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INSTALLATION GUIDE

AIG-10050-19

RNI 4.14

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Revision history

Rev No.	Date	Description
01	28-JAN-16	Initial release.
02	31-JUL-17	Updated for RNI 4.2.0.
03	28-FEB-18	Updated for RNI 4.3.0.
04	08-JUN-18	Updated for RNI 4.3.1.
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09	18-SEPT-19	Updated for RNI 4.6.1.
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12	28-AUG-20	Updated for RNI 4.8.
13	20-NOV-20	Additional updates for RNI 4.8. Added info about SQL 2019.
14	10-JUN-21	Updated for RNI 4.9. Added minimum requirements table for MS SQL configuration – Server 1 for the Extra Large RNI. Clarified SQL Server standard memory limit and recommendation.
15	25-OCT-21	Updated for RNI 4.10.
16	06-JUN-22	Updated for RNI 4.11.
17	02-DEC-22	Updated for RNI 4.12.
18	16-JUN-23	Updated for RNI 4.13. Hardware changes for Large and Extra-Large RNIs.
19	15-NOV-23	Updated for RNI 4.14. Updates for RHEL8, added UpgradePlus info, hardware changes for Small and Medium RNIs, updated RNI hardware baseline and added swap space info.

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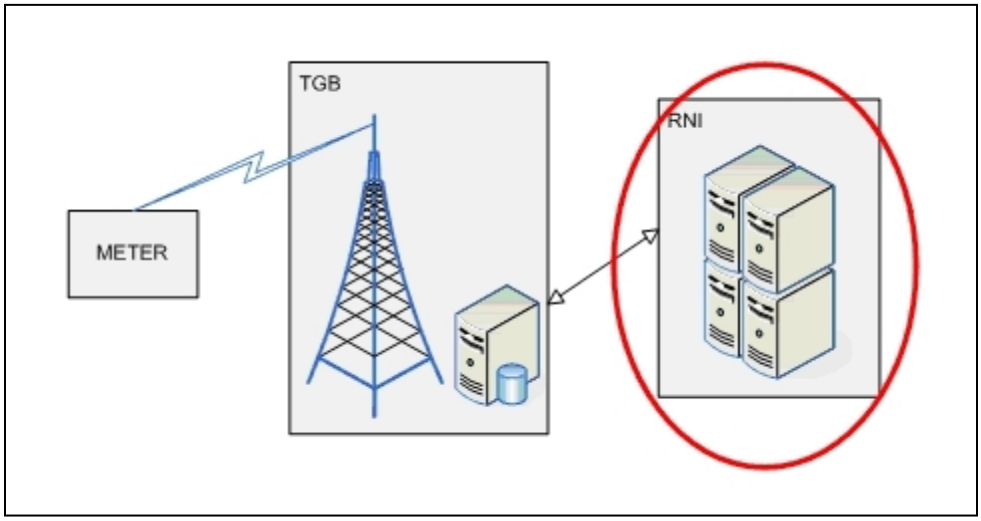
Contents

Introduction

This document describes the specifications and installations needed for the Sensus FlexNet Regional Network Interface (RNI). This document defines the baseline operating system (OS) installation that meets the FlexNet RNI application prerequisites. There are several ways to install the operating systems and software to comply with FlexNet RNI prerequisites, but they are not included here.

RNI system overview



References

The following documents and this *RNI Installation Guide* contain the information needed to install the FlexNet RNI servers:

- *RNI Server Port Settings Installation Guide*
- *RNI Hardware Security Module Installation Guide*
- *RNI Microsoft Active Directory Integration Guide* (optional)

RNI hardware baseline

The server configurations identified here provide the **MINIMUM** virtual machine and host server requirements for the core RNI, which includes a Database server and Application server (Combo). It is intended for the minimum server configuration to remain valid for future 4.x releases of RNI software, assuming no major OS related (Windows, MSSQL, RHEL, Java, etc.) changes occur. The core RNI is defined as the RNI components and does **NOT** include any additional server hardware, memory, or disk space needed for supplemental (add-on) applications such as VantagePoint™ Lighting Control, SentryPoint™ (Cathodic Protection), Network Metrics, Network Command Suite (NCS), etc. If using a supplemental application, please refer to the application installation guide for any additional server/memory requirements.

Configuration overview

Recommended server configurations are based on several primary factors, such as:

- Total number of endpoints
    - Endpoint profiles
    - Read interval rate
    - Transmission rate
    - Number of channels/snapshots being collected
    - Read protocol (standard or enhanced supervisory message)
- Message duplication rate
- Total number of base stations
- Base Station to meter density

Secondary factors such as number, type, and frequency of various commands and jobs (firmware downloads, remote connect/disconnect, demand reset), CMEP reporting mode, and encryption also play a role in the calculation. We have tested running one batch operation at a time (for example, FDWL, batch encryption, batch RCD), and run UStats jobs daily, ETL jobs daily, and daily read report (once/day) and hourly read reports (10/day). If you have different operational needs, you may need to add memory and/or compute resources. Please consult Sensus if you feel you have special operational needs or may need to adjust resources.

The sizing profiles are based on the latest, most capable processors. If a utility purchases hardware other than what is specified in this Installation Guide, it may not support the desired configuration.

Sensus maintains a premiere web page with Dell. For customers not using Dell equipment, Sensus, as a service, can evaluate the substitute hardware and associated configurations to validate compliance to 4.x requirements. For exact details, ask your Sensus sales representative.

The hardware configurations were established using simulated high-volume endpoint testing with the RNI and third-party software and applicable patches at time of test. Sensus will update the hardware configurations if any software patches impact the hardware sizing. Notification of such changes is communicated through a PIN with hardware details updated in the installation guide. For patch details, refer to the monthly patch notification maintained by the Sensus security team. We continue doing performance testing with Sentinel One antivirus software.

It is recommended that once the installation is complete, the chef VM is shutdown. This will free resources, including memory. This is especially important for the small and medium configurations that are memory constrained.

Sizing profiles

For RNI 4.14.1, the Small and Medium RNIs were tested on newer/current versions of Intel processors; the Large and Extra-large RNI hardware was refreshed in 4.13.1, so no new changes for this release. Greenfield deployments are strongly recommended to deploy on the latest versions of processors. If older generation processors are used, performance may not be as good.

Message rate (before dups) is the primary driver in sizing the RNI servers. For medium and large configurations, disk storage will be sized based on the specifics of the meter profile. Sensus can provide an estimate of the storage required, and its configuration to meet your needs.

***Note**: When an endpoint broadcasts a read message, it may be heard by multiple towers. Each tower sends the message to the RNI, and the RNI recognizes these as duplicate messages. For example, if the message is heard by three towers, the RNI receives two duplicate messages.*

To understand server hardware requirements:

1. Select the inbound message (before dups) rate for your profile.
2. The appropriate RNI size is directly below the message rate.

Inbound (before dups) Read Message Rate/sec (not to scale)

10	25	750	1500
Small	Medium	Large	Extra Large

Assumptions used to create this table:

- A representative profile for each configuration was used (see each RNI size configuration for the specifics of the tested profile)
- Duplication rate of four (message heard by an average of five towers: 4 dups, 1 original)
- Maximum of four channels and fifteen snapshots per endpoint
- RNI retains data for 60 days
- 10% Buddy rate
- MSSQL database

***Note**: As of RNI 4.11.1, the RNI no longer includes Network Pulse. To monitor FlexNet Network performance, customers must also install Network Metrics (part of the Network Command Suite). To understand server hardware requirements for Network Metrics, please refer to the Network Metrics Resource Calculator.*

Use of swap space partition on Application server(s)

For RHEL8, the Red Hat recommended swap space for systems with 8GB or more of installed RAM is at least 4GB. In our testing, we used 16GB of swap space on the Combo server for all RNI sizes and have found this to be adequate.

Small RNI

This configuration is for RNIs supporting an approximate maximum inbound message rate of 10 messages per second. All software server functions can be virtualized on a single tower, rack-mounted server, blade server, or desktop server, and support all RNI roles: Broker, Database, DBbuilder, FlexApp, Gateway, Network Controller, Postgres, Web, and Authorization.

Virtual Machine (VM) minimum requirements

VM Image	OS	Virtual CPUs	Memory (RAM) - minimum	Local Disk Storage (effective)
Chef*	RHEL8	2	4 GB (minimum)	100 GB
Combo	RHEL8	8	32 GB (minimum)	400 GB
MSSQL DB	Windows	8	24 GB (minimum)	200 GB (OS) 600 GB (SQL data)

*Used only for installation—not needed during runtime.

***Note**: Best practice in VM environments is to reserve some CPU and memory overhead for ESXi or have the disk space available for memory that needs to be cached. For example, with the RHEL8 and Windows VMs listed here, 60 GB RAM is configured for Chef, Combo, and MSSQL DB with the remaining reserved for ESXi overhead and future growth. For VM disk provisioning, it is recommended to use Thin provisioning for OS local disks and Thick provision eager zeroed for MSSQL data disks.*

Host configuration used for testing

Characteristic	Server 1 (DB and Combo)
Dell Server	PowerEdge R450
Processing	Intel Xeon Gold 5317 CPU: 2x12 cores @ 3.0 GHz processor (48 vCPUs)
Physical Memory	128 GB RAM
Disk Storage	4x1.9TB SSD SAS, RAID 10 (VM usage); 2x480GB SSD SATA, RAID 1 (ESXi usage)
Network Interface	Dual Port 10 GB NIC
Power Supply	Dual power supply
Other	Out-of-band management

Tested meter profile

- 85K meters 4 hour transmit/1 hour read interval
- 15K meters 1hour transmit/15 minute read interval

Medium RNI

This configuration is for RNIs supporting an approximate maximum inbound message rate of 25 messages per second. All software server functions can be virtualized on a single tower, rack-mounted server, blade server, or desktop server, and support all RNI roles: Broker, Database, DBbuilder, FlexApp, Gateway, Network Controller, Postgres, Web, and Authorization.

Virtual Machine minimum requirements

VM Image	OS	Virtual CPUs	Memory (RAM) - minimum	Local Disk Storage (effective)
Chef*	RHEL8	2	4 GB (minimum)	100 GB
Combo	RHEL8	8	48 GB (minimum)	400 GB
MSSQL DB	Windows	8	32 GB (minimum)	200 GB (OS) SQL Data – see Disk Storage Calculator

*Used only for installation—not needed during runtime.

***Note**: Best practice in VM environments is to reserve some CPU and memory overhead for ESXi or have the disk space available for memory that needs to be cached. For example, with the RHEL8 and Windows VMs listed here, 84 GB RAM is configured for Chef, Combo, and MSSQL DB with the remaining reserved for ESXi overhead and future growth. For VM disk provisioning, it is recommended to use Thin provisioning for OS local disks and Thick provision eager zeroed for MSSQL data disks.*

Host configuration used for testing

Characteristic	Server 1 (DB and Combo)
Dell Server	PowerEdge R450
Processing	Intel Xeon Gold 5317 CPU: 2x12 cores @ 3.0 GHz processor (48 vCPUs)
Physical Memory	256 GB RAM
Disk Storage	4x1.9TB SSD SAS, RAID 10 (VM usage); 2x480GB SSD SATA, RAID 1 (ESXi usage)
Network Interface	Dual Port 10 GB NIC
Power Supply	Dual power supply
Other	Out-of-band management

Tested meter profile

- 200K meters 4 hour transmit/1 hour read interval
- 50K meters 1 hour transmit/15 minute read interval

Large RNI

This configuration is for RNIs supporting an approximate maximum inbound message rate of 750 messages per second. The software server functions can be virtualized across two servers, each with its own local storage requirements.

- **Server 1 (DB)**: MSSQL Database and DBbuilder roles
- **Server 2 (Combo)**: Broker, FlexApp, Gateway, Network Controller, Postgres, Web, and Authorization roles; Chef

Virtual Machines minimum requirements

VM Image	OS	Virtual CPUs	Memory (RAM) - minimum	Local Disk Storage	Additional Storage
MSSQL DB	Windows	32	492 GB (minimum)	400 GB	See Disk Storage Calculator for Data, TempDB, and Trans Log sizing
Chef[1]	RHEL8	2	4 GB (minimum)	100 GB	N/A
Combo	RHEL8	60	192 GB (minimum)	900 GB	N/A

[1]Used only for installation; not needed during runtime.

***Note**: Best practice in VM environments is to reserve some CPU and memory overhead for ESXi, or have the disk space available for memory that needs to be cached. For example, 196 GB RAM is configured on the Combo host for Chef + Combo VMs, with the remaining 60 GB reserved for ESXi overhead and future VM RAM growth. On the DB host, 492 GB is configured for the MSSQL DB VM, with the remaining 10 GB reserved for ESXi overhead. It is also good to set the MSSQL maximum server memory to reserve some memory (2 to 8 GB) for the Windows OS and other applications. For VM disk provisioning, it is recommended to use Thin provisioning for OS local disks and Thick provision eager zeroed for MSSQL data disks.*

Host configurations used for testing

Characteristic	Server 1 (DB)	Server 2 (Combo)
Dell Server	PowerEdge R750	PowerEdge R650
Processing	Intel Xeon Gold 6326: 2x16 cores @ 2.9 GHz processor (64 vCPUs)	Intel Xeon Silver 4314: 2x16 cores @ 2.4 GHz processor (64 vCPUs)
Physical Memory	512 GB RAM	256 GB RAM
Local Disk Storage	2x744 GB SAS SSD, RAID 1 (for OS only)	2x1.4 TB SAS SSD, RAID 1
Additional Disks	See Disk Storage Calculator for sizing MSSQL Data: RAID 5 or 6 MSSQL TempDB: RAID 10 MSSQL TransLog: RAID 1	N/A
Network Interface	Dual Port 10 GB NIC	Dual Port 10 GB NIC
Power Supply	Dual power supply	Dual power supply
Other	Out-of-band management	Out-of-band management

Tested meter profile

- 700K meters 30 minute transmit/15 minute read interval
- 400K meters 30 minute transmit /15 minute read interval, FlexNet V2
- 420K meters 1 hour transmit /15 minute read interval
- 480K meters 4 hour transmit /1 hour read interval

Extra-Large RNI

This configuration is for very large systems supporting up to an approximate maximum message rate of 1500 inbound messages per second. All application servers are virtualized, the database server is physical. The Extra-Large RNI uses the same RNI configuration options as the Large RNI, so select the Large option when doing the installation. The MSSQL configuration uses one application server and one DB server. The Oracle configuration uses three application servers and one DB server. Both solutions are rack mounted, and may use either local, direct attached or SAN Storage.

MSSQL configuration

The configuration of an Extra Large MSSQL system consists of the following host/physical servers:

- **Physical Server 1 (DB)**: MSSQL Database and DBbuilder roles
- **Host Server 2 (Combo)**: Broker, FlexApp, Gateway, Network Controller, Postgres, Web, and Authorization roles; Chef

Physical Machine minimum requirements for Server 1

The configuration of an Extra-Large Database Server is a minimal starting point for Extra-Large Systems and may need to be scaled higher based on the incoming message rate.

OS	Physical CPUs	Memory (RAM) - minimum	Local Disk Storage[2]	Additonal Storage
Windows	64 (128 with HT)	2 TB (minimum)	744 GB	See Disk Storage Calculator for Data, TempDB, and Trans Log sizing

Virtual Machines minimum requirements for Server 2

VM Image	OS	Virtual CPUs	Memory (RAM) - minimum	Local Disk Storage[2]	Additional Storage
Combo	RHEL8	60	448 GB (minimum)	900 GB	2.5 TB (Backspools) 75 GB (Postgres)
Chef[1]	RHEL8	2	4 GB (minimum)	100 GB	NA

[1]Used only for installation; not needed during runtime.

[2]OS Disk

***Note**: Best practice in VM environments is to reserve some CPU and memory overhead for ESXi, or have the disk space available for memory that needs to be cached. For example, 452 GB RAM is configured on the Combo host for Chef + Combo VMs, with the remaining 60 GB reserved for ESXi overhead and future VM RAM growth. It is also good to set the MSSQL maximum server memory to reserve some memory (2 to 8 GB) for the Windows OS and other applications. For VM disk provisioning, it is recommended to use Thin provisioning for OS local disks and Thick provision eager zeroed for MSSQL data disks.*

Host configurations used for testing

Characteristic	Server 1 (DB)	Server 2 (Combo)
Dell Server	PowerEdge R750	PowerEdge R650
Processing	Intel Xeon Platinum 8358P: 2x32 cores @ 2.6 GHz processor (128 logical CPUs)	Intel Xeon Gold 6346: 2x16 cores @ 3.1 GHz processor (64 vCPUs)
Physical Memory	2 TB	512 GB RAM
Local Disk Storage	2x744 GB SAS SSD, RAID 1	2x1.4 TB SAS SSD, RAID 1
Additional Disks[1]	See Disk Storage Calculator for sizing MSSQL Data: RAID 5 or 6 MSSQL TempDB: RAID 10 MSSQL TransLog: RAID 1	Backspools: 2x3.5 TB SAS SSD, RAID 1 PGSQL: 2x446 GB SATA SSD, RAID 1
Network Interface	Dual Port 10 GB NIC	Dual Port 10 GB NIC
Power Supply	Dual power supply	Dual power supply
Other	Out-of-band management	Out-of-band management

[1]SSD drives required.

Tested meter profile

- 750K meters 15 minute transmit/5 minute read interval
- 350K meters 30 minute transmit/15 minute read interval
- 400K meters 30 minute transmit/15 minute read interval, FlexNet V2
- 600K meters 1 hour transmit/15 minute read interval

Oracle configuration

The configuration of an Extra-Large Oracle system consists of the following host/physical servers:

- **Physical Server 1 (DB)**: Oracle Database role
- **Host Server 2 (Network Controller)**: Broker[1], Network Controller role
- **Host Server 3 (FlexApp)**: FlexApp role
- **Host Server 4 (Web)**: Gateway, Postgres, Web, Authorization, and DBbuilder roles; Chef

Virtual Machines minimum requirements

VM Image	OS	Virtual CPUs	Memory (RAM) - minimum	Local Disk Storage	Direct Access External Storage (SAN)
NC	RHEL8	54	118 GB (minimum)	NA	500 GB, 1-2 TB (Backspools)
FlexApp	RHEL8	54	118 GB (minimum)	NA	500 GB
Chef[2]	RHEL8	2	4 GB (minimum)	NA	100 GB
Web	RHEL8	54	110 GB (minimum)	NA	500 GB 100 GB (Postgres)
DbBuilder[2]	Windows	2	4 GB (minimum)	NA	100 GB

[1] The Broker must reside on the Network Controller host.
[2] Used only for installation; not needed during runtime.

***Note**: Best practice in VM environments is to reserve some CPU and memory overhead for ESXi or have the disk space available for memory that needs to be cached. For example, with the NC VM listed here, 118 GB RAM is configured, with the remaining 10 GB reserved for the VM instance.*

Host configurations used for testing

Characteristic	Server 1 (DB)	Servers 2-4 (NC, FlexApp, Web)
Processing	Intel Xeon E7-8890 v3: 4 x18 cores @ 2.5 GHz processor (144 logical CPUs)	Intel Xeon E5-2690 v4: 2x14 cores @ 2.6 GHz processor (56 vCPUs)
Physical Memory	2 TB RAM	128 GB RAM
Disk Storage	2x960 GB SATA SSD, RAID 1	2x600 GB SATA SSD, RAID 1
SAN Capacity[1] (SSD drives used)	Storage for Oracle data and TempDB variable by profile. See storage calculator for projected need. IOPs: 7k Steady, 15k Peak	500 GB each for NC, FlexApp, Web VMs 100 GB each for Chef, DBbuilder VMs 1-2 TB for Backspools on NC VM 100 GB for Postgres on Web VM
Network Interface	10 GB NIC	10 GB NIC
Power Supply	Dual power supply	Dual power supply
Other	Out-of-band management	Out-of-band management

[1]Recommendation is to begin with only the amount of storage needed for DB data, TempDB, Backspools, and add as required to meet the number of endpoints in your system. As an alternative to the SAN, you can use directly attached local storage to fulfill this requirement.

Tested meter profile

- 1.3M meters 1 hour transmit/15 minute read interval
- 300K meters 1 hour transmit/15 minute read interval, FlexNet V2
- 20K meters 5 minute transmit/5 minute read interval
- 100K meters 4 hour transmit/1 hour read interval
- 300K lighting 4 hour transmit/1 hour read interval

Server setup overview

The RNI can run on physical machines or virtual machines. To determine the number and type of recommended servers for your deployment configuration, refer to RNI Hardware Baseline, and review the information in Sizing Profiles. Additional servers and services (such as operating system updates, and network time protocol) are required as described in the following sections.

Operating systems prerequisite overview

This section lists the operating systems that are required for the RNI. The servers with Linux-based operating systems must use Red Hat Enterprise Linux Server release 8 64-bit. The servers with Windows-based operating systems must use Microsoft Windows Server 2016 Standard 64-bit or Microsoft Windows Server 2019.

In addition to these base operating system prerequisites, there are other software prerequisites which are detailed in a later section.

Database prerequisite overview

The RNI needs at least one database server. MS SQL Standard Edition is supported in all configurations. MS SQL Enterprise Edition is optional. The database server software must be one of the following:

- Oracle 19c R1 Server
- Microsoft SQL Server 2016 Standard Edition (SP2-CU17 or later) or Enterprise Edition
- Microsoft SQL Server 2019 Standard Edition (CU21 or later) or Enterprise Edition

In addition to these database server prerequisites, there are other software prerequisites which are detailed in a later section.

Services for updating the operating systems

It is recommended that updates to the operating systems be controlled via a management infrastructure.

- To control the Windows operating systems updates, the Windows Server Updates Services (WSUS) is recommended.
- To control the RHEL8 operating system updates, a current, supported version of Red Hat Satellite Server is recommended.

NTP server and clock synchronization

The system clocks for all RNI servers must be synchronized. It is recommended that a Network Time Protocol (NTP) server be used for this purpose. The NTP client setup for each server is covered in this document. However, establishing and setting up the NTP server is beyond the scope of this document.

Virtualization software

If the RNI is running in a virtualized environment, VMWare ESXi 7.0 is the recommended software. We also recommend using VMFS6 formatting for all disk data stores.

Microsoft Windows

This section lists the details for an RNI server running Microsoft Windows Server 2016 Standard 64-bit server software or Microsoft Windows Server 2019 Standard 64-bit server software.

Microsoft operating systems

RNI servers running Windows-based operating systems must use Microsoft Windows Server 2016 Standard 64-bit server software or Microsoft Windows Server 2019 Server Standard 64-bit server software.

Additional Microsoft Windows 2016 / Windows 2019 requirements

The following sections cover additional requirements for RNI servers running Microsoft Windows Server 2016 64-bit software or Microsoft Windows Server 2019 software.

Clock synchronization

The system clocks for all RNI servers must be synchronized.

For Windows-based RNI servers, set the Internet time to automatically synchronize with the NTP server.

Web browser interface

The RNI web-based user interface requires one of the following:

- Microsoft Internet Explorer v.11 with document mode set to Edge
- Google Chrome v.48

Winrm configuration updates

The RNI installation requires the following on all Windows servers that install RNI components.

```
winrm quickconfig -q
winrm set winrm/config/winrs @{MaxMemoryPerShellMB="3000"}
winrm set winrm/config @{MaxTimeoutms="1800000"}
winrm set winrm/config/service @{AllowUnencrypted="true"}
winrm set winrm/config/service/auth @{Basic="true"}
sc config "WinRM" start= auto
net start WinRM
```

Windows antivirus configuration

To improve performance of the initial creation of the database tables and schema, it is recommended that the Windows Base Directory (that is specified in the RNI installer) be excluded from any antivirus (AV) scans.

For example, if you are using Windows Defender, and the Windows Base Directory is C:\Sensus\ in the RNI installer, you would run the following PowerShell command to exclude the path from AV scans.

```
Add-MpPreference -ExclusionPath "C:\Sensus\Database Builder SDB\"
```

To avoid Windows Hardening problems during installation of the RNI, it is recommended that the Windows Base Directory (that is specified in the RNI installer) be excluded from any antivirus scans.

For example, if you are using Windows Defender, and the Windows Base Directory is C:\Sensus\ in the RNI installer, you would run the following PowerShell command to exclude the path from AV scans.

```
Add-MpPreference -ExclusionPath "C:\Sensus\"
```

Windows servers using Oracle Database Server

If the RNI database software is Oracle Database Server 19c, then your Windows server must have some Oracle clients installed to enable the RNI components (on the Windows server) to connect to your Oracle 19c server (DBbuilder runs on the Windows server). This section lists those components.

- Install Oracle Data Access Component for Oracle Client 19c (specifying a directory path).
- Install Oracle Database Client 19c (specifying a directory path).
- Set the TNS_ADMIN environment variable to match the directory that contains the tnsnames.ora file.
- Add EZConnect to the sqlnet.ora file in ODAC.
- Ensure sqlplus is installed on the Windows server.

Windows servers using MSSQL Server

Enable instant file initialization.

Cygwin

For Windows 2016, install Cygwin and enable sshd. Set the sshd service to run as a user ID other than Administrator. For Windows 2019, Cygwin is not needed. Simply enable/start OpenSSH as it is part of the operating system.

Additional optional software

The following software and operating system configurations are not required to install the RNI, and they are not required for the RNI to run. However, the following items are helpful for administration and troubleshooting of the RNI:

- Enable Remote Desktop
- Enable/Disable Firewall Rules for Remote Desktop
- Instead of Cygwin, use Putty, etc.
- Install a user-friendly text editor (e.g., Notepad++, Sublime Text, etc.)
- Install user-friendly remote session software (e.g., mRemote, poderosa, etc.)
- Install a user-friendly file copier (e.g., WinScp, etc.)

Red Hat Enterprise Linux

This section lists the details for Red Hat Enterprise Linux 8 server.

Red Hat operating systems

The RNI servers running Linux-based operating systems must use Red Hat Enterprise Linux Server release 8 64-bit server software.

Red Hat Enterprise Linux updates

All Red Hat Enterprise Linux servers must be configured to receive updates via a management infrastructure.

Red Hat Satellite

A RNI server running Red Hat Enterprise Linux server software needs operating system updates managed by a current, supported version of Red Hat Satellite Server.

To install the RNI, each RNI server running Red Hat Enterprise Linux server software needs access to the following channels on the Red Hat Satellite Server:

- Red Hat CodeReady Linux Builder for RHEL 8 x86_64
- Extra Packages for Enterprise Linux 8 x86_64 (EPEL)
- Red Hat Enterprise Linux 8 for x86_64 – AppStream
- Red Hat Enterprise Linux 8 for x86_64 – BaseOS
- Red Hat Enterprise Linux 8 for x86_64 – Supplementary
- Red Hat Satellite Client 6 for RHEL 8 x86_64

Local repository

Any Red Hat Enterprise Linux server in the RNI may be configured to use a local repository. It is highly recommended that the local repositories are updated frequently with the most current version of Red Hat Enterprise Linux RPMs.

Additional Red Hat Enterprise Linux requirements

The following sections discuss additional requirements for RNI servers running the Red Hat Enterprise operating system.

Clock synchronization

The system clocks for all RNI servers must be synchronized. It is recommended that chronyd is used for the RNI.

Wget

The wget rpm should be installed on all Linux servers for the RNI installer.

Remove incompatible packages

The RNI uses docker-ce for containerization. Other container-based tools will cause a conflict with docker-ce and any, if installed, should be removed prior to starting the RNI installation.

- podman
- buildah

Chef server ports

Open ports 20 and 21 bi-directionally for the installer, and also open port 8080.

Database server details

The RNI needs one database server. The database server software must be one of the following:

- Microsoft SQL Server 2016 Standard Edition SP2-CU3 or later
- Microsoft SQL Server 2019 Standard Edition CU8 or later
- Oracle 19cR1 Server

Microsoft SQL Server 2016 / 2019 Server configuration

The following sections describe how to install and configure Microsoft SQL Server 2016 or SQL Server 2019 for use with the RNI.

Installation

The latest Cumulative Update (CU) for Service Pack 2 for Microsoft SQL Server 2016 should be installed. For Microsoft SQL Server 2019, the latest Cumulative Update (CU) should be installed as there is no service pack to date. You can either download the latest CU from the Microsoft website or use Microsoft Update during the installation.

MSSQL server feature installation

The RNI only requires installation of the following three MSSQL Server features:

- Database Engine Services
- Management Tools – Basic
- Management Tools – Complete

Configuration

Set the Startup Type for the MSSQL Server Database Engine to Automatic. Whether using the default service account for the Database Engine (NT Service\MSSQLSERVER) or specifying another account, make a note of this information as it is needed later. Set the Startup Type for MSSQL Server Agent to Manual or Disabled, as the RNI does not use MSSQL Server Agent.

The RNI uses database collation *SQL_Latin1_General_CP1_CI_AS*, which is the default for the English version of SQL Server.

Database engine configuration

The RNI uses MSSQL Server Authentication. Therefore, Authentication Mode must be set to Mixed Mode. Enter a password for the MSSQL Server system administrator (sa) account. This password must be provided when installing the RNI database. You must also specify a Windows account to use as MSSQL Server administrator, even though this is not required for the RNI database.

Make sure to specify the correct directories for the Temp DB and Temp DB log. If using a PCIe/NVMe SSD drive, Temp DB files should be located there. A large RNI requires 1 TB of disk space for the Temp DB and log.

You can also specify the default directories for user database files and transaction logs, but this is not required. The directories for the RNI database files and transaction log are specified during RNI database installation.

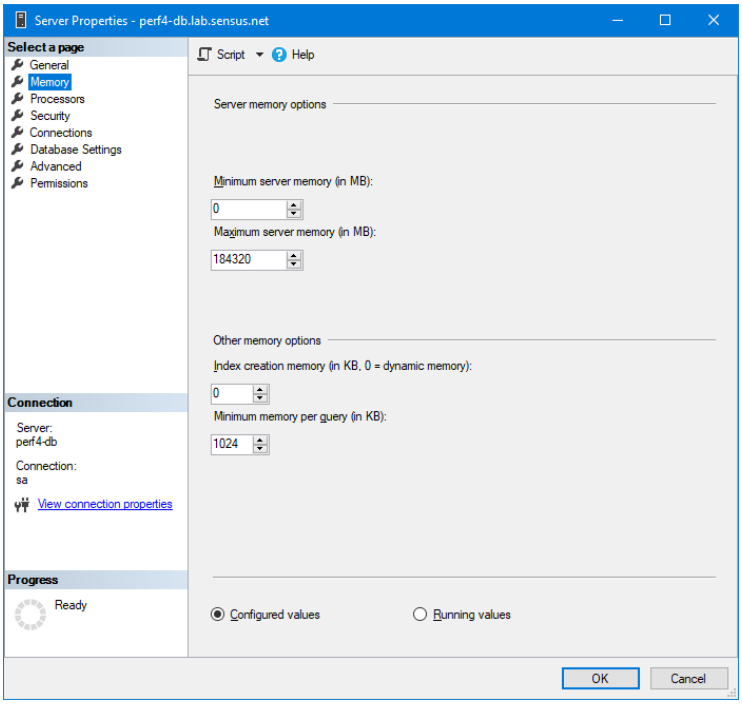
The MSSQL Server's FILESTREAM feature is not required for the RNI.

Post-installation

After installing the RNI database server software, you need to complete the following processes.

Memory

Right-click **MSQL server** > **properties** > **Mem** and set to mem to the RNI specs.



The “Maximum server memory in MB” value should generally be set to the system RAM value, minus 8 GB to leave 8GB for the Windows Operating System. Remember that this value is in Megabytes, and 1 gigabyte is 1024 MB, not 1000 MB, and set the value accordingly. In this example, this system had 188 GB of RAM available, and SQL Server is given a limit of 180GB (180 * 1024 = 184320) and 8 GB is left for the Operating System.

MSSQL Server Standard Edition

MSSQL Server Standard edition has a 128 GB Limit for its buffer cache. This limit only applies to the buffer pool memory in SQL Server and does not apply to the rest of the caches that MSSQL Server uses, such as procedure cache, thread stack, and the .NET runtime. The memory used outside of the buffer pool is not restricted by the 128GB limitation. That memory usage of MSSQL Server can and will grow to the max server memory limit listed above.

Enable instant file initialization

MSSQL Server instant file initialization is required for a large RNI installation to speed up database installation. It is also recommended for the medium RNI. Instant file initialization requires a restart of MSSQL Server.

Create multiple temporary DB files

The best practices for MSSQL Server are to create a TempDB data file for each CPU core for servers with up to 8 logical cores, and 8 TempDB data files for servers with 8 or more than 8 CPU cores. If contention is observed, Microsoft recommends that 4 additional TempDB data files should be created at a time until resource contention issues clear up. All TempDB data files should be set to the same initial size with the same growth rate or same maximum size.

If you are installing or upgrading the RNI on an existing MSSQL Server that already has more than 8 data files, it is **NOT** recommended to delete existing TempDB files.

Temporary data files should be sized as follows: Use 7.5% of the total disk space anticipated for RNI data storage and divide that number into the number of data files (rounding up). For example, if the estimated disk space for your RNI is 300GB, 7.5% of that is 22.5GB, and dividing by 8 (for example) would yield 8 TempDB files at 3 GB each (rounding up).

For additional performance use a direct attached SSD drive for TempDB files. This may need to be adjusted to accommodate specific workloads.

To create the additional files, use the following sample script (adjust the file paths, file sizes, and number of files as appropriate):

```
USE master;
ALTER DATABASE TEMPDB MODIFY FILE (NAME=tempdev, SIZE=10240MB, MAXSIZE=51200MB);
GO
ALTER DATABASE tempdb
ADD FILE (NAME = tempdb1, FILENAME = 'F:\TempDb\tempdb1.ndf', SIZE=10240MB,
MAXSIZE=51200MB);
GO
ALTER DATABASE tempdb
ADD FILE (NAME = tempdb2, FILENAME = 'F:\TempDb\tempdb2.ndf', SIZE=10240MB,
MAXSIZE=51200MB);
GO
ALTER DATABASE tempdb
ADD FILE (NAME = tempdb3, FILENAME = 'F:\TempDb\tempdb3.ndf', SIZE=10240MB,
MAXSIZE=51200MB);
GO
ALTER DATABASE tempdb
ADD FILE (NAME = tempdb4, FILENAME = 'F:\TempDb\tempdb4.ndf', SIZE=10240MB,
MAXSIZE=51200MB);
GO
ALTER DATABASE tempdb
ADD FILE (NAME = tempdb5, FILENAME = 'F:\TempDb\tempdb5.ndf', SIZE=10240MB,
MAXSIZE=51200MB);
GO
ALTER DATABASE tempdb
ADD FILE (NAME = tempdb6, FILENAME = 'F:\TempDb\tempdb6.ndf', SIZE=10240MB,
MAXSIZE=51200MB);
GO
ALTER DATABASE tempdb
ADD FILE (NAME = tempdb7, FILENAME = 'F:\TempDb\tempdb7.ndf', SIZE=10240MB,
MAXSIZE=51200MB);
GO
```

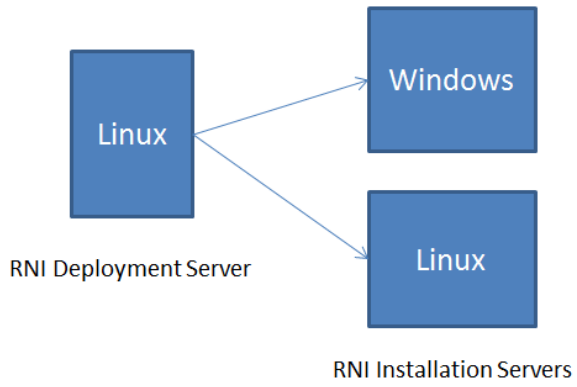
Oracle 19c server details

The following information is needed to use Oracle 19cR1 Server software for the RNI database:

- Install Oracle Database 19cR1 on the database Linux server and create the database table spaces.
- Optional for larger systems, install the Enterprise Edition with partitioning licensed.

RNI installation

An RNI installation requires a minimum of three servers: one Linux server as the RNI deployment server, and one Linux and one Microsoft Windows server for the RNI installation itself.



Depending on the performance required, there may be a need for additional RNI installation servers.

The RNI installation is based on grouping components into roles, and then assigning one or more roles to a particular RNI installation server.

RNI installation also requires the use of a distinct Linux server to act as the RNI deployment server. The deployment server communicates and deploys the various RNI components to the configured RNI servers.

Roles

The following table describes the various RNI roles.

Role	Operating System	Description
MSSQL	Windows	One of the two main database providers supported by the RNI.
ORACLE	Linux	The other of the two main database providers supported by the RNI.
DBBUILDER	Windows	Runs a utility used to deploy the main FlexNetDB (database). For MSSQL installs, this is always the same machine as MSSQL role. For Oracle installs, this is potentially a separate Windows VM.
NC	Linux	Network Controller (NC) is the edge component for interfacing to the Base Stations.
FLEXAPP	Linux	FlexNet Applications containing the core RNI functionality.
WEB	Linux	Hosts the web user interfaces for the RNI.
BROKER	Linux	Message broker that allows multiple RNI components to communicate with each other.
PG	Linux	Postgres DB that retains the transient day-to-day working state of the RNI.
AUTH	Linux	Authentication server for single sign-on (SSO) access.

Role	Operating System	Description
GW	Linux	MultiSpeak Gateway.
NMS*	Linux	Network Management System (NMS). Optional role used for the NMS application.

*No software installed as part of the core RNI but required as a reference for other components.

The database choice, network topology, and performance criteria determine the role combination.

For MSSQL deployments (two servers)

Operating System	Roles
Windows	MSSQL, DBBUILDER
Linux	NC, FLEXAPP, WEB, BROKER, PG, AUTH, GW

For small Oracle deployments (three servers)

Operating System	Roles
Linux	ORACLE
Windows	DBBUILDER
Linux	NC, FLEXAPP, WEB, BROKER, PG, AUTH, GW

For large Oracle deployments (seven servers)

Operating System	Roles
Linux	ORACLE
Windows	DBBUILDER
Linux	NC
Linux	FLEXAPP
Linux	WEB, AUTH, GW
Linux	BROKER
Linux	PG

RNI installation prerequisites

All the RNI servers, including the RNI deployment server, should be available prior to starting the RNI installation. They should be configured as described in the previous sections.

It is strongly recommended that the hostnames for all the RNI servers indicate the appropriate RNI role as part of their hostname. A sample is shown in the following table:

Example names	Role
acme-db	MSSQL, DBBUILDER
acme-combo	NC, FLEXAPP, WEB, BROKER, PG, AUTH, GW
acme-nc	NC
acme-flexapp	FLEXAPP

Please verify that the communications network comprising all RNI servers and the RNI deployment server is operational and that each of the server can ping (ICMP echo) each of the other servers. The hostname of each RNI server must be resolvable from the deployment server via DNS.

If creating a /etc/hosts file or deploying the RNI without DNS, the fully qualified name needs to be first in the list of aliases. Other aliases can be added but they need to be listed after the fully qualified name. Following is an example of entries in the hosts file:

- acme-deployment. FlexNet.net
- acme-db. FlexNet.net db dbbuilder
- acme-combo. FlexNet.net pg broker flexapp nc web gw auth

When deploying the RNI without DNS, the hosts file needs to be created on all the servers (e.g., Deployment server, db, combo) with just the fully qualified name.

Installing the RNI Installer on the Deployment server

The RNI Installer is a web-based application which is installed on the RNI Deployment server. After installation of the RNI Installer, use a web browser to perform the RNI installation.

***Important**: RNI Installer must be the only RNI application installed the Deployment server.*

SCS RPM

The SCS RPM is set to install by default on medium and large systems. This can be changed in the Installer UI in the Miscellaneous section. See *Using the RNI Installer* for details.

Mount the RNI ISO file

Mount the RNI ISO so that it is available on the Deployment server. For example, if the ISO file is located on the Deployment server, the Linux command is similar to the following:

```
mount –o loop sensus_rni_4.8.1.iso /mnt/rni_install_dir
```

Install the RNI Installer

Install the RNI Installer by executing the following:

```
cd /mnt/rni_install_dir
./installer.sh
```

Access the RNI installation web interface

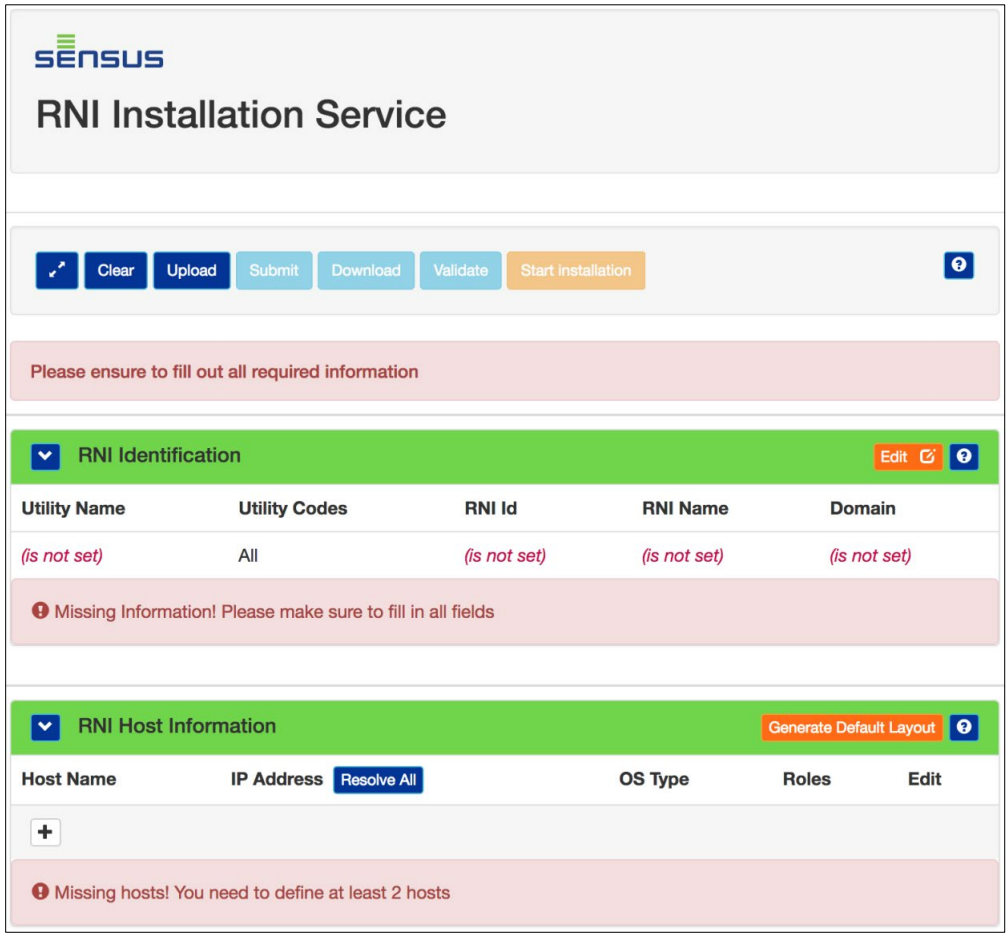
When the previous command completes, a message shows the URL to use in the web browser. It should appear similar to the following:

```
****
*
* To continue installation, browse to
* http://your-install-server:8080/rtc/rni_installer.html
*
****
```

Using the RNI Installer

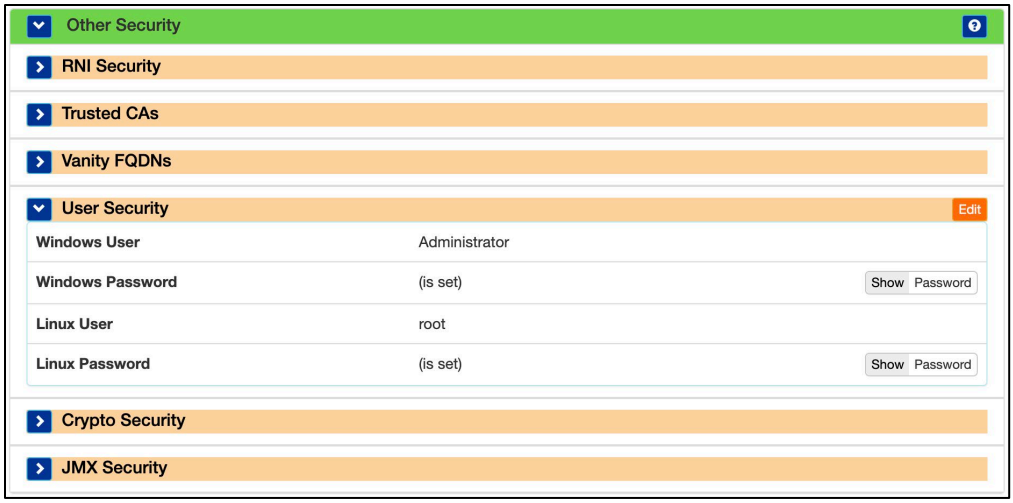
The RNI Installer is a single user interface that aggregates the details of the RNI installation and then deploys the RNI software to the configured RNI server based on that information. The RNI Installer provides validation feedback for server and configuration information prior to installing the RNI software.

Configuring the RNI installation



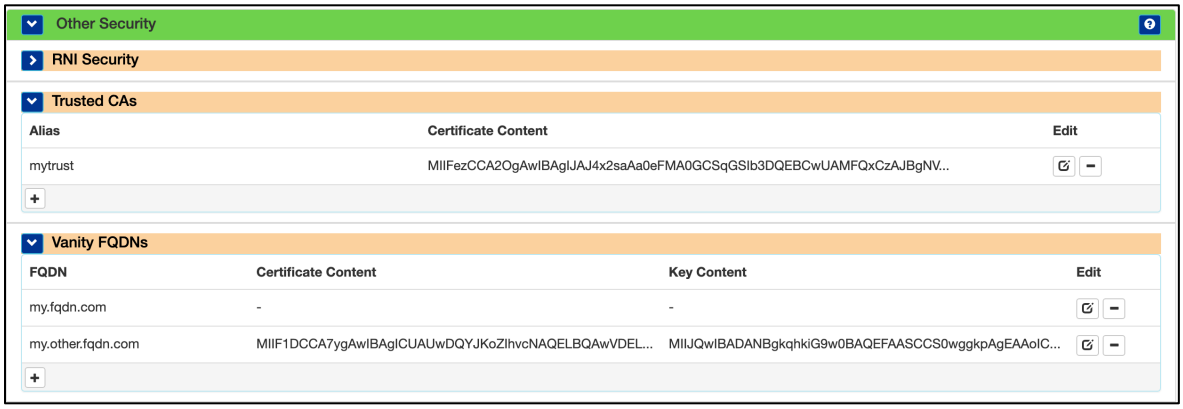
The preceding image shows the initial RNI Installer web page. The RNI Installer page is divided into sections based on commonality of information. Each section has a help icon that provides information specifically for that section.

The RNI Identification, RNI Host Information, and Other Security sections must be configured. All the other sections should be reviewed to determine if changes are necessary for this specific RNI installation. The fully qualified name on the server (e.g., hostname –f command) should match the hostname in the RNI Installer and is case sensitive. For MSSQL systems, the DB Port must remain the default, 1433. If you have password policies in place, check the General DB Settings section to ensure that the default passwords fit your password policy.



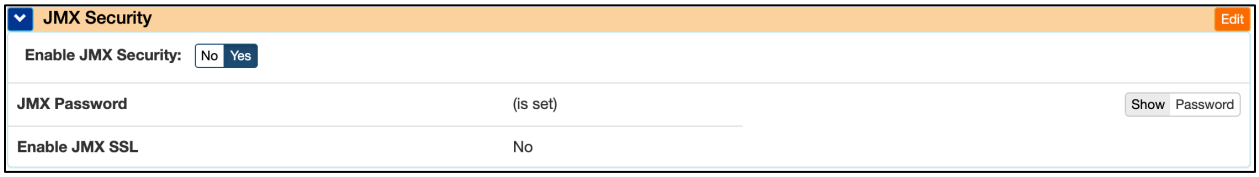
One configuration area of particular importance is the User Security area in Other Security section. For the RNI Installer to access the RNI servers and install the RNI software, the RNI Installer must be able to log on each server remotely with user rights to install software. The Windows user must have Administrator rights, and the Linux user must have root level of authority. The user must be a local user.

For RNI version 4.8, options were added to provide Trusted CAs and multiple Vanity FQDNs:

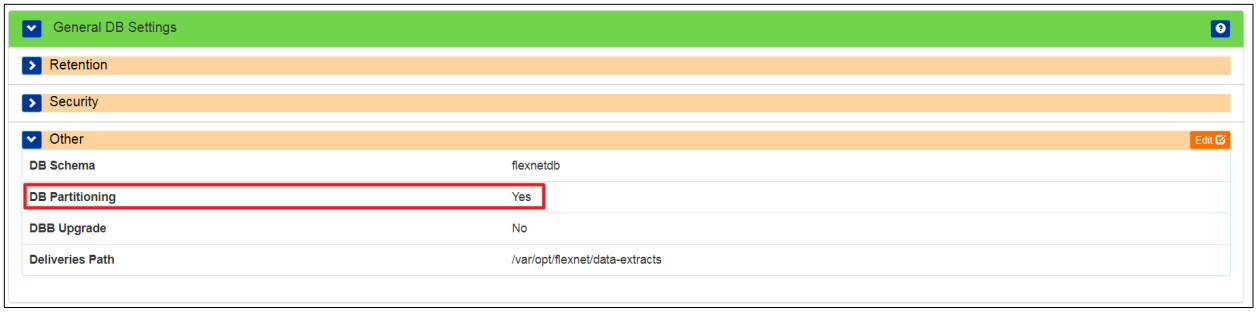


JMX Security options were also added in RNI version 4.8.

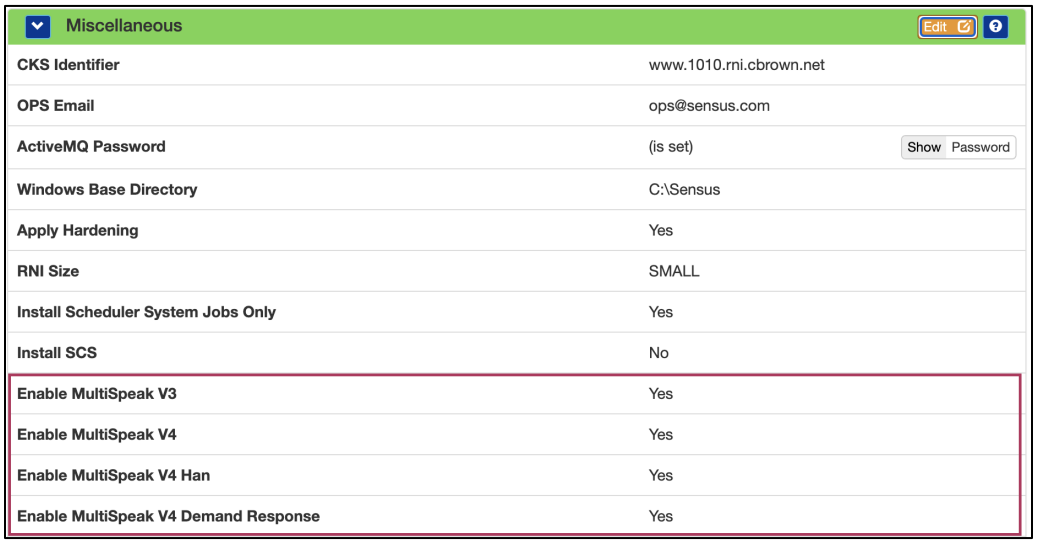
***Note**: Enabling SSL, while more secure, is not recommended except in extreme cases. This requires that the JKS key-store, trust-store, and associated password tokens are copied to any JMX client requesting access.*



For MSSQL installations, enabling DB Partitioning is recommended for improved database performance, regardless of overall system size. Specifically, installations over 100,000 endpoints should always use partitioning. Installations from 35,000 to 100,000 endpoints should consider partitioning if they have experienced database performance issues caused by excessive I/O usage.



For RNI version 4.8.1 options were added for MultiSpeak v3 and v4.

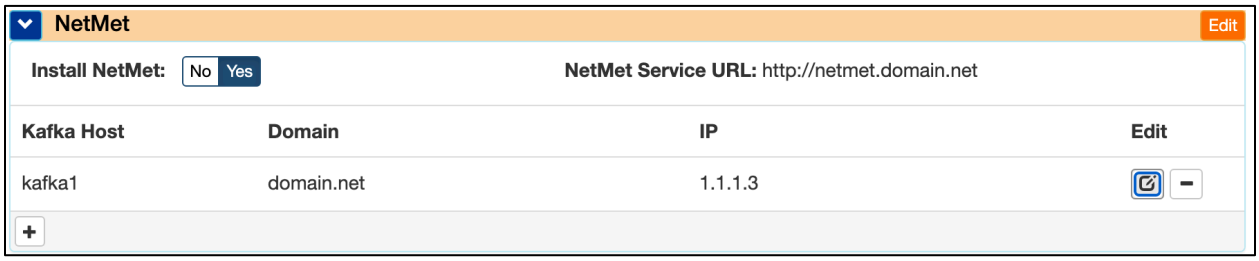


For RNI version 4.12, options were added to enable NC2NC and TxBridge security.

***Note**: Security defaults to **yes**, but if there is an existing use of these features (connecting to a system earlier than 4.12) then these should be changed to **no**. They can also be disabled post install by executing these scripts:*

- */opt/flexnet/init-support/disable-nc2nc-security.sh*
- */opt/flexnet/init-support/disable-txbridge-security.sh*

For RNI version 4.8 options were added to control the connection to Network Metrics.



For scheduler job import/export, it is recommended that when scheduler jobs are imported from a job XML file, a separate file is used for every customer or system jobs, to reduce the number of jobs imported in one operation and thus reduce the chance of timing out.

RNI Scheduler soft notification alarm flag will be enabled only for MSSQL 2016 or later, and Oracle 19c and later.

Once the entire configuration is entered on the RNI Installer, select **Submit** to save the configuration information to the Deployment server. Changes to the RNI Installer configuration must be submitted before taking any further action.

Validating the RNI installation

Once the configuration information is submitted to the Deployment server, the configuration can be validated. Select **Validate** to verify the submitted configuration information by communicating with the configured RNI servers. The following table lists the validation tests, the servers on which the tests are performed, and whether a failure of the test stops the installation.

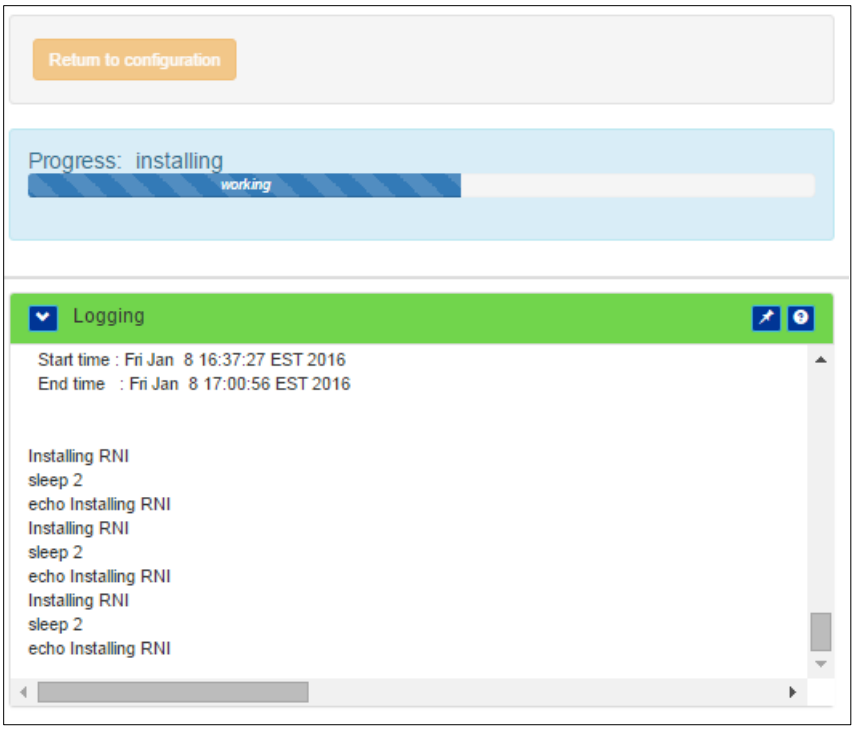
Validation Test	Servers	Blocks UI Installation
NTP is running	All Servers	No
SSH is running	Linux Servers	Yes
Windows 2016 or 2019 installed	Windows servers	Yes
Red Hat Enterprise Linux 8 installed	Linux servers	Yes
WinRM is running	Windows servers	No
Microsoft SQL Server 2016 or 2019 running	Windows DB servers	Yes
Oracle 19 CR1 running	Linux DB servers	Yes
Java 11 installed	Linux Servers	Yes
Red Hat Linux Satellite Channels available	Linux Servers	Yes

The validation tests may take several minutes to complete. When they are finished, the results display on the RNI Installer page. It is highly recommended that the servers pass all validation tests before starting the installation. All failures of tests that block UI installation must be resolved. If configuration changes are made, they must be re-submitted and validated before the RNI Installation begins.

Select **Download** to save the RNI installation configuration to the local workstation. Click **Upload** to load an RNI configuration file from the local workstation on the Deployment server. The saved RNI configuration information can then be used for the current RNI installation.

Starting the RNI installation

After the validation tests complete successfully, initiate the RNI installation by selecting **Start Installation**. RNI installation time depends on the number of RNI servers and network connectivity. A progress bar and installation messages illustrate the progress of the RNI installation as shown in the following image.



RNI installation completion

When the RNI installation completes, it displays the address for the main page of the RNI.

Restore gateway manual customizations

As of RNI 4.5, the spring-not-od-mapping.xml or spring-not-od-event-filter.xml MultiSpeak spring file should no longer be edited, because the mappings are no longer retrieved from those locations. Rather, mappings should be controlled via the addition of specific properties in flexnet.local.properties. This allows the mappings to be maintained from release to release. In addition, the properties allow per customer mappings to be created.

IMPORTANT: Upon upgrade to RNI 4.4 or later, any customizations in the spring configuration files listed here are no longer used:

- **/opt/flexnet/gateway/webapps/multispeakv4-not-od-client/WEB-INF/classes/spring/spring-not-od-mapping.xml**
- **/opt/flexnet/gateway/webapps/multispeakv4-not-od-client/WEB-INF/classes/spring/spring-not-od-event-filter.xml**
- **/opt/flexnet/gateway/webapps/multispeakv3-not-od-client/WEB-INF/classes/spring/spring-not-od-mapping.xml**
- **/opt/flexnet/gateway/webapps/multispeakv3-not-od-client/WEB-INF/classes/spring/spring-not-od-event-filter.xml**

For the purpose of mapping or suppressing ODEventNotifications that existed in the previously installed RNI gateway must be manually recreated as entries in flexnet.local.properties. See Appendix A, B, and C for more details and use cases.

RNI upgrade (UpgradePlus)

The information in the following sections describes how to upgrade the RNI servers to version 4.14.1 of the RNI software running on RHEL8. The UpgradePlus process requires a new RHEL8 deployment server and a new RHEL8 RNI server.

4.14.1 RNI upgrade limitations

Supported upgrade paths

- 4.10.2
- 4.11.1
- 4.12.1
- 4.13.1

Limitations

- Only supports MSSQL. No support for Oracle upgrades.
- Only supports RNI Combo servers. No support for multi-sever RNIs.
- Does not migrate HSM configuration migrations. HSM can still be installed and configured in 4.14.1.
- Certificates and private keys that are not under /opt/flexnet/security must be manually copied.

Upgrading the RNI Installer on the Deployment server

The RNI Installer is a web-based application and must be upgraded on a separate server, the RHEL8 Deployment server, from the RNI servers. After upgrading the RNI Installer, use a web browser to perform the RNI upgrade.

Software removal

Internet Information Services (IIS) is no longer required on Windows servers for the RNI. If IIS is only used for the RNI, it can be removed.

Software backups

If the FlexNet Gateway software has been customized in any manner, it is necessary to back up this software using the following procedure:

1. Login to the web server as root.
2. Run the following commands:

```
$ mkdir /home/gateway (or any other backup directory)
$ cd /home/gateway (or any other backup directory)
$ tar czf backup-gateway-`date +%F`.tgz /opt/flexnet/gateway
$ rpm -qa | grep multispeak > multispeak_gateway_rpms_`date +%F`.txt
```

Mount the RNI ISO

Mount the RNI ISO so that it is available on the Deployment server. For example, if the ISO file is located on the Deployment server, the Linux command is similar to the following:

```
mount -o loop sensus_rni_4.14.1.iso /mnt/rni_install_dir
```

Upgrade the RNI Installer

Upgrade the RNI Installer by executing the following:

```
cd /mnt/rni_install_dir
./upgradePlus.sh
```

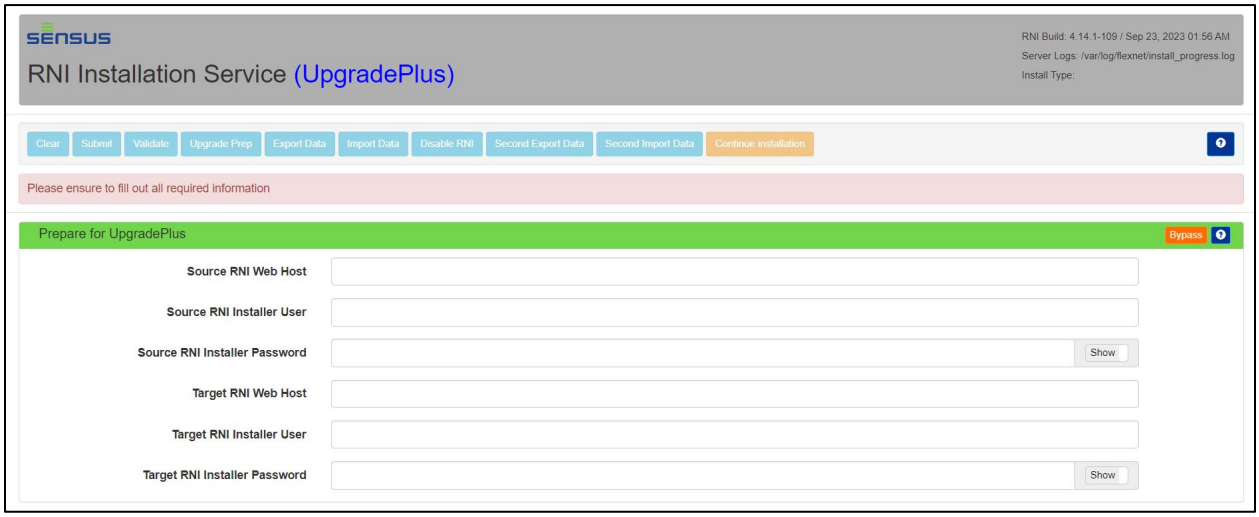
Access the RNI upgrade web interface

When the previous command completes, a message appears indicating the URL to use in the web browser. It should appear similar to the following:

```
****
*
*To continue upgrade, browse http://your-install-server:8080/rtc/rni_installer.html
*
****
```

Upgrade preparation

To prepare for the RNI upgrade, a series of steps must be performed to export/import the existing RNI data, configuration, files, etc. from the source RHEL7 RNI to the new target RHEL8 RNI. The Installer users must have root level of authority and must be a member of the FlexNet group.



Select **Submit** to save the source and target RNI information to the server. Changes to this information must be submitted before taking any further action.

Verifying the RNI information

Once the information is submitted it can be validated. Select **Validate** to verify the submitted information by communicating with the RNI servers and confirming the source is RHEL7 and the target is RHEL8.

Upgrade preparation

The existing RNI security and configuration information is copied to the RNI Installer server during the upgrade preparation process. This prevents the loss of any configuration and security information that would be caused by removing the RNI Installer server or reusing it for another RNI upgrade.

This also generates the rnicore-env.properties file located in /opt/flexnet/installer/export-import/profiles/rnicore/, which is used for the following Export/Import related activities. Any changes to the source and target information requires an additional click on **Submit** and **Upgrade Prep** to update the properties file with the correct information.

Export Data

Export Data copies all the RNI data, configuration, files, etc. to the new RHEL8 system. This is a predetermined list contained in the rnicore-env.properties file. This can be manually edited ahead of time to add or exclude specific files and directories.

- EXPORT_SOURCE_COPY_DIR_LIST
- EXPORT_SOURCE_COPY_FILE_LIST

Excluding anything explicitly called out in the exclusion list: /opt/flexnet/installer/export-import/profiles/rnicore/bin/rni-export-exclude-list.txt.

Import Data

Import Data registers all the core RNI FlexNet packages from the source RNI, into the RPMDB on the target RNI. This ensures that when the RNI upgrade happens, all the package installation/upgrades follow the proper RPM Upgrade path, instead of the file path for a clean install.

Disable RNI

Disable RNI stops and disables all services on the source RNI. This starts the maintenance window of the RNI upgrade.

Second Export Data

Second Export Data is exactly the same as the first except that it only copies the delta. Anything that may have been imported after the first export is copied.

Second Import Data

Second Import Data is exactly the same as the first except that it only copies the delta. Anything that may have come in after the first import is imported.

IP and hostname swap

Before continuing the RNI upgrade, a manual step is required to swap the IP and hostname of the source and target RNIs. The RHEL8 RNI needs to assume the identity of the source RHEL7 RNI. This ensures that anything referencing the existing source RNI will continue to work.

IMPORTANT: This IP and hostname swap is not part of the UpgradePlus solution. This must be a manual step performed by the Linux networking team as part of the upgrade process.

After the IP and hostname swap is performed, select **Continue Installation**.

Restore gateway manual customizations

As of RNI 4.4, the spring-not-od-mapping.xml or spring-not-od-event-filter.xml MultiSpeak spring file should no longer be edited, because the mappings are no longer retrieved from those locations. Rather, mappings should be controlled via the addition of specific properties in the flexnet.local.properties. This

allows the mappings to be maintained from release to release. In addition, the properties allow per customer mappings to be created.

IMPORTANT: Upon upgrade to RNI 4.4 or later, any customizations in the spring configuration files listed here are no longer used:

- **/opt/flexnet/gateway/webapps/multispeakv4-not-od-client/WEB-INF/classes/spring/spring-not-od-mapping.xml**
- **/opt/flexnet/gateway/webapps/multispeakv4-not-od-client/WEB-INF/classes/spring/spring-not-od-event-filter.xml**
- **/opt/flexnet/gateway/webapps/multispeakv3-not-od-client/WEB-INF/classes/spring/spring-not-od-mapping.xml**
- **/opt/flexnet/gateway/webapps/multispeakv3-not-od-client/WEB-INF/classes/spring/spring-not-od-event-filter.xml**

For the purpose of mapping or suppressing ODEventNotifications that existed in the previously installed RNI gateway must be manually recreated as entries in flexnet.local.properties. See Appendix A, B, and C for more details and use cases.

Appendix A: MultiSpeak customization use cases

1. Suppress publication of non-outage related events in `ODEventNotification`
2. Map `outageEventType` published in `ODEventNotification`
3. Map `priority` published in `ODEventNotification`
4. Map `problemCode` (or comment in MSv3) published in `ODEventNotification`

Use Case 1: Suppress ODEventNotification for non-outage events

The legacy method of editing the spring configuration file is deprecated as of RNI 4.4. As of RNI 4.4, control the suppression via properties added to flexnet.local.properties.

Refer to the properties 'Ms4EventMapping***' (or MSv3EventMapping for MSv3) listed in Appendix A. If you wish to suppress a specific event, add the property to flexnet.local.properties and set the value of the property to an empty value. For example, to suppress the reverse energy event, add a value:

```
Ms4EventMapping.REVERSE_ENERGY=
```

If instead, you wish to suppress this event for a specific customer 'ACME', add a value like:

```
customer.ACME.Ms4EventMapping.REVERSE_ENERGY=
```

The most specific mapping takes precedence.

You must restart the gateway for the new properties to take effect.

Use Cases 1-3

Refer to Appendix C: MultiSpeak mappings.

For example, if you wish to override the priority of the reverse energy event to be *Urgent*, add a property to the flexnet.local.properties like:

```
Ms4EventMapping.REVERSE_ENERGY=Other,Urgent,Reverse Energy,ReverseEnergyAlarmEvent
```

If you need to set this mapping for a specific customer ACME, enter a property like:

```
customer.ACME.Ms4EventMapping.REVERSE_ENERGY=Other,Urgent,Reverse
Energy,ReverseEnergyAlarmEvent
```

The most specific mapping takes precedence.

You must restart the gateway for the new properties to take effect.

Refer to Appendix B for the format of the property entry, as well as the valid values possible for event type and priority.

Appendix B: MultiSpeak properties

```
Ms4EventMapping.POWER_FAILED
Ms4EventMapping.POWER_RESTORED
Ms4EventMapping.INFERRED_POWER_FAILED
Ms4EventMapping.INFERRED_POWER_RESTORED=
Ms4EventMapping.BROWNOUT
Ms4EventMapping.BROWNOUT_INSTANT
Ms4EventMapping.OVER_VOLTAGE
Ms4EventMapping.OVER_CLASS_AMPS
Ms4EventMapping.HOT_SOCKET
Ms4EventMapping.REVERSE_ENERGY
Ms4EventMapping.TAMPER
Ms4EventMapping.SINGLE_PHASE_POWER_FAILURESinglePhaseFailOutageEvent
Ms4EventMapping.SINGLE_PHASE_POWER_FAILURE_INSTANT
Ms4EventMapping.SUCCESS
Ms4EventMapping.INFERRED_SUCCESS
Ms4EventMapping.NO_RESPONSE
Ms4EventMapping.INFERRED_DB_POWER_FAILInferredPowerFailOutageEvent
Ms4EventMapping.TRANSMISSION_FAILED
```

Appendix C: MultiSpeak mappings

MultiSpeak v4 ODEventNotification

```
################################
# Event mappings, use the following properties to modify or suppress event mapping.
#
# The property value represents in order: outageEventType, priorityType, problem Code (a String), comment
(a String)
#
# From the MultiSpeak v4 NOT_Server.wsdl possible values:
#
# outageEventType:
#      Instantaneous
#      Outage
#      Restoration
#      NoResponse
#      Inferred
#      PowerOn
#      PowerOff
#      Other
#      Unknown
#
# priorityType:
#      Normal
#      NeedsAttention
#      Urgent
#      Other
#      Unknown
#
# Setting property value to empty will suppress publication of the event!!
# Note, a customer specific mapping value takes precedence. In other words, a non customer specific
mapping
# will only be used if there is no customer specific mapping provided for that event.
#
# examples:
#
# >Map POWER_FAILED (non customer specific)
# Ms4EventMapping.POWER_FAILED=Outage,Urgent,PowerFailedAlarmEvent
#
# >Suppress POWER_FAILED (non customer specific)
# Ms4EventMapping.POWER_FAILED=
#
# >Suppress POWER_FAILED for customer ACME
# customer.ACME.Ms4EventMapping.POWER_FAILED=
#
# DO NOT edit the values below. Copy them to the flexnet.local.properties file and make edits or additions
# for specific customers there.
##
Ms4EventMapping.POWER_FAILED=
        Outage,        Urgent,           Power Failed,                     PowerFailedAlarmEvent
Ms4EventMapping.POWER_RESTORED=
        Restoration,   NeedsAttention,   Power Restored,                   PowerRestoredAlarmEvent
Ms4EventMapping.INFERRED_POWER_FAILED=
        Inferred,      Urgent,           Implied Power Failed,             PowerFailedOutageEvent
Ms4EventMapping.INFERRED_POWER_RESTORED=
        Restoration,   NeedsAttention,   Implied Power Restored,           PowerRestoredOutageEvent
Ms4EventMapping.BROWNOUT=
        Other,         NeedsAttention,   Low Voltage,                      BrownoutOutageEvent
```

```
Ms4EventMapping.BROWNOUT_INSTANT=
        Other,         NeedsAttention,   Low Voltage,                      BrownoutOutageEvent
Ms4EventMapping.OVER_VOLTAGE=
        Other,         NeedsAttention,   Over Voltage,                     OverVoltageAlarmEvent
Ms4EventMapping.OVER_CLASS_AMPS=
        Other,         NeedsAttention,   Over Current,                     OverClassAmpsAlarmEvent
Ms4EventMapping.HOT_SOCKET=
        Other,         NeedsAttention,   Over Temperature,                 HotSocketAlarmEvent
Ms4EventMapping.REVERSE_ENERGY=
        Other,         NeedsAttention,   Reverse Energy,                   ReverseEnergyAlarmEvent
Ms4EventMapping.TAMPER=
        Other,         Urgent,           Tamper,                           TamperOutageEvent
Ms4EventMapping.SINGLE_PHASE_POWER_FAILURE=
        Other,         Urgent,           Single Phase Fail,                SinglePhaseFailOutageEvent
Ms4EventMapping.SINGLE_PHASE_POWER_FAILURE_INSTANT=
        Other,         Urgent,           Single Phase Fail,                SinglePhaseFailOutageEvent
Ms4EventMapping.SUCCESS=
        PowerOn,       Normal,           Endpoint Responded,               SuccessEvent
Ms4EventMapping.INFERRED_SUCCESS=
        PowerOn,       Normal,           Implied Power On From Database,   InferredSuccessEvent
Ms4EventMapping.NO_RESPONSE=
        NoResponse,    NeedsAttention,   Endpoint Unreachable,             NoResponseOutageEvent
Ms4EventMapping.INFERRED_DB_POWER_FAIL=
        Inferred,      NeedsAttention,   Implied Power Fail From Database, InferredPowerFailOutageEvent
Ms4EventMapping.TRANSMISSION_FAILED=
        Other,         Normal,           Transmission Failure,             TransmissionFailedOutageEvent
```

MultiSpeak v3 ODEventNotification

```
################################
# Event mappings, use the following properties to modify or suppress event mapping.
#
# The property value represents in order: outageEventType, priorityType, comment (a String)
#
# From the MultiSpeak v3 5_OA_OD.wsdl possible values:
#
# outageEventType:
#      Instantaneous
#      Outage
#      Restoration
#      NoResponse
#      Inferred
#
# priorityType:
#      Normal
#      NeedsAttention
#      Urgent
#
# Setting property value to empty will suppress publication of the event!!
# Note, a customer specific mapping value takes precedence. In other words, a non customer specific
mapping
# will only be used if there is no customer specific mapping provided for that event.
#
# examples:
#
# >Map POWER_FAILED (non customer specific)
# Ms3EventMapping.POWER_FAILED=Outage,Urgent,PowerFailedAlarmEvent
#
# >Suppress POWER_FAILED (non customer specific)
# Ms3EventMapping.POWER_FAILED=
#
# >Suppress POWER_FAILED for customer ACME
# customer.ACME.Ms3EventMapping.POWER_FAILED=
#
# Do not edit the values below. Copy them to the flexnet.local.properties file and make edits or additions
# for specific customers there.
##
Ms3EventMapping.POWER_FAILED=
        Outage,         Urgent,                 PowerFailedAlarmEvent
Ms3EventMapping.POWER_RESTORED=
        Restoration,    NeedsAttention,         PowerRestoredAlarmEvent
Ms3EventMapping.INFERRED_POWER_FAILED=
        Inferred,       Urgent,                 PowerFailedOutageEvent
Ms3EventMapping.INFERRED_POWER_RESTORED=
        Restoration,    NeedsAttention,         PowerRestoredOutageEvent
Ms3EventMapping.BROWNOUT=
        Inferred,       NeedsAttention,         BrownoutOutageEvent
Ms3EventMapping.BROWNOUT_INSTANT=
        Inferred,       NeedsAttention,         BrownoutOutageEvent
Ms3EventMapping.OVER_VOLTAGE=
        Inferred,       NeedsAttention,         OverVoltageAlarmEvent
Ms3EventMapping.OVER_CLASS_AMPS=
        Inferred,       NeedsAttention,         OverClassAmpsAlarmEvent
Ms3EventMapping.HOT_SOCKET=
        Inferred,       NeedsAttention,         HotSocketAlarmEvent
Ms3EventMapping.REVERSE_ENERGY=
        Inferred,       NeedsAttention,         ReverseEnergyAlarmEvent
```

```
Ms3EventMapping.TAMPER=
        Inferred,       Urgent,                 TamperOutageEvent
Ms3EventMapping.SINGLE_PHASE_POWER_FAILURE=
        Inferred,       Urgent,                 SinglePhaseFailOutageEvent
Ms3EventMapping.SINGLE_PHASE_POWER_FAILURE_INSTANT=
        Inferred,       Urgent,                 SinglePhaseFailOutageEvent
Ms3EventMapping.SUCCESS=
        Restoration,    Normal,                 SuccessEvent
Ms3EventMapping.INFERRED_SUCCESS=
        Restoration,    Normal,                 InferredSuccessEvent
Ms3EventMapping.NO_RESPONSE=
        Outage,         NeedsAttention,         NoResponseOutageEvent
Ms3EventMapping.INFERRED_DB_POWER_FAIL=
        Inferred,       NeedsAttention,         InferredPowerFailOutageEvent
Ms3EventMapping.TRANSMISSION_FAILED=
        NoResponse,     Normal,                 TransmissionFailedOutageEvent
```

Xylem |'zīləm|

1) The tissue in plants that brings water upward from the roots;

2) a leading global water technology company.

We're a global team unified in a common purpose: creating advanced technology solutions to the world's water challenges. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. Our products and services move, treat, analyze, monitor and return water to the environment, in public utility, industrial, residential and commercial building services settings. Xylem also provides a leading portfolio of smart metering, network technologies and advanced analytics solutions for water, electric and gas utilities. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise with a strong focus on developing comprehensive, sustainable solutions.

For more information on how Xylem can help you, go to www.xylem.com

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