CHAPTER 2

RAN Backhaul Concepts

This chapter includes the following sections:

Overview of RAN Backhaul Services

Radio access network (RAN) transport manages the backhaul traffic (both voice and data) from the cell site base transceiver stations (BTSs) to aggregation nodes and to base station controllers (BSCs), between BSCs, and between the BSC and an associated mobile switching center (MSC). Figure below shows an example RAN backhaul topology.

Figure 2-1 Example RAN Backhaul Topology

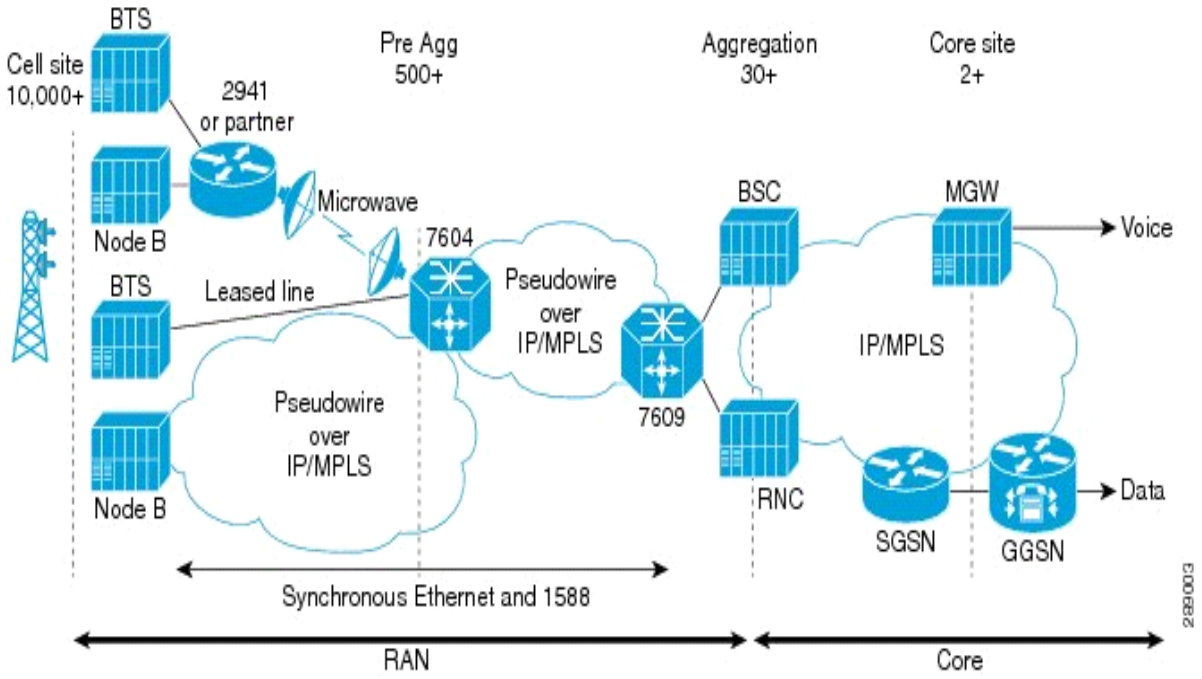
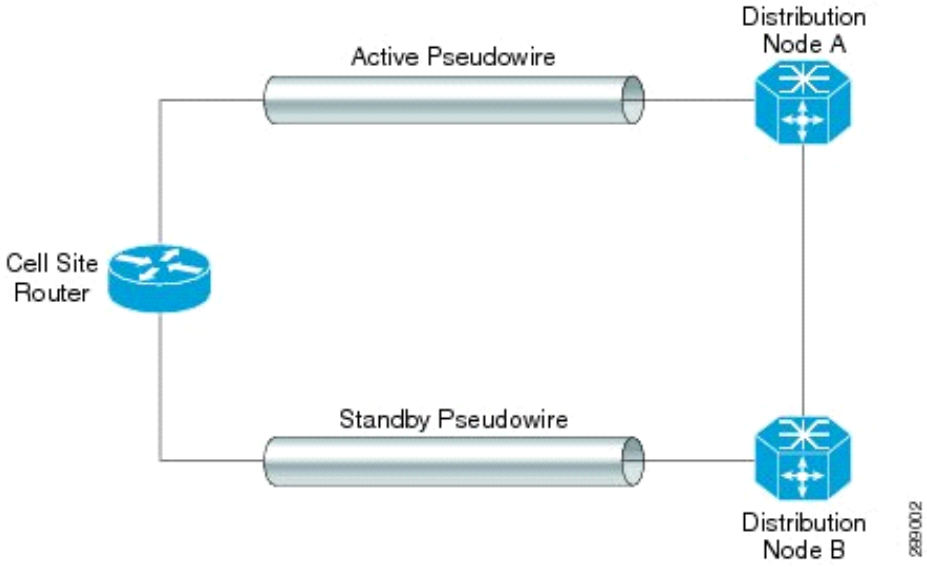


Figure below is an abstracted topology view of RAN backhaul services in Prime Fulfillment.

Figure 2-2 Abstracted RAN Backhaul Topology



Prime Fulfillment uses Internet Protocol (IP) to transport backhaul traffic in RANs. In Prime Fulfillment, you use Ethernet Virtual Circuit (EVC) policies and service requests to provision the following services to support RAN backhaul traffic management:

- Circuit Emulation Time Division Multiplexing (CEM TDM)
- Pseudowire provisioning of Asynchronous Transfer Mode (ATM)

In addition, the EVC service requests use CEM and pseudowire class objects to bundle common attributes for reuse on every node where the service is provisioned.

The basic workflow for configuring and managing RAN backhaul services in Prime Fulfillment, involves the following tasks:

1. Verify prerequisites and preform necessary setup tasks.
2. Create CEM and/or pseudowire classes to be used in RAN backhaul policies and service requests.
3. Create the CEM TDM or ATM policy.
4. Create template(s) for use in the CEM TDM or ATM service request.
5. Create the CEM TDM or ATM service request.
6. Deploy the service request to the device(s) on the network.

The Prime Fulfilment GUI and APIs allow you to create TDM-CEM and ATM Pseudowire services within an EVC service request. CEM TDM feature supports provisioning of SAToP PWE3 and CESoPSN PWE3 services, whereas ATM feature supports provisioning of ATM IMA VCC PWE3 and ATM IMA PVP PWE3 services.

Circuit Emulation Time Division Multiplexing (CEM TDM)

In Cisco Prime Fulfillment 6.2, the EVC service has been extended to support RAN Backhaul management through Circuit Emulation CEM TDM services and pseudowire provisioning of ATM services. New workflows have been added to EVC policy and service request creation to support these services. RAN Backhaul leverages existing pseudowire class support in Prime Fulfillment. A new CEM class is added to create a logical grouping of CEM attributes, such as the dejitter buffer, payload size, and idle pattern. The CEM class allows configuring the same attribute values on every node where it is provisioned. CEM TDM services support SAToP PWE3 and CESoPSN PWE3 protocols.

Circuit emulation is configured on a circuit emulation over packet (CEoP) shared port adaptor (SPA) to encapsulate time-division multiplexing (TDM) data in MPLS packets. It then sends the data over a CEM pseudowire to the remote provider edge (PE) router. An example topology is shown in the following figure.

Figure 2-3 Example Circuit Emulation (CEM) Topology

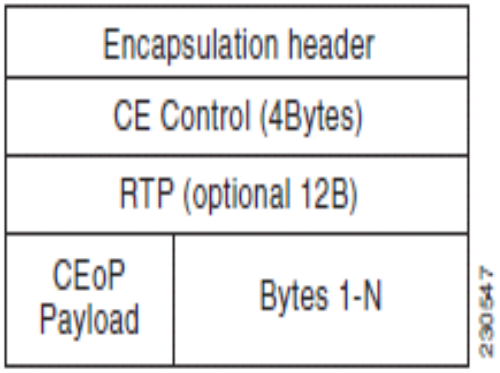
The above example shows that:

- A TDM circuit is connected to port 0 on an SPA installed in slot 1, subslot 0 (E1 controller 1/0/0).
- Two pseudowires (PW10 and PW20) are configured to carry TDM data across the MPLS network.
- Two CEM groups (2 and 3) are configured for the data in the TDM time slots.
  - Time slots 1 through 6 are sent over pseudowire 10 to the remote PE router at 10.1.1.1.
  - Time slots 8 through 13 are sent to PE router 11.1.1.1 over pseudowire 20.
- The following transport mechanisms are supported:
  - SAToP PWE3—Structure Agnostic TDM over Packet / Pseudowire Edge-to-Edge
  - CESoPSN PWE3—Circuit Emulation Service over Packet Switched Network / Pseudowire Edge-to-Edge

SAToP PWE3

Structure Agnostic TDM over Packet mode is used to encapsulate T1/E1 unstructured (unchannelized) services over packet switched networks. In unstructured (SAToP) mode, bytes are sent out as they arrive on the TDM line. Bytes do not have to be aligned with any framing. In this mode the interface is considered as a continuous framed bit stream. The packetization of the stream is done according to IETF RFC 4553. Signaling is carried transparently as a part of a bit stream. Figure below shows an unstructured mode frame format.

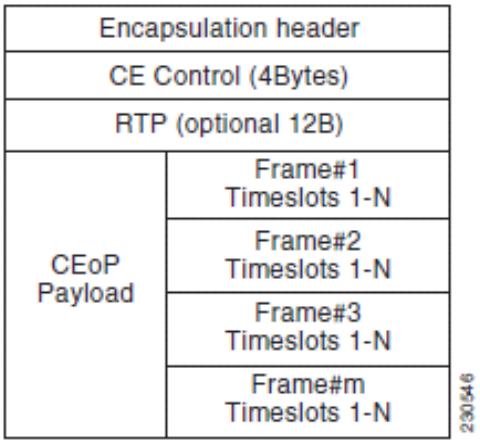
Figure 2-4 Unstructured mode Frame format



CESoPSN PWE3

Circuit Emulation Service over Packet Switched Network mode is used to encapsulate T1/E1 structured (channelized) services over PSN. Structured mode (CESoPSN) identifies framing and sends only payload, which can be channelized T1s within DS3 and DS0s within T1. DS0s can be bundled to the same packet. This mode is based on IETF RFC 5086. Figure below shows a structured frame format.

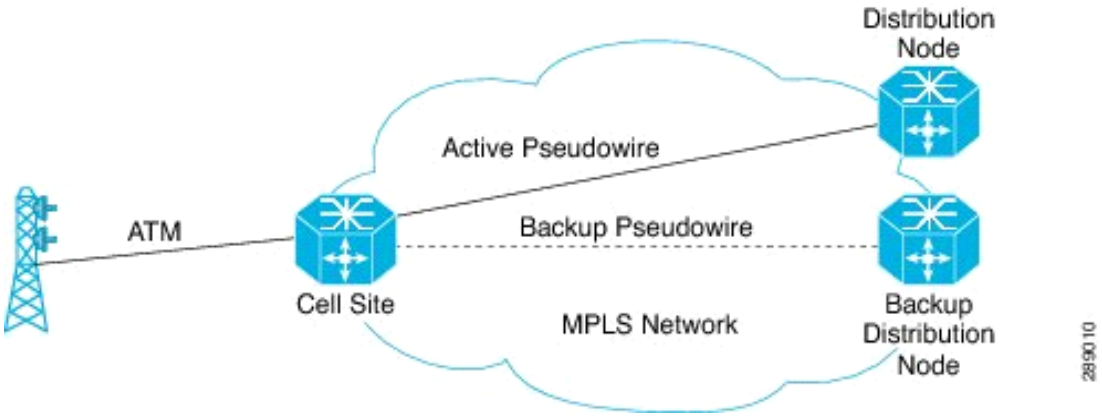
Figure 2-5 Unstructured mode Frame format



Asynchronous Transfer Mode (ATM) Services

In Cisco Prime Fulfillment 6.2, ATM services support ATM IMA VCC PWE3 and ATM IMA PVP PWE3 protocols. RAN backhaul services can be configured on an inverse multiplexing for ATM (ATM/IMA) virtual channel connection (VCC) or permanent virtual path (PVP) circuit. Data is sent over an ATM pseudowire to the remote provider edge (PE) router. When creating pseudowire with an ATM endpoint, you can select IMA interfaces under which to create the permanent virtual circuit (PVC). You can also create a controller, which allows you to create the corresponding IMA interface. An example of the topology is shown in the figure below.

Figure 2-6 Example ATM Topology



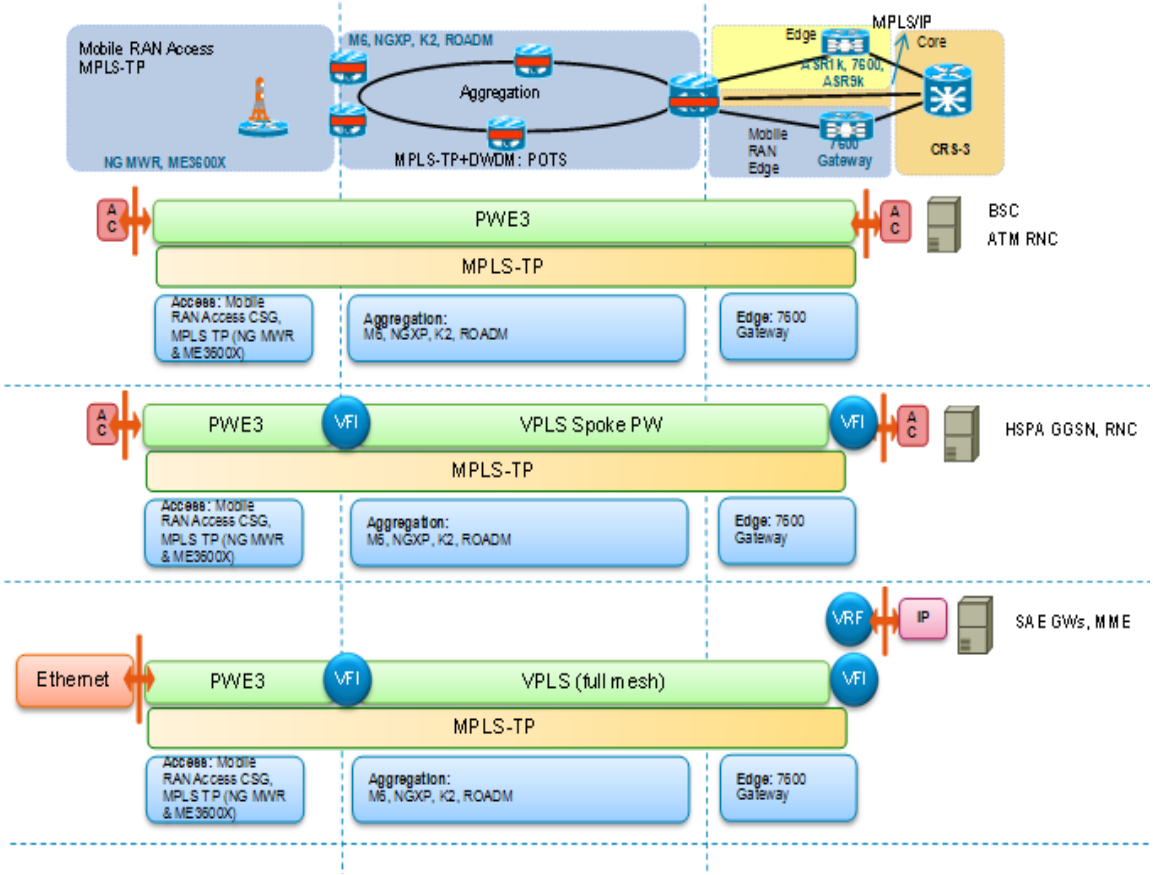
The transport mechanisms that are supported are:

- ATM IMA VCC PWE3—ATM Inverse Multiplexing for ATM/ Virtual Channel Connection/ Pseudowire Edge-to-Edge.
- ATM IMA PVP PWE3—ATM Inverse Multiplexing for ATM / Permanent Virtual Path / Pseudowire Edge-to-Edge.

RAN Backhaul Services Architecture

RAN Backhaul services enable Service Providers to migrate Mobile Wireless traffic backhaul from traditional TDM networks to increasingly cost-effective network technologies. RAN Backhaul network architectures involve a variety of virtual connection configurations. Pseudowires (single segment or multi segment) transporting TDM or ATM traffic, a combination of Ethernet access and EoMPLS, VPLS and Hierarchical VPLS, and (for LTE architectures) MPLS VPN distribution networks between Mobile RAN Edge and cell sites are typical in RAN Backhaul networks. REP ring configurations, multi-chassis Link Aggregation or MST Access Gateway configurations could lead to redundancy in the Ethernet access network. The MPLS aggregation network is characterized by Pseudowire (e.g. segments of multisegment Pseudowires), VPLS or MPLS VPN configurations or a combination of these configurations. The aggregation network transports the mobile wireless traffic between the access networks and the Mobile RAN Edge where subscriber service is handled. Figure below describes the RAN Backhaul service over an MPLS-TP architecture.

Figure 2-7 RAN Backhaul over MPLS TP architecture



In the network architecture described in the figure above, RAN Backhaul transport is supported by an end-to-end MPLS TP transport architecture reaching from a cell site router to Mobile RAN edge gateway (7600 router). Here, either single segment or multi segment PW can be statically configured and mapped to a reliable MPLS TP transport network with MPLS TP tunnels (working and protecting tunnels). With VPLS support within an MPLS TP based aggregation network, RAN Backhaul transport can occur over hierarchical VPLS configurations with Pseudowire over MPLS TP tunnels such as access to VPLS (vfi) instances on aggregation nodes. While the connectivity among VPLS (vfi) instances will most likely be provided by signaled PWs, these PWs are carried via reliable MPLS-TP tunnels among aggregation nodes and Mobile RAN edge gateways. At the Mobile RAN edge gateway traffic can be handed off from PWs or VPLS instances to attachment circuits or MPLS VPN (vrf) instances.

While an end-to-end MPLS TP transport infrastructure provides maximum operational and cost benefits, customers with existing MPLS/IP network infrastructures in the aggregation network can still take advantage of cost advantages of MPLS TP cell site routers. In these scenarios, Pseudowire transport across the access network via MPLS TP tunnels is combined with a PW segment across MPLS/IP. The access Pseudowire (transported among the cell site router and aggregation device via reliable MPLS TP tunnel) can also provide the attachment circuit to a VPLS (vfi) instance or combination of VPLS (vfi) instance and MPLS VPN (vrf) instance at the aggregation device.