
openNMS®


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Who am I

Ronny Trommer

Ausbildung Fachinformatiker - Systembetreuung

Studium Hochschule Fulda - Schwerpunkt Telekommunikation

Angestellter bei einem ISP in Fulda mit Schwerpunkt “Monitoring as a Service”

Ehrenamtliche Mitarbeit im Projekt OpenNMS

Mitgründer OpenNMS Foundation Europe e.V.

Seit 2011 für OpenNMS Group tätig

Office in Stuttgart / Zuffenhausen

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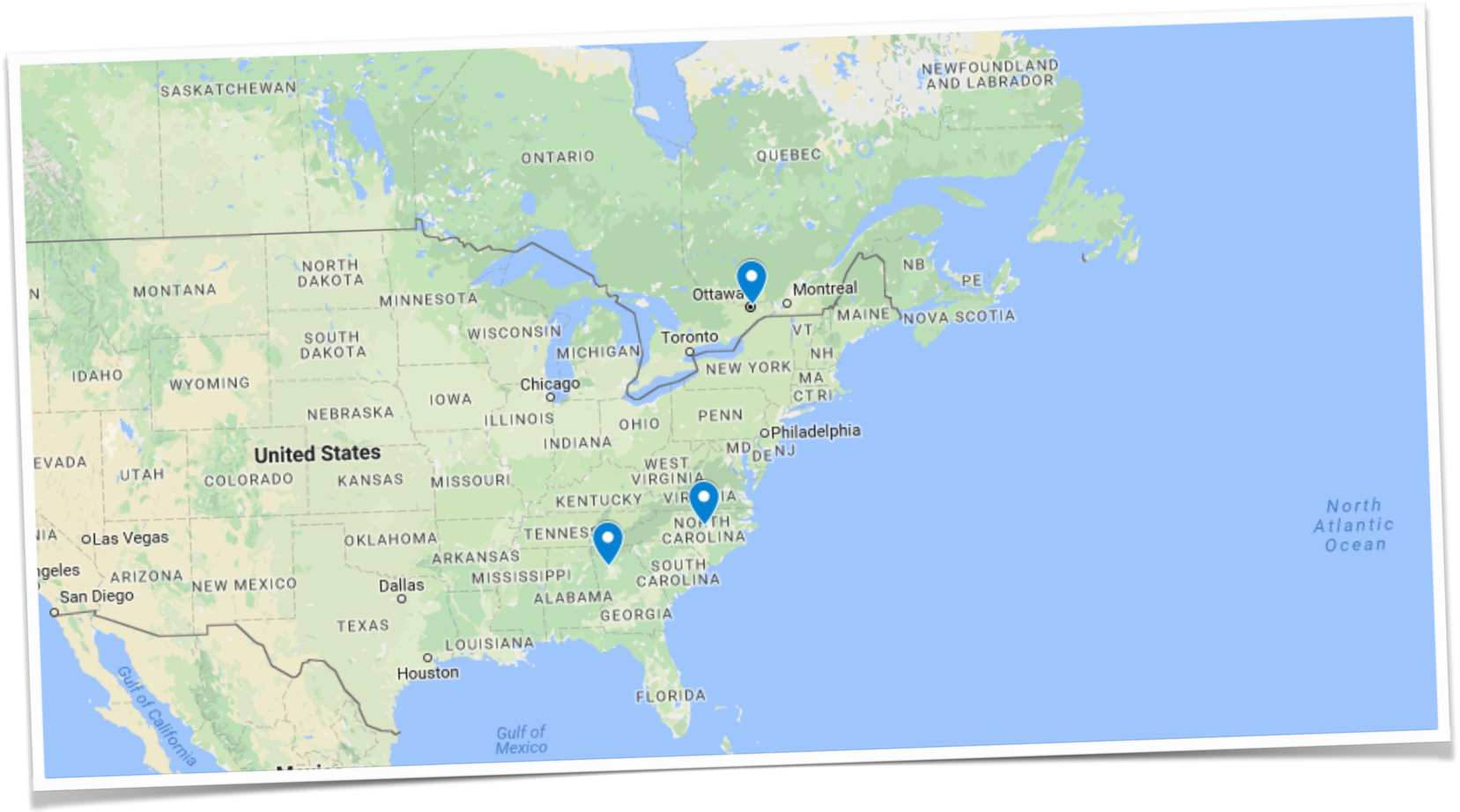
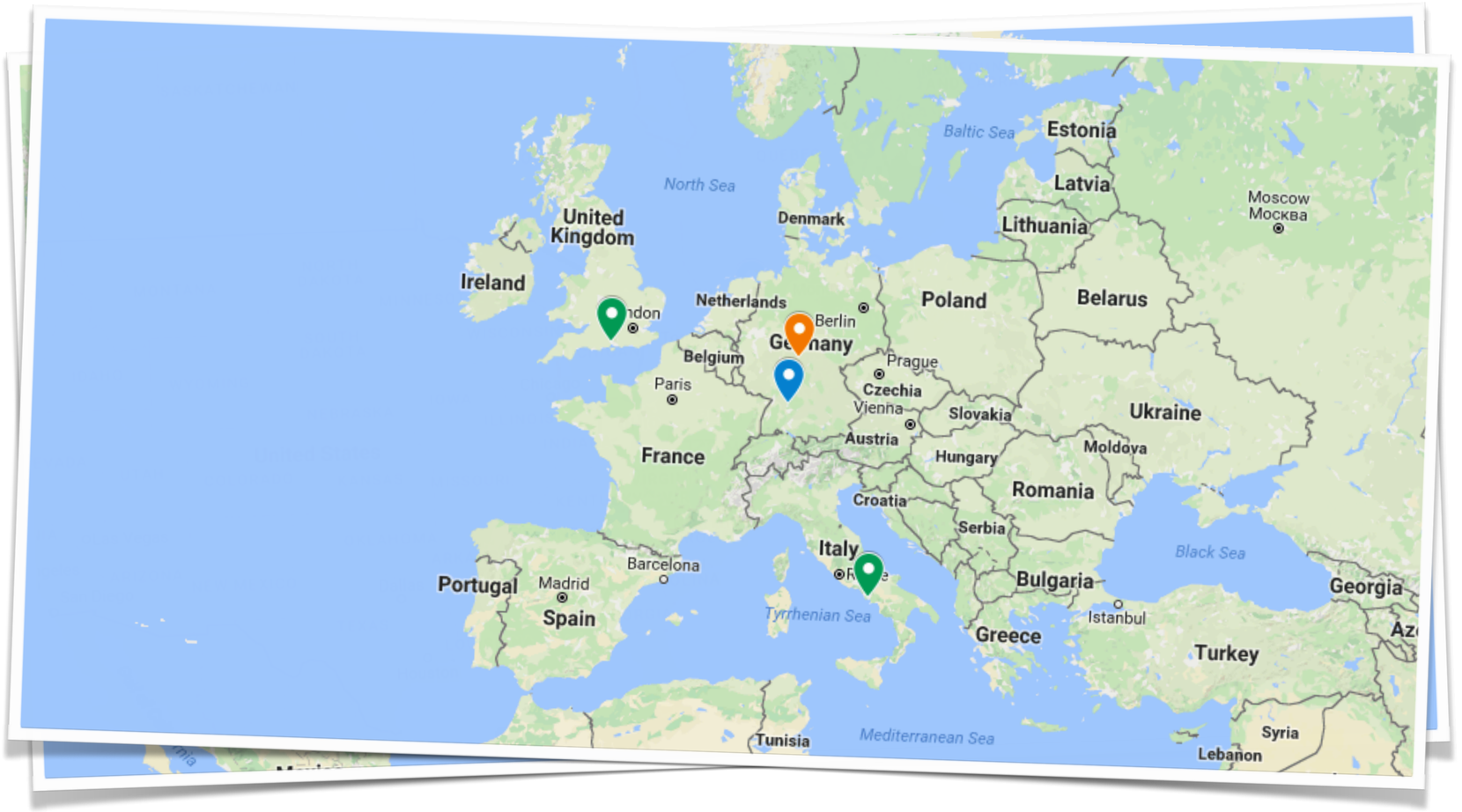
The OpenNMS Group (TOG)



HQ in Raleigh Durham Area

Offices in Atlanta and Ottawa

The OpenNMS Group (TOG)



OpenNMS Office in Stuttgart

Partner

- entimOSS in UK
- ARS Informatica Italy

Dienstleister

- NETHINKS GmbH in Fulda

Open Source und Business

- Veröffentlichung von zwei Distributionen Horizon und Meridian
- Entwicklung neuer Features für unsere Kunden unter AGPLv3 Lizenz in Horizon
- Support für den Betrieb in Kommerziellen Umgebungen
- Training und Schulungen
- Professional Services
- Meridian als Long Term Support version ist als Subscription erhältlich

Open Source und Business

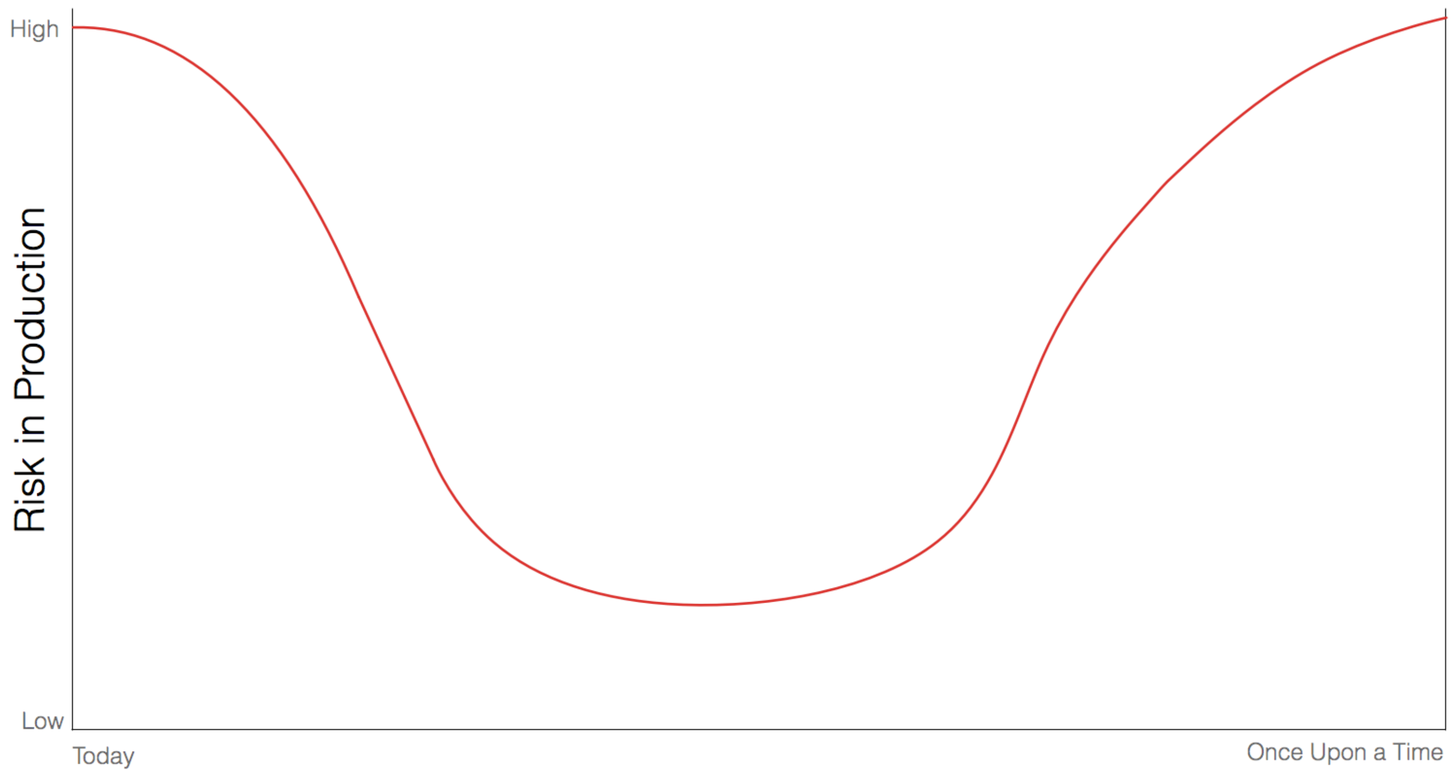
HORIZON openNMS®

- 100% Open Source - AGPLv3
- Software Innovation
- “Release Early, Release Often”
- Contribution License Agreement
- ~ 3 - 6 Monate Major Release
- vergleichbar mit “Fedora”
- Hat mehr und neuere Features als Meridian

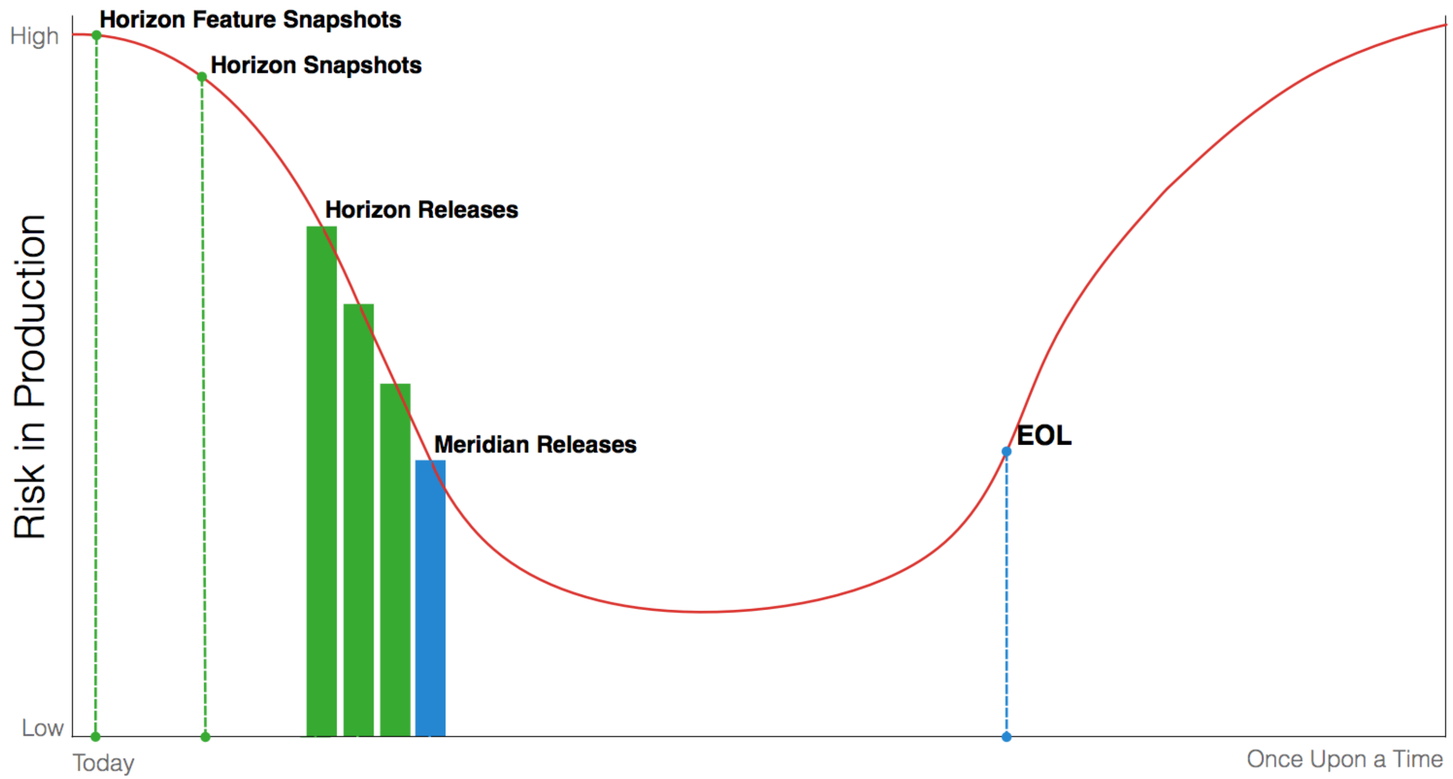
MERIDIAN openNMS®

- 100% Open Source - AGPLv3
- Proprietäre Lizenz möglich
- Long Term Support
- Packages erhältlich als jährliche Subscription
- ~ 12 Monate Major Release
- von Features in Meridian sind eine ***echte Teilmenge*** der Features von Horizon

HORIZON openNMS® VS. MERIDIAN openNMS®



HORIZON openNMS® VS. MERIDIAN openNMS®



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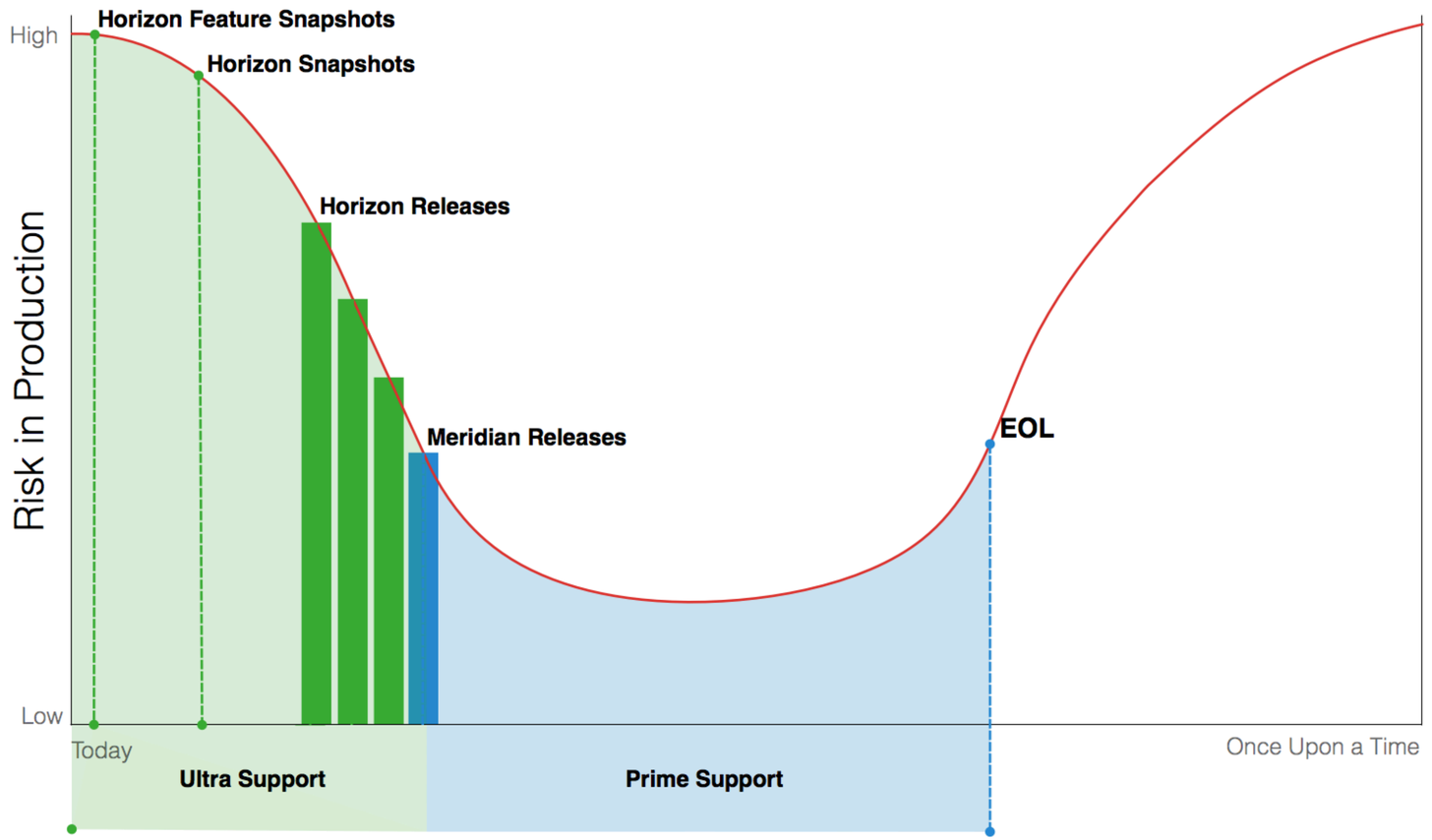

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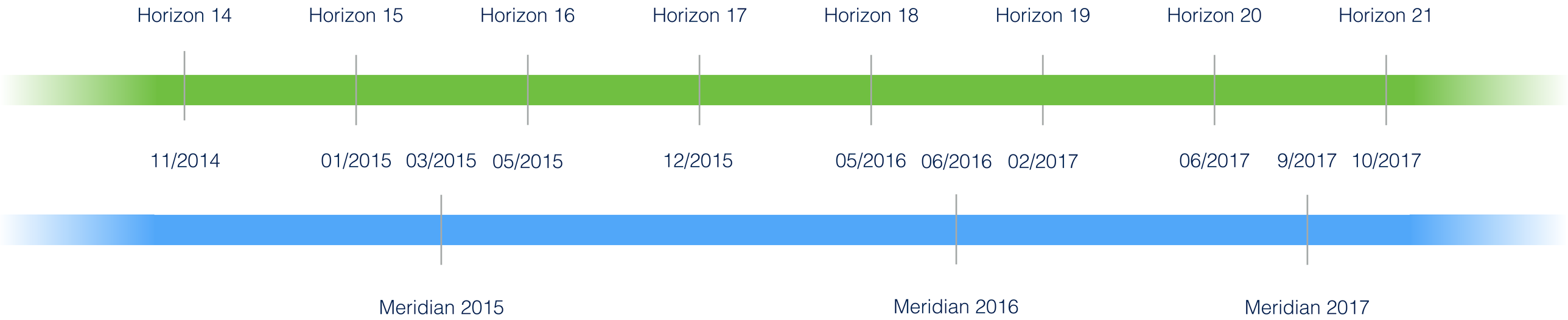


ULTRA Support

- Antwortzeit: 24 h
- Dringend: 4 hrs
- Anwendungsausfall: 4 hrs
- 24/7 ist Optional
- Unbegrenzte Anzahl Tickets
- OpenNMS consultant
- Entwicklersupport

HORIZON openNMS®

MERIDIAN openNMS®

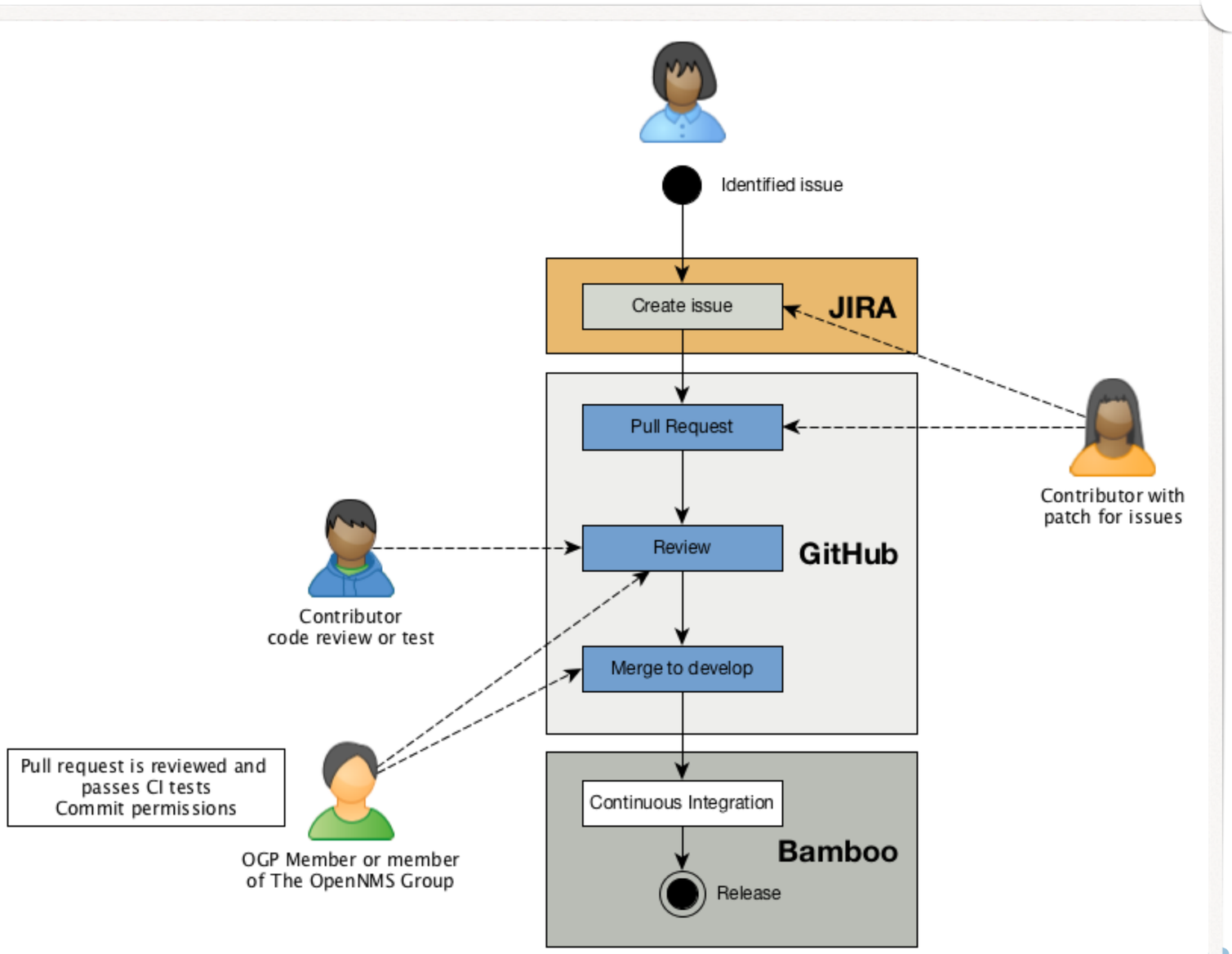
PRIME Support

- Antwortzeit: 24 h
- Dringend: 4 hrs
- Anwendungsausfall: 4 hrs
- 24/7 ist Optional
- Unbegrenzte Anzahl Tickets
- Self-Support connect.opennms.com

MERIDIAN openNMS®

Über das Projekt

- Registriert am 29.03.2000 auf SourceForge
- Netsaint später umbenannt nach Nagios wurde am 10.01.2000 registriert
- Lizenz wurde von GPL 2 auf AGPLv3
- Entwicklung öffentlich auf GitHub und managed in JIRA
- 65 nehmen an der Entwicklung aktiv teil
- > 1600 closed Pull Requests
- > 39.000 Commits

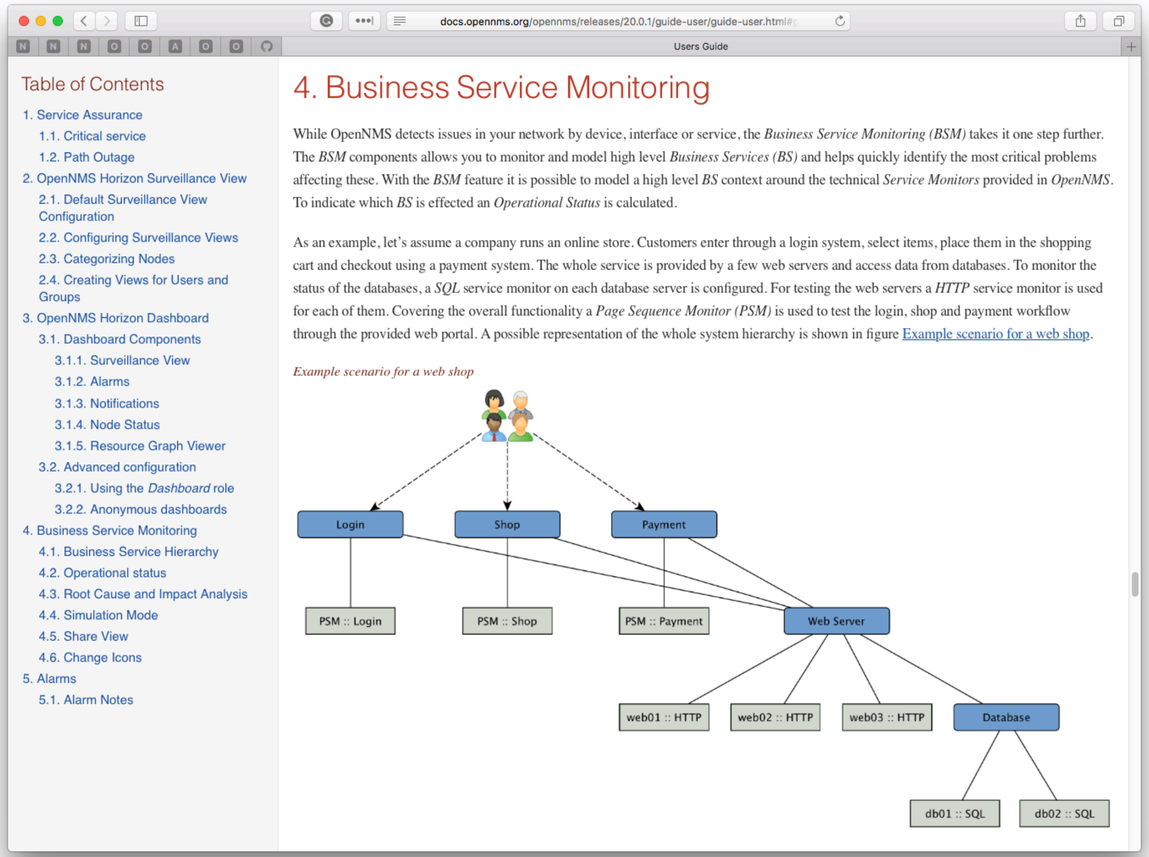


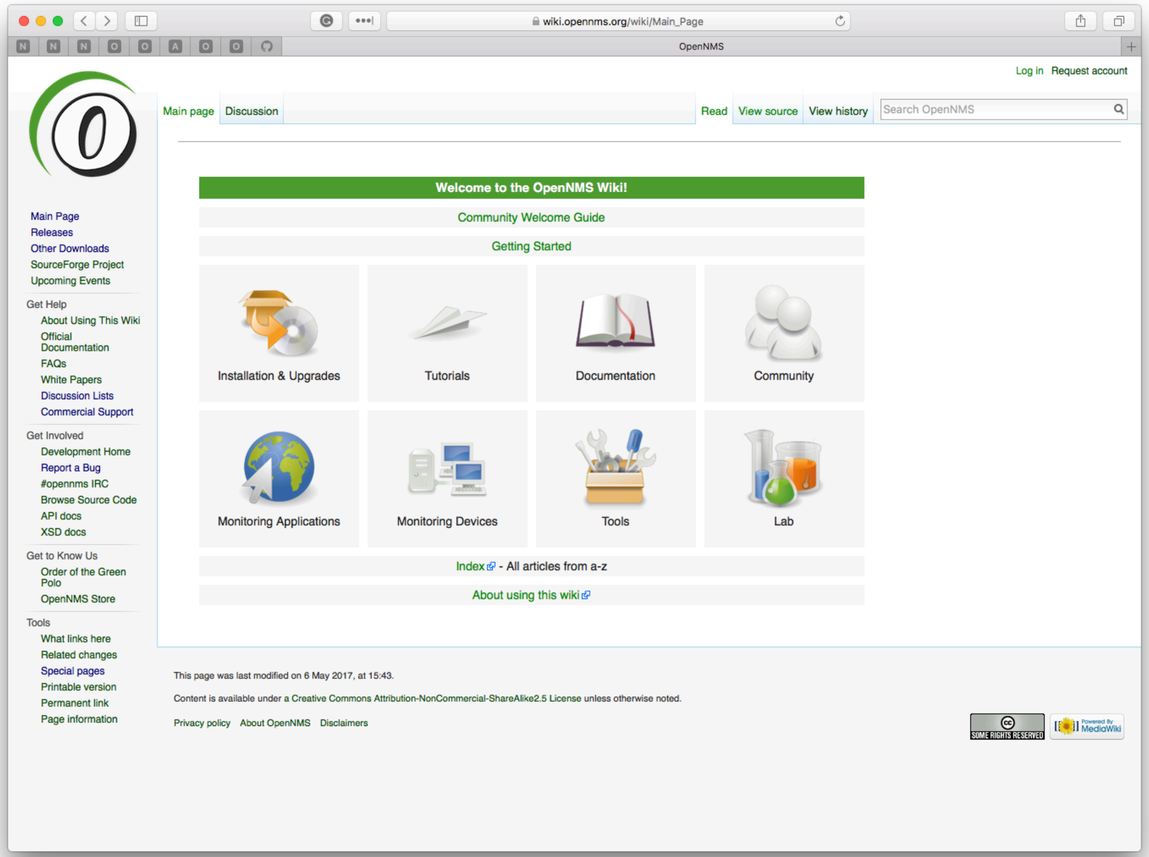
https://issues.opennms.org

https://github.com/opennms/opennms

https://bamboo.opennms.org

Dokumentation

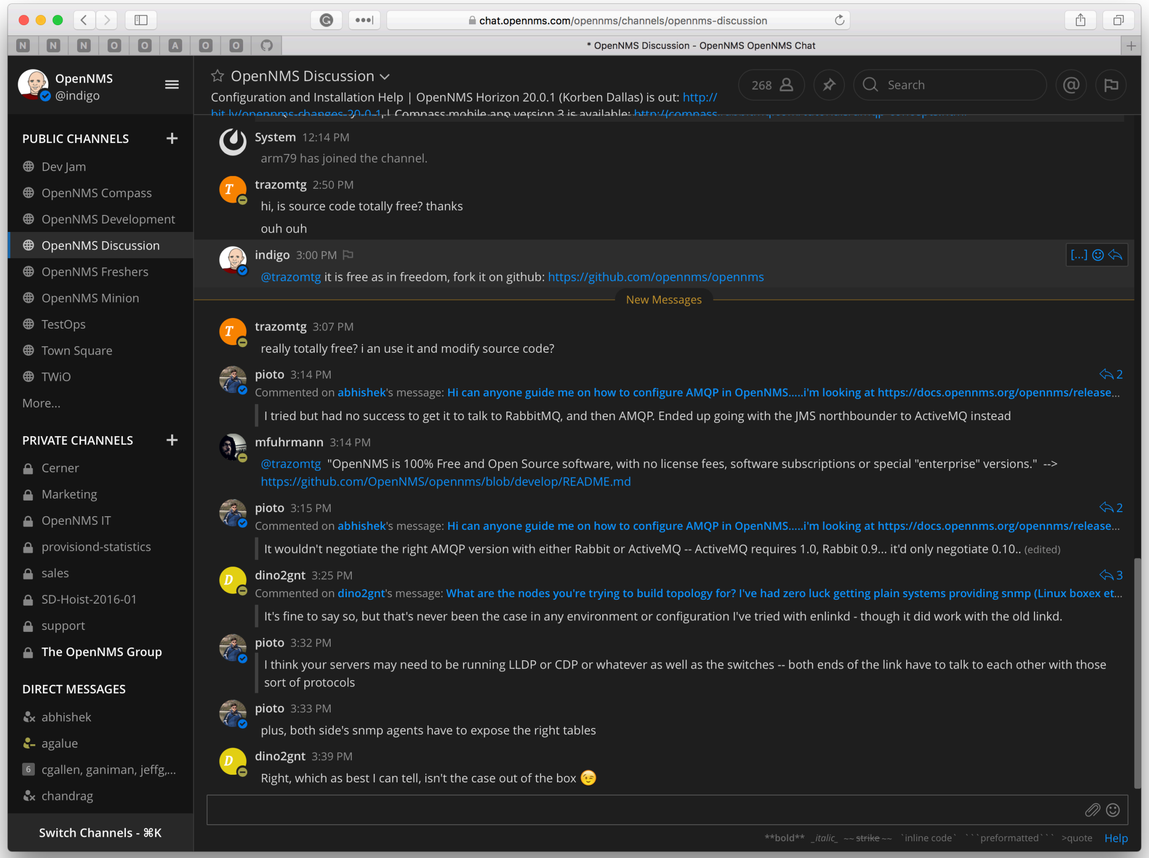


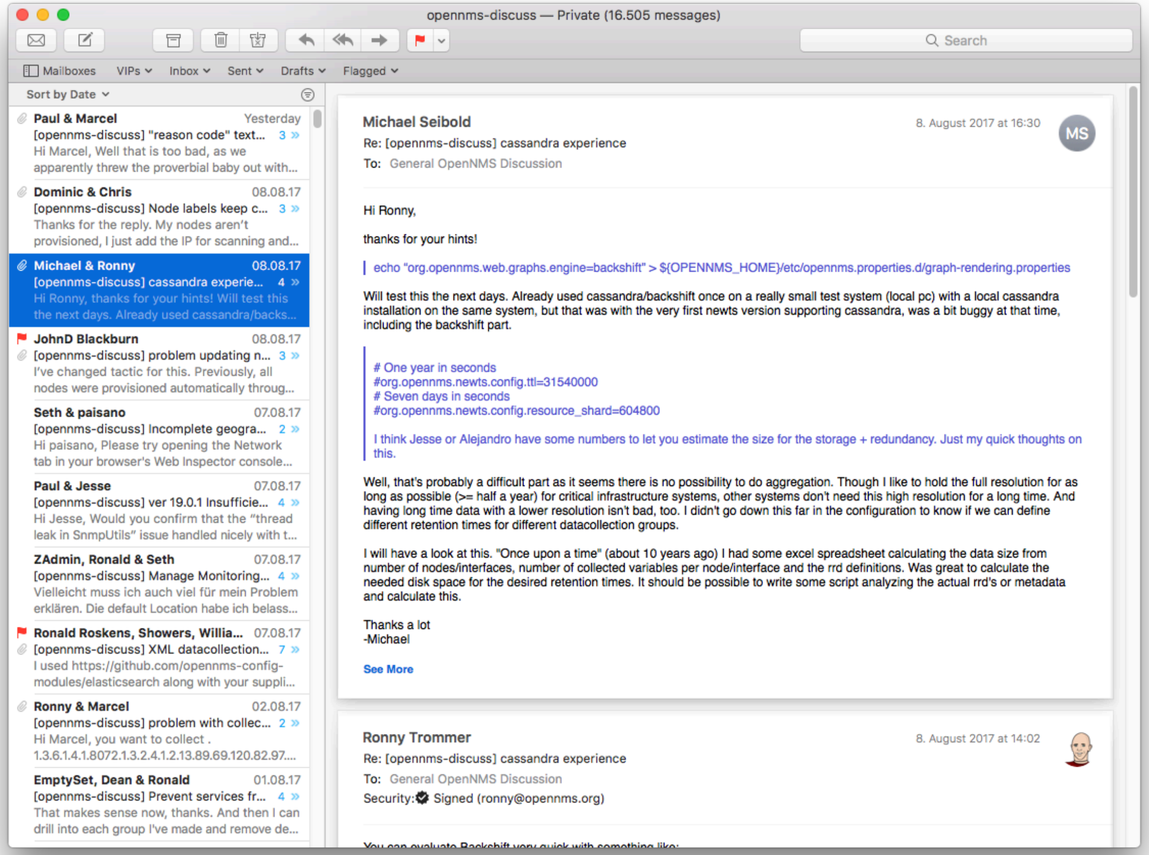


https://docs.opennms.org

https://wiki.opennms.org

Kommunikation





https://chat.opennms.com

irc://irc.freenode.net/#opennms

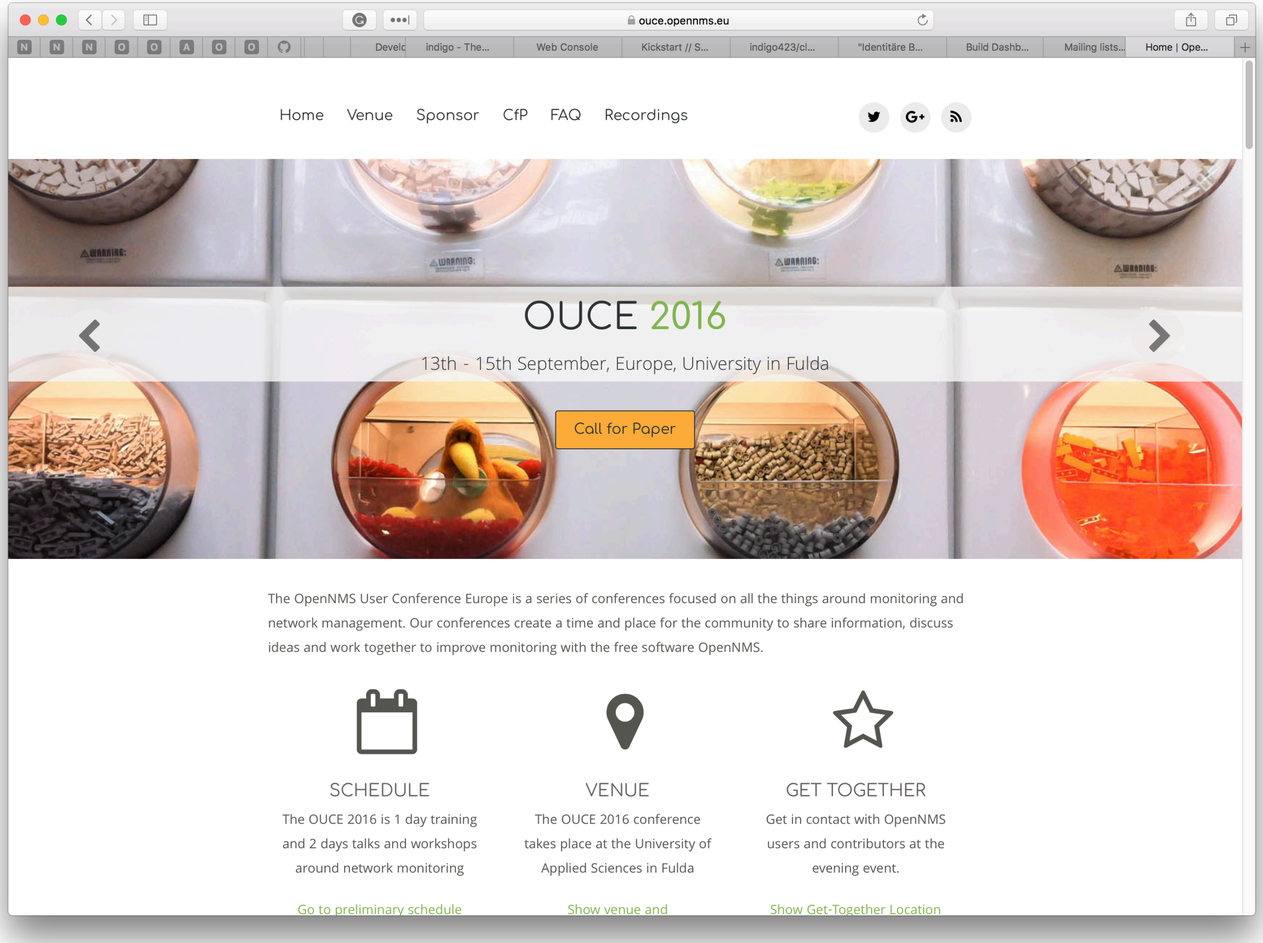
https://wiki.opennms.org/wiki/Mailing_lists

Events

- Unconference
- 5 Tage
- Workshops
- Entwicklung
- Ideenaustausch
- Veranstalter:

  Sponsoren + OpenNMS Group

Events

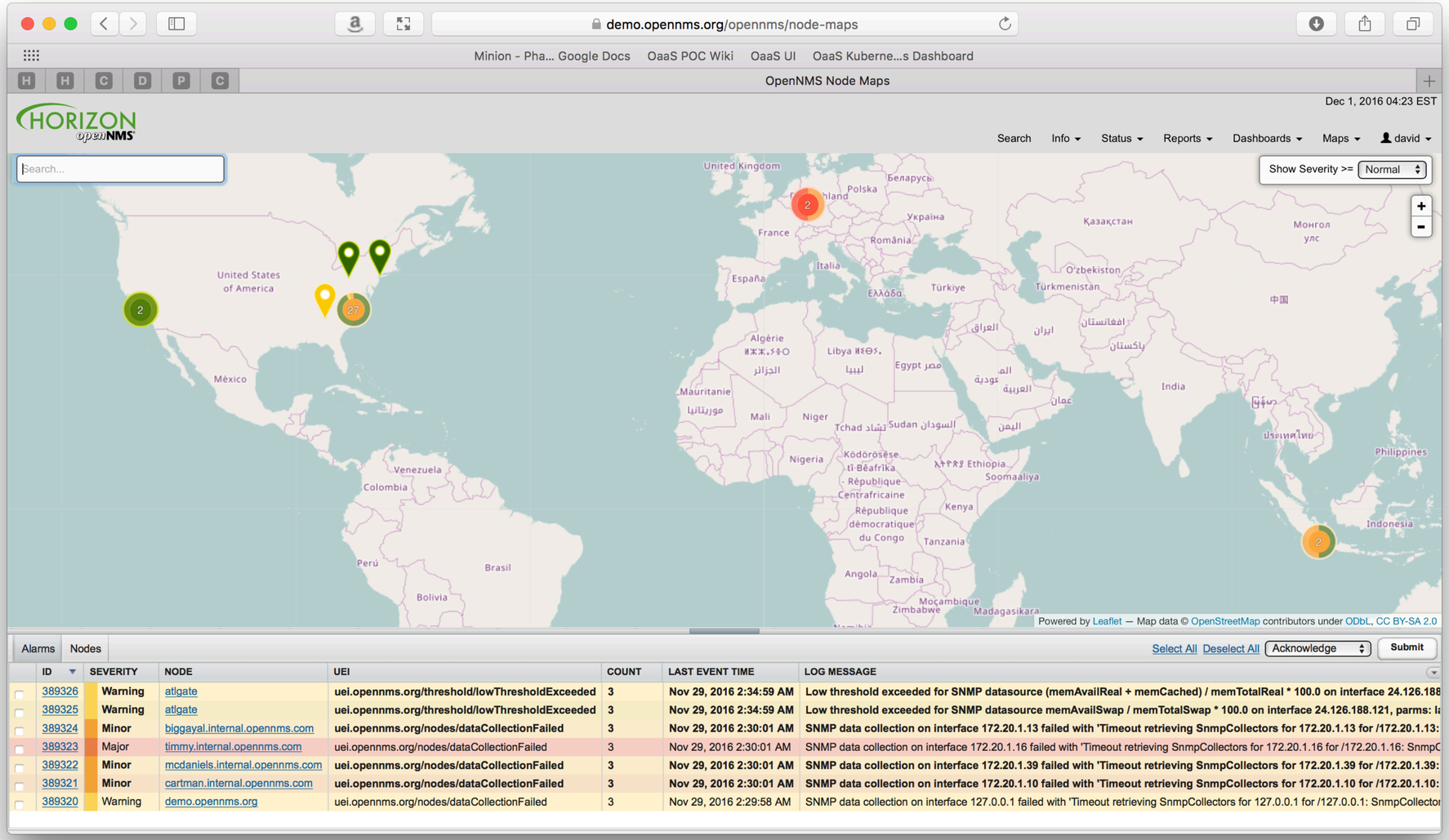


- User Conference Europe
- 2 - 3 Tage
- Workshops
- Vorträge rund um OpenNMS
- Veranstalter:

  Sponsoren + OpenNMS Foundation

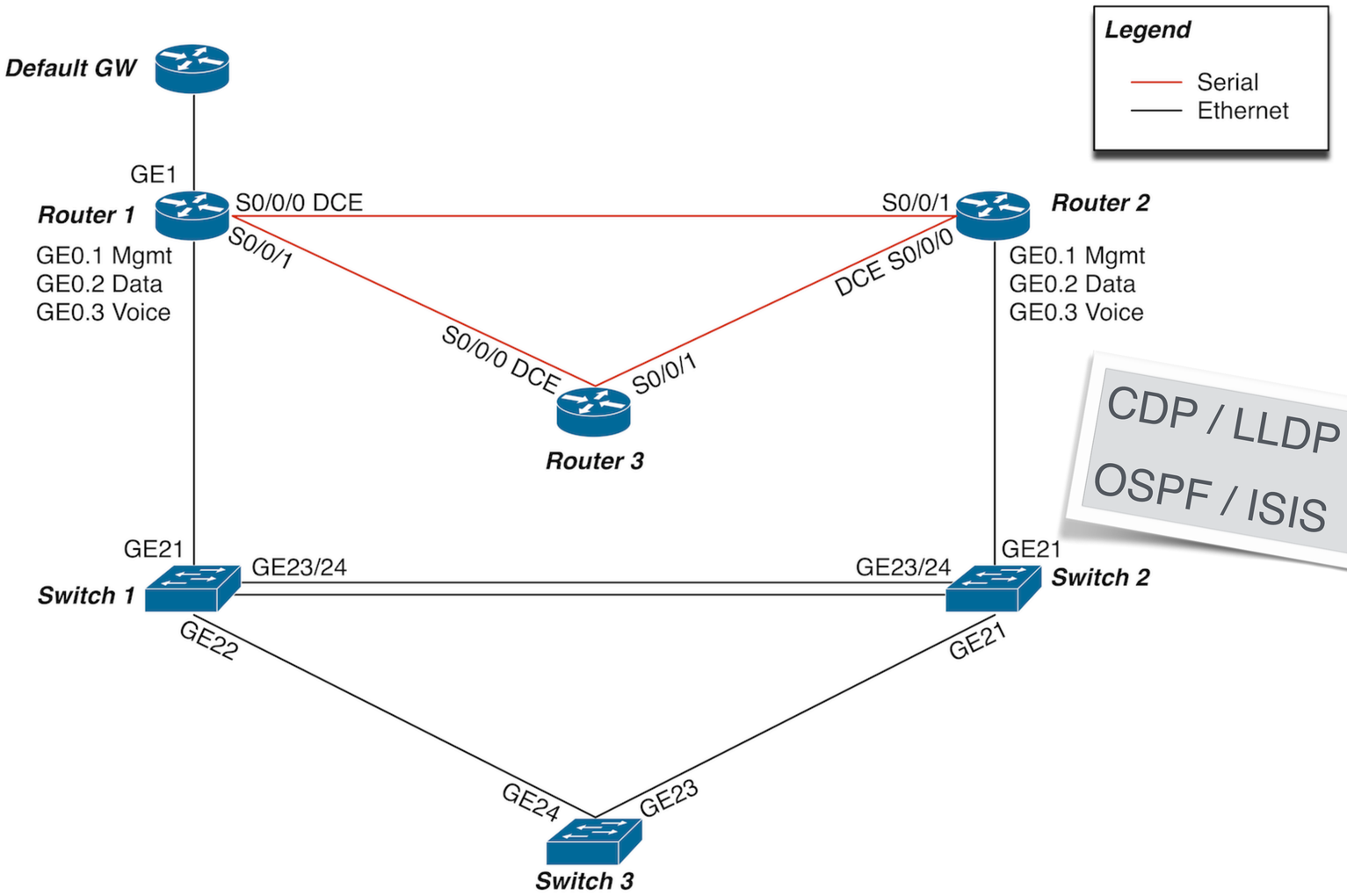
Road Map

Horizon 14



	ID	SEVERITY	NODE	UEI	COUNT	LAST EVENT TIME	LOG MESSAGE
	389326	Warning	atlgate	uei.opennms.org/threshold/lowThresholdExceeded	3	Nov 29, 2016 2:34:59 AM	Low threshold exceeded for SNMP datasource (memAvailReal + memCached) / memTotalReal * 100.0 on interface 24.126.188
	389325	Warning	atlgate	uei.opennms.org/threshold/lowThresholdExceeded	3	Nov 29, 2016 2:34:59 AM	Low threshold exceeded for SNMP datasource memAvailSwap / memTotalSwap * 100.0 on interface 24.126.188.121, parms: la
	389324	Minor	biggayal.internal.opennms.com	uei.opennms.org/nodes/dataCollectionFailed	3	Nov 29, 2016 2:30:01 AM	SNMP data collection on interface 172.20.1.13 failed with 'Timeout retrieving SnmpCollectors for 172.20.1.13 for /172.20.1.13:
	389323	Major	timmy.internal.opennms.com	uei.opennms.org/nodes/dataCollectionFailed	3	Nov 29, 2016 2:30:01 AM	SNMP data collection on interface 172.20.1.16 failed with 'Timeout retrieving SnmpCollectors for 172.20.1.16 for /172.20.1.16: SnmpC
	389322	Minor	mcdaniels.internal.opennms.com	uei.opennms.org/nodes/dataCollectionFailed	3	Nov 29, 2016 2:30:01 AM	SNMP data collection on interface 172.20.1.39 failed with 'Timeout retrieving SnmpCollectors for 172.20.1.39 for /172.20.1.39:
	389321	Minor	cartman.internal.opennms.com	uei.opennms.org/nodes/dataCollectionFailed	3	Nov 29, 2016 2:30:01 AM	SNMP data collection on interface 172.20.1.10 failed with 'Timeout retrieving SnmpCollectors for 172.20.1.10 for /172.20.1.10:
	389320	Warning	demo.opennms.org	uei.opennms.org/nodes/dataCollectionFailed	3	Nov 29, 2016 2:29:58 AM	SNMP data collection on interface 127.0.0.1 failed with 'Timeout retrieving SnmpCollectors for 127.0.0.1 for /127.0.0.1: SnmpCollector

Horizon 14



CDP / LLDP / Bridge MIB

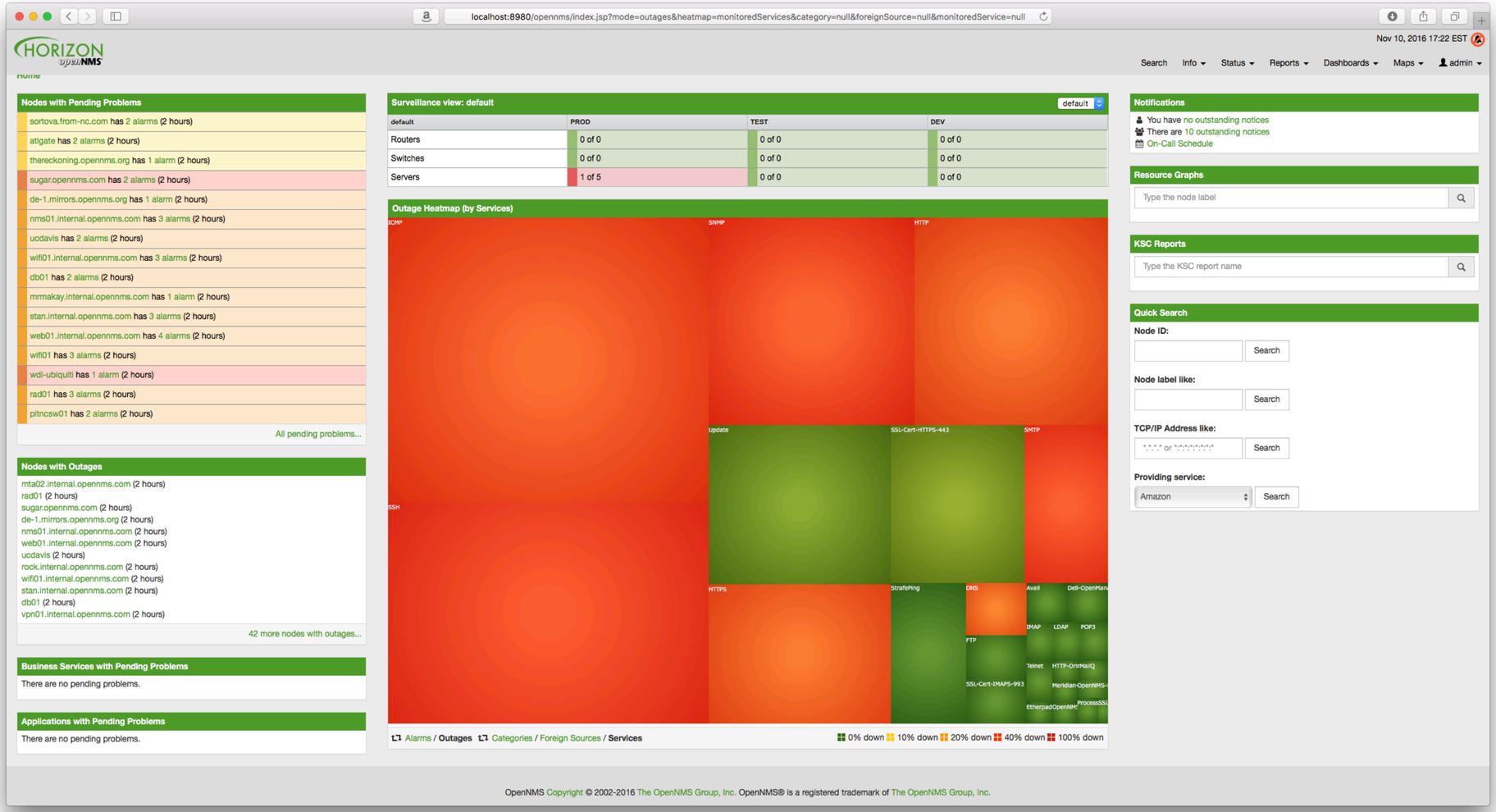
OSPF / ISIS

Horizon 15

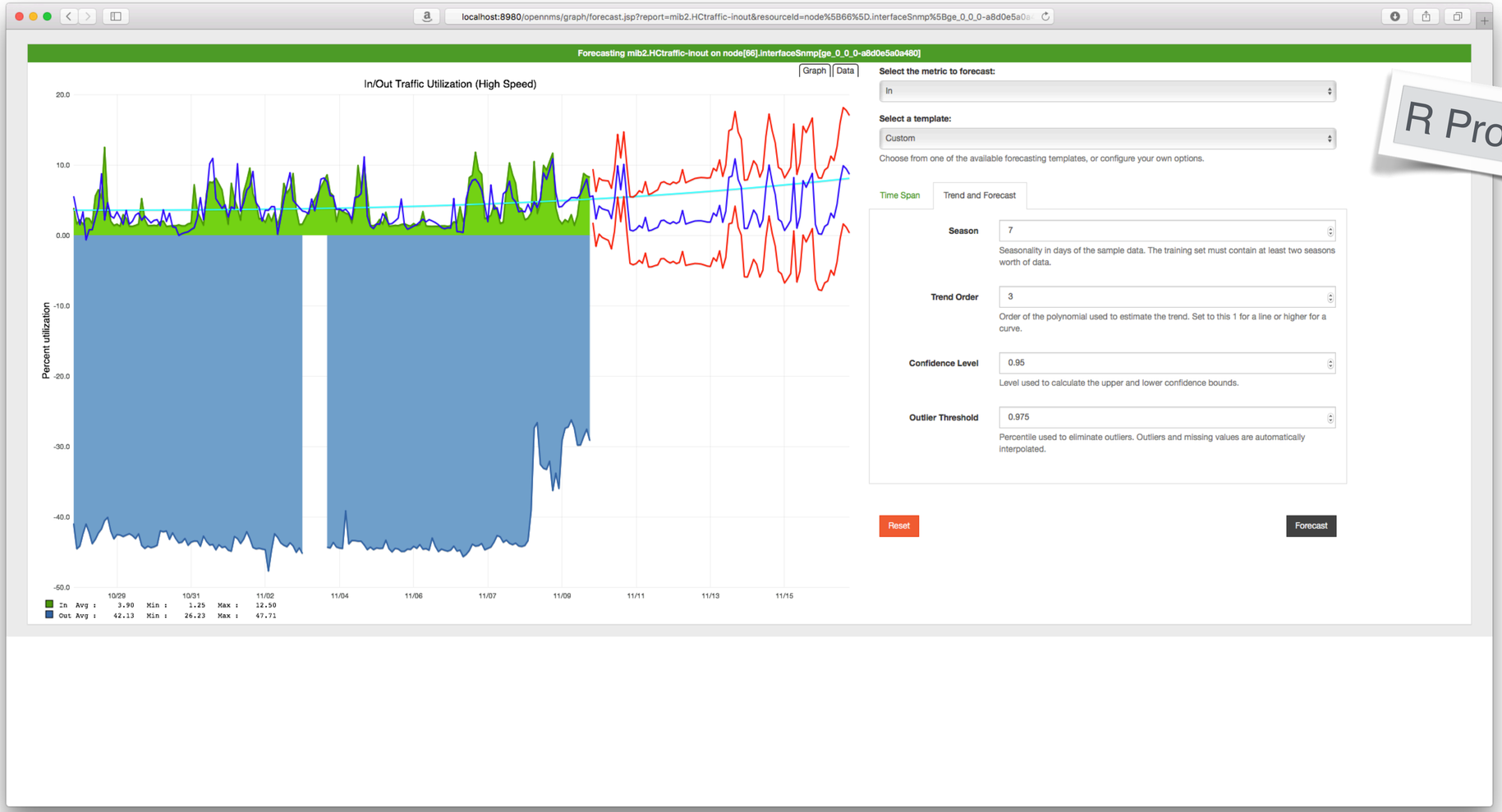
- Jetty 8
- Bootstrap Theming in Web UI

Horizon 16

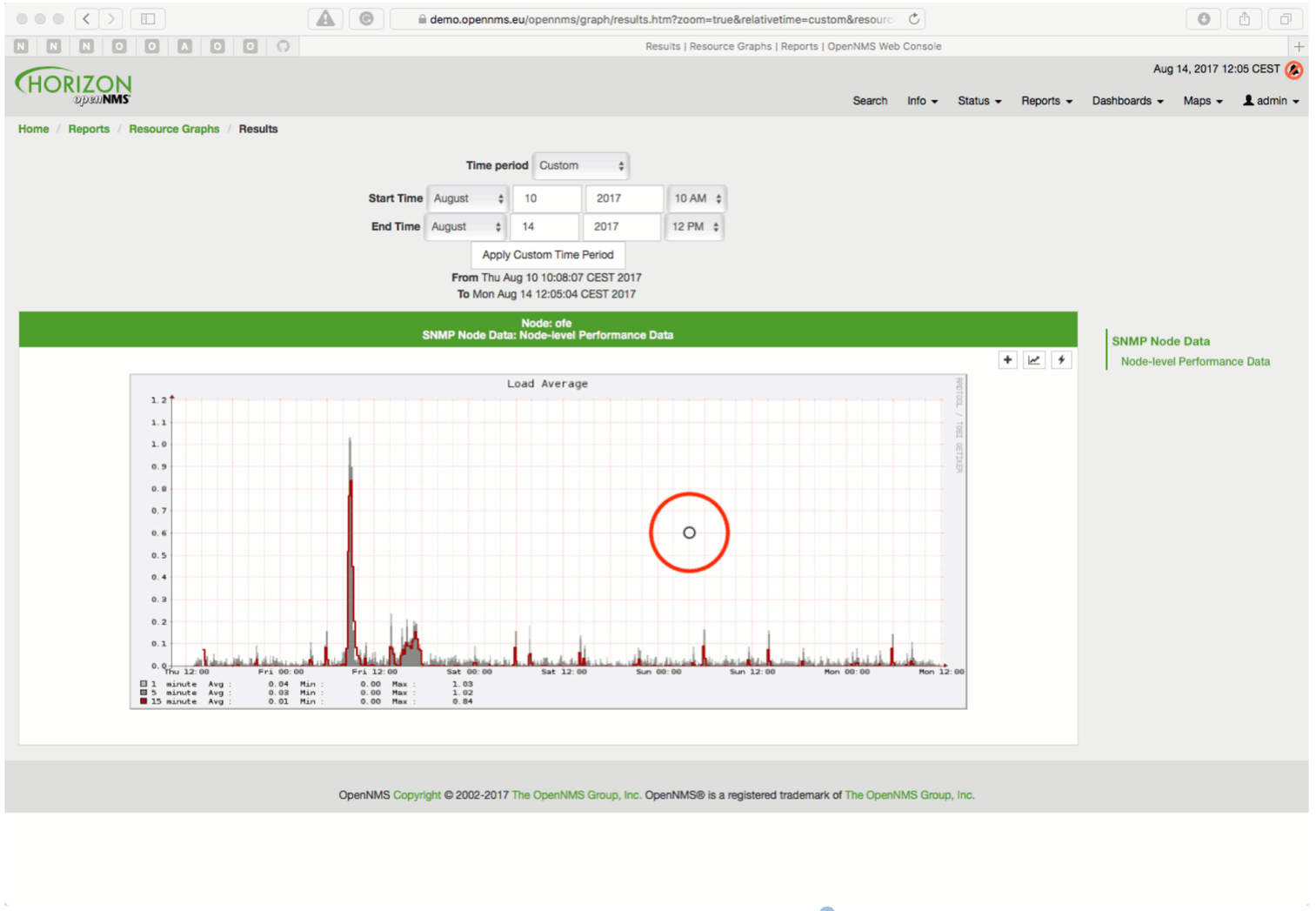
Horizon 17



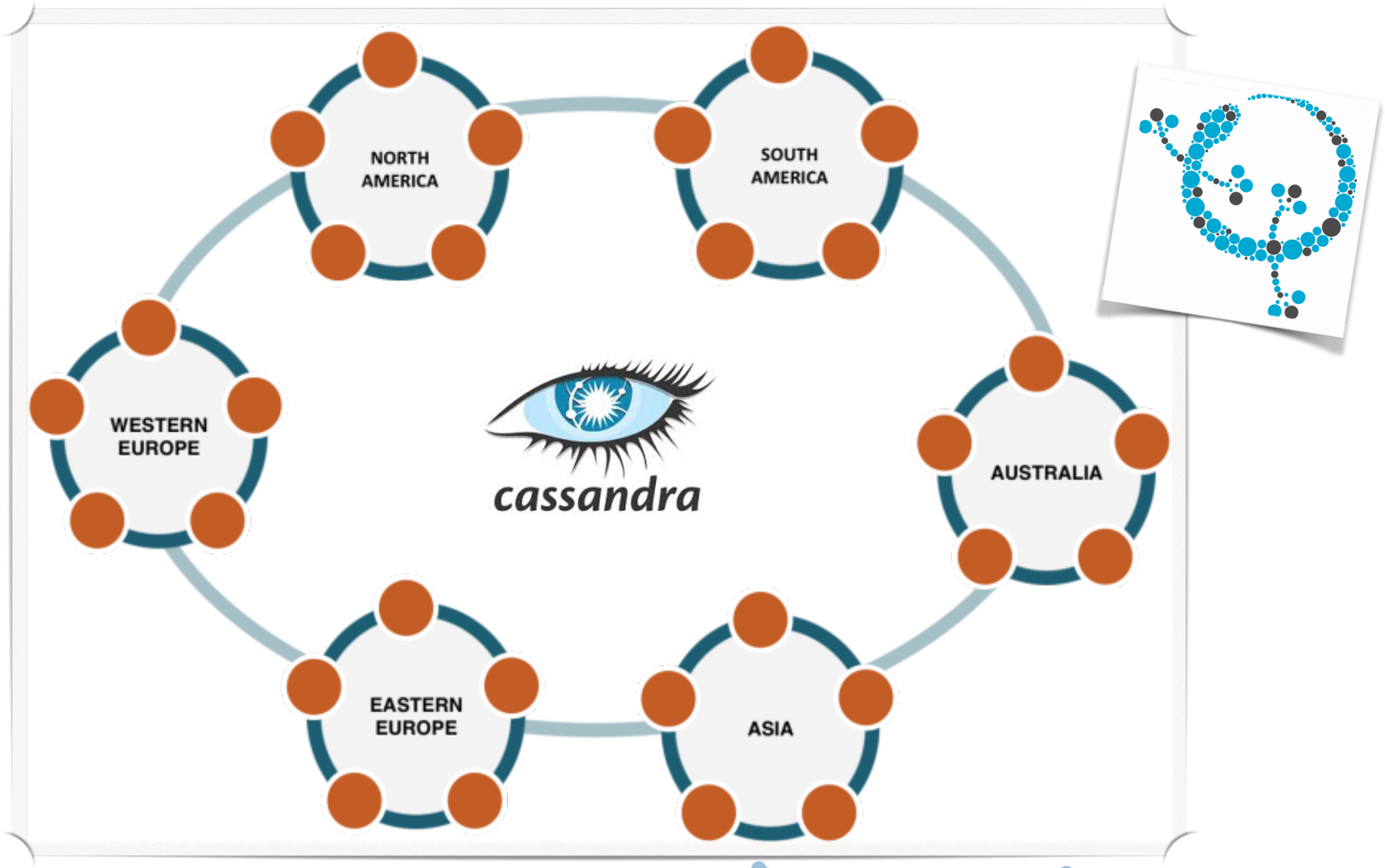
Horizon 17



Horizon 17

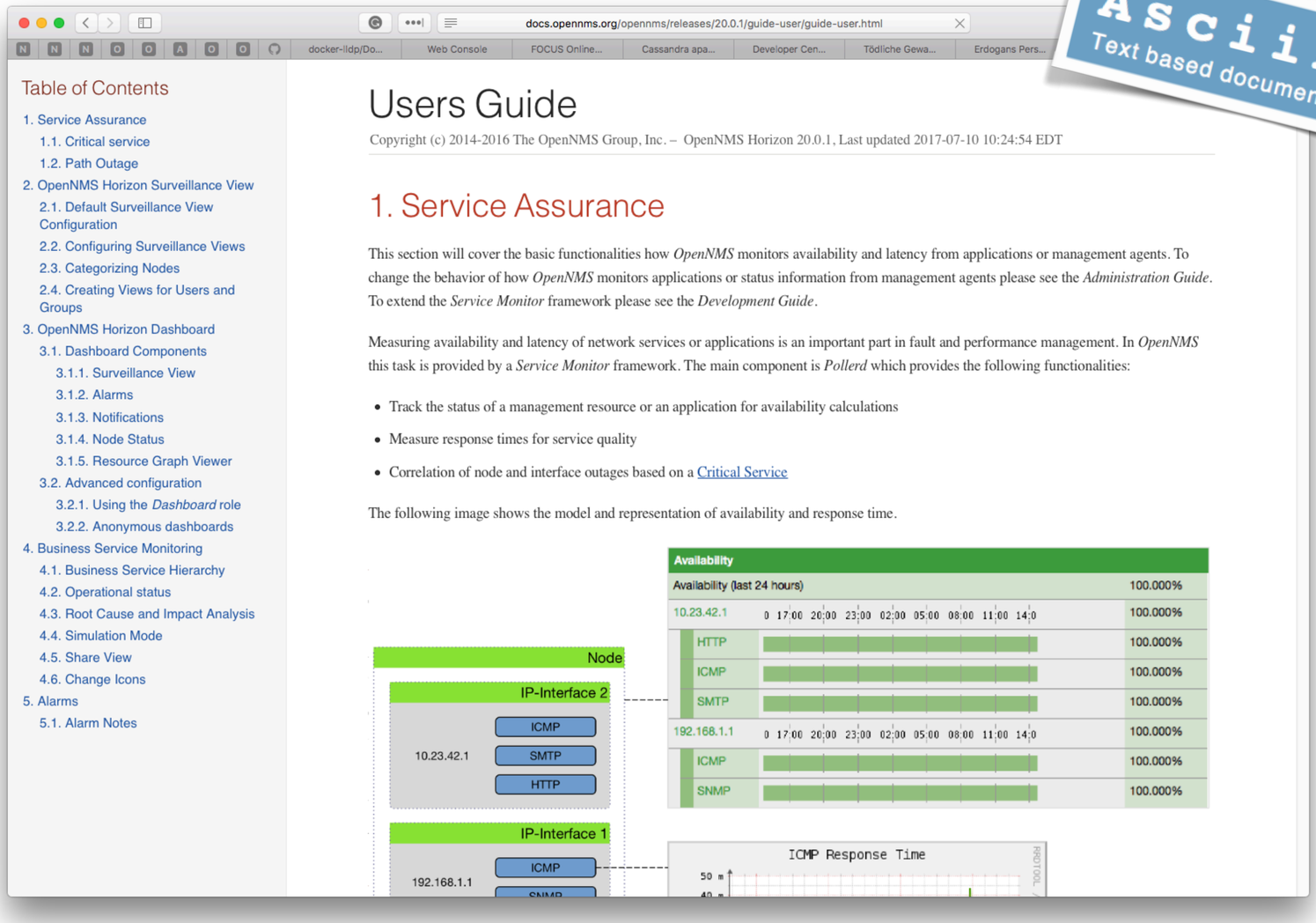


Horizon 17

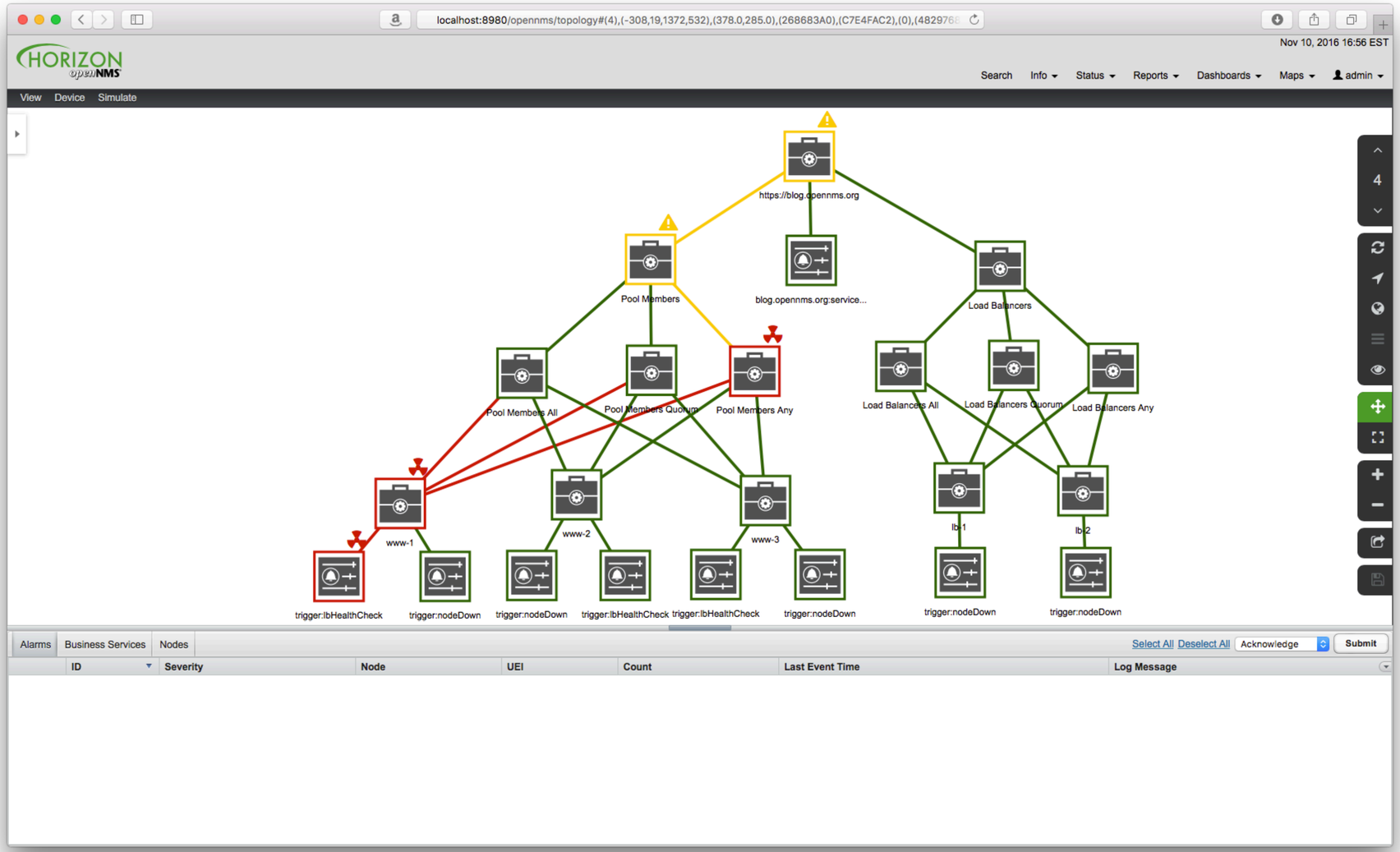


Horizon 17

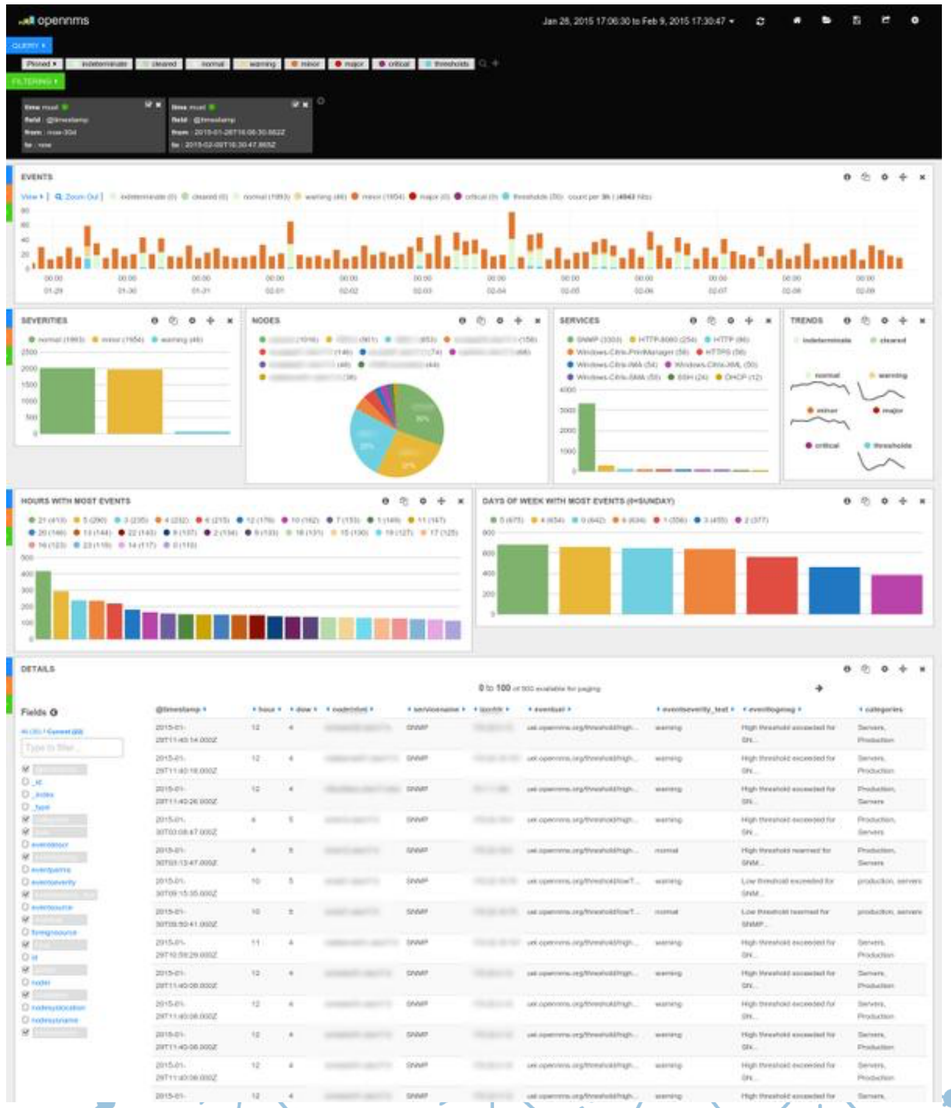
AsciiDoc
Text based document generation



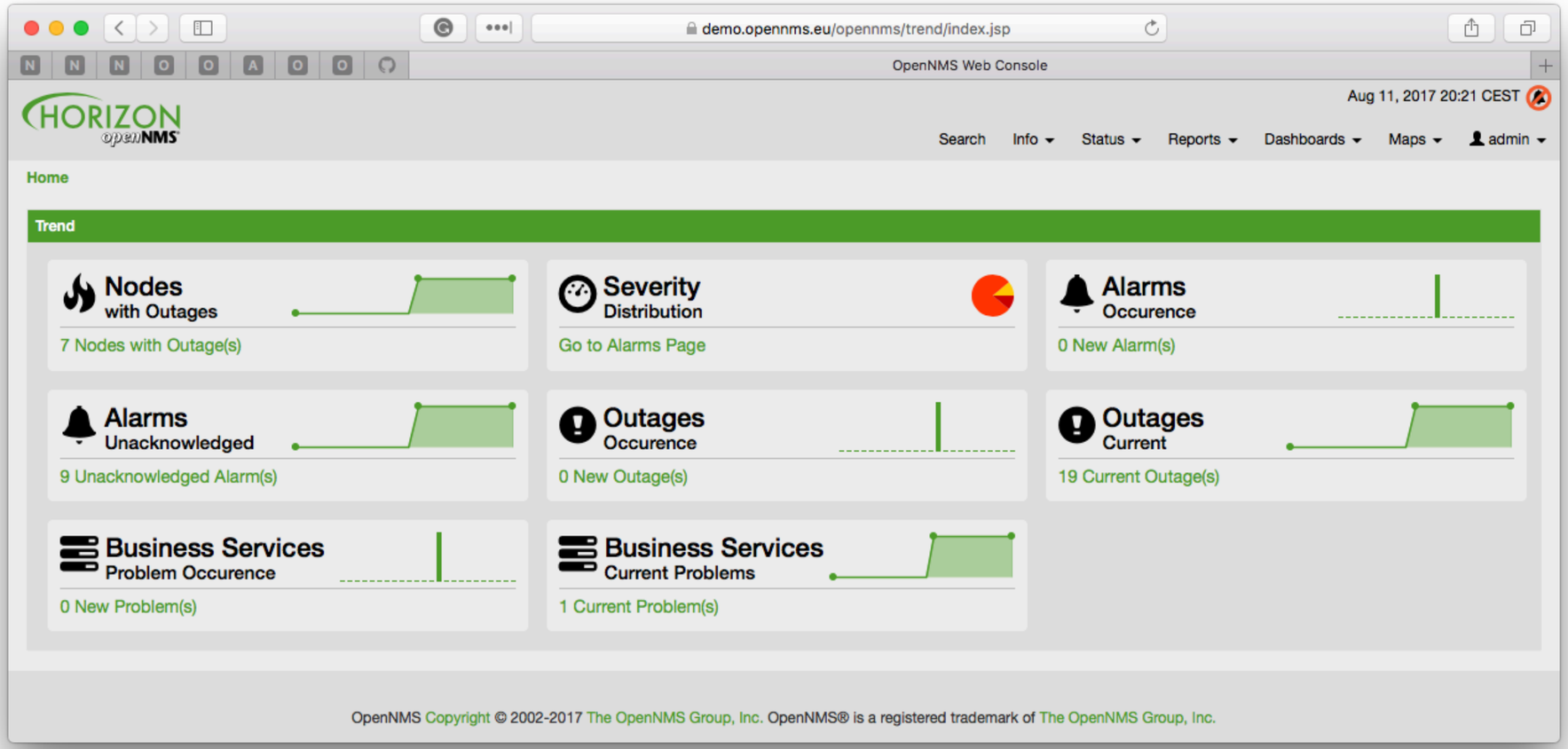
Horizon 18



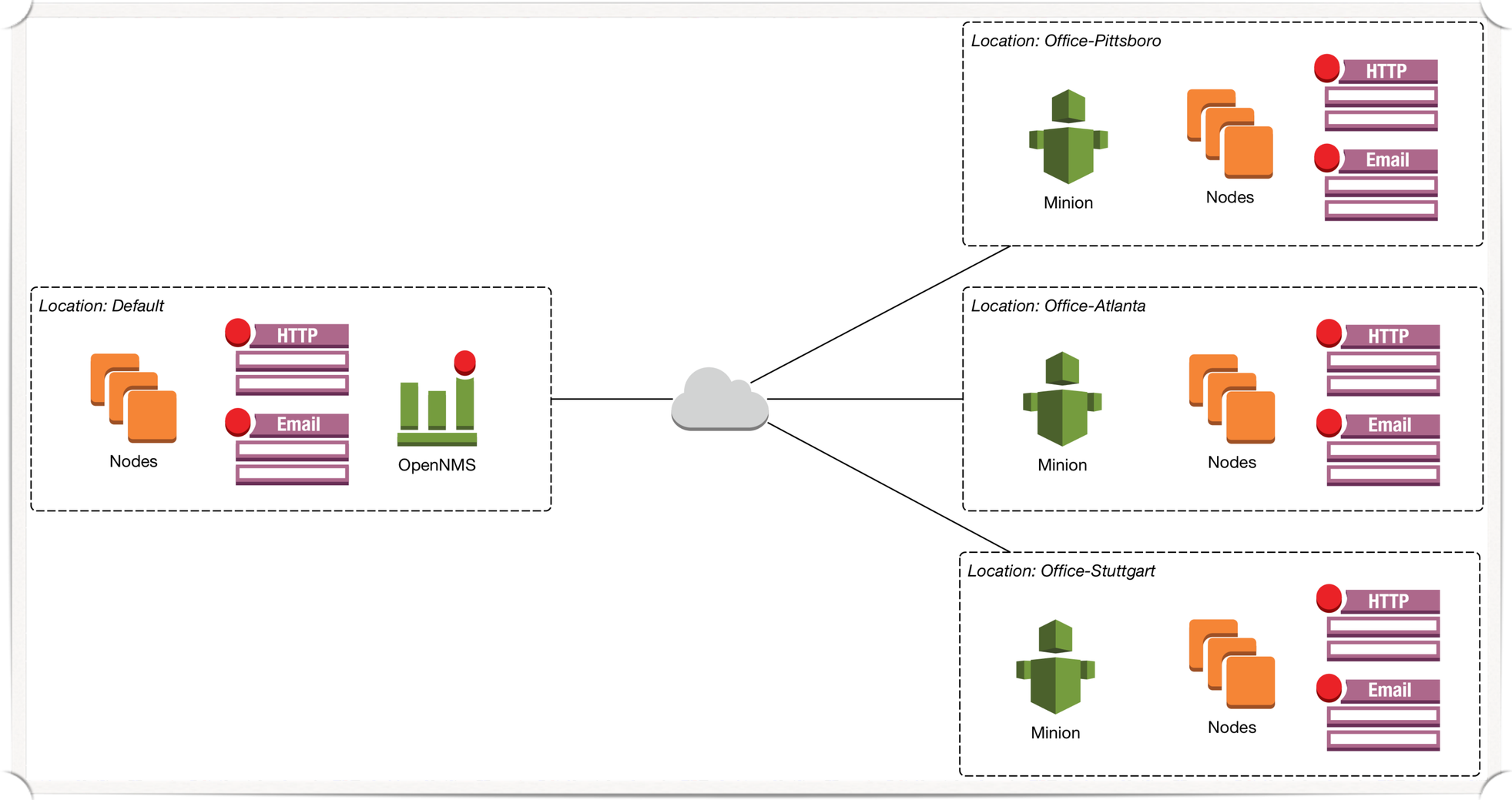
Horizon 18



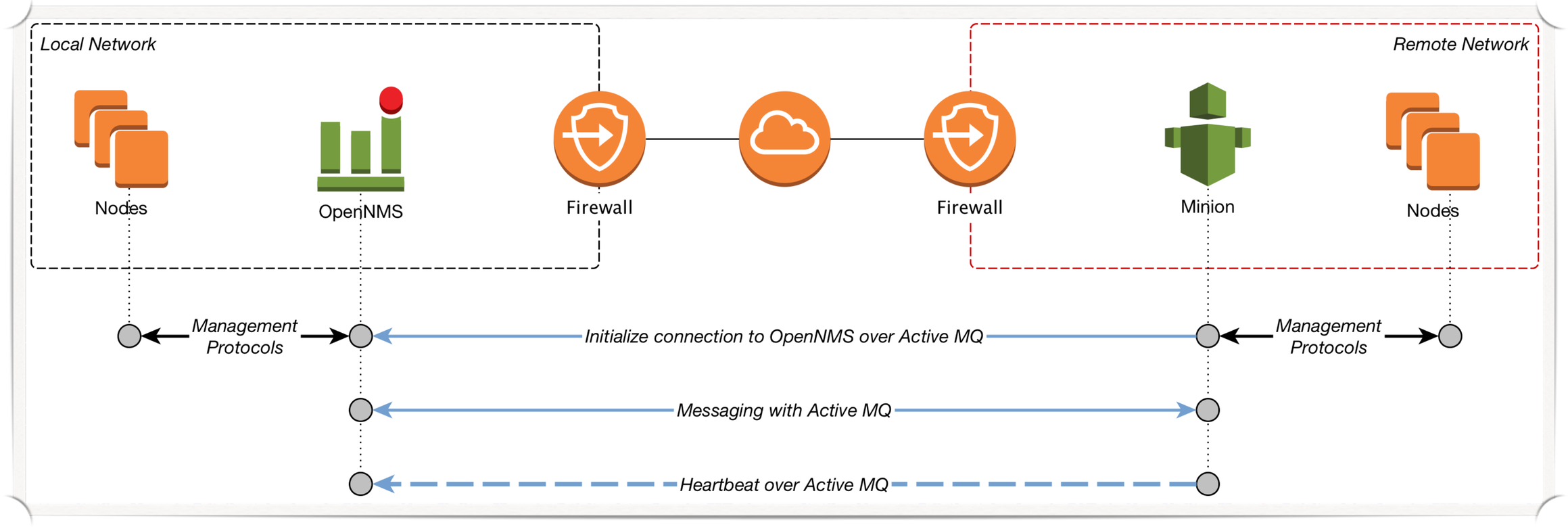
Horizon 19



Horizon 19



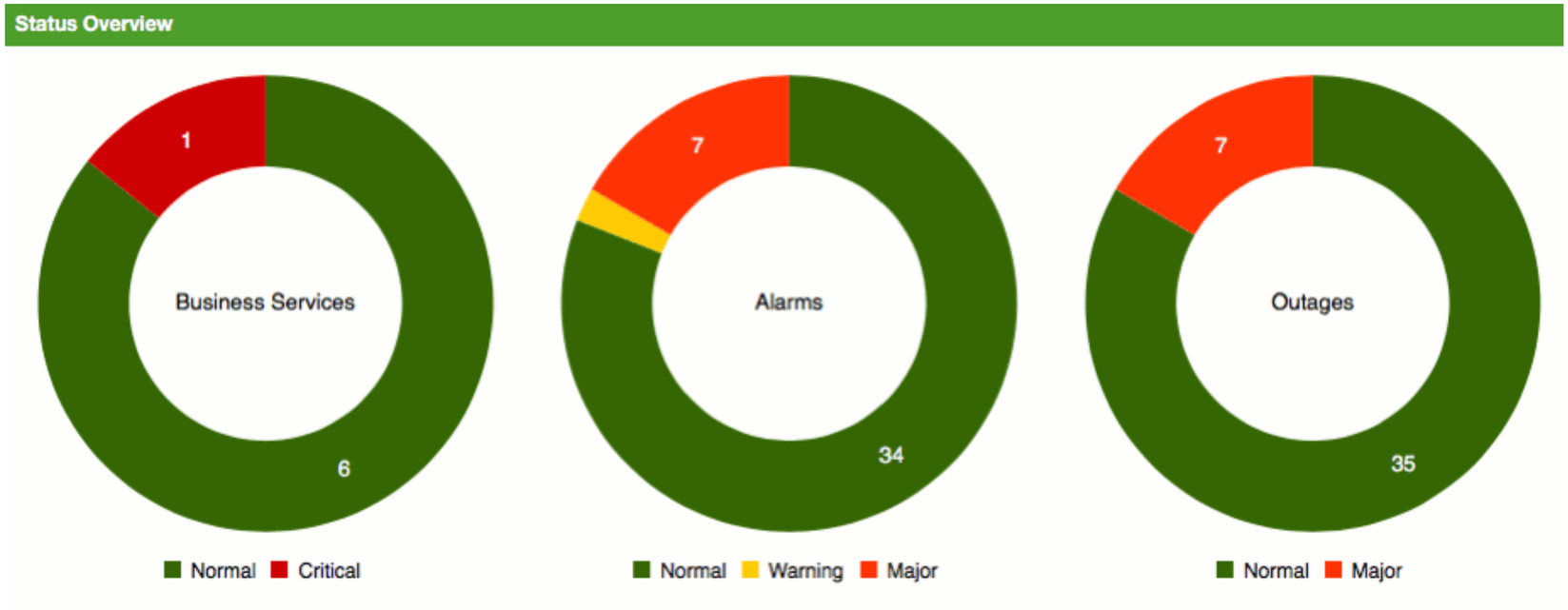
Horizon 19



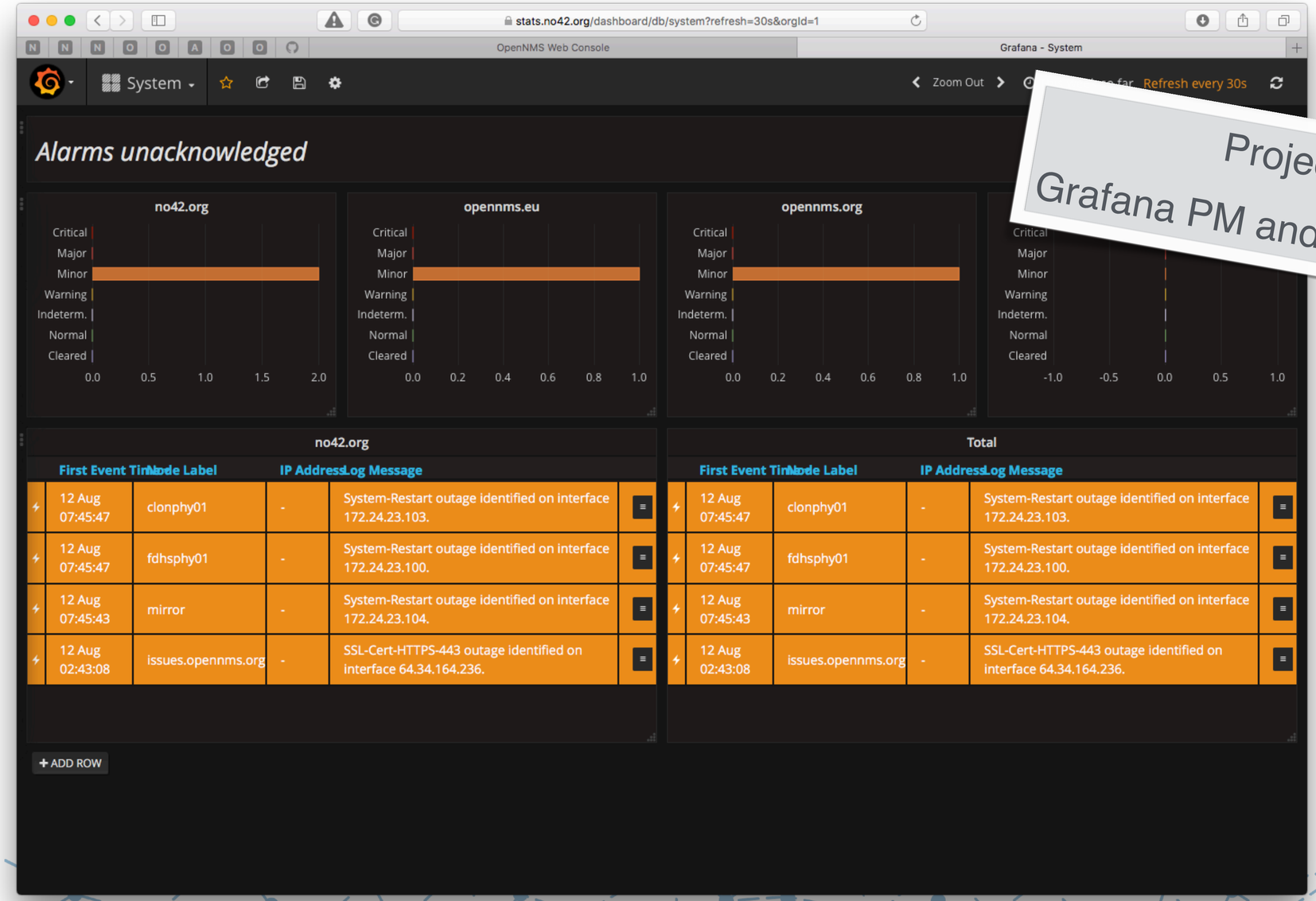
Horizon 20

- Alle Protokolle für Performance Data Collection für Minions verfügbar
- Auto-Provisioning für VMware durch Minions
- Optimierung Performance für Event-Verarbeitung mit Apache Kafka
- Bugfixes für Refactoring für Location support

Horizon 21



Horizon 21



Project Helm

Grafana PM and FM datasources

Horizon 22 … 23

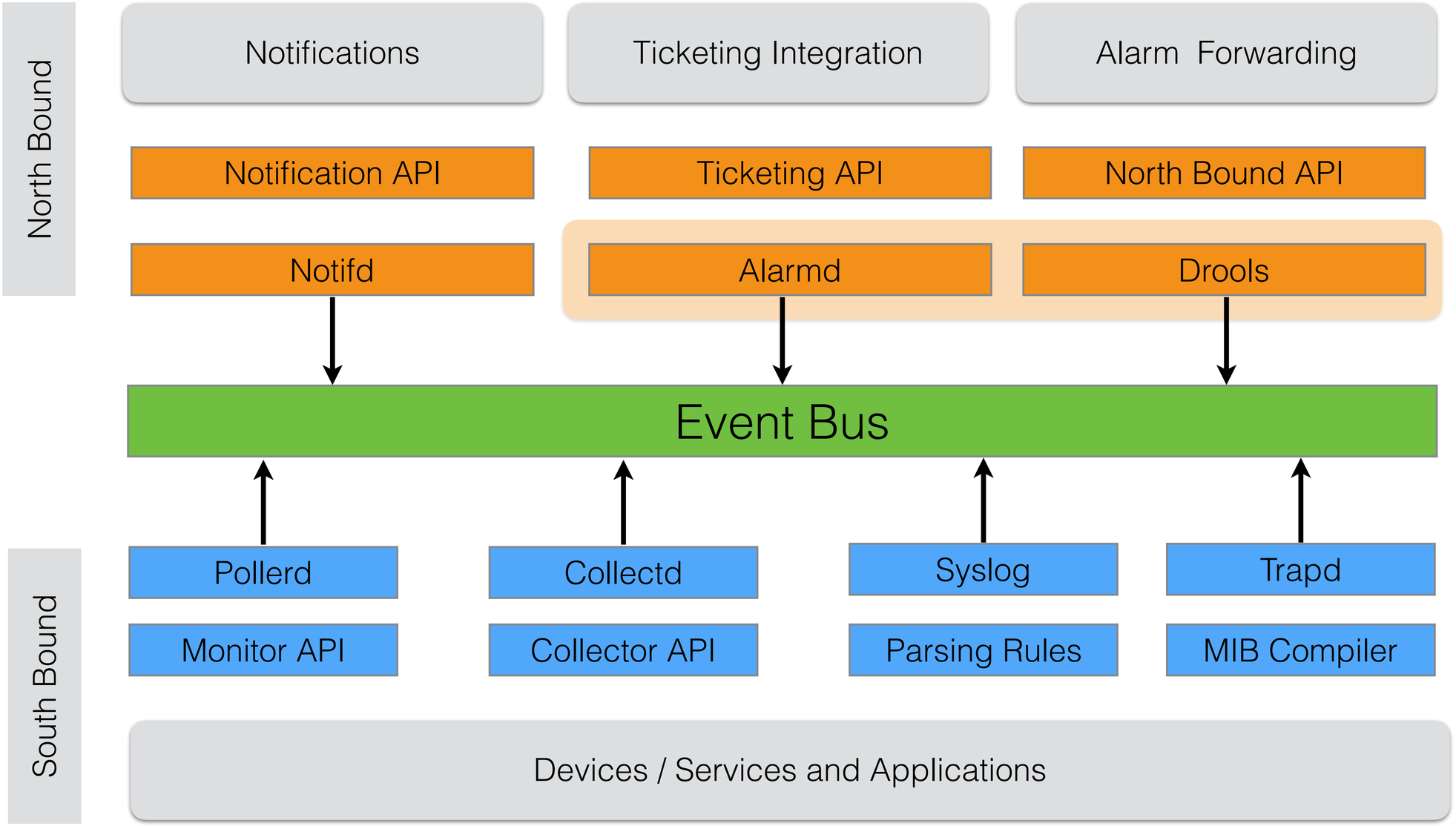
- Infrastructure to Support Streaming Telemetry push vs. poll
- Cisco NX-OS
- Junos Telemetry Interface (JTI)
- Netflow v5/v9 / J-Flow / S-Flow and IPFIX at scale

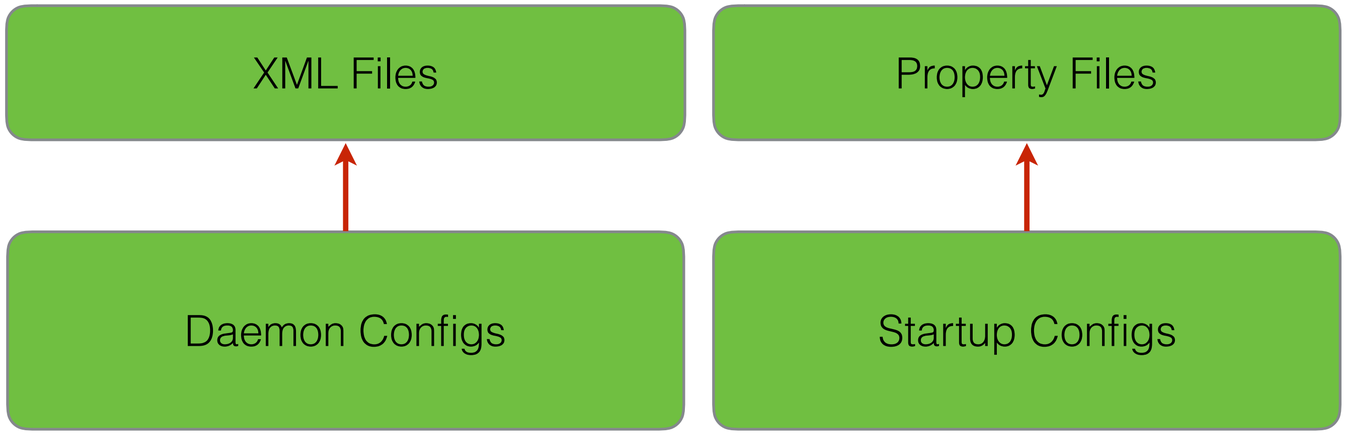
  (3084 flow pkts/sec -> 92.520 flows/sec -> 100.000 fps)
- Verbesserung Helm

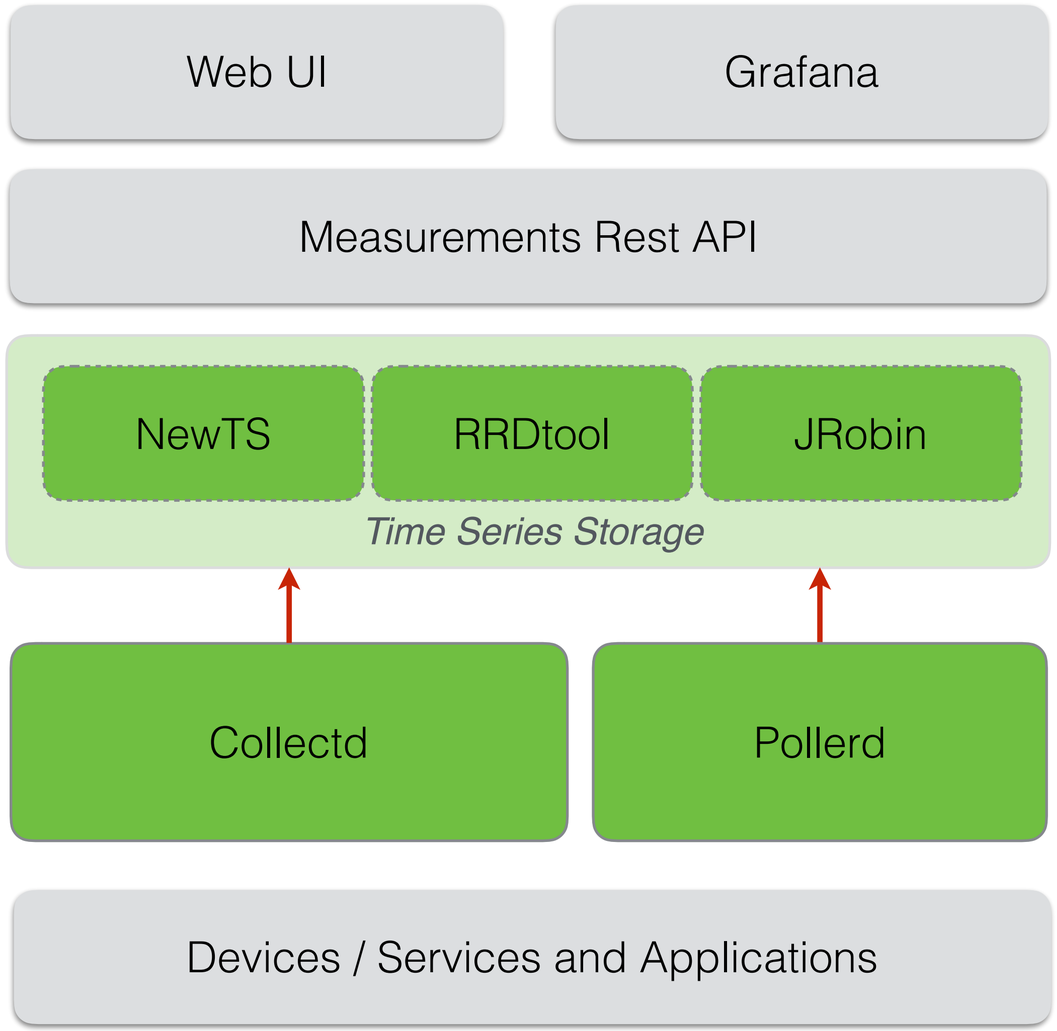
Horizon 23++

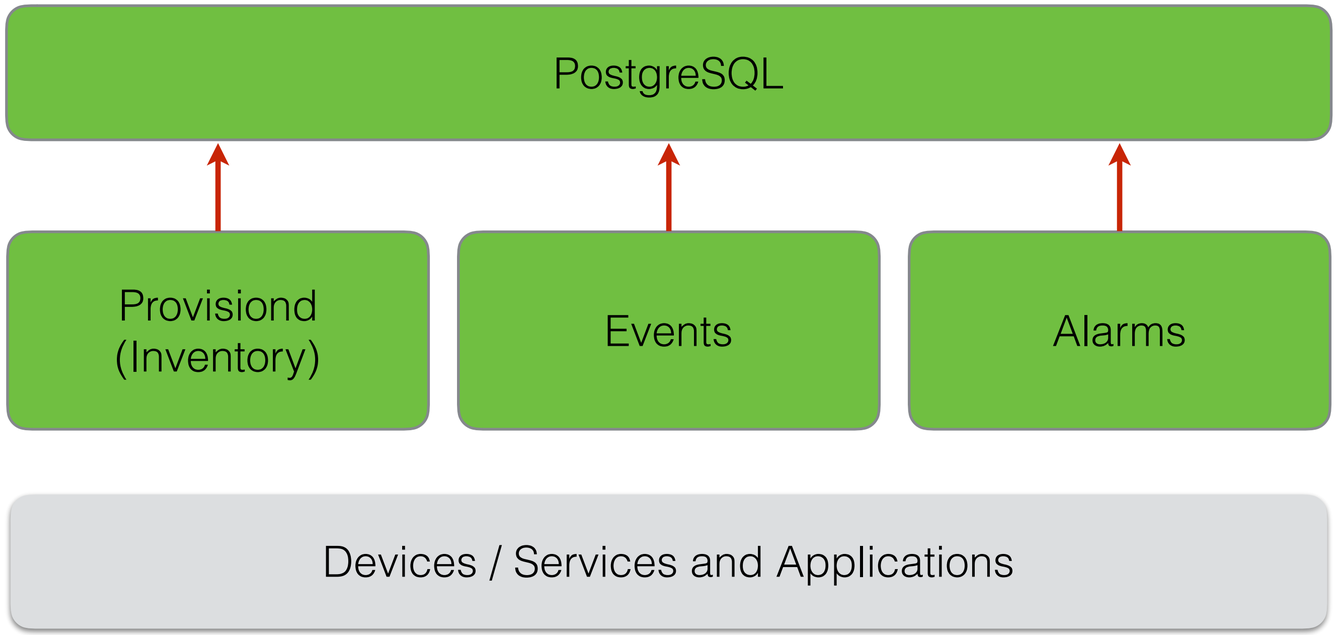
- Verteilte Scheduler in Minion für Pollerd and Collectors
- Verbesserung Event und Alarmanalyse mit ElasticSearch und Kibana
- Stabilisierung ReST API und Versionierung
- Eventd auf AMQP migrieren --> Skalierbarkeit und Ausfallsicherheit

Architektur









Skalierung Redundanz

Datenbank

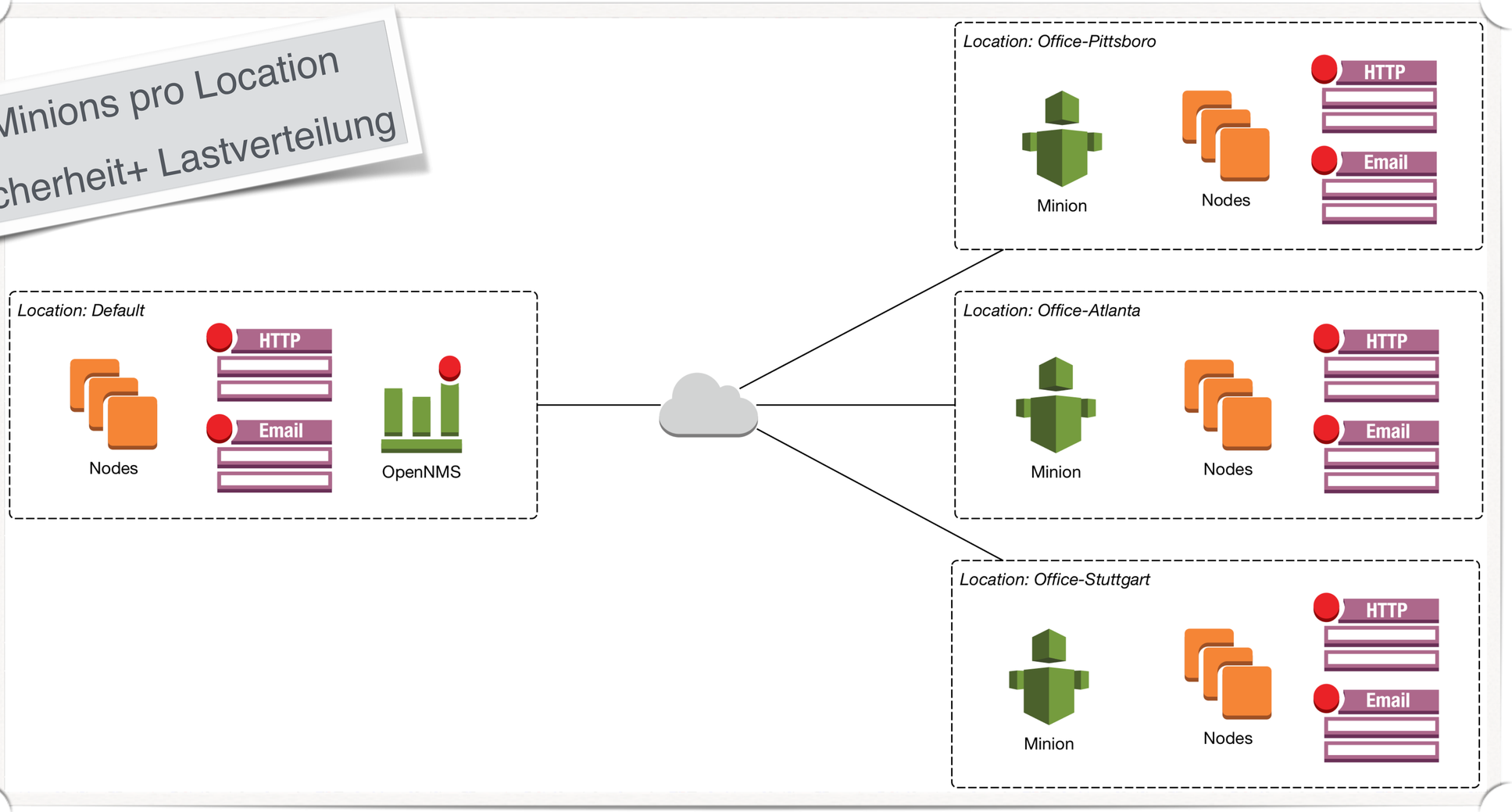
- Inventory
- Events
- Alarme
- Notifications
- PostgreSQL —> ElasticSearch

Time Series Storage

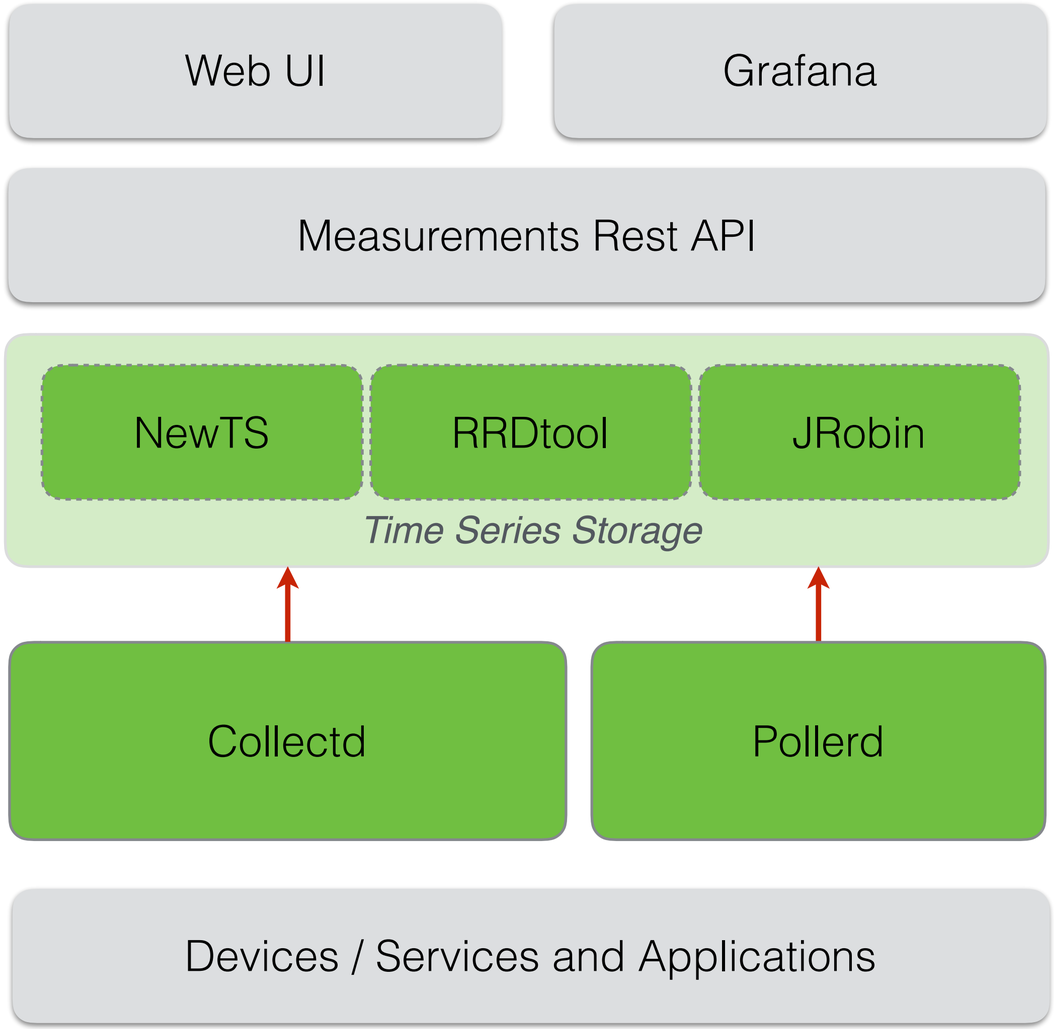
- JRobin und RRDtool liegen auf Filesystem
- NewTS —> Cassandra Cluster

Minion bei mehreren Locations

Mehrere Minions pro Location
Ausfallsicherheit+ Lastverteilung

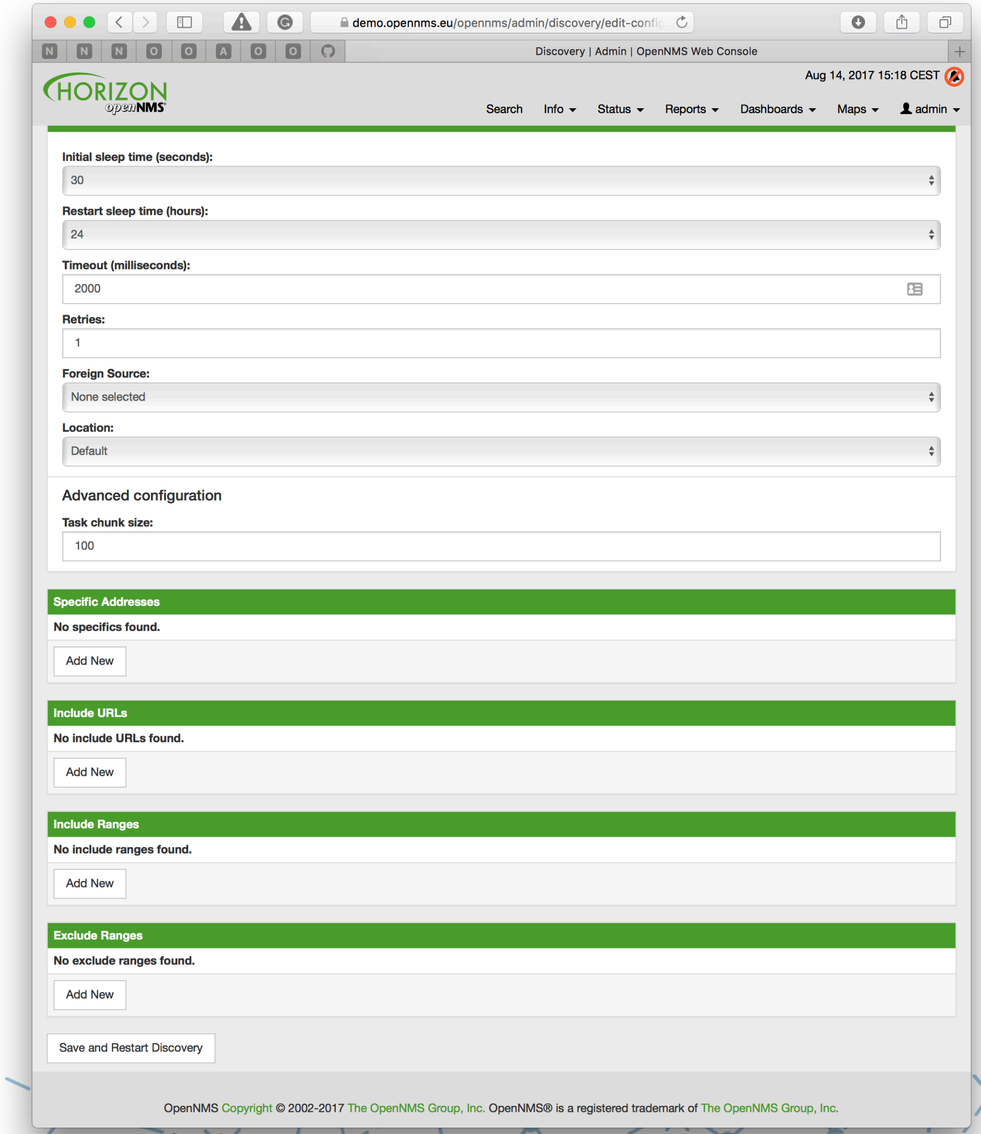


Schwer zu skalieren



Provisioning

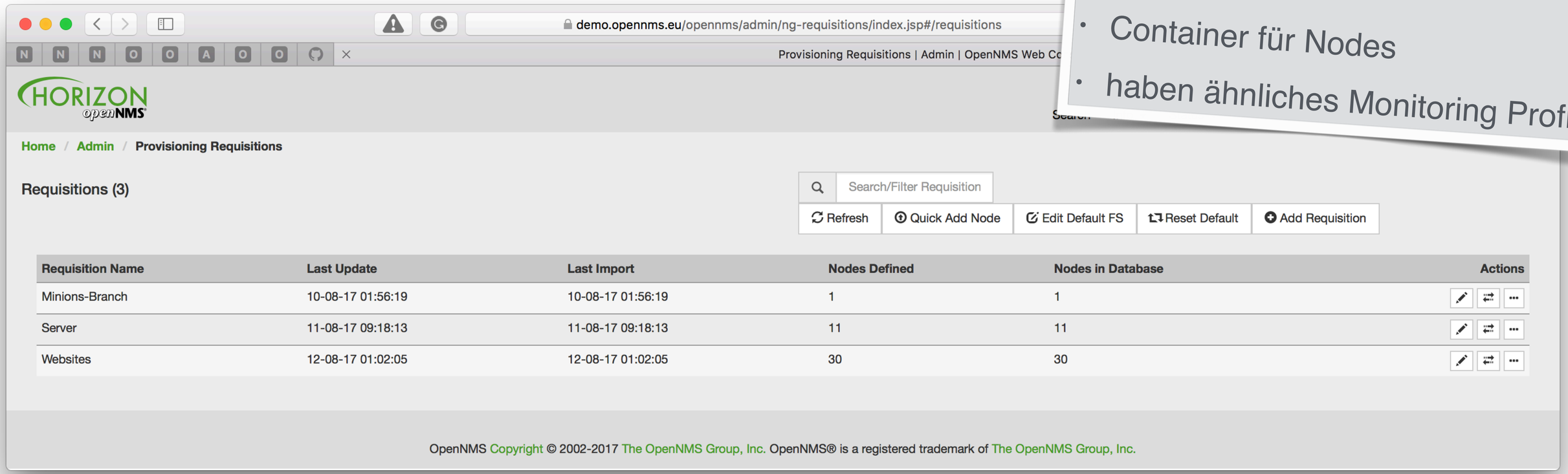
Network Discovery



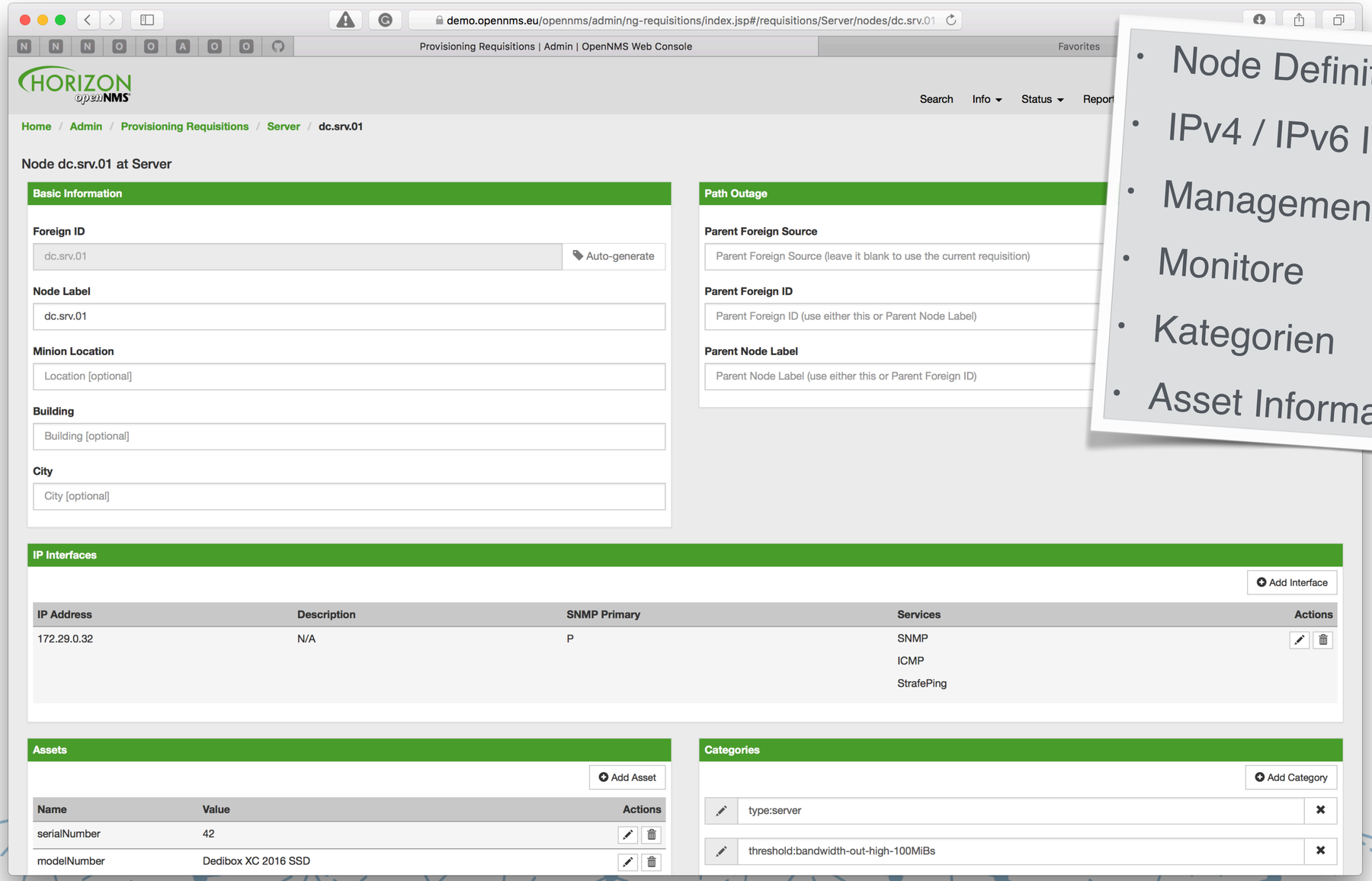
- Ping Sweep IPv4 / IPv6 Ranges
- Meist kleinere Umgebungen
- Kein Inventar oder Service Katalog vorhanden
- Service Discovery
- Include / Exclude Ranges

Provisioning

- Requisitions
- Container für Nodes
- haben ähnliches Monitoring Profil

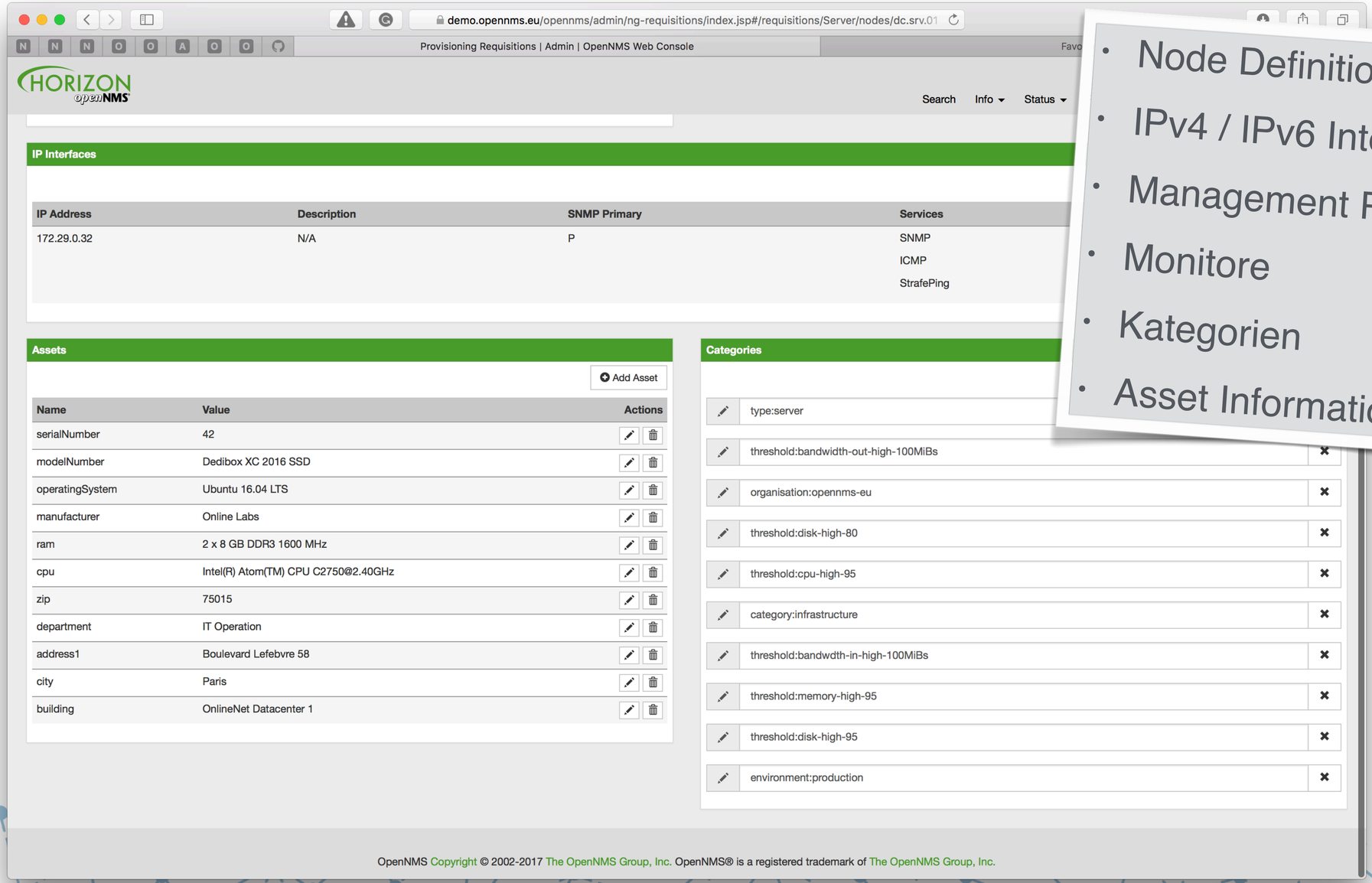


Provisioning



- Node Definition
- IPv4 / IPv6 Interfaces
- Management Protokolle
- Monitore
- Kategorien
- Asset Information

Provisioning



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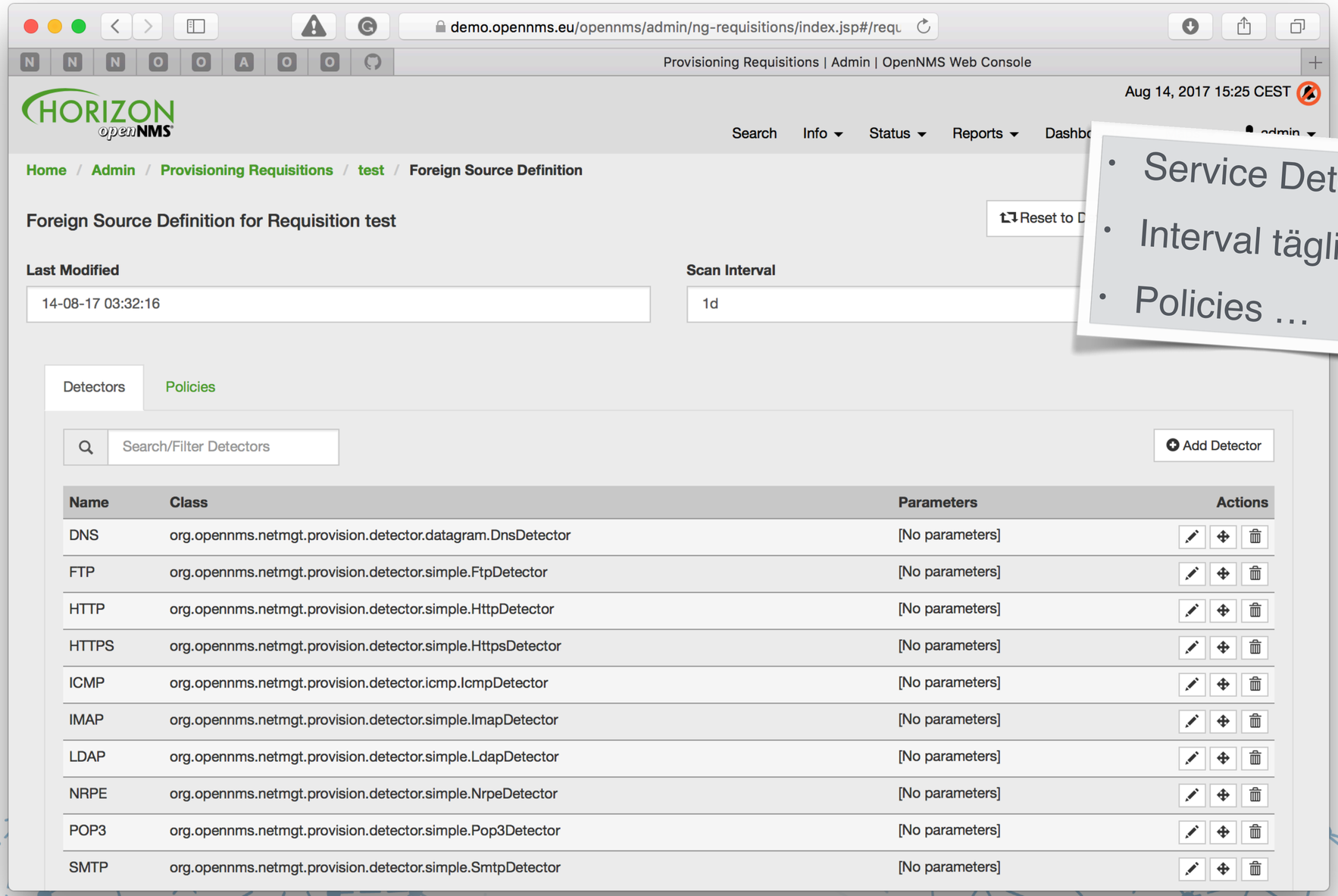
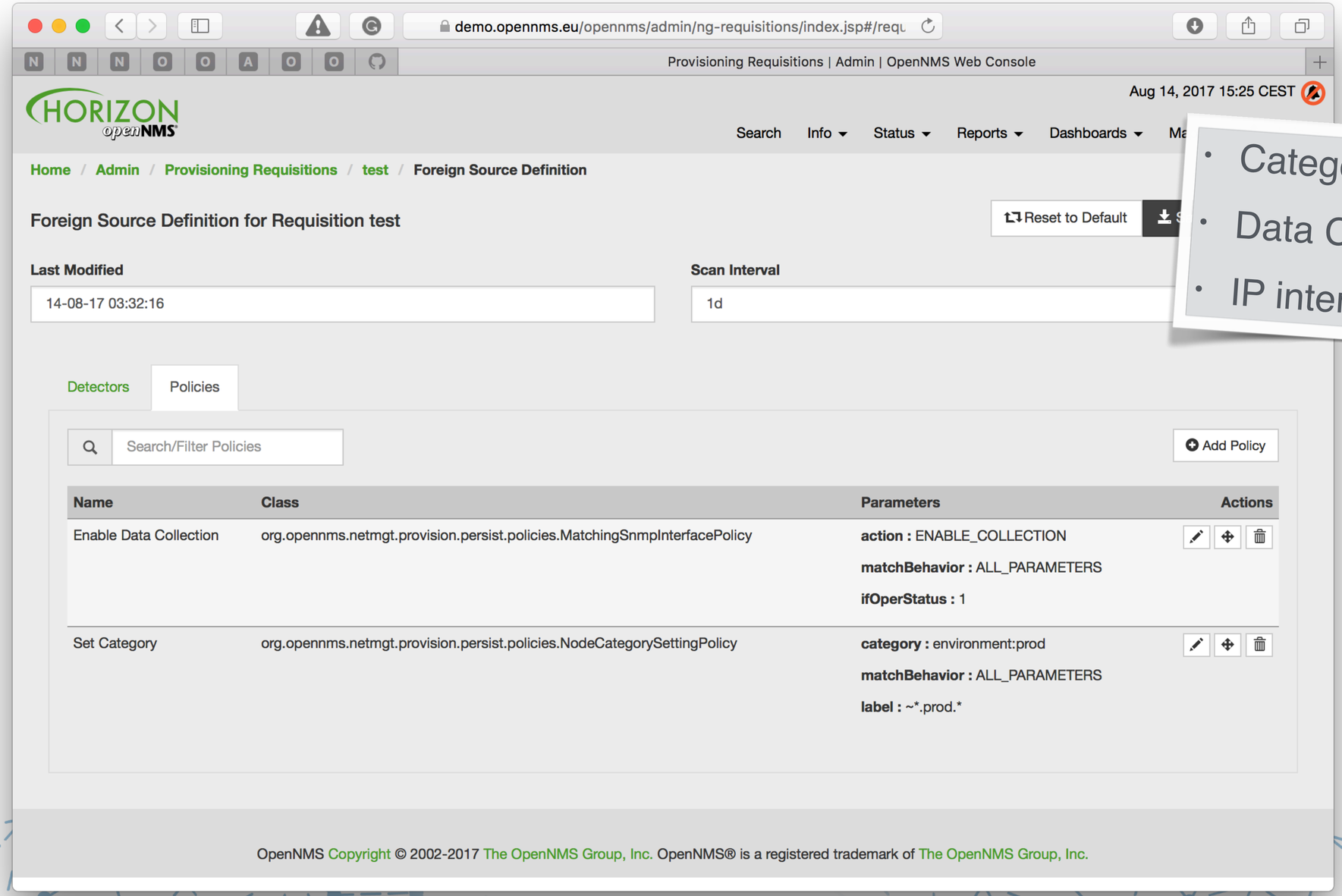
Provisioning



- Service Detectors
- Interval täglich
- Policies …

Provisioning



- Category
- Data Collection
- IP interface

ReST API

Provisioning

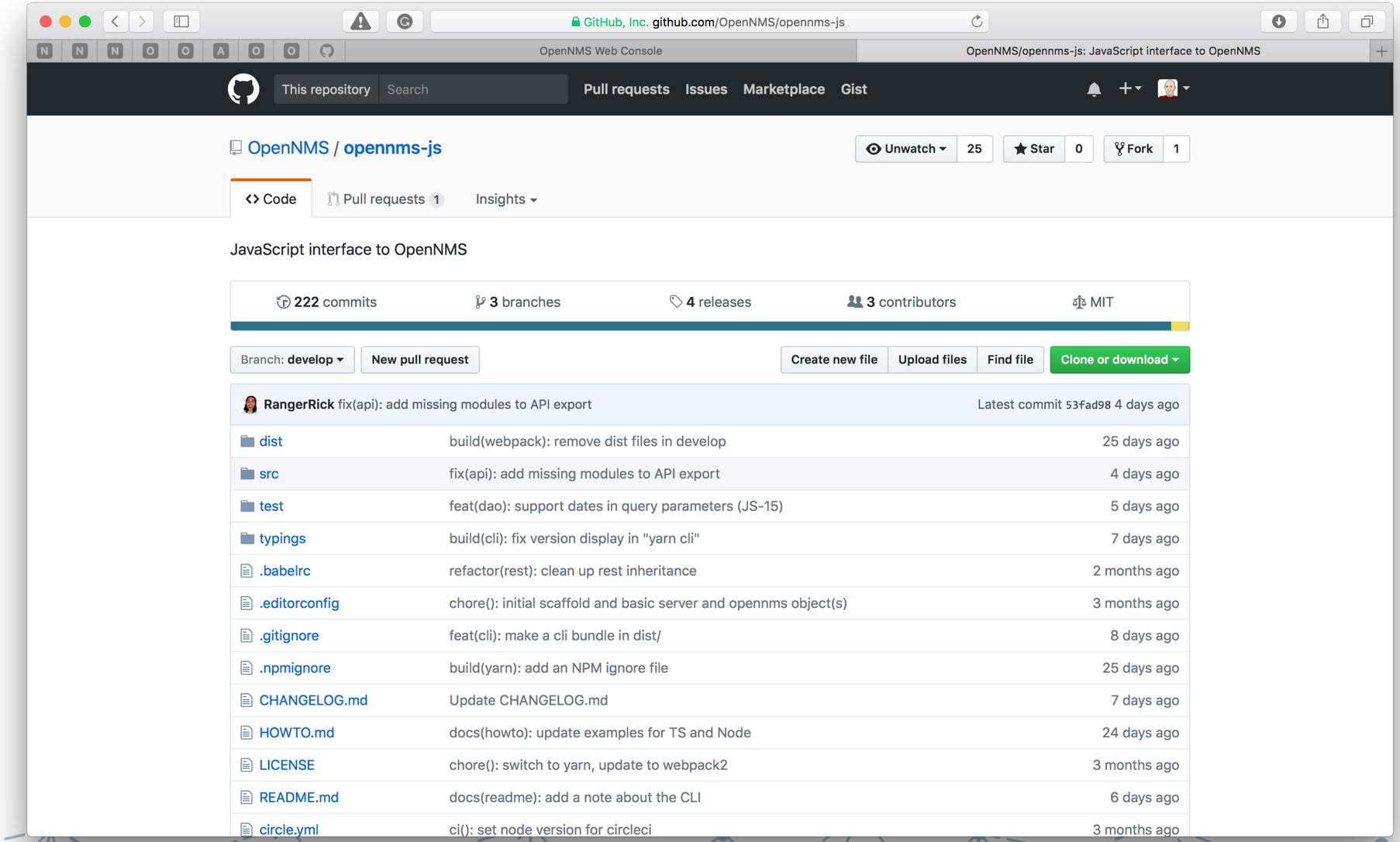
```
<model-import xmlns="http://xmlns.opennms.org/xsd/config/model-import"
  <node foreign-id="pris" node-label="pris">
    <interface ip-addr="172.29.0.8" snmp-primary="P">
      <monitored-service service-name="HTTP-8000"/>
      <monitored-service service-name="ICMP"/>
      <monitored-service service-name="StrafePing"/>
    </interface>
    <category name="type:server"/>
    <category name="threshold:bandwidth-out-high-100MiBs"/>
    <category name="organisation:opennms-eu"/>
    <category name="threshold:cpu-high-95"/>
    <category name="category:infrastructure"/>
    <category name="threshold:bandwdth-in-high-100MiBs"/>
    <category name="threshold:memory-high-95"/>
    <category name="threshold:disk-high-95"/>
    <category name="environment:production"/>
    <asset name="serialNumber" value="42"/>
    <asset name="modelNumber" value="Dedibox XC 2016 SSD"/>
    <asset name="operatingSystem" value="Ubuntu 16.04 LTS"/>
    <asset name="manufacturer" value="Online Labs"/>
    <asset name="ram" value="2 x 8 GB DDR3 1600 MHz"/>
    <asset name="cpu" value="Intel(R) Atom(TM) CPU C2750@2.40GHz"/>
    <asset name="zip" value="75015"/>
    <asset name="department" value="IT Operation"/>
    <asset name="address1" value="Boulevard Lefebvre 58"/>
    <asset name="city" value="Paris"/>
    <asset name="building" value="OnlineNet Datacenter 1"/>
  </node>
```

ReST API - Provisioning

```
curl -s -u ${OPENNMS_USER}:${OPENNMS_PASS} \
     -X POST \
     -H "Content-Type: application/xml" \
     -H "Accept: application/xml" \
     -d @demo-environment.xml \
     http://${OPENNMS_HOST}:${OPENNMS_PORT}/opennms/rest/requisitions
```

- Rest API
- Detektoren und Policies
- Nodes mit Interfaces
- Assetinformationen
- Kategorien

JavaScript Library



ReST API - Alarms

- Developed with Helm in Grafana
- Versionierung mit OpenNMS
- NodeJS CLI tool

```
indigo@blinky ~ opennms alarms                                    ✔ 10005 16:59:36
ID   Severity  Node                Count  Time              Log
282  MINOR     clonphy01           1      2017-08-12 07:47  System-Restart outage identified on interface 172.…
281  MINOR     fdhsphy01           1      2017-08-12 07:47  System-Restart outage identified on interface 172.…
280  MINOR     mirror              1      2017-08-12 07:43  System-Restart outage identified on interface 172.…
273  MINOR     issues.opennms.org  1      2017-08-12 02:08  SSL-Cert-HTTPS-443 outage identified on interface…
```

ReST API - Measurements

```
indigo@blinky ~ curl -u rest:rest \
                     -H "Accept: application/json" \
                     -H "Content-Type: application/json" \
                     -d @report.json \
                     "https://demo.opennms.eu/opennms/rest/measurements" | jq
```

ReST API - Alarms

- Events
- Alarms
- Scheduled Outages
- Provisioning
- SNMP Konfiguration
- User / Groups /Roles
- Notifications
- Performance Measurements

Konfiguration

Konfiguration - Beispiel SNMP

Node: ofe 5 Server ofe Default

View Events View Alarms View Outages Asset Info Hardware Info Availability Site Status SSH Resource Graphs Rescan Admin U

SNMP Attributes	
Name	lvps91-250-116-222.dedicated.hosteurope.de
sysObjectID	.1.3.6.1.4.1.8072.3.2.10
Location	Host-Europe VPS
Contact	admin@opennms.eu
Description	Linux lvps91-250-116-222.dedicated.hosteurope.de 2.6.32-042stab123.9 #1 SMP Thu Jun 29 13:01:59 MSK 2017 x86_64

Konfiguration - Beispiel SNMP

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sysObjectID	.1.3.6.1.4.1.8072.3.2.10
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sysObjectID	.1.3.6.1.4.1.8072.3.2.10

Konfiguration - Beispiel SNMP

sysObjectID	.1.3.6.1.4.1.8072.3.2.10

```
<systemDef name="Enterprise">
  <sysoidMask>.1.3.6.1.4.1.</sysoidMask>
  <collect>
    <includeGroup>mib2-interfaces</includeGroup>
    <includeGroup>mib2-X-interfaces</includeGroup>
    <includeGroup>mib2-tcp</includeGroup>
    <includeGroup>mib2-powerethernet</includeGroup>
  </collect>
</systemDef>
```

```
<group name="mib2-X-interfaces" ifType="all">
  <mibObj oid=".1.3.6.1.2.1.31.1.1.1.1"  instance="ifIndex" alias="ifName"        type="string"  />
  <mibObj oid=".1.3.6.1.2.1.31.1.1.1.15" instance="ifIndex" alias="ifHighSpeed"   type="string"  />
  <mibObj oid=".1.3.6.1.2.1.31.1.1.1.6"  instance="ifIndex" alias="ifHCInOctets"  type="Counter64" />
  <mibObj oid=".1.3.6.1.2.1.31.1.1.1.10" instance="ifIndex" alias="ifHCOutOctets" type="Counter64" />
</group>
```

Konfiguration - Beispiel SNMP

sysObjectID	.1.3.6.1.4.1.8072.3.2.10

```
<systemDef name="Net-SNMP">
  <sysoidMask>.1.3.6.1.4.1.8072.3.</sysoidMask>
  <collect>
    <includeGroup>net-snmp-disk</includeGroup>
    <includeGroup>net-snmp-disk-more</includeGroup>
    <includeGroup>net-snmp-disk-highlow</includeGroup>
    <includeGroup>ucd-loadavg</includeGroup>
    <includeGroup>ucd-memory</includeGroup>
    <includeGroup>ucd-sysstat</includeGroup>
    <includeGroup>ucd-sysstat-raw</includeGroup>
    <includeGroup>ucd-sysstat-raw-more</includeGroup>
    <includeGroup>lmsensors-temp</includeGroup>
    <includeGroup>lmsensors-fan</includeGroup>
    <includeGroup>lmsensors-volt</includeGroup>
  </collect>
</s
```

```
<group name="ucd-loadavg" ifType="ignore">
  <mibObj oid=".1.3.6.1.4.1.2021.10.1.5" instance="1" alias="loadavg1"  type="integer" />
  <mibObj oid=".1.3.6.1.4.1.2021.10.1.5" instance="2" alias="loadavg5"  type="integer" />
  <mibObj oid=".1.3.6.1.4.1.2021.10.1.5" instance="3" alias="loadavg15" type="integer" />
</group>
```

Konfiguration - Beispiel SNMP

datacollection-group name="Net-SNMP"

```
<systemDef name="Enterprise">
  <sysoidMask>.1.3.6.1.4.1.</sysoidMask>
  <collect>
    <includeGroup>mib2-interfaces</includeGroup>
    <includeGroup>mib2-X-interfaces</includeGroup>
    <includeGroup>mib2-tcp</includeGroup>
    <includeGroup>mib2-powerethernet</includeGroup>
  </collect>
</systemDef>
```

```
<group name="mib2-X-interfaces" ifType="all">
  <mibObj oid=".1.3.6.1.2.1.31.1.1.1.1"  instance="ifIndex" alias="ifName"
  <mibObj oid=".1.3.6.1.2.1.31.1.1.1.15" instance="ifIndex" alias="ifHighSpeed"
  <mibObj oid=".1.3.6.1.2.1.31.1.1.1.6"  instance="ifIndex" alias="ifHCInOctets"
  <mibObj oid=".1.3.6.1.2.1.31.1.1.1.10" instance="ifIndex" alias="ifHCOutOctets"
</group>
```

Konfiguration - Beispiel SNMP

datacollection-group name="Net-SNMP"

```
<systemDef name="Enterprise">
  <sysoidMask>.1.3.6.1.4.1.</sysoidMask>
  <collect>
    <includeGroup>mib2-interfaces</includeGroup>
    <includeGroup>mib2-X-interfaces</includeGr
    <includeGroup>mib2-tcp</includeGroup>
    <includeGroup>mib2-powerethernet</includeG
  </collect>
</systemDef>
```

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<group name="mib2-X-interfaces" ifType="all">
  <mibObj oid=".1.3.6.1.2.1.31.1.1.1.1"  instance="ifIndex" alias="ifName"
  <mibObj oid=".1.3.6.1.2.1.31.1.1.1.15" instance="ifIndex" alias="ifHighSpeed"
  <mibObj oid=".1.3.6.1.2.1.31.1.1.1.6"  instance="ifIndex" alias="ifHCInOctets"
```

```
<snmp-collection name="default" snmpStorageFlag="select">
    <rrd step="30">
        <rra>RRA:AVERAGE:0.5:1:20160</rra>
        <rra>RRA:AVERAGE:0.5:12:14880</rra>
        <rra>RRA:AVERAGE:0.5:288:3660</rra>
        <rra>RRA:MAX:0.5:288:3660</rra>
        <rra>RRA:MIN:0.5:288:3660</rra>
    </rrd>

    <include-collection dataCollectionGroup="MIB2"/>
    <include-collection dataCollectionGroup="Net-SNMP"/>
    <include-collection dataCollectionGroup="PostgreSQL-JDBC"/>
</snmp-collection>
```

Konfiguration - Beispiel SNMP

datacollection-group name="Net-SNMP"

```
<systemDef name="Enterprise">
  <sysoidMask>.1.3.6.1.4.1.</sysoidMask>
  <collect>
    <includeGroup>mib2-interfaces</includeGroup>
    <includeGroup>mib2-X-interfaces</includeGr
    <includeGroup>mib2-tcp</includeGroup>
    <includeGroup>mib2-powerethernet</includeG
  </collect>
</systemDef>
```

```
<group name="mib2-X-interfaces" ifType="all">
  <mibObj oid=".1.3.6.1.2.1.31.1.1.1.1"  instance="ifIndex" alias="ifName"
  <mibObj oid=".1.3.6.1.2.1.31.1.1.1.15" instance="ifIndex" alias="ifHighSpeed"
  <mibObj oid=".1.3.6.1.2.1.31.1.1.1.6"  instance="ifIndex" alias="ifHCInOctets"
```

```
<snmp-collection name="default" snmpStorageFlag="select">
    <rrd step="30">
        <rra>RRA:AVERAGE:0.5:1:20160</rra>
        <rra>RRA:AVERAGE:0.5:12:14880</rra>
        <rra>RRA:AVERAGE:0.5:288:3660</rra>
        <rra>RRA:MAX:0.5:288:3660</rra>
        <rra>RRA:MIN:0.5:288:3660</rra>
    </rrd>

    <include-collection dataCollectionGroup="MIB2"/>
    <include-collection dataCollectionGroup="Net-SNMP"/>
    <include-collection dataCollectionGroup="PostgreSQL-JDBC"/>
</snmp-collection>
```

Konfiguration - Beispiel SNMP

```
<snmp-collection name="default" snmpStorageFlag="select">
    <rrd step="30">
        <rra>RRA:AVERAGE:0.5:1:20160</rra>
        <rra>RRA:AVERAGE:0.5:12:14880</rra>
        <rra>RRA:AVERAGE:0.5:288:3660</rra>
        <rra>RRA:MAX:0.5:288:3660</rra>
        <rra>RRA:MIN:0.5:288:3660</rra>
    </rrd>

    <include-collection dataCollectionGroup="MIB2"/>
    <include-collection dataCollectionGroup="Net-SNMP"/>
    <include-collection dataCollectionGroup="PostgreSQL-JDBC"/>
</snmp-collection>
```

Konfiguration - Beispiel SNMP

```
<collectd-configuration
        threads="50">
    <package name="default-datacollection-30">
        <filter>IPADDR != '0.0.0.0'</filter>
        <include-range begin="0.0.0.1" end="255.255.255.254"/>
        <include-range begin="::1" end="ffff:ffff:ffff:ffff:ffff:ffff:ffff:ffff"/>

        <service name="SNMP" interval="30000" user-defined="false" status="on">
            <parameter key="collection" value="default"/>
            <parameter key="thresholding-enabled" value="true"/>
        </service>

    <collector service="SNMP" class-name="org.opennms.netmgt.collectd.SnmpCollector"/>
```

```
mpStorageFlag="select">

160</rra>
4880</rra>
3660</rra>
        <rra>RRA:MAX:0.5:288:3660</rra>
        <rra>RRA:MIN:0.5:288:3660</rra>
    </rrd>

    <include-collection dataCollectionGroup="MIB2"/>
    <include-collection dataCollectionGroup="Net-SNMP"/>
    <include-collection dataCollectionGroup="PostgreSQL-JDBC"/>
</snmp-collection>
```

Konfiguration - Beispiel SNMP

```
<collectd-configuration
        threads="50">
    <package name="default-datacollection-30">
        <filter>IPADDR != '0.0.0.0'</filter>
        <include-range begin="0.0.0.1" end="255.255.255.254"/>
        <include-range begin="::1" end="ffff:ffff:ffff:ffff:ffff:ffff:ffff:ffff"/>

        <service name="SNMP" interval="30000" user-defined="false" status="on">
            <parameter key="collection" value="default"/>
            <parameter key="thresholding-enabled" value="true"/>
        </service>

    <collector service="SNMP" class-name="org.opennms.netmgt.collectd.SnmpCollector"/>
```

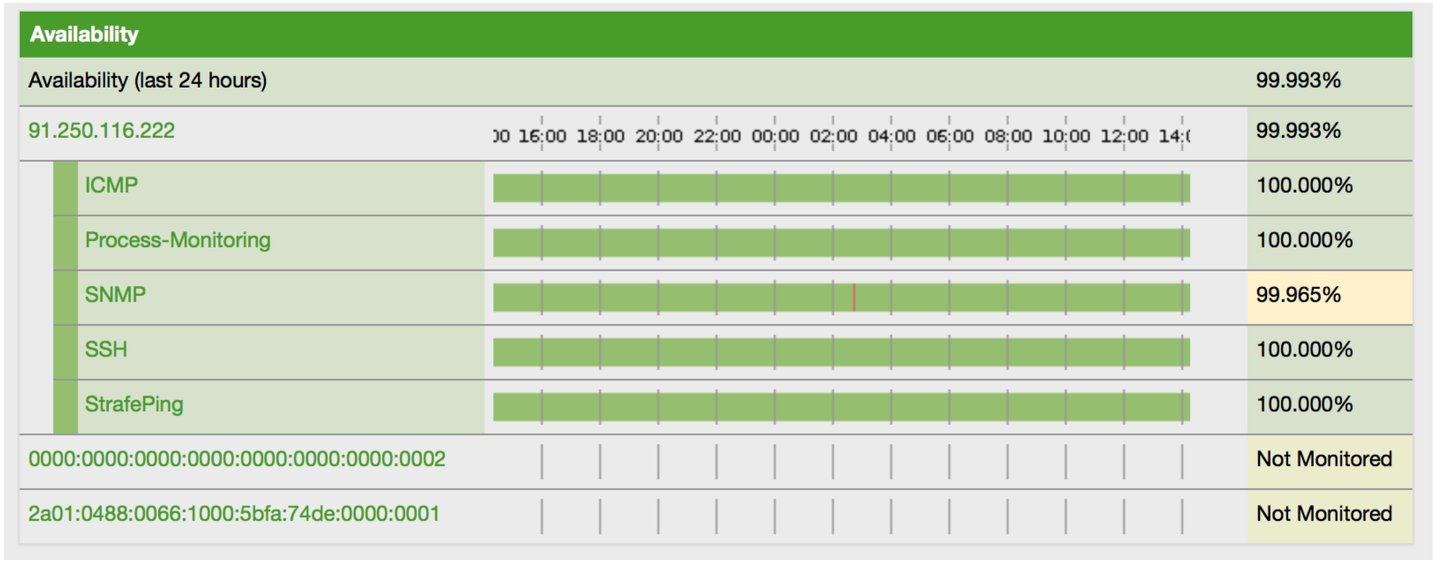
```
mpStorageFlag="select">

160</rra>
4880</rra>
3660</rra>
        <rra>RRA:MAX:0.5:288:3660</rra>
        <rra>RRA:MIN:0.5:288:3660</rra>
    </rrd>

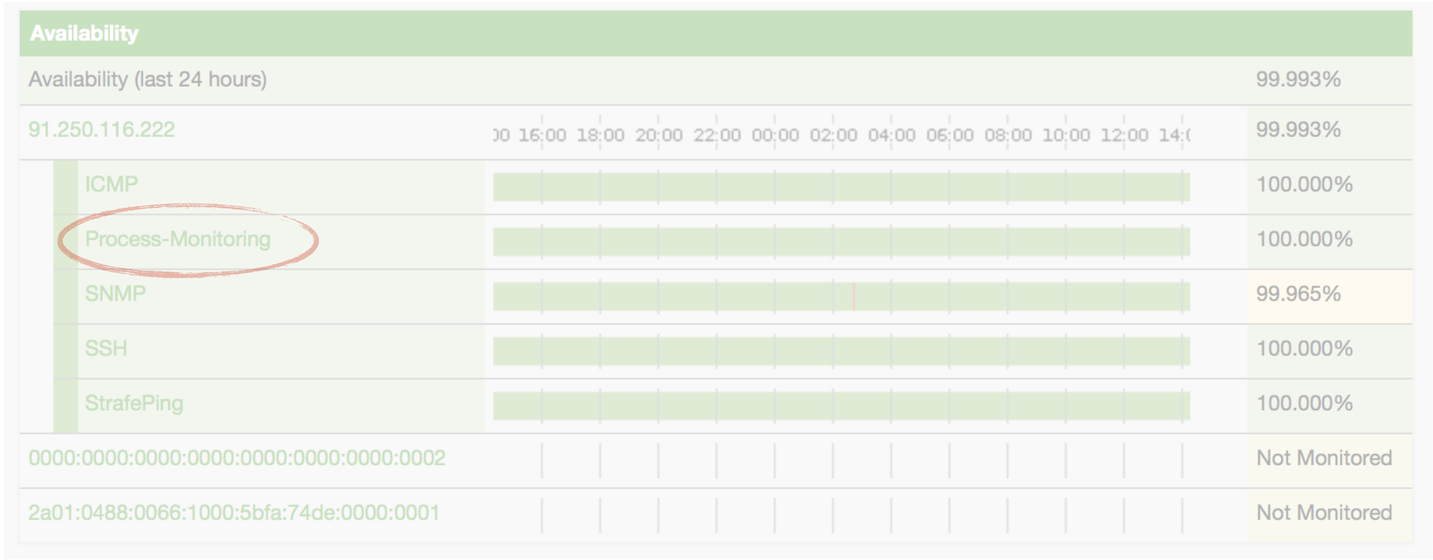
    <include-collection dataCollectionGroup="MIB2"/>
    <include-collection dataCollectionGroup="Net-SNMP"/>
    <include-collection dataCollectionGroup="PostgreSQL-JDBC"/>
```

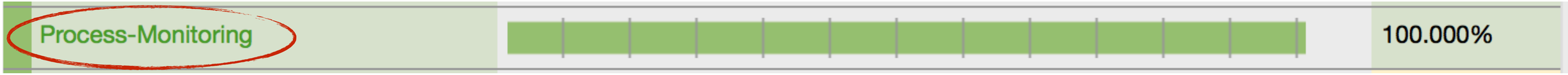
Available Collectors

Konfiguration - Service Test



Konfiguration - Service Test





Konfiguration - Service Test

```
<service name="Process-Monitoring" interval="30000" user-defined="true" status="on">
    <parameter key="retry" value="2"/>
    <parameter key="timeout" value="2000"/>
</service>
```

```
<monitor service="Process-Monitoring" class-name="org.opennms.netmgt.poller.monitors.PrTableMonitor"/>
```

Konfiguration - Service Test

```
<service name="Process-Monitoring" interval="30000" user-defined="true" status="on">
    <parameter key="retry" value="2"/>
    <parameter key="timeout" value="2000"/>
</service>
```

```
<monitor service="Process-Monitoring" class-name="org.opennms.netmgt.poller.monitors.PrTableMonitor"/>
```

Available Service Monitors

Alarm Korrelation

Alarm Generation

```
<event>
    <uei>uei.opennms.org/nodes/nodeDown</uei>
    <event-label>OpenNMS-defined node event: nodeDown</event-label>
    <descr>
        ... some description ...
    </descr>
    <logmsg dest="logndisplay">
        Node %parm[nodelabel]% is down.
    </logmsg>
    <severity>Major</severity>
    <alarm-data reduction-key="%uei%:%dpname%:%nodeid%" alarm-type="1" auto-clean="false"/>
</event>
<event>
    <uei>uei.opennms.org/nodes/nodeUp</uei>
    <event-label>OpenNMS-defined node event: nodeUp</event-label>
    <descr>
        ... some description ...
    </descr>
    <logmsg dest="logndisplay">
        Node %parm[nodelabel]% is up.
    </logmsg>
    <severity>Normal</severity>
    <alarm-data reduction-key="%uei%:%dpname%:%nodeid%" alarm-type="2"
                clear-key="uei.opennms.org/nodes/nodeDown:%dpname%:%nodeid%" auto-clean="false"/>
</event>
```

Alarm Generation

```
<event>
    <uei>uei.opennms.org/nodes/nodeDown</uei>
    <event-label>OpenNMS-defined node event: nodeDown</event-label>
    <descr>
        ... some description ...
    </descr>
    <logmsg dest="logndisplay">
        Node %parm[nodelabel]% is down.
    </logmsg>
    <severity>Major</severity>
    <alarm-data reduction-key="%uei%:%dpname%:%nodeid%" alarm-type="1" auto-clean="false"/>
</event>
<event>
    <uei>uei.opennms.org/nodes/nodeUp</uei>
    <event-label>OpenNMS-defined node event: nodeUp</event-label>
    <descr>
        ... some description ...
    </descr>
    <logmsg dest="logndisplay">
        Node %parm[nodelabel]% is up.
    </logmsg>
    <severity>Normal</severity>
    <alarm-data reduction-key="%uei%:%dpname%:%nodeid%" alarm-type="2"
                clear-key="uei.opennms.org/nodes/nodeDown:%dpname%:%nodeid%" auto-clean="false"/>
</event>
```

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    </logmsg>
    <severity>Major</severity>
    <alarm-data reduction-key="%uei%:%dpname%:%nodeid%" alarm-type="1" auto-clean="false"/>
</event>
<event>
    <uei>uei.opennms.org/nodes/nodeUp</uei>
    <event-label>OpenNMS-defined node event: nodeUp</event-label>
    <descr>
        ... some description ...
    </descr>
    <logmsg dest="logndisplay">
        Node %parm[nodelabel]% is up.
    </logmsg>
    <severity>Normal</severity>
    <alarm-data reduction-key="%uei%:%dpname%:%nodeid%" alarm-type="2"
                clear-key="uei.opennms.org/nodes/nodeDown:%dpname%:%nodeid%" auto-clean="false"/>
</event>
```
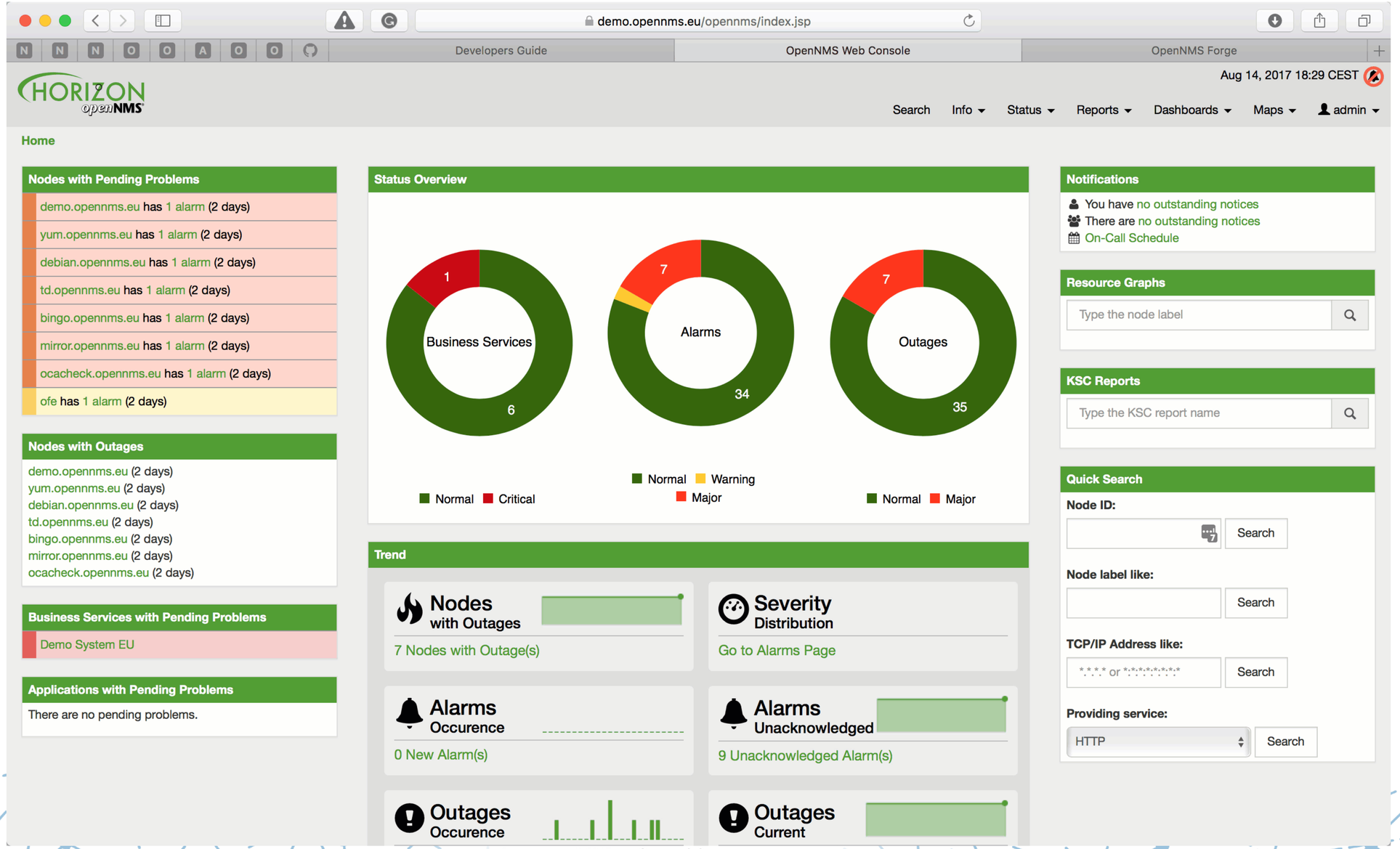

Alarm De-Duplikation

```
<event>
    <uei>uei.opennms.org/nodes/nodeDown</uei>
    <event-label>OpenNMS-defined node event: nodeDown</event-label>
    <descr>
        ... some description ...
    </descr>
    <logmsg dest="logndisplay">
        Node %parm[nodelabel]% is down.
    </logmsg>
    <severity>Major</severity>
    <alarm-data reduction-key="%uei%:%dpname%:%nodeid%" alarm-type="1" auto-clean="false"/>
</event>
<event>
    <uei>uei.opennms.org/nodes/nodeUp</uei>
    <event-label>OpenNMS-defined node event: nodeUp</event-label>
    <descr>
        ... some description ...
    </descr>
    <logmsg dest="logndisplay">
        Node %parm[nodelabel]% is up.
    </logmsg>
    <severity>Normal</severity>
    <alarm-data reduction-key="%uei%:%dpname%:%nodeid%" alarm-type="2"
                clear-key="uei.opennms.org/nodes/nodeDown:%dpname%:%nodeid%" auto-clean="false"/>
</event>
```

Alarm De-Duplikation



Complex Alarm Correlation - Drools