CHAPTER 1

Cisco MWR 2941 Router Overview

The Cisco MWR 2941 Mobile Wireless Router is cell-site access platforms specifically designed to aggregate and transport mixed-generation radio access network (RAN) traffic. The router is used at the cell site edge as a part of a 2G, 3G, or 4G radio access network (RAN). The Cisco MWR 2941 includes the following models:

- Cisco MWR 2941-DC
- Cisco MWR 2941-DC-A

The Cisco MWR 2941 router helps enable a variety of RAN solutions by extending IP connectivity to devices using Global System for Mobile Communications (GSM), General Packet Radio Service (GPRS), Node Bs using HSPA or LTE, base transceiver stations (BTSs) using Enhanced Data Rates for GSM Evolution (EDGE), Code Division Multiple Access (CDMA), CDMA-2000, EVDO, or WiMAX, and other cell-site equipment. It transparently and efficiently transports cell-site voice, data, and signaling traffic over IP using traditional T1/E1 circuits, including leased line, microwave, and satellite, as well as alternative backhaul networks, including Carrier Ethernet, DSL, Ethernet in the First Mile (EFM), and WiMAX. It also supports standards-based Internet Engineering Task Force (IETF) Internet protocols over the RAN transport network, including those standardized at the Third-Generation Partnership Project (3GPP) for IP RAN transport.

Custom designed for the cell site, the Cisco MWR 2941 features a small form factor, extended operating temperature, and cell-site DC input voltages.

Note The Cisco MWR 2941-DC and 2941-DC-A support the same features except for commands related to the 1PPS, 10Mhz, 2.048Mhz, and 1.544Mhz timing ports that are included on the 2941-DC-A. For more information, see the *Release Notes for Cisco MWR 2941-DC Mobile Wireless Edge Router for Cisco IOS Release 15.0(1)MR*.

Introduction

A typical RAN is composed of thousands of base transceiver stations (BTSs)/Node Bs, hundreds of base station controllers/radio network controllers (BSCs/RNCs), and several mobile switching centers (MSCs). The BTS/Node Bs and BSC/RNC are often separated by large geographic distances, with the BTSs/Node Bs located in cell sites uniformly distributed throughout a region, and the BSCs, RNCs, and MSCs located at suitably chosen Central Offices (CO) or mobile telephone switching offices (MTSO).

The traffic generated by a BTS/Node B is transported to the corresponding BSC/RNC across a network, referred to as the backhaul network, which is often a hub-and-spoke topology with hundreds of BTS/Node Bs connected to a BSC/RNC by point-to-point time division multiplexing (TDM) trunks. These TDM trunks may be leased-line T1/E1s or their logical equivalents, such as microwave links or satellite channels.

The following sections describe the features available on the Cisco MWR 2941:

RAN Transport Solutions

The Cisco MWR 2941 Mobile Wireless Router supports a variety of RAN transport solutions, including the following:

- IP/Multiprotocol Label Switching (MPLS) RAN backhaul: Allows you to create a high-speed backhaul for a variety of traffic types, including GSM, CDMA, HSPA/LTE, CDMA, EVDO, and WiMAX networks.
- Cell-site operations support networks: Facilitates telemetry to cell sites for remote operations and network element management.
- Cell-site IP points of presence (POPs): Allows you to offer IP services and applications at cell sites.
- Carrier Ethernet features including Resilient Ethernet Protocol (REP), Ethernet Connectivity Fault Management (CFM), Ethernet Local Management Interface (E-LMI), and Ethernet Operations, Administration, and Maintenance (OAM)
- Network clocking features including PTP, pseudowire-based clocking, and synchronous Ethernet.
- Flexible backhaul transport including MLPPP over T1, E1, xDSL, and Ethernet

MLPPP Optimization Features

The Cisco MWR 2941 supports several features that improve the performance of Multilink Point-to-Point Protocol (MLPPP) connections and related applications such as PWE3 over MLPPP and IP over MLPPP.

Distributed Multilink Point-to-Point Protocol (dMLPPP) Offload

Distributed Multilink Point-to-Point Protocol (dMLPPP) allows you to combine T1 or E1 connections into a bundle that has the combined bandwidth of all of the connections in the bundle, providing improved capacity and CPU utilization over MLPPP. The dMLPPP offload feature improves the performance for traffic in dMLPPP applications such as PWE3 over MLPPP and IP over MLPPP by shifting processing of this traffic from the main CPU to the network processor.

The Cisco MWR 2941 supports up to four serial links per T1/E1 connection and up to 24 MLPPP bundles. You can use the fixed T1/E1 ports to create up to 64 MLPPP links; if you install two four-port T1/E1 HWICs, you can create up to 96 MLPPP links.

The MWR 2941 implementation of multilink (dMLPPP) uses interleaving to allow short, delay-sensitive packets to be transmitted within a predictable amount of time. Interleaving allows the MWR 2941 to interrupt the transmission of delay-insensitive packets in order to transmit delay-sensitive packets. You

can also adjust the responsiveness of the MWR 2941 to delay-sensitive traffic by adjusting the maximum fragment size; this value determines the maximum delay that a delay-sensitive packet can encounter while the MWR 2941 transmits queued fragments of delay-insensitive traffic.

Multiclass MLPPP

The MWR 2941 implementation of dMLPPP also supports Multiclass MLPPP. Multiclass MLPPP is an extension to MLPPP functionality that allows you to divide traffic passing over a multilink bundle into several independently sequenced streams or classes. Each multiclass MLPPP class has a unique sequence number, and the receiving network peer processes each stream independently. The multiclass MLPPP standard is defined in RFC 2686.

The MWR 2941 supports the following multiclass MLPPP classes:

- Class 0- Data traffic that is subject to normal MLPPP fragmentation. Appropriate for non-delay-sensitive traffic.
- Class 1- Data traffic that can be interleaved but not fragmented. Appropriate for delay-sensitive traffic such as voice.

For instructions on how to configure MLPPP backhaul, see Chapter 18, "Configuring MLPPP Backhaul."

Note The Cisco MWR 2941 does not support some PPP and MLPPP options when the bundle is offloaded to the network processor; you can retain these options by disabling MLPPP and IPHC offloading for a given bundle. For more information, see MLPPP Offload, page 18-12.

Note The output for the **show ppp multilink** command for an offloaded MLPPP bundle differs from the output for a non-offloaded bundle. For more information, see the *Cisco MWR 2941 Mobile Wireless Edge Router IOS Command Reference, Release 15.0(1)MR*.

Intelligent Cell Site IP Services

The Cisco IP-RAN solutions allow you to deliver profit-enhancing services. This is achieved through the set of IP networking features supported in Cisco IOS software that extends to the cell site (see Figure 1-1 on page 1-4).

Cell Site Points-of-Presence

The cell site becomes a physical Point-of-Presence (POP) from which to offer hotspot services, or voice and wired ISP services, to nearby enterprises and residences. Because many cell sites are located in and around downtown areas, hotels, airports, and convention centers, they make attractive sites for co-locating public wireless LAN (PWLAN) access points and other wireless data overlays. Many of these wireless data radios are IP-based. IP networking features, like Mobile IP, VoIP, IP Multicast, VPN, and content caching, enable delivery of new revenue-generating services over these radios. The corresponding traffic "rides for free" on the spare backhaul bandwidth (Figure 1-1).

Figure 1-1 Cisco MWR 2941 Router in a Cell Site POP—Example