Understand, Visualize & Improve Continuous Integration
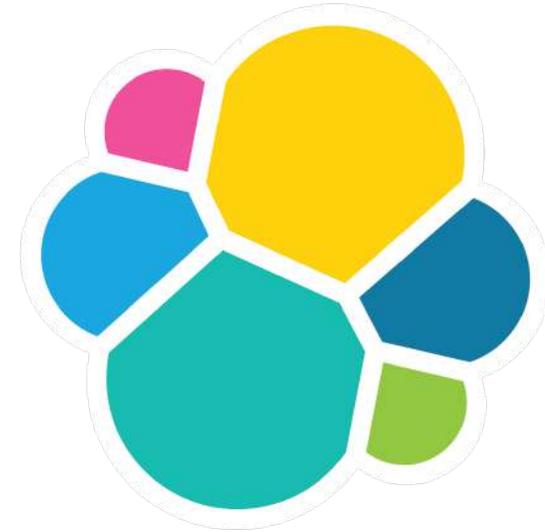
Alexander Reelsen

Community Advocate
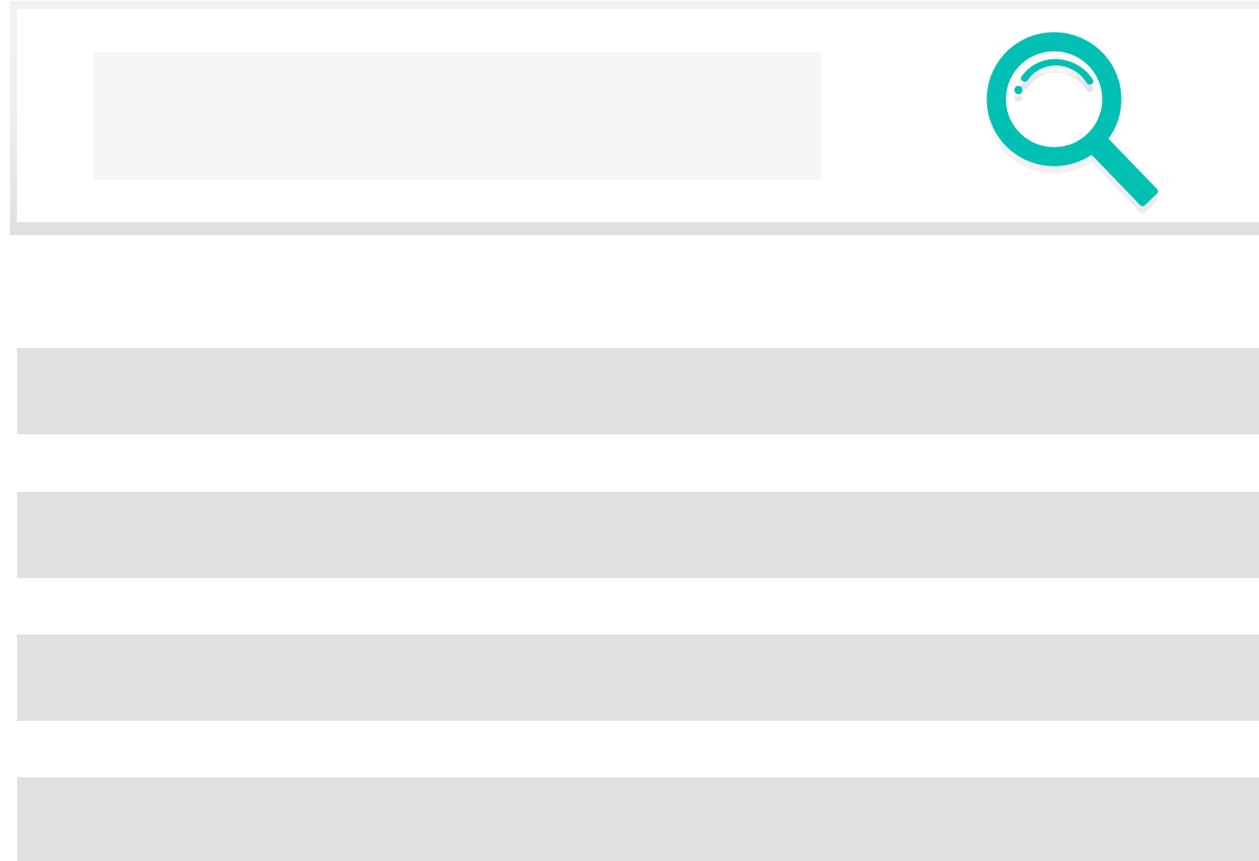
alex@elastic.co | @spinscale

How do you act on your CI data?

Everything is a search problem!

Ecommerce

Social networks

File Search

Location Search

Observability

3 solutions

Elastic Enterprise Search   Elastic Observability   Elastic Security

Powered by the stack

Kibana

Elasticsearch

Beats   Logstash

Deployed anywhere

Elastic Cloud   Elastic Cloud Enterprise   Elastic Cloud on Kubernetes
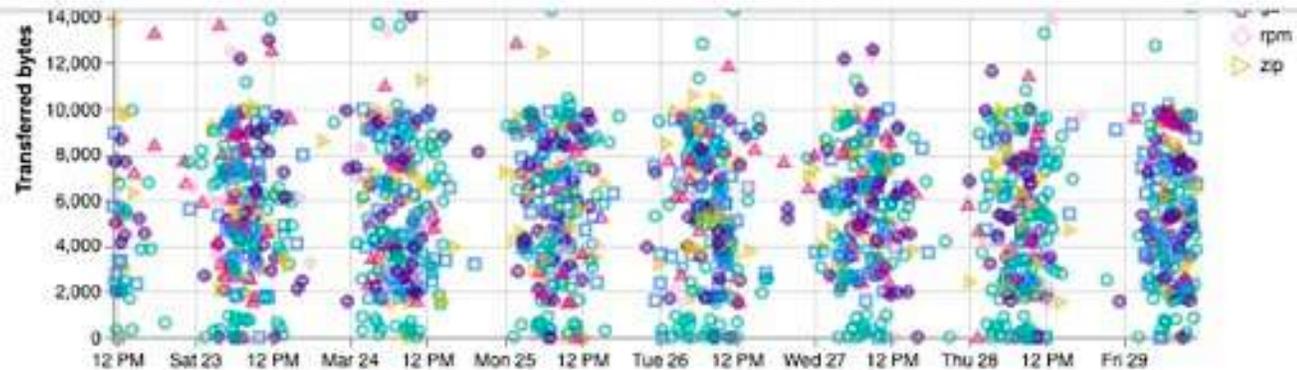
SaaS   Orchestration

elastic

Elasticsearch in one minute

- Search Engine (FTS, Analytics, Geo), near real-time
- Distributed, scalable, highly available, resilient
- Interface: HTTP & JSON
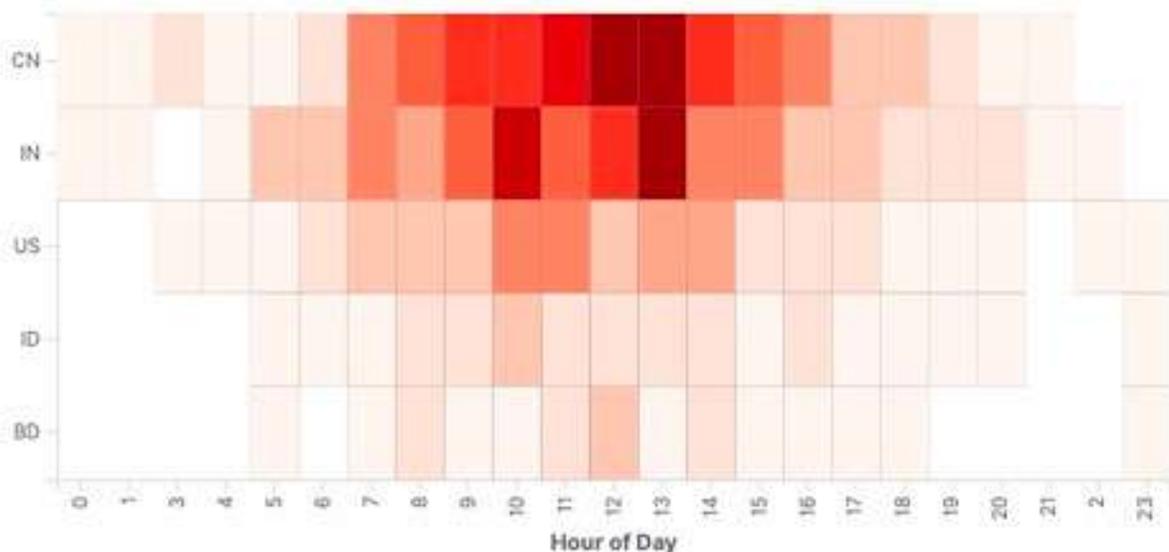- Heart of the Elastic Stack (Kibana, Logstash, Beats)

Kibana in one minute

- The window into the Elastic Stack

- Visualization & Dashboarding

- Management

- Monitoring

gz	1.594MB	34.493KB	283 ↓	7 ↓
css	1.385MB	12.378KB	270 ↓	2 ↓
zip	1.257MB	6.654KB	212 ↓	3 ↓
deb	1.085MB	6.844KB	173 ↓	1 ↓
rpm	458.989KB	0B	71 ↓	0 ↓

[Logs] Heatmap

[Vega] Source and Destination Sankey Chart

IN → CN 55 (3.4%)

[Logs] Unique Visitors by Country
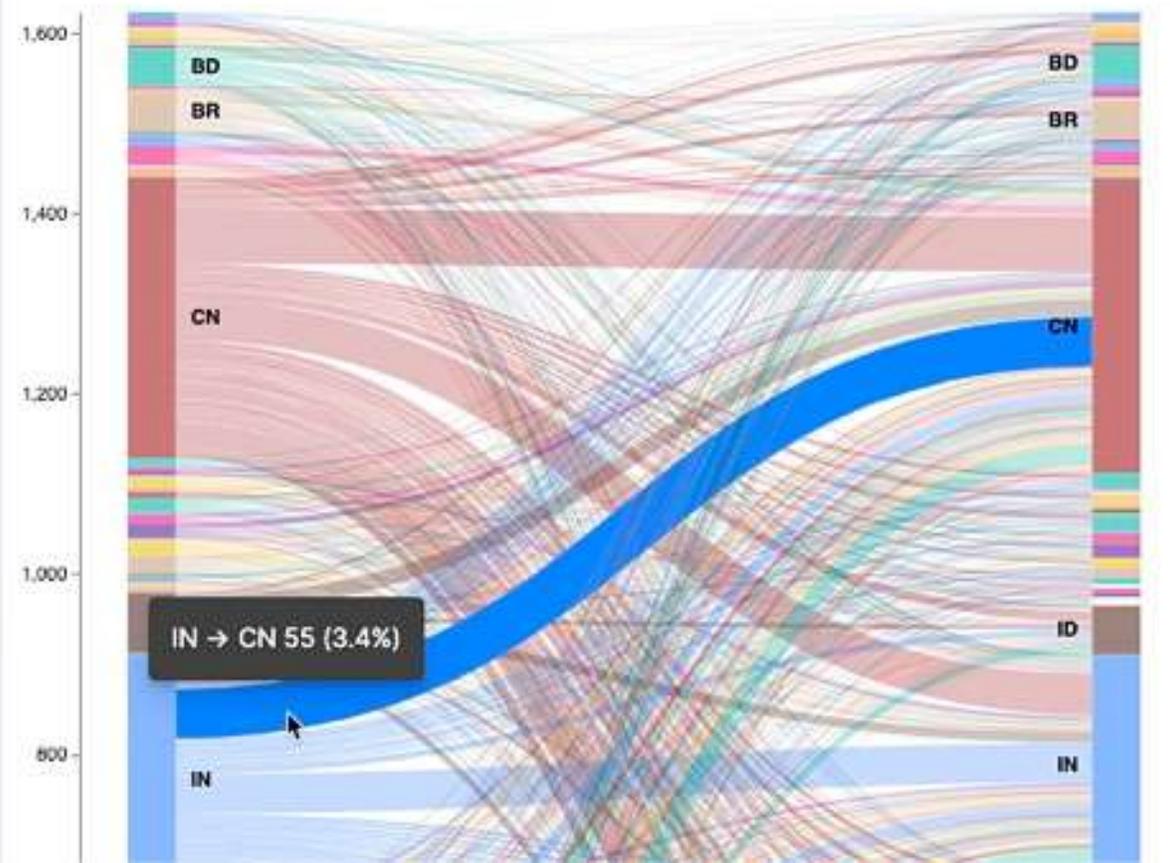
Filters   Search   KQL   Last 7 days   Show dates   ⟳ Refresh

＋ Add filter

Unique Visitors
- 5 – 69
- 69 – 133
- 133 – 197
- 197 – 261

© OpenStreetMap contributors, Elastic Maps Service , Made with NaturalEarth

2019-04-06 00:00   2019-04-07 00:00   2019-04-08 00:00   2019-04-09 00:00   2019-04-10 00:00   2019-04-11 00:00   2019-04-12 00:00   2019-04-13 00:00   2019-04-14 00:00

per 4 hours

100
75
50
25
0

● 200 2   ● 404 1   ● 503 0
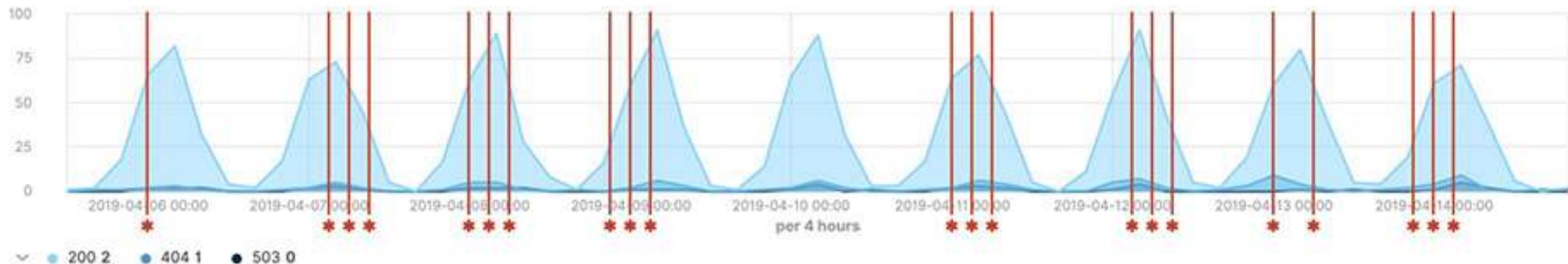
Auto apply   The changes will be automatically applied.

...

Data   Panel options   **Annotations**

Data sources

Index pattern (required)

kibana_sample_data_logs

Time field (required)

timestamp

Query string

tags:error AND tags:security

Ignore global filters?   **Ignore panel filters?**

● Yes ○ No   ● Yes ○ No

Icon (required)

Asterisk

Fields (required – comma separated paths)

geo.src, host

Row template (required)

Security Error from {{geo.src}} on {{host}}

eg. `{{field}}`

Single time series analysis of sum count

☑ show model bounds   ☑ annotations

Zoom: auto 1w 2w 1M   (aggregation interval: 1h, bucket span: 15m)
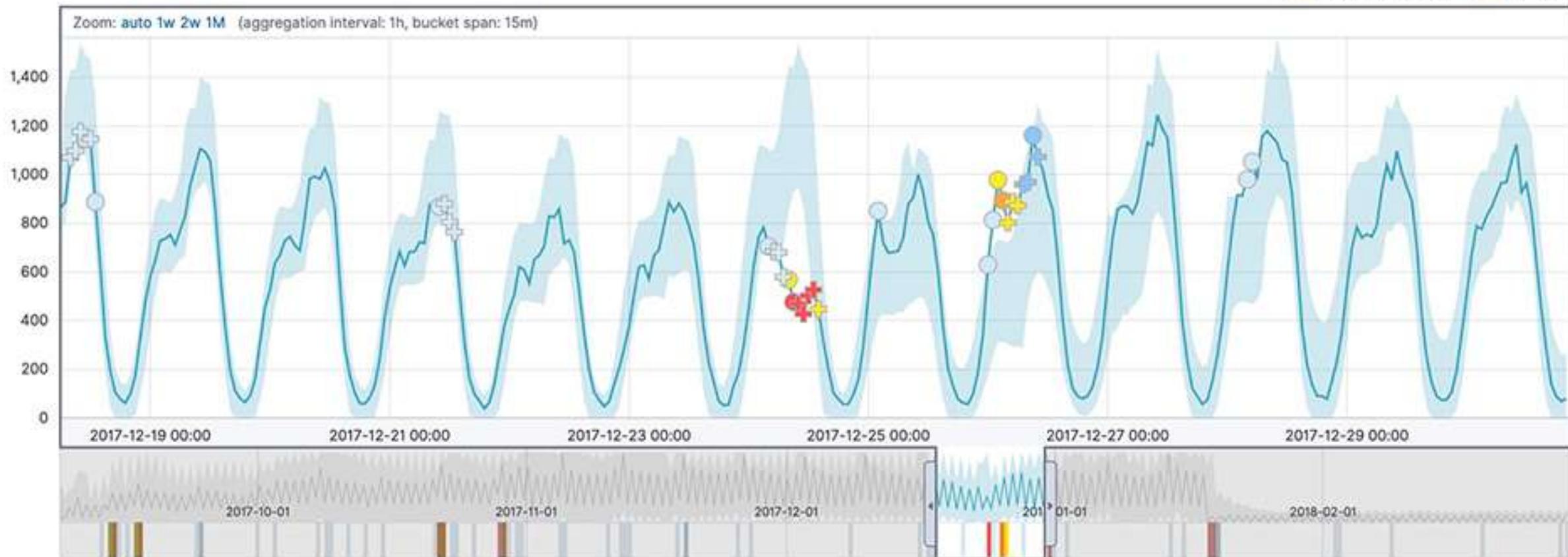
Anomalies

Severity threshold

● minor ▼

Interval

Auto ▼

	time	max severity ↓	detector	actual	typical	description	actions
›	December 24th 2017, 11:00	● 96	non_zero_count	393	1186	↓ 3x lower	⚙
›	December 24th 2017, 10:00	● 92	non_zero_count	437	1242.5	↓ 3x lower	⚙
›	December 24th 2017, 12:00	● 90	non_zero_count	401	1122.8	↓ 2x lower	⚙
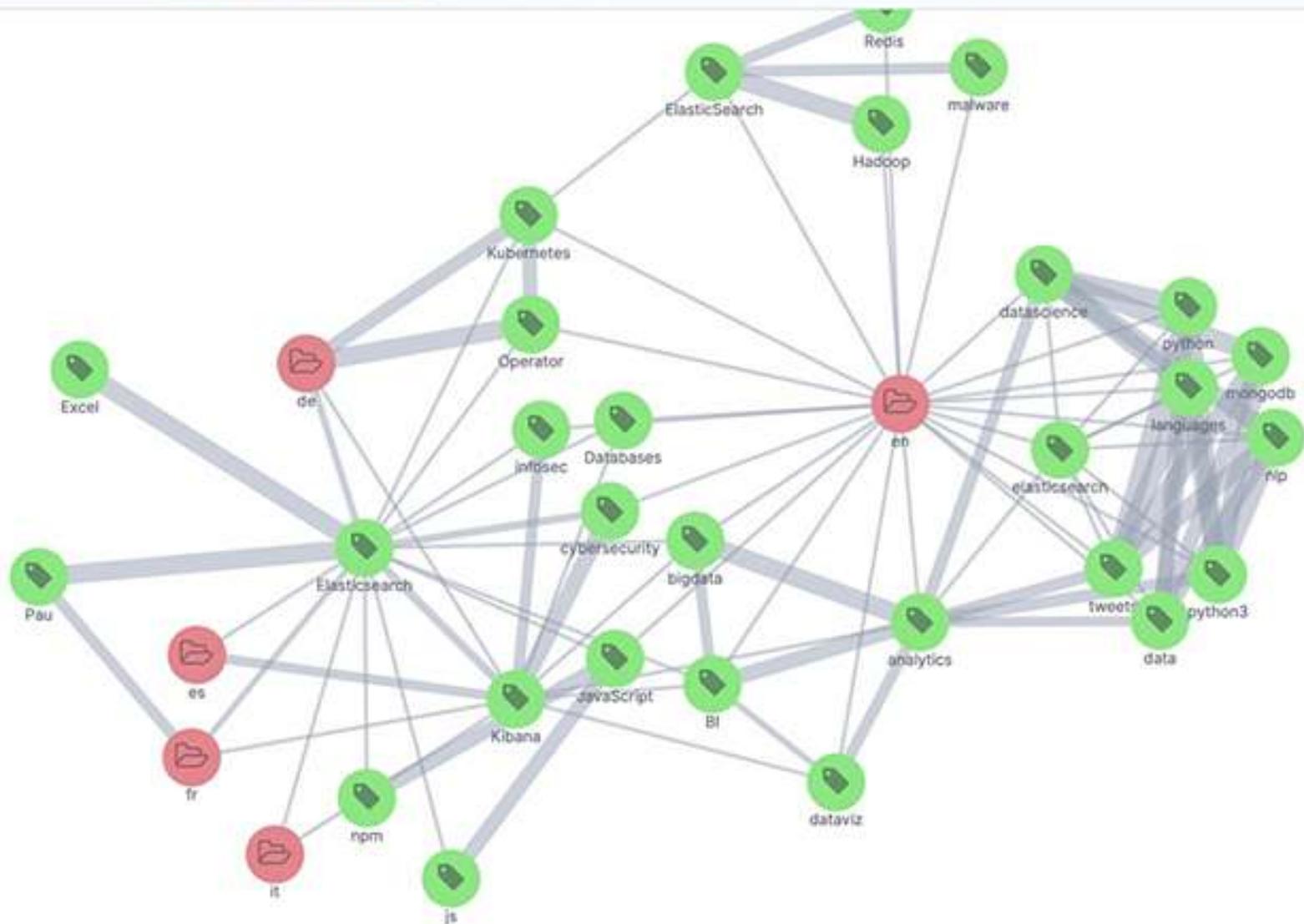
Save

∨   Search   KQL   📅 ∨   Last 7 days   Show dates   ◁ι Update

— + Add filter

kibana_sample_data_logs ∨

🔍 Search for fields   ⊗

⊜ Fields filtered   0

⌇ agent.keyword

byte🖐   ⓘ

⊞ clientip

⌇ event.dataset

⌇ extension.keyword

⌇ geo.dest
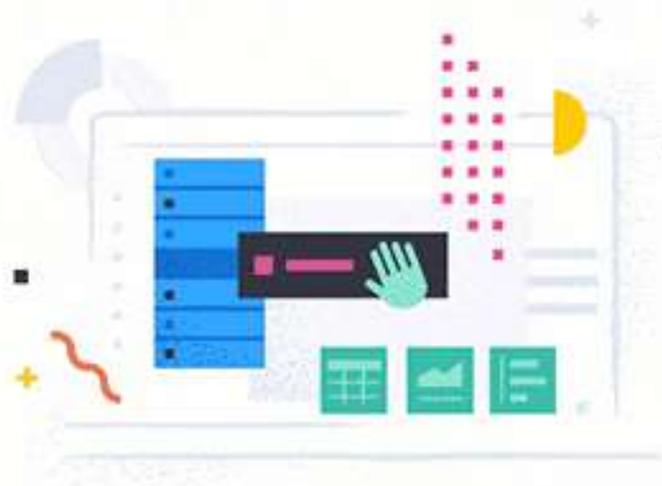
⌇ geo.src

⌇ geo.srcdest

⌇ host.keyword

⌇ index.keyword

⊞ ip

New visualization

Drop some fields here to start

Lens is a new tool for creating visualizations   BETA

Make requests and give feedback 🔗

📊 Stacked Bar Chart ∨

📊 kibana_sample_data_logs ∨

X-axis

⊕ Drop a field here

Y-axis

⊕ Drop a field here

Split series

⊕ Drop a field here

⊕

Survey time!

CI Tooling

- Jenkins, JenkinsX, TeamCity, Bamboo

- Travis, CircleCI, GitLab CI

- Azure Pipelines, AWS CI/CD, Google CI/CD

- Others?

CI infrastructure

- Self Hosted on own infrastructure
- Self Hosted in the cloud
- CI-as-a-service

CI as a role

- CI is part of ops role
- CI is part of dev role
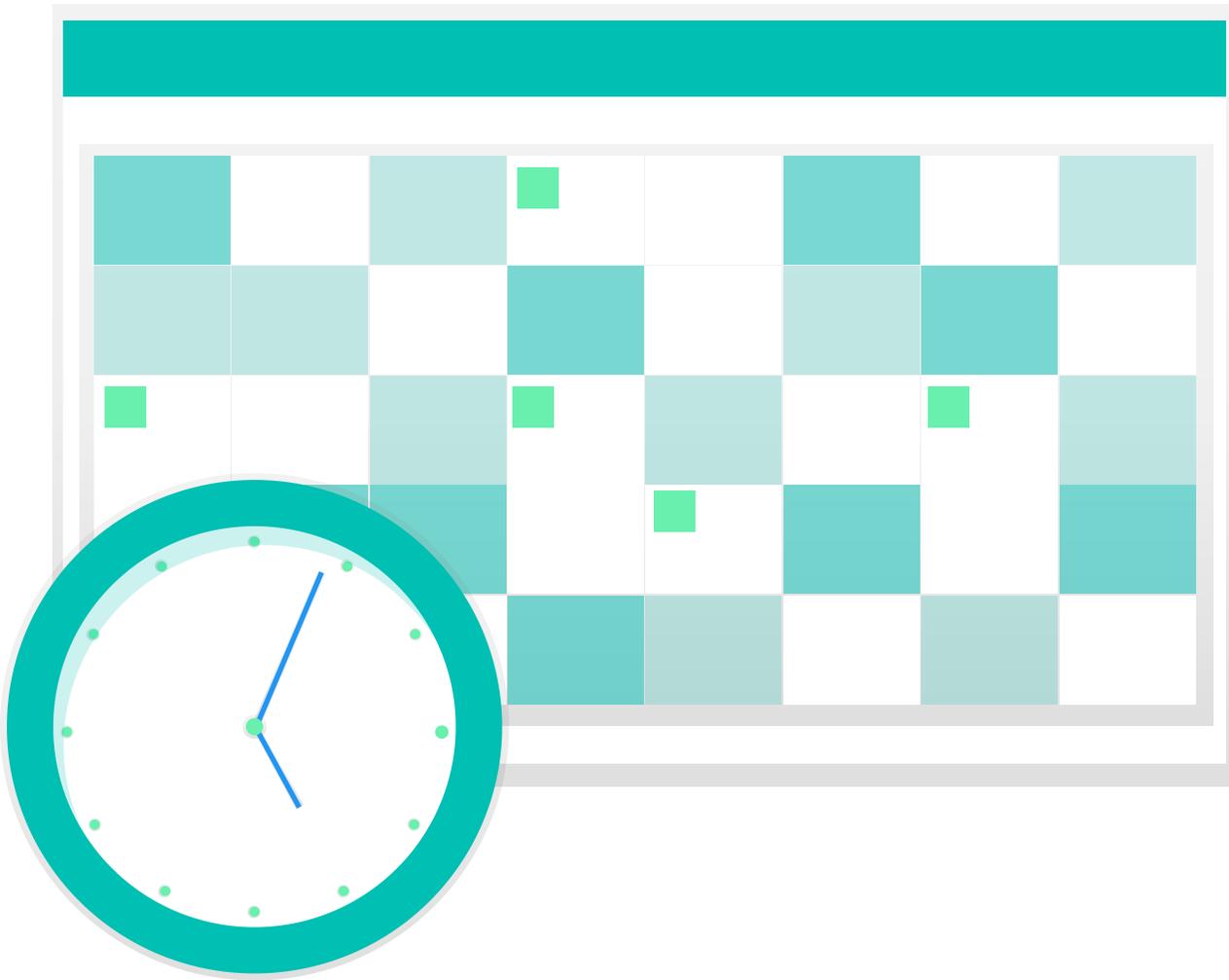- Infrastructure Engineer
- Build Engineer

Test test test

- dev branches (master, 7.x)
- release branches (7.8, 6.8)
- feature branches
- PRs
- BWC
- Benchmarking
- Packaging tests
- JVM versions
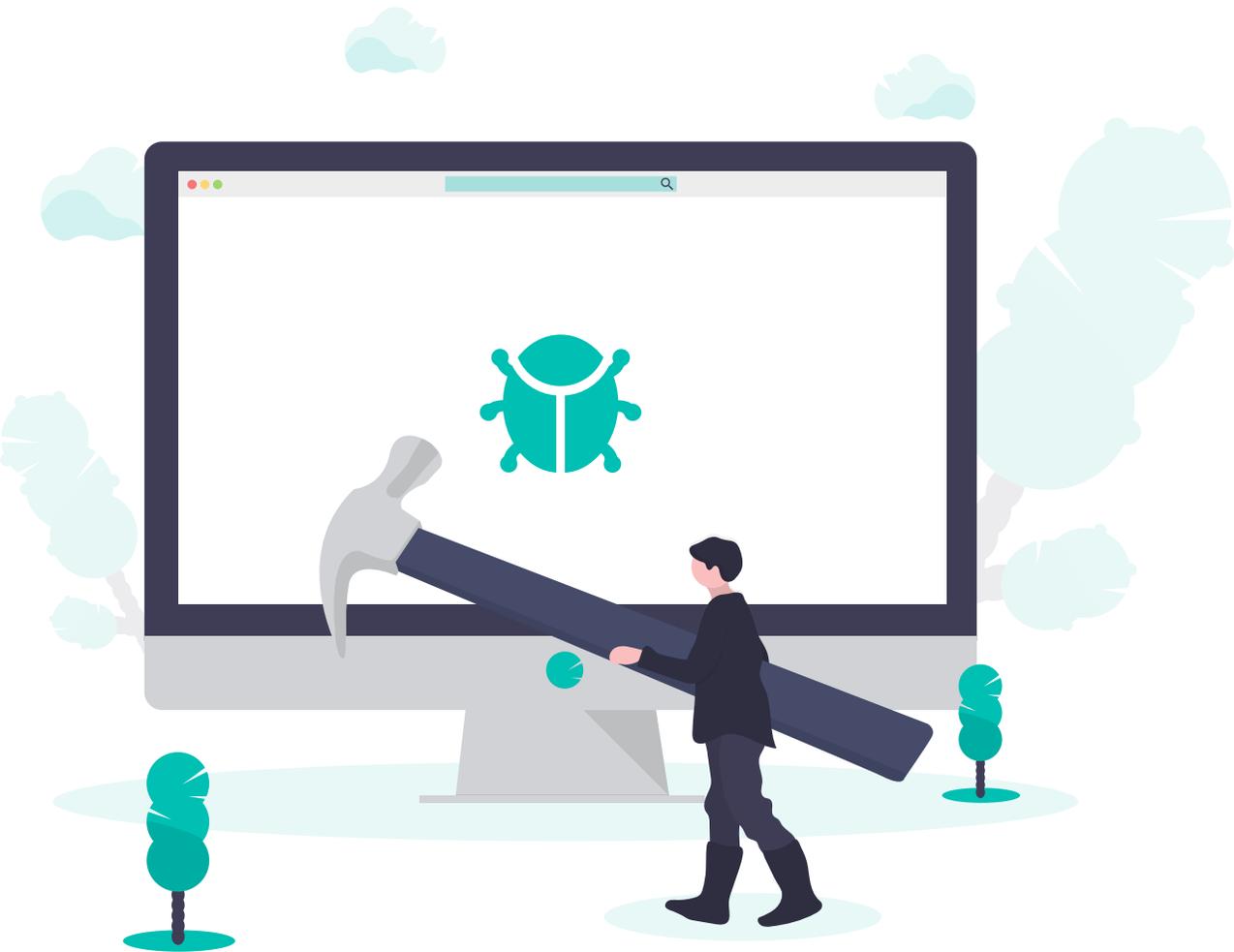- Garbage collectors
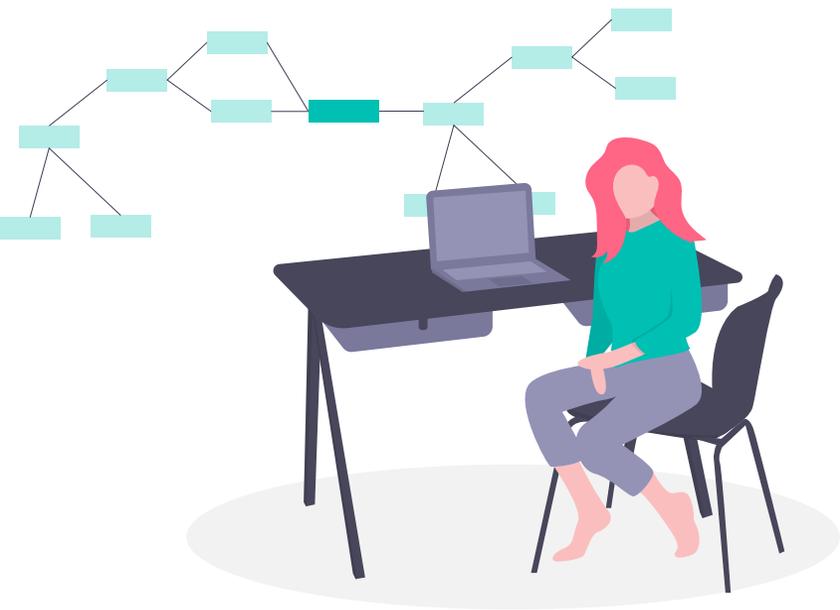- Operating systems

Do you act on CI results?

- If so, how?

What is CI data?

- Time series
- Recency
- Locality
- Fragmentation

CI output

- unstructured
- huge
- needle in the haystack (`TRACE` loglevel)
- requires postprocessing
- security

Analyzing CI results

- Detect seemingly random bugs
- Centralised lookup ability for the team
- Emails are not a good CI status medium
- Long term trends (failures, test count, coverage)

Requirements

- meta data enrichment - per branch, per test run, per test method run, failures only

- data model should be based on search requirements (query optimized)

- define search ability: by timestamp, by branch, by class, by test method, by success/failure
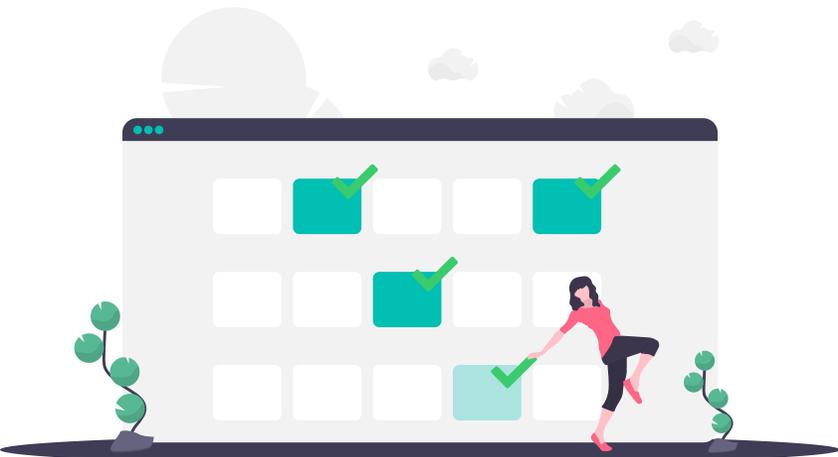
Ask your data

Did this test fail earlier this month?
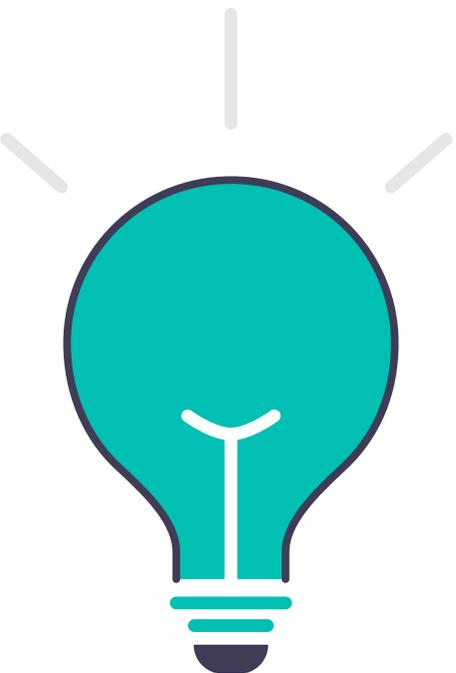
Ask your data

> Show me all failed test runs of this class
> in this branch in the last month
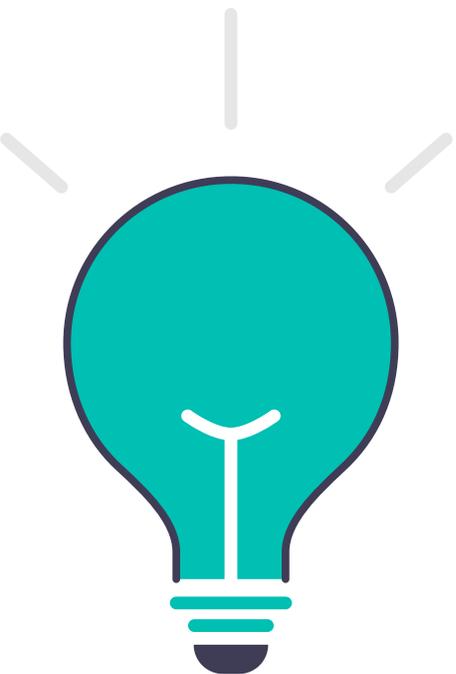
Ask your data

Is this test failing only under this OS?

Ask your data

> Is our test count increasing compared to our SLOC count?

Ask your data

> Are our successful test runs decreasing
> since we doubled the team size?

Ask your data

> Do the holidays/OOO hours have impact on our CI? Can we reduce costs?

crystal spec

Structure test output

- xUnit

- Test Anything Protocol

elastic

TAP


```
elastic/community/slack-command-community  master ✓  crystal spec --tap
ok 1 - CustomLogHandler should not log access to '/' endpoint
ok 2 - CustomLogHandler should log access to any other endpoint
ok 3 - Objects Event can retrieve html_url
ok 4 - Objects Event can retrieve region
ok 5 - Objects Event can retrieve topics
ok 6 - Objects Event can retrieve country
ok 7 - Objects Event can retrieve languages
ok 8 - Objects Event can retrieve focus
ok 9 - Objects Event can retrieve date
ok 10 - Objects Event can retrieve last updated timestamp
ok 11 - Objects Event can retrieve created at timestamp
ok 12 - Objects Event can retrieve state
ok 13 - Objects Event can retrieve title
ok 14 - Objects Event can retrieve body
ok 15 - Objects Event can retrieve id
ok 16 - Objects Event can retrieve number
ok 17 - Objects Event matches when all tags are in event
ok 18 - Objects Event does not match when not all tags are in event
ok 19 - Objects Event does not match when tags are empty
ok 20 - Objects NotificationUser should match subscriptions
ok 21 - Objects NotificationUser should ignore accepted events
ok 22 - Objects NotificationUser should not subscriptions issues that already were notified about
ok 23 - Objects NotificationUser should not emit duplicate events if event matches twice
ok 24 - Objects NotificationUser should not notify about events in the past
ok 25 - Objects NotificationUser should only include events that are within not earlier than three days of current date
ok 26 - Elastic::CFP should be able to calculate next duration
ok 27 - Elastic::CFP Elastic::CFP::GithubClient should be able to retrieve labels
ok 28 - Elastic::CFP Elastic::CFP::GithubClient should be able to retrieve labels via pagination
ok 29 - Elastic::CFP Elastic::CFP::GithubClient should be able to filter out irrelant labels
ok 30 - Elastic::CFP Elastic::CFP::GithubClient should be able to retrieve events
ok 31 - Elastic::CFP Elastic::CFP::GithubClient should be able to retrieve events and paginate
ok 32 - Elastic::CFP Elastic::CFP::SlackClient request verification should pass on matching signatures
ok 33 - Elastic::CFP Elastic::CFP::SlackClient request verification should detect replay attacks
ok 34 - Elastic::CFP Elastic::CFP::SlackClient request verification should raise on not matching signatures
ok 35 - Elastic::CFP Elastic::CFP::SlackClient can reply to a response URL with a message
ok 36 - Elastic::CFP Elastic::CFP::SlackClient can reply without attachments
ok 37 - Elastic::CFP Elastic::CFP::ElasticsearchClient can subscribe to a new list of tags
ok 38 - Elastic::CFP Elastic::CFP::ElasticsearchClient can unsubscribe from a single subscription
ok 39 - Elastic::CFP Elastic::CFP::ElasticsearchClient returns error if users tries to unsubscribe from unknown subscription
ok 40 - Elastic::CFP Elastic::CFP::ElasticsearchClient can retrieve notifications for user id
ok 41 - Elastic::CFP Elastic::CFP::ElasticsearchClient can retrieve all notifications
ok 42 - Elastic::CFP Elastic::CFP::ElasticsearchClient can add a notification to user data on version
ok 43 - Elastic::CFP Elastic::CFP::ElasticsearchClient can retrieve stats
ok 44 - MatchService should not send notifications when there are no users
ok 45 - MatchService should not send notifications when there are no events
ok 46 - MatchService should send notifications
ok 47 - SlackMessageProcessor should return unknown command error in response
ok 48 - SlackMessageProcessor should return help message to response
ok 49 - SlackMessageProcessor should return help message when text ends on help
ok 50 - SlackMessageProcessor should return error with empty tags
ok 51 - SlackMessageProcessor should return list tags to response
ok 52 - SlackMessageProcessor should list subscriptions via return URL
ok 53 - SlackMessageProcessor should tell when no subscriptions are found
ok 54 - SlackMessageProcessor should add a subscription via return URL
ok 55 - SlackMessageProcessor should show a help when calling /community events subscribe
ok 56 - SlackMessageProcessor should show a help when calling /community events unsubscribe
ok 57 - SlackMessageProcessor should not add a subscription based on unknown tags
ok 58 - SlackMessageProcessor should return an error when trying subscribe on two same tags
ok 59 - SlackMessageProcessor should delete a subscription via return URL
ok 60 - SlackMessageProcessor should show unreplied posts on discourse
ok 61 - DiscourseClient should retrieve noreplied posts and categories
ok 62 - DiscourseClient should paginate when more than one page is retrieved
1..62
```
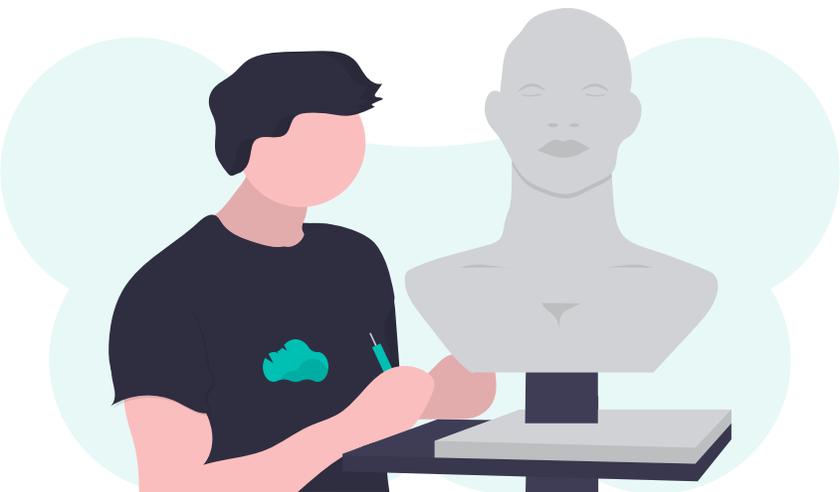
elastic

xUnit output

```xml
<?xml version="1.0"?>
<testsuite tests="62" skipped="0" errors="0" failures="0" time="0.261869582"
  timestamp="2020-07-21T12:43:50Z" hostname="rhincodon">

  <testcase file="/Users/alr/devel/elastic/community/slack-command-community/spec/custom_log_handler_spec.cr"
    classname="spec.custom_log_handler_spec" name="CustomLogHandler should not log access to &#39;/&#39;
    endpoint" time="3.6394e-5"/>
  <testcase file="/Users/alr/devel/elastic/community/slack-command-community/spec/custom_log_handler_spec.cr"
    classname="spec.custom_log_handler_spec" name="CustomLogHandler should log access to any other endpoint"
    time="0.000250577"/>
  <testcase file="/Users/alr/devel/elastic/community/slack-command-community/spec/objects_spec.cr"
    classname="spec.objects_spec" name="Objects Event can retrieve html_url" time="7.589e-6"/>
  <testcase file="/Users/alr/devel/elastic/community/slack-command-community/spec/objects_spec.cr"
    classname="spec.objects_spec" name="Objects Event can retrieve region" time="7.438e-6"/>
```

elastic

That's it - right?

- Map standard output/error to tests

- Map logger output to tests

- Add run specific meta data (branch, OS, JVM)

- Indexing/Storing strategy

- Preaggregate data (test count, success/failure, failed tests)

- Code coverage metrics

elastic

Index data into Elasticsearch

- Massage output data into proper JSON

- logstash/ `xml2json` /self written tool?

- Integration with CI

elastic

Java Output (file per class)

```xml
<?xml version="1.0" encoding="UTF-8"?>
<testsuite name="co.elastic.community.AdminServiceTests" tests="2"
    skipped="0" failures="0" errors="0" timestamp="2020-07-14T11:32:02"
    hostname="rhincodon" time="0.016">
  <properties/>

  <testcase name="testDefaultAdminService()"
    classname="co.elastic.community.AdminServiceTests" time="0.015"/>
  <testcase name="testCustomAdminService()"
    classname="co.elastic.community.AdminServiceTests" time="0.001"/>

  <system-out><![CDATA[TEST TEST TEST
]]></system-out>
  <system-err><![CDATA[]]></system-err>
</testsuite>
```

Java Output (test failure)

```xml
<?xml version="1.0" encoding="UTF-8"?>
<testsuite name="co.elastic.community.AdminServiceTests" tests="2" skipped="0"
  failures="1" errors="0" timestamp="2020-07-14T11:36:54" hostname="rhincodon" time="0.022">
  <properties/>
  <testcase name="testDefaultAdminService()" classname="co.elastic.community.AdminServiceTests" time="0.021">
    <failure
      message="org.opentest4j.AssertionFailedError: &#10;Expecting:&#10; &lt;true&gt;&#10;to be equal to:&#10; &lt;false&gt;&#10;but was not."
      type="org.opentest4j.AssertionFailedError">org.opentest4j.AssertionFailedError:
Expecting:
 &lt;true&gt;
to be equal to:
 &lt;false&gt;
but was not.
  at java.base/jdk.internal.reflect.NativeConstructorAccessorImpl.newInstance0(Native Method)
  at java.base/jdk.internal.reflect.NativeConstructorAccessorImpl.newInstance(NativeConstructorAccessorImpl.java:62)
  at java.base/jdk.internal.reflect.DelegatingConstructorAccessorImpl.newInstance(DelegatingConstructorAccessorImpl.java:45)
  at java.base/java.lang.reflect.Constructor.newInstanceWithCaller(Constructor.java:500)
  at co.elastic.community.AdminServiceTests.testDefaultAdminService(AdminServiceTests.java:13)

  ...
```

Crystal Output (single XML file)

```xml
<?xml version="1.0"?>
<testsuite tests="62" skipped="0" errors="0" failures="1" time="0.258457318"
  timestamp="2020-07-14T11:26:23Z" hostname="rhincodon">

  <testcase file="/Users/alr/devel/elastic/community/slack-command-community/spec/custom_log_handler_spec.cr"
    classname="spec.custom_log_handler_spec"
    name="CustomLogHandler should not log access to &#39;/&#39; endpoint" time="3.1523e-5"/>
  <testcase file="/Users/alr/devel/elastic/community/slack-command-community/spec/custom_log_handler_spec.cr"
    classname="spec.custom_log_handler_spec"
    name="CustomLogHandler should log access to any other endpoint" time="0.000282161">
    <failure message="Expected: 2
     got: 1">../../../../../../usr/local/Cellar/crystal/0.35.1_1/src/spec/methods.cr:76:5 in &#39;fail&#39;
../../../../../../usr/local/Cellar/crystal/0.35.1_1/src/spec/expectations.cr:447:9 in &#39;should&#39;
spec/custom_log_handler_spec.cr:33:5 in &#39;->&#39;
../../../../../../usr/local/Cellar/crystal/0.35.1_1/src/primitives.cr:255:3 in &#39;internal_run&#39;
../../../../../../usr/local/Cellar/crystal/0.35.1_1/src/spec/example.cr:33:16 in &#39;run&#39;
../../../../../../usr/local/Cellar/crystal/0.35.1_1/src/spec/context.cr:18:23 in &#39;internal_run&#39;
../../../../../../usr/local/Cellar/crystal/0.35.1_1/src/spec/context.cr:330:7 in &#39;run&#39;
../../../../../../usr/local/Cellar/crystal/0.35.1_1/src/spec/context.cr:18:23 in &#39;internal_run&#39;
../../../../../../usr/local/Cellar/crystal/0.35.1_1/src/spec/context.cr:147:7 in &#39;run&#39;
../../../../../../usr/local/Cellar/crystal/0.35.1_1/src/spec/dsl.cr:270:7 in &#39;->&#39;
../../../../../../usr/local/Cellar/crystal/0.35.1_1/src/primitives.cr:255:3 in &#39;run&#39;
../../../../../../usr/local/Cellar/crystal/0.35.1_1/src/crystal/main.cr:45:14 in &#39;main&#39;
../../../../../../usr/local/Cellar/crystal/0.35.1_1/src/crystal/main.cr:114:3 in &#39;main&#39;</failure>
  </testcase>

  ...
</testsuite>
```
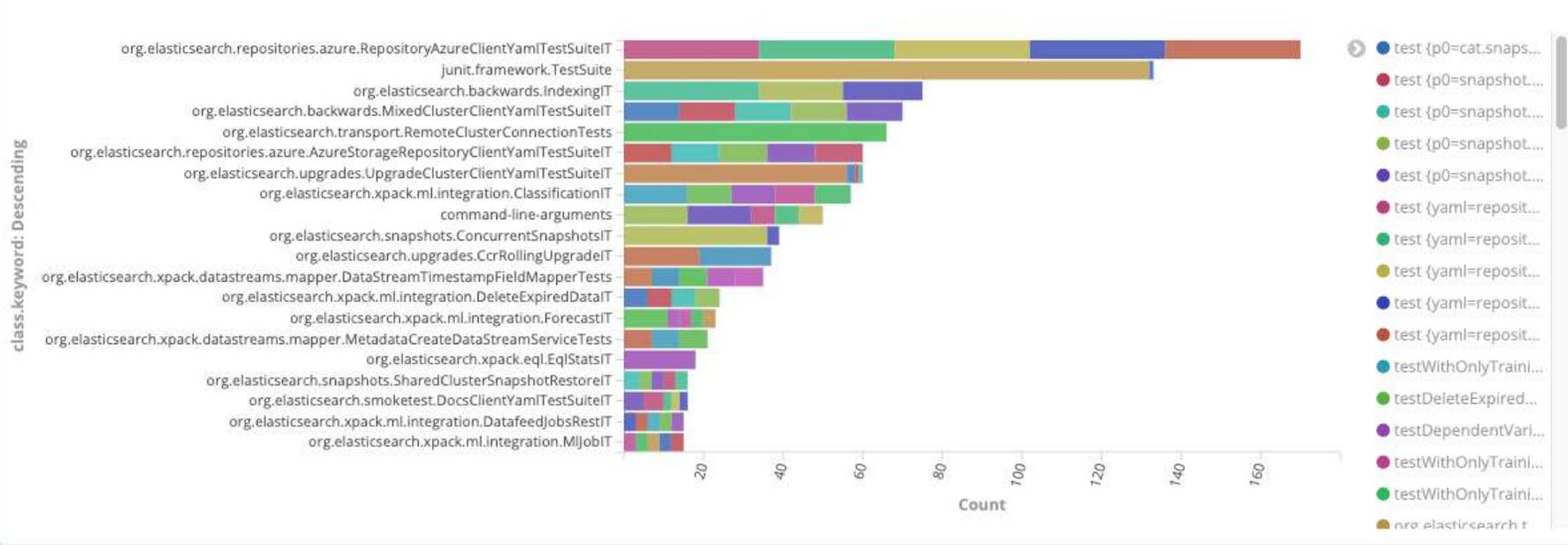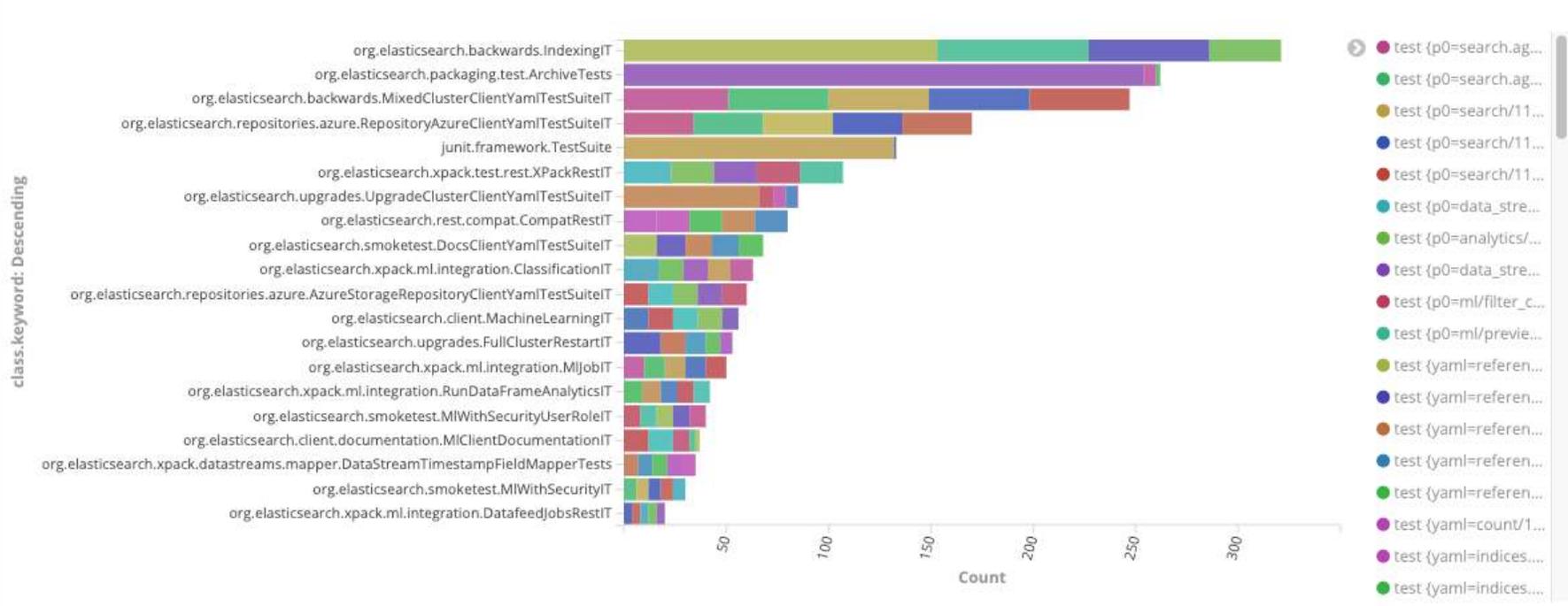
Demo

Elastic Build Stats

Elasticsearch CI

elastic

Full screen   Share   Clone   Edit   Documentation   ⟳ Auto-refresh   ❮   ⊘ Last 7d rounded to the day   ❯

>_ Search... (e.g. status:200 AND extension:PHP)   Options   ⟳ Refresh

Add a filter ✚

Alpar - Build duration intake

Alpar - Build duration PRs - daily AVG

Alpar - Build duration master intake and PRs

elastic

Alpar: Elaticsearch top test failures excluding PR builds

Legend (right side):
- test {p0=cat.snaps...
- test {p0=snapshot...
- test {p0=snapshot...
- test {p0=snapshot...
- test {p0=snapshot...
- test {yaml=reposit...
- test {yaml=reposit...
- test {yaml=reposit...
- test {yaml=reposit...
- test {yaml=reposit...
- testWithOnlyTraini...
- testDeleteExpired...
- testDependentVari...
- testWithOnlyTraini...
- testWithOnlyTraini...
- org.elasticsearch.t...

Y-axis (class.keyword: Descending):
- org.elasticsearch.repositories.azure.RepositoryAzureClientYamlTestSuiteIT
- junit.framework.TestSuite
- org.elasticsearch.backwards.IndexingIT
- org.elasticsearch.backwards.MixedClusterClientYamlTestSuiteIT
- org.elasticsearch.transport.RemoteClusterConnectionTests
- org.elasticsearch.repositories.azure.AzureStorageRepositoryClientYamlTestSuiteIT
- org.elasticsearch.upgrades.UpgradeClusterClientYamlTestSuiteIT
- org.elasticsearch.xpack.ml.integration.ClassificationIT
- command-line-arguments
- org.elasticsearch.snapshots.ConcurrentSnapshotsIT
- org.elasticsearch.upgrades.CcrRollingUpgradeIT
- org.elasticsearch.xpack.datastreams.mapper.DataStreamTimestampFieldMapperTests
- org.elasticsearch.xpack.ml.integration.DeleteExpiredDataIT
- org.elasticsearch.xpack.ml.integration.ForecastIT
- org.elasticsearch.xpack.datastreams.mapper.MetadataCreateDataStreamServiceTests
- org.elasticsearch.xpack.eql.EqlStatsIT
- org.elasticsearch.snapshots.SharedClusterSnapshotRestoreIT
- org.elasticsearch.smoketest.DocsClientYamlTestSuiteIT
- org.elasticsearch.xpack.ml.integration.DatafeedJobsRestIT
- org.elasticsearch.xpack.ml.integration.MlJobIT

X-axis (Count): 20, 40, 60, 80, 100, 120, 140, 160

Alpar: Elaticsearch top test failures

Legend (right side):
- test {p0=search.ag...
- test {p0=search.ag...
- test {p0=search/11...
- test {p0=search/11...
- test {p0=search/11...
- test {p0=data_stre...
- test {p0=analytics/...
- test {p0=data_stre...
- test {p0=ml/filter_c...
- test {p0=ml/previe...
- test {yaml=referen...
- test {yaml=referen...
- test {yaml=referen...
- test {yaml=referen...
- test {yaml=referen...
- test {yaml=count/1...
- test {yaml=indices...
- test {yaml=indices...

Y-axis (class.keyword: Descending):
- org.elasticsearch.backwards.IndexingIT
- org.elasticsearch.packaging.test.ArchiveTests
- org.elasticsearch.backwards.MixedClusterClientYamlTestSuiteIT
- org.elasticsearch.repositories.azure.RepositoryAzureClientYamlTestSuiteIT
- junit.framework.TestSuite
- org.elasticsearch.xpack.test.rest.XPackRestIT
- org.elasticsearch.upgrades.UpgradeClusterClientYamlTestSuiteIT
- org.elasticsearch.rest.compat.CompatRestIT
- org.elasticsearch.smoketest.DocsClientYamlTestSuiteIT
- org.elasticsearch.xpack.ml.integration.ClassificationIT
- org.elasticsearch.repositories.azure.AzureStorageRepositoryClientYamlTestSuiteIT
- org.elasticsearch.client.MachineLearningIT
- org.elasticsearch.upgrades.FullClusterRestartIT
- org.elasticsearch.xpack.ml.integration.MlJobIT
- org.elasticsearch.xpack.ml.integration.RunDataFrameAnalyticsIT
- org.elasticsearch.smoketest.MlWithSecurityUserRoleIT
- org.elasticsearch.client.documentation.MlClientDocumentationIT
- org.elasticsearch.xpack.datastreams.mapper.DataStreamTimestampFieldMapperTests
- org.elasticsearch.smoketest.MlWithSecurityIT
- org.elasticsearch.xpack.ml.integration.DatafeedJobsRestIT

X-axis (Count): 50, 100, 150, 200, 250, 300

elastic

Summary

- Analytics use-case
- Not needed for operational tasks
- ML: Time series anomaly detection (network outage)
- Test triage!

Test triage

- Daily single person owner for test failures
- Check failure
- Assign team
- Disable tests to stabilize
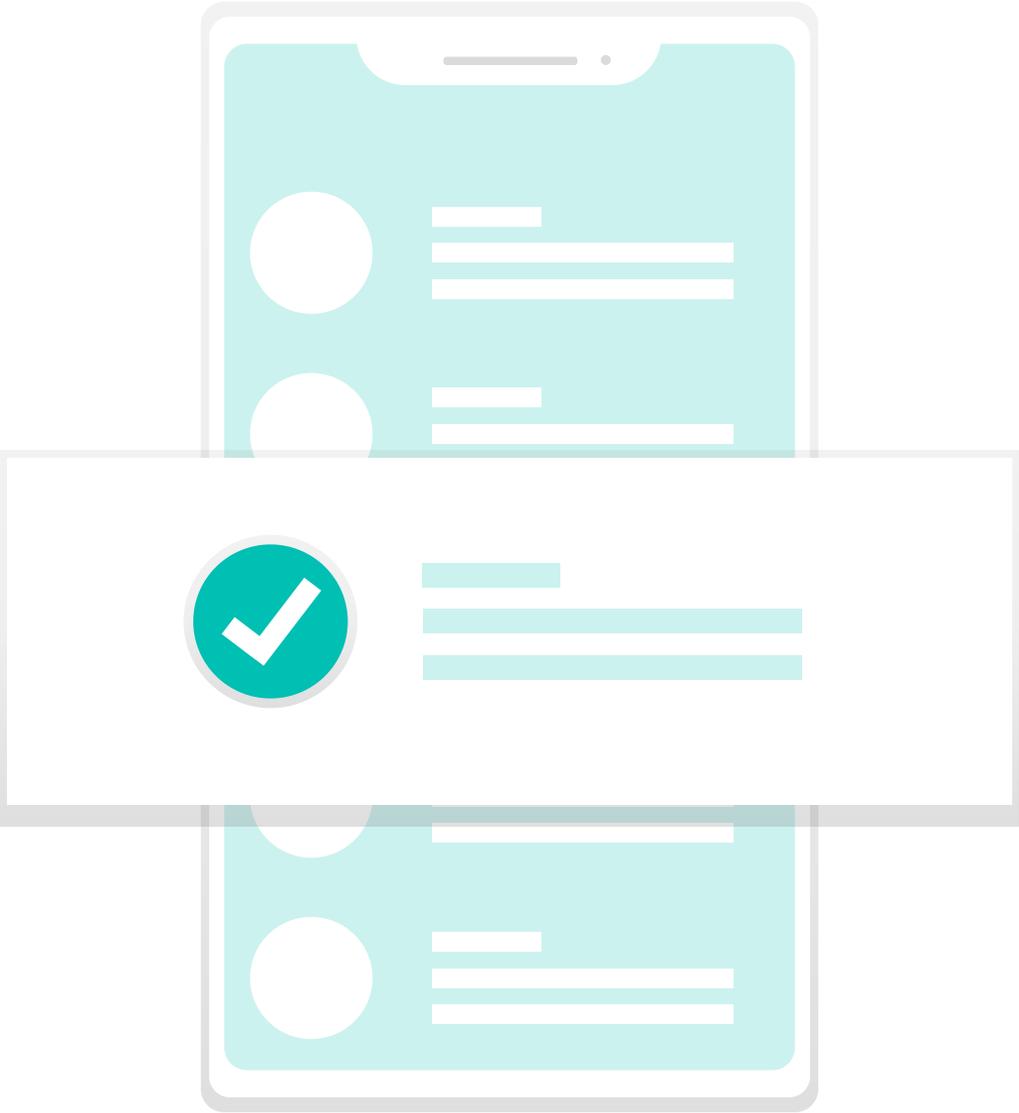
The future[tm]

- Delivery pipeline as a service (K8s: Tekton)
- Much more automated canary deployments
- Smarter test execution (affected code changes test cases first)
- Increase of specialization roles around CI/CD
- Analytics build into pipelines

Thanks for listening

Q & A

Alexander Reelsen
Community Advocate
alex@elastic.co | @spinscale

Elastic Cloud

Elastic Support Subscriptions

Getting more help

elastic

Discuss Forum

https://discuss.elastic.co

Community & Meetups

https://community.elastic.co

Explore by region

| Asia Pacific and Japan | Europe, Middle East and Africa | North and South America | Virtual |

ELASTIC - BARCELONA	ELASTIC - COPENHAGEN	ELASTIC - GOTEBORG	ELASTIC - SCOTLAND
Spain	Denmark	Sweden	United Kingdom
ELASTIC - STOCKHOLM	ELASTIC - TEL AVIV	ELASTIC - TURKEY	ELASTIC BONN USER GROUP
Sweden	Israel	Turkey	Germany
ELASTIC CAMBRIDGE & EAST ANGLIA USER GROUP	ELASTIC DUBAI USER GROUP	ELASTIC FR	ELASTIC GREECE
United Kingdom	United Arab Emirates	France	Greece
ELASTIC HELSINKI	ELASTIC KRAKOW USER GROUP	ELASTIC LONDON USER GROUP	ELASTIC LUXEMBOURG USER GROUP
Finland	Poland	United Kingdom	Luxembourg
ELASTIC MANCHESTER USER GROUP	ELASTIC MOSCOW	ELASTIC NIGERIA	ELASTIC OSLO USER GROUP
United Kingdom	Russian Federation	Nigeria	Norway
ELASTIC PORTUGAL	ELASTIC RHEINRUHR	ELASTIC SLOVAK USER GROUP	ELASTIC USER GROUP - CZ
Portugal	Germany	Slovakia	Czech Republic
ELASTIC USER GROUP - DUBLIN	ELASTIC USER GROUP ABIDJAN	ELASTIC WARSAW USER GROUP	ELASTIC ZAGREB
Ireland	Côte d'Ivoire	Poland	Croatia
ELASTICSEARCH - SOUTH AFRICA	ELASTICSEARCH SWITZERLAND	ELASTICSEARCH USER GROUP PAKISTAN	SEARCH MEETUP MUNICH
South Africa	Switzerland	Pakistan	Germany

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Thanks for listening

Q & A

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