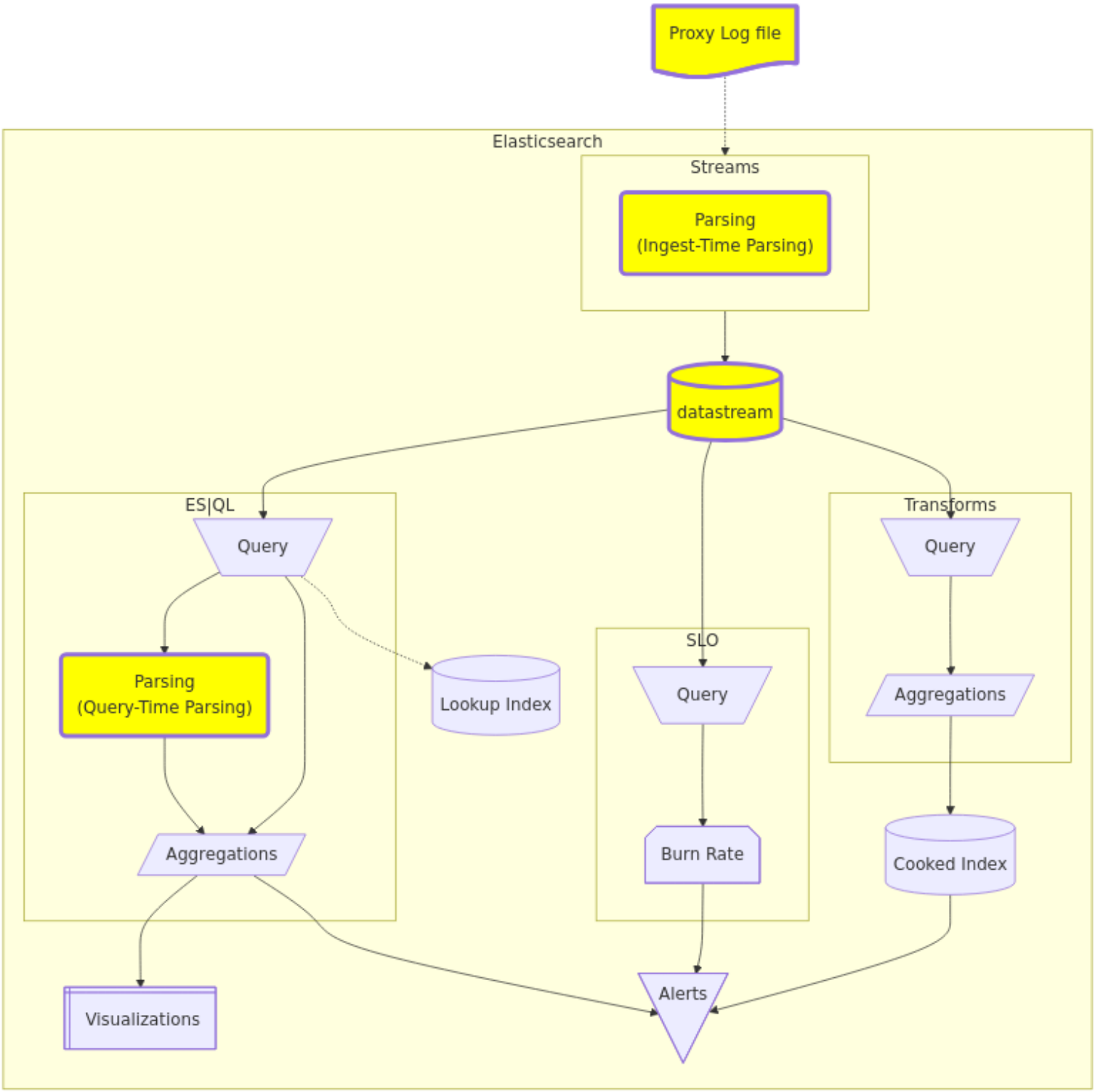
Observability 100: A Modern Logging Workflow

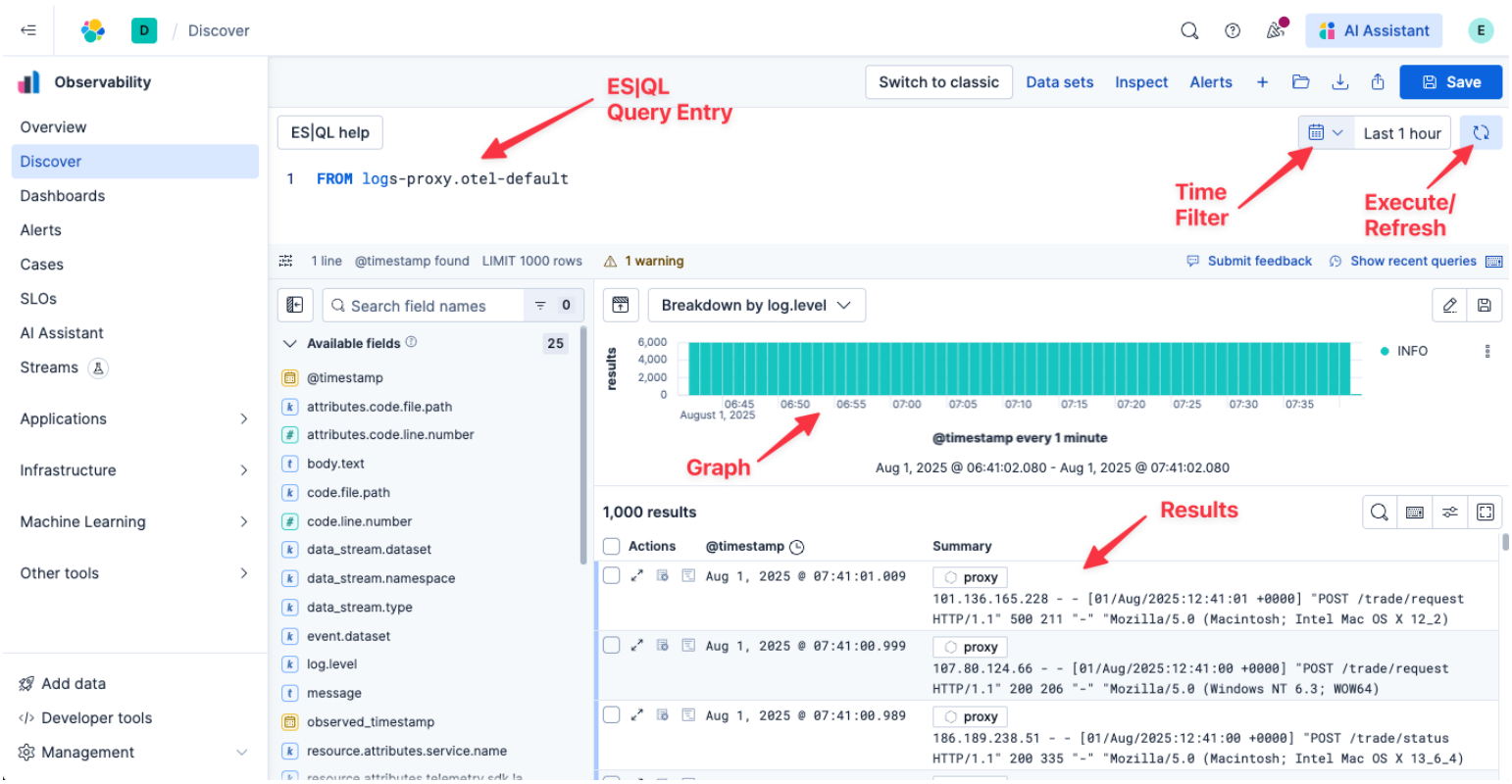
We've gotten word from our customer service department that some users are receiving an error when trying to use our web-based application. We will use this workshop to showcase Elastic's state-of-the-art logging workflow to get to the root cause of these errors.

Ingest vs. query-time parsing

Throughout this workshop, we will be pivoting back and forth between query-time parsing using ES|QL and ingest-time parsing using Streams. ES|QL lets us quickly test theories and look for possible tells in our log data. Once we've determined value in parsing our logs using ES|QL at query-time, we can shift that parsing to ingest-time using Streams. As we will see in this lab, ingest-time parsing allows for more advanced and complex workflows. Moving parsing to ingest-time also facilitates faster search results. Regardless of where the parsing is done, we will leverage ES|QL to perform aggregations, analysis, and visualization.

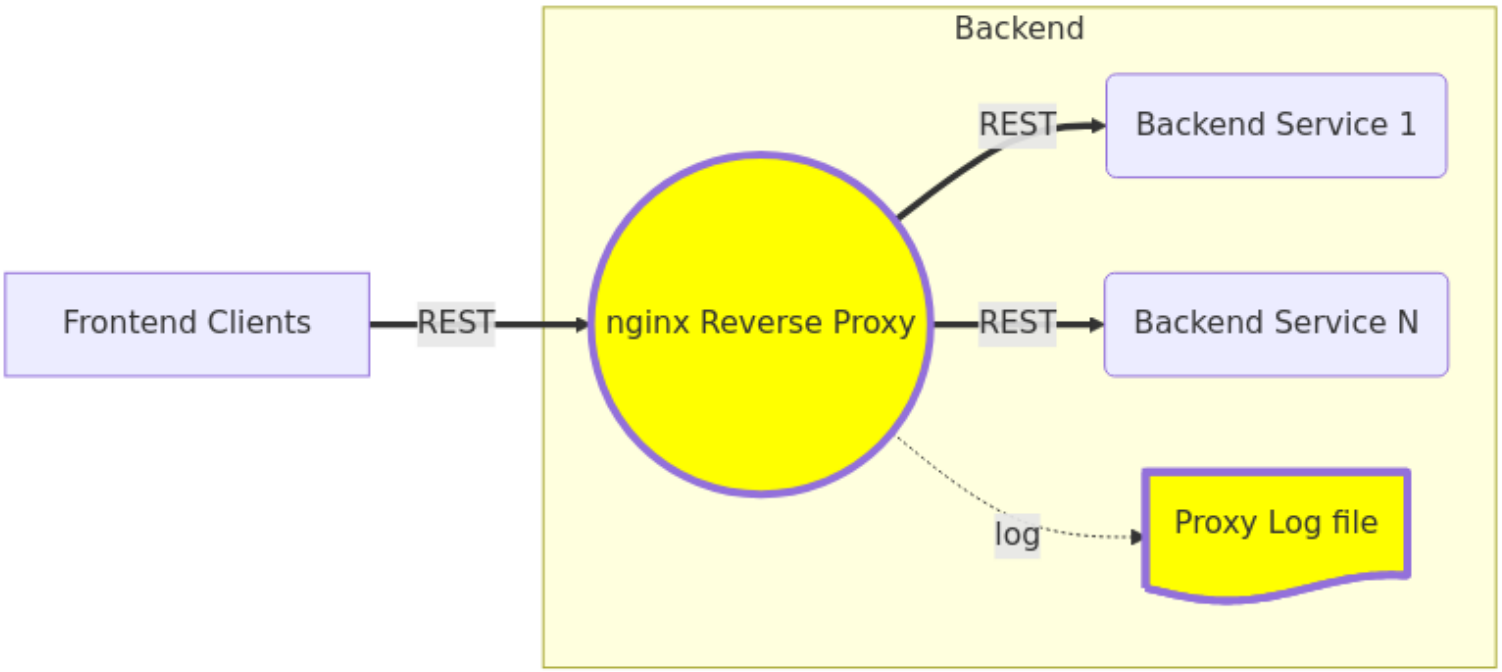


This workshop will heavily leverage ES|QL, Elastic's query-time language, to analyze our nginx reverse proxy logs. You can enter your queries in the pane at the top of the Elasticsearch tab. You can change the time window of your search using the Time Filter. To execute a search, click the Play/Refresh icon.



Getting started

We know that all of the REST API calls from our frontend web app flow through a nginx reverse proxy en route to our backend services; that seems like a good place to start our investigation.



Finding errors

Execute the following query:

```
FROM logs-proxy.otel-default
```

We can see that there are still transactions occurring, but we don't know if they are successful or failing. Before we spend time parsing our logs, let's just quickly search for common HTTP "500" errors in our nginx logs.

Execute the following query:

```
FROM logs-proxy.otel-default
| WHERE body.text LIKE "* 500 *" // look for messages containing " 500 " in the body
```

If we didn't find any 500 errors, we could of course add additional `LIKE` criteria to our `WHERE` clause, like `WHERE body.text LIKE "* 500 *" OR body.text LIKE "* 404 *"`. We will do a better job of implicitly handling more types of errors once we start parsing our logs. For now, though, we got lucky: indeed, we are clearly returning 500 errors for some users.

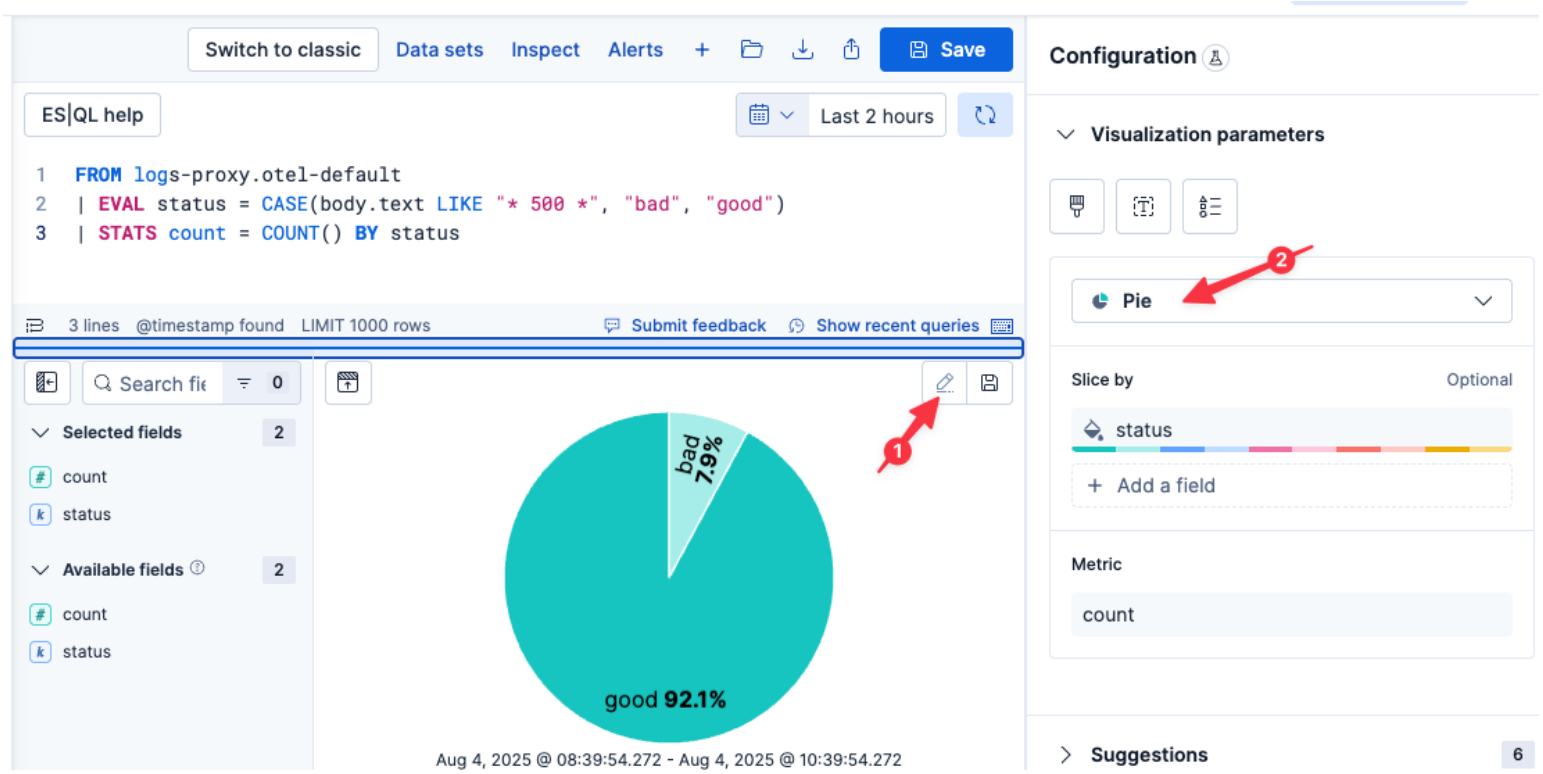
Are the errors affecting all requests?

The next thing we quickly want to understand is what percentage of requests to our backend services are resulting in 500 errors?

Execute the following query:

```
FROM logs-proxy.otel-default
| EVAL status = CASE(body.text LIKE "* 500 *", "bad", "good") // label messages containing " 500 " as "bad", else "good"
| STATS count = COUNT() BY status // count good and bad
```

Let's visualize this as a pie graph to make it a little easier to understand.



1. Click on the pencil icon to the right of the existing graph
2. Select `Pie` from the visualizations drop-down menu
3. Click `Apply and close`

This error appears to only be affecting a percentage of our overall requests. We don't yet have the tools to break this down by customer or client, but we will in a future exercise.

Are the errors still occurring?

Let's confirm that we are still seeing a mix of 500 and 200 errors (e.g., the problem wasn't transitory and somehow fixed itself).

Execute the following query:

```
FROM logs-proxy.otel-default
| EVAL status = CASE(body.text LIKE "* 500 *", "bad", "good") // label messages containing " 500 " as "bad", else "good"
| STATS COUNT() BY minute = BUCKET(@timestamp, "1 min"), status
```

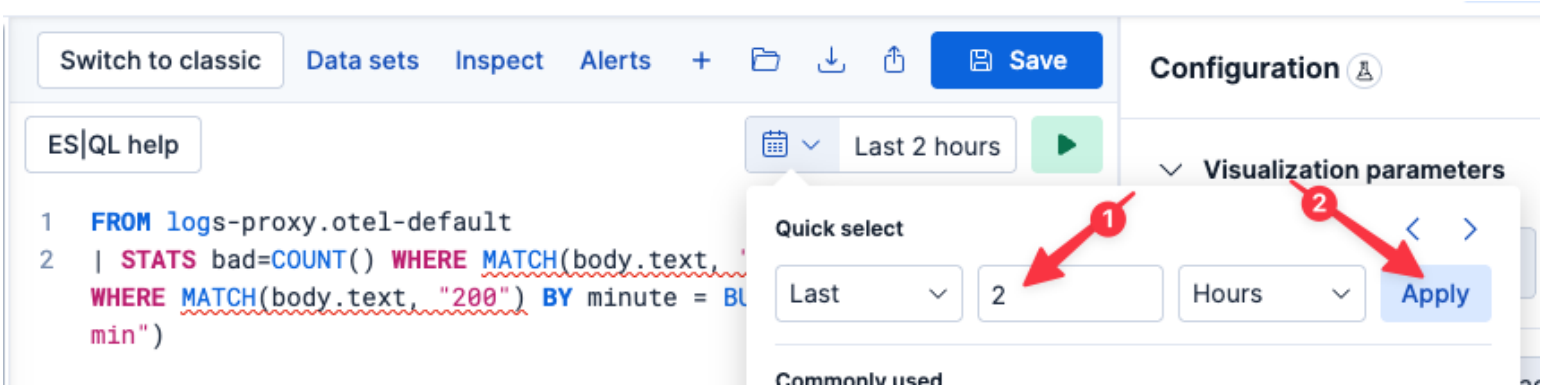
Then change the resulting graph to a bar graph over time:

1. Click on the pencil icon to the right of the existing graph
2. Select `Bar` from the visualizations drop-down menu
3. Click `Apply and close`

Indeed, we are still seeing a mix of 500 and 200 errors.

When did the errors start?

Let's see if we can find when the errors started occurring. Use the Time Filter to show the last 3 hours of data; this should automatically rerun the last query.



Ok, it looks like this issue first started happening roughly in the last 2 hours. We can use ES|QL's CHANGE_POINT to narrow it down to a specific minute:

Execute the following query:

```
FROM logs-proxy.otel-default
| EVAL status = CASE(body.text LIKE "* 500 *", "bad", "good") // label messages containing " 500 " as "bad", else "good"
| STATS count = COUNT() BY minute = BUCKET(@timestamp, "1 min"), status
| CHANGE_POINT count ON minute AS type, pval // look for distribution change
| WHERE type IS NOT NULL
| KEEP type, minute
```

A-ha! Using `CHANGE_POINT`, we can say that these errors clearly started occurring 80 minutes ago.

Parsing logs with ES|QL

As you can see, simply searching for known error codes in our log lines will only get us so far. Maybe the error code isn't just 500, or maybe we want to analyze status code vs. request URL, for example.

Fortunately, nginx logs are semi-structured which makes them (relatively) easy to parse.

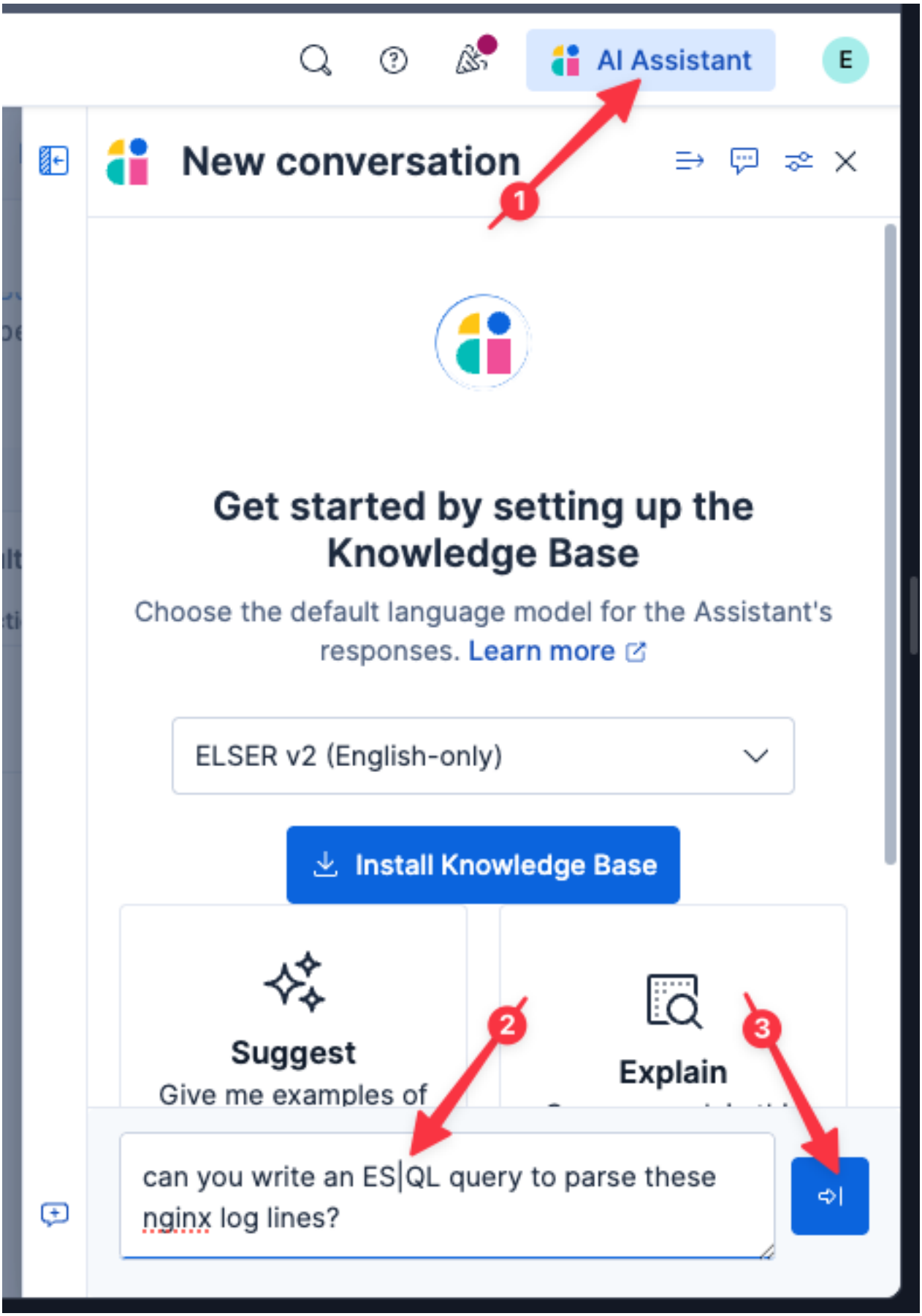
Some of you may already be familiar with grok expressions which provides a higher-level interface on top of regex; namely, grok allows you define patterns. If you are well versed in grok, you may be able to write a parsing pattern yourself for nginx logs, possibly using tools like Grok Debugger to help.

If you aren't well versed in grok expressions, or you don't want to spend the time to debug an expression yourself, you can leverage our AI Assistant to help!

1. Click on the AI Assistant button in the upper-right.
2. Enter the following prompt in the `Send a message to the Assistant` field at the bottom of the fly-out.

```
can you write an ES|QL query to parse these nginx log lines?
```

3. Click the execute button



[!NOTE] The output should look something like the following. Notably, the AI Assistant may generate slightly different field names on each generating. Because we rely on those field names in subsequent analysis, please close the flyout and copy and paste the following ES|QL expression into the ES|QL query entry box.

```
FROM logs-proxy.otel-default
| GROK body.text "%{IPORHOST:client_ip} %{USER:ident} %{USER:auth} \\[%{HTTPDATE:timestamp}\\] \"%{WORD:http_method} %{NOTSPACE:request_path
| WHERE status_code IS NOT NULL
```

```
| EVAL @timestamp = DATE_PARSE("dd/MMM/yyyy:HH:mm:ss Z", timestamp) // use embedded timestamp as record timestamp
| KEEP @timestamp, client_ip, http_method, request_path, status_code, user_agent
```

Is this affecting all backend APIs?

Let's make use of these parsed fields to break down `status_code` by `request_path` to see if this is affecting only a specific API, or several APIs?

Execute the following query:

```
FROM logs-proxy.otel-default
| GROK body.text "%{IPORHOST:client_ip} %{USER:ident} %{USER:auth} \\[%{HTTPDATE:timestamp}\\] \"%{WORD:http_method} %{NOTSPACE:request_path
| WHERE status_code IS NOT NULL
| STATS COUNT() BY status_code, request_path
```

Ok, it seems these errors are affecting all of the APIs (2) exposed by our simple backend.

> [!NOTE] You may notice that our search has gotten a little slower when we added query-time grok parsing. This is because Elasticsearch is now applying our grok pattern to *every* log line in the selected time window. In our next challenge, we will show you how we can retain fast-search over long time windows WITH parsing using ingest-time parsing!

Is this affecting all User Agents?

Our nginx access logs also include a User Agent field, which is a semi-structured field containing some information about the requesting browser. Ideally, we could also cross-reference the errors against this field to understand if it is affecting all browsers, or only some types of browsers.

Execute the following query:

```
FROM logs-proxy.otel-default
| GROK body.text "%{IPORHOST:client_ip} %{USER:ident} %{USER:auth} \\[%{HTTPDATE:timestamp}\\] \"%{WORD:http_method} %{NOTSPACE:request_path
| WHERE status_code IS NOT NULL
| WHERE TO_INT(status_code) == 500
| STATS bad = COUNT() BY user_agent
```

Unfortunately, the unparsed `user_agent` field is too unstructured to really be useful for this kind of analysis. We could try to write a grok expression to further parse `user_agent`, but in practice, it is too complicated (it requires translations and lookups in addition to parsing). Let's put a pin in this topic and revisit it in a bit when we have more tools at our disposal.

Making use of our parsed fields

Let's redraw the time graph we drew before, but this time using `status_code` instead of looking for specific error codes.

Execute the following query:

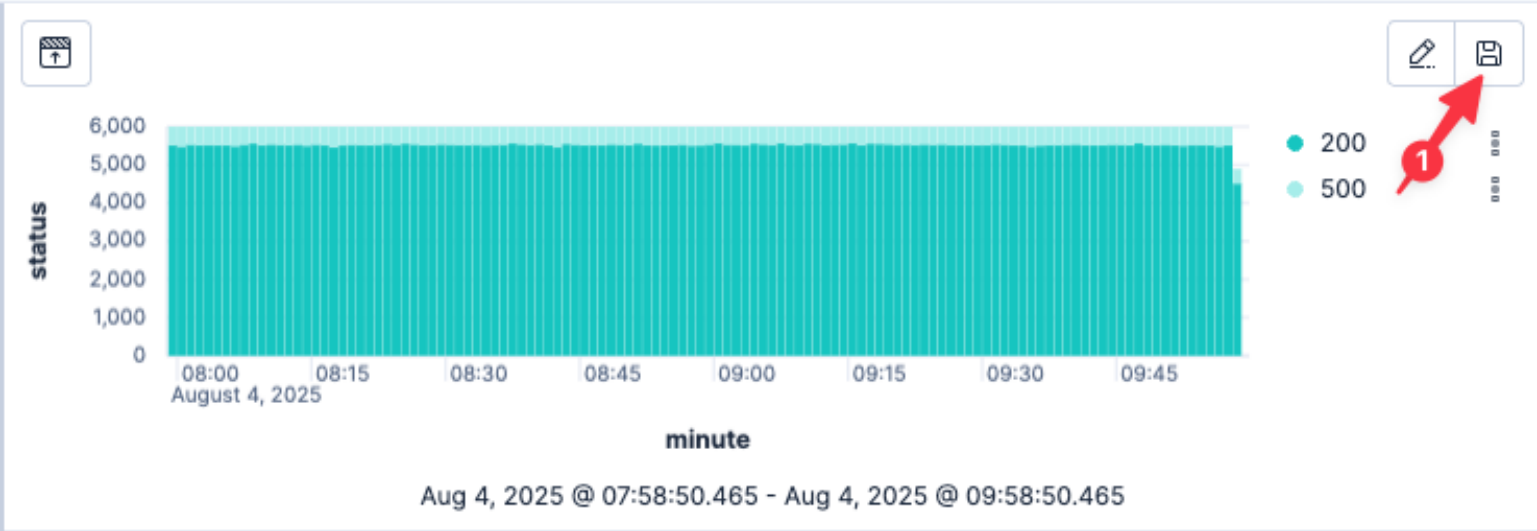
```
FROM logs-proxy.otel-default
| GROK body.text "%{IPORHOST:client_ip} %{USER:ident} %{USER:auth} \\[%{HTTPDATE:timestamp}\\] \"%{WORD:http_method} %{NOTSPACE:request_path
| WHERE status_code IS NOT NULL
| EVAL @timestamp = DATE_PARSE("dd/MMM/yyyy:HH:mm:ss Z", timestamp)
| STATS status_count = COUNT() BY status_code, minute = BUCKET(@timestamp, "1 min")
```

> [!NOTE] If the resulting graph does not default to a bar graph plotted over time, click on the Pencil icon in the upper-right of the graph and change the graph type to `Bar`

Now that we are graphing by `status_code`, we know definitively that we returning only 200 and 500 status codes.

Saving our visualization to a dashboard

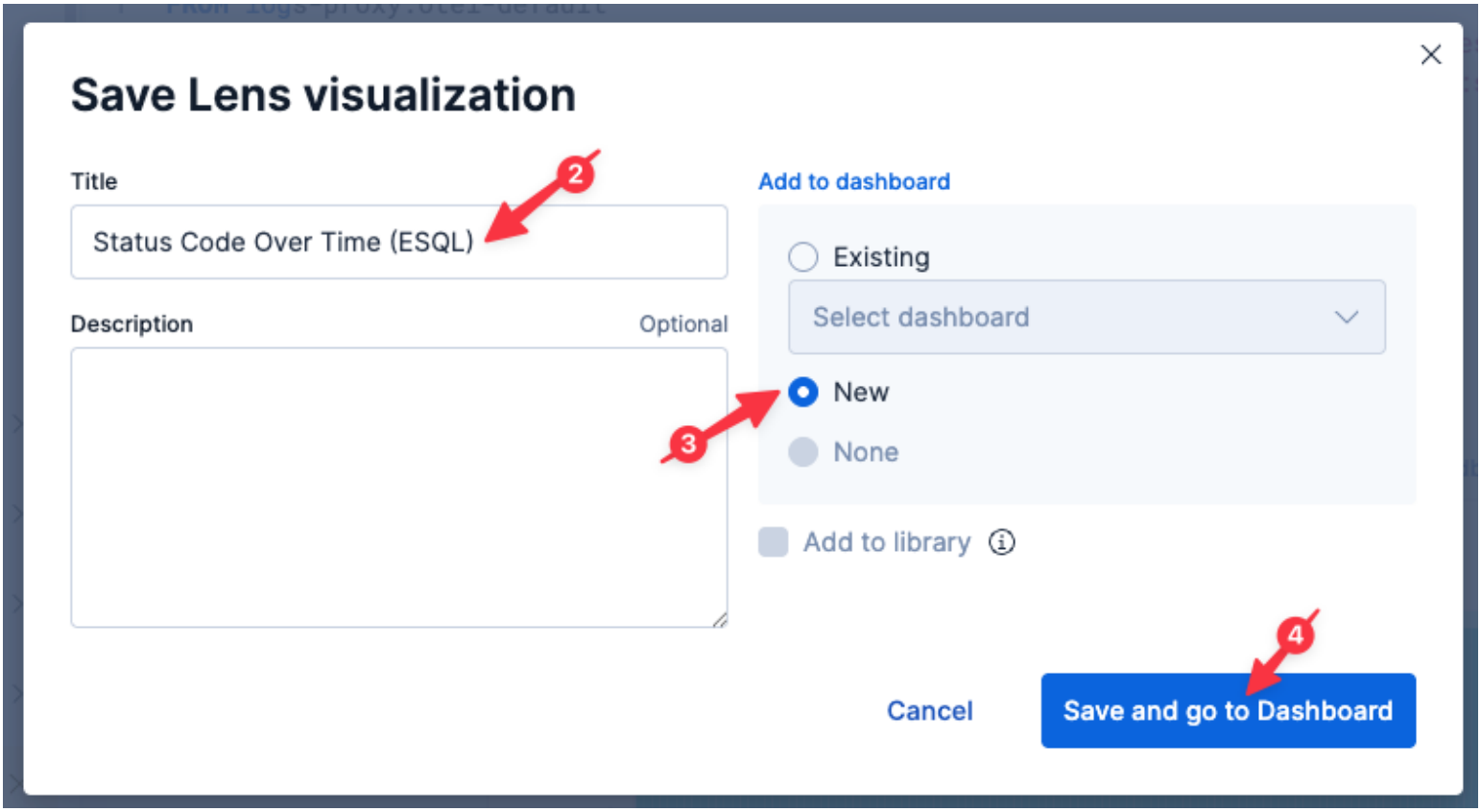
Let's save this graph to a dashboard for future use.



1. Click on the Disk icon in the upper-left of the resulting graph
2. Name the visualization

```
Status Code Over Time (ESQL)
```

3. Select `New` under `Add to dashboard`
4. Click `Save and go to Dashboard`



You will be taken to a new dashboard. Let's save it for future reference.

1. Click the `Save` button in the upper-right
2. Enter the title of the new dashboard as

```
Ingress Proxy
```

3. Click `Save`

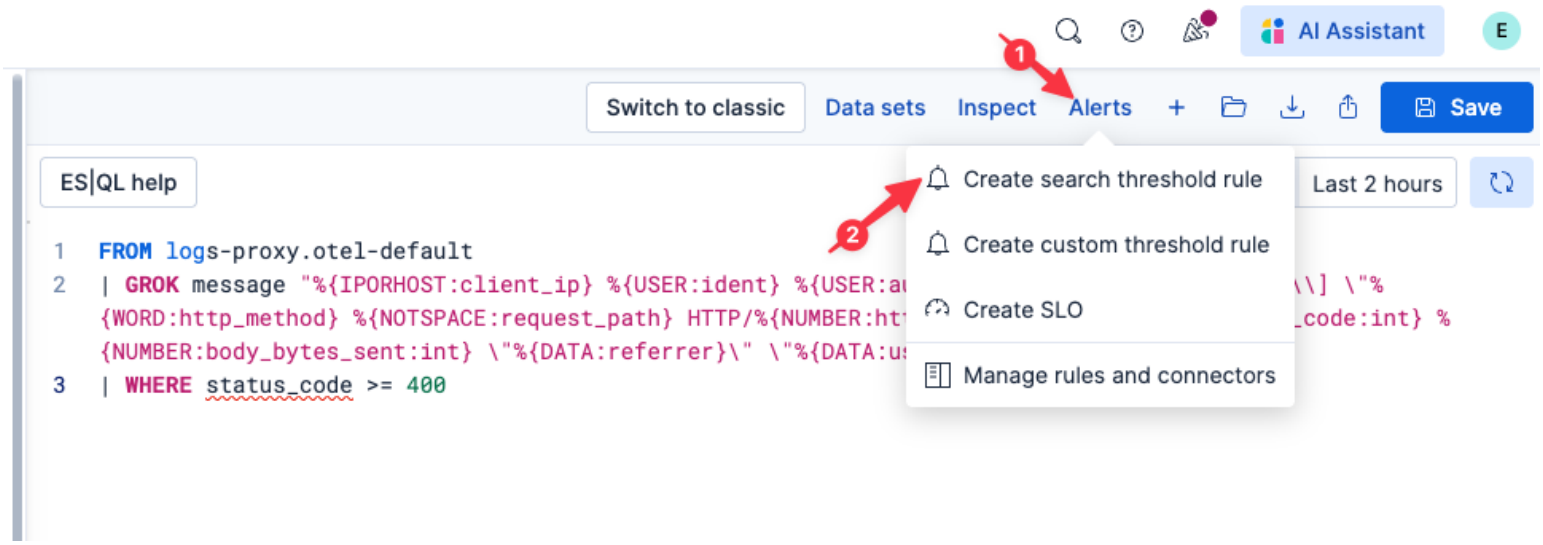
Setting up a simple alert

Go back to `Discover` using the left-hand navigation pane.

Let's create a simple alert to notify us whenever a `status_code` >= 400 is received:

Execute the following query:

```
FROM logs-proxy.otel-default
| GROK body.text "%{IPORHOST:client_ip} %{USER:ident} %{USER:auth} \\[%{HTTPDATE:timestamp}\\] \"%{WORD:http_method} %{NOTSPACE:request_path
| WHERE status_code >= 400
```



1. Click `Alerts` in the taskbar
2. Select `Create search threshold rule`
3. Click `Test query`
4. Leave the defaults and click `Next`
5. Click `Next` on `Actions` tab
6. Set `Rule name` to

```
status_code >= 400
```

7. Set `Tags` to

```
ingress
```

8. Click `Create rule` on `Details` tab
9. Click `Save rule` on the pop-up dialog

In practice, this alert is too simple. We probably are okay with a small percentage of non-200 errors for any large scale infrastructure. What we really want is to alert when we violate a SLO. We will revisit this topic in a bit.

Summary

Let's take stock of what we know:

- a percentage of requests are experiencing 500 errors
- the errors started occurring around 80 minutes ago
- the only error type seen is 500
- the errors occur over all APIs

And what we've done:

- Created a dashboard to monitor our ingress proxy
- Created graphs to monitor status codes over time
- Created a simple alert to let us know if we ever return non-200 error codes

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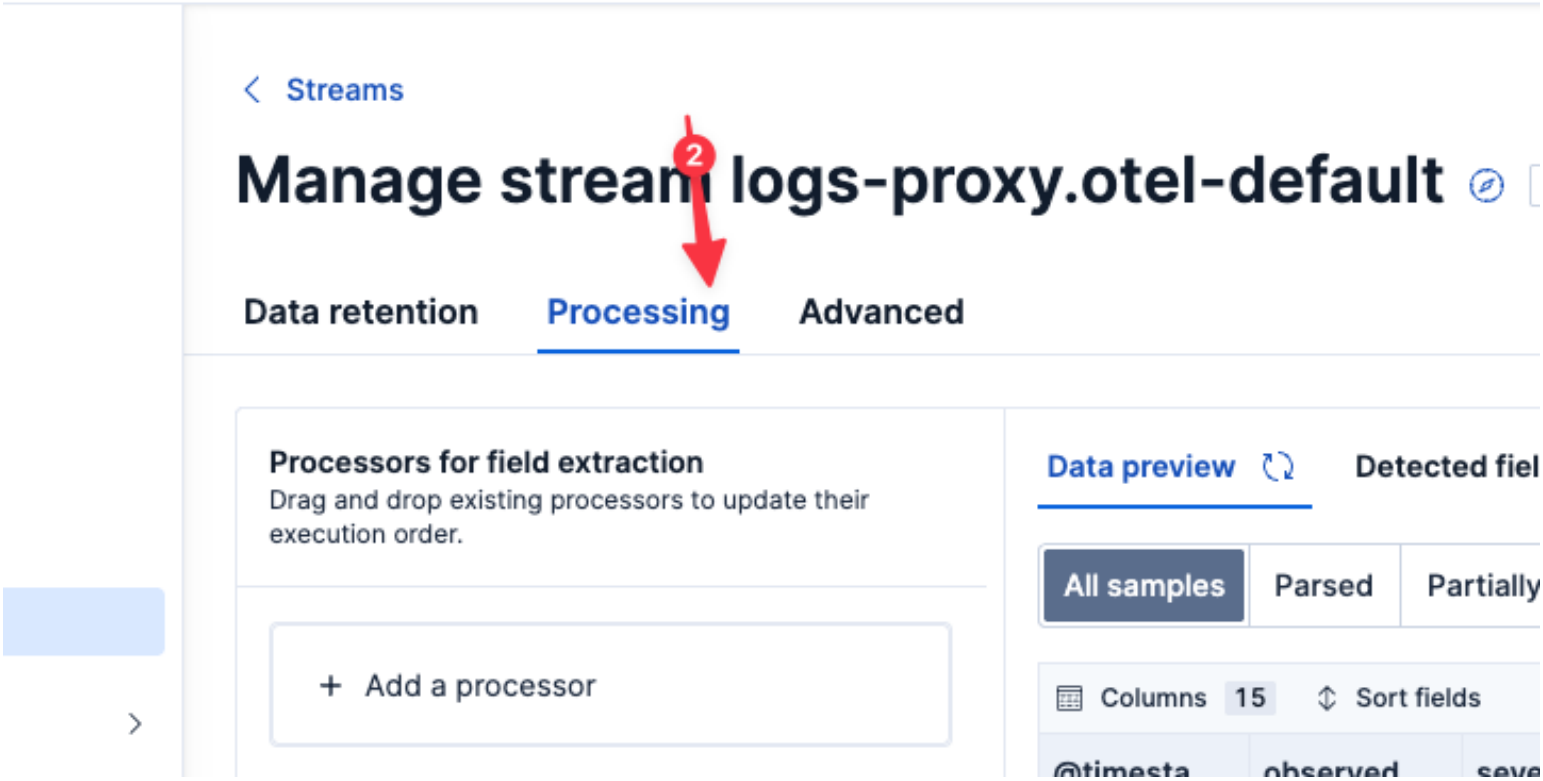
So far, we've been using ES|QL to parse our proxy logs at query-time. While incredibly powerful for quick analysis, we can do even more with our logs if we parse them at ingest-time.

Parsing with Streams

We will be working with Elastic Streams which makes it easy to setup log parsing pipelines.

1. Select `logs-proxy.otel-default` from the list of data streams (if you start typing, Elasticsearch will help you find it)
2. Select the `Processing` tab



Parsing the log message

We can parse our nginx log messages at ingest-time using the Elastic Grok processor.

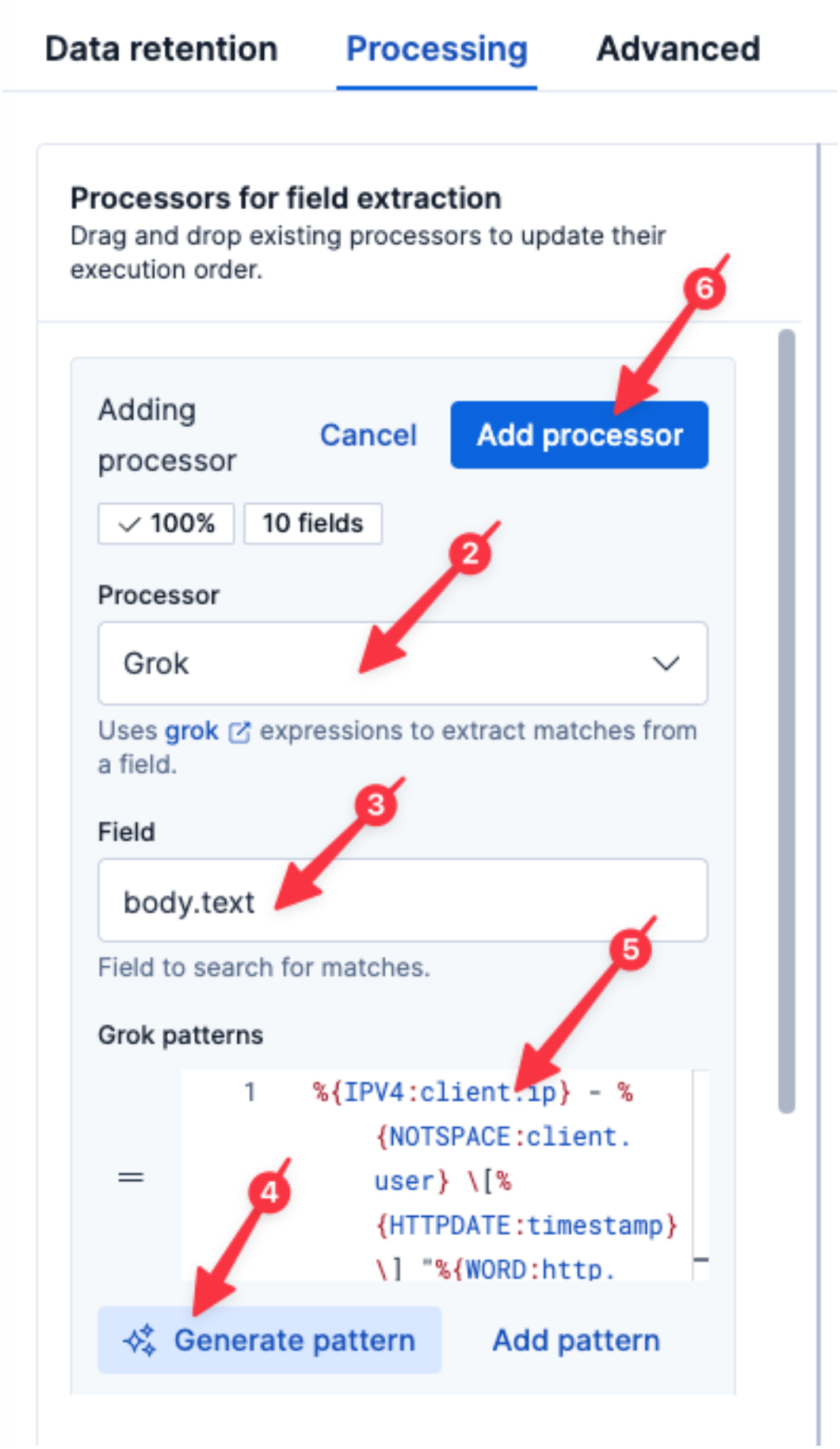
1. Click `Add a processor`
2. Select the `Grok` Processor (if not already selected)
3. Set the `Field` to

```
body.text
```

4. Click `Generate pattern`. Elasticsearch will analyze your log lines and try to determine a suitable grok pattern.
5. To ensure a consistent lab experience, copy the following grok expression and paste it into the `Grok patterns` field (rather than clicking on the `Accept` button)

```
%{IPV4:client.ip} - %{NOTSPACE:client.user} \[%{HTTPDATE:timestamp}\] "%{WORD:http.request.method} %{URIPATH:http.request.url.path} HTTP/%{NU
```

6. Click `Add processor`

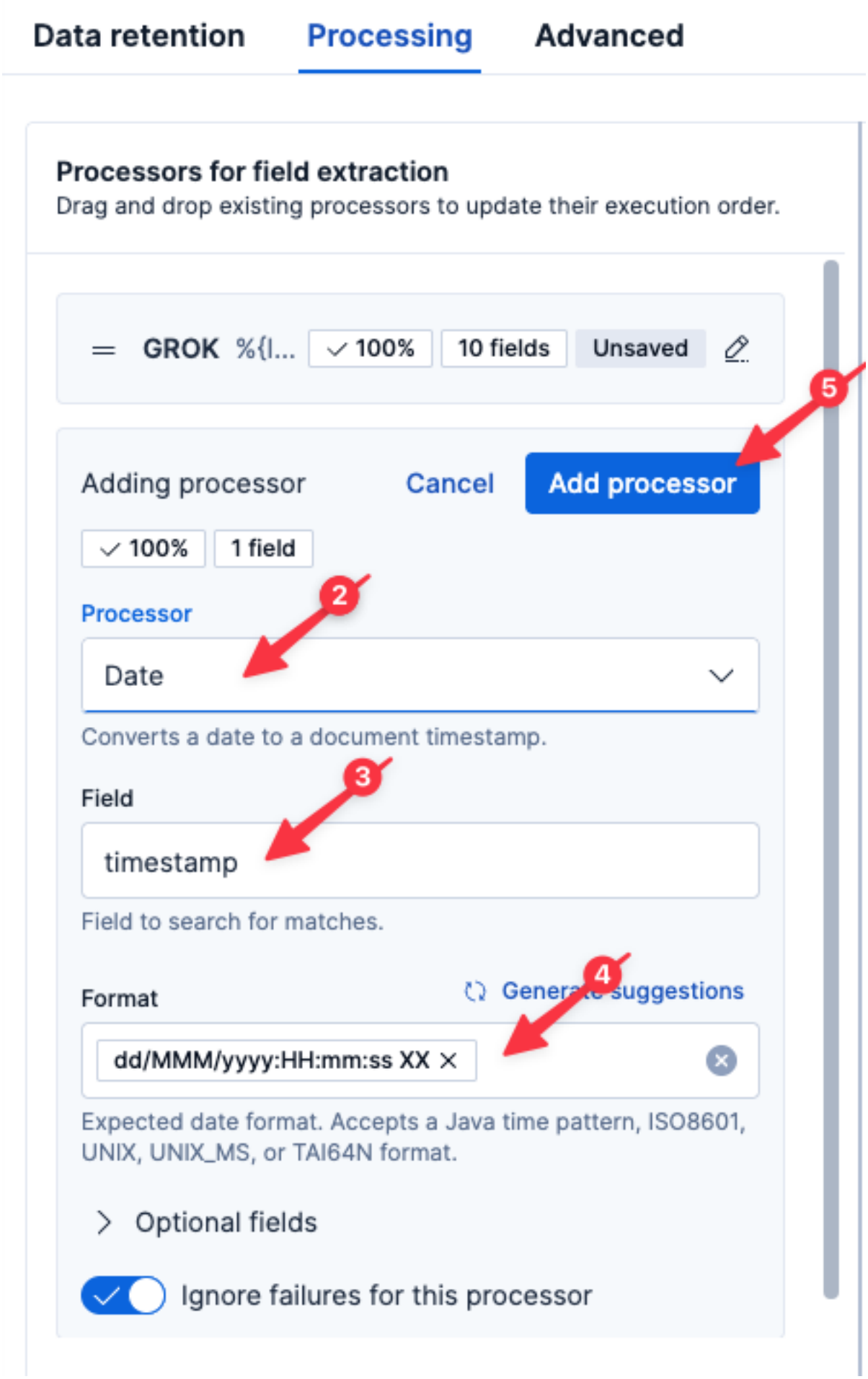


Parsing the timestamp

The nginx log line includes a timestamp; let's use that as our record timestamp.

1. Click `Add a processor`

2. Select `Date`
3. Set `Field` to `timestamp`
4. Elastic should auto-recognize the format: `dd/MMM/yyyy:HH:mm:ss XX`
5. Click `Add processor`



Now save the Processing by clicking `Save changes` in the bottom-right.

A faster way to query

Now let's jump back to Discover by clicking `Discover` in the left-hand navigation pane.

Execute the following query:

```
FROM logs-proxy.otel-default
| WHERE http.response.status_code IS NOT NULL
| KEEP @timestamp, client.ip, http.request.method, http.request.url.path, http.response.status_code, user_agent.original
```

> [!NOTE] If you get back `1,000 results` but the resulting columns are empty, remove the `Selected fields` (by clicking the `X` next to each), and then add each `Available field` (by clicking the `+` next to each).

Let's redraw our status code graph using our newly parsed field:

Execute the following query:

```
FROM logs-proxy.otel-default
| WHERE http.response.status_code IS NOT NULL
| STATS COUNT() BY TO_STRING(http.response.status_code), minute = BUCKET(@timestamp, "1 min")
```

Note that this graph, unlike the one we drew before, currently shows only a few minutes of data. That is because it relies upon the fields we parsed in the Processing we just setup. Prior to that time, those fields didn't exist. Change the time field to `Last 5 Minutes` to zoom in on the newly parsed data.

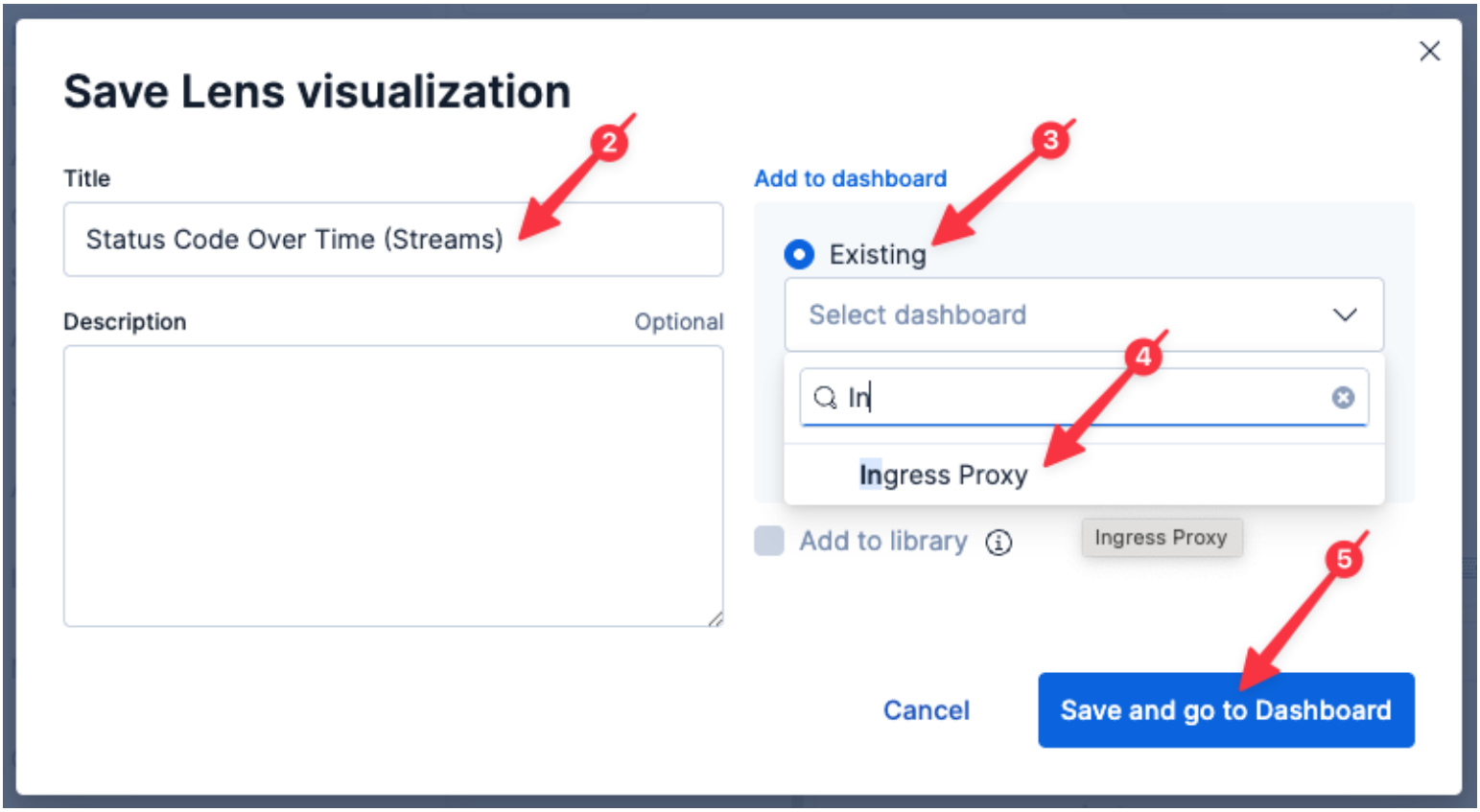
Saving our visualization to a dashboard

This is a useful graph! Let's save it to our dashboard for future use.

1. Click on the Disk icon in the upper-left of the resulting graph
2. Name the visualization

```
Status Code Over Time (Streams)
```

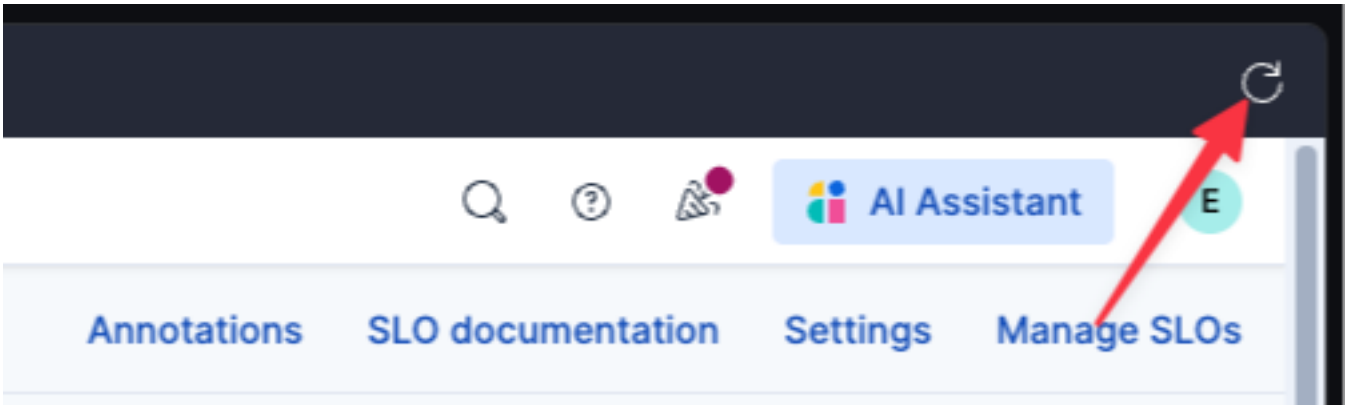
3. Select `Existing` under `Add to dashboard`
4. Select the existing dashboard `Ingress Proxy` (you will need to start typing `Ingress` in the `Search dashboards...` field)
5. Click `Save and go to Dashboard`
6. Once the dashboard has loaded, click the `Save` button in the upper-right



Creating a SLO

> [!NOTE] Because we are moving quickly, Elasticsearch may take some time to update field lists in the UI. If you encounter

a situation where Elasticsearch doesn't recognize one of the fields we just parsed, click the Refresh icon in the upper-right of the Instruqt tab and try again to create the SLO.



Remember that simple alert we created? Now that we are parsing these fields at ingest-time, we can create a proper SLO instead of a simple binary alert. With a SLO, we can allow for some percentage of errors over time (common in a complex system) before we get our support staff out of bed.

1. Click `SLOs` in the left-hand navigation pane
2. Click `Create SLO`
3. Select `Custom Query` (if not already selected)
4. Set `Data view` to `logs-proxy.otel-default`
5. Set `Timestamp field` to `@timestamp` (if not already selected)
6. Set `Good query` to

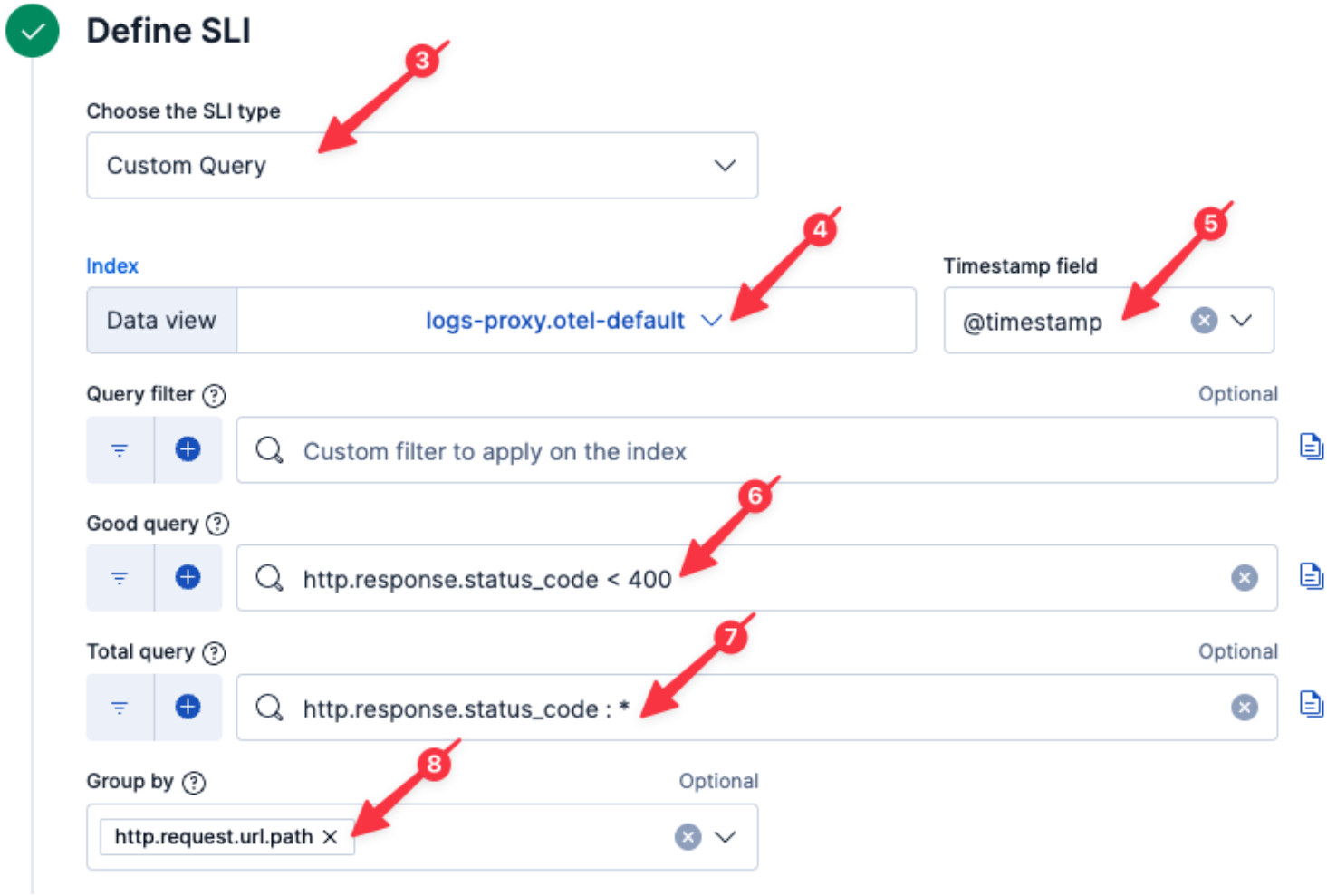
```
http.response.status_code < 400
```

7. Set `Total query` to

```
http.response.status_code : *
```

8. Set `Group by` to

```
http.request.url.path
```



9. Set `SLO Name` to

`Ingress Status`

10. Set `Tags` to

`ingress`

11. Click `Create SLO`

Alerting on a SLO

Now let's setup an alert that triggers when this SLO is breached.

1. Click on your newly created SLO `Ingress Status`
2. Under the `Actions` menu in the upper-right, select `Manage burn rate rule`

With burn rates, we can have Elastic dynamically adjust the escalation of a potential issue depending on how quickly it appears we will breach our SLO.

3. On the `Details` tab of the fly-out, set the `Rule name` to :

```
Ingress Status SLO
```

4. Set `Tags` to

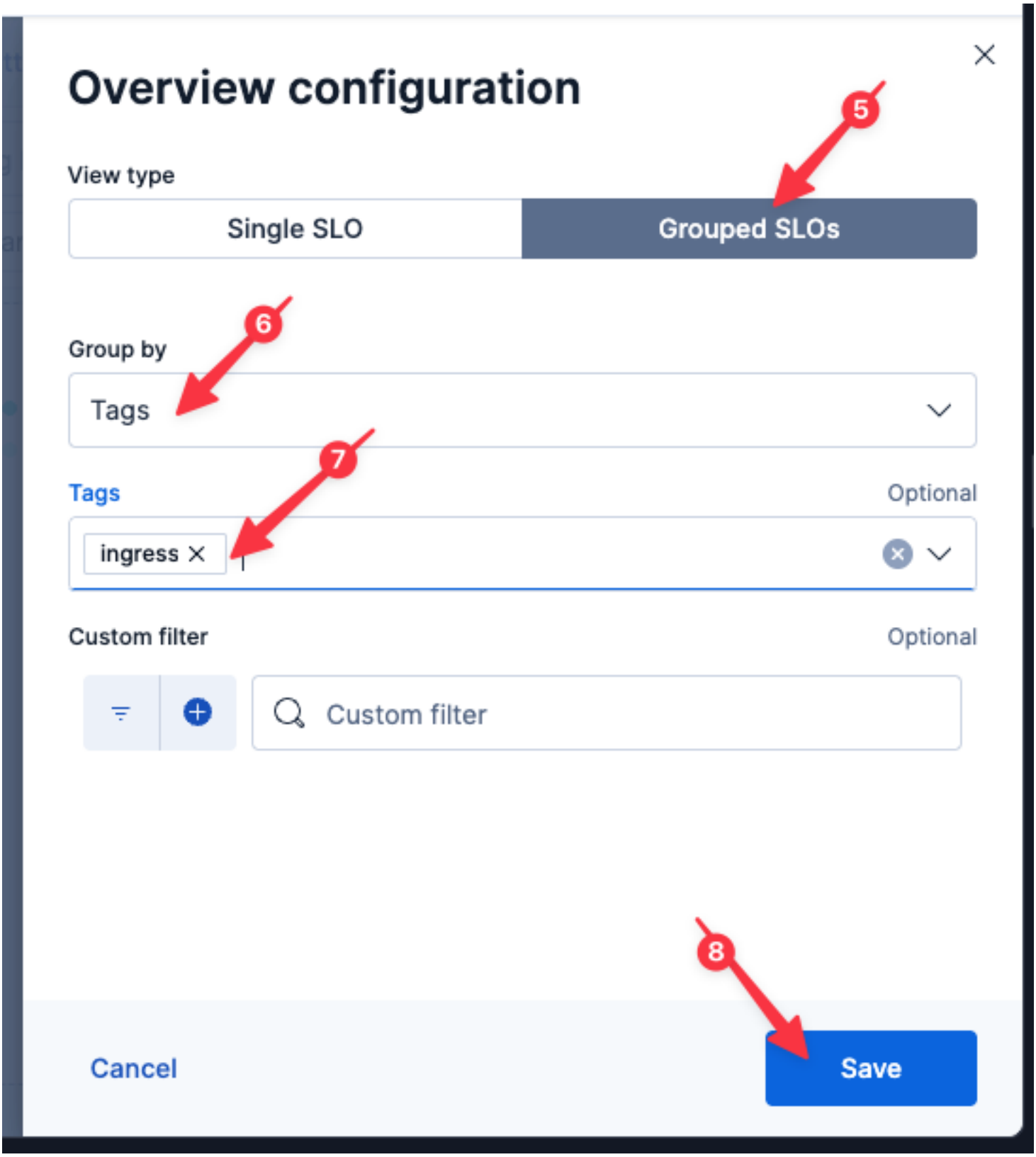
```
ingress
```

5. Click `Save changes`
6. Click `Save rule` on the pop-up dialog

Adding SLO monitors to our dashboard

Now let's add the SLO monitor to our dashboard to help us find it in the future.

1. Click `Dashboards` in the left-hand navigation pane
2. Open the `Ingress Status` dashboard (if not already open)
3. Click `Add panel`
4. Select `SLO Overview`
5. Select `Grouped SLOs`
6. Set `Group by` to `Tags`
7. Set `Tags` to `ingress`
8. Click `Save`



Note that we are dynamically adding SLOs by tag. Any additional SLOs tagged with `ingress` will also appear here.

Adding alerts to our dashboard

Let's also add our growing list of alerts to our dashboard.

1. Click `Add panel`
2. Select `Alerts`
3. Set `Filter by` to `Rule tags`
4. Set `Rule tags` to `ingress`
5. Click `Save`

Note that we are dynamically adding alerts by tag. Any additional alerts tagged with `ingress` will also appear here.

Now save the changes to our dashboard by clicking the `Save` button in the upper-right.

Summary

Let's take stock of what we know:

- a small percentage of requests are experiencing 500 errors
- the errors started occurring around 80 minutes ago
- the only error type seen is 500
- the errors occur over all APIs

And what we've done:

- Created a dashboard to monitor our ingress proxy
- Created graphs to monitor status codes over time
- Created a simple alert to let us know if we ever return non-200 error codes
- Parsed the logs at ingest-time for quicker and more powerful analysis
- Create a SLO (with alert) to let us know if we ever return a significant number of non-200 error codes over time

---

We still don't know why some requests are failing. Now that we are parsing the logs, however, we have access to a lot more information.

Is this affecting every region?

Let's analyze our clients by `client.ip` to look for possibly geographic patterns.

Adding the GeoIP processor

We can add the Elastic GeoIP processor to geo-locate our clients based on their client IP address.

1. Select `logs-proxy.otel-default` from the list of Streams.
2. Select the `Processing` tab
3. Click `Add a processor`
4. Select the `GeoIP` Processor
5. Set the `Field` to

```
client.ip
```

6. Open `Optional fields`
7. Set `Target field` to

```
client.geo
```

8. Set `Ignore missing` to true
9. Click `Add processor`
10. Click `Save changes` in the bottom-right

Analyzing with Discover

Jump back to Discover by clicking `Discover` in the left-hand navigation pane.

Adjust the time field to show the last 3 hours of data.

Execute the following query:

```
FROM logs-proxy.otel-default
| WHERE client.geo.country_iso_code IS NOT NULL AND http.response.status_code IS NOT NULL
| STATS COUNT() BY http.response.status_code, client.geo.country_iso_code
| SORT http.response.status_code DESC
```

Let's make this a pie chart to allow for more intuitive visualization.

1. Click the pencil icon to the right of the graph
2. Select `Pie` from the dropdown menu
3. Click `Apply and close`

Wow! It looks like all of our 500 errors are occurring in the `TH` (Thailand) region. That is really interesting; without more information, we might be tempted to stop our RCA analysis here. However, there is often more to the story, as we will see.

Saving our visualization to a dashboard

In the meantime, this is a useful graph! Let's save it to our dashboard for future use.

1. Click on the Disk icon in the upper-left of the resulting graph
2. Name the visualization

```
Status by Region
```

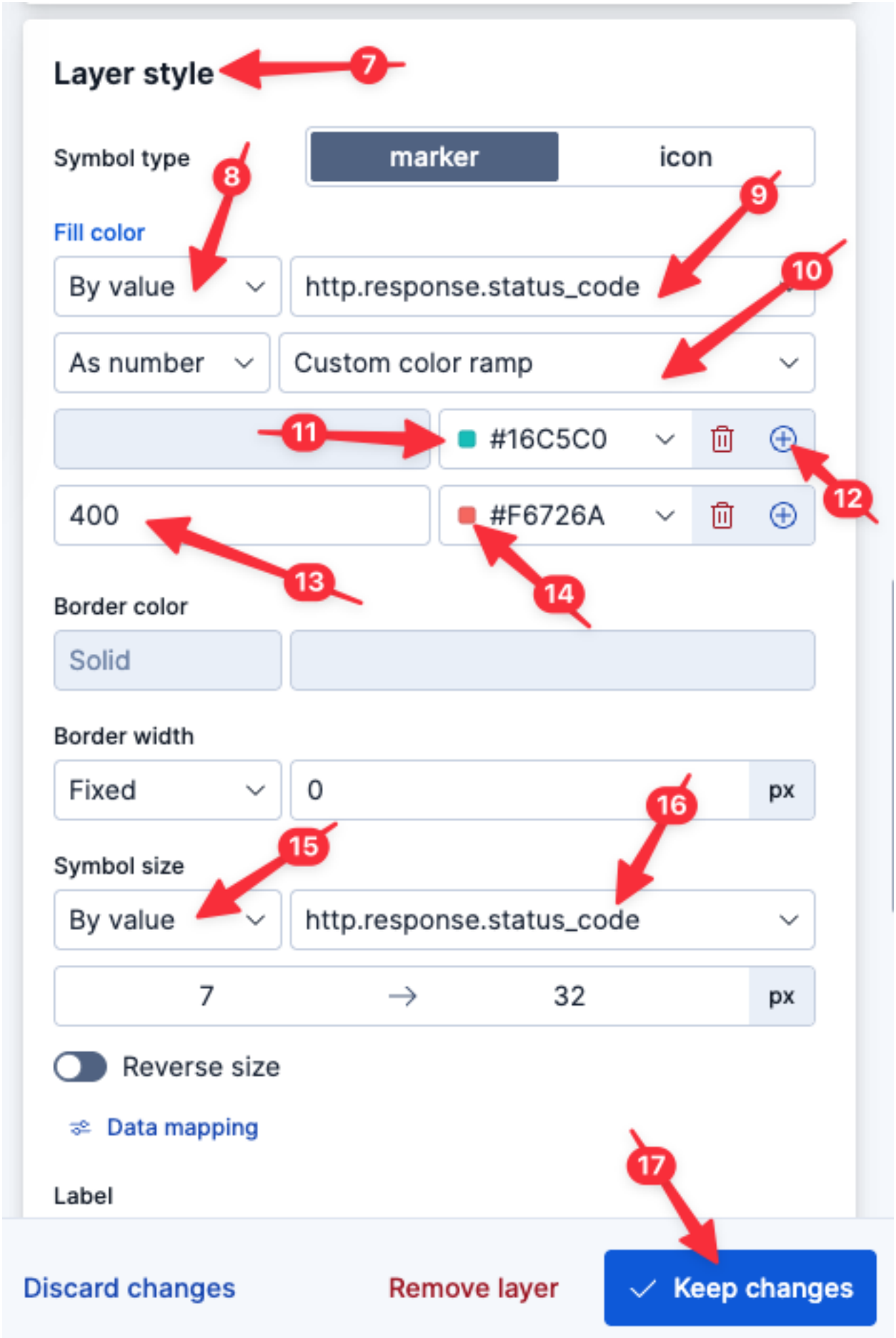
3. Select `Existing` under `Add to dashboard`
4. Select the existing dashboard `Ingress Proxy` (you will need to start typing `Ingress` in the `Search dashboards...` field)
5. Click `Save and go to Dashboard`
6. Once the dashboard has loaded, click the `Save` button in the upper-right

Visualizing with Maps

> [!NOTE] Because we are moving quickly, Elasticsearch may take some time to update field lists in the UI. If you encounter a situation where Elasticsearch doesn't recognize one of the fields we just parsed, click the Refresh icon in the upper-right of the Instruqt tab and try again to create the Map.

Sometimes it is helpful to visualize client geography on a map. Fortunately, Elastic has a built-in Map visualization we can readily use!

1. Go to `Other tools` > `Maps` using the left-hand navigation pane
2. Click `Add layer`
3. Select `Documents`
4. Select `Data view` to `logs-proxy.otel-default`
5. Set `Geospatial field` to `client.geo.location` (if this field isn't available, refresh the Instruqt virtual browser tab)
6. Click `Add and continue`
7. Scroll down to `Layer style`
8. Set `Fill color` to `By value`
9. Set `Select a field` to `http.response.status_code`
10. Select `Custom color ramp` in the field next to `As number`
11. Select a greenish color for the first number row (if not already selected)
12. Click the `+` button to the right of the first number row
13. Enter `400` in the second number row
14. Select a reddish color for the `400` number row
15. Set `Symbol Size` to `By value`
16. Set `Select a field` to `http.response.status_code`
17. Click `Keep changes`



Feel free to scroll around the globe and note the intuitive visualization of client locations and status codes.

Saving our map to a dashboard

Let's add our map to our dashboard for future reference.

1. Click the `Save` button in the upper-right
2. Set `Title` to

```
Status Code by Location
```

3. Select existing dashboard `Ingress Status` (you will need to start typing `Ingress` in the `Search dashboards...` field)
4. Click `Save and go to dashboard`

Now save the dashboard by clicking on the `Save` button in the upper-right.

Summary

Let's take stock of what we know:

- a small percentage of requests are experiencing 500 errors
- the errors started occurring around 80 minutes ago
- the only error type seen is 500
- the errors occur over all APIs
- the errors occur only in the `TH` (Thailand) region

And what we've done:

- Created a dashboard to monitor our ingress proxy
- Created graphs to monitor status codes over time
- Created a simple alert to let us know if we ever return non-200 error codes
- Parsed the logs at ingest-time for quicker and more powerful analysis
- Create a SLO (with alert) to let us know if we ever return a significant number of non-200 error codes over time
- Created visualizations to help us visually locate clients and errors

---

We know that errors appear to be localized to a specific region. But maybe there is more to the story?

Is this affecting every type of browser?

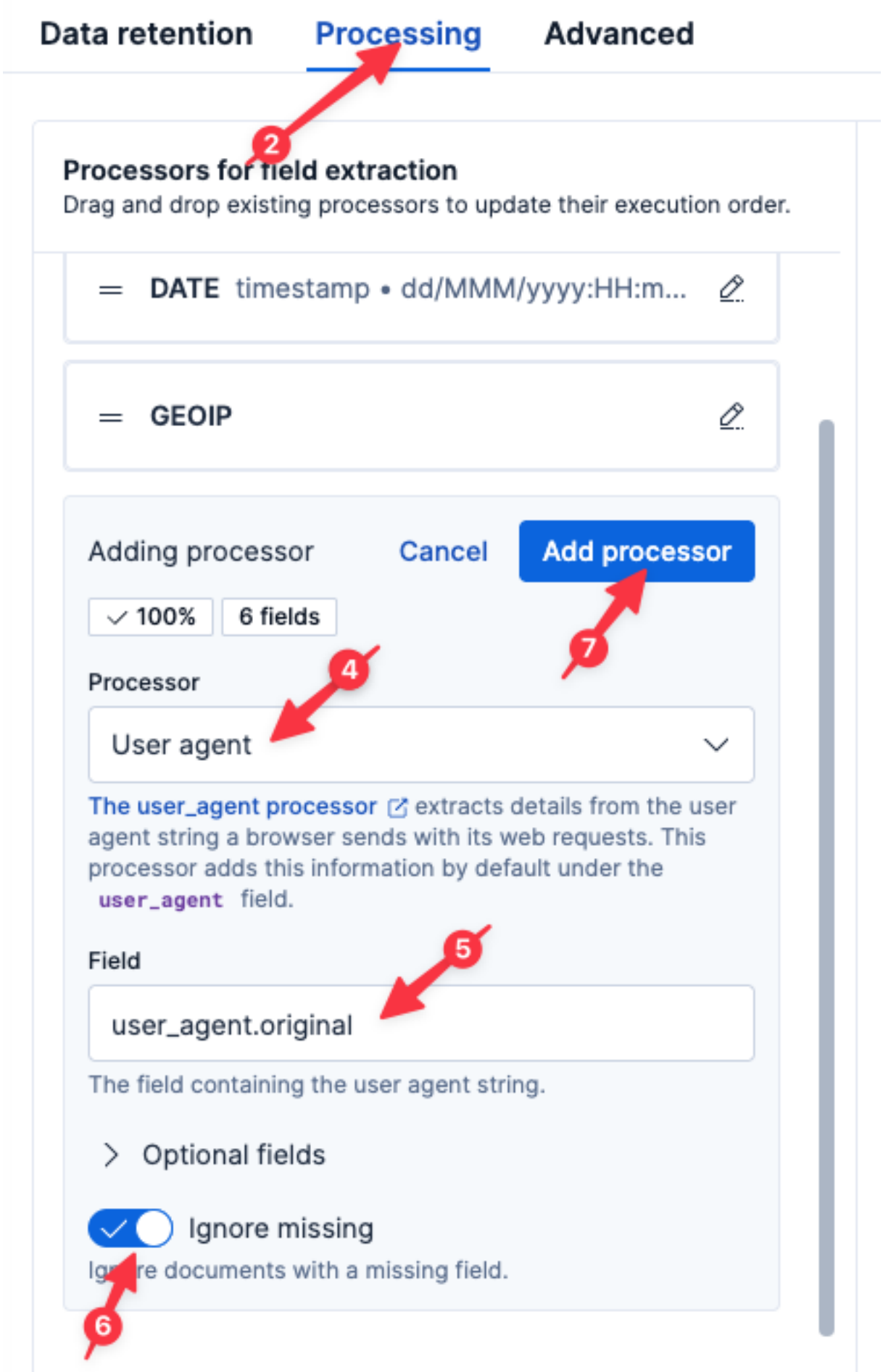
Remember the User Agent string we tried to group by and failed using ES|QL? While nearly impossible to parse with a simple grok expression, we can easily parse the User Agent string using the Elastic User agent processor.

Adding the User Agent processor

1. Select `logs-proxy.otel-default` from the list of Streams.
2. Select the `Processing` tab
3. Select `Add a processor`
4. Select the `User agent` Processor
5. Set the `Field` to

```
user_agent.original
```

6. Set `Ignore missing` to true
7. Click `Add processor`


Data retention
Processing
Advanced
2
Processors for field extraction
Drag and drop existing processors to update their execution order.
DATE timestamp • dd/MMM/yyyy:HH:m...
GEOIP
Adding processor
Cancel
Add processor
7
100%
6 fields
Processor
4
User agent
The user_agent processor extracts details from the user agent string a browser sends with its web requests. This processor adds this information by default under the user_agent field.
Field
5
user_agent.original
The field containing the user agent string.
Optional fields
Ignore missing
6
documents with a missing field.

Adding the Set processor

In addition to the fields produced by the User Agent processor, we also want a simplified combination of browser name and version. We can easily craft one using the Set processor.

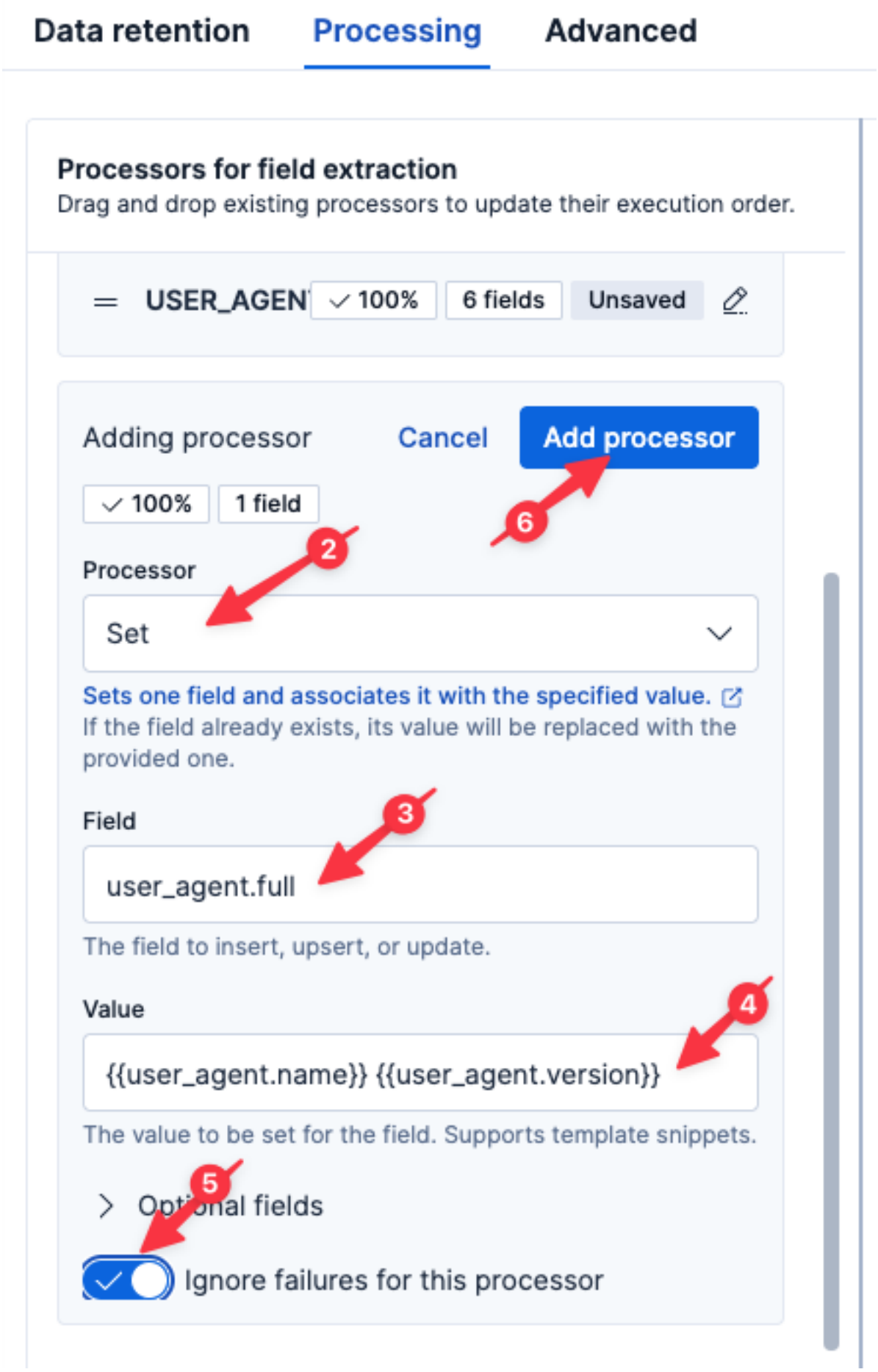
1. Click `Add a processor`
2. Select the `Set` Processor
3. Set `Field` to

```
user_agent.full
```

4. Set `Value` to

```
{{user_agent.name}} {{user_agent.version}}
```

5. Click `Ignore failures for this processor`
6. Click `Add processor`
7. Click `Save changes` in the bottom-right



This processor will add a new field `user_agent.full` to each document composed the `user_agent.name` and `user_agent.version` fields concatenated together.

Analyzing with Discover

Now let's jump back to Discover by clicking `Discover` in the left-hand navigation pane.

Execute the following query:

```
FROM logs-proxy.otel-default
| WHERE user_agent.full IS NOT NULL
| STATS good = COUNT(http.response.status_code < 400 OR NULL), bad = COUNT(http.response.status_code >= 400 OR NULL) BY user_agent.full
| SORT bad DESC
```

Ah-ha, there is more to the story! It appears our errors may be isolated to a specific browser version. Let's break this down by `user_agent.version`.

```
FROM logs-proxy.otel-default
| WHERE user_agent.full IS NOT NULL
| STATS good = COUNT(http.response.status_code < 400 OR NULL), bad = COUNT(http.response.status_code >= 400 OR NULL) BY user_agent.version
| SORT bad DESC
```

Indeed, it appears we might have a problem with version 136 of the Chrome browser!

Correlating with region

So what's the correlation with the geographic area we previously identified as being associated with the errors we saw?

Execute the following query:

```
FROM logs-proxy.otel-default
| WHERE client.geo.country_iso_code IS NOT NULL AND user_agent.version IS NOT NULL AND http.response.status_code IS NOT NULL
| EVAL version_major = SUBSTRING(user_agent.version,0,LOCATE(user_agent.version, ".")-1)
| WHERE user_agent.name == "Chrome" AND TO_INT(version_major) == 136
| STATS COUNT() BY client.geo.country_iso_code
```

A-ha! It appears that this specific version of the Chrome browser (v136) has only been seen in the `TH` region! Quite possibly, Google has rolled out a specialized or canary version of their browser first in the `TH` region. That would explain why we saw errors only in the `TH` region.

Congratulations! We found our problem! In the next challenge, we will setup a way to catch new User Agents in the future.

Summary

Let's take stock of what we know:

- a small percentage of requests are experiencing 500 errors
- the errors started occurring around 80 minutes ago
- the only error type seen is 500
- the errors occur over all APIs
- the errors occur only in the `TH` region
- the errors occur only with browsers based on Chrome v136

And what we've done:

- Created a dashboard to monitor our ingress proxy
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- Create a SLO (with alert) to let us know if we ever return a significant number of non-200 error codes over time
- Created visualizations to help us visually locate clients and errors ____

Now that we know what happened, let's try to be sure this never happens again by building out more reporting and alerting.

Generating a breakdown of user agents

As long as we are parsing our User Agent string, let's build some visualizations of the makeup of our browser clients. We can accomplish this using our parsed User Agent string and ES|QL.

Breakdown by OS

Execute the following query:

```
FROM logs-proxy.otel-default
| WHERE user_agent.os.name IS NOT NULL
| STATS COUNT() by user_agent.os.name, user_agent.os.version
```

1. Click on the pencil icon to the right of the existing graph
2. Select `Treemap` from the visualizations drop-down menu
3. Click `Apply and close`

Saving our visualization to a dashboard

Let's save it to our dashboard for future use.

1. Click on the Disk icon in the upper-left of the resulting graph
2. Name the visualization

```
Client OSs
```

3. Select `Existing` under `Add to dashboard`
4. Select the existing dashboard `Ingress Proxy` (you will need to start typing `Ingress` in the `Search dashboards...` field)
5. Click `Save and go to Dashboard`
6. Once the dashboard has loaded, click the `Save` button in the upper-right

Breakdown by Browser

Let's also create a chart depicting the overall breakdown of browsers.

Jump back to Discover by clicking `Discover` in the left-hand navigation pane.

Execute the following query:

```
FROM logs-proxy.otel-default
| WHERE user_agent.name IS NOT NULL
| STATS COUNT() by user_agent.name
```

1. Click on the pencil icon to the right of the existing graph
2. Select `Pie` from the visualizations drop-down menu
3. Click `Apply and close`

Adding our visualization to a dashboard

Let's save it to our dashboard for future use.

1. Click on the Disk icon in the upper-left of the resulting graph
2. Name the visualization

```
Client Browsers
```

3. Select `Existing` under `Add to dashboard`
4. Select the existing dashboard `Ingress Proxy` (you will need to start typing `Ingress` in the `Search dashboards...` field)
5. Click `Save and go to Dashboard`
6. Once the dashboard has loaded, click the `Save` button in the upper-right

Generating a table of user agents

It would also be helpful is to keep track of new User Agents as they appear in the wild.

Jump back to Discover by clicking `Discover` in the left-hand navigation pane.

Execute the following query:

```
FROM logs-proxy.otel-default
| WHERE user_agent.full IS NOT NULL
| STATS @timestamp.min = MIN(@timestamp), @timestamp.max = MAX(@timestamp) BY user_agent.full
```

This is good, but it would also be helpful, based on our experience here, to know the first country that a given User Agent appeared in.

Execute the following query:

```
FROM logs-proxy.otel-default
| WHERE user_agent.full IS NOT NULL
| STATS @timestamp.min = MIN(@timestamp), @timestamp.max = MAX(@timestamp) BY user_agent.full, client.geo.country_iso_code
| SORT @timestamp.min ASC // sort first seen to last seen
| STATS first_country_iso_code = TOP(client.geo.country_iso_code , 1, "asc"), first_seen = MIN(@timestamp.min), last_seen = MAX(@timestamp.ma
| SORT user_agent.full, first_seen, last_seen, first_country_iso_code
```

Fabulous! Now we can see every User Agent we encounter, when we first encountered it, and in what region it was first seen.

Using LOOKUP JOIN to determine release date

Say you also wanted to know when a given User Agent was released to the wild by the developer?

We could try to maintain our own User Agent lookup table and use ES|QL LOOKUP JOIN to match browser versions to release dates:

Execute the following query:

```
FROM ua_lookup
```

We built this table by hand; it is far from comprehensive. Now let's use `LOOKUP JOIN` to do a real-time lookup for each row:

Execute the following query:

```
FROM logs-proxy.otel-default
| WHERE user_agent.full IS NOT NULL
| EVAL user_agent.name_and_vmajor = SUBSTRING(user_agent.full, 0, LOCATE(user_agent.full, ".")-1) // simplify user_agent
| STATS @timestamp.min = MIN(@timestamp), @timestamp.max = MAX(@timestamp) BY user_agent.name_and_vmajor, client.geo.country_iso_code
| SORT @timestamp.min ASC // sort first seen to last seen
| STATS first_country_iso_code = TOP(client.geo.country_iso_code , 1, "asc"), first_seen = MIN(@timestamp.min), last_seen = MAX(@timestamp.ma
| SORT user_agent.name_and_vmajor, first_seen, last_seen, first_country_iso_code
| LOOKUP JOIN ua_lookup ON user_agent.name_and_vmajor // lookup release_date from ua_lookup using user_agent.name_and_vmajor key
| KEEP release_date, user_agent.name_and_vmajor, first_country_iso_code, first_seen, last_seen
```

We can quickly see the problem with maintaining our own `ua_lookup` index. It would take a lot of work to truly track the release date of every Browser version in the wild.

Using COMPLETION to determine release date

Fortunately, Elastic makes it possible to leverage an external Large Language Model (LLM) as part of an ES|QL query using the COMPLETION command. In this case, we can pipe each browser to the LLM and ask it to return the release date.

Execute the following query:

```
FROM logs-proxy.otel-default
| WHERE user_agent.full IS NOT NULL
| STATS @timestamp.min = MIN(@timestamp), @timestamp.max = MAX(@timestamp) BY user_agent.full, client.geo.country_iso_code
| SORT @timestamp.min ASC // sort first seen to last seen
| STATS first_country_iso_code = TOP(client.geo.country_iso_code , 1, "asc"), first_seen = MIN(@timestamp.min), last_seen = MAX(@timestamp.ma
| SORT first_seen DESC
| LIMIT 10 // intentionally limit to top 10 first_seen to limit LLM completions
| EVAL prompt = CONCAT(
   "when did this version of this browser come out? output only a version of the format mm/dd/yyyy",
   "browser: ", user_agent.full
  ) | COMPLETION release_date = prompt WITH openai_completion // call out to LLM for each record
| EVAL release_date = DATE_PARSE("MM/dd/YYYY", release_date)
| KEEP release_date, first_country_iso_code, user_agent.full, first_seen, last_seen
```

[!NOTE] If this encounters a timeout, try executing the query again.

You'll note that we are limiting our results to only the top 10 last seen User Agents. This is intentional to limit the number of `COMPLETION` commands executed, as each one will result in a call to our configured external Large Language Model (LLM). Notably, the use of the `COMPLETION` command is in Tech Preview; future revisions of ES|QL may include a means to more practically scale the use of the `COMPLETION` command.

Let's save this search for future reference:

1. Click the `Save` button in the upper-right
2. Set `Title` to

```
ua_release_dates
```

3. Click `Save`

Saving an ES|QL query allows others on our team to easily re-run it on demand. By saving the query, we can also add it to our dashboard!

Adding our table to a dashboard

1. Click `Dashboards` in the left-hand navigation pane
2. Open the `Ingress Status` dashboard (if it isn't already open)
3. Click `Add from library`

4. Find and select `ua_release_dates`
5. Close the fly-out
6. Click `Save` to save the dashboard

Organizing our dashboard

As we are adding panels to our dashboard, we can group them into collapsible sections.

1. Click on `Add panel`
2. Select `Collapsible Section`
3. Click on the Pencil icon to the right of the name of the new collapsible section
4. Name the collapsible section

`User Agent`

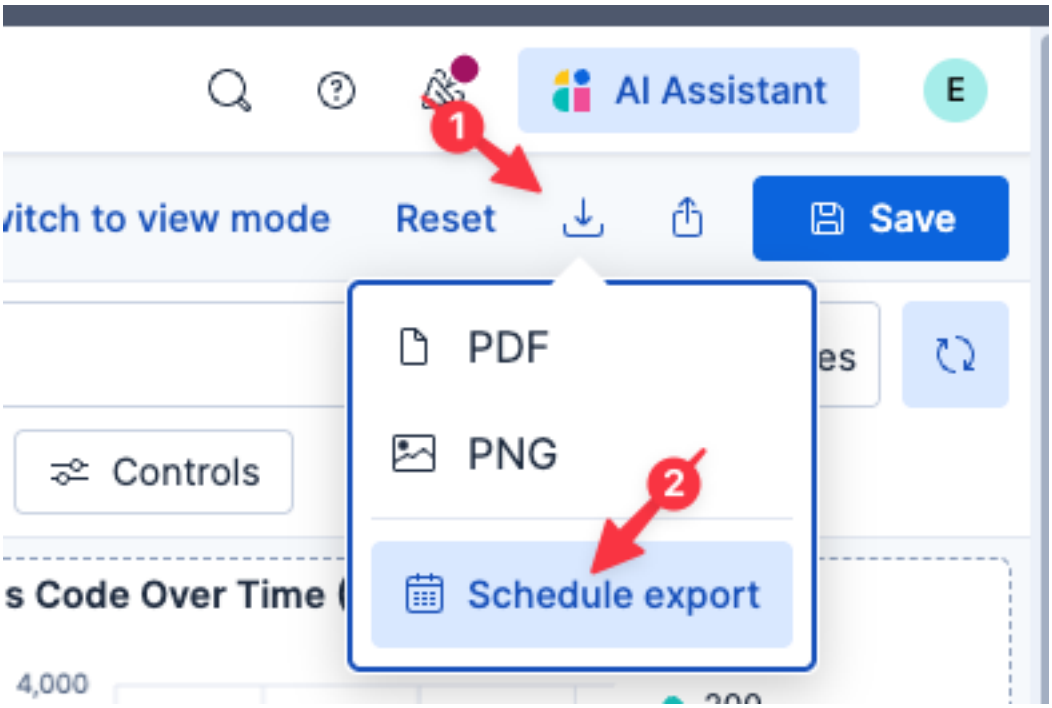
5. Click the green check box next to the name of the collapsible section
6. Open the collapsible section (if it isn't already) by clicking on the open/close arrow to the left of the collapsible section name
7. Drag the `ua_release_dates` table, the `Client Browsers` pie chart, and the `Client OSs` treemap into the body below the `User Agent` collapsible section
8. Click `Save` to save the dashboard

Feel free to create additional collapsible sections to group and organize other visualizations on our dashboard.

Scheduling a report

The CIO is concerned about us not testing new browsers sufficiently, and for some time wants a nightly report of our dashboard. No problem!

1. Click on `Export` icon
2. Select `Schedule exports`
3. Click `Schedule exports` at the bottom-right of the resulting fly-out



Alert when a new UA is seen

Ideally, we can send an alert whenever a new User Agent is seen. To do that, we need to keep state of what User Agents we've already seen. Fortunately, Elastic Transforms makes this easy!

Transforms run asynchronously in the background, querying data, aggregating it, and writing the results to a new index. In this case, we can use a Pivot transform to read from our parsed proxy logs and pivot based on `user_agent.full`. This will create a new index with one record per `user_agent.full`. We can then alert whenever a new record is added to this index, indicating a new User Agent!

Creating a transform

[!NOTE] Because we are moving quickly, Elasticsearch may take some time to update field lists in the UI. If you encounter a situation where Elasticsearch doesn't recognize one of the fields we just parsed, click the Refresh icon in the upper-right of the Instruqt tab and try again to create the Transform.

1. Go to `Management` > `Stack Management` > `Transforms` using the left-hand navigation pane
2. Click `Create your first transform`
3. Select `logs-proxy.otel-default`
4. Select `Pivot` (if not already selected)
5. Set `Search filter` to

```
user_agent.full :*
```

6. Set `Group by` to `terms(user_agent.full)`
7. Add an aggregation for `@timestamp.min`
8. Click `> Next`

Time range

Last 1 hour

Use full data

Search filter

user_agent.full :*

Edit JSON query

Runtime fields

No runtime field

Edit runtime fields

Source documents

Results are limited to a maximum of 10000 for preview purposes

Columns 10/57 Sort fields Histogram charts

1755095800000 - 175... @timestamp	1 category attributes.code.file.path	Chart not supported. attributes.code.file.path....	0 attributes.code.line.num...	Chart not sup body.text
Aug 13, 2025 @ 09:37:5...	proxy.py	proxy.py	0	107.80.111.1
Aug 13, 2025 @ 09:37:5...	proxy.py	proxy.py	0	103.107.52.5
Aug 13, 2025 @ 09:37:5...	proxy.py	proxy.py	0	102.65.25.10
Aug 13, 2025 @ 09:37:5...	proxy.py	proxy.py	0	103.107.52.2
Aug 13, 2025 @ 09:37:5...	proxy.py	proxy.py	0	149.254.212

Rows per page: 5

1 2 3 4 5 ... 2000

Transform configuration

Group by

user_agent.full

Edit JSON config

Add a group by field ...

Aggregations

@timestamp.min

Add an aggregation ...

Preview

Columns 2 Sort fields

user_agent.full	@timestamp.min
Chrome 126.0.6478.222	August 13th 2025, 09:3...
Chrome 127.0.6533.37	August 13th 2025, 09:3...
Chrome 128.0.6613.59	August 13th 2025, 09:3...
Chrome 131.0.6778.27	August 13th 2025, 09:3...
Chrome 133.0.6943.116	August 13th 2025, 09:3...

Rows per page: 5

1 2 3 4 6 7

Next

9. Set the `Transform ID` to

`user_agents`

10. Set `Time field` to `@timestamp.min` (if not already selected)
11. Set `Continuous mode` on
12. Set `Delay` under `Continuous mode` to `0s`
13. Open `Advanced settings`
14. Set the Frequency to `1s` under `Advanced Settings`
15. Click `Next`

Transform ID

user_agents

9

Transform description

Description (optional)

Use transform ID as destination index name

Destination ingest pipeline

Select an ingest pipeline (optional)

Create data view

Time field for data view

10

@timestamp.min

Select a primary time field for use with the global time filter.

11

Continuous mode

Date field for continuous mode

@timestamp

Select the date field that can be used to identify new documents.

Delay

12

0s

Time delay between current time and latest input data time.

Retention policy

Advanced settings

13

Frequency

14

1s

The interval to check for changes in source indices when the transform runs continuously.

Maximum page search size

500

The initial page size to use for the composite aggregation for each checkpoint.

Number of failure retries

The number of retries on a recoverable failure before the transform task is marked as failed. Set it to -1 for infinite retries.

15

Previous

Next

16. Click `Create and start`

[!NOTE] We are intentionally choosing very aggressive settings here strictly for demonstration purposes (e.g., to quickly trigger an alert). In practice, you would use more a more practical frequency, for example.

Our transform is now running every second looking for new User Agents in the `logs-proxy.otel-default` datastream. It is smart enough to only look for new User Agents across log records which have arrived since the last run of the transform. When a new User Agent is seen, a corresponding record is written to the `user_agents` index.

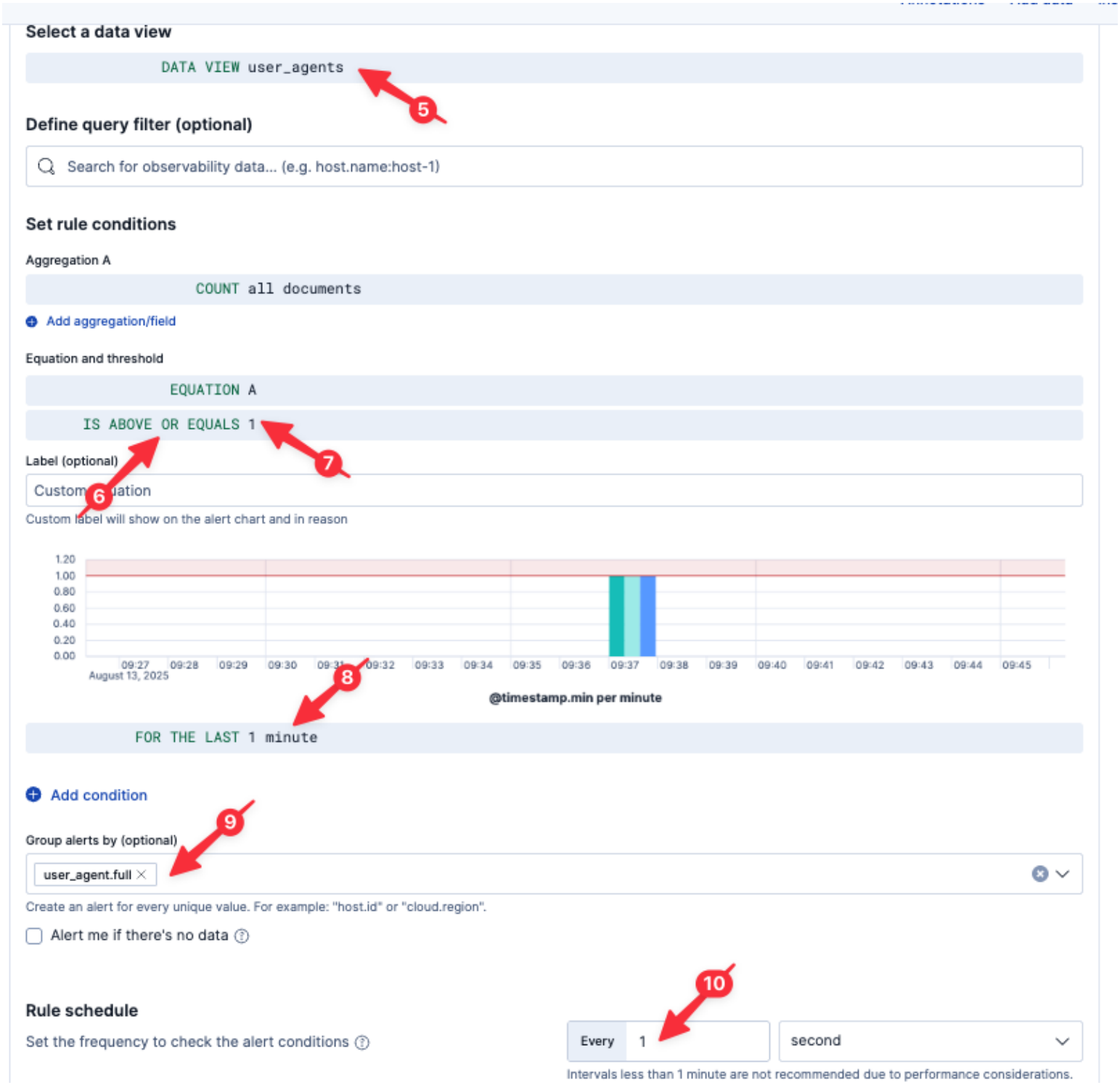
Creating an alert

Let's create a new alert which will fire whenever a new User Agent is seen. We specifically want to alert whenever a new record is written to the `user_agents` index, which in turn is maintained by the transform we just created.

1. Go to `Alerts` using the left-hand navigation pane
2. Click `Manage Rules`
3. Click `Create Rule`
4. Select `Custom threshold`
5. Set `DATA VIEW` to `user_agents`
6. Change `IS ABOVE` to `IS ABOVE OR EQUALS`
7. Set `IS ABOVE OR EQUALS` to `1`
8. Set `FOR THE LAST` to `1 minute`
9. Set `Group alerts by (optional)` to

`user_agent.full`

10. Set `Rule schedule` to `1 seconds`



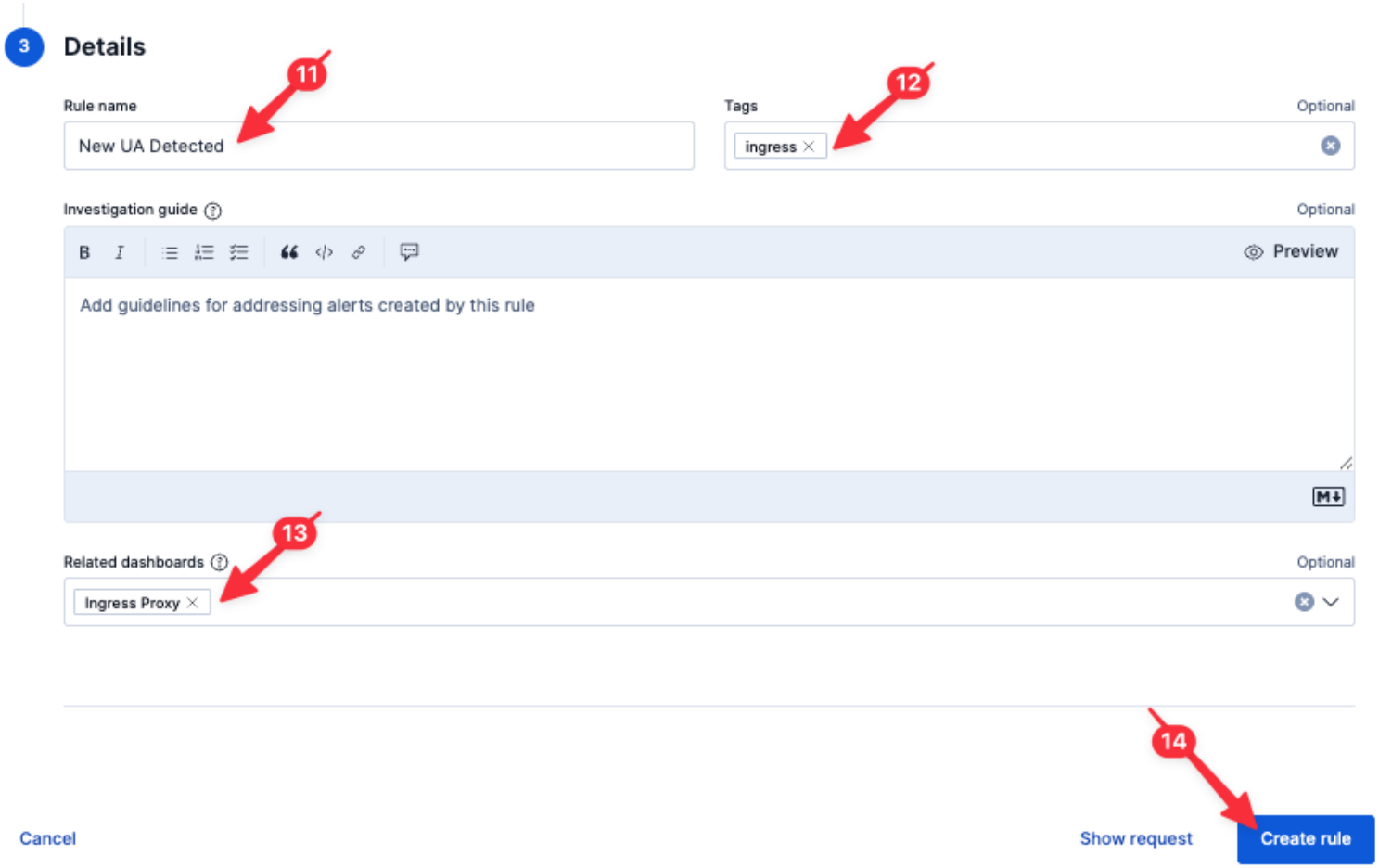
11. Set `Rule name` to

```
New UA Detected
```

12. Set `Tags` to

```
ingress
```

13. Set `Related dashboards` to `Ingress Proxy`
14. Click `Create rule`
15. Click `Save rule` in the resulting pop-up



[!NOTE] We are intentionally choosing very aggressive settings here strictly for demonstration purposes (e.g., to quickly trigger an alert). In practice, you would use more a more practical frequency, for example.

Testing our alert

1. Open the button label="Terminal" Instruqt tab
2. Run the following command:

```
curl -X POST http://kubernetes-vm:32003/err/browser/chrome
```

This will create a new Chrome UA v137. Let's go to our dashboard and see if we can spot it.

1. Open the button label="Elasticsearch" Instruqt tab
2. Go to `Dashboards` using the left-hand navigation pane
3. Open `Ingress Proxy` (if it isn't already open)

Look at the table of UAs that we added and note the addition of Chrome v137! You'll also note a new active alert `New UA Detected`!

Summary

Let's take stock of what we know:

- a small percentage of requests are experiencing 500 errors
- the errors started occurring around 80 minutes ago
- the only error type seen is 500
- the errors occur over all APIs
- the errors occur only in the `TH` region
- the errors occur only with browsers based on Chrome v136

And what we've done:

- Created a dashboard to monitor our ingress proxy
- Created graphs to monitor status codes over time
- Created a simple alert to let us know if we ever return non-200 error codes
- Parsed the logs at ingest-time for quicker and more powerful analysis
- Create a SLO (with alert) to let us know if we ever return a significant number of non-200 error codes over time

- Created visualizations to help us visually locate clients and errors
- Created graphs in our dashboard showing the breakdown of User Agents
- Created a table in our dashboard iterating seen User Agents
- Created a nightly report to snapshot our dashboard
- Created an alert to let us know when a new User Agent string appears ____

Sometimes our data contains PII information which needs to be restricted to a need-to-know basis and kept only for a limited time.

Limiting access

With Elastic's in-built support for RBAC, we can limit access at the index, document, or field level.

In this example, we've created a limited_user with a limited_role which restricts access to the `client.ip` and `body.text` fields (to avoid implicitly leaking the `client.ip`).

In the Elasticsearch tab, we are logged in as a user with full privileges. Let's check our access. 1. Open the button label="Elasticsearch" tab 2. Open a log record and click on the `Table` tab in the flyout 3. Note access to the `client.ip` and `body.text` fields

In the Elasticsearch (Limited) tab, we are logged in as a user with limited privileges. Let's check our access.

1. Open the button label="Elasticsearch (Limited)" tab
2. Open a log record and click on the `Table` tab in the flyout
3. Note that `client.ip` and `body.text` fields don't exist

Let's change permissions and see what happens:

1. Open the button label="Elasticsearch" tab
2. Go to `Management` > `Stack Management` > `Security` > `Roles` using the left-hand navigation pane
3. Select `limited_viewer`
4. For Indices `logs-proxy.otel-default`, update `Denied fields` to remove `body.text` (it should only contain `client.ip`)
5. Click `Update role`

Now let's ensure our limited user has access to `body.text`.

1. Open the button label="Elasticsearch (Limited)" Instruqt tab
2. Close the open log record flyout
3. Run the search query again
4. Open a log record
5. Note that `client.ip` doesn't exist, but `body.text` now does!

Limiting retention

Say your records department requires you to keep these logs generally accessible only for a very specific period of time. We can ask Elasticsearch to automatically delete them after some number of days.

1. Open the button label="Elasticsearch" Instruqt tab
2. Go to `Streams` using the left-hand navigation pane
3. Select `logs-proxy.otel-default` from the list of Streams
4. Click on the `Data retention` tab
5. Click `Edit data retention`
6. Select `Set specific retention days`
7. Set to `30` days

Elasticsearch will now remove this data from its online indices after 30 days. At that time, it will only be available in backups.

Summary

Let's take stock of what we know:

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- Created visualizations to help us visually locate clients and errors
- Created graphs in our dashboard showing the breakdown of User Agents
- Created a table in our dashboard iterating seen User Agents
- Created a nightly report to snapshot our dashboard
- Created an alert to let us know when a new User Agent string appears
- Setup RBAC to restrict access to `client.ip`
- Setup retention to keep the logs online for only 30 days

Wrap-Up

Over the course of this lab, we learned about:

- Using ES|QL to search logs
- Using ES|QL to parse logs at query-time
- Using ES|QL to do advanced aggregations, analytics, and visualizations
- Creating a dashboard
- Using ES|QL to create Alerts
- Using AI Assistant to help write ES|QL queries
- Using Streams to setup ingest-time log processing pipeline (GROK parsing, geo-location, User Agent parsing)
- Setting up SLOs
- Using Maps to visualize geographic information
- Scheduling dashboard reports
- Setting up a Pivot Transform and Alert
- Setting up RBAC
- Setting up data retention

We put these technologies to use in a practical workflow which quickly took us from an unknown problem to a definitive Root Cause. Furthermore, we've setup alerts to ensure we aren't caught off-guard in the future. Finally, we built a really nice custom dashboard to help us monitor the health of our Ingress Proxy.

All of this from just a lowly nginx access file. That's the power of your logs unlocked by Elastic. ____