



POLITECNICO
MILANO 1863



AWS IoT

Parte seconda

Marco D. Santambrogio – marco.santambrogio@polimi.it

Emanuele Del Sozzo – emanuele.delsozzo@polimi.it

Lorenzo Di Tucci – lorenzo.ditucci@mail.polimi.it

Giuseppe Natale – giuseppe.natale@polimi.it

Marco Rabozzi – marco.rabozzi@polimi.it

Alberto Scolari – alberto.scolari@polimi.it

Matteo Ferroni – matteo.ferroni@polimi.it

Ver. aggiornata al 19/12/2016

Outline

- Amazon Elasticsearch Service setup
- Create an index in Elasticsearch
- Create a rule in AWS IoT
- Create a graph in Kibana



Elasticsearch

<https://www.elastic.co/products/elasticsearch>

*Elasticsearch is a **distributed**, **RESTful search** and **analytics engine** capable of solving a growing number of use cases. As the heart of the Elastic Stack, it centrally **stores** your data so you can discover the expected and uncover the unexpected.*

Based on Apache Lucene, it provides:

- **full-text search engine**
- **HTTP web interface**
- **schema-free JSON documents**



elastic



POLITECNICO MILANO 1863

3

b o t
t e g
a 5 2

Amazon Elasticsearch Service

<https://console.aws.amazon.com/es/>

The screenshot shows the AWS Elasticsearch Service console. At the top, there's a navigation bar with links for Services, Resource Groups, AWS IoT, and Support, along with user information for Matteo Ferroni and Ireland. Below the navigation is a large orange circular icon containing a stylized bar chart. The main title "Amazon Elasticsearch Service" is centered above a brief description: "Amazon Elasticsearch Service (Amazon ES) makes it easy to set up, operate, and scale an Elasticsearch cluster in the cloud." Below the description are two buttons: a blue "Get started" button and a smaller blue "Getting started guide" link.



Launch an Elasticsearch cluster

Create Elasticsearch clusters in minutes.

[Learn more](#)



Manage and monitor

Manage your cluster and monitor the traffic.

[Learn more](#)



Load and query data

Use popular tools to load and analyze your data.

[Learn more](#)



POLITECNICO MILANO 1863

4



Amazon Elasticsearch Service - Setup

Elasticsearch domain name: *pynq-test*

Create Elasticsearch domain

Step 1: Define domain

Step 2: Configure cluster

Step 3: Set up access policy

Step 4: Review



Define domain

A domain is a collection of all the resources needed to run your Elasticsearch cluster.

Domain Name

Enter a name for your Elasticsearch domain. The domain name will be part of your domain endpoint.

Elasticsearch domain name

pynq-test

The name must start with a lowercase letter and must be between 3 and 28 characters. Valid characters are a-z (lowercase only), 0-9, and - (hyphen).

Version

Select the version of the Elasticsearch engine for your domain.

Elasticsearch version

2.3 ▾



POLITECNICO MILANO 1863

5

b o t
t e g
a 5 2

Amazon Elasticsearch Service - Setup

The AWS Free Tier includes usage of up to 750 hours per month of a t2.micro instance type and up to 10 GB of Magnetic or General Purpose EBS storage.
Learn more. Amazon Elasticsearch Service Free Tier.

All T2 instance types need EBS storage.

Node configuration

Selecting the correct instance type and instance count depends on the compute, memory, and storage needs of your application. Take into account the size of the Elasticsearch indices, shards, and replicas you intend to create, the types of queries you will run, and the amount of storage you will need as you decide these settings. If you have a large volume of data to upload or anticipate a large amount of query traffic to your domain, you can preconfigure the cluster to handle this requirement.

Instance count	<input type="text" value="1"/> i
Instance type	<input type="text" value="t2.micro.elasticsearch (Free ti..."/> ▼ i



Amazon Elasticsearch Service - Setup

The AWS Free Tier includes usage of up to 750 hours per month of a t2.micro instance type and up to 10 GB of Magnetic or General Purpose EBS storage.
Learn more. Amazon Elasticsearch Service Free Tier.

All T2 instance types need EBS storage.

Storage configuration

Choose a storage type for your data nodes. If you choose the EBS storage type, you will need to specify the EBS volume type and EBS volume size for the cluster. The EBS volume size setting is configured per instance. Multiply the volume size by the number of data nodes in your cluster for the total storage size available in your cluster. Take into account size of indices, shards, and replicas you intend to create in your cluster when configuring storage settings. Storage settings do not apply to any dedicated master nodes in the cluster.

Storage type	EBS	
EBS volume type*	General Purpose (SSD)	
EBS volume size*	10	

Total cluster size will be 10 GB (EBS volume size x Instance count).



Amazon Elasticsearch Service - Policy

Set up access policy



To allow or block access to the domain, select a policy template from the template selector or add one or more Identity and Access Management (IAM) policy statements in the **Edit the access policy** box.

Set the domain access policy to

Add or edit the access policy

```
1 {  
2     "Version": "2012-10-17",  
3     "Statement": [  
4         {  
5             "Effect": "Allow",  
6             "Principal": {  
7                 "AWS": [  
8                     "*"  
9                 ]  
10            },  
11            "Action": [  
12                "es:*"  
13            ],  
14            "Resource": "arn:aws:es:eu-west-1:631211024482:domain/pynq-test/*"  
15        }  
16    ]  
17 }
```

Allow open access to the domain ▾

Select a template

Allow or deny access to one or more AWS accounts or IAM users

Allow access to the domain from specific IP(s)

Allow open access to the domain

(Not recommended because anyone can upload documents)

Deny access to the domain

(If you choose this policy, no one can access your domain endpoint)



Amazon Elasticsearch Service - Waiting

✓ You have successfully created an Elasticsearch domain.

You can update your domain configuration or access policy now. The domain endpoint will be available once the domain has reached an Active status.

pynq-test



Configure cluster

Modify access policy

Manage tags

Your domain is being initialized, which takes about 10 minutes. You cannot load data or run queries against your domain until the initialization is complete. The domain status will change to Active as soon as your domain is ready to use.

Domain status

Loading

▶ Delete Elasticsearch domain



POLITECNICO MILANO 1863

9

b o t
t e g
a 5 2

Amazon Elasticsearch Service - Active

pynq-test



Configure cluster

Modify access policy

Manage tags

Domain status Active

Elasticsearch version 2.3

Endpoint search-pynq-test-xiwn3ly22x7c7m5hnzsunxlkw.eu-west-1.es.amazonaws.com

Domain ARN arn:aws:es:eu-west-1:631211024482:domain/pynq-test

Kibana search-pynq-test-xiwn3ly22x7c7m5hnzsunxlkw.eu-west-1.es.amazonaws.com/_plugin/kibana/

Cluster health

Indices

Monitoring

Status Green

Number of nodes 1

Number of data nodes 1

Active primary shards 0

Active shards 0

Relocating shards 0

Initializing shards 0

Unassigned shards 0



POLITECNICO MILANO 1863

10

b o t
t e g
a 5 2

Amazon Elasticsearch Service - Active

pynq-test



Configure cluster

Modify access policy

Manage tags

Domain status Active

Elasticsearch version 2.3

Endpoint search-pynq-test-xiwn3ly22x7c7m5hnzsunxlkw.eu-west-1.es.amazonaws.com

Domain ARN <arn:aws:es:eu-west-1:631211024482:domain/pynq-test>

Kibana search-pynq-test-xiwn3ly22x7c7m5hnzsunxlkw.eu-west-1.es.amazonaws.com/_plugin/kibana/

Cluster health

Indices

Monitoring

Status Green

Number of nodes 1

Number of data nodes 1

Active primary shards 0

Active shards 0

Relocating shards 0

Initializing shards 0

Unassigned shards 0



POLITECNICO MILANO 1863

10

b o t
t e g
a 5 2

Elasticsearch - Create index

- An **index** is the top level logical structure in Elasticsearch to store your data
- You can use an HTTP client such as **curl** to make a:

```
curl -i -X PUT -d '{  
  "mappings": {  
    "sample": {  
      "properties": {  
        "timestamp": {  
          "type": "long",  
          "copy_to": "datetime"  
        },  
        "datetime": {  
          "type": "date",  
          "store": true  
        },  
        "temperature": {  
          "type": "long"  
        }  
      }  
    }  
  }  
}' 'https://search-pynq-test-xiwn3ly22x7c7m5hnzsunxlkw.m.eu-west-1.es.amazonaws.com/samples'
```



Elasticsearch - Create index

- An **index** is the top level logical structure in Elasticsearch to store your data
- You can use an HTTP client such as **curl** to make a:

```
curl -i -X PUT -d '{  
  "mappings": {  
    "sample": {  
      "properties": {  
        "timestamp": {  
          "type": "long",  
          "copy_to": "datetime"  
        },  
        "datetime": {  
          "type": "date",  
          "store": true  
        },  
        "temperature": {  
          "type": "long"  
        }  
      }  
    }  
  }  
' 'https://search-pynq-test-xiwn3ly22x7c7m5hnzsunxlkwm.eu-west-1.es.amazonaws.com/samples'
```



Elasticsearch - Create index

- An **index** is the top level logical structure in Elasticsearch to store your data
- You can use an HTTP client such as **curl** to make a:

```
curl -i -X PUT -d '{  
  "mappings": {  
    "sample": {  
      "properties": {  
        "timestamp": {  
          "type": "long",  
          "copy_to": "datetime"  
        },  
        "datetime": {  
          "type": "date",  
          "store": true  
        },  
        "temperature": {  
          "type": "long"  
        }  
      }  
    }  
  }  
}' 'https://search-pynq-test-xiwn3ly22x7c7m5hnzsunxlkwm.eu-west-1.es.amazonaws.com/samples'  

```



Elasticsearch - Create index

- An **index** is the top level logical structure in Elasticsearch to store your data
- You can use an HTTP client such as **curl** to make a:

```
curl -i -X PUT -d '{  
  "mappings": {  
    "sample": {  
      "properties": {  
        "timestamp": {  
          "type": "long",  
          "copy_to": "datetime"  
        },  
        "datetime": {  
          "type": "date",  
          "store": true  
        },  
        "temperature": {  
          "type": "long"  
        }  
      }  
    }  
  }  
}' 'https://search-pynq-test-xiwn3ly22x7c7m5hnzsunxlkwm.eu-west-1.es.amazonaws.com/samples'  
  
  

```



Elasticsearch - Create index

- An **index** is the top level logical structure in Elasticsearch to store your data
- You can use an HTTP client such as **curl** to make a:

```
curl -i -X PUT -d '{  
  "mappings": {  
    "sample": {  
      "properties": {  
        "timestamp": {  
          "type": "long",  
          "copy_to": "datetime"  
        },  
        "datetime": {  
          "type": "date",  
          "store": true  
        },  
        "temperature": {  
          "type": "long"  
        }  
      }  
    }  
  }  
}' 'https://search-pynq-test-xiwn3ly22x7c7m5hnzsunxlkwm.eu-west-1.es.amazonaws.com/samples'  
  

```



Elasticsearch - Create index

- An **index** is the top level logical structure in Elasticsearch to store your data
- You can use an HTTP client such as **curl** to make a:

```
curl -i -X PUT -d '{  
  "mappings": {  
    "sample": {  
      "properties": {  
        "timestamp": {  
          "type": "long",  
          "copy_to": "datetime"  
        },  
        "datetime": {  
          "type": "date",  
          "store": true  
        },  
        "temperature": {  
          "type": "long"  
        }  
      }  
    }  
  }  
' 'https://search-pynq-test-xiwn3ly22x7c7m5hnzsunxlkw.m.eu-west-1.es.amazonaws.com/samples'
```



Response:

HTTP/1.1 200 OK

*Access-Control-Allow-Origin: **

Content-Type: application/json; charset=UTF-8

Content-Length: 21

Connection: keep-alive

{"acknowledged":true}



AWS IoT <> Elasticsearch

- Configure an **AWS IoT rule** that can route the inbound data from connected boards to the Elasticsearch index

The screenshot shows the AWS IoT Rules interface. On the left, there's a sidebar with a red arrow pointing to the 'Rules' icon. The main area features a large circular icon with a gear inside, surrounded by arrows, symbolizing data flow. Below it, the text 'You don't have any rules yet' is displayed, followed by a descriptive paragraph about rules and two buttons: 'Learn more' and 'Create a rule'.

AWS IoT

Dashboard Connect Registry Security Rules Test

You don't have any rules yet

Rules give your things the ability to interact with AWS and other web services. Rules are analyzed and actions are performed based on the messages sent by your things.

Learn more Create a rule



AWS IoT <> Elasticsearch

- Configure an **AWS IoT rule** that can route the inbound data from connected boards to the Elasticsearch index

Create a rule

Create a rule to evaluate messages sent by your things and specify what to do when a message is received (for example, write data to a DynamoDB table or invoke a Lambda function).

Name

route_to_elastic

Description

Route data from the board to Elasticsearch



POLITECNICO MILANO 1863

13

b o t
t e g
a 5 2

AWS IoT <> Elasticsearch

- Configure an **AWS IoT rule** that can route the inbound data from connected boards to the Elasticsearch index

Message source

Indicate the source of the messages you want to process with this rule.

Using SQL version [?](#)

2016-03-23



Rule query statement

```
SELECT *, timestamp() AS timestamp FROM 'boards/#'
```

Attribute

*, timestamp() AS timestamp

Topic filter

boards/#

Condition

e.g. temperature > 75



AWS IoT <> Elasticsearch

- Configure an **AWS IoT rule** that can route the inbound data from connected boards to the Elasticsearch index

Message source

Indicate the source of the messages you want to process with this rule.

Using SQL version

2016-03-23



Rule query statement

```
SELECT *, timestamp() AS timestamp FROM 'boards/#'
```

Attribute

*, timestamp() AS timestamp

Topic filter

boards/#

Condition

e.g. temperature > 75



AWS IoT <> Elasticsearch

- Configure an **AWS IoT rule** that can route the inbound data from connected boards to the Elasticsearch index

Message source

Indicate the source of the messages you want to process with this rule.

Using SQL version 

2016-03-23 

Rule query statement

```
SELECT *, timestamp() AS timestamp FROM 'boards/#'
```

The 'boards/#' part of the query is circled in red.

Attribute

```
*, timestamp() AS timestamp
```

The '*' part of the attribute list is highlighted with a green brush.

Topic filter

```
boards/#
```

The 'boards/#' part of the topic filter is circled in red.

Condition

```
e.g. temperature > 75
```



AWS IoT <> Elasticsearch

- Configure an **AWS IoT rule** that can route the inbound data from connected boards to the Elasticsearch index

Select an action

Select an action.

 Insert a message into a DynamoDB table
DYNAMODB

 Split message into multiple columns of a database table (DynamoDBv2)
DYNAMODBV2

 Invoke a Lambda function passing the message data
LAMBDA

•
•
•

 Send messages to the Amazon Elasticsearch Service
AMAZON ELASTICSEARCH



AWS IoT <> Elasticsearch

Configure action



Send messages to the Amazon Elasticsearch Service

AMAZON ELASTICSEARCH

This action will send the message to an Amazon Elasticsearch cluster.

*Domain name

A dropdown arrow icon is located to the right of the input field.

Create a new resource

*Endpoint

<https://search-pynq-test-xiwn3ly22x7c7m5hnzsunxlkwm.eu-west-1.es.amazonaws.com>

*ID

`${newuuid()}`

*Index

samples

*Type

sample

- **Configure action and create a IAM role**

Choose or create a role to grant AWS IoT access to the Amazon Elasticsearch resource to perform this action.

*IAM role name

A dropdown arrow icon is located to the right of the input field.

Create a new role

Give AWS IoT permission to send a message to the selected resource.

Update role



POLITECNICO MILANO 1863

16

b o t
t e g
a 5 2

AWS IoT <> Elasticsearch

Configure action

 Send messages to the Amazon Elasticsearch Service
AMAZON ELASTICSEARCH

This action will send the message to an Amazon Elasticsearch cluster.

Domain name

pynq-test

Create a new resource

*Endpoint

https://search-pynq-test-xiwn3ly22x7c7m5hnzsunxlkwm.eu-west-1.es.amazonaws.com

*ID

\${newuuid()}

*Index

samples

*Type

sample

- Configure action and create a IAM role

Choose or create a role to grant AWS IoT access to the Amazon Elasticsearch resource to perform this action.

*IAM role name

elastic-role



Create a new role

Give AWS IoT permission to send a message to the selected resource.

Update role



POLITECNICO MILANO 1863

16

b o t
t e g
a 5 2

AWS IoT <> Elasticsearch

Configure action

 Send messages to the Amazon Elasticsearch Service
AMAZON ELASTICSEARCH

This action will send the message to an Amazon Elasticsearch cluster.

*Domain name

pynq-test

Create a new resource

*Endpoint

https://search-pynq-test-xiwn3ly22x7c7m5hnzsunxlkwm.eu-west-1.es.amazonaws.com

*ID 

\${newuuid()}

*Index 

samples

*Type 

sample

- Configure action and create a IAM prole

Choose or create a role to grant AWS IoT access to the Amazon Elasticsearch resource to perform this action.

*IAM role name

elastic-role



Create a new role

Give AWS IoT permission to send a message to the selected resource.

Update role



POLITECNICO MILANO 1863

16

b o t
t e g
a 5 2

AWS IoT <> Elasticsearch

Configure action

 Send messages to the Amazon Elasticsearch Service
AMAZON ELASTICSEARCH

This action will send the message to an Amazon Elasticsearch cluster.

*Domain name

pynq-test

Create a new resource

*Endpoint

https://search-pynq-test-xiwn3ly22x7c7m5hnzsunxlkwm.eu-west-1.es.amazonaws.com

*ID

\${newuuid()}

*Index

samples

*Type

sample

- Configure action and create a IAM role

Choose or create a role to grant AWS IoT access to the Amazon Elasticsearch resource to perform this action.

*IAM role name

elastic-role



Create a new role

Give AWS IoT permission to send a message to the selected resource.

Update role



POLITECNICO MILANO 1863

16

b o t
t e g
a 5 2

AWS IoT <> Elasticsearch

Configure action

 Send messages to the Amazon Elasticsearch Service
AMAZON ELASTICSEARCH

This action will send the message to an Amazon Elasticsearch cluster.

*Domain name 

*Endpoint
<https://search-pynq-test-xiwn3ly22x7c7m5hnzsunxlkwm.eu-west-1.es.amazonaws.com>

*ID 

*Index 

*Type

- Configure action and create a IAM prole

Choose or create a role to grant AWS IoT access to the Amazon Elasticsearch resource to perform this action.

*IAM role name 

Give AWS IoT permission to send a message to the selected resource. 



AWS IoT <> Elasticsearch

Configure action

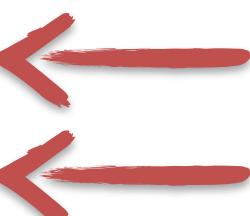
 Send messages to the Amazon Elasticsearch Service
AMAZON ELASTICSEARCH

This action will send the message to an Amazon Elasticsearch cluster.

*Domain name 

*Endpoint

*ID 
*Index
*Type



- Configure action and create a IAM prole

Choose or create a role to grant AWS IoT access to the Amazon Elasticsearch resource to perform this action.

*IAM role name 
Give AWS IoT permission to send a message to the selected resource. 



AWS IoT <>> Elasticsearch

- AWS IoT rule created!



Dashboard

Connect

Registry

Security

Rules

Test

Rules

route_to_elastic
ENABLED

...



Kibana



<https://www.elastic.co/products/kibana>

*Kibana lets you **visualize** your Elasticsearch data and navigate the Elastic Stack, so you can do anything from learning why you're getting paged at 2:00 a.m. to understanding the impact rain might have on your quarterly numbers.*



Kibana is loading. Give me a moment

here. I'm loading a whole bunch of code.

Don't worry, all this good stuff will be cached

up for next time!

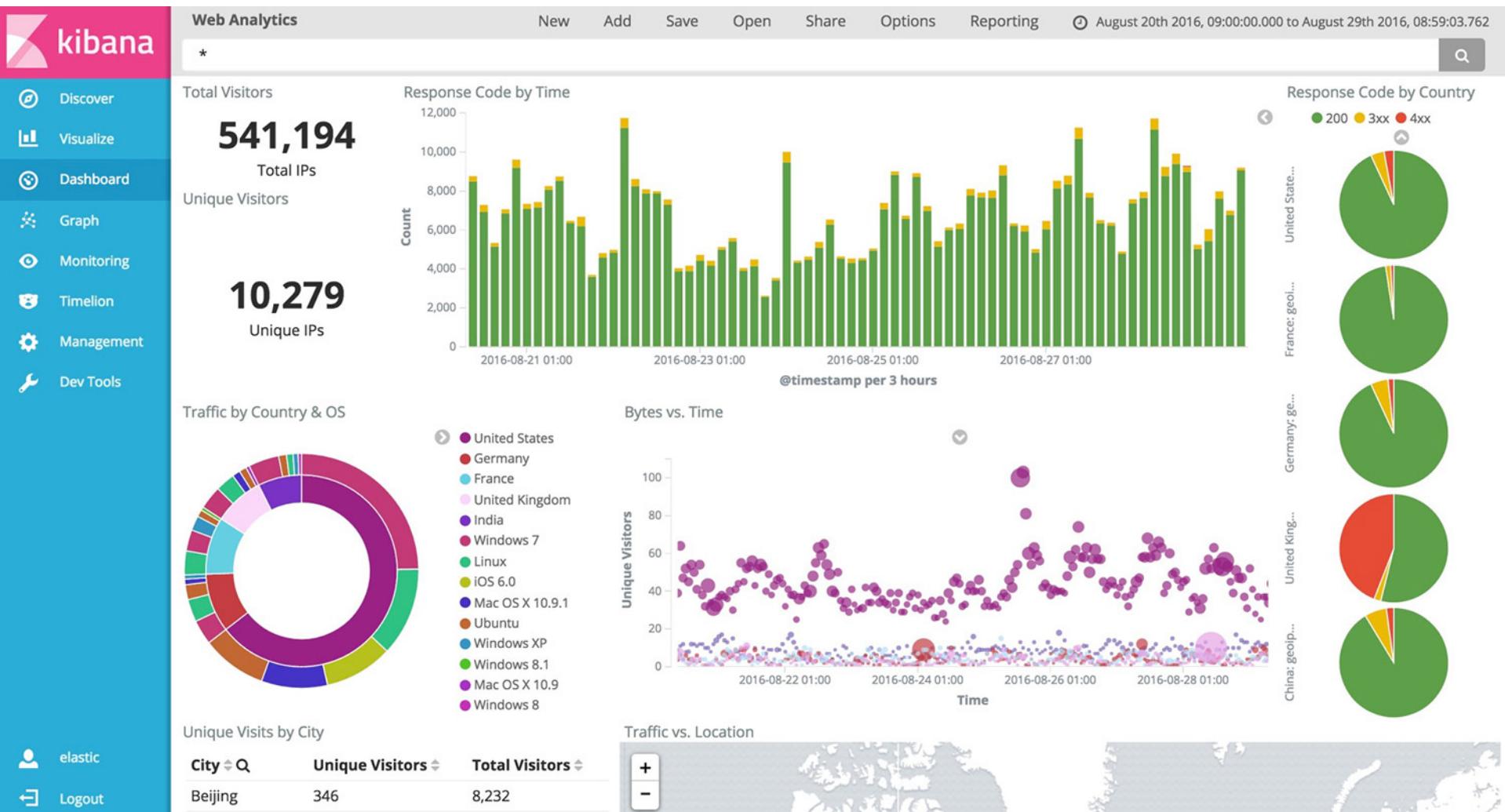


POLITECNICO MILANO 1863

18

b o t
t e g
a 5 2

Kibana

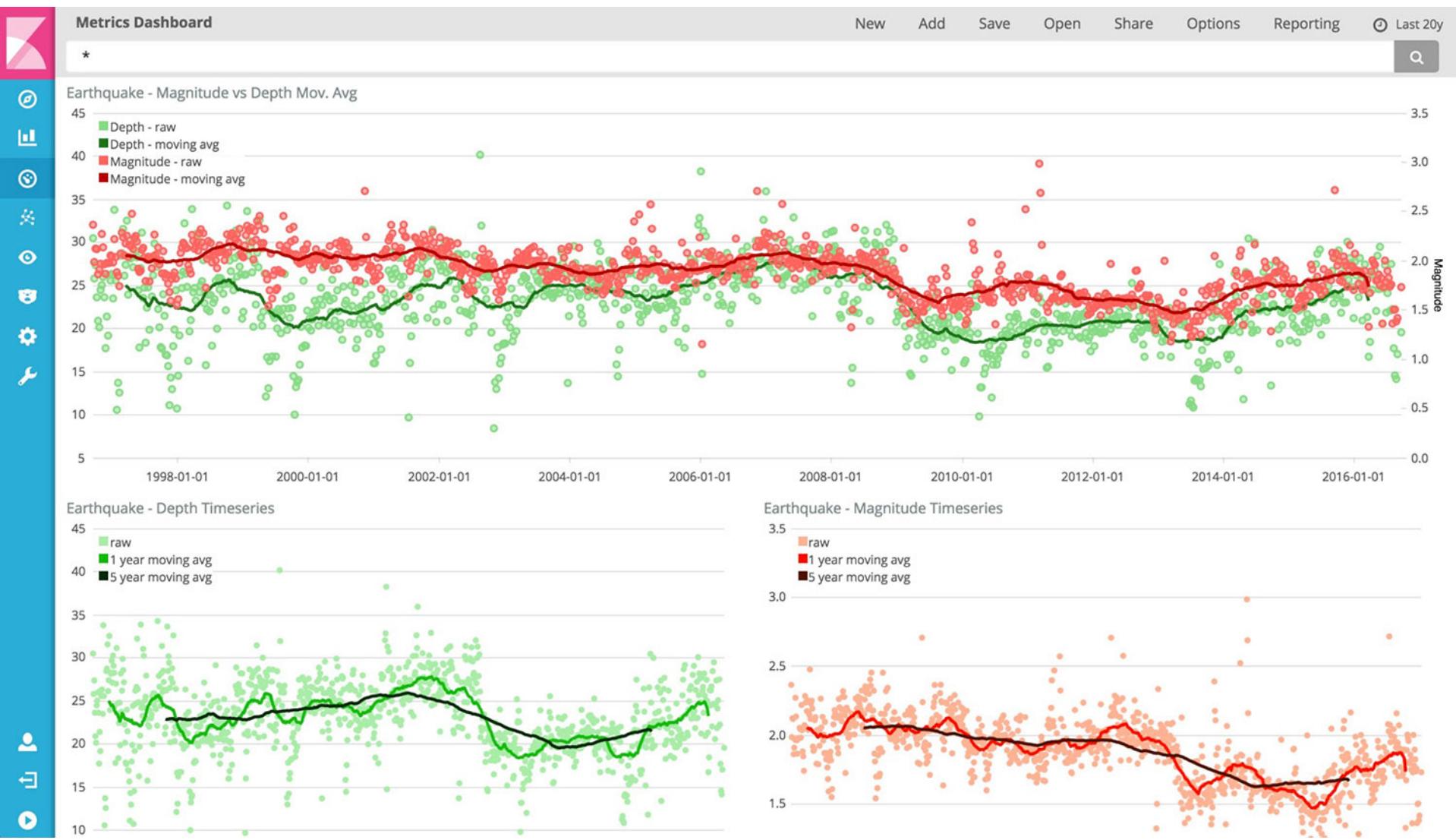


POLITECNICO MILANO 1863

19

b o t
t e g
a 5 2

Kibana

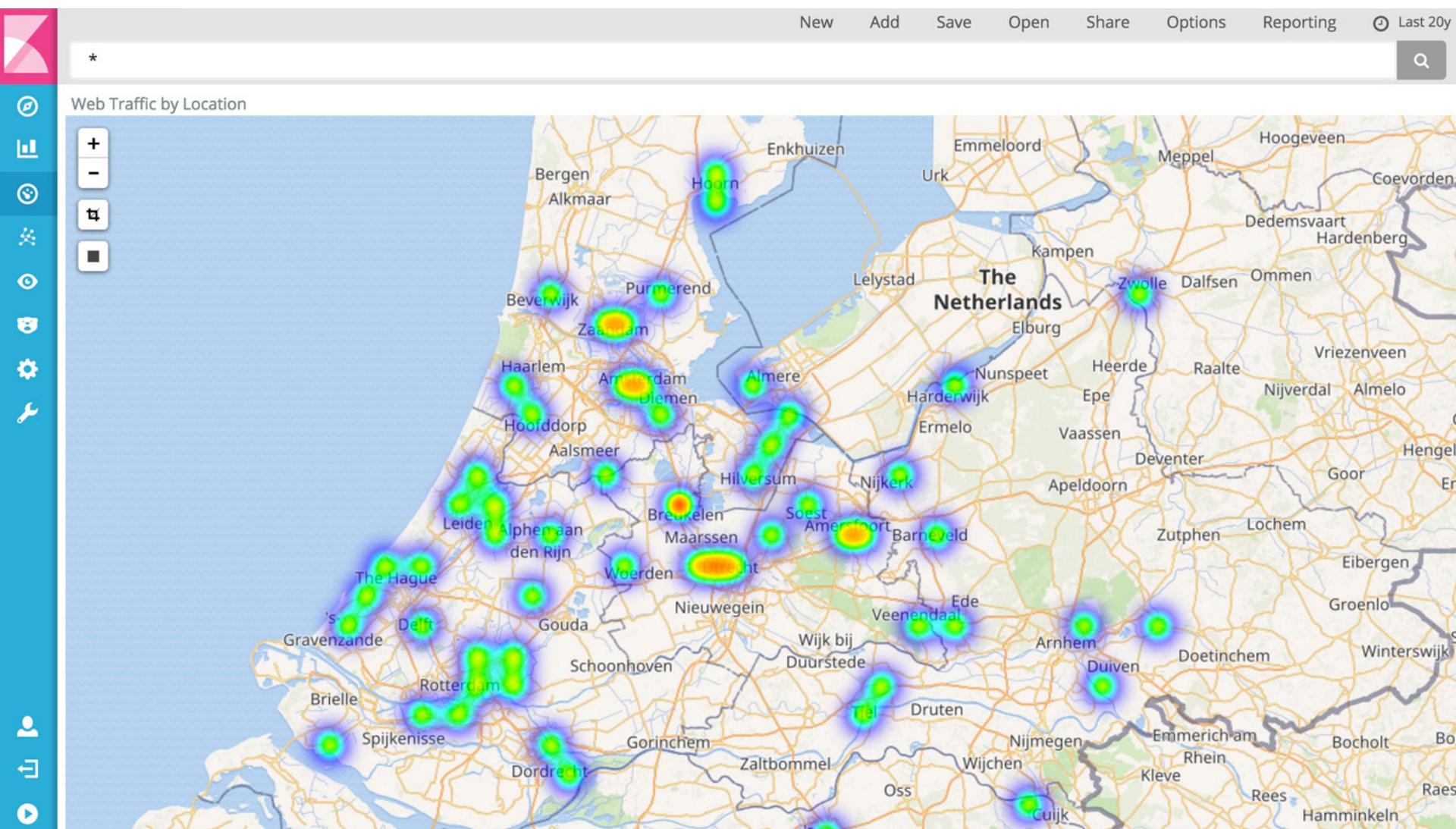


POLITECNICO MILANO 1863

20

b o t
t e g
a 5 2

Kibana



Kibana - First access

On the “Configure an index pattern” page that you see at the beginning, enter “**samples**” as the “Index name or pattern” and select “**datetime**” under “Time-field name”

Configure an index pattern

In order to use Kibana you must configure at least one index pattern. Index patterns are used to identify the Elasticsearch index to run search and analytics against. They are also used to configure fields.

Index contains time-based events

Use event times to create index names

Index name or pattern

Patterns allow you to define dynamic index names using * as a wildcard. Example: logstash-*

samples

Time-field name i refresh fields

datetime

Create



POLITECNICO MILANO 1863

22

b o t
t e g
a 5 2

Kibana - First access

On the “Configure an index pattern” page that you see at the beginning, enter “**samples**” as the “Index name or pattern” and select “**datetime**” under “Time-field name”

Configure an index pattern

In order to use Kibana you must configure at least one index pattern. Index patterns are used to identify the Elasticsearch index to run search and analytics against. They are also used to configure fields.

Index contains time-based events
 Use event times to create index names

Index name or pattern
Patterns allow you to define dynamic index names using * as a wildcard. Example: logstash-*

samples

Time-field name i refresh fields
datetime

Create



Kibana - First access

On the “Configure an index pattern” page that you see at the beginning, enter “**samples**” as the “Index name or pattern” and select “**datetime**” under “Time-field name”

★ samples



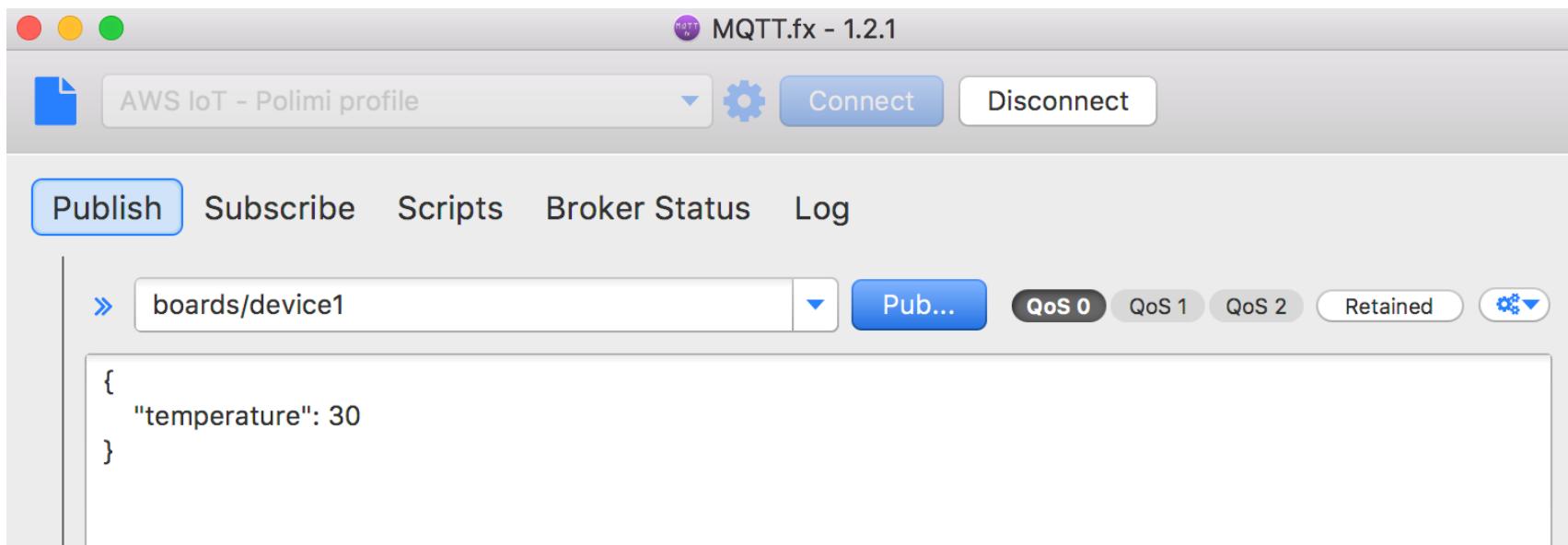
This page lists every field in the **samples** index and the field's associated core type as recorded by Elasticsearch. While this list allows you to view the core type of each field, changing field types must be done using Elasticsearch's [Mapping API](#).

Fields (7)	Scripted fields (0)				
name	type	format	analyzed	indexed	controls
_index	string				
datetime	date		✓		
temperature	number			✓	
_source	_source				
timestamp	number			✓	
_id	string				
_type	string				



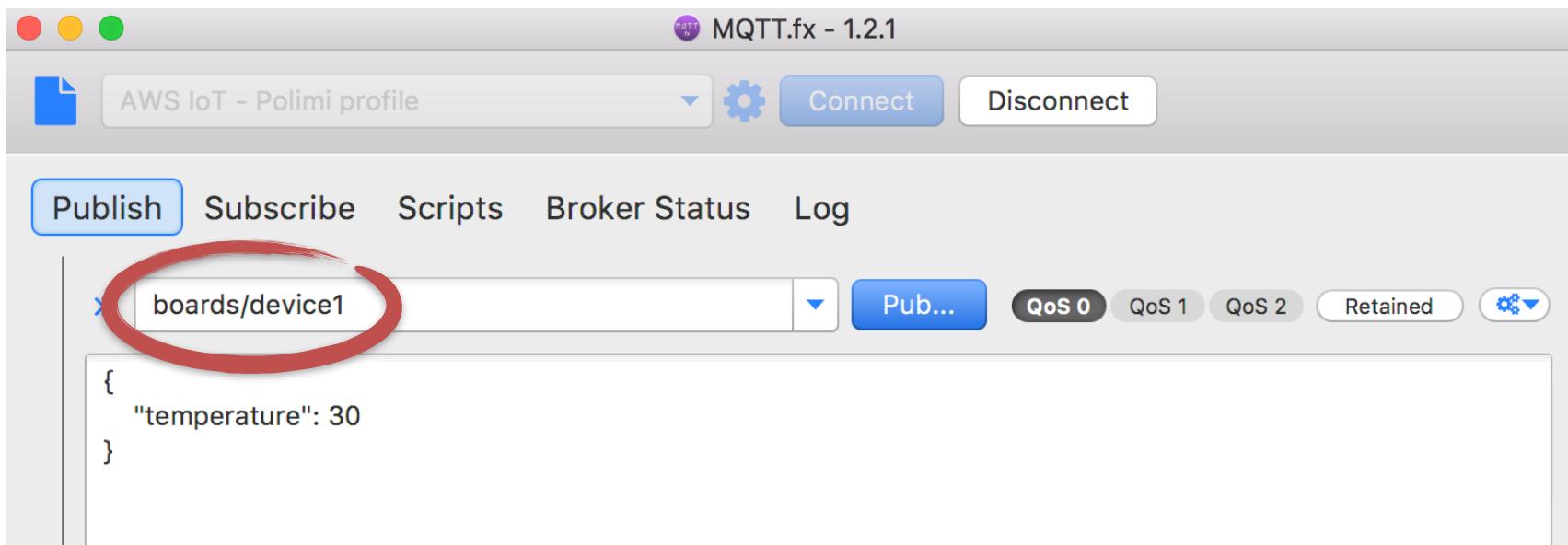
AWS IoT <>> Elasticsearch <>> Kibana

- Publish data using a MQTT client



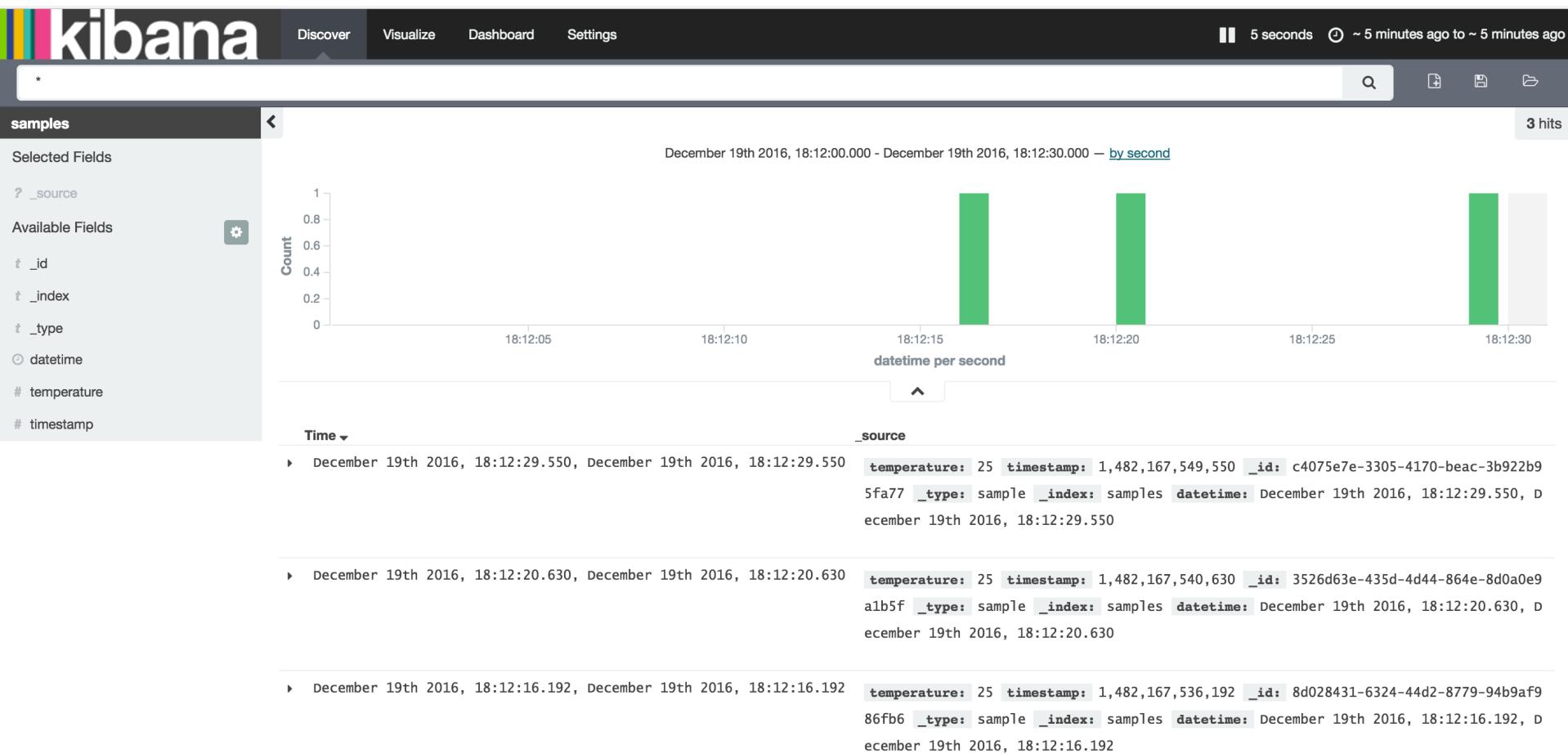
AWS IoT <>> Elasticsearch <>> Kibana

- Publish data using a MQTT client



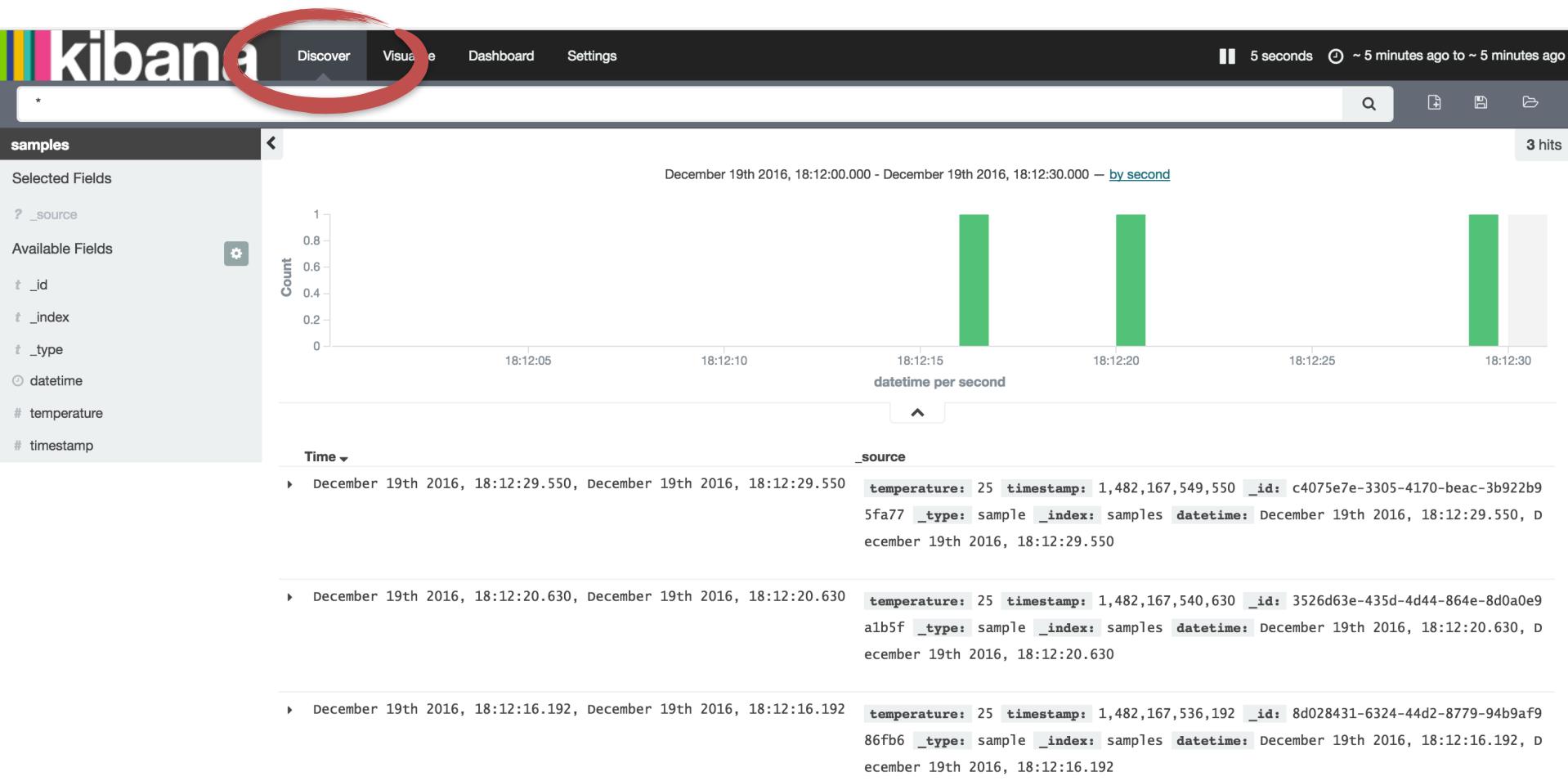
AWS IoT <> Elasticsearch <> Kibana

- Discover data using Kibana



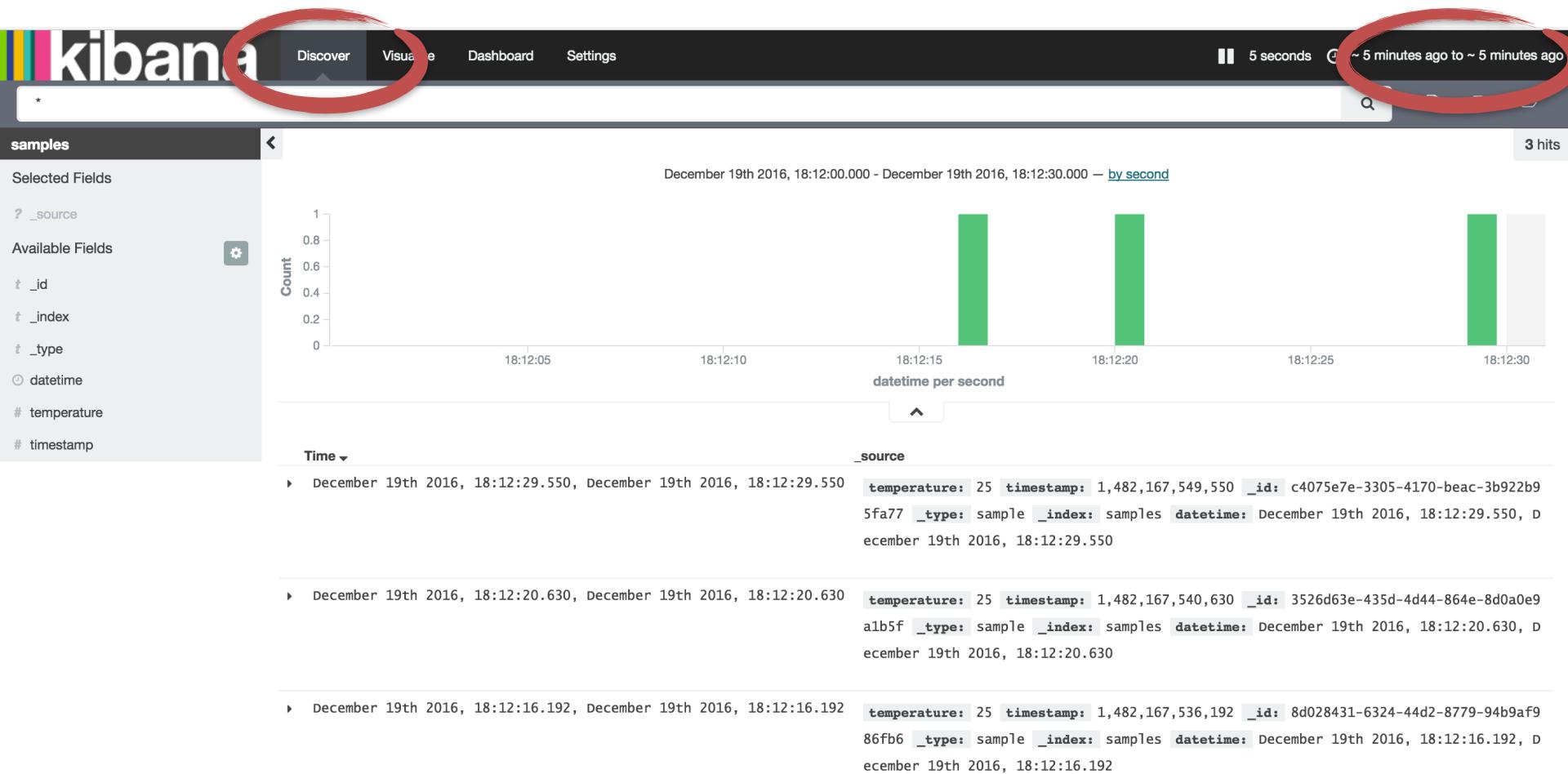
AWS IoT <> Elasticsearch <> Kibana

- Discover data using Kibana



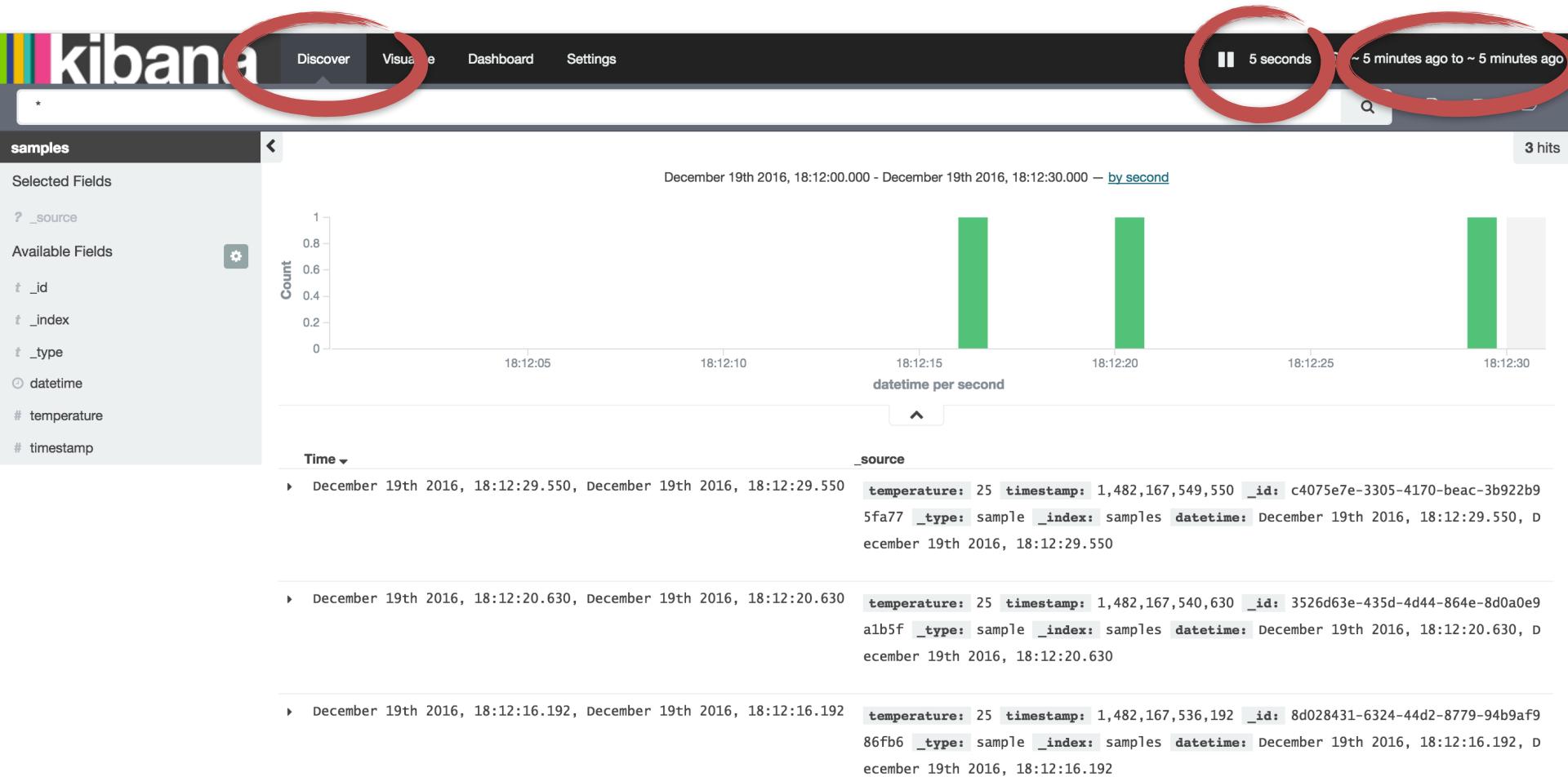
AWS IoT <> Elasticsearch <> Kibana

- Discover data using Kibana



AWS IoT <> Elasticsearch <> Kibana

- Discover data using Kibana



Kibana - Create a graph

- Choose the graph style



Step 1

Create a new visualization

Area chart	Great for stacked timelines in which the total of all series is more important than comparing any two or more series. Less useful for assessing the relative change of unrelated data points as changes in a series lower down the stack will have a difficult to gauge effect on the series above it.
Data table	The data table provides a detailed breakdown, in tabular format, of the results of a composed aggregation. Tip, a data table is available from many other charts by clicking grey bar at the bottom of the chart.
Line chart	Often the best chart for high density time series. Great for comparing one series to another. Be careful with sparse sets as the connection between points can be misleading.
Markdown widget	Useful for displaying explanations or instructions for dashboards.
Metric	One big number for all of your one big number needs. Perfect for show a count of hits, or the exact average a numeric field.
Pie chart	Pie charts are ideal for displaying the parts of some whole. For example, sales percentages by department. Pro Tip: Pie charts are best used sparingly, and with no more than 7 slices per pie.



Kibana - Create a graph

- Choose the graph style
- Select a source

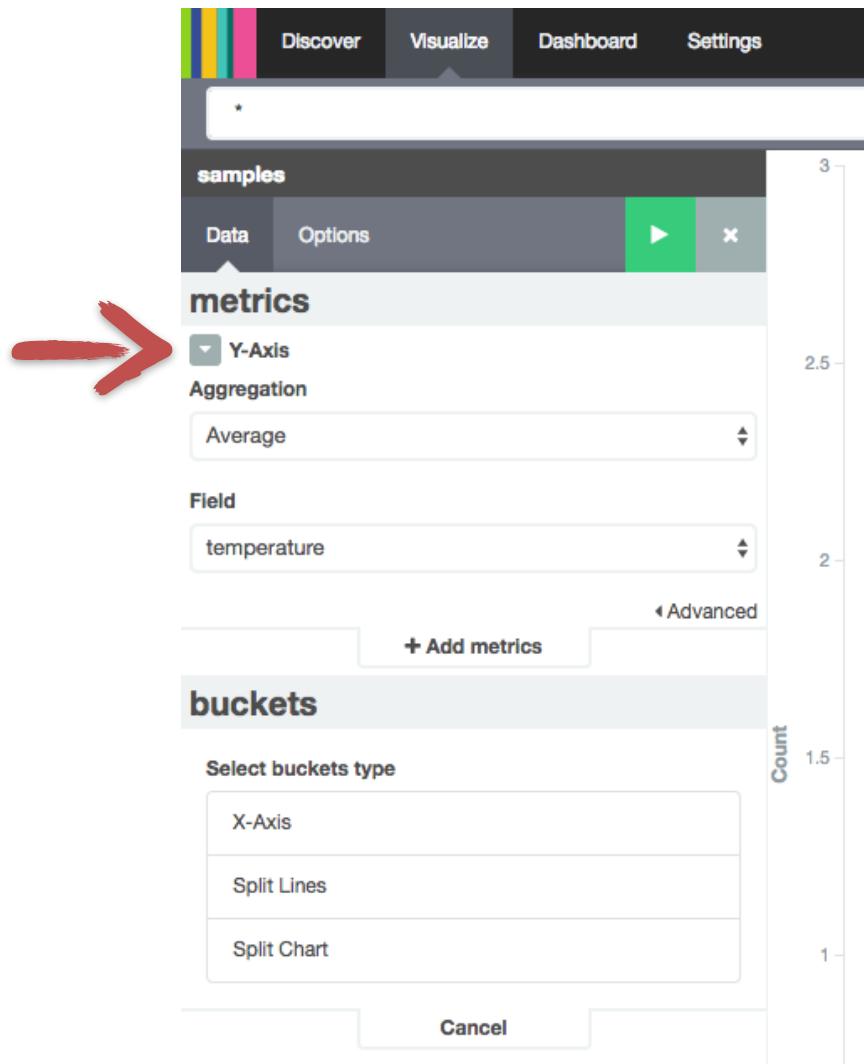
The screenshot shows the Kibana interface with a dark header bar. The header includes four colored vertical bars (yellow, green, pink, blue) on the left, followed by the menu items: Discover, Visualize (which is highlighted in white), Dashboard, and Settings.

The main content area has a title "Select a search source" and a "Step 2" indicator in a green box. Below the title are two options: "From a new search" and "From a saved search". A large red arrow points from the text "From a new search" towards the "From a new search" option in the list.



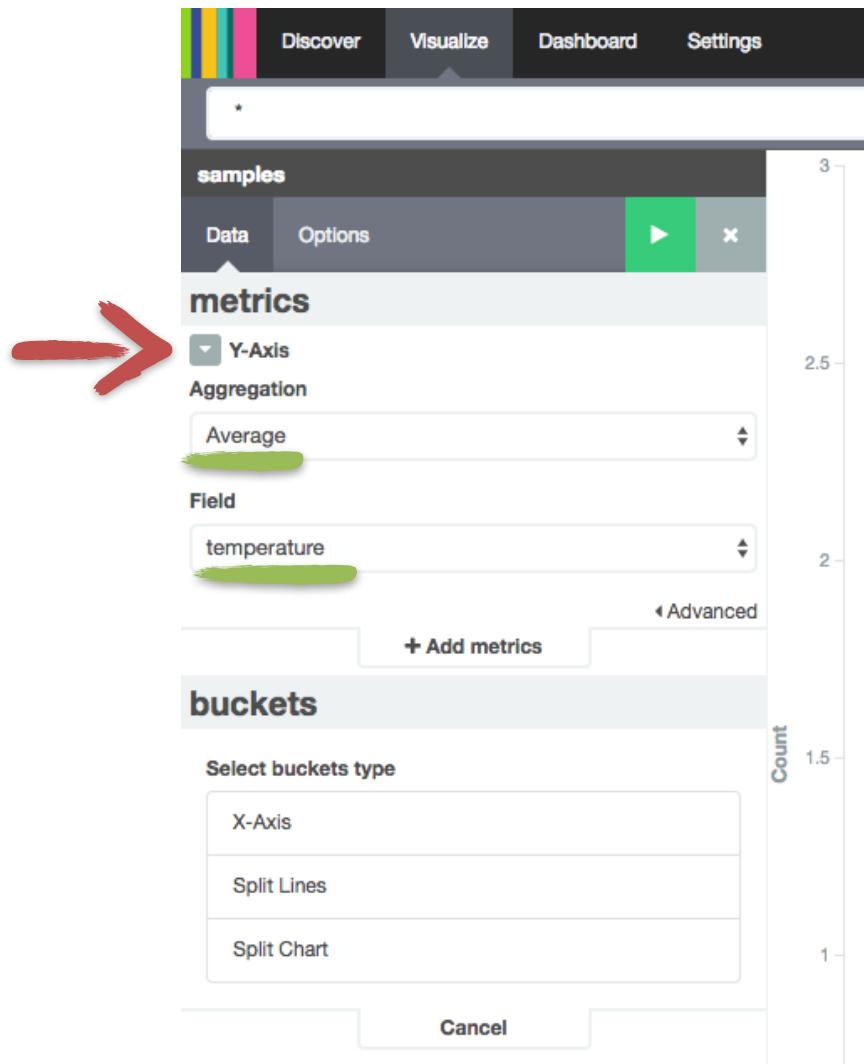
Kibana - Create a graph

- Choose the graph style
- Select a source
- Configure the Y-Axis



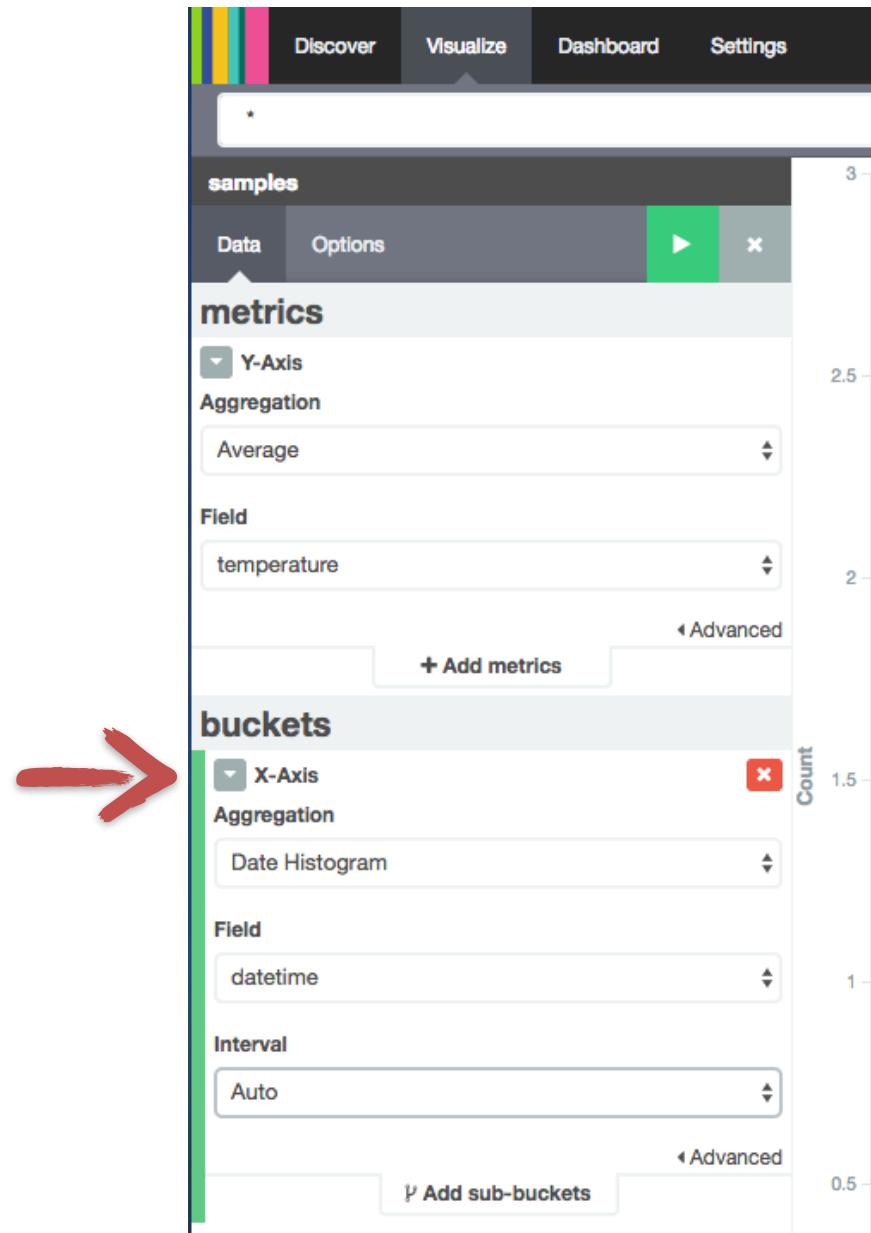
Kibana - Create a graph

- Choose the graph style
- Select a source
- Configure the Y-Axis



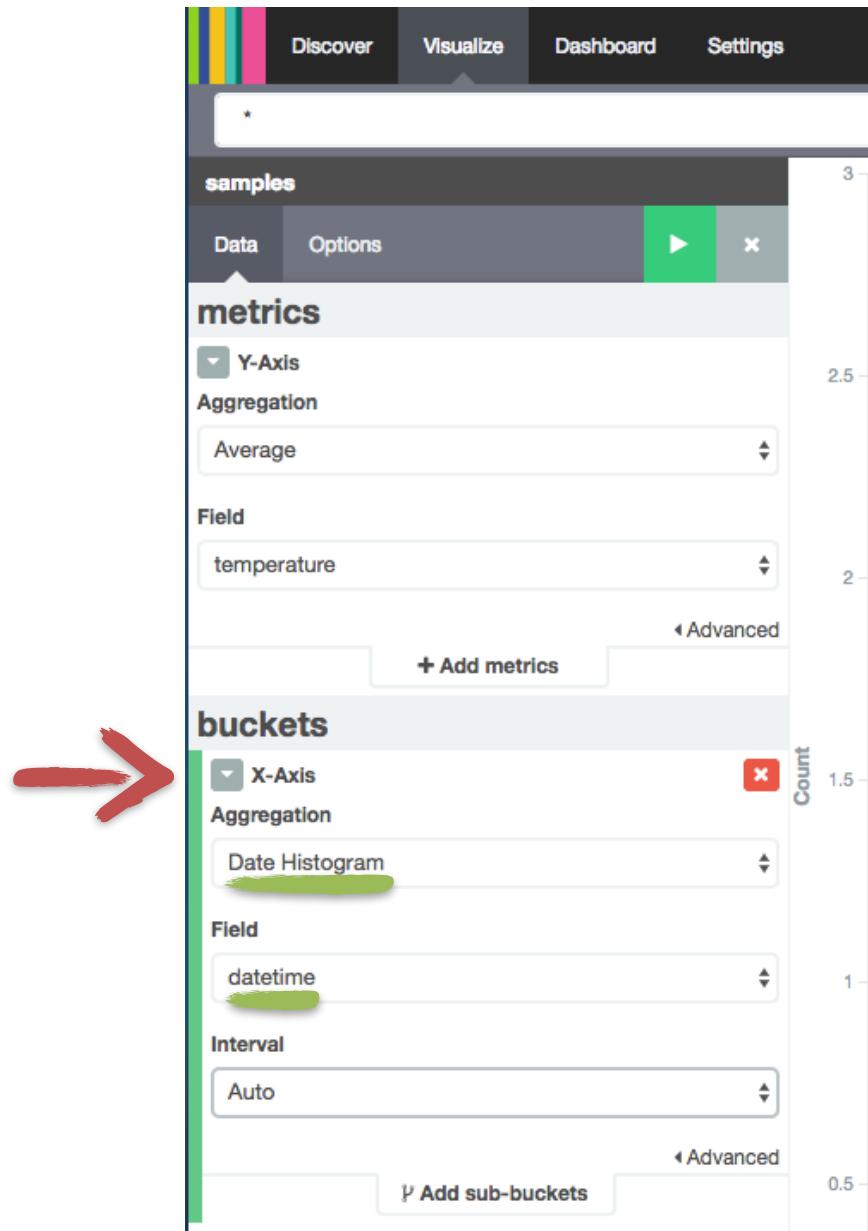
Kibana - Create a graph

- Choose the graph style
- Select a source
- Configure the Y-Axis
- Configure the X-Axis



Kibana - Create a graph

- Choose the graph style
- Select a source
- Configure the Y-Axis
- Configure the X-Axis



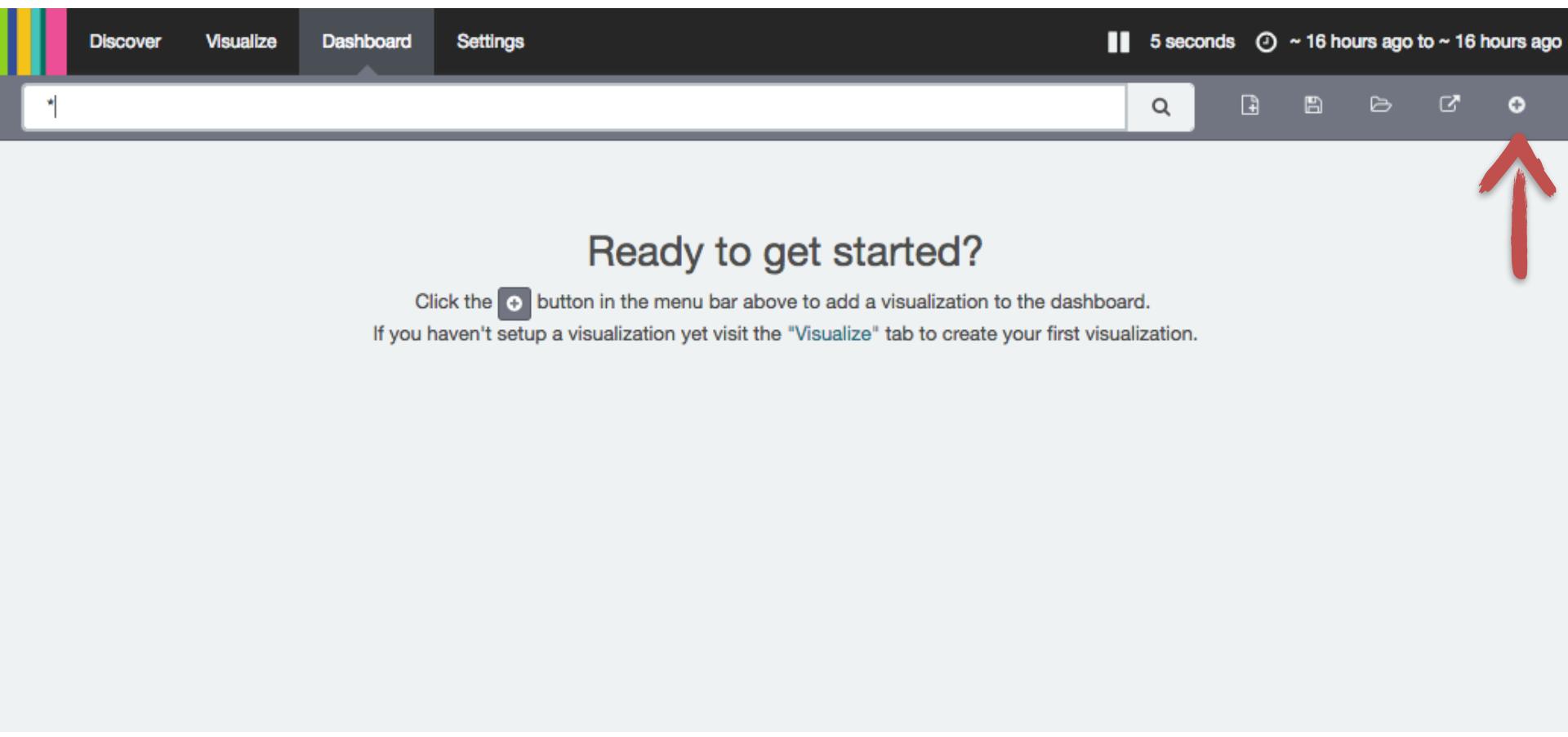
Kibana - Create a graph

- Choose the graph style
- Select a source
- Configure the Y-Axis
- Configure the X-Axis
- Play and test

The screenshot shows the Kibana interface with the 'Discover' tab selected. The main area displays a visualization titled 'samples'. Below it, there are three sections: 'metrics', 'Y-Axis', and 'buckets'. The 'metrics' section contains a single item: 'Average temperature'. A red arrow points from the top right towards this metric. The 'Y-Axis' section has a button labeled '+ Add metrics'. The 'buckets' section shows an 'X-Axis' configuration with the value 'datetime per second'.



Kibana - Add the graph to the dashboard



The screenshot shows the Kibana interface with the following elements:

- Top Bar:** Includes tabs for "Discover", "Visualize", "Dashboard" (which is highlighted in dark grey), and "Settings". It also displays search and filter controls, and time range selection ("5 seconds" and "~16 hours ago to ~16 hours ago").
- Main Area:** A large text area with the heading "Ready to get started?" followed by instructions: "Click the + button in the menu bar above to add a visualization to the dashboard. If you haven't setup a visualization yet visit the "Visualize" tab to create your first visualization."
- Right Side:** A red arrow points upwards from the bottom right towards the "+" button in the top right corner of the menu bar.



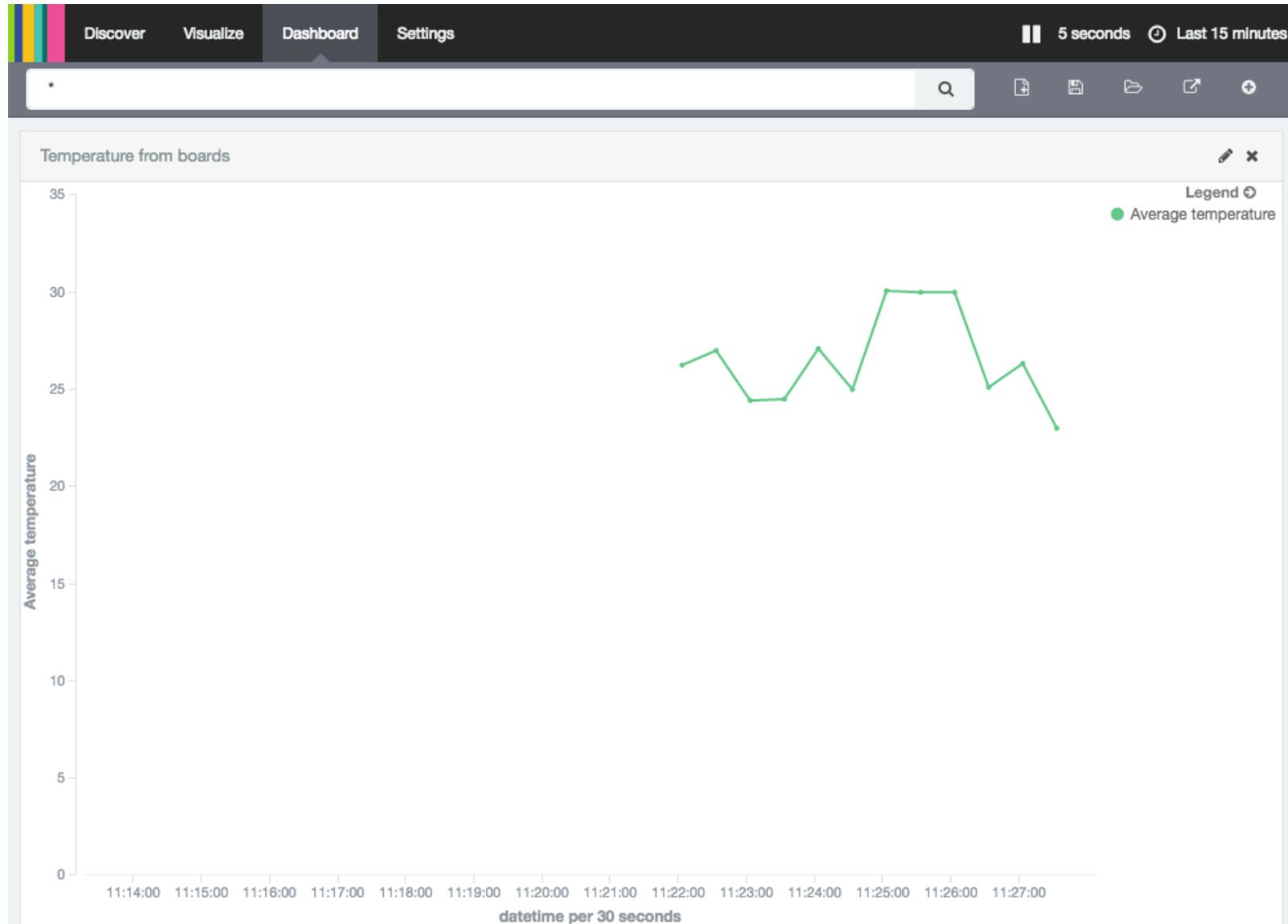
Kibana - Add the graph to the dashboard

The screenshot shows the Kibana interface with the following elements:

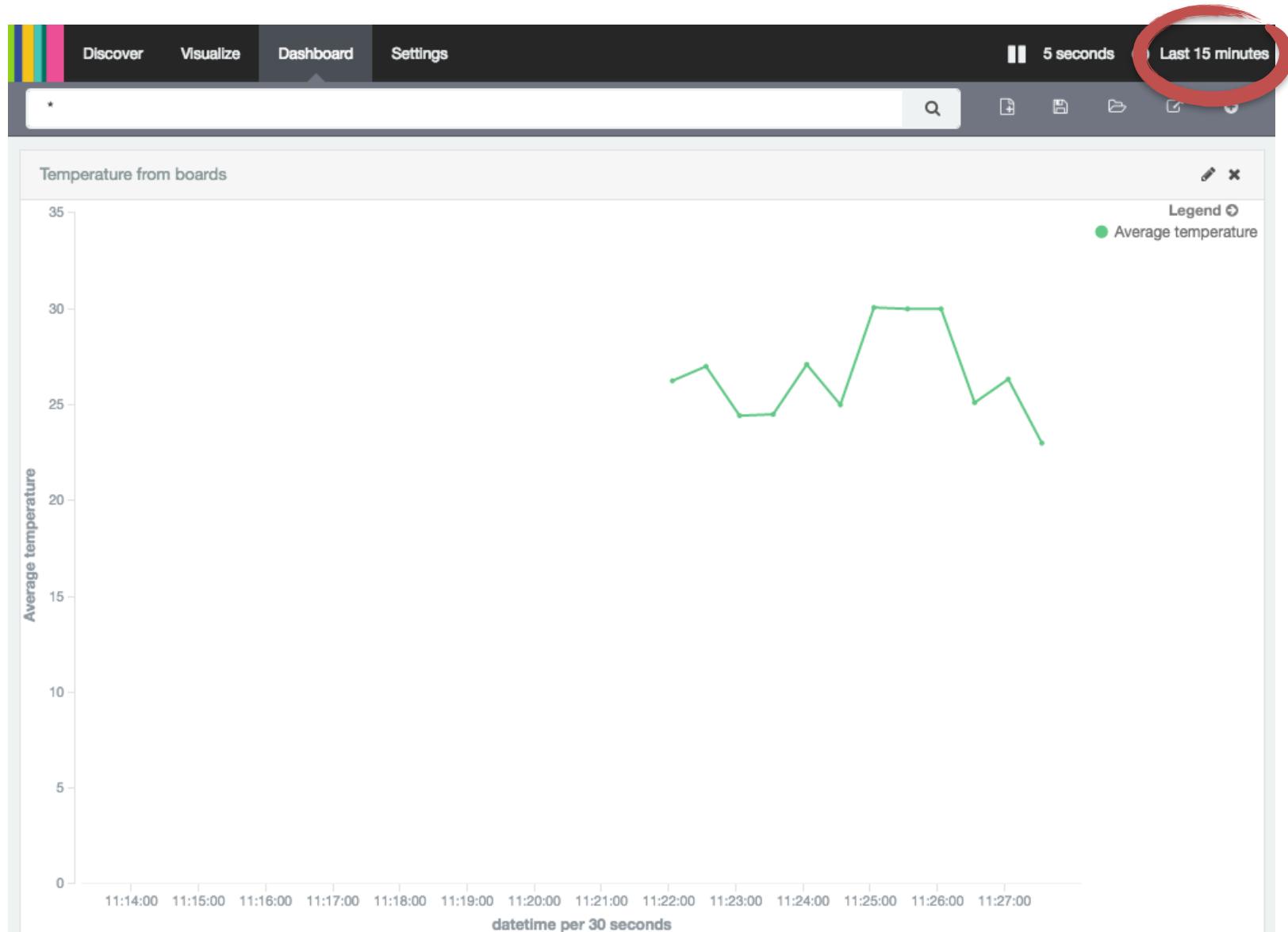
- Top Bar:** Discover, Visualize, Dashboard (highlighted), Settings. Time range: 5 seconds, ~16 hours ago to ~16 hours ago.
- Visualizations Tab:** Visualizations (selected), Searches.
- Visualization Filter:** Temperature from boards (highlighted with a red arrow).
- Manage Visualizations:** 1 visualizations.
- Preview Area:** A line chart titled "Temperature from boards".
 - Y-axis:** Average temperature (0 to 25).
 - X-axis:** Time per second (18:12:15).
 - Legend:** Average temperature (green line).
 - Annotations:** A red arrow points to the visualization filter entry.



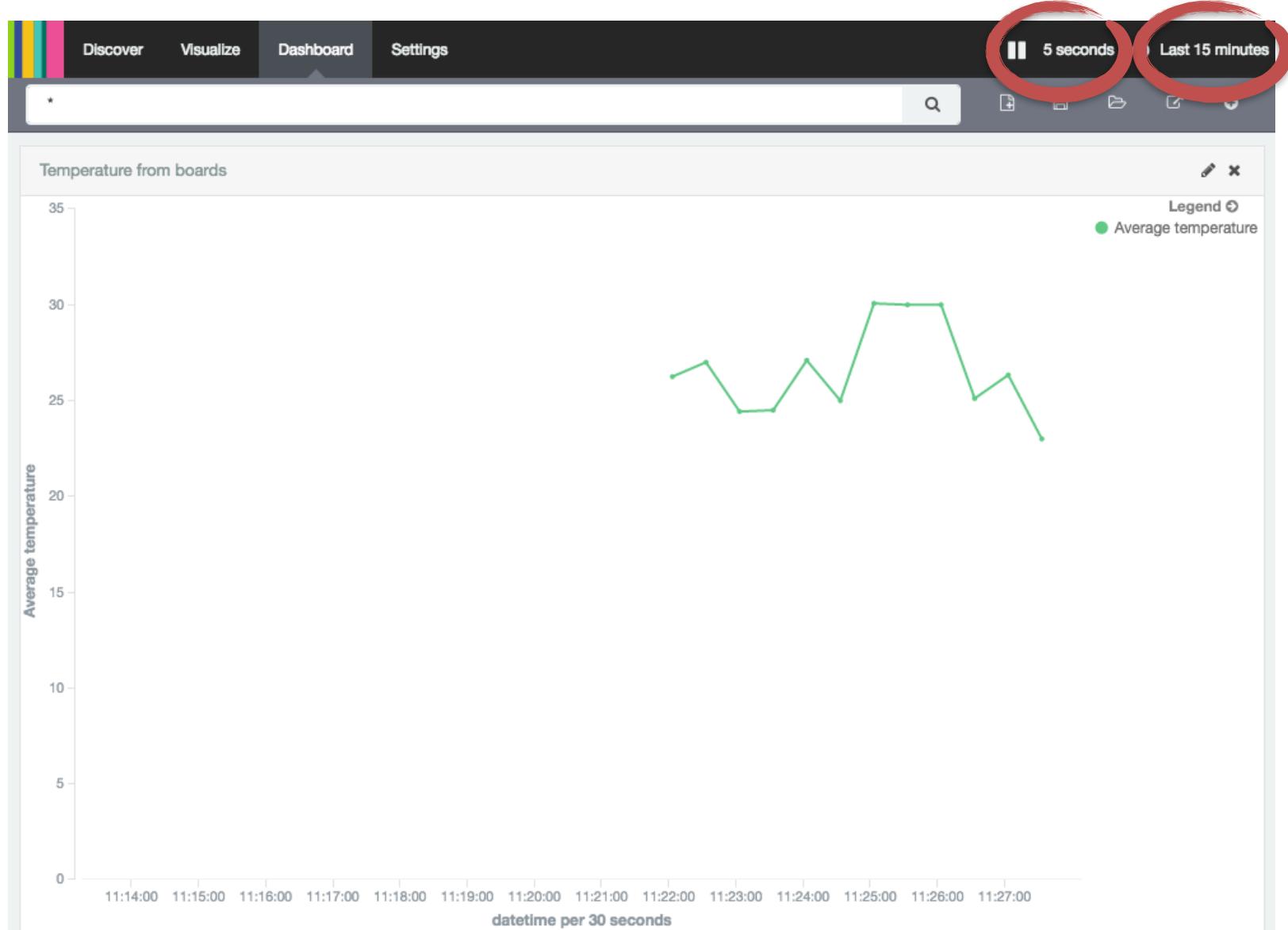
Kibana - Dashboard



Kibana - Dashboard

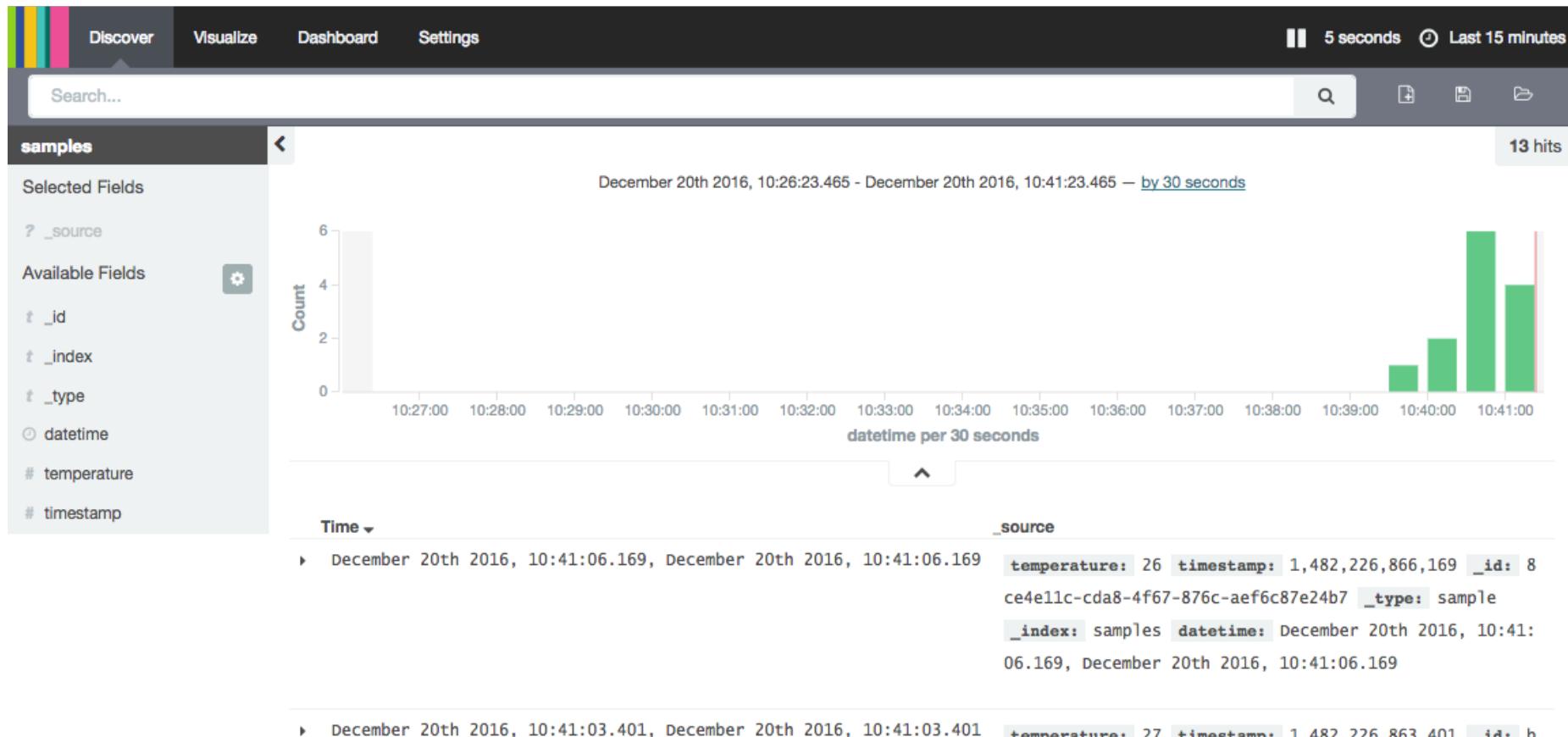


Kibana - Dashboard



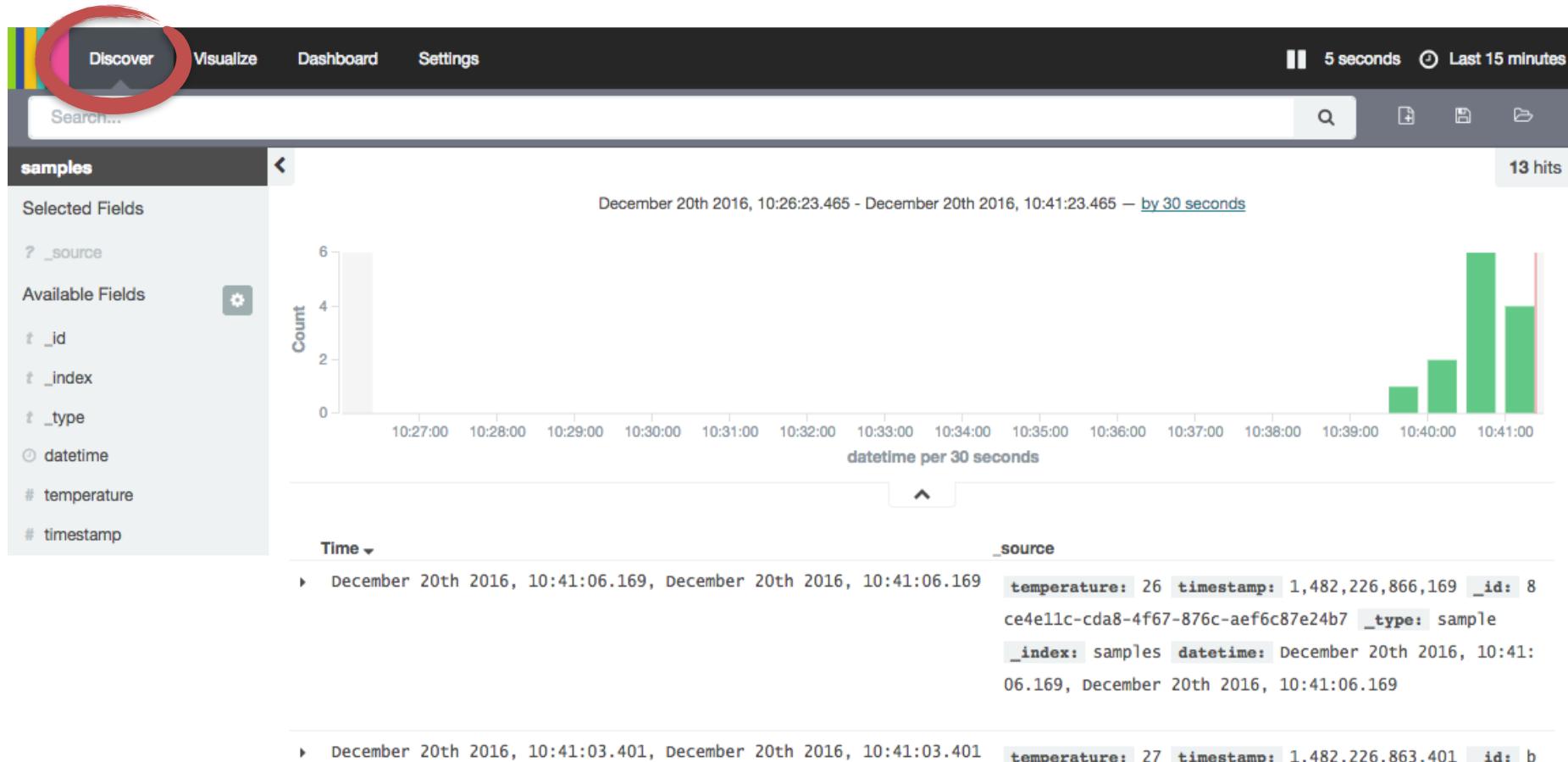
Kibana - Discover

- Use the “discover” view to check if data is arriving



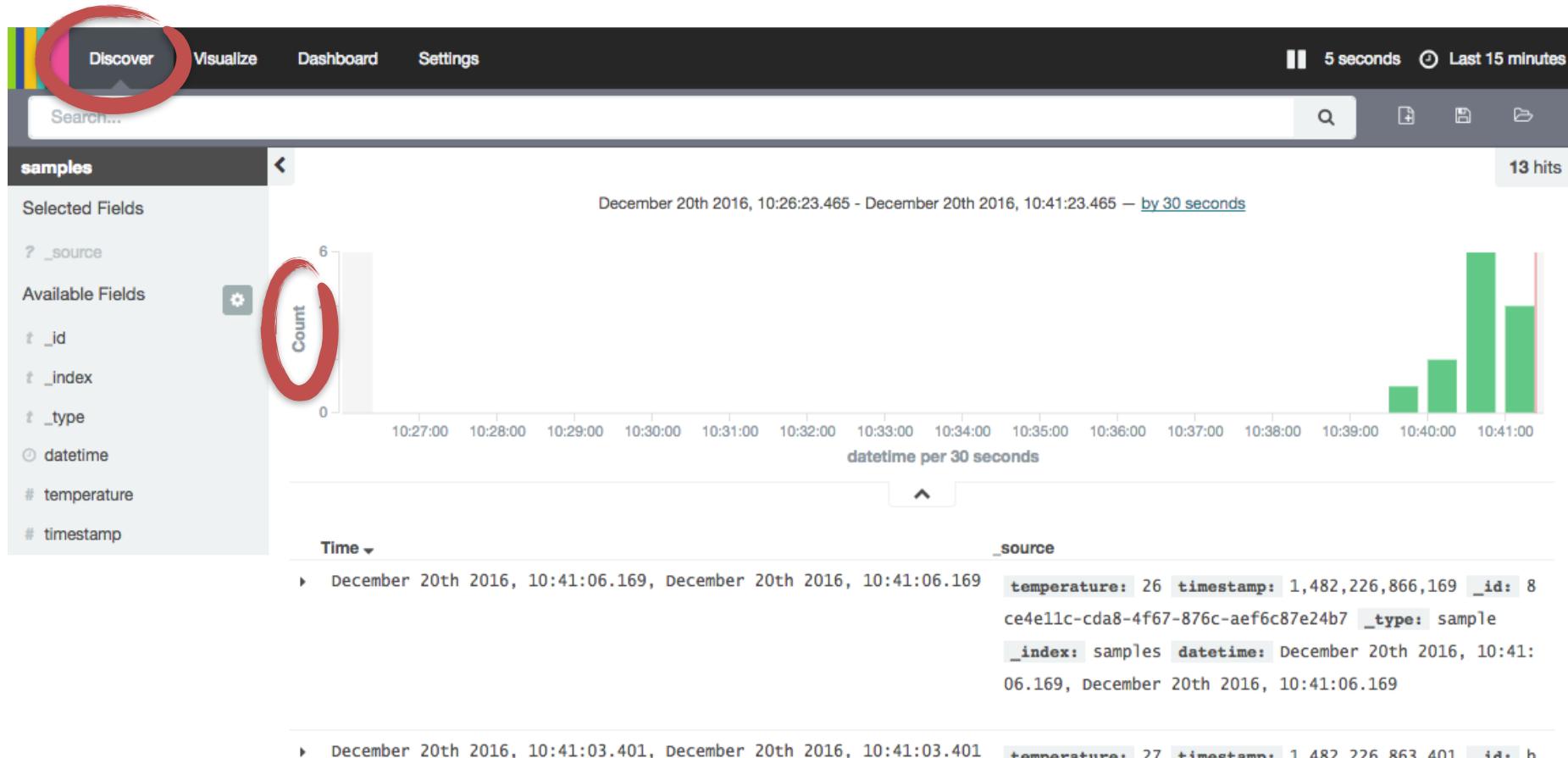
Kibana - Discover

- Use the “discover” view to check if data is arriving



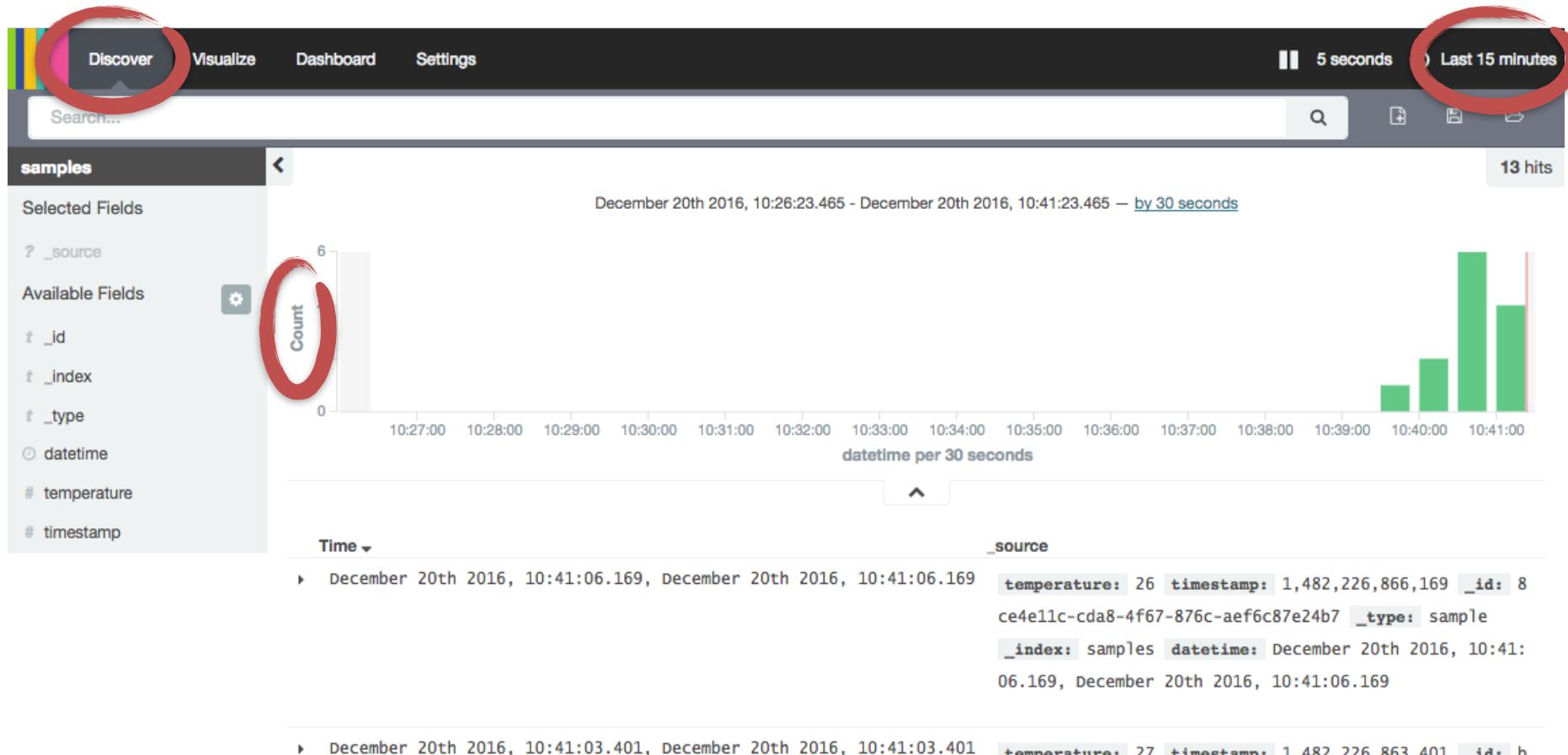
Kibana - Discover

- Use the “discover” view to check if data is arriving



Kibana - Discover

- Use the “discover” view to check if data is arriving



Kibana - Discover

- Use the “discover” view to check if data is arriving

