



~ % whoami

Ronny Trommer

University of Applied Sciences in Fulda  
Telecommunication

Co-founder OpenNMS Foundation Europe e.V.

Freifunker and visit Hackerspaces

# ~ % locate



**Fulda**

Germany

Sunny · 61°F  
3:11 PM

SAVE NEARBY SHARE

**Photos** **Photo Sphere**

**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](#)

**Population:** 64,008 (Jun 30, 2009)  
**Area:** 40.17 mi<sup>2</sup>  
**Dialling codes:** 0661

Map data ©2015 GeoBasis-DE/BKG (©2009), Google Terms Privacy maps.google.at Send feedback 50 mi



~ % locate





~ % locate

**Pittsboro**

**Pittsboro, NC**  
Mostly Cloudy · 55°F  
9:17 AM

Directions

SAVE NEARBY SHARE

Photos

**Quick facts**

Pittsboro is a town in Chatham County, North Carolina, United States. The population was 3,743 at the 2010 census. It is the county seat of Chatham County. [Wikipedia](#)

**Population:** 3,962 (2013)  
**Area codes:** Area codes 919 and 984  
**Area:** 4.17 mi<sup>2</sup>

**Pittsboro NC**

Map data ©2015 Google Terms Privacy maps.google.at Send feedback 50 mi

# 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



<https://github.com/opennms>



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

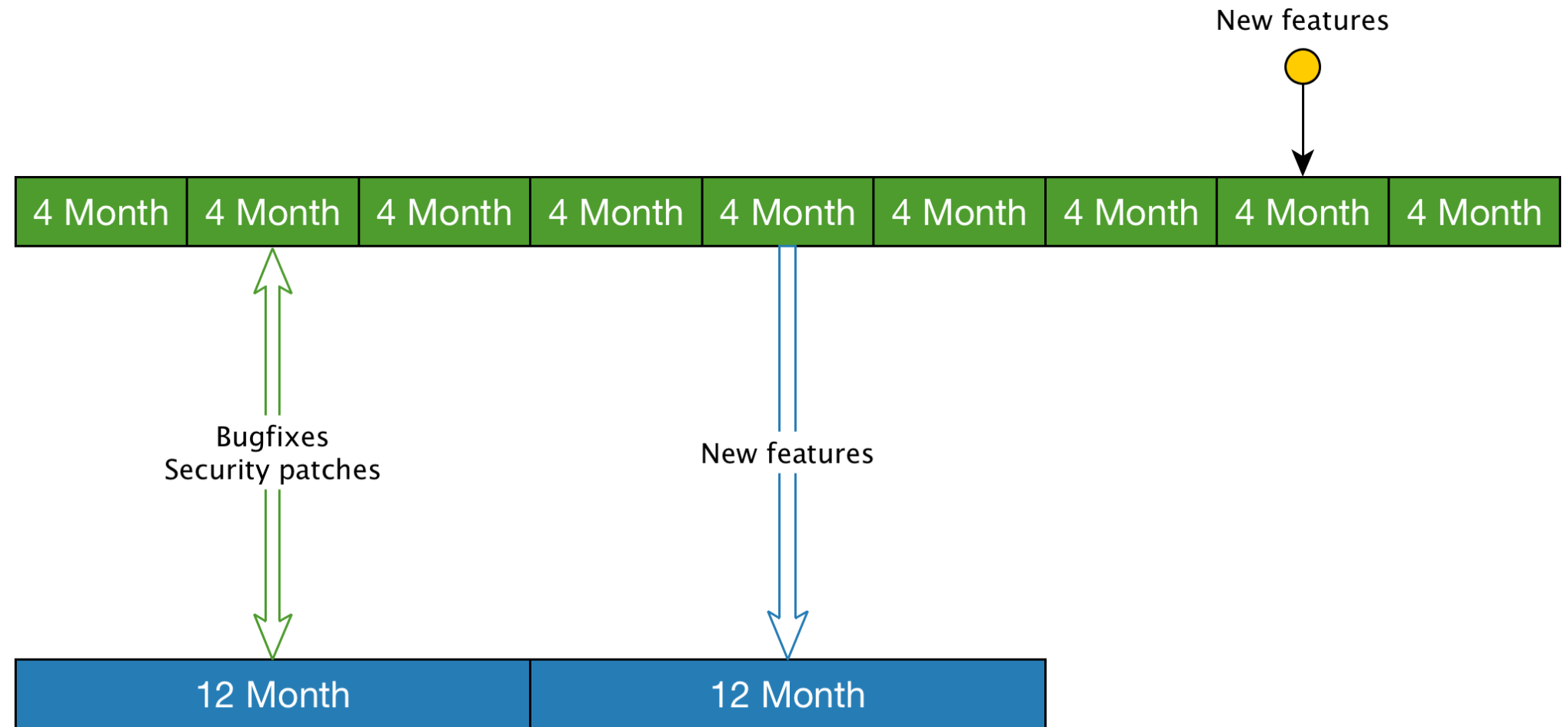


Like RHEL

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

Index

Day 1  
2015-09-30

Day 2  
2015-10-01

Speakers

Events

<http://www.opennms.eu>




OUCE

YouTube AT

Search

Upload



OpenNMS Project

opennms

Subscribe 471

Home Videos Playlists Channels Discussion About

Uploads

Date added (newest - oldest) Grid

43:32

OUCE 2015 - yourCMDB and OpenNMS

86 views • 1 month ago

43:25

OUCE 2015 - Provisioning Integration Server

50 views • 1 month ago

42:11

OUCE 2015 - OpenNMS License Manager

41 views • 1 month ago

51:15

OUCE 2015 - OpenNMS Map Use Cases 2015

99 views • 1 month ago

50:41

Issue Tracker // JIRA

- Found a bug?
- Something not working as expected?
- Found a typo?
- Some information required is missing?
- Documentation is outdated?
- Feature/Enhancement request?
- Open an issue @ <https://issues.opennms.org> (account required)

36:14

33:15

27:28

<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

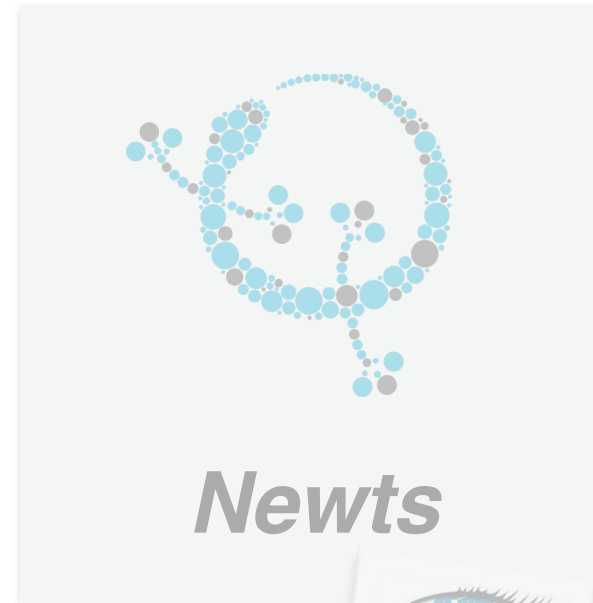
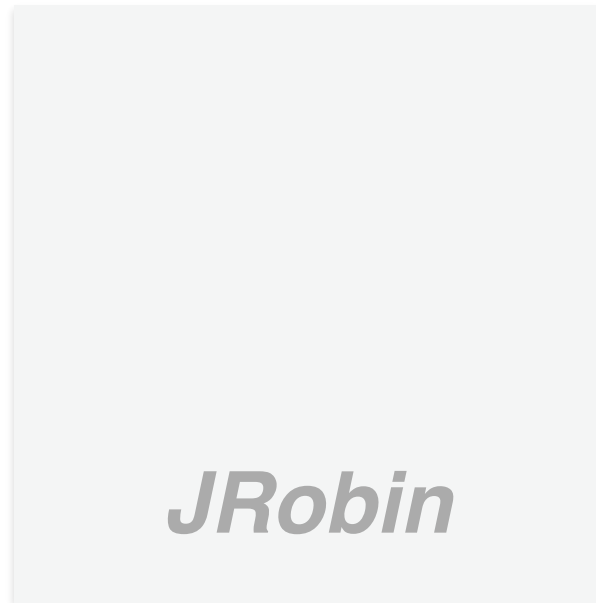
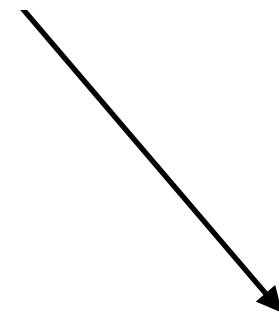
Accounting

Performance

Security



Inventory  
Monitoring Events

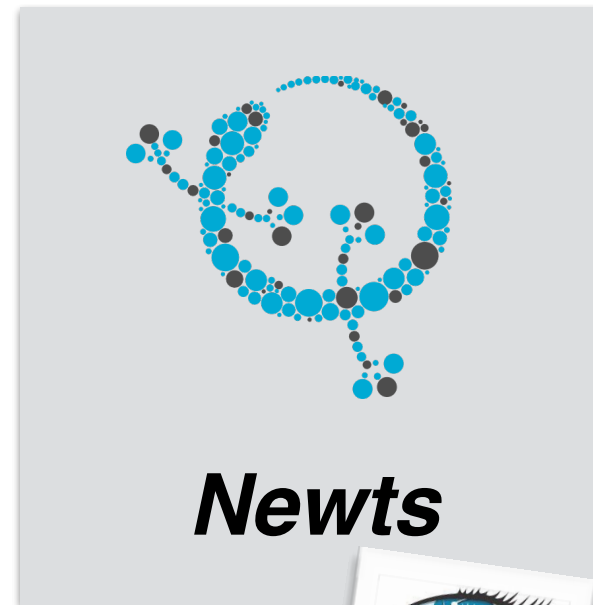






Time Series Data

Inventory  
Monitoring Events



SNMP Agent

Syslog Agent

JMX Agent

WMI Agent

Pollerd

Trapd

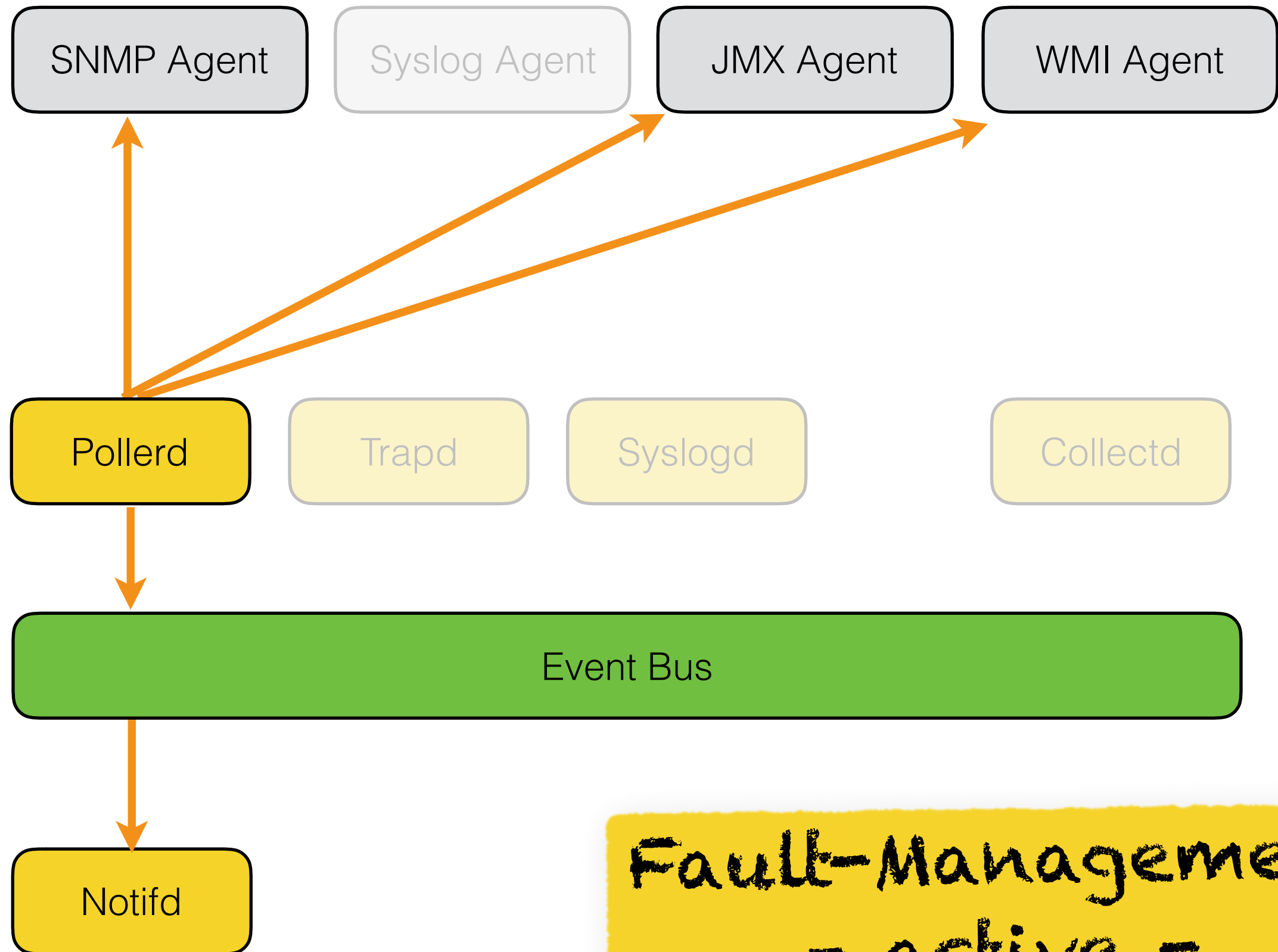
Syslogd

Collectd

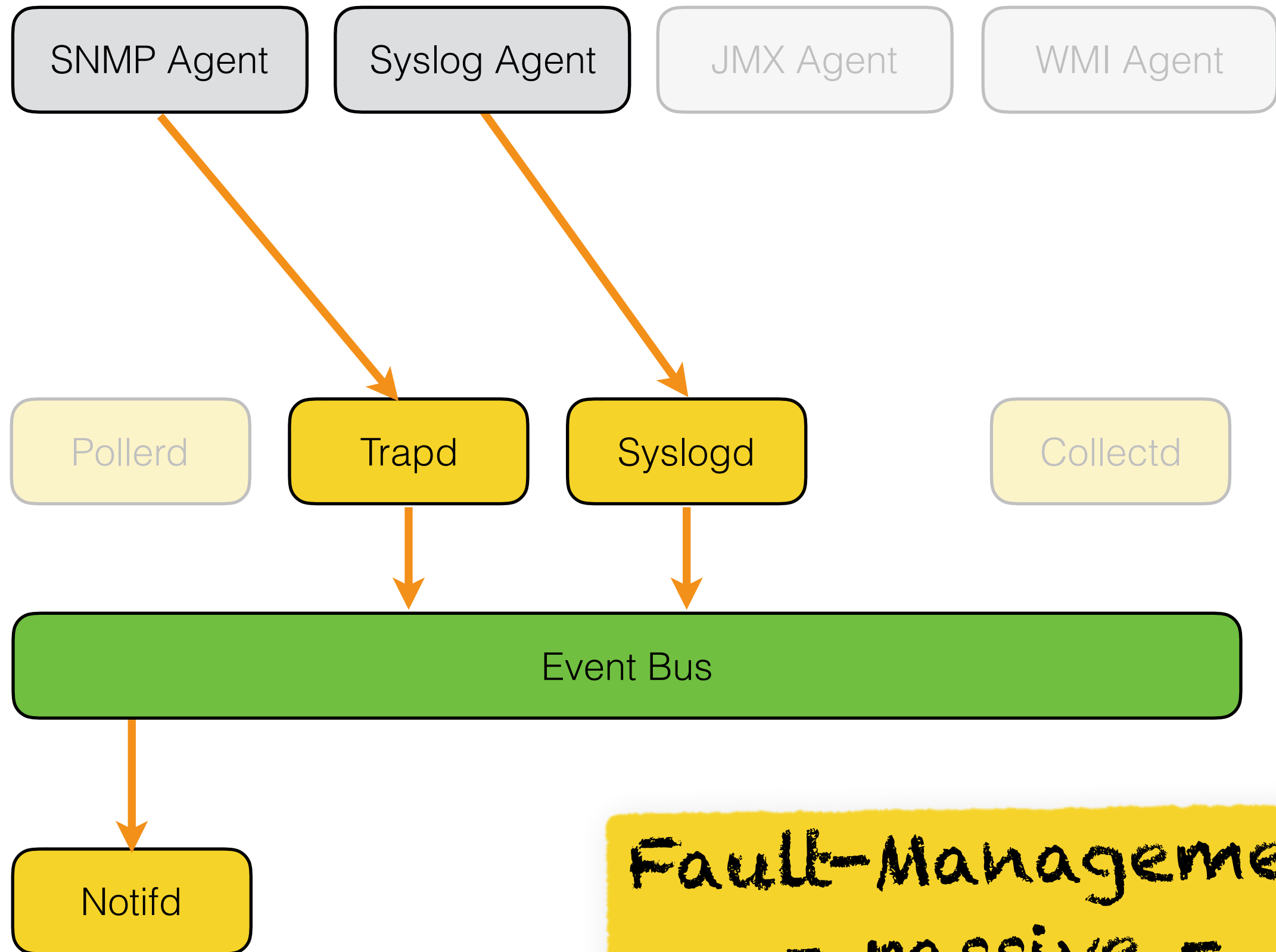
Event Bus

Notifd

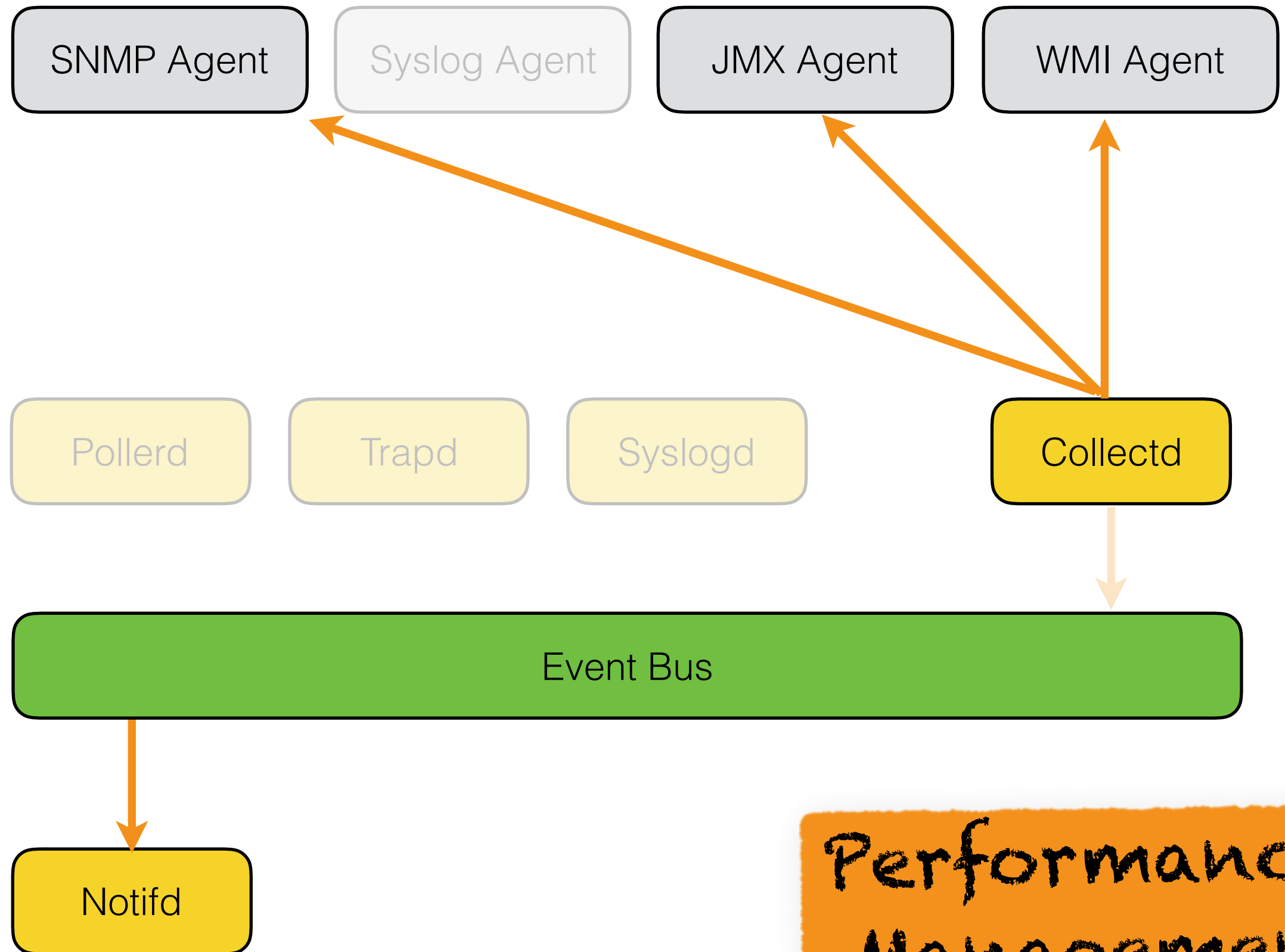
**Fault-Management**  
**- active -**



**Fault-Management**  
- active -



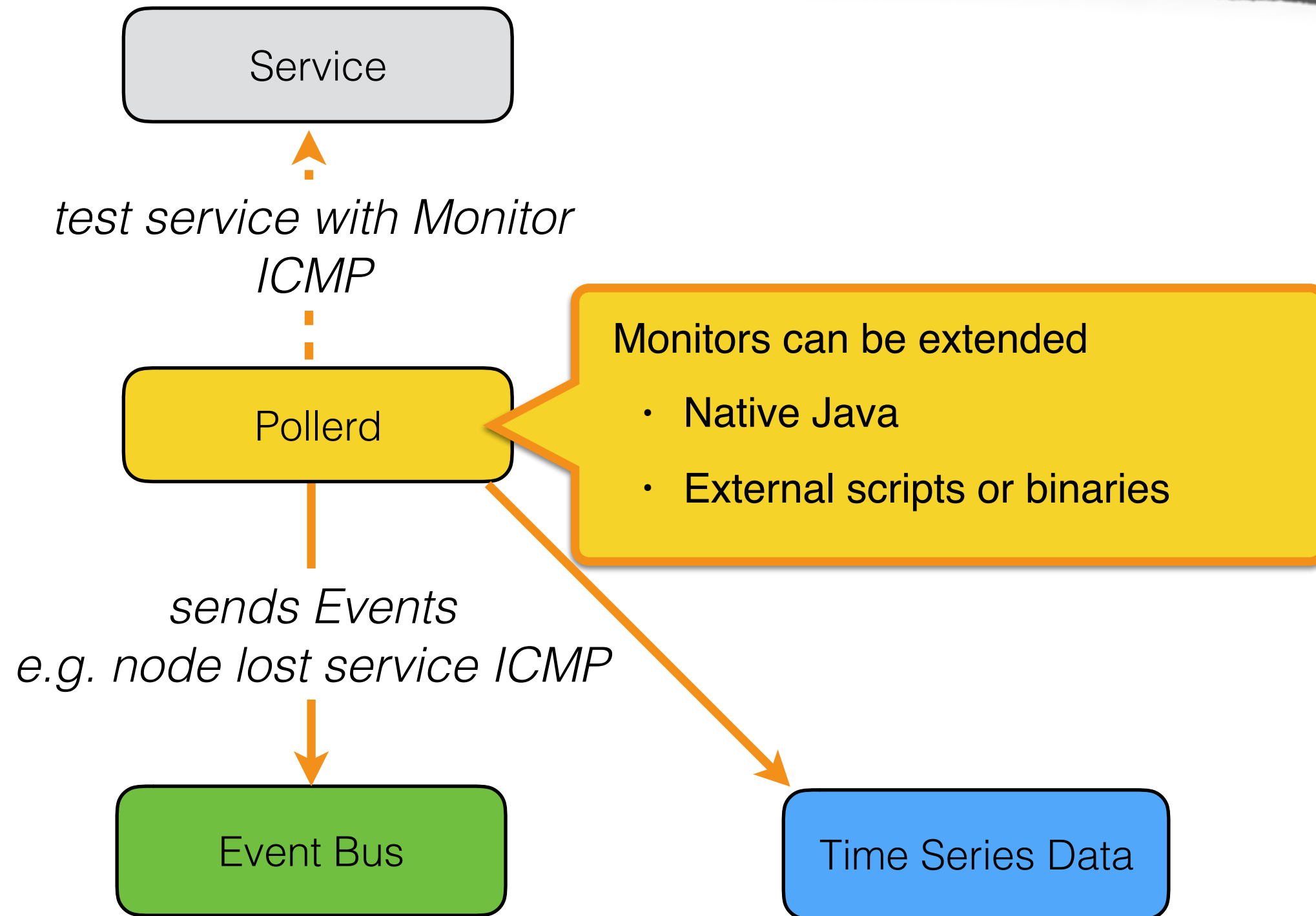
**Fault-Management**  
**- passive -**



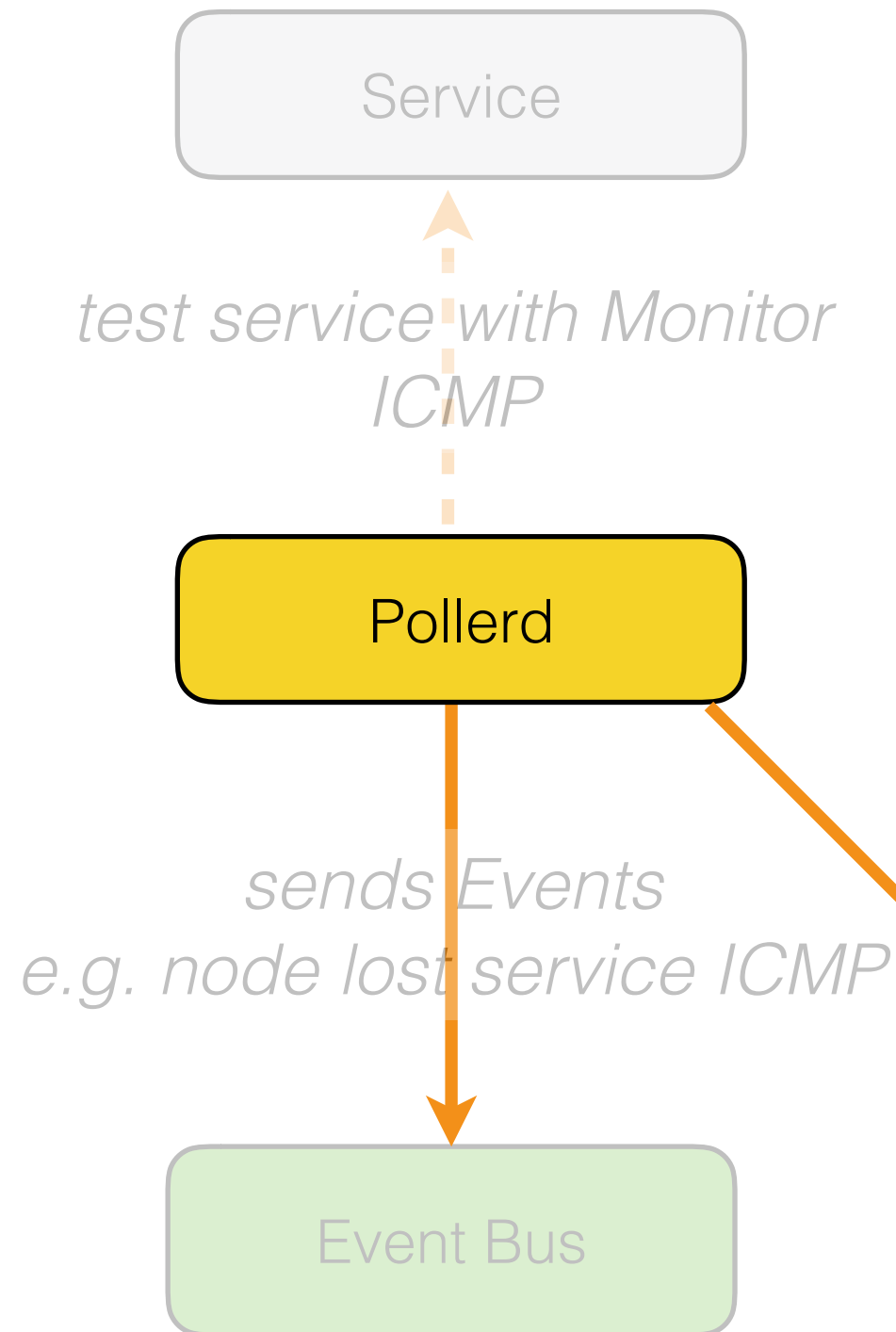
Performance-  
Management



# 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

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# Fault-Management

## Monitoring

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

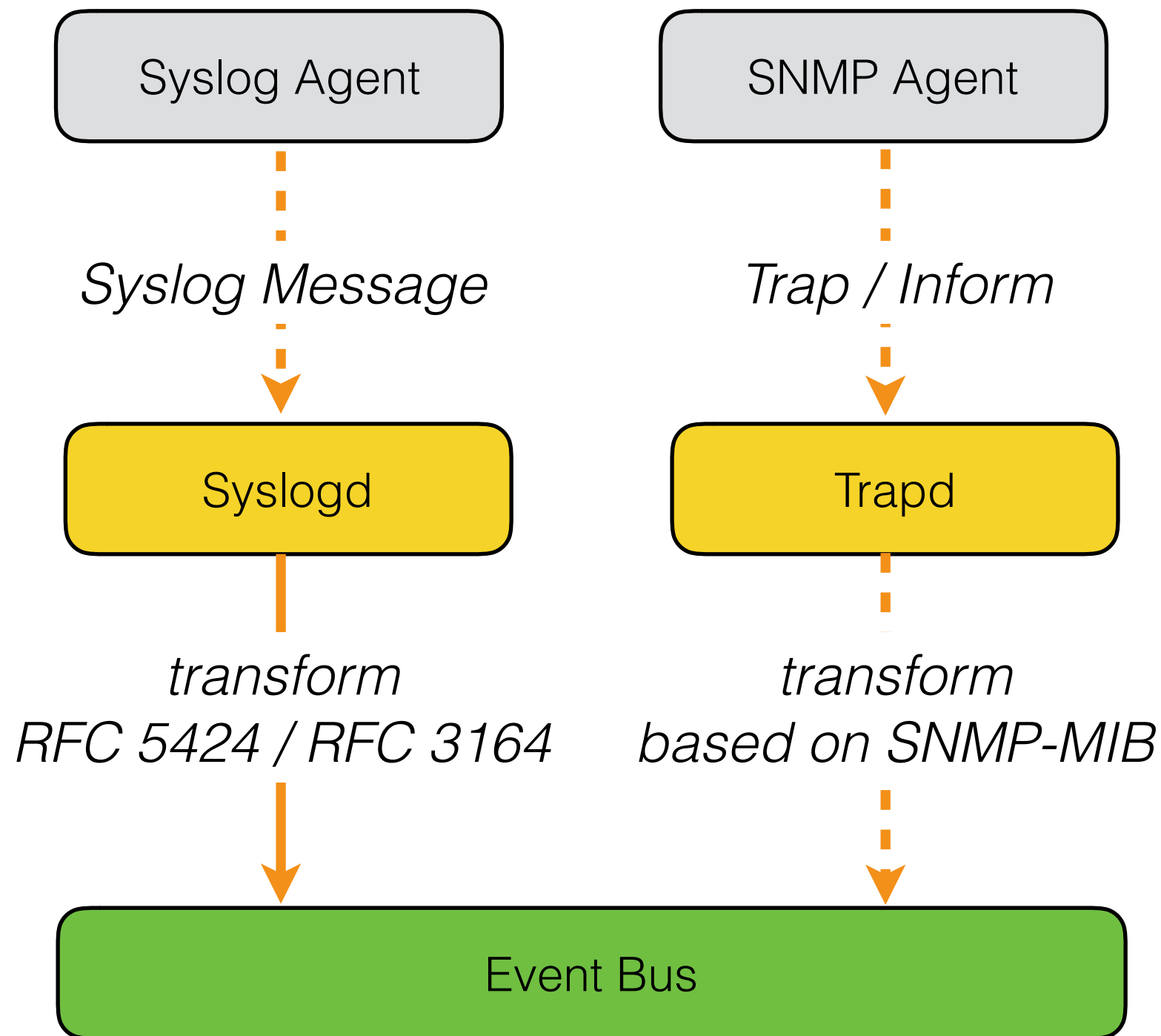
Availability	
Availability (last 24 hours)	
	98.024%
172.20.1.39	97.161%
DNS	100.000%
HTTP	100.000%
ICMP	100.000%
SNMP	100.000%
SSH	100.000%
Update	82.964%
192.168.100.1	Not Monitored
2600:5800:f2a2:0000:0000:0000:0023	99.319%
DNS	97.275%
HTTP	100.000%
ICMP	100.000%
SSH	100.000%

with Monitors  
Thread Pool  
ity

test servi  
sen  
e.g. node

# Fault-Management

- passive -





# Performance Management

Management Agent

Collectd

*samples*

Time Series Data

*threshold Events*

Event Bus

- Active data collection
- Schedules Collectors
- Collectors run in a Thread Pool
- SNMP / JMX / WMI / JDBC  
XML / JSON / HTTP / NSClient++

# Performance Management

System Object ID

**.1.3.6.1.4.1.9.1.1643**

Standard MIB-II

Rules: **.1.3.6.1.4.1**

ifInHcOctets

ifOutHcOctets

System Object ID

**.1.3.6.1.4.1.311.3.2.10**

# Performance Management

Cisco ENV MIB

System Object ID  
.1.3.6.1.4.1.**9**.1.1643

Rules: .1.3.6.1.4.1.**9**  
ciscoEnvTemperature

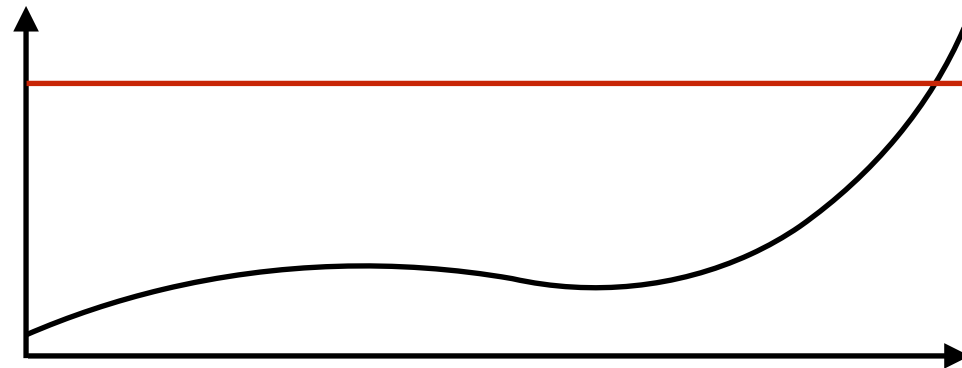
Microsoft MIB

System Object ID  
.1.3.6.1.4.1.**311**.3.2.10

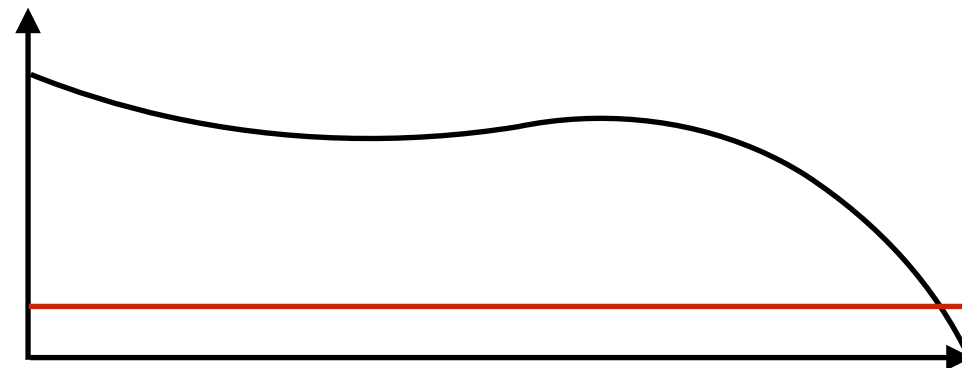
Rules: .1.3.6.1.4.1.**311**  
cpuPercentBusy

# Performance Management

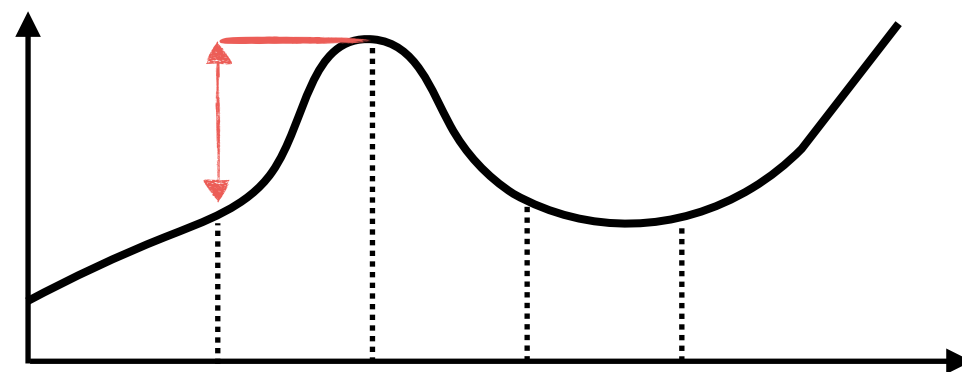
High Threshold



Low Threshold

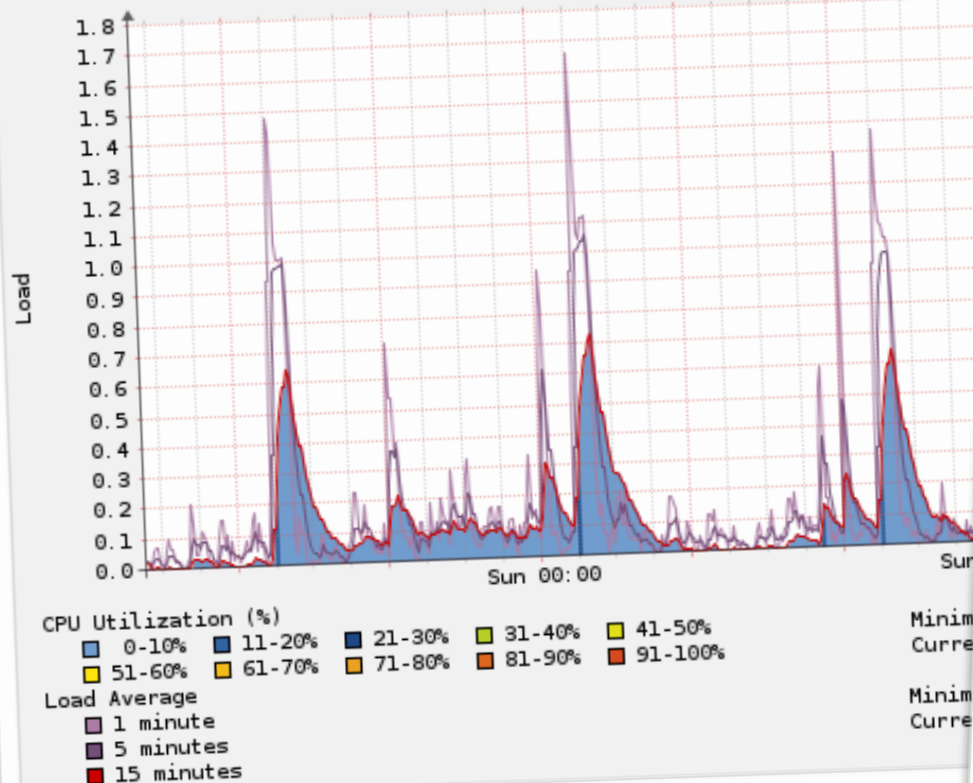


Change Threshold  
relative / absolute

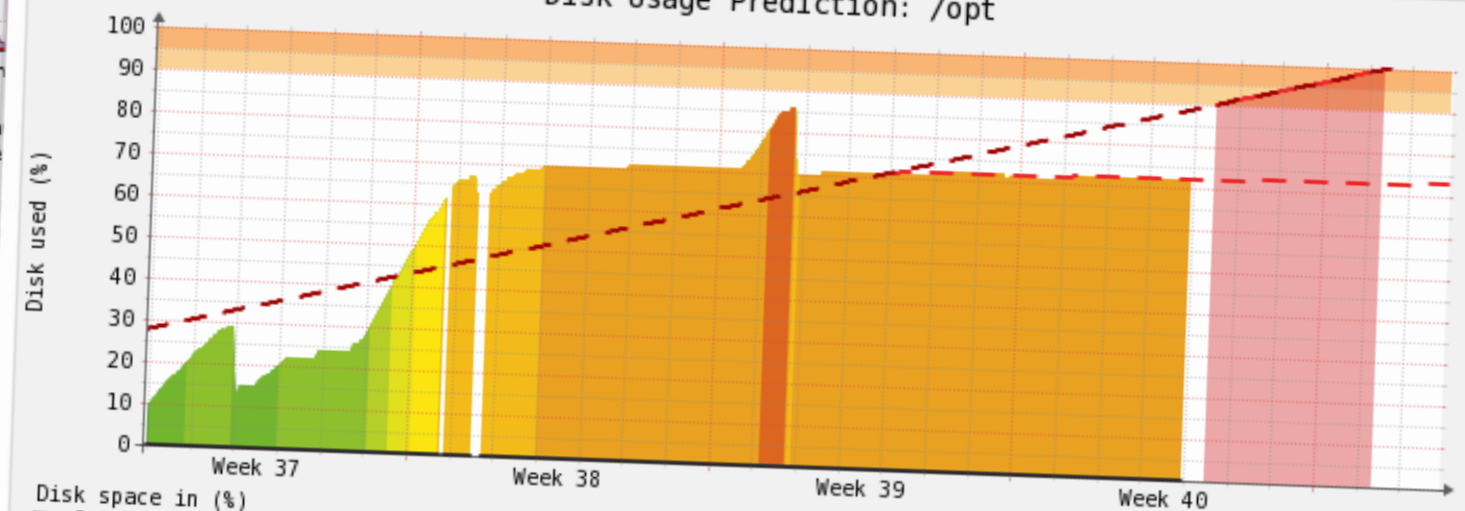


# Performance Management

CPU Statistics



Disk Usage Prediction: /opt



	Last	Minimum	Average	Maximum
Percent	72.00%	9.86%	58.61%	86.00%
Inodes	0.00%	0.00%	0.00%	0.00%

	Used	Free	Total
Last Bytes	3.16T	1.23T	4.40T

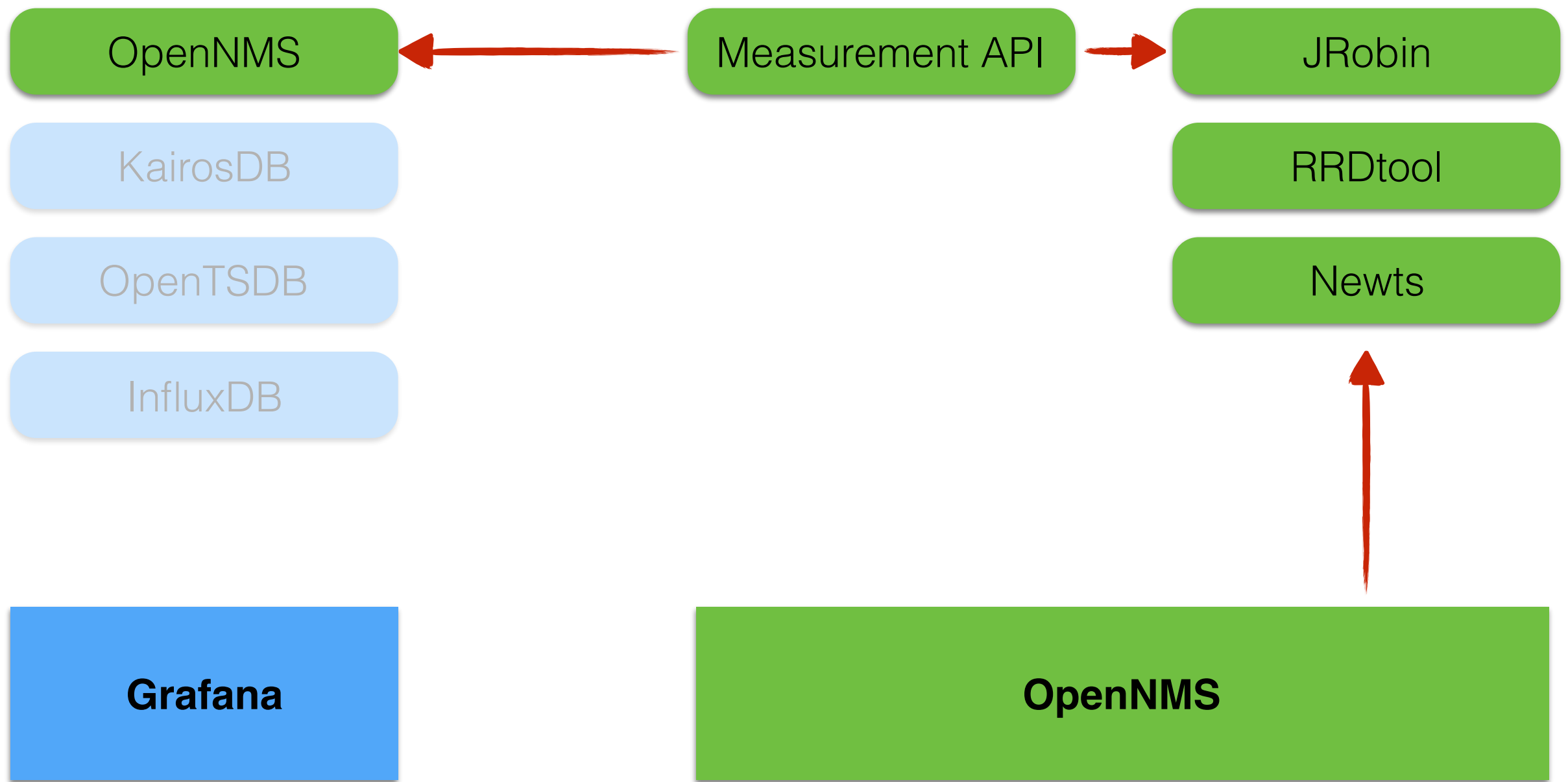
Trend since 1 week  
 Reach 90% at Thu 01 Jan 1970 01:00:00 AM CET  
 Reach 100% at Thu 01 Jan 1970 01:00:00 AM CET

Trend since 1 month  
 Reach 90% at Fri 04 Oct 2013 09:12:00 AM CEST  
 Reach 100% at Tue 08 Oct 2013 06:48:00 AM CEST



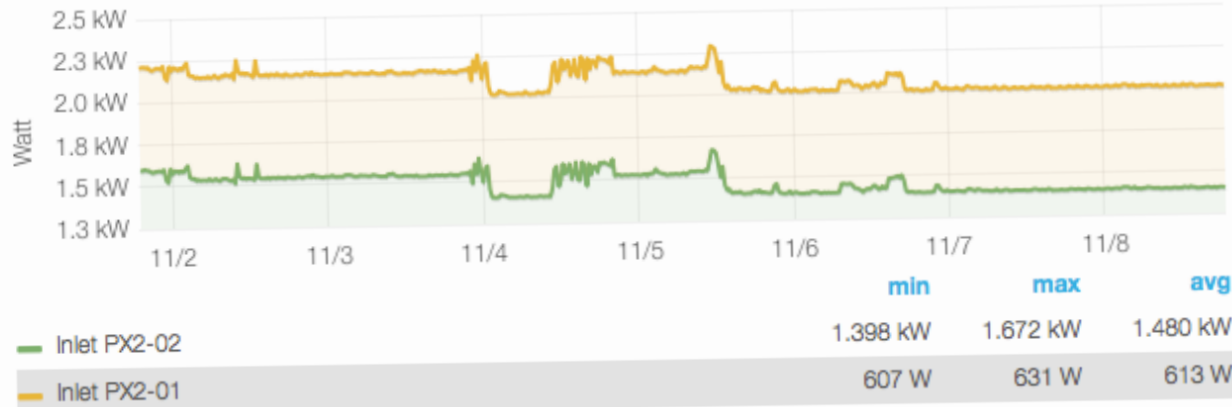


# Performance Management

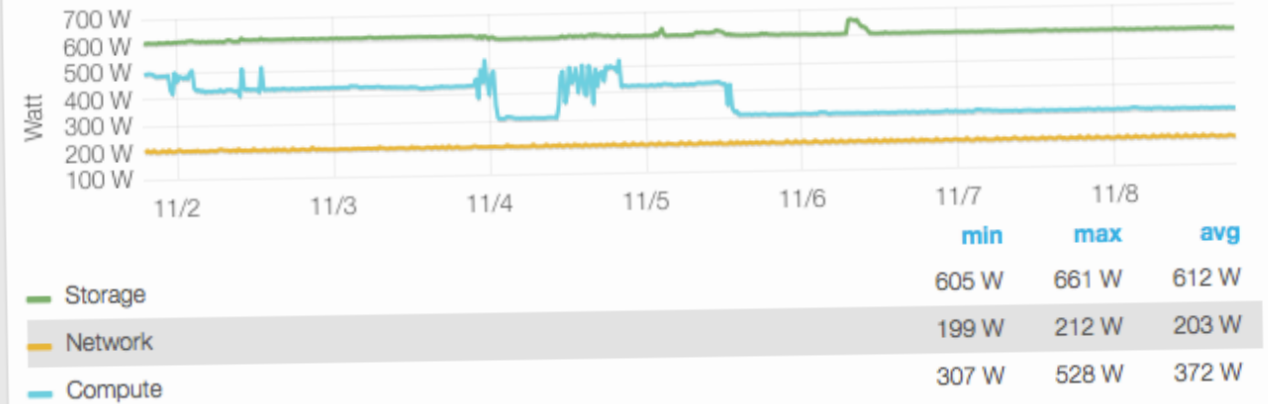




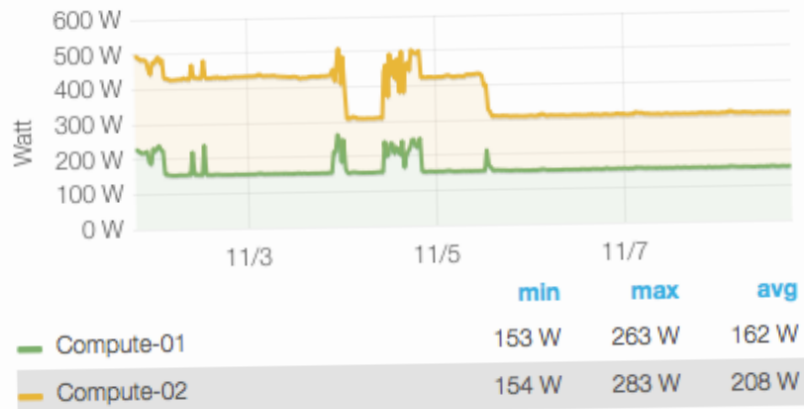
### Total Power Rack Research



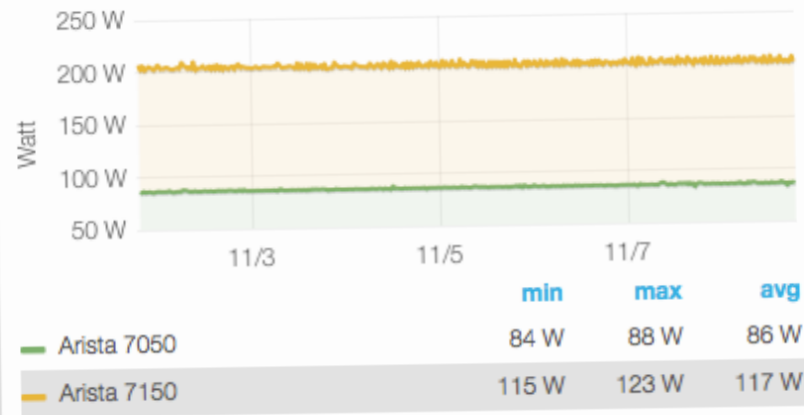
### Power Open Stack



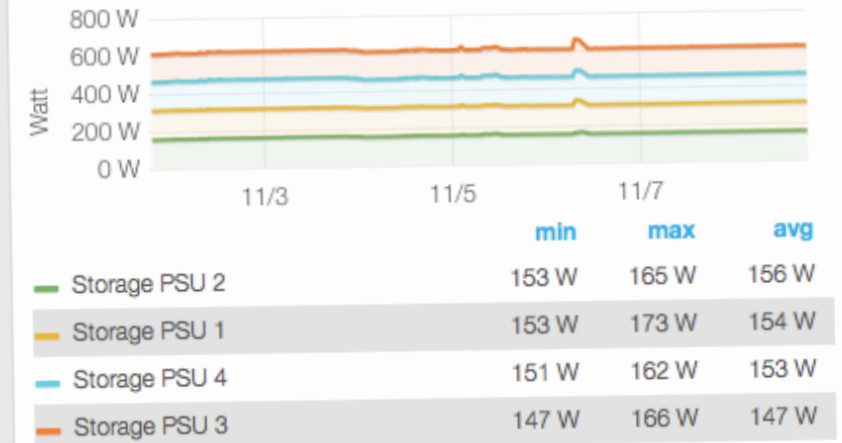
### Power Compute



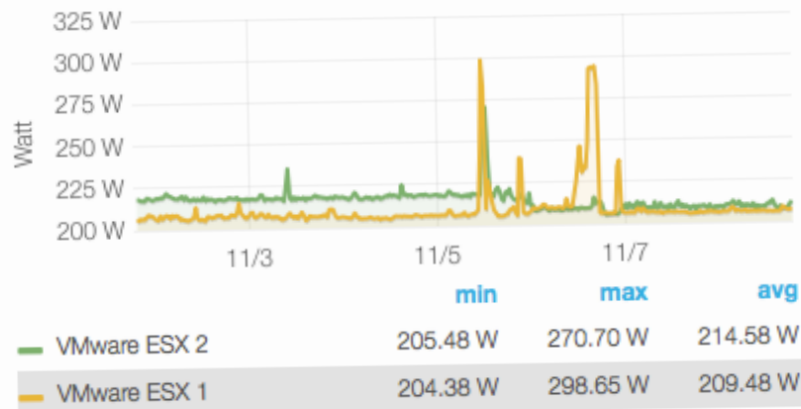
### Power Network



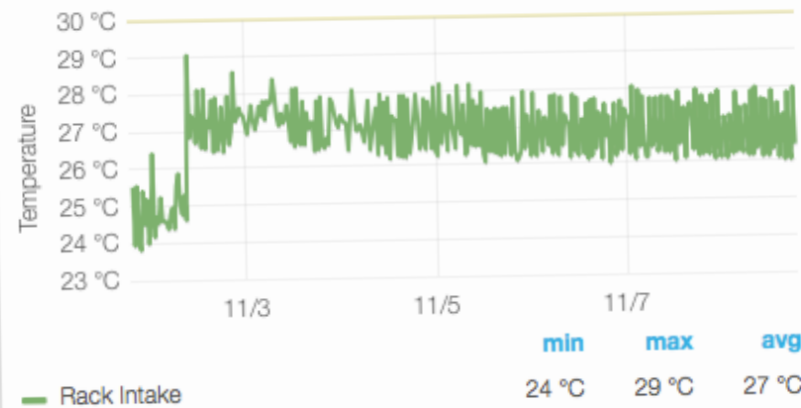
### Power Storage



### Power VMware ESX



### Rack Research Environment



### Rack Research Environment







A Bunch Of **Nodes**



**Discover** nodes in **IP** ranges.

# A Bunch of Nodes

Auto Discovery

Rescan for new devices

Home / Admin / Discovery / Mod

Save and Restart Discovery

## General settings

Initial sleep time (sec.): 30

Restart sleep time (hours): 24

Threads: 15

Retries: 1

Timeout (ms.):  
2000

## Specifics

Add New

IP Address

## Include URLs

Add New

URL

## Include Ranges

Add New

Begin Address

17

## Exclude Ranges

Add New

Begin

http://www.op

http://www.open-factory.org/my\_ip\_discovery.txt

Discovery | Admin | OpenNMS We... 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

172.16.0.10 172.16.0.90 Delete

SNMP Agent

HTTP

SMTP

ICMP Interface

ICMP Interface

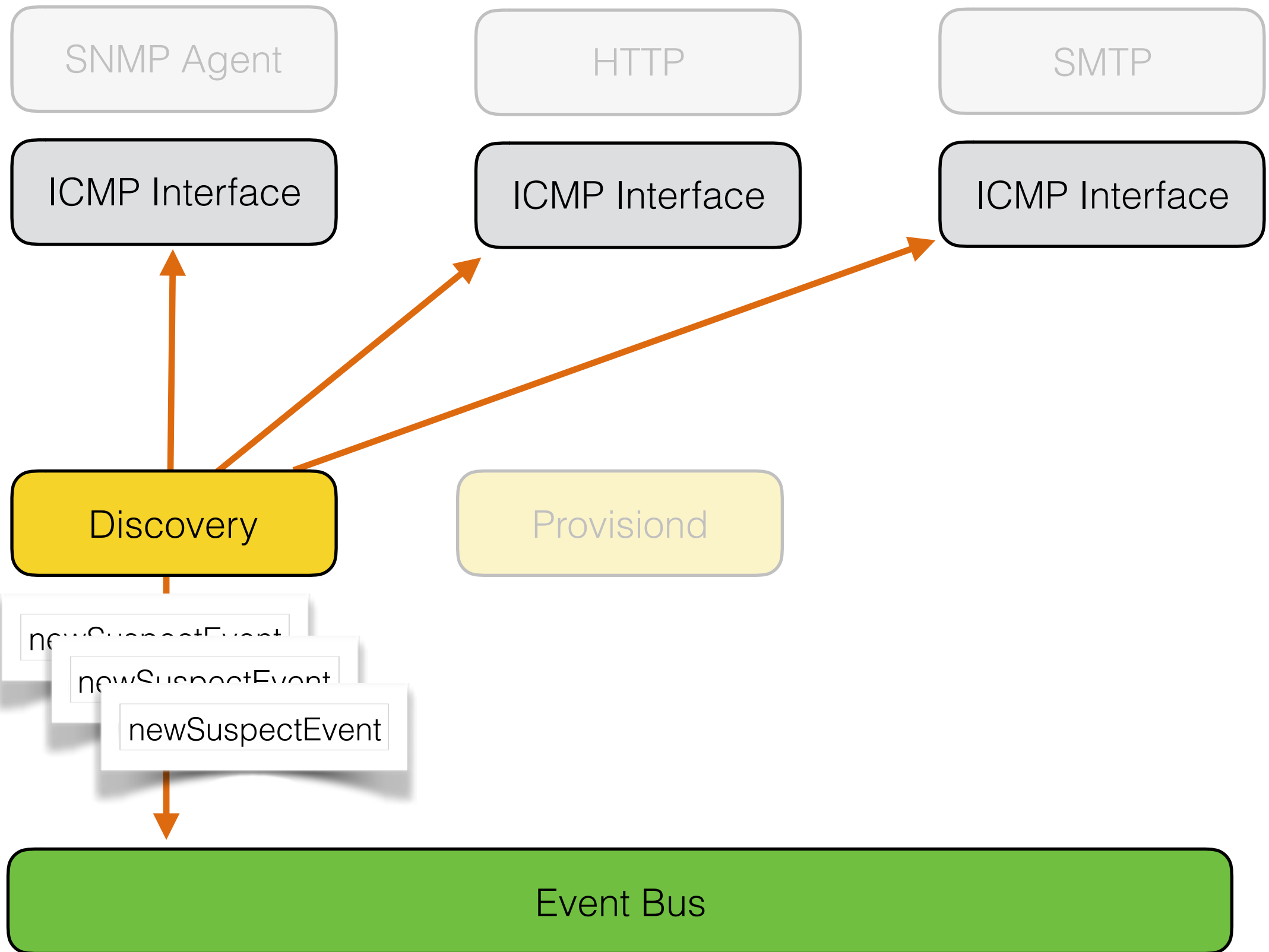
ICMP Interface

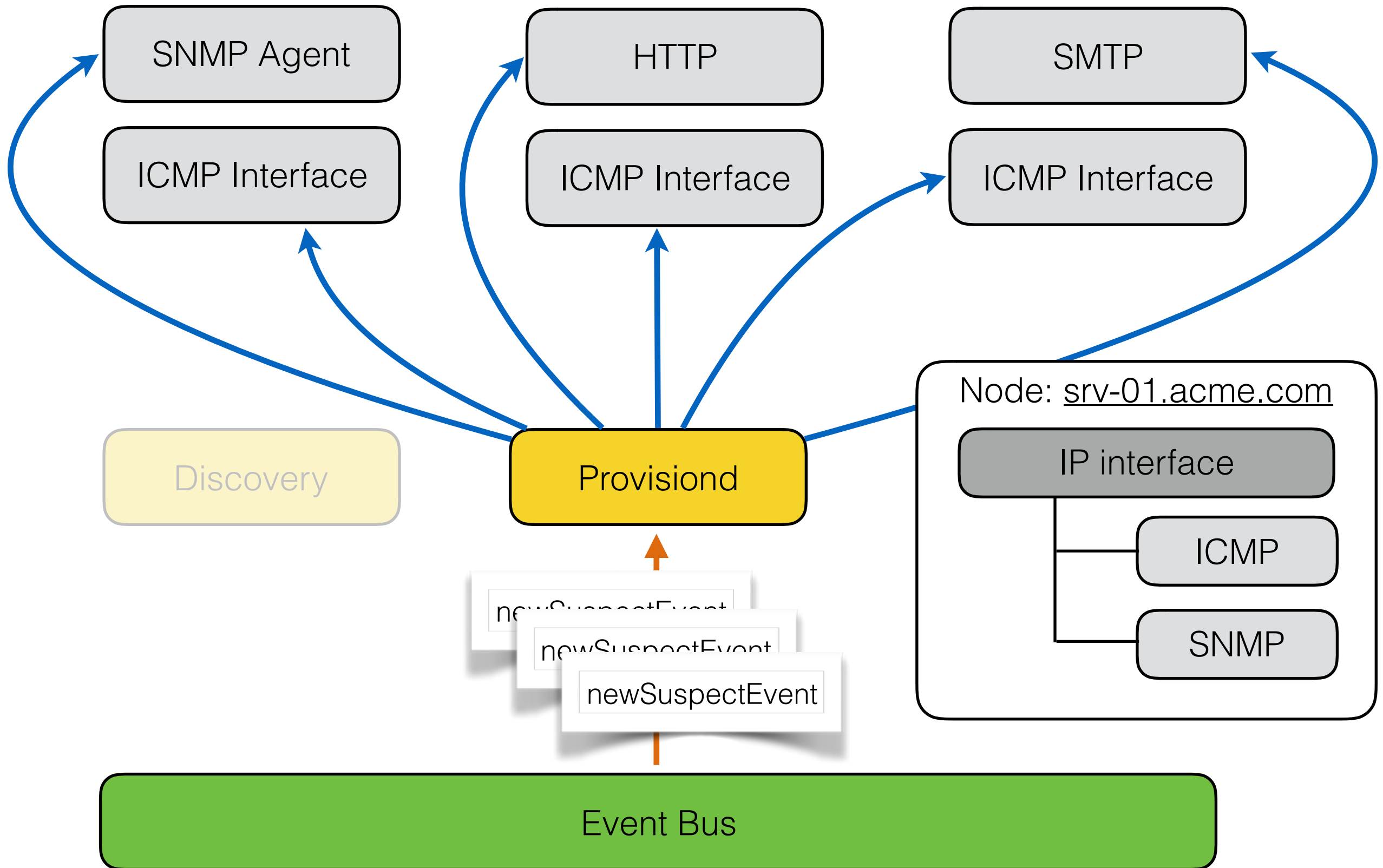
Discovery

Provisiond

Event Bus







**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		100000000
2	Broadcom Corporation NetXtreme BCM5703X Gigabit Ethernet	eth0		1000000000
3	Broadcom Corporation NetXtreme BCM5703X Gigabit Ethernet	eth1		0
4	ham0	ham0		100000000
5	virbr1	virbr1		0

Description

Linux mcDaniel's 0.10.0 (2015-10-09) i686

## Node Interfaces

IP Interfaces

## Node Interfaces

IP Interfaces

Physical Interfaces

IP Address	IP Host Name	IfIndex	Mar
172.20.1.39	mcdaniels.internal.opennms.com	2	M
192.168.100.1	192.168.100.1	5	M
2600:5800:f2a2:0000:0000:0000:0000:0023	mcdaniels.internal.opennms.com	2	M







virbr1

0

Description







Linux mcdaniels 0.10.0  
(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\..*`



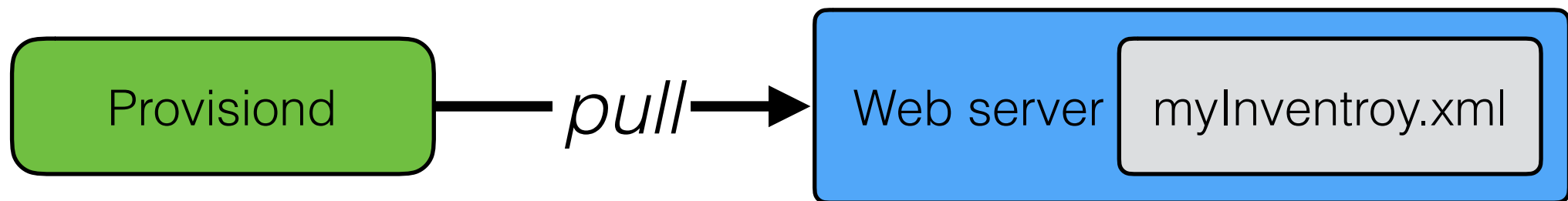
## SNMP data collection policy

-   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.**



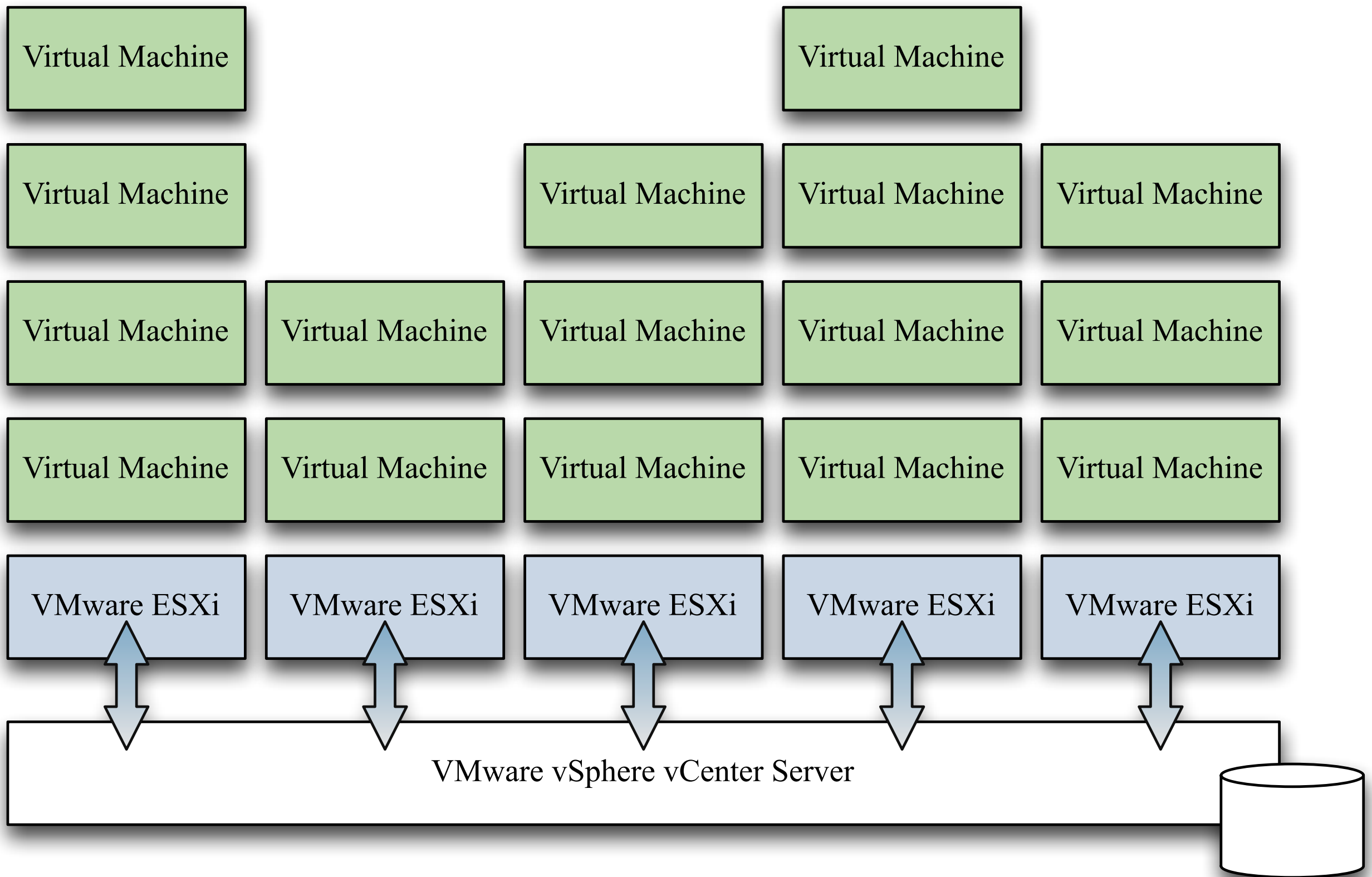
```
1 <requisition-def import-name="my-Inventory" import-url-resource="http://myhost/myInventory.xml">
2   <cron-schedule>0 10 0 * * ? *</cron-schedule>
3 </requisition-def>
4
```

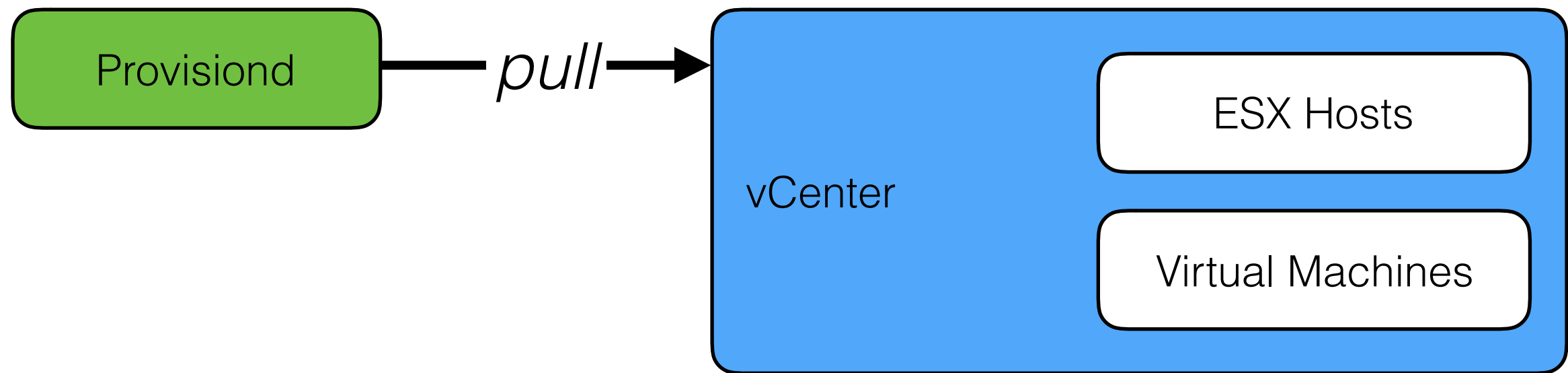
provisiond-configuration.xml

```
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.**



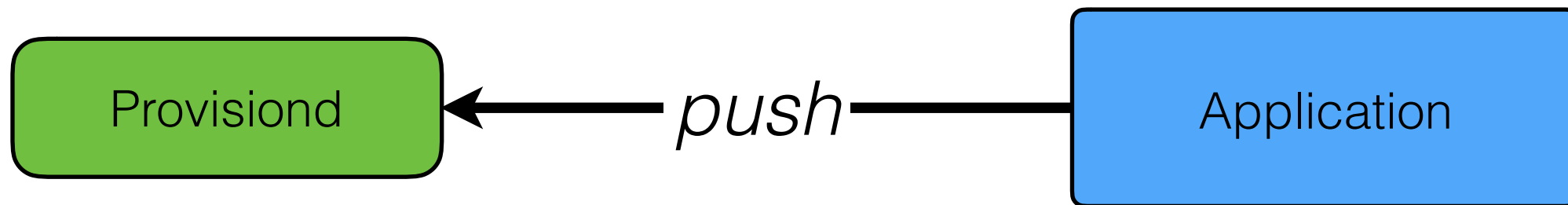




```
1 <requisition-def import-name="my-vCenter-01" import-url-resource="vmware://192.168.10.198">
2   <cron-schedule>0 10 0 * * ? *</cron-schedule>
3 </requisition-def>
4
5 <requisition-def import-name="my-vCenter-02" import-url-resource="vmware://192.168.10.187">
6   <cron-schedule>0 10 0 * * ? *</cron-schedule>
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
<code>/requisitions</code>	Adds (or replaces) a requisition.
<code>/requisitions/{name}/nodes</code>	Adds (or replaces) a node in the specified requisition. This operation can be very helpful when working with <code>[[Large Requisitions]]</code> .
<code>/requisitions/{name}/nodes/{foreignId}/interfaces</code>	Adds (or replaces) an interface for the given node in the specified requisition.
<code>/requisitions/{name}/nodes/{foreignId}/interfaces/{ipAddress}/services</code>	Adds (or replaces) a service on the given interface in the specified requisition.
<code>/requisitions/{name}/nodes/{foreignId}/categories</code>	Adds (or replaces) a category for the given node in the specified requisition.
<code>/requisitions/{name}/nodes/{foreignId}/assets</code>	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](http://docs.opennms.org/opennms/releases/16.0.3/guide-development/guide-development.html#_rest_api)

# Useful resources

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