

Integrated Services Routers 4000 Series Digital Voice Configuration Example

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Introduction

This document provides an introduction to the Network Interface Modules (NIM) on the newest generation of Cisco routers and how to set them up. It also covers the new configuration of Primary Rate Interface (PRI) circuits and clocking on this new platform.

The Cisco Integrated Services Routers (ISR) 4000 Series are available in these models:

- Cisco ISR4461
- Cisco ISR4451
- Cisco ISR4431
- Cisco ISR4351
- Cisco ISR4331
- Cisco ISR4321

The sections in this documentation apply to all platforms unless explicitly stated otherwise. The document talks about PRI configuration on these platforms and common issues faced.

Prerequisites

Requirements

There are no specific requirements for this document.

Components Used

This document is not restricted to specific software and hardware versions.

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, make sure that you understand the potential impact of any command.

NIM

Cisco IOS® XE Release 3.9S and higher supports Cisco's Fourth-Generation T1/E1 Voice and WAN NIM, which are needed in order to configure voice or data over T1/E1.

Types

The list of available Cisco T1/E1 NIMs are as follows:

Part Number	Description
NIM-1MFT-T1/E1	1-port multi-flex trunk voice/clear-channel data T1/E1 module
NIM-2MFT-T1/E1	2-port multi-flex trunk voice/clear-channel data T1/E1 module
NIM-4MFT-T1/E1	4-port multi-flex trunk voice/clear-channel data T1/E1 module
NIM-8MFT-T1/E1	8-port multi-flex trunk voice/clear-channel data T1/E1 module
NIM-1CE1T1-PRI	1-port multi-flex trunk voice/channelized data T1/E1 module
NIM-2CE1T1-PRI	2-port multi-flex trunk voice/channelized data T1/E1 module
NIM-8CE1T1-PRI	8-port multi-flex trunk voice/channelized data T1/E1 module

Limitations

The NIM cards are supported only on the Cisco ISR 4000 Series. The NIM Multiflex Trunk (MFT) modules use only Packet Voice Digital Signal Processor Module 4 (PVDM4) Digital Signal Processors (DSPs). The older PVDM2s and PVDM3s are not supported on these platforms.

Clocking

When the NIM is used for voice applications, all voice T1/E1s have to be synchronized to a single clock source and any difference in clocks risk clock slips or interface flaps. When the NIM is used for mixed data and voice applications, each data port can use an independent clock and the voice ports can use a clock source independent from the data ports.

Network synchronization is supported for NIMs when you enter the **network-clock**

synchronization automatic command in global configuration mode. This command is made ineffective for a particular NIM if you enter the **no network-clock participation slot / subslot** command. The **network-clock input-source priority controller [t1|e1] slot/bay/port** command is used in order to configure the primary clock source.

You can enter the **show network clocks synchronization** command in order to check the network clocks on the router and the **show platform hardware subslot 0/2 module device networkclock** command in order to verify if a module participates in backplane clock.

PVDM4

The Cisco PVDM4 is installed on a slot on the motherboard or on a Cisco Fourth-Generation T1/E1 Voice and WAN Network Interface Module.

Note: ISR 4461 does not have any motherboard slots

Types

The PVDM4 comes in different flavors.

Name	Description
PVDM4-32	32-channel, high-density, voice DSP module
PVDM4-64	64-channel, high-density, voice DSP module
PVDM4-128	128-channel, high-density, voice DSP module
PVDM4-256	256-channel, high-density, voice DSP module

Supported Channels

This is a list of the number of channels supported on the various flavors of the PVDM4 categorized by the complexity of the codecs that are supported.

Complexity	PVDM4-32	PVDM4-64	PVDM4-128	PVDM4-256
Low-Complexity Voice	32	64	128	256
Medium-Complexity Voice	24	48	96	192
High-Complexity Voice	16	32	64	128

Installation

Unlike previous generations of PVDM2 and PVDM3 DSP modules, the PVDM4 modules are installed directly on the T1/E1 NIMs. Dependent upon the number of channels required, the appropriate DSP module is installed on the NIM.

DSP Module	TDM Voice Services	Media Services (Transcoding, Conferencing, etc.)
DSPs on Analog NIM (FXO/FXS)	Fixed on NIM Module	No
PVDM4 DSPs on T1/E1 NIM	Yes	Yes
PVDM4 DSPs on SM/Motherboard Slot	No	Yes

Note: PVDM2 and PVDM3 DSP modules are *NOT* supported on the ISR 4000 series platforms

Software License Requirements

Voice applications require a minimum of the Unified Communications Technology Package. The Cisco 4400 Series has a software package that is similar to that of the ISR G2, which is Right-To-Use (RTU), also known as honor-based.

After 60 days, an evaluation license automatically converts to an RTU license. At that point, it is expected that an RTU license will be purchased for that feature on that platform. This model is the same as that for the ISR G2.

Note: Smart Licensing enabled with 16.10.1a across routing Platforms. (ASR, ISR, CSR, ISRv). [Migrate from traditional licensing to smart licensing](#)

Configure

Commands Syntax

```
card type { t1 | e1 } slot subslot
```

```
network-clock synchronization automatic
```

```
network-clock synchronization participate slot / subslot
```

```
network-clock input-source priority controller [t1|e1] slot/bay/port
```

```
voice-card slot
```

```
codec complexity { flex [ reservation-fixed { high | medium } ]  
| high | medium | secure }
```

```
controller { t1 | e1 } slot / subslot / port
```

```
framing {sf | esf}
```

```
or
```

```
framing {crc4 | no-crc4}
```

```
linecode {ami | b8zs}
```

```
or
```

```
linecode { ami | hdb3 }
```

```
pri-group timeslots timeslot-range [ nfas_d | service ][voice-dsp]
```

Note: NIM-xMFT-T1/E1 - Since the **pri-group** command on the NIM-xMFT-T1/E1 is only used for voice, the keyword **voice-dsp** is not needed.

Note: NIM-xCE1T1-PRI - The option keyword **voice-dsp** is only available to the NIM-xCE1T1-PRI (x could be 1, 2, or 8) on the ISR 4000 series. Default is without the keyword

voice-dsp.

Sample Configuration

```
card type t1 0 2
card type t1 0 3
!
isdn switch-type primary-5ess
!
network-clock synchronization automatic
network-clock synchronization participate 0/2
!
voice-card 0/2
dsp services dspfarm
no watchdog
!
network-clock input-source 1 controller t1 0/2/0
!
controller T1 0/2/0
framing esf
linecode b8zs
clock source line primary
cablelength long 0db
pri-group timeslots 1-24 voice-dsp
!
interface Serial0/2/0:23
encapsulation hdlc
isdn switch-type primary-5ess
no cdp enable
!
voice-port 0/2/0:23
```

Verify

There is currently no verification procedure available for this configuration.

Troubleshoot

Use this section in order to confirm that your configuration works properly.

Issue 1

When you try to configure voice PRI on ISR G4, this error appears:

```
=====
T1 0/1/0: No DSP resources to configure voice feature
=====
```

Solution

There is only one PVDM slot on the motherboard. The Time Division Multiplexing (TDM) cards can not use the motherboard PVDMs. Dependent upon the number of channels required, the appropriate DSP module is installed on the NIM. For IP services such as to transcode and conference, the PVDM4 DSP module can be installed on the motherboard of the ISR 4000 Series

platform.

If the **show inventory** output shows this information, it signifies that the PVDM card is installed on the motherboard.

```
NAME: "PVDM subslot 0/4", DESCR: "PVDM4-32 Voice DSP Module"  
PID: PVDM4-32 , VID: V02, SN: FOC18334AVD
```

Once the PVDM card is placed on the NIM, the **show inventory** command indicates:

```
NAME: "subslot 0/1 db module 0", DESCR: "PVDM4-128 Voice DSP Module"  
PID: PVDM4-128 , VID: V01, SN: FOC17176BLL
```

Issue 2

The T1 module has no DSP as per the **show inventory** command, but this configuration worked:

```
controller T1 0/2/0  
  pri-group timeslots 1-24 service mgcp
```

```
!
```

```
interface Serial0/2/0:23  
  
  isdn bind-13 ccm-manager
```

Solution

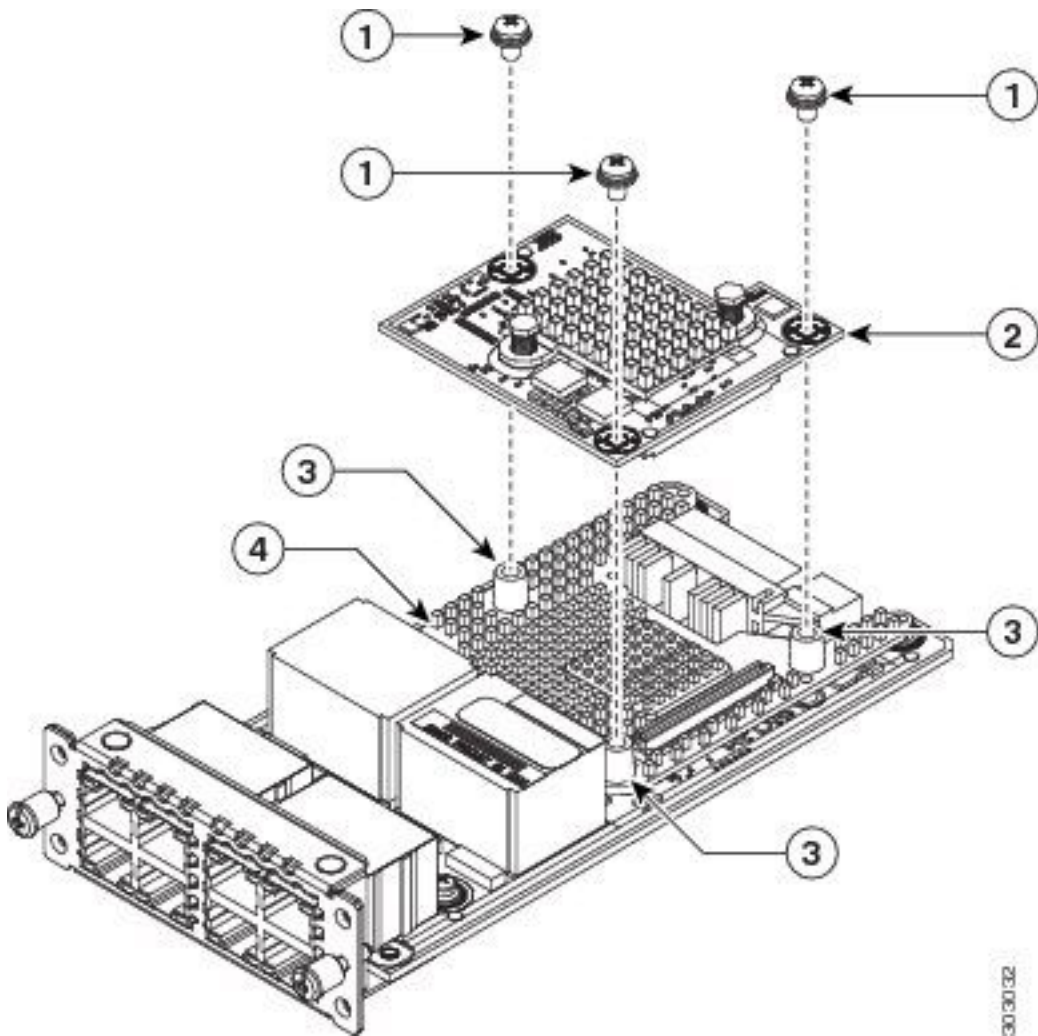
This is a known issue documented in Cisco bug ID [CSCuo86715](#). On all the Cisco IOS-XE Releases earlier than 15.4(3)S1, the previous commands are accepted, even if DSPs are not available on the NIM. Release 15.4(3)S1 has this issue fixed and the user is prompted with the "T1 0/2/0: No DSP resources to configure voice feature" error message if there are no available DSPs on the NIM.

Issue 3

How should the PVDM 4 be installed on a NIM? Are the PVDM4s hot swappable?

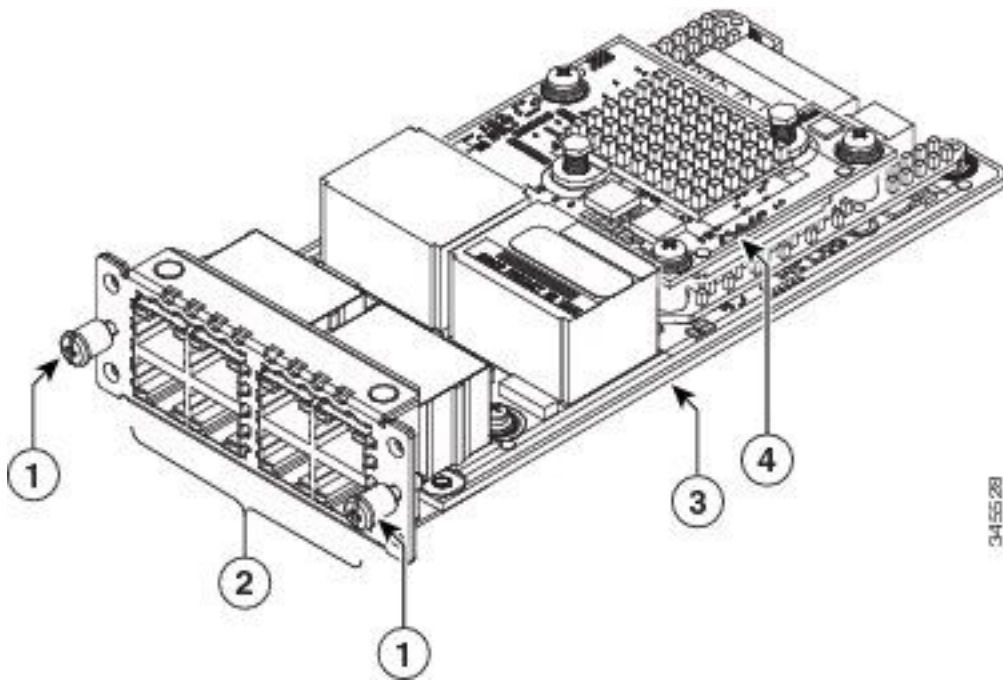
Solution

There are two places where PVDM4 DSPs are installed. For TDM services, the DSP is installed on the T1/E1 NIM. Since the NIMs support online insertion and removal (OIR) they can be removed without powering down the ISR 4000 Series device, and the DSPs on the NIM can be removed. However, the router must be shut down in order to insert or remove a PVDM4 on the motherboard. Follow this schematic representation in order to install the PVDM4 on NIM.



303032

1 Screws 2 PVDM4
3 Standoffs 4 Heatsink



345528

1 Screws 2 Ports
3 Network interface module 4 PVDM4