Monitoring at Scale with Open Source

AusNOG – 7 Sept 2017

Tarus Balog

tarus@opennms.org

History

- OpenNMS was started in the Summer of 1999
- First Code Contributed to Sourceforge on 30 March 2000
- Maintained by Oculan until May, 2002
- Maintained by the OpenNMS Group since September, 2004

OpenNMS is the world's first enterprise-grade network management application platform developed under the open source model.

world's first

• NetSaint	2000-01-10	1323
• OpenNMS	2000-03-30	4141
• Zabbix	2001-03-23	23494
• Nagios	2001-05-03	26589
• RRDTool	2003-01-13	71544
• Groundwork	2006-02-21	160654
• ZenOSS	2006-03-20	163126
• Hyperic	2006-07-17	172556

enterprise-grade

OpenNMS was designed from Day One to monitor tens if not hundreds of thousands of devices. Current work is focused on removing those constraints to allow for millions of devices and billions of metrics.

That scalability comes in a number of forms:

- Discrete devices (hundreds of thousands)
- Performance metrics (millions)
- Events per second (thousands)
- Remote monitors (thousands)

application platform

While OpenNMS works “out of the box”, it really starts to shine when you customize it. It is highly configurable and offers a myriad of ways to integrate with other systems.

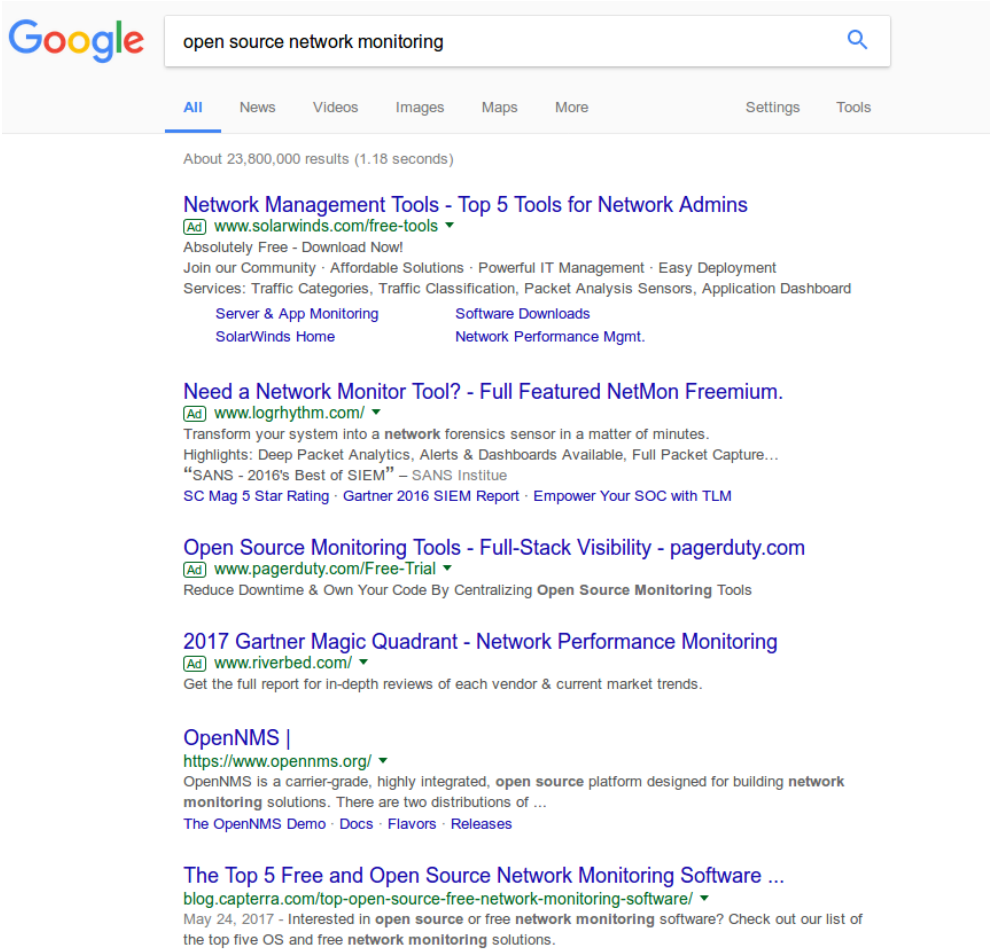
- Full-featured ReST Interface for both configuration and queries, forms the basis for OpenNMS Compass
- Device and event information stored in a database
- Notification system can execute arbitrary commands
- Built-in integration includes
  - RANCID configuration management
  - DNS for provisioning
  - Trouble Ticketing API (RT, Jira, OTRS, Remedy, etc.)

open source

Fully 100% of the OpenNMS source code is available under an Open Source license (as defined by the Open Source Initiative).

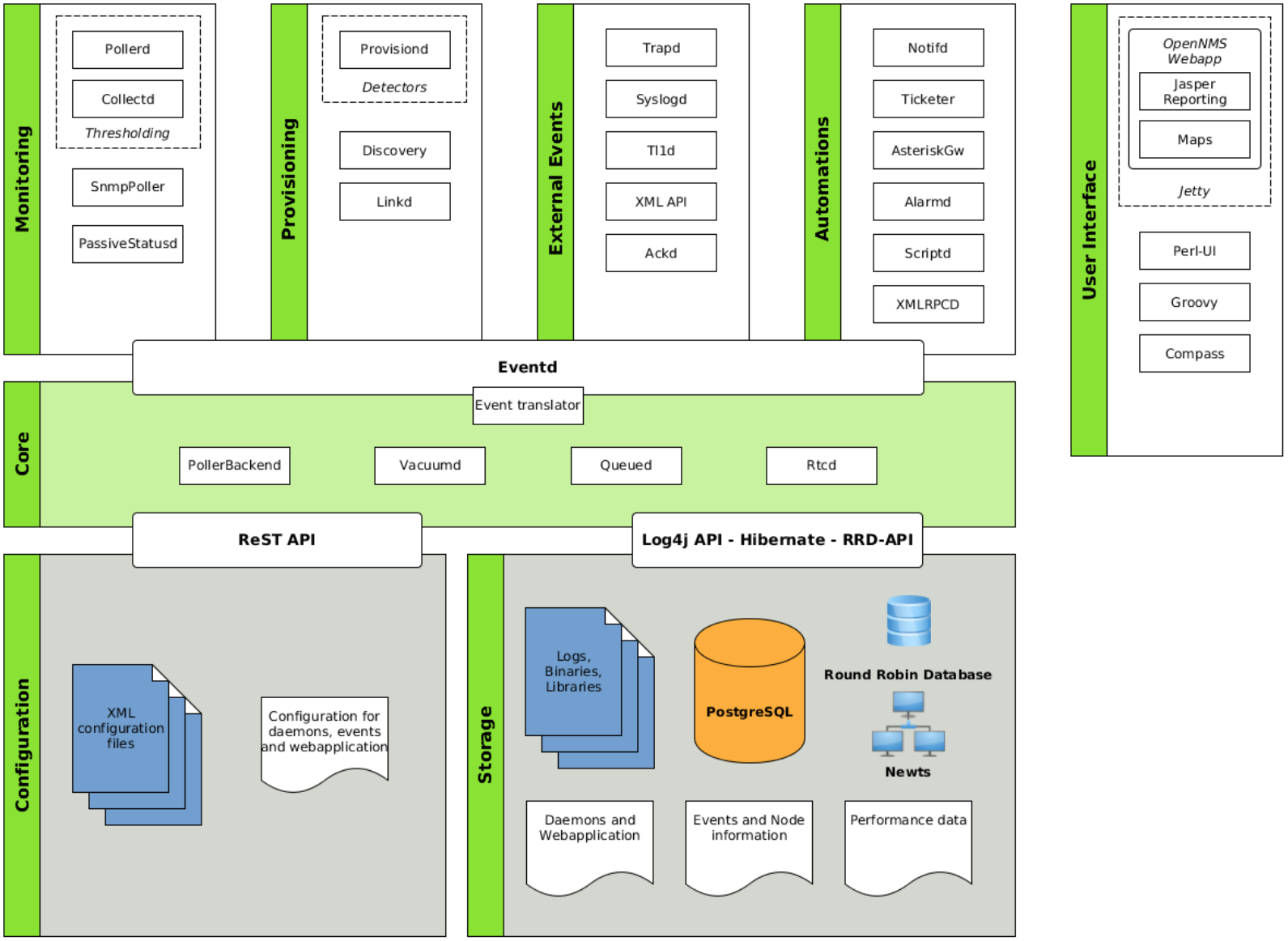
The main application is published under the AGPLv3, with various subsystems such as Newts published under more permissive licenses such as the Apache License.

It's the Community



The Four Main Areas of OpenNMS

- Event and Notification Management: Generate, receive, enhance, reduce and correlate various network alerts and feed them to a robust notification system.
- Provisioning: Both Automated Discovery and Directed Discovery.
- Service Assurance: Is a particular network service reachable and available?
- Performance Data Collection: Gather numeric data from across the network for display, trending and thresholding


Monitoring
Pollerd
Collectd
Thresholding
SnmpPoller
PassiveStatusd
Provisioning
Provisiond
Detectors
Discovery
Linkd
External Events
Trapd
Syslogd
Tl1d
XML API
Ackd
Automations
Notifd
Ticketer
AsteriskGw
Alarmd
Scriptd
XMLRPCD
User Interface
OpenNMS Webapp
Jasper Reporting
Maps
Jetty
Perl-UI
Groovy
Compass
Eventd
Event translator
Core
PollerBackend
Vacuumd
Queued
Rtcd
ReST API
Log4j API - Hibernate - RRD-API
Configuration
XML configuration files
Configuration for daemons, events and webapplication
Storage
Logs, Binaries, Libraries
PostgreSQL
Round Robin Database
Newts
Daemons and Webapplication
Events and Node information
Performance data

Event and Notification Management

- OpenNMS can receive events from various sources: SNMP, syslog, TL/1, custom events
- Events can be enhanced to include external information
- Events can be exported to Elasticsearch
- Events can create notifications
- Events can be turned into alarms
  - Alarms can be reduced to remove duplicates
  - Correlation can be performed via automations or Drools rules
- Alarms can integrated with Trouble Ticketing systems

OpenNMS Events

6991966	**Normal** ⊞⊟	Aug 31, 2017 10:11:37 AM ◀▶	ike.internal.opennms.com	172.20.1.25 ⊞⊟	SNMP ⊞⊟
		uei.opennms.org/nodes/dataCollectionSucceeded ⊞⊟ Edit notifications for event			
		SNMP data collection on interface 172.20.1.25 previously failed and has been restored.			
6991960	**Normal** ⊞⊟	Aug 31, 2017 10:07:10 AM ◀▶	ike.internal.opennms.com		
		uei.opennms.org/nodes/nodeUp ⊞⊟ Edit notifications for event			
		Node ike.internal.opennms.com is up.			
6991953	**Major** ⊞⊟	Aug 31, 2017 9:56:51 AM ◀▶	ike.internal.opennms.com		
		uei.opennms.org/nodes/nodeDown ⊞⊟ Edit notifications for event			
		Node ike.internal.opennms.com is down.			
6991952	**Minor** ⊞⊟	Aug 31, 2017 9:55:54 AM ◀▶	ike.internal.opennms.com	172.20.1.25 ⊞⊟	SNMP ⊞⊟
		uei.opennms.org/nodes/dataCollectionFailed ⊞⊟ Edit notifications for event			
		SNMP data collection on interface 172.20.1.25 failed with 'Timeout retrieving SnmpCollectors for 172.20.1.25 for /172.20.1.25: SnmpCollectors for 172.20.1.25: snmpTimeoutError for: /172.20.1.25'.			

SNMP Traps

Home / Events / Event 6988079

Event 6988079			
Severity	Warning	**Node**	mrtwig.internal.opennms.com
Time	Aug 29, 2017 12:20:53 AM	**Interface**	172.20.1.8
Service			
UEI	uei.opennms.org/IETF/Bridge/traps/topologyChange		

Log Message

Bridge MIB: Topology Change.

Description

A topologyChange trap is sent by a bridge when any of its configured ports transitions from the Learning state to the Forwarding state, or from the Forwarding state to the Blocking state. The trap is not sent if a newRoot trap is sent for the same transition. Implementation of this trap is optional.

Operator Instructions

No instructions available.

Syslog Events

Event 6992380			
Severity	Normal	**Node**	
Time	Aug 31, 2017 12:16:24 PM	**Interface**	127.0.0.1
Service			
UEI	uei.opennms.org/syslogd/authpriv/Notice		

Log Message

An OpenNMS Event has been received as a Syslog Message

Message: pam_unix(su-l:auth): authentication failure; logname=tarus uid=18600004 euid=0 tty=pts/0 ruser=tarus rhost= user=root

Description

The interface 127.0.0.1 generated a Syslog Message.
Node ID: 0
Host: Unknown
Interface: 127.0.0.1
Message: pam_unix(su-l:auth): authentication failure; logname=tarus uid=18600004 euid=0 tty=pts/0 ruser=tarus rhost= user=root
Process: su
PID: 3320

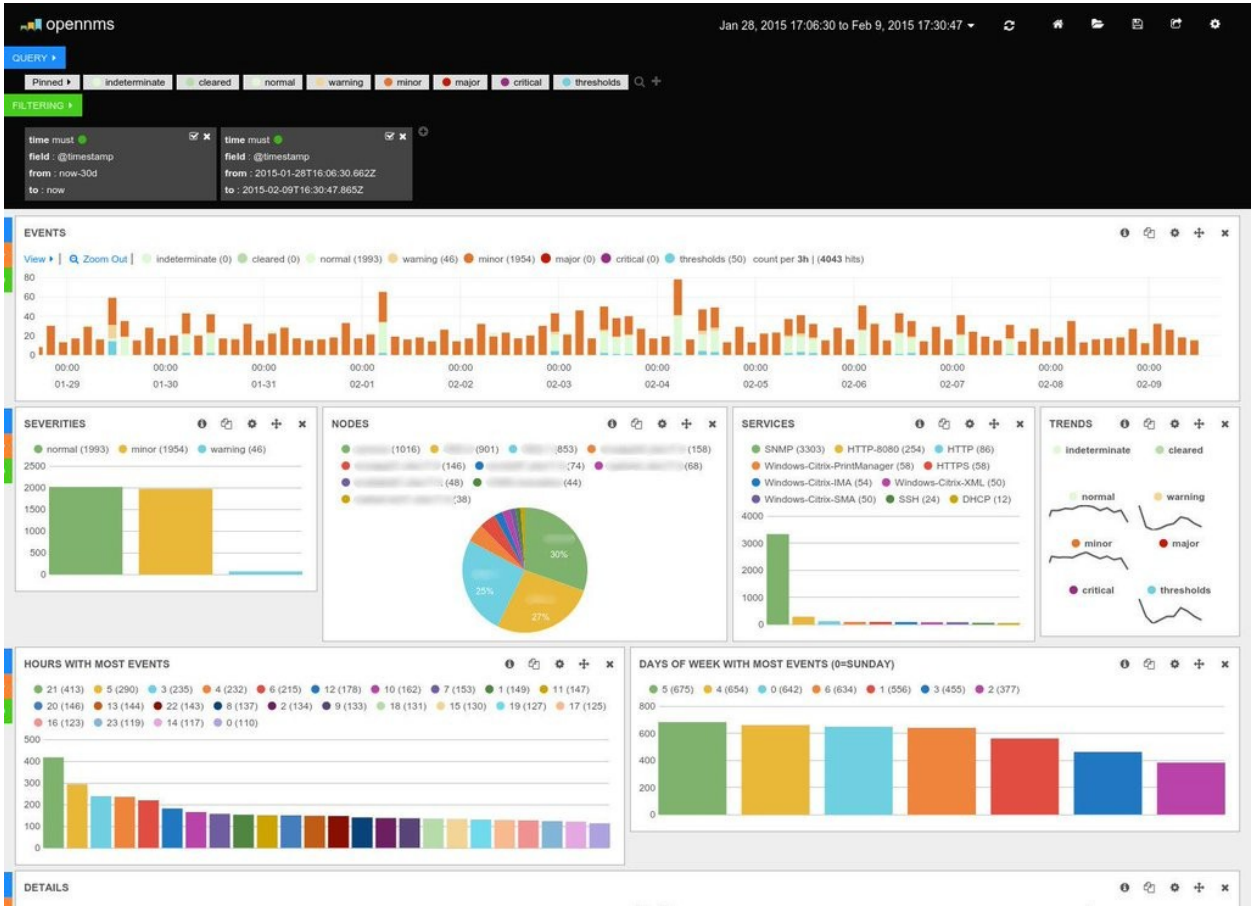
Custom Events

6991339	**Normal** ⊞ ⊟	Aug 31, 2017 1:02:38 AM ◀ ▶	sync.opennms.com
		uei.opennms.org/internal/backup/backupCompleted ⊞ ⊟ Edit notifications for event	
		TOG Event: Backup process completed on sync.opennms.com.	
6991328	**Normal** ⊞ ⊟	Aug 31, 2017 1:00:04 AM ◀ ▶	sync.opennms.com
		uei.opennms.org/internal/backup/backupStarted ⊞ ⊟ Edit notifications for event	
		TOG Event: Backup process started on sync.opennms.com.	

Event Translator

6982188	**Normal** ⊞ ⊟	Aug 24, 2017 3:04:02 PM ◧ ◨	apxncdr01.internal.opennms.com	172.20.1.1 ⊞ ⊟
		uei.opennms.org/translator/traps/SNMP_Link_Up ⊞ ⊟ Edit notifications for event		
		Agent Interface Up (linkUp Trap) on interface index:517; ifDescr:ge-0/0/2; ifName:ge-0/0/2; IfAlias:VPN01		
6982187	**Minor** ⊞ ⊟	Aug 24, 2017 3:03:56 PM ◧ ◨	apxncdr01.internal.opennms.com	172.20.1.1 ⊞ ⊟
		uei.opennms.org/translator/traps/SNMP_Link_Down ⊞ ⊟ Edit notifications for event		
		Agent Interface Down (linkDown Trap) on interface index:517; ifDescr: ge-0/0/2; ifName:ge-0/0/2; ifAlias:VPN01		

Elasticsearch



Notifications

- Events can create notifications, a “poor man’s trouble ticket”
- A number of actions can be performed, such as:
  - Send an e-mail
  - Send an SMS
  - Contact via PagerDuty
- Notifications can be escalated
- Any command that can be run from the OpenNMS server can be used in notifications.

Alarms

- Events are like logs, alarms are used for workflow
- Alarms can reduce multiple similar events into one alarm
- Automations can act on alarms to escalate or clear them
- Complex business rules implemented using Drools
- Alarms can have “sticky” and “journal” notes
- There is an API to interface with common Trouble Ticketing software such as Remedy, RT, OTRS and Jira.

Event Reduction

Ack	ID	Severity	Node	Interface	Service	Count	Last Event Time	First Event Time
☐	11283	Warning [+] [-]	PDU-G01L [+] [-]	10.123.7.18 [+] [-]		9720	12/17/06 6:29:55 AM [<] [>]	10/20/06 1:33:36 AM [<] [>]
		Ackd:	Ackd Time:			UEI: uei.opennms.org/generic/traps/SNMP_Authen_Failure [+] [-]		
		Incorrect Community Name (authenticationFailure Trap) enterprise:.1.3.6.1.4.1.318 (.1.3.6.1.4.1.318) args(1):.1.3.6.1.4.1.318.2.3.3.0=""						
☐	4762	Minor [+] [-]	tasrvad01.bos3 [+] [-]	10.24.1.10 [+] [-]	SNMP [+] [-]	2866	12/17/06 11:21:23 AM [<] [>]	9/5/06 6:26:23 PM [<] [>]
		Ackd:	Ackd Time:			UEI: uei.opennms.org/nodes/dataCollectionFailed [+] [-]		
		SNMP data collection on interface 10.24.1.10 failed.						
☐	5379	Normal [+] [-]	tasrvad01.bos3 [+] [-]	10.24.1.10 [+] [-]	SNMP [+] [-]	2852	12/17/06 11:11:17 AM [<] [>]	9/6/06 5:54:57 PM [<] [>]
		Ackd:	Ackd Time:			UEI: uei.opennms.org/nodes/dataCollectionSucceeded [+] [-]		
		SNMP data collection on interface 10.24.1.10 prevously failed and has been restored.						
☐	4744	Minor [+] [-]	tasrvsr01c02.bos3 [+] [-]	10.24.1.14 [+] [-]	SNMP [+] [-]	1441	12/15/06 11:28:08 PM [<] [>]	9/5/06 6:26:18 PM [<] [>]
		Ackd:	Ackd Time:			UEI: uei.opennms.org/nodes/dataCollectionFailed [+] [-]		
		SNMP data collection on interface 10.24.1.14 failed.						
☐	4825	Normal [+] [-]	tasrvsr01c02.bos3 [+] [-]	10.24.1.14 [+] [-]	SNMP [+] [-]	1429	12/15/06 11:43:18 PM [<] [>]	9/5/06 6:36:39 PM [<] [>]
		Ackd:	Ackd Time:			UEI: uei.opennms.org/nodes/dataCollectionSucceeded [+] [-]		
		SNMP data collection on interface 10.24.1.14 prevously failed and has been restored.						

Automation Example

Ack	▼ ID Severity	Node	Count	Last Event Time	Log Msg
☐	3	localhost ⊞ ⊟	1	Dec 5, 2016 3:42:31 AM ◀ ▶	HTTP outage identified on interface 127.0.0.1 with reason code: HTTP connection exception on port: 80: Connection refused/Ports: 80.

Resolve the Alarm

Ack	▼ ID Severity	Node	Count	Last Event Time	Log Msg
☐	4	localhost ⊞⊟	1	Dec 5, 2016 3:43:31 AM ◧◨	The HTTP outage on interface 127.0.0.1 has been cleared. Service is restored.
☐	3	localhost ⊞⊟	1	Dec 5, 2016 3:42:31 AM ◧◨	HTTP outage identified on interface 127.0.0.1 with reason code: HTTP connection exception on port: 80: Connection refused/Ports: 80.

Ack	▼ ID Severity	Node	Count	Last Event Time	Log Msg
☐	4	localhost ⊞⊟	1	Dec 5, 2016 3:43:31 AM ◧◨	The HTTP outage on interface 127.0.0.1 has been cleared. Service is restored.
☐	3	localhost ⊞⊟	1	Dec 5, 2016 3:42:31 AM ◧◨	HTTP outage identified on interface 127.0.0.1 with reason code: HTTP connection exception on port: 80: Connection refused/Ports: 80.

Drools

Alarm 764000			
Severity	Minor	**Node**	[redacted]
Last Event	Aug 31, 2017 10:11:19 AM	**Interface**	
First Event	Aug 31, 2017 10:11:19 AM	**Service**	
Count	1	**UEI**	uei[redacted]/vendor/OpenNMS/Applications/[redacted]
Ticket ID	12792866	**Ticket State**	OPEN
Reduction Key	uei[redacted]/vendor/OpenNMS/Applications/[redacted] - Too many error when calling [redacted]:High:Moderate/Limited		

Log Message

Beacon Alarm: [redacted] - Too many error when calling [redacted] 10 more failures per hour happened when [redacted] occurred on host [redacted] alarmName=[redacted] - Too many error when calling [redacted] Open=[redacted] _urgency=High _impact=Moderate/Limited _ci=[redacted] _service=[redacted] requisitionName=[redacted] Operations=2017-08-31 10:11:20 EDT :: Re-parented event to node 49150 based on hostname [redacted]

2017-08-31 10:11:20 EDT :: No scheduled outages, releasing event. 2017-08-31 10:11:20 EDT :: application_enrich:BeaconAlarm :: Enriched description and set log message. node_name=[redacted] reductionKey=uei.[redacted]/vendor/OpenNMS/Applications/[redacted] - Too many error when calling [redacted]:High:Moderate/Limited applicationRefined=true msg=Beacon Alarm: [redacted] - Too many error when calling [redacted] 10 more failures per hour happened when [redacted] calling [redacted]. Possible cause: 1. [redacted] issue(service down) 2. Unexpected error(LDAP issue, timeout) May check [redacted] consult [redacted] team which now called [redacted])

Description

Beacon Alarm: [redacted] - Too many error when calling [redacted] 10 more failures per hour happened when [redacted] calling [redacted]. Possible cause: 1. [redacted] issue(service down) 2. Unexpected error(LDAP issue, timeout) May check [redacted] (consult [redacted] team which now called [redacted].
Event Parameters:

```
          alarmName: [redacted] - Too many error when calling GuidMapper
               Open: [redacted]
         _urgency: High
          _impact: Moderate/Limited
              _ci: [redacted]
         _service: [redacted]
   requisitionName: [redacted]
        Operations: 2017-08-31 10:11:20 EDT :: Re-parented event to node 49150 based on hostname [redacted]
                    2017-08-31 10:11:20 EDT :: No scheduled outages, releasing event. 2017-08-31 10:11:20 EDT :: application_enrich:BeaconAlarm :: Enriched description and set log message.
         node_name: [redacted]
     reductionKey: uei.[redacted]/vendor/OpenNMS/Applications/[redacted] - Too many error when calling [redacted]:High:Moderate/Limited
applicationRefined: true
               msg: Beacon Alarm: [redacted] - Too many error when calling [redacted] 10 more failures per hour happened when [redacted] calling [redacted]. Possible cause: 1. [redacted] issue( service down) 2. Unexpected error( LDAP issue, timeout) May check
                    [redacted] ( consult [redacted] team which now called [redacted])
```

Sticky Memo

2017-08-31 10:11:21 EDT :: Creating [redacted] ticket
opened [redacted] ticket 12792866 for this event.

Save Delete

Author: Drools
Updated: Aug 31, 2017 10:11:30 AM
Created: Aug 31, 2017 10:11:21 AM

Journal Memo

Save Delete

Alarm “sticky” and “journal” Notes

Alarm 615990			
Severity	Minor	**Node**	nms01
Last Event	Aug 31, 2017 2:05:11 PM	**Interface**	172.20.1.11
First Event	Aug 31, 2017 2:05:11 PM	**Service**	HTTP
Count	1	**UEI**	uei.opennms.org/nodes/nodeLostService
Ticket ID	5225	**Ticket State**	OPEN
Reduction Key	uei.opennms.org/nodes/nodeLostService::243:172.20.1.11:HTTP		

Log Message

HTTP outage identified on interface 172.20.1.11 with reason code: HTTP connection exception on port: 80: Connection refused/Ports: 80.

Description

A HTTP outage was identified on interface 172.20.1.11.

A new Outage record has been created and service level availability calculations will be impacted until this outage is resolved.

Sticky Memo

Opened a ticket and acknowledge this alarm

Save Delete

Author:	Updated:	Created:
tarus	Aug 31, 2017 2:06:11 PM	Aug 31, 2017 2:06:11 PM

Journal Memo

When this happens, open a ticket with the Web Operations team.

Save Delete

Author:	Updated:	Created:
tarus	Aug 31, 2017 2:07:30 PM	Aug 31, 2017 2:06:12 PM

Trouble Ticket Integration

Alarm 615990			
Severity	Minor	**Node**	nms01
Last Event	Aug 31, 2017 2:05:11 PM	**Interface**	172.20.1.11
First Event	Aug 31, 2017 2:05:11 PM	**Service**	HTTP
Count	1	**UEI**	uei.opennms.org/nodes/nodeLostService
Ticket ID		**Ticket State**	CREATE_PENDING
Reduction Key	uei.opennms.org/nodes/nodeLostService::243:172.20.1.11:HTTP		

Log Message

HTTP outage identified on interface 172.20.1.11 with reason code: HTTP connection exception on port: 80: Connection refused/Ports: 80.

Description

A HTTP outage was identified on interface 172.20.1.11.

A new Outage record has been created and service level availability calculations will be impacted until this outage is resolved.

Trouble Ticket Integration

Alarm 615990			
Severity	Minor	**Node**	nms01
Last Event	Aug 31, 2017 2:05:11 PM	**Interface**	172.20.1.11
First Event	Aug 31, 2017 2:05:11 PM	**Service**	HTTP
Count	1	**UEI**	uei.opennms.org/nodes/nodeLostService
Ticket ID	5225	**Ticket State**	OPEN
Reduction Key	uei.opennms.org/nodes/nodeLostService::243:172.20.1.11:HTTP		

Log Message

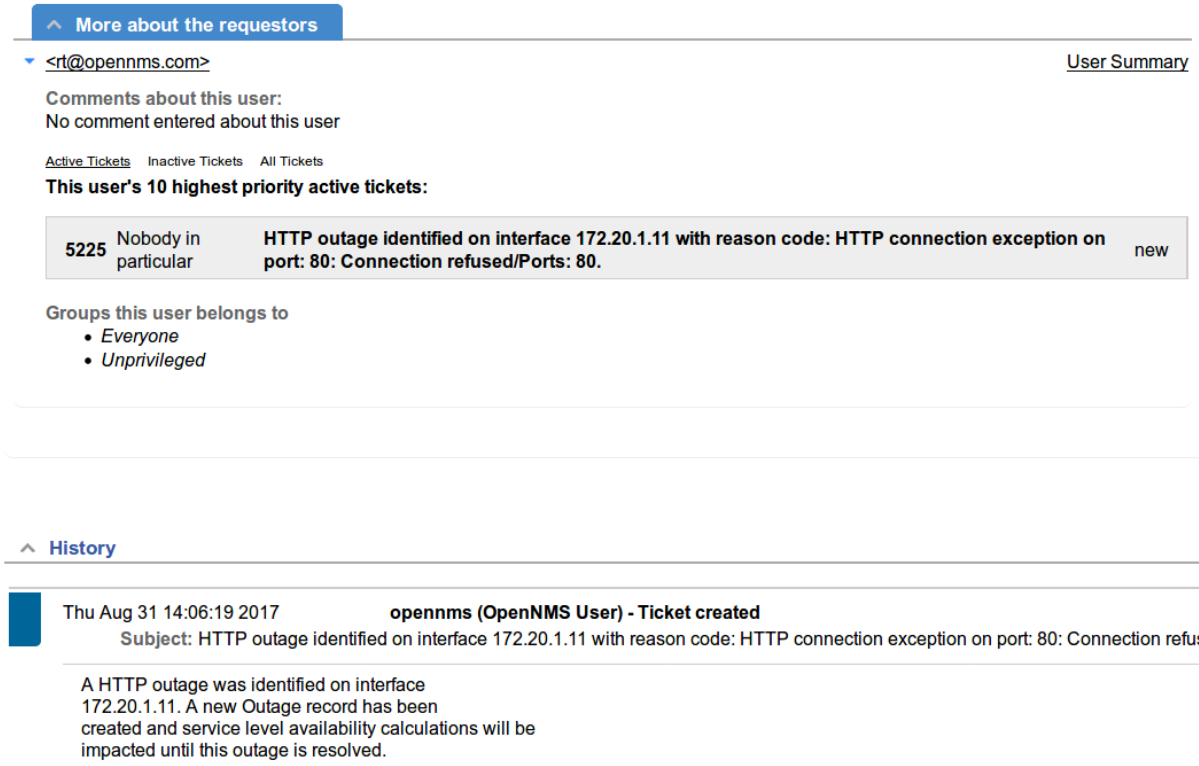
HTTP outage identified on interface 172.20.1.11 with reason code: HTTP connection exception on port: 80: Connection refused/Ports: 80.

Description

A HTTP outage was identified on interface 172.20.1.11.

A new Outage record has been created and service level availability calculations will be impacted until this outage is resolved.

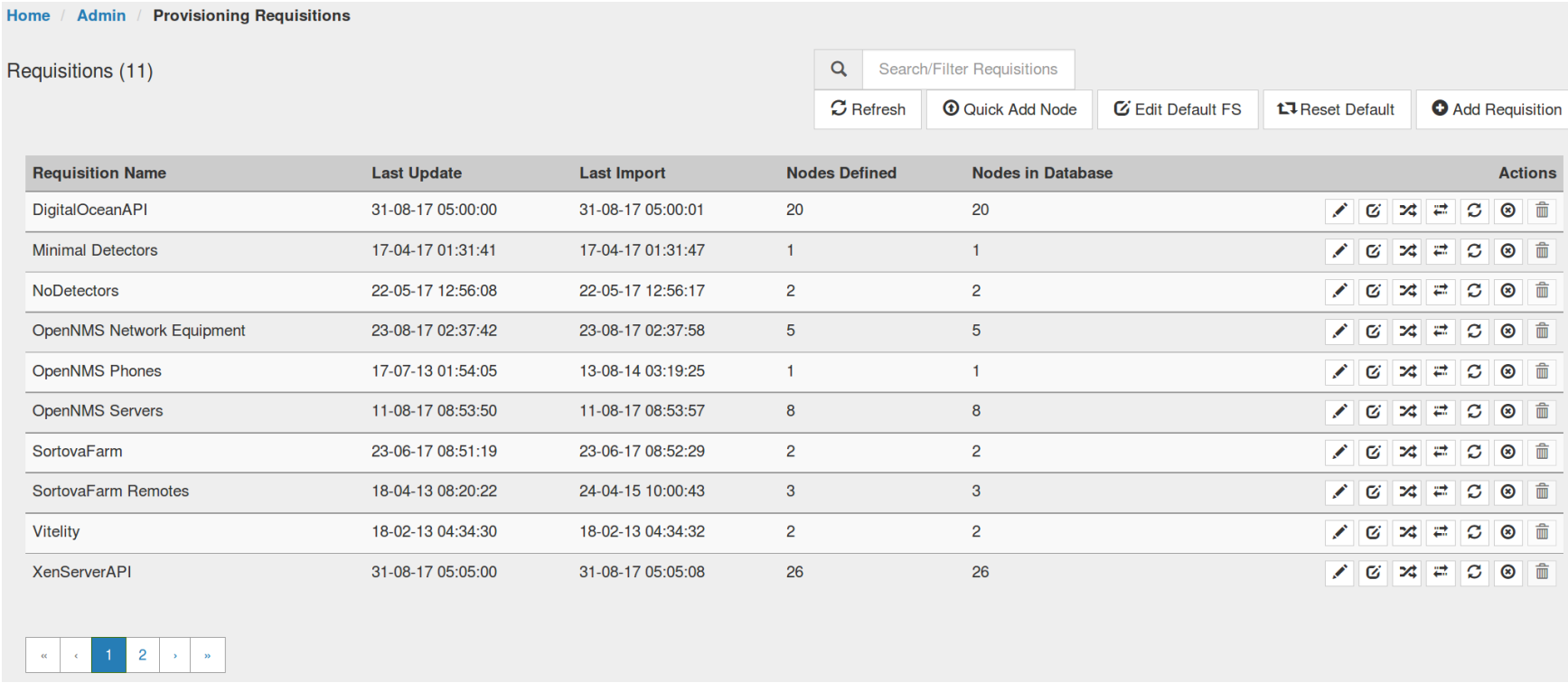
Trouble Ticket Integration



Provisioning

- OpenNMS can automatically scan your network for devices
- For large networks, this can be impractical
- The provisioning system provides several ways to add devices:
  - WebUI
  - XML file import
  - ReST API
- Multi-threaded discovery processes handles large devices

Requisitions



Requisitions – Node List

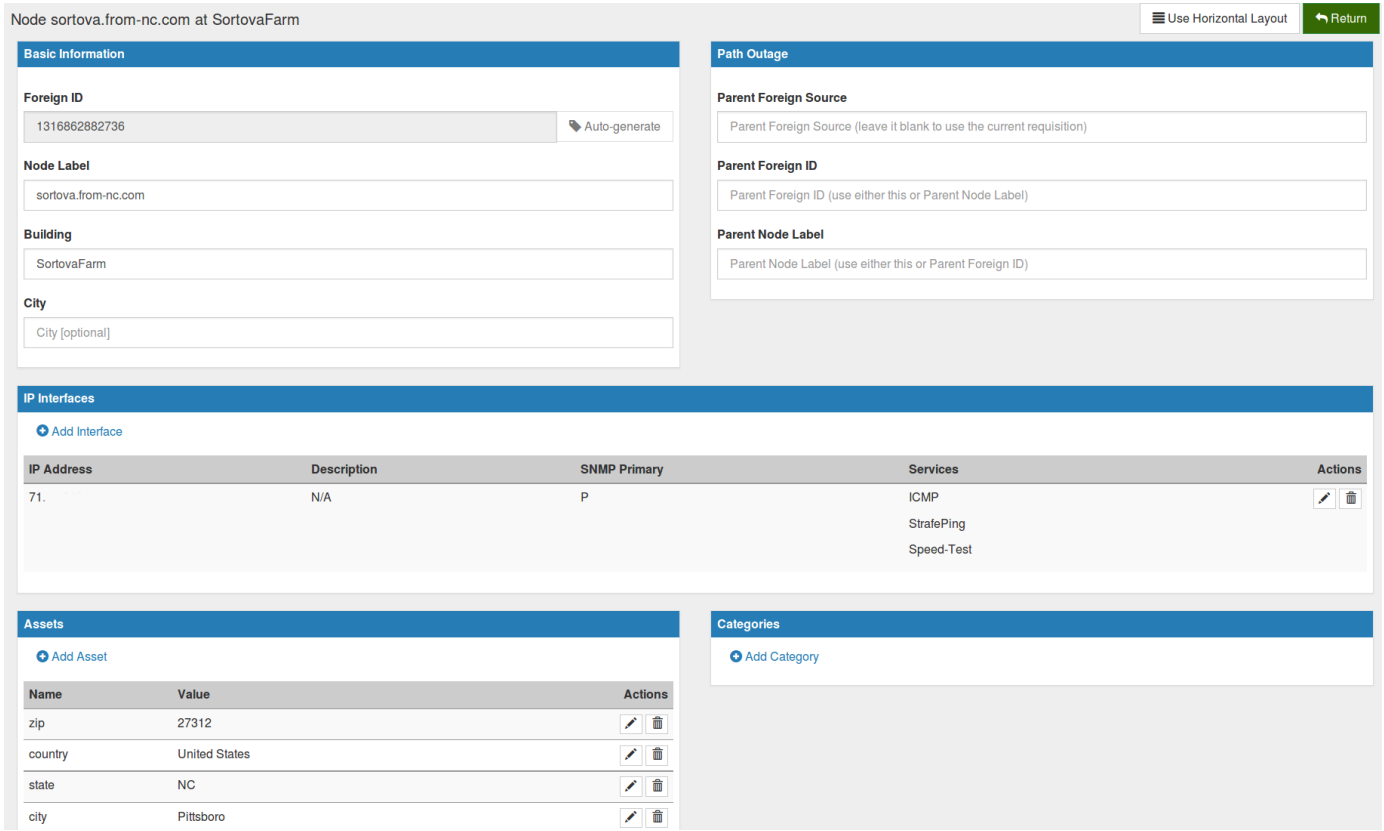
Requisition SortovaFarm (2 defined, 2 deployed)

Search/Filter Nodes

Refresh | Edit Definition | Synchronize | Add Node | Return

Node Label	Foreign ID	Building	City	IP Addresses	# Assets	# Categories	Has Parent	Actions
rabalog.dyndns.org	1316862940820	SortovaFarm	N/A	174. (P)	5	0	No	
sortova.from-nc.com	1316862882736	SortovaFarm	N/A	71. (P)	5	0	No	

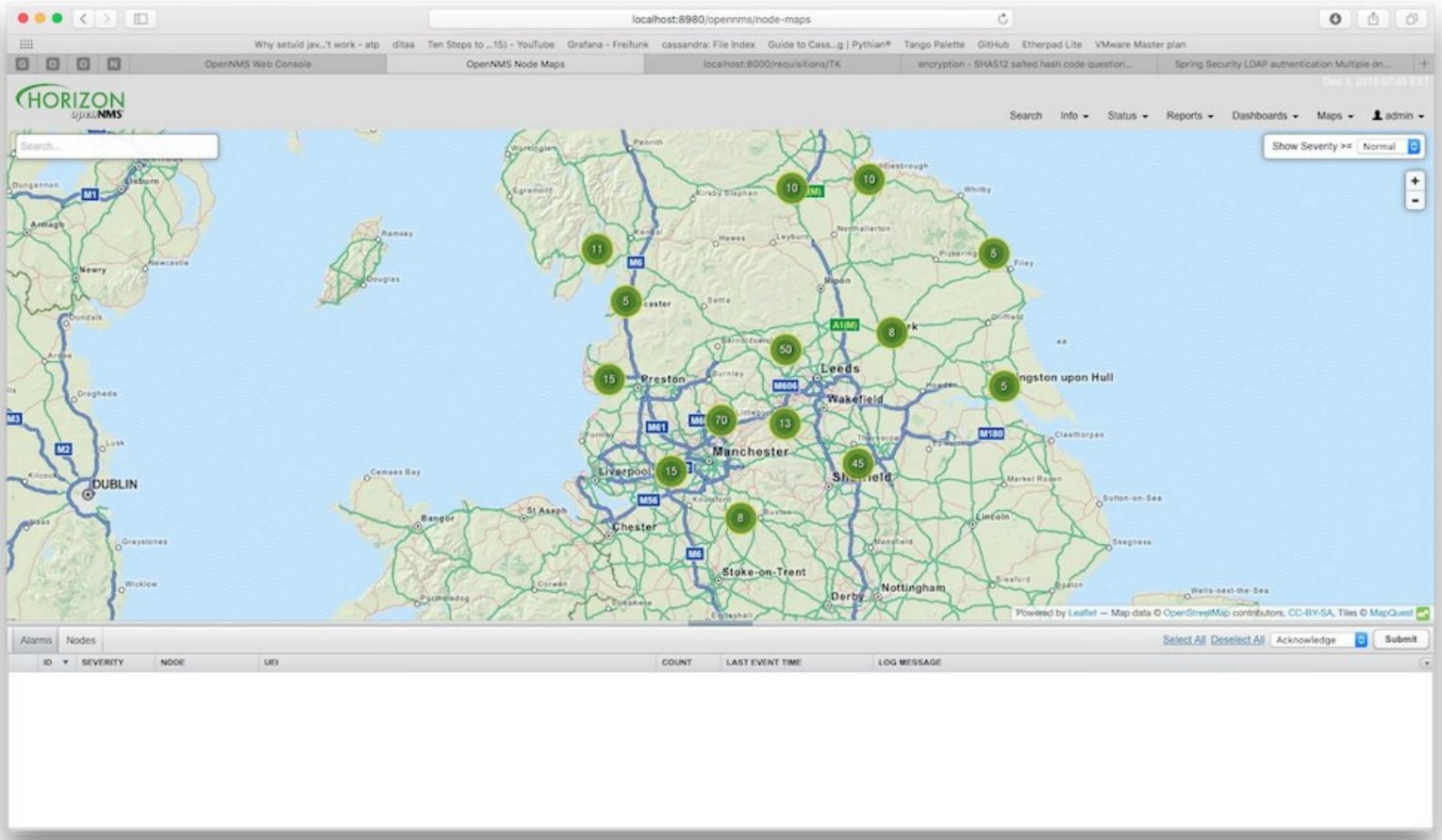
Requisitions – Specific Node



Requisitions – XML

```
<model-import xmlns="http://xmlns.opennms.org/xsd/config/model-import" date-stamp="2017-06-23T08:5
1:19.772-04:00" foreign-source="SortovaFarm" last-import="2017-06-23T08:52:29.773-04:00">
   <node building="SortovaFarm" foreign-id="1316862940820" node-label="rabalog.dyndns.org">
      <interface descr="eth0" ip-addr="174.x.x.x" status="1" snmp-primary="P">
         <monitored-service service-name="ICMP"/>
      </interface>
      <asset name="zip" value="27205"/>
      <asset name="country" value="United States"/>
      <asset name="state" value="NC"/>
      <asset name="city" value="Asheboro"/>
      <asset name="address1" value="1655 Main Street"/>
   </node>
   <node building="SortovaFarm" foreign-id="1316862882736" node-label="sortova.from-nc.com">
      <interface descr="" ip-addr="71.x.x.x" status="1" snmp-primary="P">
         <monitored-service service-name="ICMP"/>
         <monitored-service service-name="StrafePing"/>
         <monitored-service service-name="Speed-Test"/>
      </interface>
      <asset name="zip" value="27312"/>
      <asset name="country" value="United States"/>
      <asset name="state" value="NC"/>
      <asset name="city" value="Pittsboro"/>
      <asset name="address1" value="115 First Avenue"/>
   </node>
</model-import>
```

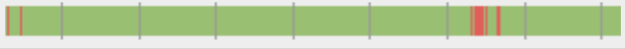
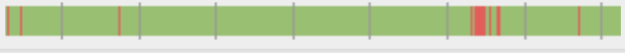
Geographical Map



Service Assurance

- OpenNMS performs synthetic transactions to test the availability of services
- Built-in monitors range in complexity from the ICMP and TCP monitors up to the Page Sequence and Selenium Monitors
- There is a unique “downtime model” to manage transient errors
- Services that can’t be actively polled can be monitored via the Passive Status Keeper
- The Remote Poller tests services from the point of view of remote locations
- You can create service hierarchies to mange business services

Monitored Services

Availability		
Availability (last 24 hours)		97.535%
172.20.1.25	17:00 20:00 23:00 02:00 05:00 08:00 11:00 14:0(	97.535%
HTTP		97.224%
HTTP-Drinks		Not Monitored
ICMP		98.032%
SNMP		97.775%
SSH		97.827%
StrafePing		Not Monitored
Update		96.816%

Downtime Model

The OpenNMS downtime model is unique:

```
<downtime interval="30000" begin="0" end="300000" />
                           <!-- 30s, 0, 5m -->
<downtime interval="300000" begin="300000" end="43200000" />
                           <!-- 5m, 5m, 12h -->
<downtime interval="600000" begin="43200000" end="432000000" />
                           <!-- 10m, 12h, 5d -->
<downtime begin="432000000" delete="true" />
                           <!-- anything after 5 days delete -->
```

Remember to remove the “end” when removing delete

Passive Status Keeper

```
# snmptrap -v 1 -c public 127.0.0.1 .1.3.6.1.4.1.99999.2 \
  localhost 6 1 ' ' .1.3.6.1.4.1.99999.3.1 s 'They be bored'
```

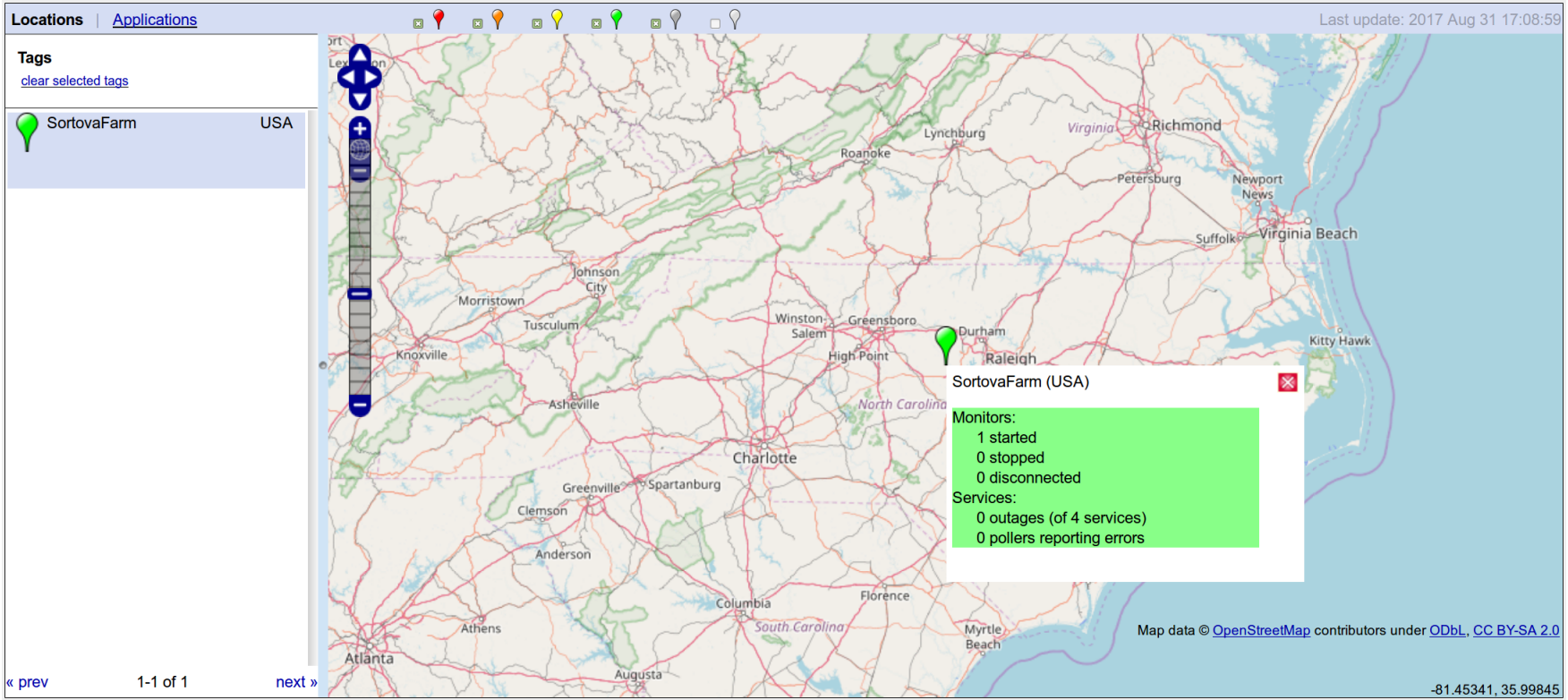
Recent Events

389	12/6/16 22:00:06		Minor	Class-Mood outage identified on interface 127.0.0.1 with reason code: They be bored.
388	12/6/16 21:59:51		Normal	Status information for service Class-Mood has been updated.
387	12/6/16 21:59:51		Warning	OpenNMS Class is moody: They be bored

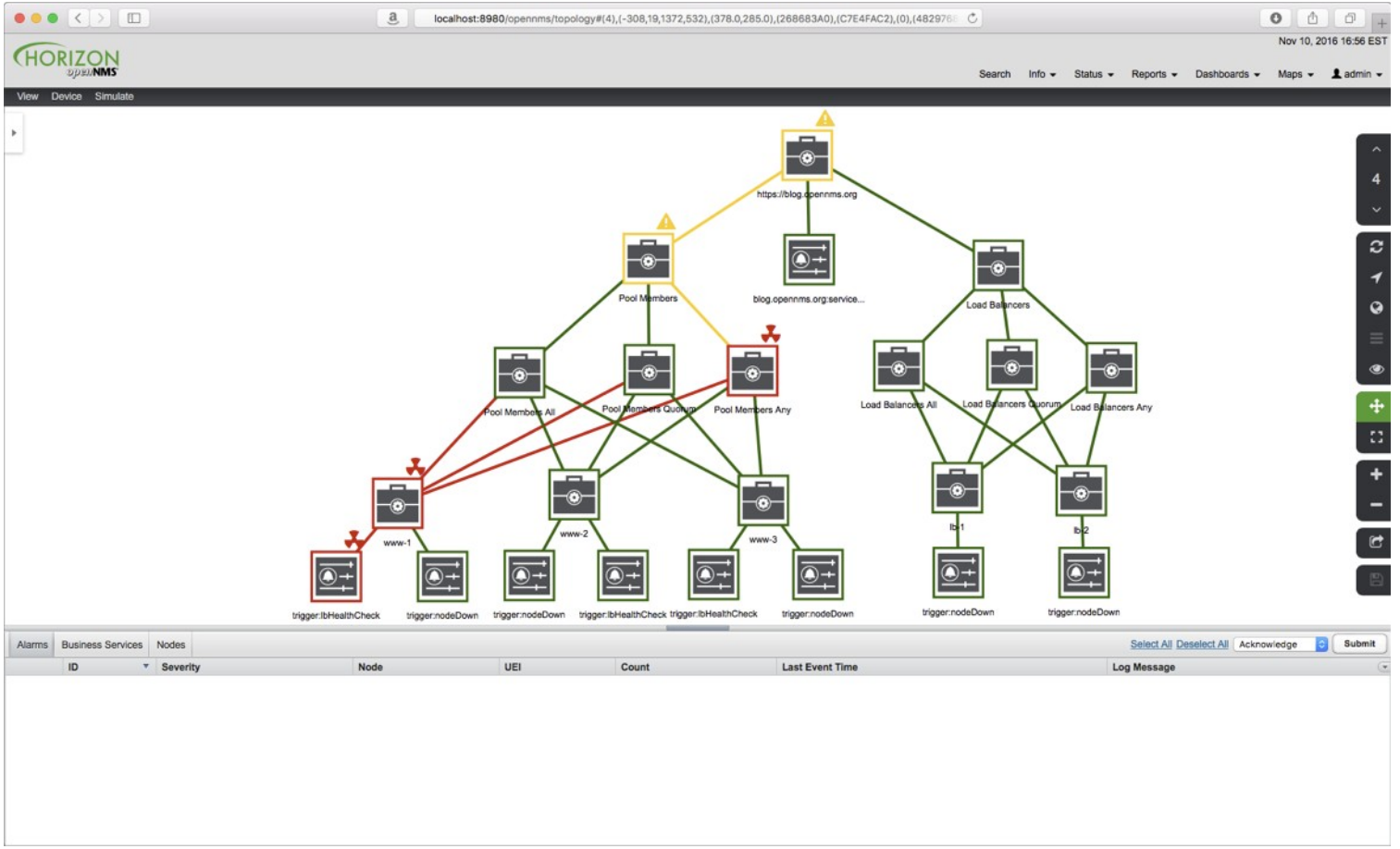
☐	59	localhost ⊞ ⊟	1	Dec 6, 2016 10:00:06 PM ◧ ◨	Class-Mood outage identified on interface 127.0.0.1 with reason code: They be bored.

☐ 27	389		Minor	Dec 6, 2016 10:00:06 PM			localhost ⊞ ⊟	127.0.0.1 ⊞	Class-Mood ⊞
				The Class-Mood service poll on interface localhost (127.0.0.1) on node localhost failed at Tuesday, December 6, 2016 10:00:06 PM EST.					

Remote Poller



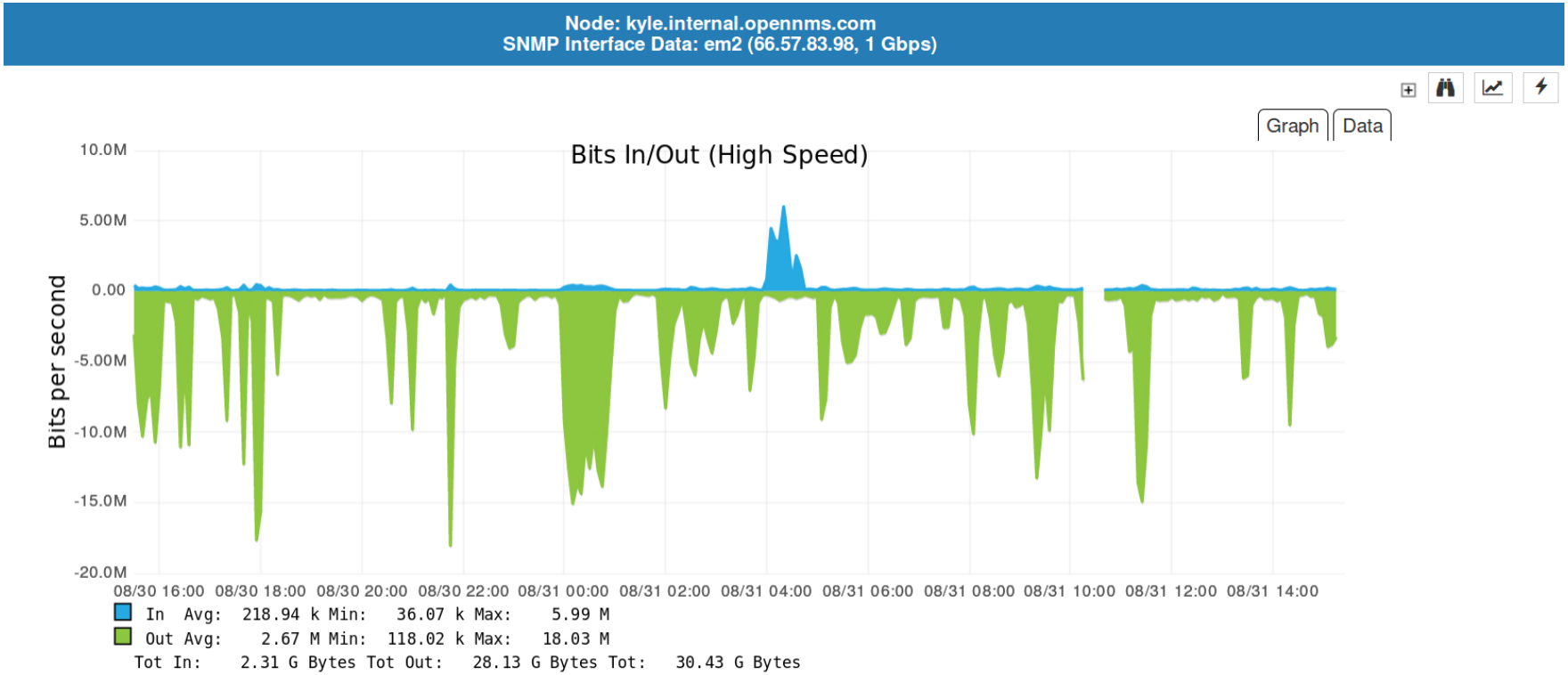
Business Service Monitor



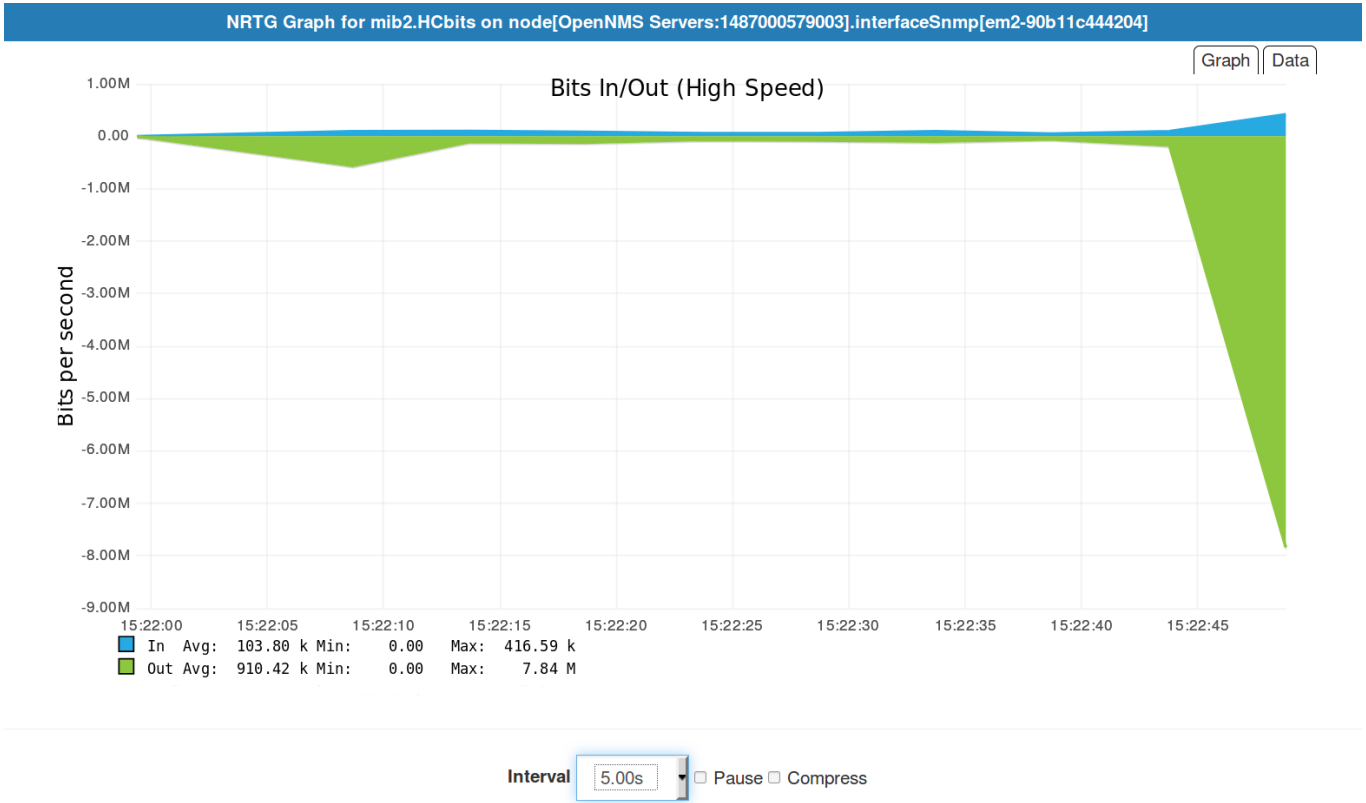
Data Collection

- OpenNMS can collect data from numerous sources, such as SNMP, HTTP, XML, JSON, JDBC, vSphere etc.
- The data can be stored, graphed, checked for thresholds and trends can be calculated
- Virtually unlimited scale using storage via Newts running on Cassandra or ScyllaDB
- Integration with external tools such as Graphite and Grafana

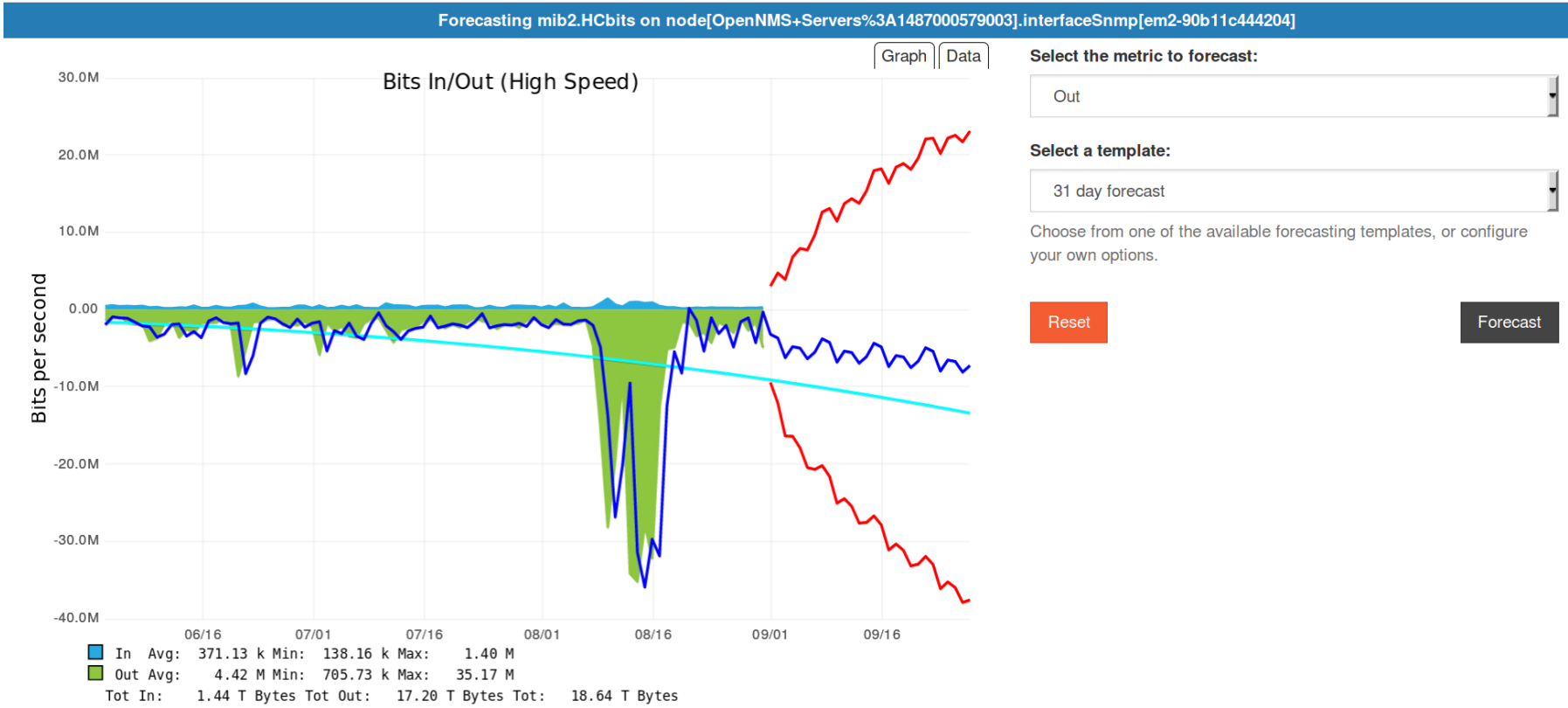
SNMP Data Collection



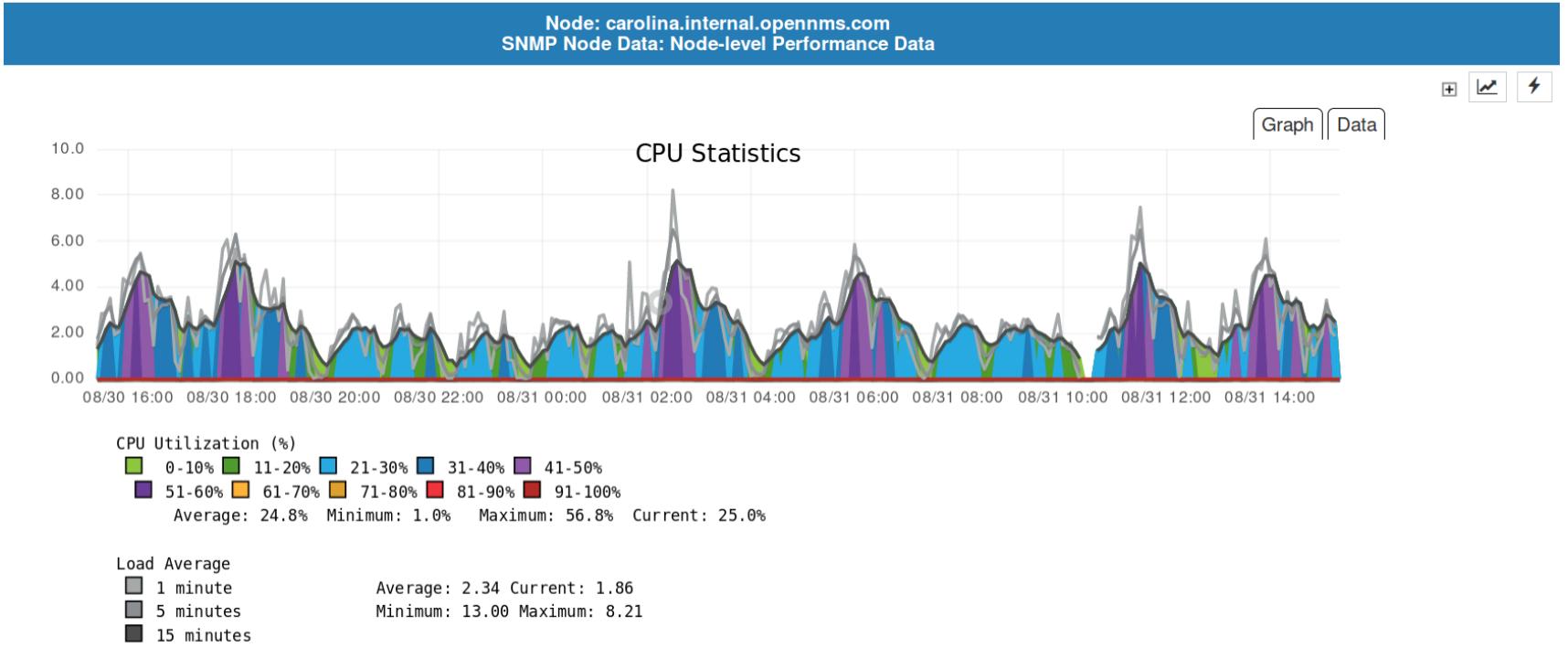
Near Real-time Graphing (NRTG)



Trending with R

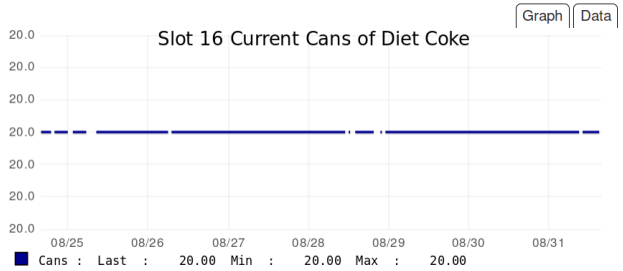


SNMP Data Collection

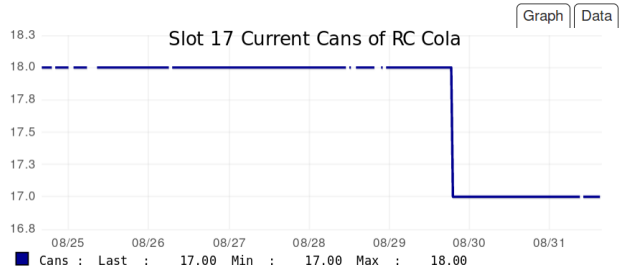


HTTP Data Collection

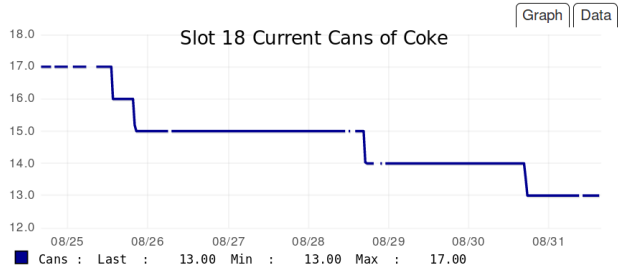
OpenNMS Drink Machine Slot 16
From: Thu Aug 24 15:16:59 EDT 2017 **Node: ike.internal.opennms.com**
To: Thu Aug 31 15:16:59 EDT 2017 **SNMP Node Data: Node-level Performance Data Detail**



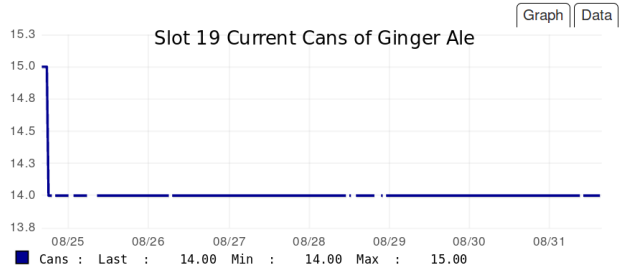
OpenNMS Drink Machine Slot 17
From: Thu Aug 24 15:16:59 EDT 2017 **Node: ike.internal.opennms.com**
To: Thu Aug 31 15:16:59 EDT 2017 **SNMP Node Data: Node-level Performance Data Detail**



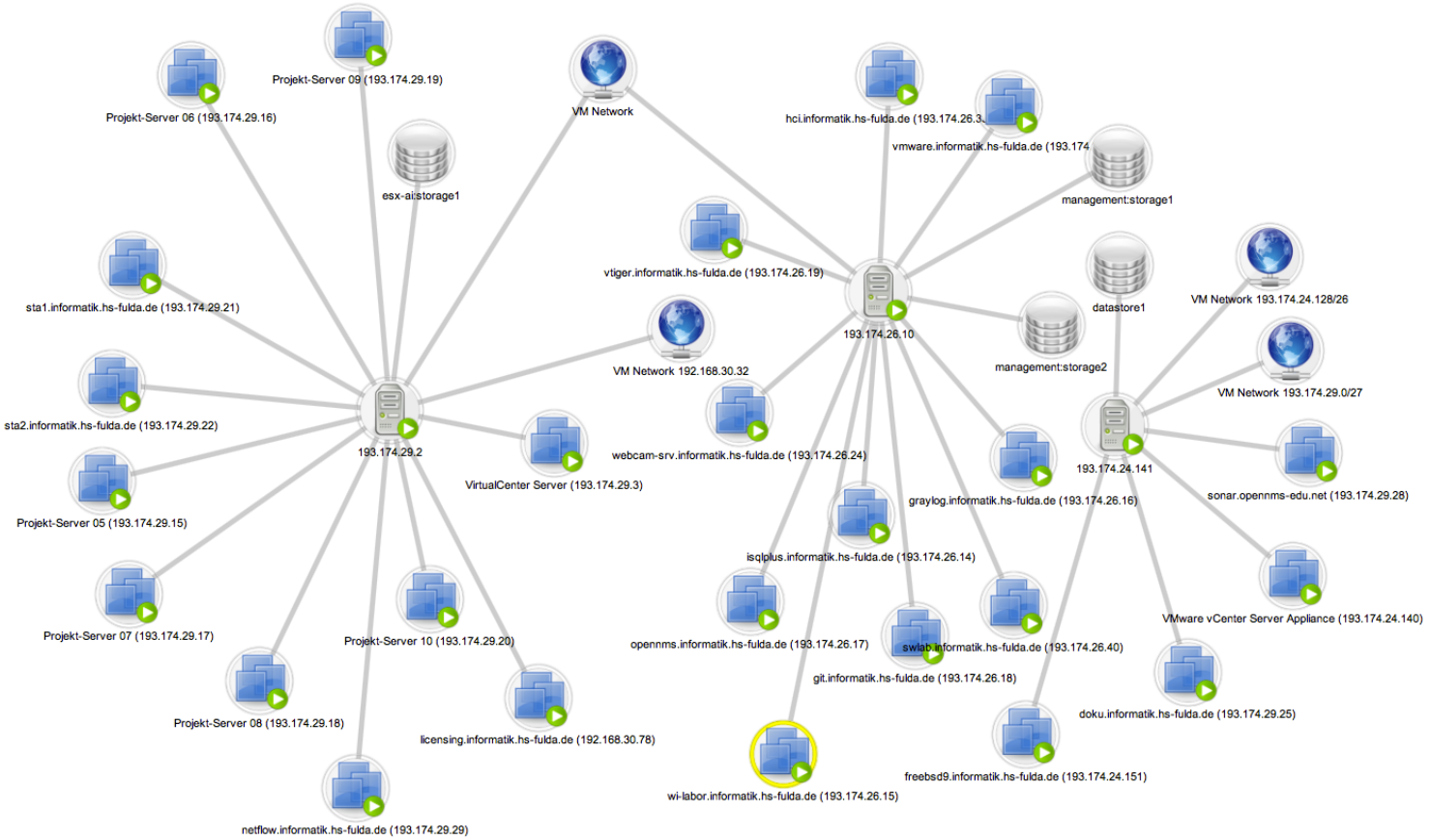
OpenNMS Drink Machine Slot 18
From: Thu Aug 24 15:16:59 EDT 2017 **Node: ike.internal.opennms.com**
To: Thu Aug 31 15:16:59 EDT 2017 **SNMP Node Data: Node-level Performance Data Detail**



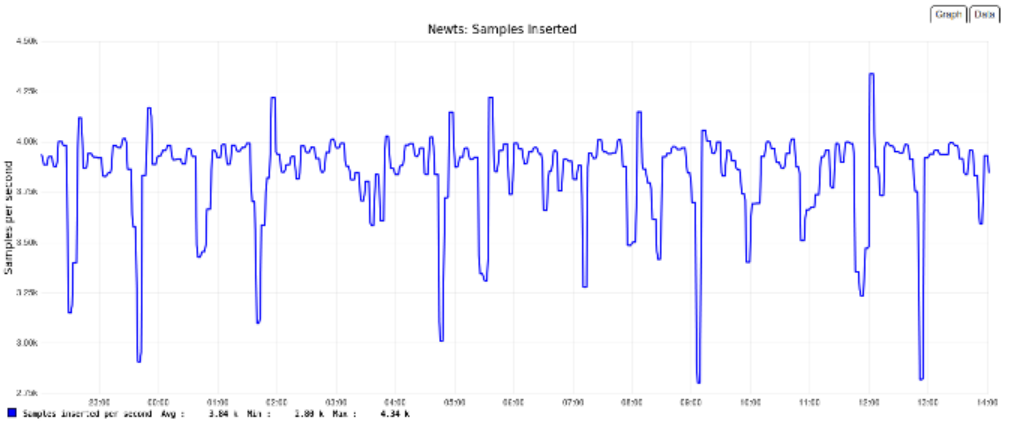
OpenNMS Drink Machine Slot 19
From: Thu Aug 24 15:16:59 EDT 2017 **Node: ike.internal.opennms.com**
To: Thu Aug 31 15:16:59 EDT 2017 **SNMP Node Data: Node-level Performance Data Detail**



VMWare



Newts




```
org.opennms.newts.stress.InsertDispatcher.samples
             count = 10512100
         mean rate = 51989.68 events/second
     1-minute rate = 51906.38 events/second
     5-minute rate = 38806.02 events/second
    15-minute rate = 31232.98 events/second
```

Grafana

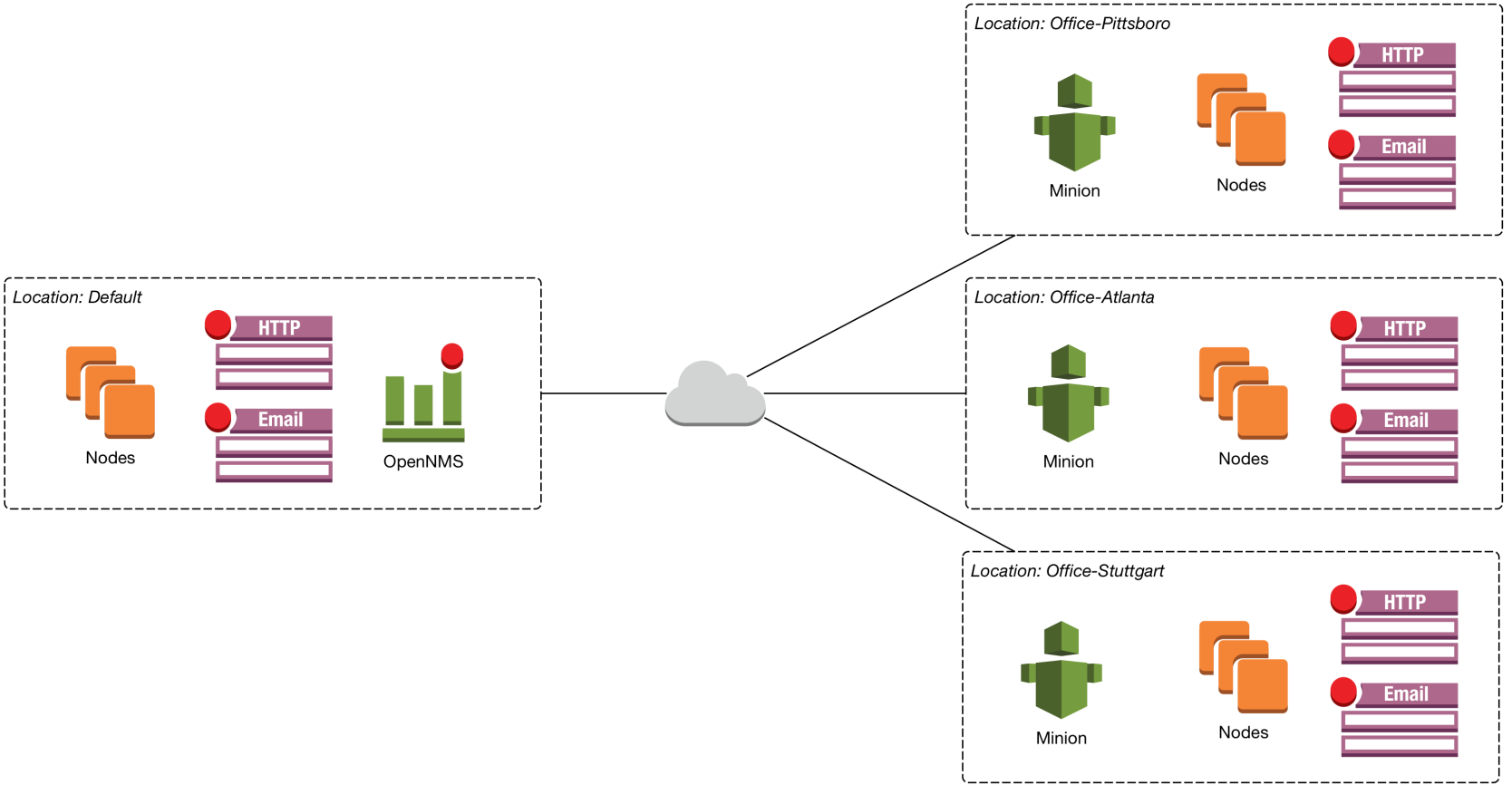
The Goal

"Internet of Things" Scale

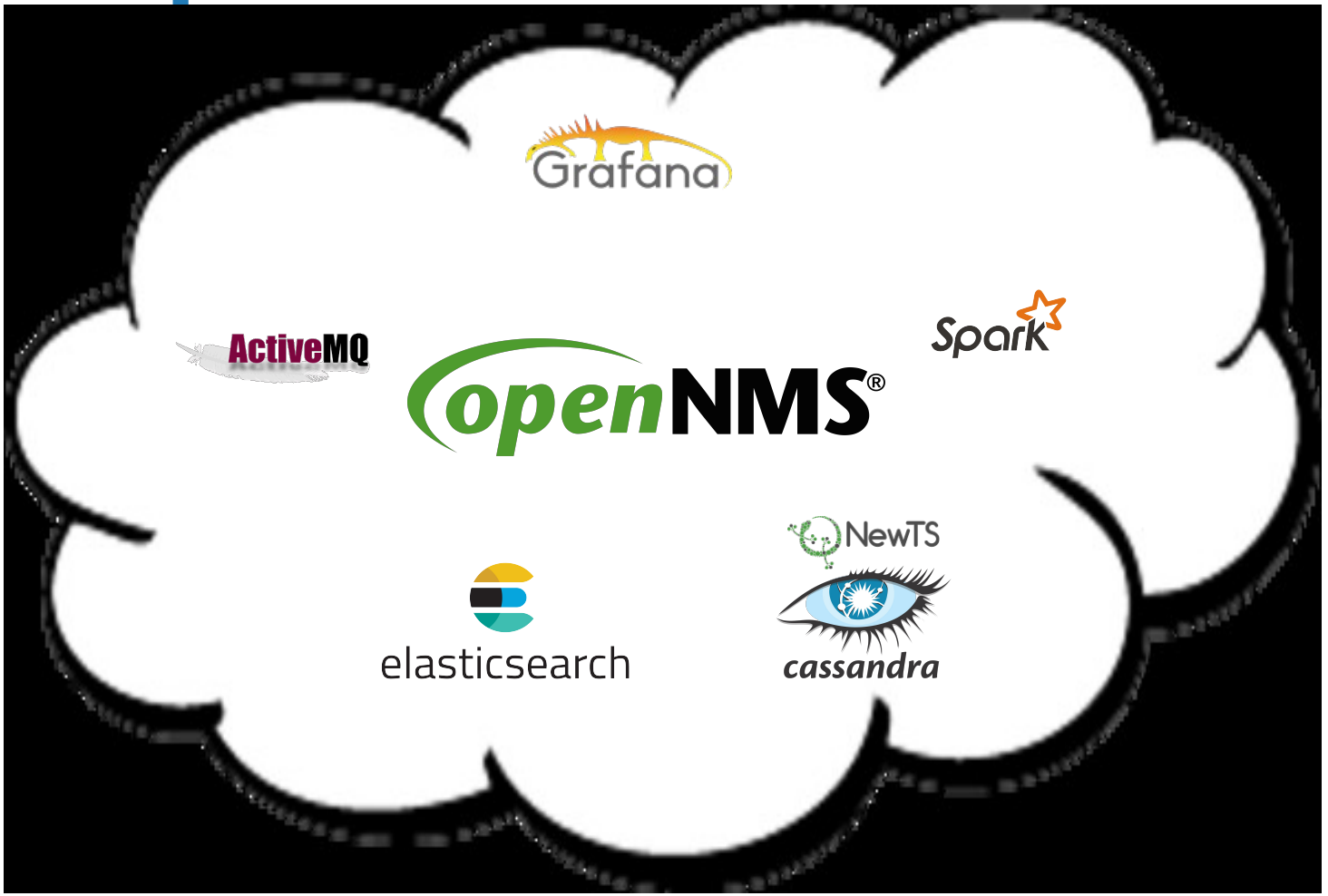
Millions of Devices

Billions of Metrics

Minion



OpenNMS in the Cloud



Resources

The OpenNMS Project:

- website: https://www.opennms.org
- wiki: https://wiki.opennms.org
- demo: https://demo.opennms.org
- chat: https://chat.opennms.com
- forum: http://ask.opennms.eu