting for Filbeat to ship it logs - start Filebeat

```
# go back to the filebeat directory in a new terminal and  filebeat

# linux, mac
./filebeat -e -c filebeat.yml -d "logstash"

# windows
.\filebeat.exe -e -c filebeat.yml -d "logstash"
```

Test the Filebeat/Logstash Integration

- Check if documents are being printed in the terminal

```
# in the logstash-terminal-window you should see documents being printed

{
        "message" => "46.105.14.53 - - [14/Jan/2016:22:36:26 +0000] \"GET /blog/tags/puppet?flav=rss20 HTTP/1.1\" 200 14872 \"-\"
\"UniversalFeedParser/4.2-  pre-314-svn +http://feedparser.org/\"",
       "@version" => "1",
    "@timestamp" => "2016-02-10T01:05:18.520Z",
             "beat" => { "hostname" => "your_host_name", "name" => "front001" },  "count" => 1,
            "fields" => nil,
      "input_type" => "log",
            "offset" =>  3799864
          "source" => "/home/vagrant/courseware/access.log",
            "tags" => [ [0] "front-end", [1] "apache", [2] "web-tier", ... ],
             "type" => "log",
            "host" => "your_host_name"
}
```

Now let's send it to logstash

- Stop Filebeat and Logstash
- Kill Logstash and Filebeat and clean reading state

```
# in the logstash-terminal-window kill the logstash process
Ctrl-C
# in the filebeat-terminal-window kill the filebeat process
Ctrl-C

# Attention: filebeat creates a '.filebeat' file with last reading state.
# To read the entire log file in the next execution, you need to delete .filebeat before restart.
# We want all the data in Elasticsearch, so let's delete it.
# It may or may not exist

rm .filebeat
```


Configure logstash output

- Set the logstash_stdout.conf to elasticsearch
  - Edit courseware/logstash_configs/logstash_stdout.conf

```
# there is a file in the sample folder called logstash_elasticsearch.conf
# with a more complex config. Check it out!

vim ../courseware/logstash_configs/logstash_elasticsearch.conf

# also, edit the output to add your Elasticsearch host  output {
# for each event prints a dot (.) in the stdout
   stdout { codec => dots }

   elasticsearch {
      hosts => 'localhost:9200'
   }
}
```

Run logstash

- Logstash will start listening to port 5044, but no data yet...

```
# execute logstash with elasticsearch config from the logstash directory:
# linux, mac
./bin/logstash -f ../courseware/logstash_configs/logstash_elasticsearch.conf

# windows
.\bin\logstash -f ..\courseware\logstash_configs\logstash_elasticsearch.conf

# you should see something like the following

Settings: Default pipeline workers: 4  Logstash startup completed
```

Run filebeat

- Start sending apache log events to Logstash
  - one line is one event

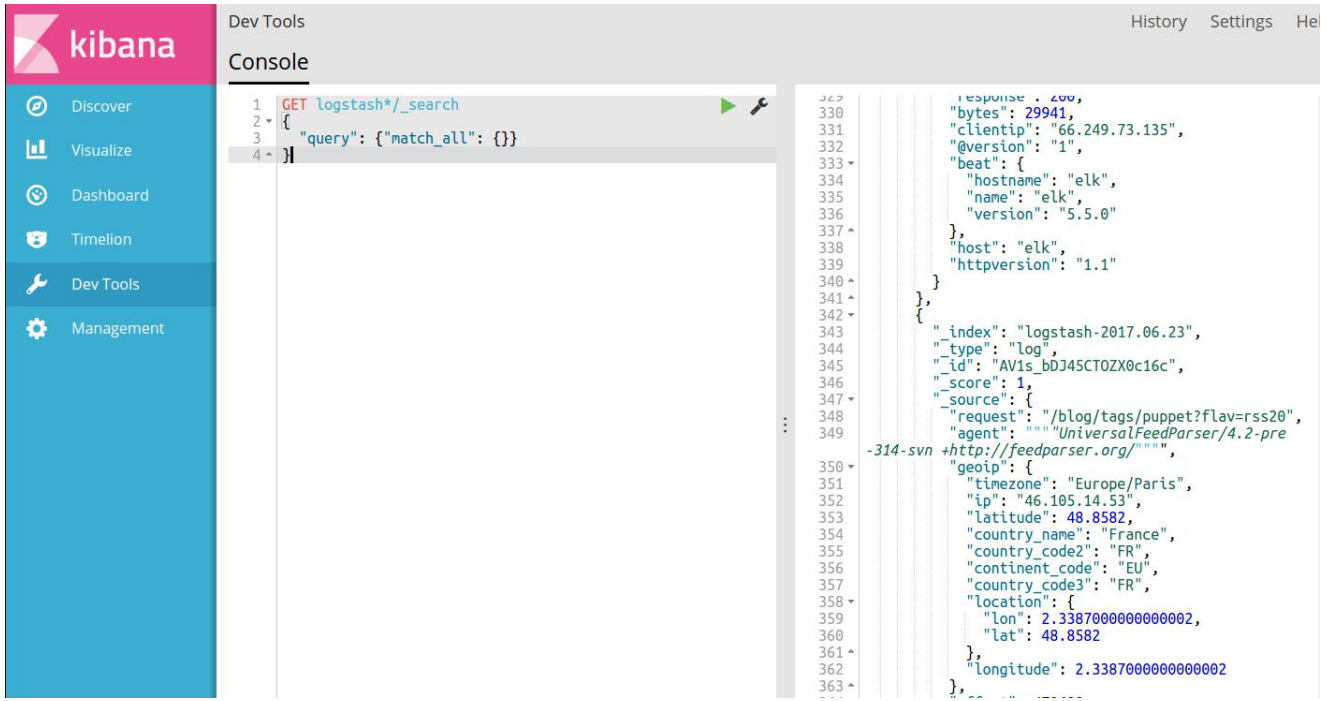
```
# in the filebeat-terminal-window start filebeat

# linux, mac
./filebeat -e -c filebeat.yml -d "logstash"

# windows
.\filebeat.exe -e -c filebeat.yml -d "logstash"
```

You should see lots of dots in the logstash window!!!!!

Checkout Kibana

- In the Dev Tools section
- Type the following into the Console

```
GET logstash*/_search
{
  "query": {"match_all": {}}
}
```



Congratulation

- You have completed Lab 5
- You have now configured logstash to forward Beats
- You can now configure different outputs of logstash
- You can perform some filtering

Enhanced Logstash Lab 6

Doing more work with Logstash

Customizing Logstash

- Using different inputs
- GROKing
- Section references

Different inputs

- Logstash can take data from many sources
- Inputs get their data from plugins
  - https://www.elastic.co/guide/en/logstash/current/input-plugins.html
- If there isn't one then you can use
  - exec
    - Run a custom command
  - beats
    - Build your own Beat

Example Yahoo data feed

- This returns a csv formated output
  - "Microsoft Corporation",73.60,73.55

```
input {
   exec {
      command => "curl -s 'http://download.finance.yahoo.com/d/quotes.csv?s=MSFT&f=nab'"
      type => stock
      interval => 30
   }
}
```

Filter the data (groking)

- Define the format of the input stream
- Apply names to the data
  - stock_name
  - askprice
  - bidprice

```
filter {
   grok {
      match => {"message" => "%{QUOTEDSTRING:stock_name},%{NUMBER:askprice:float},%{NUMBER:bidprice:float}"}
      # This checks the message field for a Number and creates a stockprice field of type float
   }
```


Remove dangerous characters

- Mutate the data
- Comes after you assign the field name from grok
  - This example removes the dot

```
    mutate {
        gsub => [
            "stock_name", '\.', ''
        ]
    }
}
```

Filter reference

https://www.elastic.co/guide/en/logstash/current/filter-plugins.html

Output plugins

- Logstash can send to other systems
  - Not specific to Elasticsearch

https://www.elastic.co/guide/en/logstash/current/output-plugins.html

Lab

- Implement the Yahoo feed into your logstash
- Get information for the following stocks
  - IBM
  - GOOGLE
  - MICROSOFT
  - APPLE

Kibana Customising Lab 7

Creating custom Kibana Visualizations and Dashboards for the Apache log data

Visualize Overview

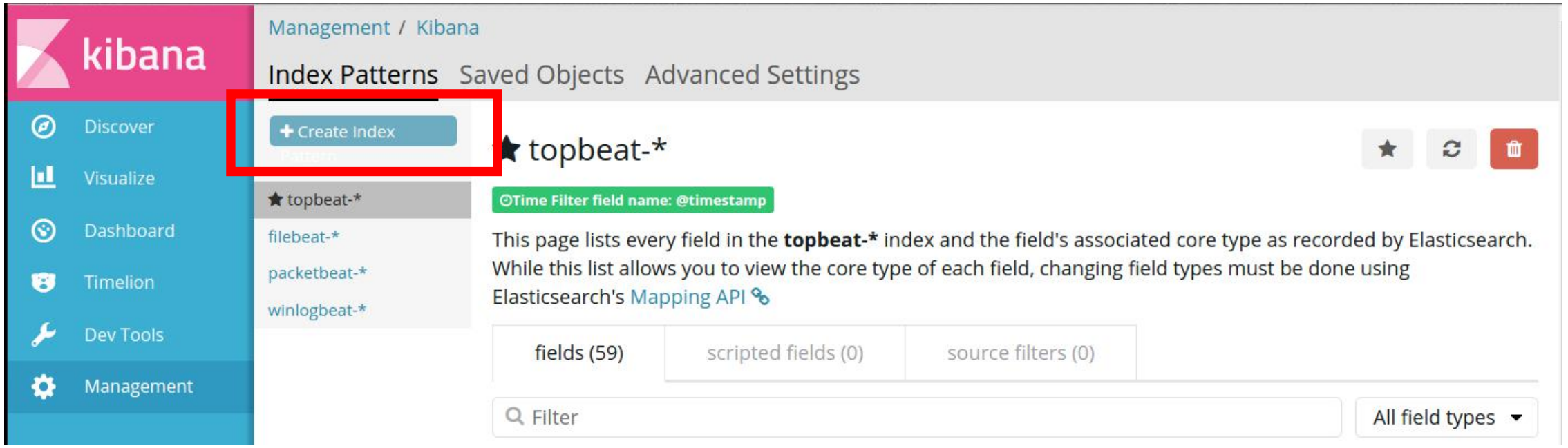
- Configure 'logstash-*' Index Pattern
- Create a Metrics Visualization
- Create a Pie Chart
- Create a Bar Chart
- Create a Line Chart
- Create a Tile Map
- Create a Dashboard
- Create Extra Visualizations

Set The Time Picker To "Last 30 Days"

- Kibana needs to see a time range with data

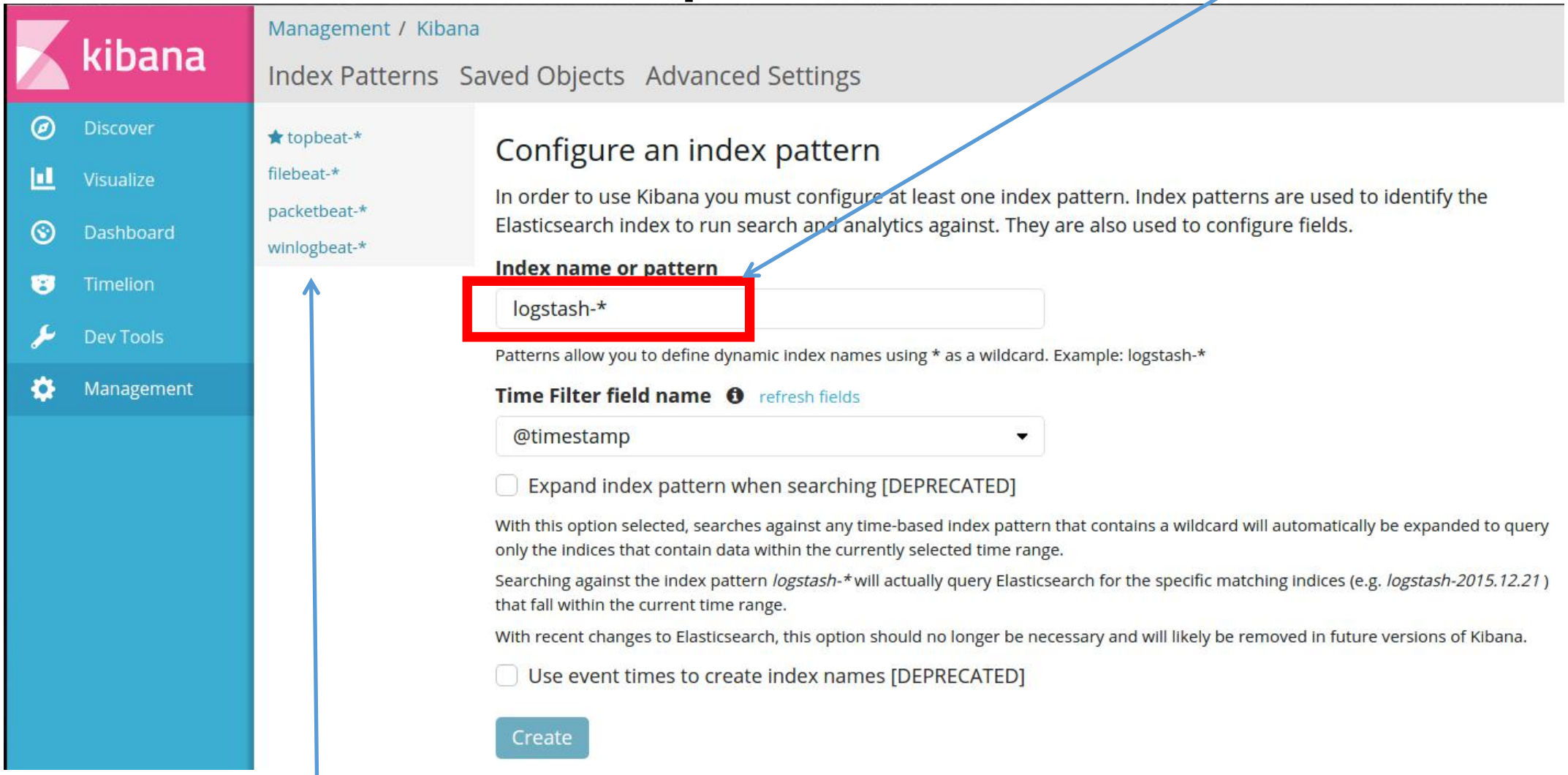
Configure logstash-* index

- Go to the Management screen
- Click **Create Index**



Create the index pattern

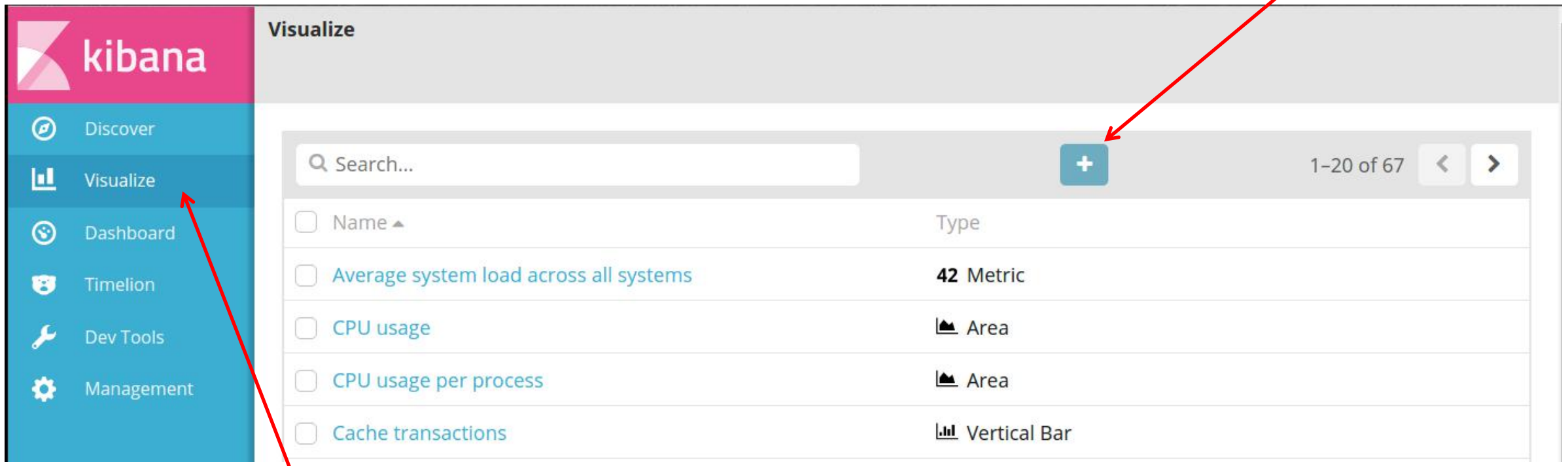
Type in the pattern



Existing patterns

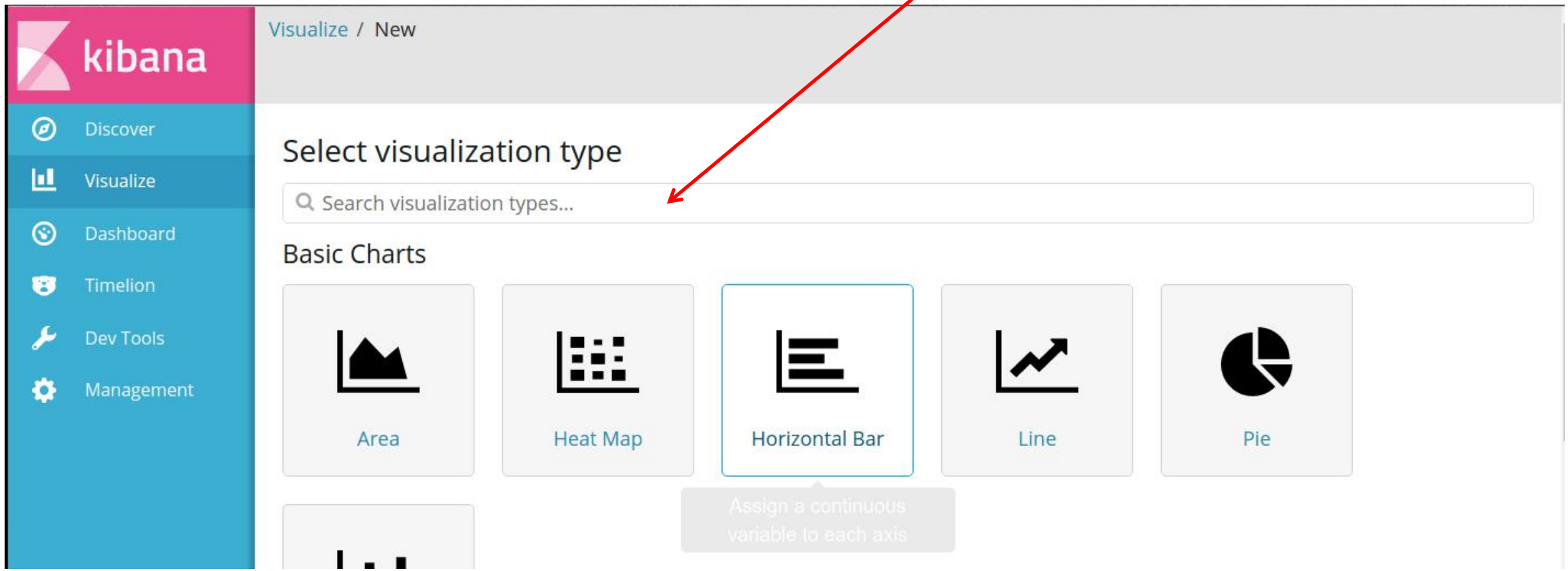
Creating visuals

2. Create new chart



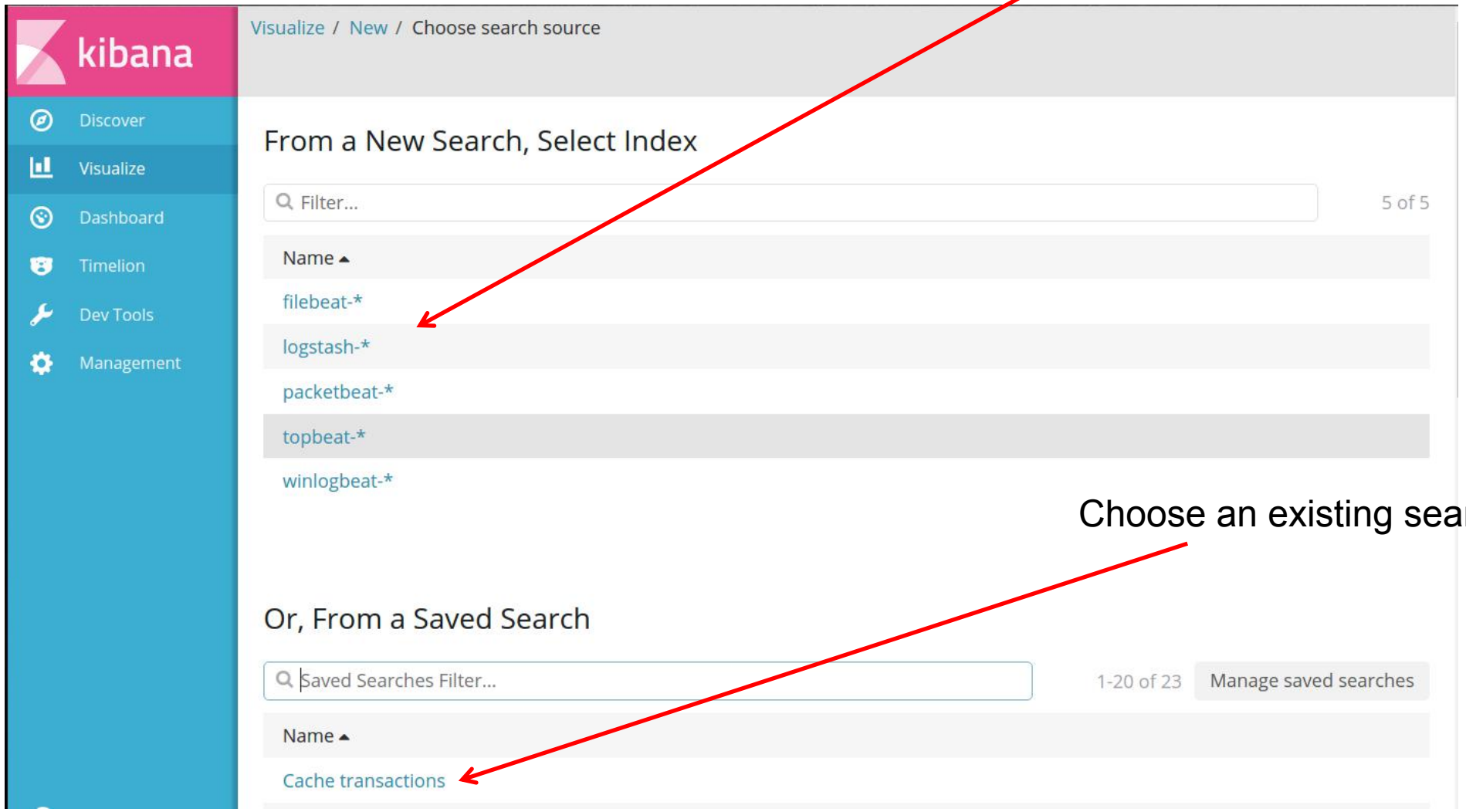
1. Select Visualize

Choose type



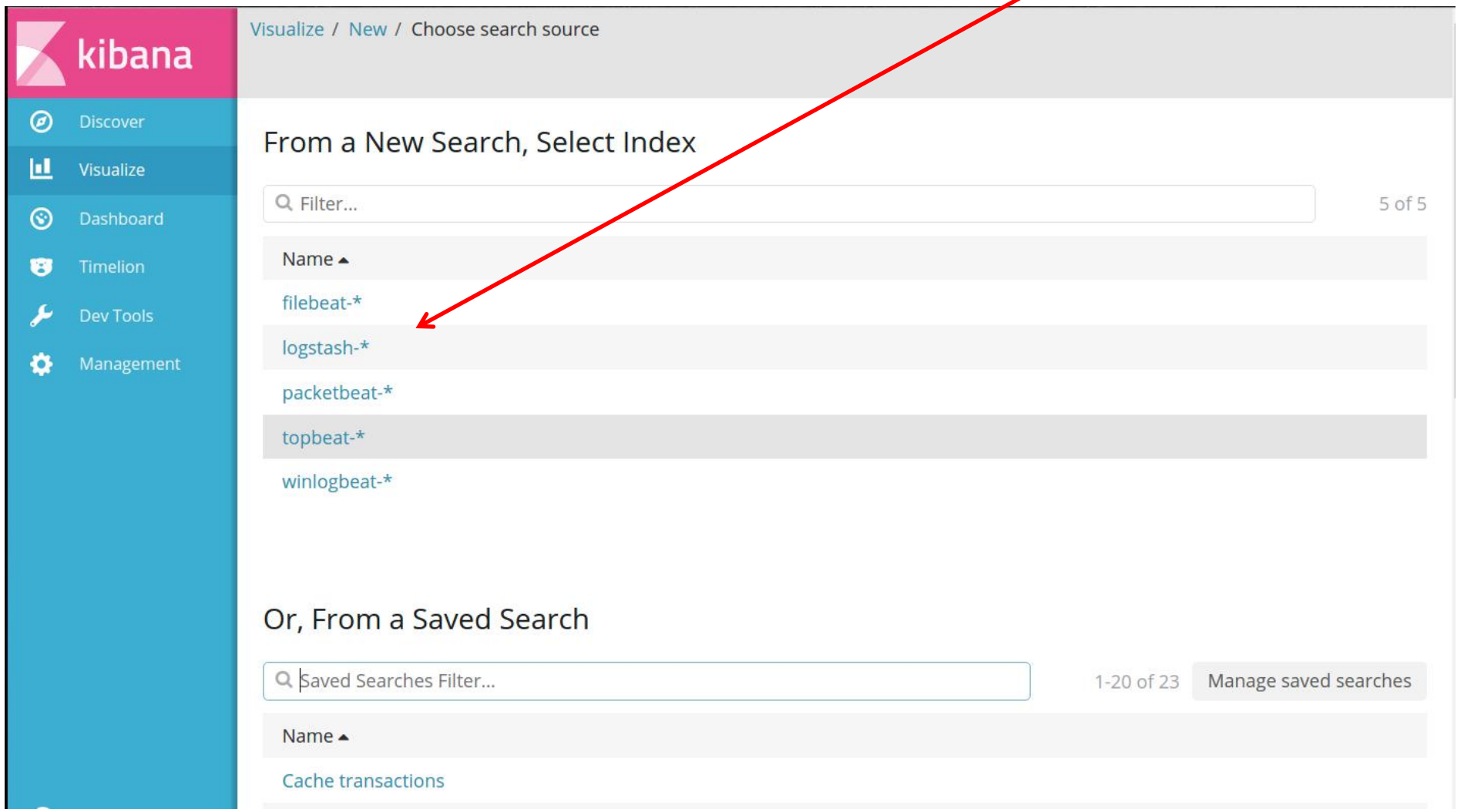
Data source

Select a new Index to create the search



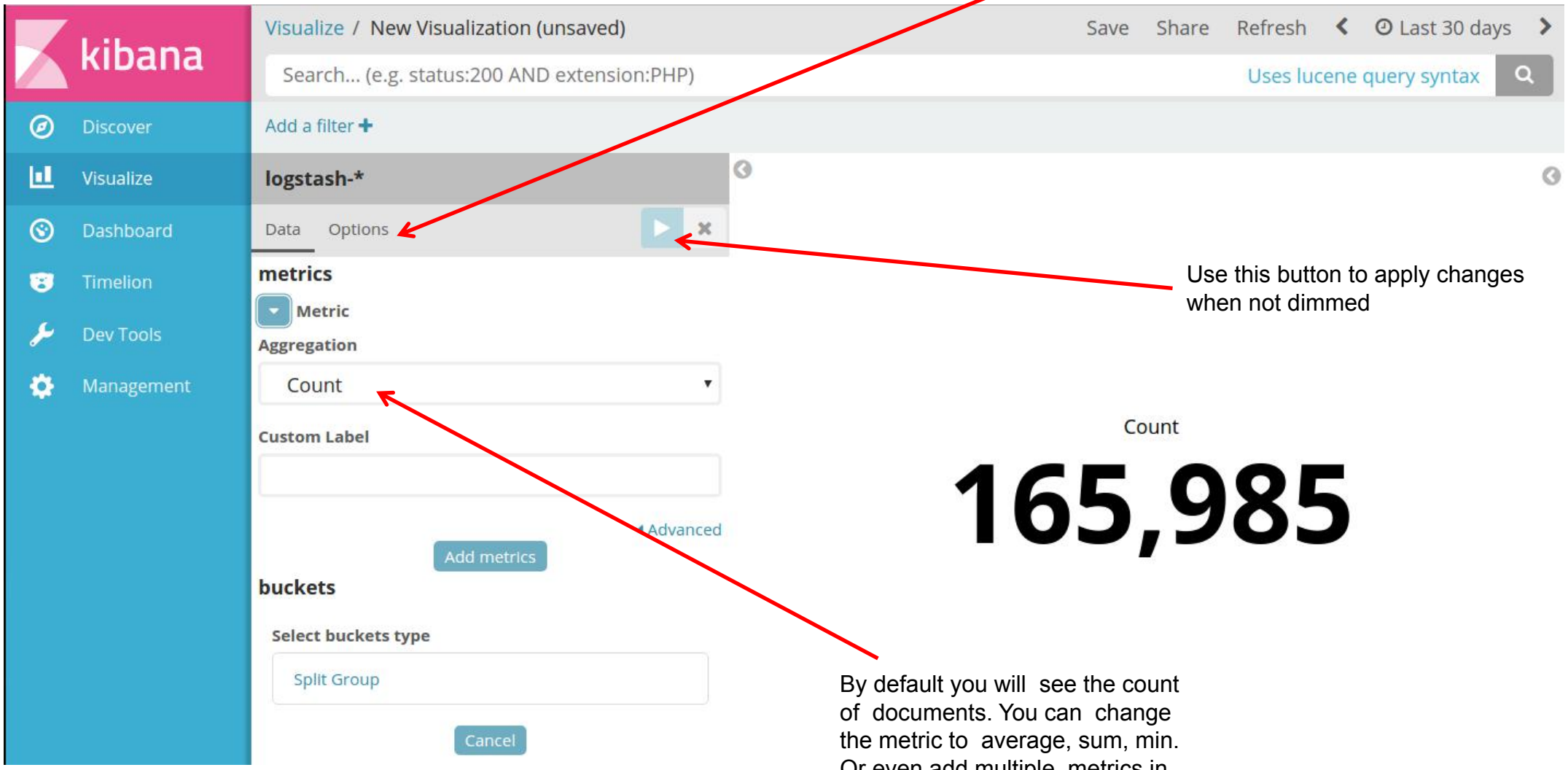
Choose an existing search

Create the metric



Metric visualization

You can change the font size in the options menu.



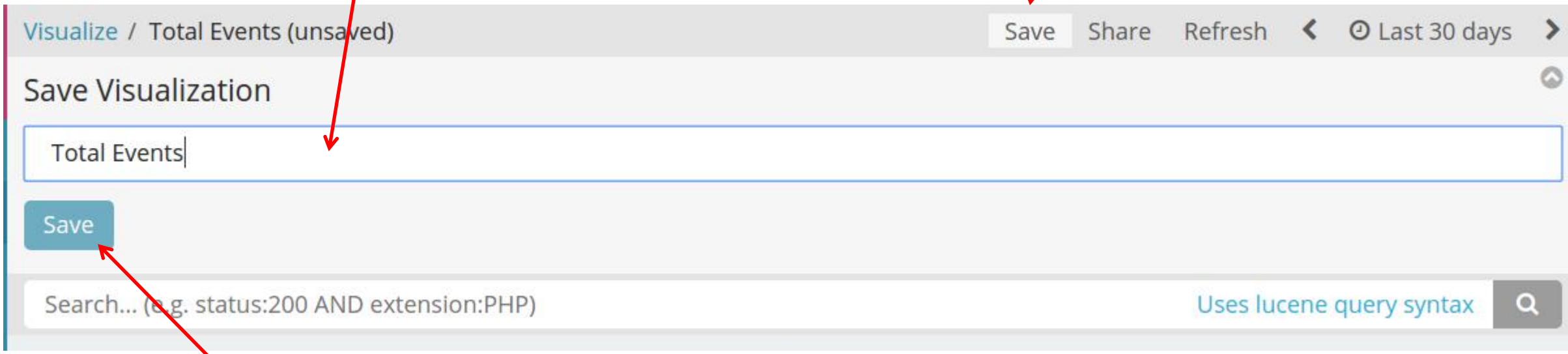
Use this button to apply changes when not dimmed

By default you will see the count of documents. You can change the metric to average, sum, min. Or even add multiple metrics in the same visualizations.

Saving

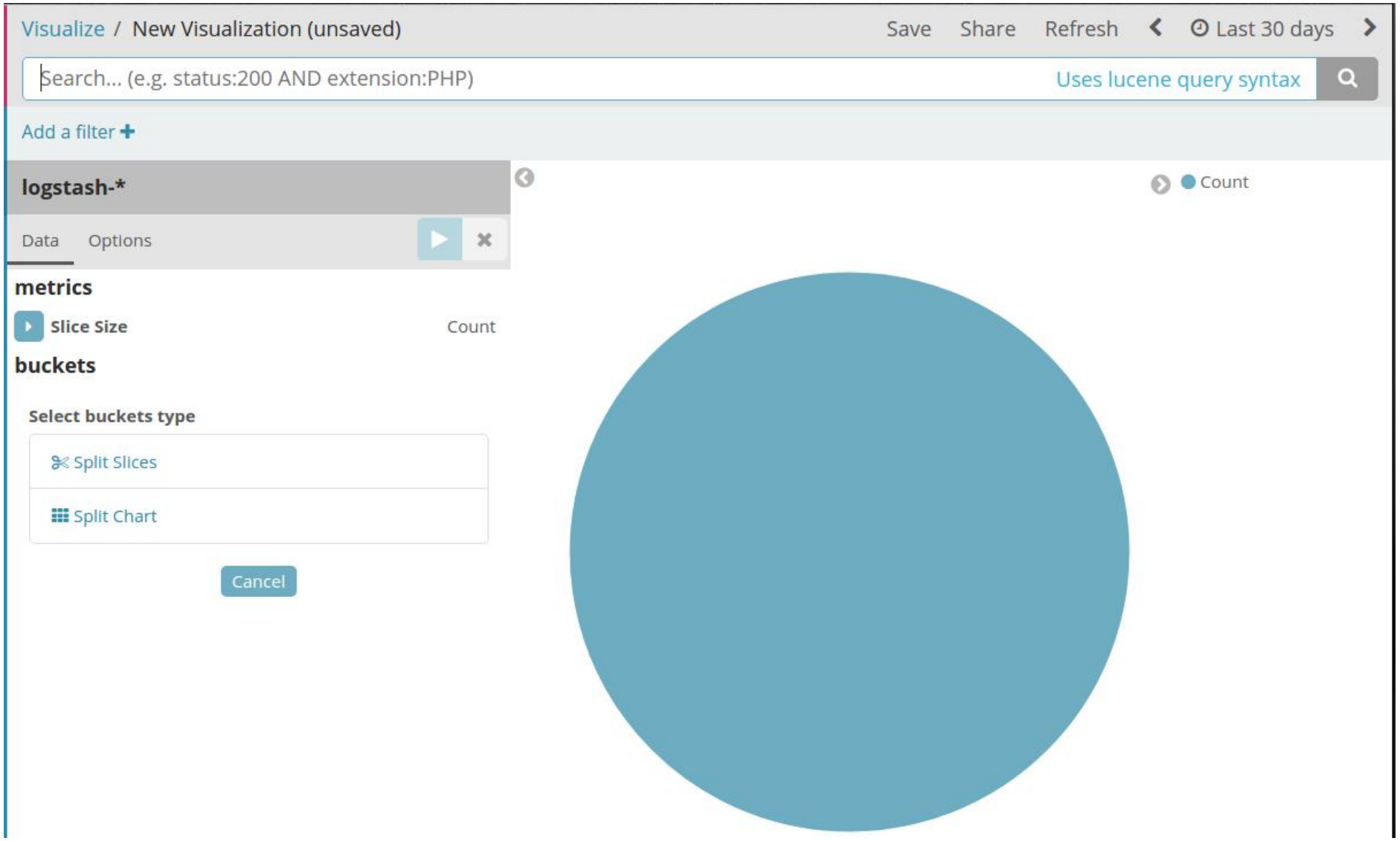
1. Save it

2. Enter the name to save the visual

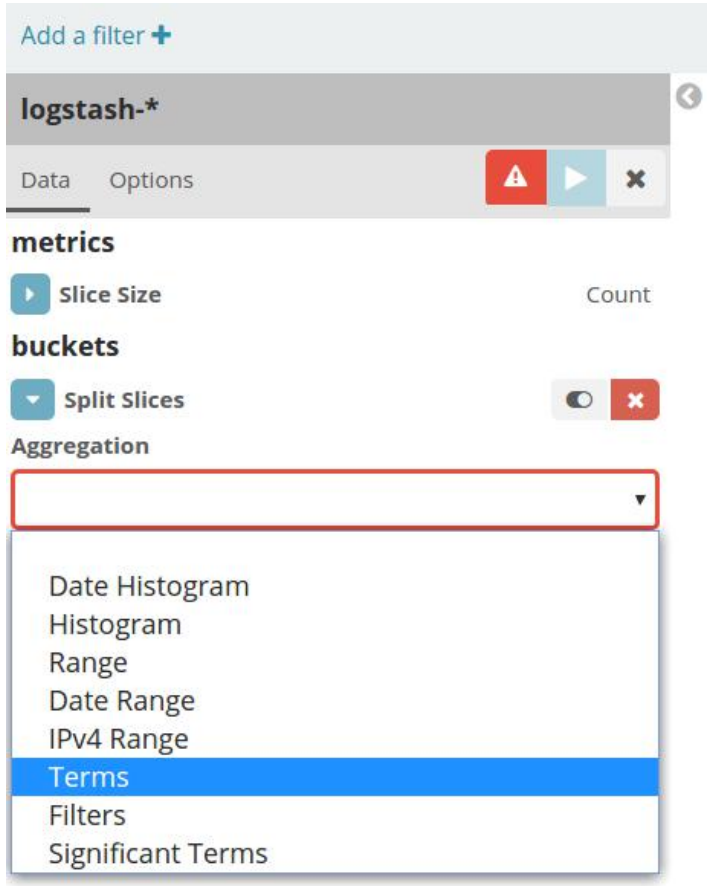


3. Save the visual

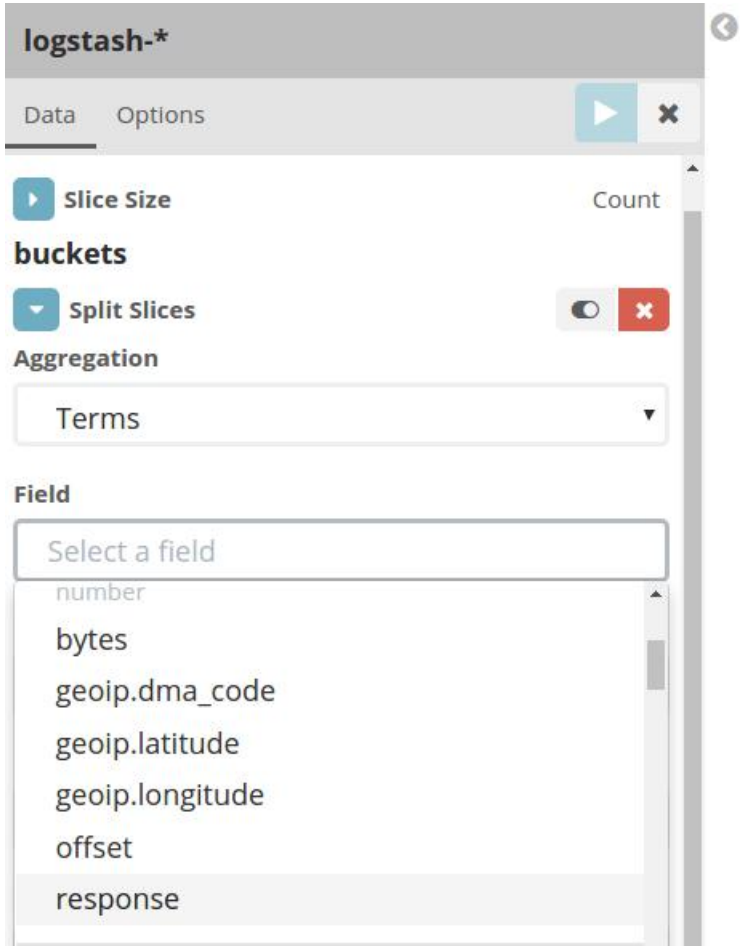
Pie chart



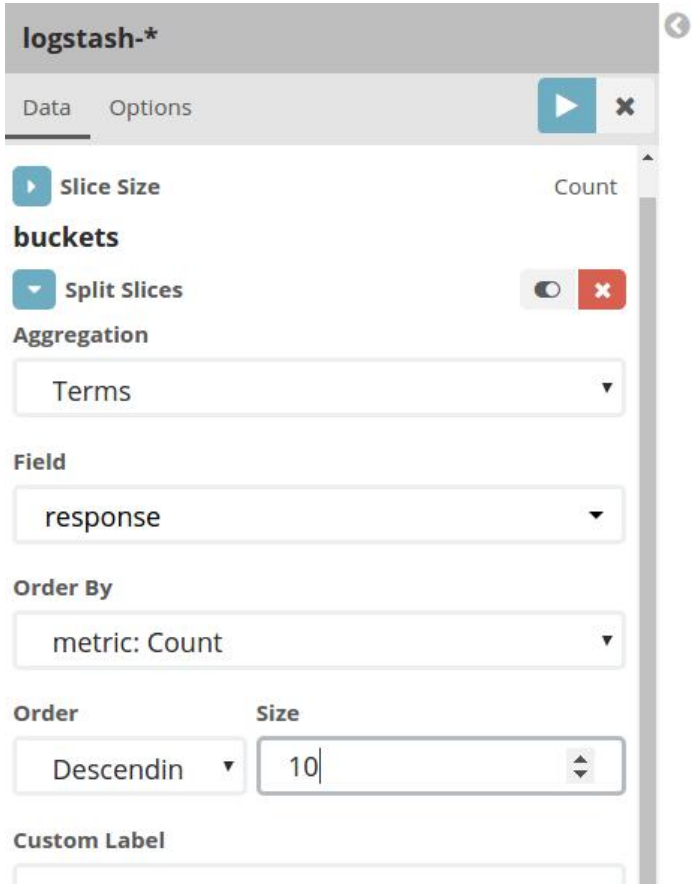
Split by top 10 responses



Create a terms aggregation



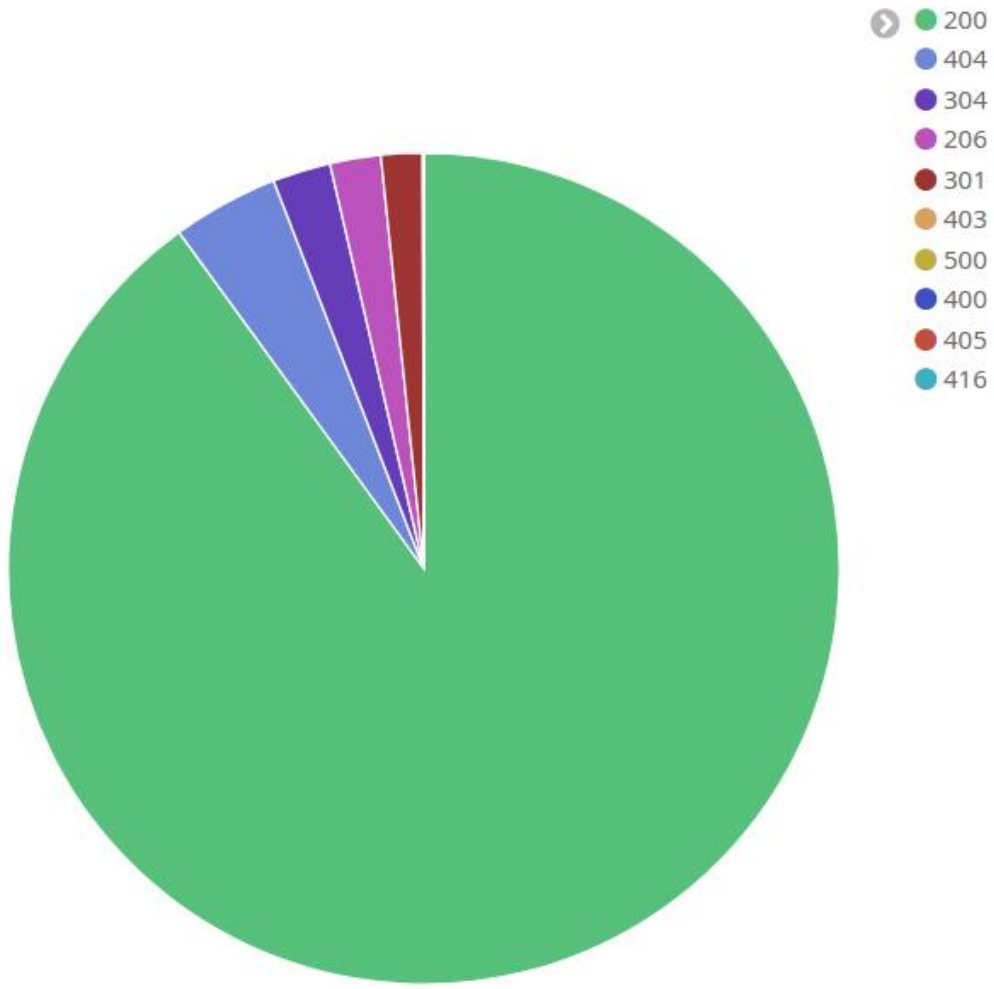
Select the response field



Set the size to 10 and click Apply Changes

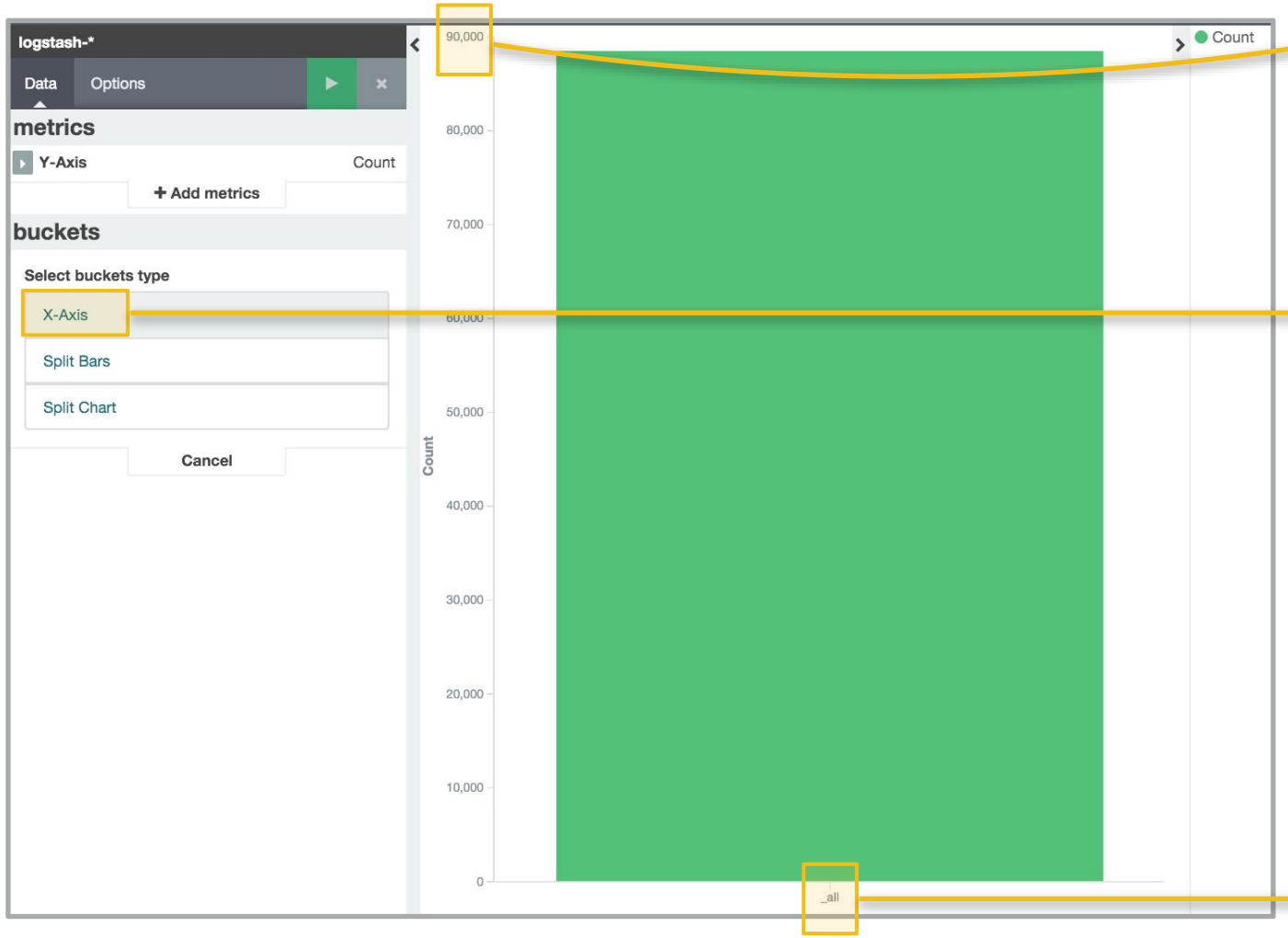
Pie chart

Do not forget to save and name your visualization (e.g. Response Codes)



Bar chart

Create a new visualization of type **Vertical bar chart**



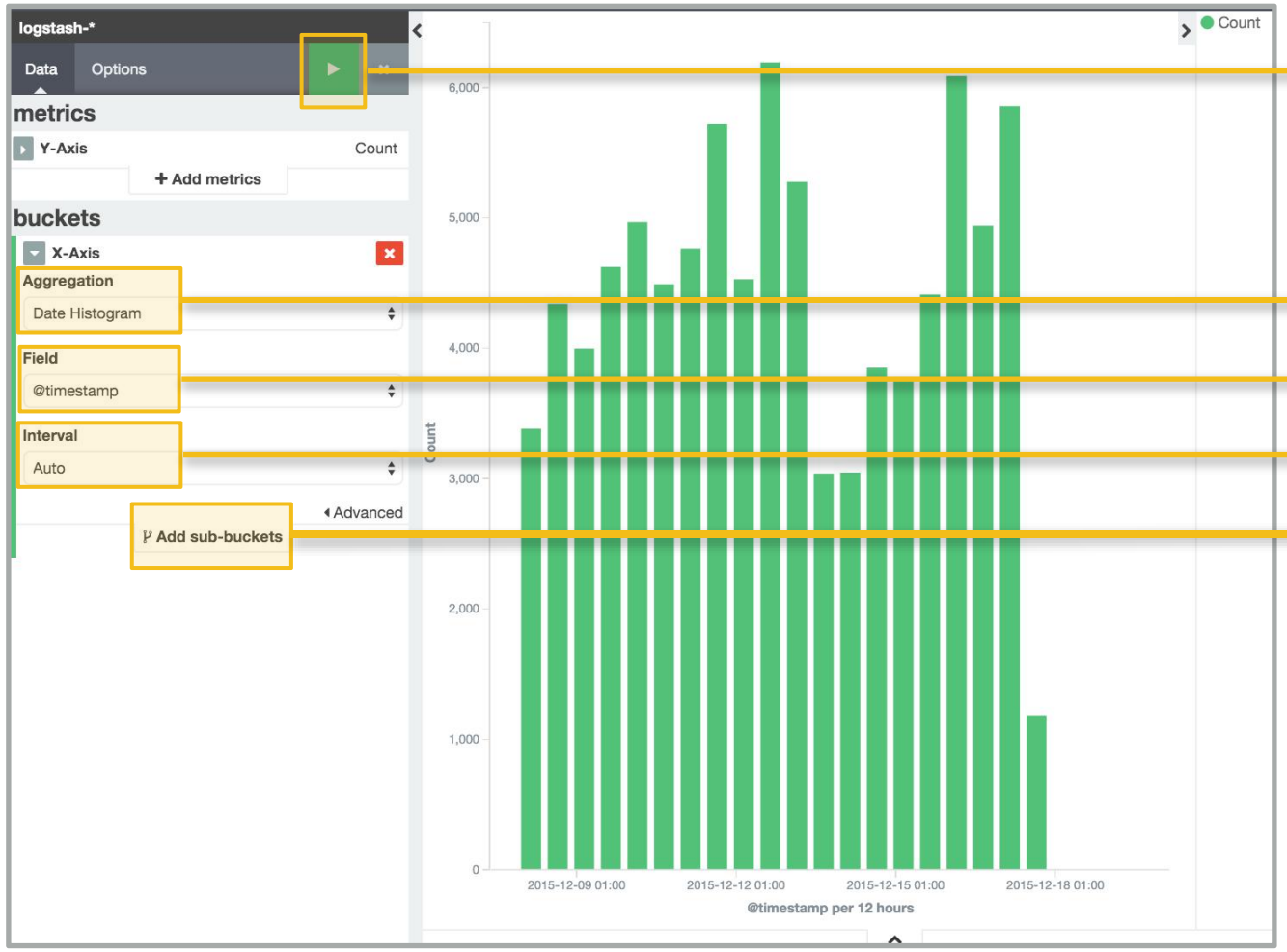
2 Y-Axis represents the count.

3 Split the X-Axis into many buckets.

1 All documents in a single bar (bucket).

Bar chart

Split the X-Axis into multiple bars based on the event time



4. Click apply.

1. Select **Date Histogram** aggregation.

2. On the field **@timestamp**.

3. Set the bucket **Interval** to **Auto**.

5. Let's sub-divide each bar.

Bar chart

Sub-divide each bar into 5 bars based on the response code

6 Click apply. And do not forget to save the visualization (e.g. **Events over Time by Response Code**).

1 Select **Terms** aggregation.

2 On the field **response**.

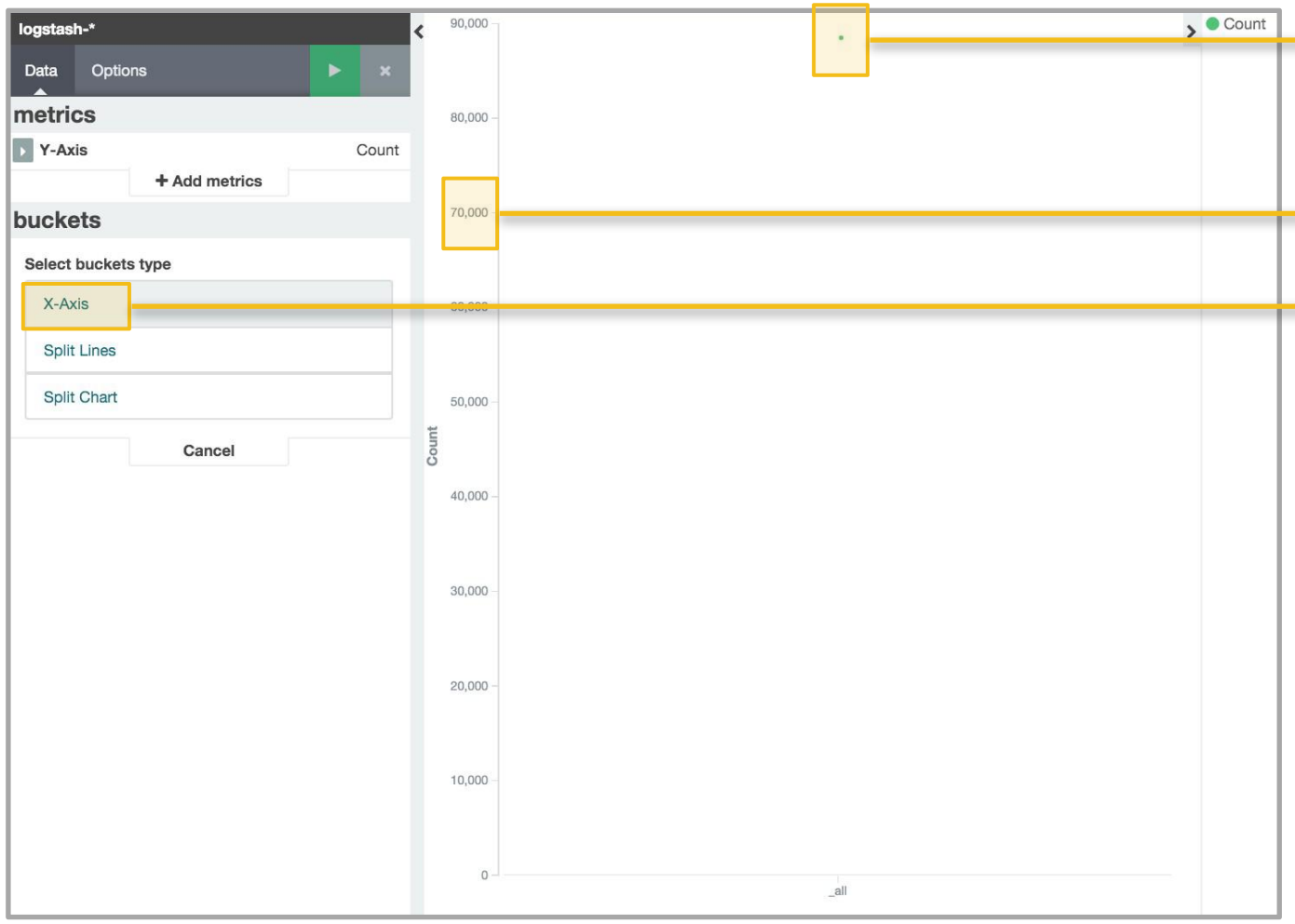
3 Order by the number of events.

4 Sub-divide each bar into a maximum of 5 bars.

5 Order in descending order.

Line chart

Create a new visualization of type Line chart



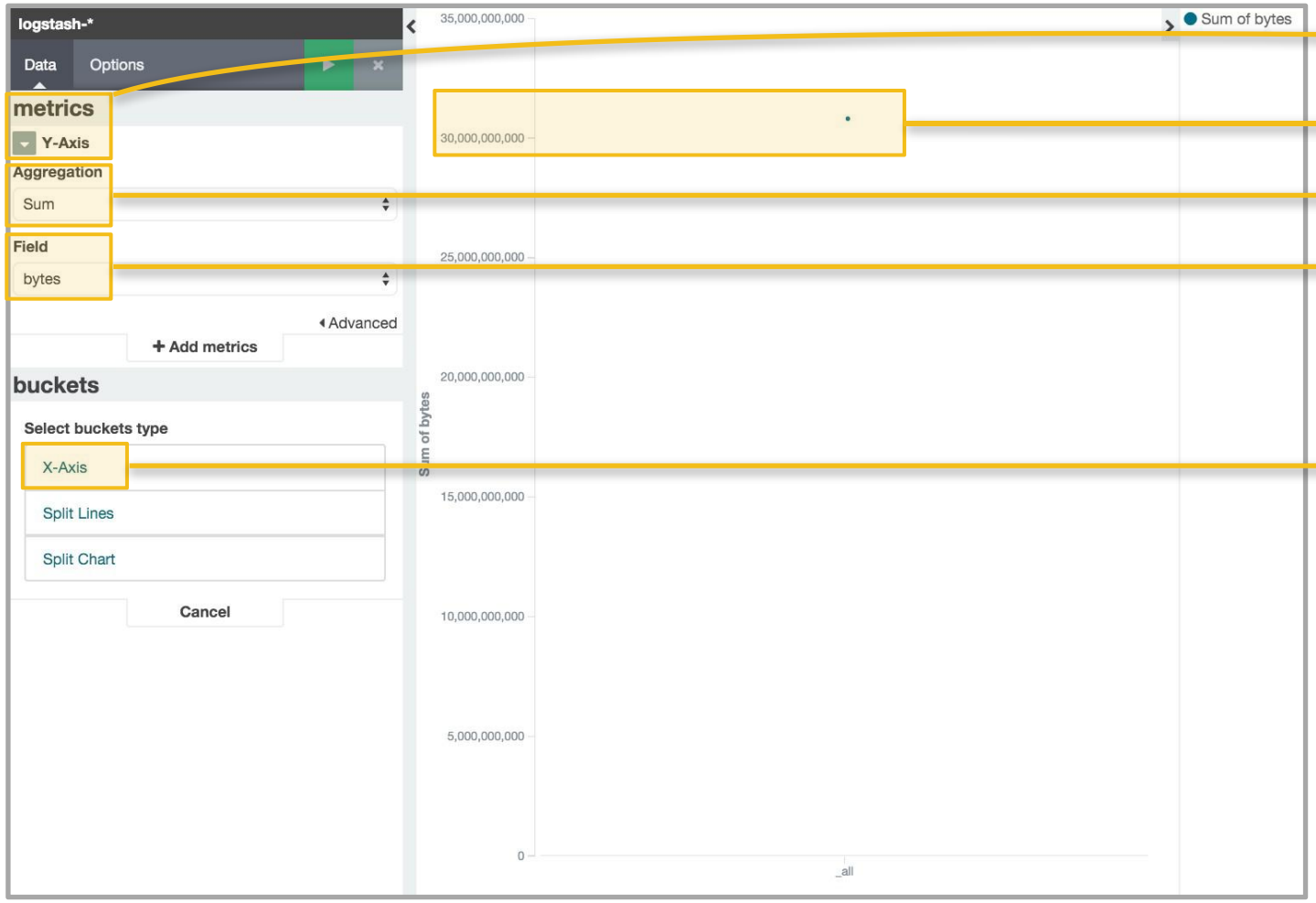
All documents in a single point (bucket).

Y-Axis represents the count.

Split the X-Axis into many buckets.

Line chart

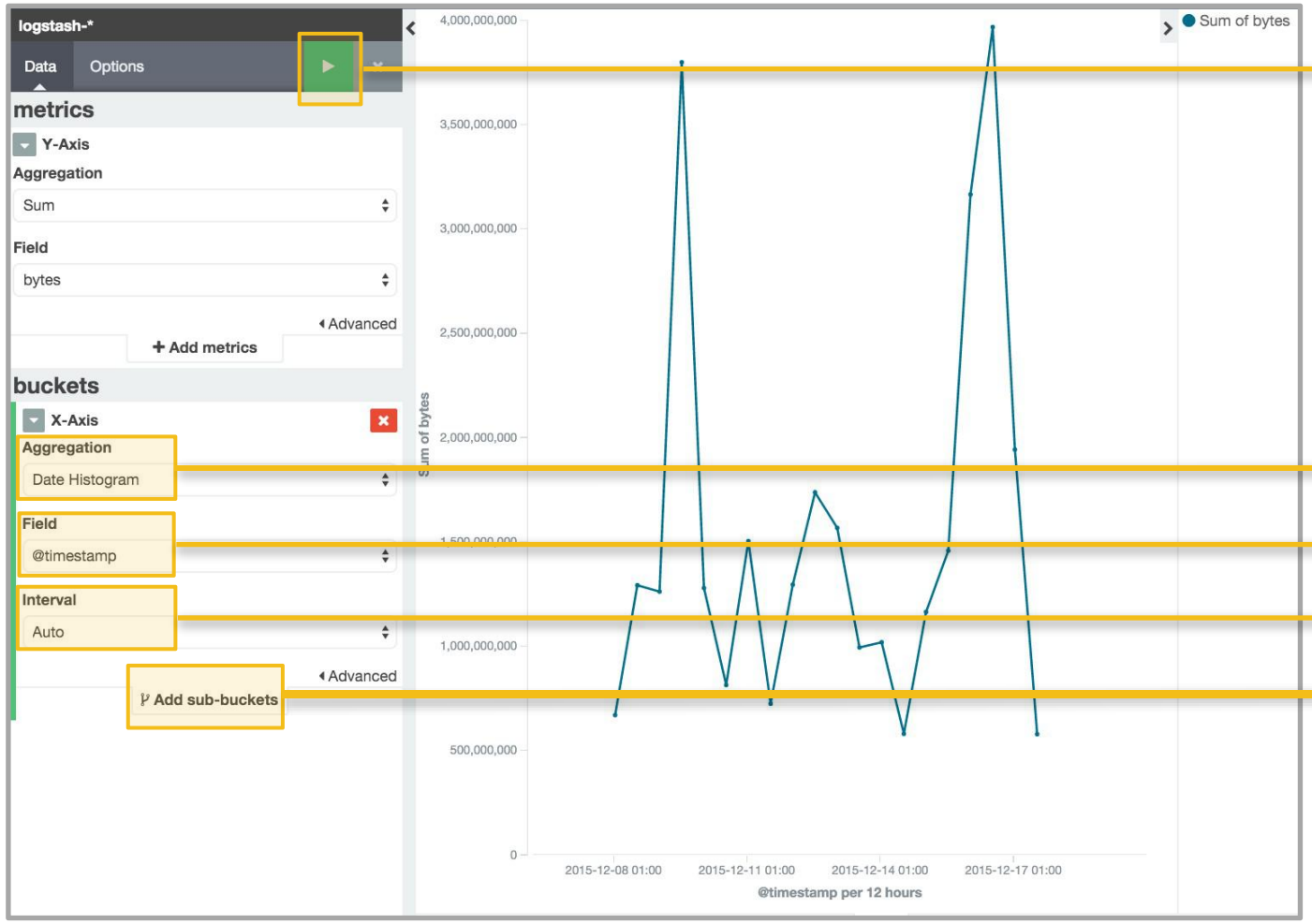
Instead of documents, let's "count" bytes served



1. Open the Y-Axis metric, so we can change it.
4. After the apply button, you will still see one bucket, but with a very different value.
2. **Sum** values.
3. On the field **bytes**.
5. Split the X-Axis into many buckets (points).

Line chart

Split the X-Axis into multiple bars based on the event time



4 Click apply.

1 Select **Date Histogram** aggregation.

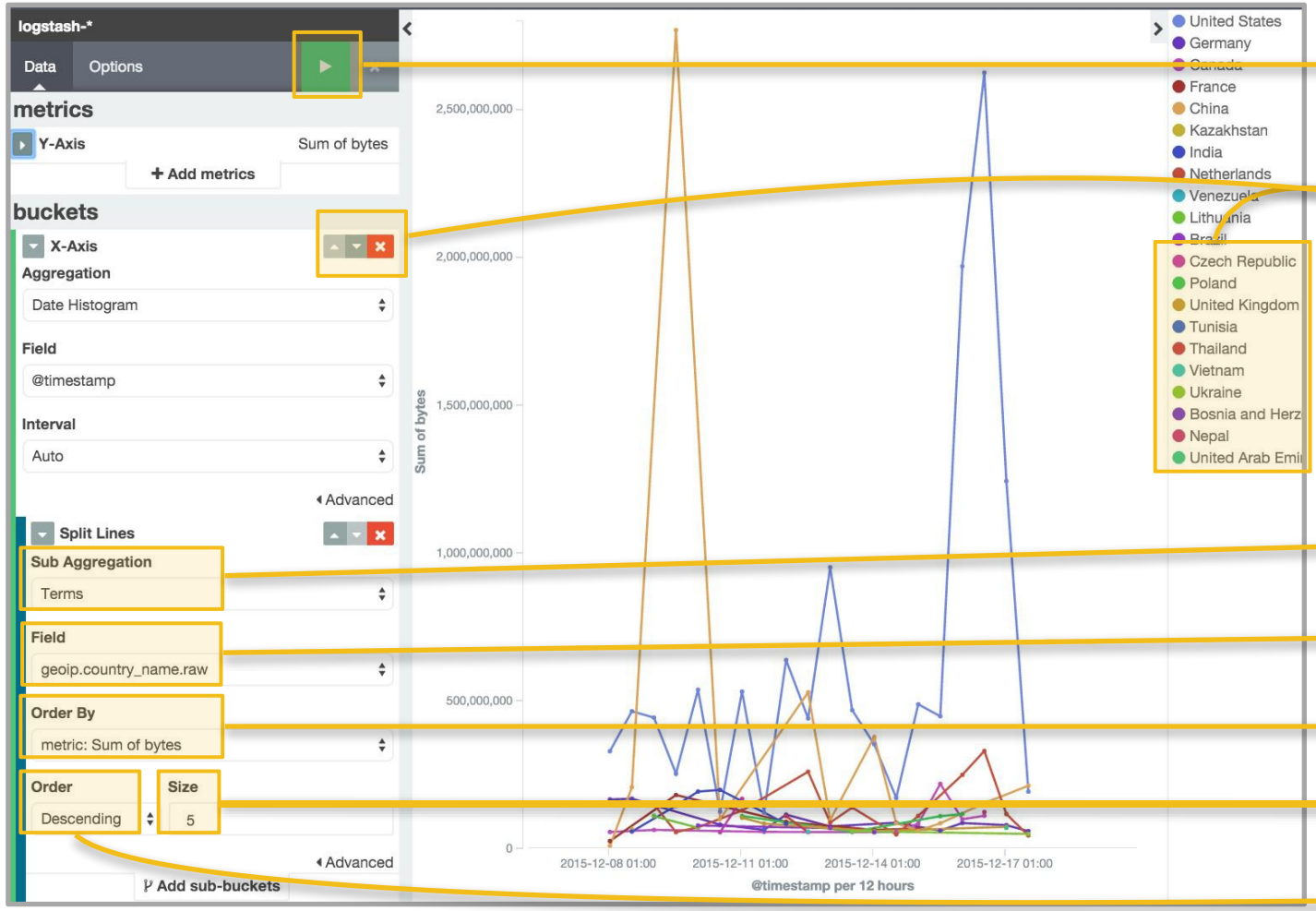
2 On the field **@timestamp**.

3 Set the bucket **Interval** to **Auto**.

5 Let's sub-divide each point.

Line chart

Bandwidth over Time by Country



6 Click apply.

Why do we have more than 5 countries? Try clicking the down arrow (changes the aggregation execution order) and click apply again. And do not forget to save the visualization (e.g. **Top 5 Countries Bandwidth over Time**).

1 Select **Terms** aggregation.

2 On the field **geoip.country_name.raw**. Ask an instructor why the **.raw** inner field!!

3 Order by the **Sum of bytes**.

4 Sub-divide each point into a maximum of 5 points.

5 Order in descending order.

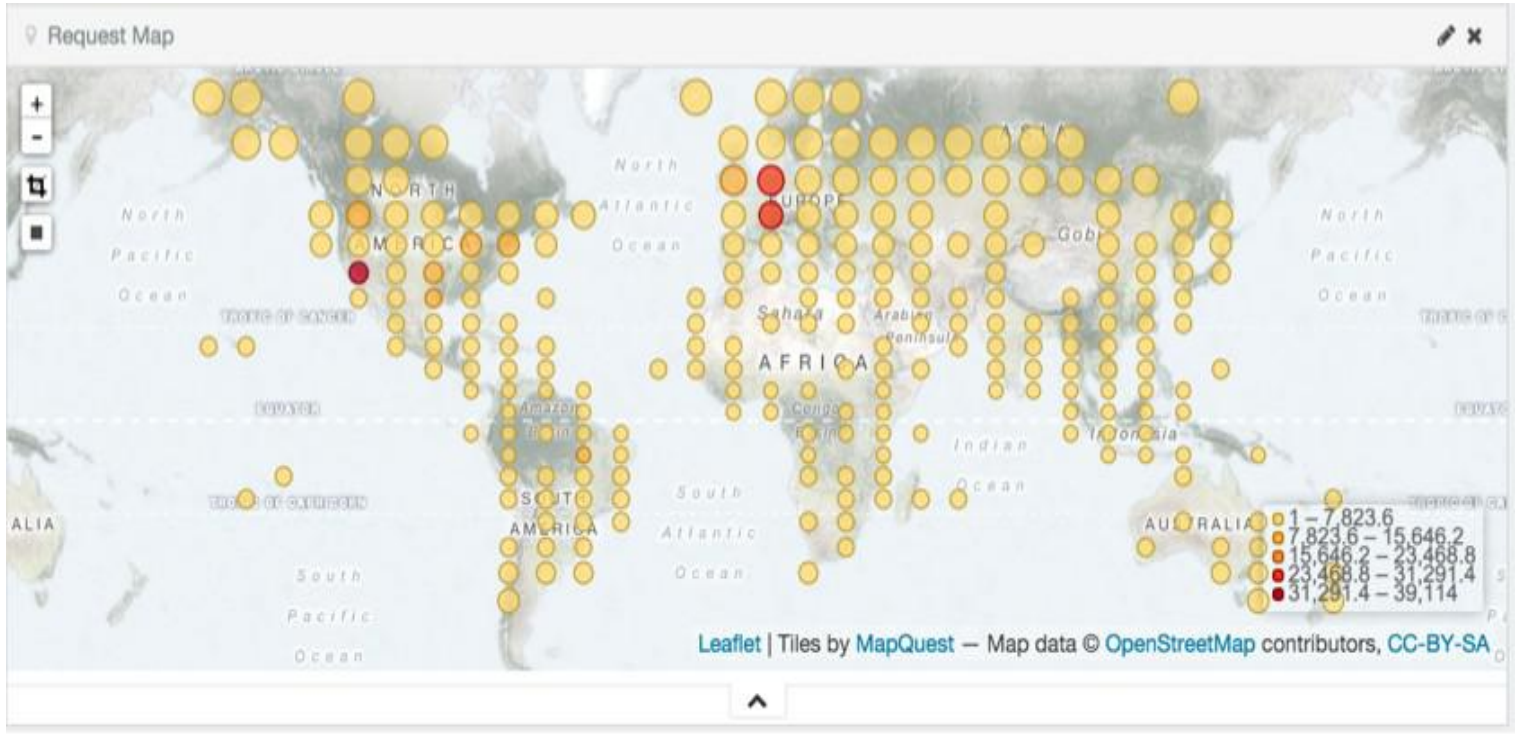
Tile Map

Create a visualization that uses geo-coordinates and a map

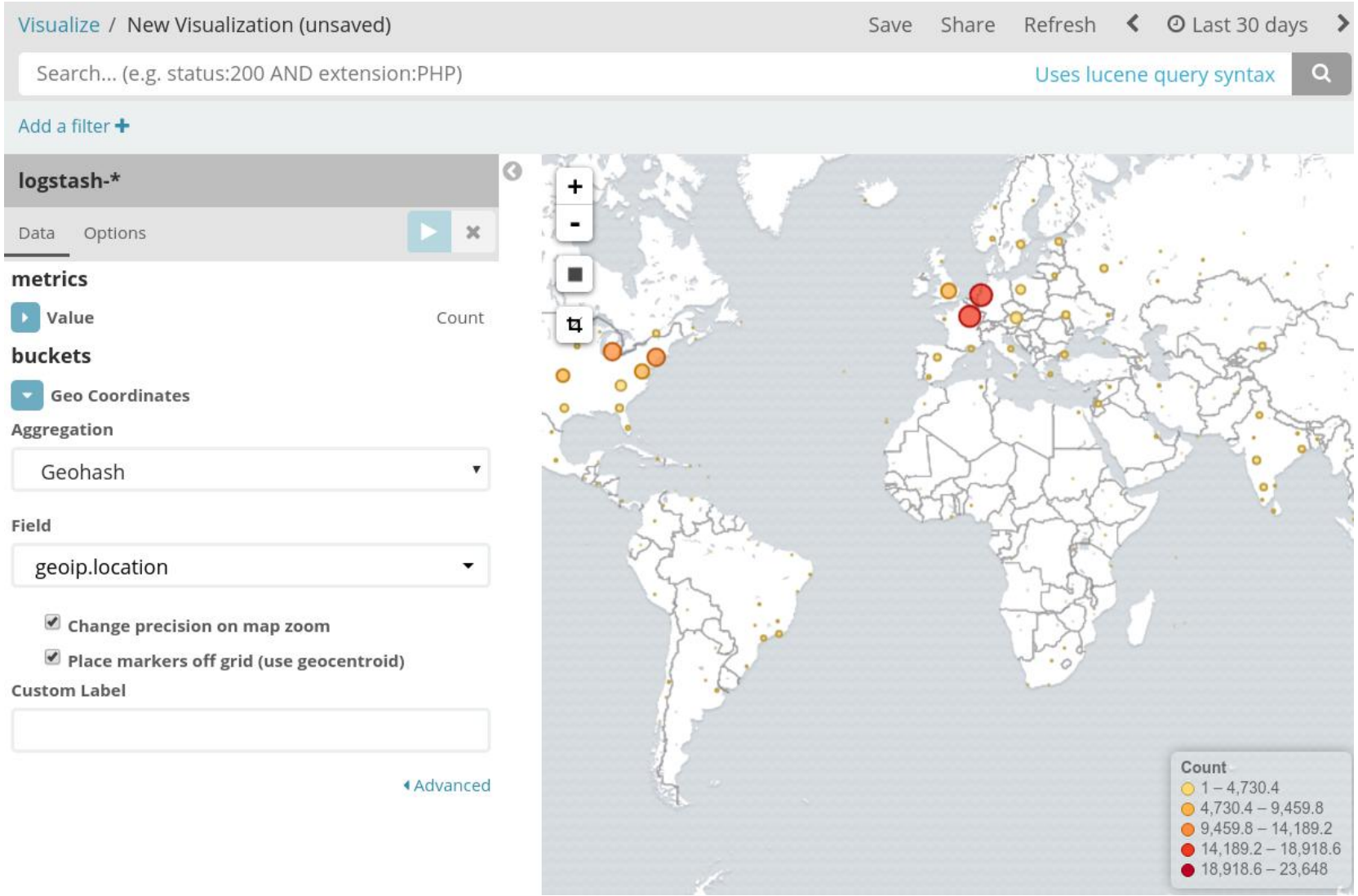
1. Create a "Co-ordinate Map" Visualization
2. Add "Geo Coordinates" based on the "geoip.location" field

In the "Options" select "Shaded Circle Markers"

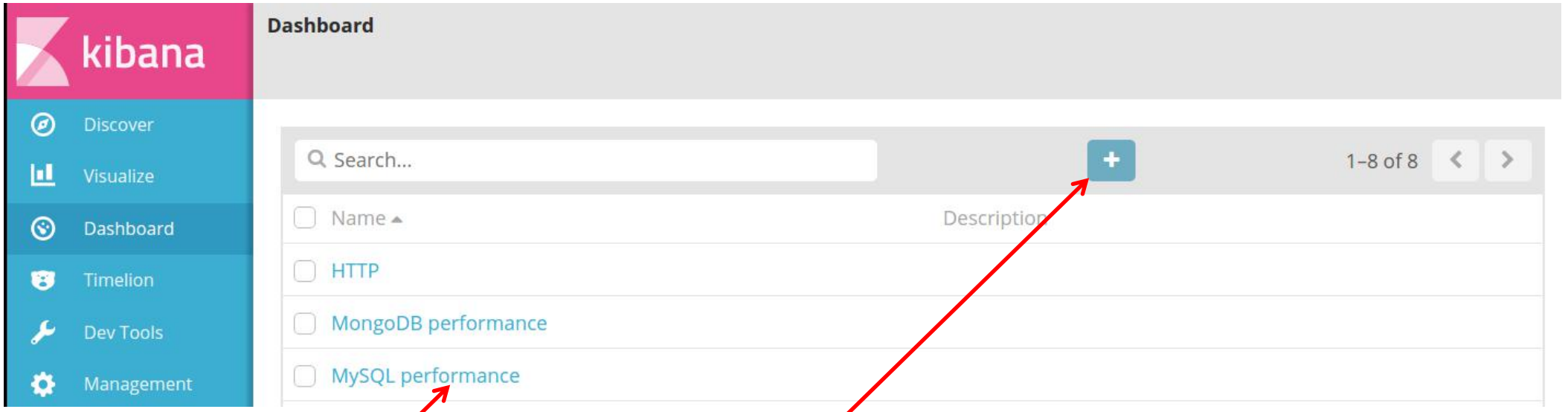
Apply and save the visualization



The co-ordinate map visual



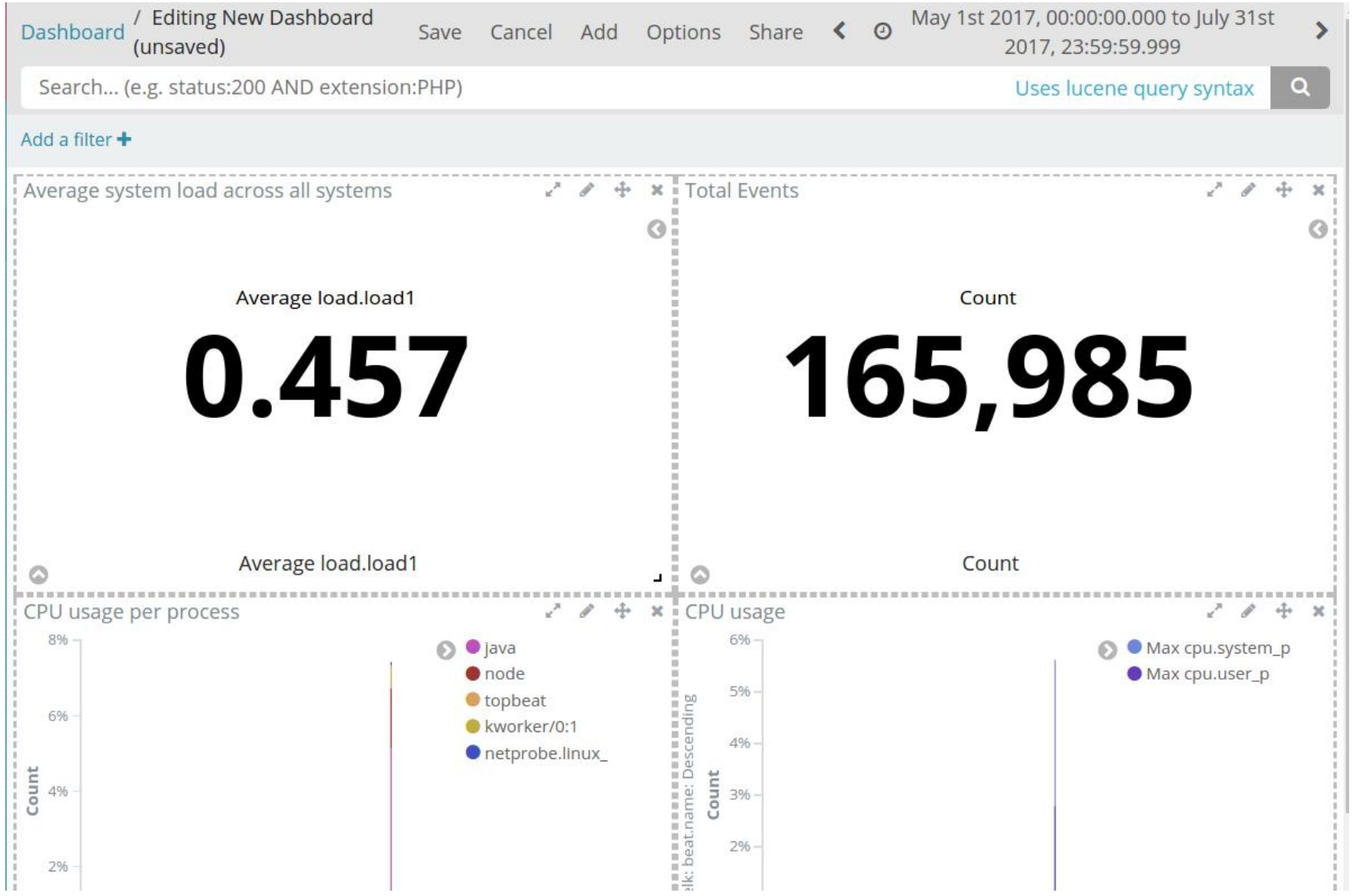
Putting it together in a dashboard



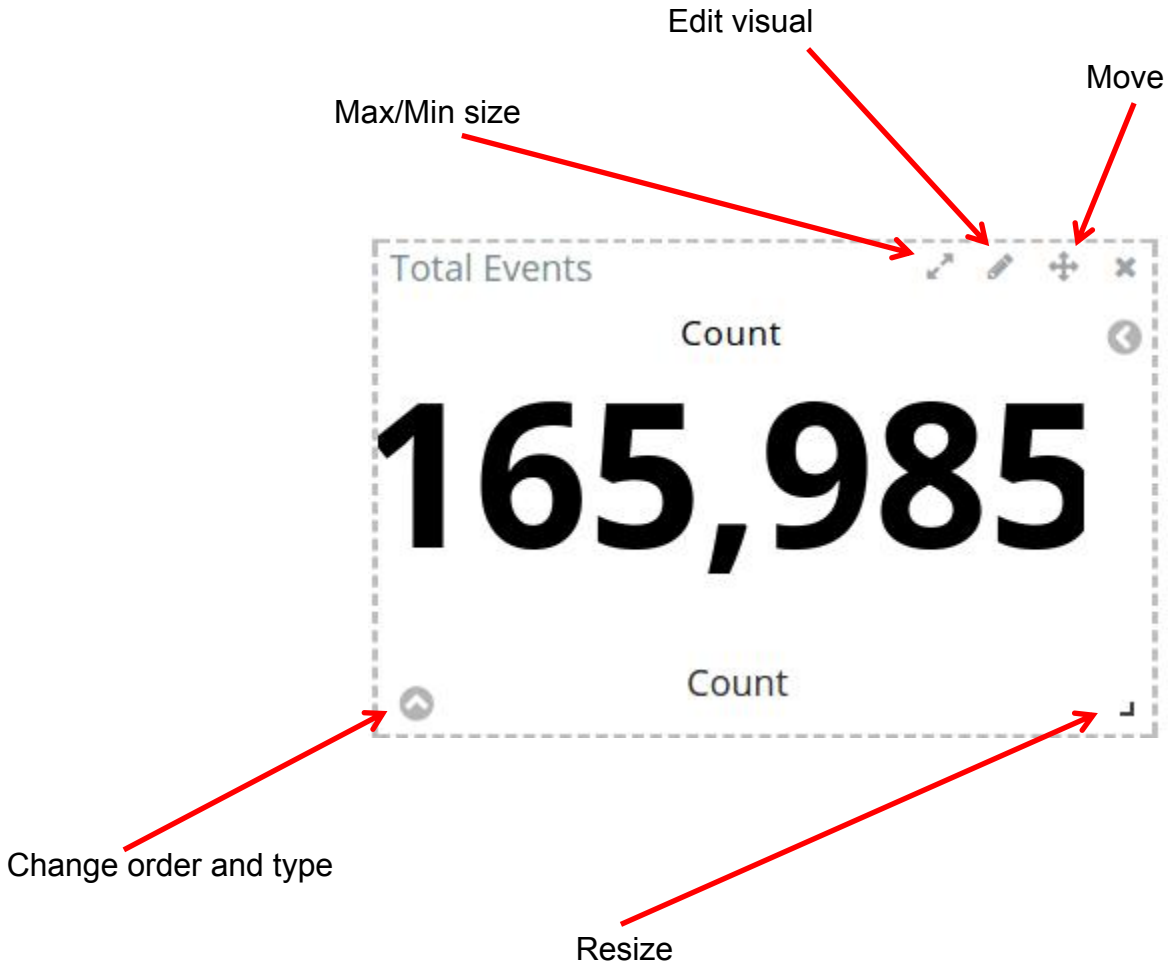
Create a new dashboard

Select existing dashboards

Dashboard not looking good?



Drag and resize



Visualizations – Technical Challenges

Here's some good ideas on visualizations to make - try and solve them!

(Bar chart) Histogram on response codes with interval 100	(Line chart) Bytes Date Histogram	(Pie chart) Doughnut chart for User agents by device by country
(Data table) Top 10 IPs	(Data table) Top 10 Requests	(Line chart) Split Lines of country fields by response codes (exclude USA)

Congratulation

- You have completed Lab 7
- You now have a fully functional ELK stack
- You now have the ability to create visualizations