QUICK LOOK

ALTERNATIVE BACKHAUL AND DATA OFFLOAD SOLUTIONS
FOR GSM AND UMTS OPERATORS

The Cisco® RAN Optimization solution offers alternative radio access network (RAN) backhaul transport and data offload over Metro Ethernet, xDSL, cable, and WiMax technologies, enabling mobile operators to reduce backhaul operating expenses (OpEx) and increase available cell-site bandwidth.

SUMMARY

Mobile operators need to connect their cell-site base transceiver stations (BTSs)/NodeBs with regional base station controllers/radio network controllers (BSCs/RNCs) over a reliable connection. The common media used for such connections are E1/T1 time-division multiplexing (TDM) landline links at 2 Mbps/1.56 Mbps each, which mobile operators either own or, more often, lease from fixed-line service providers. Especially for long-distance links or for remote areas where landlines may not be readily available, leasing fees can be very high. In addition, technological advancements demand for new services, and competitive pressure require mobile operators to continuously expand their network and increase bandwidth capacity at cell sites and thus deploy additional E1/T1 links and increase their operating expenses.

The Cisco Systems® solution for RAN optimization offers wireless mobile operators worldwide the possibility to use alternative backhaul technologies to complement or replace their expensive TDM backhaul network for both Global System for Mobile Communications (GSM) Abis and Universal Mobile Telecommunications Service (UMTS) Iub links. Using widely available and reliable IP-based transport technologies, the Cisco RAN Optimization solution enables operators to connect their BTSs and NodeBs using xDSL, Metro Ethernet, cable, or WiMax technologies.

Furthermore, proprietary Cisco optimization algorithms deliver a 30 to 50 percent efficiency gain on RAN links, enabling mobile operators to reduce the number of links or amount of bandwidth they need to connect RAN nodes. Alternative backhaul and optimization techniques allow mobile operators to reduce RAN OpEx, while providing for future network expansion and shorter deployment times.

CHALLENGES

Network operating expenses represent about 20 to 30 percent—and up to 70 percent in some cases—of total OpEx for a mobile operator. Keeping operating expenses under control is therefore a priority in today’s competitive and cost-sensitive business environment. In addition, any means to expand the network as the number of subscribers increases and to provide additional services—without requiring an increase in operating expenses—represents a competitive advantage that cannot be underestimated.

The Cisco RAN Optimization solution offers multiple advantages to mobile operators seeking to reduce their network operating expenses while expanding their infrastructures and providing innovative services. It allows for immediate savings on expensive landline bandwidth by employing a unique Cisco technology that compresses and optimizes GSM and UMTS traffic with compression efficiency between 30 and 50 percent. It also allows using excess bandwidth on existing links to add additional channels or deploy new services—without any increase in operating expense.

Mobile operators worldwide are facing three contemporary phenomena: the expansion of their customer base, the reduction in voice average revenue per user (ARPU), and the increase in data ARPU. An expanding customer base demands the deployment of additional resources, in terms of voice channels, bandwidth, and new technologies (2.5G, 3G). Challenged with decreasing ARPU and strong competition, operators need to satisfy their customers’ demand for expansion and new technologies with reduction in costs and operating expenses. Finally, the widening acceptance of data services (General Packet Radio Service [GPRS], Enhanced Data Rates for Global Evolution EDGEUMTS, and High-Speed downlink Packet Access...
[HSDPA]) and the increasing data ARPU hurry operators to seek new revenue flows from data services, thus requiring deployment of expanded data networks and additional bandwidth.

These two competing challenges, the need for network expansion and provision of new services, and the necessity to keep operating expenses low, are both balanced and well satisfied with Cisco RAN Optimization.

Cisco RAN Optimization solution allows mobile operators to achieve three main goals:

- Reduce OpEx for RAN backhaul by optimizing and aggregating backhaul links for both GSM Abis and UMTS Iub interfaces
- Use an alternative IP-based backhaul technology such as Metro Ethernet, xDSL, cable, or WiMax, to further reduce RAN backhaul OpEx, provide greater bandwidth to cell sites, and offload data traffic to broadband connections.
- Introduce IP services on the cell site, delivering advanced services to mobile customers and creating new revenue-generating opportunities

SOLUTIONS
RAN Transport over Alternative Broadband Backhaul

Using a proprietary optimization protocol, based on compressed IP and the de facto worldwide standard Cisco IOS® Software for routing, the Cisco RAN Optimization solution allows mobile operators to transport their RAN traffic using alternative backhaul technologies, such as Metro Ethernet, cable, xDSL, and WiMax.

The Cisco solution frames RAN voice and data frames into IP packets and transports them transparently over a suitable IP network. On the other side, the RAN frames are extracted from the IP packets, and the Abis or Iub data streams are rebuilt. The result is a transparent, vendor-independent RAN optimization solution that delivers optimization efficiency up to 50 percent without any effect on voice and data quality. Alternative backhaul takes advantage of the IP-based proprietary technology implemented by Cisco, offering less expensive solutions for RAN backhaul over broadband networks. Cisco RAN Optimization is the only available solution that delivers standards-based end-to-end IP broadband connectivity for RAN transport.

When the broadband network provides the necessary service-level agreement (SLA), the advanced quality of service (QoS) mechanisms and features offered by Cisco IOS Software help ensure a reliable, lossless, and smooth end-to-end transport of RAN traffic over broadband networks, protecting the RAN backhaul from inefficiencies, loss, or jitter. The end result is an alternative backhaul solution that delivers service reliability, no effect on voice or data quality, scalable bandwidth, and overall reduction in OpEx.
Because of strict timing tolerances, the BTSs and NodeBs deployed at cell sites need a reliable clocking source to keep them synchronized with central node BSCs and RNCs. Because alternative backhaul networks may not be able to provide a reliable clocking source, an external clocking source is needed. Cisco suggests the use of a Global Positioning System (GPS) external antenna, connected to the cell-site nodes, as a precise and reliable synchronization clocking source (Figure 1).

**Figure 1. Overview of Alternative Backhaul Network with GPS Clock Source**

Whenever a reliable external clocking source is not available, an alternative solution is to maintain a single E1 line to reach the cell site, only for clocking purposes. Synchronization to both BTS and NodeB at the cell site would then be provided by the E1 SDH clocking source (Figure 2).

**Figure 2. Overview of Alternative Backhaul Network with SDH Clock Source**

Voice and data traffic, for both GSM and UMTS, can be transported over alternative broadband backhaul, taking advantage of larger available bandwidth and lower costs. Latency on the broadband network, contracted under the SLA, needs to be limited below the tolerance limits of the RAN nodes (BTS, NodeB) and may depend on the radio vendor and underlying technology.

The use of an alternative backhaul allows mobile operators to save on high T1/E1 leasing costs and to gain higher flexibility in bandwidth management. Most of the alternative backhaul technologies allow bandwidth resources to be selected from a broad spectrum of available options and allow adding more bandwidth with ease and speed.
These solutions are therefore the most suitable for innovative mobile operators that seek ways to increase their business and expand their networks with efficiency as demand increases, without increasing their OpEx. A single Metro Ethernet connection, delivering many Mbps of bandwidth to the cell site, can replace multiple expensive and inefficient E1 links, saving OpEx, maintenance, and operational costs and reducing the time to add additional bandwidth or channels.

**HSDPA Offload over Alternative Backhaul**

Demand for data services is increasing worldwide, and mobile operators already see their data ARPU growing much more quickly than voice ARPU. In order to help ensure proper coverage and available bandwidth to deliver satisfactory data services to their subscribers, mobile operators are seeking technological solutions to increase available data rate and channels. GPRS, EDGE, UMTS, and HSDPA all require additional bandwidth to be deployed at the cell site, in order to support a growing customer base for data services.

While 2G data solutions such as GPRS and EDGE are in-band data transport technologies sharing the available channels and bandwidth of voice GSM, newer technologies tend to be more demanding in terms of bandwidth requirements. In particular, HSDPA requires a minimum bandwidth at cell site of 3.8 Mbps. This means that operators need to deploy two additional E1 lines only for HSDPA traffic, alongside the other E1 lines already in place for GSM and UMTS voice traffic.

Although HSDPA will provide an enhanced experience to the mobile data user, with larger bandwidth and faster access times, it represents a huge capital investment. In fact, operators need to deploy two additional E1 lines to each cell site in order to start providing the service, with a corresponding increase in their OpEx. In contrast, mobile data services still represent an emerging market, and it will take time for data services to be used fully by the mainstream customer base. Therefore mobile operators need to increase their OpEx upfront and wait to recover their investment in HSDPA.
The Cisco alternative broadband backhaul solution offers mobile operators worldwide the possibility to start deploying HSDPA services today with little increase in their OpEx. By offloading data traffic on less expensive alternative broadband backhaul, operators can avoid deploying expensive E1 lines and save on OpEx. In addition, broadband networks allow for a smooth, easy, and fast increase of available bandwidth when needed, reducing time to market for network expansion and for the provision of new services (Figure 3).

**Figure 3. Overview of Data Offload over Alternative Backhaul**

Data offload routes the UMTS data traffic and HSDPA traffic from the expensive E1 backhaul to a broadband network, such as Metro Ethernet, xDSL, cable, or WiMax. The broadband network needs only to provide an SLA as required by cell-site radio vendors, while Cisco IOS Software QoS features take care of queuing, jitter reduction, loss avoidance, and end-to-end connection reliability.

Data offload can be the first step toward a complete offload of all cell-site traffic, voice and data, over a broadband backhaul.

As a first step, data offload is an efficient cost-saving solution for operators that cannot manage synchronization issues for their GSM and UMTS networks over broadband backhaul, that are bound contractually to their E1 service provider and cannot reduce the number of E1 lines, or that simply prefer a graceful transition to alternative backhauling.

**BENEFITS**

- Provides access to economical IP transport network technologies, such as Metro Ethernet, xDSL, cable, and WiMax
- Reduces RAN backhaul OpEx, maintenance, and operational costs
- Aggregates multiple channels and different technologies over the same backhaul connection, providing bandwidth efficiency and cost reduction
- Allows for easy and smooth growth of backhaul bandwidth, as demanded by customer coverage or new services, and avoids the limitation of slotted 2-Mbps E1 lines
- Delivers broadband data services to the cell sites and to mobile customers
- Does not affect voice quality or data transfer rates, uses a vendor-independent solution and does not change the proprietary bit stream in either the GSM Abis or UMTS Iub interfaces
- Provides a centralized network management platform, based on the Cisco Mobile Wireless Transport Manager (MWTM) product, that tracks the status of each node—up to the cell-site nodes—and provides real-time data on backhaul utilization and efficiency gain. Through the use of intuitive, workflow-based monitoring and control capabilities, Cisco MWTM helps reduce TCO and onsite maintenance costs.
- Is transparent to BTS/NodeB operational procedures and software upgrades
SUPPORTING SOLUTIONS, PRODUCTS, AND SERVICE OFFERINGS

The Cisco RAN Optimization solution is part of a broader Cisco offering for RAN infrastructure optimization for GSM and UMTS networks, as well as Code Division Multiple Access (CDMA) infrastructures. Supporting solutions, products, and service offerings are:

- Cisco MWR 1941-DC-A Mobile Wireless Edge Router
- Cisco MWTM management platform
- Cisco Advanced Services for RAN Optimization

WHY CISCO?

Cisco provides a complete IP-based RAN infrastructure optimization solution that increases efficiency, reduces costs, and enables additional services based on IP, where Cisco is the recognized market leader.

Worldwide leader in IP networking solutions:

- IP-based transport of RAN traffic, compliant with Third-Generation Partnership Project (3GPP) R5/R6
- IP end-to-end services at cell site

World-class reliable and expandable solution:

- RAN vendor-independent solution integrates with all major existing RANs
- Transparent RAN solution; does not affect voice quality and data throughput
- Wide range of interface choices for alternative backhaul

World-class network management products:

- Integrated management solution based on Simple Network Management Protocol (SNMP) allows for centralized management of remote sites
- Expertise and knowledge in deploying network management solutions to manage thousands of nodes

World-class technical support:

- Worldwide support organizations (Cisco Advanced Services, TAC)

FOR MORE INFORMATION

For more information about Cisco alternative backhaul optimization solutions and products, visit the Cisco RAN Optimization RAN Website at http://www.cisco.com/go/mobile.