OTTO MOTORS

elastic{on}

Elastic - The Quick Starter Stack for Robotics, IoT, and Big Data

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Anthony Tod – VP, Software Engineering

OTTO Motors Inc.

Feb 27, 2018

Agenda

The Quick Starter Stack for Robotics, IoT, and Big Data

1. Introducing OTTO Motors
2. IoT, Elastic, and fishing…
3. Our Elastic IoT Stack - tips and tricks included!
4. Elastic at Work

Who is OTTO Motors?

CLEARPATH

2,000+ self-driving robots in over 40 countries.

CLEARPATH ROBOTICS™

Market-leading mobile robots for advanced research and development.

OTTO MOTORS

Flexible and intelligent self-driving vehicles for industrial materials handling.

CLEARPATH
ROBOTICS™

OTTO

MOTORS

WE DESIGN, MANUFACTURE AND OPERATE SELF-DRIVING VEHICLES FOR INDUSTRY, WITH THE ULTIMATE GOAL OF MAKING HUMAN DRIVING OBSOLETE.

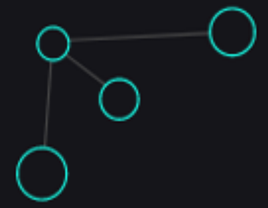
Self-driving vehicles relieve the burden of material movement so your workforce can focus on higher value activities.

Overcome Labour Shortages

One OTTO can work three shifts, seven days a week.

Recover Wasted Floor Space

OTTO reduces the time materials are in motion, freeing up floor space.



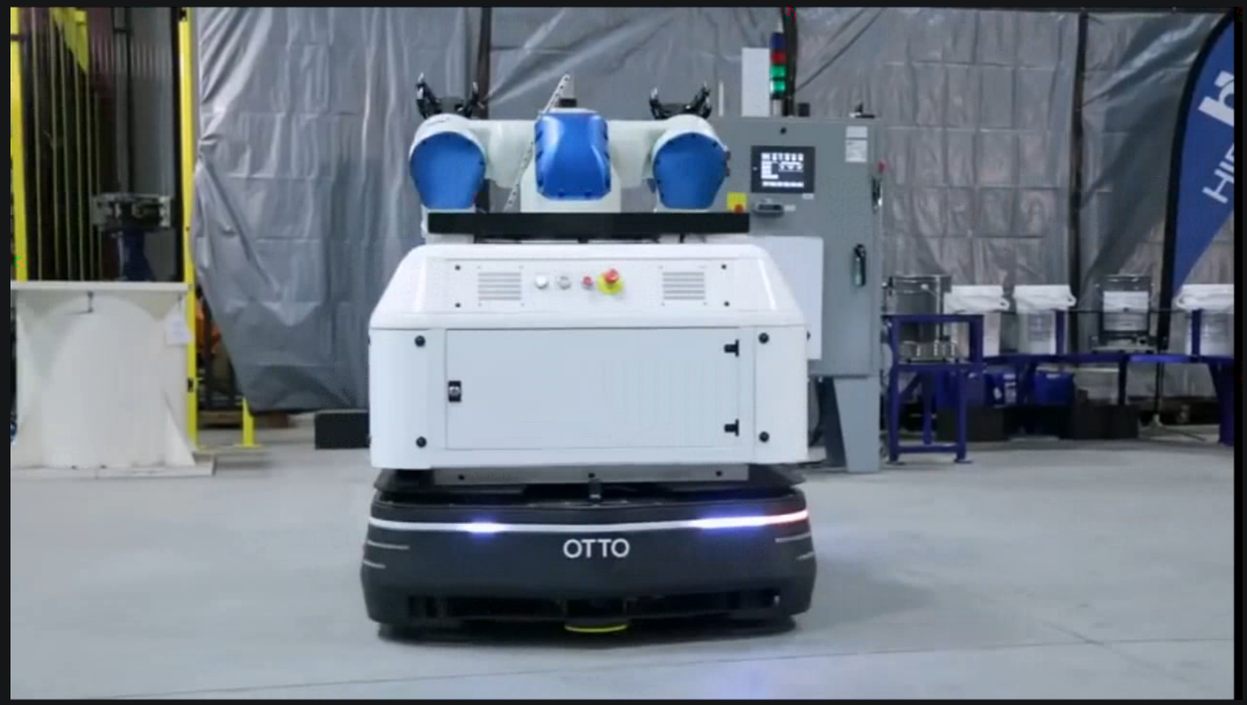
Standardize Across All Facilities

The best processes in each facilitiy can be shared with all facilities.

Get Real-Time Insights Anywhere

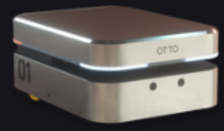
Metrics about OTTO can report on productivity and uncover lean opportunities.


OTTO



OTTO 1500

Move pallets, racks, and loads weighing up to 1500kg.



OTTO 100

Move carts, bins, and boxes weighing up to 100kg.

elastic

elastic on

PUTTING OTTO TO WORK

OTTO can be put to work a way that fits your workflow. The OTTO Fleet Manager connec multiple self-driving vehicles to your production process for higher levels of efficiency and control

Workstation dispatch

Create jobs for OTTO manually with a tablet or computer in the workstation or on a fork truck.

Scheduled dispatch

Create a custom schedule of jobs by day, time, and production requirements.

Automated dispatch

Call OTTO for work with connected PLCs and sensors located pickup and delivery points.

Software dispatch

ERP, WMS, MES integrations for automated and coordinated material moves.

IoT, Elastic, and fishing…


Woods for trees...


The cruel sea...

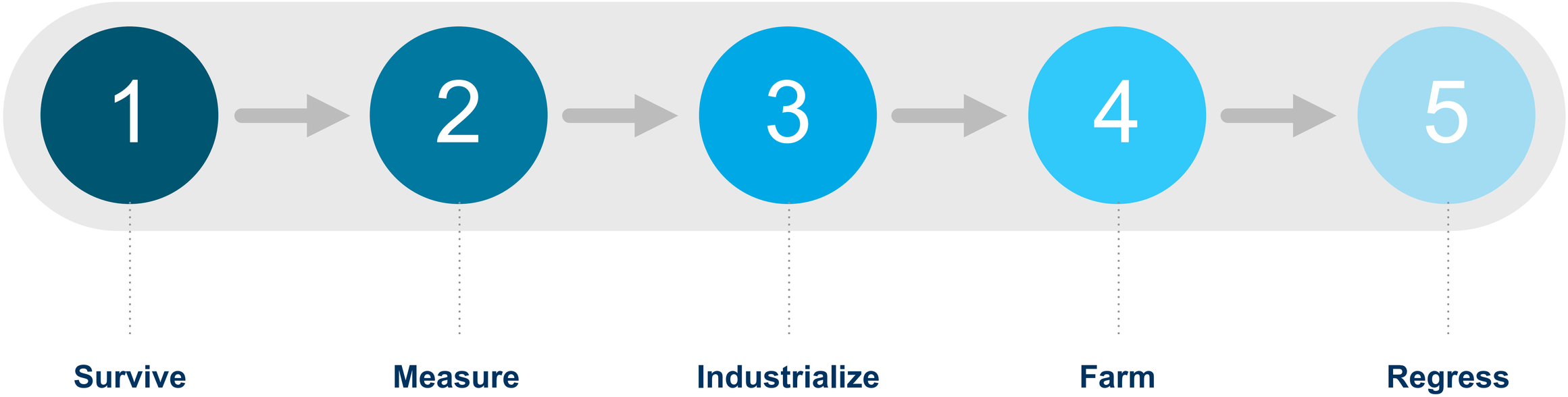

Diagnostic is the water of enlightenment in the desert of uncertainty

Be Careful what you wish for


We just need somewhere to stand

Diagnostic lifecycle

From lifeboat to cruise liner.



Teach a man to fish

For every system we ever deploy?

All Systems Correlated, Arbitrary Aggregated Measurement by Automation

For every thing in the system we can measure?

Full System Correlated, Arbitrary Aggregated Measurement by Automation

In a graph, with an arbitrary time domain, capture it always, so it's there whenever I look?

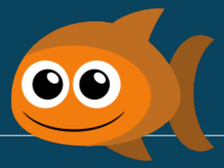
Specific Aggregated Measurement by Automation

This is too hard, how do I make that number come to me?

Specific Instantaneous Measurement by Automation

I can't keep asking you, how do I find it?

Specific Instantaneous Measurement by inspection



What is the temperature of the motor from that robot?

Specific Instantaneous Measurement by request

Teach a man to fish: Part II

Working out limits is hard, can the computer do it?

Notification on AI derived outliers

It kicks me too often, can it wait until it is important?

Notification on time / state based conditions

Looking is hard, can it tell me when things I don't like happen?

Notification on manual instantaneous limits

I can see "all the things"

All Systems Correlated, Arbitrary Aggregated Measurement by Automation

Why call this IoT?

- IoT isn't a new concept or idea…
- The "perfect storm" exists now for IoT – you can't ignore it anymore
  - Wide spectrum of connectivity options
  - Growing cloud, on prem, field and edge computing choices
  - Rich ecosystem of software components and solutions
- So *WHY* do IoT?
  - Make products better, faster
  - Find new opportunities and insights


splunk>
Apache Solr
fluentd
mongoDB
hadoop
Microsoft Azure
jupyter
APACHE Spark
MQTT.ORG
Sphinx
kafka
redis
Apache Zookeeper
elastic
APACHE STORM™
PostgreSQL
presto
CouchDB relax
InfluxDB
Google BigQuery
amazon web services
{GRAYLOG2
Open source Log Management
Watson IoT™
cassandra
riak
graphite
MySQL™
Pachyderm

Elastic – Quick Starter for IoT

- HTTP / JSON API’s
- Easy to use client libraries
- Rich data collection options

- Start with a single install
- Easily scale as you grow
- No other systems required to start

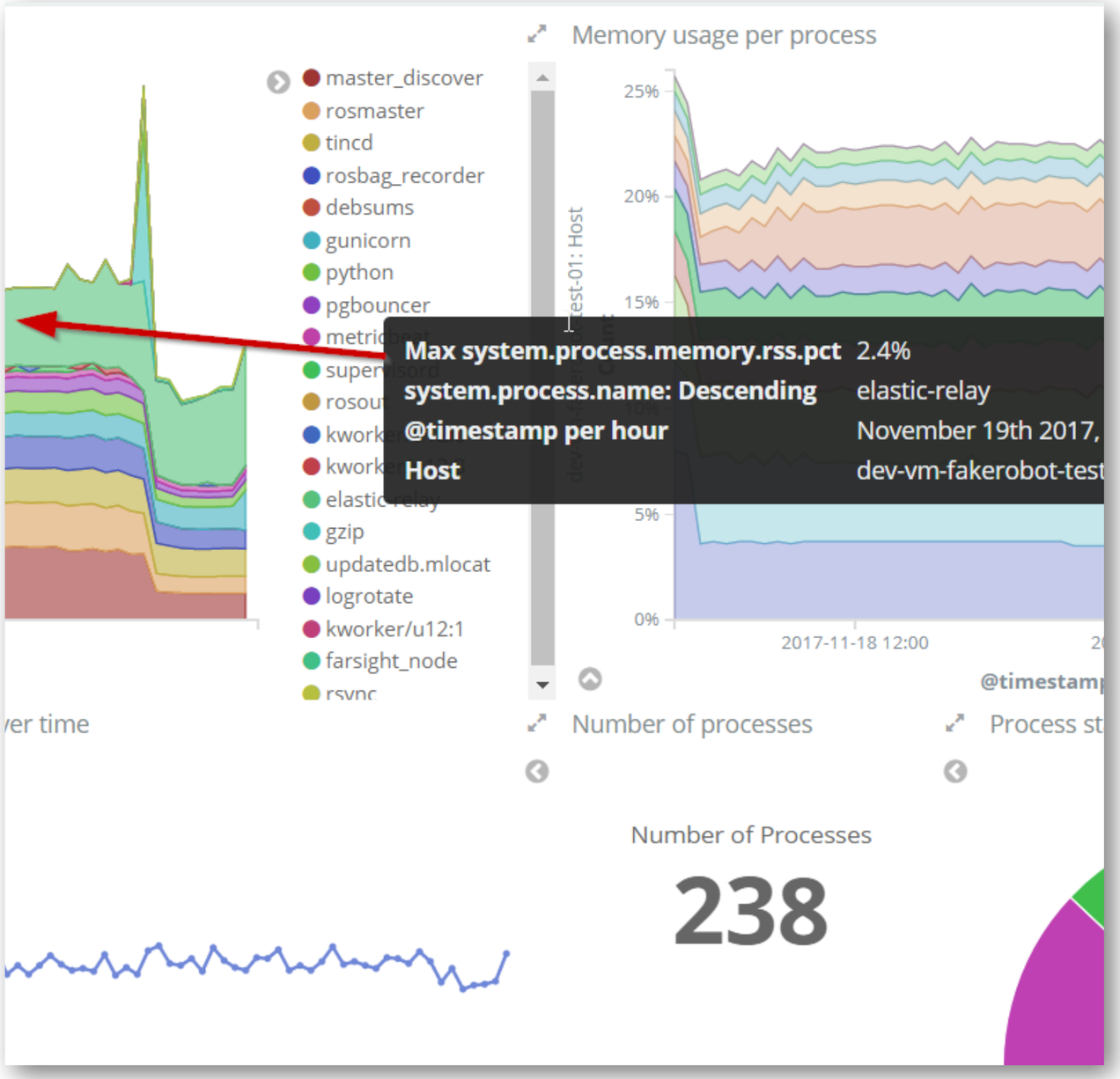
- Web based, easy to use
- Ever expanding features
- Well integrated (X-Pack)

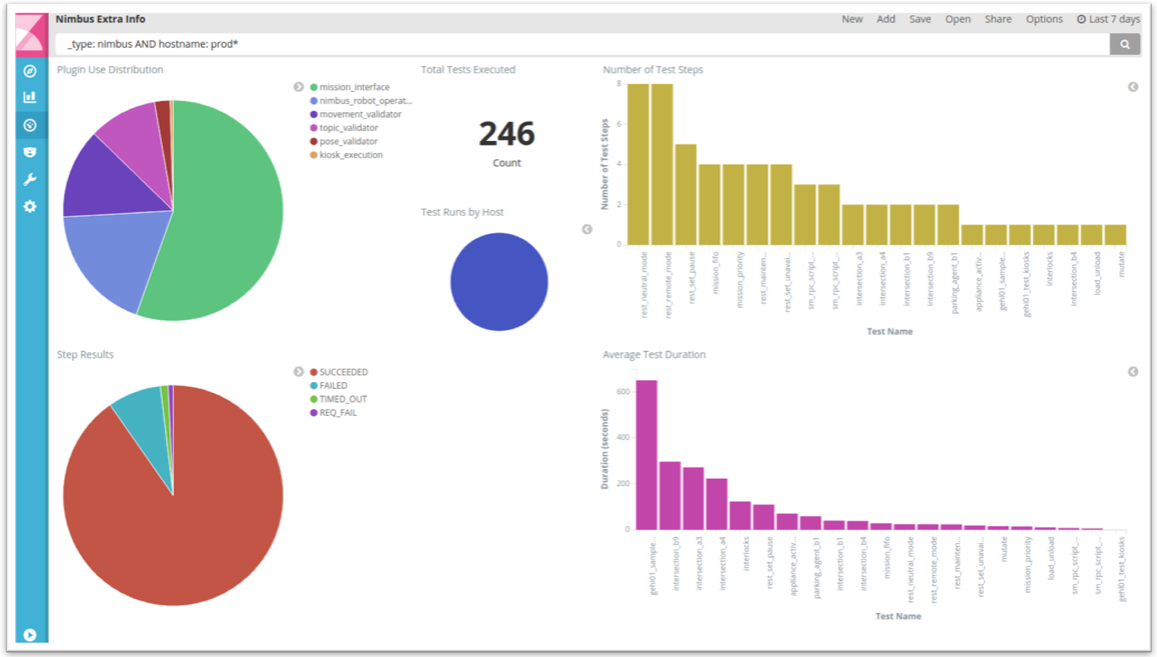
Not just for IoT…

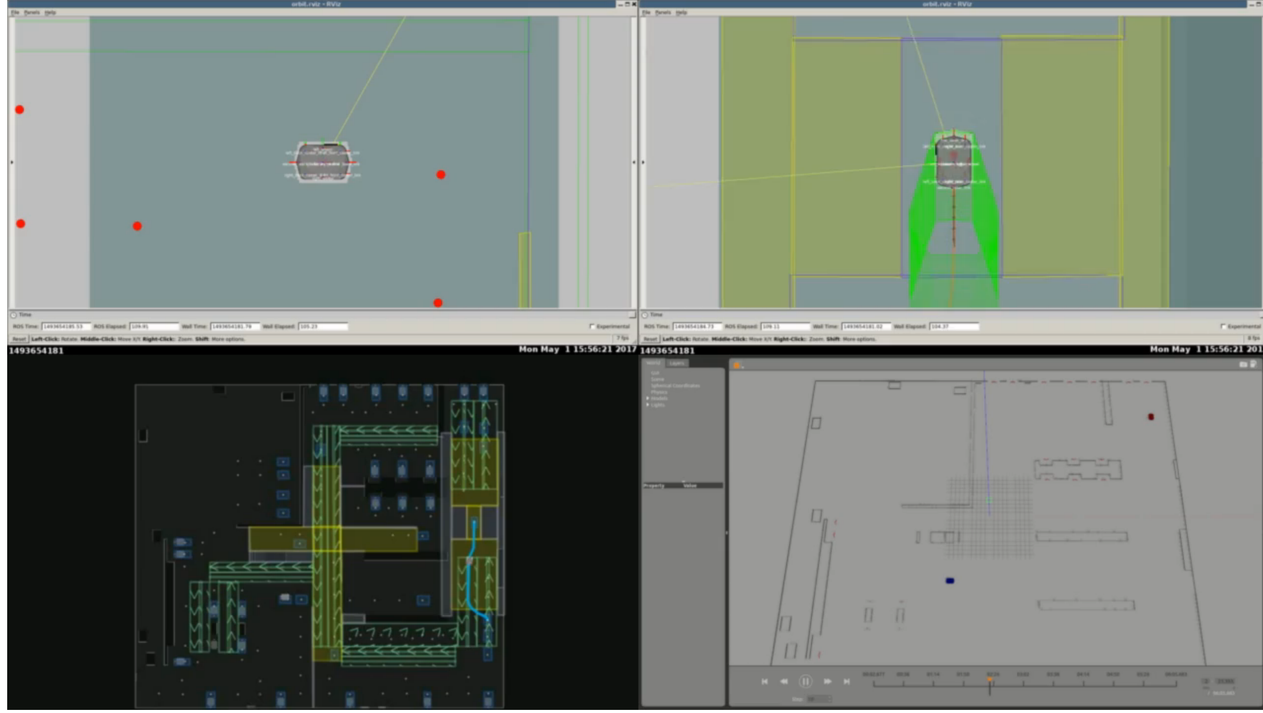
- We have found our needs to monitor, manage and de-risk software development, testing and infrastructure along with IT needs also benefit with the Elastic stack

  We share a growing set of systems, tools and expertise with both our IoT and internal efforts equally

  Internal systems use the same IoT paths




Nimbus Extra Info
New Add Save Open Share Options Last 7 days
_type: nimbus AND hostname: prod*
Plugin Use Distribution
mission_interface
nimbus_robot_operat...
movement_validator
topic_validator
pose_validator
kiosk_execution
Total Tests Executed
246
Count
Test Runs by Host
Number of Test Steps
Number of Test Steps
Test Name
Step Results
SUCCEEDED
FAILED
TIMED_OUT
REQ_FAIL
Average Test Duration
Duration (seconds)
Test Name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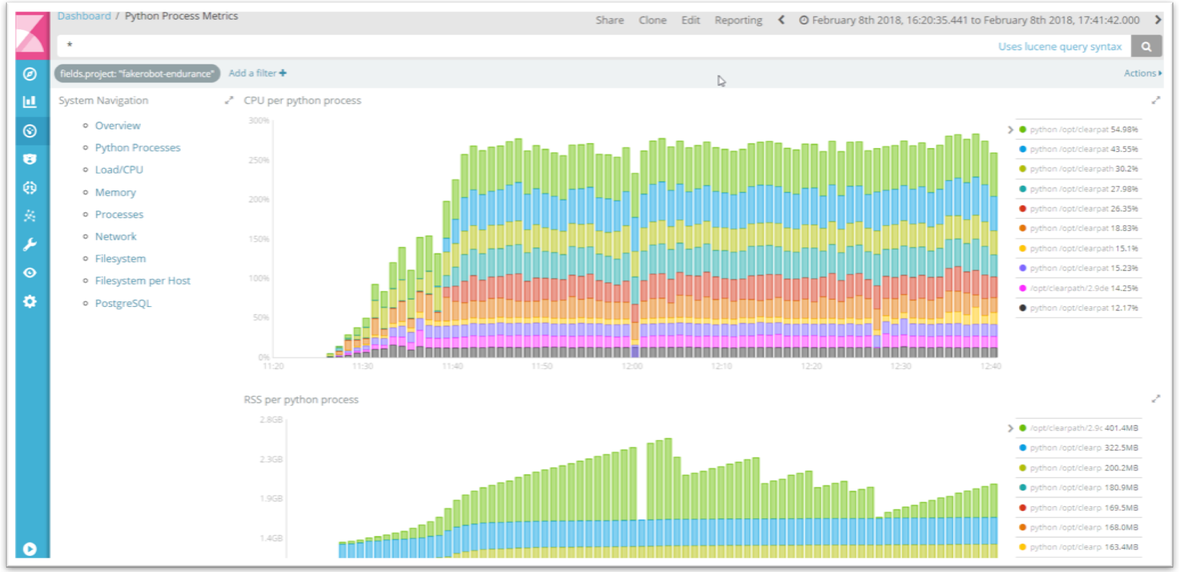
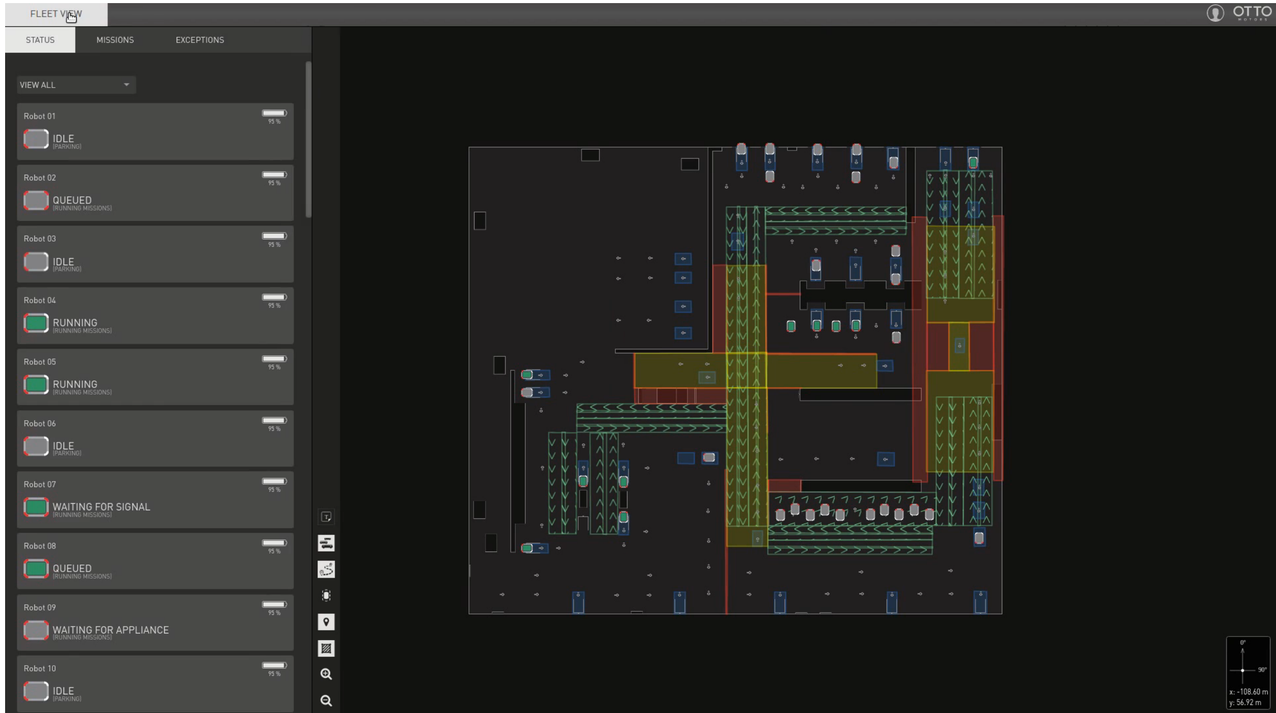
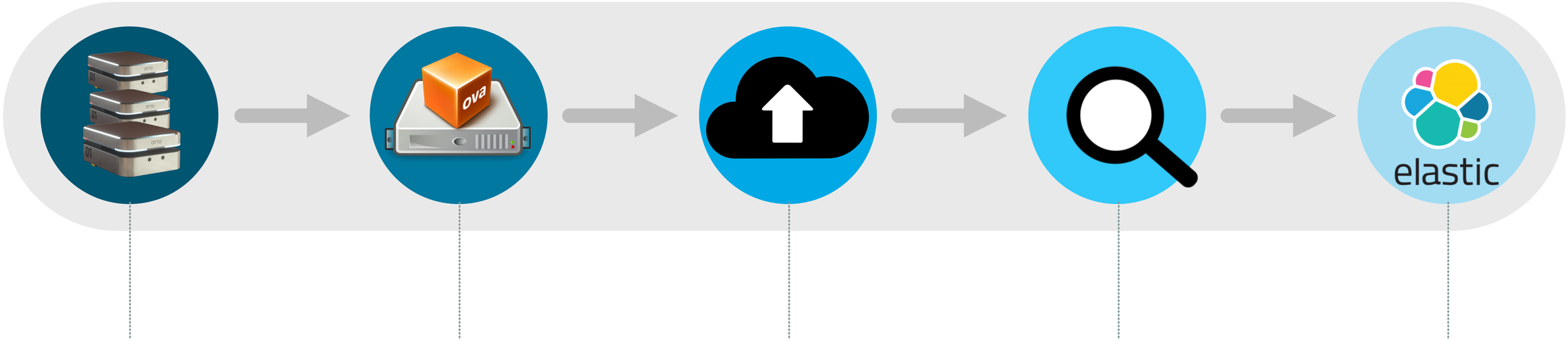

Dashboard / Python Process Metrics
Share Clone Edit Reporting
February 8th 2018, 16:20:35.441 to February 8th 2018, 17:41:42.000
Uses lucene query syntax
fields.project: "fakerobot-endurance"
Add a filter
Actions
System Navigation
Overview
Python Processes
Load/CPU
Memory
Processes
Network
Filesystem
Filesystem per Host
PostgreSQL
CPU per python process
RSS per python process


FLEET VIEW
OTTO
STATUS
MISSIONS
EXCEPTIONS
VIEW ALL
Robot 01
IDLE
Robot 02
QUEUED
Robot 03
IDLE
Robot 04
RUNNING
Robot 05
RUNNING
Robot 06
IDLE
Robot 07
WAITING FOR SIGNAL
Robot 08
QUEUED
Robot 09
WAITING FOR APPLIANCE
Robot 10
IDLE

Our Elastic IoT Stack

How we gather IoT Data



Robots send key Data to their Fleet Manager VM on customer premises

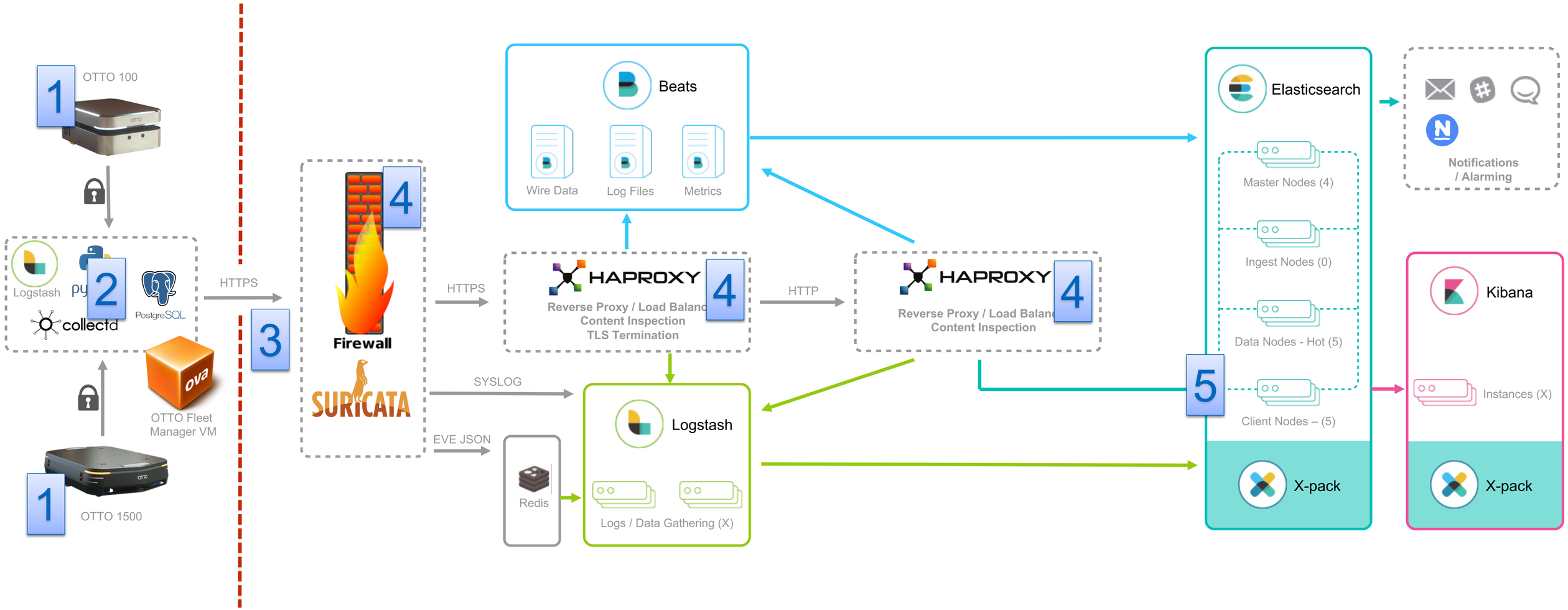
Fleet Manager aggregates key data locally

Data is transmitted back to OTTO HQ at controlled intervals

Data origin, context and content is analyzed and accepted or rejected

Accepted data is Indexed and stored in Elasticsearch

IoT Component Diagram



Monitoring our IoT Stack

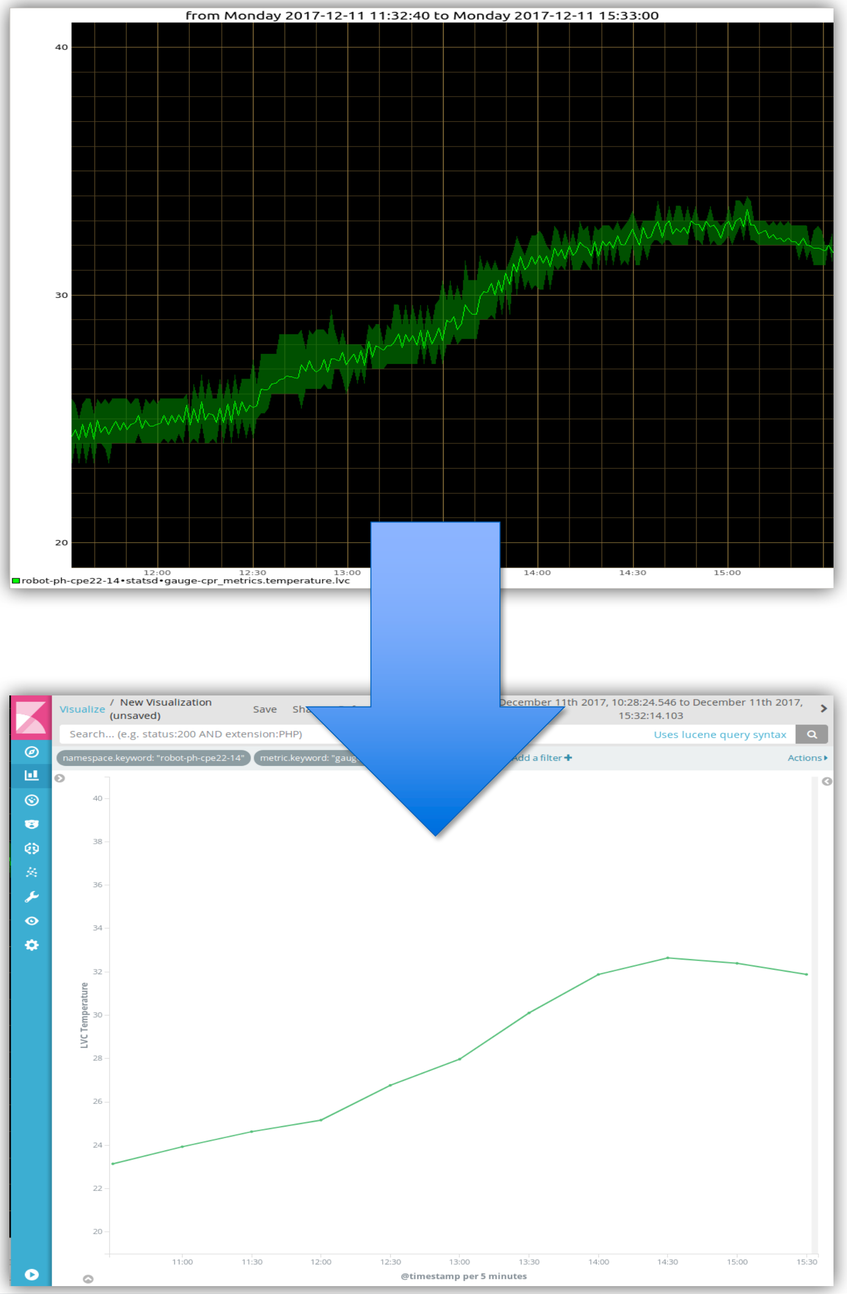
- We use a mixture of load balancers, reverse proxy servers, IPS/IDS, Firewalls, Virtualization technologies along with industry standard encryption together to ensure the safe transport and acceptance of valid data

- Elastic also is a key resource used to *monitor* our transport of said IoT data

- Elastic helps keep elastic safe!

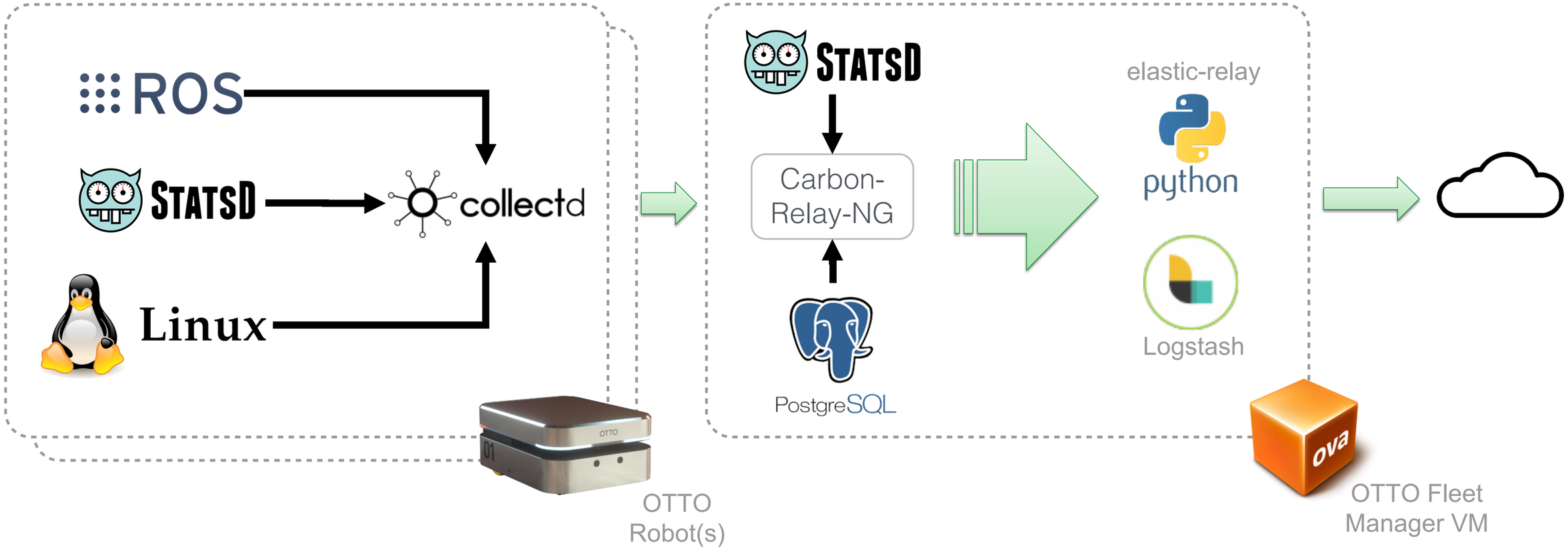
Edge Architecture

- We poll over 5k+ data points every 10 seconds from each Robot in a fleet
- From per process CPU time to WiFi signal strength, motor temperatures, navigation details and other metrics related to autonomous software functions are all gathered
- All data is aggregated in 30 minute reporting windows using various numerical techniques (lossy) – this gives us a better storage/network utilization balance



Edge Architecture Components

- We use a mixture of services on Robots and our Fleet Manager VM. Data is aggregated and then sent back to our on-premises Elastic cluster.

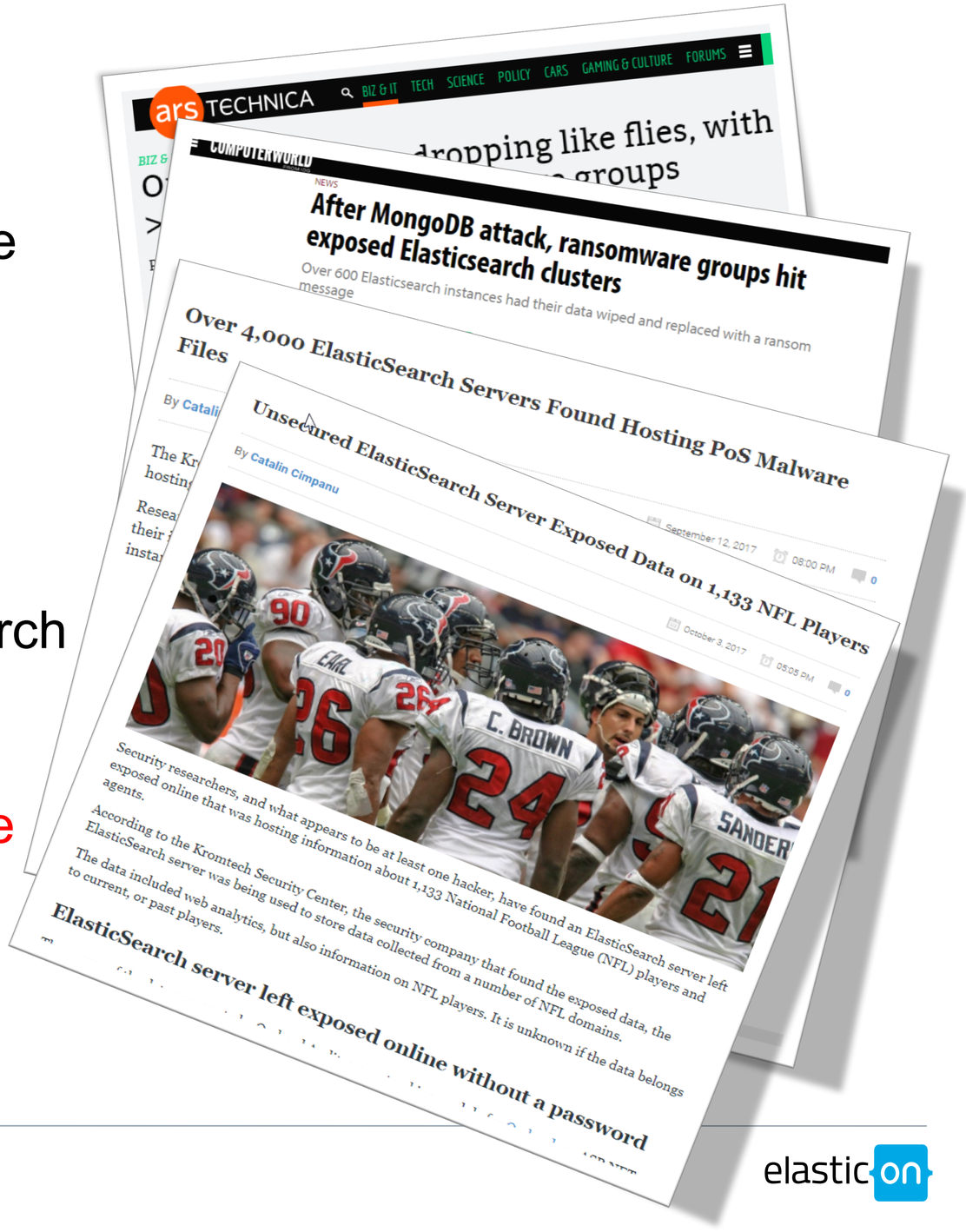


Edge Architecture Summary

- **Accuracy** - Collects lots of low level measurements before final ingestion
- **Big Picture** - Flexible aggregation of raw measurements easily (min/max, avg, delta, stdev, rate, etc…)
- **Flexible** - Aggregation reporting period is configurable, changed on the fly later?
- **Resilient** - Store and forward, uplink does not have to be online all the time

Exposing Elastic

- IF you ask an Elastic Engineer, they'll tell you the following advice (and it's good advice to follow)
  - Write your own application API's, have your applications in field talk to your service API's
  - Have your service, internally talk to Elasticsearch as its own backend privately
  - DO NOT EXPOSE Elasticsearch directly to the internet!

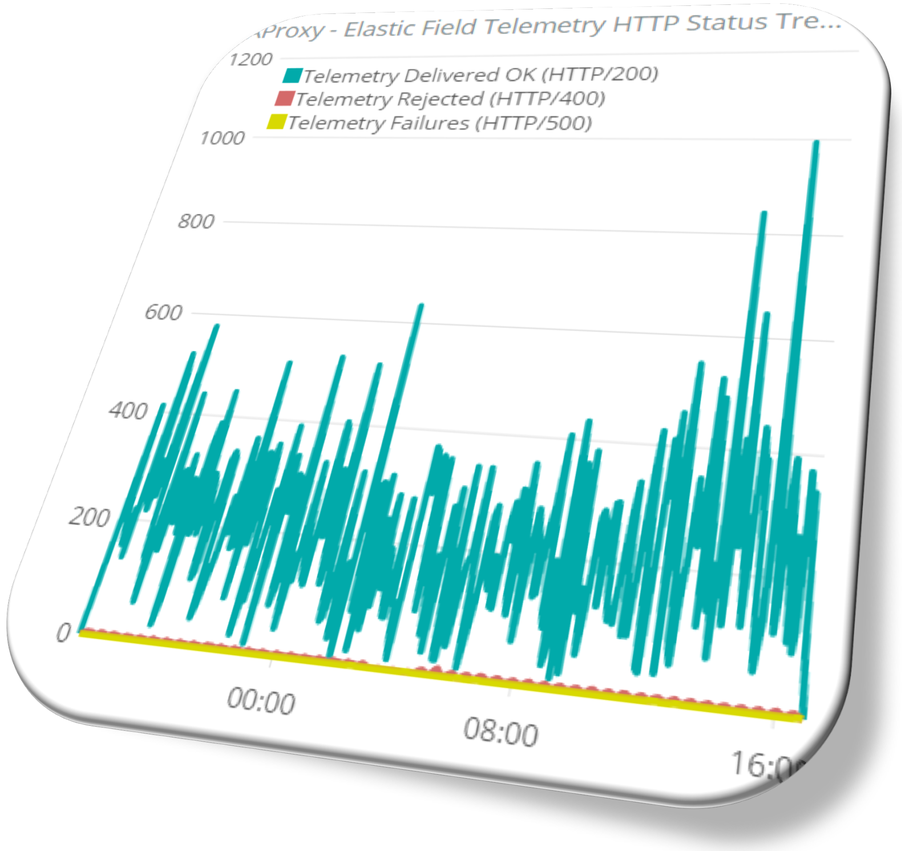


Secure Elasticsearch with HAProxy

We use HAProxy to inline scan and limit data/paths/API's

- Applications behind reverse proxies that limit transactions provide a better security story

- We filter based on payloads, context, origin, reputation and API usage along with other attributes



Bulk is Better

Elasticsearch Bulk API's allow for many transactions to be sent together. Great for IoT!

```
POST _bulk
{ "index" : { "_index" : "test", "_type" : "type1", "_id" : "1" } }
{ "field1" : "value1" }
{ "delete" : { "_index" : "test", "_type" : "type1", "_id" : "2" } }
{ "create" : { "_index" : "test", "_type" : "type1", "_id" : "3" } }
{ "field1" : "value3" }
{ "update" : {"_id" : "1", "_type" : "type1", "_index" : "test"} }
{ "doc" : {"field2" : "value2"} }
```

Example HAProxy _**BULK** rules

Allow Bulk API to write into Index's my_indices.* via only 'insert/update' operation(s)

```
# Allow specific of bulk inbound data to anything named my_indices_*
acl url_inbound_bulk url_reg ^\/example/elastic/my_indices.*/_bulk
acl url_inbound_bulk url_reg ^\/example/elastic/_bulk

# _bulk body acceptance checks - limit body privileges in elastic pa
acl elastic_bulk_supported_methods req.body -m reg -i "^{\"update\":
acl elastic_bulk_supported_methods req.body -m reg -i "^{\"index\":{

# _bulk body deny checks - block destructive operations in elastic b
acl elastic_bulk_denied_methods req.body -m reg -i "^{\"delete\""
acl elastic_bulk_denied_methods req.body -m reg -i "^{\"create\""
acl elastic_bulk_denied_methods req.body -m reg -i "^{\"script\""
```

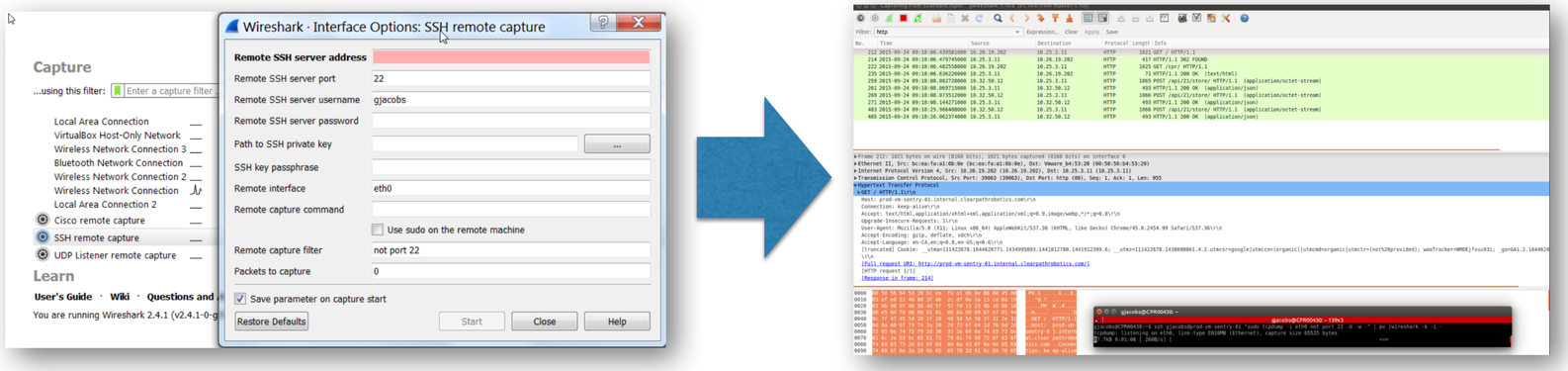
More Example HAProxy Rules

Block BULK payloads we can’t fully examine, and limit Index access by name

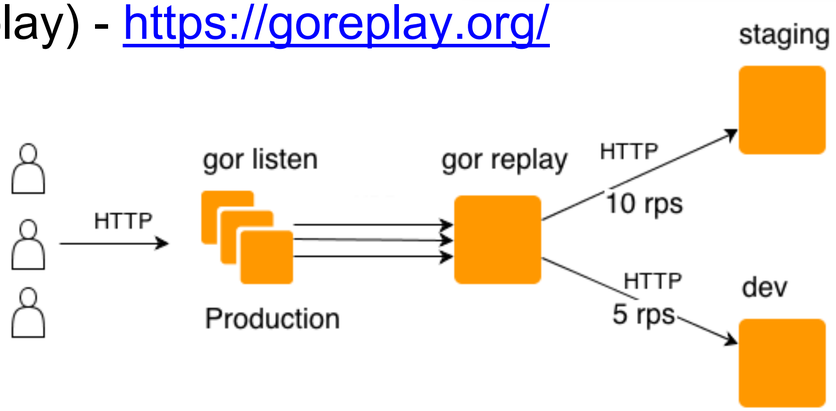
```
 # Need to do content inspection - hence buffer entire payload
option http-buffer-request


# Block chunked payloads we can’t inspect  - chunked streams get drop
acl elastic_bulk_denied_payloads hdr_beg(Transfer-Encoding) -i chunke


# Only allow bulk feed to access their associated indices
acl elastic_example_bulk_allow_indices req.body -m reg -i "\"_index\":
```

Helpful Tools for ACL Building

- Documentation and other examples online – read the fine manuals!
- Wireshark / SSH piping of tcpdump live traffic remotely



- GOR (Go and Replay) - https://goreplay.org/



Naming Standards = Good

- Having a naming standard for Indices and aliases simplify content inspection rules, administration and automation
- Rules block namespace access to indices and operations via URL paths – naming standards help in part
- Allows us to build better workflows and tooling

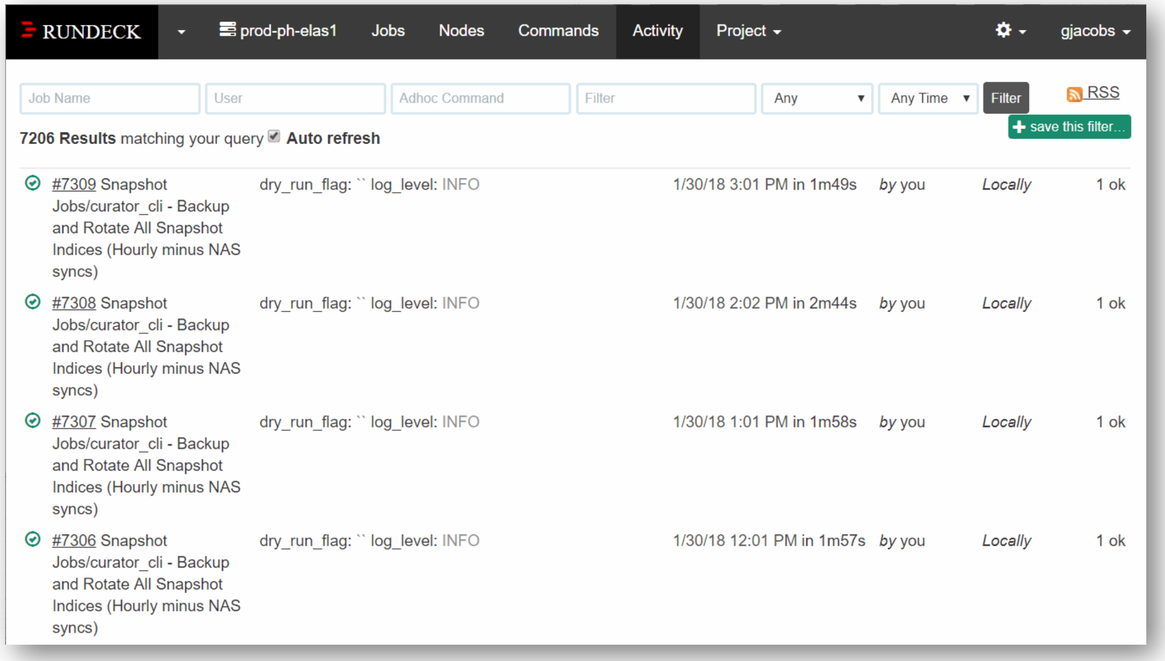
Make Elastic work better with some of these friends

RunDeck + Elastic Curator =

- **RunDeck** - complex workflows and tasks, including time triggered events

- **Elasticsearch Curator** - helps you curate, your indices and snapshots easily (and much more)

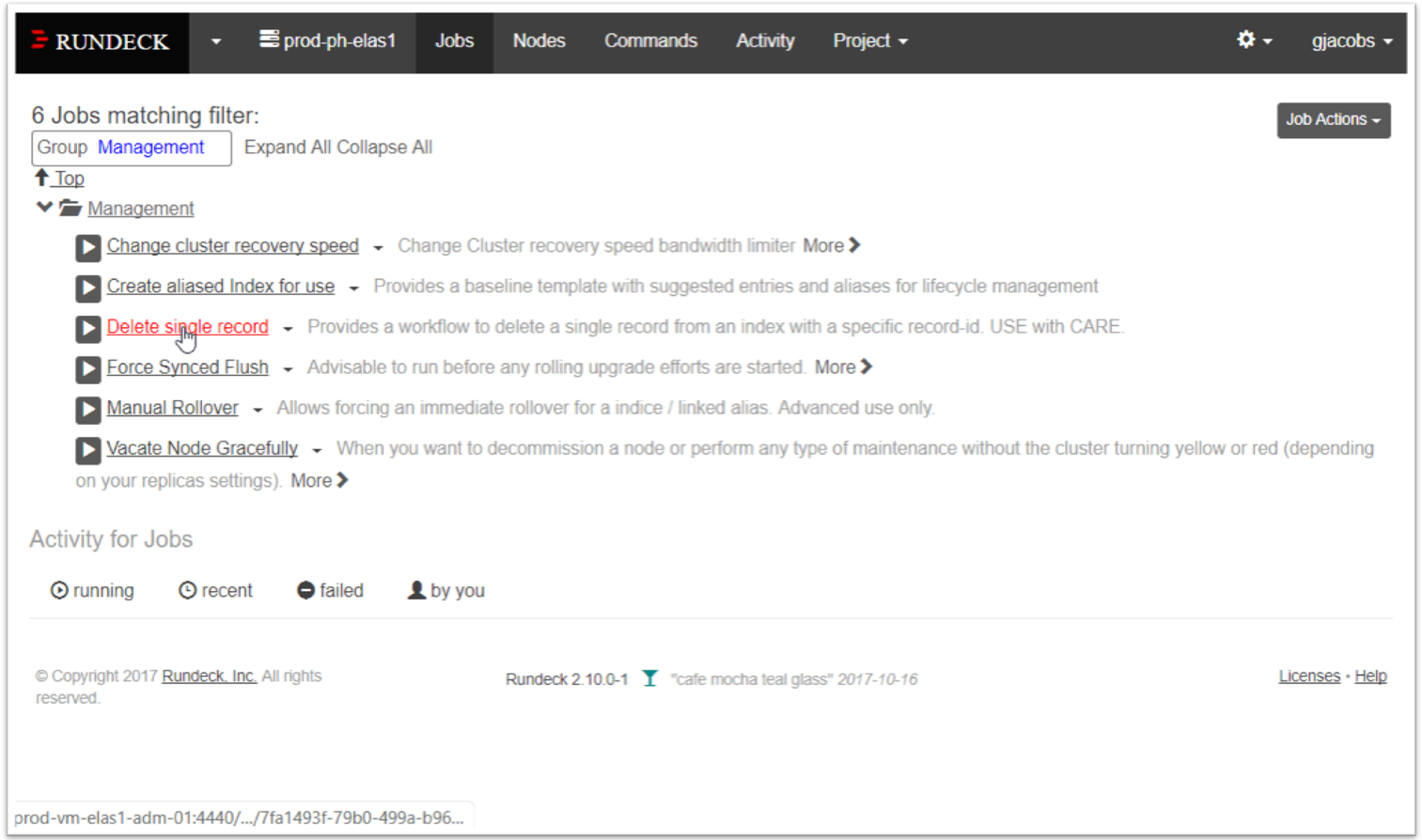
- *Combined together* they've proven to be a superb administrator workflow stack that is easy to use

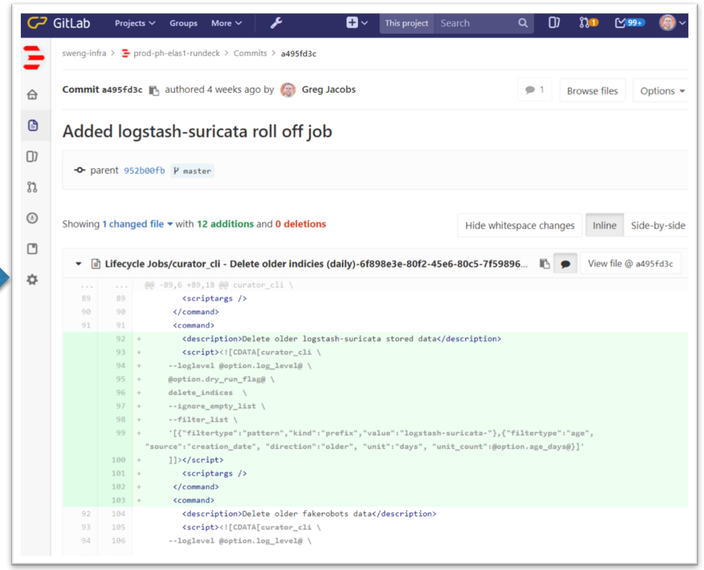


RUNDECK

RunDeck Curator Examples – Source Control

- One-Click source control for all configuration changes, RunDeck has SCM Plugins for that!





RunDeck Curator Config Management

- We use RunDeck to entirely manage curator configurations
- Can change any aspect via RunDeck, and SCM it!

1. [28 lines]
   Generate global curator configuration file
2. [139 lines]
   Generate Rollover Configuration to Execute (RunDeck SCM Managed)
3. [2 lines]
   Execute curator Rollover API job

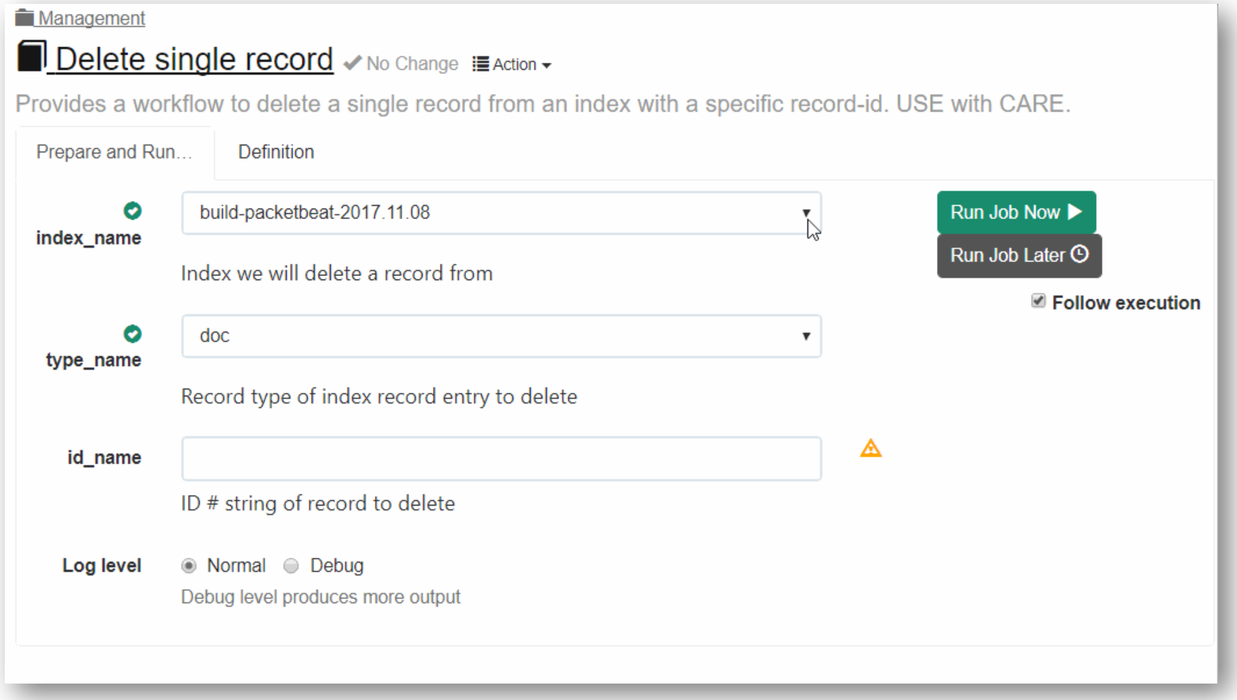
```
#!/bin/sh

FILE="/etc/curator/curator.yml"

/bin/cat <<EOM >$FILE
---
client:
  hosts:
    - 127.0.0.1
  port: 9200
  url_prefix:
  use_ssl: False
  certificate:
  client_cert:
  client_key:
  ssl_no_validate: False
  http_auth:
  timeout: 240
  master_only: False

logging:
  loglevel: @option.log_level@
  logfile:
  logformat: default
  blacklist: ['elasticsearch', 'urllib3']

EOM
cat /etc/curator/curator.yml
```

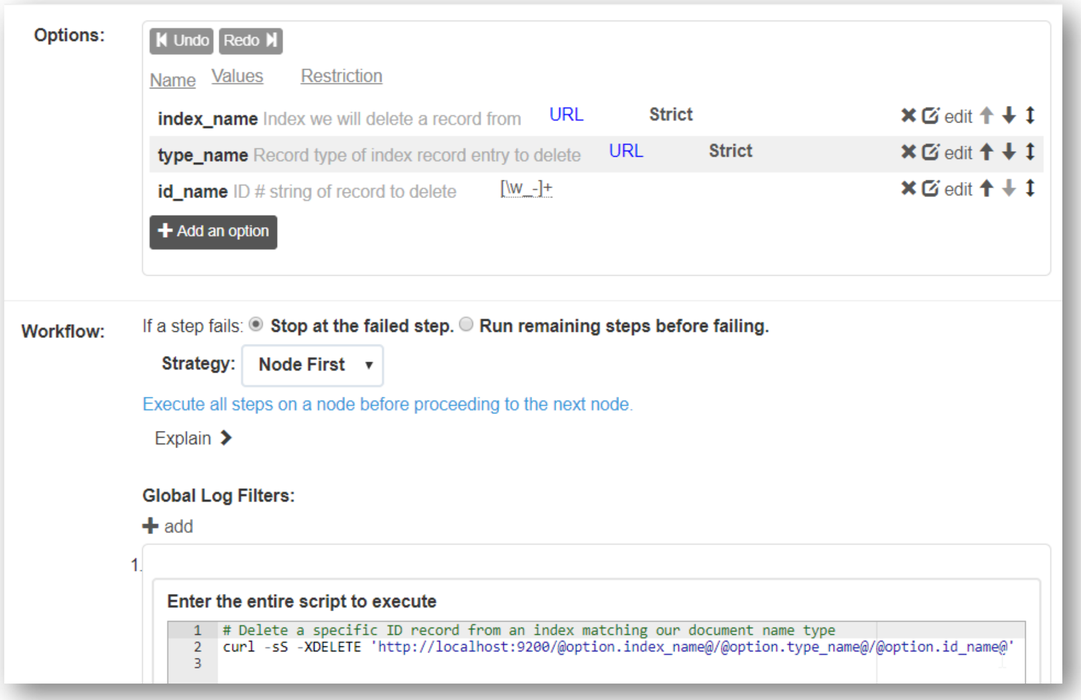
```
#!/bin/sh

FILE="/etc/curator/rollover.yml"

/bin/cat <<EOM >$FILE
---
# Rollover infrastructure team HAProxy logs matching conditions below
actions:
  1:
    action: rollover
    description: >-
      Rollover the HAProxy associated with index 'als_infra_haproxylogs_ingress'
    options:
      continue_if_exception: True
      disable_action: False
      name: als_infra_haproxylogs_ingress
      conditions:
        max_age: 1d
        max_docs: 10000000
```

```
# Execute Curator Rollover job as per configuration saved by RunDeck
/usr/local/bin/curator @option.dry_run_flag@  --config /etc/curator/curator.yml /etc/curator/rollover.yml

```

RunDeck Options Providers + Elastic API's

- Option providers allow rich 'wizard' style workflows for users easily

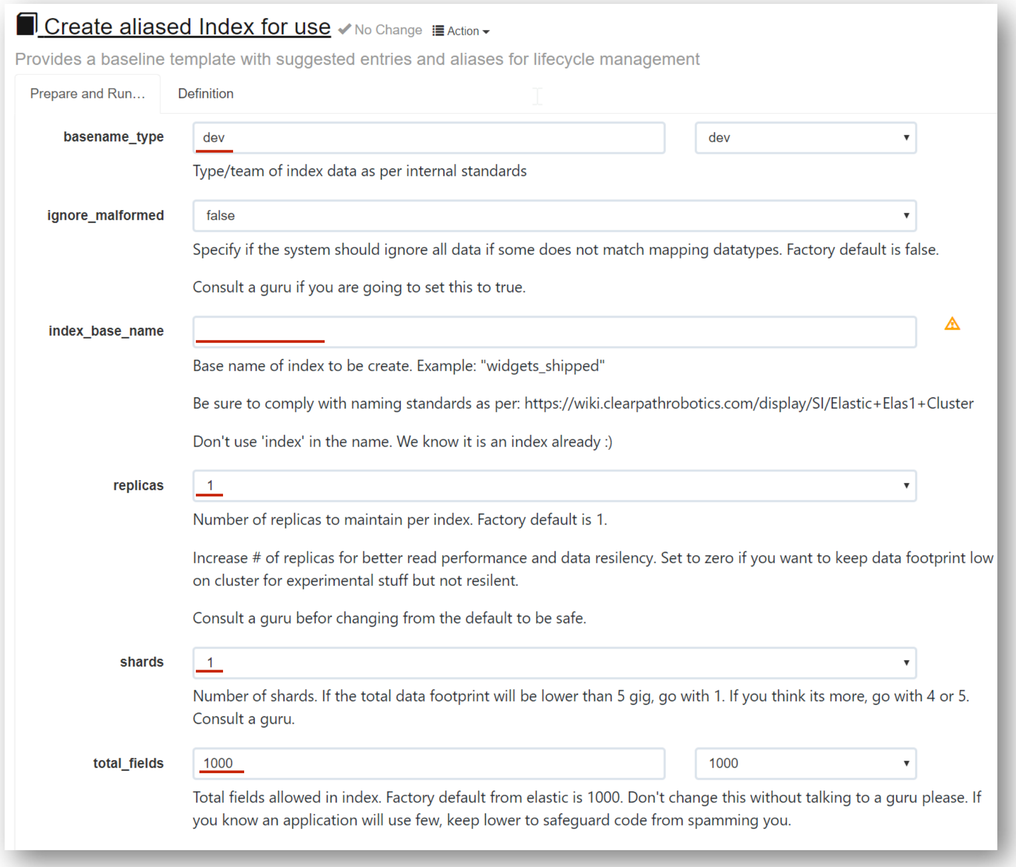





```
# Delete a specific ID record from an index matching our document name type
curl -sS -XDELETE 'http://localhost:9200/@option.index_name@/@option.type_name@/@option.id_name@'
```

RunDeck Options Providers + Elastic API's

- This below is a 'wizard' allows easy setup of new indices with Rollover aliases. Note inline documentation.

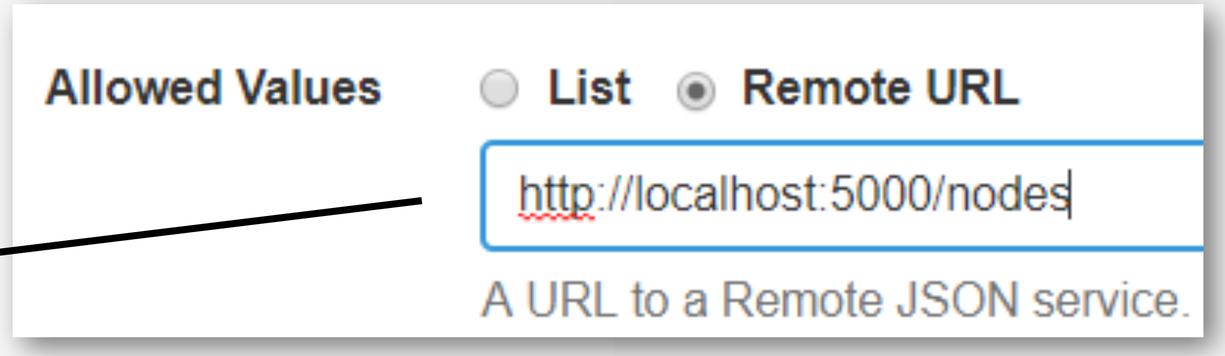



```
# Create an index template that sets up the alias grouping for rotation handling for Rollover API usage
curl -sS -XPUT 'http://localhost:9200/_template/@option.basename_type@_@option.index_base_name@' -d '
{
  "order": 0,
  "template": "@option.basename_type@_@option.index_base_name@-*",
  "settings": {
    "number_of_shards": @option.shards@,
    "number_of_replicas": @option.replicas@,
    "index": {
      "mapping": {
        "total_fields": {
          "limit": "@option.total_fields@"
        },
        "ignore_malformed": "@option.ignore_malformed@"
      }
    }
  },
  "mappings": {},
  "aliases": {
    "als_@option.basename_type@_@option.index_base_name@": {},
    "als_@option.basename_type@_@option.index_base_name@_ingress": {}
  }
}
'
```

Elastic Python RunDeck Options Provider

Example - Use the _cat API to provide a list of nodes to RunDeck

```python
from flask import Flask, request, jsonify
import json
import requests
app = Flask(__name__)

@app.route('/nodes')
def get_nodes():
    r = requests.get('http://localhost:9200/_cat/nodes?h=name')
    results = list()
    for node in sorted(r.text.splitlines()):
        results.append({'name': node, 'value': node})
    return jsonify(results)

if __name__ == '__main__':
    app.run(host='0.0.0.0', port=5000)
```

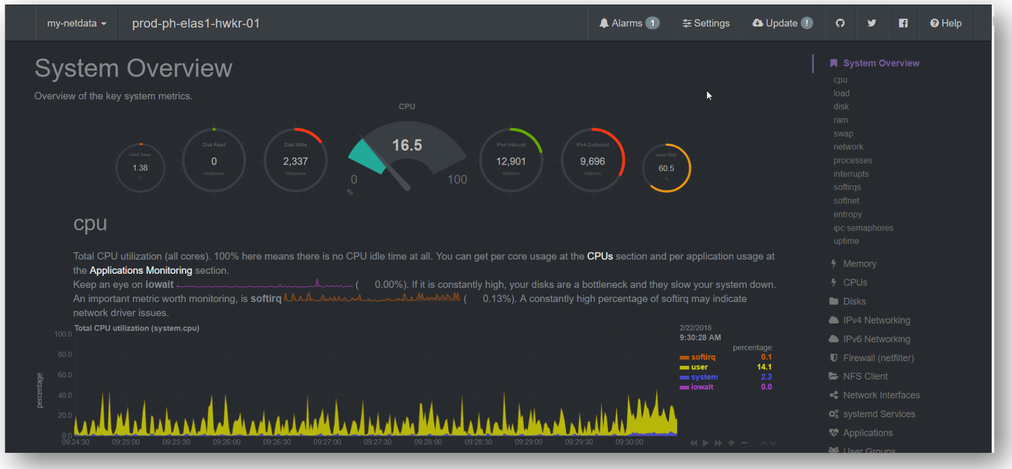


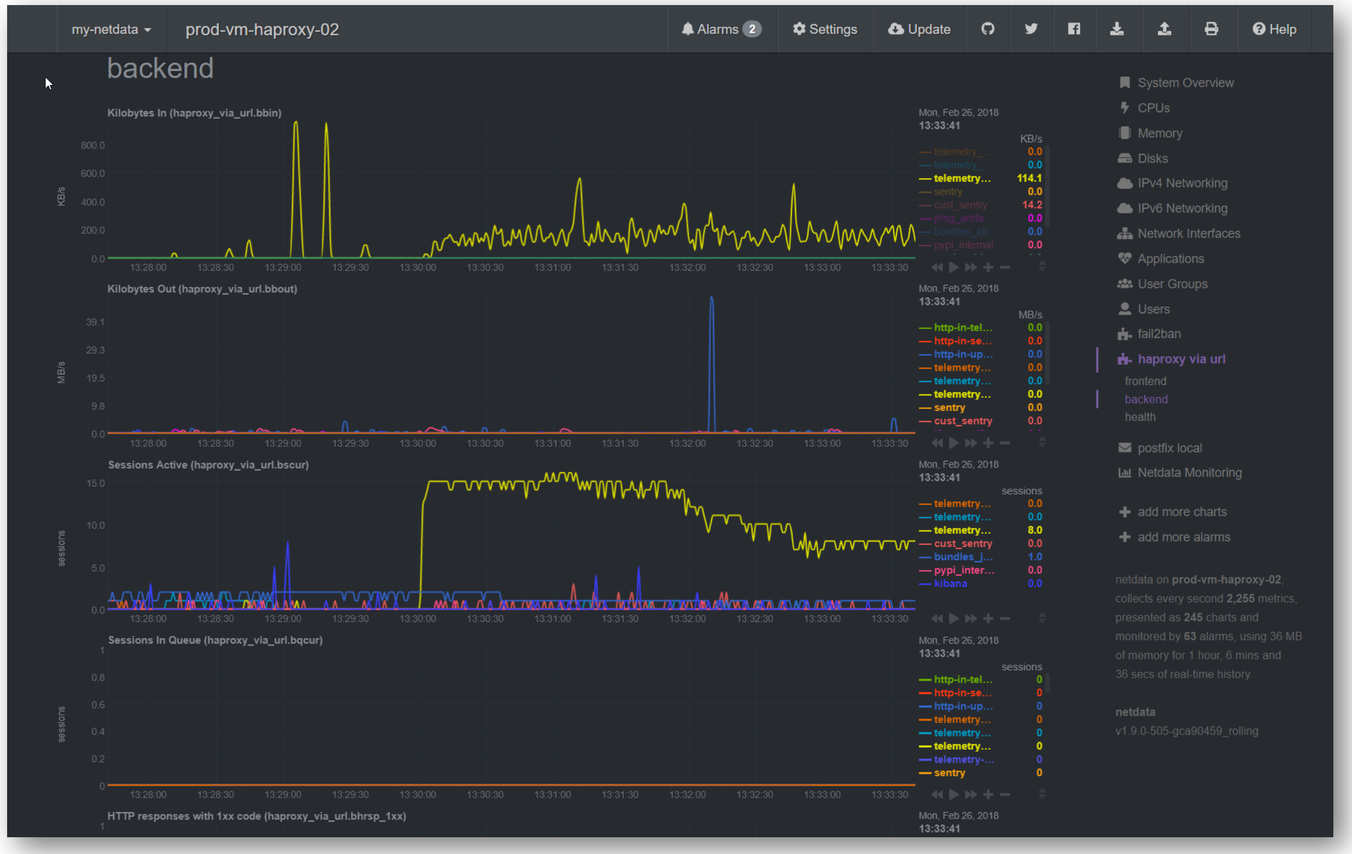
NetData – See your cluster in real-time

- NetData has helped us understand and observe how our cluster works in real-time via custom dashboards
- https://github.com/firehol/netdata/wiki/Custom-Dashboards (see custom dashboard examples)

NetData – **top** for your browser (and more)

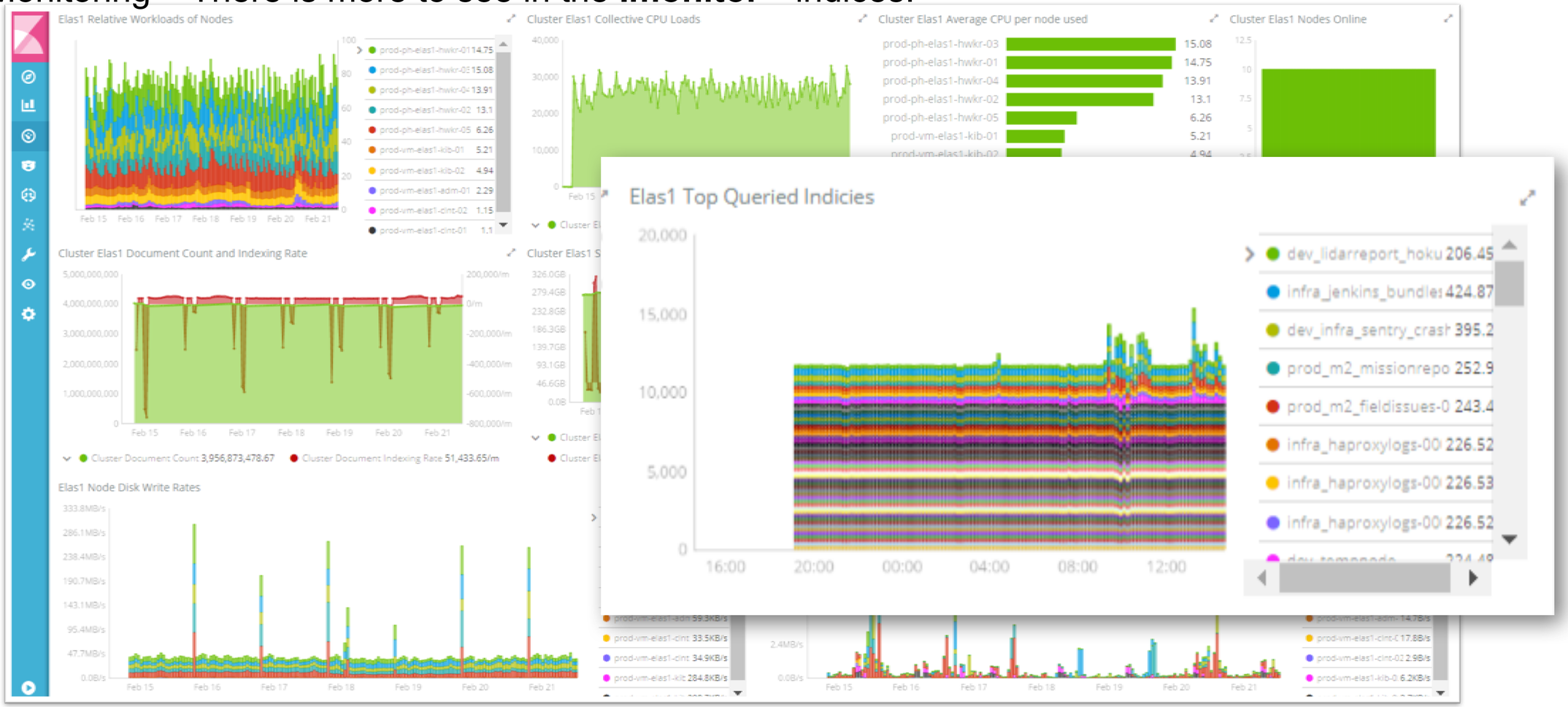
- Single pane of glass to view details on any single node and services like HAProxy, Elastic, Java JMX etc
- See https://my-netdata.io for more details!





X-Pack Monitoring – Custom Dashboards

- X-Pack Monitoring – There is more to see in the **.monitor-*** indices!



Sentry + Elastic

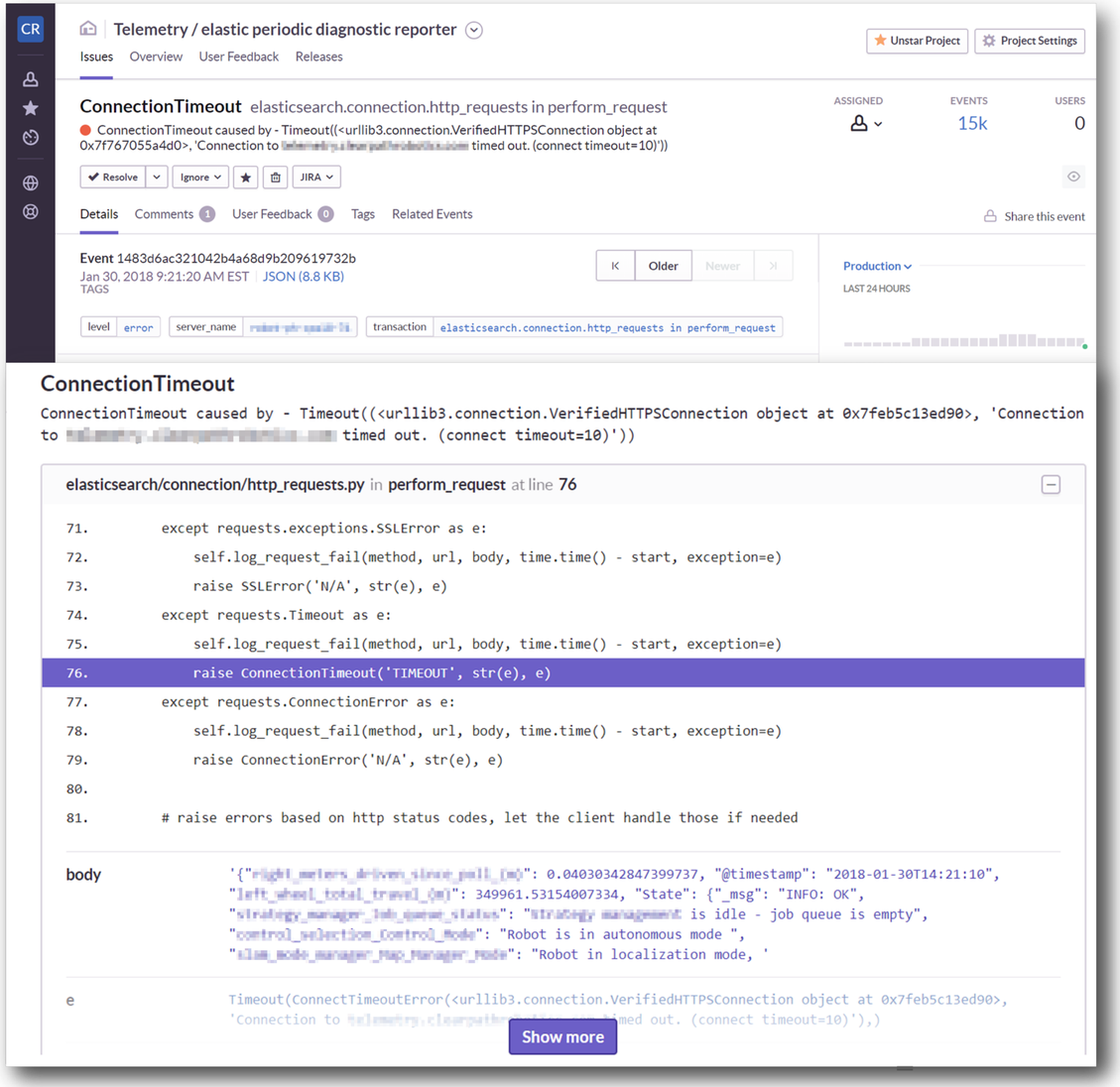
More reliable products via IoT

Sentry – Never reproduce a software failure!

- We use Sentry in all aspects of our product development and usage

- Javascript, Python, C/C++ (our own custom component) and other languages supported turn key including logging hooks

- Used to ensure our IoT stack components, can report back any failures so we can easily correct issues

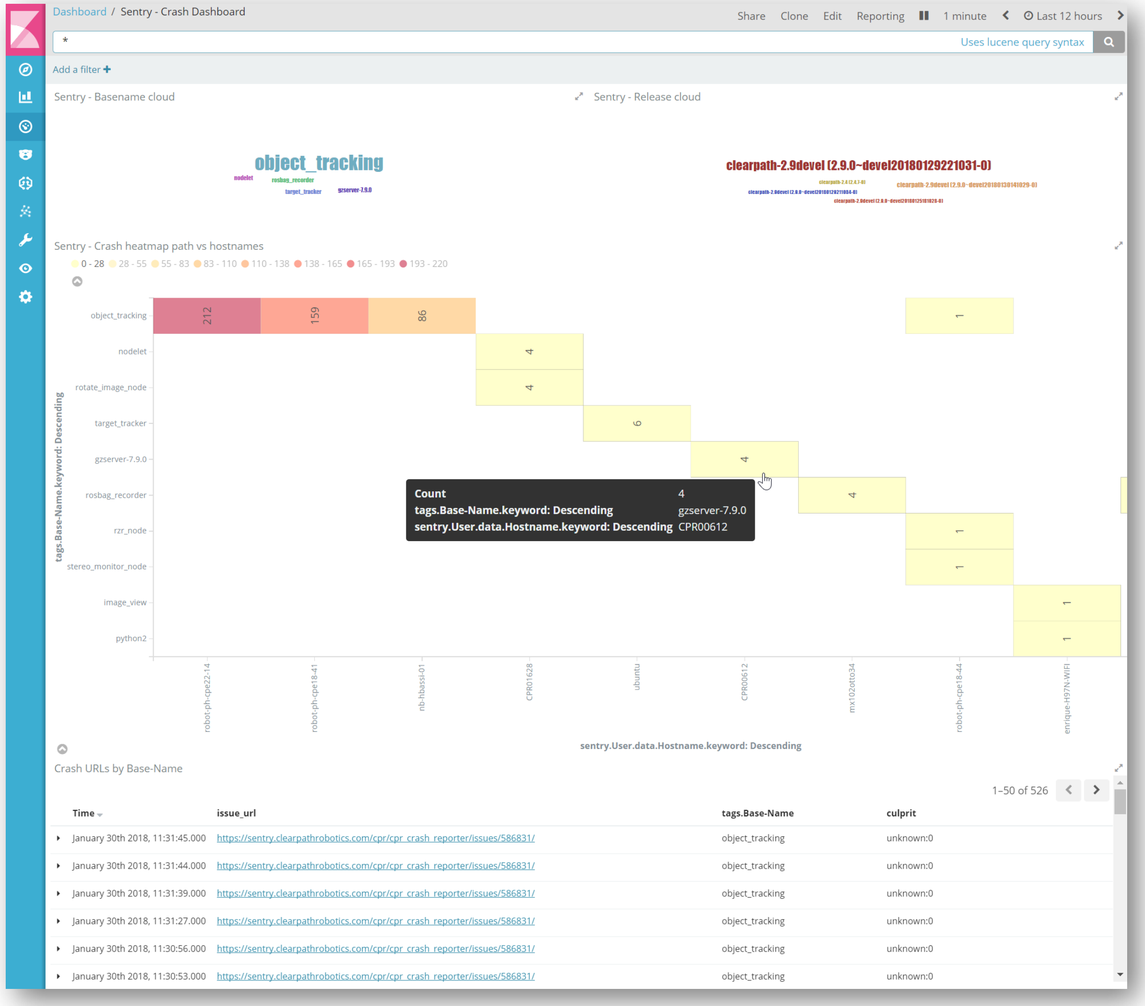


Sentry + Elastic

Software Failures – Big Data Metrics

Experimental Sentry Elastic Reporting

- Sentry server based on Python Django - write custom plugins!
- Presently indexing every software failure into Elasticsearch
- Vast potential for improved workflows and metrics based software quality initiatives

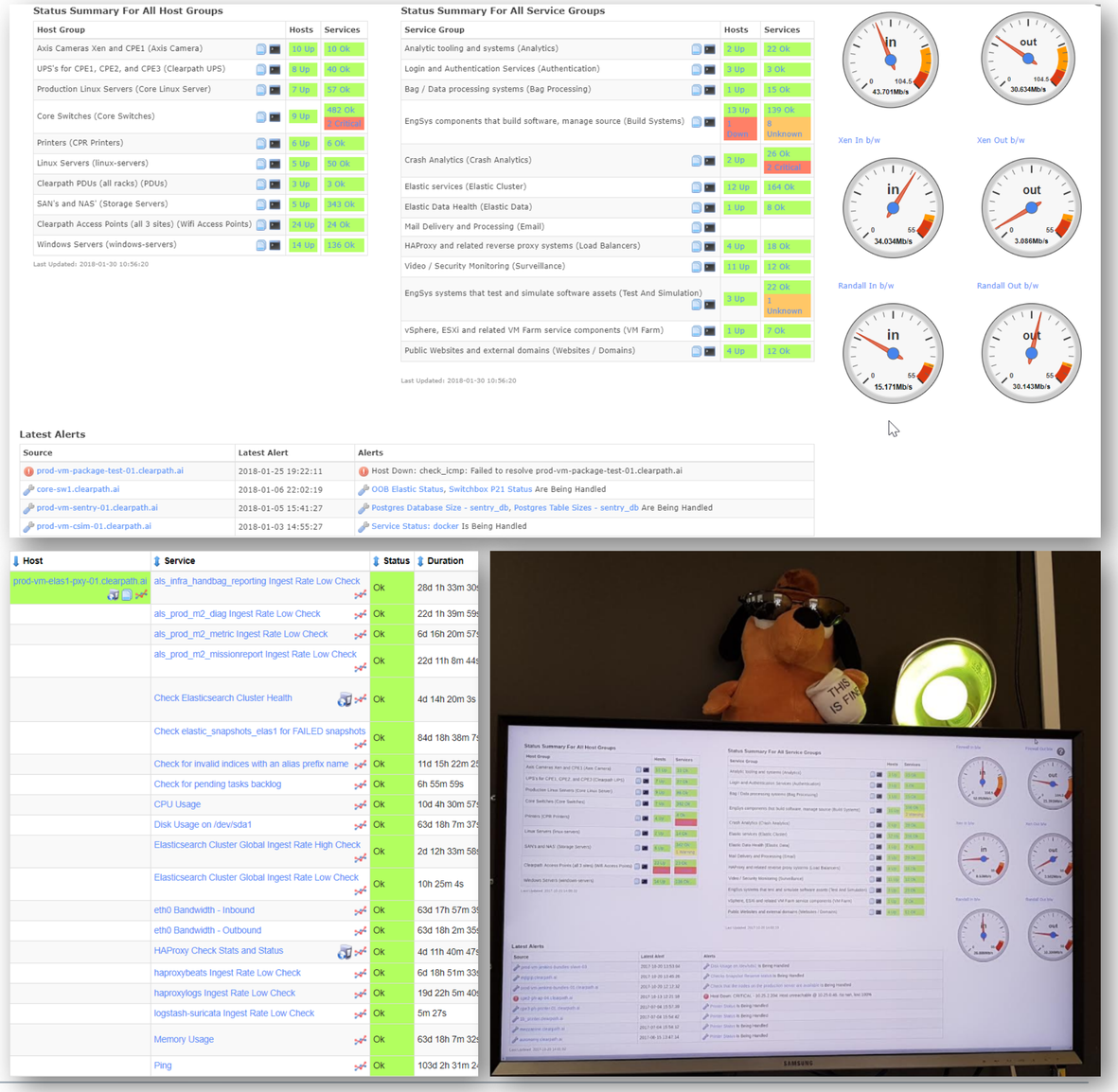


Elastic + Nagios

Diagnostics to your door

You *need* more than just X-Pack Monitoring

- We monitor and run over 250+ diagnostic tests on our cluster
- Checks test both elastic *and* its data
- **`_CAT`** API's make easy checks/tests using URL rules
  - `check_xi_service_http! -r "als_|sals_" --invert-regex -f ok -I prod-vm-elas1-pxy-01 -u '/_cat/indices/' -p 9200`
- Lots of great Elastic Nagios scripts available for use online
- Philips Hue Lights driven by Nagios API's



Elastic + systemd

SSD failure and systemd

How I learned to *love* systemd

- Using Linux and Elastic?

  … **systemd** can make life easier

- Make issues easier to troubleshoot
- Smarter handling of failures

```
kernel: [1544287.003167] ata2.00: failed command: WRITE FPDMA QUEUED
kernel: [1544287.003335] ata2.00: cmd 61/08:00:30:38:81/00:00:3a:00:00/40 tag 0 ncq 4096 out
kernel: [1544287.003335]          res 40/00:10:58:9c:81/00:00:3a:00:00/40 Emask 0x50 (ATA bus error)
kernel: [1544287.003816] ata2.00: status: { DRDY }

kernel: [1544303.114586] blk_update_request: I/O error, dev sdb, sector 981547056
kernel: [1544303.119340] Buffer I/O error on dev sdb1, logical block 122693126, lost async page write
kernel: [1544303.128784] sd 1:0:0:0: rejecting I/O to offline device
kernel: [1544303.133622] sd 1:0:0:0: [sdb] killing request

systemd[1]: Unmounting /mnt/data...
systemd[1]: Stopped Elasticsearch.
systemd[1]: Unmounted /mnt/data.

systemd[1]: Timed out waiting for device SAMSUNG_MZ7KM960HAHP-00005 1.
systemd[1]: Dependency failed for /mnt/data.
systemd[1]: mnt-data.mount: Job mnt-data.mount/start failed with result 'dependency'.
```

```
root@prod-ph-elas1-hwkr-01:/# head  /usr/lib/systemd/system/elasticsearch.service
[Unit]
Description=Elasticsearch
Documentation=http://www.elastic.co
Wants=network-online.target
After=network-online.target
RequiresMountsFor=/mnt/data/nodes                <---- this one
ConditionPathIsMountPoint=/mnt/elastic_snapshots   <---- and this one
```

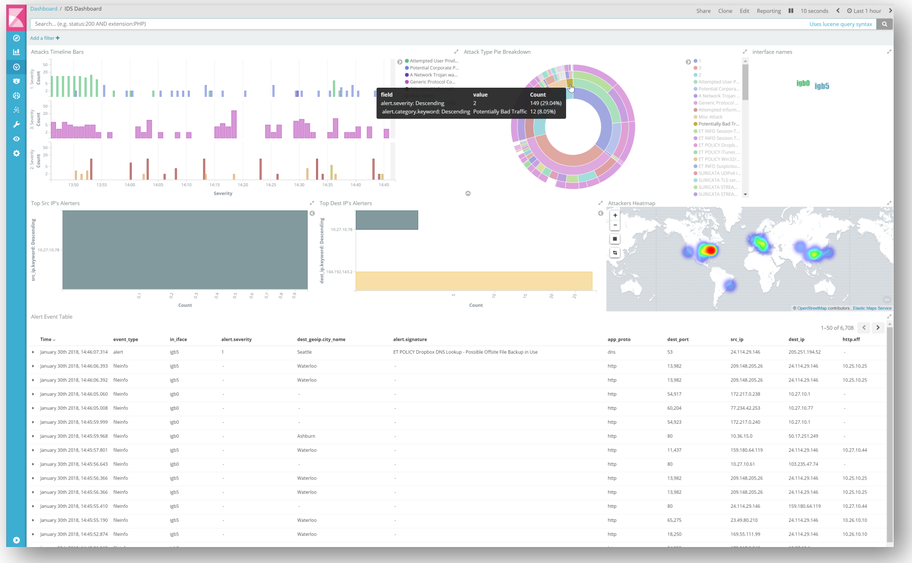
Suricata EVE + Elastic

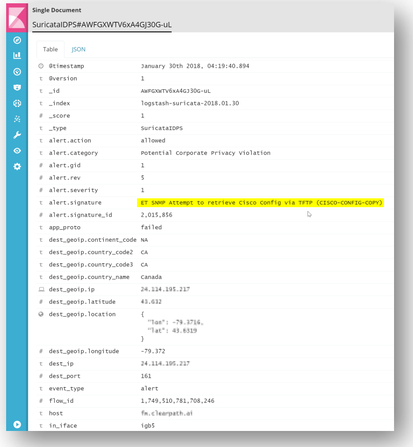
Easy Elastic Intrusion Detection / Prevention Stack

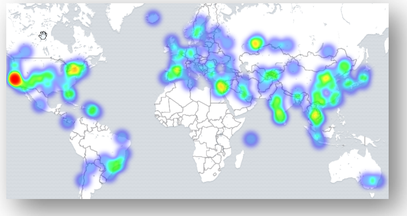
New to IDS/IPS? This is a great starter stack!

- IoT must have security as part of its scope
- Suricata EVE + Elastic = *Low* barrier way to get started
- pfSense makes Suricata even easier to setup and use!

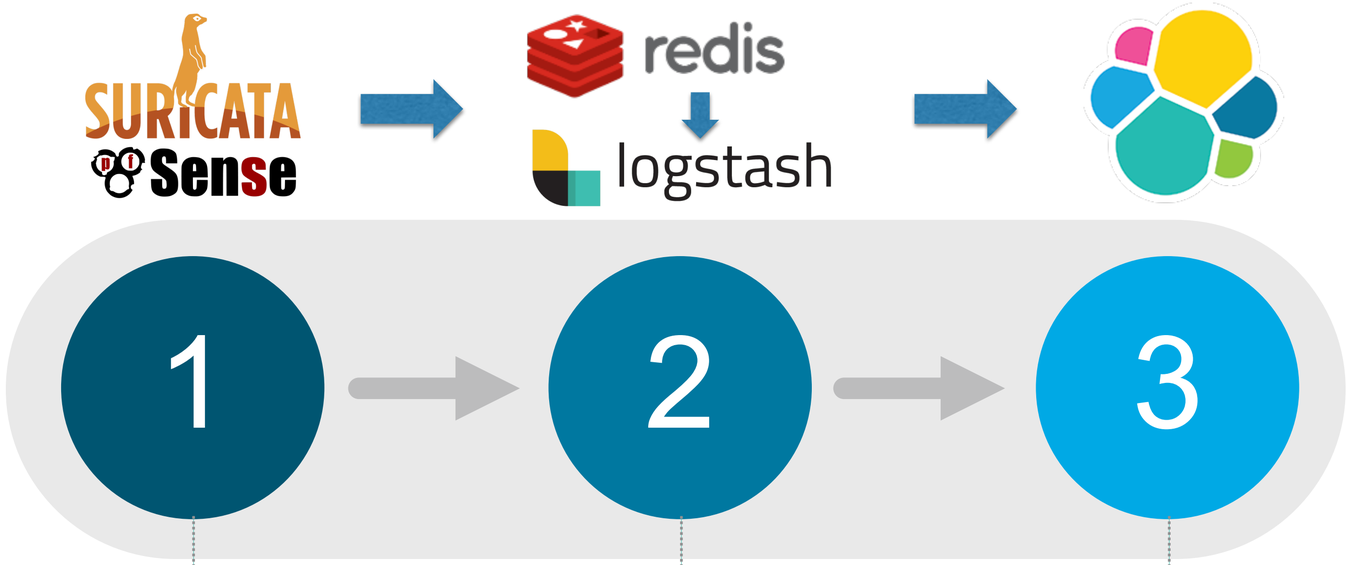
See https://www.pfsense.org/ and https://suricata-ids.org/







Intrusion Detection easy as 1-2-3

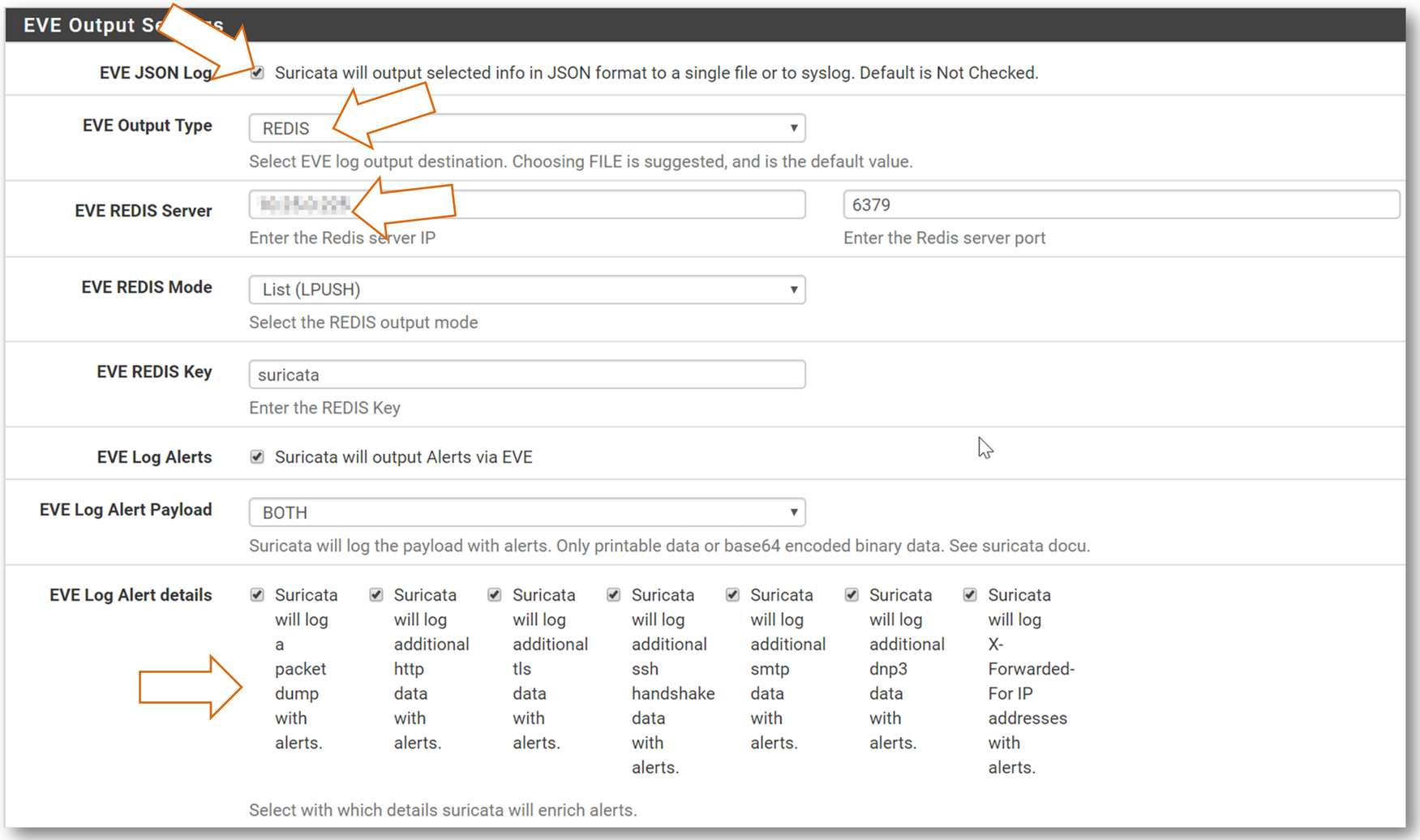


Suricata outputs EVE JSON to Redis

Logstash pulls from Redis and sends to Elasticsearch

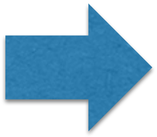
Elasticsearch and Kibana to action

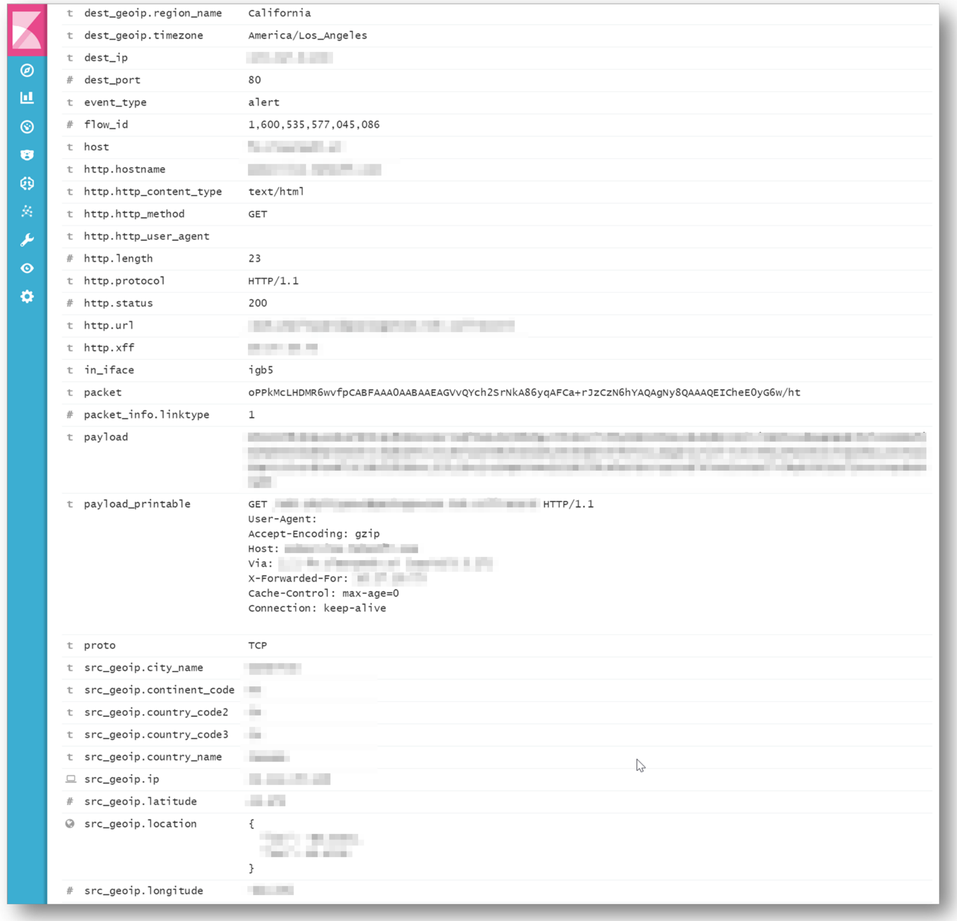
pfSense - EVE Setup



Suricata – YAML EVE Example

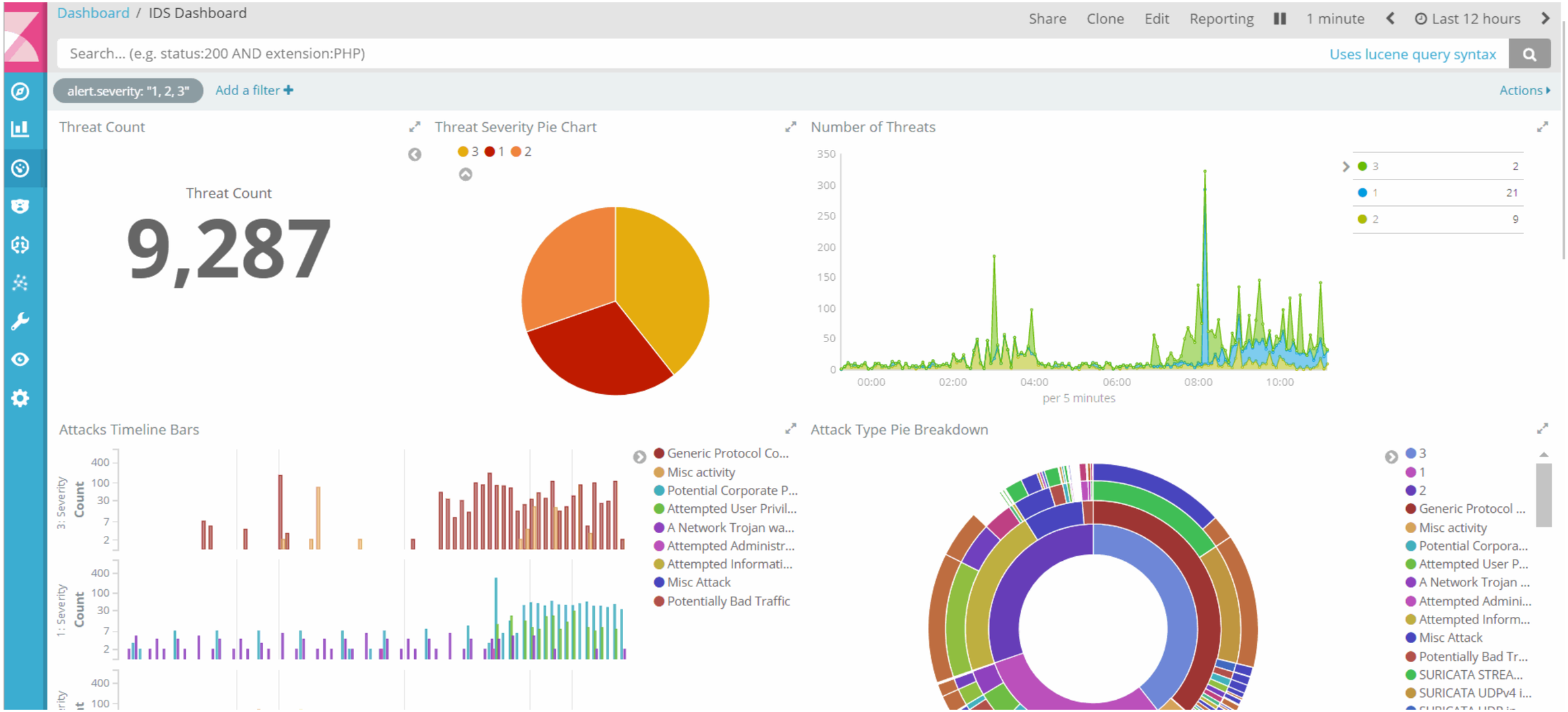
```
- eve-log:
    enabled: yes
    type: redis
    redis:
      server: 192.168.10.178
      port: 6379
      mode: list
      key: "suricata"
    types:
      - alert:
          payload: yes           # enable dumping payload in Base64
          payload-printable: yes # enable dumping payload in printable (lossy) format
          packet: yes            # enable dumping of packet (without stream segments)
          http: yes              # enable dumping of http fields
          tls: yes               # enable dumping of tls fields
          ssh: yes               # enable dumping of ssh fields
          smtp: yes              # enable dumping of smtp fields
          dnp3: yes              # enable dumping of DNP3 fields
          tagged-packets: yes    # enable logging of tagged packets
      - http:
          extended: yes
          custom: [accept, .....<more here if you want>...., x-authenticated-user]
      - dns:
          query: yes
          answer: yes
      - tls:
          extended: no
      - files:
          force-magic: no
      - ssh
      - smtp:
          extended: yes
          custom: [received, x-mailer, x-originating-ip, relays, reply-to, bcc]
          md5: [subject]
```





http://suricata.readthedocs.io/en/latest/output/eve/eve-json-output.html

Suricata + Kibana



https://github.com/gregwjacobs/ElasticSuricata

What’s next for our IoT stack?

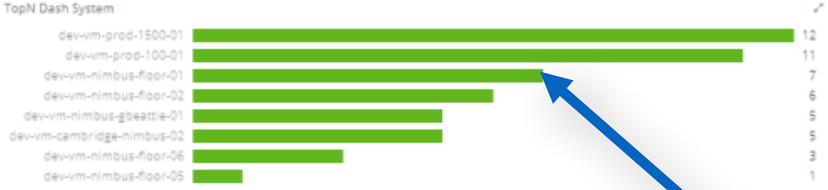
- Kafka Cluster for Ingress, cold storage (HDFS + Hadoop) and multi-cluster mirroring?
- Auditbeats usage to verify secure products in-field. Mine edge use cases to drive product roadmaps!
- Our own abstracted IoT API’s ? Perhaps we BULK up? I really do like the **_BULK** API – kudos!
- APM all the things!
- Machine Learning driven insights, alarming and actionable automation driving business processes
- Customer facing data driven products and/or services
  - Elastic Cloud Enterprise on premises?
  - Kibana Multi-Tenant, Kibana Canvas, Customer Elastic Cloud pods?

Elastic at work…

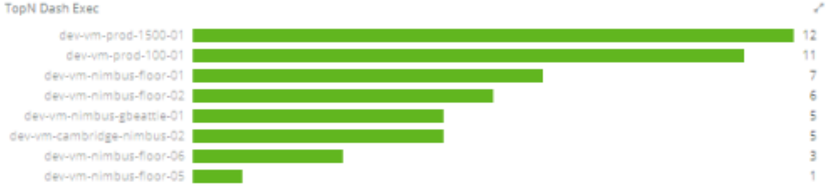
host.keyword:dev-vm-nimbus-* OR host.keyword:dev-vm-cambridge-nimbus-* OR host.keyword:dev-vm-prod-*

Uses lucene query syntax

System by Robot Count

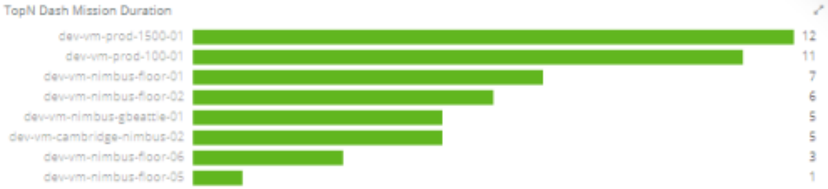


Exec



Handbags 200

Mission Duration

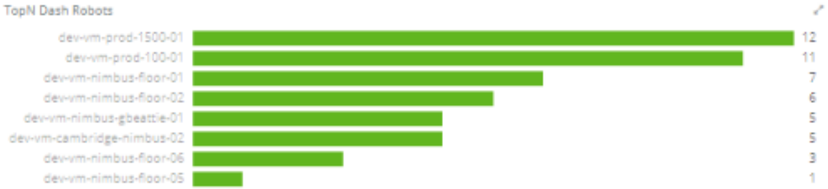


Mission Count 3,633

Click here

Utilization

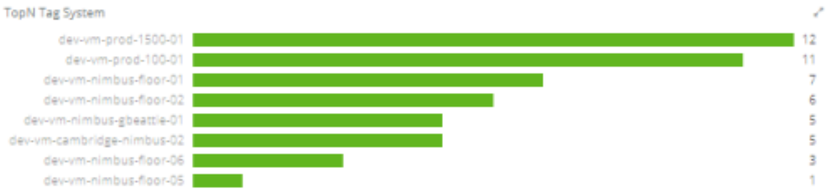
Robots



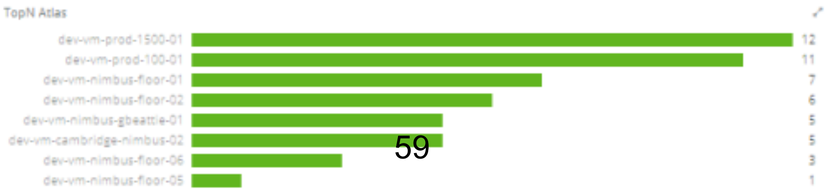
Network by Uplink

Meters Driven 129,910.54

System Tags

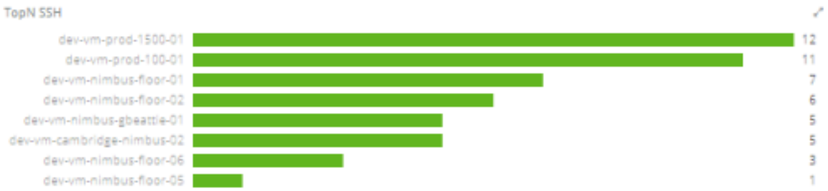


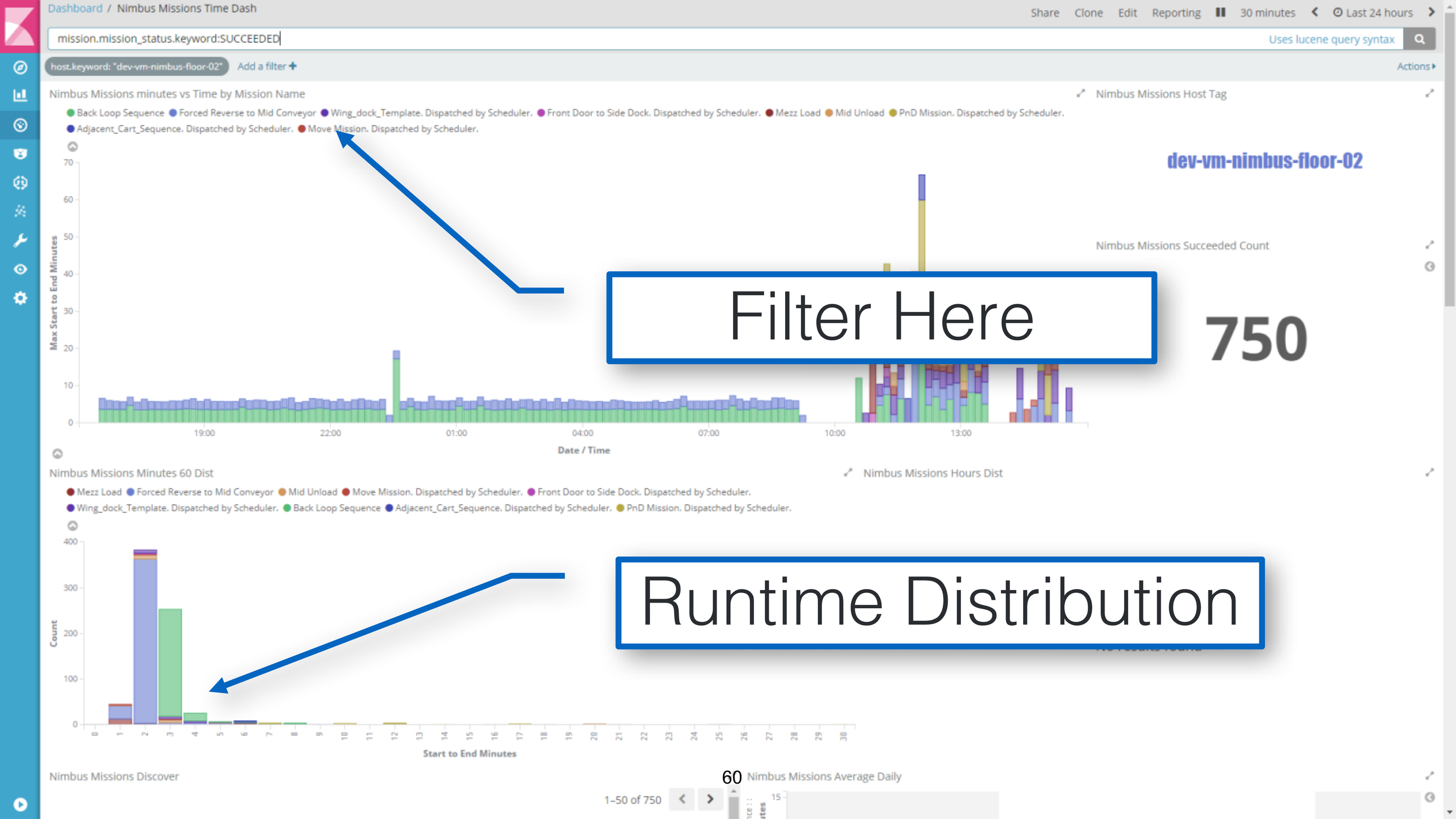
Atlas - CPR Only

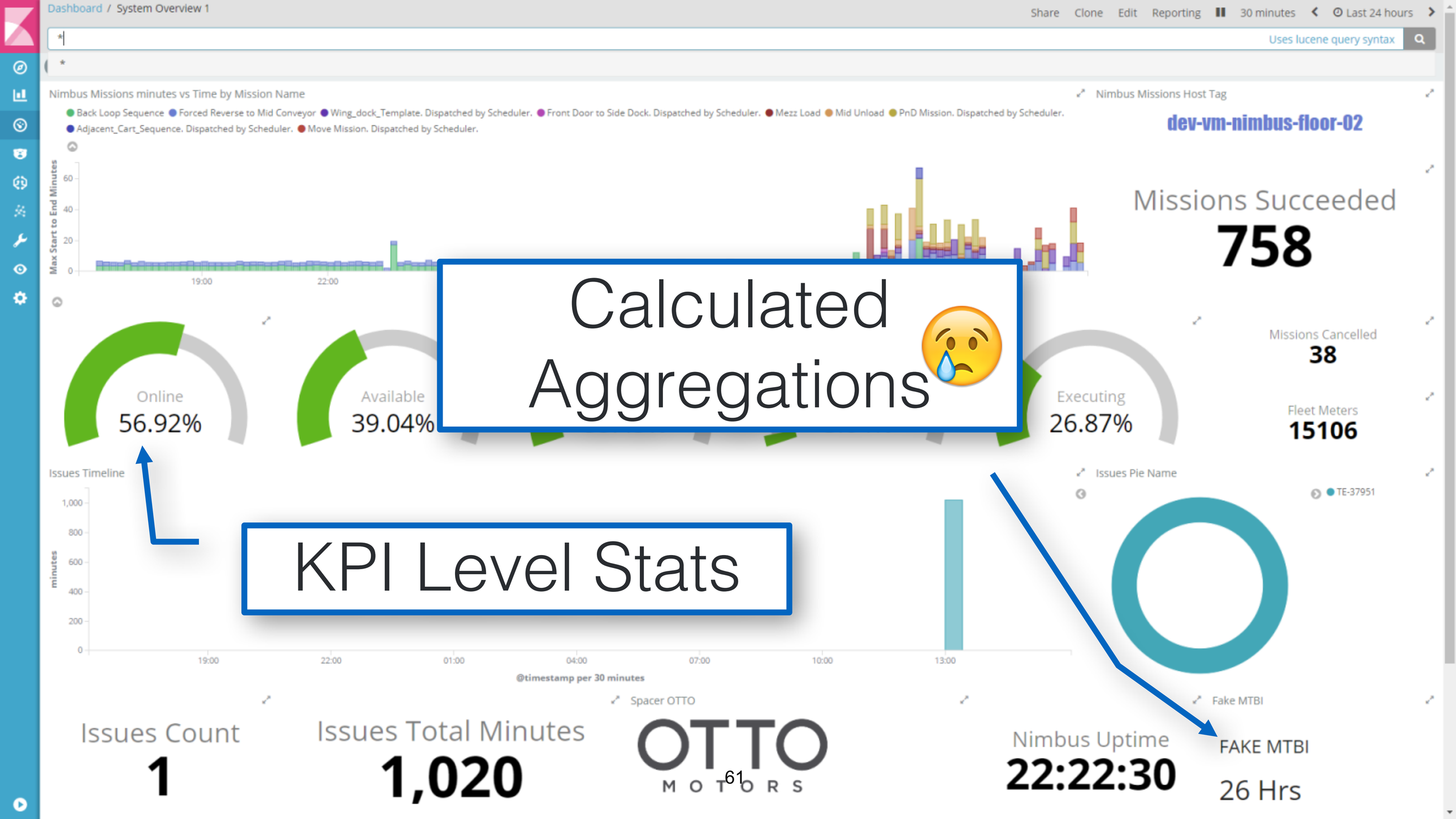


SSH - CPR Only

Chrome Secure Shell Critical Install Instructions




Dashboard / Nimbus Missions Time Dash
Share
Clone
Edit
Reporting
30 minutes
Last 24 hours
mission.mission_status.keyword:SUCCEEDED
Uses lucene query syntax
host.keyword: "dev-vm-nimbus-floor-02"
Add a filter +
Actions
Nimbus Missions minutes vs Time by Mission Name
Back Loop Sequence
Forced Reverse to Mid Conveyor
Wing_dock_Template. Dispatched by Scheduler.
Front Door to Side Dock. Dispatched by Scheduler.
Mezz Load
Mid Unload
PnD Mission. Dispatched by Scheduler.
Adjacent_Cart_Sequence. Dispatched by Scheduler.
Move Mission. Dispatched by Scheduler.
Max Start to End Minutes
Date / Time
Nimbus Missions Host Tag
dev-vm-nimbus-floor-02
Nimbus Missions Succeeded Count
750
Filter Here
Nimbus Missions Minutes 60 Dist
Count
Start to End Minutes
Nimbus Missions Hours Dist
Runtime Distribution
Nimbus Missions Discover
1–50 of 750
Nimbus Missions Average Daily


Dashboard / System Overview 1
Share
Clone
Edit
Reporting
30 minutes
Last 24 hours
Uses lucene query syntax
Nimbus Missions minutes vs Time by Mission Name
Back Loop Sequence
Forced Reverse to Mid Conveyor
Wing_dock_Template. Dispatched by Scheduler.
Front Door to Side Dock. Dispatched by Scheduler.
Mezz Load
Mid Unload
PnD Mission. Dispatched by Scheduler.
Adjacent_Cart_Sequence. Dispatched by Scheduler.
Move Mission. Dispatched by Scheduler.
Max Start to End Minutes
Nimbus Missions Host Tag
dev-vm-nimbus-floor-02
Missions Succeeded
758
Calculated Aggregations
Online
56.92%
Available
39.04%
Executing
26.87%
Missions Cancelled
38
Fleet Meters
15106
Issues Timeline
minutes
@timestamp per 30 minutes
KPI Level Stats
Issues Pie Name
TE-37951
Issues Count
1
Issues Total Minutes
1,020
Spacer OTTO
OTTO MOTORS
Nimbus Uptime
22:22:30
Fake MTBI
FAKE MTBI
26 Hrs

Dashboard / Handbag Events dashboard elk

Share Clone Edit Reporting 30 minutes Last 24 hours

Search... (e.g. status:200 AND extension:PHP) Uses lucene query syntax

Press F11 to exit full screen

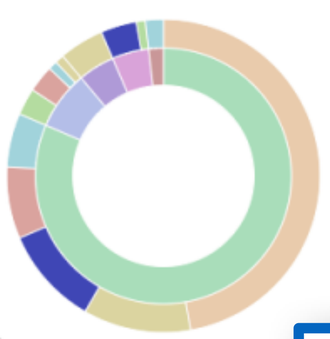
Add a filter +

Fleet Nimbus Instance Handbag

dev-vm-nimbus-floor-02

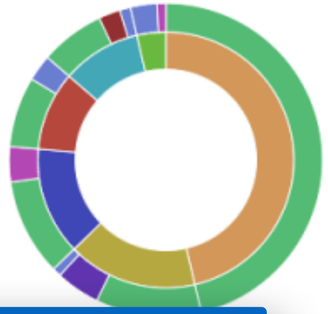
Where?

Handbag Description by Robot pie



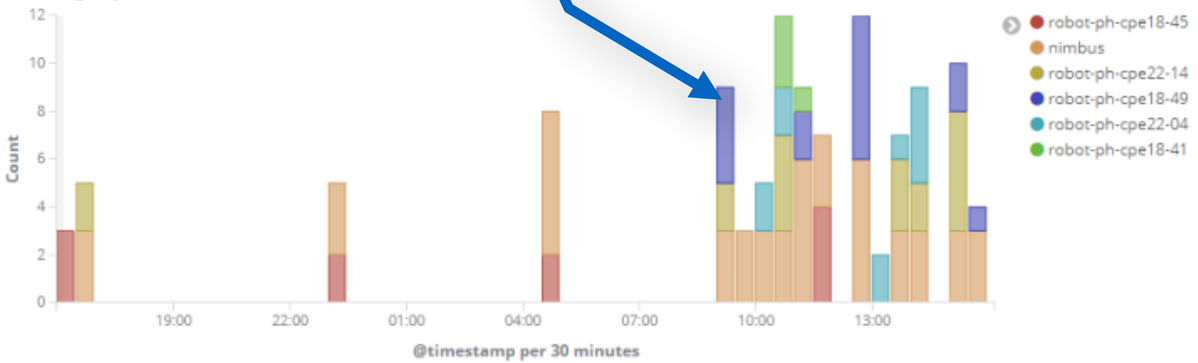
Testing
lost localization
appliance failure
e-stop button pressed
traction loss detected
nimbus
robot-ph-cpe22-14
robot-ph-cpe18-49
robot-ph-cpe18-45
robot-ph-cpe22-04
robot-ph-cpe18-41

Handbag Robot by Description pie



nimbus
robot-ph-cpe22-14
robot-ph-cpe18-49
robot-ph-cpe18-45
robot-ph-cpe22-04
robot-ph-cpe18-41
Testing
appliance failure
lost localization
e-stop button pressed
traction loss detected

HandBag - By robot event counts



robot-ph-cpe18-45
nimbus
robot-ph-cpe22-14
robot-ph-cpe18-49
robot-ph-cpe22-04
robot-ph-cpe18-41

What?

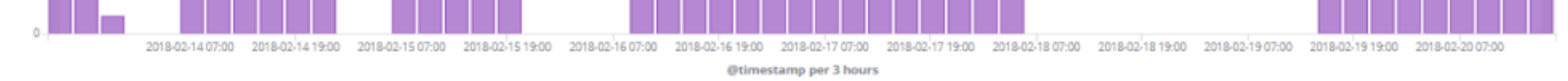
HandBag - By description event cou

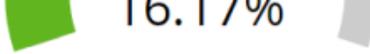
lost localization
Testing
appliance failure
e-stop button pressed
traction loss detected

Link to assets

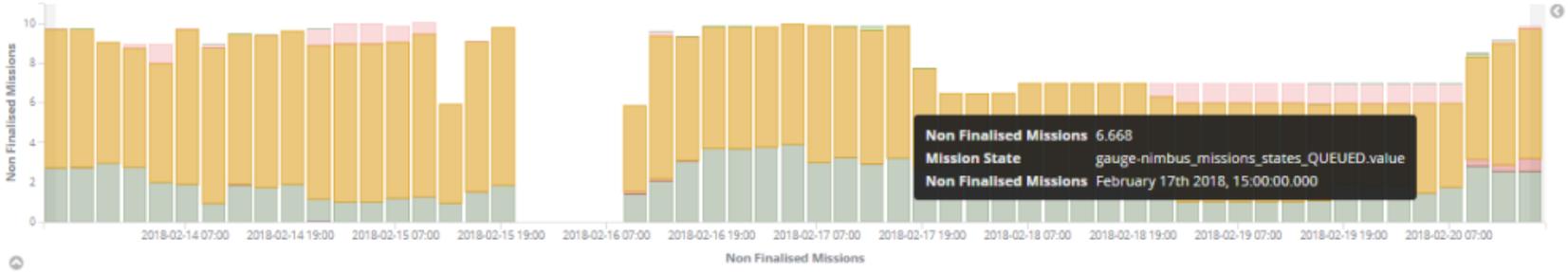
Handbag events table

Time	description	host	namespace	incident_id	path		
February 20th 2018, 15:45:33.000	Testing	dev-vm-nimbus-floor-02	nimbus	924FF45D	http://handbags/dev-vm-nimbus-floor-02/nimbus/nimbus_924FF45D_1.bag	-	robots
February 20th 2018, 15:45:33.000	Testing	dev-vm-nimbus-floor-02	nimbus	924FF45D	http://handbags/dev-vm-nimbus-floor-02/nimbus/nimbus_924FF45D_2.bag	-	nimbus
February 20th 2018, 15:45:33.000	Testing	dev-vm-nimbus-floor-02	nimbus	924FF45D	http://handbags/dev-vm-nimbus-floor-02/nimbus/nimbus_924FF45D_3.bag	-	logs
February 20th 2018, 15:45:33.000	Testing	dev-vm-nimbus-floor-02	robot-ph-cpe18-49	924FF45D	http://handbags/dev-vm-nimbus-floor-02/robot-ph-cpe18-49/robot_ph_cpe18_49_924FF45D_1.bag	-	dash_cam
February 20th 2018, 15:13:58.153	e-stop button pressed	dev-vm-nimbus-floor-02	robot-ph-cpe18-49	-	http://handbags/dev-vm-nimbus-floor-02/robot-ph-cpe18-49/robot_ph_cpe18_49_base_2018-02-20-20-13-28_pre.bag	base	-
February 20th 2018, 15:13:58.153	e-stop button pressed	dev-vm-nimbus-floor-02	robot-ph-cpe18-49	-	http://handbags/dev-vm-nimbus-floor-02/robot-ph-cpe18-49/robot_ph_cpe18_49_base_2018-02-20-20-13-28_post.bag	base	-
February 20th 2018, 15:12:44.000	Testing	dev-vm-nimbus-floor-02	robot-ph-cpe22-14	E746CCDE	http://handbags/dev-vm-nimbus-floor-02/robot-ph-cpe22-14/robot_ph_cpe22_14_E746CCDE_1.bag	-	dash_cam





State nimbus missions non finalised AVG



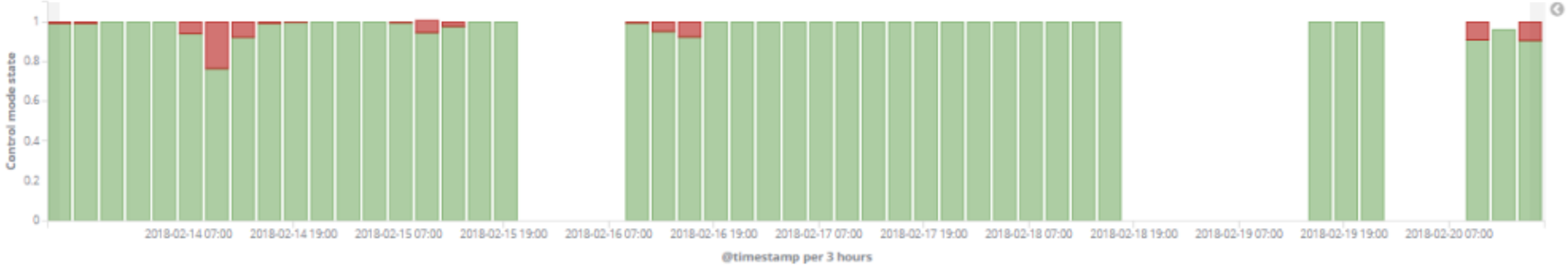
State nimbus missions non finalised pie AVG

Metric Avg Missions Exec

Avg Missions Executing

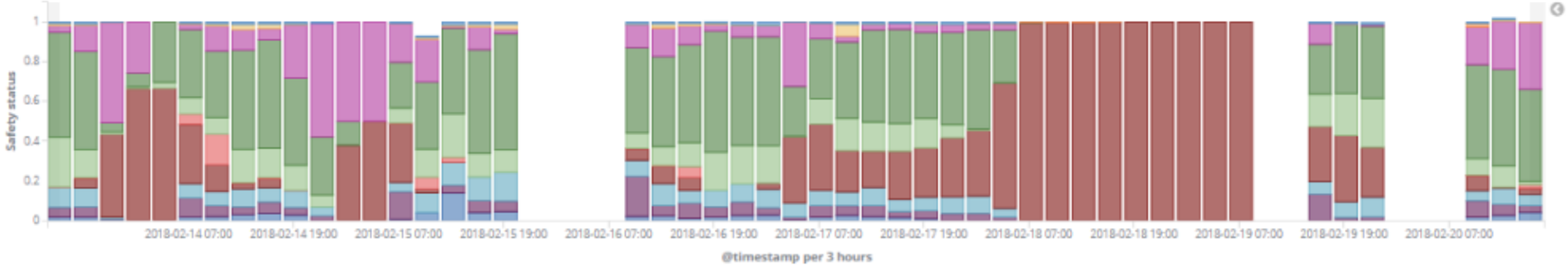
2.082

State controlmode



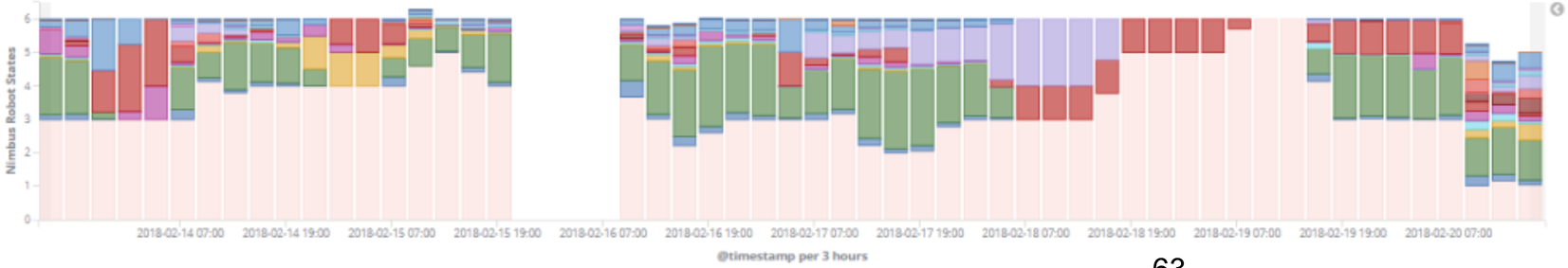
State controlmode pie

State safetystatus

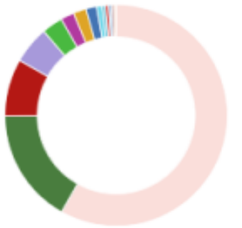


State safetystatus pie

State Nimbus Robots



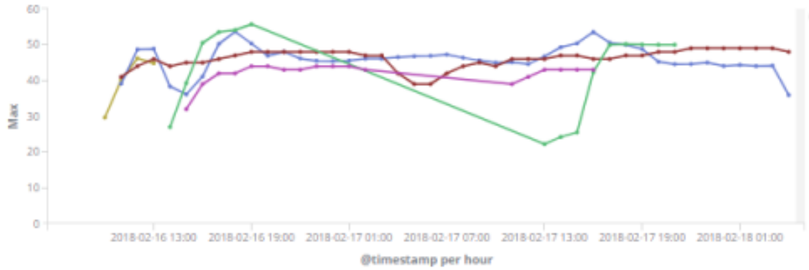
State Nimbus Robots Pie



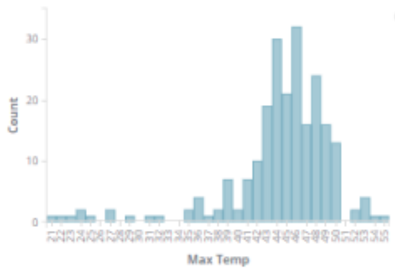
State fleet activity

State fleet activity pie

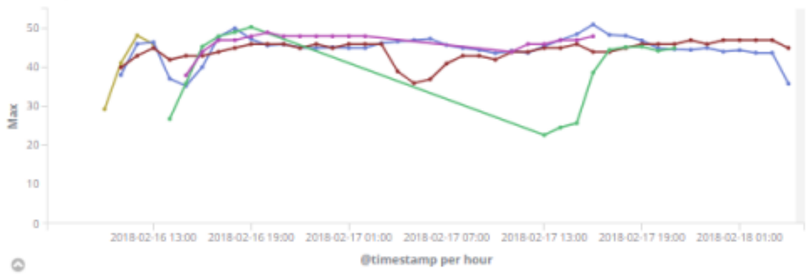
Robot Left Motor Temperature Max



Robot Left Motor Temperature Max Dist



Robot Right Motor Temperature Max



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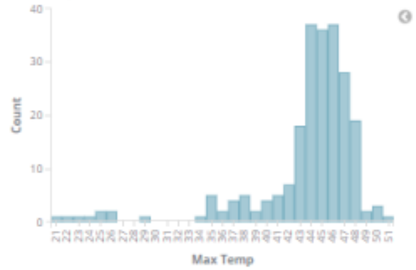
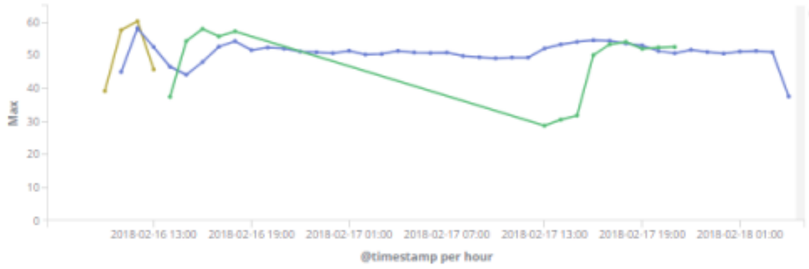
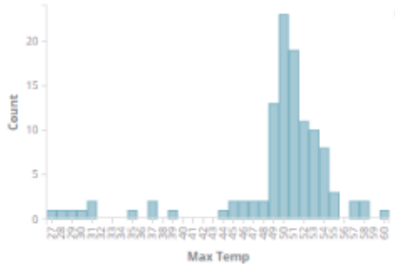


Robot Left Bridge Temperature Max



Robot Left Bridge Temperature Max Dist



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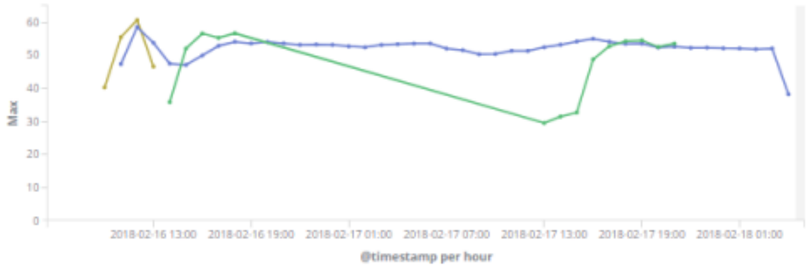

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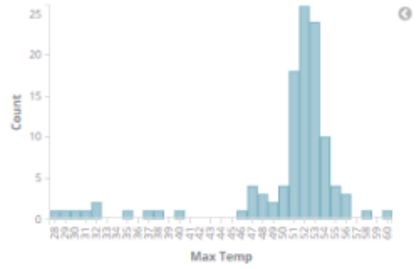
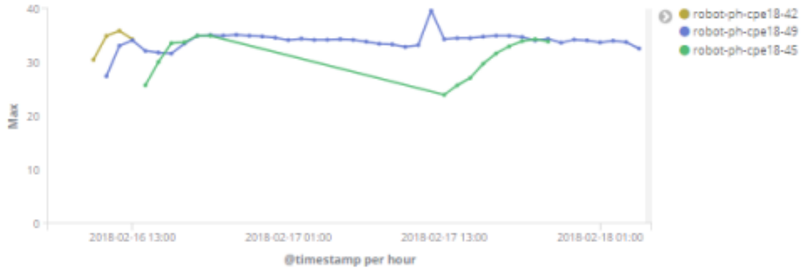


Robot Lift Motor Temperature Max



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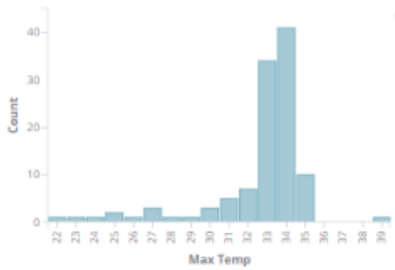
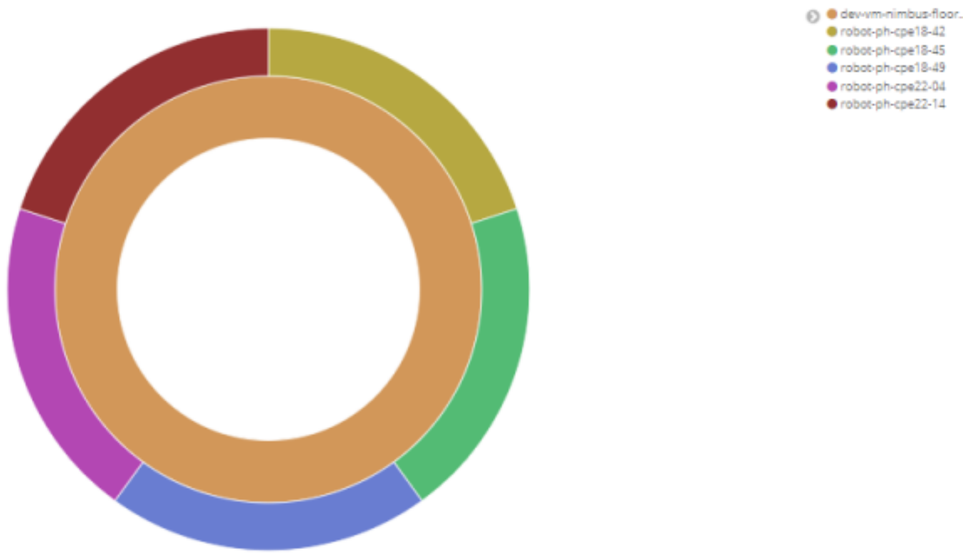


Nimbus Robot Host Pie



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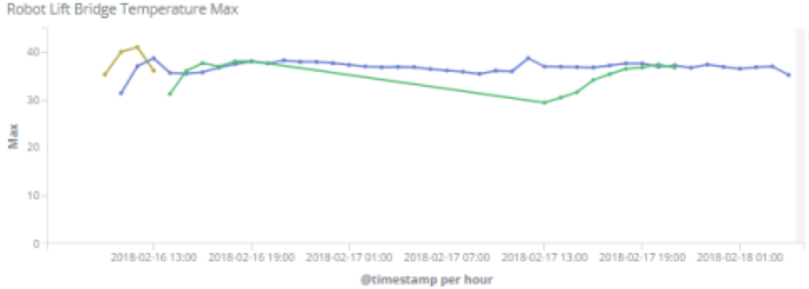

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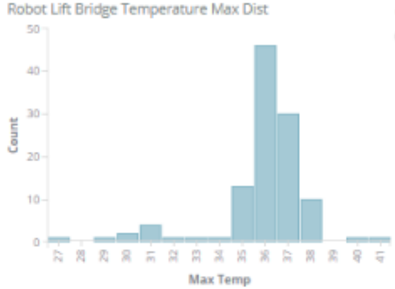
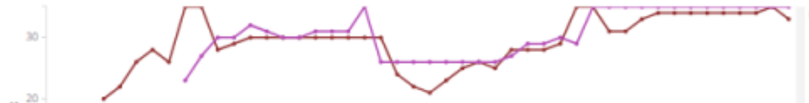
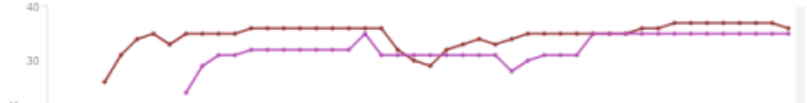


Robot Left Brake Temperature Max



Robot Left Brake Temperature Max Dist

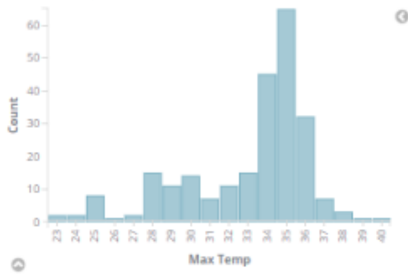
Robot Right Brake Temperature Max



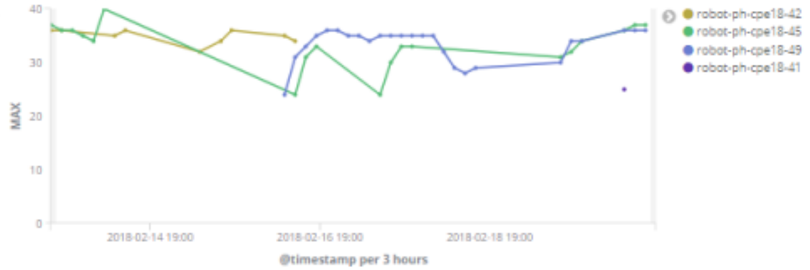
Robot Right Brake Temperature Max Dist

Robot Battery Cell 0 Temperature Max

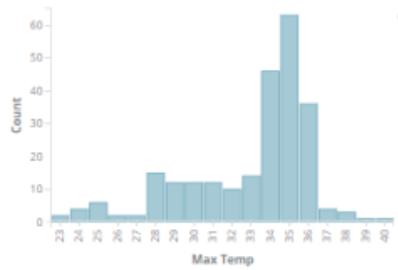
Robot Battery Cell 0 Temperature Max Dist



Robot Battery Cell 1 Temperature Max



Robot Battery Cell 1 Temperature Max Dist



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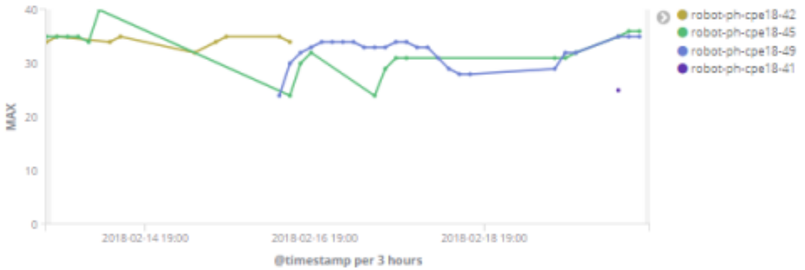
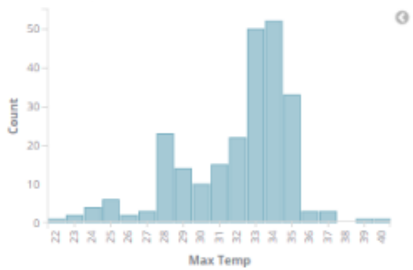
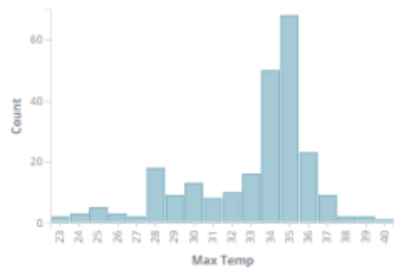


Robot Battery Cell 2 Temperature Max Dist

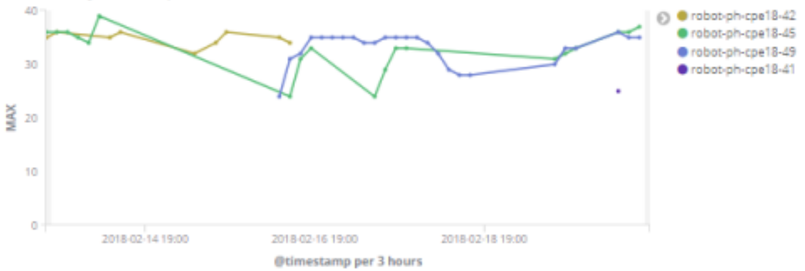


Robot Battery Cell 3 Temperature Max

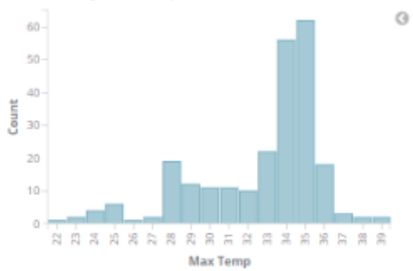
Robot Battery Cell 3 Temperature Max Dist



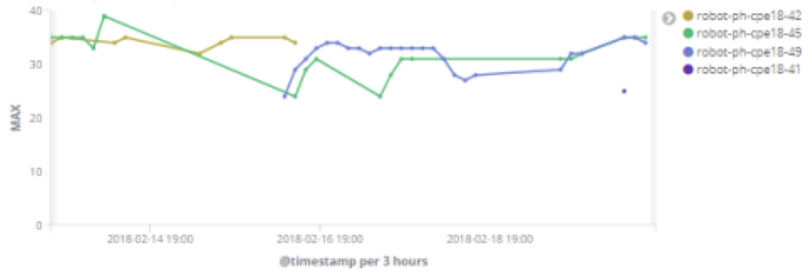
Robot Battery Cell 4 Temperature Max



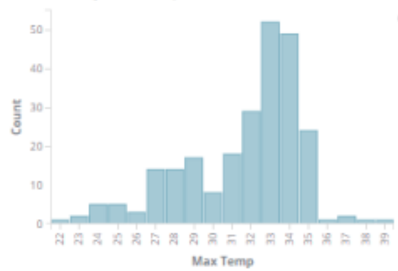
Robot Battery Cell 4 Temperature Max Dist



Robot Battery Cell 5 Temperature Max



Robot Battery Cell 5 Temperature Max Dist



Nimbus Robot Host Pie


Dashboard / Temp Node
Share
Clone
Edit
Reporting
January 22nd 2018, 00:00:00.000 to January 29th 2018, 23:59:59.999
*
Uses lucene query syntax
Add a filter
Temp Node - Location
Fergus
Rockwood
Acton
Elmira
Guelph
Waterloo
Kitchener
Hespeler
New Hamburg
Cambridge
Sheffield
Branchton
Rockton
Paris
Brantford
Woodstock
Norwich
Count
2,297 – 2,758.8
2,758.8 – 3,220.6
3,220.6 – 3,682.4
3,682.4 – 4,144.2
4,144.2 – 4,606
© OpenStreetMap contributors , Elastic Maps Service
Temp Node - Temperature Chart
2018-01-22 19:00
2018-01-23 19:00
2018-01-24 19:00
2018-01-25 19:00
2018-01-26 19:00
2018-01-27 19:00
2018-01-28 19:00
@timestamp per 3 hours
Temp Node - Temperature Distribution
Count
Temperature Degrees
Temp Node - Humidity Chart
@timestamp per 3 hours
Temp Node - Humidity Distribution
Humidity
Temp Node - Machine

Nimbus Robot Host Pie

Fleet Meters

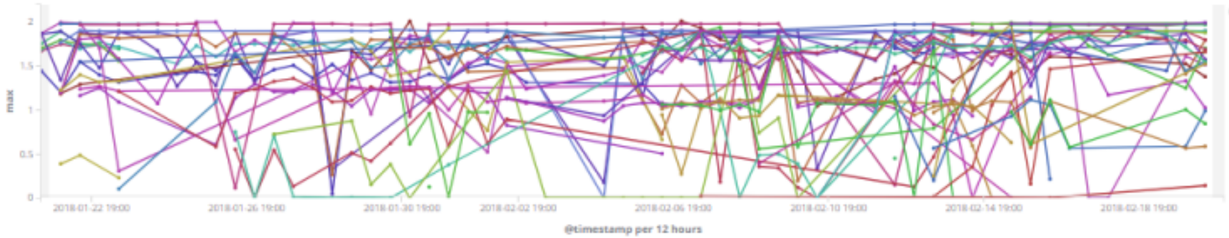
3370450

Spacer OTTO

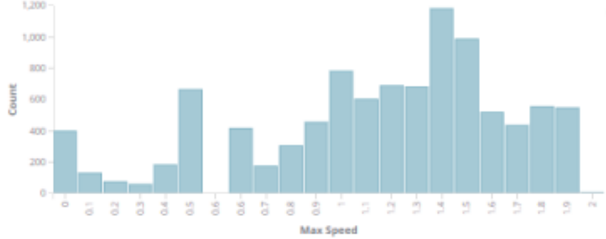
OTTO MOTORS

Robot meters pie

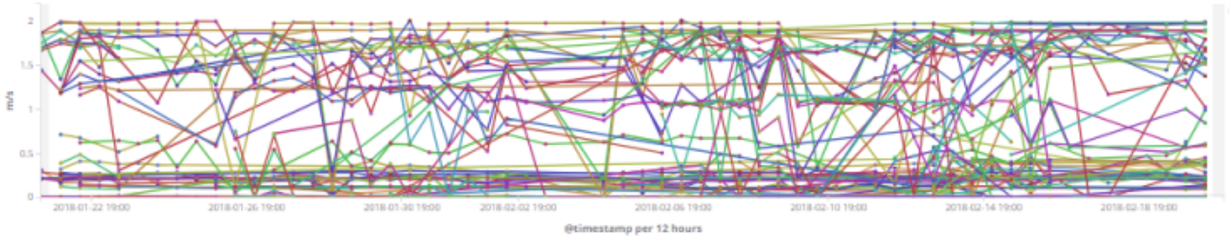
Robot Speed Max



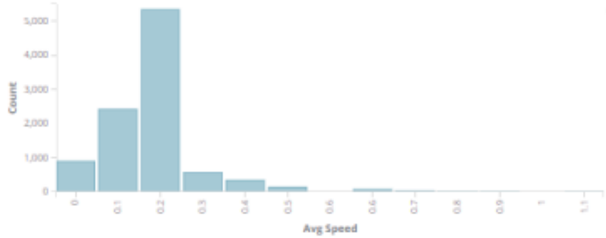
Robot Speed Max Dist



Robot Speed Min Max Avg



Robot Speed Avg Dist



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robot-ph-cpe22-145	235,010.425
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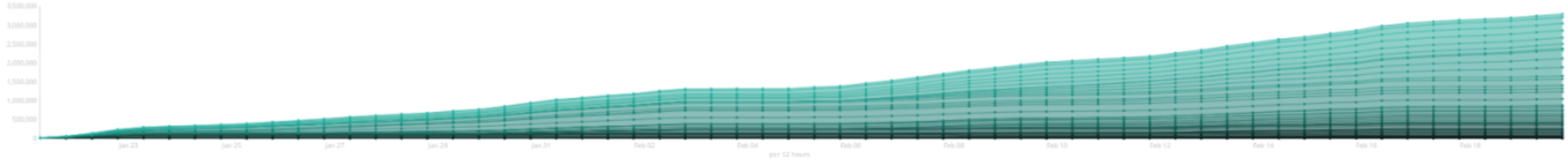
robot-ph-cpe22-38	185,205.813
robot-ph-cpe18-44	174,394.938
robot-ph-cpe22-140	172,457.132
robot-ph-cpe22-14	171,717.607
robot-ph-cpe22-84	169,656.688

Export: Raw Formatted

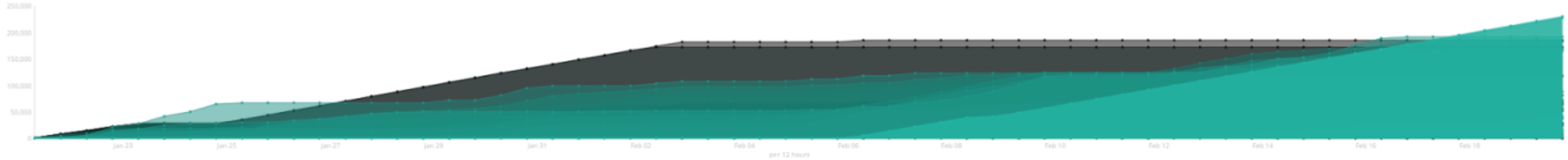
1 2 3 4 5 ...6 »

Page Size 10

Robot Meters Cumulative Stacked



Robot Meters Cumulative Raw



Information Radiators

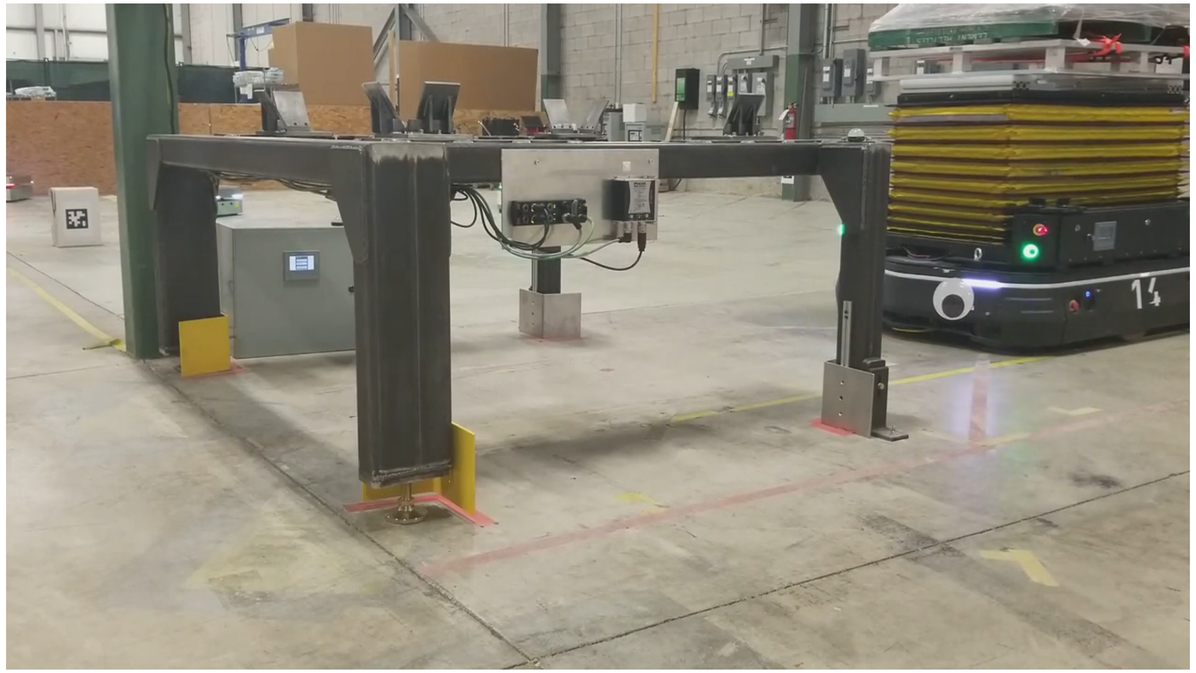
Vicon Motion Tracking + Elastic

How we went from hours to real-time

- Same motion capture technology, used for films and video games
- Robots must have precise repeatable location and navigation
- Complex to measure, monitor and verify motions and behaviors of robots – gigabytes of data to digest

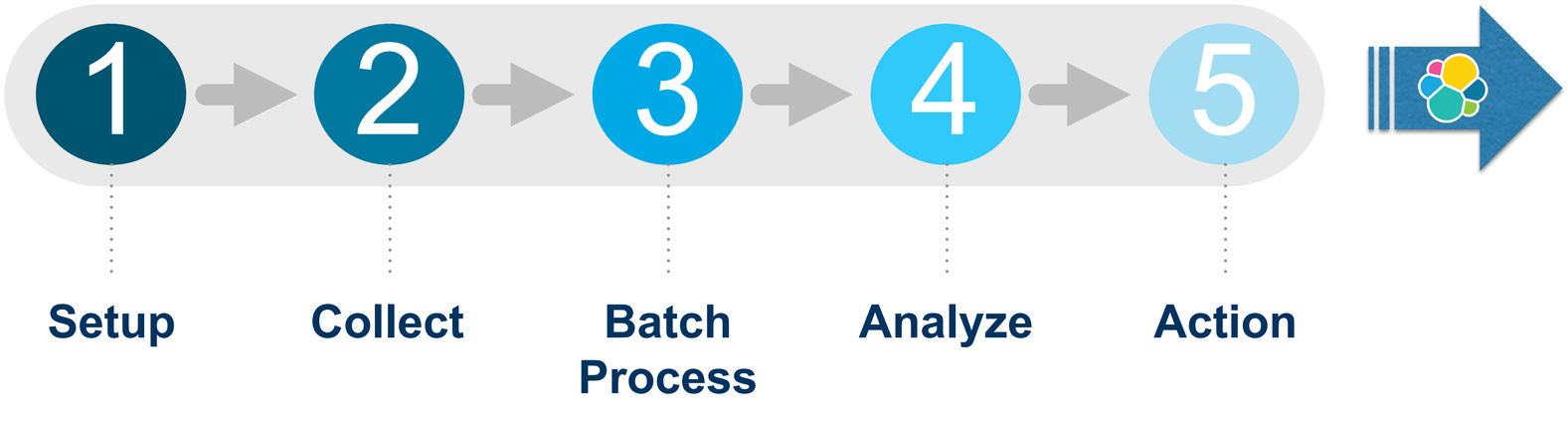
Well Grounded Robots

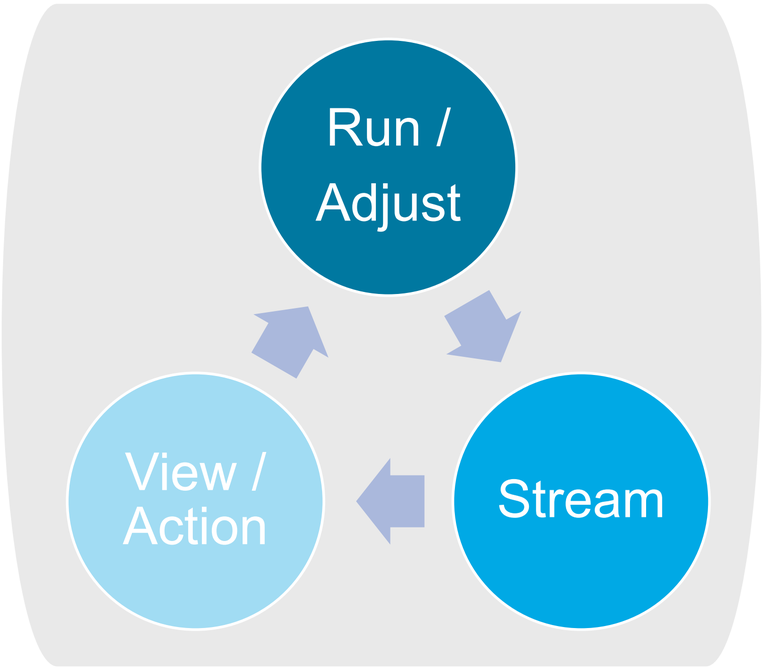
You have to know where you are…



From batch to real-time

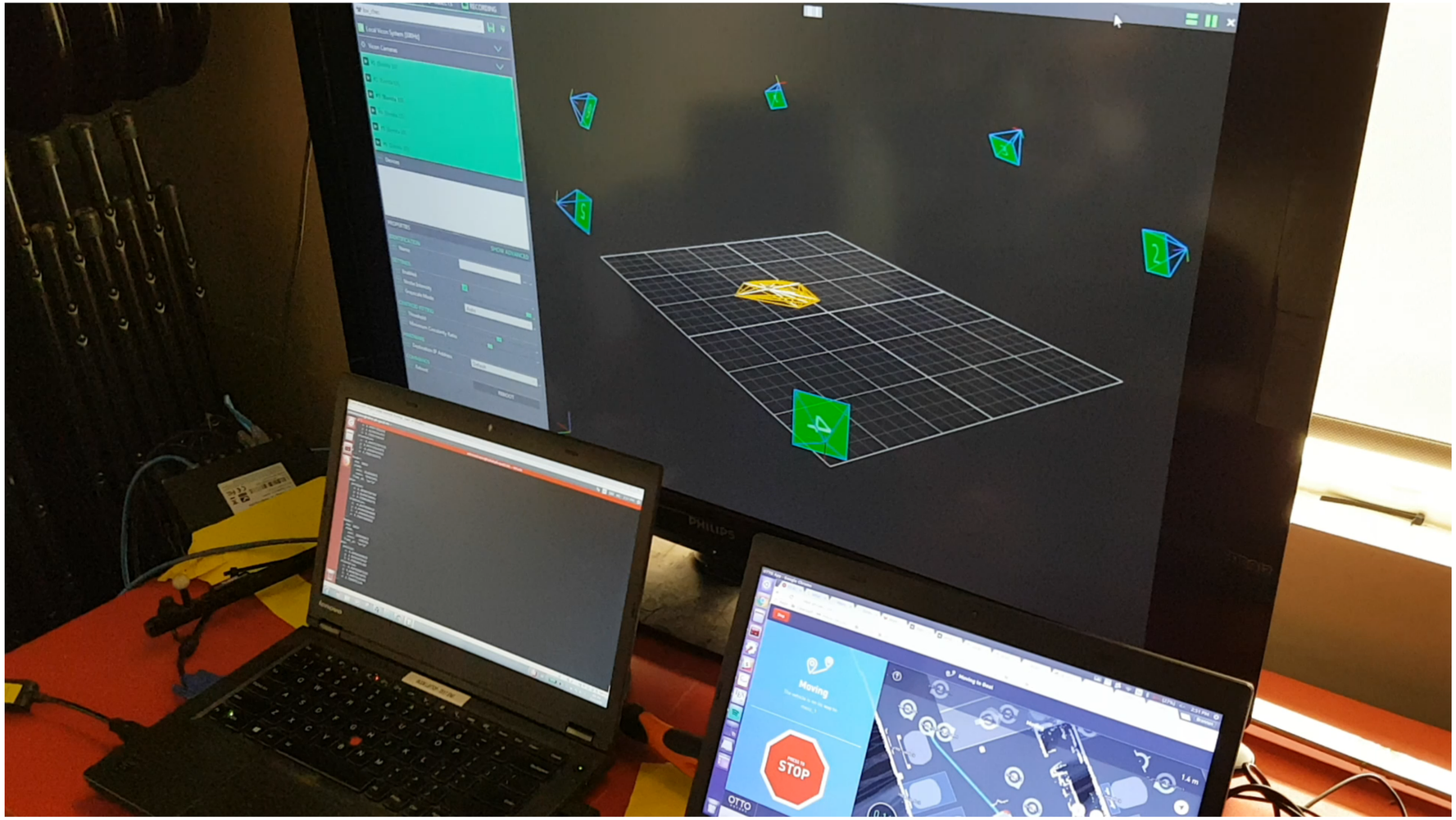
- The old process took hours to days to know if testing was valid
- Steaming and consumption of the data in real-time with Elastic and Kibana allows test sanity or adjustments with real-time feedback
- No need to wait for results, they are generated in real-time





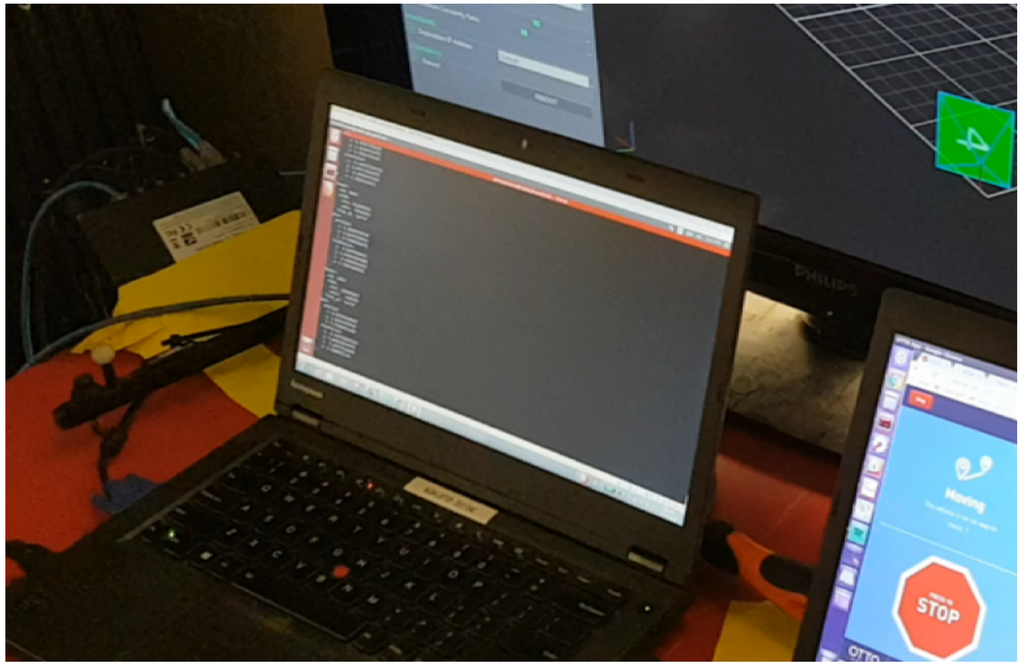
From batch to real-time

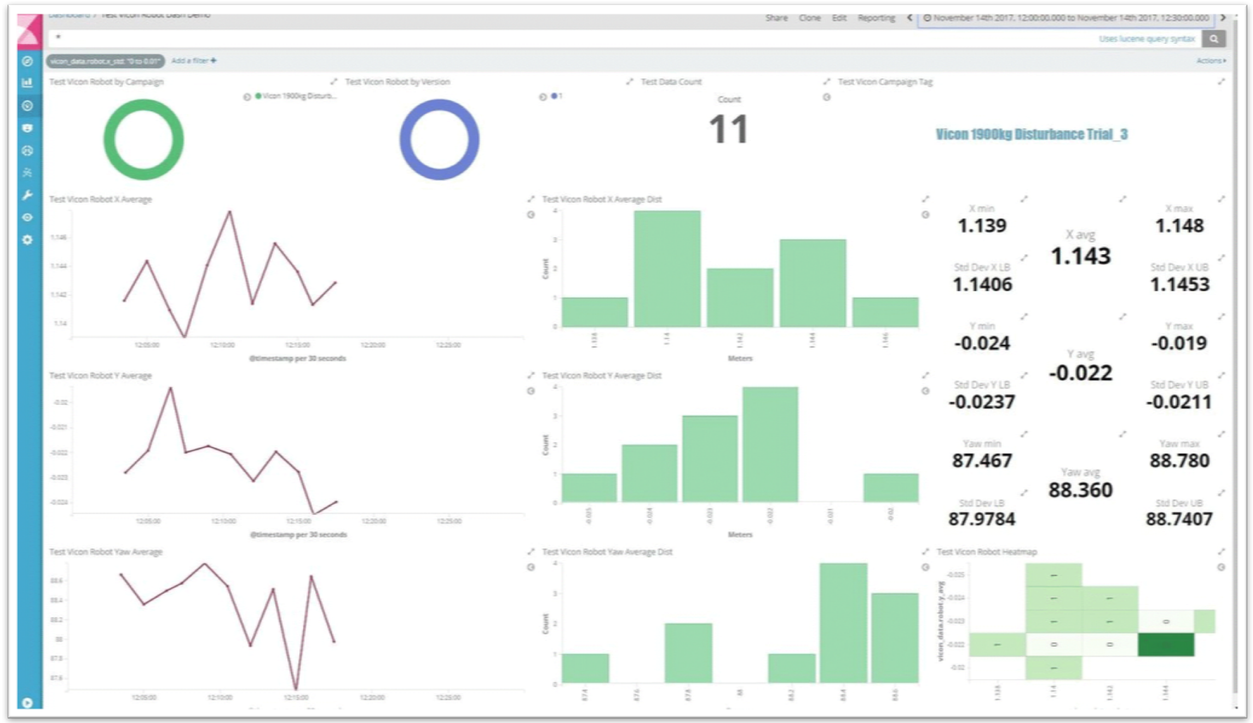
- Motion Tracking, Autonomous Robots and Elasticsearch!



From batch to real-time

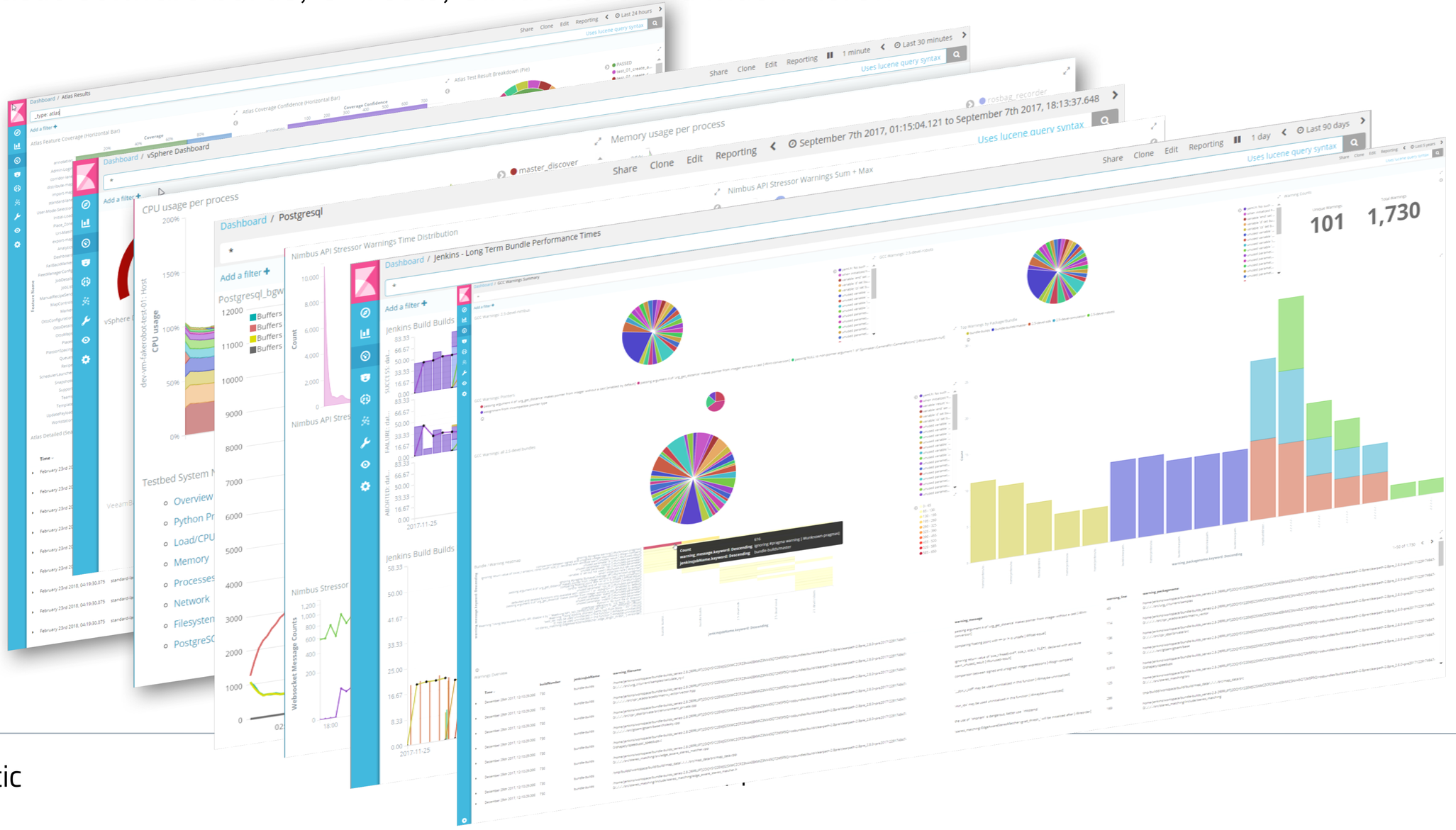
- Streaming real-time co-ordinate data and measurement calculations to Elasticsearch





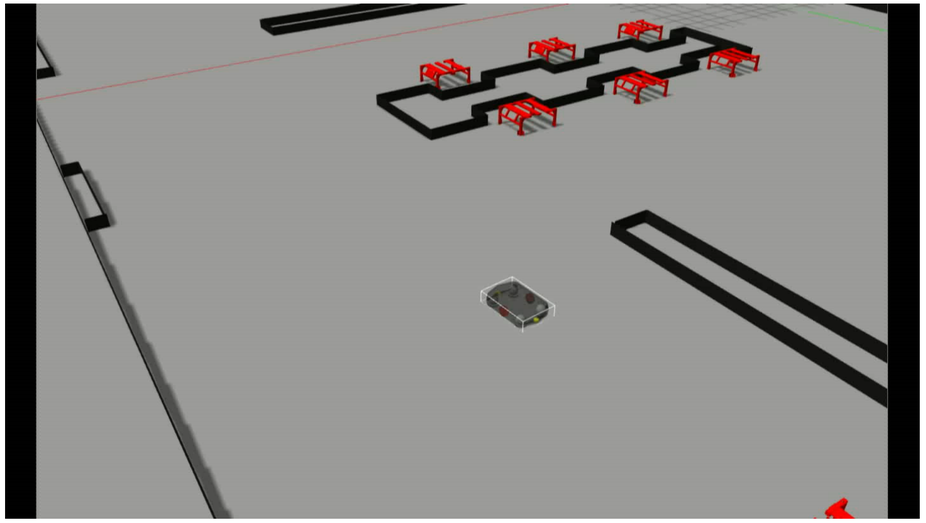
If we build it...

- We Elastic software builds, CI Tests, Simulations and much more…



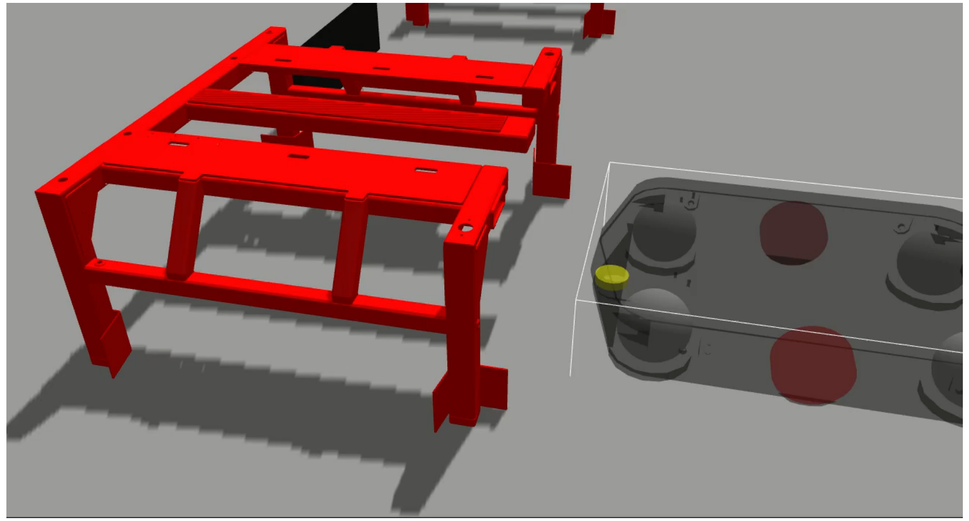
Customer Insights

- The same IoT strategy for us supports our customers
- A simple pivot reveals customer process flows
- Driving and measuring performance improvements on the factory floor
- Vast potentials for new customer facing services



More Questions?

Visit us at the AMA



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