

Juniper Networks Mobile Backhaul Solution

Changing Backhaul Economics with a Scalable, Flexible Solution

Challenge

Existing backhaul solutions are expensive, impacting profitability for mobile operators. As the demand for bandwidth—especially data services—grows, service providers need a scalable solution that protects their investment at the cell site and gives them the flexibility to add next-generation technologies quickly and cost effectively.

Solution

Operators can now meet these challenges with the Juniper Networks Mobile Backhaul Solution, which extends IP/MPLS all the way to the cell site. The Juniper solution includes products for the cell site, metro backhaul network and aggregation site, all managed by a comprehensive network management solution.

Juniper Benefits

The Juniper Mobile Backhaul Solution offers service providers:

- Reduced operating expenses due to lower cost-per-bit of IP-based transport and Juniper's comprehensive network management featuring zero-touch deployment and proven JUNOScope software.
- Improved scalability, which allows operators to purchase incremental bandwidth as needed to match demand.
- Investment protection, by supporting both legacy and next-generation technologies at the cell site.

The Challenge

Consumers are demanding more mobile services—especially bandwidth-hungry data services. New value-added services such as push-to-talk, interactive gaming, multimedia messaging, mobile VPNs, and video streaming offer operators new ways to attract and hold subscribers and grow revenues. Service providers are already seeing rapid growth in data services, and this trend will continue to accelerate.

Realizing the potential requires upgrading the mobile infrastructure, in particular, the mobile backhaul. Limitations of the existing mobile backhaul solutions include:

- **Cost:** For mobile backhaul today, mobile operators use copper or microwave time-division multiplexing (TDM) links, often leased from other service providers. The cost is high: \$24.6 billion worldwide in 2007, expected to rise to \$34 billion in 2008—representing up to 30 percent of all OPEX expenditures. Unlike infrastructure costs, this expense is ongoing, draining profits and impacting competitiveness. Any cost savings realized in backhaul go straight to the bottom line.
- **Scalability:** A typical cell site requires two or three leased T1/E1 lines, representing 4 to 6 Mbits/sec of bandwidth. New data-intensive mobile services could double this requirement—and more. Adding this much capacity via TDM lines is time-consuming and economically prohibitive. Carriers need the ability to add capacity on demand to respond to changing customer needs.
- **Flexibility:** As mobile networks evolve from 2G to 3G and beyond, cell sites must support multiple transport technologies such as TDM, Asynchronous Transfer Mode (ATM) and IP/Ethernet. Carriers have substantial investments in 2G technology, so a rip-and-replace strategy is not feasible. The next generation of backhaul components must support the multiple coexistent technologies at the cell site.
- **Efficiency:** Because each T1/E1 line is dedicated, excess capacity cannot easily be shared. The current method of providing backhaul capacity invariably involves a substantial amount of unused—and expensive—bandwidth in the mobile backhaul.

The Juniper Networks Mobile Backhaul Solution

To address these challenges, Juniper Networks offers its advanced Mobile Backhaul Solution. The Juniper solution leverages IP/MPLS technology that is already in use in many mobile packet cores across the entire mobile infrastructure.

Unlike piecemeal approaches that mix and match components, the Juniper Mobile Backhaul Solution is a fully integrated, high-performance architecture addressing the needs of the cell site, metro backhaul and aggregation. The Juniper solution also includes a comprehensive network management component to increase operational efficiency and minimize OPEX.

Solution Components

The Juniper Mobile Backhaul Solution includes (see Figure 1):

- Juniper BX 7000 Multi-Access Gateway
- Juniper M-series Aggregation Site Gateway with circuit emulation PICs
- Juniper MX-series for metro backhaul aggregation
- JUNOScope IP Services Manager with extensions for mobile backhaul

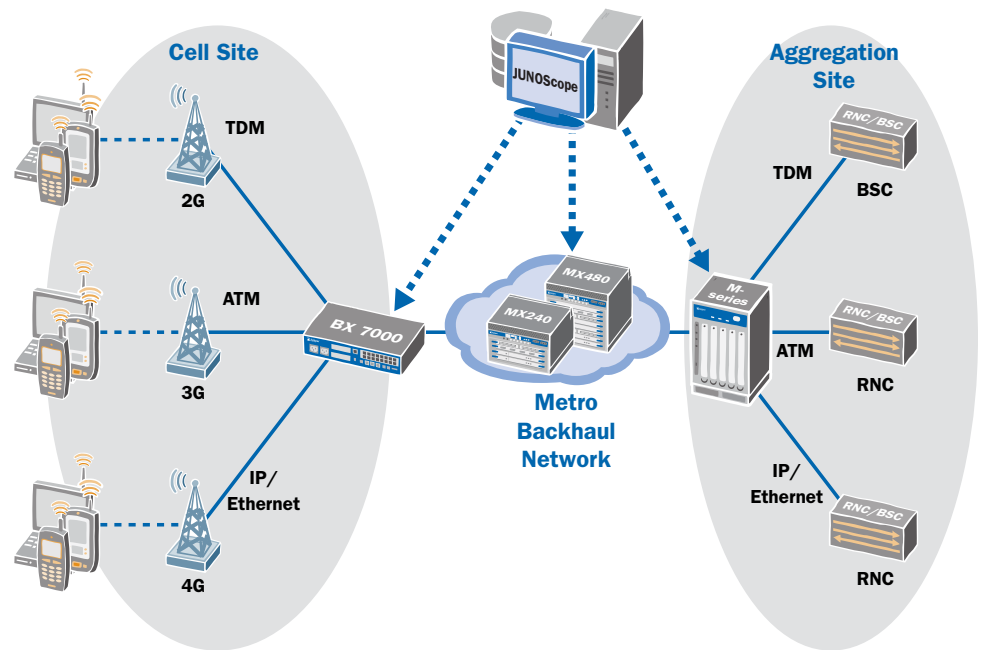


Figure 1: Juniper Mobile Backhaul Solution

Juniper BX 7000 Multi-Access Gateway

Designed for the demanding environment of the cell site, the Juniper BX 7000 Multi-Access Gateway interfaces to common uplinks including T1 and E1, DSL, and Ethernet. It reliably transports TDM, ATM and packet traffic over IP/MPLS using pseudowire technology. The Juniper BX 7000 includes a replaceable interface module which supports higher density at the cell site while minimizing equipment variety.

The Juniper BX 7000 supports a range of timing synchronization options, with future-proofing provided by a slot for field-replaceable timing modules. The BX 7000 supports today's technologies as well as emerging standards such as WiMAX and Third-Generation Partnership Project (3GPP) Long Term Evolution (LTE).

By deploying the Juniper BX 7000, mobile operators can retain their existing investment in 2G and 3G cell sites while reaping the benefits of IP/MPLS-based transport. Services can be migrated gradually, for example, by offloading the high-growth data transport as a first step.

Features

- Provides transport of legacy T1/E1 circuits across an ATM network
- Compact form factor (9.45 inches/24 cm deep), ideal for cell site deployments
- Temperature hardened option for uncontrolled environments
- Passive cooling design for increased reliability and reduced power consumption
- Unique expansion slots for additional advanced clocking and backhaul options
- Feature-rich software support for TDM and ATM pseudowires, ATM-IMA, MPLS, and GRE

See the BX 7000 datasheet for complete product specifications.

Juniper Aggregation Site Gateway (M-Series with Circuit Emulation PICs)

The Juniper Aggregation Site Gateway terminates pseudowires, sending TDM traffic to the base station controller, and ATM and IP traffic to the radio network controller. Based on the Juniper M-series router, the Juniper Aggregation Site Gateway features two new circuit emulation PICs designed specifically for mobile backhaul applications:

- 12-port T1/E1 circuit emulation PIC
- 4-port ChOC3/STM1 circuit emulation PIC

Features

- Provides transport of legacy T1/E1 circuits across an ATM network
- Software configurable
- Support for synchronization across packet networks
- L2 or L3 VPNs

See the M-series and Circuit Emulation PICs datasheets for complete product specifications.

Juniper MX-Series Ethernet Services Routers for Metro Backhaul Transport

Juniper MX-series routers are ideal for IP/MPLS-based metro backhaul transport. They offer all the benefits of IP/MPLS—fast reroute, resiliency, reliability, and operation, administration and management (OAM). The MX-series implements both Layer 2 and Layer 3 VPNs.

While the Juniper solution is fully interoperable with a wide range of metro aggregation architectures and components, there are a number of advantages to using MX-series routers, including:

- Pseudowire-VPLS interworking: The Juniper solution with MX-series routers supports pseudowire interworking with VPLS, in which an access pseudowire from the BX 7000 Multi-Access Gateway is cross-connected with a point-to-point VPLS instance in the metro backhaul network. This feature allows mobile operators to address a number of technical requirements, including multihoming, control plane scaling, and multicasting, as well as segmentation issues that can arise when backhaul components reside in different administrative domains.
- Comprehensive network management: JUNOScope IP Service Manager allows network operators to manage the full end-to-end mobile backhaul network from a central location, as described below.

JUNOScope IP Service Manager with Extensions for Mobile Backhaul

JUNOScope is a suite of comprehensive Web-based tools for operational management and administration of Juniper routers, including the BX 7000, M-series and MX-series. Juniper has extended JUNOScope with powerful new features designed to address the demanding requirements of mobile backhaul.

Using JUNOScope, network managers can provision services, manage device configurations, track inventory, diagnose faults, and monitor the backhaul infrastructure from a central location. JUNOScope can push software upgrades to all the components in the Juniper mobile backhaul solution, minimizing the need for costly site visits. As a result, JUNOScope reduces operating costs and improves operational efficiency.

Clock Synchronization

Timing and synchronization are critical elements in radio access networks to maintain good voice quality, reduce interference and manage call handovers between base stations. In a typical TDM network, the various entities are synchronized on a common Primary Reference Source. As the industry moves to packet-based transport networks to distribute TDM services, the same level of synchronization is needed to avoid cut-outs, lost handovers, blocks or failed call-setup.

There are several approaches to achieve this timing synchronization, including Synchronous Ethernet, Adaptive Clock Recovery, IEEE 1588 v2, DSL NTR, and BITS input.

Juniper's solution will support all of these timing synchronization options, meeting strict threshold requirements for jitter and wander. The initial release supports Adaptive Clock Recovery, along with line and loop timing capability of the T1/E1 ports.

Through the use of a replaceable timing module, the Juniper solution allows network managers to mix different synchronization options in the network, optimizing cost and accuracy while minimizing equipment variety.

The Juniper Aggregation Site Gateway and BX 7000 Multi-Access Gateway derive timing from multiple sources simultaneously to ensure that each mobile operator gets timing from its own clock source and maintains accurate clock recovery.

Zero-Touch Deployment

The costs associated with managing a large number of cell site gateways can become a significant drain on profits. Recognizing this fact, Juniper has designed the BX 7000 for zero-touch deployment, meaning that it can self-configure with no human intervention. This powerful feature streamlines the deployment process, shortens the time to service delivery, and reduces training requirements for cell site support staff. Figure 2 shows how the BX 7000 communicates with the Dynamic Host Configuration Protocol (DHCP) server and the automatic configuration server to obtain an IP address and initial configuration.

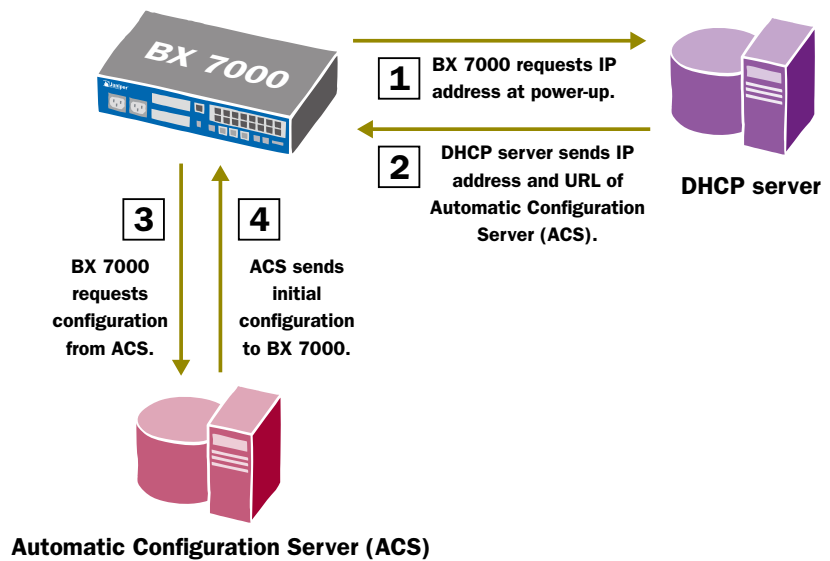


Figure 2: BX 7000 Zero-Touch Deployment

Features and Benefits

Mobile operators are beginning to view the mobile backhaul as not just an out-of-pocket expense but a strategic asset, key to their success in tomorrow's highly competitive and bandwidth-intensive marketplace. The Juniper end-to-end Mobile Backhaul Solution offers operators solid advantages, including reduced OPEX, improved scalability, high reliability, streamlined administration and investment protection.

Reduce OPEX

Extending IP/MPLS—a proven and familiar technology for most mobile operators—into backhaul can offer substantial reductions in cost-per-bit for backhaul transport. For example, replacing three T1 lines with Carrier Ethernet results in savings of up to 70 percent or more for each cell site.

The comprehensive network management features of the Juniper solution greatly reduce ongoing operational expenses and increase operational efficiency. The Juniper solution virtually eliminates site visits except for hardware upgrades.

Improve Scalability

Juniper's IP/MPLS-based Mobile Backhaul Solution scales much more easily than other solutions, since operators can purchase incremental bandwidth as needed from fixed-line operators. Using packet-based backhaul avoids the problem of unused bandwidth that is common with TDM leased line backhaul.

Operators can also consolidate all traffic on a single cost-efficient and high-speed Ethernet uplink as opposed to multiple groups of slow and expensive TDM circuits. In addition, because of Carrier Ethernet's option of fine-grained bandwidth, mobile operators can "pay as they grow," dialing up bandwidth as subscriber traffic increases.

Protect Investments in Cell Site Infrastructure

The Juniper BX 7000 cell site router interfaces with 2G cell sites, making it an easy addition to existing infrastructures. At the same time, the Juniper solution supports 3G and evolving 4G technology to future proof investments in cell site installations. Juniper's comprehensive Mobile Backhaul Solution allows mobile operators to use an end-to-end common IP/MPLS transport network that can support L1/L2 backhaul as well as business and residential services.

Summary—Why Juniper?

For more than a decade, Juniper Networks has been helping service providers evolve to secure, converged packet infrastructures. Juniper solutions for mobile operators feature industry-leading IP/MPLS expertise, comprehensive and proven security, authentication and authorization, and open and scalable solutions in the IP/MPLS core. Now Juniper, the clear leader in IP/MPLS technology, brings this expertise to the mobile backhaul with an end-to-end solution that addresses the current needs of the mobile operator and provides a scalable and flexible platform for growth and expansion in the years to come.

Next Steps

Mobile operators are facing a daunting set of challenges as they look to compete effectively and grow revenues—and profits. The Juniper Networks Mobile Backhaul Solution offers an integrated, high-performance alternative to today's costly approach of leased lines. Contact your Juniper Networks representation today to discuss how Juniper can help you succeed, or visit us at www.juniper.net/mobilebackhaul.

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About Juniper Networks

Juniper Networks, Inc. is the leader in high-performance networking. Juniper offers a high-performance network infrastructure that creates a responsive and trusted environment for accelerating the deployment of services and applications over a single network. This fuels high-performance businesses. Additional information can be found at www.juniper.net.



To purchase Juniper Networks solutions, please contact your Juniper Networks sales representative at 1-866-298-6428 or authorized reseller.