LEGACY TDM TRAFFIC CONVERGENCE OVER IP/MPLS WITH BX SERIES AND M SERIES CIRCUIT EMULATION PICS

Challenge

Maintain revenue stream from legacy services, offer next-generation IP/MPLS-based services, and maximize profitability through cost reduction, simplification, and investment protection.

Solution

Juniper Networks next-generation transport for TDM solution provides end-to-end TDM traffic convergence from low-speed circuit emulation services at remote/branch sites to dense high-speed circuit emulation services at hub/aggregation sites.

Benefits

Juniper's solution allows service providers to offer both legacy and next-generation services over a converged IP/MPLS infrastructure in a way that reduces costs, maximizes profitability, and ensures network and service reliability.

Today's service providers want to continue to offer profitable legacy services such as leased lines, while at the same time offering modern IP, MPLS, and Ethernet-based services. Providers are also looking to reduce costs by consolidating and simplifying their networks.

Juniper Networks time-division multiplexing (TDM) convergence solution provides service providers with the ability to offer both legacy and next-generation access services across a common IP/MPLS edge and core infrastructure. Juniper's solution protects legacy investments and reduces costs by simplifying the network and consolidating multiple networks into one. Elements of Juniper's solution also feature environmental hardening which enables deployment in harsh conditions.

The Challenge

In order to efficiently scale their core, edge, and access networks to the increasing demand for broadband multimedia services like voice, data, and video, service providers must evolve their networks to support modern and native IP, MPLS, and Ethernet-based services. And to maintain consistent to increasing average revenue per user (ARPU) during this transition, service providers must continue offering high revenue legacy services as well. In most cases, building and maintaining redundant networks is both prohibitive and adverse to the service provider's cost reduction initiatives, so converging these legacy and next-generation services on top of a common transport network is critical to profitability and scalability.

The Juniper Networks Legacy TDM Traffic Convergence Solution

The Juniper solution enables service providers to provide legacy TDM and next-generation IP services, while maintaining network reliability and introducing core and edge infrastructure cost reductions. The solution consists of Juniper Networks® BX7000 Multi-Access Gateway for low-speed circuit emulation at branch sites, and Juniper Networks M Series Multiservice Edge Routers with Circuit Emulation PICs for dense and high-speed circuit emulation at aggregation sites. With this solution, service providers can:

- Cap investment in TDM SONET/SDH infrastructure
- Converge to a single IP/MPLS infrastructure to transport IP, TDM, Frame Relay, ATM, and Ethernet traffic
- Reduce network complexity and thus reduce OpEx

The circuit emulation function itself is delivered via the open IETF standard SATOP (Structure Agnostic TDM over Packet) documented in RFC 4553. This standard describes a pseudowire encapsulation for TDM bit streams, such as T1, E1, T3, and E3, that disregards any framing structure imposed on these streams.

The applications that run on TDM services often rely on the network for the real-time determinism that they require for end-to-end communications. This real-time determinism requires clocking and synchronization capabilities that are not provided by packet-based networks. Juniper provides a flexible solution that meets these demanding requirements through a variety of capabilities. For example, the BX7000 supports adaptive clock recovery, line timing, and loop timing, while the M Series supports loop timing and provides support for an external synchronization source on the Juniper Networks M40e Multiservice Edge Router, M120 Multiservice Edge Router, and M320 Multiservice Edge Router.

Because TDM services have been around for so many decades, there are high expectations regarding the quality and reliability of TDM-based services. Juniper's solutions for TDM transport over IP/MPLS are based on pseudowire circuit emulation to IP/MPLS interworking standards. These standards include MPLS capabilities like fast reroute for service availability even in the event of a failure in the network, as well as traffic engineering to guarantee the appropriate levels of bandwidth across all network hops.

Lastly, given the huge geographic scope over which TDM services are delivered, it is frequently not possible to make the same "controlled environment" assumptions that can be made when deploying general-purpose routers. In recognition of this reality, the BX7000 supports extended operating temperatures

and fanless operation, as well as an option for an enclosure to offer even further environmental hardening (for example, rain protection).

Features and Benefits

The key features of this solution are:

- A single platform to transport both VoIP and TDM voice traffic
- Standards-based TDM transport over packet
- Guaranteed bandwidth through traffic engineering, differentiated services, and other value-added capabilities
- A wide selection of synchronization options
- Temperature hardening for outside plant deployment

Specialized features of the Juniper solution enable service providers to converge IP, TDM, Frame Relay, ATM, and Ethernet traffic onto a single edge and core infrastructure which, in turn, offers the following benefits:

- CapEx reduction by eliminating the need to build or maintain multiple overlay networks to transport each traffic type
- OpEx reduction by simplifying the network and focusing operations on a single type of infrastructure as opposed to multiple disparate and redundant networks
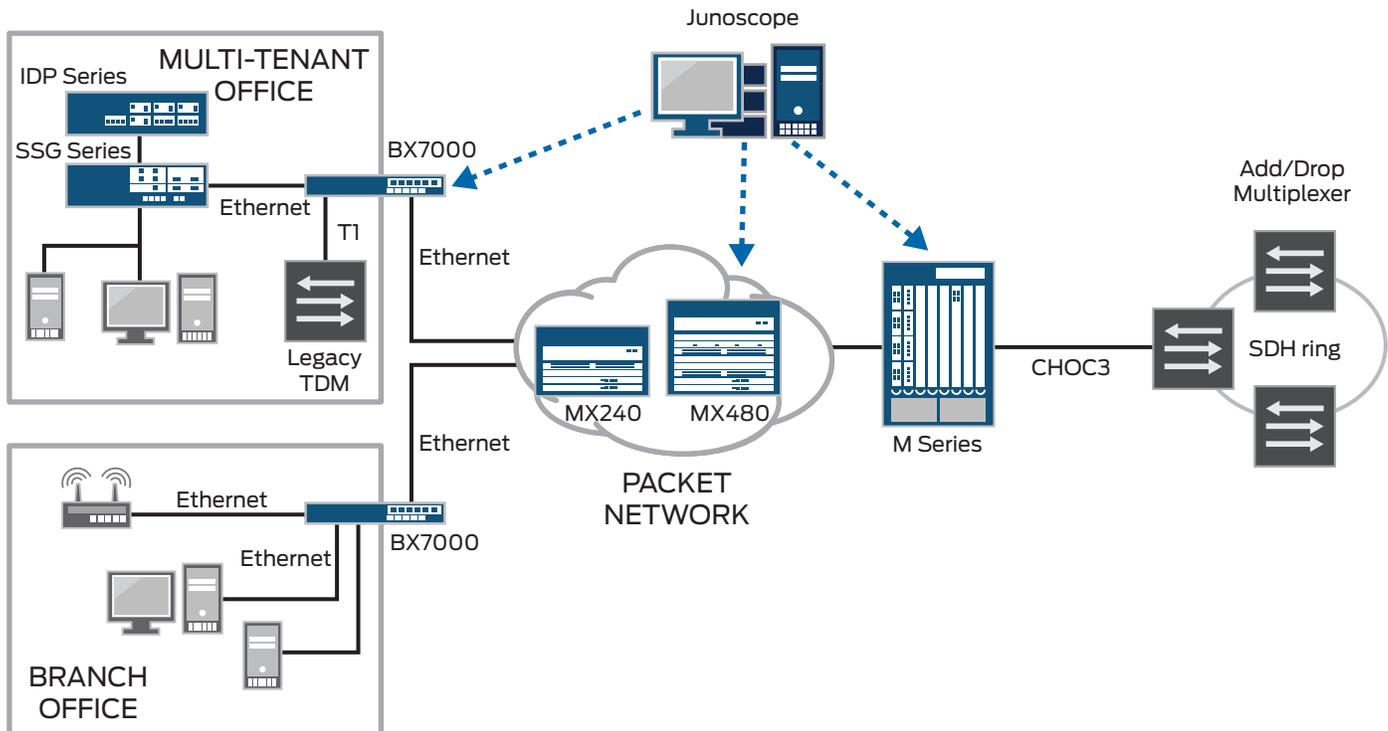- High service quality to continue to meet subscriber expectations

Figure 1: Legacy leased line service over IP/MPLS

Application Examples

The Juniper TDM convergence solution has numerous applications. Three such applications are described in this solution brief.

Legacy Leased Line Service over IP/MPLS

As shown in the figure below, the Juniper TDM convergence solution enables operators to provide leased line services over a converged (hence lower cost) packet network. The BX7000 can flexibly support branch offices which may require a combination of both T1/E1 (for legacy TDM) and/or Ethernet (for data), as well as multi-tenant sites which require greater port density and may also require hardening for outside plant installations.

Mobile Switching Center Site Interconnect

Another application for which the TDM convergence solution is well suited is interconnected Mobile Switching Centers (MSCs). As shown in the figure below, the BX7000 can be deployed in distributed MSC sites and M Series Multiservice Edge Routers can be deployed in central sites in order to do voice trunking over a single converged packet network as opposed to a legacy TDM infrastructure.

PBX Interconnect Between Branch Offices

Many enterprises are looking to reduce the cost of their infrastructure supporting voice services. Some of these enterprises make the jump directly to VoIP, whereas other enterprises want to continue to use the TDM voice equipment they've already purchased but achieve lower cost by getting rid of the TDM connectivity that legacy equipment requires. In the latter case, Juniper's converged TDM solution can help realize that converged and lower cost transport. The following figure illustrates this application, showing interconnecting PBXs in two branch offices over the same packet infrastructure that also carries the enterprise's data services.

Solution Components

The Juniper next-generation transport solution delivers all of the benefits discussed above and consists of the following components:

- **M Series routers with Circuit Emulation PICs**
  M Series Multiservice Edge Routers feature an architecture with clean separation between the control, forwarding, and service planes. The essential value proposition of the M Series is that the single platform can support multiple services without compromise, thus maximizing revenue and minimizing operational and capital costs. Services supported include a broad array of VPNs, network-based security, real-time voice and video, bandwidth on demand, rich multicast of premium content, IPv6 services, granular accounting, and much more.

  The Circuit Emulation PIC family includes a 12-port T1/E1 PIC and a 4-port ChOC3/STM1 PIC. The ChOC3/STM1 PIC features four channelized STM1/OC3 down to T1/E1 ports that can be configured for TDM. The T1/E1 PIC features 12 T1/E1 ports that can be configured for TDM per port. These PICs enable operators to evolve their networks cost effectively to deploy new services, while reducing the cost of transporting services such as voice, video, and data traffic. The PICs contain a rich set of TDM, IP, and MPLS features to support both legacy circuit and next-generation packet technologies.

- **BX7000 Multi-Access Gateway**
  The BX7000 is designed for the space and environmental requirements of access network locations. It enables the transport of TDM, ATM, and packet traffic over IP/MPLS using pseudowire technology. In independent studies, the BX7000 has been shown to reduce annual operating expenses by up to 84 percent.
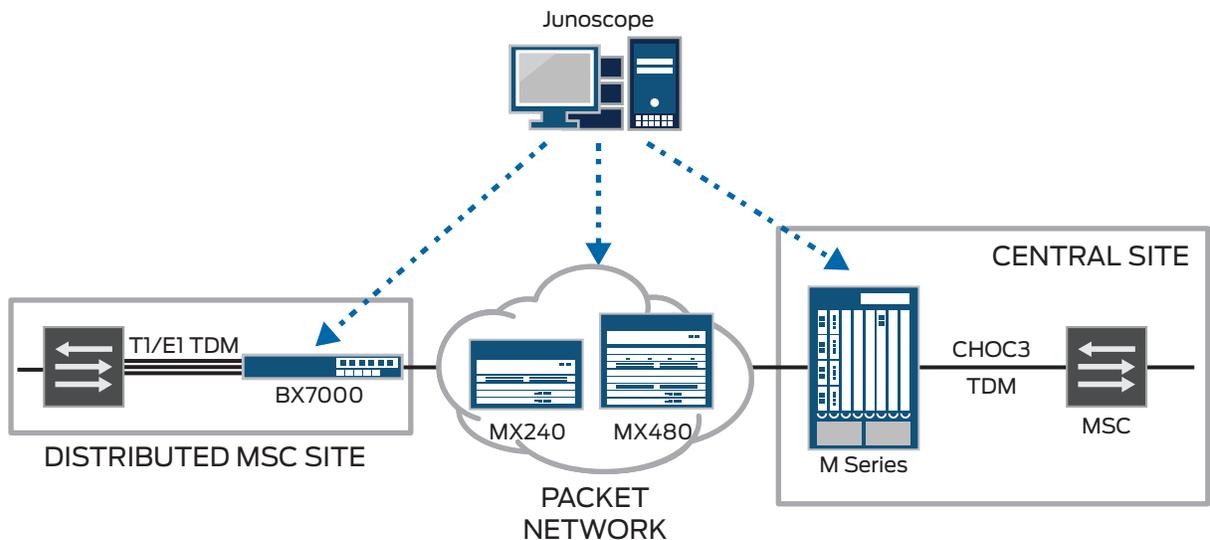

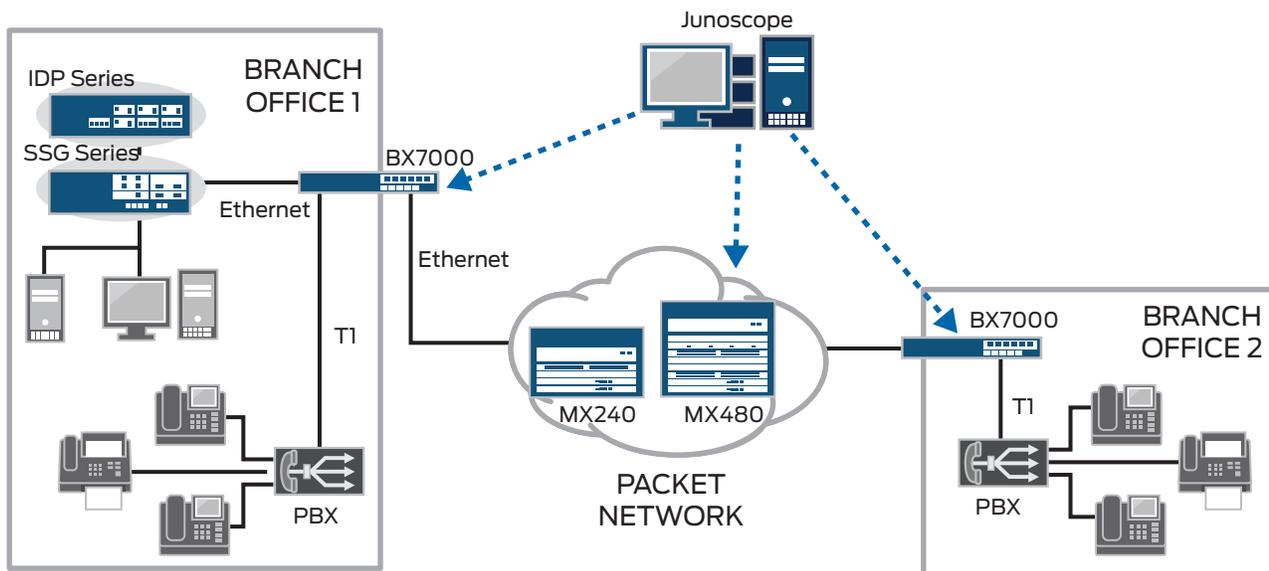Figure 2: Mobile Switching Center (MSC) site interconnect

Figure 3: PBX interconnect between branch offices

The BX7000 features 16 T1/E1 ports, up to seven (7) 10/100/1000 Ethernet ports, and a comprehensive suite of IP/MPLS features. The physical system itself is temperature hardened and small in form factor. A zero-touch configuration feature enables a simplified and economical deployment of very large numbers of these systems.

- **Juniper Networks Junoscope Software**
  The Junoscope management system supports the BX7000, the M Series with Circuit Emulation PICs, and also an intervening metro Ethernet network built with Juniper Networks MX Series 3D Universal Edge Routers. It is this end-to-end support that allows Juniper's solution to feature further cost savings via simplified provisioning and operations.

Summary: Simplified TDM to Next-Generation Transition

The Juniper TDM convergence solution enables service providers to simplify their transition from TDM to a next-generation network. The solution eliminates multiple overlay networks, thus reducing both capital and operating expenditures. Juniper Networks Junos® operating system's support of capabilities such as high availability

and traffic engineering ensure predictable, reliable, and high-quality service delivery. The BX7000 makes this solution very versatile, allowing deployment in harsh environmental conditions and supporting a variety of synchronization options. Juniper's solution also facilitates investment protection by capping investment in TDM and SONET/SDH and enabling convergence onto a next-generation IP/MPLS infrastructure.

Next Steps

For more information about Juniper's TDM convergence solution, please refer to the Juniper Networks website at **www.juniper.net**. Please contact the Juniper sales team to learn how Juniper can help you in your TDM to next-generation transition.

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**.

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