DSLAM Network Migration from ATM to Ethernet Utilizing the Tellabs® 8800 Multiservice Router Series

Overview

The Tellabs® 8800 Multiservice Router (MSR) Series was designed as an advanced service evolution platform. This application note describes how the Tellabs® 8800 MSR series can help meet immediate needs, improve existing Digital Subscriber Line (DSL) services and support investment protection as service providers migrate current Asynchronous Transfer Mode (ATM) Digital Subscriber Line Access Multiplexer (DSLAM) network infrastructures from ATM to Ethernet. The Tellabs 8800 MSR series offers a network migration path to enable new advanced services while leveraging the cost advantages, protocol efficiencies and flexibility of Ethernet.

Current Topology

The majority of existing ATM DSLAM networks utilize Point-to-Point Protocol over Ethernet (PPPoE) and a separate ATM Permanent Virtual Connection (PVC) per subscriber. Traffic is carried via ATM AAL5 with a UBR+ best effort traffic class and a minimum bandwidth threshold per subscriber. All ATM PVCs are aggregated and terminated into an ATM port on each Internet Service Provider's (ISP) Broadband Remote Access Server (BRAS), as shown in Figure 1.

The Transition of ATM to Ethernet

The significant cost advantage offered by Ethernet networks, standardization and availability of Ethernet services and the prohibitively high cost of higher speed ATM BRAS interfaces is driving the migration of the aggregation network to Internet Protocol (IP)/Ethernet.

In order to support the transition of ATM network infrastructure to Ethernet, the Tellabs 8800 MSR series supports ATM-to-Ethernet service interworking. In ATM-Ethernet Interworking Function (IWF), each ATM Virtual Path Identifier (VPI) or Virtual Channel Identifier (VCI) is mapped to a corresponding "stacked" Ethernet Virtual Local Area Network (VLAN) via Q-in-Q. Each subscriber identified by VPI/VCI is mapped to a corresponding inner "customer" C-Tag, and each ATM DSLAM identifier is mapped to a "service provider" S-Tag. If the aggregation network infrastructure supports Multiprotocol Label Switching (MPLS), an additional MPLS label is added that corresponds to the subscriber's ISP. The subscriber's packets received by the Tellabs 8800 MSR series equipment are mapped and sent to the ISP BRAS over the corresponding Label Switched Path (LSP).

If the aggregation network infrastructure is based on Ethernet VLANs, an additional VLAN "Q" tag is added that corresponds to each subscriber's ISP. The subscriber's packets received by the Tellabs 8800 MSR series equipment are mapped and sent to the ISP BRAS over the corresponding VLAN.

DSL Service Evolution Enabled by the Tellabs 8800 MSR Series

The Tellabs 8800 MSR series enables service providers to evolve existing DSL services to:

- Ensure fairness of traffic to ISP customers
- Significantly improve treatment of high priority traffic, including Voice over Internet Protocol (VoIP)
- Expand service offerings with tiered services
- Establish groundwork for IPTV services

The Tellabs 8800 MSR series utilizes a highly innovative approach in its Quality of Service (QoS) implementation and modeling that mirrors those previously available only for ATM networks. Any flow, regardless of service, can be configured with any of the following service classes:

- Continuous Bit Rate (CBR) — Ideal for voice traffic
- Variable Bit Rate, Real Time (VBR-rt)
- Variable Bit Rate, Non Real Time (VBR-nrt)
- Unspecified Bit Rate (UBR)

The UBR service class has additional value-added capabilities, as follows:

- UBR+ — Unspecified Bit Rate with a guaranteed minimum rate
- UBR+Max — Unspecified Bit Rate with a limited maximum rate

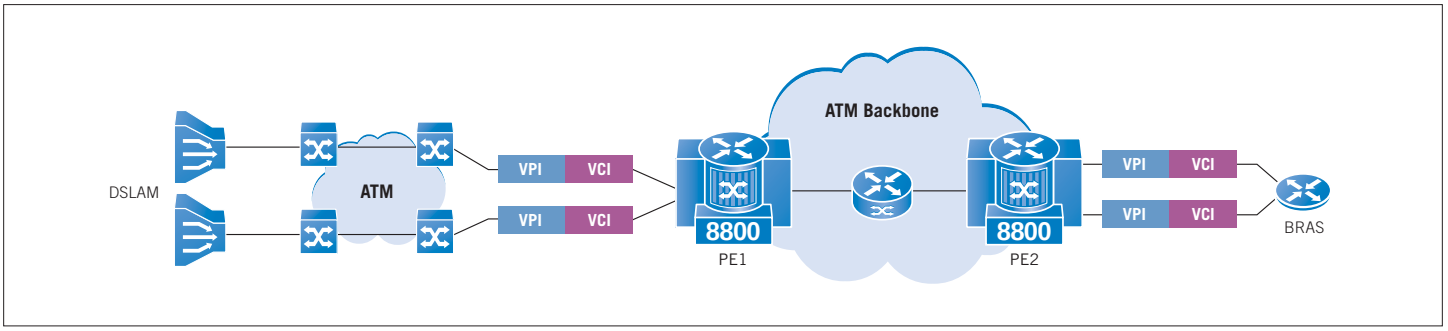

Figure 1. ATM end-to-end network (DSLAM-to-BRAS)

When an individual flow is configured to support any of the above QoS classes, the traffic parameters used are always consistent with the original service type (i.e., peak data rate, minimum data rate, and peak burst size for Ethernet services).

The Tellabs 8800 MSR series supports an extensive range of service profiles that are configurable with a modified packet-based weighted fair queuing algorithm, scaling in support of 32,000 queues per line card. For example, in the case of a VoIP service, a CBR or VBR-rt service class might be selected, which in turn guarantees the bandwidth and latency of the service across the network.

Providing Bandwidth Fairness of Subscriber Traffic to ISP Customers

The Tellabs 8800 MSR series can improve a best effort service offering by ensuring that all traffic with the same priority is given the same transmissions chances. Alternatively, all aggregate ISP traffic can be treated equally (or weighted based on bandwidth agreements), ensuring one ISP's traffic flow does not starve another. The two diagrams below contrast the classic implementation of queuing for same priority flows compared to the improvement enabled with the Tellabs 8800 MSR series.

In Figure 2 all of the high priority CBR traffic goes into the same queue. Therefore, they are processed on a First Come First Served (FCFS) basis. Figure 3 illustrates queuing with the Tellabs 8800 MSR series, in which these flows are handled by different independent queues and placed on the line on a fair round-robin basis. This methodology is more conducive for delay and jitter-sensitive applications like VoIP and streaming media.

Improved Routing of High-Priority Traffic

New Ethernet DSLAMs are the preferred access platform for DSL services. The migration from ATM to Ethernet DSLAMS is rapidly being followed by the migration from PPPoE to native Ethernet and Dynamic Host Configuration Protocol (DHCP). During this migration, service providers have the opportunity to reduce protocol layer complexity and take advantage of the Tellabs 8800 MSR series advanced networking capabilities.

The Tellabs® 8860 Multiservice Router (MSR) has the ability to perform deep packet processing, advanced filtering as defined in access control lists (ACLs) and filters, and forwarding based on traffic type and desired priority. The Tellabs 8800 MSR series supports strict QoS requirements, ensuring that all high-priority traffic is processed and placed on the line before other traffic.

In addition to packet parsing and classification, the Tellabs 8800 MSR series can buffer packets for 200 msec, supporting the ability to absorb bursts of traffic without dropping traffic. The buffer prioritizes and delivers high-priority voice or video traffic and plays a key role in traffic shaping and in ensuring that jitter and delay standards are met.

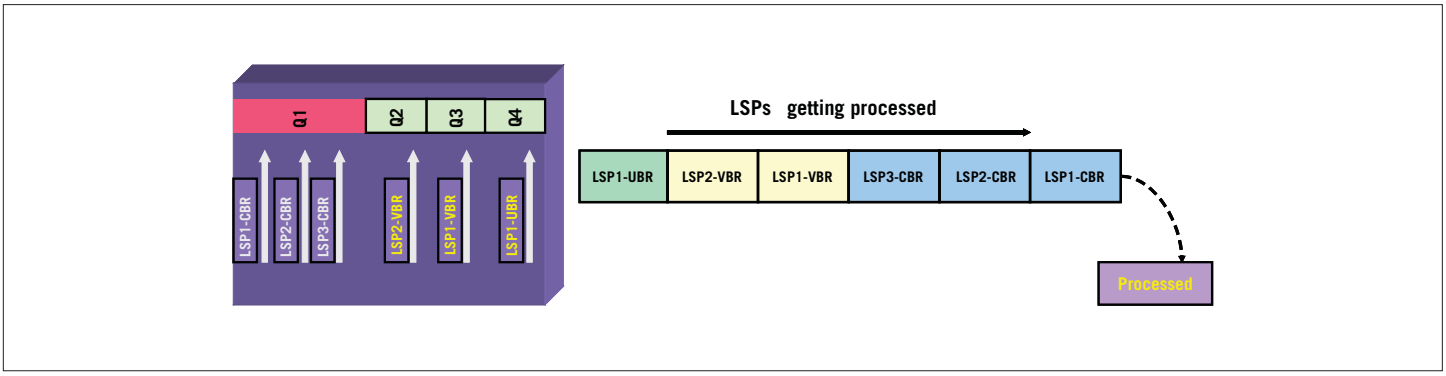

Figure 2. Classic implementation of queuing for same priority flows

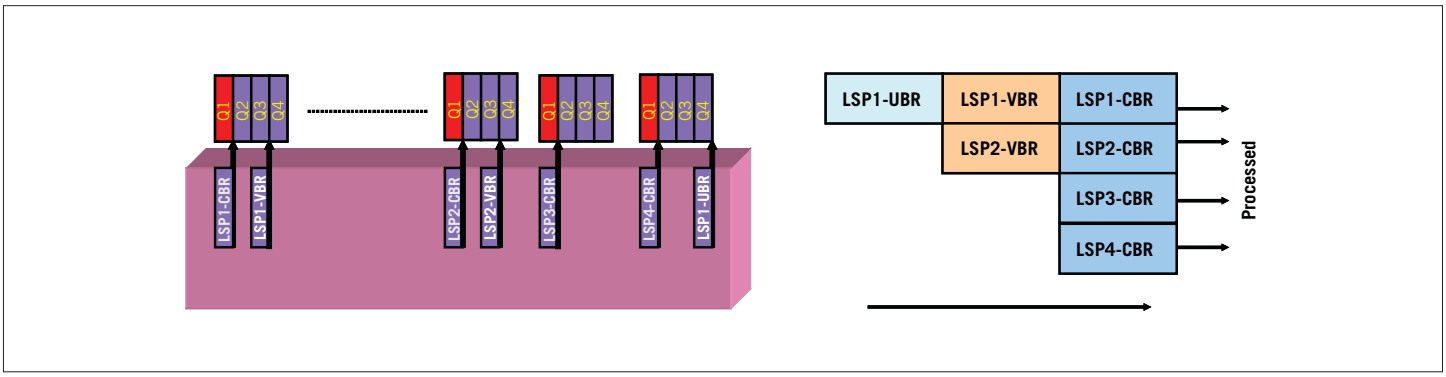

Figure 3. Tellabs® 8800 Multiservice Router series implementation of independent queuing for same priority flows

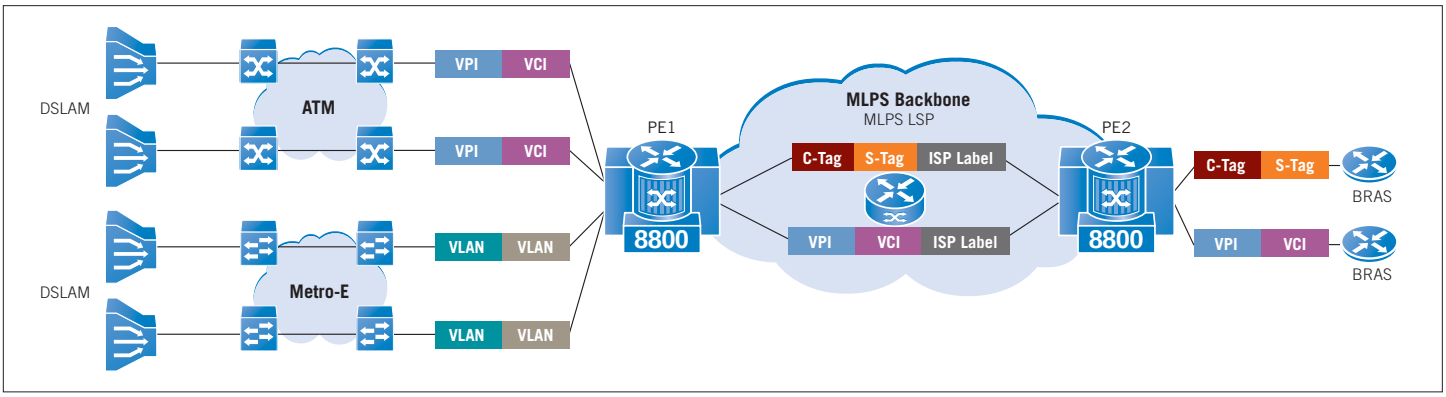

Figure 4. Mixed ATM and Ethernet network

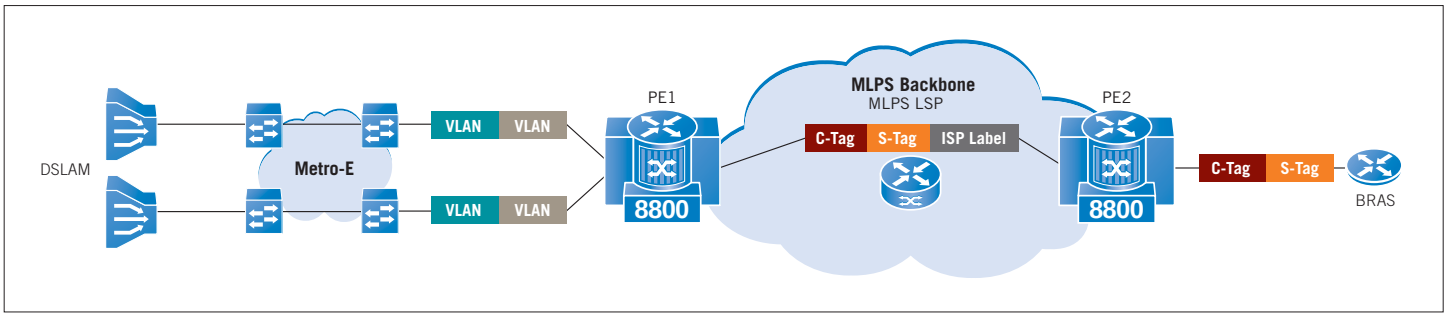

Figure 5. All-Ethernet network

Enhanced Traffic Management and Resiliency

Service providers migrating to MPLS can take full advantage of their investment and commitment to MPLS, bridging ATM service guarantees with the cost and simplicity of Ethernet and the ubiquity of IP (Figure 4). MPLS traffic engineering has shown substantial improvements in the delay, jitter and traffic congestion drawbacks typically seen in traditional IP networks. MPLS Fast Reroute (FRR) provides sub-50 Mbps protection schemes, comparable to Synchronous Optical Network technologies (SONET). Additional benefits include improvements in OAM functionality, Bidirectional Forwarding Detection (BFD), Media Access Control (MAC) ping and MAC trace-route assists in link detection and troubleshooting.

Evolution to IPTV and Beyond

The Tellabs 8800 MSR series offers a common multi-access aggregation network with the advanced networking capabilities required to support the evolution of access networks. Widely deployed ATM DSLAMs, IP DSLAMs and new ATM-based Broadband Passive Optical Network (BPON) and Ethernet-based Gigabit Passive Optical Network (GPON) platforms (Figure 5) can all leverage the service interworking, scalability and granular per-subscriber/per-flow queuing features that the Tellabs 8800 MSR series offers.

As DSL aggregation networks evolve from cells to packets, the Tellabs 8800 MSR series provides an advanced service evolution platform that enables services providers to migrate their networks to a simpler, more cost-effective Ethernet infrastructure.

North America

Tellabs
One Tellabs Center
1415 West Diehl Road
Naperville, IL 60563
U.S.A.
+1 630 798 8800
Fax: +1 630 798 2000

Asia Pacific

Tellabs
3 Anson Road
#14–01 Springleaf Tower
Singapore 079909
Republic of Singapore
+65 6215 6411
Fax: +65 6215 6422

Europe, Middle East & Africa

Tellabs
Abbey Place
24–28 Easton Street
High Wycombe, Bucks
HP11 1NT
United Kingdom
+44 870 238 4700
Fax: +44 870 238 4851

Latin America & Caribbean

Tellabs
1401 N.W. 136th Avenue
Suite 202
Sunrise, FL 33323
U.S.A.
+1 954 839 2800
Fax: +1 954 839 2828

Statements herein may contain projections or other forward-looking statements regarding future events, products, features, technology and resulting commercial or technological benefits and advantages. These statements are for discussion purposes only, are subject to change and are not to be construed as instructions, product specifications, guarantees or warranties. Actual results may differ materially.

The following trademarks and service marks are owned by Tellabs Operations, Inc., or its affiliates in the United States and/or other countries: TELLABS®, TELLABS and T symbol®, and T symbol®. Any other company or product names may be trademarks of their respective companies.

© 2007 Tellabs. All rights reserved.
74.1779E Rev. B 1/07