



~ % whoami

Ronny Trommer

University of Applied Sciences in Fulda
Telecommunication

Co-founder OpenNMS Foundation Europe e.V.

Freifunker and visit Hackerspaces

~ % locate

The image displays a composite view of a mobile device screen and a desktop map interface.

Smartphone Screen (Left):

- Search bar: fulda
- Image: A large image of a classical building with a fountain in front.
- Location: Fulda, Germany
- Weather: Sunny · 61°F · 3:11 PM
- Buttons: SAVE, NEARBY, SHARE
- Photos: Two thumbnail images of the building.
- Quick facts:

Fulda is a city in Hesse, Germany; it is located on the river Fulda and is the administrative seat of the Fulda district. In 1990, the town hosted the 30th Hessentag state festival. [Wikipedia](#)
- Statistics:

Population: 64,008 (Jun 30, 2009)
Area: 40.17 mi²
Dialling codes: 0661

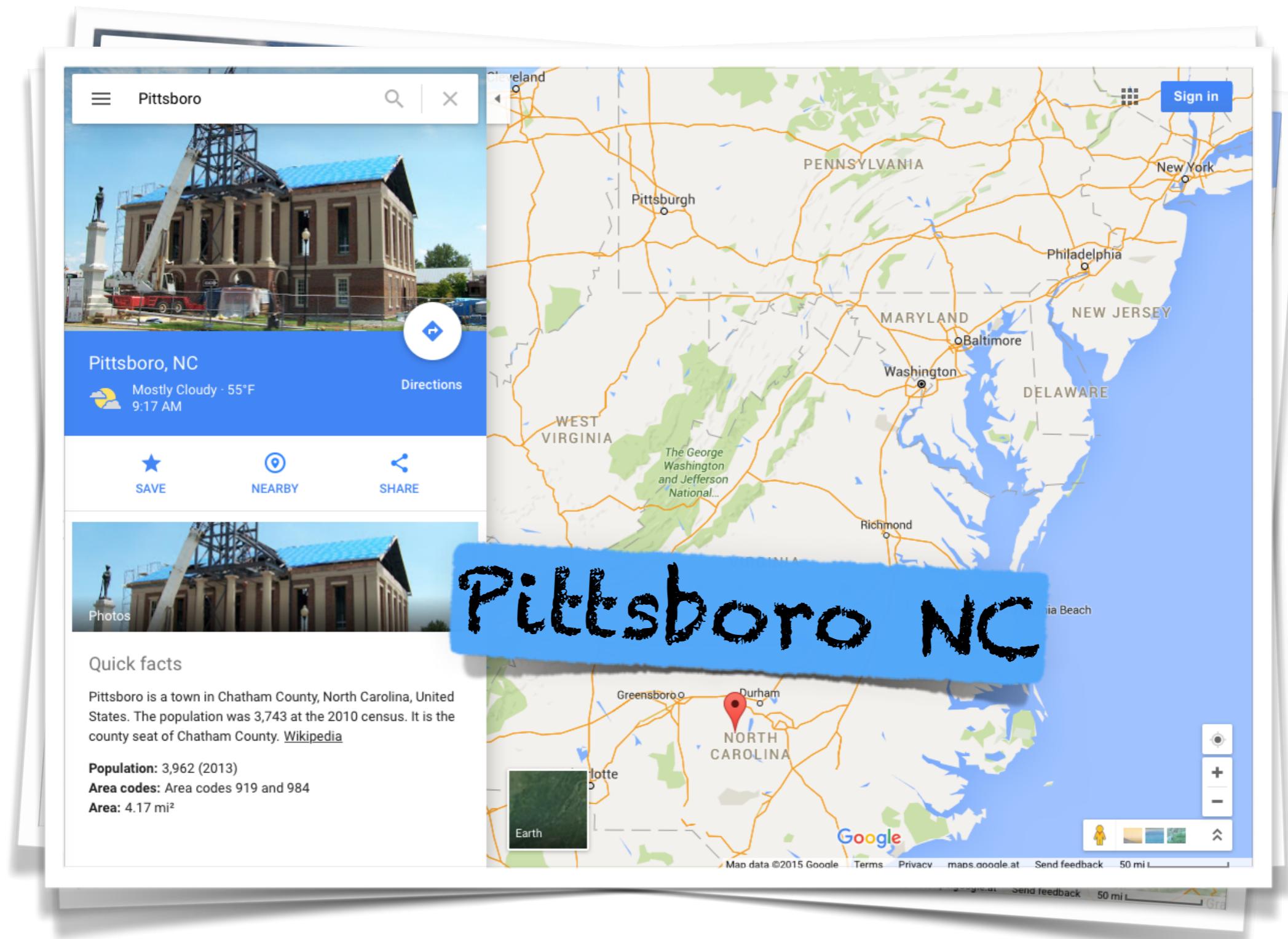
Google Map (Right):

- A blue callout bubble contains the word "Fulda".
- The map shows parts of several countries: Netherlands, Belgium, Luxembourg, Germany, Austria, and Switzerland.
- Major cities labeled include Amsterdam, The Hague, Brussels, Antwerp, Düsseldorf, Cologne, Frankfurt, Mannheim, Stuttgart, Nuremberg, Augsburg, Munich, Salzburg, Dresden, Prague, and Zurich.
- Rivers like the Rhine, Main, and Neckar are visible.
- Google map controls are visible at the bottom right.

~ % locate



~ % locate



What is OpenNMS?

What is OpenNMS?

World's first enterprise grade network management platform developed under the **open source** model.

- *Tarus Balog*

SourceForge registered
2000



Free as in Freedom



<https://github.com/openhums>

Debian 8

Ubuntu 14.04 LTS

CentOS 7.1 / RHEL 7

Windows 2012 Server

Debian 8

Ubuntu 14.04 LTS

CentOS 7.1 / RHEL 7

Windows 2012 Server



Like Fedora

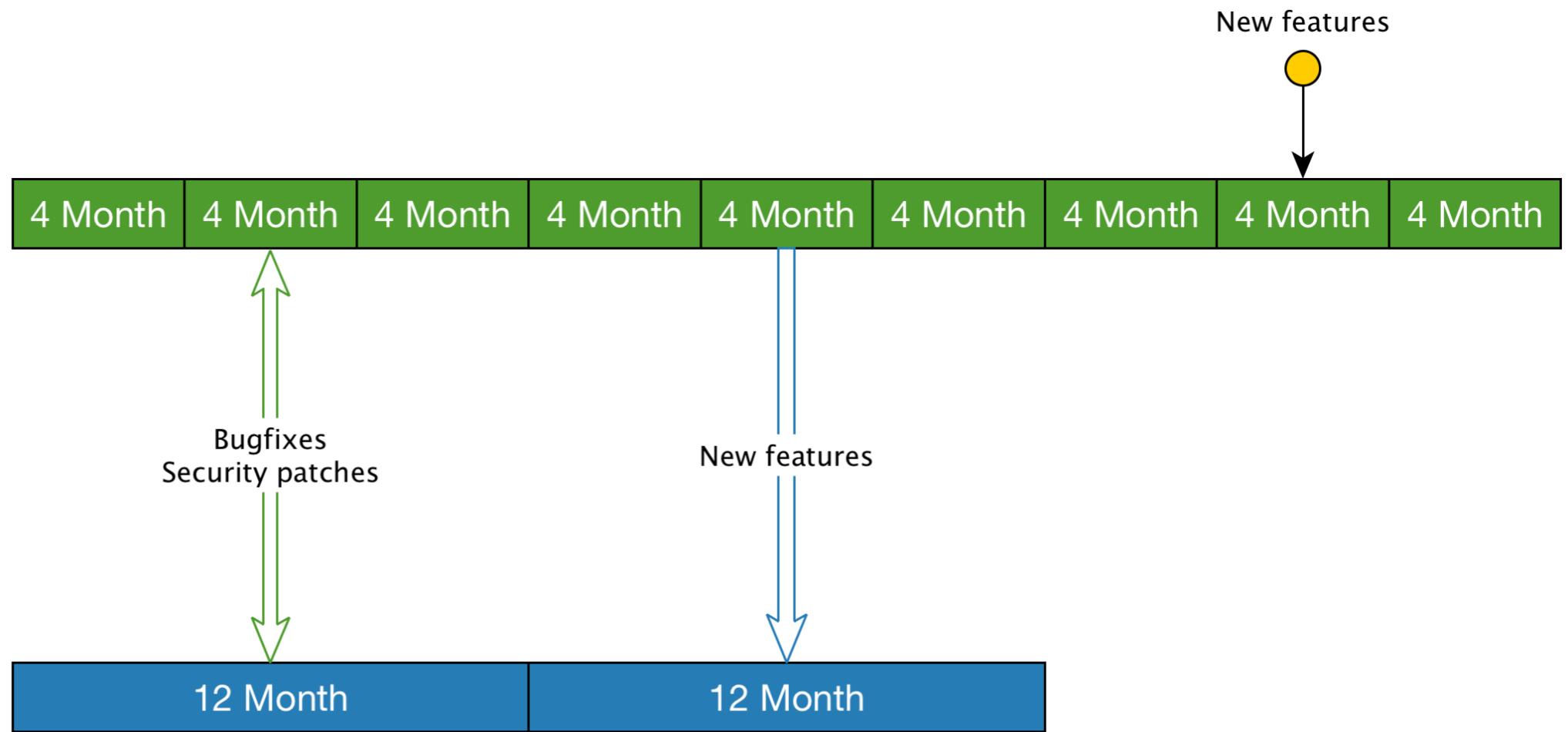
release early
release often

community
support

Like RHEL

Subscription

commercial
support



Versions

foundation

base for Meridian (14.0.3)

stable

16.0.3

testing

16.0.4

unstable

release candidate 17

snapshot

18.0.0-SNAPSHOT

Some numbers

Contributors 52

Commits > 30.000

Accepted Pull Requests > 400

SNMP MIB Objects for data collection > 2000

Trap MIBS > 200

Downloads ~ 6000 / month

GitHub Commits



DevJam

- First held in 2005 with 7 participants(4 of which are still active community members)
 - DevJam has been held 8 times over the last 9 years(2005-2013 except 2009)
 - 6 times it has been located at the University of Minnesota – Twin Cities Campus



OUCE

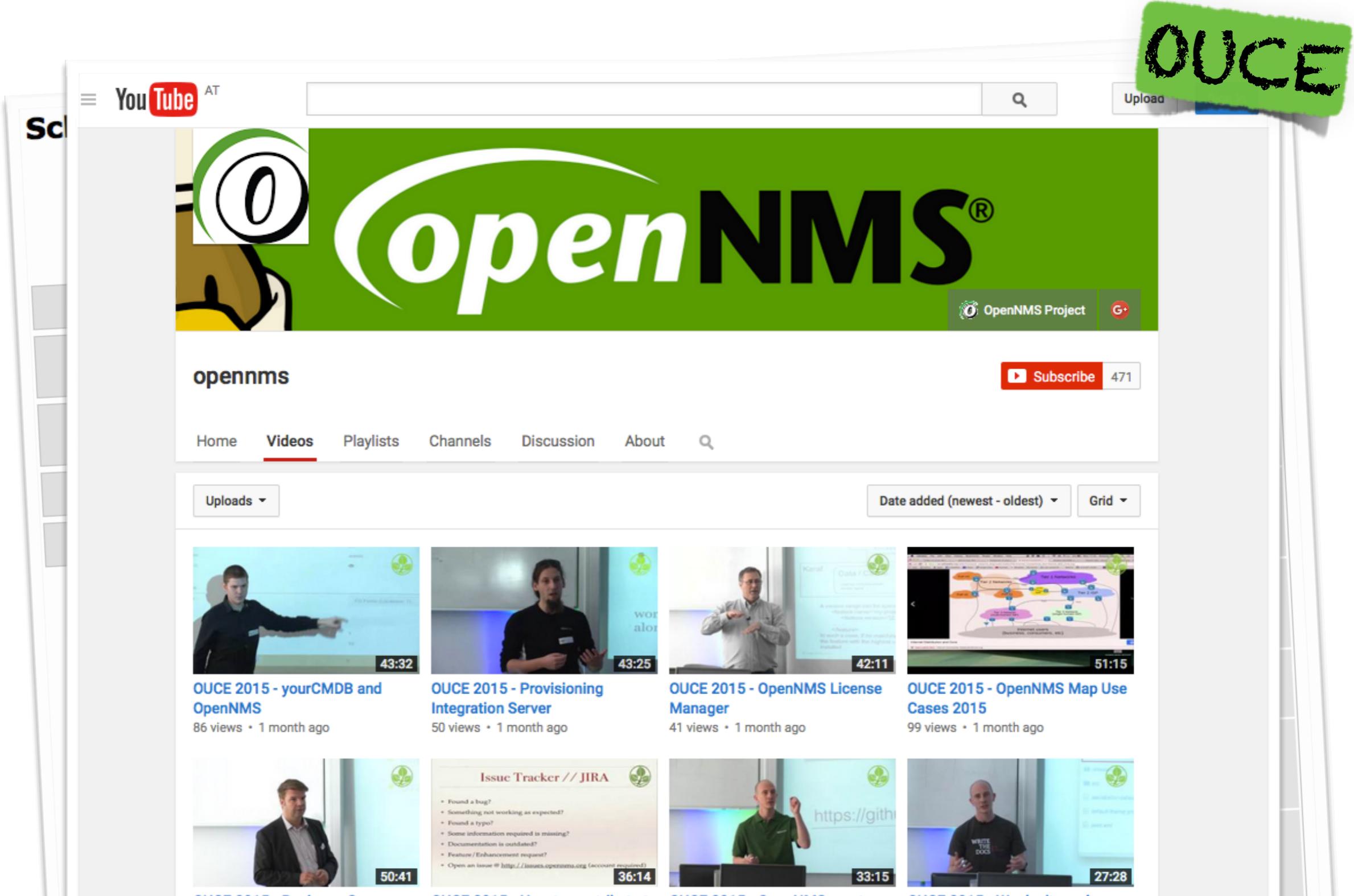
Schedule OpenNMS User Conference 2015

Version 1.0

Events

| | Title | Track | Speakers |
|---|---|------------------|---------------------------|
|  | Bad Voltage | Keynote & Events | • Tarus Balog |
|  | Branding OpenNMS As users, contributors, developers, and maintainers, what do we want to... | Workshops | • Jessica Hustace |
|  | Business Cases using OpenNMS in my 30 min up to 45 min talk I will give an overview on how customers for... | Case Studies | • Uwe Bergmann |
|  | Dancing on the head of ping How do we build a scalable Software as a Service (SaaS) monitoring solution... | Case Studies | • Ian 'idn' Norton |
|  | Enhanced REST search capabilities in OpenNMS 17 I worked on a new REST interface implementation for OpenNMS during OpenNMS... | Technology | • Seth Leger |
|  | Get together Viva Havanna Bonifatiusplatz 2 36037 Fulda Website:... | Keynote & Events | • Uwe Bergmann |
|  | How to contribute to OpenNMS Open source software depends on the user's contributions. This talk should... | Case Studies | • <u>Markus von Rüden</u> |
|  | Internet of Thingies The Things Are Coming! All The Things! Just that nobody really knows what... | Workshops | • Ken Eshelby |
| | | | • Seth Leger |

<http://www.opennms.eu>



<https://www.youtube.com/user/opennms/videos>

Probably you know FCAPS?

Probably you know FCAPS?

Fault

Configuration

Accounting

Performance

Security

Probably you know FCAPS?

Fault

Configuration

Accounting

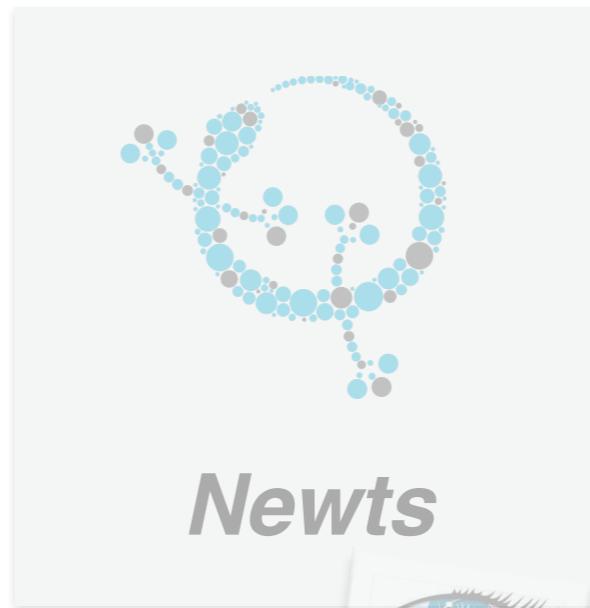
Performance

Security



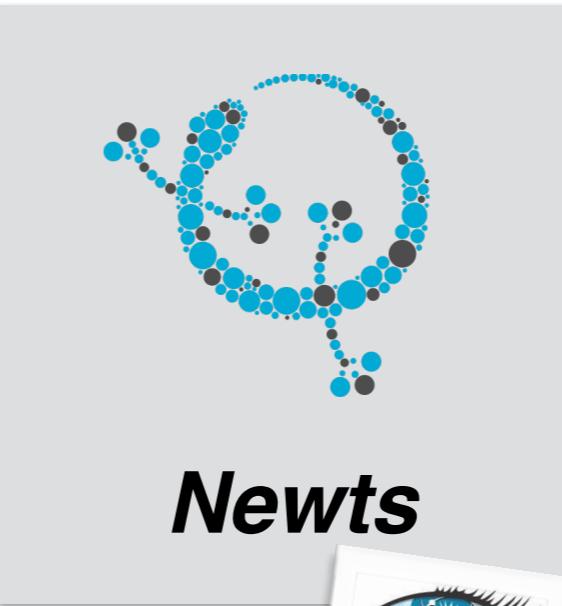
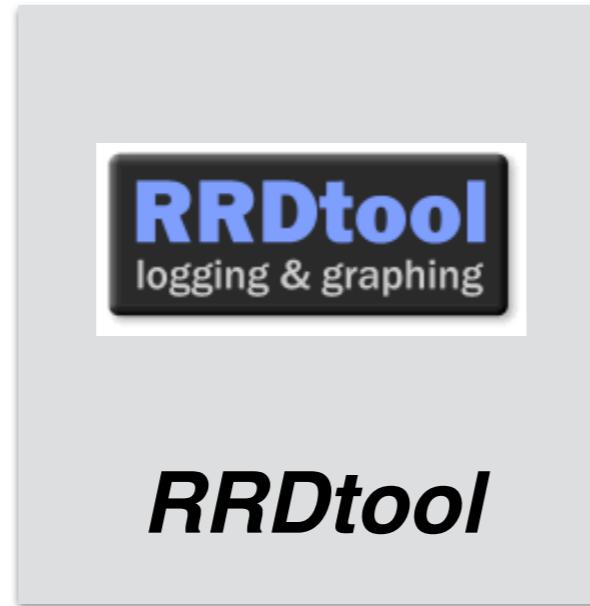
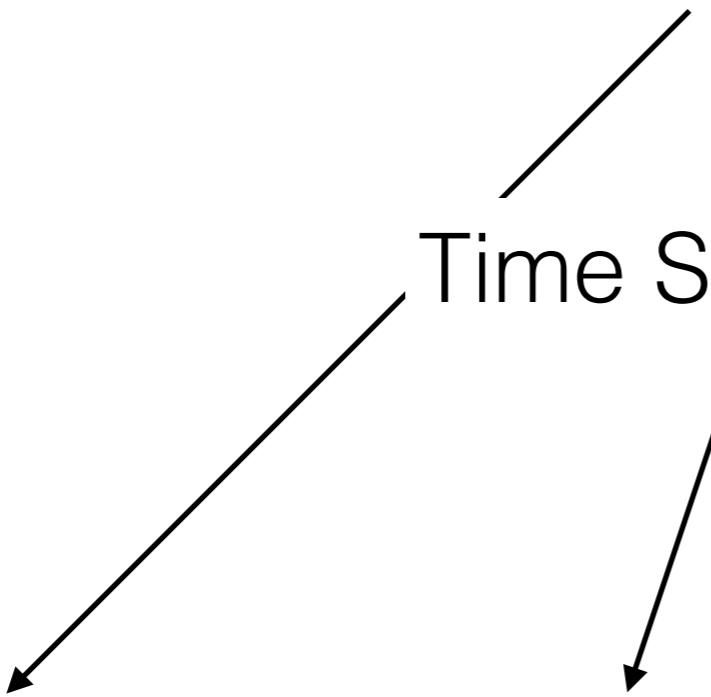
Inventory

Monitoring Events





Time Series Data



Inventory
Monitoring Events



SNMP Agent

Syslog Agent

JMX Agent

WMI Agent

Pollerd

Trapd

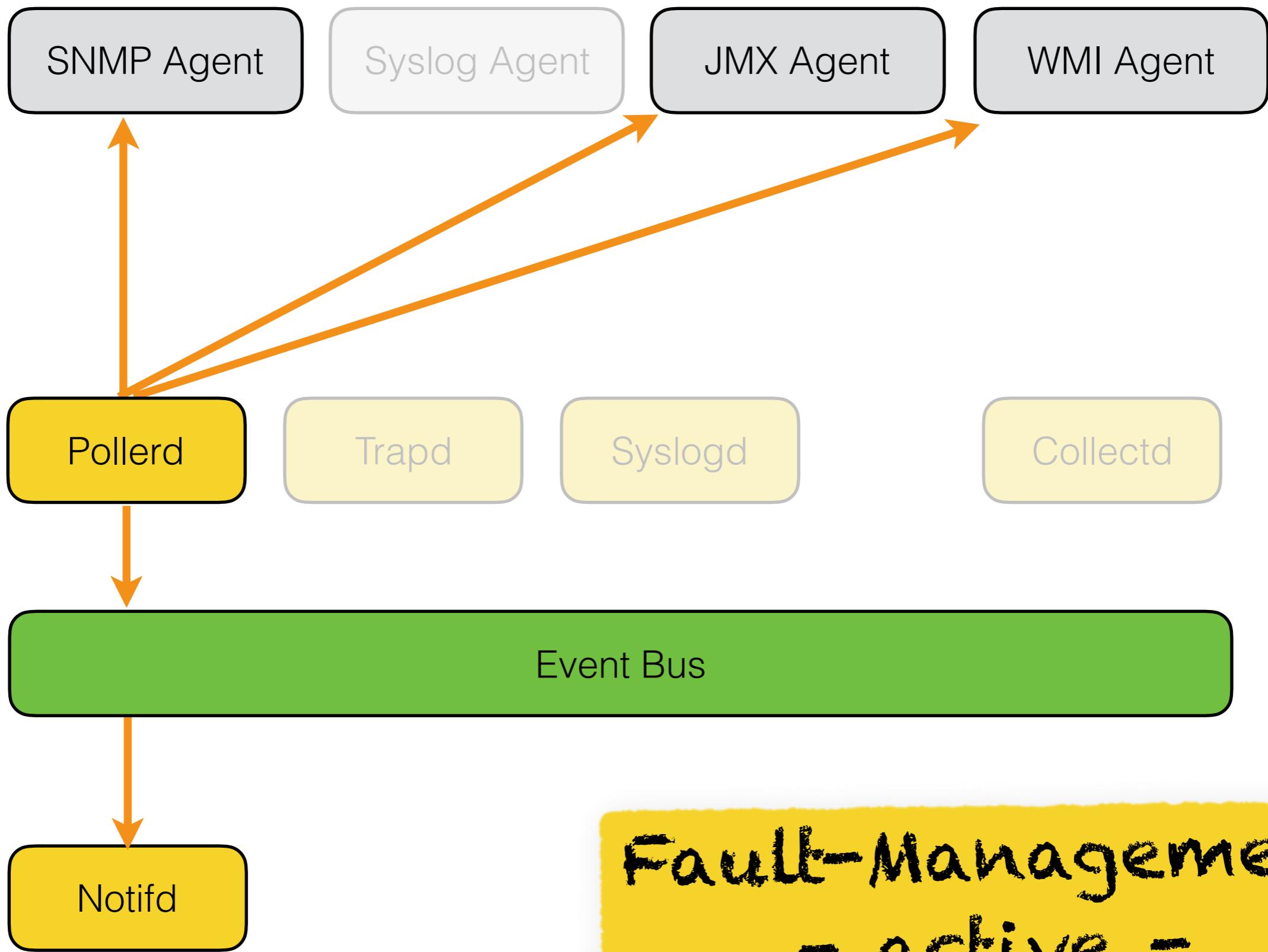
Syslogd

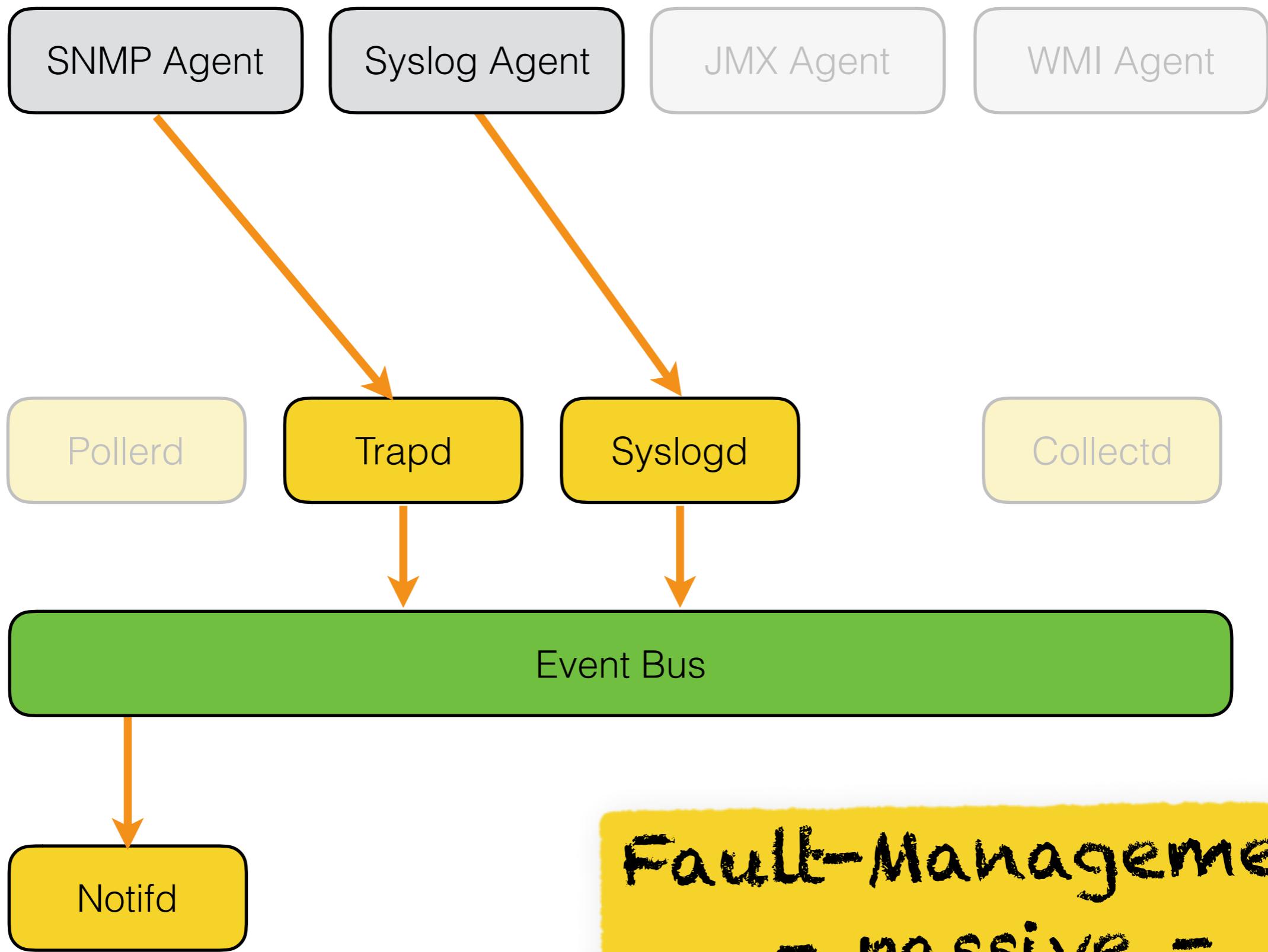
Collectd

Event Bus

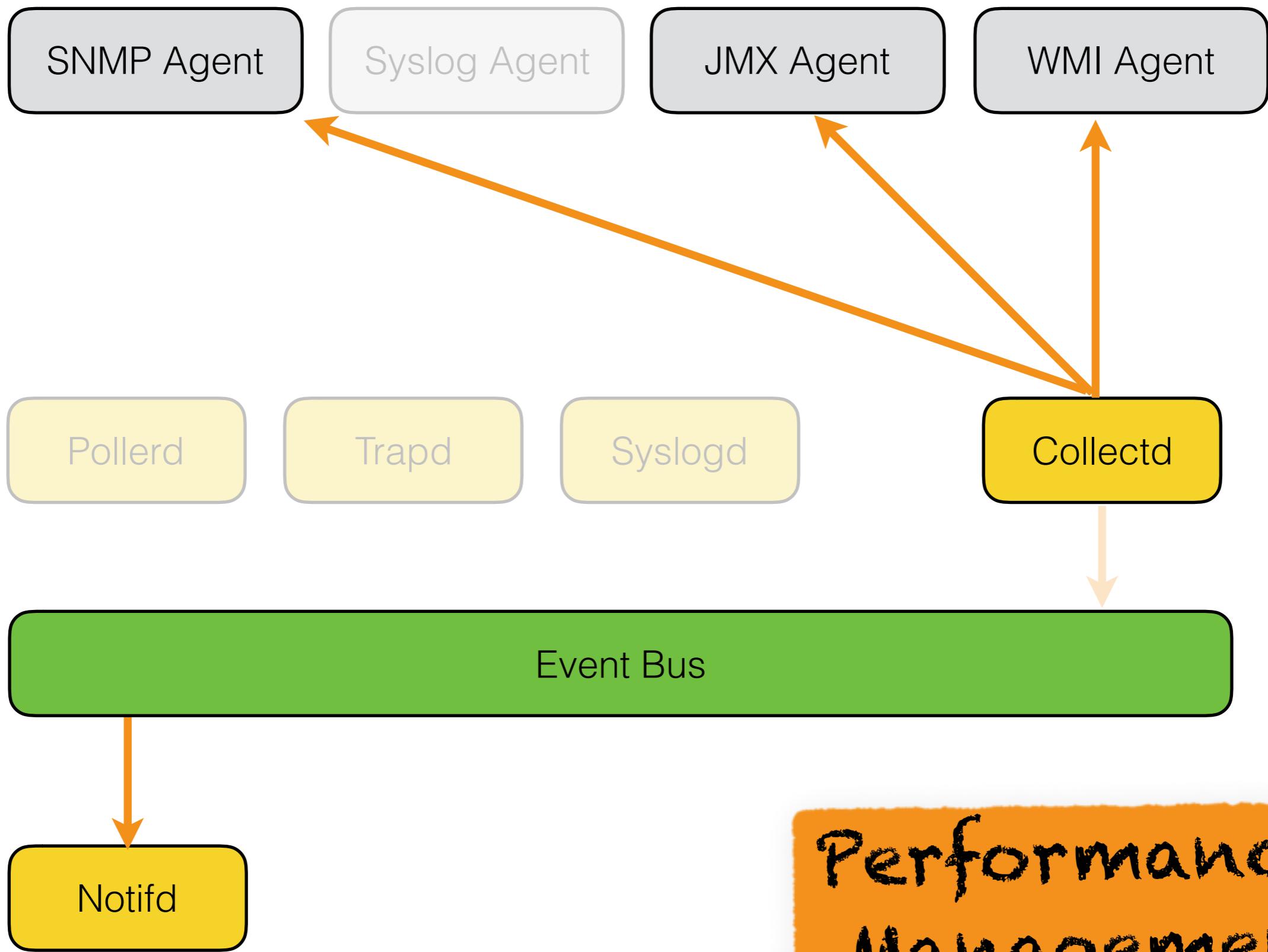
Notifd

Fault-Management
- active -



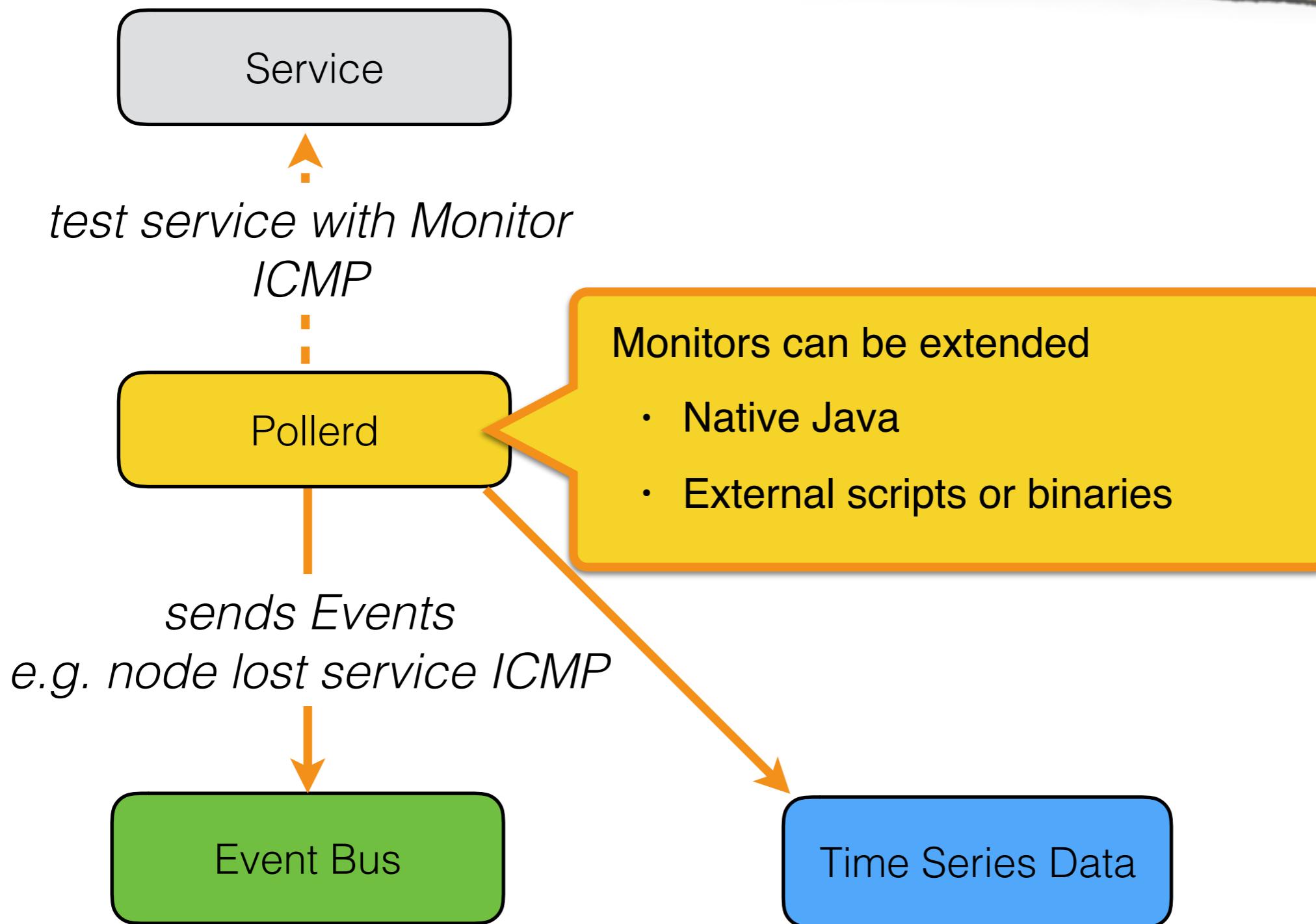


Fault-Management
- passive -



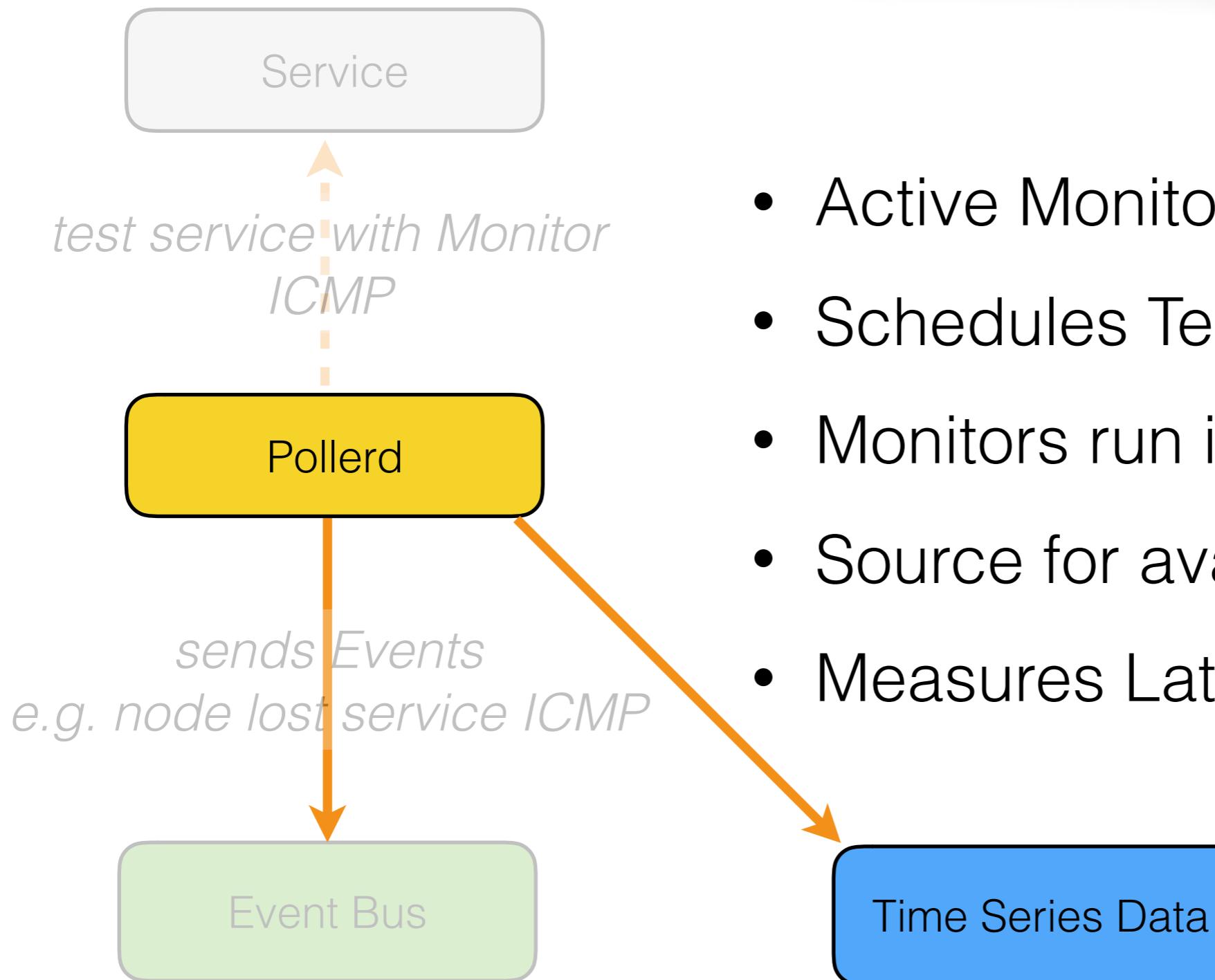
Performance-
Management

Fault-Management - active -



Fault-Management

- active -



- Active Monitoring
- Schedules Tests with Monitors
- Monitors run in a Thread Pool
- Source for availability
- Measures Latency

Fault-Management

- active -

Service

Nov 8, 2015 11:40 EST

HORIZON openNMS

Search Info ▾ Status ▾ Reports ▾ Dashboards ▾ Maps ▾ demo ▾

Home / SLM / DNS and DHCP Servers

This category includes all managed interfaces which are running either DNS (name resolution) servers or DHCP servers.

All With outages With availability less than 100%

| Nodes | Outages | 24hr Availability |
|--------------------------------|---------|-------------------|
| cartman.internal.opennms.com | 0 of 3 | 98.008% |
| connect.opennms.com | 0 of 1 | 100.000% |
| mcdaniels.internal.opennms.com | 0 of 2 | 98.638% |
| mrmakay.internal.opennms.com | 1 of 2 | 50.000% |
| sync.opennms.com | 0 of 1 | 100.000% |

Last updated: Sun Nov 08 11:40:42 EST 2015

OpenNMS Copyright © 2002-2015 The OpenNMS Group, Inc. OpenNMS® is a registered trademark of The OpenNMS Group, Inc.

Fault-Management

test servi

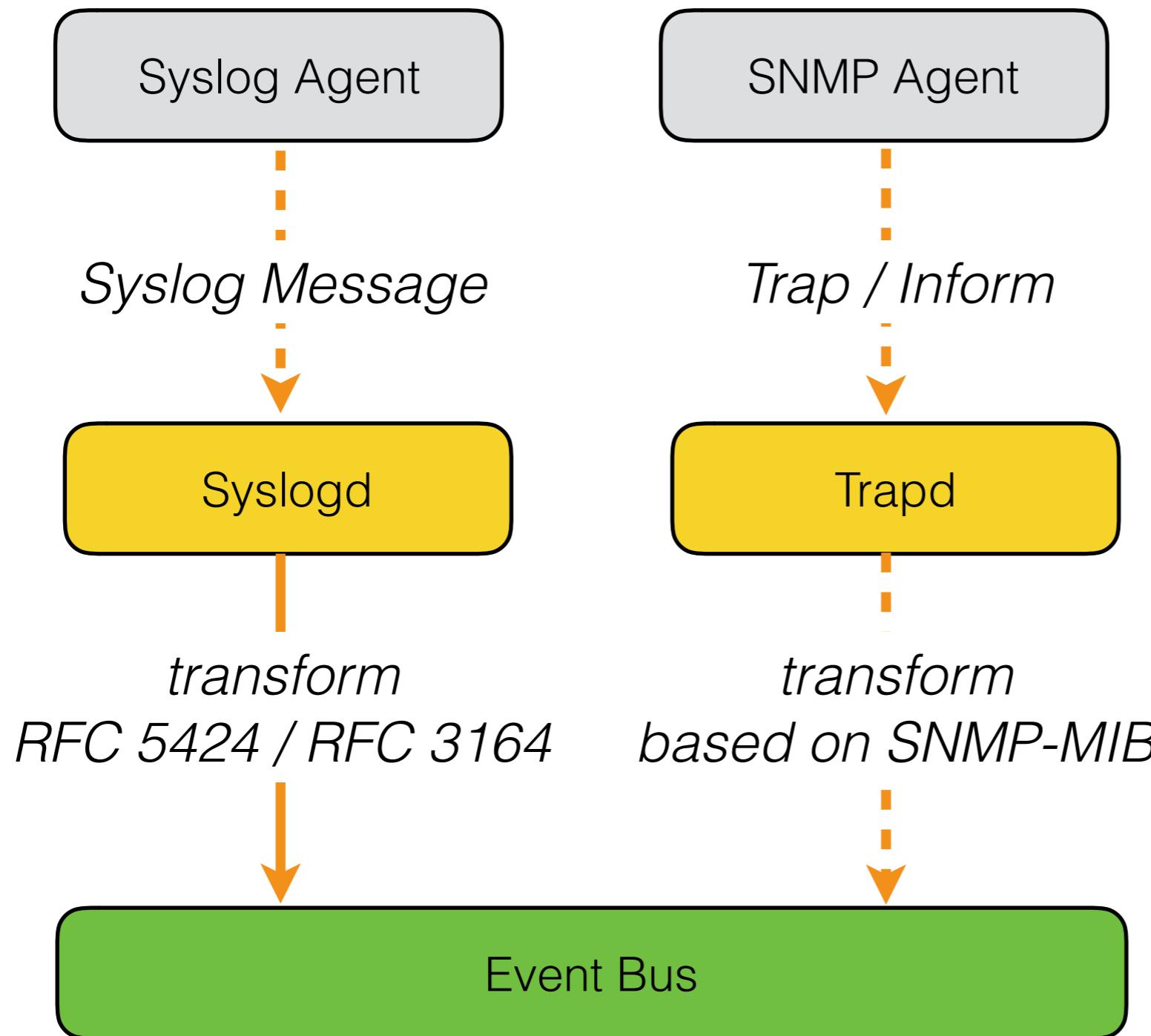
th Monitors
hread Pool
ity

sen
e.g. node /

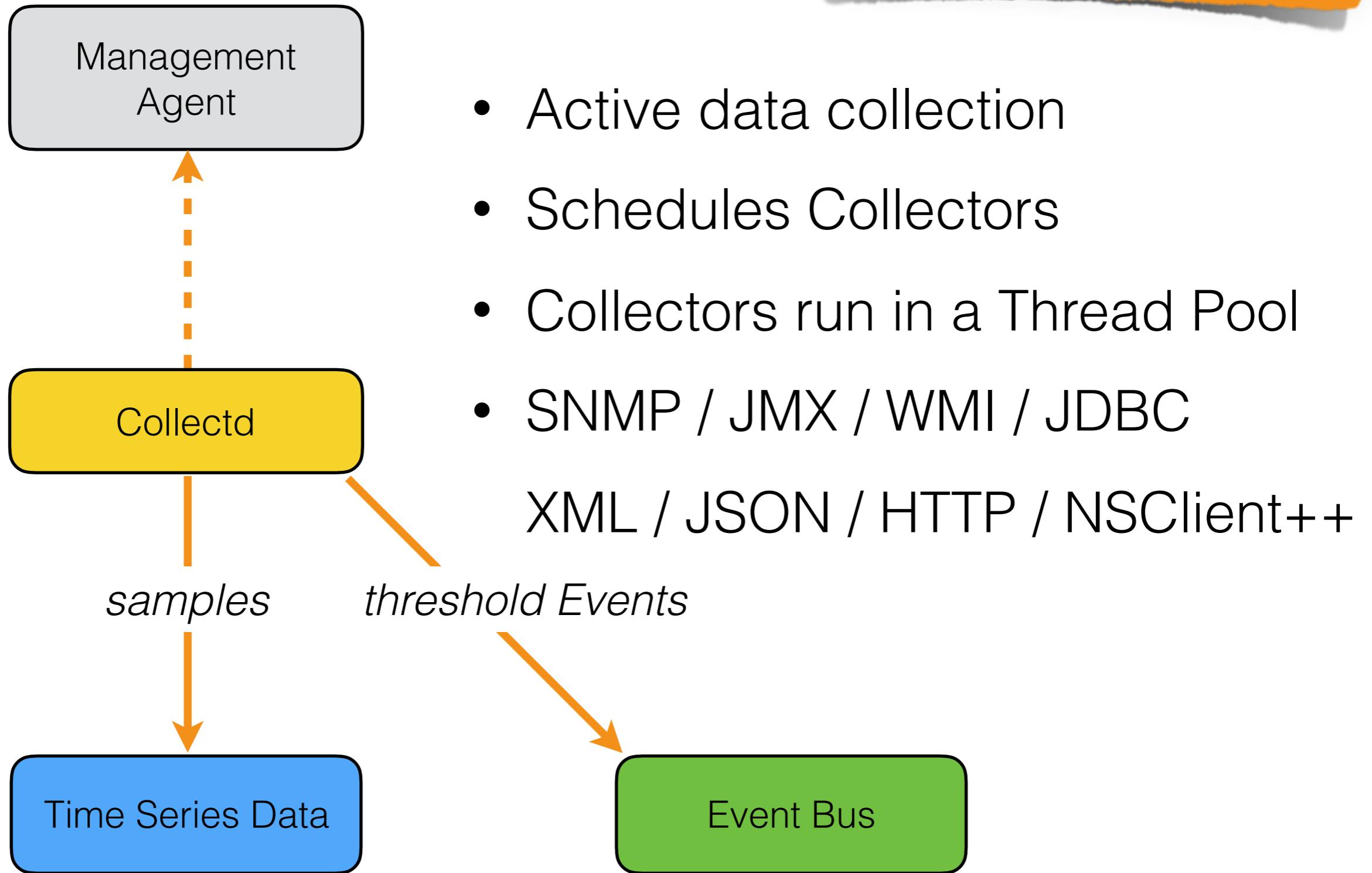
| SNMP Attributes | | | | | | | | |
|------------------------------------|--|-------|-------|-------|-------|-------|-------|---------------|
| Name | mcdaniels | | | | | | | |
| sysObjectID | 1.3.6.1.4.1.8072.3.2.10 | | | | | | | |
| Location | Dell Rack, Server Room, The OpenNMS Group, 220 Chatham Business Drive, Pittsboro, NC, 27312, USA, North America, Earth | | | | | | | |
| Contact | Tarus Balog | | | | | | | |
| Description | Linux mcdaniels 3.16.0-4-686-pae #1 SMP Debian 3.16.7-ckt11-1+deb8u5 (2015-10-09) i686 | | | | | | | |
| Availability | | | | | | | | |
| Availability (last 24 hours) | | | | | | | | 98.024% |
| 172.20.1.39 | 10 | 15:00 | 19:00 | 23:00 | 03:00 | 07:00 | 11:00 | 97.161% |
| DNS | | | | | | | | 100.000% |
| HTTP | | | | | | | | 100.000% |
| ICMP | | | | | | | | 100.000% |
| SNMP | | | | | | | | 100.000% |
| SSH | | | | | | | | 100.000% |
| Update | | | | | | | | 82.964% |
| 192.168.100.1 | 10 | 15:00 | 19:00 | 23:00 | 03:00 | 07:00 | 11:00 | Not Monitored |
| 2600:5800:f2a2:0000:0000:0000:0023 | 10 | 15:00 | 19:00 | 23:00 | 03:00 | 07:00 | 11:00 | 99.319% |
| DNS | | | | | | | | 97.275% |
| HTTP | | | | | | | | 100.000% |
| ICMP | | | | | | | | 100.000% |
| SSH | | | | | | | | 100.000% |

Fault-Management

- passive -



Performance Management



Performance Management

System Object ID

.1.3.6.1.4.1.9.1.1643

System Object ID

.1.3.6.1.4.1.311.3.2.10

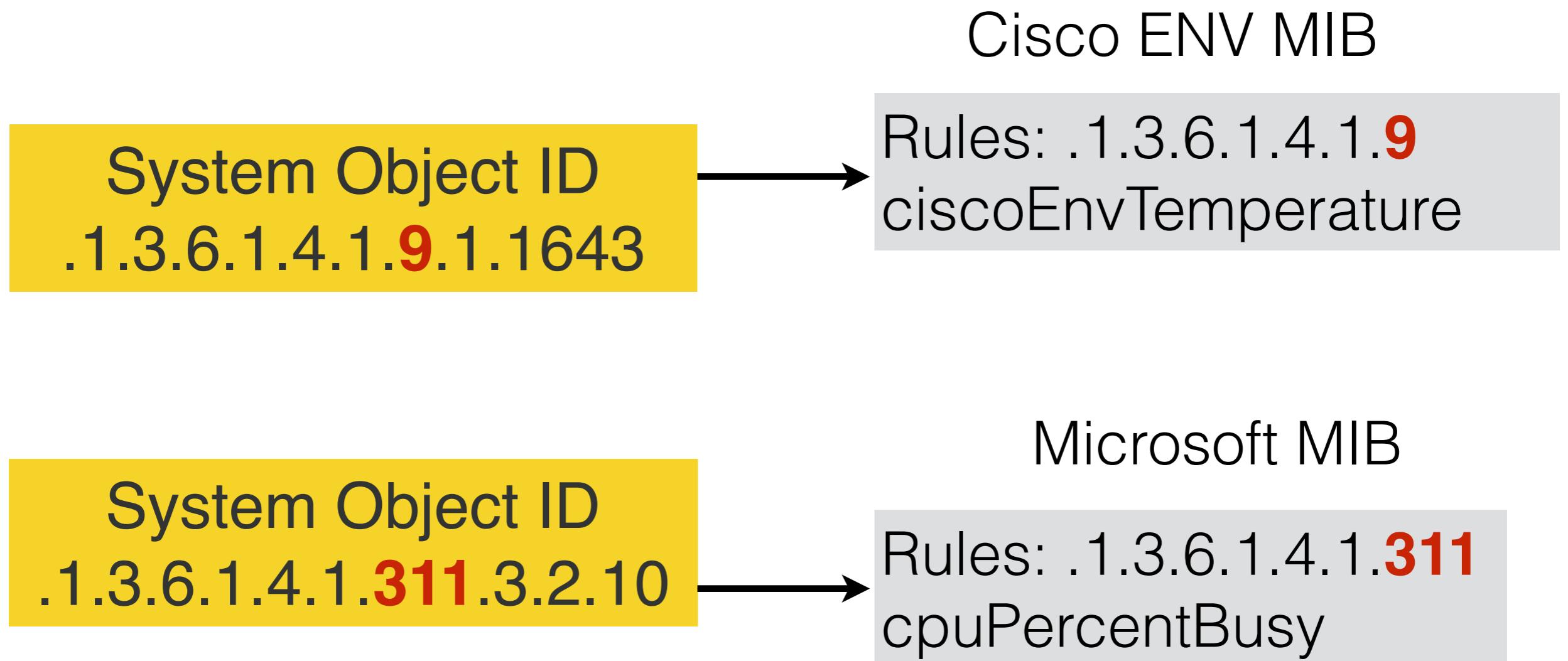
Standard MIB-II

Rules: **.1.3.6.1.4.1**

ifInHcOctets

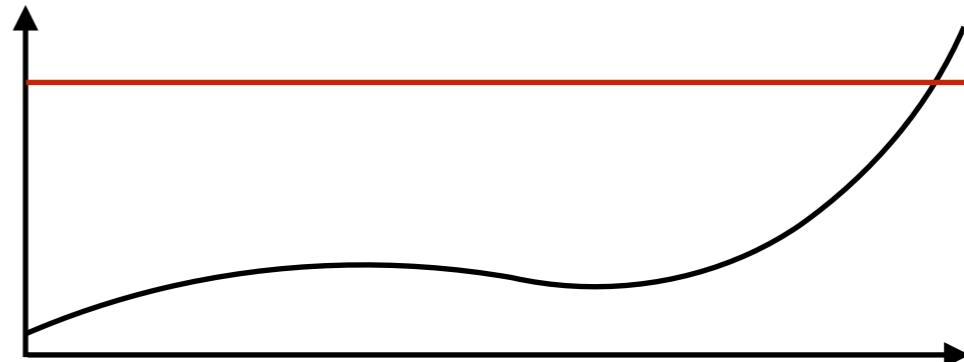
ifOutHcOctets

Performance Management

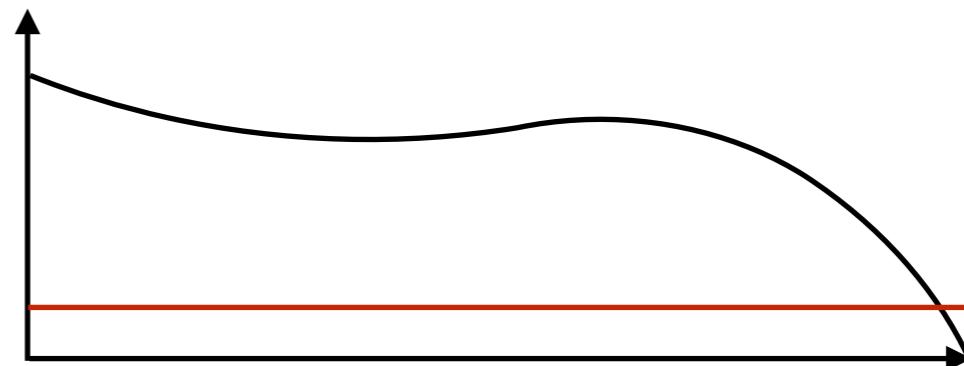


Performance Management

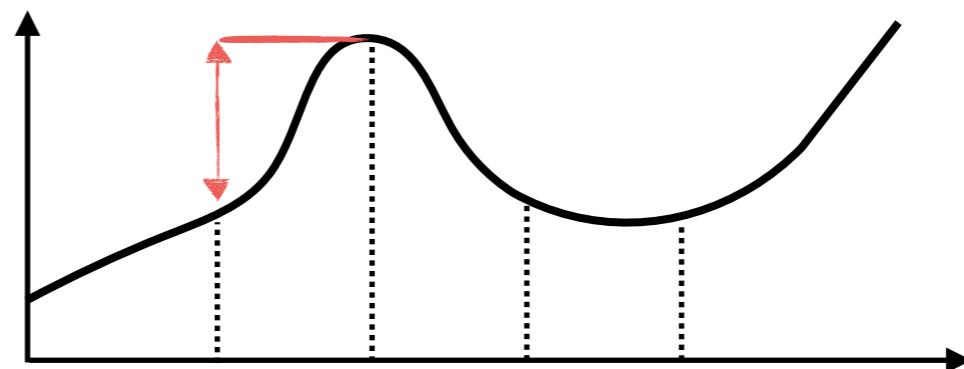
High Threshold



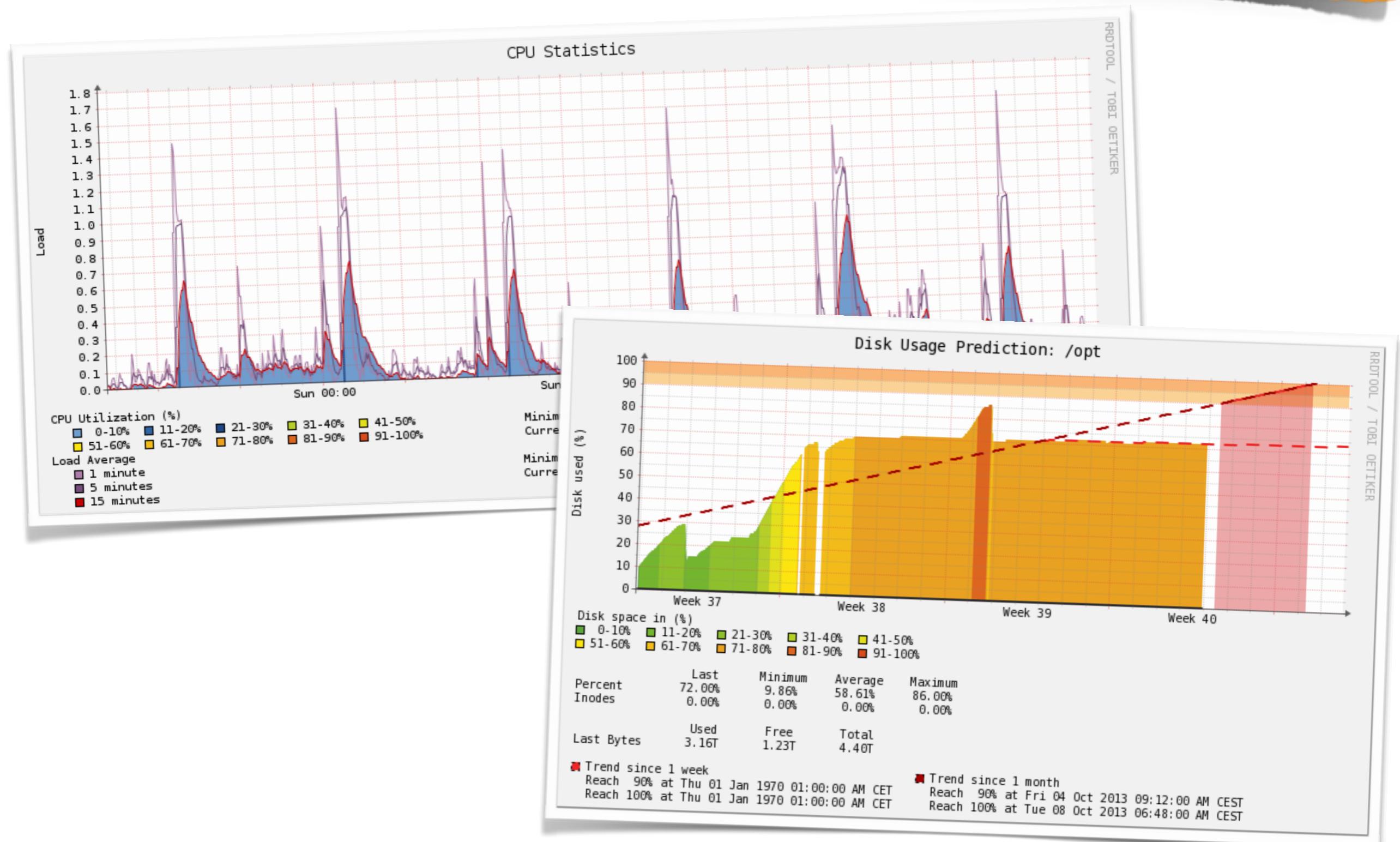
Low Threshold



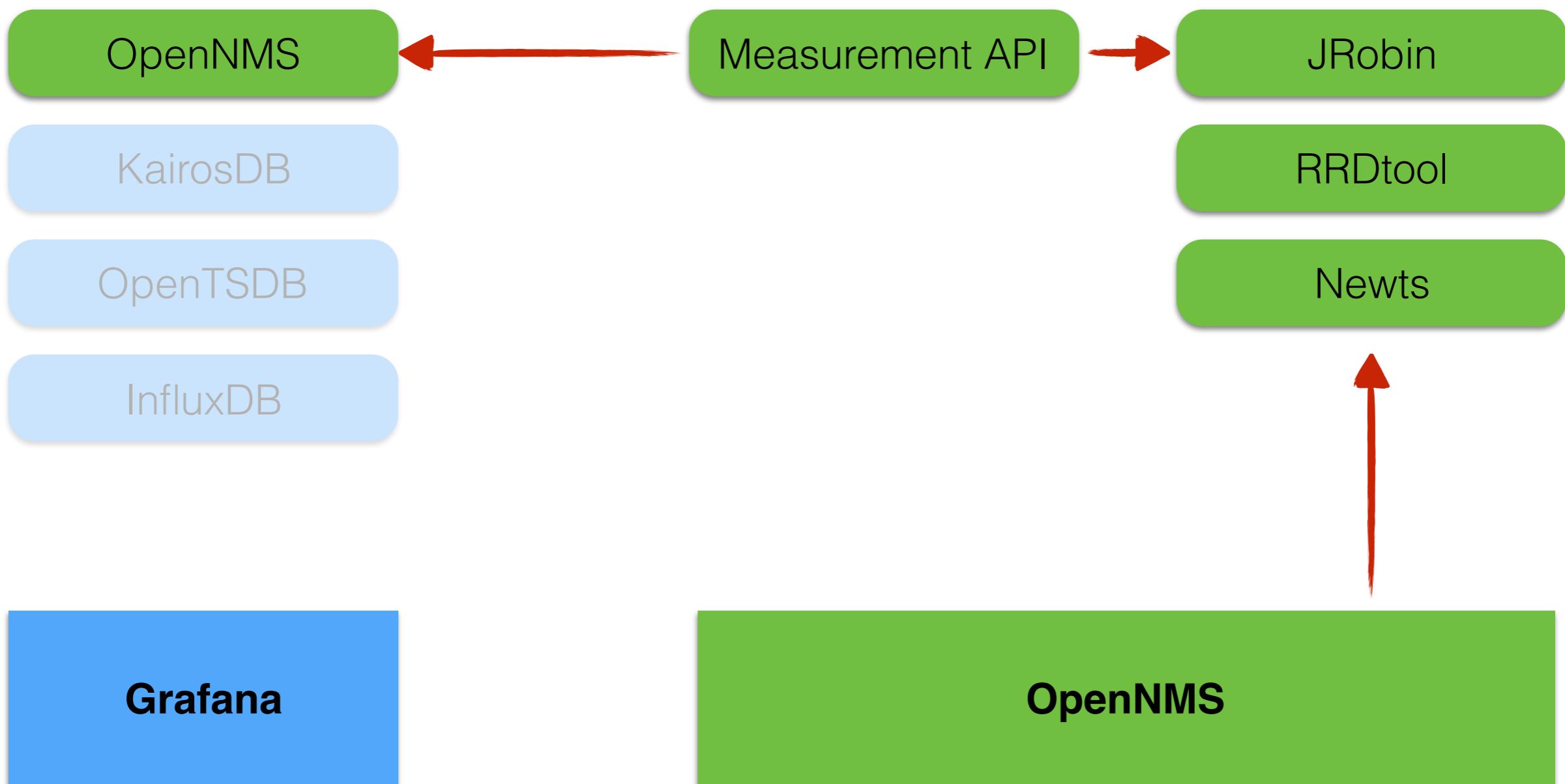
Change Threshold
relative / absolute

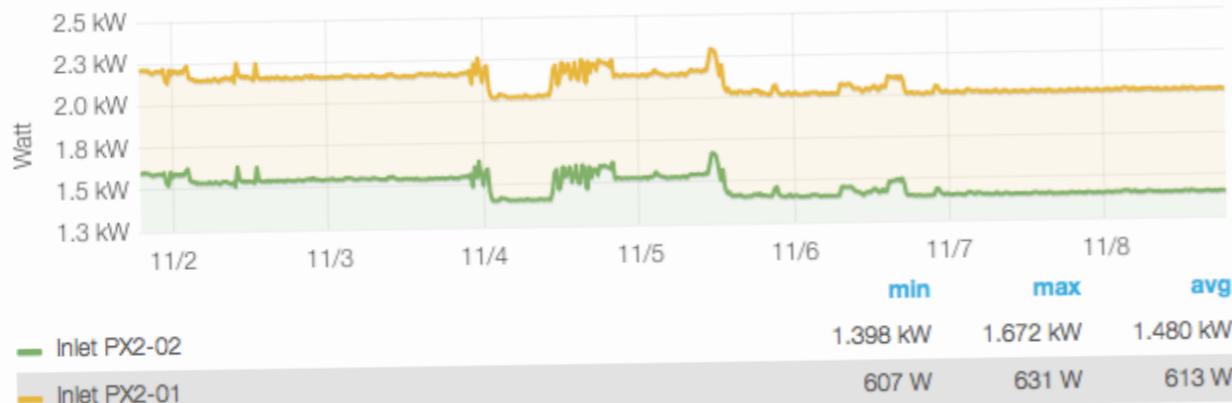
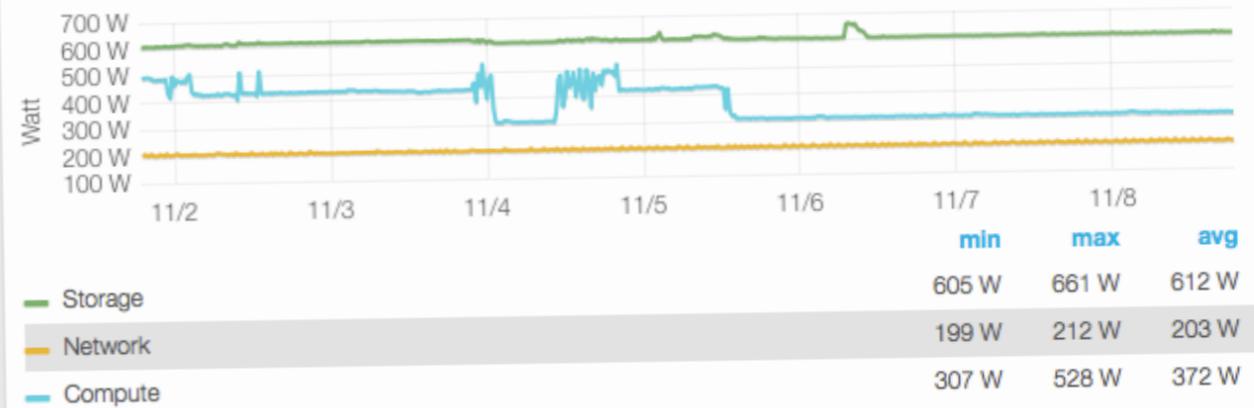
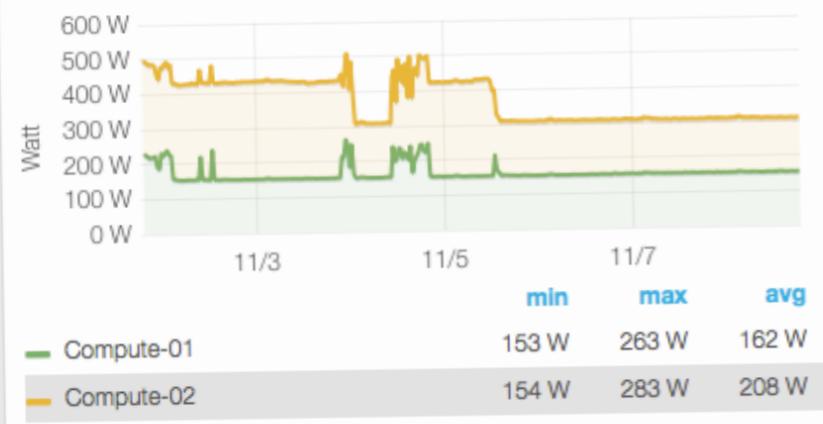
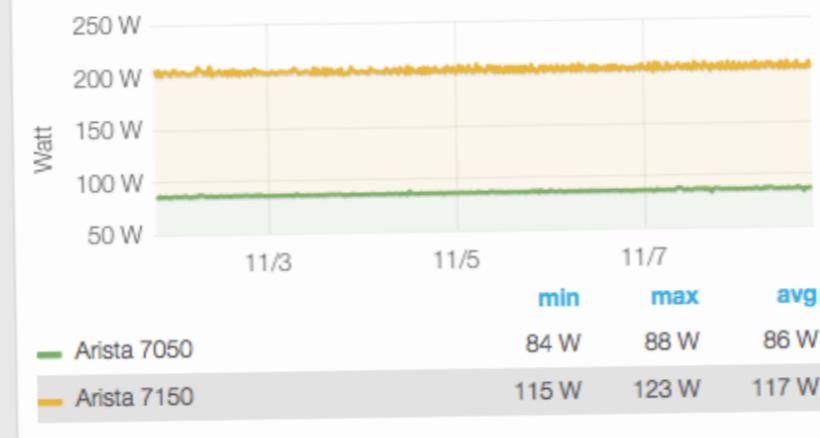
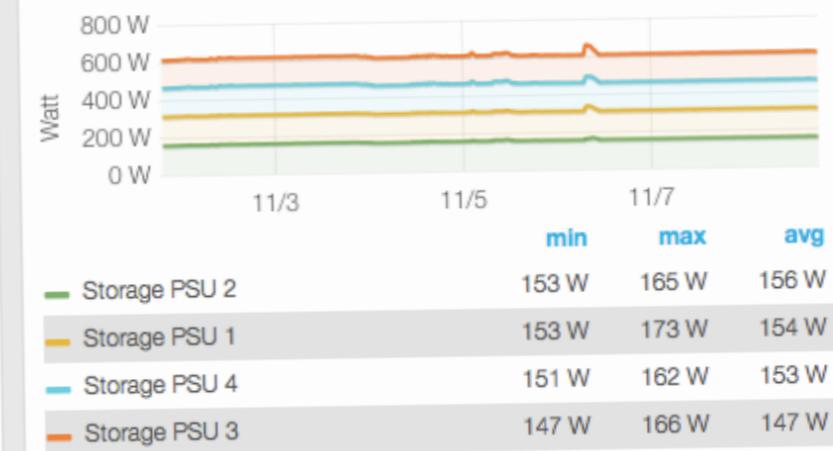
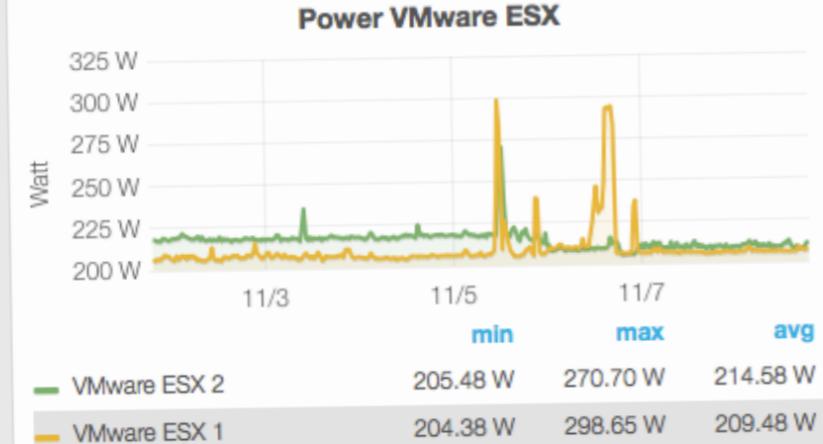
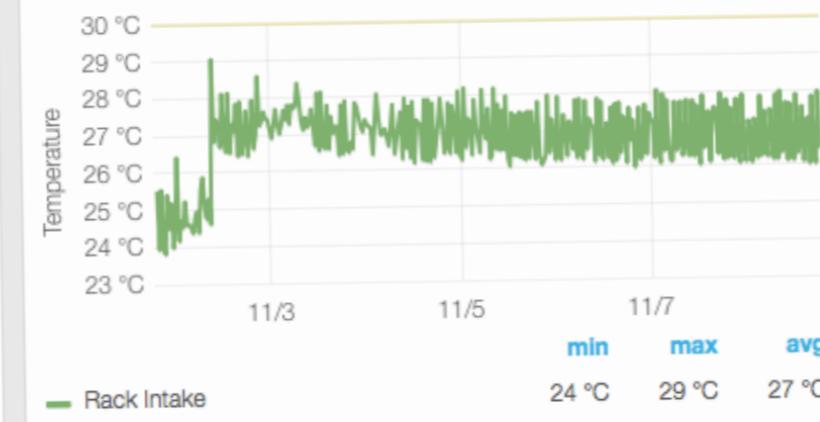


Performance Management



Performance Management



**Total Power Rack Research****Power Open Stack****Power Compute****Power Network****Power Storage****Power VMware ESX****Rack Research Environment****Rack Research Environment**



A Bunch Of **Nodes**

© WENN

Discover nodes in IP ranges.

A Bunch of Nodes

Auto Discovery

Home / Admin / Discovery / Modi

Save and Restart Discovery

General settings

Initial sleep time (sec.): 30 Restart sleep time (hours): 24 Threads: 15 Retries: 1 Timeout (ms.): 2000

Rescan for new devices

IP Address

Add New

http://www.op

Specifics

Discovery | Admin | OpenNMS We...

http://www.open-factory.org/my_ip_discovery.txt

Include URLs

Add New

URL

http://www.open-factory.org/my...

74.125.39.99
74.125.39.103
74.125.39.104
74.125.39.105
74.125.39.106
74.125.39.147
216.239.32.10
216.239.34.10
216.239.36.10
216.239.38.10

Include Ranges

Add New

Begin Address

Exclude Ranges

Add New

Begin

172.16.0.10

172.16.0.90

Delete

SNMP Agent

HTTP

SMTP

ICMP Interface

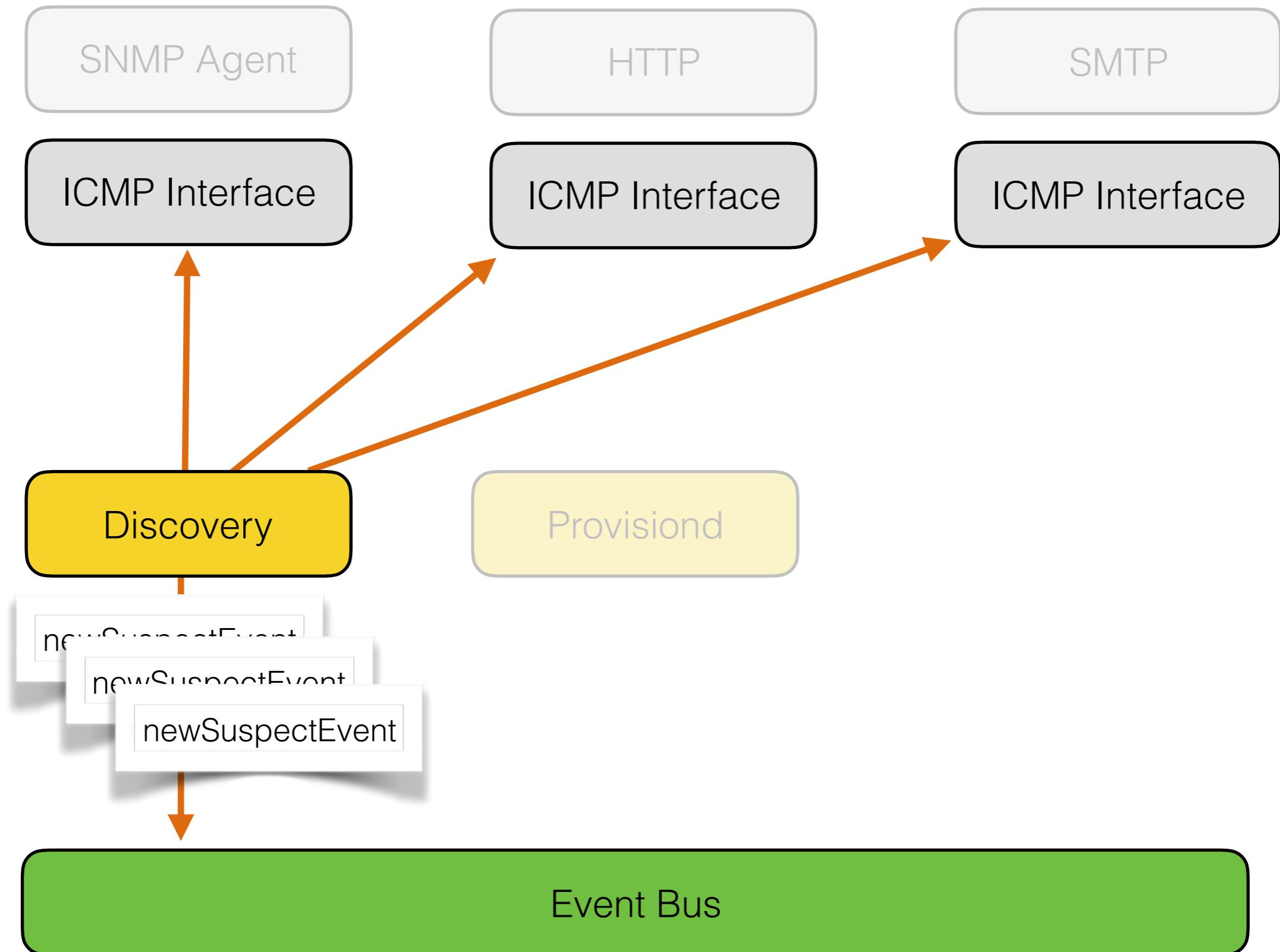
ICMP Interface

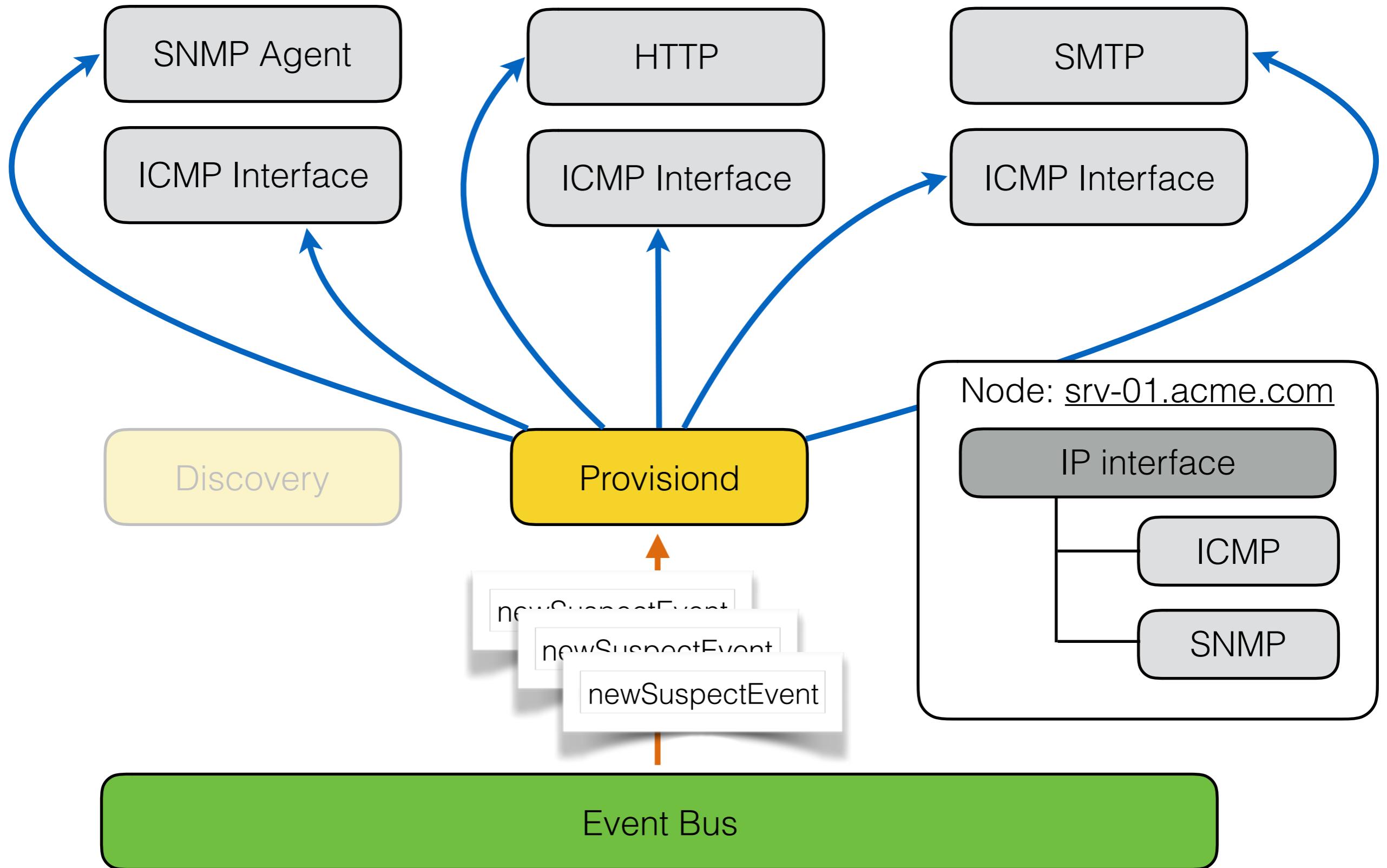
ICMP Interface

Discovery

Provisiond

Event Bus







Home / Search / Node

Node: mcdaniels.internal.opennms.com

52

[View Events](#) [View Alarms](#) [View Outages](#) [Asset Info](#) [Hardware Info](#) [SSH](#) [HTTP](#) [Resources](#)

Node has no problems.

SNMP Attributes

| | |
|-------------|---|
| Name | mcdaniels |
| sysObjectID | .1.3.6.1.4.1.8072.3.2.10 |
| Location | Dell Rack, Server Room, The OpenNMS Group, 220 Chatham Business Drive, Pittsboro, NC, 27312, USA, North America, Earth |
| Contact | Tarus Balog |
| Description | Linux mcdaniels 3.16.0-4-686-pae #1 SMP Debian 3.16.7-ckt11-1+deb8u5 (2015-10-09) i686 |

Node Interfaces

IP Interfaces

Physical Interfaces

| Index | SNMP IfDescr | SNMP IfName | SNMP IfAlias | SNMP IfSpeed |
|-------|---|-------------|--------------|--------------|
| 1 | lo | lo | | 10000000 |
| 2 | Broadcom Corporation NetXtreme BCM5703X Gigabit Ethernet | eth0 | | 1000000000 |
| 3 | Broadcom Corporation NetXtreme BCM5703X Gigabit Ethernet | eth1 | | 0 |
| 4 | ham0 | ham0 | | 10000000 |
| 5 | virbr1 | virbr1 | | 0 |

Description

Linux mcdaniels 0.0.1
(2015-10-09) i686

Node Interfaces

IP Interfaces

Node Interfaces

IP Interfaces

Physical Interfaces

| IP Address | IP Host Name | ifIndex | Mac Address |
|------------------------------------|--------------------------------|---------|-------------|
| 172.20.1.39 | mcdaniels.internal.opennms.com | 2 | M |
| 192.168.100.1 | 192.168.100.1 | 5 | M |
| 2600:5800:f2a2:0000:0000:0000:0023 | mcdaniels.internal.opennms.com | 2 | M |

Description

Linux mcdaniels 3.19.0-25-generic
(2015-10-09) i686



IP based “monitoring” policy

| | | |
|---|-------------------------|---|
| • | name unmanaged_loopback | class org.opennms.netmgt.provision.pers |
| ◦ | key action | value UNMANAGE |
| ◦ | key matchBehavior | value ALL_PARAMETERS |
| ◦ | key ipAddress | value ~42\.42\..* |



SNMP data collection policy

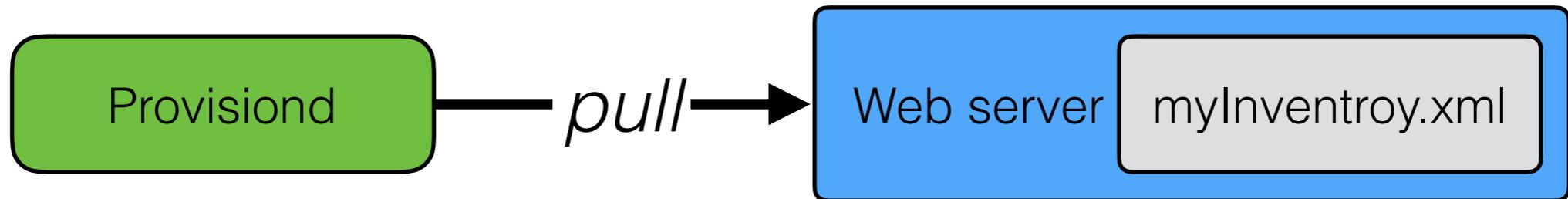
- name uplink_datacollection class org.opennms.netmgt.provision.pers...
 - key action value ENABLE_COLLECTION
 - key matchBehavior value ALL_PARAMETERS
 - key ifAlias value ~Uplink.*



Node category policy

| | | | | |
|---|------|----------------|-------|------------------------------------|
| • | name | category_cisco | class | org.opennms.netmgt.provision.pers |
| ◦ | key | category | value | Cisco-Systems |
| ◦ | key | matchBehavior | value | ALL_PARAMETERS |
| ◦ | key | sysObjectId | value | ~\.\1\.\3\.\6\.\1\.\4\.\1\.\9\..* |

Import from an existing inventory.



```
1 <requisition-def import-name="my-Inventory" import-url-resource="http://myhost/myInventory.xml">
2   <cron-schedule>0 10 0 * * ? *</cron-schedule>
3 </requisition-def>
4
```

provisionond-configuration.xml

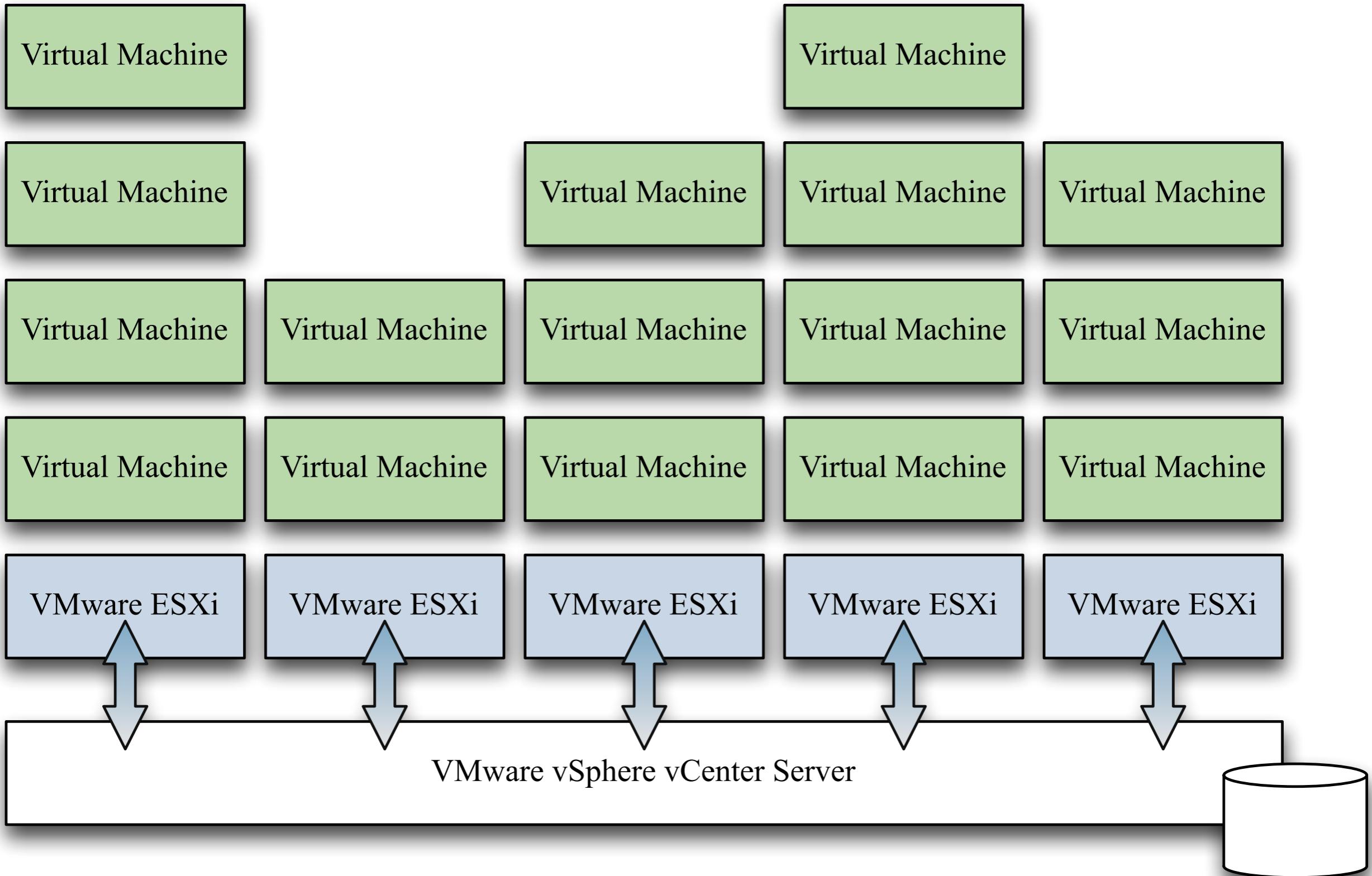
BetterSource

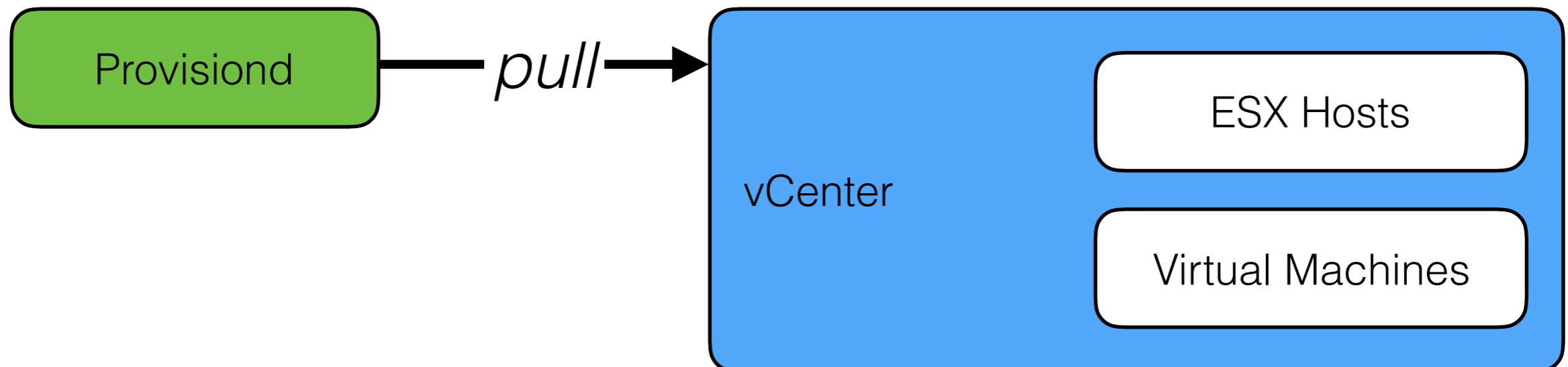
http://www.open-factory.org/mynodes.xml

Google

```
1 <?xml version="1.0" encoding="UTF-8" standalone="yes"?>
2 <model-import last-import="2010-09-27T20:07:42.497+02:00" foreign-source="MyInventory"
date-stamp="2010-09-29T10:04:23.456+02:00"
xmlns="http://xmlns.opennms.org/xsd/config/model-import">
3   <node node-label="MyNodeB" foreign-id="1285747378071" building="MyInventory">
4     <interface status="1" snmp-primary="P" ip-addr="1.1.1.5" descr="">
5       <monitored-service service-name="SNMP"/>
6       <monitored-service service-name="ICMP"/>
7     </interface>
8     <category name="Routers"/>
9     <asset value="Cisco" name="vendor"/>
10    <asset value="FD1" name="building"/>
11  </node>
12  <node node-label="MyNodeA" foreign-id="1285747351321" building="MyInventory">
13    <interface status="1" snmp-primary="P" ip-addr="1.1.1.1" descr="">
14      <monitored-service service-name="StrafePing"/>
15      <monitored-service service-name="ICMP"/>
16    </interface>
17    <category name="Switches"/>
18    <asset value="FD2" name="building"/>
19    <asset value="HP" name="vendor"/>
20  </node>
21 </model-import>
22
```

Import Nodes from VMware.

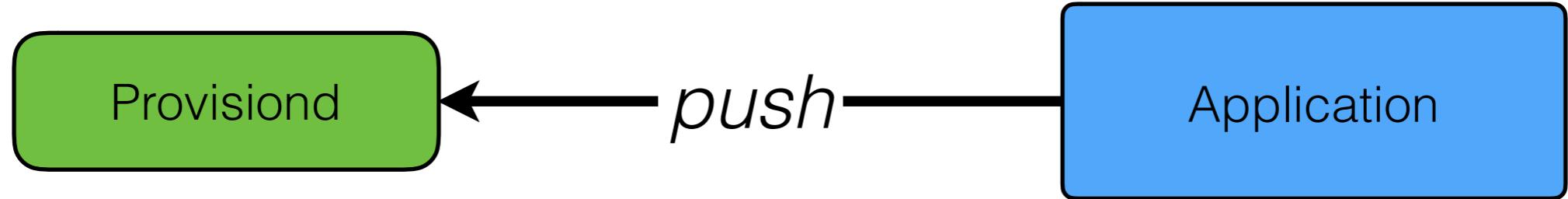




```
1 <requisition-def import-name="my-vCenter-01" import-url-resource="vmware://192.168.10.198">
2   <cron-schedule>0 10 0 * * ? *</cron-schedule>
3 </requisition-def>
4
5 <requisition-def import-name="my-vCenter-02" import-url-resource="vmware://192.168.10.187">
6   <cron-schedule>0 10 0 * * ? *</cron-schedule>
7 </requisition-def>
8
9 <requisition-def import-name="my-vCenter-03" import-url-resource="vmware://192.168.10.123">
10  <cron-schedule>0 10 0 * * ? *</cron-schedule>
11 </requisition-def>
```

~

provisiond-configuration.xml



POSTs (Adding Data)

| Resource | Description |
|--|--|
| /requisitions | Adds (or replaces) a requisition. |
| /requisitions/{name}/nodes | Adds (or replaces) a node in the specified requisition. This operation can be very helpful when working with [[Large Requisitions]]. |
| /requisitions/{name}/nodes/{foreignId}/interfaces | Adds (or replaces) an interface for the given node in the specified requisition. |
| /requisitions/{name}/nodes/{foreignId}/interfaces/{ipAddress}/services | Adds (or replaces) a service on the given interface in the specified requisition. |
| /requisitions/{name}/nodes/{foreignId}/categories | Adds (or replaces) a category for the given node in the specified requisition. |
| /requisitions/{name}/nodes/{foreignId}/assets | Adds (or replaces) an asset for the given node in the specified requisition. |

http://docs.opennms.org/opennms/releases/16.0.3/guide-development/guide-development.html#_rest_api

Useful resources

| | |
|----------------------------------|--|
| Community Welcome Guide | http://www.opennms.eu/welcome/ |
| OpenNMS with Vagrant | http://www.opennms.org/wiki/ OpenNMS and Vagrant with VirtualBox |
| OpenNMS running in Docker | https://hub.docker.com/u/opennms/ |
| OpenNMS Wiki | http://www.opennms.org/wiki/Main_Page |
| Issue Tracker | http://issues.opennms.org |
| Continuous Integration | http://bamboo.internal.opennms.com:8085/browse/OPENNMS- ONMS/branches |
| Mailing Lists | http://www.opennms.org/wiki/Mailing_lists |