Cisco 2-Port T1/E1 Protection Switching RAN Voice/WAN Interface Card

The Cisco® 2-Port T1/E1 Protection Switching RAN Voice/WAN Interface Card (VWIC) is a general-purpose VWIC that features advanced processing and T1/E1 protection switching and is specifically designed for the Cisco RAN Optimization Solution and Cisco IP Transfer Point (ITP).

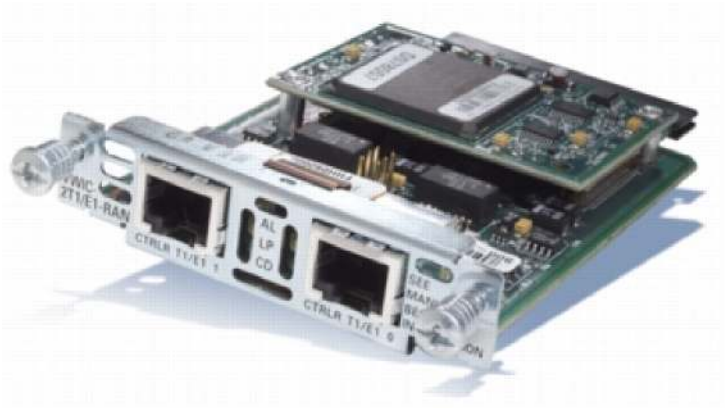
Overview

Today's mobile wireless operators need a flexible Radio Access Network (RAN) to efficiently support multiple generations of radio technologies and quickly adapt as their network characteristics and business needs evolve. And, to remain profitable, operators must reduce operating expenses (OpEx) while expanding their networks and providing new services.

The Cisco RAN Optimization Solution is a comprehensive family of IP-based solutions to optimize RAN architectures. An optimized RAN can significantly reduce OpEx and support new revenue-generating services for both GSM and UMTS mobile wireless operators. The solution includes a bit-transparent technology that integrates smoothly into an existing RAN, providing optimized RAN transport over IP to increase bandwidth efficiency of GSM/GPRS/EDGE and UMTS/HSDPA backhaul transport. The solution also provides cell-site IP points of presence (POPs) to enable profitable new services and applications, and alternative RAN backhaul support to economically transport high-throughput cell-site traffic such as circuit-switched Universal Mobile Telecommunications Service (UMTS) data and High-Speed Downlink Packet Access (HSDPA) traffic.

The Cisco 2-Port T1/E1 Protection Switching RAN VWIC is an integral part of the Cisco RAN Optimization Solution (Figure 1). The Cisco T1/E1 RAN VWIC supports traditional T1/E1 communications and it features advanced processing for applications such as the Cisco RAN Optimization Solution and circuit emulation over packet or standard-based Pseudowire Emulation Edge to Edge (PWE3). For example, the VWIC enables the Cisco MWR 1941-DC-A Mobile Wireless Router's cell-site access platform to perform optimization of delay-sensitive GSM/GPRS/EDGE traffic for efficient and transparent transport over traditional T1/E1 RAN backhaul networks, achieving efficiency gains up to 50 percent and often more, as well as over alternative RAN backhaul networks such as DSL, IEEE 802.16, and Metro Ethernet. With PWE3 support, the Cisco T1/E1 RAN VWIC enables mobile operators to extend their service offering. Operators can use more scalable, more robust Multiprotocol Label Switching (MPLS) networks to provide standards-based circuit emulation services and to carry data streams or protocols that do not meet the format requirements of other multiservice platform interfaces. In addition, the Cisco T1/E1 RAN VWIC supports an extended operating temperature, and features solid-state protection switching relays to support 1:1 cell-site access-platform redundancy for high availability with a custom T1/E1 Y-cable.

Figure 1. Cisco 2-Port T1/E1 Protection Switching RAN VWIC



Features and Benefits

Table 1 lists the features and benefits of the Cisco T1/E1 RAN VWIC, and Table 2 lists its applications.

Table 1. Features and Benefits

Feature	Benefits
• Two independent T1/E1 or fractional T1/E1 ports with RJ-48C physical connectors • Software-configurable T1/E1 mode • T1/E1 interface loopbacks, 75- and 120-ohm impedances (balanced and unbalanced), framing (SF and ESF), and line codes (AMI, B8ZS, HDB3); support for E1 structured and unstructured operation • LEDs for data carrier detect (DCD), loopback (LP), and alarm (AL)	Flexible worldwide deployment
Integrated T1/E1 protection switching relays	99.9998% availability for less than one minute per year of downtime with 1:1 redundant configurations using the Cisco MWR 1941-DC-A Mobile Wireless Edge Router
Integrated channel service unit/data service unit (CSU/DSU)	Eliminates the need for external CSU/DSUs
Specialized high-performance hardware	Provides hardware-accelerated processing of delay-sensitive GSM/GPRS/EDGE and UMTS/HSDPA traffic for transparent transport over T1/E1 or IP RAN backhaul with up to 50% traffic optimization and often more
Extended operating temperature range of –10 to 55℃	Operates reliably in outdoor cell sites
“Wet” T1 support	Provide protection against +/– 130V DC span-powering voltages

Table 2. Applications

Application	Description	System Requirements
IP RAN	Optimized RAN transport over IP • 50% or more measured efficiency gain on GSM and UMTS traffic • 2G and 3G aggregation with 3G riding for free • Single IP backhaul network for 2G/3G/4G with no change to RAN backhaul design • Optimized Pseudowire (OPW) • Cost-efficient offload of bandwidth-intensive HSPA and UMTS data to an alternative backhaul link Pseudowire emulation and mobile voice/data offload • Pseudowire Emulation Edge to Edge (PWE3) ◦ Circuit Emulation Services over Packet Switched Network (CESoPSN), IETF draft-ietf-pwe3-cesopsn-xx.txt ◦ Structure-Agnostic Transport over Packet (SAToP), IETF RFC 4553 ◦ ATM over MPLS, IETF RFC 4717 ◦ ATM over L2TPv3, IETF RFC 4454 • Cost-efficient offload of bandwidth-intensive HSPA and UMTS data to an alternative backhaul link Unified IP RAN • Intelligent cell site enables new-revenue generating services • Remote cell site management and LAN extension • Easy expansion to 4G Cell-site router redundancy	Cisco MWR 1941-DC-A Cisco IOS® Software Release 12.4(12)MR2 or later
IP Transfer Point	The Cisco IP Transfer Point (ITP) is a comprehensive solution for transporting Signaling System 7 (SS7) traffic over traditional time-division multiplexing (TDM) networks or advanced SS7-over-IP (SS7oIP) networks, using standard-based IETF Signaling Transport (SIGTRAN) protocols. For more information regarding Cisco ITP, please visit: http://www.cisco.com/en/US/products/sw/wirelssw/ps1862/index.html	Cisco 2811 ITP Cisco IOS Software Release 12.4(11)SW1 or later

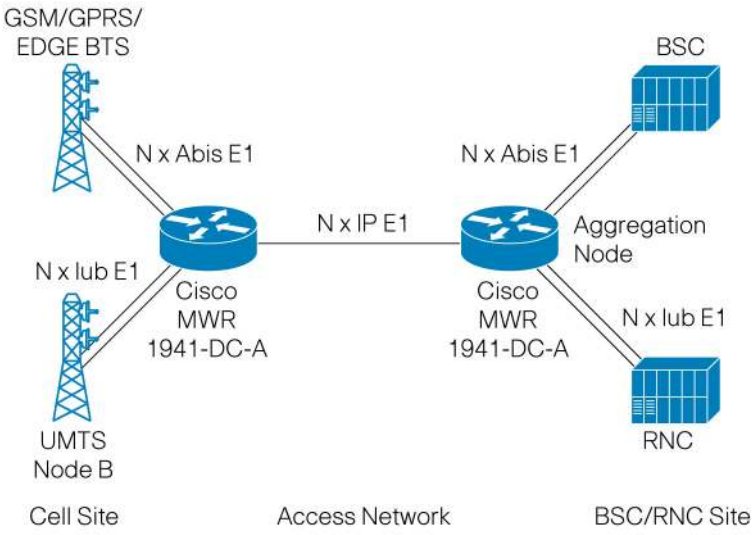
Cisco Ran Optimization Applications

Optimized RAN transport over IP

The Cisco RAN Optimization solution enables mobile operators to aggregate and transparently transport mixed-generation (2G, 3G, 4G) digital voice and data calls over the existing RAN backhaul network using IP, as well as optimize over the backhaul network to reduce the amount of required backhaul bandwidth by as much as 50 percent and often much more. As a result, the solution reduces existing backhaul transmission costs and enables more cost-efficient deployment of new RAN technologies. The backhaul network is typically the largest operational expense in the mobile operator's network.

The Cisco T1/E1 RAN VWIC terminates GSM Abis T1/E1s, UMTS Iub T1/E1s, and backhaul T1/E1s, and processes the GSM/GPRS/EDGE and UMTS/HSDPA traffic for IP-based optimization over the RAN backhaul transport network. As RAN traffic loads change, the Cisco T1/E1 RAN VWIC used for a GSM Abis T1/E1 can be reused for a UMTS Iub T1/E1. Or as backhaul networks move to high-speed alternative backhaul technologies such as those used for broadband access, a Cisco T1/E1 RAN VWIC used for a backhaul T1/E1 can be reused for a UMTS Iub T1/E1 (Figure 2).

Figure 2. Cisco T1/E1 RAN VWIC Used for a GSM Abis T1/E1 and UMTS Iub T1/E1



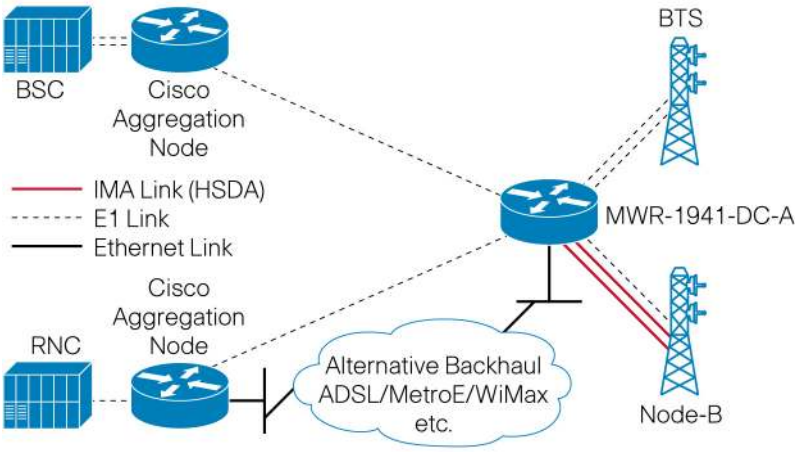
Pseudowire Emulation and Mobile Voice/Data Offload

The Cisco IP-based RAN Optimization Solution allows for a variety of backhaul transport media, enabling higher-capacity and lower-cost alternative RAN transport networks for GSM/GPRS/EDGE and UMTS/HSDPA traffic. Higher-speed broadband backhaul media such as DSL and Metro Ethernet are ideally suited for transport of UMTS circuit-switched data and HSDPA data traffic.

The Cisco T1/E1 RAN VWIC terminates UMTS or HSDPA Iub T1/E1s or multiple UMTS or HSDPA Iub T1/E1s as an IMA interface, and processes the data traffic for IP-based optimization and offload onto an alternative RAN backhaul network such as DSL, IEEE 802.16, or Metro Ethernet.

The Cisco T1/E1 RAN VWIC is designed to meet the emerging PWE3 standards for TDM Circuit Emulation over Pseudowires (CEoP) and ATM over Pseudowires (ATMoP). For CEoP, the Cisco T1/E1 RAN VWIC supports standards-compliant Circuit Emulation Services over Packet Switched Network (CESoPSN) and Structure-Agnostic Transport over Packet (SAToP) transport. By enabling CEoP, the Cisco T1/E1 RAN VWIC regards the data as an arbitrary bit stream with no predefined format or structure. All data bits are simply transported to a defined destination encapsulated in MPLS packets. For ATMoP, the Cisco T1/E1 RAN VWIC supports standards-compliant ATM-over-MPLS and ATM-over-L2TPv3 transport. The ATMoP service allows mobile operators to effectively manage the bandwidth at the edges of their transport network while implementing value-added Layer 3 services. Advanced traffic management features, such as per-PVC traffic shaping, can also be used to help ensure that traffic from one customer does not affect traffic from another (Figure 3).

Figure 3. IP-Based Optimization and Offload onto an Alternative RAN Backhaul Network



Cell-Site Router Redundancy

Used in conjunction with Cisco MWR 1941-DC-A Mobile Wireless Edge Router, the Cisco T1/E1 RAN VWIC supports router redundancy at a cell site while sharing a single T1/E1 Abis/Iub and backhaul links to yield highly available RAN transport. A pair of Cisco MWR 1941-DC-A routers is deployed at the cell site, providing an active and standby router for redundancy. A failure of one Cisco MWR 1941-DC-A router, or a component of the router, causes the standby router to take over as the active router for the cell site. Each pair of Cisco MWR 1941-DC-A routers at the cell site is identical in hardware configuration, and connected to each other through the integrated 100BASE-T interfaces. The individual T1/E1 links to a Cisco MWR 1941-DC-A are cabled from a single T1/E1 termination block in the cell site, connecting to both the active and standby routers utilizing a Y-cable. The redundancy design to control the active/standby transitions of the router pair uses Hot Standby Router Protocol Plus (HSRP+) to control the relays on the Cisco T1/E1 RAN VWIC in each router, which ensures that the relays on the active router are closed and the relays on the standby router are open to avoid double termination of the T1/E1 links.

Depending on the Cisco MWR 1941-DC-A router implementation, the Cisco T1/E1 RAN VWIC can be used in a standalone router or in redundant Cisco MWR 1941-DC-A router configurations. For redundant configurations, a special Y-cable is required to connect the active and standby routers. The Y-cable provides a dual E1 or T1 PRI connection.

The specifications of the Y-cable are:

- Cisco T1/E1 RAN VWIC Y-cables should be made with four twisted-pair, shielded, 28-gauge cables.
- The cable length of each stub (from the RJ-48C connector to the junction point) should not exceed 3 inches (76 mm).
- The cable length from junction point to the patch panel is determined by the customer.
- All signals that propagate in the same direction must share the same twisted pair. For example, RX TIP and RX RING must form a single twisted pair.
- All unused twisted pairs should be cut flush on both ends of the cable. Any unused wire in a twisted pair where one wire is in use should be cut flush at both ends.

The Y-cable is available from Anixter, a third-party vendor. (Part number Q#00066036.) Please see http://www.anixter.com for local sales offices worldwide.

Specifications

Table 3 lists specifications for the Cisco T1/E1 RAN VWIC. Tables 4 and 5 list T1 and E1 interface specifications, respectively. Table 6 lists regulatory compliance and Table 7 lists part numbers for the Cisco T1/E1 RAN VWIC.

Table 3. Cisco T1/E1 RAN VWIC System Specifications

Description	Specification
LEDs	CD, LP, and AL
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 (56 g) minimum, 0.18 lb (81 g) maximum
Operating Temperature	–10 to +55°C (14 to 131°F)
Storage Temperature	–40 to 85°C (–40 to 185°F)
Relative Humidity	5 to 90% noncondensing, ±5%
DSU/CSU	• Selectable DSX-1 cable length in increments from 0 to 655 ft in DSU mode • Selectable DS-1 CSU line build-out: 0, –7.5, –15, and –22.5 dB • Selectable DS-1 CSU receiver gain: 26 or 36 dB
Diagnostics	• ANSI T1.403 Annex B/V.54 loopup/down code recognition, network loopback, user initiated loopbacks, network payload loopback, local DTE loopback, remote line (codes: V.54, loop up, and loop down) • BERT patterns all 0's, all 1's, 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, CRC errors, loss of network signal (red alarm), loss of network frame, receive (blue alarm) (AIS) from network, receive (yellow) 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

Table 4. T1 Interface Specifications

Description	Specification
Transmit Bit Rate	1.544 Mbps ± 50 bps/32 PPM
Receive Bit Rate	1.544 Mbps ± 50 bps/32 PPM
Line Code	AMI, B8ZS
AMI Ones Density	Enforced for N x 56 Kbps channels
Framing Format	D4 (SF) and ESF
Output Level (LBO)	0, –7.5, or –15 dB
Input Level	+1 dB0 down to –24 dB0
DTE Interface	Fractional Service
DCE Interface	G.704/structured

Table 5. E1 Interface Specifications

Description	Specification
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
Input Level	+1 dB0 down to –24 dB0
DTE Interface	Fractional Service
DCE Interface	G.704/structured

Table 6. Regulatory Standards Compliance

Description	Specification
T1 Compliance (Partial List)	ANSI T1.403 FCC Part 68 Bellcore – AT&T Accunet (62411) ATT 54016 JATE Green Book GR 1089
E1 Compliance (Partial List)	TBR4, TBR12, TBR13 ITU-T G.703, G.704, G.823, I.431 S016 (Australia)

Ordering Information

The Cisco T1/E1 RAN VWICs are orderable through the following part numbers.

Table 7. Part Numbers

Part Number	Description
VWIC-2T1/E1-RAN	Cisco 2-Port T1/E1 Protection Switching RAN VWIC
VWIC-2T1/E1-RAN=	Cisco 2-Port T1/E1 Protection Switching RAN VWIC, Spare

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