

Whats New OpenNMS 2019

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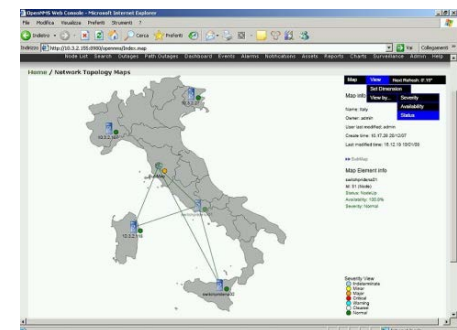
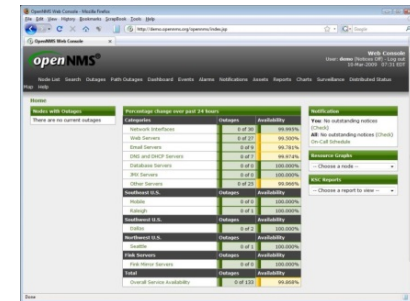


Contents

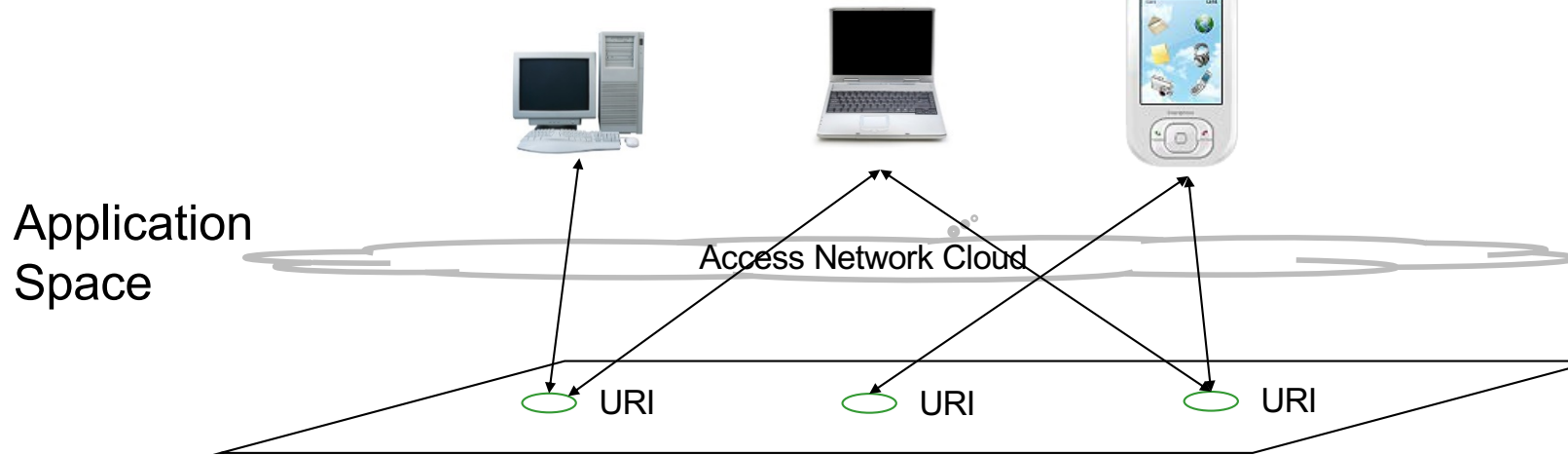
OpenNMS Project Overview

OpenNMS Functional Overview

Future directions

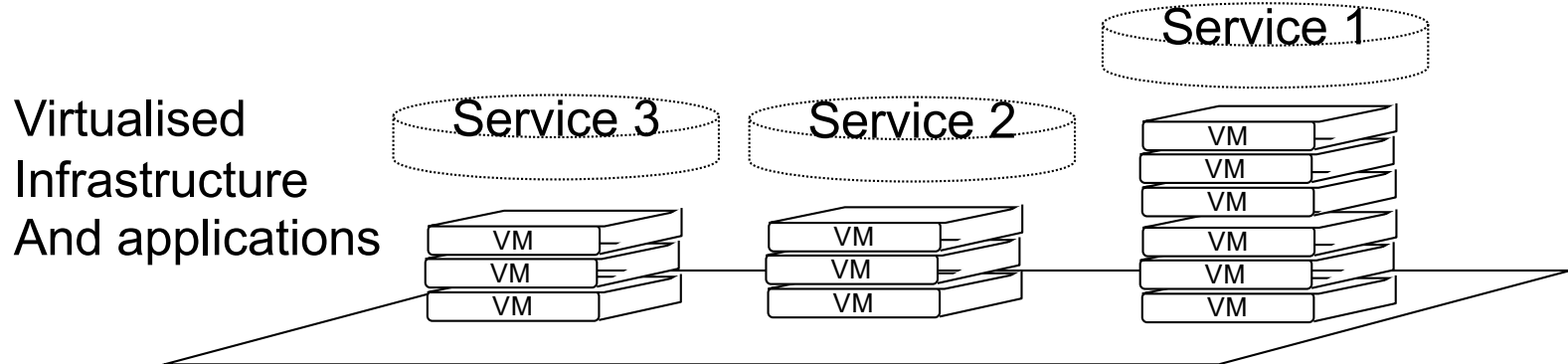


Converged Virtualised Services



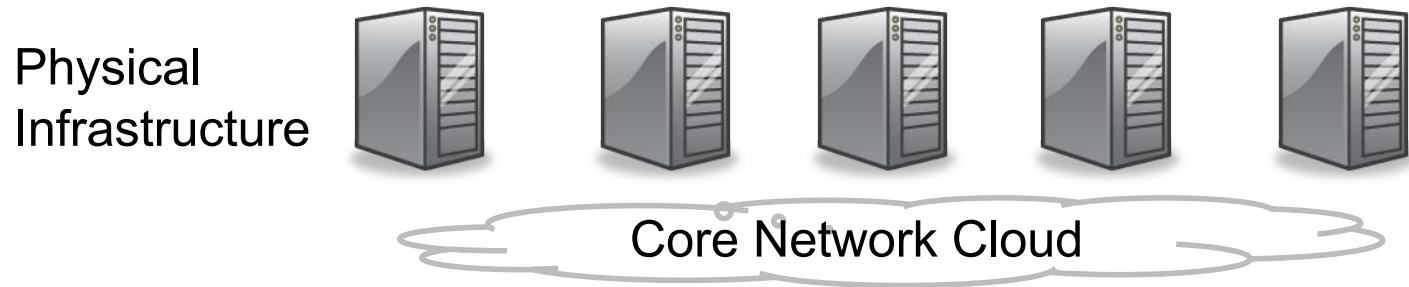
End user Services (Apps) are a mash-up of web services accessed through standard and proprietary protocols;

- HTTP, REST, SOAP, JSON, RSS,
- **Open Data / RDF etc.**
- **'Internet of things'**



Services hosted in 'Cloud' designed to scale through addition of VM resources

'cloud bursting'
'cloud brokering'



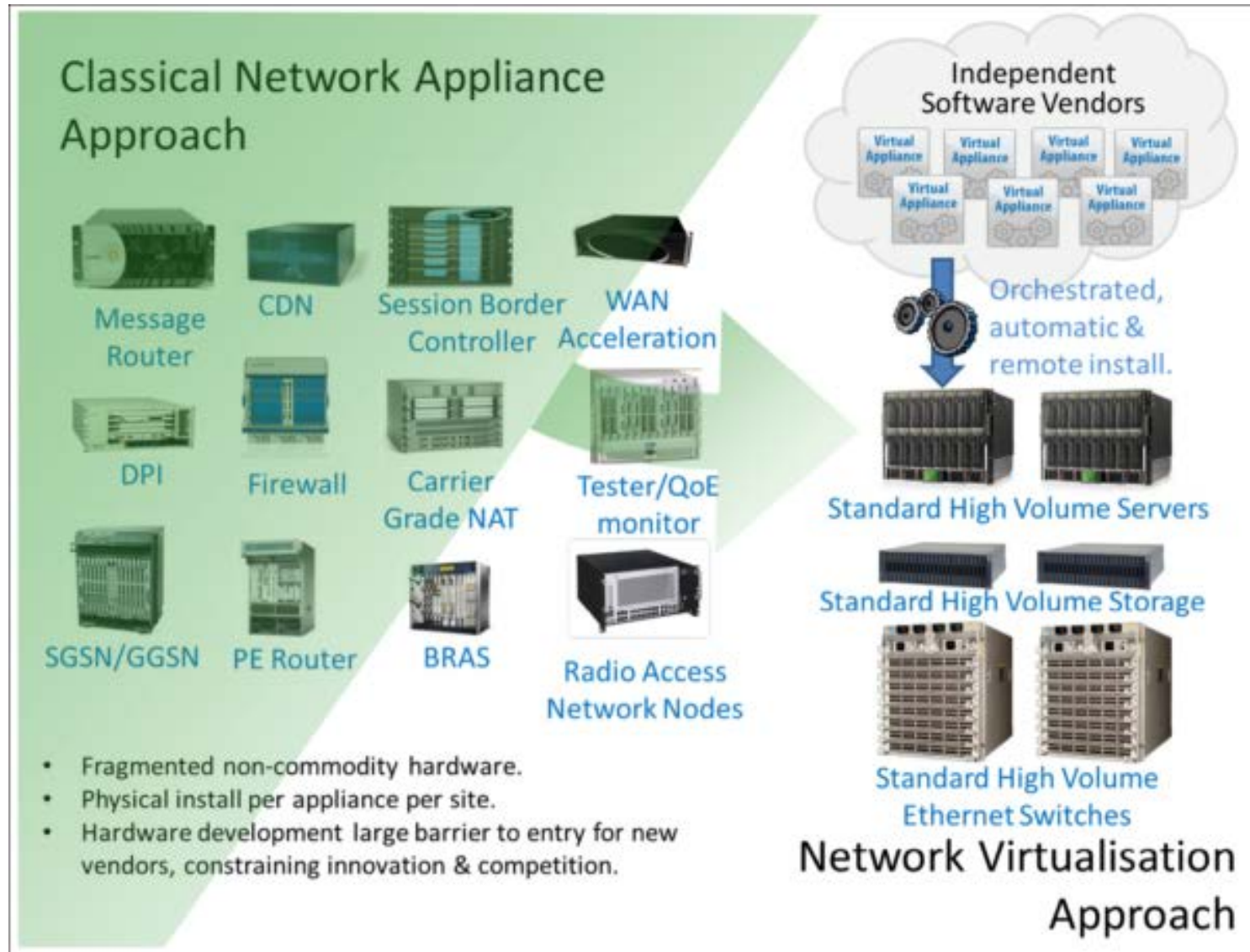
Underlying physical infrastructure

- Commodity hardware
- Geographical Diversity
- Rapid Churn
- Network Connectivity

Moving to Virtualised Networks

You May Have Heard Of

- **Software defined Networking**
 - Research / Data Centre
 - Open Flow
- **Network Functions Virtualisation**
 - Service providers – ETSI
- **TM Forum ZOOM**
 - Zero-touch Orchestration, Operations and Management (ZOOM)



- **ETSI's vision for Network Functions Virtualisation**

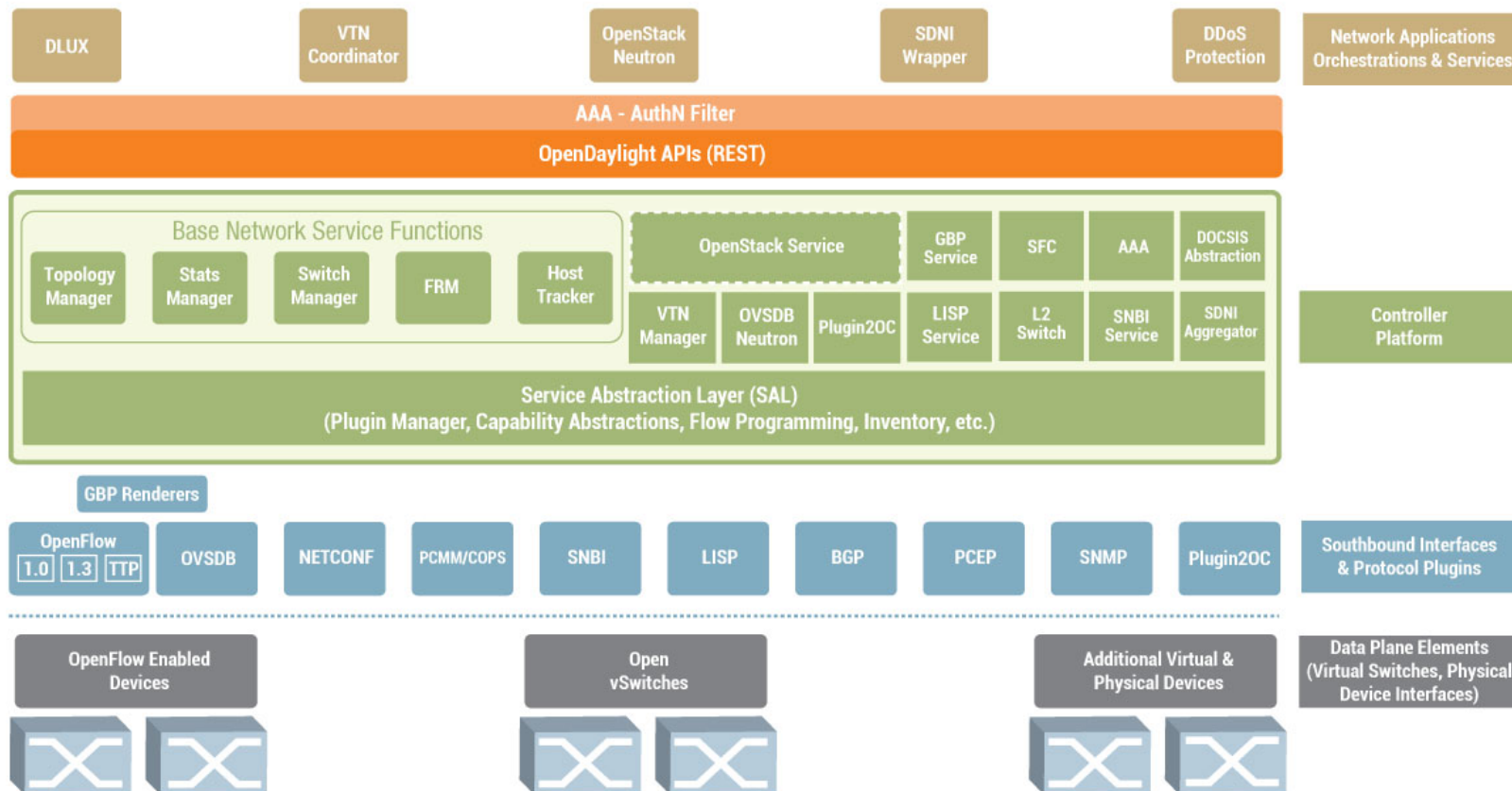
- http://www.telco2research.com/articles/WP_telco2-network-functions-virtualisation-NFV-vs-software-defined-networking-SDN_Summary

OSGi – facilitates integration into Open Daylight SDN/SFV controller



LEGEND

AAA: Authentication, Authorization & Accounting
AuthN: Authentication
BGP: Border Gateway Protocol
COPS: Common Open Policy Service
DLUX: OpenDaylight User Experience
DDoS: Distributed Denial Of Service
DOCSIS: Data Over Cable Service Interface Specification
FRM: Forwarding Rules Manager
GBP: Group Based Policy
LISP: Locator/Identifier Separation Protocol
OVSDDB: Open vSwitch DataBase Protocol
PCEP: Path Computation Element Communication Protocol
PCMM: Packet Cable MultiMedia
Plugin2OC: Plugin To OpenContrail
SDNI: SDN Interface (Cross-Controller Federation)
SFC: Service Function Chaining
SNBI: Secure Network Bootstrapping Infrastructure
SNMP: Simple Network Management Protocol
TTP: Table Type Patterns
VTN: Virtual Tenant Network



The OpenNMS Project

- **OpenNMS**
 - Open Network Management System
 - OpenNMS is the world's first **Enterprise and Carrier grade** network management platform developed under the **open source model**.
- **Technology**
 - Written in Java
 - Packaged for Windows, Linux and most Unix distributions
 - Proven scalability
 - 300,000 data points every 5 minutes
 - Policy driven discovery of core nodes with 5000+ interfaces
- **Websites**
 - www.opennms.org
 - <http://sourceforge.net/projects/opennms/>



Proven Scalability

- Nearly 60,000 Devices on a Single Instance (Swisscom)
- 1.2 Million Data Points Every Five Minutes (New Edge)
- 32,000 Interfaces per Device (Wind)
- 2000 events/sec (SRNS)
- 3000 Remote Monitors (Papa Johns)



Wide community of commercial users



- Papa Johns Pizza <http://www.papajohns.com/>
- Minnesota Children's Hospital <http://www.childrensmn.org/>
- Oregon State University <http://oregonstate.edu>
- Permanente Medical Group www.permanente.net
- Myspace www.myspace.com
- Ocado www.ocado.com
- FreshDirect <http://www.freshdirect.com>
- Fox TV (Australia) <http://www.foxtel.com.au>
- BBC Monitoring www.monitor.bbc.co.uk
- FastSearch <http://www.fastsearch.com/>
- New Edge Networks <http://www.newedgenetworks.com/>
- Rackspace <http://www.rackspace.com>
- Swisscom Eurospot <http://www.swisscom-eurospot.com>
- Wind Telecomunicazioni SpA (Italy) <http://www.wind.it>
- BT www.bt.co.uk
- Arqiva <http://www.arqiva.com/>
- Airspeed <http://airspeed.ie/>



- And many more - 4000 downloads per week



Community and Governance

- **User community**
 - Guess is that the active user community is probable closer to 10,000 people.
 - Support customers; 100+ globally
- **Developer Community**
 - We have 35 developers with commit access
- **Assets**
 - Licence GPL
 - The IPR is owned by The OpenNMS Group, Inc.
 - OpenNMS Trademark owned by The OpenNMS Group
- **Governance**
 - The community is managed by The Order of the Green Polo. All active OGP members have a vote on the direction of the project.
- **Foundation**
 - The independent OpenNMS Europe foundation has been created to represent the interests of the user community and run the user conferences
 - <http://www.opennms.eu/>



DEV-JAM Atlanta July 2008

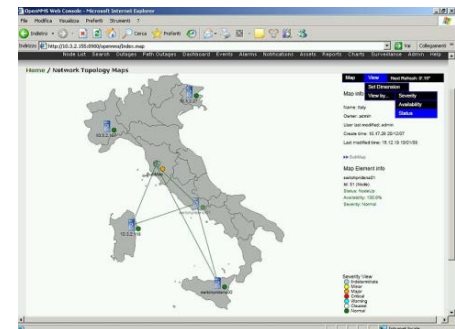
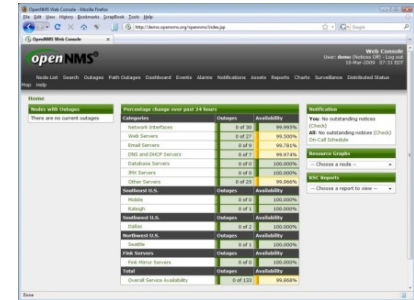


DEV-JAM Minneapolis June 2013

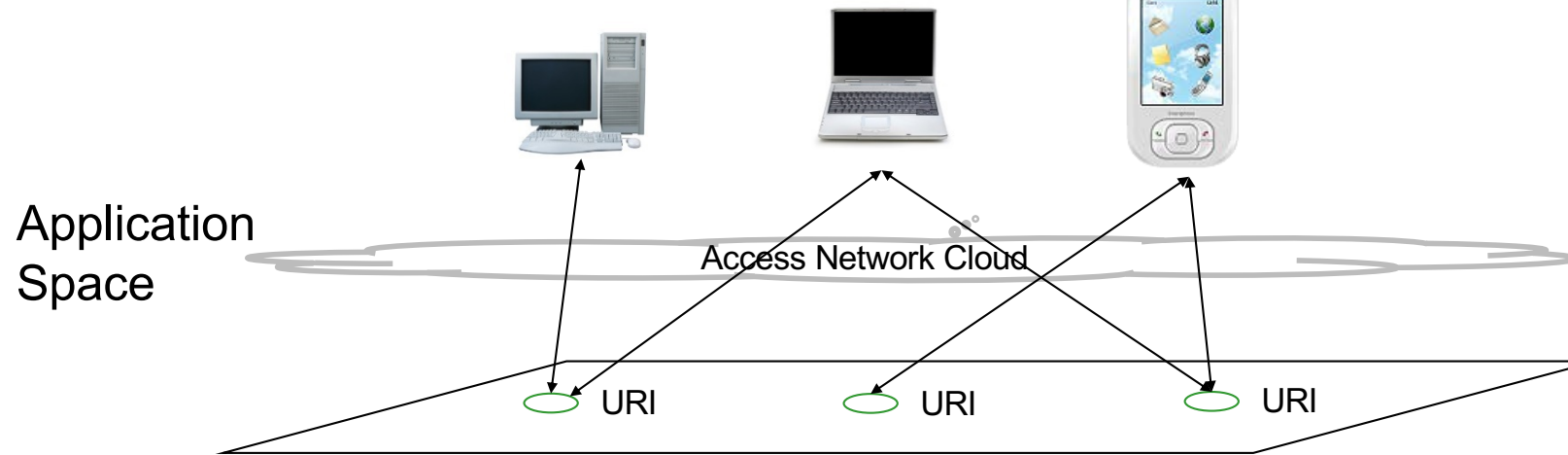


DEV-JAM Minneapolis June 2014

Current Capabilities

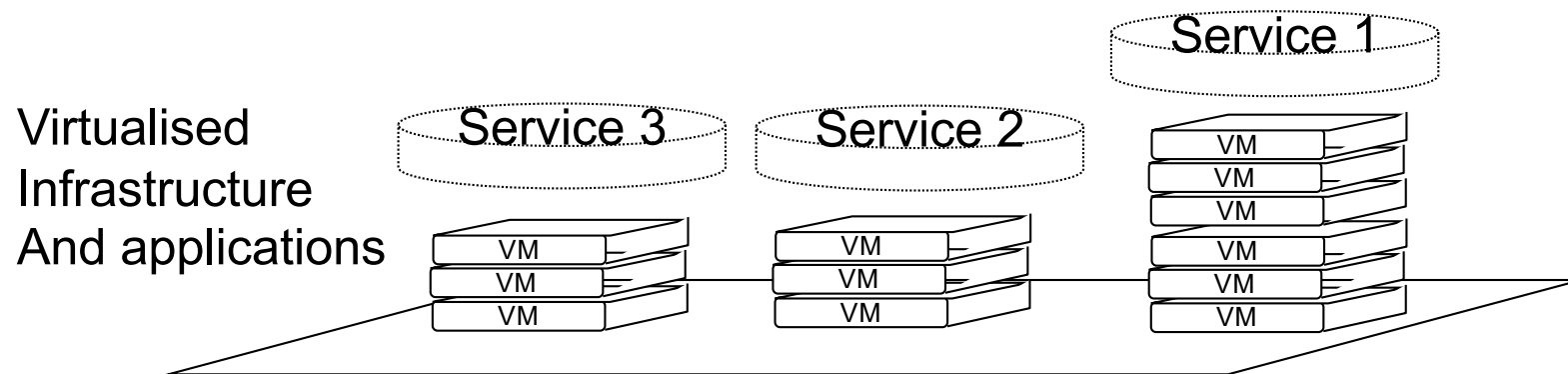


Managing Virtualised Services



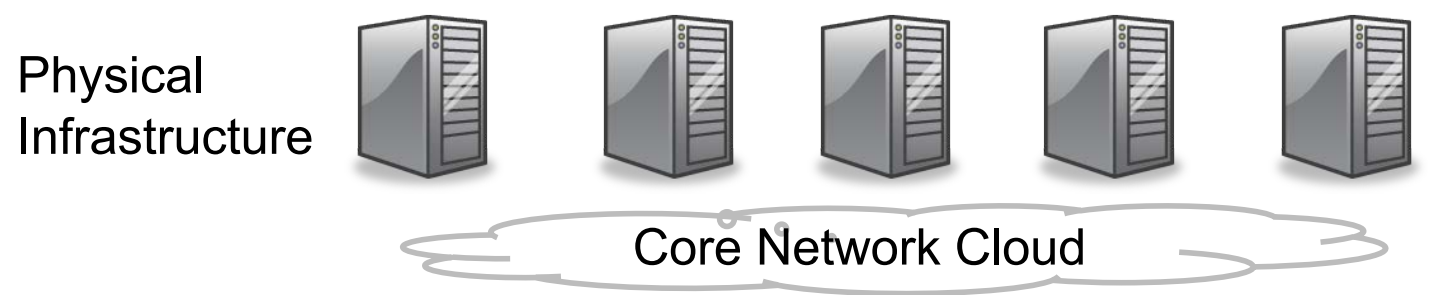
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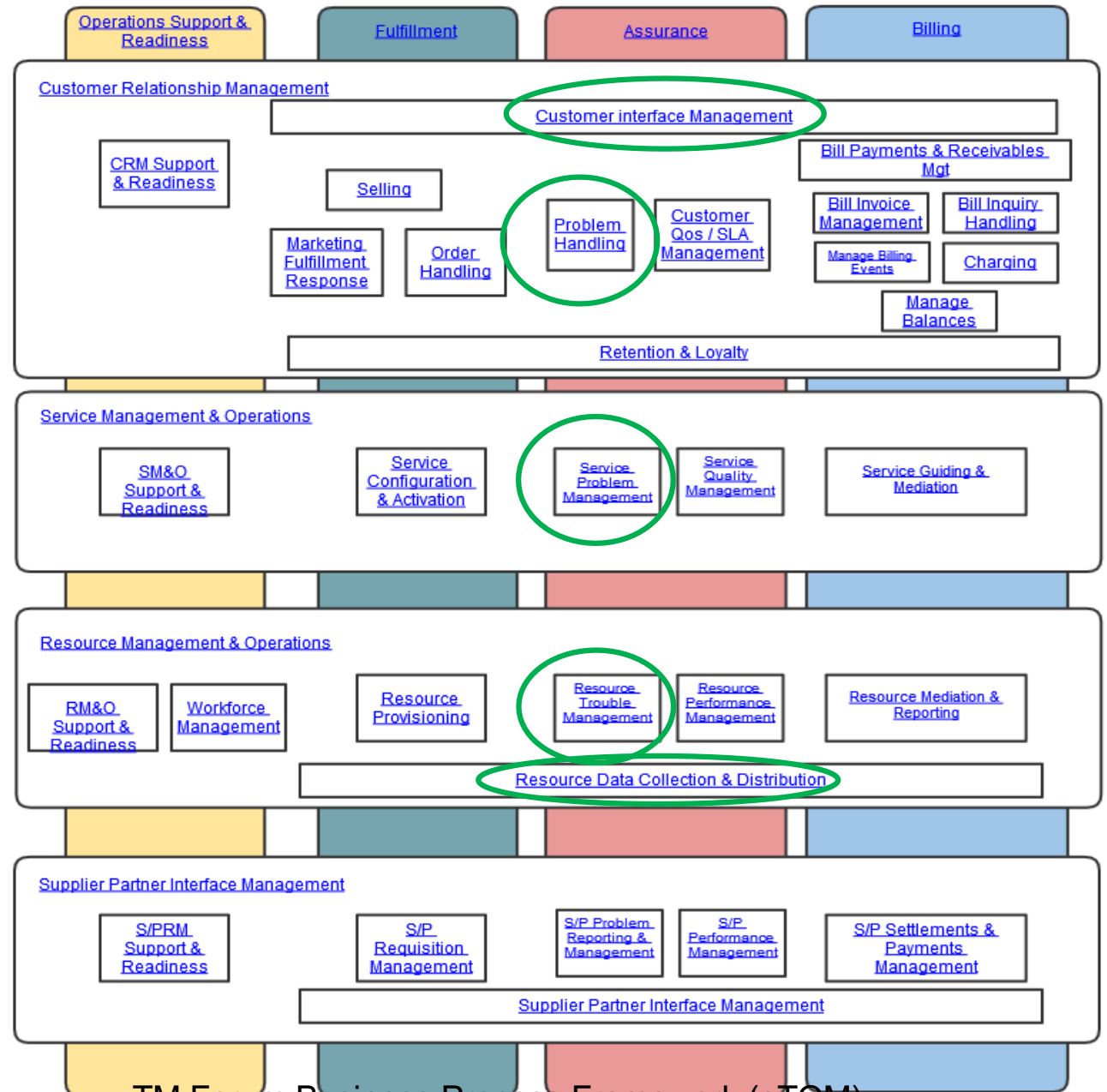
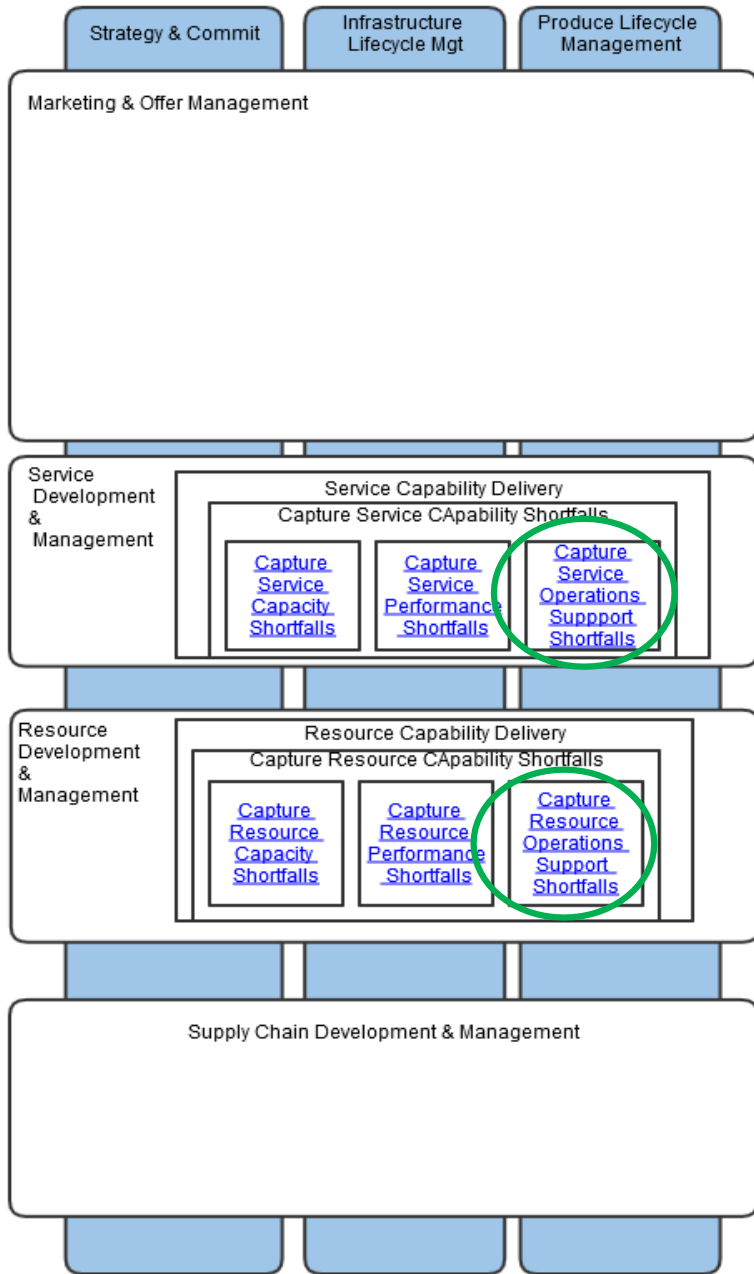
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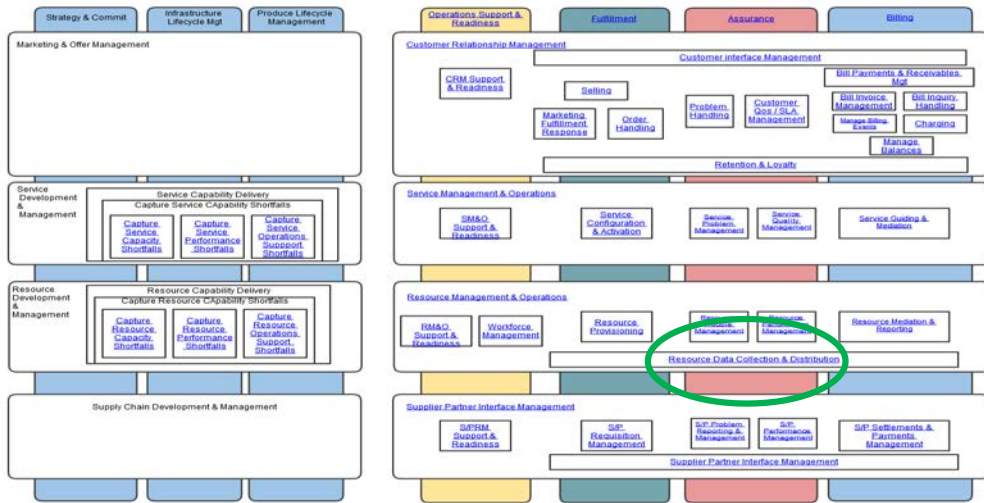
Underlying physical infrastructure

- Commodity hardware
- Geographical Diversity
- Rapid Churn
- Network Connectivity

OpenNMS Problem Handling touch points



Resource Data Collection at All Layers



Synthetic Transactions / Data Collection

- ICMP / HTTP / HTTPS
- ReST / WS / XML
- DHCP / DNS / FTP / LDAP Radius
- IMAP / POP3 / SMTP / NTP
- JDBC / JSR160 (JMX) / WMS / WBEM
- NSClient (Nagios Agent) / NRPE (Nagios Remote Plugin Executor)
- SMB / Citrix
- SNMP / SSH TCP

Application Space

Virtualisation

- VMware integration
- Open Stack (being developed)

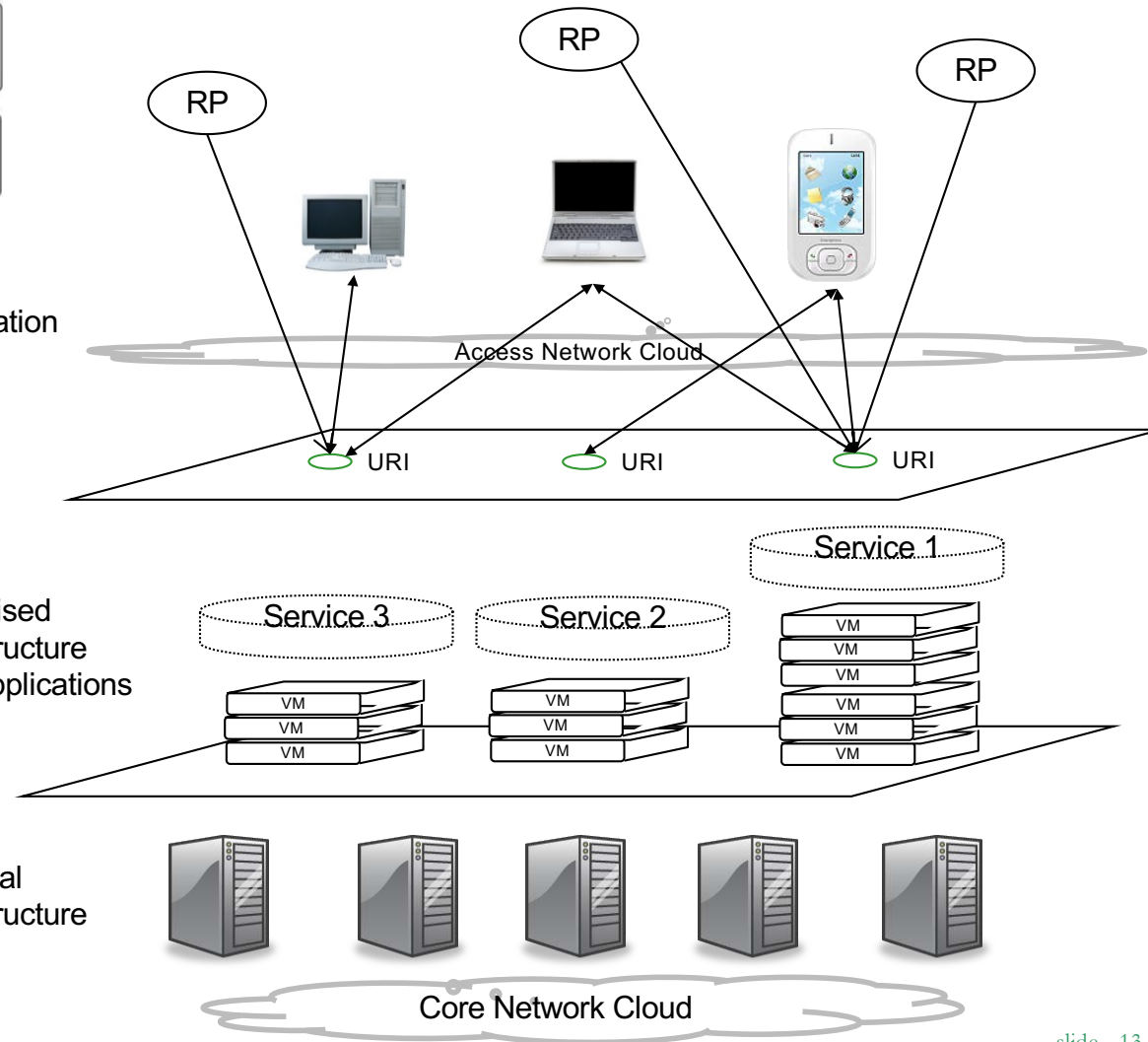
Virtualised Infrastructure And applications

Service & Network discovery

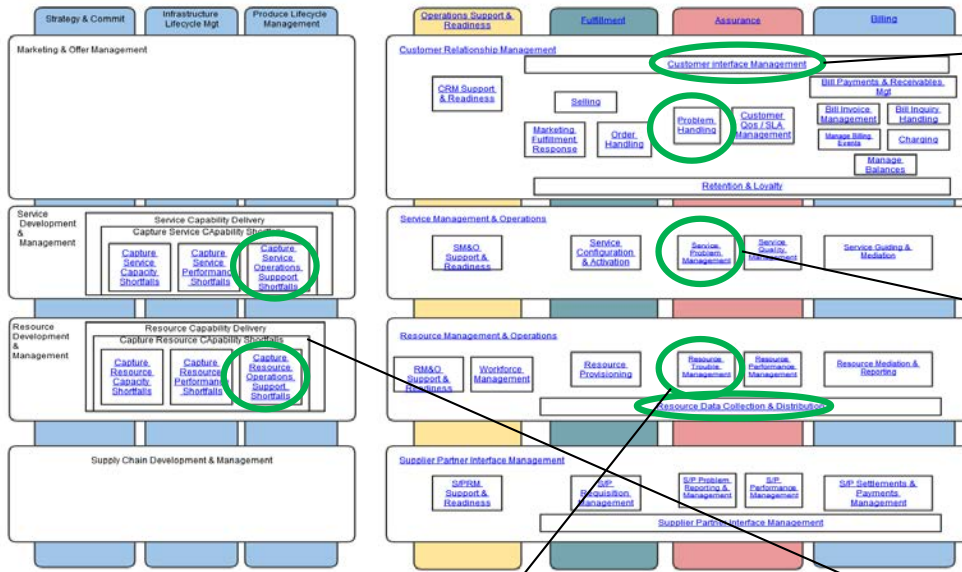
- VMware integration
- Policy driven Layer 2 network discovery

Physical Infrastructure

- **Remote Pollers**
 - Remotely monitor services from multiple locations

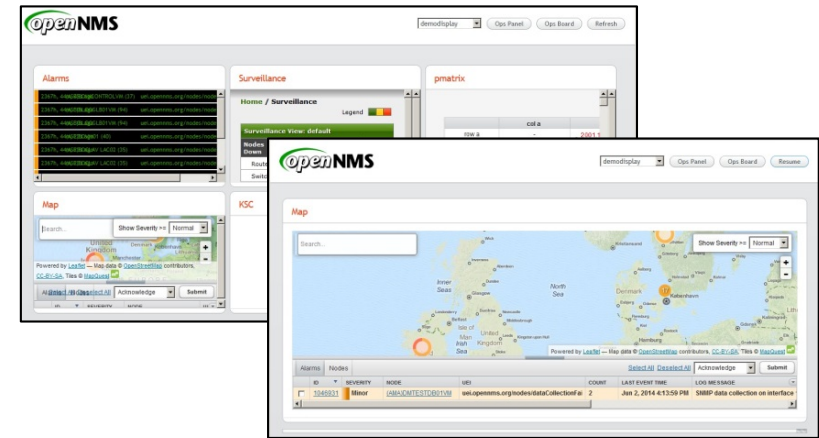


Presentation supports Service Provider Business Processes



Customer view

- Customer specific dashboards / Wallboards



- **Service / Resource Problem management**

- **Event Collection**

- OpenNMS can record all event occurrences

- **Alarm Correlation**

- Data base automations
- Jboss Rules correlation engine for more sophisticated down stream alarm suppressing.

- **User Notifications and scheduled escalation**

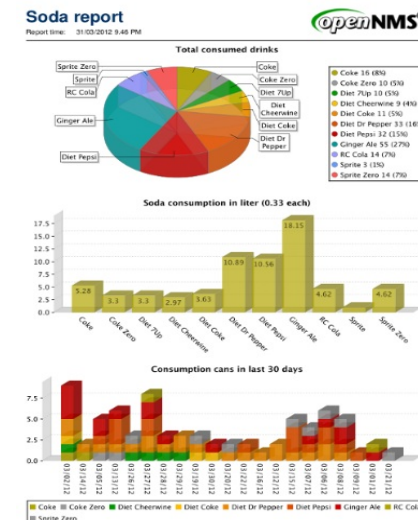
- Notification escalation mechanism between users.

- **Trouble ticket integration**

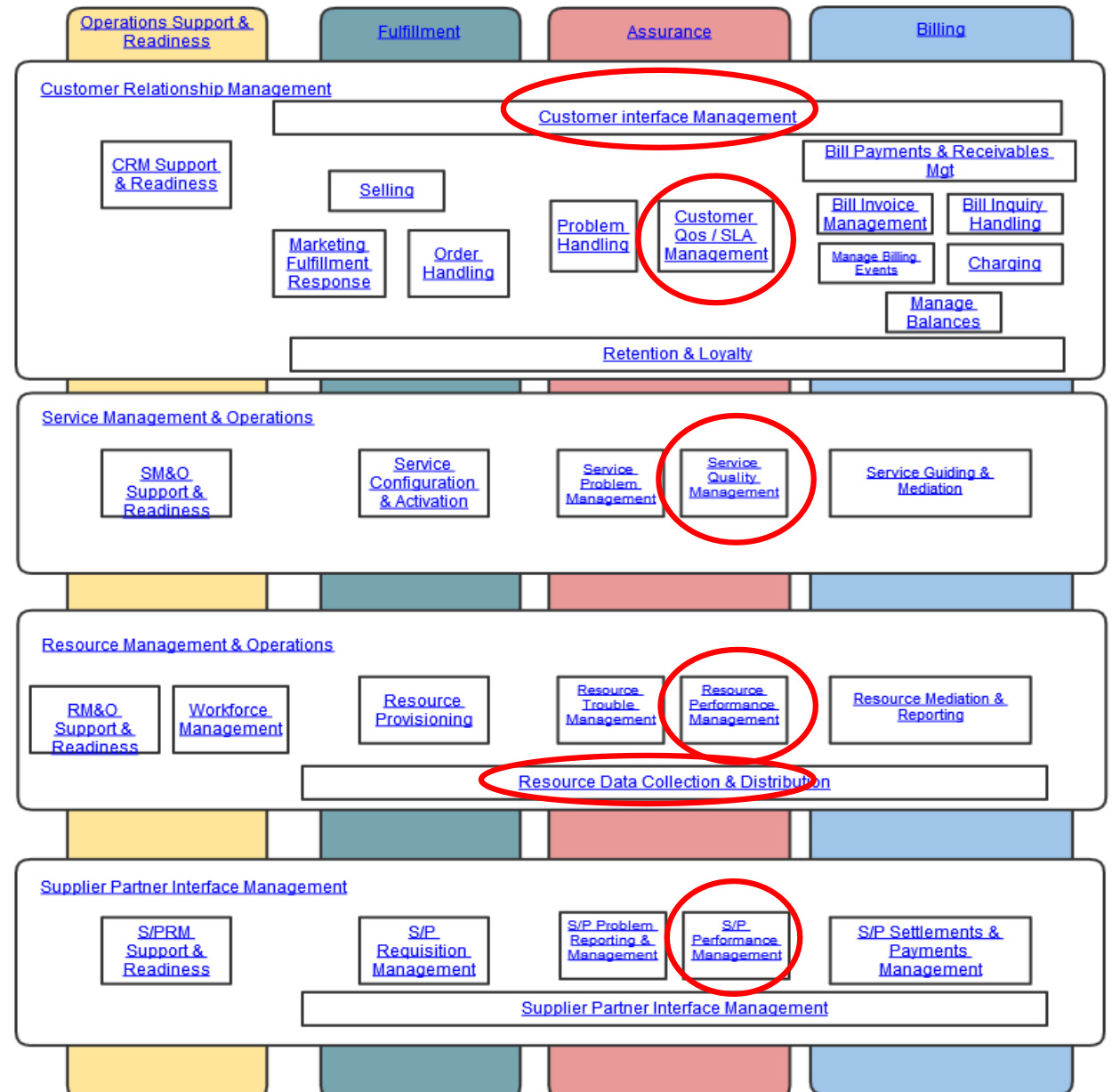
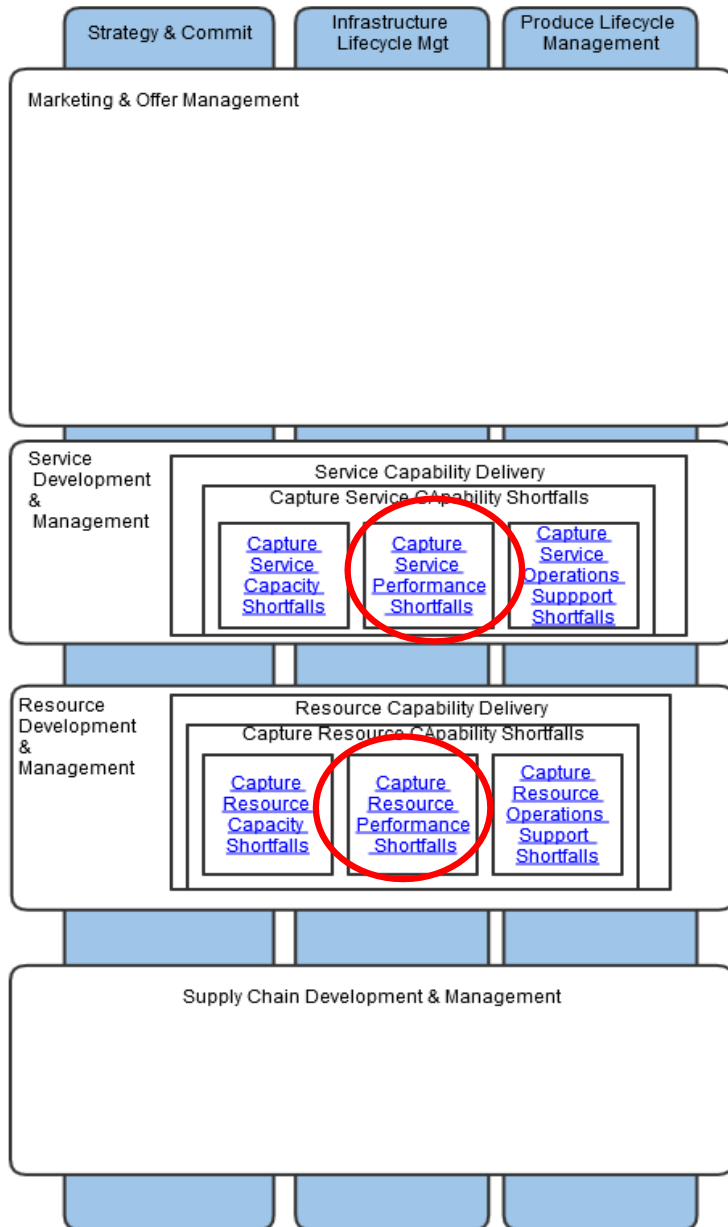
- RT and OTRS, Remedy, Jira etc.

- **Business Intelligence Reports**

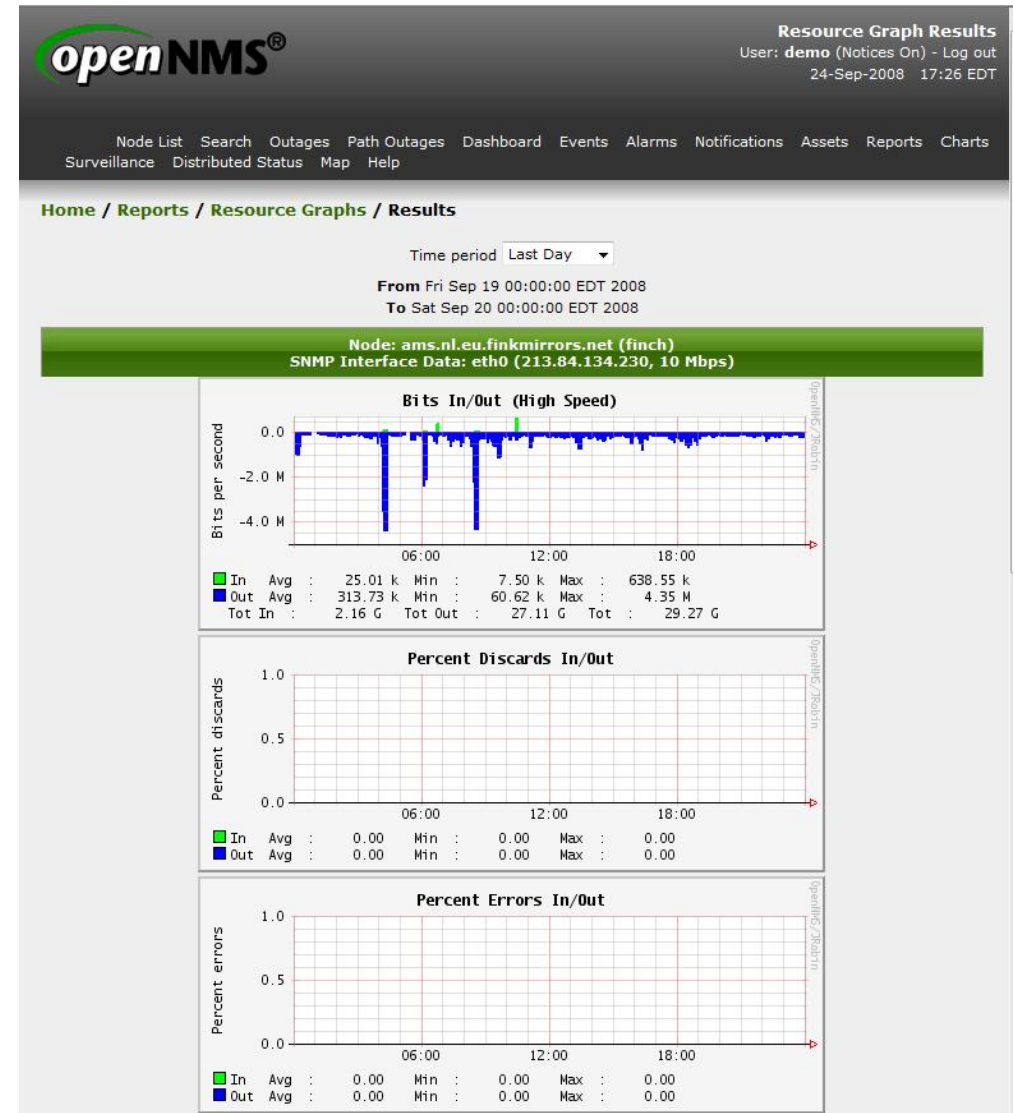
- Operations / Customer / SLA reports



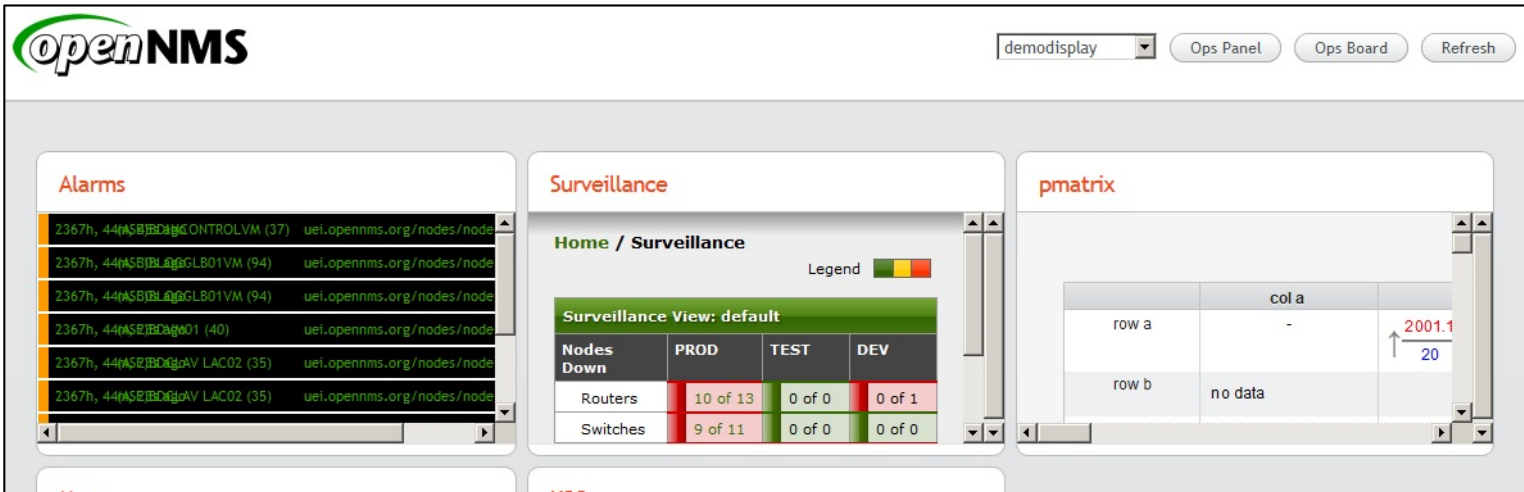
OpenNMS Performance touch points



- **Polled Data collection**
 - Multiple sources
 - Regular collection
 - Low cost and highly scalable
- **Visualisation**
 - Per interface or per node – not network wide
- **Threshold Alerting**
 - Binary thresholds
 - How do we track over time
 - How do we predict problems
- **Reports - Jasper**
 - Some calculation capability
 - Difficult to write and change – particularly with RRD data sources
- **Cassandra**
 - RRD moving to Cassandra
- **Do performance measures drive the work on the NOC**
 - Probably not...



New User Dash / Wall Board (Release 1.13+)

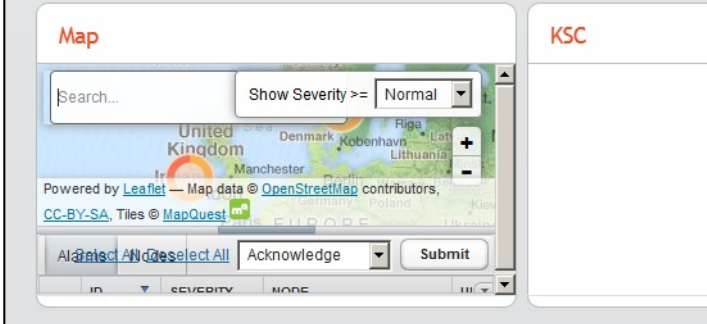


The dashboard includes the following widgets:

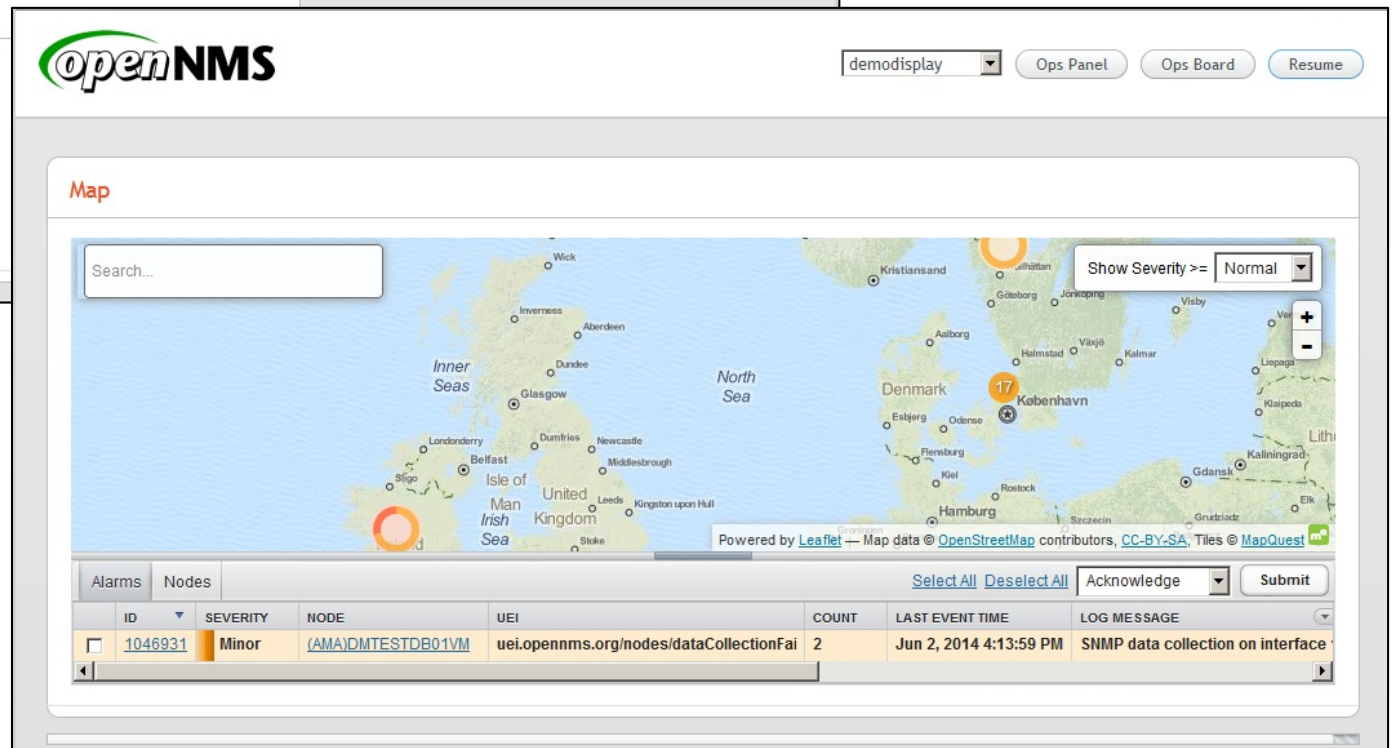
- Alarms:** A list of active alarms with columns for ID, severity, node, and UEI.
- Surveillance:** A 'Home / Surveillance' section with a legend and a 'Surveillance View: default' table.

Nodes Down	PROD	TEST	DEV
Routers	10 of 13	0 of 0	0 of 1
Switches	9 of 11	0 of 0	0 of 0
- pmatrix:** A matrix widget showing data for 'col a' and 'row a' (value: 2001.1) and 'row b' (value: no data).

Customised User Dashboard display



The Map widget features a search bar, a 'Show Severity >= Normal' dropdown, and a map of Europe. Below the map are controls for 'Alerted / Acknowledge', 'Deselect All', and 'Submit'.



The Map widget is shown with an alarm table below it:

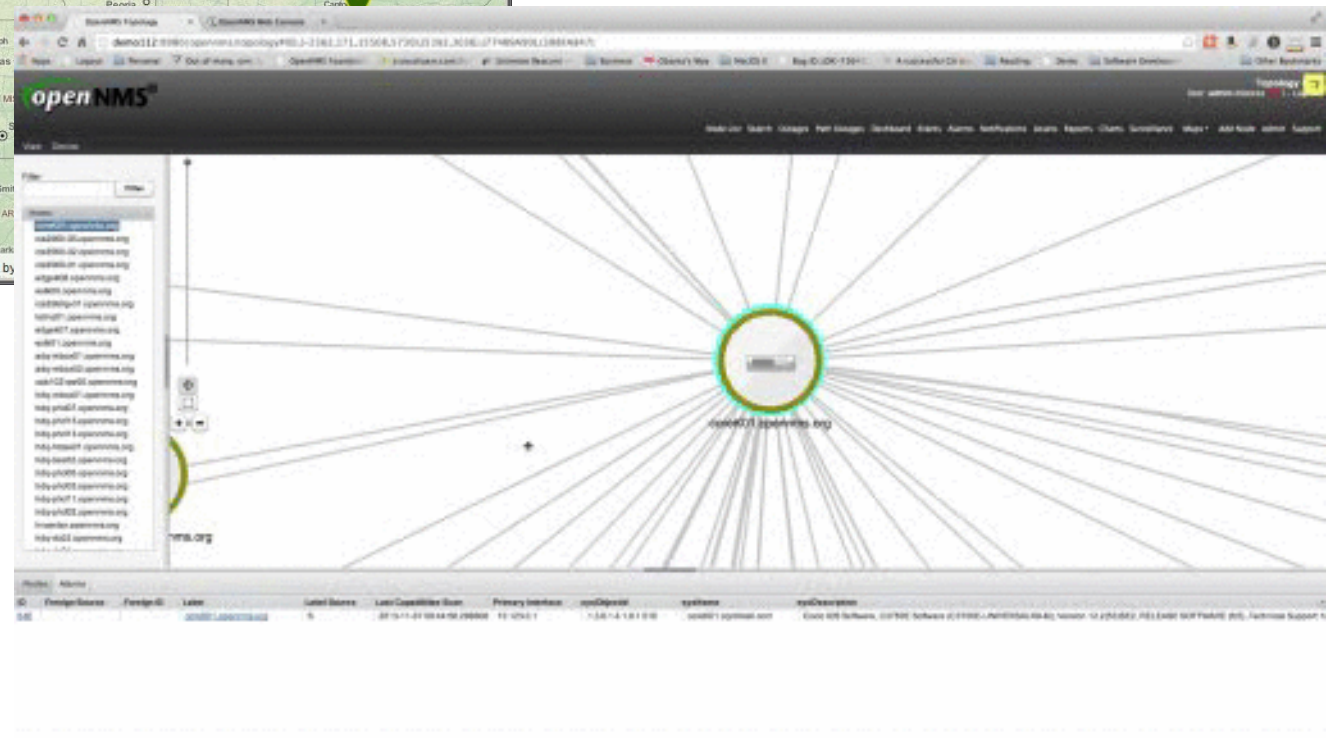
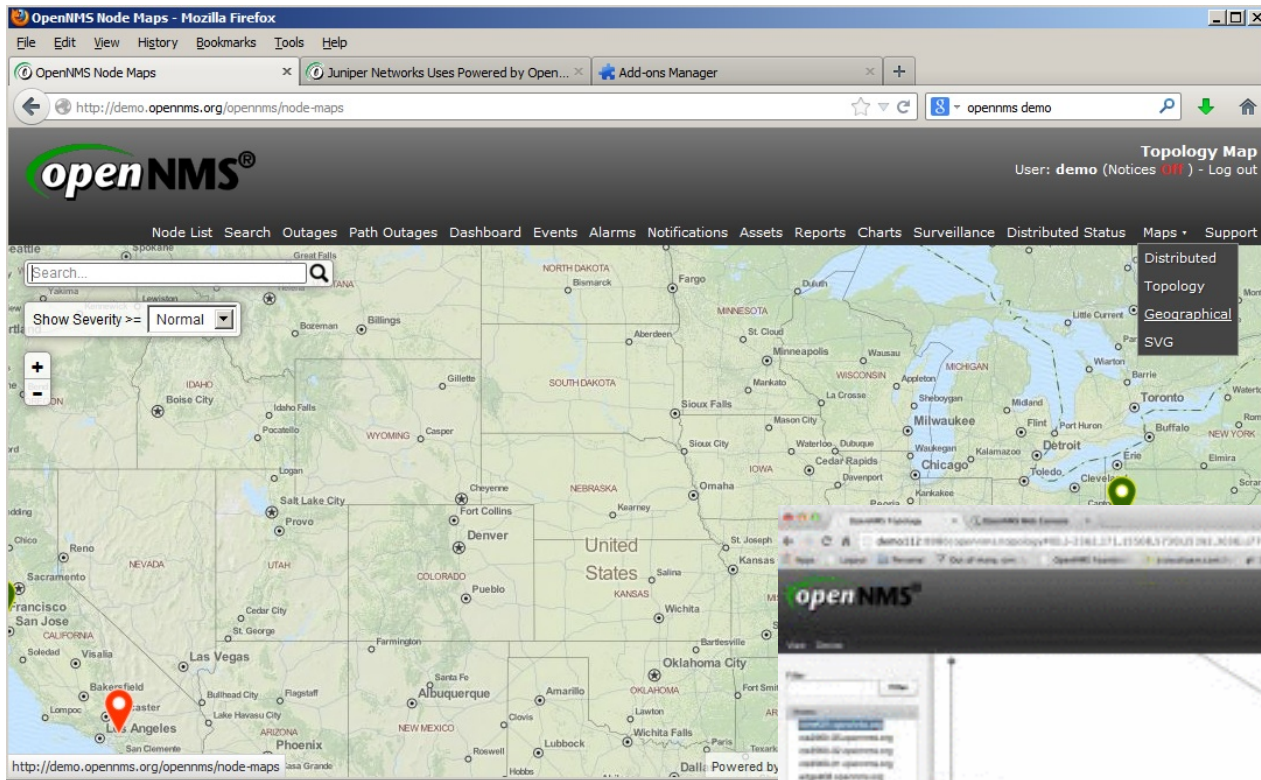
ID	SEVERITY	NODE	UEI	COUNT	LAST EVENT TIME	LOG MESSAGE
<input type="checkbox"/> 1046931	Minor	(AMA)DMTESTDB01VM	uei.opennms.org/nodes/dataCollectionFai	2	Jun 2, 2014 4:13:59 PM	SNMP data collection on interface

Rotating Wallboard display

(Boost priority for unacknowledged problems)

Maps & Topology

- **Geographical node map (using Google maps or Open Streetmap)**



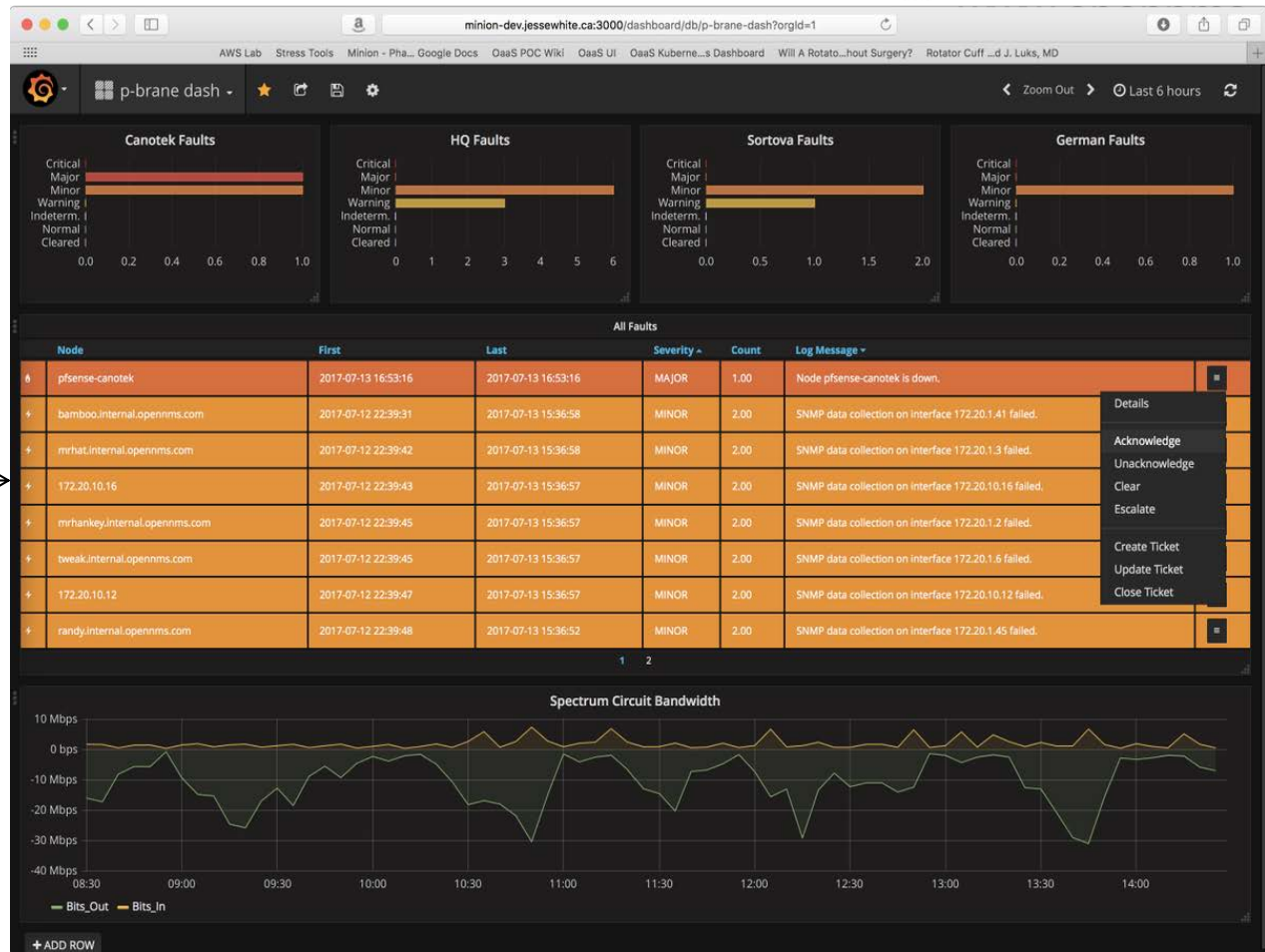
- **STUI Semantic Topology UI**
- **Allows users to semantically navigate between related nodes to diagnose problems**
- **Node relations are automatically discovered**

ReST API & tools to create your own dashboard

OpenNMS can work as a backend data collection engine for your own portal / UI or for integration with other systems

ReST API

- Performance Data
- Alarms / Situations
- Entities



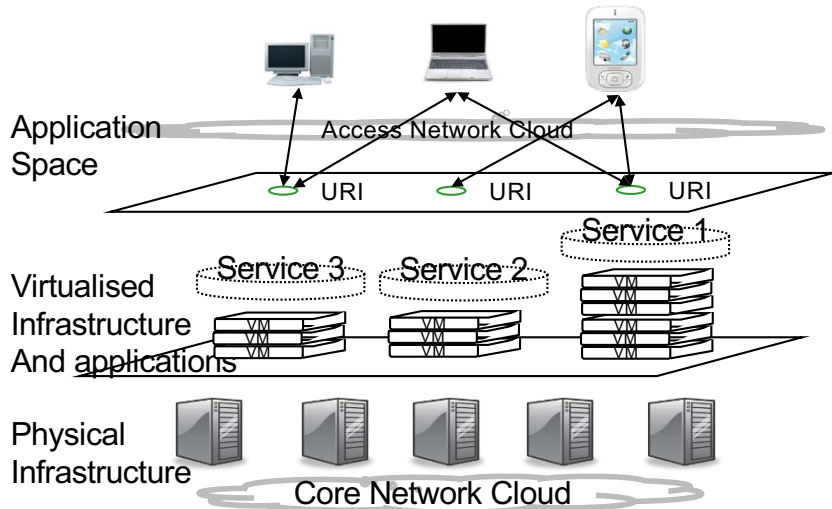
OpenNMS Core

Managed Services

Grafana Dashboard Code ;

<https://github.com/j-white/grafana-opennms-plugin/tree/master/opennms>

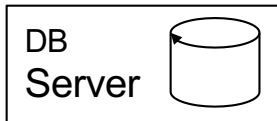
Business Service Monitoring



- Now able to model complete services and relationships between processes

ID	Severity	Node	UEI	Count	Last Event Time	Log Message

Load Balancer Nginx / Varnish



Application Specific Component's

Management Configuration



NAT / VPN Network

Common Component's

OpenNMS Compass

OpenNMS[®] Compass

An OpenNMS Mobile App by The OpenNMS Group, Inc.



About OpenNMS[®] Compass

OpenNMS Compass is a modern mobile iOS and Android client for OpenNMS[®] Horizon[™] and OpenNMS[®] Meridian[™] servers.

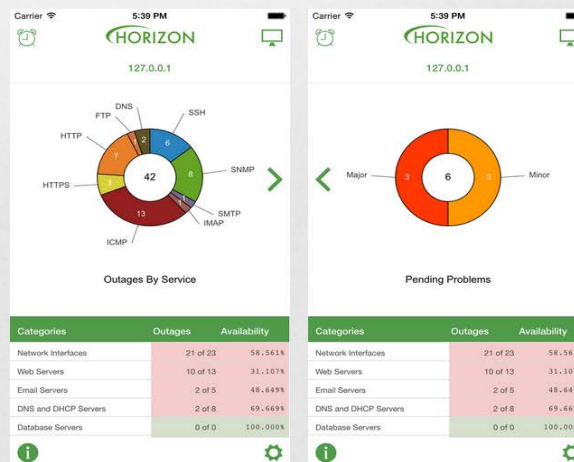
It provides a simple dashboard for viewing outage and alarm data, node details, and more.

Features

Outage and Alarm Dashboard

At a glance, you can see a summary of any current outages and services with pending problems. One tap will take you to a more detailed view of outages or alarms.

On supported systems^{*}, surveillance categories are also displayed, giving you quick access to availability just like your OpenNMS[®] Horizon[™] or OpenNMS[®] Meridian[™] server UI.



ANDROID



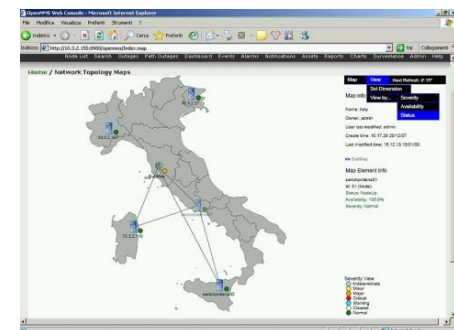
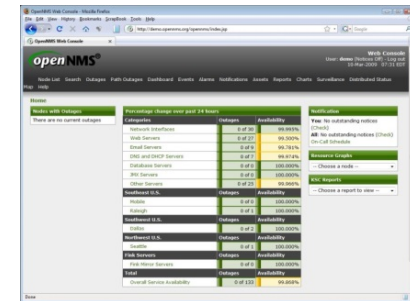
iPhone

Contents

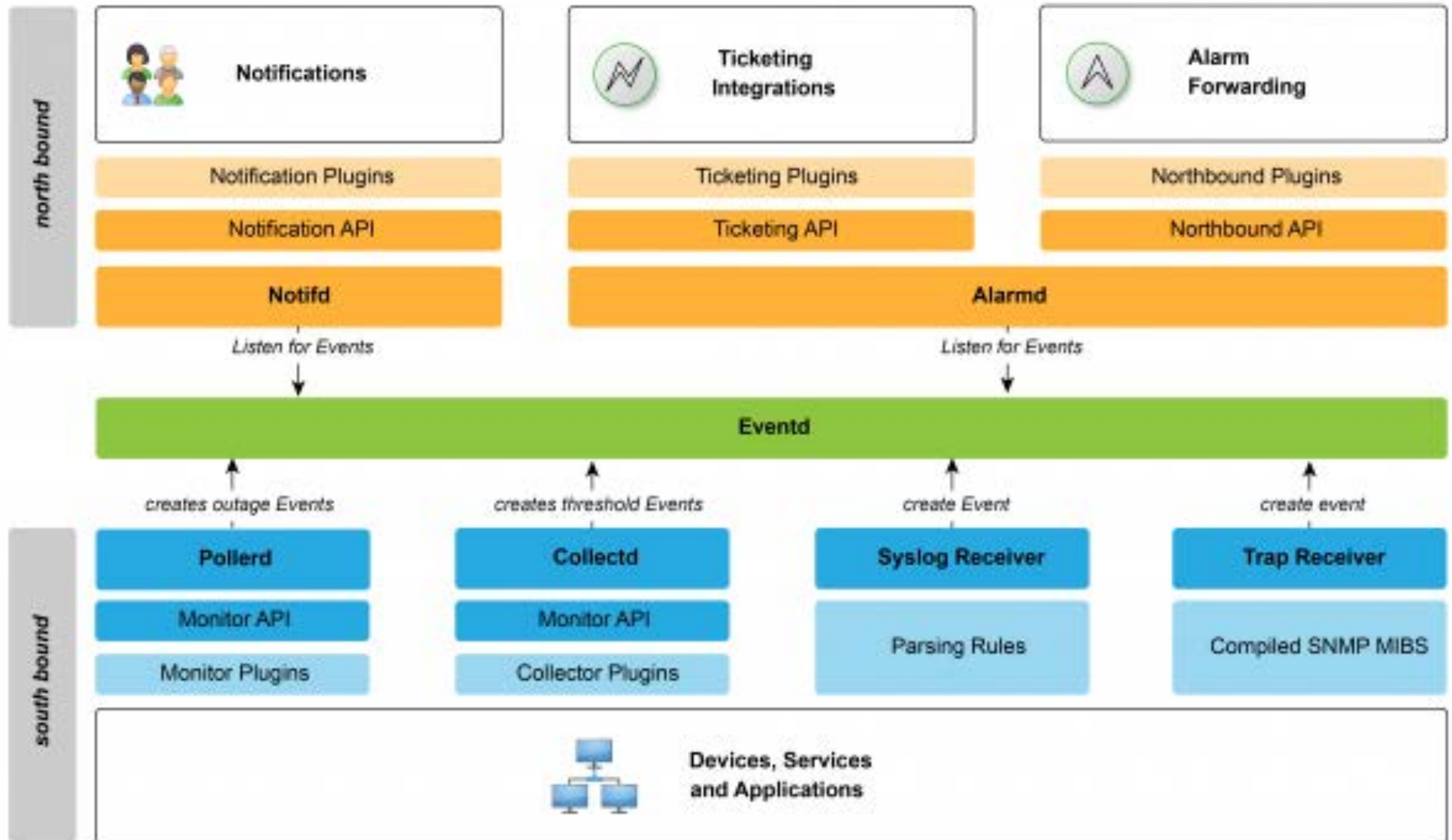
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OpenNMS Functional Overview

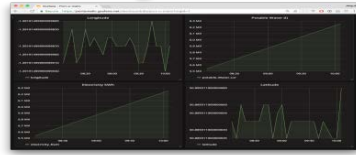
Future directions



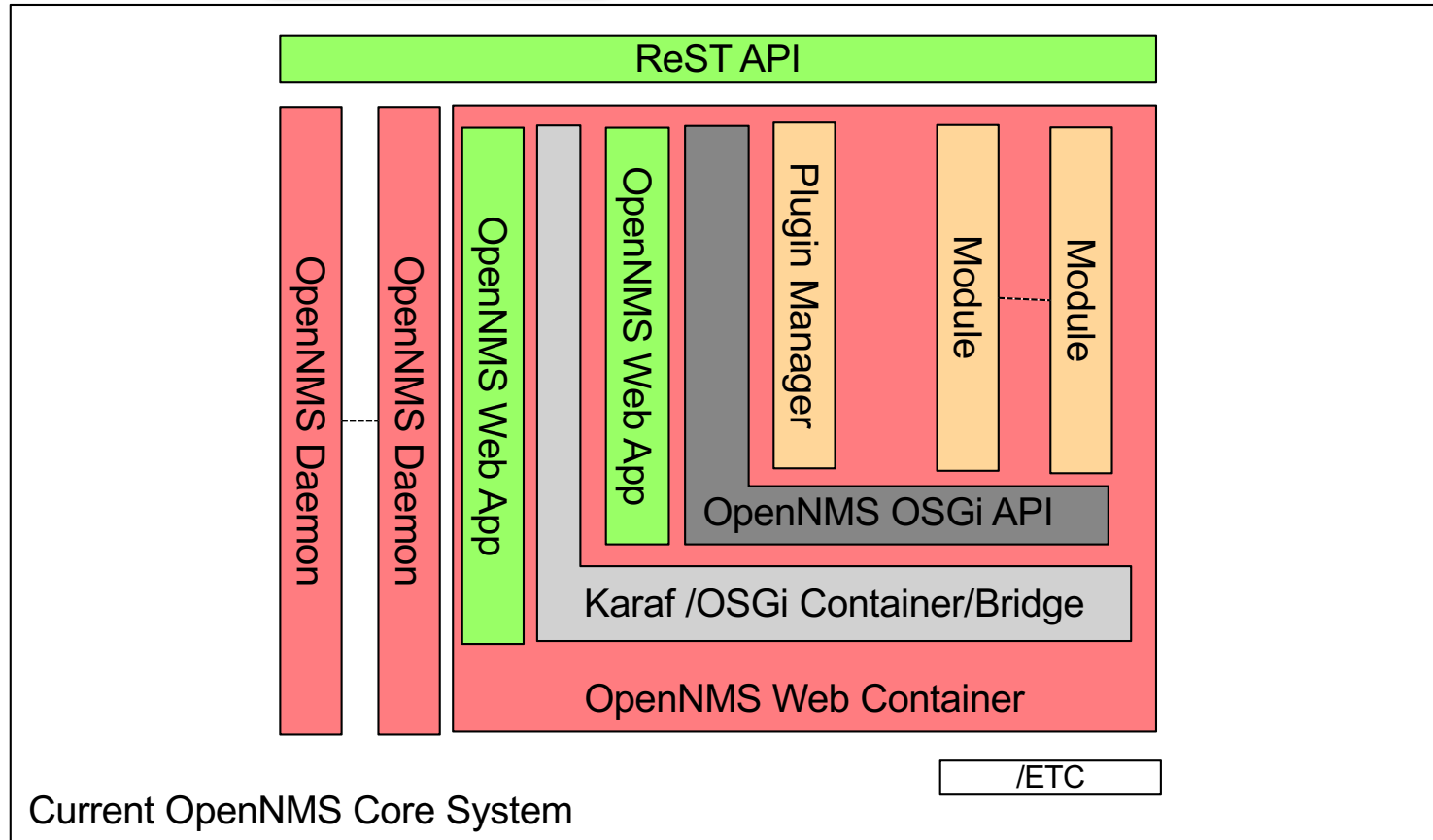
- plugin architecture



Current Core System



Grafana / Helm / Kibana
Data Visualisation



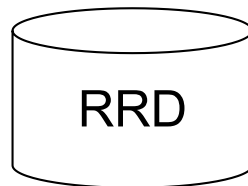
Performance Persistence

Configuration / Event Persistence

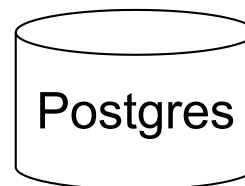
Cassandra



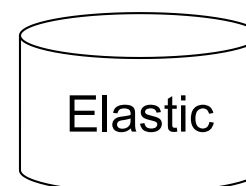
RRD



Postgres



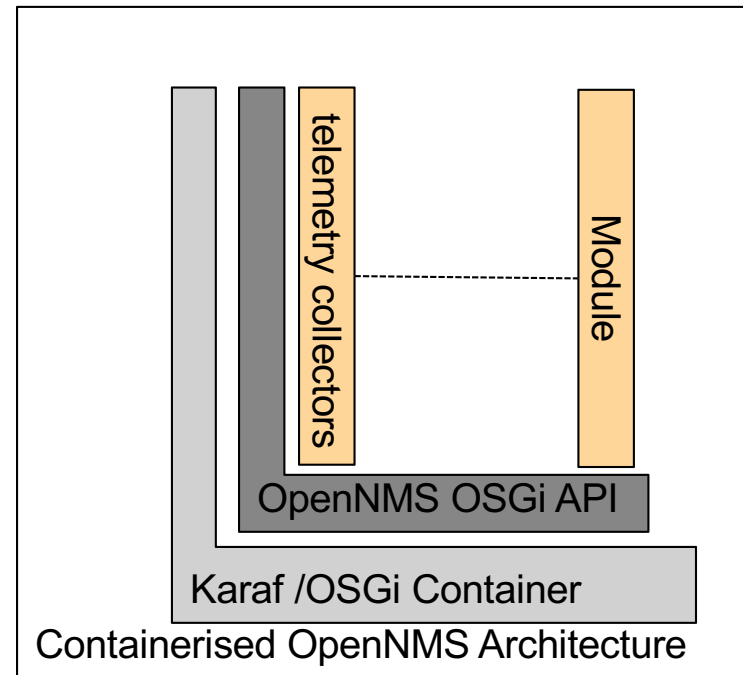
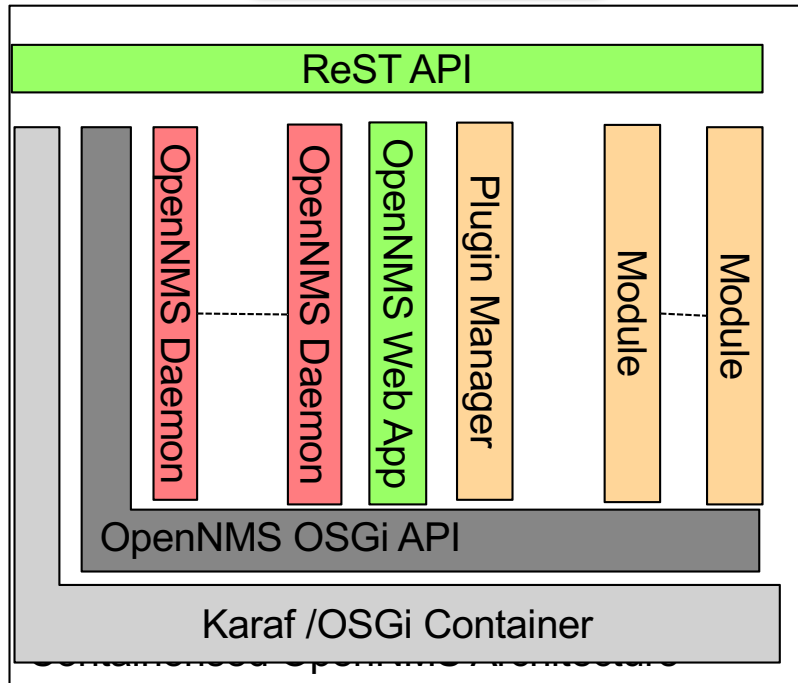
Elastic



Target System - Sentinel



Grafana / Helm / Kibana
Data Visualisation



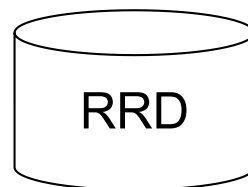
Kubernetes
or similar

- Functions determined by which modules run in container
- Containers Manager by kubernetes
- Configuration Persisted separately

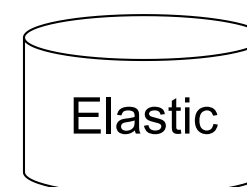
Messaging Layer (ActiveMQ/Camel/Kafka/Protobuf)

Performance Persistence

Cassandra

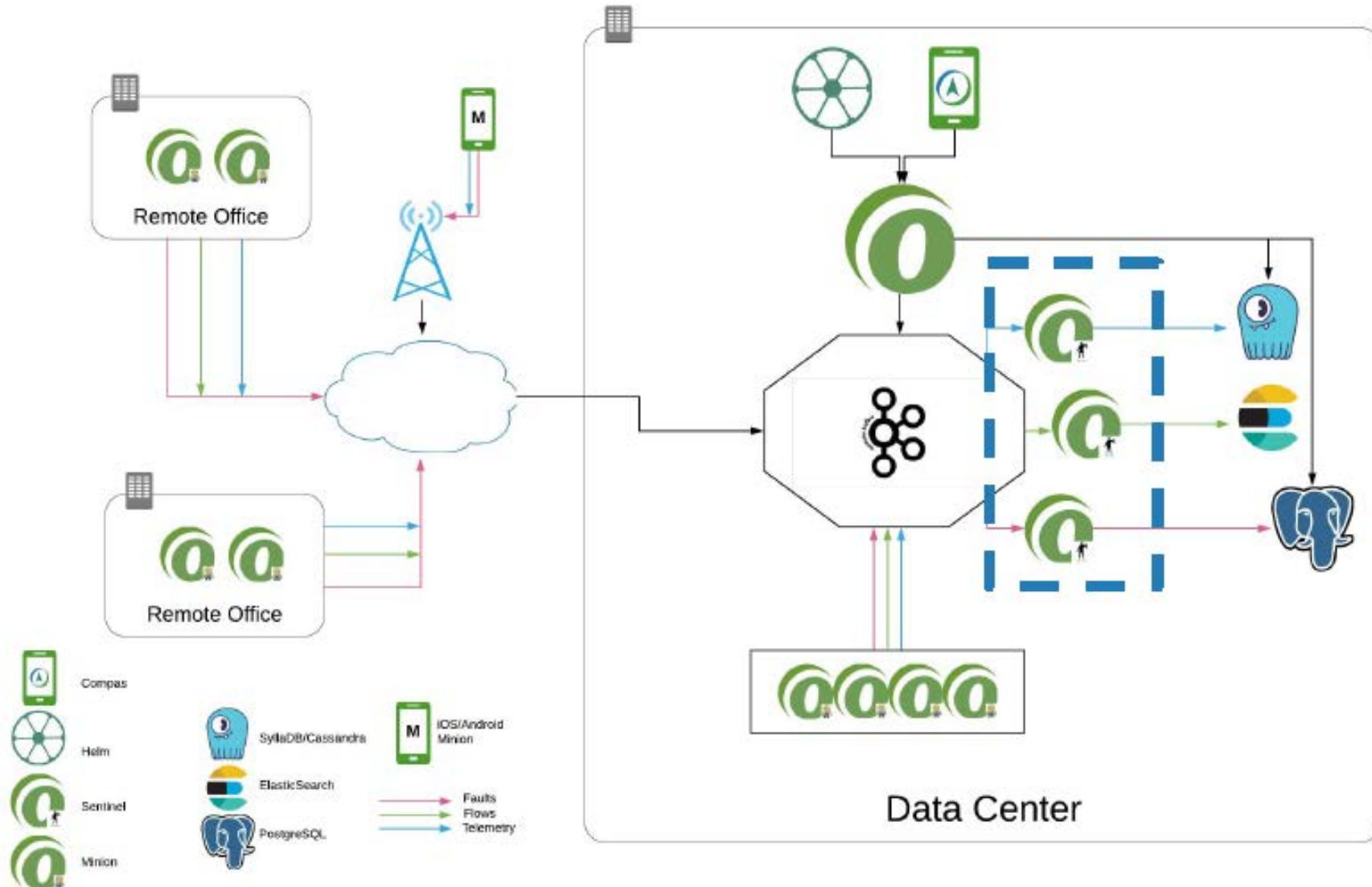


Configuration / Event Persistence



(We are also investigating alternative cloud persistence strategies)

- sentinel allows distributed OpenNMS connected through kafka



Roadmap to OpenNMS as a Service

/OaaS ROADMAP

MINION

HORIZON 19

Enables monitoring from the Cloud and eliminates complexities with VPNs and duplicate IPs in private IP networks.

FEB '17

HELM

HORIZON 21

APIv2 for OaaS Console

JUN '17

OCT '17

APR '18

DRIFT

HORIZON 22

Network Traffic Analysis and DeepDive Tool

MAY '18

OCT '18

Alec

SEXTANT

HORIZON 24

Spacial Temporal Correlation

DEC '18

MAR '19

ELASTICSEARCH

HORIZON 20

Big Data Forensics Storage

STREAMS

HORIZON 21.1.0

Support for OaaS Timeline, Realtime Analytics, and OEM Integration

SENTINEL

HORIZON 23

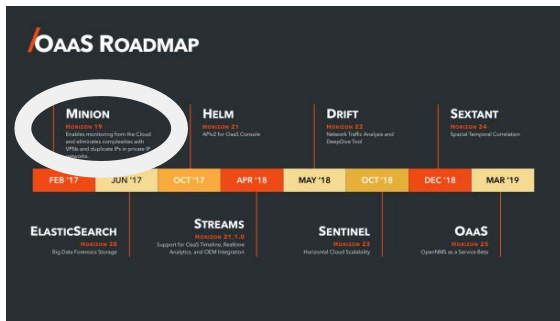
Horizontal Cloud Scalability

OaaS

HORIZON 25

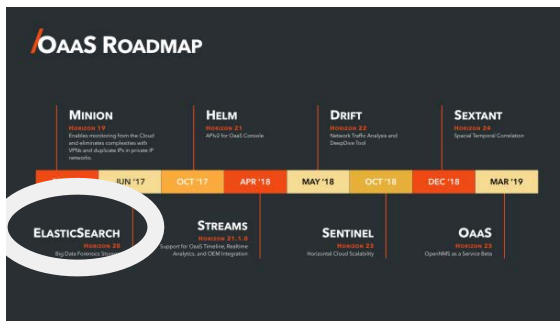
OpenNMS as a Service Beta

Roadmap Details



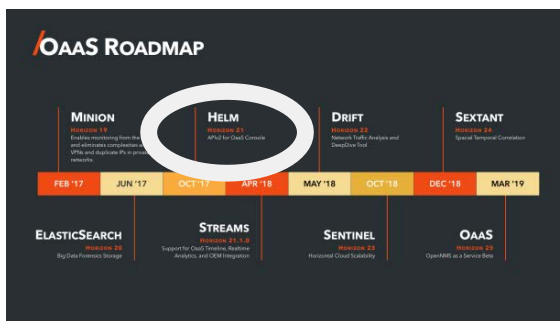
- **Minion**

- Karaf OSGi based remote polling and data collection which can be offered on stand alone hardware or embedded in a cloud environment. We are integrating this with hardware provided by Netgate which also hosts the pfsense firewall. This introduced both distribution and scalability to OpenMMS and the ability to control other applications hosted in Karaf remotely.



- **Elastic search**

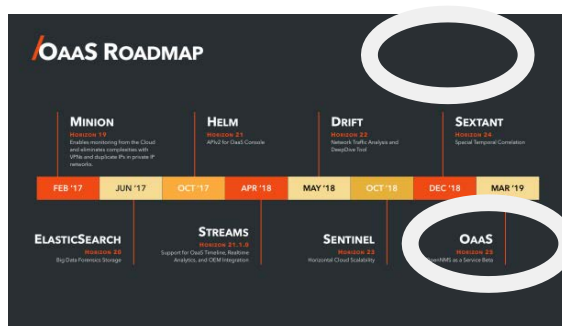
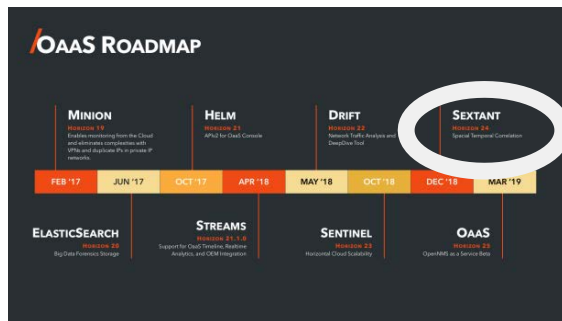
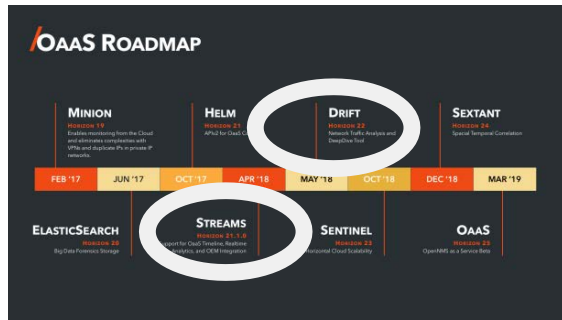
- Improve the ability to use Elastic search to store events alarms and streaming telemetry data (Netflow etc). IN combination with Cassandra, this makes our back end data storage highly scalable and searchable.



- **Helm**

- Grafana based dashboard plugin which allows multiple OpenNMS systems or partitioned views to be displayed on a single dashboard of fault and performance data. This uses the OpenNMS ReST API.

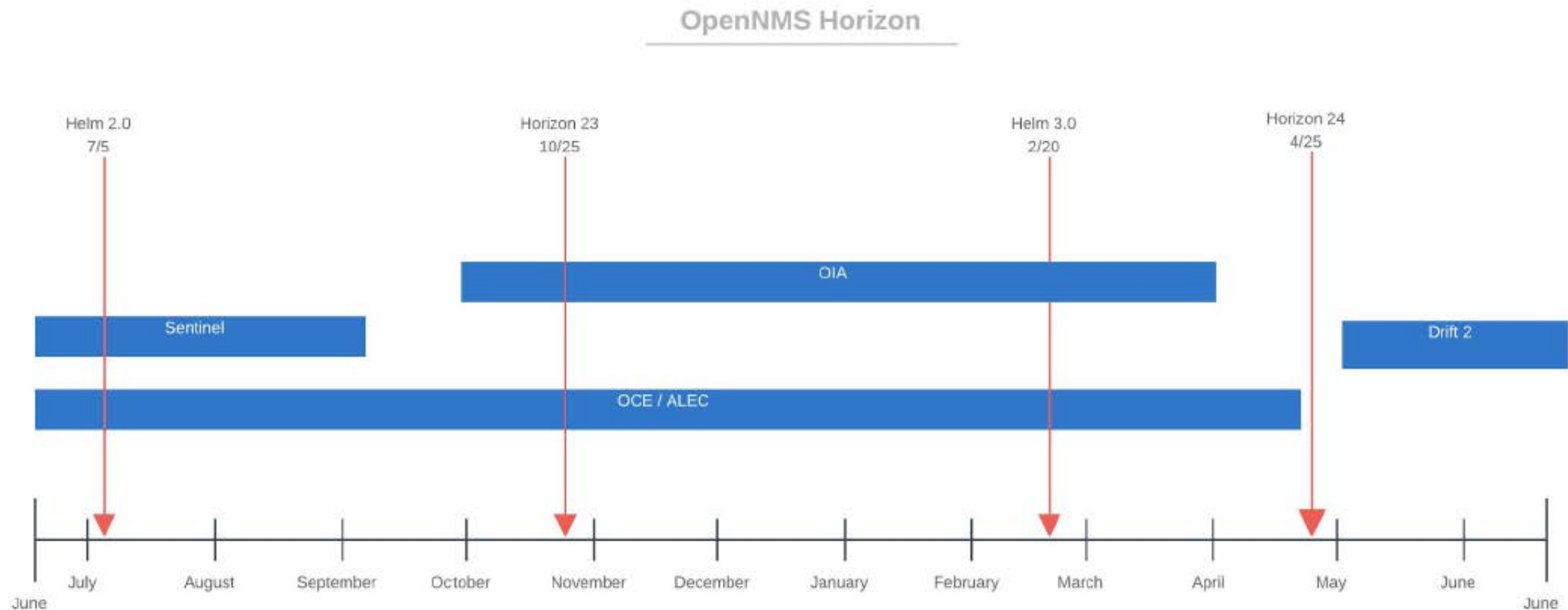
Roadmap Details 2



- **Streams**
 - Remote (minion based) streaming telemetry data collectors .
- **Drift**
 - Collecting Netflow, JFlow, SFlow, and steaming telemetry. Advanced visualisation and data analytics of performance data
- **Sentinel**
 - Sentinel is completion of the re-packaging all of the OpenNMS daemons as Karaf (OSGi) hosted services. This allows OpenNMS components to be deployed as highly scalable micro services in docker containers.
 - Demonstrated key components architecture using Kubernetes and Amazon containers at the Redhat Developers conference.
 - Currently targeted at commercial cloud providers (e.g. AWS) but offers an opportunity to explore deploying OpenNMS as an NFV in an architecture such as ONAP if we find a service provider partner.
 - publishing of inventory, faults, and performance metrics to Kafka topic for Sentinel and other integrations
- **ALEC Architecture for learning enabled correlation**
 - Advanced correlation and AI based fault and performance analytics
- **OaaS - OpenNMS as a service**
 - Fully cloud deployable multi tenanted network management solution with remote appliances which can be deployed to users physical sites for data collection.

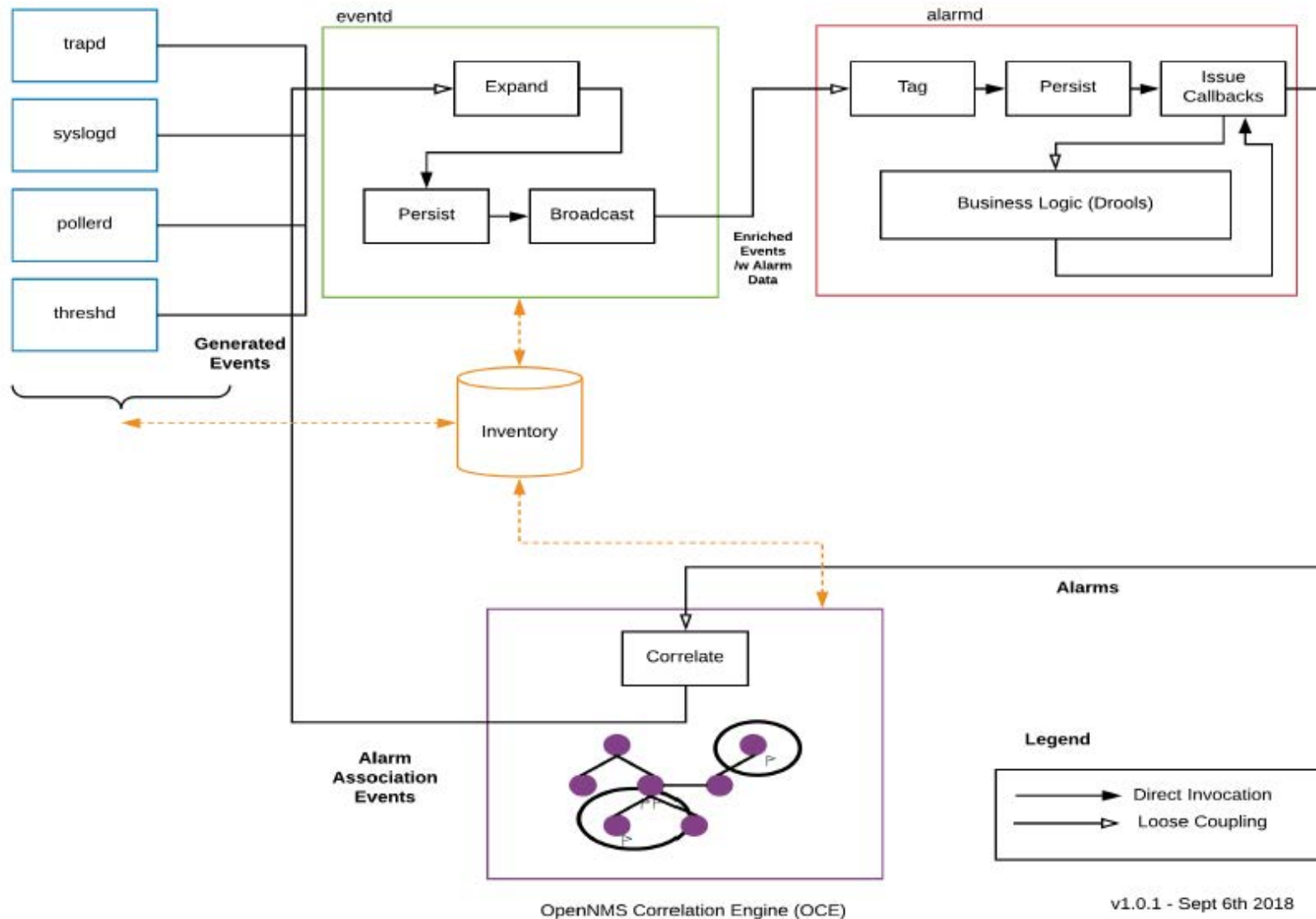
Immediate Releases

- **OIA OpenNMS Integration Architecture**
 - OSGI plugin architecture and stable api
- **Helm - Grafana**
 - Performance, Events, Correlated alarms
- **ALEC – correlation**
 - correlation api; time / topology based correlation / machine learning (tensor flow)

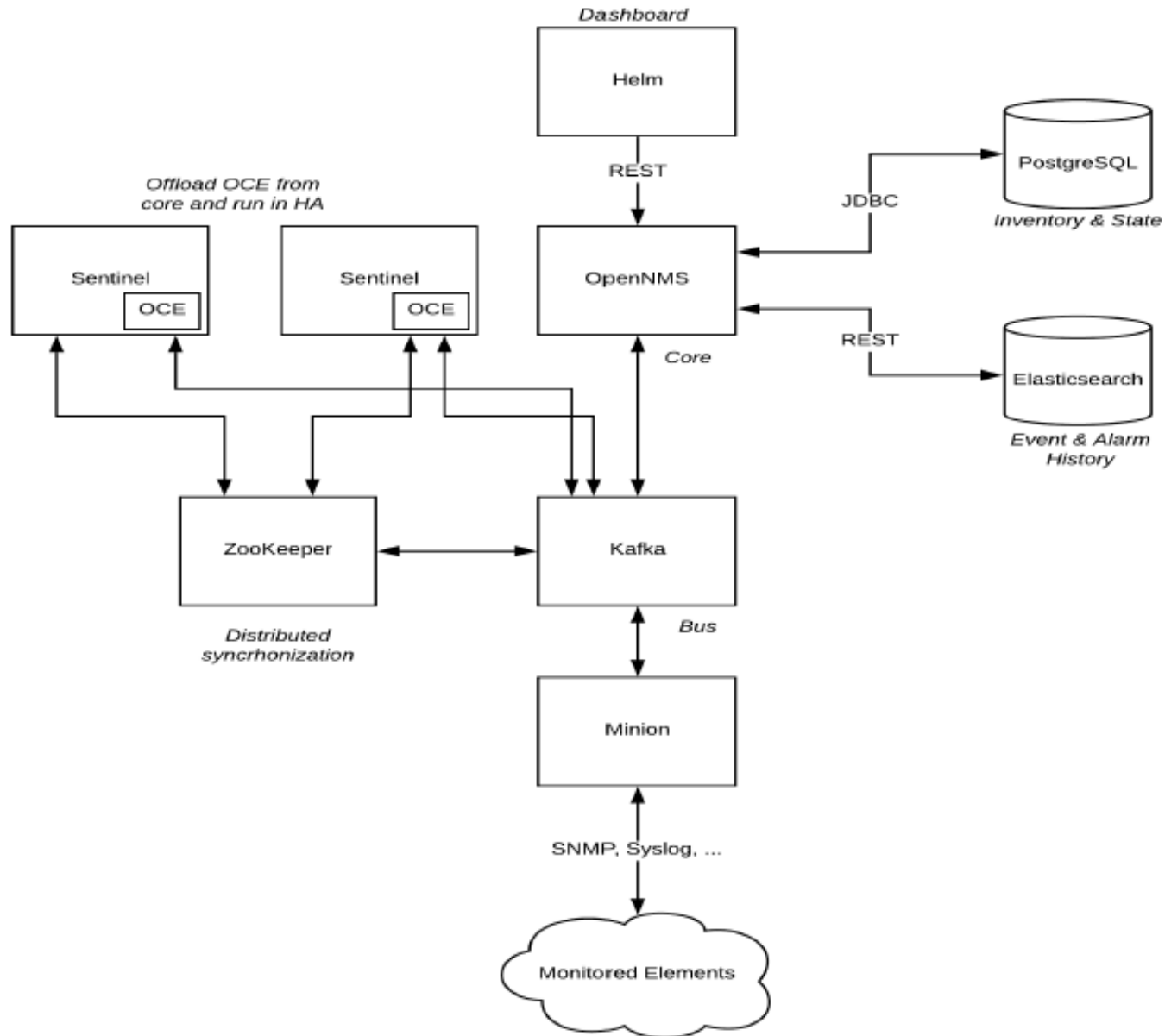


ALEC Architecture for learning enabled correlation

Lifecycle and Correlation

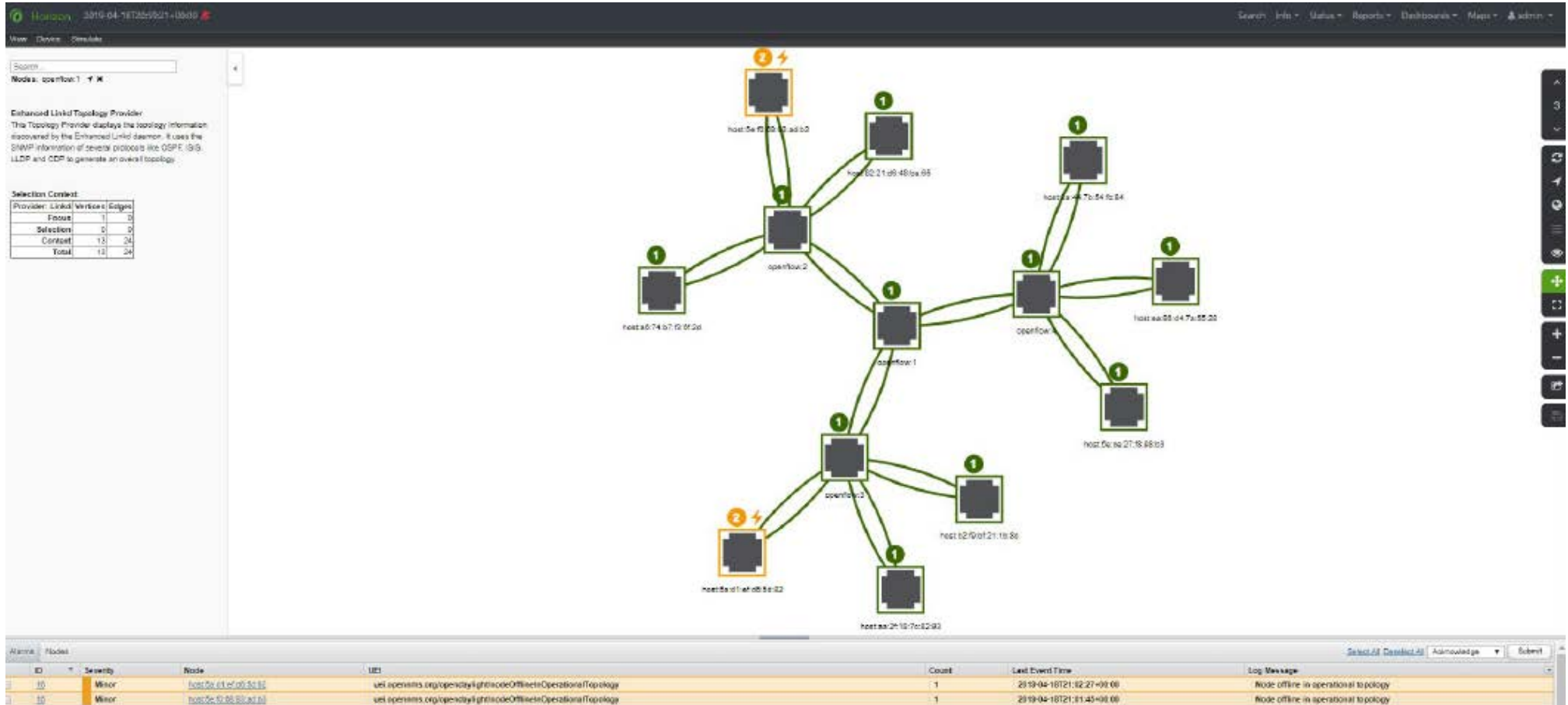


ALEK Distributed install



OpenDaylight integration

- **XX**



The screenshot displays the OpenNMS web interface. On the left, there is a sidebar with a search bar, a 'Nodes: openflow:1' indicator, and a table titled 'Selection Context'.

Provider	Link	Vertices	Edges
Focus	1	0	0
Selection	0	0	0
Context	13	24	0
Total	13	24	0

The main area shows a network topology diagram with nodes labeled 'openflow:1' and 'openflow:2'. Nodes are connected by green lines. Some nodes have status indicators: a lightning bolt in a yellow circle (2) and a green circle with '1'. The nodes are labeled with IP addresses: host:54:fd:02:02:ad:b0, host:02:21:d9:46:0a:95, host:a4:7a:54:0a:54, host:a0:03:d4:7a:02:20, host:0a:0a:27:18:88:03, host:02:19:0f:21:1a:88, host:a0:24:1b:7c:02:93, and host:a0:74:b7:12:0f:2d.

At the bottom, an 'Alarms' table is visible:

ID	Severity	Node	URL	Count	Last Event Time	Log Message
10	Minor	host:0a:01:c7:00:5c:13	url:opennms.org/openid4glt/nodeOffline/OperationalTopology	1	2019-04-18T21:52:27+00:00	Node offline in operational topology
10	Minor	host:5e:52:86:83:ad:b1	url:opennms.org/openid4glt/nodeOffline/OperationalTopology	1	2019-04-18T21:51:45+00:00	Node offline in operational topology

- **1. A solution for IoT Systems Monitoring**
 - Already monitoring large IoT Systems
 - Sensus – wireless IoT networks in UK
- **2. OpenNMS as a Platform for IoT Applications**

VERTICALISED SOLUTIONS



Applications
Visualisation



SERVICE PLATFORMS



Data Storage Processing
Alerting
Analytics Security



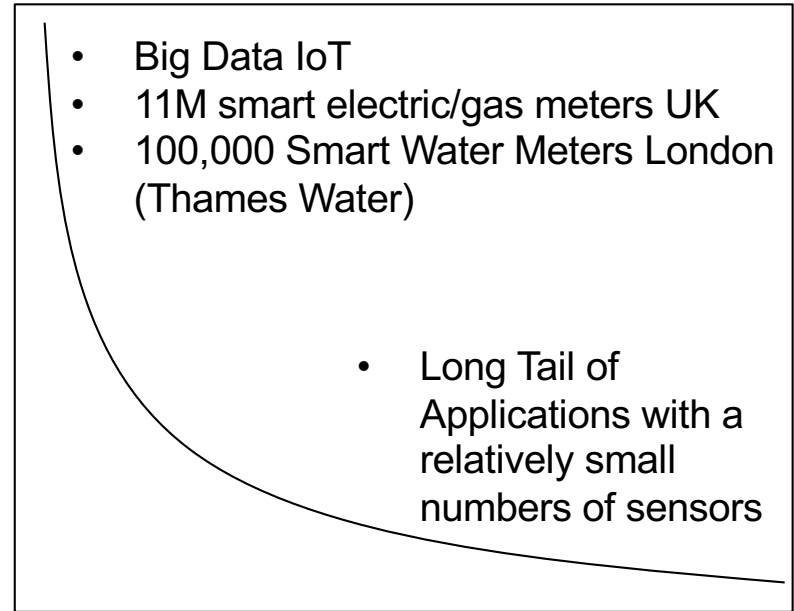
Connectivity
Wifi / LTE / 5G /
LoRaWan



Devices
(Device Platforms)



SERVICE LAYERS



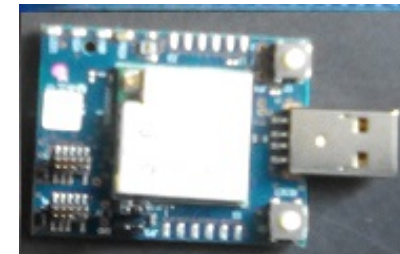
OpenNMS could find a role in the long tail of applications proven and (relatively) simple to deploy solution

Case Study – Monitoring Tailings

- Herb Garcea Insitu Systems, Inc.
- www.insitusys.com



- **Mine tailings**
 - are the ore waste of mines, and are typically a mud-like material. Worldwide, the storage and handling of tailings is a major environmental issue. Many tailings are toxic and must be kept perpetually isolated from the environment.
 - <https://www.nps.gov/articles/aps-v13-i2-c8.htm>
 - Series: Alaska Park Science - Volume 13 Issue 2: Mineral and Energy Development Long-term Risk of Tailings Dam Failure



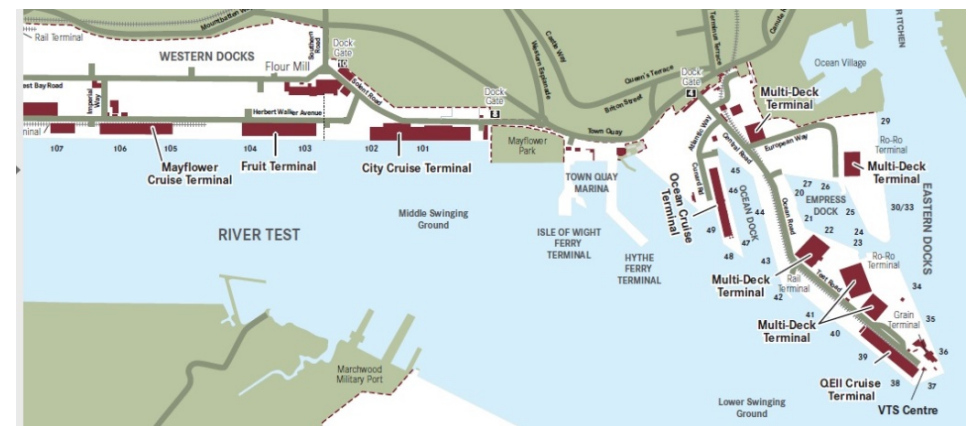
Case Study

Southampton Air Pollution Monitoring

- The UK's number one cruise port, which welcomes 1.7m passengers
- Each ship up to 6000 passenger and crew
- Ship turn around 1-2 days
- Increasing problem of air pollution due to generators running while ships in port



- www.climateconversations.org.uk
- Nesta funded project managed by
- Mandi Bissett
- opennms.computenodes.net/grafana



Joining the OpenNMS Community

- **Download and test latest OpenNMS Horizon 17+**
- **Try against your network**
 - Large scale data centre time series data
- **Research partners – labs / universities**
- **Give it a go**
 - <http://opennms.org> – Project site
 - <http://opennms.co.uk> – UK / Ireland specific information
 - LinkedIn OpenNMS group

