

Cisco 7200 and 7500 Series Routers T1, E1 Enhanced Digital Voice Port Adapters

Overview

The Cisco enhanced digital voice port adapters (PA-VXC-2TE1+, PA-VXB-2TE1+, and PA-VXA-1TE1-24+, PA-VXA-1TE1-30+) for Cisco 7200 and 7500 Series Routers, provide high-capacity voice termination to private branch exchanges (PBXs), and the Public Switched Telephone Network (PSTN) for central-site and large-branch packet voice applications.

The enhanced digital voice port adapter series consists of three members: the Two-Port T1 and E1 High-Capacity Enhanced Digital Voice Port Adapter, the Two-Port T1 and E1 Moderate-Capacity Enhanced Digital Voice Port Adapter, and the One-Port T1 and E1 Enhanced Digital Voice Port Adapters. All three port adapters offer the same industry-leading feature set and performance. The cards differ only in their overall voice-channel capacity. Customers can choose the solution that best meets their network's scalability requirements without worrying about differences in features.

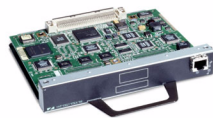


Figure 1: Two-Port and One-Port T1 and E1 High Capacity Enhanced Digital Voice Port Adapter and Cisco 7200 VXR Series Router

The enhanced digital voice port adapters are highly integrated solutions offering a leap forward in voice-channel density and application flexibility. These single-width port adapters incorporate two or one universal ports that can be configured for either T1 or E1 connection with high-performance digital signal processors (DSPs) that support up to 120 channels of compressed voice (see Table 1 for the number of channels supported by each port adapter). Integrated channel service units/digital service units (CSU/DSU) echo cancellation, and Digital Signal Level 0 (DS0) drop and insert functionality eliminate the need for external line-termination devices and multiplexers, which simplifies network design and management.



The enhanced digital voice port adapters offer an end-to-end interoperable voice-over-IP (VoIP) solution with the Cisco 1750, 2600, 3600, 3660, 3810, 5300, 5400, 5800, 7200, 7400 and 7500 products. Powerful voice management on the Cisco 7200, 7400, and 7500 Series is offered through the Cisco Voice Manager 2.0 Web-based user interface for provisioning, configuration, and monitoring functions. Device-level network management is also available using the Cisco Element Management Framework (CEMF)-based Element Management System (EMS). End-to-end network management and Fault, Configuration, Accounting, Provisioning, and Security (FCAPS) are now available using CIC, CPC, and third-party FCAPS products.

Multiservice Networks

Rather than deploying separate voice and data networks, enterprises and service providers can merge these into a common multiservice infrastructure. Deploying a multiservice network with data, voice, and video provides tremendous cost savings by eliminating redundant network infrastructure, reducing voice toll charges and reducing network-management overhead. A white paper, “Multiservice IP Telephony Business Case,” which is available online at http://www.cisco.com/warp/public/cc/so/neso/vvda/iptl/msipt_bc.pdf, reports the results of a study conducted by Renaissance Worldwide Inc. that investigated the cost savings to enterprise organizations by implementing a combined data and voice infrastructure. The study shows a minimum 169 percent return on investment (ROI) generated over a three-year life cycle for a 100-user business location, and a 136 percent ROI for a 1000-user campus location.

Product Overview

The voice port adapter, combined with Cisco 7000 Series routers, is an ideal single-box solution for implementing a multiservice network in headquarters and larger regional offices. Now, enterprise offices with hundreds of users can deploy multiservice networking using a single-box solution. Service providers offering data- and telephony-managed services can connect a single platform to their central offices or points of presence (POPs) for an integrated voice gateway or wide-area network (WAN) solution.

The enhanced digital voice port adapter provides an ideal migration path to a multiservice network. Customers can gradually shift voice traffic from traditional circuit-switched networks to a single infrastructure carrying data, voice, and video over packet networks without replacing any legacy PBX or key communication system equipment. This port adapter provides the ideal solution for PBX and PSTN access to IP telephony in Cisco AVVID (Architecture for Voice, Video and Integrated Data), allowing the deployment of new packet voice applications while migrating from traditional voice networks. The voice port adapter seamlessly interoperates with other multiservice platforms from Cisco, enabling customers to easily create a complete end-to-end packet voice solution.

The enhanced digital voice port adapters provide a solution for several common applications, including:

- Toll bypass—The enhanced digital voice port adapter acts as the gateway interface for PBXs to route voice with data and video over a single network infrastructure, creating a multiservice network.
- Cisco AVVID gateway—The enhanced digital voice port adapters provide powerful, high-capacity, quality-of-service (QoS)-enabled CiscoAVVID gateway functionality for PBX and PSTN access to IP telephony in a Cisco AVVID solution.
- VoIP, voice-over-ATM (VoATM), or voice-over-Frame Relay (VoFR) gateway to the PSTN—The enhanced digital voice port adapter acts as a gateway between the multiservice WAN and the PSTN. This allows users to place calls both within the private voice network and to the PSTN from IP telephones, legacy PBX, phone, fax, and key communication systems using VoIP, VoATM, or VoFR.
- Fax gateway services—The enhanced digital voice port adapter acts as a gateway between desktop IP-based fax applications and fax over the PSTN. This allows users to send a fax from their IP desktop to any fax system on the public telephone network.



- Managed customer premises equipment (CPE)—Service providers can deploy the Cisco 7200 and Cisco 7400 with the Enhanced Digital Voice Port Adapters as managed integrated voice/data CPE in enterprise networks and completely manage these CPE with service-level agreements (SLAs).

With support for VoIP, VoATM, and VoFR, multiple signaling types, and voice compression from 64-kbps down to 5.3-kbps, the enhanced digital voice port adapter delivers the functionality and flexibility required for large-scale, multiservice network deployments across LAN and WAN environments.

Application Example

Multisite enterprises generally handle many voice calls placed between their locations. The enterprise can reduce costs by providing a private voice service between sites, avoiding tariffs or voice tolls. Traditionally, the voice network was built separately from the data network because the technologies were quite different and separate groups managed voice and data. The Cisco 7000 Series routers with enhanced digital voice port adapters is a key tool to create next-generation, multiservice networks.

The performance, rich QoS features, and robust, multichannel WAN capabilities of the Cisco 7000 Series platforms makes them the logical choice for central-site deployment where data traffic from the LAN and traffic from large numbers of remote sites converge.

The voice port adapter acts as a gateway between traditional voice systems and the multiservice WAN. The voice port adapter connects to the PBX at enterprise headquarters while other interfaces in the Cisco 7000 Series Router connect to the WAN. The branch sites use another 7000 Series or other voice-enabled router in a similar configuration. When a voice call is made from the headquarters to a branch, the PBX routes the call to the voice port adapter. The port adapter, using the integrated digital signal processors (DSPs), compresses the voice into a VoIP, VoATM, or VoFR packet. This packet is then routed across the WAN, much like any other data packet. At the branch, the voice-enabled router converts the packet back into the traditional voice system. At the branches, the router may connect to the local PBX or key system, or the telephones may be directly connected to the router to provide a low-cost, all-in-one solution. The voice port adapter also provides the link between this private multiservice WAN and the public telephone system.

As users make the transition to IP telephones, the enhanced digital voice port adapter connects the VoIP telephone system to the traditional telephony network. The voice port adapter acts as a gateway between IP telephones and the traditional phone system to ensure that all users can still communicate with each other and across the PSTN.

The end result is that users at multiple locations can communicate with voice, fax, or data across a common network backbone, avoiding voice toll charges and providing the reduced capital and operating costs of an integrated, multiservice network.

Key Features and Benefits

The enhanced digital-voice port adapters provide a highly scalable, voice-gateway solution for completing calls between IP telephones in the LAN, PBX-connected telephones at the central site, traditional telephones and PBXs at remote sites, and the PSTN.

Some of the key features and benefits include:

- Integrated solution—Provides voice services integrated into existing Cisco 7000 Series routers
- End to end—Interoperable with Cisco's full range of multiservice voice and data products, including the Cisco 1750, 2600, 3600, 3810, AS 5300, AS5400 and AS5800 routers; IP phones; and IP-PBX systems
- Scalable management—Enables the administration of large dial plans via H.323 v2 gateway and gatekeeper interoperability and support

- Voice processing—Offloads all voice processing to the enhanced digital voice port adapter, leaving the other processing engines on the router to provide routing and such other services as security and QoS
- High density—The single-width port adapters provide enterprises and service providers with the ability to scale to any size campus using Cisco gateways

The Two-Port Enhanced Enhanced Digital Voice Port Adapter supports up to 120 voice channels. It allows the configuration of up to 12 T1/E1 digital voice ports per Cisco 7200 Series Router with up to 720 voice channels. With the two, four, or eight-port T1, E1 MIX-enabled port adapters, and with the DSP farm capability on the enhanced digital voice port adapters, up to 20 T1 or 18 E1 voice terminations are supported.

The Two-Port T1 and E1 Moderate-Capacity Enhanced Digital Voice Port Adapter supports up to 48 voice channels. It allows the configuration of up to 12 T1 or 6 E1s digital voice ports per Cisco 7200 Series Router with up to 288 voice channels.

The One-Port T1 and E1 Enhanced Digital Voice Port Adapters can terminate one T1 or one E1 trunk and support up to 24 or 30 voice channels.

- Universal Ports—The interface ports per port adapter configurable as either T1 (with integrated CSU/DSU) or E1 (with integrated G.703/G.704 120-ohm interface). This reduces spare inventory costs in international environments, eliminating the need to maintain separate stores of E1 and T1 products.
- Multiservice Interchange and DSP Farm Support—Voice channels can be time-division multiplexing (TDM) switched between port adapter slots in VXR chassis, allowing DSP resources to be shared between port adapters in the same chassis. In other words, DSP capacity that is unused on one port adapter may be utilized by another MIX-enabled port adapter. When combined with other MIX-enabled port adapters, this feature greatly expands the voice capacity of the router as it provides more voice ports without requiring the addition of new DSP resources. For example, the High-Capacity Enhanced Digital Voice Port Adapter supports up to 120 voice channels, of which up to 60 will be used by its two T1/E1 ports. This leaves enough DSP capacity to handle 72 (for T1) or 60 (for E1) additional voice channels sourced from another MIX-enabled port adapter.
- VoIP, VoATM, and VoFR termination—Full VoIP, VoATM, and voice over Frame Relay gateway functionality for support of mixed environments.
- High-density DSP technology—Full support for low bit rate voice compression (down to 5.3-Kbps) on all T1/E1 port channels, including eight standard-compression algorithms plus echo cancellation, full dial tone multifrequency (DTMF)/MF tone detection and generation, and dial pulse generation. The programmable digital signal processors can support the following codec types:
 - G.729a/b
 - G.726
 - G.711
 - G.729
 - G.729b
 - G.723.1
 - G.723.1a
 - G.728
 - GSM/EFR
- Silence Suppression—Voice-activity detection prevents sending data when no voice is present, which conserves network bandwidth. Comfort-noise generation prevents uncomfortable "dead silence" on the receiving end.

- Clocking Options—Can be clocked internally from the network, or the network clock from one port can be sent to the other port on the card or to other cards across the MIX bus in the VXR chassis.
- Flexible Signaling—Supports multiple signaling options, including Channel-Associated Signaling (CAS) and Common Channel Signaling. The set of signaling options include T1 CAS, E1 CAS, R2, PRI user and network side, Q.SIG, FG-D, Multi-D. Transparent CCS is a unique feature supported for carrying vendor-proprietary common channel signaling without concerns for interoperability.

Enhanced Digital Voice, Port Adapter Family Comparison

Members of the enhanced digital-voice, port-adapter series offer the same set of feature-rich voice services. The only difference between the products is the number of voice channels they can support. Table 1 illustrates the differences.

Table 1. Number of Channels Supported on the Enhanced Digital Voice Port Adapters

Product	No. of High-Complexity Channels	No. of Medium-Complexity Channels	GSM/EFR	Group 3 Fax
PA-VXA-1TE1-24+		24		24
PA-VXA-1TE1-30+		30		30
PA-VXB-2TE1+	24	48	24	48
PA-VXC-2TE1+	60	120	60	120

Specifications

Voice Channel Support:

- Medium Complexity – ITU-T Codecs Supported (G.729a/b, G.726, G.711)
- High Complexity – ITU-T Codecs Supported (G.729, G.729b, G.723.1, G.723.1a, G.728)
- GSM/EFR
- Fax-relay (Group 3 up to 14.4 K)

Table 1 above summarizes the number of calls supported on each of the voice port adapters.

Voice Standards Support

- FRF.11 Vo FR
- Vo ATM (VoAAL2 available now on the Cisco 7200 Series routers from Cisco IOS Software Release 12.2(2)T, VoAAL5 and CES available on the Cisco 7200 and 7500 Series)
- H.323 version 2 VoIP including RAS, Fast Connect, and Codec negotiation
- H.323 v2 and MGCP 0.1 Call Control Protocols

DSP Features

- Fax relay: T.30 fax protocol with relay, V.17, V.29, V.27
- Echo cancellation: 32 ms meeting G.165
- DTMF/R2/MF/SF/CP tone detection and generation
- Dial-pulse detection and generation
- Energy-based VAD and codec-specific VAD
- Comfort-noise generator



Signaling Supported

- E1 CAS, T1 CAS (robbed-bit signaling)
- E1 R2
- PRI User and Network Side
- Transparent CCS
- Q.SIG
- FG-D
- Multi-D Channel

Port-configured as T1 Features

- DS1 100-ohm interfaces with RJ-48c connectors
- D4 super frame (SF) and extended super frame (ESF) framing
- Alternate mark inversion (AMI) or binary 8-zero substitution (B8ZS) line encoding
- Full FDL support and FDL performance monitoring per ANSI T1.403 or AT&T TR 54016
- Selectable DSX-1 cable length in increments from 0 to 655 feet
- Selectable DS1 CSU line build-out: 0, -7.5, -15, and -22.5 dB
- Selectable DS1 CSU receiver gain: 26 or 36 dB
- DS1 line protection per UL1459/1950, FCC part 68
- Full support for DSX-1 Management Information Base (MIB), RFC 1406, including alarm detection and reporting
- DSX-1 MIB remote access supported
- DS0 Drop and Insert

Port-configured as E1 Features

- E1 120-ohm (G.703) with RJ-48c connectors
- Software-configurable E1 national bits
- HDB3, AMI encoding
- CRC4 and non-CRC4 framing
- Full support for E1 MIB, RFC 1406, including alarm detection and reporting
- DS0 Drop and Insert

Full Bit-error, Rate-testing Capabilities on each E1/T1

- Programmable pseudo-random pattern up to 24-bits in length including 211-1, 215-1, 220-1, 220-1 QRSS, 233-1, all zeros, all ones, alternating ones and zeros
- 32-bit-error count registers

Supported Loopbacks

- Line loopback: T1/E1 stream is loopbacked at the LIU toward the network.
- Payload loopback: T1/E1 data stream is loopbacked at the framer toward the network.
- Diagnostic local loopback: T1/E1 data stream is loopbacked at the framer toward the system.
- Remote loopback: T1 stream is loopbacked at the LIU toward the network upon request from the far-end via FDL.

Network Management Support

- CEMF-based EMS

- SNMP protocol-compliant
- Manageable via an MIB browser
- CiscoView interface for configuration
- Cisco Voice Manager (CVM) supported
- Netsys

Country Support

- Approved in most countries
- Software Configurable Ring Cadence and Call Progress Tones

Ordering Information

Part Number	Description
PA-VXC-2TE1+	Two-Port T1/E1 High-Capacity Enhanced Digital Voice Port Adapter
PA-VXC-2TE1+=	Two-Port T1/E1 High-Capacity Enhanced Digital Voice Port Adapter
PA-VXB-2TE1+	Two-Port T1/E1 Moderate-Capacity Enhanced Digital Voice Port Adapter
PA-VXB-2TE1+(=)	Two-Port T1/E1 Moderate-Capacity Enhanced Digital Voice Port Adapter
PA-VXA-1TE1-24+(=)	One-Port T1/E1 Enhanced Digital Voice Port Adapter with 24 channels
PA-VXA-1TE1-30+(=)	One-Port T1/E1 Enhanced Digital Voice Port Adapter with 30 channels

Cisco IOS Software Support

The high-capacity, enhanced digital-voice port adapter is supported in all Cisco IOS Software feature sets, except the ENTERPRISE MCM images, starting with releases 12.1(2)T and 12.1(3)T.

The following table shows platform and voice signaling support by Cisco IOS software release for the enhanced digital voice port adapters.

Signaling	7200	7500	7400
T1 CAS, E1 CAS, Q.SIG, PRI Q.931 User/Network, R2, T-CCS, Multi-D Channel	12.1(3)T	12.1(3)T	12.2(2)DD



Feature D	12.1(5)T	12.1(5)T	12.2(2)DD
RAI	12.2(4)T	12.2(4)T	12.2(4)B
MGCP	12.2(2)T	12.2(2)T	12.2(2)DD
PA-VXC-2TE1+, PA-VXB-2TE1+	12.1(3)T	12.1(3)T	12.2(2)DD
PA-VXA-1TE1-24+, PA-VXA-1TE1-30+ with all the above features	12.2(4)T	12.2(4)T	12.2(4)B



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