

Cost-saving DSLAM Aggregation

Digital Subscriber Line (DSL) deployment throughout the U.S continues its exponential growth. Service providers need to manage DSL traffic growth cost effectively to maximize return on investment in services enabled through DSL lines. Additional services are enabled through the DSL network such as Triple Play which adds Voice with Voice over IP and Video with IPTV allowing the service provider to compete with a very cost effective solution in those markets. This network rollout puts a strain on current network assets, requiring costly network build-outs.

GDC's advanced Xedge Multiservice Packet switch (MSPx) allows service providers to lower capital and operational costs by adapting cost-saving migration strategies no matter what upgrade path they choose.

Legacy Considerations

As DSLAMs are deployed at the Points of Presence (POP), bonded T1s or DS3s are individually provisioned through the current infrastructure to the Central Office (CO). Typically, these backhaul circuits are only partially utilized. Connecting bonded T1s or individual DS3s to the current network elements will deplete valuable ports and bandwidth that could be used for revenue-generating private line services (Figure 1).

DSLAMs have evolved from legacy ATM-based interfaces to next-generation IP DSLAMs. Although ATM DSLAMs are not actively being developed or enhanced, most providers have a number of them in service, and for cost reasons they will continue to do so. Bandwidth for each connection type will take its own partially utilized provisioned circuit to the CO. This complicates the DSLAM infrastructure.

The Xedge Solution

In addressing these legacy and infrastructure complexities, the carriers must also determine whether to upgrade their existing overburdened Time Division Multiplex (TDM) network, or move to a more efficient packet based network that is more conducive to today's data needs. This decision is compounded by the requirement to support their legacy TDM and ATM services for some time to come.

By implementing DSLAM aggregation through GDC's Xedge MSPx, carriers can increase revenue at local exchanges without increasing facility costs. The Xedge MSPx switch allows aggregation of multiple services comprised of IP, Ethernet, ATM and TDM transported over a SONET/TDM based network, or a lower cost Metro Ethernet infrastructure. Carriers can thus better utilize bandwidth and increase revenue at local exchanges without increasing facility costs (Figure 2).

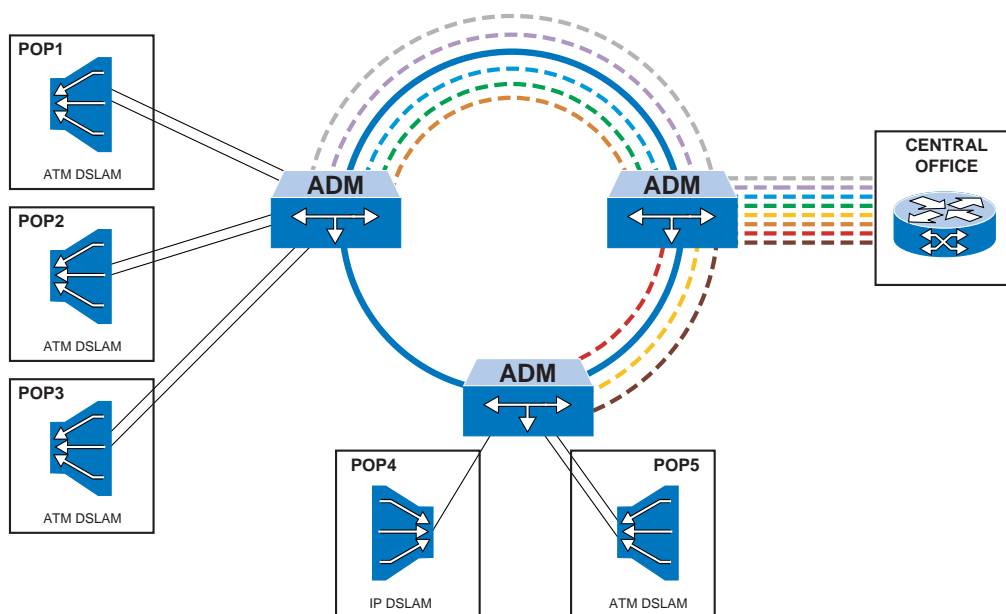


Figure 1: Legacy DSLAM Infrastructure

SONET or Metro Ethernet

Figure 2 shows Xedge switches in a Sonet network. GDC's MSPx can also provide the same function over a metro Ethernet network. In either network, cost savings are realized as DSLAM aggregation frees up bandwidth. Statistical gains are achieved from each POP to the CO for additional revenue generating services.

Figure 3 shows Xedge switches providing T1/DS3 services over the Ethernet network. This provides the traditional "private line" service over today's Ethernet backbone.

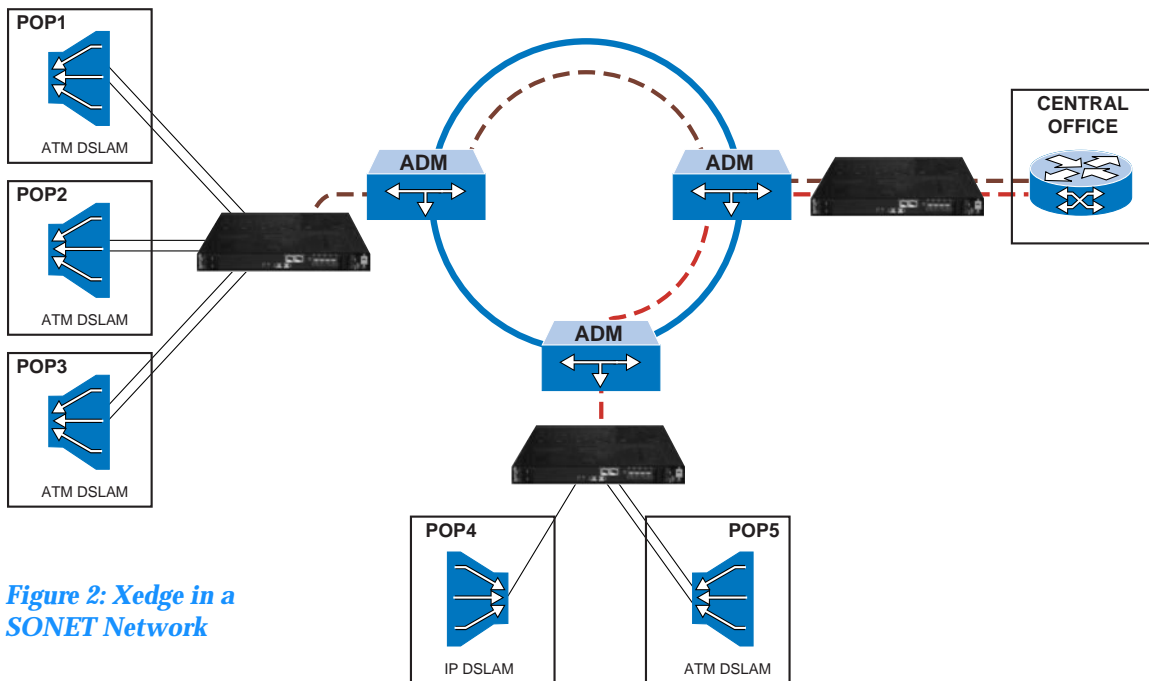


Figure 2: Xedge in a SONET Network

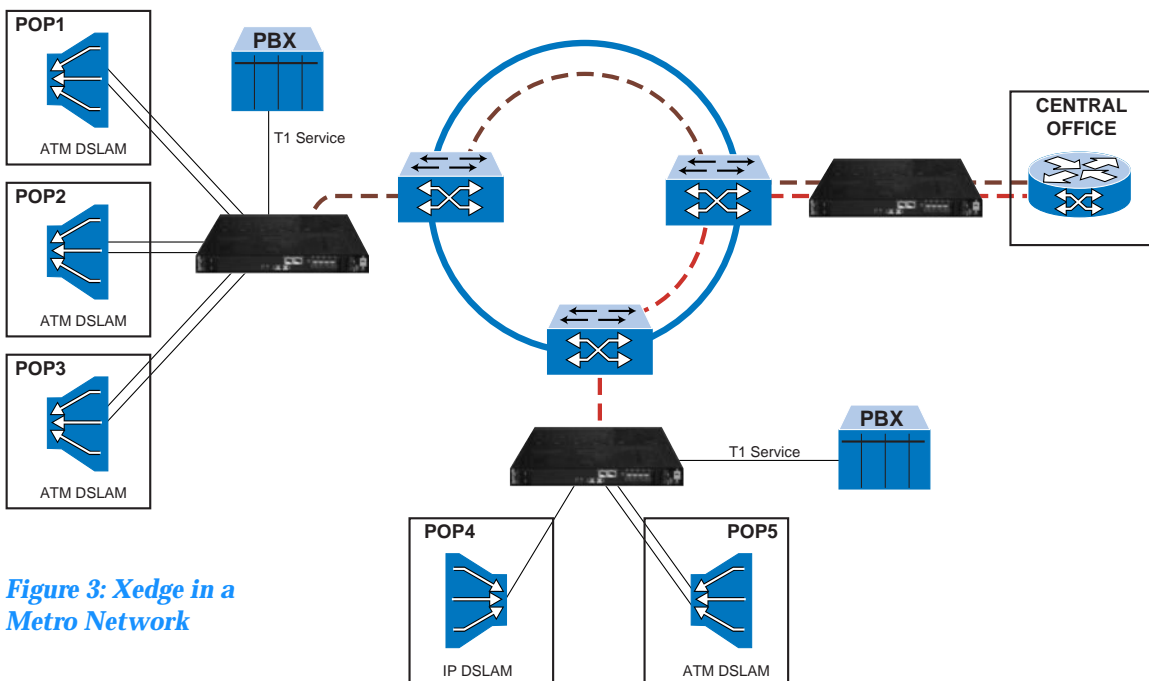


Figure 3: Xedge in a Metro Network

Xedge MultiService Packet Platform

GDC's powerful MSPx platform enables multiservices (Frame Relay, TDM, Ethernet, ATM, and IP) over MPLS, ATM, or Ethernet trunk interfaces. The technology allows service providers and private network operators to offer converged solutions while reducing capital and operational expenditures (Figure 4). GDC's network manager, ProSphere, facilitates the provisioning of virtual private wire services (VPWS) using pseudowire emulation.

The MSPx can support up to 112 OC3s and up to 28 OC12s in a 16 slot shelf; and up to 28 DS3s (E3s). Up to 224 DS1/E1 ports in the large chassis can be bonded into subgroups. Each subgroup can be 2, 4 or 8 DS1s/E1s.

The 16 slot shelf also provides for up to 70 FE ports and 14 Gigabit Ethernet ports all of which can be used for which can be used for subscribe or NNI links. Smaller shelves in the Xedge family can be used to scale according to specific site application requirements.

GDC strives to reduce the cost of ownership for WAN operators by designing, integrating and supporting hybrid network solutions that deliver significant return on investment. With the introduction of the Xedge MSPx, service providers can lower costs by eliminating multiple private lines and/or overlay networks. A flatter network requires less hardware for overall maintenance.

Future-Proof Packet Evolution

The Xedge 6000 multiservice platform has carrier class resiliency featuring redundant DC power supplies, switch fabrics, system controllers, as well as Automatic Protection Switching and abundant re-routing mechanisms to assure service level agreements. GDC's technology enables transport of legacy services and also supports innovative services such as Ethernet E-Line, VPLS, and VPWS.

The Xedge6000 can accept various revenue enabling services as subscribers and service demands grow. These include, but are not limited to:

- Ethernet E-Line services
- Virtual Wire Private Services with Pseudowire Emulation
- MPLS, Ethernet, or ATM trunks
- Packet circuit emulation conforming to SATOP and CESPSN standards
- RSVP-TE dynamic MPLS signalling supporting Martini Draft Pseudowire Emulation
- Dry Martini Pseudowire over VLAN
- IP Packet Forwarding
- Advanced traffic management including traffic shaping of each connection

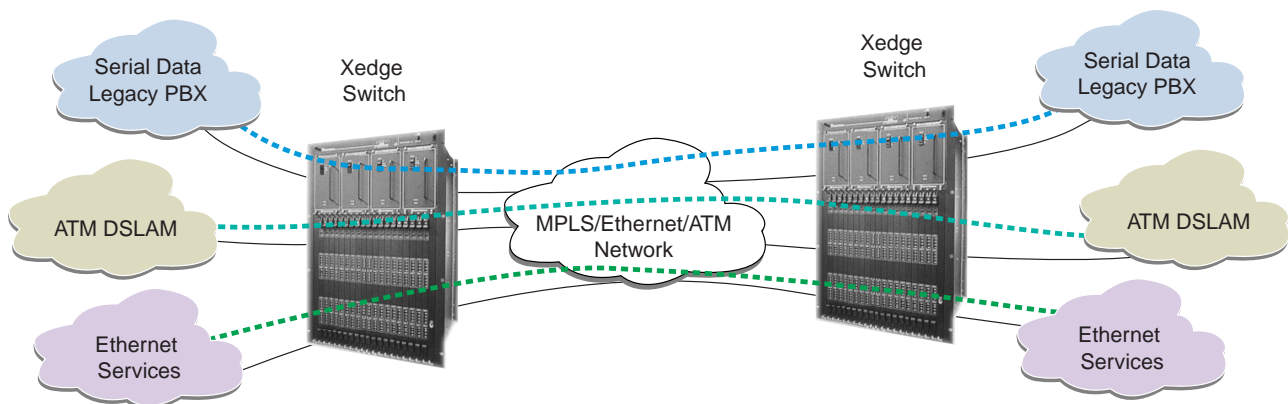


Figure 4: The Xedge MultiService Packet Exchange Platform

GDC Solutions for Rural Markets

Managing DSLAM Aggregation Link Constraints

Each segment of the DSL market has a different business model with different standards for cost-effectiveness. For example, in remote areas where the number of DSL subscribers is limited, DSL deployment must be cost justified on a different cost-benefit basis because backhauling DSL services from the remote areas to a major POP may require, at minimum, a DS-3/E3, creating costly network access charges. The Xedge MSPx packet switch enables carriers and service providers to deploy DSL services over lower cost DS-1/E1 links in remote areas where DSL concentration is limited. This protects the packet switching investment for future DSL growth and allows carriers to deliver additional data services, such as Ethernet, dedicated/private lines, and Internet services to those remote areas.

Carriers and service providers deploy DSL services in remote areas by aggregating traffic from many remote customer sites and transmitting this aggregated traffic back to their major POP. For example, at a number of customer sites, DSL modems transmit data and voice services back to a remote wire center towards a DSLAM. Traffic is aggregated in the DSLAM and transmitted to a remote Xedge 6000 via bonded T1/E1 links. The aggregated traffic then leaves the remote wire center and is directed towards the major POP via ATM WAN connections - either via low cost 4xDS1 (T1) IMA connections or via higher cost DS-3, E3 or OC-3c connections.

This solution delivers low monthly networking costs; a 4xDS1 IMA connection costs much less than a DS-3 or OC-3c leased line. What's more, it is scalable; multiple DSLAMs can be connected, allowing the access provider to rapidly scale new services. The carrier and service providers can easily expand as DSL services grow in a specified remote area by replacing the NxDS-1/E1 IMA WAN links with a full DS-3/E3 ATM WAN link. The remaining IMA cards can then be reconfigured to provide DS1 ATM access for customers requiring special or dedicated services, delivering an additional revenue stream for the carrier.

Using Existing Infrastructure for IPTV Service

IPTV has a tremendous revenue growth potential for rural carriers. Major upgrades in core infrastructure (e.g., 10G Ethernet rings) are underway to support this evolution. As carriers transition from an ATM network infrastructure to support IPTV applications, GDC can assist carriers in the following ways:

- using existing ATM DSLAM infrastructure to deliver new services before completely changing to an IP DSLAM delivery system.
- using GDC's edge switch technology to enhance the capacity, traffic management, and transport capabilities of an existing ATM network to support IPTV applications.

In the first scenario, the Xedge MSPx can convert MPEG2 Ethernet/IP video packets to ATM VPi/VCI's suitable for delivery over an existing ATM delivery system.

In the second scenario, the wireline Ethernet capabilities of GDC's Xedge MSPx outperforms competitive offerings, regardless of technology used in the core of the network.



Figure 5: IPTV Service via Existing Infrastructure