Cisco ASR 9000-Based Next-Generation Mobility Services Infrastructure

Executive Summary

Mobile wireless subscribers are increasingly demanding content any place, any time, anywhere. Consider the popularity of the iPhone and other handheld devices (Figure1). Data sessions over mobile networks in which consumers worldwide seek real-time information they formerly did not normally access are increasing sharply.

Figure 1.   Mobility Devices

Heavy Reading reports that in 2007 the Mobile Data volumes increased from 4- to 8-fold, influenced by lower pricing and higher end-user data rates.

In addition, Infonetics Research reports that mobile subscribers are expected to grow from 3.1B in 2007 to 4.4B in 2011. In countries like India, new subscribers are growing at a rate of 6 million per month, and new base-station deployments are reaching 1000 per month. India and other countries such as China will lead the Asia-Pacific region in the highest number of base stations deployed globally. Also the report mentions that the Subscriber use of data and video is increasing; as operators continue to roll out increased bandwidth per subscriber, the high-speed downlink packet access (HSDPA) capacities have grown successively from 3.6M to 7.2M to 14.4M and on to 28.8M (Infonetics Research, "Mobile Backhaul Equipment, Installed Base, and Services Market Share and Forecasts", April 2008)

Further increasing the need for bandwidth is a technology evolution, including increased bandwidth capability in the last mile with newer radio technology and migration to IP-based technologies, and mobile backhaul using Ethernet as the main technology. Mobile service providers worldwide are exploring means to flatten their capital expenditures (CapEx) growth while using the most scalable option at a cheaper cost. They are also looking for ways to continue interactions with older equipment to avoid service-quality degradations and any service interruptions. These mobile service providers are also looking for longevity of their investments to accommodate requirements on these networks led by fixed mobile convergence as well as long-term evolution (LTE) technologies to reduce the number of complete equipment upgrades to their infrastructure.

Cisco has been a critical player in this space with its strength in mobility gateway solutions and IP and Ethernet technologies, and now - with the introduction of the Cisco ASR 9000 Series - Cisco provides a new long-term strength. The routers offer a highly scalable and flexible platform that has the critical built-in system attractions for the mobile market and, in fact, can meet and exceed the expectations in this area.

This paper reviews the mobile backhaul solution with the Cisco ASR 9000 including it's ability to provide the needed clocking and timing distribution solution introduced herein.

Mobile Backhaul (Radio Access Network Backhaul)

Mobile backhaul is a critical link transporting subscriber (data, voice, and video) traffic between the base station (base transceiver station [BTS] or NodeB) and the radio network controller BSC or Radio Node Controller (RNC). Mobile backhaul architectures have traditionally been based on time-division multiplexing (TDM) and ATM technologies, but in the ever-evolving mobile services scenario – which is now expected to be dominated by iPhones and iPhone-like smartphones – the traditional circuit-based bandwidth networks are constraining and expensive (Figure2).

Figure 2.   Mobile Backhaul Equipment, Installed Base, and Services
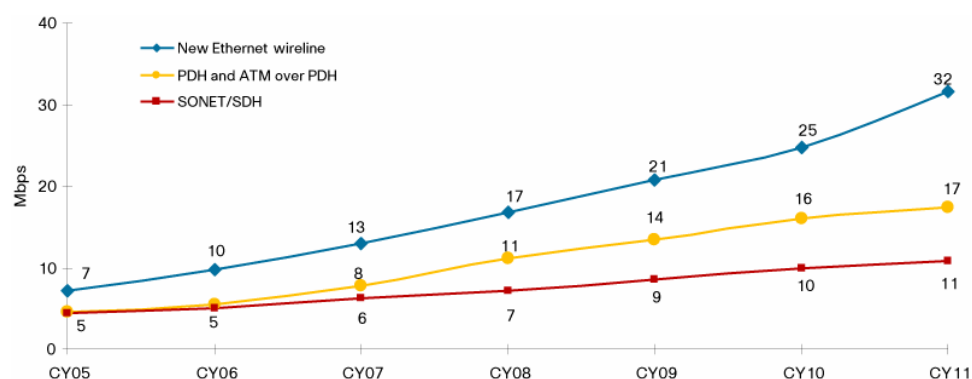
Source : Infonetics, 2008 ("Infonetics Research, Mobile Backhaul Equipment, Installed Base, and Services Market Share and Forecasts", April 2008)

Challenges

The explosion in the data traffic for mobile users comes with challenges for the mobile operators related to the management of the traffic across a converged network that is expected to provide lower cost per bit without compromising the flexibility of the services being offered.

In addition, the monthly recurring charges for existing backhaul technologies (Plesiochronous Digital Hierarchy [PDH], ATM over PDH, and SONET/SDH) increase linearly with the capacity, and the average revenue per user (ARPU) is not expected to grow as fast as the rate of data traffic, further pushing the mobile operators to keep the CapEx lower and eventually gain a lower cost per bit.

The demand is for a backhaul network that can provide low latency, higher bandwidth, network intelligence, resiliency, security, quality of service (QoS), and service differentiation.

These challenges are directing the mobile carriers toward native Ethernet and IP Multiprotocol Label Switching (IP/MPLS)-based packet backhaul architectures. Most operators are expected to plan for the transition to the next-generation IP/MPLS with a hybrid approach, wherein they continue with second- and third-generation (2G and 3G, respectively) voice on the current TDM technology and use packet technologies for the new data service Evolution-Data Optimized (EV-DO) and HSDPA traffic.

Cisco ASR 9000 in Radio Access Network Backhaul

The Cisco Solution for Radio Access Networks (RANs) Aggregation is an integral part of the IP Next-Generation Network (IP NGN) strategy for Global System for Mobile Communications (GSM) and Code Division Multiple Access (CDMA) mobile operators. It extends IP expertise from the network core to aggregation sites with an efficient and flexible transport solution that ensures support for both present and future requirements for 3G and 4G applications. Figure 3 shows where the Cisco ASR 9000 plays a role in the Cisco RAN architecture.

Figure 3.   Cisco RAN Architecture: Reduce Costs and Provide Service-Delivery Assurance
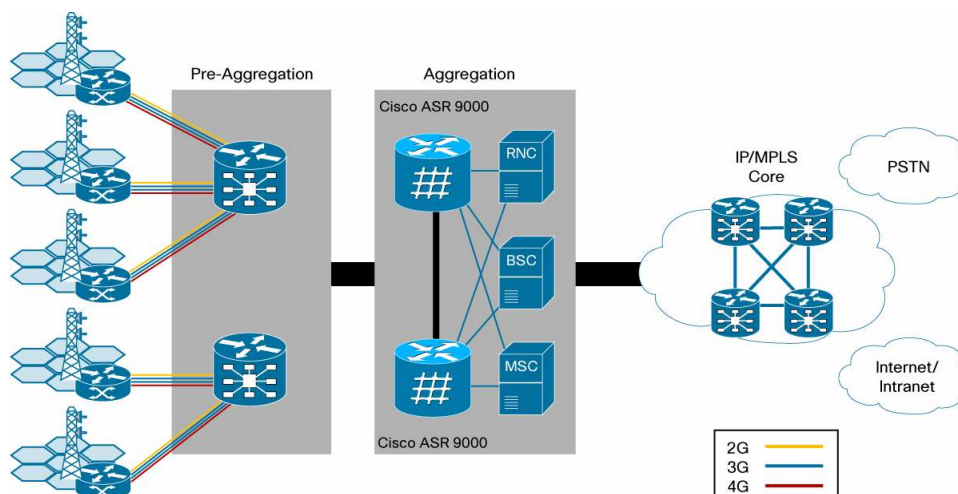
The Cisco solution addresses the network layer of a mobile carrier focusing on the aggregation and the cell-site part. It enables cost-effective, secure deployment of mobile backhauling transport networks.

By using standards-based Mobile Transport over IP, you can take advantage of the same technologies that many are now using in their core and aggregation networks – Ethernet and IP/MPLS – to reduce their costs while building an architecture that can support future (and possibly unknown) network requirements. It is important to note that standards-based pseudowires do not force a wholesale network upgrade. Instead, they allow mobile operators to cap their investment in traditional equipment and evolve to an all-IP based solution over time.

Cisco ASR 9000 Series

Cisco ASR 9000 Series offers a scalable, low-power, next-generation Carrier Ethernet platform with a system architecture specifically designed to accommodate a service provider's unique convergence requirements of Layer 2 Ethernet transport plus Layer 3 services.

Figure 4. Cisco ASR 9000 Series Aggregation Services Router

Scalability

The Cisco ASR 9000 offers exceptional capacity for the Carrier Ethernet platform, with its ability to scale to a capacity up to 6.4 Tbps. It is a highly scalable Carrier Ethernet router, optimized for aggregation of dense 10 Gigabit Ethernet and 100 Gigabit Ethernet connections.

Modularity

The Cisco ASR 9000 Series supports modularized system components both hardware and software – isolating failure and faults to subsystem or component level.

It brings the time-tested and robust capabilities of Cisco IOS® XR Software to the edge. The operating system supports true software and process modularity. The Cisco IOS® XR Software is an innovative self-healing, distributed operating system designed for always-on operation while scaling system capacity up into the Tbps.

The Cisco IOS® XR capabilities allow each process to run in separate protected memory, including each routing protocol. With multiple instances of control, data and management planes.

Optimized for Mobile Operators

The Cisco ASR 9000 Series is specifically designed to give mobile operators flexibility in offering new and incremental services by providing a strong foundation for mobile services and RAN service backhaul. This solution enables providers to take the necessary steps for the delivery of next-generation services for the mobile space.

The Cisco ASR 9000 Series is designed to help mobile service providers effectively manage the challenges they face:

- Density and bandwidth for Next-Generation services
- Flexible service offerings on a converged platform
- Unpredictability of mobile data demand
- Ease of operation network reliability

High Availability

The Cisco ASR 9000 Series platform hardware and software is architected with a view to maintaining high availability. Features such as software modularity are critical to maintaining high service availability.

The router supports critical high-availability features such as:

- Nonstop Forwarding (NSF) and Stateful Switchover (SSO)
- Pseudowire (PW) Redundancy for Layer 2 Services
- Virtual Router Redundancy Protocol (VRRP) with subsecond failover
- In Service Software Upgrade (ISSU)

Quality of Service

Quality of service is important for preserving the integrity of voice and data services throughout the network – especially in RAN aggregation. QoS is also an important feature because it is needed to prioritize and reserve bandwidth for voice services.

The Cisco ASR 9000 Series supports QoS and allows service providers not only to avoid congestion in the network but also to prioritize different classes of traffic. The router supports up to four different levels of hierarchy.

Clock Synchronization

As networks rapidly migrate to Ethernet, a methodology is needed to overcome the inherent limitations of the technology with respect to synchronization transfer. Without this capability "network timing holes" would exist, making evolution of older equipment and applications to NGN costly, slow, and painful.

The Cisco ASR 9000 Series addresses this demand to distribute synchronization (frequency and time). It provides native support for Synchronous Ethernet (SyncE; frequency distribution)-based clock synchronization mechanisms, with the additional flexibility to support IEEE 1588, Precision Time Protocol Version 2 (PTPv2).

Layer 2 Services

The Cisco ASR 9000 Series is well-positioned to provide Layer 2 Ethernet transport convergence with Layer 3 services. The router is built with a strong foundation for the next-generation software architecture that addresses the Carrier Ethernet service requirements, including service flexibility; scalability; network redundancy; high availability; performance; operations, administration, and management (OA&M); and QoS.

These features are critical for a cost-effective mobile backhaul transport architecture, and they carry mobile subscriber data, voice, and video traffic across a converged Carrier Ethernet network.

The common provisioning model offers:

- Transparent Virtual Private Wire Services (VPWS) and Virtual Private LAN Services (VPLS) transitions (Easy Layer 2 VPN [L2VPN])
- Flexible VLAN tag matching for User-Network Interface (UNI) classification
- Flexible service mapping (VPWS, VPLS, bridging, etc.)

Complete OA&M coverage includes:

- Standard 802.3ah for link-level fault detection

- Standard 802.1ag draft 8.1 compliance

- MPLS OA&M and Virtual Circuit Connectivity Verification (VCCV) support

- Ethernet service-level agreement (SLA) and Y.1731 Performance Monitoring (future)

Network Management

The Cisco ASR 9000 Aggregation Services Router supports the Cisco Active Network Abstraction (ANA), which is a flexible and powerful product suite for device, network and service management in a multitechnology, multiservice network environment.

Some important features follow:

- Network and service fault Isolation and correlation

- Service activation

- Network and service discovery

Cisco Services for Cisco ASR 9000

Through a lifecycle services approach, Cisco delivers comprehensive support to service providers to help them successfully deploy, operate, and optimize their IP Next-Generation Networks (IP NGNs). Cisco Services for the Cisco ASR 9000 Aggregation Services Router provide the services and proven methodologies that help assure service deployment with substantial return on investment, operational excellence, optimal performance, and high availability. These services are delivered using leading practices, tools, processes, and lab environments developed specifically for Cisco ASR 9000 deployments and postimplementation support. The Cisco Services team addresses your specific requirements, mitigates risk to existing revenue-generating services, and helps accelerate time to market for new network services.

For more information about Cisco Services, contact your local Cisco account representative or visit www.cisco.com/go/spservices.

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