

Cisco T1/E1 Multiflex Voice/WAN Interface Cards for the Cisco **1700** Series Modular Access Routers

The Cisco T1/E1 Multiflex Voice/WAN Interface Cards (Multiflex VWIC) for the Cisco 1700 Series modular access routers offer service providers and enterprise customers a flexible multiservice solution to support multiple voice, data, and integrated voice/data applications. The Cisco Multiflex VWICs facilitate the migration from data-only or channelized voice and data to packet voice solutions and simplifies deployment, management, and sparing.

Introduction

The Cisco single- and dual-port T1/E1 Multiflex VWICs combine WIC and VIC functionality providing small and medium-sized businesses and small branch offices unparalleled flexibility, versatility, and investment protection. (See Figure 1.)

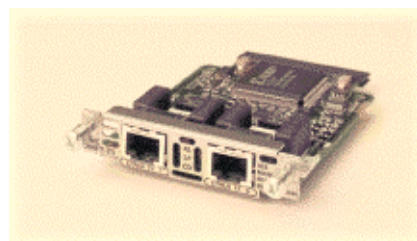
The Cisco Multiflex VWICs are supported on the Cisco 1721, Cisco 1751 and 1760 modular access routers. The Multiflex VWICs are shared across Cisco 1700, 2600, and 3600 Series routers using WIC/VIC or VIC slots.¹ (Cisco 1721 supports data services only; data and voice supported on the Cisco 1751 and 1760.)

The T1/E1 Multiflex VWICs support both data and voice services. Customers who choose to integrate voice and data in multiple steps can preserve their investment in a T1/E1 WAN interface, because the multiflex VWIC can be reused in packet voice applications.

The Cisco T1/E1 Multiflex Voice/WAN Interface Cards enable the following applications:

- *Data*²—The multiflex VWIC functions as a WIC for T1/fractional T1 and E1/fractional E1 applications. The one- and two-port E1 versions include models that support unframed G.703. To simplify remote management, the T1 version integrates a fully managed data/channel service unit (DSU/CSU) and the E1 version includes a fully managed DSU.
- *Packet voice*—The multiflex VWIC functions as a VIC to provide T1 or E1 connections to private branch exchanges (PBXs) and central offices, enabling new services and reducing voice/fax toll charges.

Figure 1
 Cisco Dual-Port T1/E1
 Multiflex Voice/WAN
 Interface Card



1. For PRI Voice Application, T1/E1 VWICs work in WIC/VIC slot only.

2. If any channel is used as a data channel, the VWIC has to be plugged into WIC/VIC slot only.



- *Multiplexed voice/data*—The multiflex VWIC functions as a dual-port T1 or E1 “drop-and-insert” multiplexer with integrated DSU/CSUs, reducing the complexity and number of network components and facilitating a graceful migration to bandwidth-efficient packet voice.

Key Benefits

The Cisco Dual-Port T1/E1 Multiflex Voice WAN Interface Cards include the features and benefits given in Table 1.

Table 1 Features and Benefits of the Cisco Dual-Port T1/E1 Multiflex Voice WAN Interface Cards for Cisco 1700 Series

Features	Benefits
Reduces networking life-cycle costs:	<ul style="list-style-type: none"> • Enables graceful migration from data-only to multiplexed voice and data to packetized voice applications • Reduces training, deployment, management, and sparring inventory over single-purpose interfaces
Maximizes investment protection:	<ul style="list-style-type: none"> • Offers multifunction support for LAN-to-LAN routing, multiplexed voice and data, and packetized voice • Modules shared between Cisco 1700, 2600, and 3600 Series modular access routers • E1 versions support both balanced and unbalanced modes • Specific models to support E1 G.703 unframed for utilizing the full 2.048 Mbps; improves branch-office network manageability and reliability • Eliminates costly external third-party CSU/DSUs and drop-and-insert multiplexers • Simplifies remote network management by allowing a single management tool, such as CiscoView or CiscoWorks, to support the router, CSU/DSU, and drop-and-insert multiplexer
Maximizes system resources:	<ul style="list-style-type: none"> • Increases supported T1/E1 port density—up to two T1/E1 connections in a single VWIC or VIC slot • Increases digital voice channel density—up to 30 digital DSO voice channels per router • Enables new services with easy migration to bandwidth-efficient packet voice

Customers who integrate voice and data in stages can preserve their investment in WAN interfaces: The multiflex VWIC can support data-only applications as a WAN interface; it can be used to integrate voice and data with the drop-and-insert multiplexer functionality; and it can be configured to support packetized voice in the future.

Applications

Packet Voice Solutions: PBX and Central Office Connectivity

The multiflex VWICs provide PBX and Public Switched Telephone Network (PSTN) connectivity for the Cisco 1700 Series routers. The Cisco 1751 and 1760 support the industry-standard H.323, Media Gateway Control Protocol 1.0 (MGCP), and Session Initiation Protocol (SIP)-based voice over IP (VoIP), as well as industry-standard FRF.11- and FRF.12-based voice over Frame Relay (VoFR).



T1 channel associate signaling (T1 CAS), E1 R2, T1/E1 Primary Rate Interface (PRI), and T1/E1 PRI QSIG are supported on the T1/E1 VWIC interfaces. The Cisco 1700 routers support up to 24 digital DS0s for T1 connection and 30 digital DS0s for E1 connection per router. When using for PRI voice application, T1/E1 VWICs have to be plug into WIC/VIC slot on the Cisco 1700 routers.

Data Solutions: Single- and Dual-Port T1/E1 WIC with Integrated DSU/CSU

The multiflex VWICs simplify small branch-office connectivity by integrating the functionality of a router, T1/E1 or fractional T1/E1 serial interface with a fully managed DSU/CSU.

When used for “data-only” WAN connectivity in the WIC/VIC slots, the multiflex VWICs support numerous functions, including Cisco IOS® command-line interface (CLI)-initiated loopback control, which is similar to the popular WIC-1DSU-T1. Additionally, the multiflex VWIC is also offered in a dual-port version, including dual E1 configurations, enabling increased WAN port density for the routers. The E1 VWICs include integrated DSUs, whereas the T1 VWICs integrate CSU and DSU functionality, simplifying remote network management.

The dual-port multiflex VWICs increase configuration flexibility on the Cisco 1700 routers by eliminating the need for two single-port T1/E1 WAN interface cards. Increasing the T1/E1 port density in a single slot enables the deployment of new applications, such as local serial aggregation with the WIC-2T or WIC-2A/S, or ISDN backup with the WIC-1B-S/T or WIC-1B-U.

The VWICs also support a limited channelized capability in which the T1 or E1 service can be flexibly split into two fractional channel groups. Thus, a single physical port can provide connection to two other sites.

The Cisco 1700 routers support up to two full T1/E1 or fractional data services per system. Either two single-port T1/E1 VWICs or one dual-port T1/E1 VWIC can be used to achieve maximum bandwidth.

The VWIC-1MFT-G703 and VWIC-2MFT-G703 are standard E1 interfaces and, therefore, VWIC-1MFT-G703 includes all of the features from the VWIC-1MFT-E1 when it is not in unframed G.703 mode. The VWIC-2MFT-G703 has all the features of the VWIC-2MFT-E1-DI when not in unframed G.703 mode. Additional flexibility is provided on the VWIC-2MFT-G703 and allows the configuration of one port for unframed G.703 while configuring the other for standard framed E1.

Multiplexed Voice/Data Solutions: Dual-Port T1/E1 Drop-and-Insert Multiplexer with Integrated DSU/CSU

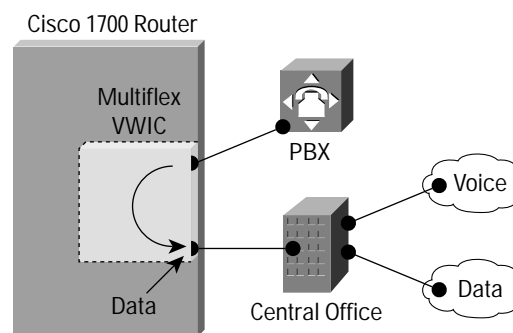
These dual-port multiflex VWICs simplify small branch-office connectivity by enabling a Cisco 1700 Router to consolidate the functions of a router, a fully managed drop-and-insert multiplexer, and a fully managed DSU/CSU into a single box. Typically, a drop-and-insert multiplexer is used for channelized (such as time-division multiplexing [TDM]) integration of voice and data onto a single T1/fractional T1 or E1/fractional E1 connection to the central office. Consolidating to a single line is significantly less costly than maintaining two separate physical lines to the central office. Drop-and-insert functionality is supported only between two ports within the same VWIC for Cisco 1700 routers.

To achieve higher availability, enhanced availability drop and insert (EADI) is supported on the T1/E1 drop-and-insert VWICs. EADI enhances availability by allowing the Cisco IOS Software to be reloaded while maintaining TDM switching.



The dual-port T1/E1 drop-and-insert VWIC can be plugged in either the WIC/VIC slots or the VIC slots. While in the former mode, the T1/E1 service is shared either between TDM and data service or between TDM and packet voice services; and in the latter mode, the service is shared only between packet voice services and TDM. When the T1/E1 service is shared between TDM and packet voice services, the router data cannot use either of the VWIC ports as a WAN connection. Figure 2 illustrates how the T1/E1 service is shared between TDM and data service.

Figure 2
Drop and Insert to Share a T1/FT1 or E1/FE1 Service



To illustrate, consider the example of a PBX with a T1 interface that needs to support a maximum of 10 simultaneous calls. With 24 DS0s in a T1 service (1.544 Mbps), only 14 DS0s or 896 kbps of bandwidth is left for the transport of data from the router (14 x 64 kbps). The number of DS0s assigned for PBX calls and the remainder that are available for use with router data are fully configurable (statically, not dynamically). In the case of an E1 service, 30 DS0s are available for division between voice and router data.

In this example, one port of the dual-port drop-and-insert multiflex VWIC is connected to the PBX and the other port is connected to the central office. The ten DS0s from the PBX are TDM-switched to the central-office port on the VWIC itself. The configuration of this TDM switching is flexible so that DS0s on the PBX port do not have to be mapped to DS0s with the same timeslots on the central-office port. The remaining 14 DS0s on the VWIC central-office port terminate through the backplane connector of the VWIC on the router as a single aggregate channel group. The 14 DS0s are not individually addressable by the router as a channelized service, but can be split into two channel groups.

The term “drop and insert” is normally used when router data (or data from another data device) is multiplexed with voice calls. However, when used in the VIC mode, the router data cannot use either of the VWIC ports as a WAN connection. A more generic term for “drop and insert” is “digital crossconnect.” Digital cross connection of voice channels only is supported by the dual-port drop-and-insert multiflex VWIC when used in VIC mode. For example, a single T1 connection from a PBX to the PBX port on the VWIC can be divided up between DS0s that are for packetized voice (such as VoIP) and DS0s that are TDM-switched to the central-office port of the VWIC for standard circuit-switched voice connectivity.

In addition to support for drop and insert, the dual-port drop-and-insert VWICs provide all the functionality of the single- and dual-port multiflex VWICs. Thus, they can serve as dual-port T1/E1 interfaces with integrated DSU/CSU when drop and insert is not configured.



TDM Cross Connect Solution

The time-division multiplexing (TDM) DS0 channel can be cross-connected with analog voice ports on the Cisco 1760. This feature called channel bank will provide support for 2 to 6 ports cross connected to a T1 channel associated signal (CAS) using a 2-port Voice Interface Card (VIC), and a maximum of 12 ports using a 4-port VIC.

A comparison of the features and specifications and specifications of the multiflex VWICs are shown in Tables 2 and 3.

Table 2 Multiflex VWIC Feature Comparison

	Data support "VIC mode"	Voice support "VIC mode"	Drop-and-insert multiplexing	Unframed E1 G.703	Two channel groups on one port	Management and diagnostics
WIC-1DSU-T1	Yes	No	No	No	No	Yes
VWIC-1MFT-T1	Yes	Yes	No	No	Yes	Yes
VWIC-2MFT-T1	Yes	Yes	No	No	Yes	Yes
VWIC-2MFT-T1-DI	Yes	Yes	Yes	No	Yes	Yes
VWIC-1MFT-E1	Yes	Yes	No	No	Yes	Yes
VWIC-2MFT-E1	Yes	Yes	No	No	Yes	Yes
VWIC-2MFT-E1-DI	Yes	Yes	Yes	No	Yes	Yes
VWIC-1MFT-G703	Yes	Yes	No	Yes	Yes	Yes
VWIC-2MFT-G703	Yes	Yes	Yes	Yes	Yes	Yes

Table 3 Specifications

Product Number	Description
VWIC-1MFT-T1	One-port RJ-48 multiflex trunk - T1
VWIC-2MFT-T1	Two-port RJ-48 multiflex trunk - T1
VWIC-2MFT-T1-DI	Two-port RJ-48 multiflex trunk - T1 with drop and insert
VWIC-1MFT-E1	One-port RJ-48 multiflex trunk - E1
VWIC-2MFT-E1	Two-port RJ-48 multiflex trunk - E1
VWIC-2MFT-E1-DI	Two-port RJ-48 multiflex trunk - E1 with drop and insert
VWIC-1MFT-G703	One-port RJ-48 multiflex trunk - E1 G.703
VWIC-2MFT-G703	Two-port RJ-48 multiflex trunk - E1 G.703
CAB-E1-RJ45BNC	E1 cable RJ-45 to dual BNC (unbalanced)
CAB-E1-RJ45TWIN	E1 cable RJ-45 to twinax (balanced)

Cisco IOS Software Release

Cisco Systems, Inc.

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The T1/E1 multiflex VWICs are supported on the Cisco 1751 and 1760 routers beginning with the Cisco IOS 12.2(4)YB release. The Cisco 1721 router supports the T1/E1 VWICs in Cisco IOS 12.2(8)YJ release. Cisco IOS 12.2(4)YB and 12.2(8)YJ have integrated into 12.2(15)T. Features of the T1/E1 network interface are shown in Tables 4 and 5.

Data Features

- T1/E1 or fractional T1/E1 network interface
- N x64-kbps or N x56-kbps nonchannelized data rates (T1:n = 1 to 24, E1:n = 1 to 31)
- Standards based, including ANSI T1.403 and AT&T Publication 62411

Table 4 Specification for T1 Network Interface

Transmit bit rate	1.544 Mbps 50 bps/32 ppm
Receive bit rate	1.544 Mbps 50 bps/32 ppm
Line code	AMI ¹ , B8ZS ²
AMI ¹ Density	Enforced for N x56-kbps channels
Framing format	D4 (SF) ³ and ESF ⁴
Output level (LBO)	0, -7.5, or -15 dB
Input level	+1 dB0 down to -24 dB0
DTE interface (WIC mode)	Fractional service
DTE interface (VIC mode)	G.704/structured
DCE interface	G.704/structured

1. Alternate mark inversion
2. Binary 8-zero substitution
3. Super Frame
4. Extended Superframe

Table 5 Specification for E1 Network Interface

Transmit bit rate	2.048 Mbps 100 bps/50 ppm
Receive bit rate	2.048 Mbps 100 bps/50 ppm
Data rate	1.984 Mbps (framed mode) per E1 port
Clocking	Internal and loop (recovered from network)
E1 national bits	Software configurable
Encoding	HDB3 ¹



Table 5 Specification for E1 Network Interface

DTE² interface (WIC mode)	Fractional service
DTE interface (VIC mode)	G.704/structured
DCE interface	G.704/structured

1. High-density bipolar with three zeros
2. Data terminal equipment

Table 6 DSP Modules for the Cisco 1751 and 1Cisco 760 Series

Part Number	Number of DSPs
PVDM-256K-4	1xDSP
PVDM-256K-8	2xDSP
PVDM-256K-12	3xDSP
PVDM-256K-16	4xDSP
PVDM-256K-20	5xDSP

Table 7 Maximum Channels Support per DSP

Codec	Kbps	Max Channels/DSP (Digital Calls)
G.711	64 (PCM)	6
G.729a	8 (CS-ACELP)	3
G.726	16 (ADPCM)	3
G.723.1	5.3/6.3 (ACELP)	2
G.728	32 (ADPCM/LDCLP)	2

- + DSP used for the digital calls and for the analog calls have to be calculated separately
- + One DSP can support multiple Codecs concurrently

Dimensions (H x W x D)

- 0.8 x 3.1 x 4.8 in.
- (2.1 x 7.9 x 12.2 cm)

Weight

- 0.12 lb (56g) (minimum) to 0.18 lb (81g) (maximum)



Diagnostics

- ANSI T1.403 Annex B/V.54 loopup/down code recognition, network loopback, and user-initiated loopbacks, network payload loopback, local DTE loopback, remote line (codes: V.54, loop up, and loop down)
- Bit error rate tester (BERT) patterns all 0s, all 1s, 1:2, 1:8, 3:24, QRW, QRSS, 63, 511, 2047, and V.54/T1.403 annex B bit patterns, two user-programmable 24-bit patterns
- Alarm detection: alarm indication signal (AIS); time slot 16 AIS; remote alarm; far-end block error (FEBE); out of frame (OOF); cyclic redundancy check (CRC); multiframe OOF; signaling multiframe OOF; frame errors; cyclic redundancy check (CRC) errors; loss of network signal (red alarm); loss of network frame receive (blue alarm); AIS from network receive (yellow alarm) from network Performance Reports/Error Counters CRC; errored seconds; burst errored seconds; severely errored seconds; Ft and Fs framing errors for SF framing; FPS framing errors for ESF framing; 24-hour history stored in 15-minute increments
- Onboard processor for real-time facility data link (FDL) messaging; in-band code detection and insertion; alarm integration; and performance monitoring
- Full FDL support and FDL performance monitoring according to configurable standard: ANSI T1.403 or AT&T TR 54016

DSU/CSU

- Selectable DSX-1 cable length in increments from 0 to 655 feet in DSU mode
- Selectable DS1 CSU line build-out: 0, -7.5, -15, and -22.5 dB
- Selectable DS1 CSU receiver gain: 26 or 36 dB

Packet Voice Support

Support for a single multiflex VWIC and basic voice connectivity is as follows:

- The single-port T1 multiflex or dual-port T1 multiflex VWIC supports 1 to 24 DS0 channels (voice calls)
- The single-port E1 multiflex or dual-port T1 multiflex VWIC connects 1 to 30 DS0 channels (voice calls)
- CD (data Carrier Detect)
- LP (loopback)
- AL (alarm)

Table 6 identifies various management aspects of the T1/E1 multiplex VWICs.

Table 8 Management

Feature	Description
Telnet/console	Remote and local configuration, monitoring, and troubleshooting from Cisco IOS CLI
SNMP ¹	Router and DSU/CSU managed by single SNMP agent; router/DSU/CSU appear as single network entity to user Standard MIB ² (MIB II) Cisco integrated DSU/CSU MIB RFC 1406 T1 MIB, including alarm detection and reporting
SNMP traps	Generated in response to alarms



1. Simple Network Management Protocol
2. Management Information Base

Environmental

- Operating temperature: 0 to 40 C (32 to 104 F)
- Storage temperature: -25 to +70 C (-13 to 158 F)
- Relative humidity
 - 5 to 85% noncondensing operating
 - 5 to 95% noncondensing, nonoperating

T1 Compliance (partial list)

- ANSI T1.403
- US (UL 1950, T1)
- TIA/EIA IS-968
- CS-03 Part II
- Canada (CSA 950, T1)
- U.S. (FCC Part 15 Class B, T1)
- U.K. (BS6301, EN60950, EN41003)
- Canada (CSA C108.8 Class A, T1)
- Bellcore—AT&T Accunet (62411)
- ATT 54016
- Japan (VCCI Class 2, VCCI-V-3/97.04, T1, JATE Green Book, IEC950)

E1 Compliance (partial list)

- Australia (TS 016, AS/NZS 3548:1995)
- Germany (TUV GS, EN60950)
- Germany (VDE 0878 parts 3 and 30)
- France (NFC98020, EN60950, EN41003)
- Sweden (SS447-2-22, SS636334, EN60950)
- U.K. (NTR4)
- Europe (EN55022 Class B, EN55102-1, EN55102-2, CTR12, EN60950, EN50082-1:1992, EN55022:1994)
- CCITT/ITU G.704, I.431
- ETSI NET5, ETS300156
- CTR4
- CTR13



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