Node-RED – SE Harmony Hub Node

User Manual

04/2020

EIO0000004103.00

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All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

Table of Contents

Safety Information

Important Information

NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result** in minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

About the Book

At a Glance

Document Scope

This document describes:

- installation and uninstallation of SE Harmony Hub node.
- configuration of the node.
- usage of the node.
- limitations.

Validity Note

This document has been updated with the release of SE Harmony Hub node V1.0.0.

Related Documents

Title of Documentation	Reference Number
Node-RED - SE Aveva Insight Node - User Manual	*EIO0000004102*
Harmony XB5R ZBRN1/ZBRN2 User Manual	*EIO0000001177*

You can download these technical publications and other technical information from our website at https://spiceportal.schneider-electric.com/web/industrial-automation-products-campus/ecostruxure-plant-data-expert. See launch book where all the marketing aspects are detailed on IAP Campus Portal.

Part I
Introduction

Chapter 1
Overview

What Is in This Chapter?

This chapter contains the following topics:

General Information

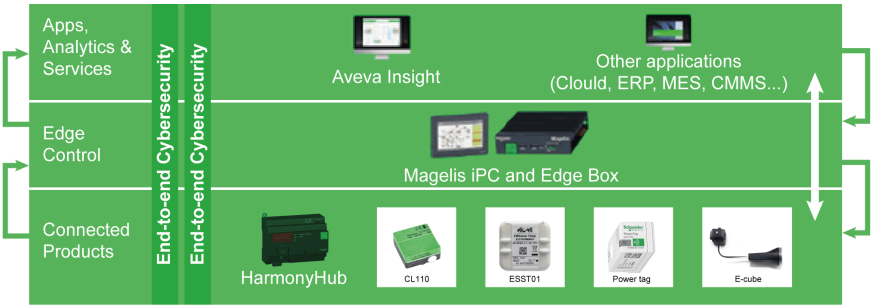
IIoT (Industrial Internet of Things)

IoT is a network of intelligent computers, devices, and objects that collect and share huge amounts of data. IIoT is the use of Internet of Things (IoT) technologies in manufacturing. With Industrial Internet of Things (IIoT), the device itself will be seamlessly wired to the business systems.

Operational Technology (OT) is a category of hardware and software that monitors and controls the physical devices. Due to increasing trend towards convergence of IT (Information Technology) and OT (Operational Technology), the plant managers in charge of operational technology are more efficient being remote.

Node-RED in EcoStruxure™

Node-RED is an IoT wiring tool to connect services through a user-friendly graphical interface. Schneider Electric has selected Node-RED as the technology to deliver basic connectivity through tested, validated and documented nodes.



Connected Products

The secondary sensing vision is to integrate an additional layer of non-intrusive sensors mostly for installed base machines. The aim is to transform standard brownfield asset into connected asset. It means adding an additional layer of sensors and transferring data from connected devices to the upper levels. Predictive maintenance, energy saving, MES or CMMS are the typical apps integrated with these kind of solution.

Edge Control

Edge control provides connectivity for OT and IT systems and data processing right next to the machines. Instead of sending data to the cloud for processing and waiting for the analytical results, edge control devices collect and process data next to the machines. Then, those devices push their data to the cloud, thus saving bandwidth and enabling increased responsiveness. Magelis iPC and Magelis Edge Box offer smart application design and engineering to leverage asset performance with end-to-end cybersecurity.

Schneider Electric provides nodes that are tested, validated, and supported to run with Node-RED on the Magelis iPC and Edge Box.

There are three main advantages of Schneider Electric nodes:

- **Scalability**: easy to add connected devices in a cyber-secure manner.
- **Time to market**: significant reduction in integration time to implement a use case solution *(see page 116)*.
- **Expert support**: access to our strong L3 support team experts and the available technical documentation.

Apps, Analytics and Services

SE Harmony Hub node is a specific node created by Schneider to simplify the Node-RED flows for several typical use cases. This node helps ease the commissioning process to pair the products connected to their Harmony Hub gateway. The web page included with this node also provides the means to specify the data to be retrieved by the channel and to define the polling rate.

Magelis Edge Box

The new Magelis Edge Box meets IIoT challenges at the Edge Control level by enabling secured communication from connected products on the shop floor to the required software and applications on the top floor. The Edge box plugs itself on top of your current application, there is no need to stop or modify your control application (including 3rd party control devices).

Magelis Edge Box types are commercialized, as detailed in the following table:

Magelis Edge Box	Reference
Magelis HMIBSC	*Reference HMIBSCEA53D1L0T HMIBSC with ARM, Linux*
Magelis HMIBMI	*Reference HMIBMIEA5DD110L HMIBMI with Intel Atom*
Magelis HMIBMO	*Reference HMIBMOMA5DD1E01: HMIBMO with Intel Atom*

Magelis iPC

The Magelis iPC is a robust industrial device without a fan or even a hard drive, requiring no maintenance, and designed to run in the machine or plant field, even in harsh environments. New IIoT monitors for the Magelis iPC come tested, validated, and supported in two versions - agent and server.

Magelis iPC Box types are commercialized, as detailed in the following table:

Magelis iPC	Reference
Magelis HMIBMP	*Reference HMIBMPHI74D4801 HMIBMP with 4 expansion slots, Intel Core I7*
Magelis HMIBMU	*Reference HMIBMUSI29D2801 HMIBMU with 2 expansion slots, Intel Celeron*

Harmony Hub

The Harmony Hub converts radio frequency inputs to the Modbus TCP/IP and Serial protocol and acts as an equipment that collects data from wireless sensors (up to 60 sensors per Harmony Hub gateway). This offer allows for more flexibility and simplicity of installation thanks to the connected battery-free devices.

Harmony Hub ZBRN1

Sensors

The secondary sensor ecosystem in Schneider Electric is as described below. The Harmony Hub gateway supports the type of sensors listed below.

Sensor	Description
Temperature and Humidity sensor - CL110 	The Easergy CL110 is a battery-powered and wireless contact thermal and humidity sensor using the ZigBee Green Power 2.4 GHz protocol. The accuracy of the thermal measurement is ±1 ^{o}C and the humidity measurement is around 2%.
ESST01 	ESST01 sensors are wireless sensors with batteries measuring temperature values.
Energy meter - Power tag 	Power tag sensor is a compact, the smallest wireless energy sensor on the market, which ensures that it can be mounted to any existing board, as there is almost no room on the DIN rail. It reduces installation time by up to 90%, saves space, and reduces cable errors. Take advantage of full load control and quickly determine if the load is not working on the circuit breaker or on the PowerTag ® load itself. Providing real-time energy and power measurements, this wireless power sensor gives you the ability to track your properties.

Sensor	Description
Energy Estimator - E-cube 	The E-Cube sensor is self-powered by the current going through the process. It tests and memorizes the energy consumption before submitting it to the Zigbee Gateway.

SE Harmony Hub Node Integration in Ecostruxure™ Architecture

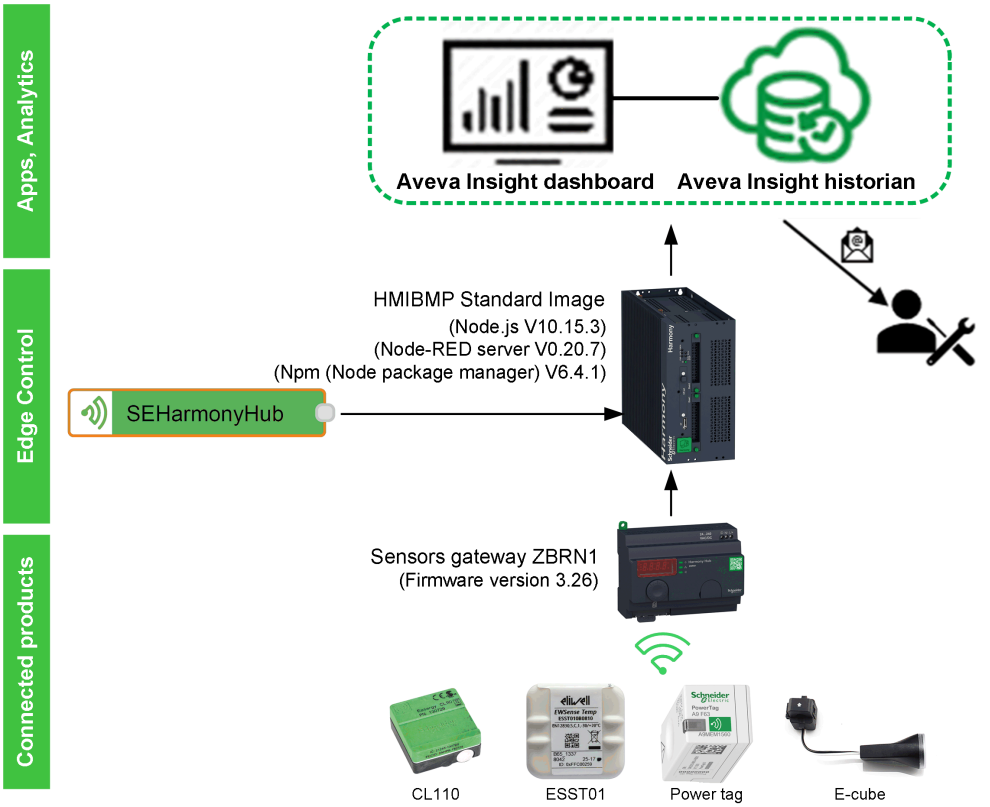
Harmony Hub gateway collects physical signals from secondary sensor ecosystem.
SE Harmony Hub node is a data collection node that connects to the Harmony Hub gateway, collects data that may be eventually published to any data publishing node.


```
{
    "name": "SEHarmony Hub",
    "id": "192.168.10.159",
    "timestamp": "2020-01-23T03:37:12.600Z",
    "devices": [
        {
            "macAddress": "ffd000c7",
            "name": "channel_1",
            "type": "e3",
            "data": {
                "RSSI": {
                  "value": -45,
                  "unit": "dBm",
                  "type": "int"
                },
                "Timestamp": {
                  "value": "2020-01-23T03:37:08.602Z",
                  "type": "string"
                },
                "Temperature": {
                  "value": 24.39,
                  "unit": "°C",
                  "type": "float"
                },
                "Current": {
                  "value": 1.07,
                  "unit": "A",
                  "type": "float"
                },
                "ApparentEnergy": {
                  "value": 2583.773,
                  "unit": "kVAh",
                  "type": "float"
                }
            }
        }
    ]
}
```

```
{
    "data": [
     {
     "channel_1_dateTime": "2020-01-23T03:40:47.337Z",
     "channel_1_RSSI": -45,
     "channel_1_Timestamp": "2020-01-23T03:40:43.383Z",
     "channel_1_Temperature": 24.39,
     "channel_1_Current": 1.07,
     "channel_1_ApparentEnergy": 2583.788,
            "channel_1_SensorType": "e3"

        }
    ]
}
```

The following figure shows integration of SE Harmony Hub node in Ecostruxure™:



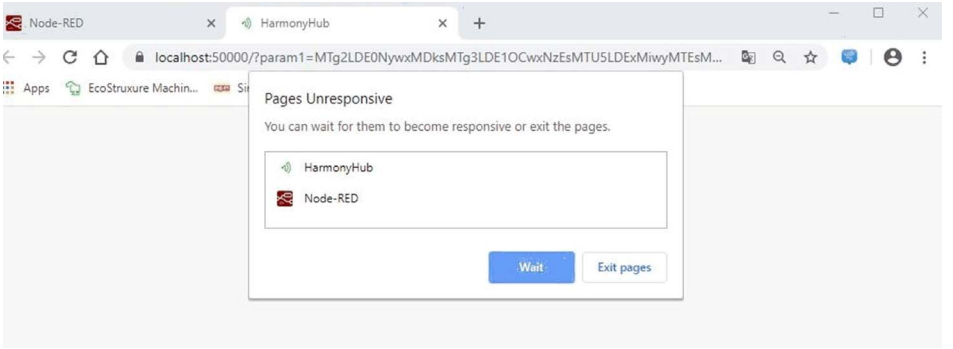
Key Points for SE Harmony Hub Node

- You can pair up to 60 sensors with the Harmony Hub gateway *(see page 14)*.
- Poll rate allowed is minimum of 5 seconds to maximum of 24 hours.
- SPS sensors are not supported. However, the user can pair from the HMI gateway and the user can still see it on the web page, but the values are not available.

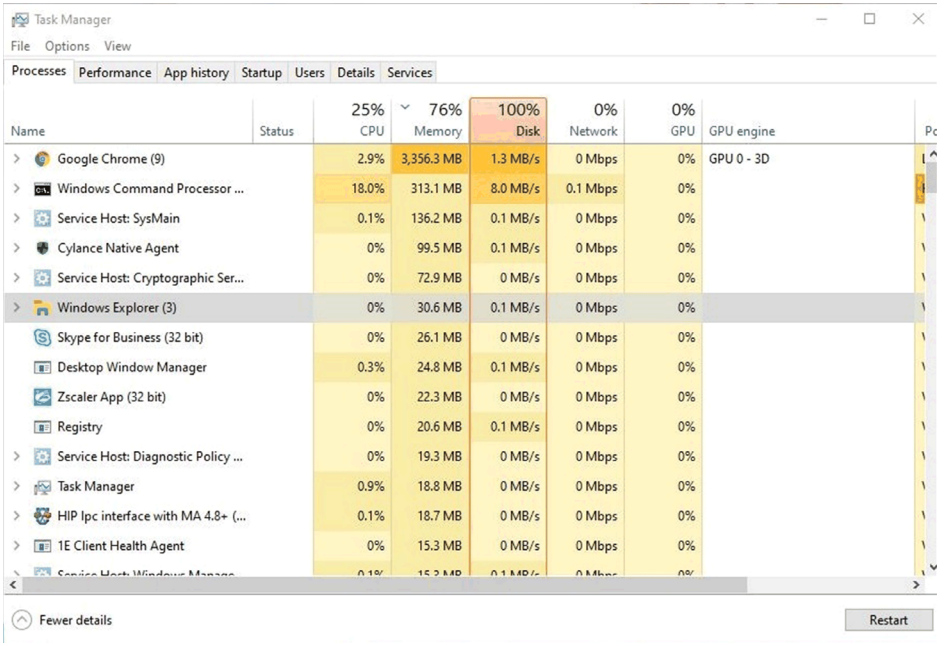
Best Practices for Node-RED

1. Running Node-RED as a service on Windows using NSSM *(see page 20)*.
2. Use Browsers Wisely
   When more web pages are accessed in the browser, Node-RED server may not be responsive to the program. Remove unused web pages in the browser to prevent this.

If Node-RED application is not responsive, you can see the below messages on your browser.



3. Stop Unused Services
   Stop unused services that consume more memory displayed in **Task Manager**.



NOTE: Memory consumption can be observed by using **Task Manager**.

Limitations

The SE Harmony Hub node has the following limitations:

1. Operating system anything less than Windows 10 is not supported.
2. Node-RED application is supported in any browser with V8 engine or similar (for instance; Google chrome V73.0, Firefox V66.0).Refer README for future version support.
3. Node-RED web page is only available in English, irrespective of the system language.
4. SE Harmony Hub node will not work on Node.js® unstable versions and 6.x.x, 8.x.x and 12.x.x versions.
5. SE Harmony Hub node should work on Node.js V10.15.3 and Node-RED 0.20.7 version only. Refer README for future version support.
6. If the user removes the sensor using the HMI of Harmony Hub gateway, the pairing status of the sensor will continue to show as Paired on the web page, unless the node is re-deployed.
7. The SE Harmony Hub serial gateway with firmware version 3.26 is disconnected if the queue control delay is increased to 200 ms on the node configuration page.
8. If two nodes are connected to the same gateway, one node would not receive a response from the gateway because the node stays in the connected state and does not start the process. This is a limitation of the firmware.
9. When you launch a Node-RED server, it takes time to get started, in order to avoid this refer to **Commissioning of Node-RED procedure** (steps 11...14) *(see page 48)*.
10. In SE Harmony Hub V1.0.0 node, the lowest poll rate possible is 5 seconds. If 35 or more sensors are paired, it is recommended to keep the poll rate to 10 seconds or higher to avoid data loss.
11. Harmony Hub web page application has minimum screen resolution supported for 1360 x 768 pixel and if you go below this resolution, scrollbar will appear.
12. When the user wants to do the offline installation, the internet should be disabled. It takes longer to install if the internet is enabled.
13. SE Harmony Hub V1.0.0 node, SPS (push button) is not supported. Refer README for future version support.
14. It is not possible to rename the sensors already paired, the user has to delete and add sensors.
15. During pairing of sensors with gateway below operations are not recommended:
    - Do not perform any deployment in the Node-RED environment.
    - Do not refresh Harmony Hub web page.

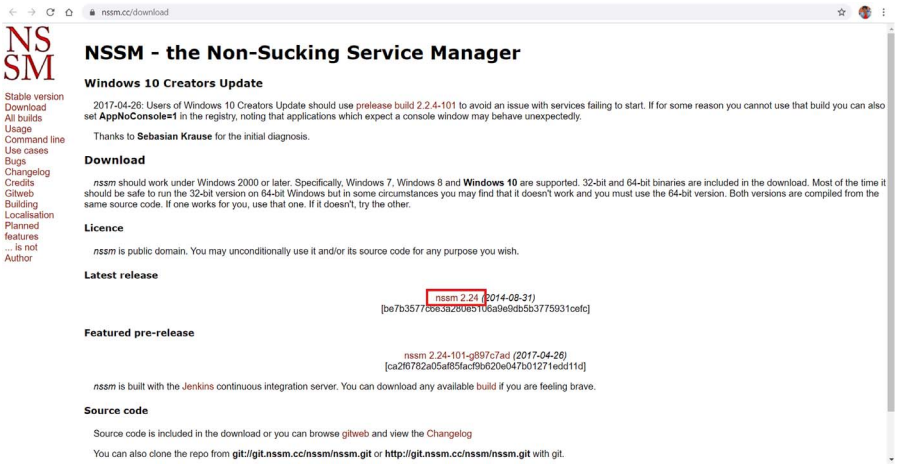
Installation of NSSM

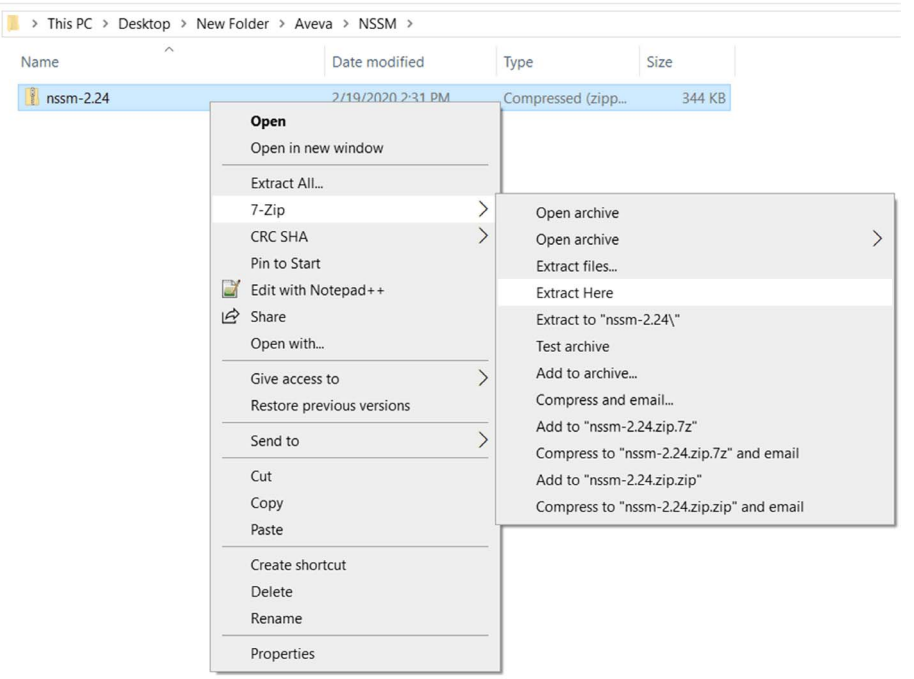
Running Node-RED as a service on Windows Using NSSM

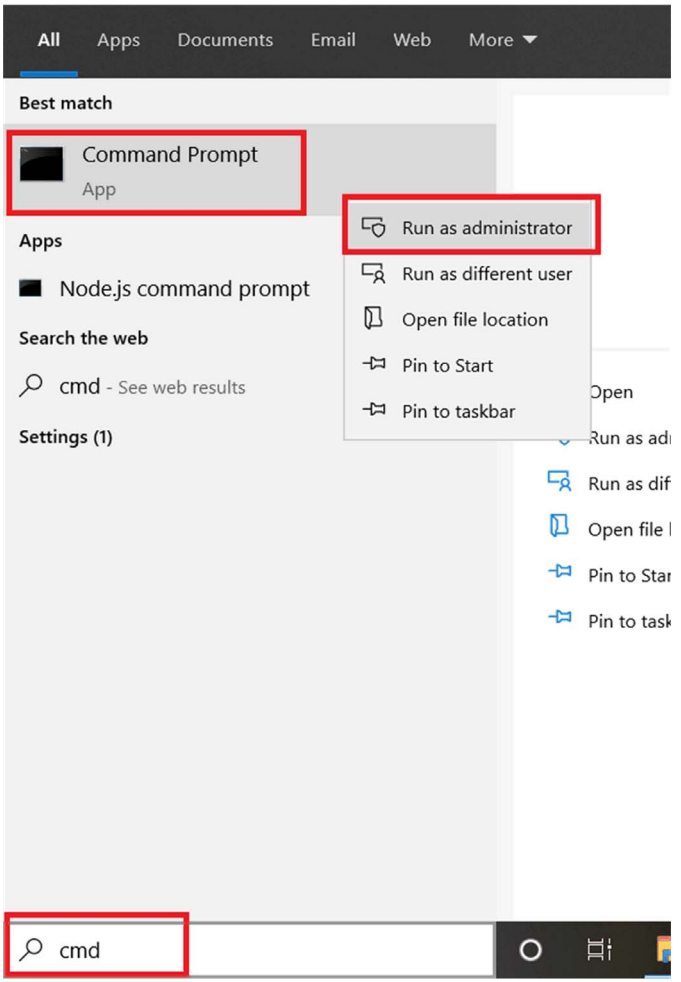
You need to install NSSM (Non-Sucking Service Manager) to open Node-RED server directly from the web page.

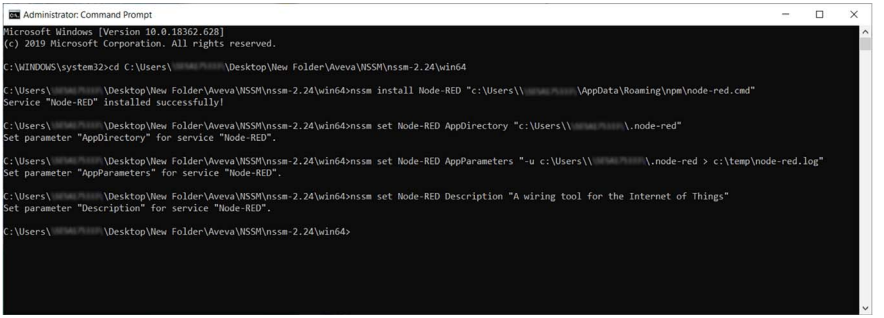
NOTE: Installation of NSSM is applicable for Windows platform only.

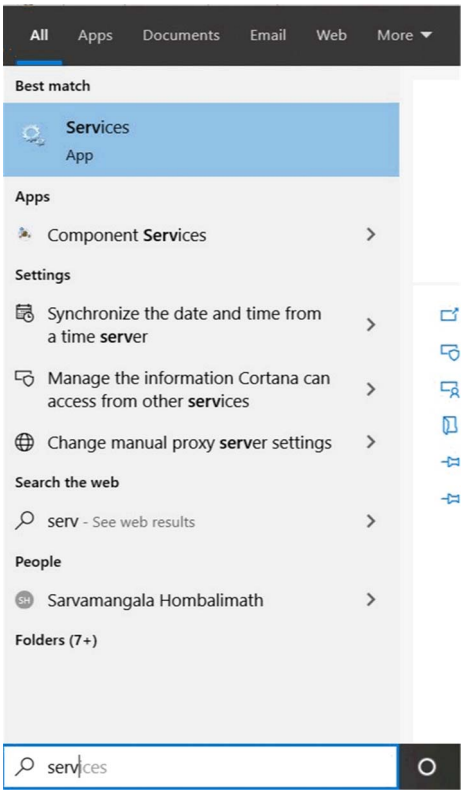
The following procedure shows the installation of NSSM:

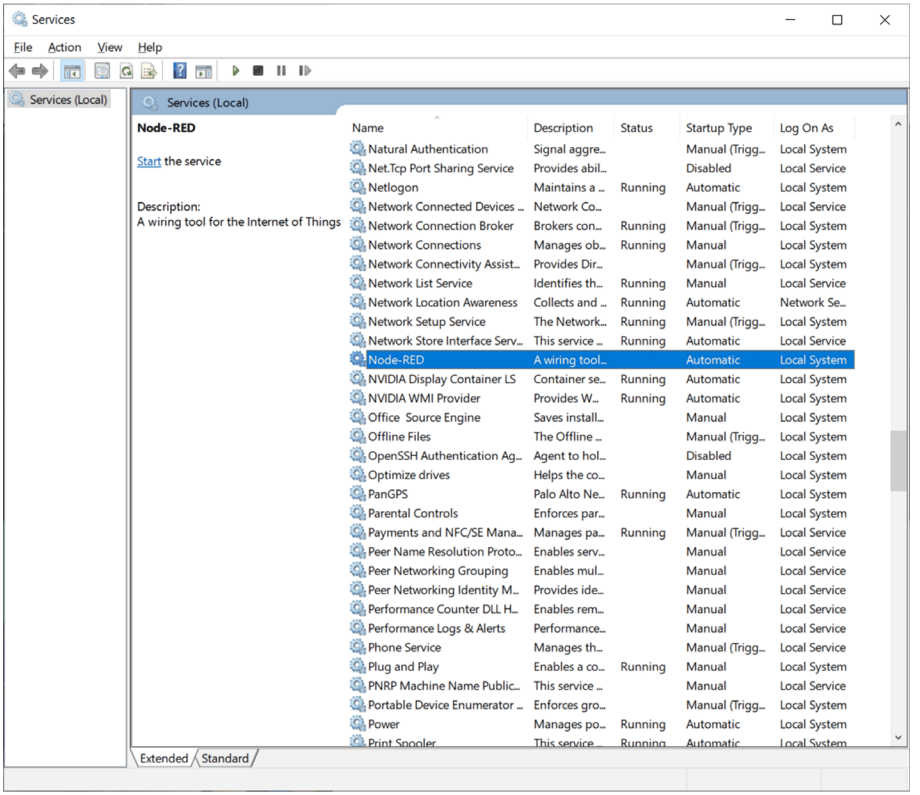
Step	Action
1	Download the `nssm-2.24.zip` file from the link given below: *https://nssm.cc/download* **NOTE:** Make sure unzip software is available in your device, if not available, download it from the given link: *https://www.7-zip.org/download.html*
2	Click **nssm 2.24** link. 

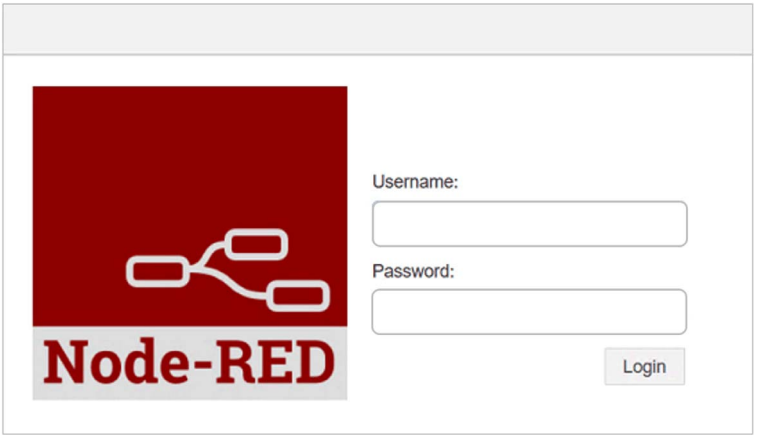
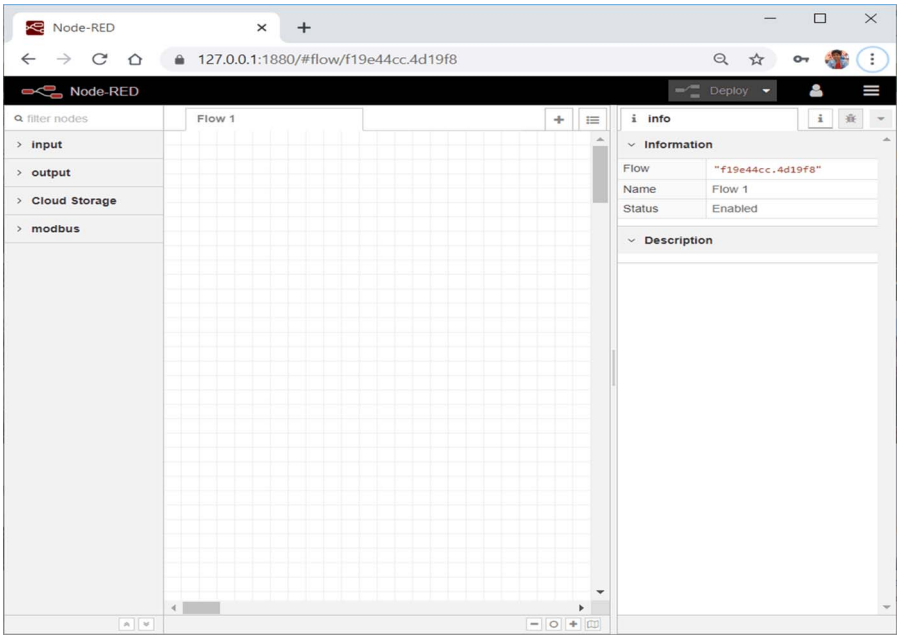
Step	Action
3	Right-click the downloaded `nssm-2.24.zip` file and select **7-Zip → Extract Here**.  **Result**: The selected file is unzipped.

Step	Action
4	Type `cmd` in search bar and right-click **Command Prompt → Run as administrator**.  **Result**:Command Prompt opens.
5	Copy the location of the folder you downloaded. For example: `C:\Users\SESAXXXXXX\Desktop\New Folder\Aveva\NSSM\nssm-2.24\win64` **NOTE:** Use your device name in the text above instead of **SESAXXXXXX**.

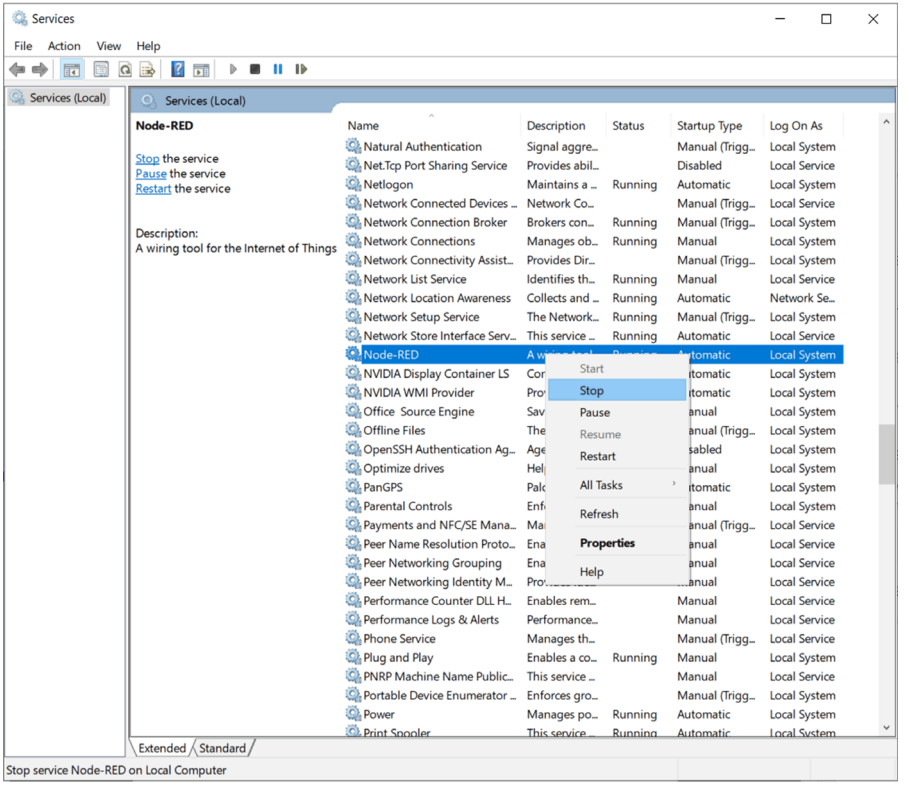
Step	Action
6	Navigate to the location where NSSM is installed. Paste in the command prompt adding `cd`. For example: `cd C:\Users\SESAXXXXXX\Desktop\New Folder\Aveva\NSSM\nssm-2.24\win64`
7	Type `nssm install Node-RED "c:\Users\SESAXXXXXX\AppData\Roaming\npm\node-red.cmd"` and press **Enter** **Result**: Service “Node-RED” installed successfully.
8	Type `nssm set Node-RED AppDirectory "c:\Users\SESAXXXXXX\.node-red"` and press **Enter**. **Result**: Set parameter “AppDirectory” for service “Node-RED”.
9	Type `nssm set Node-RED AppParameters "-u c:\Users\SESAXXXXXX\.node-red > c:\temp\node-red.log"` and press **Enter**. **Result**: Set parameter “AppParameters” for service “Node-RED”.
10	Type `nssm set Node-RED Description "A wiring tool for the Internet of Things"` and press **Enter**. **Result**: Set parameter “Description” for service “Node-RED”. 

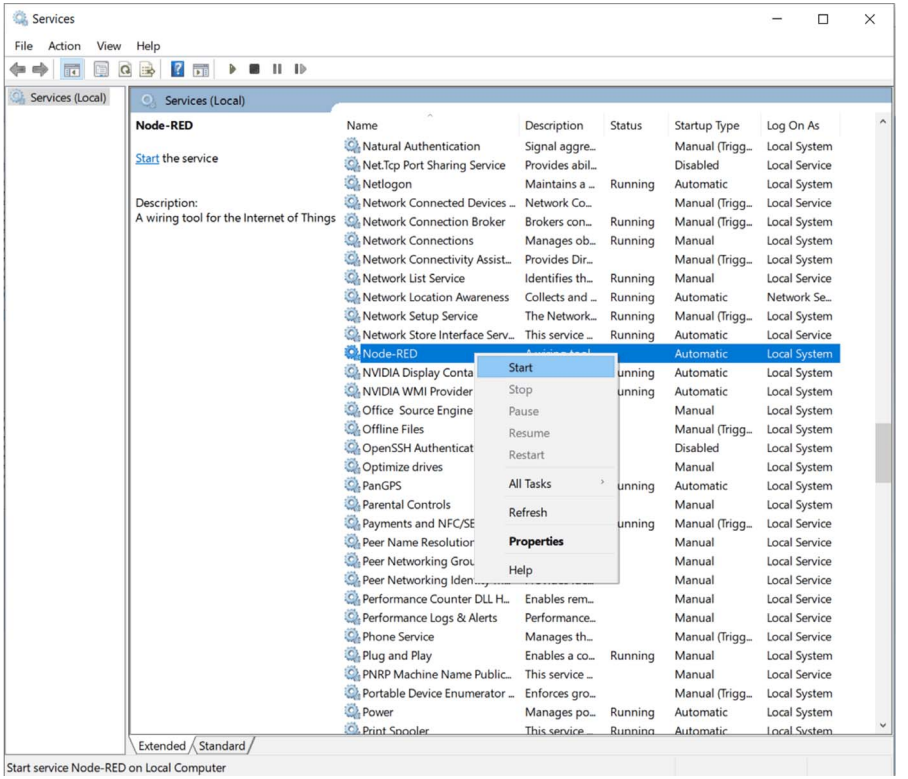
Step	Action
11	Type `Services` in search bar and click **Services**.  **Result**: Services window appears.

Step	Action
12	
13	Restart your computer.

Step	Action
14	Type the *https://127.0.0.1:1880/* in a supported browser. Type the **Username** and **Password** in related fields and click **Login**.  **Result**: Node-RED factory editor appears.
15	

Step	Action
16	When you install/uninstall any node in your system, **Stop** using Node-RED in **Services**.



Step	Action
17	Once installation/uninstallation process is completed in your system, **Start** Node-RED in **Services** to launch Node-RED application. 

To disable Node-RED as a service follow the steps given below:

- Navigate to NSSM folder in command prompt.
- Type `nssm remove <service-name> confirm` and press **Enter**.

Part II
Installation and Uninstallation - SE Harmony Hub Node

What Is in This Part?

This part contains the following chapters:

Chapter 2
Prerequisites

System Requirements

Operating System

The SE Harmony Hub node V1.0.0 is supported on the following operating systems:

- Microsoft Windows 10
  - Standard Image and IIoT One Image (RC7 and above)

  NOTE: Magelis HMIBMP - User has to install the Node.js, Node-RED and Python software in the **Magelis HMIBMP** box (Standard Image) manually.
- Linux Linaro - V1.00.010 and above
  - IIoT One Image (V1.00.010 and above)

  NOTE: Magelis HMIBSC - The required softwares like Node.js, Node-RED and Python are pre-installed in the **Magelis HMIBSC** box.

Hardware Requirements

NOTE: The SE Harmony Hub node is supported in **Magelis HMIBMP** and **Magelis HMIBSC** only. Other **Magelis Edge Box** and **Magelis iPC** will be supported in future versions of the node.

IIoT Edge Box	PC hardware	Specification
Magelis HMIBMP	Processor	Reference HMIBMPHI74D4801 HMIBMP with 4 expansion slots, Intel Core I7
	RAM	8 GB
	Hard disk space	500 GB HDD
	Operating system	Microsoft Windows 10
Magelis HMIBSC	Processor	Reference HMIBSCEA53D1L0T HMIBSC with ARM
	Hard disk space	eMMC and TPM for hardware encryption
	Operating system	Linux Yocto

Software Requirements

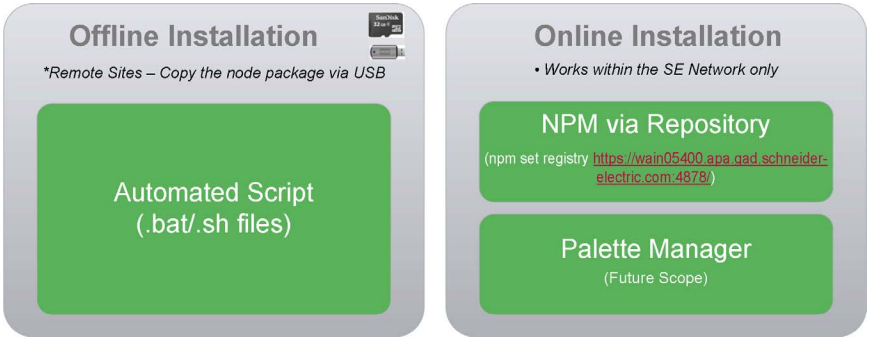
- Node.js V10.15.3 *(see page 35)*
- Node-RED server V0.20.7 *(see page 42)*
- Npm (Node package manager) V6.4.1

- Python V2.7 (online installation mode only) *(see page 44)*
- Supported browser: Node-RED application is supported in any browser with V8 engine or similar (for instance: Google chrome V73.0, Firefox V66.0)

NOTE: The software versions mentioned above support the SE Nodes installation. Other versions do not support it.

Accessing the SE Harmony Hub Node

You can perform two modes of installation (online/offline) on either of the platforms:



Each installation mode can be performed on either of the two platforms.:

- Install the node - Windows platform *(see page 77)*
- Install the node - Linux platform *(see page 67)*

Chapter 3
Installation and uninstallation of SE Harmony Hub Node - Windows Platform

What Is in This Chapter?

This chapter contains the following sections:

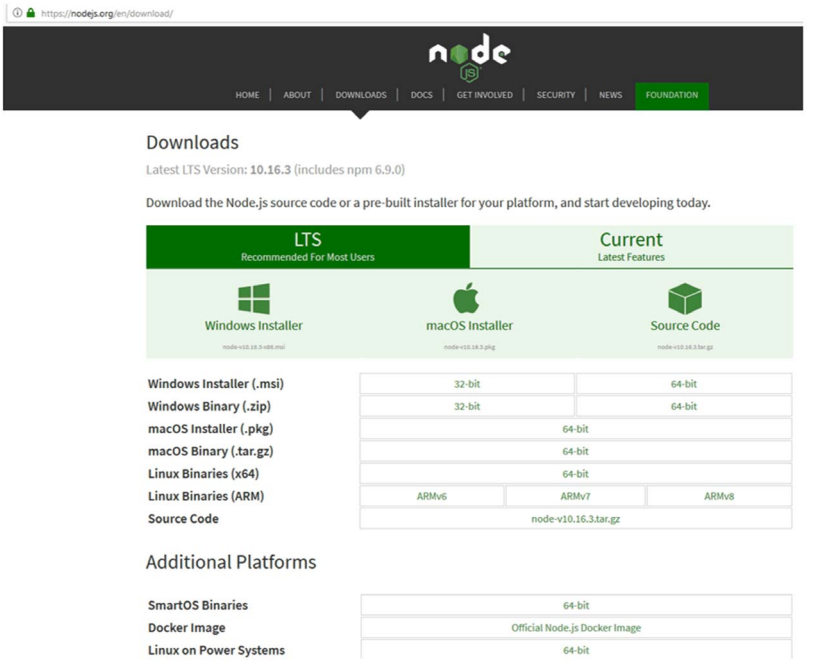
Section 3.1
Installing SE Harmony Hub node - Windows Platform

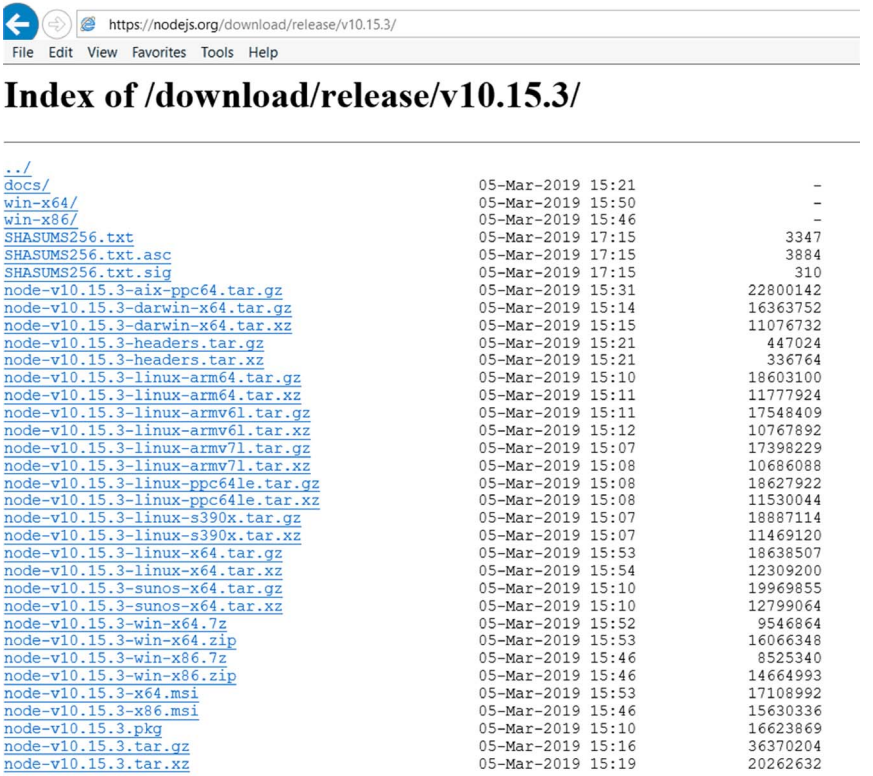
What Is in This Section?

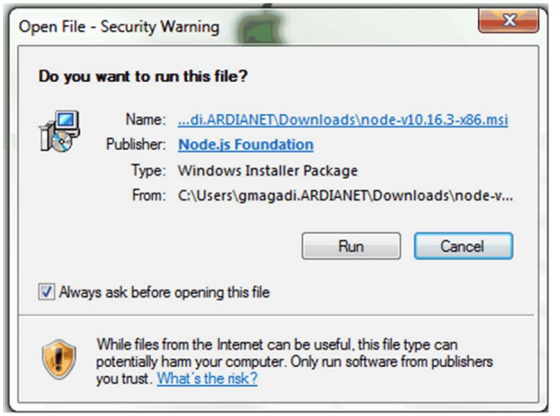
This section contains the following topics:

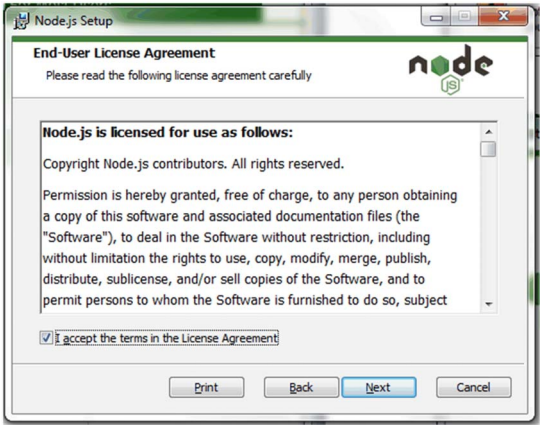
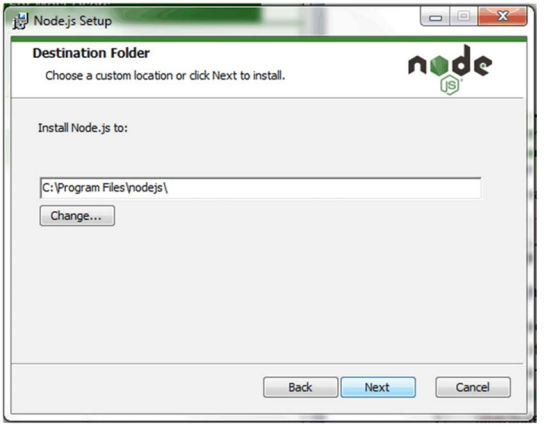
Installing Node.js

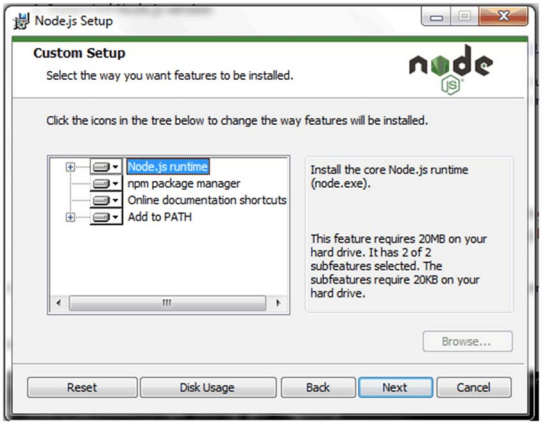
This table shows the installation procedure for Node.js:

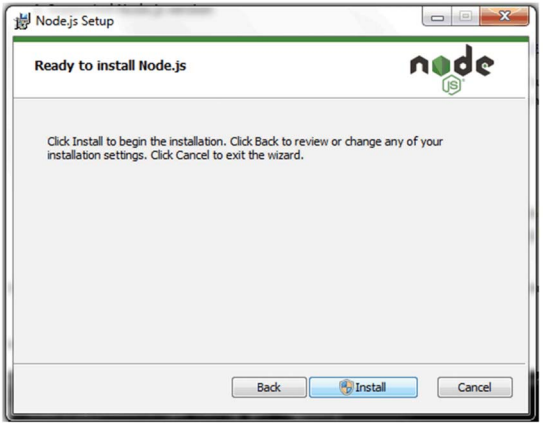
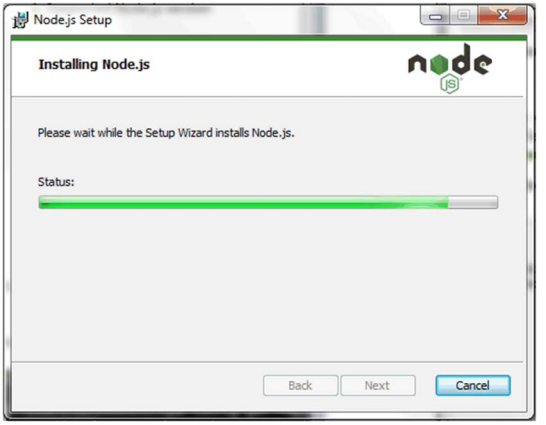
Step	Action
1	Open the Node.js® for Windows from the below link: *https://nodejs.org/en/download/* 

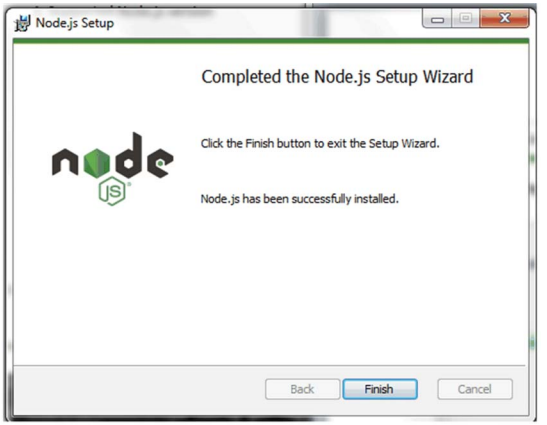
Step	Action
2	Use the `node-v10.15.3-x64.msi` version. Download the Node.js® from the link given below: *https://nodejs.org/download/release/v10.15.3/* 
3	Select `node-v10.15.3-x64.msi` for download.
4	Double-click the downloaded file to start the installation process. **Result**: **Open File** dialog box appears.

Step	Action
5	Click **Run**.  **Result**: Node.js Setup Wizard dialog box appears.
6	Click **Next**.  **Result**: **End–User License Agreement** dialog box appears.

Step	Action
7	Select **I accept the terms in the License Agreement** and click **Next**. 
8	Click **Next**. 

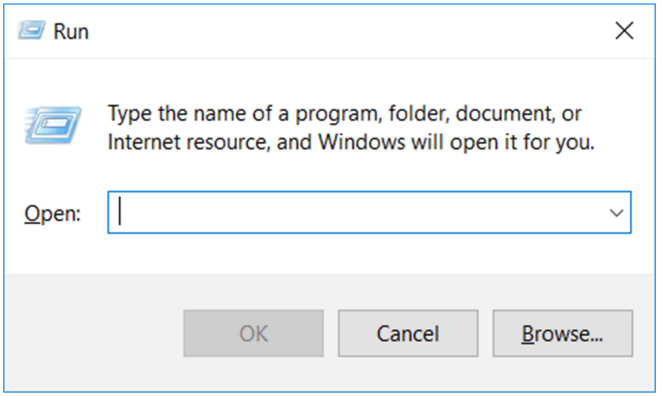
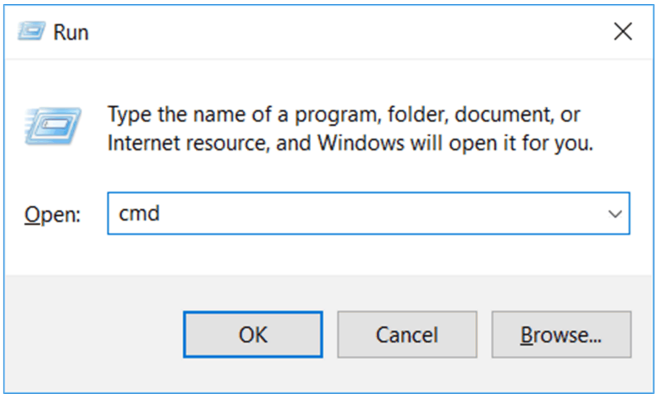
Step	Action
9	Click **Next**. 

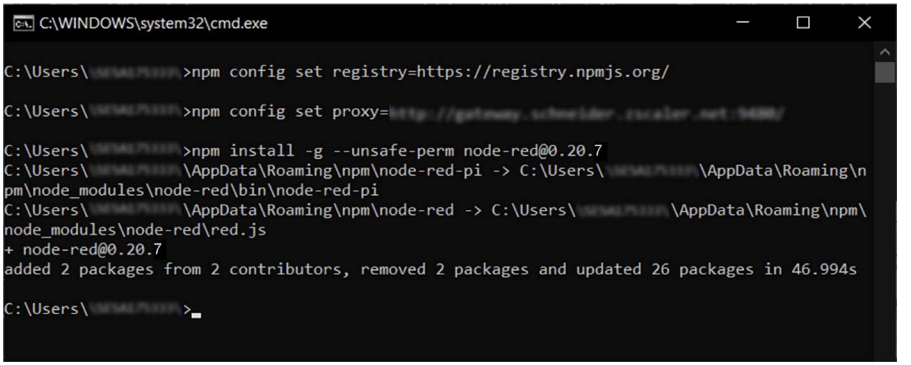
Step	Action
10	Click **Install**.  

Step	Action
11	Click **Finish**. 
12	Node.js installation is completed.

Installing Node-RED

This table shows the installation procedure for Node-RED:

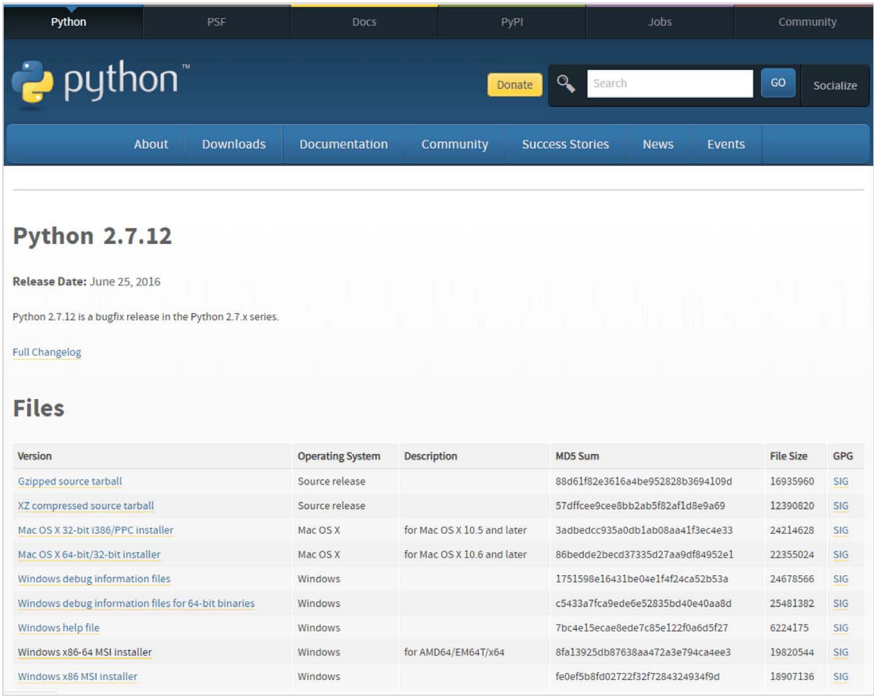
Step	Action
1	Click  and type **Run** in the search bar and press **Enter**. 
2	Type the `cmd` in the **Run** dialog box and press **OK**.  **Result**: Command prompt window appears.
3	With Schneider network connected, type the text given below in the command prompt and press **Enter**. `npm config set registry=https://registry.npmjs.org/`

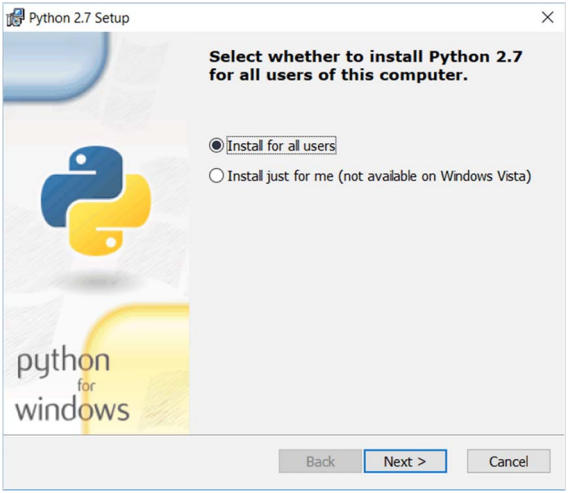
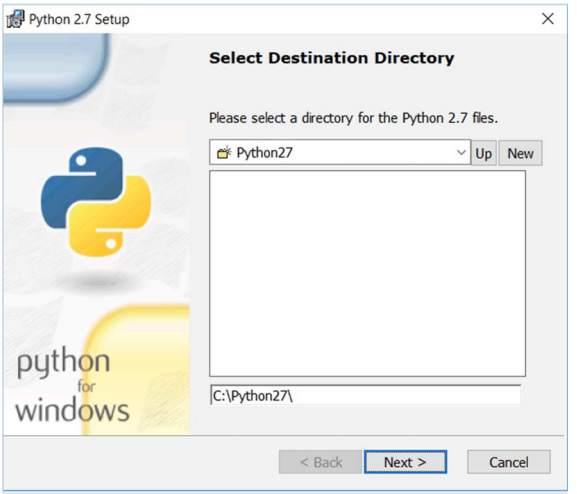
Step	Action
4	Type the valid proxy with respect to your organization or country (for instance, http://yourproxy:XXXX/) and press **Enter**. `npm config set proxy=http://yourproxy:XXXX/`
5	Type `npm install -g --unsafe-perm node-red@0.20.7` and press **Enter**. 
6	Node-RED application is installed.

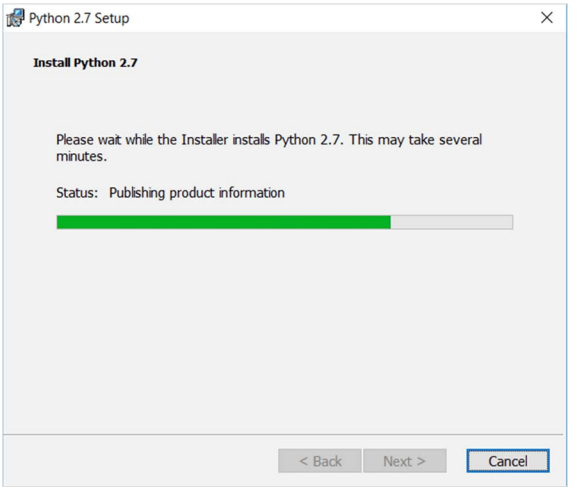
Installing Python

NOTE: Python installation is applicable only for online installation mode in Windows platform.

This table shows the installation procedure for Python:

Step	Action
1	Download `python 2.7.x` version from the link given below: *https://www.python.org/downloads/release/python-2712/*
2	Click the `Windows x86-64 MSI` to download the file. 
3	Downloaded file name: `python-2.7.12.amd64`.
4	Double-click the downloaded file to install python software.

Step	Action
5	Select **Install for all users** and click **Next** 
6	Click **Next** 

Step	Action
7	Click **Next**  

Step	Action
8	Click **Finish**  **Result**: Python installation is completed.

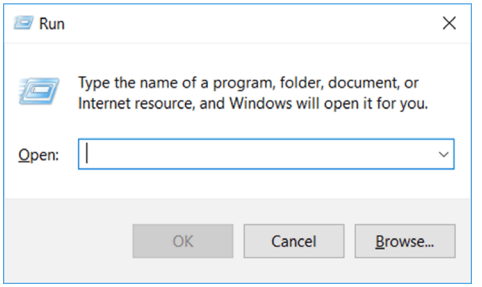
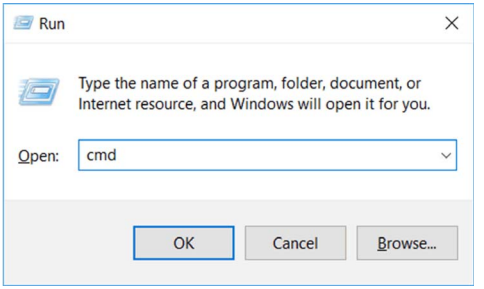
Commissioning of Node-RED server

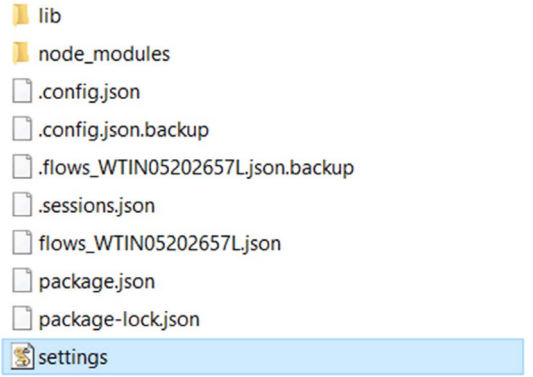
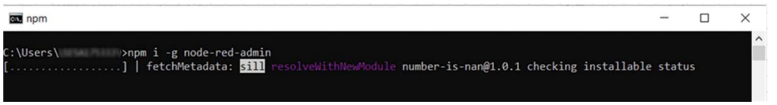
Overview

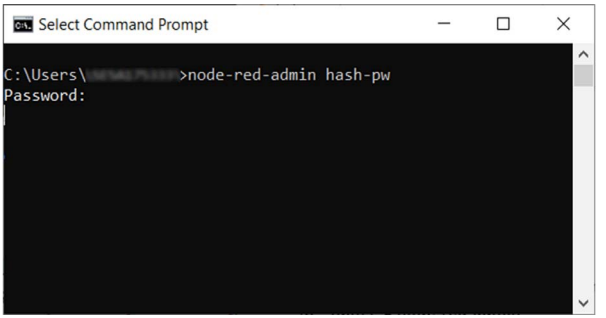
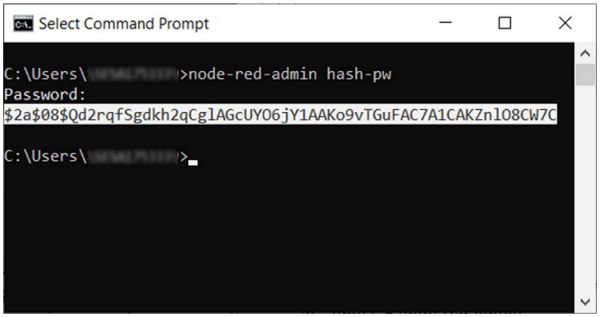
Before enabling login credentials you need to install the Node-RED software. It has to be a secured platform to be compliant with cybersecurity.

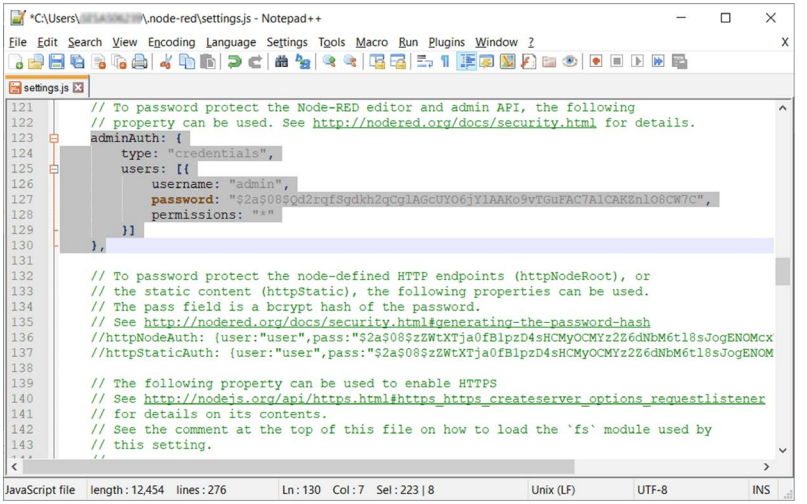
Securing Node-RED - Enable Login Credentials

The following steps explains the enabling of user authentication when accessing the Node-RED Editor.

Step	Action
1	Click  and type **Run** in the search bar and press **Enter**. 
2	Type the `cmd` in the run dialog box and click **OK**.  **Result**: Command prompt window appears.
3	Type `npm config set registry https://registry.npmjs.org` in the command prompt and press **Enter**.

Step	Action
4	Type `npm set proxy http://yourproxy:XXXX/` in the command prompt and press **Enter**. **NOTE:** Type the valid proxy with respect to your organization or country.
5	Type `node-red` in the command prompt and press **Enter**. **Result**: `.node-red` folder is created in `Local Disk (C:)/Users/SESAXXXXXX/`.
6	In .node-red folder open settings.js file in the Notepad++. **NOTE:** Download **Notepad++** software if not available in your windows system. 
7	Type `npm i -g node-red-admin` in the command prompt and press **Enter**.  **Result**: Node-RED admin is installed globally.

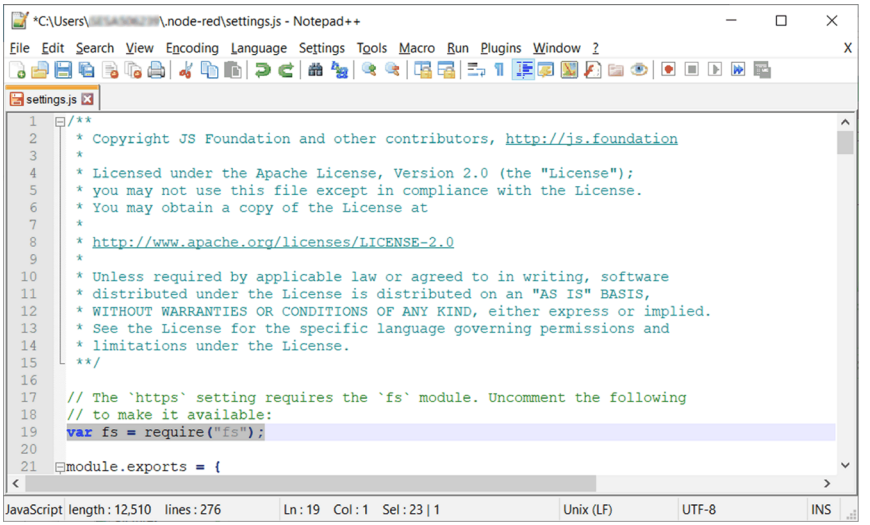
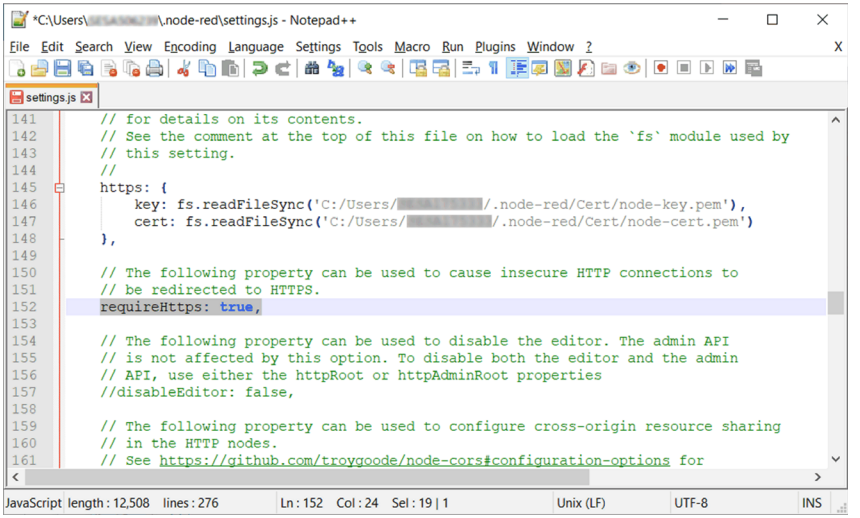
Step	Action
8	Type `node-red-admin hash-pw` in the command prompt and press **Enter**. 
9	Type the **Password** and press **Enter**.  **Result**: The password is encrypted.

Step	Action
10	Copy the encrypted text (password), search for `adminAuth` in settings.js file and paste encrypted text as password. Uncomment (remove //) `adminAuth` credential details. 

Securing Node-RED - Enabling SSL

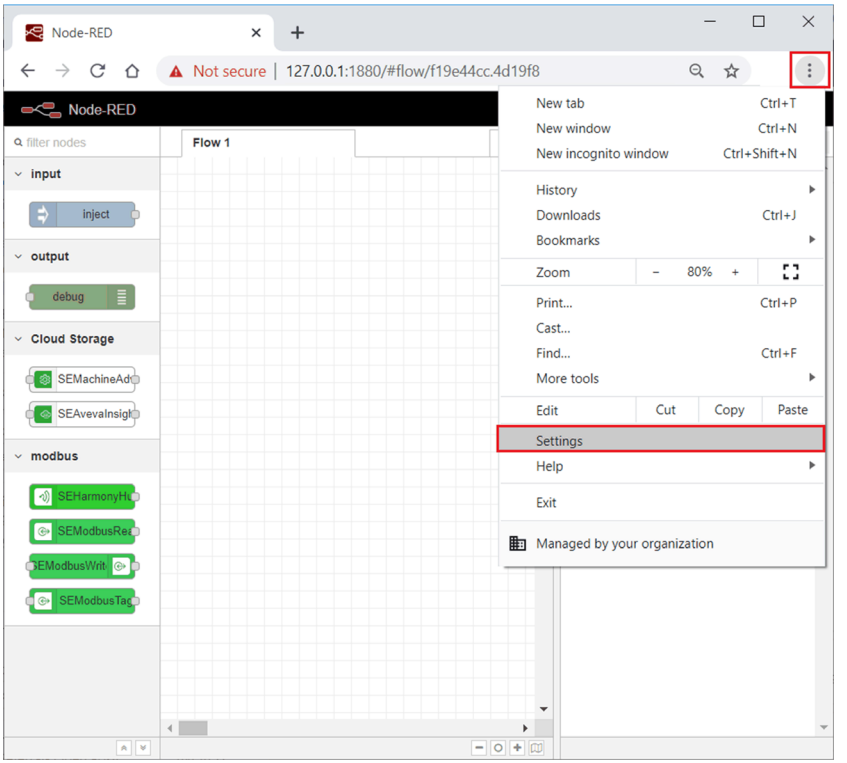
Follow the steps below to enable SSL (Secure Socket Layer) on Node-RED - Editor:

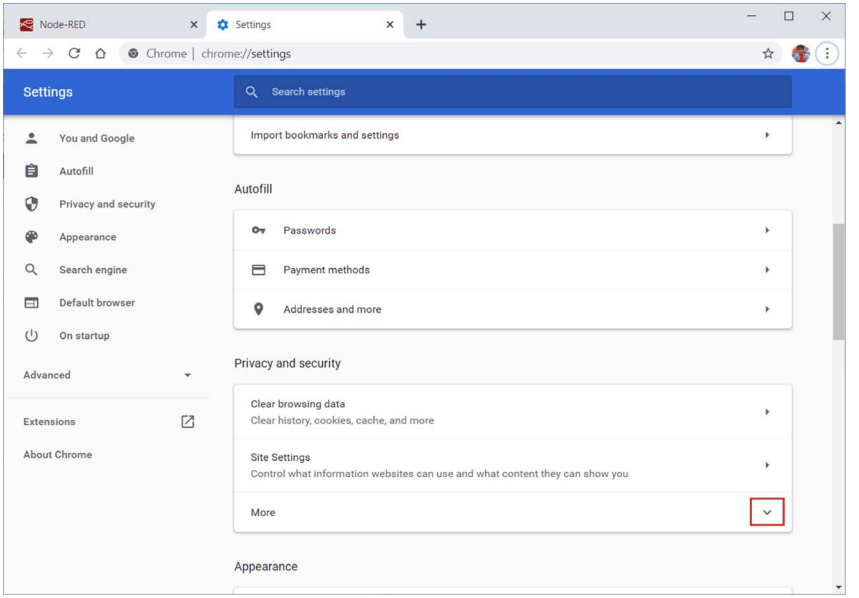
Step	Action
1	Create a new folder called **Cert** in .node-red folder. For instance, `C:/Users/SESAXXXXXX/.node-red`
2	Copy the SSL certificate files (for instance, node-key.pem and node-cert.pem) and paste them in the path given below: For instance, `C:/Users/SESAXXXXXX/.node-red/Cert`
3	Open **settings.js** file in **Notepad++**. The **settings.js** file will be located in the path given below: `C:/Users/SESAXXXXXX/.node-red/`

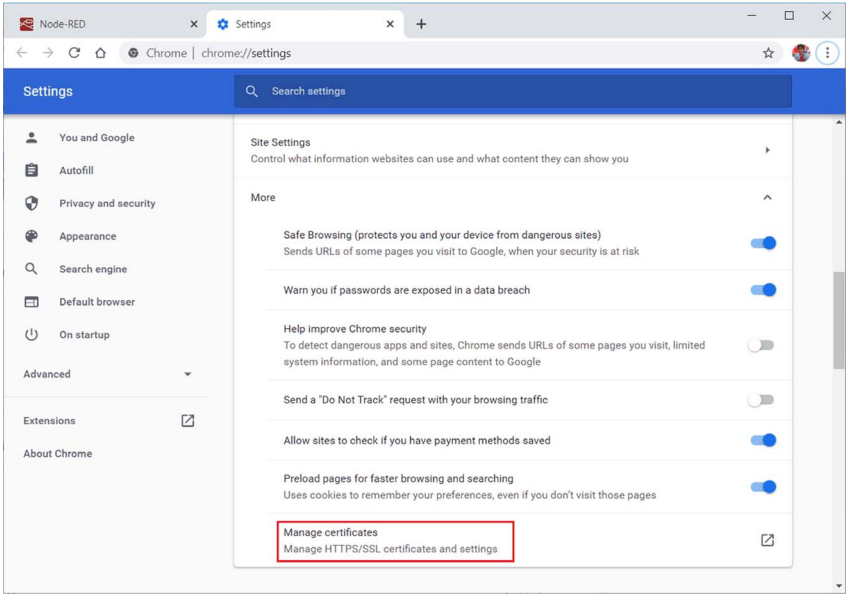
Step	Action
4	Search for the `var fs` and uncomment (remove //) the statement. 
5	Search for `https` in settings.js file and edit the key and cert files path and uncomment (remove //) `https` details. Search for the `requireHttps` and uncomment (remove //) the statement. 

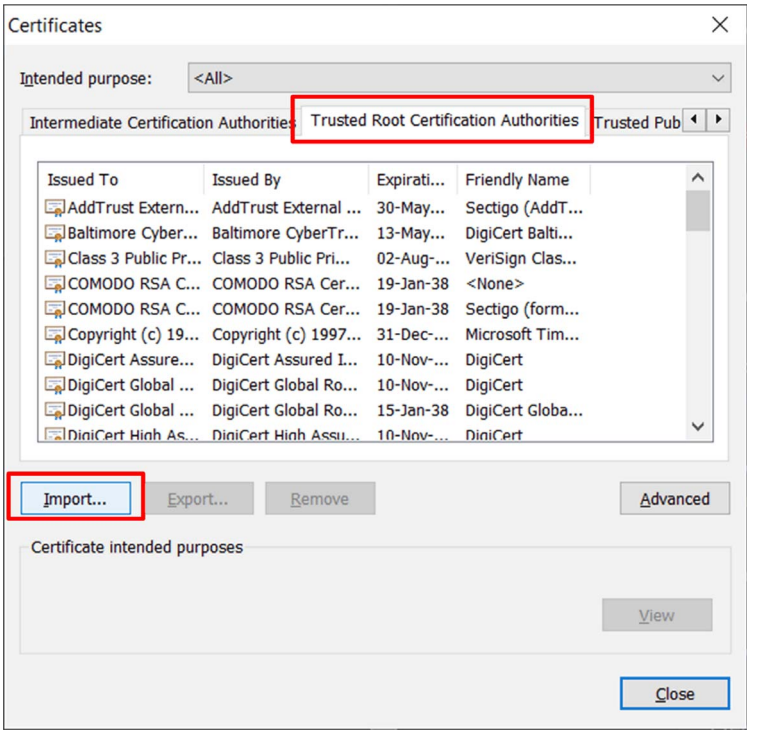
Step	Action
6	Save the **settings.js** file and close.
7	Restart the node-red server.

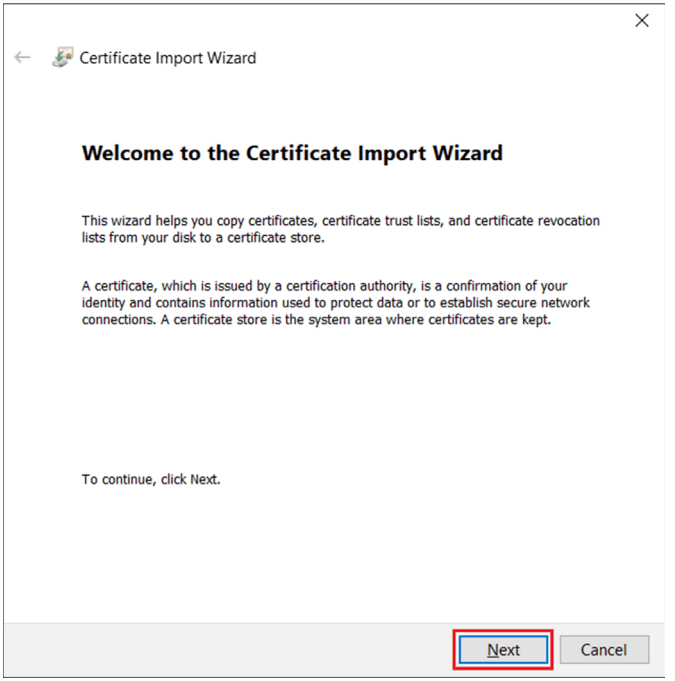
If your Node-RED server (*https://127.0.0.1.1880/*) is showing Not-secure then follow the steps given below to make the server secure:

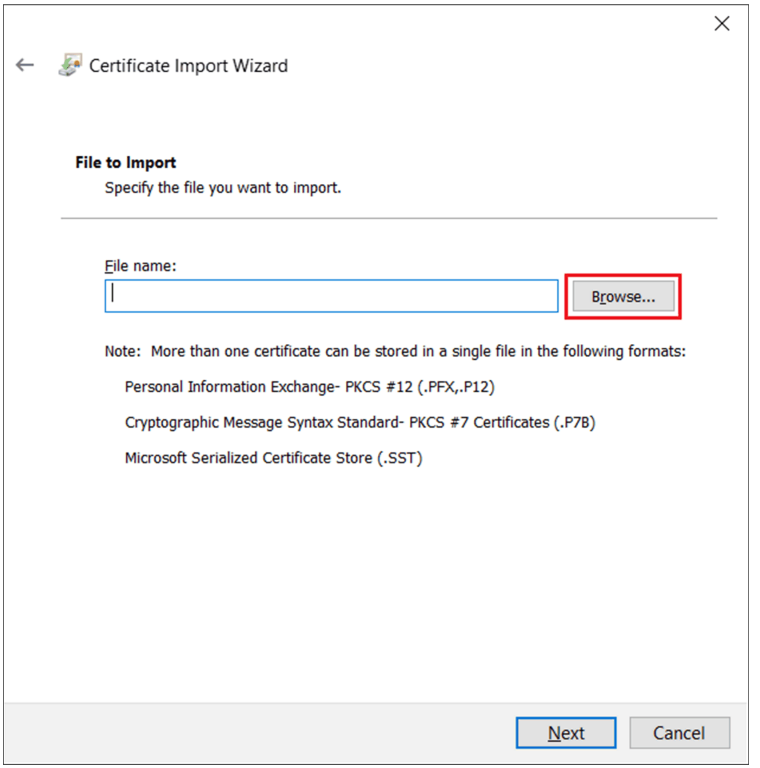
Step	Action
1	Open Node-RED application in a specified browser. Click **Kebab Menu** → **Settings** as shown in the image below.  **Result**: Settings window appears.

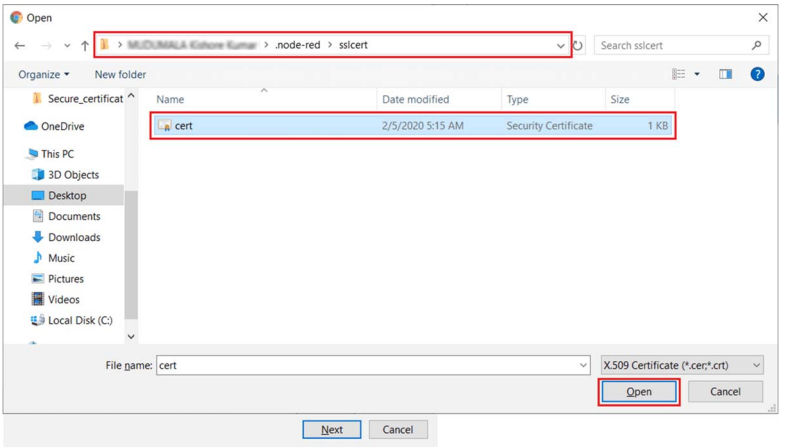
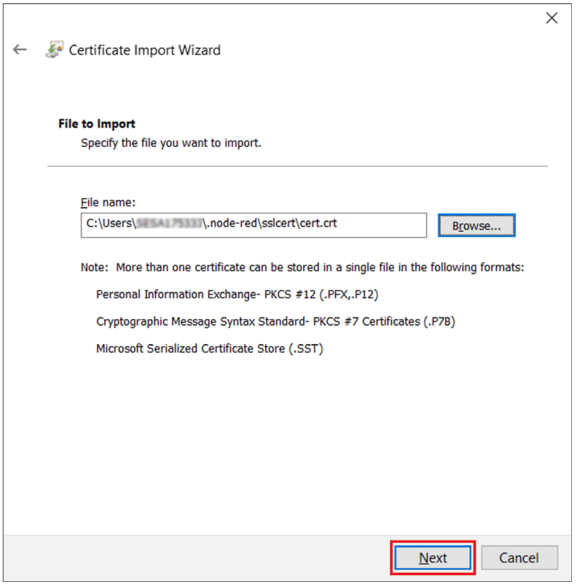
Step	Action
2	Click **More** drop-down. 

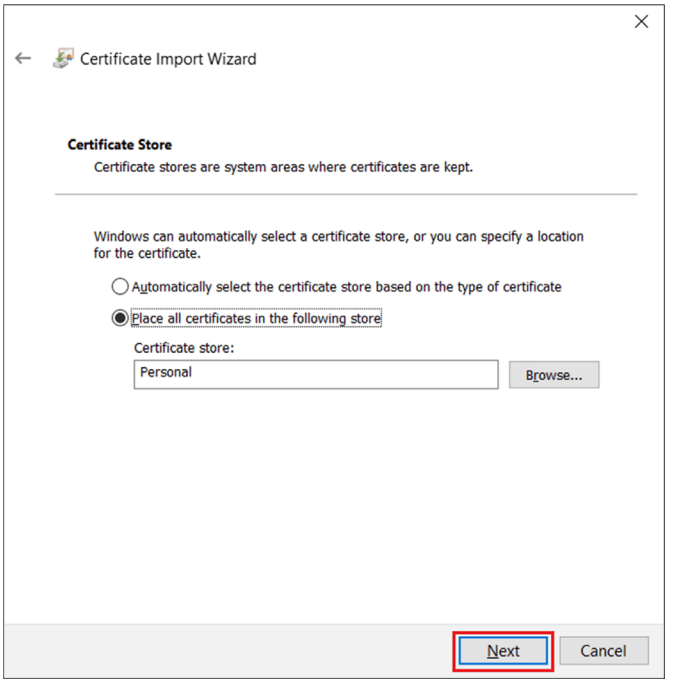
Step	Action
3	Click **Manage certificates**. 

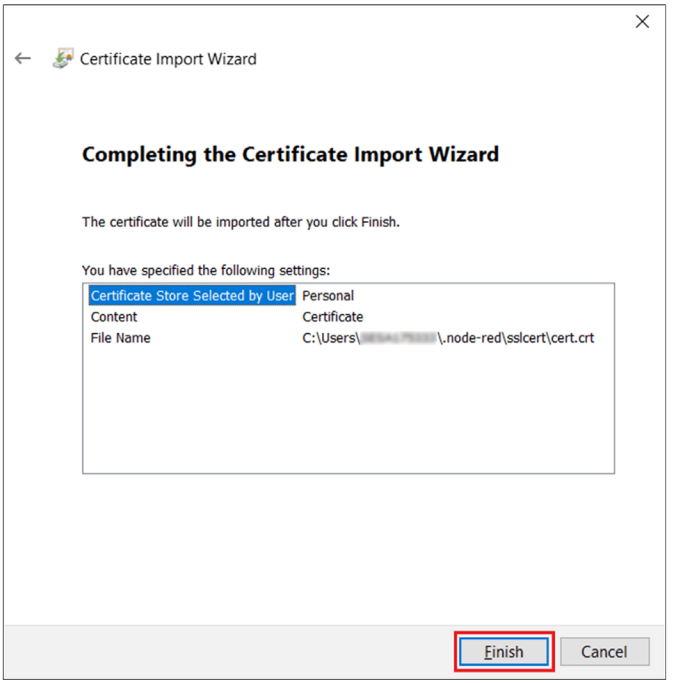
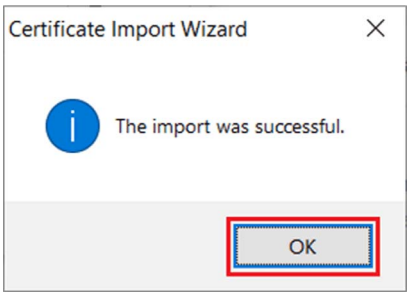
Step	Action
4	Click **Trusted Root Certification Authorities** and **Import...**. 

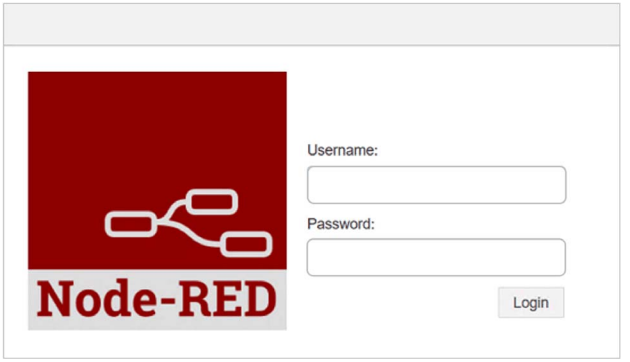
Step	Action
5	Click **Next**. 

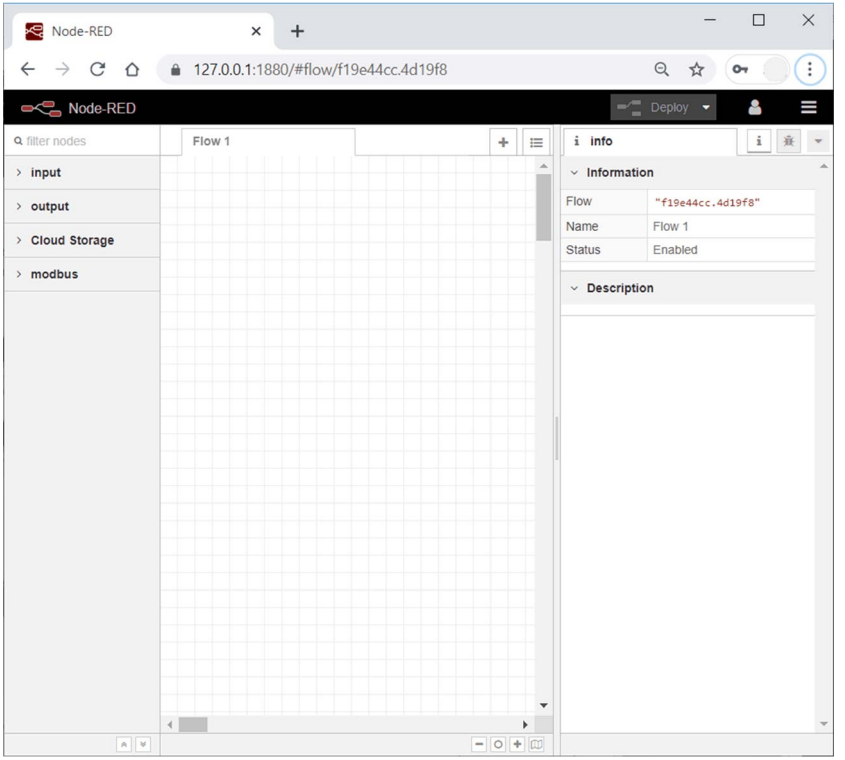
Step	Action
6	Click **Browse...**. 

Step	Action
7	Select the location of the certificates which are available in the .node-red folder. Select **cert** and click **Open**. For example, `C:/Users/SESAXXXXXX/.node-red/sslcert` 
8	Click **Next**. 

Step	Action
9	Click **Next**. 

Step	Action
10	Click **Finish**. 
11	Click **OK**. 
12	Reload the browser, and restart your computer if required.

Step	Action
13	Copy *https://127.0.0.1.1880/* and paste the link in a supported browser. Type the **Username** and **Password** in related fields and click **Login**. 

Step	Action
14	Secured Node-RED application is launched successfully. 

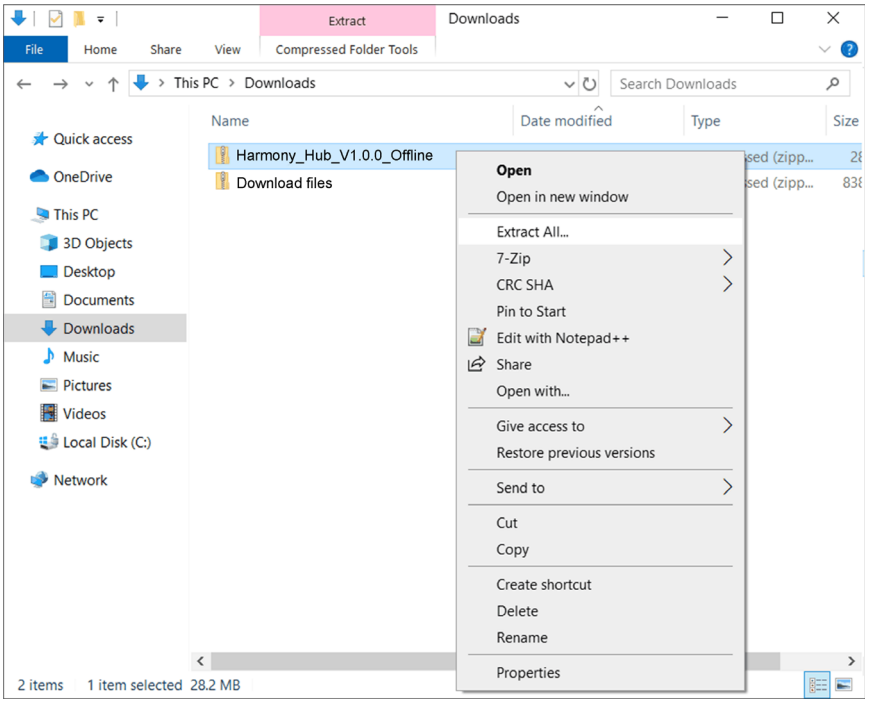
Installing SE Harmony Hub Node - Offline Installation Mode

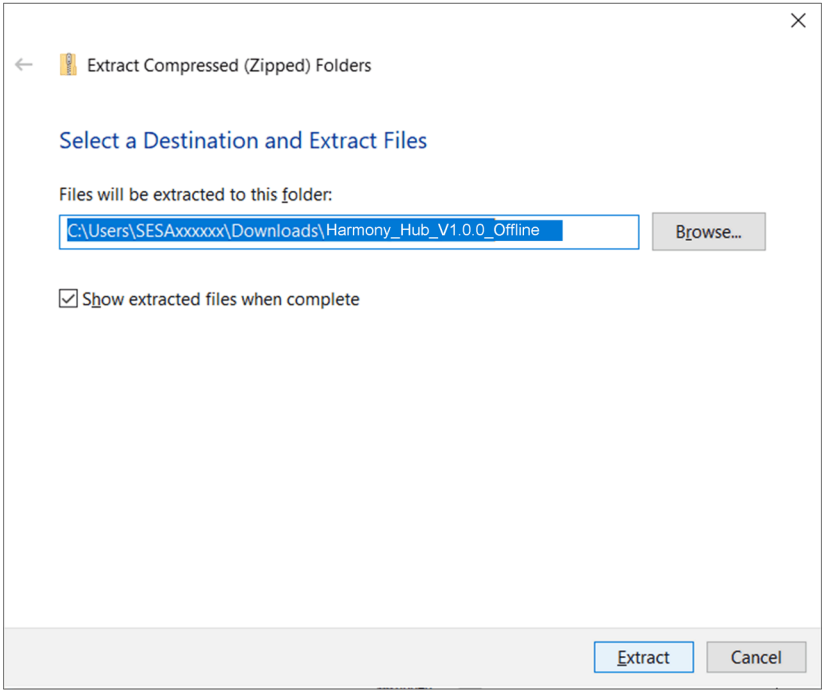
Overview

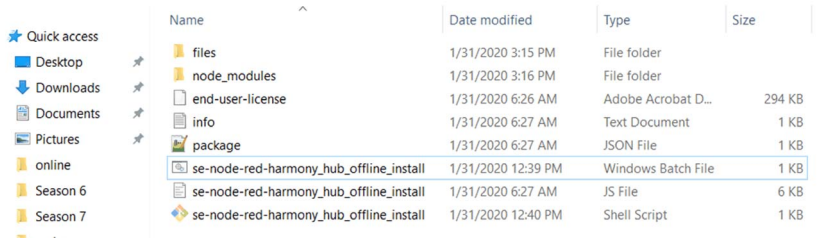
You should install the software below in your system before proceeding with the offline installation mode:

- Node.js *(see page 35)*
- Node-RED *(see page 42)*

Installing SE Harmony Hub Node

Step	Action
1	Download the `Harmony_Hub_V1.0.0_Offline.Zip` file from the link given below: *https://schneider-electric.box.com/s/xsmgvjhjo4km8jwlsn8qyprgb0gy8bv6* **NOTE:** Make sure unzip software is available in your device, if not available, download it from the given link: *https://www.7-zip.org/download.html*
2	Right click the downloaded `Harmony_Hub_V1.0.0_Offline` file and select **Extract All...**  **Result**: The selected file is unzipped.

Step	Action
3	Click **Extract**.  **Result**: The selected file is unzipped.

Step	Action
4	Open `Harmony_Hub_V1.0.0_Offline` folder. Double click on the `se-node-red-harmony_hub_offline_install.bat` file for installing node.  **Result**: The below license document and statement appears: • EULA (End User Licensing Agreement) document will appear in PDF format. Read it carefully and go back to command prompt window. • `Please read the Terms & Conditions carefully. Do you agree to our Terms & Conditions? (yes/no):`
5	Type `yes` and press **Enter** to agree the terms and conditions and install SE Harmony Hub node.  **Result**: SE Harmony Hub node is successfully installed. **NOTE:** The node package is saved in the User folder (for example: `C:\Users\SESAxxxxxx\Harmony_Hub_V1.0.0_Offline`). **NOTE:** If you type `no`, the installation is canceled.
6	Launch SE Harmony Hub node *(see page 97)*.

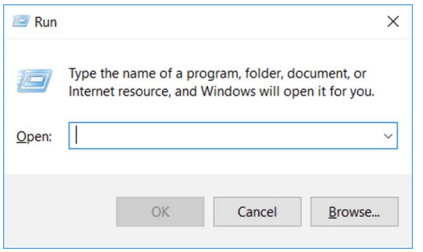
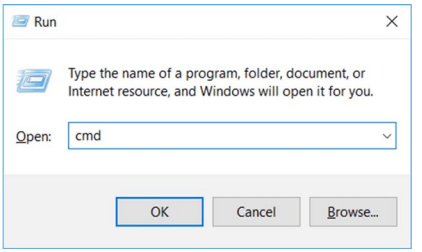
Installing SE Harmony Hub Node - Online Installation Mode

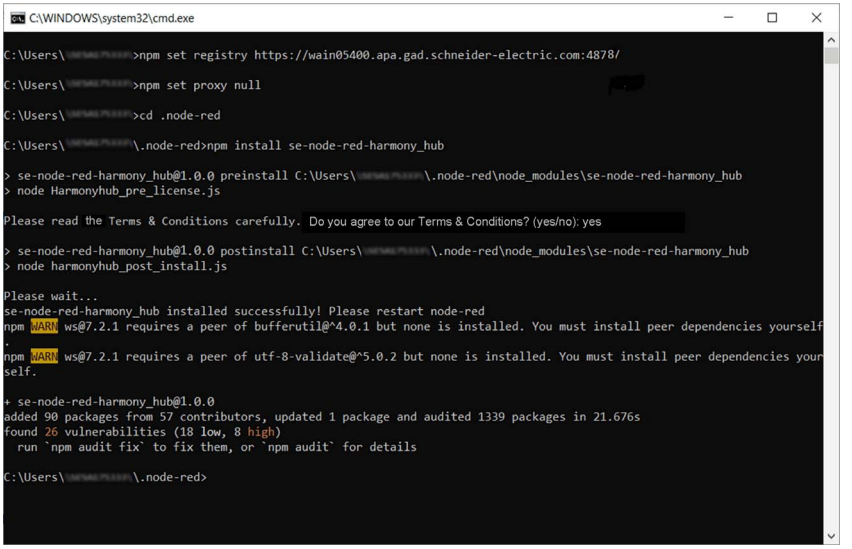
Overview

You should install the software below in your system before proceeding with the online installation mode:

- Node.js *(see page 35)*
- Node-RED *(see page 42)*
- Python v2.7.x *(see page 44)*

Installing SE Harmony Hub Node

Step	Action
1	Click  and type **Run** in the search bar and press **Enter**.  **Result**: **Run** dialog box appears.
2	Type the **cmd** in the **Run** dialog box and click **OK**.  **Result**: Command prompt window appears.
3	Type the below text in the command prompt and press **Enter**: `npm set registry https://wain05400.apa.gad.schneider-electric.com:4878/`

Step	Action
4	Type the text given below in the command prompt: `npm set proxy null` **Note:** If set proxy null command is not working, remove proxy for respective types as follows: • `npm config rm proxy` • `npm config rm http-proxy` • `npm config rm https-proxy`
5	Press **Enter**.
6	Type the text given below in the command prompt: `cd .node-red`
7	Press **Enter**.
8	Type `npm install se-node-red-harmony_hub` and press **Enter** to install SE Harmony Hub node. **Result**: The below license document and statement appears: • EULA (End User Licensing Agreement) document will appear in PDF format. Read it carefully and go back to command prompt window. • `Please read the Terms & Conditions carefully. Do you agree to our Terms & Conditions? (yes/no):`
9	Type `yes` and press **Enter** to agree the terms and conditions and install SE Harmony Hub node.  **Result**: Installation is successfully completed. **NOTE:** If you type `no`, the installation is canceled.
10	To launch SE Harmony Hub node *(see page 97)*, refer the node usage section.

NOTE: The online installation process sometimes does not work with in Schneider Network, due to Schneider proxy issue. If you face proxy issue, follow the offline installation process as a workaround *(see page 64)*.

Section 3.2
Uninstalling SE Harmony Hub node - Windows Platform

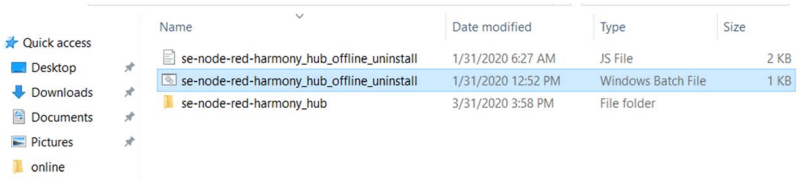
What Is in This Section?

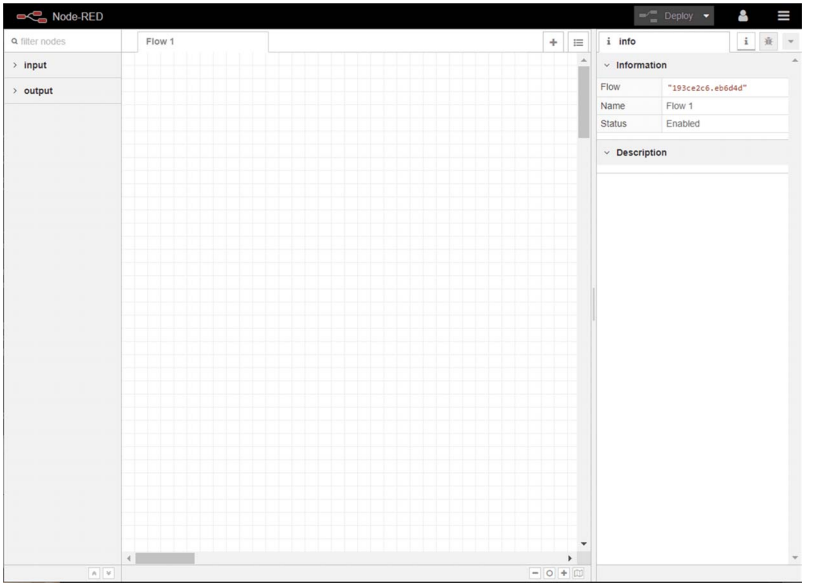
This section contains the following topics:

Uninstalling SE Harmony Hub Node - Offline Uninstallation Mode

NOTICE
LOSS OF DATA Backup the data before uninstalling SE Harmony Hub node. **Failure to follow these instructions can result in equipment damage.**

This procedure explains how to uninstall SE Harmony Hub node:

Step	Action
1	Delete SE Harmony Hub node from the flow.
2	Click  and **Logout** from Node-RED application.
3	Stop the Node-RED server running in the command prompt window.
4	Open users folder. For example: `C:\Users\SESAXXXXXX`
5	Double click `se-node-red-harmony_hub_offline_uninstall.bat` file to uninstall SE Harmony Hub node.  **Result**: SE Harmony Hub node is uninstalled.

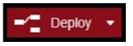
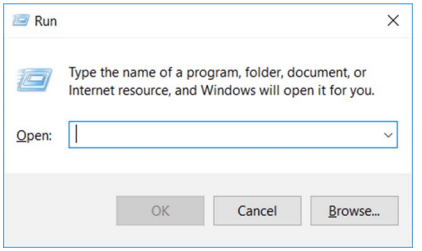
Step	Action
6	To restart Node-RED server, follow the steps: 1. Type `node-red` in the command prompt and press **Enter**. **Result**: Node-RED server starts. 2. Copy the IP address (*https://127.0.0.1:1880/*) in which the Node-RED server is running. 3. Open a browser. 4. Paste the IP address in the **URL** field in the browser and press **Enter**. 5. Type the **Username** and **Password** in related fields and click **login**. **Result**: Node-RED factory window reappears. 

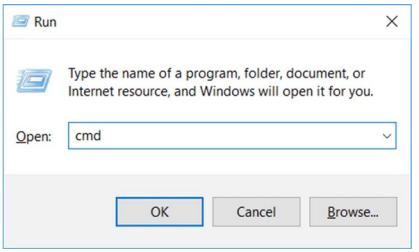
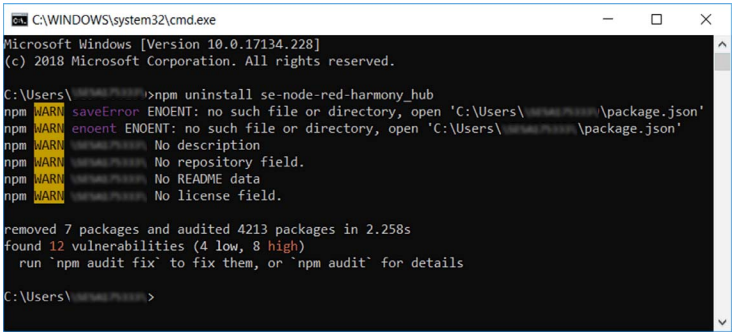
Uninstalling SE Harmony Hub Node - Online Uninstallation Mode

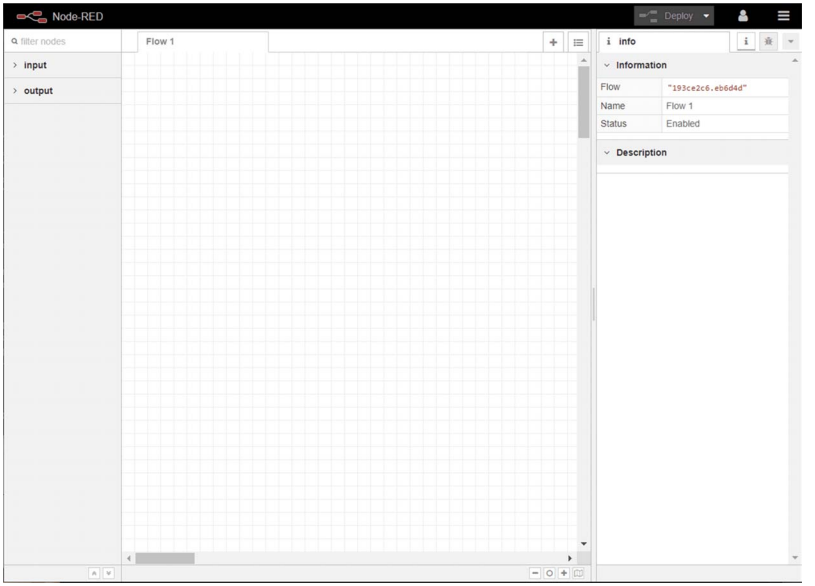
NOTE: You can uninstall SE Harmony Hub node using the command prompt.

NOTICE
LOSS OF DATA Backup the data before uninstalling SE Harmony Hub node. **Failure to follow these instructions can result in equipment damage.**

This procedure explains how to uninstall SE Harmony Hub node:

Step	Action
1	Delete SE Harmony Hub node from the flow.
2	Click  and **Logout** from Node-RED application.
3	Stop Node-RED server running in the command prompt window.
4	Click  and type **Run** in the search bar and press **Enter**.  **Result**: **Run** dialog box appears.

Step	Action
5	Type **cmd** in the **Run** dialog box and click **OK**.  **Result**: Command prompt window appears.
6	Type *cd .node-red* and press **Enter**.
7	Type *npm uninstall se-node-red-harmony_hub*.
8	Press **Enter**.  **Result**: SE Harmony Hub node is uninstalled.

Step	Action
9	To restart Node-RED server, follow the steps: 1. Type `node-red` in the command prompt and press **Enter**. **Result**: Node-RED server starts. 2. Copy the IP address (*https://127.0.0.1:1880/*) in which the Node-RED server is running. 3. Open a browser. 4. Paste the IP address in the **URL** field in the browser and press **Enter**. 5. Type the **Username** and **Password** in related fields and click **login**. **Result**: Node-RED factory window reappears. 

Chapter 4
Installation and uninstallation of SE Harmony Hub Node - Linux Platform

NOTE: Linux version of SE Harmony Hub node will be supported in the future updates.

NOTE: Magelis HMIBSC - The required softwares like Node.js, Node-RED and Python are pre-installed in the **Magelis HMIBSC** box.

Hardware requirements for Linux - Linaro - V1.00.010

IIoT Edge Box	PC hardware	Specification
Magelis HMIBSC	Processor	Reference HMIBSCEA53D1L0T HMIBSC with ARM
	Hard disk space	eMMC and TPM for hardware encryption
	Operating system	Linux Yocto

What Is in This Chapter?

This chapter contains the following sections:

Section 4.1
Installing SE Harmony Hub Node – Linux Platform

What Is in This Section?

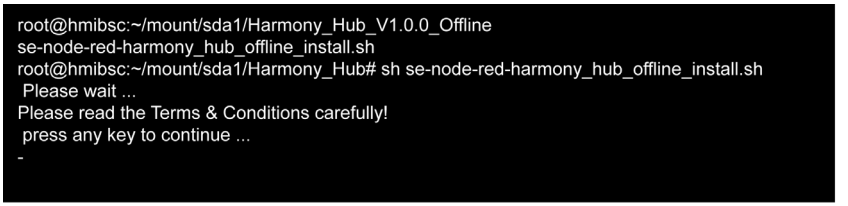
This section contains the following topics:

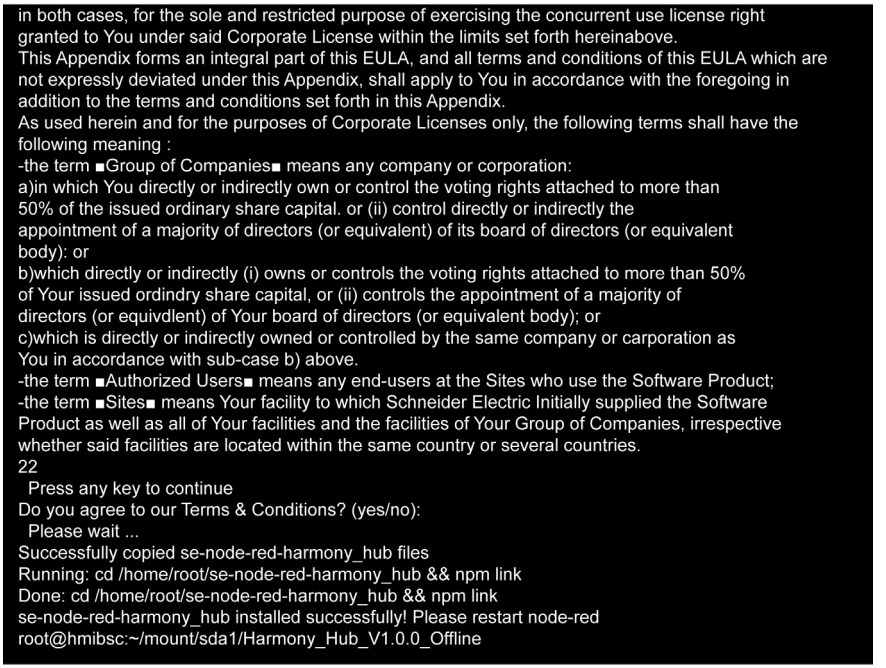
Installing SE Harmony Hub Node – Offline Installation Mode

The Linux based Edge Boxes (for example, HMIBSC) have in-built Node-RED-as-a-Service. This provides Node.js, Node-RED and python are pre-installed in the OS image.

The SE Harmony Hub node is installed by the user from the portable disk.

The below procedure is applicable for the Edge Boxes running on Linux Yocto (for example, HMIBSC):

Step	Action
1	Download the `Harmony_Hub_V1.0.0_Offline.Zip` file from the link given below: *https://schneider-electric.box.com/s/xsmgvjhjo4km8jwlsn8qyprgb0gy8bv6*
2	Extract the downloaded file `Harmony_Hub_V1.0.0_Offline.Zip` and transfer the extracted folder (`Harmony_Hub_V1.0.0_Offline`) into a portable disk. Example: Pendrive.
3	Connect the potable device to IIoT Edge Box.
4	• Navigate to the directory of the portable device (for instance, `cd mount/media/<disk name>`) and press **Enter**. • Type `cd Harmony_Hub_V1.0.0_Offline` and press **Enter** to go to the directory where the offline files for SE Harmony Hub node are placed.
5	Type `sh se-node-red-harmony_hub_offline_install.sh` and press **Enter** to install the SE Harmony Hub node. **Result**: Please read the Terms & Conditions carefully! press any key to continue... statement appears.
6	Press any key to read the Terms & Conditions.  **NOTE:** Press any key to continue until the result appears below. **Result**: `Do you agree to our Terms & Conditions? (yes/no):.`
7	Read the entire license document and **press any key to continue...** at the end of each page. **Result**: Do you agree to our Terms & Conditions? (yes/no):

Step	Action
8	Type `yes` and press **Enter** to agree the terms and conditions and install SE Harmony Hub node.  in both cases, for the sole and restricted purpose of exercising the concurrent use license right granted to You under said Corporate License within the limits set forth hereinabove. This Appendix forms an integral part of this EULA, and all terms and conditions of this EULA which are not expressly deviated under this Appendix, shall apply to You in accordance with the foregoing in addition to the terms and conditions set forth in this Appendix. As used herein and for the purposes of Corporate Licenses only, the following terms shall have the following meaning : -the term ■Group of Companies■ means any company or corporation: a)in which You directly or indirectly own or control the voting rights attached to more than 50% of the issued ordinary share capital. or (ii) control directly or indirectly the appointment of a majority of directors (or equivalent) of its board of directors (or equivalent body): or b)which directly or indirectly (i) owns or controls the voting rights attached to more than 50% of Your issued ordindry share capital, or (ii) controls the appointment of a majority of directors (or equivdlent) of Your board of directors (or equivalent body); or c)which is directly or indirectly owned or controlled by the same company or carporation as You in accordance with sub-case b) above. -the term ■Authorized Users■ means any end-users at the Sites who use the Software Product; -the term ■Sites■ means Your facility to which Schneider Electric Initially supplied the Software Product as well as all of Your facilities and the facilities of Your Group of Companies, irrespective whether said facilities are located within the same country or several countries. 22 Press any key to continue Do you agree to our Terms & Conditions? (yes/no): Please wait ... Successfully copied se-node-red-harmony_hub files Running: cd /home/root/se-node-red-harmony_hub && npm link Done: cd /home/root/se-node-red-harmony_hub && npm link se-node-red-harmony_hub installed successfully! Please restart node-red root@hmibsc:~/mount/sda1/Harmony_Hub_V1.0.0_Offline **Result**: se-node-red-harmony_hub installed successfully. Please restart node-red by rebooting **Magelis HMIBSC** Edge box. **NOTE:** If you type `no`, the installation is canceled.

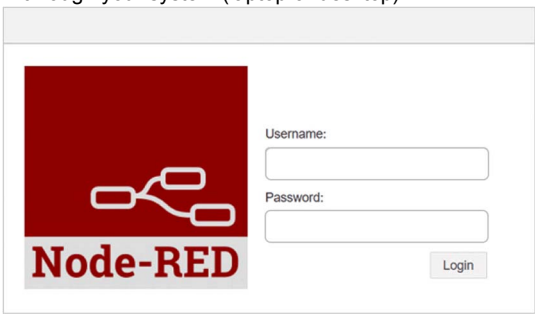
Step	Action
9	To check if your node is uninstalled follow the steps below ● Open a browser from system (laptop or desktop) connected in same network as the Linux Edge box: ❍ Go to https:\\<ip address>:1880 **NOTE:** To know your ip address, type `ifconfig` in your Linux edge box. ❍ Login window appears. Use your Node-RED login credentials to operate Linux Edge box through your system (laptop or desktop). **NOTE:** As browser is not available in Linux edge box you can connect to another system (laptop or desktop) using the ip address of Linux Edge box.

```
/home/root$ ifconfig
eth0      Link encap:Ethernet  HWaddr 74:FE:48:34:66:93
          inet addr:192.168.10.78  Bcast:192.168.255.255  Mask:255.255.0.0
          inet6 addr: 2405:204:551b:d6f7:76fe:48ff:fe34:6693%4804152/64 Scope:Global
          inet6 addr: fe80::76fe:48ff:fe34:6693%4804152/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:144095435 errors:79654 dropped:40320 overruns:0 frame:39334
          TX packets:145389576 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:10131566838 (9.4 GiB)  TX bytes:11357314537 (10.5 GiB)

eth1      Link encap:Ethernet  HWaddr 74:FE:48:34:66:94
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1%4804152/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:174 errors:0 dropped:0 overruns:0 frame:0
          TX packets:174 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1
          RX bytes:13456 (13.1 KiB)  TX bytes:13456 (13.1 KiB)

wlan0     Link encap:Ethernet  HWaddr 02:00:16:B1:2F:02
          inet addr:192.168.225.250  Bcast:192.168.225.255  Mask:255.255.255.0
          inet6 addr: 2405:204:551b:d6f7:0:16ff:feb1:2f02%4804152/64 Scope:Global
          inet6 addr: fe80::16ff:feb1:2f02%4804152/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:21598 errors:0 dropped:0 overruns:0 frame:0
          TX packets:5230 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:1019306 (995.4 KiB)  TX bytes:434633 (424.4 KiB)
```

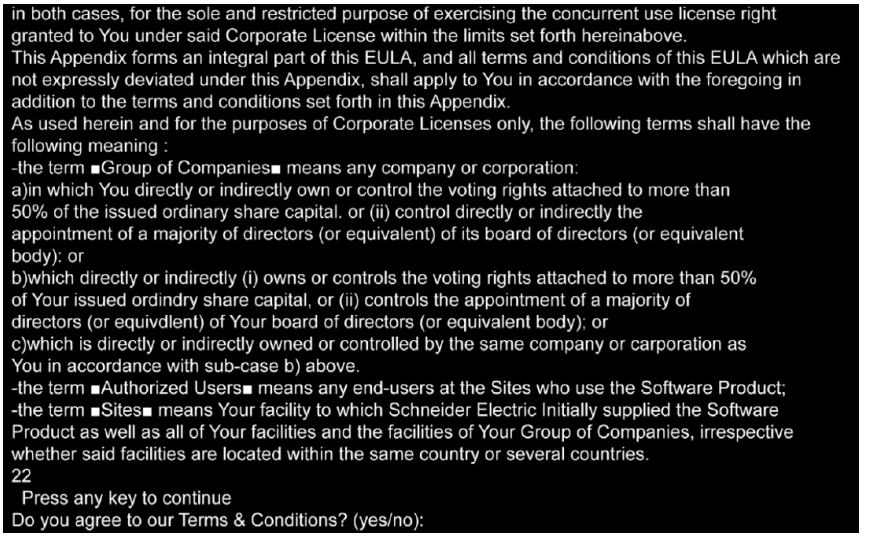


Installing SE Harmony Hub Node - Online Installation Mode

The Linux based Edge Boxes (for example, HMIBSC) have in-built Node-RED-as-a-Service. This means Node.js, Node-Red and python are pre-installed in the OS image.

To install SE Harmony Hub node follow the steps given below:

Step	Action
1	Type the text given below in the terminal and press **Enter**: `npm set registry https://wain05400.apa.gad.schneider-electric.com:4878/`
2	Type the text given below in the terminal and press **Enter**: `npm set proxy null` **Note:** If set proxy null command is not working, remove proxy for respective types as follows: • `npm config rm proxy` • `npm config rm http-proxy` • `npm config rm https-proxy`
3	Type `npm install se-node-red-harmony_hub` and press **Enter**. **NOTE:** Press any key to continue until the result appears. **Result**: `Do you agree to our Terms & Conditions? (yes/no):.`

Step	Action
4	Type `yes` and press **Enter** to agree the terms and conditions and install SE Harmony Hub node.  in both cases, for the sole and restricted purpose of exercising the concurrent use license right granted to You under said Corporate License within the limits set forth hereinabove. This Appendix forms an integral part of this EULA, and all terms and conditions of this EULA which are not expressly deviated under this Appendix, shall apply to You in accordance with the foregoing in addition to the terms and conditions set forth in this Appendix. As used herein and for the purposes of Corporate Licenses only, the following terms shall have the following meaning : -the term ■Group of Companies■ means any company or corporation: a)in which You directly or indirectly own or control the voting rights attached to more than 50% of the issued ordinary share capital. or (ii) control directly or indirectly the appointment of a majority of directors (or equivalent) of its board of directors (or equivalent body): or b)which directly or indirectly (i) owns or controls the voting rights attached to more than 50% of Your issued ordindry share capital, or (ii) controls the appointment of a majority of directors (or equivdlent) of Your board of directors (or equivalent body); or c)which is directly or indirectly owned or controlled by the same company or carporation as You in accordance with sub-case b) above. -the term ■Authorized Users■ means any end-users at the Sites who use the Software Product; -the term ■Sites■ means Your facility to which Schneider Electric Initially supplied the Software Product as well as all of Your facilities and the facilities of Your Group of Companies, irrespective whether said facilities are located within the same country or several countries. 22 Press any key to continue Do you agree to our Terms & Conditions? (yes/no): **Result**: Installation is successfully completed. **NOTE:** If you type `no`, the installation is cancelled.
5	Restart Node-RED application by rebooting **Magelis HMIBSC** Edge box.

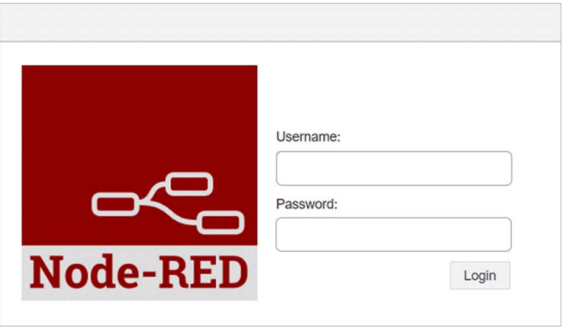
Step	Action
6	Open a browser from system (laptop or desktop) connected in same network as the Linux Edge box: ● Go to https:\\<ip address>:1880 **NOTE:** To know your ip address, type `ifconfig` in your Linux edge box. ● Login window appears. Use your Node-RED login credentials to operate Linux Edge box through your system (laptop or desktop). **NOTE:** As browser is not available in Linux edge box you can connect to another system (laptop or desktop) using the ip address of Linux Edge box.

```
/home/root$ ifconfig
eth0      Link encap:Ethernet  HWaddr 74:FE:48:34:66:93
          inet addr:192.168.10.78  Bcast:192.168.255.255  Mask:255.255.0.0
          inet6 addr: 2405:204:551b:d6f7:76fe:48ff:fe34:6693%4804152/64 Scope:Global
          inet6 addr: fe80::76fe:48ff:fe34:6693%4804152/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:144095435 errors:79654 dropped:40320 overruns:0 frame:39334
          TX packets:145389576 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:10131566838 (9.4 GiB)  TX bytes:11357314537 (10.5 GiB)

eth1      Link encap:Ethernet  HWaddr 74:FE:48:34:66:94
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1%4804152/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:174 errors:0 dropped:0 overruns:0 frame:0
          TX packets:174 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1
          RX bytes:13456 (13.1 KiB)  TX bytes:13456 (13.1 KiB)

wlan0     Link encap:Ethernet  HWaddr 02:00:16:B1:2F:02
          inet addr:192.168.225.250  Bcast:192.168.225.255  Mask:255.255.255.0
          inet6 addr: 2405:204:551b:d6f7:0:16ff:feb1:2f02%4804152/64 Scope:Global
          inet6 addr: fe80::16ff:feb1:2f02%4804152/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:21598 errors:0 dropped:0 overruns:0 frame:0
          TX packets:5230 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:1019306 (995.4 KiB)  TX bytes:434633 (424.4 KiB)
```



Section 4.2
Uninstalling SE Harmony Hub Node - Linux Platform

What Is in This Section?

This section contains the following topics:

Uninstalling SE Harmony Hub Node - Offline Uninstallation Mode

The below procedure is applicable for the Edge Boxes running on Linux Yocto (for example, **HMIBSC**):

Step	Action
1	Type `ls` and press **Enter**. **Result**: Installed nodes appears.
2	Type `sh se-node-red-harmony_hub_offline_uninstall.sh` and press **Enter** to uninstall the SE Harmony Hub node. root@hmibsc:~# ls se-node-red-harmony_hub_offline_uninstall.sh root@hmibsc:~# sh se-node-red-harmony_hub_offline_uninstall.sh Running: cd /home/root/se-node-red-harmony_hub && npm unlink Done: cd /home/root/se-node-red-harmony_hub && npm unlink Running: cd /home/root && rm -rf se-node-red-harmony_hub Done: cd /home/root && rm -rf se-node-red-harmony_hub root@hmibsc:~# **NOTE:** After uninstalllation restart Node-RED by rebooting **Magelis HMIBSC** Edge box.

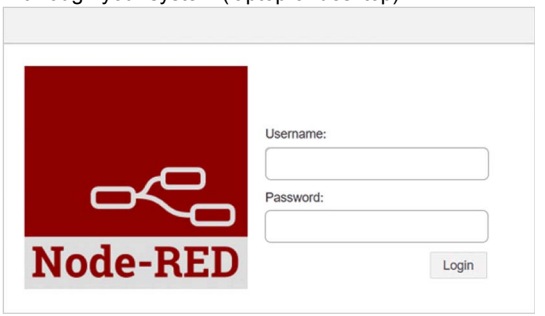
Step	Action
3	To check if your node is uninstalled follow the steps below ● Open a browser from system (laptop or desktop) connected in same network as the Linux Edge box: ❍ Go to https:\\<ip address>:1880 **NOTE:** To know your ip address, type `ifconfig` in your Linux edge box. ❍ Login window appears. Use your Node-RED login credentials to operate Linux Edge box through your system (laptop or desktop). **NOTE:** As browser is not available in Linux edge box you can connect to another system (laptop or desktop) using the ip address of Linux Edge box.

```
/home/root$ ifconfig
eth0      Link encap:Ethernet  HWaddr 74:FE:48:34:66:93
          inet addr:192.168.10.78  Bcast:192.168.255.255  Mask:255.255.0.0
          inet6 addr: 2405:204:551b:d6f7:76fe:48ff:fe34:6693%4804152/64 Scope:Global
          inet6 addr: fe80::76fe:48ff:fe34:6693%4804152/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:144095435 errors:79654 dropped:40320 overruns:0 frame:39334
          TX packets:145389576 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:10131566838 (9.4 GiB)  TX bytes:11357314537 (10.5 GiB)

eth1      Link encap:Ethernet  HWaddr 74:FE:48:34:66:94
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1%4804152/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:174 errors:0 dropped:0 overruns:0 frame:0
          TX packets:174 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1
          RX bytes:13456 (13.1 KiB)  TX bytes:13456 (13.1 KiB)

wlan0     Link encap:Ethernet  HWaddr 02:00:16:B1:2F:02
          inet addr:192.168.225.250  Bcast:192.168.225.255  Mask:255.255.255.0
          inet6 addr: 2405:204:551b:d6f7:0:16ff:feb1:2f02%4804152/64 Scope:Global
          inet6 addr: fe80::16ff:feb1:2f02%4804152/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:21598 errors:0 dropped:0 overruns:0 frame:0
          TX packets:5230 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:1019306 (995.4 KiB)  TX bytes:434633 (424.4 KiB)
```



Uninstalling SE Harmony Hub Node - Online Uninstallation Mode

This procedure explains how to uninstall the SE Harmony Hub node:

Step	Action
1	From the browser where Node-RED server is running, delete the SE Harmony Hub node from the flow.
2	Click **Deploy**  and **Logout** from the Node-RED application.
3	Go to **HMIBSC** terminal.
4	Type `npm uninstall se-node-red-harmony_hub`.
5	Press **Enter** to uninstall the SE Harmony Hub node. **Result**: SE Harmony Hub node is successfully uninstalled.
6	Restart Node-RED application by rebooting **Magelis HMIBSC** Edge box.

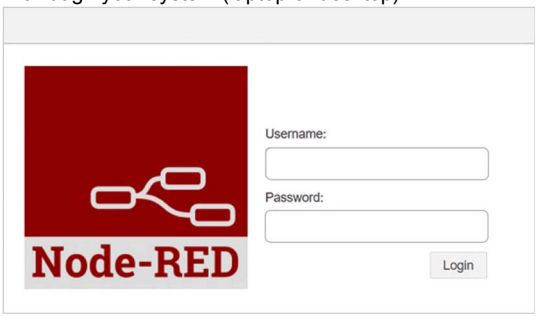
Step	Action
7	To check if your node is uninstalled follow the steps below ● Open a browser from system (laptop or desktop) connected in same network as the Linux Edge box: ❍ Go to https:\\<ip address>:1880 **NOTE:** To know your ip address, type `ifconfig` in your Linux edge box. ❍ Login window appears. Use your Node-RED login credentials to operate Linux Edge box through your system (laptop or desktop). **NOTE:** As browser is not available in Linux edge box you can connect to another system (laptop or desktop) using the ip address of Linux Edge box.

```
/home/root$ ifconfig
eth0      Link encap:Ethernet  HWaddr 74:FE:48:34:66:93
          inet addr:192.168.10.78  Bcast:192.168.255.255  Mask:255.255.0.0
          inet6 addr: 2405:204:551b:d6f7:76fe:48ff:fe34:6693%4804152/64 Scope:Global
          inet6 addr: fe80::76fe:48ff:fe34:6693%4804152/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:144095435 errors:79654 dropped:40320 overruns:0 frame:39334
          TX packets:145389576 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:10131566838 (9.4 GiB)  TX bytes:11357314537 (10.5 GiB)

eth1      Link encap:Ethernet  HWaddr 74:FE:48:34:66:94
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1%4804152/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:174 errors:0 dropped:0 overruns:0 frame:0
          TX packets:174 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1
          RX bytes:13456 (13.1 KiB)  TX bytes:13456 (13.1 KiB)

wlan0     Link encap:Ethernet  HWaddr 02:00:16:B1:2F:02
          inet addr:192.168.225.250  Bcast:192.168.225.255  Mask:255.255.255.0
          inet6 addr: 2405:204:551b:d6f7:0:16ff:feb1:2f02%4804152/64 Scope:Global
          inet6 addr: fe80::16ff:feb1:2f02%4804152/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:21598 errors:0 dropped:0 overruns:0 frame:0
          TX packets:5230 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:1019306 (995.4 KiB)  TX bytes:434633 (424.4 KiB)
```



Part III
Node Usage

What Is in This Part?

This part contains the following chapters:

Chapter 5
About SE Harmony Hub Node

What Is in This Chapter?

This chapter contains the following topics:

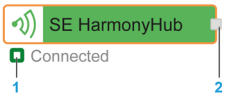
Introduction

Overview

SE Harmony Hub node is a data collecting node using Modbus communication protocol (TCP or Serial). SE Harmony Hub node is connected to the Harmony Hub gateway which retrieves sensors data which are commissioned and connected wirelessly to the gateway. SE Harmony Hub Node extracts the sensors data from the gateway and displays it on the web page to monitor the latest data at the specified time intervals. The data from sensors will be in Common Message Structure (CMS) format *(see page 120)*.

Node Description

SE Harmony Hub node consists of one node that reads from the connected devices:



Item number	Item name	Description
1	Connection status	Indicates the following connection status: ● **Connecting**: Node is connecting to the Harmony Hub gateway. ● **Connected**: Node is connected to the gateway. ● **Success**: Data is read from the gateway successfully. ● **Error**: Indicates when the node detects an error. ● **ConfigError**: Parameters are not configured properly. ● **Read Error**: Error in reading data from gateway.
2	Output	Generated CMS is passed as an output.

Types of Sensors and respective parameters

You can use the sensors and the respective parameters below to connect to the node:

- E3 sensor (Electrical Energy Estimator)
  - RSSI
  - Sensor Type
  - Timeout
  - Timestamp
  - Temperature
  - Current
  - Apparent Power
  - Active Power
  - Apparent Energy

  - Corrected Apparent Energy
  - Active Energy
- CL110 sensor (thermal monitoring)
  - RSSI
  - Sensor Type
  - Timeout
  - Timestamp
  - Battery
- ESST01 sensor (Radio probes sensors - thermal monitoring)
  - RSSI
  - Sensor Type
  - Timeout
  - Timestamp
  - Battery
  - Temperature
- S1 sensor (generic ZigBee Green Power sensor)
  - RSSI
  - Sensor Type
  - Timeout
  - Timestamp
  - Battery
  - Temperature
  - Energy
  - Unit of Measure
  - Power Phase A
  - Power Phase B
  - Power Phase C
  - Current Phase A
  - Current Phase B
  - Current Phase C
  - Voltage Phase A
  - Voltage Phase B
  - Voltage Phase C
  - CO2 Level
  - CO Level
  - Illuminace
  - Pressure
  - Flow
  - Humidity
  - Occupancy
  - State

RSSI (Received Signal Strength Indicator)

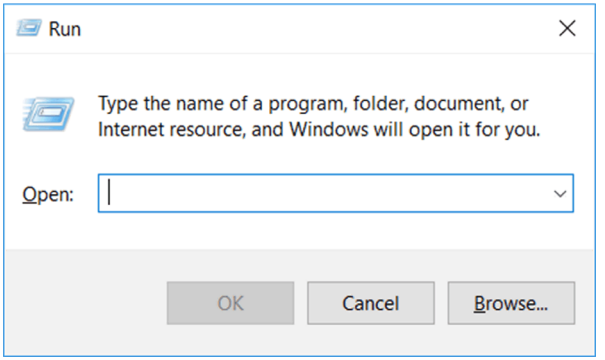
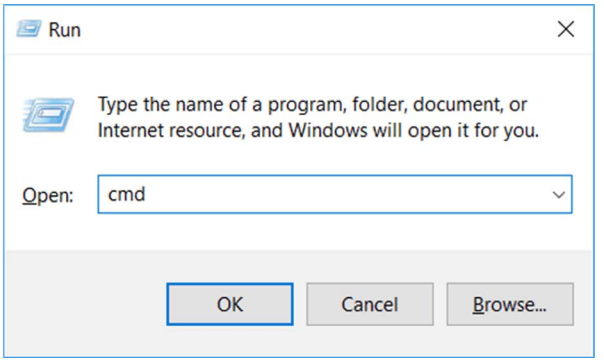
The **RSSI** signals strength are given below:

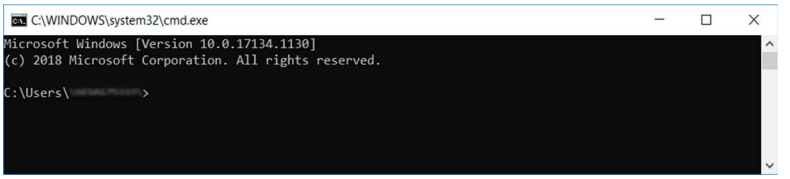
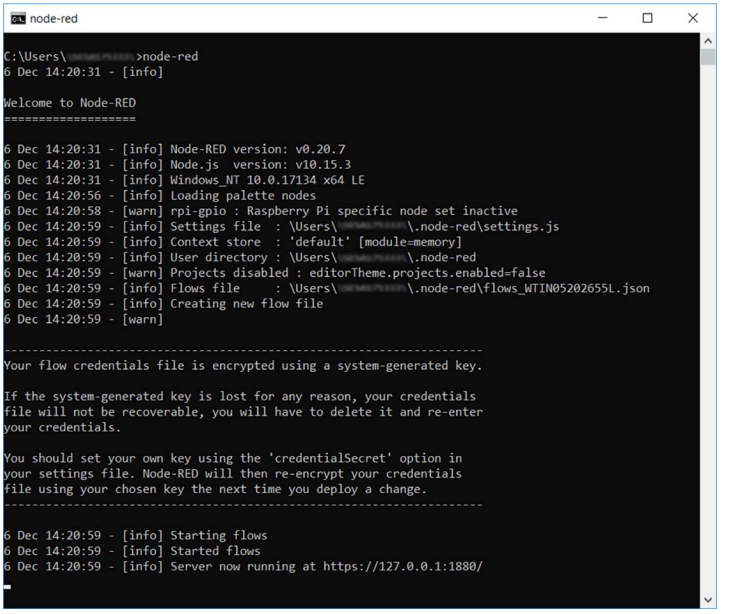
- **High**: If the **RSSI** signal strength is between -10...-70 dbm then signal is high and the signal strength indicate 4 green bars.
- **Medium**: If the **RSSI** signal strength is between -70...-80 dbm then signal is medium and the signal strength indicate 3 orange bars.
- **Low**: If the **RSSI** signal is between -80...-100 dbm then the signal is slow and the signal strength indicate 1 red bars.

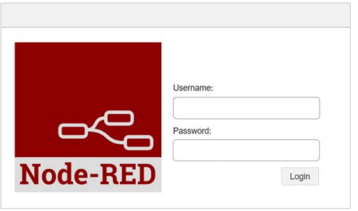
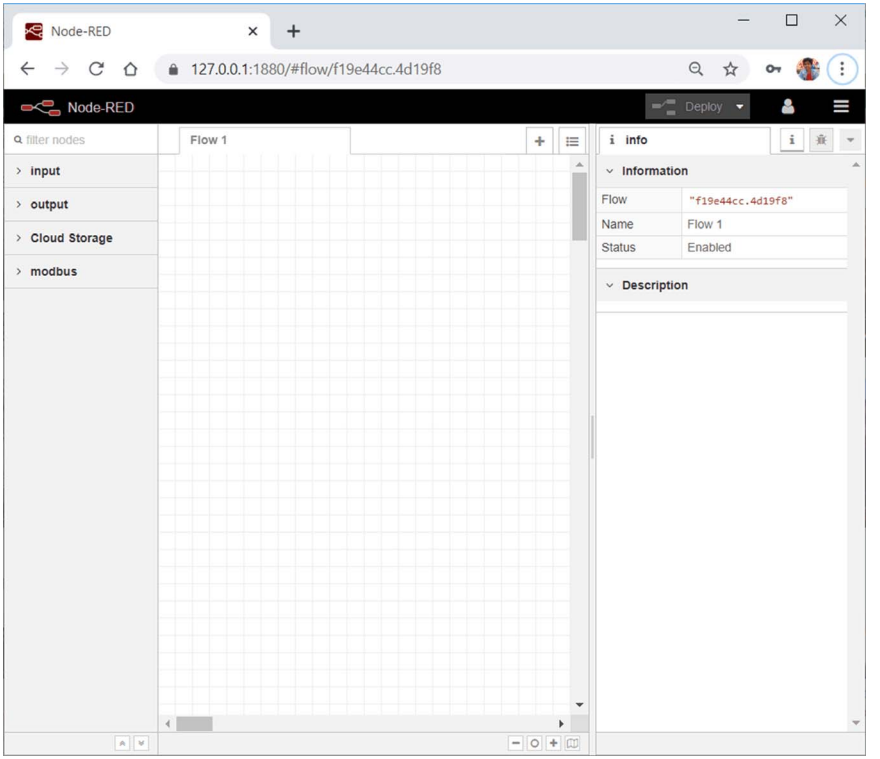
Launching the Node-RED Server and SE Harmony Hub Node

Node-RED

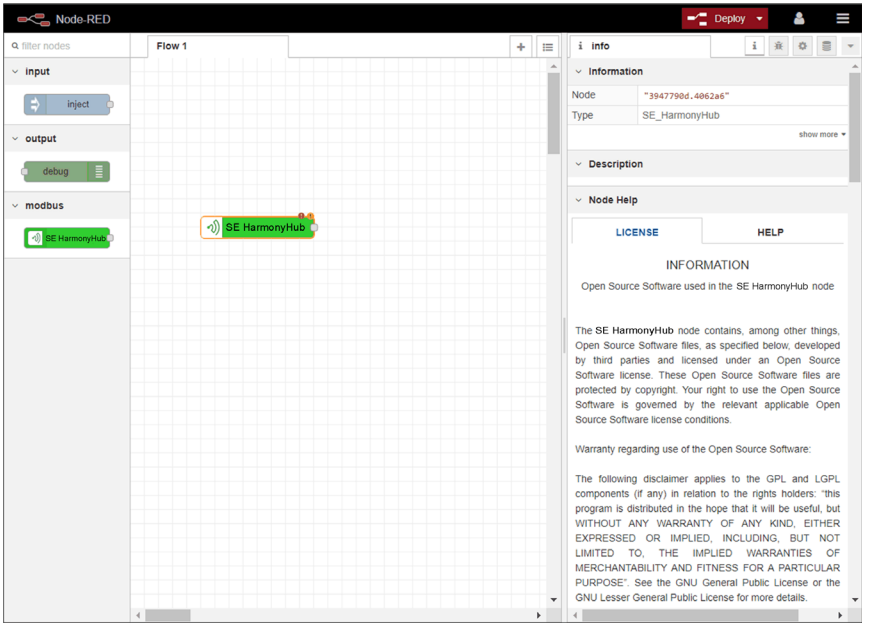
After the Node-RED and SE Harmony Hub node are installed, launch the Node-RED server.

Step	Action
1	Click  button, type **Run** in the search bar and press **Enter** 
2	Type the `cmd` in the **Run** dialog box and click **OK**.  **Result**: Command prompt window appears.

Step	Action
3	Type *node-red* in the command prompt and press **Enter**. 
4	Node-RED server now running at *https://127.0.0.1:1880/* 

Step	Action
5	Copy the URL in which the Node-RED server is running (*https://127.0.0.1:1880/*) and open the link in a supported browser. Type the **Username** and **Password** in related fields and click **Login**.  **Result**: Node-RED factory window appears.
6	 **Result**: Node-RED editor appears.

SE Harmony Hub Node

Step	Action
1	In the Node-RED window, use the scroll bar to find the SE Harmony Hub node on the left side. **NOTE:** Alternatively, you can also search from the **Filter Nodes** search option available at the left side node palette area.  **Result**: In **modbus** category, the SE Harmony Hub node is available. **NOTE:** SE Harmony Hub nodes license information is available in the **LICENSE** tab. Help manual is available in the **HELP** tab (right next to **LICENSE** tab).
2	Drag-and-drop the SE Harmony Hub node on a flow page.

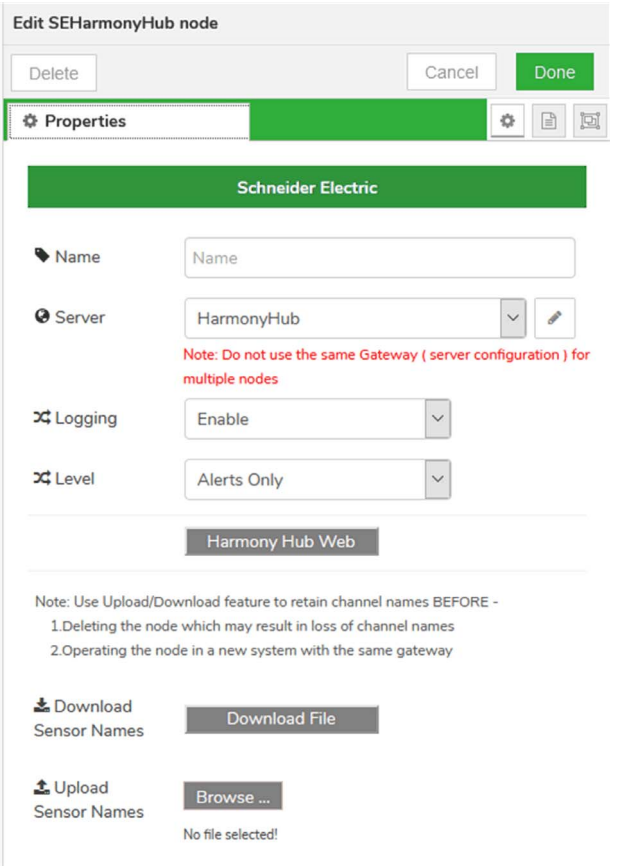
Chapter 6
SE Harmony Hub Node Configuration

What Is in This Chapter?

This chapter contains the following topics:

Configuring SE Harmony Hub node

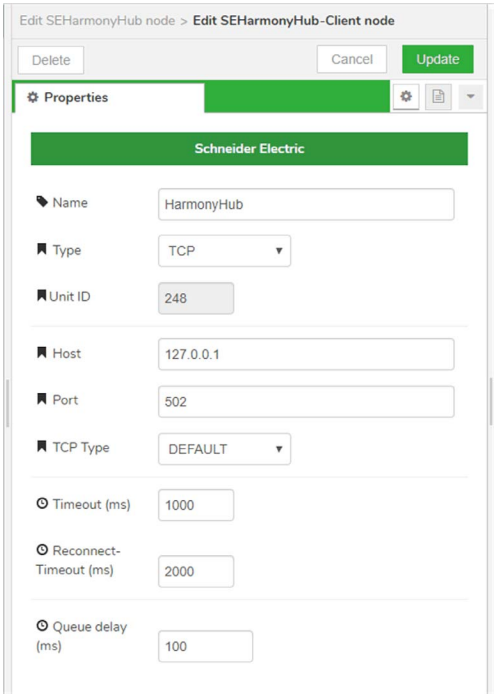
Double-click on the SE Harmony Hub node. The configuration screen of the node appears:



Parameters	Description
Name	Type the name to be displayed on the node.
Server	Click  icon to configure the parameters of the selected server type. For **TCP** and **Serial**, refer to the below tables. **NOTE:** Do not use the same Gateway (server configuration) for multiple nodes.

Parameters	Description
Logging	Select the **Enable** or **Disable** for logging the events. By default, **Enable** is selected. When Enabled, the log events are recorded in the log file. The log files will be saved in the path given below: `<Installed Node Directory>/nodes/log/` For instance the location will be: • Offline installation ❍ `<User Directory>/se-node-red-harmony_hub/nodes/log/` • Online installation ❍ `<User Directory>/.node-red/node_modules/se-node-red-harmony_hub/nodes/log/`
Level	Select the logging level from the list: • **All Events** Error, info, debug messages are logged • **Alerts Only** Error messages are logged **NOTE:** By default, **Alerts Only** is selected.
Harmony Hub Web	Click **Done** and **Deploy**  to save the changes. **NOTE:** Once configure settings are saved **Harmony Hub Web** will be enabled. Click **Harmony Hub Web** to navigate to the web page to commission the channels and to get the data from Zigbee sensors.
Download Sensor Names	Click **Download File** to download the data of sensor paired to the Harmony Hub gateway. **NOTE:** The channel names cannot be changed in downloaded file as the data is encrypted.
Upload Sensor Names	Click **Browse...** and select the respective file to be uploaded and the data appears in the **Harmony Hub Web** page. The file contains channel names of the sensors which are paired. **NOTE:** Whenever we upload a file, all the channel names will be replaced by the corresponding names in the uploaded file.

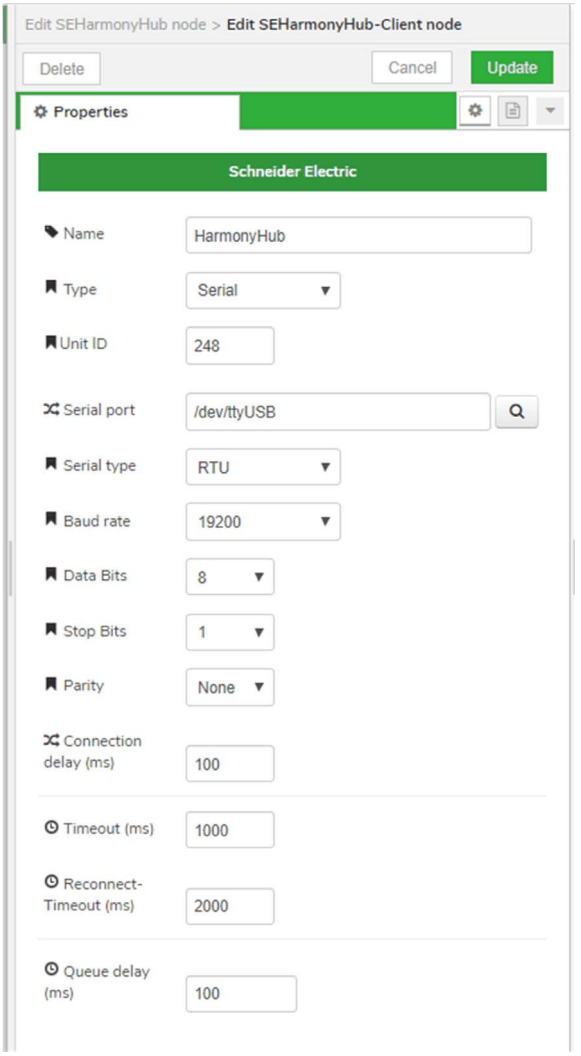
Server type: **TCP** properties



Server configuration for **TCP** connection:

Parameters	Description
Unit ID	Type the slave address of the **Serial** (**TCP**: 248 non editable) device.
Host	Type the slave address.
Port	Type the port number.
TCP Type	Select the **TCP Type** from the drop-down list: • **Default** • **RTU-BUFFERD**
Timeout	Set the timeout for `ModbusRTU` command. By default, the time duration for connecting is 1000 ms.
Reconnect timeout	Set the reconnect time out for reconnecting the node. By default, the reconnect time is 2000 ms.
Queue delay (ms)	Set the time interval to delay sending the commands from queue. By default, the queue delay is 100 ms.

Server type: **Serial** Properties



Server configuration for **Serial** connection:

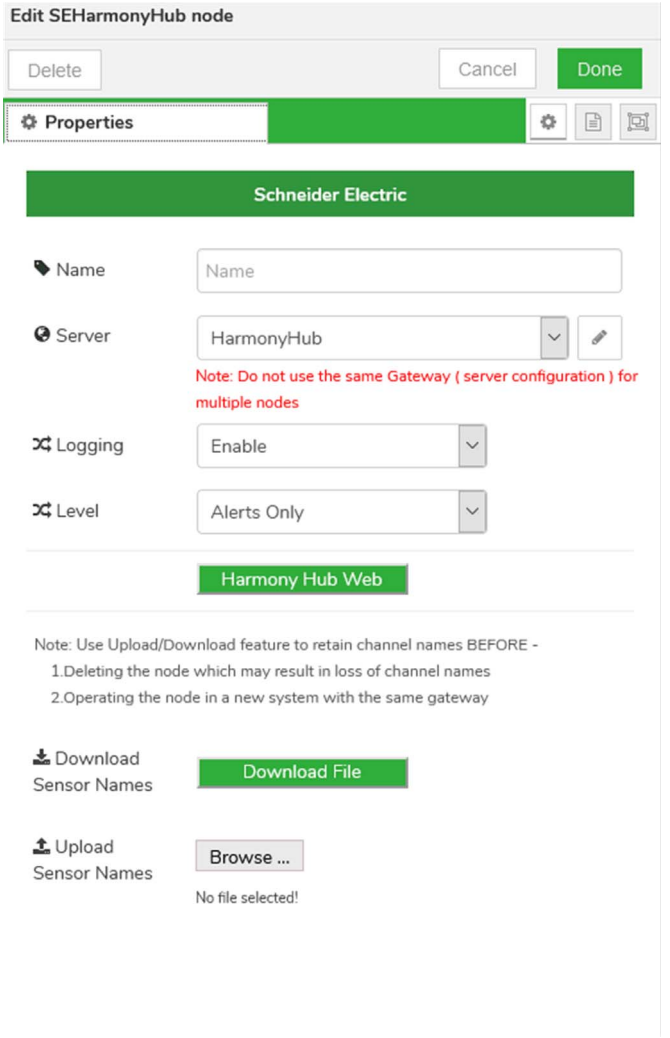
Parameters	Description
Serial Port	Click Search button `/dev/ttyUSB`)

Parameters	Description
Serial Type	Select the required option from the drop-down list: • **RTU** • **RTU-BUFFERD**
Baud rate	Select the suitable option from the drop-down list: • **115200** • **57600** • **38400** • **19200** • **9600** • **4800** • **2400** • **1200** • **300** • **110** • **75** **NOTE:** Based on the rate selected, the information is transferred in a communication channel.
Data Bits	Select the suitable option from the drop-down list: • **8** • **7** • **6** • **5** **NOTE:** Based on the bit selected, the information is transferred in a communication channel.
Stop Bits	Select the suitable option from the drop-down list: • **1** • **1.5** • **2**
Parity	Select the suitable parity bit from the drop-down list: • **None** • **Even** • **Mark** • **Odd** • **Space**
Connection delay (ms)	Type the delay time for sending data after reconnection. By default, the value is 100 ms.
Timeout (ms)	Set the timeout for `ModbusRTU` command. By default, the delay time is 1000 ms.
Reconnect-Timeout (ms)	Set the reconnect time out for reconnecting the node. By default, the reconnect time is 2000 ms.

Parameters	Description
Queue delay (ms)	Set the time interval to delay sending the commands from queue. By default, the queue delay is 100 ms.

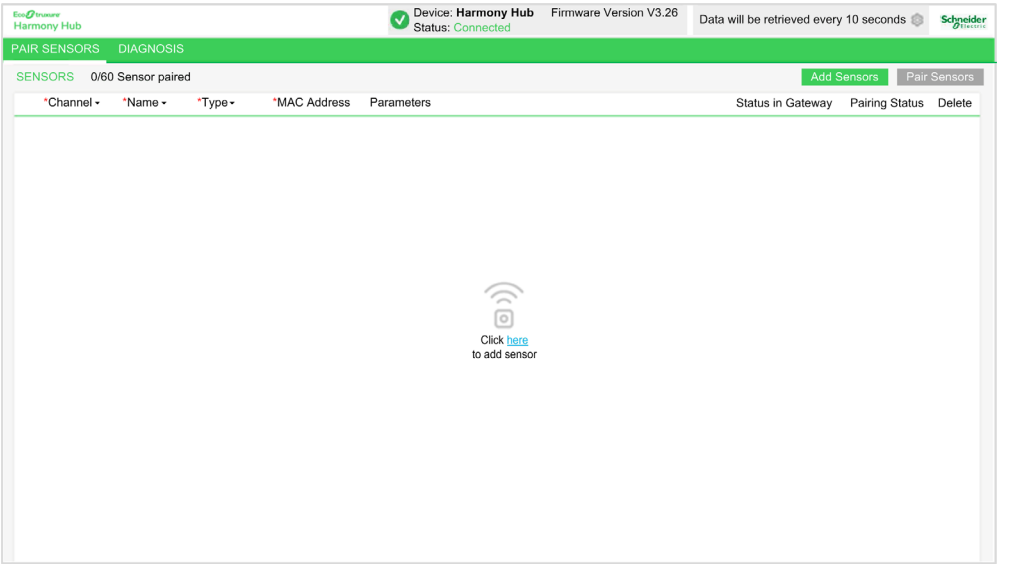
Launching SE Harmony Hub Node Web Page

Click **Harmony Hub Web** to navigate to the web page, when it is enabled (tab colour turns green).

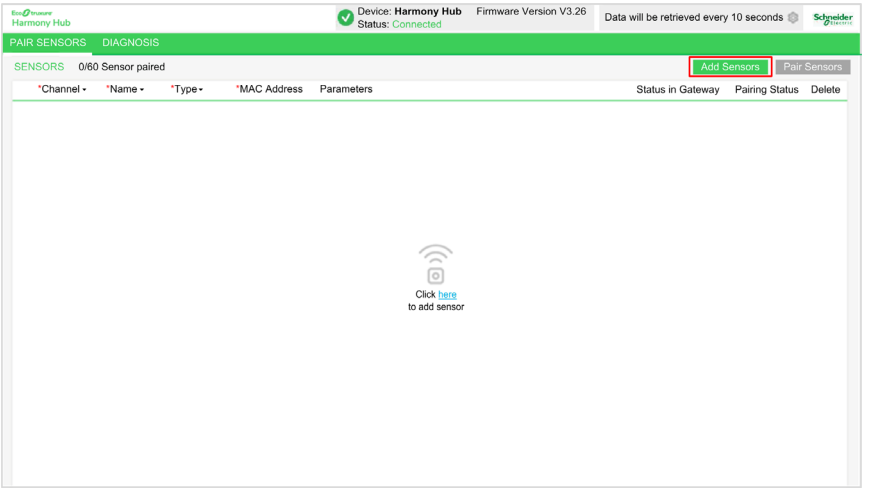


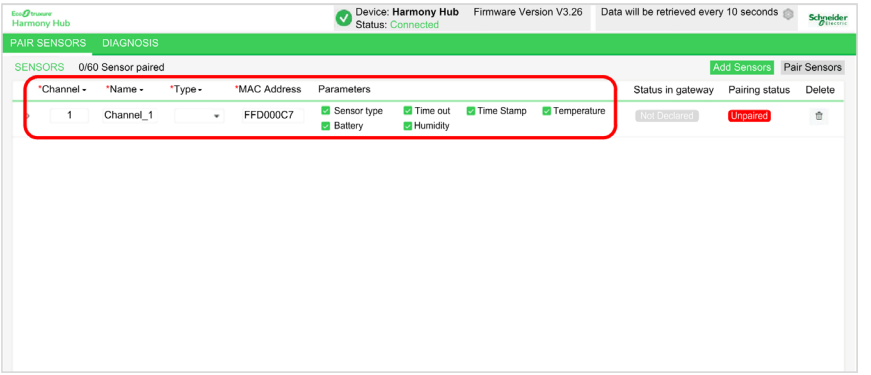
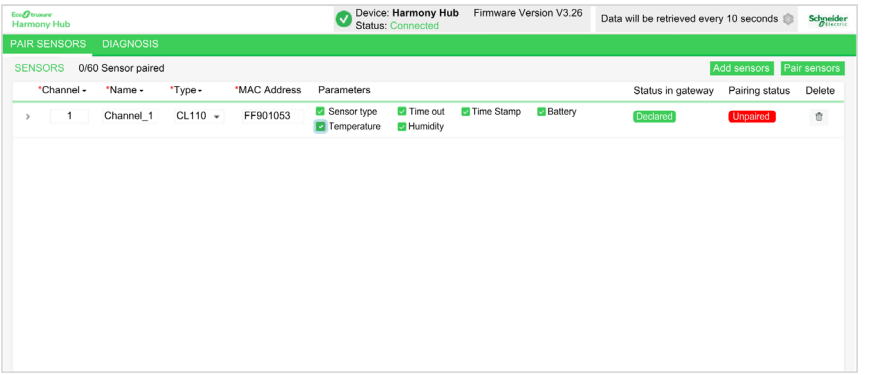
The **SE Harmony Hub Node** web page appears where you can add and pair the sensors to be monitored. You can monitor maximum 60 sensors at a time. Make sure that the sensor is not paired to any other device.

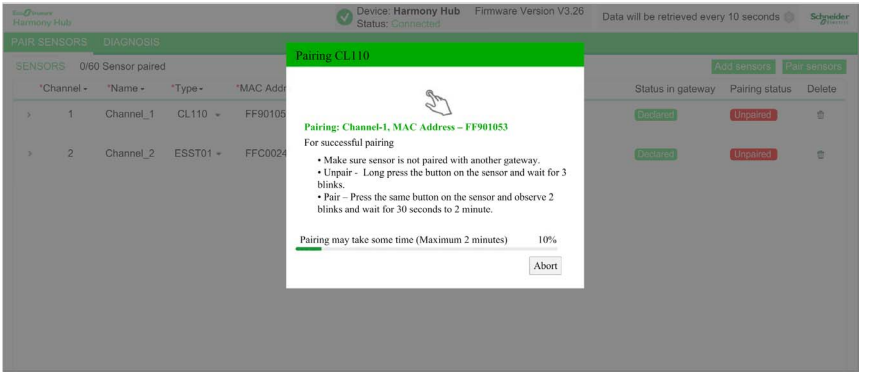
The following figure shows **SE Harmony Hub Node** web page:

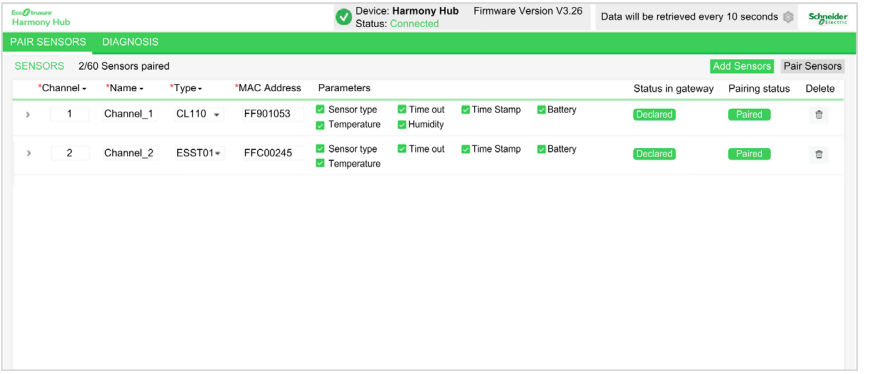


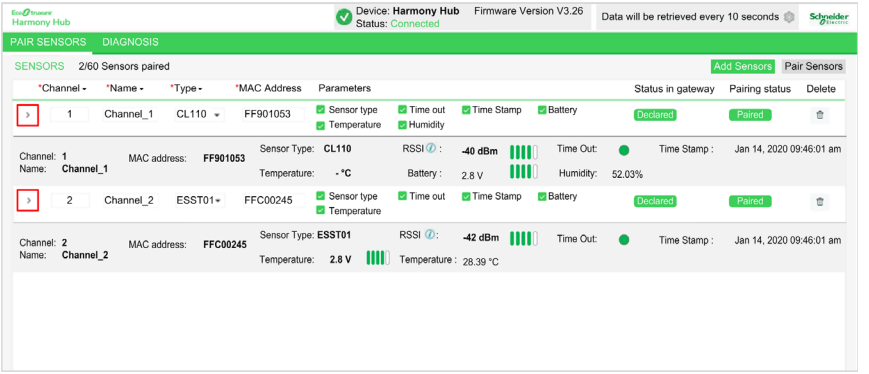
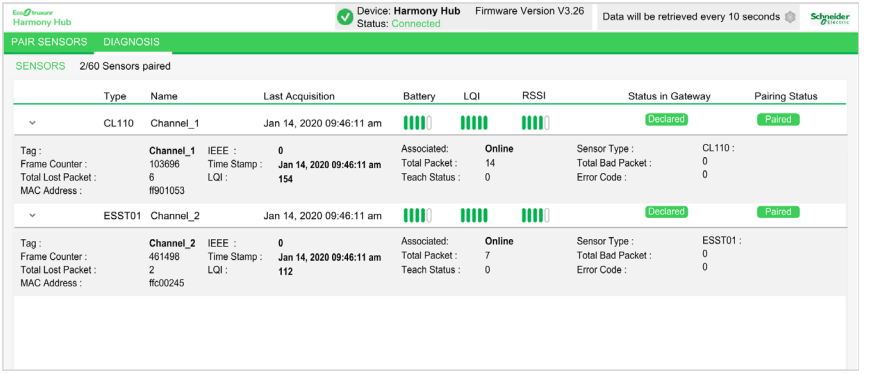
The table shows procedure to pair the sensors (CL110 and ESST01) in Harmony Hub gateway:

Step	Action
1	Click **Add Sensors**. 

Step	Action
2	Declare the sensors in the required fields: • **Channel** • **Name** • **Type** • **MAC Address** • Select the parameters **NOTE:** To declare the sensor, you have to select atleast one parameter. 
3	Check if the Status in gateway is changed to **Declared**. 
4	You can add multiple sensors by clicking **Add Sensors**.

Step	Action
5	Click **Pair sensors**.  **NOTE:** The sensor takes maximum 120 seconds to connect to the SE Harmony Hub node. You can pair maximum 60 sensors at a time. **NOTE:** While pairing single sensor, you can not abort the process. For multiple sensors, if you want to abort, the pairing for the on-going sensor is completed and the process stops.

Step	Action
6	To pair CL110 and ESST01 sensors to Harmony Hub gateway, follow the step given below: ● Press the highlighted button till three LED flashes to reset the sensor. ● Press highlighted button till two LED flashes to start pairing process. ● Within 120 seconds, the sensor will be paired to the gateway.  CL110  ESST01 **Result**: Pairing status is changed to **Paired**. **NOTE:** To pair other sensors (Power tag, E-cube) you need not wait for LED blinks.
7	The data for the selected sensor parameters are received from the gateway and the data is converted to Common Message Structure (CMS) format *(see page 120)*. 

Step	Action
8	Expand highlighted option to monitor the selected parameters.  **Result**: Once the sensor is paired, all parameters are displayed.
9	Click **DIAGNOSIS** tab to diagnose the paired sensors. For example: 

Chapter 7
Context Monitoring Use Case

What Is in This Chapter?

This chapter contains the following topics:

Context Monitoring

Overview

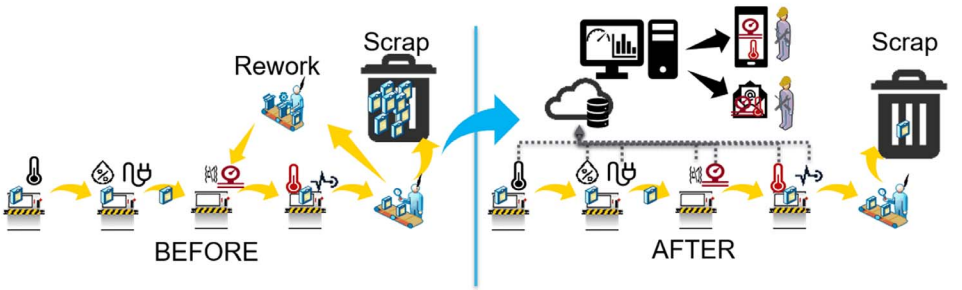
Imagine a production line in a plant with several devices that are subjected to drift. Such device drifts include scraps and rework. This means waste of time, waste of money and sometimes loss of consumers if they are not delivered on time and at a good quality standard.

Our value proposition is to provide a solution for monitoring process parameters from upstream to downstream. To do so, the solution proposed is as follows:

- Collects secondary sensing process parameters (wireless Zigbee sensors), hence the use of the SE Harmony Hub node.
- Use alert system to prevent quality issues based on supplier specifications or people experience.

SE Aveva Insight node collects data in CMS format *(see page 120)* from collection node (SE Harmony Hub), converts it into SE Aveva Insight data format and pushes the data to the Aveva Insight cloud. Enable the **SET ALERT** function in Aveva Insight cloud to receive the data in specific time intervals.

The following figure shows the context monitoring use case with before/after situation:



Context Monitoring Use Case

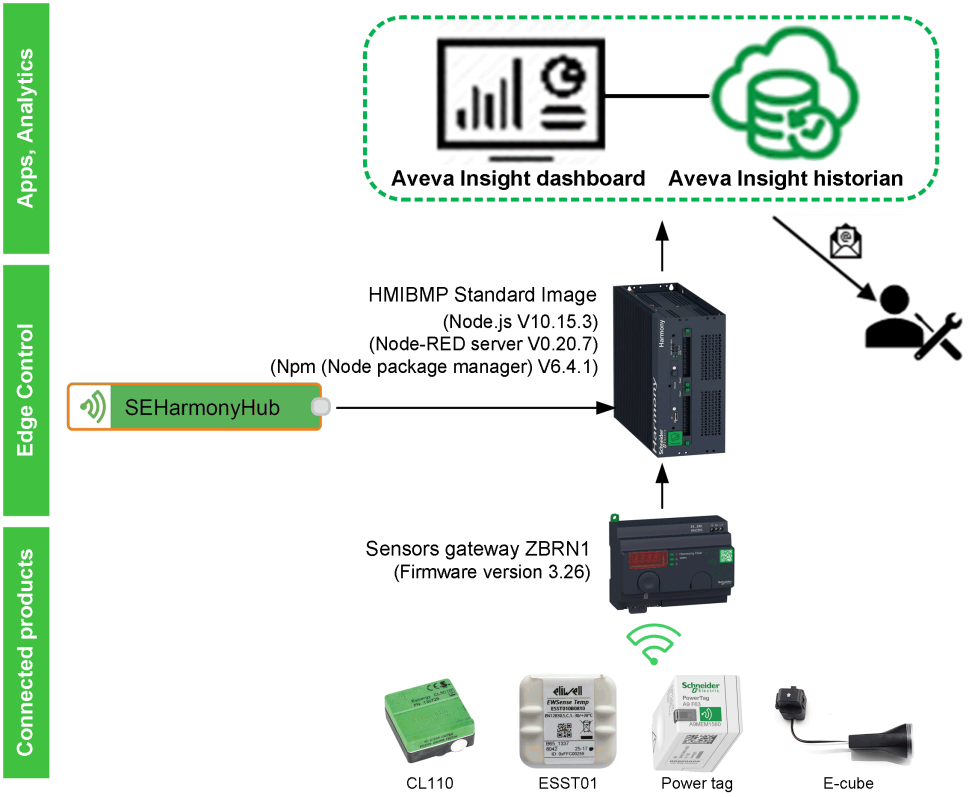
The pain is reduced by using a collection node (SE Harmony Hub) and a publishing node (SE Aveva Insight).

Below given are the steps performed by Engineers:

- **Automation Engineer**:
  - installs node.
  - installs sensors on the machine to be monitored and pair them to Harmony Hub gateway.
  - creates data flow.
- **Maintenance Engineer**:
  - creates an account in AVEVA Insight.
  - creates dashboard in AVEVA Insight.

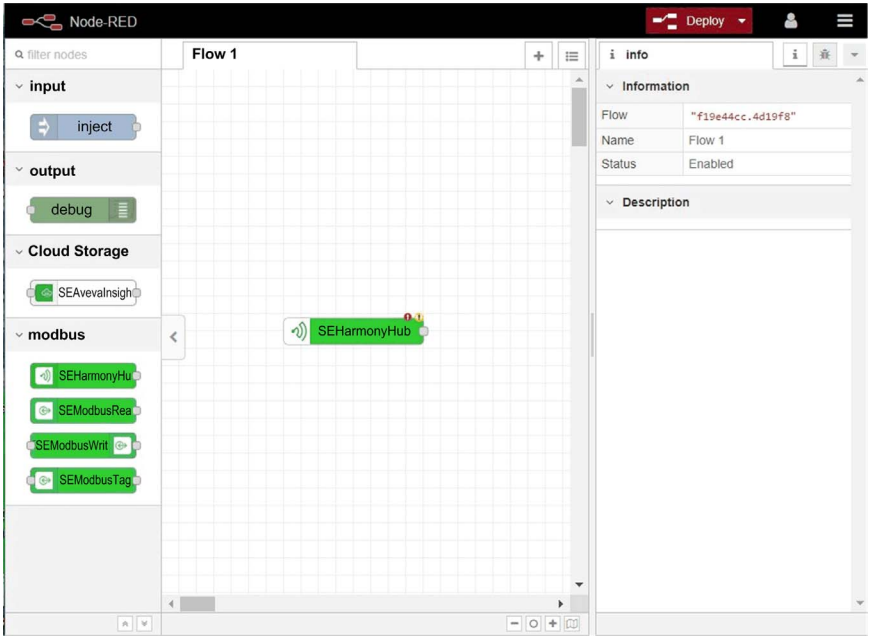
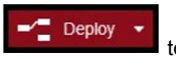
- logs in AVEVA Insight and configures the threshold for the collected variables.
- activate alerts triggering.

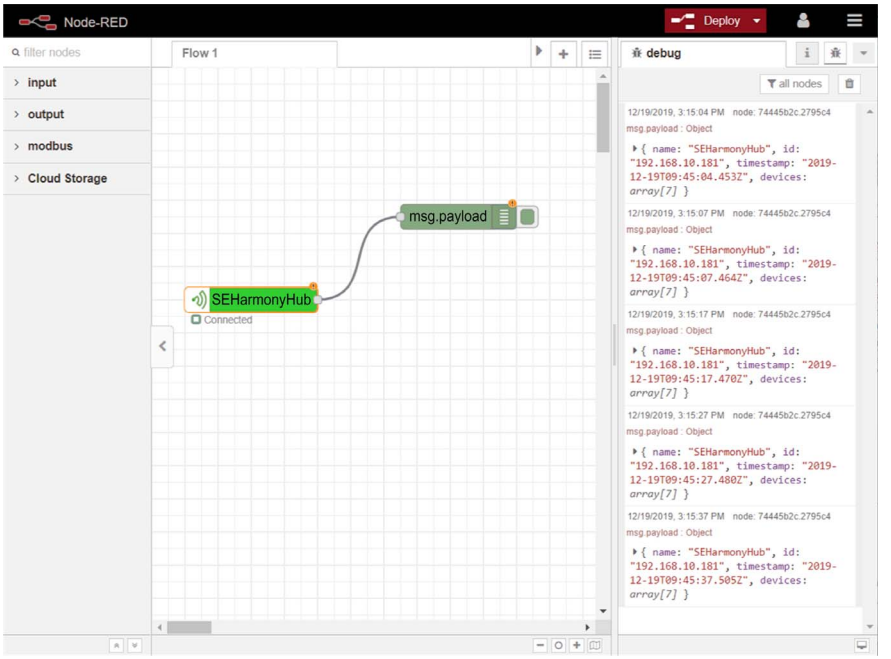
The following figure shows an architecture of context monitoring use case:



SE Harmony Hub Node Usage

The procedure for SE Harmony Hub node usage is given below:

Step	Action
1	Launch the Node-RED server and SE Harmony Hub node *(see page 97)*.
2	Drag and drop the SE Harmony Hub node on the flow as shown below: 
3	Double-click SE Harmony Hub node. **Result**: **Edit SEHarmonyHub node** opens.
4	Configure SE Harmony Hub node *(see page 102)* and click **Harmony Hub Web**. **Result**: **Harmony Hub Web** landing page appears in new tab.
5	Launch the **Harmony Hub Web** page *(see page 97)*.
6	Click **Done** and **Deploy**  to save the changes. **Result**: The nodes status changes to **Connected**.
7	Once the sensors are paired in **Harmony Hub Web** page, the node output data is available in Common Message Structure (CMS) format *(see page 120)* which is pushed to publishing node.

Step	Action
8	Below is an example to push the data of SE Harmony Hub node to the debug node. 

Common Message Structure (CMS)

A Node-RED flow works by passing messages between nodes. All messages are conformed in a common message format to simplify the navigation of the message content. The messages are simple JavaScript objects that can have any set of properties.

To avoid any intermediate function nodes, CMS is standard JSON format between a connecting node and a publishing node. JSON is a standard way for representing a JavaScript object as a string. It is commonly used by web APIs to return data.

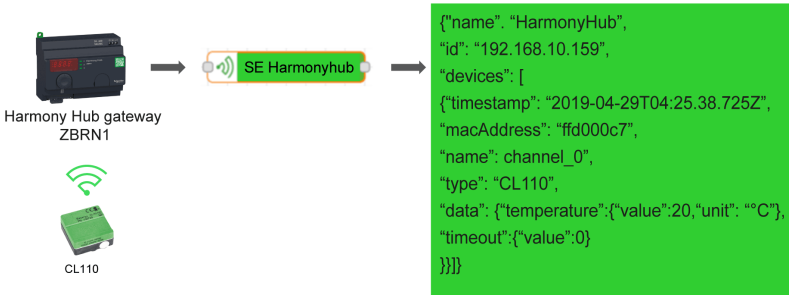
The following is the CMS structure:

Field	Description
Name	Name of the node.
Id	Unique Identifier of the device.
Timestamp	The exact time at which the read or write operation is performed by the node.
Devices	Applicable for Harmony Hub sensor. All nested objects consists of one or many Device objects.

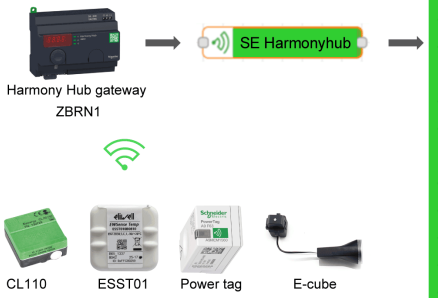
Field	Description
Data	Object at root level and as a composite inside devices object. It contains at least one property object.
Error	Detected error at the root level, not tied to any parameter. ● Scenario 1: Gateway disconnected. ● Scenario 2: Gateway timed out. ● Scenario 3: Modbus port not opened. ● Scenario 4: Gateway connected. Read Error encountered.
Property	If data object exists, then atleast one property (value) is mandatory. This is mapped to the parameter details. It contains Error, Value, Unit, Type.
Error	Local detected error pertaining to the parameter. ● Scenario 1: No Radio (at a sensor level) ● Scenario 2: Parameter Read Error encountered. (e.g.: FF, FFFF, FFFFFFFF) ❍ Value: When mandatory, always in case of success. When optional, in case of error. ❍ Unit - optional field ❍ Type- optional field

The following graphics are an example of CMS input data:

Example 1: One gateway (**associated with one sensor**) is connected directly through SE Harmony Hub node.



Example 2: One gateway (**associated with multiple sensors**) is connected directly through SE Harmony Hub node.



{"macAddress":"ff900e53","name":"channel_0","type":"CL110","data":
{"RSSI":{"value":-60,"unit":"dBm","type":"int"},"TimeOut":
{"value":0,"type":"int"},"Timestamp":
{"value":"2020-02-13T06:05:26.343Z","type":"string"},"Temperature":
{"error":"Parameter Read Error encountered","unit":"°C","type":"float"},
"Battery":
{"value":2.8,"unit":"V","type":"float"},"Humidity":
{"value":36.25,"unit":"%","type":"float"}}}

{"macAddress":"ffc00245","name":"channel_1","type":"ESST01","data":
{"RSSI":{"value":-63,"unit":"dBm","type":"int"},"TimeOut":
{"value":0,"type":"int"},"Timestamp":
{"value":"2020-02-13T06:05:47.670Z","type":"string"},"Battery":
{"value":2.8,"unit":"V","type":"float"},"Temperature":
{"value":25.71,"unit":"°C","type":"float"}}}

NOTE: Here we have shown SE Harmony Hub node output for two sensors only.Output may vary if you use multiple sensors paired to Harmony Hub gateway.

Part IV
IIoT and Cybersecurity

Chapter 8
IIoT and Cybersecurity

Cybersecurity

Overview

Because of the IIoT design, industrial and control systems are increasingly vulnerable to cyber-attacks for the following reasons:

- Magelis Edge Box and Magelis iPC are commercially available in the market.
- Publishing nodes can be remotely accessible.
- IIoT designs are a strategic location in the industrial processes that is of interest to hackers.

To secure the industrial installation, the following fundamental characteristics should be considered:

- Availability of the system to help ensure that the system remains operational
- Integrity of the data to maintain the integrity of information
- Confidentiality to avoid information disclosure

General Practices

To keep the system as secured as possible, secure the environment where the Box is installed.

Unauthorized persons may gain access to the Magelis iPC and Magelis Edge Box as well as to other devices on the network/fieldbus of the machine and connected networks via insufficiently secure access to the software and networks.

Before creating user login details, cross-check again if it is necessary to give access to others. Users may have one of two permissions (*-full access/read-only access). Admin login and password details must be secured.

To avoid unauthorized access to the Magelis iPC and Magelis Edge Box, you must have the:

- Operating system, libraries, runtime environments, etc. are installed and correctly configured.
- Patch management controls to ensure that all software is kept up-to-date.
- Configuration change management controls.
- Malicious code detection and prevention controls, for example:
  - Anti-virus signature and pattern updates are applied in a timely fashion.
  - Application whitelisting.
- Access control and permission management.
- Backup and restore functionality.
- Area where the Box is placed must be physically protected to keep the device as safe as possible.

- Authentication and authorization enabled for Node-RED environment.
- SSL enabled to secure Node-RED in Windows platform *(see page 48)*. By default, SSL is enabled to secure Node-RED in the HMIBSC boxes.

Cybersecurity Certification

Schneider Electric developed cybersecurity guidelines based on the following recommendations:

- ISA Secure.