



DSP Optimization on the Cisco 1751, Cisco 1760, and Cisco 2801 Routers

This document describes optimizing the digital signal processor (DSP) resources among voice services, including transcoding and conferencing, on the Cisco 1751, Cisco 1760, and Cisco 2801 routers. It also describes new software configuration information for changing the codec complexity of analog voice interface cards (VICs).

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DSP Optimization

This section describes the extent of DSP optimization possible on both analog voice cards and digital voice cards when DSPs provide voice services, including transcoding and conferencing.

Cisco 1751 and Cisco 1760 Routers

Cisco 1751 and Cisco 1760 routers use the following PVDMs:

- PVDM-256K-4 (1 DSP)
- PVDM-256K-8 (2 DSPs)
- PVDM-256K-12 (3 DSPs)
- PVDM-256K-16HD (4 DSPs)
- PVDM-256K-20HD (5 DSPs)

Conferencing needs dedicated DSP resources. A DSP will support one conference call with a maximum of six participants. Up to five conferencing calls can be supported on the Cisco 1751 and Cisco 1760 routers.



When conferencing service resources have been allocated, the remaining DSPs can be allocated to the voice and transcoding service requirements. A DSP supports two transcoding channels. Thus, the Cisco 1751 router supports up to 16 transcoding channels, and the Cisco 1760 router supports up to 20 transcoding channels.

DSP usage for voice channel allocation can be optimized by changing the codec complexity of the analog VICs.

With a medium-complexity codec configured:

- One DSP can serve four analog voice ports.
- If one DSP serves only two analog ports (due to an odd number of 2-port analog VICs in the system), one BRI port (2 channels) can also be served by this DSP.

With a high-complexity codec configured:

- One DSP can serve two analog voice ports.

After the DSP channels are assigned to all the analog cards, the remaining unused DSP resources will first be assigned to the BRI ports and then assigned to the T1/E1 channels.

Cisco 2801 Routers

Cisco 2801 routers use the following PVDMs:

- PVDM2-8 (1 DSP)
- PVDM2-16 (1 DSP)
- PVDM2-32 (2 DSPs)
- PVDM2-48 (3 DSPs)
- PVDM2-64 (4 DSPs)

Conferencing needs dedicated DSP resources. A DSP will support eight conference calls on a G.711 codec, or two conference calls on a G.729/G.711 configuration. (The PVDM2-8 will support four conference calls on G.711 or 1 conference call on G.729/G.711.) There is a maximum of eight participants per conference. Up to 30 conferencing calls can be supported on the Cisco 2801 routers.

When conferencing service resources have been allocated, the remaining DSPs can be allocated to the voice and transcoding service requirements. A DSP supports six transcoding channels. The Cisco 2801 router supports up to 30 transcoding channels.

DSP usage for voice channel allocation can be optimized by changing the codec complexity of the analog VICs.

With a medium-complexity codec configured:

- One DSP can serve eight analog voice ports.

With a high-complexity codec configured:

- One DSP can serve six analog voice ports.

After the DSP channels are assigned to all the analog cards, the remaining unused DSP resources will first be assigned to BRI ports and then assigned to T1/E1 channels.

DSP Resource Calculator

The DSP Resource Calculator is a web-based tool that helps the user to calculate the number of DSPs required on the system and that determines the number of calls that can be handled simultaneously using each of the codec standards. Users are required to input information such as the platform type, IOS release number, VIC slot configuration, and the type of codecs they wish to use on these interfaces. The tool then displays the number of DSPs required to run the configuration and generates the necessary configuration that the user would be prompted to input in order to start the system.

To see the DSP Resource Calculator application, refer to the following URL:

www.cisco.com/cgi-bin/Support/DSP/dsp-calc.pl

Codec Complexity

Codec complexity refers to the amount of processing power that a codec compression technique requires. Some codecs require more processing power than others. Codec complexity affects call density, which is the number of calls that can take place simultaneously on the DSP interface.

Codec complexity can be either low, medium, or high. The differences in complexity between these codecs are in the amount of CPU power necessary to run the algorithm and, therefore, the number of voice channels that can be supported by a single DSP.

The Cisco 1751 and Cisco 1760 routers support medium-complexity modes, which serve a maximum of four voice channels. They also support two types of high-complexity (HC) modes: the analog HC mode, which serves two voice channels, and the digital Flexi-6 HC mode, which serves up to six voice channels.

The Cisco 2801 router supports medium-complexity modes which serve a maximum of eight voice channels, high complexity modes which serve six voice channels, and the Flexi mode, which is capable of serving up to 16 voice channels.

Restrictions

The codec complexity feature has the following restrictions:

- Codec complexity can be changed only on analog VICs.
- The complexity type selected by the user can restrict the codecs supported. When medium complexity is selected, the G.723 and G.728 codecs are not supported.
- After the codec complexity command is executed, depending on the DSP resources available, the voice ports on the router can be added, or deleted, or they can remain the same.
- If there are an odd number of analog VICs and one BRI VIC in the system, one BRI port can be served by the medium-complexity DSP while another BRI port can be served by the high-complexity Flexi-6 DSP.

Prerequisites

Before configuring the voice ports, calculate the number of DSPs required to run the configuration and generate the necessary configuration in order to start the system. See the “[DSP Resource Calculator](#)” section on page 3.

Before changing the codec complexity, you must shut down all voice ports. Follow these steps to shut down the voice ports:

1. Remove all ds0-group, pri-group, and cas-custom configurations that add voice ports in the router from all T1 and E1 controllers.
2. Use the **shutdown** command in the BRI interface configuration mode to shut down all the BRI interfaces.
3. Use the **shutdown** command in the voice-card configuration mode to shut down all the analog VICs.

Configuring Codec Complexity

To configure the codec complexity on the analog VIC, use the following commands, beginning in privileged EXEC mode:

	Command	Purpose
Step 1	Router # show voice dsp	Checks the DSP voice channel activity. If any of the DSP voice channels is busy, the codec complexity cannot be changed.
Step 2	Router # show voice port summary	Verifies that all the DSP voice channels are in shutdown state and that no ds0-group is configured in the T1/E1 interfaces. When all the DSP channels are in the idle state, continue to Step 3.
Step 3	Router # configure terminal	Enters global configuration mode.
Step 4	Router(config)# voice-card 0	Enters voice-card configuration mode and specifies that the voice card is in slot 0. In the Cisco 1751 routers, the slot numbers range from 0 to 2; in the Cisco 1760 and Cisco 2801 routers, the slot numbers range from 0 to 3.
Step 5	Router(config-voicecard)# codec complexity { high medium }	(For analog voice ports) Specifies the codec complexity, based on the codec standard being used. The keywords are as follows: <ul style="list-style-type: none"> • high—Specifies two voice channels encoded in the following formats: G.711a-law, G.711u-law, G.723 Annex A(r5.3), G.723 Annex A(r6.3), G.723(r5.3), G.723(r6.3), G.726(r16), G.726(r24), G.726(r32), G.728 G.729(br8), G.729(r8). • medium—Specifies four voice channels encoded in the following formats: G.711a-law, G.711u-law, G.726(r16), G.726(r24), G.726(r32), G.729(br8), G.729(r8). Configuring the codec complexity as medium, blocks the G.723(8) and G.728 voice calls on the voice-card. Using the no form of this command will restore the default.

Verification Example

The following examples show codec complexity verification on the Cisco 1751 and Cisco 1760 routers.

[Example 1](#) and [Example 2](#) show scenarios in which codecs of different complexities are configured on the Cisco 1760 router. In these examples the router has a dual FXS VIC in slot 0 and slot 3, a T1 2-port multiflex VWIC in slot 1, and a dual NT or TE BRI VIC in slot 2.

Example 1

In this example, the FXS analog voice card in slot 0 and slot 3 are both configured with high-complexity codec.

Enter the **show voice dsp** command to check the status of the active voice calls, the number of MIPS consumed, and the DSP assigned to the voice ports:

```
router-1760#show voice dsp
```

DSP TYPE	DSP NUM	CH	CODEC	DSPWARE VERSION	CURR STATE	BOOT STATE	RST	AI	VOICEPORT	TS	PAK ABORT	TX/RX PACK COUNT
C549	000	00	g711ulaw	3.6	Idle	Idle	0	0	0/0		NA 0	9/0
C549	000	01	g711ulaw	3.6	Idle	Idle	0	0	0/1		NA 0	9/0
C549	001	00	g711ulaw	3.6	Idle	Idle	0	0	3/0		NA 0	9/0
C549	001	01	g711ulaw	3.6	Idle	Idle	0	0	3/1		NA 0	9/0
C549	002	00	g711ulaw	3.6	Idle	Idle	0	0	2/0		NA 0	0/0
C549	002	01	g711ulaw	3.6	Idle	Idle	0	0	2/0		NA 0	0/0
C549	002	02	g711ulaw	3.6	Idle	Idle	0	0	2/1		NA 0	0/0
C549	002	03	g711ulaw	3.6	Idle	Idle	0	0	2/1		NA 0	0/0

Active Voice Call details

```
Current total analog signalling channels:4
Current max allowed digital timeslot for voice:48
Current number of DSP group:1
Group 0:
Current allocated analog signalling channels:4
Current free analog signalling channels:0
Current allocated digital signalling channels:4
Current free digital signalling channels:44
Port(s) served:0/0 0/1 1/0 1/1 3/0 3/1 2/0 2/1
Current Available MIPS:1000
```

SPMM	DSPRM	State	Image	D-sig allocate	D-sig free	A-sig allocate	A-sig free	Mips Free	Voice/Xcode Chan
Dsp	Dsp								
0/0	0	UP	FIXHC	0	0	2	0	100	0
0/1	1	UP	FIXHC	0	0	2	0	100	0
0/2	2	UP	FLEX6	4	2	0	0	100	0
0/3	3	UP	FLEX6	0	6	0	0	100	0
0/4	4	UP	FLEX6	0	6	0	0	100	0
1/0	5	UP	FLEX6	0	6	0	0	100	0
1/1	6	UP	FLEX6	0	6	0	0	100	0
1/2	7	UP	FLEX6	0	6	0	0	100	0
1/3	8	UP	FLEX6	0	6	0	0	100	0
1/4	9	UP	FLEX6	0	6	0	0	100	0

Enter the **show voice port summary** command to display summary information for all the voice ports:

```
router-1760# show voice port summary
```

PORT	CH	SIG-TYPE	ADMIN OPER	STATUS	STATUS	EC
=====	==	=====	=====	=====	=====	=====

```

0/0    -- fxs-ls      up  dorm on-hook  idle  y
0/1    -- fxs-ls      up  dorm on-hook  idle  y
2/0    1  bri-voice      up  up  none      none  y
2/0    2  bri-voice      up  up  none      none  y
2/1    1  bri-voice      up  up  none      none  y
2/1    2  bri-voice      up  up  none      none  y
3/0    -- fxs-ls      up  dorm on-hook  idle  y
3/1    -- fxs-ls      up  dorm on-hook  idle  y
1/0:0  01  e&m-wnk        up  dorm idle     idle  y
1/0:0  02  e&m-wnk        up  dorm idle     idle  y
1/0:0  03  e&m-wnk        up  dorm idle     idle  y
1/0:0  04  e&m-wnk        up  dorm idle     idle  y
1/0:0  05  e&m-wnk        up  dorm idle     idle  y
1/0:0  06  e&m-wnk        up  dorm idle     idle  y
1/0:0  07  e&m-wnk        up  dorm idle     idle  y
1/0:0  08  e&m-wnk        up  dorm idle     idle  y
1/0:0  09  e&m-wnk        up  dorm idle     idle  y
1/0:0  10  e&m-wnk        up  dorm idle     idle  y
1/0:0  11  e&m-wnk        up  dorm idle     idle  y
1/0:0  12  e&m-wnk        up  dorm idle     idle  y
1/0:0  13  e&m-wnk        up  dorm idle     idle  y
1/0:0  14  e&m-wnk        up  dorm idle     idle  y
1/0:0  15  e&m-wnk        up  dorm idle     idle  y
1/0:0  16  e&m-wnk        up  dorm idle     idle  y
1/0:0  17  e&m-wnk        up  dorm idle     idle  y
1/0:0  18  e&m-wnk        up  dorm idle     idle  y
1/0:0  19  e&m-wnk        up  dorm idle     idle  y
1/0:0  20  e&m-wnk        up  dorm idle     idle  y
1/0:0  21  e&m-wnk        up  dorm idle     idle  y
1/0:0  22  e&m-wnk        up  dorm idle     idle  y
1/0:0  23  e&m-wnk        up  dorm idle     idle  y
1/0:0  24  e&m-wnk        up  dorm idle     idle  y

```

Example 2

In this example, the FXS voice card in slot 0 is configured with medium-codec complexity, and the FXS voice card in slot 3 is configured with high-codec complexity. The first BRI port shares the DSP with the FXS port in slot 0, and the second BRI port shares the DSP with the T1 port in slot 1.

Enter the **show voice dsp** command to check the status of the active voice calls, the number of MIPS consumed, and the DSP assigned to the voice ports:

```
router-1760#show voice dsp
```

DSP TYPE	DSP NUM	DSP CH	DSP CODEC	DSPWARE VERSION	CURR STATE	BOOT STATE	RST	AI	VOICEPORT	PAK TS	ABORT	TX/RX PACK COUNT
C549	000	00	g711ulaw	3.6	Idle	Idle	0	0	0/0	NA	0	45625/0
C549	000	01	g711ulaw	3.6	Idle	Idle	0	0	0/1	NA	0	45715/0
C549	000	02	g711ulaw	3.6	Idle	Idle	0	0	2/0	NA	0	1447/0
C549	000	03	g711ulaw	3.6	Idle	Idle	0	0	2/0	NA	0	1435/0
C549	001	00	g711ulaw	3.6	Idle	Idle	0	0	3/0	NA	0	45722/0
C549	001	01	g711ulaw	3.6	Idle	Idle	0	0	3/1	NA	0	45824/0
C549	002	00	g711ulaw	3.6	Idle	Idle	0	0	2/1	NA	0	0/0
C549	002	01	g711ulaw	3.6	Idle	Idle	0	0	2/1	NA	0	0/0

Active Voice Call details

```

Current total analog signalling channels:6
Current max allowed digital timeslot for voice:48
Current number of DSP group:1
Group 0:

```

Current allocated analog signalling channels:6
 Current free analog signalling channels:0
 Current allocated digital signalling channels:26
 Current free digital signalling channels:22
 Port(s) served:0/0 0/1 1/0 1/1 3/0 3/1 2/0 2/1
 Current Available MIPS:1000

SPMM	DSPRM	State	Image	D-sig allocate	D-sig free	A-sig allocate	A-sig free	Mips Free	Voice/Xcode Chan
0/0	0	UP	FIXMC	0	0	4	0	100	0
0/1	1	UP	FIXHC	0	0	2	0	100	0
0/2	2	UP	FLEX6	6	0	0	0	100	0
0/3	3	UP	FLEX6	6	0	0	0	100	0
0/4	4	UP	FLEX6	6	0	0	0	100	0
1/0	5	UP	FLEX6	6	0	0	0	100	0
1/1	6	UP	FLEX6	2	4	0	0	100	0
1/2	7	UP	FLEX6	0	6	0	0	100	0
1/3	8	UP	FLEX6	0	6	0	0	100	0
1/4	9	UP	FLEX6	0	6	0	0	100	0

Enter the **show voice port summary** command to display summary information for all the voice ports:

router-1760# **show voice port summary**

PORT	CH	SIG-TYPE	ADMIN	OPER	STATUS	STATUS	EC
0/0	--	fxs-ls	up	dorm	on-hook	idle	y
0/1	--	fxs-ls	up	dorm	on-hook	idle	y
2/0	1	bri-voice	up	up	none	none	y
2/0	2	bri-voice	up	up	none	none	y
2/1	1	bri-voice	up	up	none	none	y
2/1	2	bri-voice	up	up	none	none	y
3/0	--	fxs-ls	up	dorm	on-hook	idle	y
3/1	--	fxs-ls	up	dorm	on-hook	idle	y
1/0:0	01	e&m-wnk	up	dorm	idle	idle	y
1/0:0	02	e&m-wnk	up	dorm	idle	idle	y
1/0:0	03	e&m-wnk	up	dorm	idle	idle	y
1/0:0	04	e&m-wnk	up	dorm	idle	idle	y
1/0:0	05	e&m-wnk	up	dorm	idle	idle	y
1/0:0	06	e&m-wnk	up	dorm	idle	idle	y
1/0:0	07	e&m-wnk	up	dorm	idle	idle	y
1/0:0	08	e&m-wnk	up	dorm	idle	idle	y
1/0:0	09	e&m-wnk	up	dorm	idle	idle	y
1/0:0	10	e&m-wnk	up	dorm	idle	idle	y
1/0:0	11	e&m-wnk	up	dorm	idle	idle	y
1/0:0	12	e&m-wnk	up	dorm	idle	idle	y
1/0:0	13	e&m-wnk	up	dorm	idle	idle	y
1/0:0	14	e&m-wnk	up	dorm	idle	idle	y
1/0:0	15	e&m-wnk	up	dorm	idle	idle	y
1/0:0	16	e&m-wnk	up	dorm	idle	idle	y
1/0:0	17	e&m-wnk	up	dorm	idle	idle	y
1/0:0	18	e&m-wnk	up	dorm	idle	idle	y
1/0:0	19	e&m-wnk	up	dorm	idle	idle	y
1/0:0	20	e&m-wnk	up	dorm	idle	idle	y
1/0:0	21	e&m-wnk	up	dorm	idle	idle	y
1/0:0	22	e&m-wnk	up	dorm	idle	idle	y
1/0:0	23	e&m-wnk	up	dorm	idle	idle	y
1/0:0	24	e&m-wnk	up	dorm	idle	idle	y

Related Documents

For additional information about installing and configuring the Cisco routers, refer to the following documentation:

- *Cisco 17xx Routers Hardware Installation Guide*—provides information on installing the Cisco 17xx routers.
- *Quick Start Guide - Setting up the Cisco 17xx Routers*—provides information for quick installation of the Cisco 17xx routers.
- *Cisco 17xx Routers Software Configuration Guide*—provides sample networks and router configurations for the Cisco 17xx routers.
- *Cisco 2800 Routers Hardware Installation Documentation*—provides information on installing the Cisco 2801 routers.
- *Quick Start Guide - Setting up the Cisco 2800 Routers*—provides information for quick installation of the Cisco 2801 routers.
- *Cisco 2800 Routers Software Configuration Documentation*—provides sample networks and router configurations for the Cisco 2801 routers.
- Cisco IOS Release 12.3 *Configuration Guides and Command References*—provide IOS commands and configurations for your router.

Obtaining Documentation

Cisco documentation and additional literature are available on Cisco.com. Cisco also provides several ways to obtain technical assistance and other technical resources. These sections explain how to obtain technical information from Cisco Systems.

Cisco.com

You can access the most current Cisco documentation at this URL:

<http://www.cisco.com/univercd/home/home.htm>

You can access the Cisco website at this URL:

<http://www.cisco.com>

You can access international Cisco websites at this URL:

http://www.cisco.com/public/countries_languages.shtml

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You can find instructions for ordering documentation at this URL:

http://www.cisco.com/univercd/cc/td/doc/es_inpk/pdi.htm

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- Registered Cisco.com users (Cisco direct customers) can order Cisco product documentation from the Ordering tool:

<http://www.cisco.com/en/US/partner/ordering/index.shtml>

- Nonregistered Cisco.com users can order documentation through a local account representative by calling Cisco Systems Corporate Headquarters (California, USA) at 408 526-7208 or, elsewhere in North America, by calling 800 553-NETS (6387).

Documentation Feedback

You can send comments about technical documentation to bug-doc@cisco.com.

You can submit comments by using the response card (if present) behind the front cover of your document or by writing to the following address:

Cisco Systems
Attn: Customer Document Ordering
170 West Tasman Drive
San Jose, CA 95134-9883

We appreciate your comments.

Obtaining Technical Assistance

For all customers, partners, resellers, and distributors who hold valid Cisco service contracts, Cisco Technical Support provides 24-hour-a-day, award-winning technical assistance. The Cisco Technical Support Website on Cisco.com features extensive online support resources. In addition, Cisco Technical Assistance Center (TAC) engineers provide telephone support. If you do not hold a valid Cisco service contract, contact your reseller.

Cisco Technical Support Website

The Cisco Technical Support Website provides online documents and tools for troubleshooting and resolving technical issues with Cisco products and technologies. The website is available 24 hours a day, 365 days a year at this URL:

<http://www.cisco.com/techsupport>

Access to all tools on the Cisco Technical Support Website requires a Cisco.com user ID and password. If you have a valid service contract but do not have a user ID or password, you can register at this URL:

<http://tools.cisco.com/RPF/register/register.do>

Submitting a Service Request

Using the online TAC Service Request Tool is the fastest way to open S3 and S4 service requests. (S3 and S4 service requests are those in which your network is minimally impaired or for which you require product information.) After you describe your situation, the TAC Service Request Tool automatically provides recommended solutions. If your issue is not resolved using the recommended resources, your service request will be assigned to a Cisco TAC engineer. The TAC Service Request Tool is located at this URL:

<http://www.cisco.com/techsupport/servicerequest>

For S1 or S2 service requests or if you do not have Internet access, contact the Cisco TAC by telephone. (S1 or S2 service requests are those in which your production network is down or severely degraded.) Cisco TAC engineers are assigned immediately to S1 and S2 service requests to help keep your business operations running smoothly.

To open a service request by telephone, use one of the following numbers:

Asia-Pacific: +61 2 8446 7411 (Australia: 1 800 805 227)

EMEA: +32 2 704 55 55

USA: 1 800 553 2447

For a complete list of Cisco TAC contacts, go to this URL:

<http://www.cisco.com/techsupport/contacts>

Definitions of Service Request Severity

To ensure that all service requests are reported in a standard format, Cisco has established severity definitions.

Severity 1 (S1)—Your network is “down,” or there is a critical impact to your business operations. You and Cisco will commit all necessary resources around the clock to resolve the situation.

Severity 2 (S2)—Operation of an existing network is severely degraded, or significant aspects of your business operation are negatively affected by inadequate performance of Cisco products. You and Cisco will commit full-time resources during normal business hours to resolve the situation.

Severity 3 (S3)—Operational performance of your network is impaired, but most business operations remain functional. You and Cisco will commit resources during normal business hours to restore service to satisfactory levels.

Severity 4 (S4)—You require information or assistance with Cisco product capabilities, installation, or configuration. There is little or no effect on your business operations.

Obtaining Additional Publications and Information

Information about Cisco products, technologies, and network solutions is available from various online and printed sources.

- Cisco Marketplace provides a variety of Cisco books, reference guides, and logo merchandise. Visit Cisco Marketplace, the company store, at this URL:
<http://www.cisco.com/go/marketplace/>
- The Cisco *Product Catalog* describes the networking products offered by Cisco Systems, as well as ordering and customer support services. Access the Cisco Product Catalog at this URL:
<http://cisco.com/univercd/cc/td/doc/pcat/>
- *Cisco Press* publishes a wide range of general networking, training and certification titles. Both new and experienced users will benefit from these publications. For current Cisco Press titles and other information, go to Cisco Press at this URL:
<http://www.ciscopress.com>
- *Packet* magazine is the Cisco Systems technical user magazine for maximizing Internet and networking investments. Each quarter, Packet delivers coverage of the latest industry trends, technology breakthroughs, and Cisco products and solutions, as well as network deployment and

troubleshooting tips, configuration examples, customer case studies, certification and training information, and links to scores of in-depth online resources. You can access Packet magazine at this URL:

<http://www.cisco.com/packet>

- *iQ Magazine* is the quarterly publication from Cisco Systems designed to help growing companies learn how they can use technology to increase revenue, streamline their business, and expand services. The publication identifies the challenges facing these companies and the technologies to help solve them, using real-world case studies and business strategies to help readers make sound technology investment decisions. You can access iQ Magazine at this URL:

<http://www.cisco.com/go/iqmagazine>

- *Internet Protocol Journal* is a quarterly journal published by Cisco Systems for engineering professionals involved in designing, developing, and operating public and private internets and intranets. You can access the Internet Protocol Journal at this URL:

<http://www.cisco.com/ipj>

- World-class networking training is available from Cisco. You can view current offerings at this URL:

<http://www.cisco.com/en/US/learning/index.html>

