

# OpenNMS Release Notes

Copyright (c) 2016-2019 The OpenNMS Group, Inc.

OpenNMS Horizon v25.1.2, Last updated 2020-01-07 12:05:45 EST

# Table of Contents

What's New in OpenNMS Horizon 25 .....	2
System Requirements .....	2
Breaking Changes.....	2
PostgreSQL 10.....	2
Elasticsearch 7.x Support.....	2
Flows.....	2
Minion Packages Combined .....	2
Sentinel Now Requires an ID and Location.....	3
Helm 4 .....	3
Removed from Horizon 25 .....	3
Event (and Alarm) Date/Time Formats.....	3
New Features and Improvements .....	3
Docker Containers.....	3
Systemd Updates .....	3
Poller.....	4
Thresholding.....	4
Flows.....	4
Elasticsearch.....	4
Detectors, Monitors, and Collectors .....	4
Reporting.....	5
New or Updated Karaf Shell Commands .....	5
UI Improvements.....	5
Development Considerations .....	6
Internals.....	6
Changelog.....	6
Release 25.1.2 .....	6
Release 25.1.1 .....	7
Release 25.1.0 .....	8
Release 25.0.0 .....	10

Copyright © 2004-2019 The OpenNMS Group, Inc.

Permission is granted to copy, distribute and/or modify this document under the terms of the GNU Free Documentation License, Version 1.1 or any later version published by the Free Software Foundation; with no Invariant Sections, with no Front-Cover Texts and with no Back-Cover Texts. A copy of the license is available at <http://www.gnu.org/copyleft/fdl.html> OpenNMS is the creation of numerous people and organizations, operating under the umbrella of the OpenNMS project. The source code is published under the GNU Affero GPL, version 3 or later and is Copyright © 2002-2019 The OpenNMS Group, Inc.

The current corporate sponsor of OpenNMS is The OpenNMS Group, which also owns the OpenNMS trademark.

Please report any omissions or corrections to this document by creating an issue at <http://issues.opennms.org>.

# What's New in OpenNMS Horizon 25

## System Requirements

- **Java 8 through 11:** OpenNMS Horizon 25 runs on JDK 8 through 11. We recommend the most recent version of OpenJDK 11.
- **Default Heap Size:** The default heap size is now 2GB.
- **PostgreSQL 10 or higher:** Horizon 25 requires any supported version of PostgreSQL 10 or higher.

## Breaking Changes

### PostgreSQL 10

OpenNMS Horizon 25 is supported on PostgreSQL 10 or later.

If you are upgrading from an OpenNMS using an older PostgreSQL version, you can use the [pg\\_upgrade](#) tool to migrate. For details on the migration process, see [the PostgreSQL pg\\_upgrade documentation](#).

If you are running on a distribution that does not provide PostgreSQL 10 packages by default, you can [download packages provided by PostgreSQL instead](#).

### Elasticsearch 7.x Support

All of the features that leverage integrations with Elasticsearch i.e. event & alarm history, flows & situation feedback have been updated to support Elasticsearch 7.x. Elasticsearch versions before 7.x are no longer supported.

Given the pace of changes and the number of breaking changes between major versions of Elastisearch, we will focus on supporting a single major version of Elasticsearch per release moving forward.

### Flows

While working on improvements to flow support we have modified the index templates and it is no longer possible to query flows stored in indices created with prior version of OpenNMS. We will revisit ways to migrate these in a future release.

### Minion Packages Combined

The Minion RPM and Debian/Ubuntu packages have been combined into a single package. Previously it was possible to just install the core container and optionally a set of features on top, but in the real world no one used this, and it's still possible to choose what features are used with configuration.



If you were previously *only* installing the sub-packages and not installing the wrapper `opennms-minion` RPM package, you may need to run this command to upgrade cleanly:

```
$ yum swap 'opennms-minion*' -- install opennms-minion
```

## Sentinel Now Requires an ID and Location

The documentation for setting up a Sentinel already suggested setting ID and Location, but now they are required for tracing.

## Helm 4

Technically not a part of OpenNMS, but it's important to note that Helm 4 introduces a datasource that *replaces* the "Faults" datasource. Migration of existing dashboards requires a few manual steps; documentation on how to do so will be available in [the latest Helm documentation](#) once Helm 4 goes live.

## Removed from Horizon 25

- The Alarm Change Notifier plugin has been removed due to performance problems. Use the Alarm History function instead.
- The `resourcecli` tool has been removed in favor of [Karaf shell commands](#) to perform the same operations.

## Event (and Alarm) Date/Time Formats

Events and alarms previously used the current locale for formatting timestamps. As of Horizon 25.1.0, we now format dates as ISO-8601 date-time with offsets (eg, `2011-12-03T10:15:30+01:00`) and we expect dates in incoming events to be the same. This reduces the amount of code we run through trying to figure out date formats while parsing events, and simplifies things to work no matter what locale you are using.

# New Features and Improvements

## Docker Containers

- Docker containers are now built automatically as part of our CI process.
- The `horizon` Docker container now runs as non-root by default.

## Systemd Updates

The OpenNMS, Minion, and Sentinel packages all contain first-class Systemd files for startup. If you're upgrading from a previous release, you may need to do a `systemctl enable <service>` (`minion`, `sentinel`, etc.) and `systemctl daemon-reload` for things to start up as expected.

## Poller

- Pollerd now reloads properly with a `daemonReload` event.
- Filters that use `<include-url>` now reload when Pollerd configuration reloads.
- It is now possible to configure the poller with wildcard configurations that match multiple services. For details, see [the Admin Guide section on Service Patterns](#).

## Thresholding

- Thresholding state is now persisted to the database, and can also be shared with Sentinel.
- Thresholding can now be applied to streaming telemetry data, including scaling to multiple Sentinel instances.
- Thresholding expressions now support [meta-data](#)
- Threshold state can be managed through the Karaf shell.

## Flows

A large number of improvements have been made to flow support.

- Flow classification rules are now configurable with custom priorities and custom groups can be created.
- The node list, node details, and resource graph pages indicate whether flows are available.
- Basic clock skew detection for flow timestamps has been introduced.
- Flows can be grouped by monitoring location.

ReST queries and Helm have been enhanced to support new flow features:

- Support has been added for querying traffic for specific applications over time.
- Support has been added for querying a list of "Top N" hosts, similar to applications and conversations.
- Hostnames can now be shown in Helm rather than just IP addresses, when available.

## Elasticsearch

- It is now possible to set a custom prefix for the indices, which allows for multiple OpenNMS instances to share the same cluster.

## Detectors, Monitors, and Collectors

- TTLs can be customized per-detector, monitor, or collector.
- A JMS/ActiveMQ detector and monitor have been added.
- The TLS Certificate Monitor now supports using STARTTLS to negotiate.

## Reporting

- The scheduled reporting UI has been updated and improved.
- It is now possible to configure OpenNMS to integrate with Grafana and schedule PDF reports generated from Grafana dashboards.
- Time zone is now considered when scheduling reports.
- Scheduled reports now support multiple recipients.

## New or Updated Karaf Shell Commands

The following new commands have been added to support new or existing functionality:

- `events:send` - send an OpenNMS event
- `opennms-dns:stress` - stress-test the new internal DNS resolver
- `opennms-kv-blob:get` - print a record from the blob store
- `opennms-kv-blob:put` - inserts a string into the blob store
- `opennms-kv-blob:benchmark` - benchmark the internal OpenNMS blob store
- `opennms-kv-json:get` - print a record from the JSON store
- `opennms-kv-blob:put` - inserts a record into the JSON store
- `opennms-measurements:show-measurements` - show measurements data
- `opennms-measurements:show-newts-samples` - show raw sample data from Newts
- `opennms-measurements:show-resources` - show/filter the resource tree
- `opennms-measurements:delete-resource` - delete the measurements and meta-data for a resource
- `opennms-snmp:fit` - given an IP address, "fit" that address to an SNMP config profile
- `opennms-snmp:remove-from-definition` - remove an IP address from an SNMP config definition
- `opennms-threshold-states:enumerate` - list threshold states
- `opennms-threshold-states:details` - show the details of a specific threshold state
- `opennms-threshold-states:clear` - clear a specific threshold state
- `opennms-threshold-states:clear-all` - reset all threshold states
- `provision:import-requisition` - import a requisition from a URL

Additionally, a few commands have been updated to have `opennms-` as their prefix:

- `snmp:show-config` → `opennms-snmp:show-config`
- `snmp:walk` → `opennms-snmp:walk`

## UI Improvements

- The UI has gone through a refresh, moving to Bootstrap 4 and vastly cleaning up our HTML to make it easier to make further improvements going forward.

- "Graph All" now works properly even when there are a large number of resources to graph.
- Node, interface, and service meta-data is now configurable in the requisition UI.
- The Backshift graph zooming regression introduced with the web asset refactor has been fixed.
- The rendered graph page can now be searched/filtered to pare down results, and graphs are now lazily loaded.
- The alarm list can now be filtered by surveillance category.

## Development Considerations

- The [OpenNMS Integration API](#) now supports processing thresholds.

## Internals

A ton of other internal improvements have been made:

- The complete node object is now exposed to Scriptd and script policies.
- A bunch more things have been added to the Karaf `health:check` command-line.
- Elasticsearch client performance has been improved by enabling compression where possible.
- A new DNS resolution service has been introduced internally that should speed up hostname lookups.
- A new key/value store was added, for internal use in things like thresholding persistence and user session data.
- The `snmp-config.xml` file now supports "profiles" for influencing the behavior of IPs that don't match existing definitions. For details, see [the Admin Guide section on SNMP Profiles](#).
- Our embedded Drools has been updated to the latest 7.x release.
- More instrumentation has been added to the Jaeger OpenTracing support introduced in Horizon 24.
- A ton of performance improvements have been made in various parts of the codebase.
- 2 new roles have been added:
  - `ROLE_REPORT_DESIGNER` - use the ReST APIs or UI for manipulating reports and report schedules
  - `ROLE_FLOW_MANAGER` - use the Rest APIs or UI for managing flow classification rules

## Changelog

### Release 25.1.2

Release 25.1.2 is the fourth release in the Horizon 25 series.

It contains a number of alarm classification bug fixes and performance improvements, flow enhancements, and more.



The codename for 25.1.2 is *Pierogi*.

## Bug

- possible issue in JCIFS Monitor - continuously increase of threads - finally heap dump (Issue [NMS-12407](#))
- Wrong links in the Help/Support page (Issue [NMS-12418](#))
- Classification Engine reload causes OOM when defining a bunch of rules (Issue [NMS-12429](#))
- TCP Listeners are broken (Issue [NMS-12430](#))
- Cannot define a specific layer in topology app URL (Issue [NMS-12431](#))
- Classification UI: Error responses are not shown properly (Issue [NMS-12432](#))
- Classification Engine: The end of the range is excluded, which is not intuitive (Issue [NMS-12433](#))
- Ticket-creating automations are incorrectly enabled by default (Issue [NMS-12439](#))
- Enable downtime model-based node deletion to happen when unmanaged interfaces exist (Issue [NMS-12442](#))
- Improve alarmd Drools engine performance by using STREAM mode (Issue [NMS-12455](#))

## Enhancement

- Refactoring of the Cassandra installation instructions (Issue [NMS-12397](#))
- SNMP detector should use snmp profiles (Issue [NMS-12406](#))
- Allow telemetry flows to balance across Kafka partitions (Issue [NMS-12427](#))
- Add system test for IpfixTcpParser (Issue [NMS-12434](#))
- Associate exporter node using Observation Domain Id (Issue [NMS-12435](#))

## Release 25.1.1

Release 25.1.1 is the third release in the Horizon 25 series.

It contains a number of bug fixes mostly related to alarm and event processing and potential resource leaks, as well as provisioning enhancements to SNMP profiles.

The codename for 25.1.1 is *Bánh bột lọc*.

## Bug

- Readiness probe with Minion in Kubernetes with health:check does not work (Issue [NMS-12120](#))
- AlarmLifecycleListenerManagerIT and AlarmdIT flapping (Issue [NMS-12309](#))
- Strange behavior on used threads and file descriptors on Minion (Issue [NMS-12366](#))
- Upstream Drools Bug: From with modify fires unexpected rule (Issue [NMS-12367](#))
- Build failure during release for 25.1.0 in CircleCI (Issue [NMS-12380](#))
- Discovery does not honor exclude-range inside a definition (Issue [NMS-12385](#))

- Discovery exclude-range is not location-aware (Issue [NMS-12386](#))
- Update OpenJDK 11.0.4 to 11.0.5 (Issue [NMS-12387](#))
- Elasticsearch event forwarder manipulates in-flight event (Issue [NMS-12390](#))
- send-event.pl is broken after OpenNMS 25.1.0 update (Issue [NMS-12392](#))
- SNMP profile fitting is not triggered in some cases when MINION is involved (Issue [NMS-12399](#))
- Alarmd fails intermittently and OOMs (Issue [NMS-12412](#))
- SNMP Remove from definitions fails for definitions with profile label (Issue [NMS-12413](#))

## Enhancement

- Migrate guide to run with Docker from GitHub repo to Installation guide (Issue [NMS-12375](#))
- Enhance new snmp profiles to allow fitting to nodes inside requisitions without SNMP service associated to any IPs configured (Issue [NMS-12396](#))
- Use OpenJDK 8 JDK for build environment (Issue [NMS-12398](#))

## Release 25.1.0

Release 25.1.0 is the second release in the Horizon 25 series.

It contains a bunch of bug fixes and enhancements, including packaging fixes, BSM updates, alarmd improvements, and much more.



This release contains a couple of breaking changes:

1. Dates in event XML (in the ReST API and published to the event port) now must be formatted in standard ISO-8601 format (eg, `2019-11-05T14:36:00-04:00`).
2. Scriptd has been changed to execute scripts in a single read-only transaction by default. If you need the ability to write changes to the database or need to do your own transaction management for any other reason, you will need to add `transactional="false"` to the `<scriptd-configuration ...>` tag in the `scriptd-configuration.xml` file.

The codename for 25.1.0 is [Momo](#).

## Bug

- removed service will break BSM web ui (Issue [NMS-9322](#))
- Event parameters no longer preserve ordering (Issue [NMS-9827](#))
- The JMX-Cassandra service goes down for all the cluster when a single instance is down. (Issue [NMS-10027](#))
- deleting a BSM monitor while an alarm is active doesn't clear the alarm (Issue [NMS-10184](#))
- default event description is incorrect (Issue [NMS-10346](#))
- Config tester doesn't detect missing xml datacollection file (Issue [NMS-10396](#))

- Minion fails to start on Raspberry Pi (Issue [NMS-10447](#))
- BSM alarm severity is not being updated (Issue [NMS-10578](#))
- snmp authentication error traps with Enhanced Linkd / bridge discovery (Issue [NMS-10582](#))
- Elasticsearch forwarding fails to recover after outage (Issue [NMS-10697](#))
- Flow rest results for top N queries are not returned in the correct order (Issue [NMS-12104](#))
- Flow Classification not functioning as expected (Issue [NMS-12259](#))
- ReST API for meta-data doesn't support JSON (Issue [NMS-12272](#))
- UI for meta-data is only present when using the horizontal layout (Issue [NMS-12273](#))
- Groups disappear in classification UI (Issue [NMS-12291](#))
- BSM simulation mode does not reset the last state (Issue [NMS-12302](#))
- Docker image for sentinel runs the process as root (Issue [NMS-12311](#))
- Docker image for Minion runs with UID 1001 but the minion user has UID 997 (Issue [NMS-12312](#))
- Web Assets Dependency Rollup 2019-09-24 (Issue [NMS-12320](#))
- Memory leak in Drools engine for alarmd (Issue [NMS-12322](#))
- Minion RPM upgrade deletes /opt/minion (Issue [NMS-12324](#))
- Threshold state keys do not incorporate the collected resource's instance label (Issue [NMS-12329](#))
- Reportd generated reports cause: "No bean named " is defined" in Persisted Reports (Issue [NMS-12337](#))
- InterfaceNodeCache doesn't remove deleted nodes immediately (Issue [NMS-12338](#))
- Delivering a report with "-" in local part of email address is not working (Issue [NMS-12342](#))
- XMLMarshalException in ipc.log: Unexpected close tag </inst>; expected </instance> (Issue [NMS-12343](#))
- Update installation guide to CentOS 8 (Issue [NMS-12348](#))
- Install guide for R-core is broken for CentOS 8 (Issue [NMS-12352](#))
- Karaf feature install issue with opennms-core-tracing-jaeger (Issue [NMS-12359](#))
- Fix requisition cache when accessing the Requisitions UI via "Edit in Requisition" (Issue [NMS-12360](#))
- Listing monitoring locations from the administrative WebUI is not working (Issue [NMS-12377](#))

## Enhancement

- Add more information into BSM alarms (Issue [NMS-9352](#))
- Refactor the compatibility matrix in the documentation (Issue [NMS-9684](#))
- Be able to change the number of rows for the pagination control on the Requisitions UI (Issue [NMS-9793](#))
- Documentation typo for /rest/ifservices on the developers guide (Issue [NMS-9842](#))

- Add Web-Hook as delivery option (Issue [NMS-12153](#))
- Refactor Event Timestamps to ISO-8601 Format (Breaking Change) (Issue [NMS-12263](#))
- Improve robustness of CassandraBlobStore for async operations (Issue [NMS-12274](#))
- Clearing threshold states via shell should take effect immediately and not require restart (Issue [NMS-12277](#))
- List Kafka RPC/Sink topics, Expose Metrics on Karaf shell (Issue [NMS-12294](#))
- Create proper systemd files for OpenNMS, Minion and Sentinel (Issue [NMS-12299](#))
- Add ability to update definitions when SNMP profile changes (Issue [NMS-12307](#))
- Fix security vulnerability with jackson-databind (Issue [NMS-12308](#))
- Availability boxes on node pages including sub pages differ (Issue [NMS-12321](#))
- OpenNMS 25 Dependency Still Allows Old PostgreSQL Versions (Issue [NMS-12341](#))
- Update base container image to use CentOS 8 (Issue [NMS-12353](#))
- Remove floating OpenJDK dependencies in OCI build (Issue [NMS-12354](#))
- Detect and help resolve Karaf bootstrap issues (Issue [NMS-12356](#))
- Update CISCO-ENTITY-SENSOR-MIB threshold trap events to include alarm-data (Issue [NMS-12362](#))
- switch core/web-assets from yarn to npm (Issue [NMS-12363](#))
- Collect and display file descriptor statistics via JMX for OpenNMS and Minion (Issue [NMS-12364](#))

## Release 25.0.0

Release 25.0.0 is the first release in the Horizon 25 series.

It contains a huge number of bug fixes and enhancements, most notably massive thresholding improvements, big changes to netflow and other streaming telemetry data, reporting and UI updates, plus much more.

The codename for 25.0.0 is *Baozi*.

### Bug

- "Graph all" fails with 'Request Header Fields Too Large' error (Issue [NMS-8712](#))
- reload Pollerd doesn't work correctly (Issue [NMS-9181](#))
- No class found exception in OSGi for org.osgi.service.jdbc.DataSourceFactory (Issue [NMS-9341](#))
- GenericResourceType is altering index names on class object initialization (Issue [NMS-9702](#))
- Updating external lists referenced by include-url requires restart OpenNMS (Issue [NMS-10071](#))
- Telephone PIN Field in User Details is Misplaced (Issue [NMS-10073](#))
- HealthCheck should not fail for Elasticsearch if flows are not enabled (Issue [NMS-10498](#))
- Syslog incorrect dates being parsed into database (Issue [NMS-10605](#))
- Zooming with Backshift is broken (Issue [NMS-10635](#))

- MonitoredServiceDaoIT test fail due to database (Issue [NMS-10643](#))
- EventdIT test failure (Issue [NMS-10644](#))
- DuplicatePrimaryAddressIT logs a failure due to logging assertion (Issue [NMS-10645](#))
- Reflected file download vulnerability in /api/v2/scanreports (Issue [NMS-10703](#))
- Insecure cache-control for session cookies (Issue [NMS-10704](#))
- Reflected XSS vulnerability in notification/detail.jsp and outage/detail.htm (Issue [NMS-10707](#))
- Kafka alarm producer synchronization fails due to missing event (Issue [NMS-10724](#))
- Documentation broken (Issue [NMS-10759](#))
- [circleci] Building container images fails intermittently (Issue [NMS-10834](#))
- Fix version range for maven-jaxb-schemagen-plugin version in root pom (Issue [NMS-11760](#))
- Sentinel container does not contain integration API in maven repository (Issue [NMS-11766](#))
- Windows is failing tests due to spurious cleanup errors (Issue [NMS-12102](#))
- AS is stored as signed int in flow doc (Issue [NMS-12105](#))
- Add local cache to reverse hostname resolution in flows (Issue [NMS-12117](#))
- karaf.log appears on the root file system when running Minion/Sentinel on Ubuntu/Debian. (Issue [NMS-12125](#))
- Sentinel cannot persist Telemetry when running under OracleJDK 11 (Issue [NMS-12126](#))
- Cannot debug Telemetry persistence on Sentinel (Issue [NMS-12127](#))
- Outage timeline is empty (Issue [NMS-12160](#))
- Minion not showing label correctly and label cannot be edited (Issue [NMS-12164](#))
- WsManWQLDetector, ActiveMQDetector missing setBeanProperties (Issue [NMS-12175](#))
- sFlow adapter drops flows due to NPE (Issue [NMS-12185](#))
- BulkRequests should log more details of why it failed (Issue [NMS-12188](#))
- The Cron Expression is only shown for reports which are created with the new UI (Issue [NMS-12189](#))
- Fix typo in sonar.sh (Issue [NMS-12196](#))
- Minion memory leak related to new DNS lookup functionality (Issue [NMS-12207](#))
- JMX Metrics for Newts disappeared (Issue [NMS-12216](#))
- Can't change Minion location in the Provisiond UI (Issue [NMS-12217](#))
- Changing a nodes location breaks the service polling schedule (Issue [NMS-12219](#))
- Wrong PID in opennms.pid (Issue [NMS-12226](#))
- interfaceresolv event token is incorrect (Issue [NMS-12227](#))
- Kafka RPC: Slow callbacks cause lag on response topics (Issue [NMS-12232](#))
- WS-MAN doesn't work with JDK 11 (Issue [NMS-12235](#))
- Kafka RPC: StackOverflowError while unmarshaling causes processing to halt (Issue [NMS-](#)

12236)

- Ops wallboard hanging due to Vaadin session deadlock (Issue [NMS-12237](#))
- Fix flapping DatabaseReportPageIT (Issue [NMS-12241](#))
- Invalid timestamps used for CollectionSets generated by telemetryd (Issue [NMS-12242](#))
- DNS resolved hostname should always be reflected in 'iphostname' field in ipinterface table (Issue [NMS-12249](#))
- Cannot change the type of a scheduled outage (Issue [NMS-12255](#))
- DefaultReportWrapperService: failed to run or render report (Issue [NMS-12258](#))
- Rewrite test in ScheduleOutageIT for new UI (Issue [NMS-12264](#))
- vmwarereqtool freezes and never return to the prompt after is executed (Issue [NMS-12265](#))
- EnhancedLinkd-Thread-x-of-x - Null Pointer Exception (Issue [NMS-12267](#))
- ScriptPolicy scripts encounter LazyInitializationException on calling node.getSnmpInterface() (Issue [NMS-12268](#))
- Remove old comment from data source configuration (Issue [NMS-12270](#))
- Fix usage description of vmwarereqtool (Issue [NMS-12275](#))
- Poller take a long time to startup/initialize on large systems (Issue [NMS-12285](#))
- Ordering of classification groups does not work (Issue [NMS-12286](#))
- Default settings in container image don't write RRD files (Issue [NMS-12290](#))
- Grafana report generation is timing out (Issue [NMS-12297](#))
- Default "90% Interface Throughput" Threshold Doesn't Work (Issue [NMS-12301](#))
- ConcurrentModificationException when cloning events (Issue [NMS-12306](#))

## Enhancement

- Remove alarm-change-notifier plugin (Issue [NMS-10658](#))
- Enforce VertexRef to be immutable (Issue [NMS-11138](#))
- View traffic for specific hosts over time (flows) (backend work) (Issue [NMS-11153](#))
- Initial CircleCI pipeline (Issue [NMS-11157](#))
- Update flow indicators for SNMP interfaces to link to deep dive tool (Issue [NMS-11169](#))
- Refactor GraphProvider to return Graph instead of being the Graph itself (Issue [NMS-11264](#))
- Design new header for PDF reports (Issue [NMS-11305](#))
- Edges should allow to contain vertices of different namespaces (Issue [NMS-11343](#))
- View traffic for specific conversations over time (flows) (backend work) (Issue [NMS-11345](#))
- Core structure/API of new Graph Service (Issue [NMS-11366](#))
- Implement domain specific graph objects in New Graph service (Issue [NMS-11408](#))
- View traffic for specific applications over time (flows) - back end work (Issue [NMS-11458](#))
- Use composite aggregation instead of convo\_key field from flow documents (Issue [NMS-11473](#))



- Provide new GraphProvider implementation for the ApplicationTopologyProvider (Issue [NMS-11506](#))
- Indicators for nodes with flow data (Issue [NMS-11523](#))
- The GraphService interface should return GenericGraph instead of Graph<?, ?> (Issue [NMS-11554](#))
- Provide capability to expose GraphContainerProviders with only one graph (SingleGraphContainerProvider) (Issue [NMS-11574](#))
- Make GraphRepository accessible via OSGI (Issue [NMS-11575](#))
- Make GraphRepository persist collections (Issue [NMS-11624](#))
- Implement ReST Service for the new Graph Service (Issue [NMS-11636](#))
- Search for nodes that have flow data (Issue [NMS-11654](#))
- Refactoring Docker Container Images towards Horizon 25 (Issue [NMS-11719](#))
- Run container image as non-root (Issue [NMS-11720](#))
- Replace custom bash templating with Confd and streamline entrypoint script (Issue [NMS-11721](#))
- Replace current (Spring Webflow) Reporting UI with an angular implementation (Issue [NMS-11723](#))
- CircleCI (Issue [NMS-11830](#))
- Thresholding for streaming metrics & more (Issue [NMS-11834](#))
- Project Drift Enhancements (Issue [NMS-11836](#))
- Grafana Integration (Issue [NMS-11844](#))
- Enterprise Reporting Enhancements (Issue [NMS-11861](#))
- Grouped flow classification rules (Issue [NMS-11975](#))
- Make Graph immutable (Issue [NMS-11985](#))
- Skew detection for flow timestamps (Issue [NMS-11993](#))
- Run system tests using OpenJDK 11 (Issue [NMS-11995](#))
- Top N hosts (flows) (Issue [NMS-11998](#))
- Dynamically change a node's location (Issue [NMS-12053](#))
- Customize priority of flow classification rules (Issue [NMS-12058](#))
- Flow classification role (Issue [NMS-12065](#))
- Add support for sending events from a Minion (Issue [NMS-12078](#))
- Hostname resolution for flows (Issue [NMS-12087](#))
- Provide search capabilities (Issue [NMS-12092](#))
- KPIs for resource graphs (Issue [NMS-12095](#))
- Migrate system tests to use TestContainers framework (Issue [NMS-12107](#))
- Remove hack from opennms-spring-extender to expose ServiceRegistry (Issue [NMS-12122](#))
- Upgrade Bootstrap to latest 4.3.x version (Issue [NMS-12124](#))

- Allow tarball installation in Docker images for Horizon (Issue [NMS-12133](#))
- Add the ability to trigger a requisition import via the Karaf shell (Issue [NMS-12135](#))
- Store and read thresholding configuration from PostgreSQL (Issue [NMS-12140](#))
- Add support for sending events from Sentinel (Issue [NMS-12141](#))
- Stickiness for distributed processing in telemetryd (Issue [NMS-12142](#))
- Share thresholding state across Sentinels (Issue [NMS-12143](#))
- Create Jasper report templates for Grafana dashboards (Issue [NMS-12144](#))
- Improve Grafana report rendering speed (Issue [NMS-12145](#))
- Implement easier datetime selection (Issue [NMS-12147](#))
- Consider timezone when scheduling reports (Issue [NMS-12148](#))
- Allow multiple recipients when delivering/scheduling a report (Issue [NMS-12149](#))
- Add ability to edit existing scheduled reports (Issue [NMS-12150](#))
- Allow for searching a dashboard (Issue [NMS-12152](#))
- Easier Schedule Definition (Issue [NMS-12154](#))
- Improve performance of hostname resolution for flows (Issue [NMS-12157](#))
- Remove Legacy Database Reports (Web Flow) (Issue [NMS-12158](#))
- UsersRestService: /users/whoami returns 404 on ldap authenticated user (not in users.xml) (Issue [NMS-12159](#))
- User conceptualizes profile-fitting for SNMP across enterprise (Issue [NMS-12167](#))
- User provisions nodes with SNMP profiles in place (Issue [NMS-12169](#))
- Grafana reporting: Render exceptions in images instead of aborting (Issue [NMS-12170](#))
- Collect and graph packet reception rates for telemetryd listeners (Issue [NMS-12182](#))
- Allow developer to push OCI's to docker hub from arbitrary branches (Issue [NMS-12187](#))
- Enable flow UDP listener by default on Minion and OpenNMS (Issue [NMS-12190](#))
- Upgrade Drools to latest 7.x release (Issue [NMS-12191](#))
- Grafana Reporting: Add time to date range in report header of template (Issue [NMS-12200](#))
- Show configured rule groups (Issue [NMS-12212](#))
- Edit (CRUD) rule groups via rest & gui (Issue [NMS-12213](#))
- Add reply-to field to notification emails (Issue [NMS-12224](#))
- Ensure the reporting jar for jasperstudio is still working and containing all the relevant jars (Issue [NMS-12229](#))
- Verify Database Reporting Documentation is still up to date (Issue [NMS-12230](#))
- Dependency based testing (Issue [NMS-12233](#))
- Update minimum required version of PostgreSQL for H25 (Issue [NMS-12238](#))
- Report scheduler should be disableable (Issue [NMS-12240](#))



- Add support for meta-data fields in thresholding expressions (Issue [NMS-12247](#))
- Manage persisted threshold state via shell (Issue [NMS-12248](#))
- Increase default heap size to 2GB (Issue [NMS-12276](#))
- Expose Kafka Lag on Sink/RPC through Karaf shell (Issue [NMS-12295](#))
- Expose RPC/Sink Metrics on Karaf shell (Issue [NMS-12296](#))
- Expose health:check via ReST (Issue [NMS-12298](#))
- Add a JMS broker monitor (Issue [NMS-7188](#))
- Expose the complete OnmsNode object in Scriptd to avoid LazyInitializationExceptions (Issue [NMS-8294](#))
- Document RPC TTL tuning (Issue [NMS-10376](#))
- Redesign default threshold events (Issue [NMS-10672](#))
- Filter alarm list by surveillance categories (Issue [NMS-10695](#))
- use sevntu-checkstyle-maven-plugin from maven-central (Issue [NMS-10717](#))
- use org.asteriskjava:asterisk-java from maven-central (Issue [NMS-10718](#))
- Angular requests do not handle 401 responses from the OpenNMS backend (Issue [NMS-10719](#))
- Increase logging clarity for flow processing (Issue [NMS-10723](#))
- Support compression in JestClient for Elasticsearch (Issue [NMS-10859](#))
- Publish Docker images from CircleCI to DockerHub (Issue [NMS-11722](#))
- Improve the sample content for the NXOS GPB Parser Groovy Script. (Issue [NMS-11759](#))
- Design thresholding support for telemetryd on Sentinel (Issue [NMS-11776](#))
- Thresholding support for push metrics (Issue [NMS-11797](#))
- View traffic for specific conversations over time (flows) (frontend work) (Issue [NMS-12074](#))
- Provide possibility to add Grafana Instances (Issue [NMS-12075](#))
- View traffic for specific applications over time (flows) - front end work (Issue [NMS-12076](#))
- View traffic for specific hosts over time (flows) (frontend work) (Issue [NMS-12077](#))
- Support wildcards in service names (Issue [NMS-12080](#))
- Refactor threshd out of opennms-services (Issue [NMS-12081](#))
- Configurable index name for Event & Alarm Forwarder (Issue [NMS-12082](#))
- Add a UI to edit meta-data in requisition (Issue [NMS-12083](#))
- Custom TTLs for detectors, monitors and collectors (Issue [NMS-12096](#))
- Update Elasticsearch integrations to support ES 7.x (Issue [NMS-12099](#))
- Update Webpack Build to Latest Babel and TypeScript (Issue [NMS-12130](#))
- Enhance CircleCI workflow to reduce build times and tests (Issue [NMS-12136](#))
- Add SonarQube Code Coverage to CircleCI Workflow (Issue [NMS-12163](#))
- Create feature to install thresholding service on sentinel (Issue [NMS-12180](#))

- Postgres KeyValueType implementation via JDBC (Issue [NMS-12181](#))
- Update warmerge plugin dependency to 0.5 (Issue [NMS-12194](#))
- Enhance Jaeger OpenTracing Logging with tag for thread name (Issue [NMS-12195](#))
- Upgrade Kafka components to 2.3.0 (Issue [NMS-12203](#))
- Add enhancements to DNS Resolver and Circuit Breaker (Issue [NMS-12215](#))
- Leverage telemetry sequencing for better thresholding performance (Issue [NMS-12243](#))
- Remove session lock from Drools in alarmd (Issue [NMS-12244](#))
- Karaf shell command for benchmarking performance of BlobStore (Issue [NMS-12245](#))
- Add support for STARTTLS to TLS certificate monitor (Issue [NMS-12252](#))
- Resource Graphs : Graph Selection fails to render when many resources are selected (Issue [NMS-12256](#))
- split shell utilities into a separate module (Issue [NMS-12266](#))
- allow using fetched RPMs in `build_container_image.sh` (Issue [NMS-12271](#))
- Add documentation about classification rule & group sorting (Issue [NMS-12278](#))
- Migrate resourcecli to the Karaf shell (Issue [NMS-12280](#))
- Add Karaf shell command to view raw sample stored in Newts (Issue [NMS-12281](#))
- Be able to execute ICMP requests through Java when running as non-root (Issue [NMS-12283](#))
- Update Minion packaging to use single RPM/Deb (Issue [NMS-12300](#))