OpenConfig telemetry demo with Juniper devices

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OVERVIEW OF THE DEMO

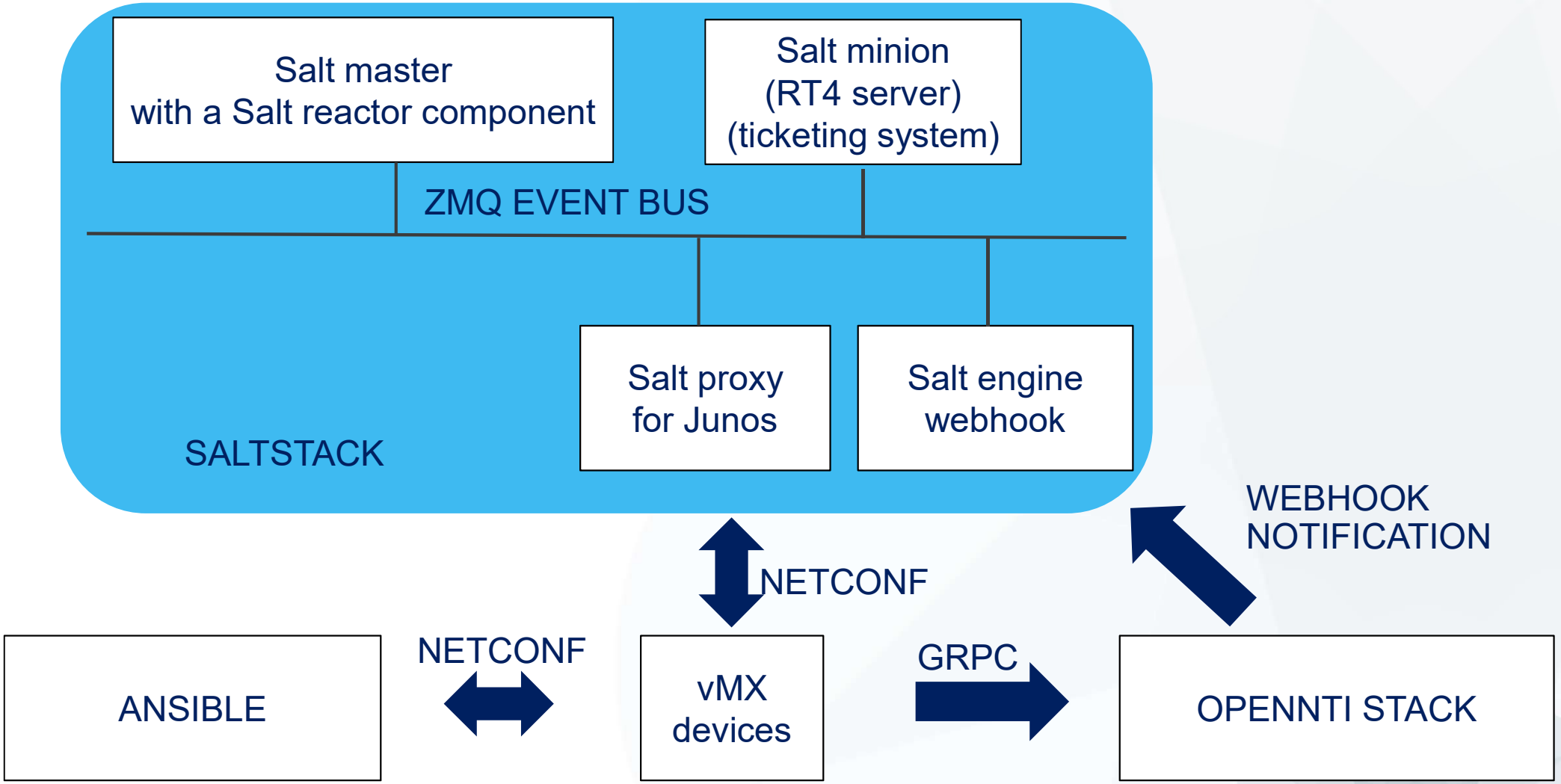
- OpenConfig configuration on vMX devices using Ansible
- OpenConfig streaming telemetry with vMX devices and OPENNTI
- Webhook notifications from OPENNTI to SaltStack
- SaltStack orchestration to create automatically a RT4 ticket

Juniper Event Driven Infrastructure (J-EDI)

- Uses regular/native SaltStack building blocks
  - Salt master, minions, event bus, reactor, …
  - Salt proxies for Junos (Juniper contribution to SaltStack)
  - Salt sls and execution modules for Junos (Juniper contribution to SaltStack)
  - Salt junos_syslog engines (Juniper contribution to SaltStack)
- Uses the event bus as an automation backplane
- Loosely couples a growing collection of open-source and Juniper maintained tools
- Is developed by Juniper. Is installed, configured, and supported by Juniper Professional Services.

J-EDI PLUGINS USED FOR THIS DEMO

- Request Tracker 4 plugin
  - RT4 is a popular ticketing system.
  - It has an API that can be used for the CRUD operations against tickets.
  - J-EDI interacts with RT4 using its API to automate tickets manipulation (tickets creation and update)



LAB TOPOLOGY

- The 2 vMX devices are connected between them

- JUNOS has:
  - Netconf server
  - OpenConfig support
  - gRPC server

```
lab@dc-vmx-2> show configuration system services netconf | display set
set system services netconf ssh
lab@dc-vmx-2> show version | match "openconfig|telemetry"
JUNOS na telemetry [17.2R1-S2.1-C1]
JUNOS Openconfig [0.0.0.4]
```

OPENCONFIG CONFIGURATION USING ANSIBLE

- Generates the OpenConfig configuration for each Junos device
  - Rendering a Jinja template
- Deploys the OpenConfig on Junos devices
  - using the Ansible module junos_template
- Audits the operational states on Junos devices
  - using the Ansible module junos_command
- Automation content https://github.com/ksator/openconfig-demo-with-juniper-devices
- Documentation https://github.com/ksator/openconfig-demo-with-juniper-devices/wiki

OPENCONFIG CONFIGURATION USING ANSIBLE

- Get the remote repository content locally

```
git clone https://github.com/ksator/openconfig-demo-with-juniper-devices.git
cd openconfig-demo-with-juniper-devices/
```

- Run the playbook in dry-run to see which devices would change

```
ansible-playbook pb.conf.bgp.oc.yaml --check --tag 'configuration'
```

- Add the flag diff to see which configuration changes would happen on a device

```
ansible-playbook pb.conf.bgp.oc.yaml --check --diff --limit dc-vmx-1 --tag 'configuration'
```

- Execute the ansible playbook
  - to generate and deploy the openconfig configuration on junos device.
  - to audit the operational states
    - compare the actual state against the desired state (session state should be established)

```
ansible-playbook pb.conf.bgp.oc.yaml
```

MANUAL VERIFICATIONS ON JUNOS DEVICES

- Display the commit history

```
lab@dc-vmx-2> show system commit
0   2017-11-24 12:37:27 UTC by lab via netconf
    OC BGP configuration from Ansible
```

- Print the changes between the two last commit

```
lab@dc-vmx-2> show configuration | compare rollback 1
```

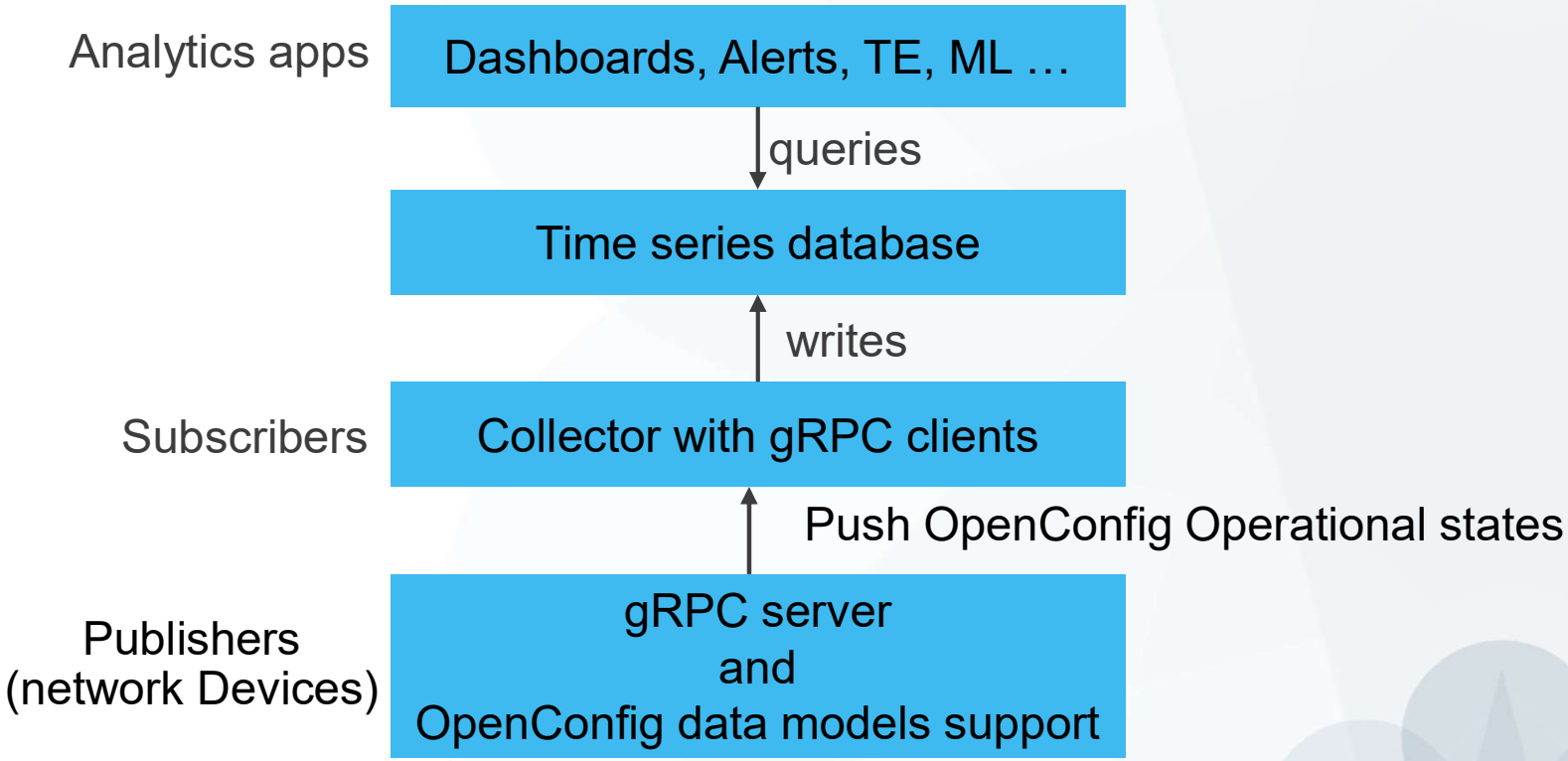
- Print the OpenConfig BGP running configuration on the Junos device

```
lab@dc-vmx-2> show configuration openconfig-bgp:bgp | display json
```

- Validate the BGP operational state

```
lab@dc-vmx-2> show bgp neighbor
```

OpenConfig streaming telemetry overview



OPEN-NTI STACK USED FOR THIS DEMO

- OpenNTI is a multi-containers application to collect and visualize time series data from network devices.
  - It is available https://github.com/Juniper/open-nti
- Telegraf
  - Plugin-driven collector
    - OpenConfig telemetry input plugin (gRPC collector subscribes to OpenConfig operational states on vMX devices)
    - InfluxDB output plugin (Telegraf writes data to InfluxDB)
- InfluxDB
  - time series database
- Grafana
  - Dashboards application
    - Queries InfluxDB to get the data
    - generates graphs
    - Triggers webhook notifications when an alert change state
      - HTTP POST with JSON body to SaltStack

GRPC CONFIGURATION

- grpc servers
  - The grpc service is configured on vMX

- grpc client
  - The telegraf input plugin for OpenConfig is configured to subscribe:
    - To the sensor BGP
    - To grpc servers (the vMX devices).
    - With a frequency of 3000 ms

=> The vMX will stream BGP operational states using the OpenConfig data model to telegraf every 3000 ms

START OPEN-NTI STACK

- Print the running containers
  - OPEN-NTI containers are not running

```
# docker ps
```

- Set the environment variables from a file

```
# source open-nti.params
```

- Run a multi-container applications

```
# docker-compose -f docker-compose.yml up -d
```

- Print the running containers
  - OPEN-NTI containers are running

```
# docker ps
```

InfluxDB queries from web interface

- InfluxDB has API, CLI and web interface.
- You can make queries for interacting with data in InfluxDB.
- Examples to get data using InfluxDB web interface:

```
SHOW MEASUREMENTS
SHOW TAG VALUES FROM "/bgp" WITH KEY = "device"
SHOW TAG VALUES FROM "/bgp" WITH KEY = "/bgp/neighbors/neighbor/@neighbor-address"
SHOW TAG VALUES FROM "/bgp" WITH KEY = "/bgp/neighbors/neighbor/@neighbor-address"
WHERE device='172.30.52.86'
SHOW TAG VALUES FROM "/bgp" WITH KEY = "/bgp/peer-groups/peer-group/@peer-group-
name"
SELECT * FROM  "/bgp" WHERE device='172.30.52.86' limit 10
SELECT * FROM  "/bgp" WHERE  "/bgp/neighbors/neighbor/@neighbor-address"
='192.168.1.1' limit 10
```

Query: SHOW TAG VALUES FROM "/bgp" WITH KEY = "/bgp/neighbors/neighbor/@neighbor-address" WHERE device='172.30.52.86'

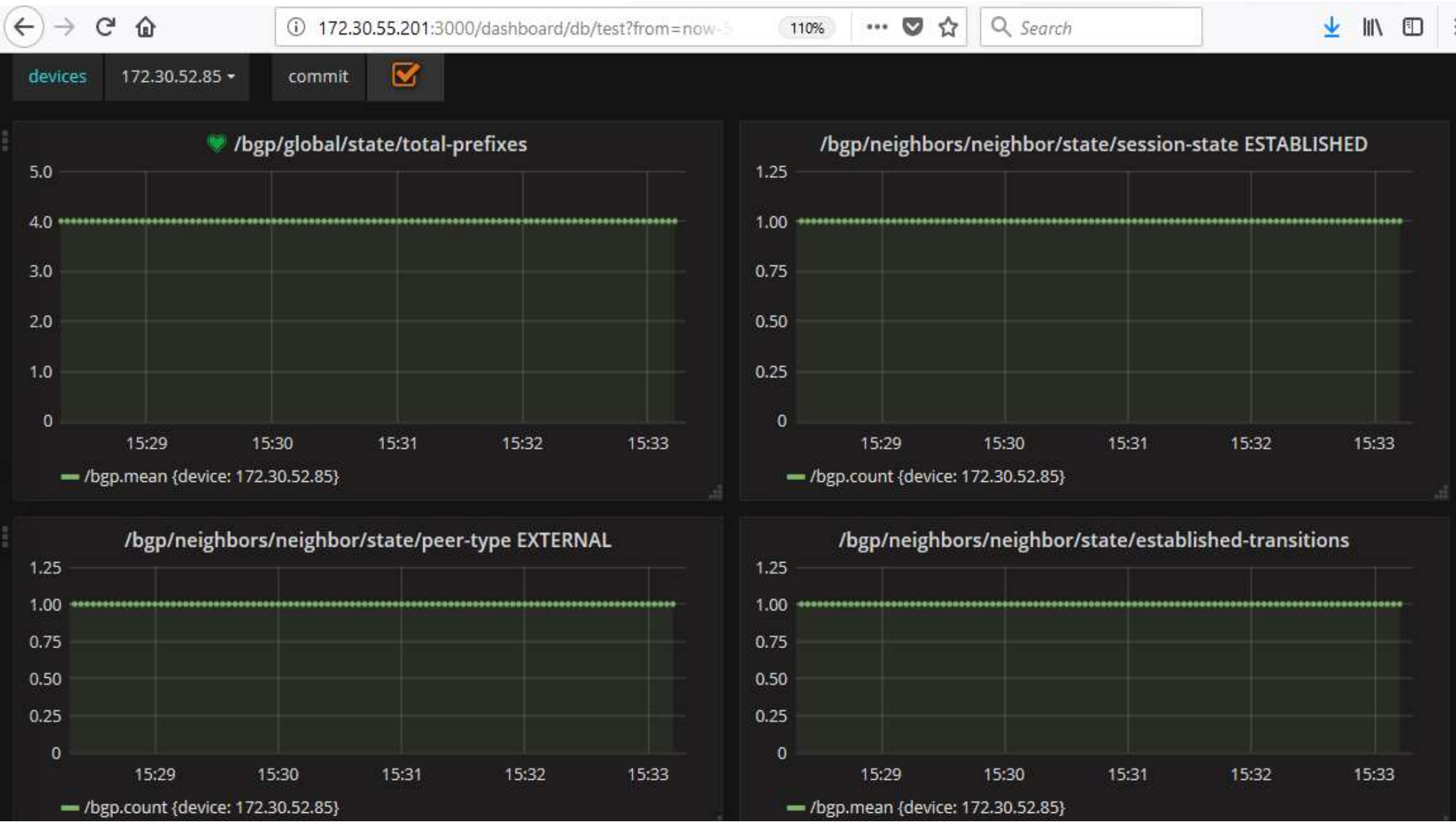
Generate Query URL | Query Templates

/bgp

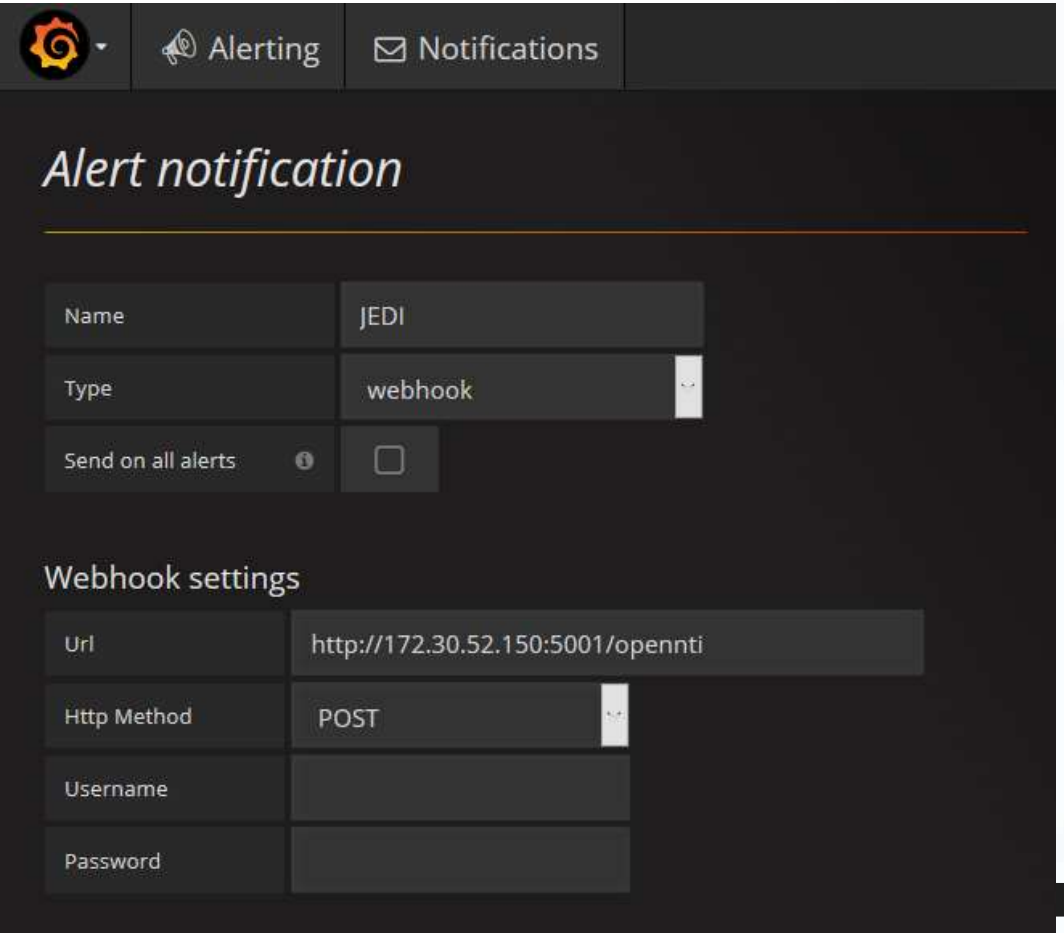
key	value
/bgp/neighbors/neighbor/@neighbor-address	"192.168.1.1"

Grafana

- Grafana uses dashboards composed of individual graphs.
- Each graph queries data from the configured Grafana Data Source
- This demo has a dashboard with 4 graphs.
  - Each graph make queries to InfluxDB to get OpenConfig states streamed by Junos devices to telegraf

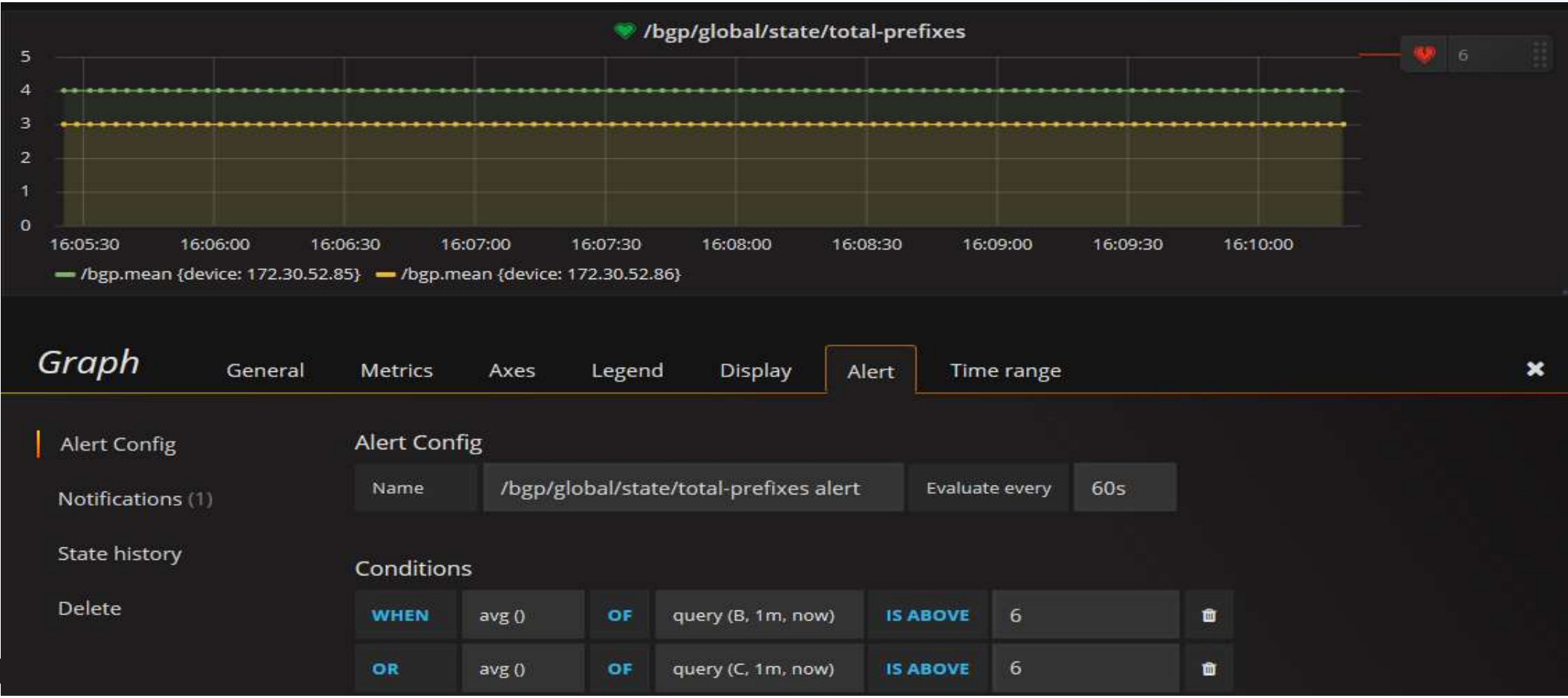

172.30.55.201:3000/dashboard/db/test?from=now-5
110%
Search
devices
172.30.52.85
commit
/bgp/global/state/total-prefixes
5.0
4.0
3.0
2.0
1.0
0
15:29
15:30
15:31
15:32
15:33
/bgp.mean {device: 172.30.52.85}
/bgp/neighbors/neighbor/state/session-state ESTABLISHED
1.25
1.00
0.75
0.50
0.25
0
15:29
15:30
15:31
15:32
15:33
/bgp.count {device: 172.30.52.85}
/bgp/neighbors/neighbor/state/peer-type EXTERNAL
1.25
1.00
0.75
0.50
0.25
0
15:29
15:30
15:31
15:32
15:33
/bgp.count {device: 172.30.52.85}
/bgp/neighbors/neighbor/state/established-transitions
1.25
1.00
0.75
0.50
0.25
0
15:29
15:30
15:31
15:32
15:33
/bgp.mean {device: 172.30.52.85}

NOTIFICATIONS FOR ALERTS



- When an alert changes state, Grafana will use a webhook to notify SaltStack
  - HTTP POST with a JSON body to http://172.30.52.150:5001/opennti

ALERT FOR A GRAPH

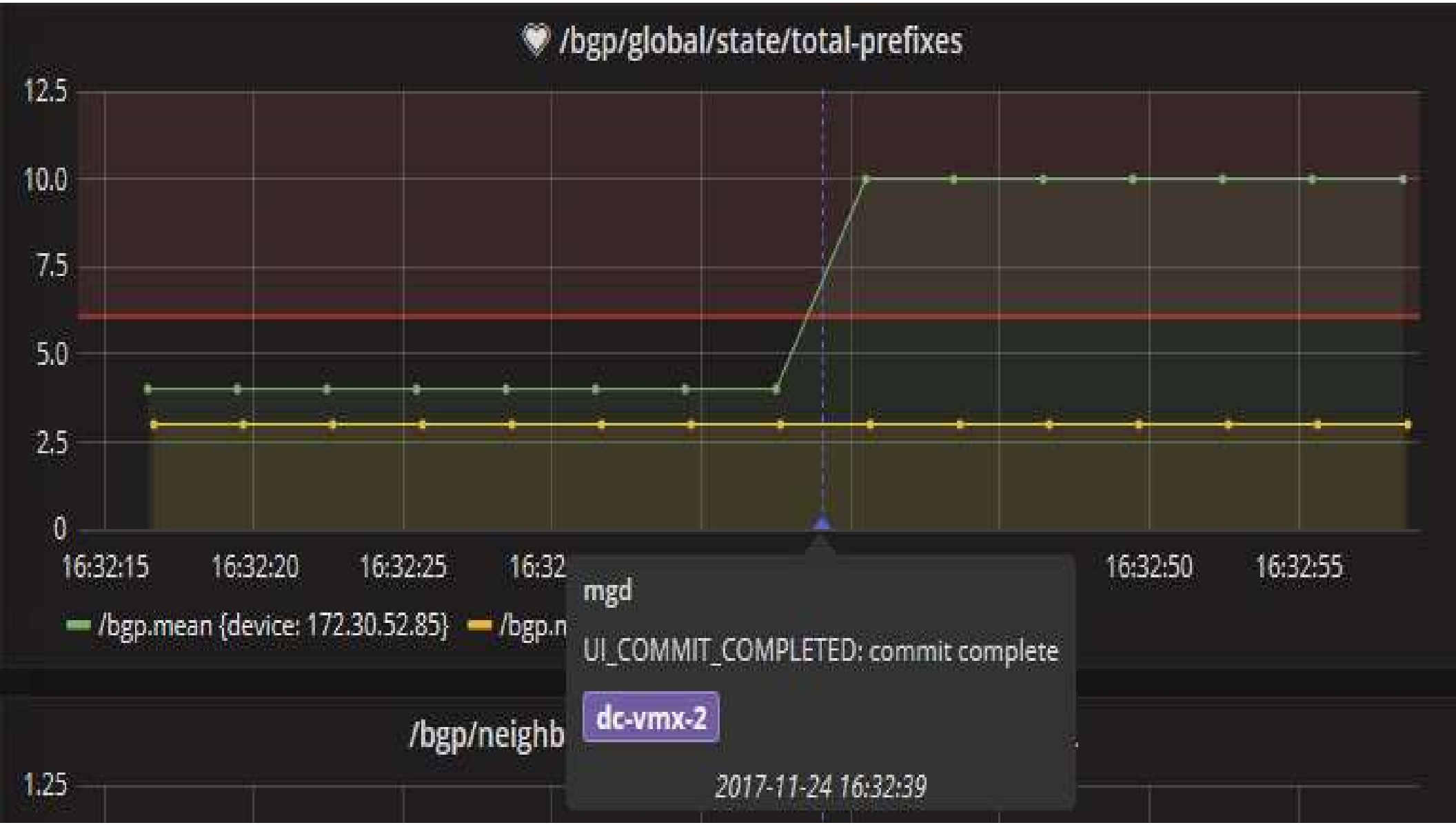


LET'S TRIGGER A NOTIFICATION

- Lets use SaltStack to change the vMX2 configuration in order to have the vMX2 to advertise more BGP routes to vMX1
  - So the vMX1 will learn more BGP routes
  - This will change the alert state for the graph /bgp/global/state/total-prefixes
    - This will trigger the notification (webhook to SaltStack)

```
salt 'dc-vmx-2' state.apply junos.routes_to_propagate
```

```
lab@dc-vmx-2> show system commit
0   2017-11-24 15:32:39 UTC by SaltStack via netconf
    configured the model routes_to_propagate using SaltStack
```


/bgp/global/state/total-prefixes
12.5
10.0
7.5
5.0
2.5
0
16:32:15
16:32:20
16:32:25
16:32
16:32:50
16:32:55
/bgp.mean {device: 172.30.52.85}
/bgp.n
mgd
UI_COMMIT_COMPLETED: commit complete
dc-vmx-2
2017-11-24 16:32:39
/bgp/neighb
1.25

SALTSTACK API FOR WEBHOOK NOTIFICATIONS

- SaltStack listens for webhook notifications on port 5001, and send an equivalent ZMQ

```
# more /etc/salt/master
...
engines:
  - webhook:
      port: 5001
...
```

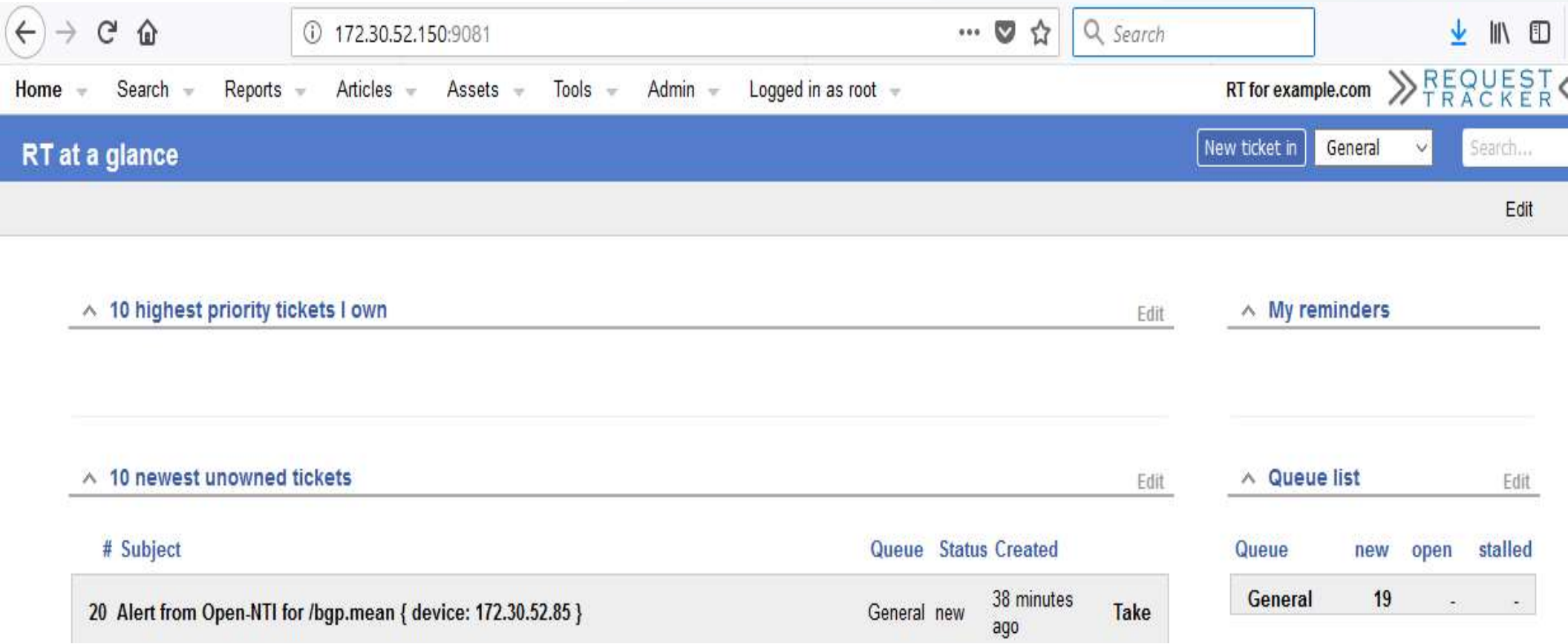
- Grafana notifications use HTTP POST to http://172.30.52.150:5001/opennti
- So the Salt engine 'webbook' generates and publishes to the event bus a ZMQ message
  - with the topic ‘salt/engines/hook/opennti’
  - and a JSON body that has the same content as the webhook.

SALTSTACK REACTOR

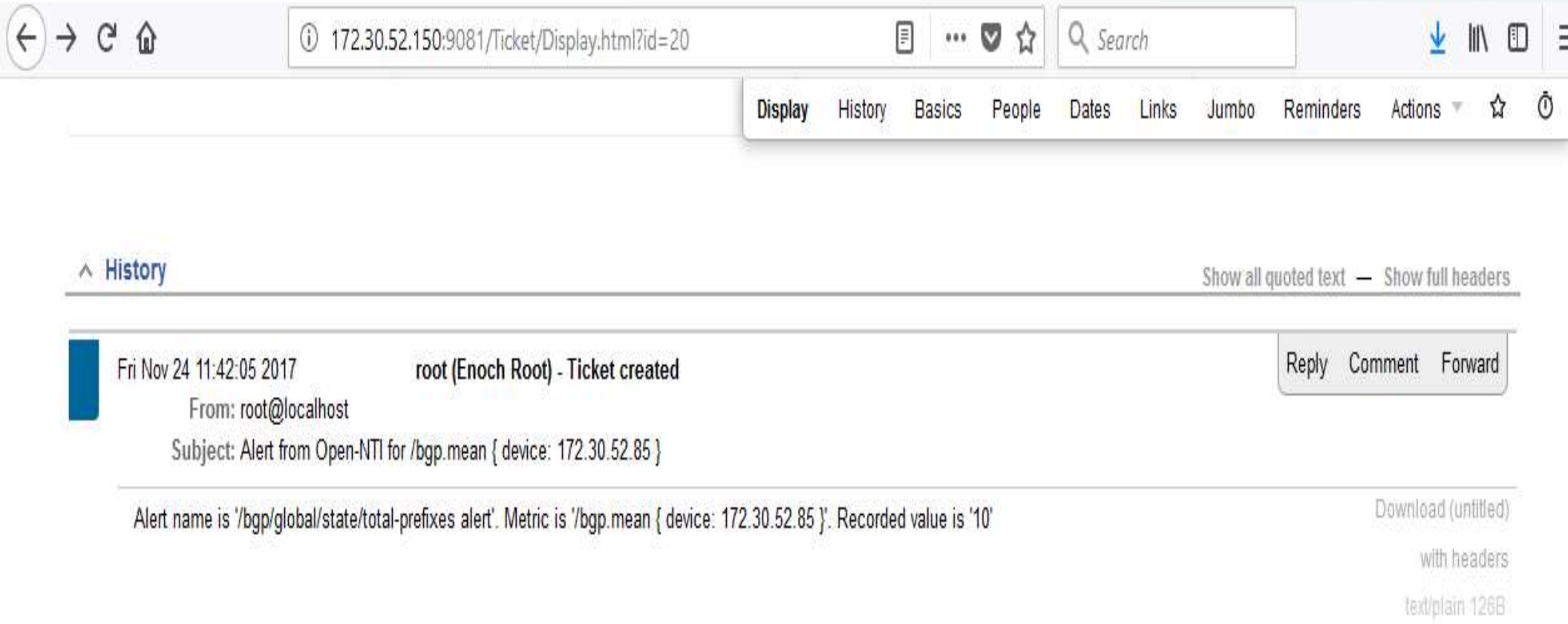
```
# salt-run reactor.list
...
  salt/engines/hook/opennti:
      - /srv/reactor/create_opennti_ticket.sls
...
```

- The SaltSatck reactor is subscribing to the topic ‘salt/engines/hook/opennti’
- If a ZMQ message ‘salt/engines/hook/opennti’ is published on the event bus, SaltSatck will execute the state file create_opennti_ticket.sls
  - This will create an RT4 ticket if it receives

RT4 TICKET CREATED AUTOMATICALLY BY J-EDI



RT4 TICKET DETAILS




Thank you