

# Installation Guide

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OpenNMS Horizon 17.0.1-SNAPSHOT

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# Chapter 1. Installation Overview

The *OpenNMS* platform can be installed in several ways. This guide describes the installation of the platform on *Red Hat Enterprise Linux (RHEL)*-based, *Debian*-based and *Microsoft Windows* operating systems. The following abbreviations will be used to refer to the following operating systems:

- *RHEL*: Red Hat Enterprise Linux 6 or higher, CentOS 6 or higher, Fedora 20 or higher
- *Debian*: Debian 7 or higher, Ubuntu 14.04 or higher
- *Microsoft Windows*: Windows 8.1, Windows Server 2012, Windows 10

Installable, precompiled software packages are provided through *RHEL Yum* and *Debian APT* repository servers and from the [OpenNMS Sourceforge project page](#). Installing *OpenNMS* requires the following prerequisites:

- A configured [Yum or APT Package Repository](#) for your platform (Linux only)
- Internet access to download and verify *OpenNMS* packages from the Yum or APT package repositories
- [Oracle Java SE Development Kit 8](#) environment
- PostgreSQL database version 9.1 or higher
- A time-series database engine to persist long-term performance data:
  - *JRobin*: The default choice. *JRobin* is included inside *OpenNMS* and doesn't require additional software to be installed.
  - [RRDtool](#): A higher performance, file-based database.
  - [Newts](#): The highest performance solution. *Newts* uses an Apache Cassandra database for clustered scalability.

## NOTE

*OpenJDK 8* can be used, but for production and critical environments *Oracle Java SE Development Kit 8* is recommended.

`${OPENNMS_HOME}` will be used to refer to the path where *OpenNMS* is installed. It is different depending on your platform:

## NOTE

- *RHEL*: `/opt/opennms`
- *Debian*: `/usr/share/opennms`
- *Microsoft Windows*: `C:\Program Files\opennms`

With the *opennms* meta package all dependencies needed for the components mentioned above are maintained. The following sections describe how to install *OpenNMS* on a single system. Dependencies for *Java* and the *PostgreSQL* database are maintained with the *opennms* meta installation package.

# Chapter 2. Yum/APT Package Repositories

Installation packages are available for different releases of *OpenNMS*. You need to choose which release you would like to run and then configure your package repository to point to that release. Configuring a package repository will enable you to install and update the software by using standard Linux software update tools like *yum* and *apt*.

The following package repositories are available:

Table 1. OpenNMS package repositories

Release	Description
<code>stable</code>	Latest stable release. This version is recommended for all users.
<code>testing</code>	Release candidate for the next stable release.
<code>snapshot</code>	Latest successful development build, the "nightly" build.
<code>branches/\${BRANCH-NAME}</code>	Install from a specific branch name for testing a specific feature that is under development. Available branches can be found in <a href="http://yum.opennms.org/branches/">http://yum.opennms.org/branches/</a> or <a href="http://debian.opennms.org/dists/branches/">http://debian.opennms.org/dists/branches/</a> .

To install a different release the repository files have to be installed and manually modified.

## 2.1. RHEL Yum Repository

Install the configuration for a package repository

```
rpm -Uvh http://yum.opennms.org/repofiles/opennms-repo-${RELEASE}-rhel7.noarch.rpm <1>
rpm --import http://yum.opennms.org/OPENNMS-GPG-KEY
```

① Replace `${RELEASE}` with a release name like `stable` (recommended), `testing`, or `snapshot`.

## 2.2. Debian APT Repository

Create a new apt source file (eg: `/etc/apt/sources.list.d/opennms.list`), and add the following 2 lines:

Package repository configuration for Debian-based systems

```
deb http://debian.opennms.org ${RELEASE} main <1>
deb-src http://debian.opennms.org ${RELEASE} main <1>
```

① Replace `${RELEASE}` with a release name like `stable` (recommended), `testing`, or `snapshot`.

Import the packages' authentication key with the following command:

GPG key import for Debian-based systems

```
wget -O - http://debian.opennms.org/OPENNMS-GPG-KEY | apt-key add -
```

# Chapter 3. OpenNMS

After configuring the package repository, you are ready to install the *OpenNMS* packages, configure the database, and initialize the *OpenNMS* platform.

## 3.1. RHEL

This section describes how to install the *OpenNMS* platform on *CentOS 7.1*. The setup process is described in the following steps:

1. Installation of the *opennms* meta package which handles all dependencies
2. Initialize *PostgreSQL* database and configure access
3. Initialize *OpenNMS* and first start of the application

### 3.1.1. Install OpenNMS

Installation of the full application with all dependencies like *PostgreSQL* and *Java*

```
yum -y install opennms
```

The following packages will be automatically installed:

- *opennms*: The platform meta package which handles all dependencies from *OpenNMS* repository.
- *jicmp6* and *jicmp*: *Java* bridge to allow sending *ICMP* messages from *OpenNMS* repository.
- *opennms-core*: *OpenNMS* core services, e.g. *Provisiond*, *Pollerd* and *Collectd* from *OpenNMS* repository.
- *opennms-webapp-jetty*: *OpenNMS* web application from *OpenNMS* repository
- *jdk1.8*: *Oracle Java SE Development Kit 8* environment from *OpenNMS* repository
- *postgresql*: *PostgreSQL* database server from distribution repository
- *postgresql-libs*: *PostgreSQL* database from distribution repository

**TIP** | Verify the version of the *OpenNMS* packages that was installed with `yum info opennms`.

With the successful installed packages the *OpenNMS* platform is installed in the following directory structure:

```
[root@localhost /opt/opennms]# tree -L 2
.
├── opennms
│   ├── bin
│   ├── contrib
│   ├── data
│   ├── deploy
│   ├── etc
│   ├── jetty-webapps
│   ├── lib
│   ├── logs -> /var/log/opennms
│   ├── share -> /var/opennms
│   └── system
```

### 3.1.2. Prepare PostgreSQL

The *CentOS* package installs but doesn't initialize the *PostgreSQL* database directory. Additionally *OpenNMS* requires authentication to access the database and are described in this section. Initialize the database directory with

*Initialization of the PostgreSQL database*

```
postgresql-setup initdb
```

*System startup configuration for PostgreSQL*

```
systemctl enable postgresql
```

*Startup PostgreSQL database*

```
systemctl start postgresql
```

The next step is setting the *postgres* super user password and creating an *opennms* database user with password. Additionally it is required to configure the authentication method to allow authentication from the local network.

*Accounting and database management for OpenNMS*

```
su - postgres
createuser -P opennms
createdb -O opennms opennms
exit
```

*Set password for Postgres super user*

```
su - postgres
psql -c "ALTER USER postgres WITH PASSWORD 'YOUR-POSTGRES-PASSWORD';"
exit
```

#### NOTE

The super user is required to be able to initialize and change the database schema for installation and updates.

To allow *OpenNMS* access to the database over the local network *PostgreSQL* has to be configured.

```
vi /var/lib/pgsql/data/pg_hba.conf
```

#### Configuration of network access for PostgreSQL

```
host    all             all             127.0.0.1/32     md5<1>
host    all             all             ::1/128          md5<1>
```

- ① Change method from `ident` to `md5` for `IPv4` and `IPv6` on localhost.

#### Apply configuration changes for PostgreSQL

```
systemctl reload postgresql
```

In the next step configure the *OpenNMS* database configuration.

```
vi ${OPENNMS_HOME}/etc/opennms-datasources.xml
```

#### Configuration for database authentication in OpenNMS

```
<jdbc-data-source name="opennms"
  database-name="opennms"
  class-name="org.postgresql.Driver"
  url="jdbc:postgresql://localhost:5432/opennms"
  user-name="** YOUR-OPENNMS-USERNAME **"<1>
  password="** YOUR-OPENNMS-PASSWORD **" /><2>

<jdbc-data-source name="opennms-admin"
  database-name="template1"
  class-name="org.postgresql.Driver"
  url="jdbc:postgresql://localhost:5432/template1"
  user-name="postgres"<3>
  password="** YOUR-POSTGRES-PASSWORD **" /><4>
```

- ① Set the user name to access the *OpenNMS* database table
- ② Set the password to access the *OpenNMS* database table
- ③ Set the `postgres` user for administrative access to PostgreSQL
- ④ Set the password for administrative access to PostgreSQL

### 3.1.3. Initialize OpenNMS

*OpenNMS* is now configured to access the database. It is required to set the *Java* environment running *OpenNMS* and initialize the database schema.

#### Configuration of Java environment for OpenNMS

```
${OPENNMS_HOME}/bin/runjava -s
```

#### Initialization of database and system libraries

```
${OPENNMS_HOME}/bin/install -dis
```

### System startup configuration for OpenNMS

```
systemctl enable opennms
```

### Startup OpenNMS

```
systemctl start opennms
```

After starting *OpenNMS* the web application can be accessed on <http://<ip-or-fqdn-of-your-server>:8980/opennms>. The default login user is *admin* and the password is initialized to *admin*.

**IMPORTANT** | Change the default admin password to a secure password immediately.

## 3.2. Debian

**IMPORTANT** | This guide does not apply to OpenNMS Meridian, which can be installed only on Red Hat Enterprise Linux or CentOS systems.

This section describes how to install the *OpenNMS* platform on *Ubuntu 14.04 LTS*. The setup process is described in the following steps:

1. Installation of the *opennms* meta package which handles all dependencies
2. Initialize *PostgreSQL* database and configure access
3. Initialize *OpenNMS* and first start of the application

### 3.2.1. Install OpenNMS

*Installation of the full application with all dependencies like PostgreSQL and Java*

```
apt-get update  
apt-get install -y opennms
```

The following packages will be automatically installed:

- *opennms*: The platform meta package which handles all dependencies from *OpenNMS* repository.
- *jicmp6* and *jicmp*: Java bridge to allow sending *ICMP* messages from *OpenNMS* repository.
- *opennms-core*: *OpenNMS* core services, e.g. *Provisiond*, *Pollerd* and *Collectd* from *OpenNMS* repository.
- *opennms-webapp-jetty*: *OpenNMS* web application from *OpenNMS* repository
- *jdk1.8*: Oracle Java 8 environment from *OpenNMS* repository
- *postgresql*: *PostgreSQL* database server from distribution repository
- *postgresql-lib*: *PostgreSQL* database from distribution repository

**TIP** | Verify the version of the *OpenNMS* packages that was installed with `apt-cache show opennms`.

With the successful installed packages the *OpenNMS* platform is installed in the following directory structure:



```
[root@localhost /usr/share/opennms]# tree -L 2
.
├── opennms
│   ├── bin
│   ├── data
│   ├── deploy
│   ├── etc -> /etc/opennms
│   ├── instances
│   ├── jetty-webapps
│   ├── lib -> ../java/opennms
│   ├── logs -> /var/log/opennms
│   ├── share -> /var/lib/opennms
│   └── system
```

### 3.2.2. Prepare PostgreSQL

The *Debian* package installs also *PostgreSQL* database and is already initialized and added in the runlevel configuration. It is only necessary to start the *PostgreSQL* database without a restart.

*Startup PostgreSQL database*

```
service postgresql start
```

The next step is creating an *opennms* database user with password and configure the authentication method.

*Accounting and database management for OpenNMS*

```
su - postgres
createuser -P opennms
createdb -O opennms opennms
exit
```

#### NOTE

It is not necessary to change the authentication method in `pg_hba.conf`, it is by default set to `md5` for localhost connections.

*Set password for Postgres super user*

```
su - postgres
psql -c "ALTER USER postgres WITH PASSWORD 'YOUR-POSTGRES-PASSWORD';"
exit
```

#### NOTE

The super user is required to be able to initialize and change the database schema for installation and updates.

```
vi ${OPENNMS_HOME}/etc/opennms-datasources.xml
```

## Configuration for database authentication in OpenNMS

```
<jdbc-data-source name="opennms"
  database-name="opennms"
  class-name="org.postgresql.Driver"
  url="jdbc:postgresql://localhost:5432/opennms"
  user-name="** YOUR-OPENNMS-USERNAME **" <1>
  password="** YOUR-OPENNMS-PASSWORD **" /><2>

<jdbc-data-source name="opennms-admin"
  database-name="template1"
  class-name="org.postgresql.Driver"
  url="jdbc:postgresql://localhost:5432/template1"
  user-name="postgres" <3>
  password="** YOUR-POSTGRES-PASSWORD **" /><4>
```

- ① Set the user name to access the *OpenNMS* database table
- ② Set the password to access the *OpenNMS* database table
- ③ Set the *postgres* user for administrative access to PostgreSQL
- ④ Set the password for administrative access to PostgreSQL

### 3.2.3. Initialize OpenNMS

*OpenNMS* is now configured to access the database. It is required to set the *Java* environment running *OpenNMS* and initialize the database schema.

#### Configuration of Java environment for OpenNMS

```
${OPENNMS_HOME}/bin/runjava -s
```

#### Initialization of database and system libraries

```
${OPENNMS_HOME}/bin/install -dis
```

**NOTE** | It is not necessary to add *OpenNMS* to the run level manually, it is automatically added after setup.

#### Startup OpenNMS

```
service opennms start
```

After starting *OpenNMS*, the web application can be accessed on <http://<ip-or-fqdn-of-your-server>:8980/opennms>. The default login user is *admin* and the password is initialized to *admin*.

**IMPORTANT** | Change the default admin password to a secure password immediately.

## 3.3. Microsoft Windows

**IMPORTANT** | This guide does not apply to *OpenNMS Meridian*, which can be installed only on Red Hat Enterprise Linux or CentOS systems.

*OpenNMS* is mostly developed on Unix/Linux based systems, nevertheless it is possible to install the platform on *Microsoft Windows* operating systems. To install the application a graphical installer is provided and can be used to install *OpenNMS* on *Microsoft Windows*. This section describes how to install the *OpenNMS* platform on *Microsoft Windows 2012 Server*.

**NOTE** | The standalone installer for *Microsoft Windows* is only available for the most recent stable version of *OpenNMS*.

**IMPORTANT** | It is required to have [Oracle JDK 8](#) installed. The *JRE* is **NOT** sufficient.

**TIP** | To edit *OpenNMS* configuration files on *Microsoft Windows* the tool [Notepad++](#) can deal with the formatting of *.property* and *.xml* files.

The setup process is described in the following steps:

1. Installation of *PostgreSQL* database service
2. Download and install the graphical *OpenNMS* installer
3. First start of the *OpenNMS* application

### 3.3.1. Install PostgreSQL

*PostgreSQL* is available for *Microsoft Windows* and latest version can be downloaded from [Download PostgreSQL](#) page. Follow the on-screen instructions of the graphical installer.

**NOTE** | The placeholder `{PG-VERSION}` represents the *PostgreSQL* version number. A version of *9.1+* is required for *OpenNMS*.

The following information has to be provided:

- Installation directory for *PostgreSQL*, e.g. `C:\Program Files\PostgreSQL{PG-VERSION}`
- Password for the database superuser (*postgres*), this password will be used during the *OpenNMS* setup.
- Port to listen for *PostgreSQL* connections, default is `5432` and can normally be used.
- Locale for the database, keep `[Default locale]`, if you change the locale, *OpenNMS* may not be able to initialize the database.

**TIP** | It is not required to install anything additional from the *PostgreSQL Stack Builder*.

**NOTE** | The database data directory is automatically initialized during the setup and the `postgresql-x64-{PG-VERSION}` is already added as service and automatically started at system boot.

**NOTE** | It is not necessary to change the authentication method in `pg_hba.conf`, it is by default set to `md5` for localhost connections.

### 3.3.2. Install OpenNMS with GUI installer

For *Microsoft Windows* environments download the `standalone-opennms-installer-{ONMS-VERSION}.zip` file from the [OpenNMS SourceForge](#) repository. Extract the downloaded *ZIP* file.

**NOTE** | The `{ONMS-VERSION}` has to be replaced with the latest stable version.

Start the graphical installer and follow the on screen instructions. The following information has to be provided:

- Path to *Oracle JDK*, e.g. `C:\Program Files\Java\jdk1.8.0_51`

- Installation path for *OpenNMS*, e.g. `C:\Program Files\OpenNMS`
- Select packages which has to be installed, the minimum default selection is *Core* and *Docs*
- PostgreSQL Database connection
  - Host: Server with *PostgreSQL* running, e.g. `localhost`
  - Name: Database name for *OpenNMS*, e.g. `opennms`
  - Port: *TCP* port connecting to *PostgreSQL* server, e.g. `5432`
  - Username (administrative superuser): *PostgreSQL* superuser, e.g. `postgres`
  - Password (administrative superuser): Password given during *PostgreSQL* setup for the superuser
  - Username (runtime user for `opennms`): Username to connect to the *OpenNMS* database, e.g. `opennms`
  - Password (runtime user for `opennms`): Password to connect to the *OpenNMS* database, e.g. `opennms`
- Configure a discovery range for an initial node discovery. If you don't want any discovery set begin and end to the same unreachable address.

#### IMPORTANT

Choose secure passwords for all database users and don't use the example passwords above in production.

#### WARNING

There is currently an open issue in the installer [NMS-7831](#). Username and password are not written to the `opennms-datasources.xml` file and has to be changed manually. The initialize of the database will fail with an authentication error.

#### Configuration for database authentication in *OpenNMS*

```
<jdbc-data-source name="opennms"
  database-name="opennms"
  class-name="org.postgresql.Driver"
  url="jdbc:postgresql://localhost:5432/opennms"
  user-name="** YOUR-OPENNMS-USERNAME **"<1>
  password="** YOUR-OPENNMS-PASSWORD **" /><2>

<jdbc-data-source name="opennms-admin"
  database-name="template1"
  class-name="org.postgresql.Driver"
  url="jdbc:postgresql://localhost:5432/template1"
  user-name="postgres"<3>
  password="** YOUR-POSTGRES-PASSWORD **" /><4>
```

- ① Set the user name to access the *OpenNMS* database table
- ② Set the password to access the *OpenNMS* database table
- ③ Set the `postgres` user for administrative access to PostgreSQL
- ④ Set the password for administrative changes of the *OpenNMS* database table

After setting the username and passwords in `opennms-datasources.xml` re-run the graphical installer and also initialize the database. *OpenNMS* can be started and stopped with the `start.bat` and `stop.bat` script located in `%OPENNMS_HOME%\bin` directory.

After starting *OpenNMS* with the `start.bat` file the web application can be accessed on <http://<ip-or-fqdn-of-your-server>:8980/opennms>. The default login user is *admin* and the password is initialized to *admin*.

**IMPORTANT** | Change the default admin password to a secure password immediately.

**TIP** | The Wiki article [Configuring OpenNMS as Windows Service](#) describes how to create a *Windows Service* from the `start.bat` files. There is also a [Java Wrapper](#) which allows to install *Java* applications as *Windows Service*.

# Chapter 4. Oracle Java SE Development Kit 8

Installing the *Oracle Java SE Development Kit 8 (JDK8)* requires installation packages provided by *Oracle* or a 3rd-party maintainer for *Debian*-based Linux distributions. The following tools should be installed to follow this installation manual:

- Download files and tools with `wget` and `curl`
- Extract archives with `tar`
- Text manipulation with `sed`
- Editing text, e.g. `vi`, `nano` or `joe`
- Internet access

## WARNING

By downloading the *Oracle Java SE Development Kit 8* RPM installer, you will accept the license agreement from *Oracle* which can be found on the [Java distribution](#) web site.

## 4.1. RHEL

This section describes how to install *Oracle Java SE Development Kit 8* on a *RPM*-based system like *Red Hat Enterprise Linux 7* or *CentOS 7.1*.

*Download Oracle JDK RPM*

```
wget --no-cookies \  
  --no-check-certificate \  
  --header \  
    "Cookie: oraclelicense=accept-securebackup-cookie" \  
    "http://download.oracle.com/otn-pub/java/jdk/8u45-b14/jdk-8u45-linux-x64.rpm" \  
-O /tmp/jdk-8-linux-x64.rpm
```

*Install Oracle JDK RPM file*

```
yum install /tmp/jdk-8-linux-x64.rpm
```

## 4.2. Debian

This section describes how to install *Oracle Java SE Development Kit 8* on a *Debian*-based system like *Debian 8* or *Ubuntu 14.04 LTS*.

*Add Java repository from webupd8 maintainer*

```
SU -  
echo "deb http://ppa.launchpad.net/webupd8team/java/ubuntu trusty main" | tee  
/etc/apt/sources.list.d/webupd8team-java.list  
echo "deb-src http://ppa.launchpad.net/webupd8team/java/ubuntu trusty main" | tee -a  
/etc/apt/sources.list.d/webupd8team-java.list
```

Add repository key server and update repository

```
apt-key adv --keyserver hkp://keyserver.ubuntu.com:80 --recv-keys EEA14886
apt-get update
```

Install Oracle Java SE Development Kit 8

```
apt-get install -y oracle-java8-installer
```

## 4.3. Microsoft Windows

This section describes how to install *Oracle Java SE Development Kit 8* on a system running the *Microsoft Windows Server 2012* operating system.

Download the *Microsoft Windows Java SE Development Kit 8* installer with PowerShell or a browser

```
cd C:\Users\Administrator\Downloads
Invoke-WebRequest http://javadl.sun.com/webapps/download/AutoDL?BundleId=107944 -Outfile java8-
installer.exe
```

Start the `java8-installer.exe` from the command line or with *Windows Explorer* from the Administrator's *Download* folder.

**NOTE** | The setup requires administrative privileges.

## 4.4. Java Environment

To locate the *Java* system files, applications typically use the `$JAVA_HOME` environment variable. The environment can be set for a specific user or globally for the whole system on boot time.

- RHEL: `/usr/java/jdk1.8.0_51`
- Debian: `/usr/lib/jvm/java-8-oracle`
- Microsoft Windows: `C:\Program Files\Java\jre1.8.0_51`

### 4.4.1. Set JAVA\_HOME on Linux

*Option 1: Set the Java environment for the current user*

```
vi ~/.bash_profile
export JAVA_HOME=/path/to/java
```

*Option 2: Set the Java environment for all users on boot time*

```
vi /etc/profile
export JAVA_HOME=/path/to/java
```

### 4.4.2. Set JAVA\_HOME on Microsoft Windows

*Option 1: Set JAVA\_HOME as user specific system variable*

```
setx "JAVA_HOME" "path\to\java"
```

*Option 2: Set JAVA\_HOME as a System variable*

```
setx /M "JAVA_HOME" "path\to\java"
```



# Chapter 5. RRDtool

In most *Open Source* applications, [RRDtool](#) is often used and is the de-facto open standard for *Time Series Data*. The basic installation of *OpenNMS* comes with *JRobin* but it is simple to switch the system to use *RRDtool* to persist *Time Series Data*. This section describes how to install *RRDtool*, the *jrrd2 OpenNMS Java Interface* and how to configure *OpenNMS* to use it. *RRDtool* can be installed from the official package repositories provided by *RHEL* and *Debian* based *Linux* distributions.

## 5.1. RHEL

*Installation on RHEL/CentOS*

```
yum install rrdtool
```

## 5.2. Debian

*Installation of RRDtool on Debian/Ubuntu*

```
apt-get install rrdtool
```

## 5.3. Source

If you want the latest version of RRDtool, you may want to compile it from source. Instructions for doing so are at [rrdbuild](#).

### IMPORTANT

The latest version of RRDtool may not always be compatible with the version of *OpenNMS* that you want to run. Please ask about RRDtool support on the discussion lists or chat rooms if you have any problems running a new version of RRDtool.

### NOTE

If you want to install the latest *RRDtool* from source, make sure the `rrdtool` binary is in search path. To make the setup easier, you can link the binary to `/usr/bin/rrdtool` which is the location where *OpenNMS* will expect to find the executable binary.

## 5.4. Install jrrd2 Interface

To get access from the *OpenNMS Java Virtual Machine* you have to install *jrrd2* as an interface. You can install it from the *OpenNMS* package repository with:

*Installation of jrrd2 on RHEL/CentOS*

```
yum install jrrd2
```

*Installation of jrrd2 on Debian/Ubuntu*

```
apt-get install jrrd2
```

### NOTE

With *OpenNMS 17.0.0* it is preferred to use *jrrd2* instead of *jrrd*. The *jrrd2* module is improved for performance by adding multithreading capabilities.

## 5.5. Configure OpenNMS Horizon

To configure *OpenNMS* to use *RRDtool* instead of *JRobin* configure the following properties in `rrd-configuration.properties`.

### Configuration of RRDtool in OpenNMS on RHEL/CentOS

```
org.opennms.rrd.strategyClass=org.opennms.netmgt.rrd.rrdtool.MultithreadedJniRrdStrategy
org.opennms.rrd.interfaceJar=/usr/share/java/jrrd2.jar
opennms.library.jrrd2=/usr/lib64/libjrrd2.so
```

### Configuration of RRDtool in OpenNMS on Debian/Ubuntu

```
org.opennms.rrd.strategyClass=org.opennms.netmgt.rrd.rrdtool.MultithreadedJniRrdStrategy
org.opennms.rrd.interfaceJar=/usr/share/java/jrrd2.jar
opennms.library.jrrd2=/usr/lib/jni/libjrrd2.so
```

**TIP** | *OpenNMS* expects the *RRDtool* binary in `/usr/bin/rrdtool`.

Table 2. References to the RRDtool binary

Configuration file	Property
<code>opennms.properties</code>	<code>rrd.binary=/usr/bin/rrdtool</code>
<code>response-adhoc-graph.properties</code>	<code>command.prefix=/usr/bin/rrdtool</code>
<code>response-graph.properties</code>	<code>command.prefix=/usr/bin/rrdtool</code> <code>info.command=/usr/bin/rrdtool</code>
<code>snmp-adhoc-graph.properties</code>	<code>command.prefix=/usr/bin/rrdtool</code>
<code>snmp-graph.properties</code>	<code>command.prefix=/usr/bin/rrdtool</code> <code>command=/usr/bin/rrdtool info</code>

# Chapter 6. Newts

*Newts* is a time-series data store based on [Apache Cassandra](#). *Newts* is a persistence strategy, that can be used as an alternative to [JRobin](#) or [RRDtool](#).

## IMPORTANT

It is currently not supported to initialize the *Newts* keyspace from *Microsoft Windows Server* operating system. *Microsoft Windows* based *Cassandra* server can be part of the cluster, but keyspace initialization is only possible using a *\_Linux-*based system.

## 6.1. Setting up Cassandra

### WARNING

*Cassandra* is only required when using *Newts*. If your *OpenNMS Horizon* system is not using *Newts*, you can skip this section.

It is recommended to install *Cassandra* on a dedicated server, but is also possible to run a node on the *OpenNMS Horizon* server itself. This installation guide describes how to set up a single *Cassandra* instance on the same system as *OpenNMS Horizon* for the purpose of evaluating and testing *Newts*. These steps are not suitable for a production *Cassandra Cluster*. If you already have a running cluster you can skip this section.

For further information see [Cassandra Getting Started Guide](#). Before setting up a production cluster make sure to consult [Anti-patterns in Cassandra](#).

### 6.1.1. RHEL

This section describes how to install the latest *Cassandra 3.0.x* release on a *RHEL* based systems for *Newts*. The first step is to add the *DataStax* community repository and install the required *GPG Key* to verify the integrity of the *RPM packages*. After that install the package with *yum* and the *Cassandra* service is managed by *Systemd*.

#### NOTE

This description was built on *CentOS 7.2*.

#### NOTE

*Cassandra 3.x* requires *Java 8+*. See [installing Java on RHEL](#) for instructions.

*Add the DataStax repository*

```
vi /etc/yum.repos.d/datstax.repo
```

*Content of the datstax.repo file*

```
[datstax]
name = "DataStax Repo for Apache Cassandra"
baseurl = https://rpm.datastax.com/community
enabled = 1
gpgcheck = 1
```

*Install GPG key to verify RPM packages*

```
rpm --import https://rpm.datastax.com/rpm/repo_key
```

*Install latest Cassandra 3.0.x package*

```
yum install dsc30
```

*Enable Cassandra to start on system boot*

```
chkconfig cassandra on
```

*Start cassandra service*

```
service cassandra start
```

**TIP** | Verify whether the *Cassandra* service is automatically started after rebooting the server.

### 6.1.2. Debian

This section describes how to install the latest *Cassandra 3.0.x* release on a *Debian*-based system for *Newts*. The first step is to add the *DataStax* community repository and install the required *GPG Key* to verify the integrity of the *DEB packages*. After that install the packages with *apt* and the *Cassandra* service is added to the runlevel configuration.

**NOTE** | This description was built on *Debian 8.3* and *Ubuntu 16.04 LTS*.

**NOTE** | *Cassandra 3.x* requires Java 8+. See [installing Java on Debian](#) for instructions.

*Add the DataStax repository*

```
vi /etc/apt/sources.list.d/cassandra.sources.list
```

*Content of the cassandra.sources.list file*

```
deb https://debian.datastax.com/community stable main
```

*Install GPG key to verify DEB packages*

```
wget -O - https://debian.datastax.com/debian/repo_key | apt-key add -
```

*Install latest Cassandra 3.0.x package*

```
apt-get update  
apt-get install dsc30
```

The *Cassandra* service is added to the runlevel configuration and is automatically started after installing the package.

**TIP** | Verify whether the *Cassandra* service is automatically started after rebooting the server.

### 6.1.3. Microsoft Windows

This section describes how to install the latest *Cassandra 3.0.x* release on a *Microsoft Windows Server* based systems for *Newts*. The first step is to download the graphical installer and register *Cassandra* as a *Windows Service* so it can be managed through the *Service Manager*.

**NOTE** | This description was built on *Windows Server 2012*.

**NOTE** | *Cassandra 3.x* requires Java 8+. See [installing Java on Windows](#) for instructions.

Download the DataStax graphical installer for Cassandra from PowerShell or a Browser

```
cd C:\Users\Administrator\Downloads
Invoke-WebRequest https://downloads.datastax.com/community/datstax-community-64bit_3.0.6.msi -Outfile
datstax-community-64bit_3.0.6.msi
```

Run the Windows Installer file from *PowerShell* or through *Windows Explorer* and follow the setup wizard to install. During the installation, accept the options to automatically start the services. By default the *DataStax Server*, *OpsCenter Server* and the *OpsCenter Agent* will be automatically installed and started.

**NOTE** | The *DataStax OpsCenter Server* is only required to be installed once per *Cassandra Cluster*.

**IMPORTANT** | If you install the *DataStax OpsCenter* make sure you have *Chrome* or *Firefox* installed.

## 6.2. Configure OpenNMS Horizon

Once *Cassandra* is installed, *OpenNMS Horizon* can be configured to use *Newts*. To enable and configure *Newts*, set the following properties in `${OPENNMS_HOME}/etc/opennms.properties`:

*Configuration for OpenNMS Horizon*

```
# Configure storage strategy
org.opennms.rrd.storeByForeignSource=true
org.opennms.timeseries.strategy=newts

# Configure Newts time series storage connection
org.opennms.newts.config.hostname=$ipaddress$
org.opennms.newts.config.keyspace=newts
org.opennms.newts.config.port=9042
```

**NOTE** | The `org.opennms.newts.config.hostname` property also accepts a comma separated list of hostnames and or IP addresses.

Once *Newts* has been enabled, you can initialize the *Newts* schema in *Cassandra* with the following:

*Initialize Newts keyspace in Cassandra*

```
${OPENNMS_HOME}/bin/newts init
```

Optionally, you can now connect to your *Cassandra* cluster and verify that the keyspace has been properly initialized:

*Verify if the keyspace is initialized with cqlsh*

```
cqlsh
use newts;
describe table terms;
describe table samples;
```

Restart *OpenNMS Horizon* to apply the changes.

# Chapter 7. R Statistics System

*R* is a free software environment for statistical computing and graphics. *OpenNMS* can leverage the power of *R* for forecasting and advanced calculations on collected time series data.

*OpenNMS* interfaces with *R* via *stdin* and *stdout*, and for this reason, *R* must be installed on the same host as *OpenNMS*. Note that installing *R* is optional, and not required by any of the core components.

**IMPORTANT** | The *R* integration is not currently supported on *Microsoft Windows* systems.

## 7.1. RHEL

This section describes how to install *R* on a *RHEL* based system.

**NOTE** | This description was built on *RHEL 7* and *CentOS 7.1*.

*Install the EPEL repositories*

```
yum install epel-release
```

*Install R*

```
yum install R
```

## 7.2. Debian

This section describes how to install *R* on a *Debian*-based system.

**NOTE** | This description was built on *Debian 8* and *Ubuntu 14.04 LTS*.

*Install R*

```
sudo apt-get install r-recommended
```