

Integrating Third Party Devices with **Cisco FND & OpenCSMP**

Modification History

Revision	Date	Originator	Comments
1	15 Nov 2024	Manojna, Vinodh	Initial draft
2	01 Mar 2025	Manojna	Added Caveats, Glossary and reformatted sections
3	25 Jul 2025	Manojna	Updated OpenCSMP prerequisites section

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1. Prerequisites

1.1 FND Installation

Install FND version 5.0.0-70 RPMs.

Refer: https://www.cisco.com/c/en/us/td/docs/routers/connectedgrid/iot_fnd/install/oracle/b-cisco-iot-fnd-install-guide-oracle-r43x/m-installing-iot-fnd-rpm-for-the-first-time--oracle-only-deployment.html

1.2 OpenCSMP:

Download latest v1.0.0 release: <https://github.com/CiscoDevNet/csmp-agent-lib/releases/tag/v1.0.0>

Cisco DevNet Github repository: <https://github.com/CiscoDevNet/csmp-agent-lib>

Refer: [README](#), [CSMP Developer Tutorial - 0v11.pdf](#)

1.3 Signing CSMP POST messages:

1. If the CSMP agent is enabled with signature settings, ensure that FND has HSM or SSM modules installed with the certificates. Refer the below FND documentation links for SSM and HSM installation:

https://www.cisco.com/c/en/us/td/docs/routers/connectedgrid/iot_fnd/install/oracle/b-cisco-iot-fnd-install-guide-oracle-r43x/m-installing-iot-fnd-rpm-for-the-first-time--oracle-only-deployment.html#Cisco_Concept.dita_09694780-0e30-418c-a852-215b7f45bc36

https://www.cisco.com/c/en/us/td/docs/routers/connectedgrid/iot_fnd/install/oracle/b-cisco-iot-fnd-install-guide-oracle-r43x/m-generating-and-installing-certificates1.html#Cisco_Concept.dita_b0b9e74f-f70a-442b-aa5f-62e9e68ac810

2. Registering Third-Party Devices in IoT FND

Follow the below steps to create a new device type metadata for a TPD:

Step 1 Run the addGenericEndpoints.sh script in opt/cgms/bin directory. The system prompts for the device type name.

Step 2 Provide an alphanumeric name. The script creates the endpoint-meta directory under opt/cgms/server/cgms/conf directory, if not present already. If the name of the new device type is provided as endpointdevice1, then the sub directory is created under endpoint-meta directory as:

opt/cgms/server/cgms/conf/endpoint-meta/endpointdevice1

The addGenericEndpoints.sh script copies all the template files from endpoint-meta-templates directory, renames them as per the device type name provided and moves it under new device type directory.

Note: Addition or removal of existing set of template files is not allowed.

Step 3 Edit the opt/cgms/server/cgms/conf/endpoint-meta/endpointdevice/endpointdevice1Meta.json file to update the metadata of the device type required for registration of new device.

```
{
  "device_info": {
    "device_type": " ",
    "device_function": " ",
    "device_description": " ",
    "display_string": " ",
    "pids": [ ] ,
    "vendorId": " ",
    "vendorName": " ",
    "configure_vendortlv": "",
    "device_actions": [
      "reboot",
      "ping",
      "traceroute",
      "inventory",
    ],
    "hw_info": " "
  }
}
```

The description for each field is provided below:

- **device_type** : Enter alphanumeric characters for the name of the device type to be registered (Eg: endpointdevice1).
- **device_function** : Mention any of the existing mesh functions. The list of device functions currently supported in IoT FND are meter (1), extender (2), gateway (3), cge (4), root (5), controller (6), sensor (7), networknode (8), gasmeter (9). entPhysicalFunction field in Hardware Description TLV11 should report one of the above device functions.
- **device_description** : Provide a brief information about the device type.

- **display_string** : Enter the display name for the endpoint device as it is to be displayed in the left side tree of the Field Devices page under Endpoint category. The display string is in the format <device function>-<display string> (Eg: METER-ENDPOINTDEVICE1).
- **pids** : (optional) Enter the device pids as comma separated values (for example, “spid1”, “spid2”).
- **vendorId**: Enter the vendorId which is used in Vendor TLV 127. Vendor Id are based on IANA PEN assignments. IANA PEN assignments for VendorTLV is defined in [iana_pen.h](#) in the OpenCSMP code which is based on IANA PEN registry here <https://www.iana.org/assignments/enterprise-numbers/>
- **vendorName**: Enter the vendor name which corresponds to the vendorId.
- **device_actions** : (optional) This indicates the supported actions that could be performed for this device. The default set of actions are
 - **Ping** : The Ping button is used to send a ping to the device to determine its network connectivity.
 - **Traceroute** : The Traceroute button is used to trace the route to the device.
 - **Refresh Metrics** : The Refresh Metrics button is used to manually update the metrics of the device.
 - **Reboot** : The reboot button is used to reboot the device.
 - **Sync Config Membership** : The Sync Config Membership button is used to synchronize the config membership for this device.
 - **Sync Firmware Membership**: The Sync Firmware Membership button is used to synchronize the firmware membership for this device.
- **configure_vendortlv** : Enter true for FND to support config push of Vendor TLV 127.
- **hw_info** : Enter the hardware id for this device type which is present in the compatible firmware image header. Currently FND 5.0.0-70 allows users to have a unique 1:1 mapping between the device_type and hw_info. For example: All the methane sensors with the same hw_info can be onboarded using a unique device_type namely methane_sensors followed by a specific suffix which are unique to these methane sensors.

Step 4 Start IoT FND after adding or updating the metadata files. IoT FND reads the endpoint-meta directory and creates the appropriate tables in IoT FND for each device type. In case of any issues during IoT FND start up, it logs the errors in server.log and continues with the startup process.

Step 5 Once IoT FND is restarted, you can add the devices to IoT FND by importing the csv file containing the EID and devicetype newly created above.

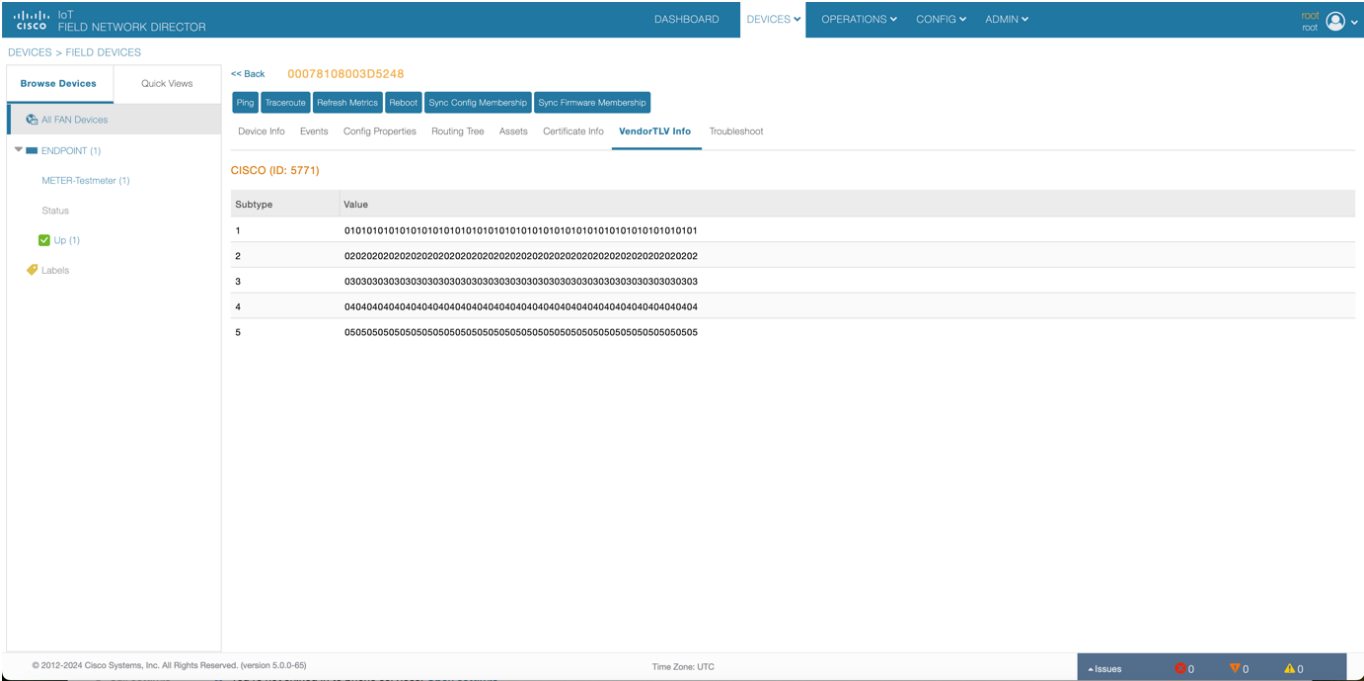
For more info about adding endpoints, see [Adding Routers, Head-End Routers, IC3000 Gateway, Endpoint and Extenders and IR500 in Bulk](#). On addition, the device gets listed under Endpoints Category in the Field Devices page.

The below screenshot depicts the metadata of the sample device type created.

```
[root@iot-fnd-oracle testmeter]# cat testmeterMeta.json
{
  "device_info": {
    "device_type": "testmeter",
    "device_function": "meter",
    "device_description": "Its a test meter",
    "display_string": "testmeter",
    "pids": ["OPENC SMP"],
    "vendorId": "5771",
    "vendorName": "CISCO",
    "configure_vendortlv": "true",
    "hw_info": "OPENC SMP",
    "device_actions": [
      "reboot",
      "ping",
      "traceroute",
      "inventory"
    ]
  }
}
```

3. Field Devices Page

A new tab “VendorTLV Info” in the device inventory page displays the vendor TLV details along with vendor name as: vendor-name (vendor-id) Eg: Cisco (ID: 5771) , where ID is the IANA PEN of the Vendor received by FND from CSMP agent during device registration.



4. Config Group

The new endpoint devices shall show up in the UI with the default group name (default-deviceType). The config is read from the template meta data file(default<deviceType>Template.json). Any changes in the template meta data file will get reflected in the default group.

Below is the default config template supported as part of the metadata file

“default<deviceType>Template.json” where now VendorTlv should be added as part of periodic metrics to fetch Vendor TLV during periodic metric refresh.

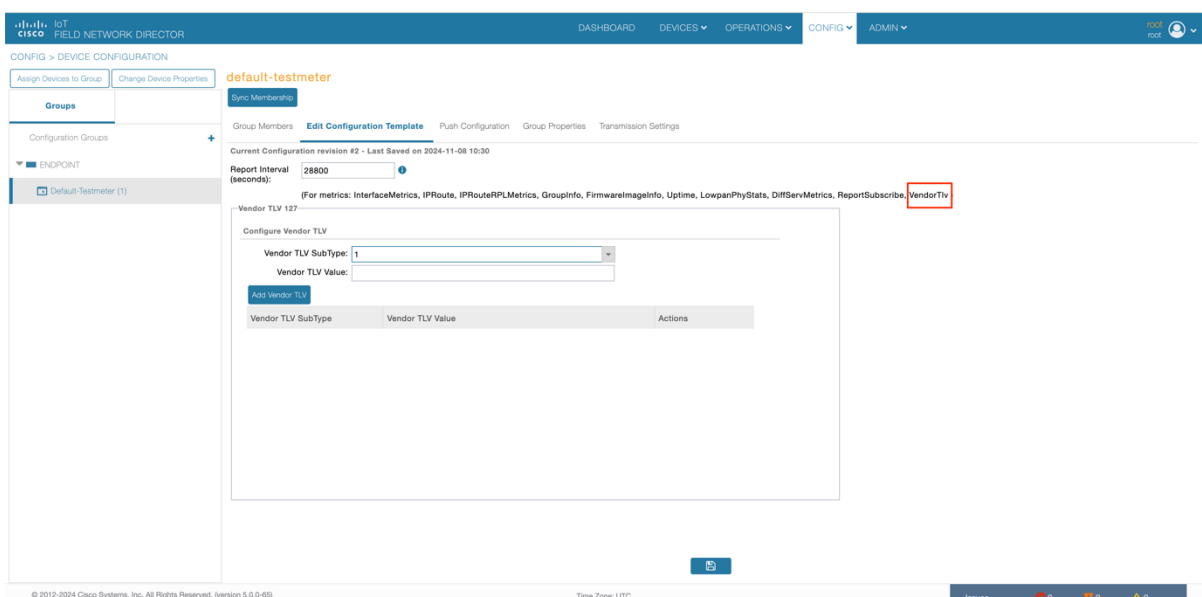
For the VendorTlv to be subscribed as part of the periodic metric refresh, VendorTlv must be added to the “default<deviceType>Template.json” file as indicated below.

```
[root@iot-fnd-oracle testmeter]# cat defaulttestmeterTemplate.json
[{
  "name": "ReportSubscribe",
  "value": {
    "interval": 28800,
    "tlvid": ["InterfaceMetrics", "IPRoute", "IPRouteRPLMetrics", "GroupInfo", "FirmwareImageInfo", "Uptime", "LowpanPhyStats", "DiffServMetrics", "ReportSubscribe", "VendorTlv"]
  }
}]
[root@iot-fnd-oracle testmeter]# cat defaulttestmeterTemplateNoIPRoute.json
[{
  "name": "ReportSubscribe",
  "value": {
    "interval": 28800,
    "tlvid": ["InterfaceMetrics", "GroupInfo", "FirmwareImageInfo", "Uptime", "LowpanPhyStats", "DiffServMetrics", "ReportSubscribe", "VendorTlv"]
  }
}]
[root@iot-fnd-oracle testmeter]#
```

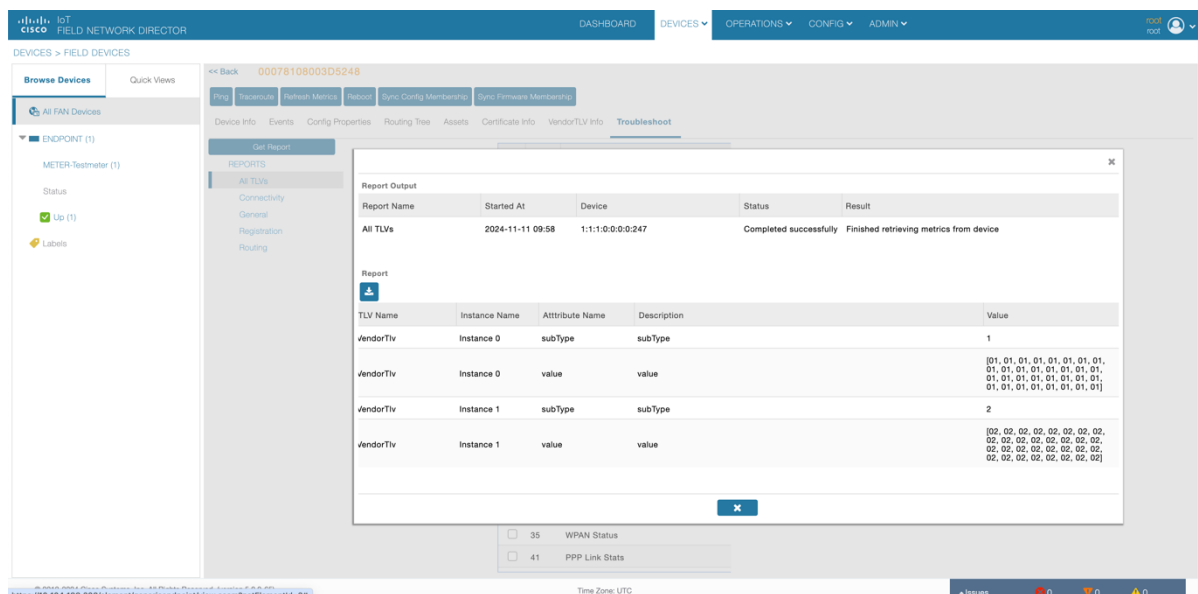
5. Push Config

Config changes can be pushed to devices. Changing the report interval and pushing the config to new endpoint devices .

Changing the Vendor TLV 127 details and pushing the config to the new endpoint devices and retrieving the Vendor TLV 127 details as part of refresh metrics. The vendor TLV subtype can be selected from the dropdown box(non editable) containing the supported subtypes read during the registration.



GET operation of Vendor TLV 127 can be done in FND in the troubleshooting tab.



6. Firmware Upgrade

Firmware image for a particular device will have the header containing the metadata of the image. Below are the metadata fields in the firmware image header which are read by FND.

hdrVersion	mandatory
hdrLen	mandatory
appRevMajor	mandatory
appRevMinor	mandatory
appBuild	mandatory
appLen	mandatory
appName	mandatory
appGitBranch	not mandatory
appGitCommit	not mandatory
appGitFlag	not mandatory
appBuildDate	mandatory
hwld	mandatory
kernelVersion	not mandatory

Upload firmware image to FND

- Choose CONFIG > Firmware Update -> Images -> PLC-RF
- Click on + (plus icon) next to the FIRMWARE IMAGES heading to browse the firmware from your local system.
- Browse and click on Add file.

IoT FIELD NETWORK DIRECTOR

 DASHBOARD DEVICES OPERATIONS CONFIG ADMIN

CONFIG > FIRMWARE UPDATE

Assign devices to Group

Groups

Images

FIRMWARE IMAGES

▼ ENDPOINT

- RF
- PLC
- BBU
- LMAC
- PLC-RF**
- IOx-IP500

PLC-RF

Firmware Images

Name	Version	Hardware ID	Vendor Hardware ID	Kernel Version	Size	Active Download?
No data is available to display						

No data to display | Page 1 of 1 | 50

© 2012-2024 Cisco Systems, Inc. All Rights Reserved. (version 5.0.0-68)
 Time Zone: UTC
 Issues 0 0 0

Add Firmware Image to: endpoint

File: Browse

Add File

Upload firmware image to the devices group

- Choose CONFIG > Firmware Update
- Click the Groups tab (left-pane).
- Select the Endpoint firmware group to update.
- In the right panel, select Firmware Management and then click the Upload Image button. In the entry panel that appears, do the following:
 - From the Select Type drop-down menu, choose the firmware type for your device. - PLC-RF
 - From the Select an Image drop-down menu, choose the firmware bundle to upload
 - Click Upload Image.

Schedule install and reload the device with the uploaded firmware image

- Click the Schedule Install and Reload button (Calendar icon)
- In the page that appears, specify the date and time for the installation of the image and rebooting of device.
- Click the Set Reboot Time button.
- The device will reboot at the time that the user has entered and will come up with the uploaded firmware image.

CONFIG > FIRMWARE UPDATE

Assign devices to Group

Groups Images

Firmware Groups

▼ ENDPOINT

Default-Testmeter (1)

default-testmeter

Firmware Management Devices Logs Transmission Settings

Upload Image

Current Status: Upload Finished

Image: opencsmp-node-6.9.99-OPENC SMP (PLC-RF)

Uploaded/Devices: 1/1

Error/Devices: 0/1

Not Synced/Devices: 0/1

Sync Membership

% Completed

Filter by: Subnet

ALL (2) | PLC-RF (2)

Image	Uploaded	Running	Backup	Boot Loader	LMAC	BBU	Third Party	Status	Scheduled Reload	Actions
opencsmp-node-6.9.99-OPENC SMP	1	0	0	0	0	0	0			
opencsmp-node-OPENC SMP	0	1	0	0	0	0	0			

Schedule Install and Reload



Set reload time for devices:

2024-11-22 06:30

For Group:default-testmeter
With Image:opencsmp-node-6.9.99-OPENC SMP
(Your Time Zone : UTC)

Set Reboot Time

Close

Set firmware image as backup.

- Click the Set as Backup button.
- Click Yes to confirm backup.

IoT FIELD NETWORK DIRECTOR

DASHBOARDDEVICES↓OPERATIONS↓CONFIG↓ADMIN↓

root root

CONFIG > FIRMWARE UPDATE

Assign devices to Group

Groups

Images

Firmware Groups

ENDPOINT

Default-Testmeter (1)

default-testmeter

Firmware Management

Devices

Logs

Transmission Settings

Upload Image

Current Status: Upload Finished

Image: opencsmp-node-6.9.99-OPENC SMP (PLC-RF)

Uploaded/Devices: 1/1

Error/Devices: 0/1

Not Synced/Devices: 0/1

Sync Membership

% Completed

Filter by: Subnet

39

1

0

1-10

11-20

21-30

31-40

41-50

51-60

61-70



71-80

81-90

91-99

100

ALL(2) | PLC-RF(2)

Image	Uploaded	Running	Backup	Boot Loader	LMAC	BBU	Third Party	Status	Scheduled Reload	Actions
opencsmp-node-6.9.99-OPENC SMP	1	0	0	0	0	0	0			
opencsmp-node-OPENC SMP	0	1	0	0	0	0	0			

Confirm



Set Image: "opencsmp-node-6.9.99-OPENC SMP" as Backup for group:"default-testmeter"?
This operation will skip devices that don't have backup slot

Yes

No

Cancel reload of the scheduled firmware image

- Click the Cancel Reload button.
- Click Yes to confirm Cancel Reload.

IoT FIELD NETWORK DIRECTOR

DASHBOARDDEVICES↓OPERATIONS↓CONFIG↓ADMIN↓

root root

CONFIG > FIRMWARE UPDATE

Assign devices to Group

Groups

Images

Firmware Groups

ENDPOINT

Default-Testmeter (1)

default-testmeter

Firmware Management

Devices

Logs

Transmission Settings

Upload Image

Current Status: Reload Scheduling Finished

Image: opencsmp-node-6.9.99-OPENC SMP (PLC-RF)

Reloaded/Devices: 0/1



Error/Devices: 0/1

Not Synced/Devices: 0/1

Sync Membership

Cancel Reload

ALL(2) | PLC-RF(2)

Image	Uploaded	Running	Backup	Boot Loader	LMAC	BBU	Third Party	Status	Scheduled Reload	Actions
opencsmp-node-6.9.99-OPENC SMP	1	0	0	0	0	0	0		2024-11-22 07:49:00 - 1	
opencsmp-node-OPENC SMP	0	1	0	0	0	0	0			



Cancel Reload Image: "opencsmp-node-6.9.99-OPENCSMP (PLC-RF)"
on group:"default-testmeter"?

Yes

No

7. Caveats:

1. Creation of duplicate device types is not allowed.
2. A unique 1:1 mapping needs to exist between device_type and hw_info.
3. Removal of already created device type is currently not supported. Please create a new device type instead.

8. Glossary:

- | | |
|-------------|----------------------------------|
| 1. FND | Cisco Field Network Director |
| 2. OpenCSMP | Opensource CSMP Agent library |
| 3. CSMP | CoAP Simple Management Protocol |
| 4. CoAP | Constrained Application Protocol |
| 5. TPD | Third Party Device |
| 6. TLV | Type Length Value |