



**General DataComm**

*The Best Connections in the Business*

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# WIDE AREA SOLUTION HYBRIDS

**Enable MultiService Convergence**

A briefing document prepared by

**General DataComm, Inc.**

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## The Application Support Challenge

To set the challenge: commercial enterprises strive to meet their business goals within prescribed budgets; government agencies, states, and municipalities seek to fulfill their public charters within legislated cost constraints. Network operators face the daily tasks of reconciling support for multiservice network users with the capabilities--and capacities--of the networks providing wide-area connectivity. Everyone involved looks for ways to trim costs and save dollars.

Widely dispersed firms/agencies must maintain services to many sites remote from regional and central headquarters. These same organizations look out on operational stocks of communications gear that enable every kind of connectivity, from telemetry & security applications demanding little network share, to video & multi-user applications requiring high-bandwidth availability at any time during the business day.

Some applications, like voice telephony and real-time interactive video, demand priority in the network because of inherent characteristics (sensitivity to delay & jitter); other applications, like mission-critical control information, public safety, and surveillance, demand priority handling in the network because of their defined value to an organization's objectives. Another broad range of applications accepts what networks offer it. These apps, like Internet access, email exchange, and store-and-forward services, tolerate variable delay & jitter; however, the sheer number of such events – and the volume of network bandwidth they occupy – requires operators to pay attention to meeting these users' needs.

Add to these environments new distributed, and flexible, services like voice-over-IP *VoIP*; low-cost access router technologies; high-quality, yet relatively low-bandwidth, video; and, a growing demand for broadband Internet access. In the private sector, legacy, revenue-generating, functions contend side-by-side in the evolving network with newer, distributed client-server & peer-to-peer business-model applications. Public-sector networks experience the same growth strains with the added pressure of ever growing limits on funds and expenditures. In short, the goal of true convergence has constraints.

The pressure is on in most organizations, asking network decision makers and operators, whose budgets and staffs have been right-sized to reflect today's economic realities, to do more with less.

The resulting challenge for private- and public-sector network operators is to satisfy user needs with sound, yet forward-thinking, network environments. At General DataComm (GDC), our focus is enabling customers to meet this challenge successfully with hybrid networking solutions.

## GDC's Hybrid Networking

By "Hybrid Networking," GDC defines an approach to evolving real multiservice networks that recognizes the business values of established technology solutions alongside the capabilities of more recently introduced communications platforms. Hybrid Networking reconciles customer needs (and environments) with the right product solution for the network space.

For the private wide-area networking space, in which the organization's WAN facilities are leased for private use from service providers and/or owned outright by the private organization, GDC recognizes several imperatives.

## User Applications

First, rarely if ever does a new technology immediately, and totally, replace another. There is no doubt that the new IP voice capabilities mentioned earlier will take a larger and larger share of the voice component in private networks, over time. Considering the sheer number of traditional TDM-based PBXs (and lines) installed worldwide, however, and the relative "comfort level" network operators have with these systems, some industry analysts expect VoIP to become the installed equal to standard private

telephony in 5-10 years, perhaps longer. During this period, networks will have to support both types of voice.

A similar situation applies to support for various types of data. Demand for high-speed applications, and the perceived need for networks to support them, continues to grow in importance. At the same time, legacy data applications of all types continue to play important roles in private-business, and government-agency, operations--SCADA information, industrial process control, security telemetry, applications non-standard in their bandwidth requirements (satellite, microwave, etc.). These latter applications may not require great amounts of network share, but their reliable transport is often central to business and agency success. So, like the voice example above, networks will be required to support bursty IP/Ethernet flows and connection-oriented circuit traffic for years to come.

A hybrid private networking approach is the best real-world way of delivering these disparate voice and data models. That is why GDC has made significant effort to introduce Pseudowire technology to converge hybrid networks where feasible.

### Networking Platforms

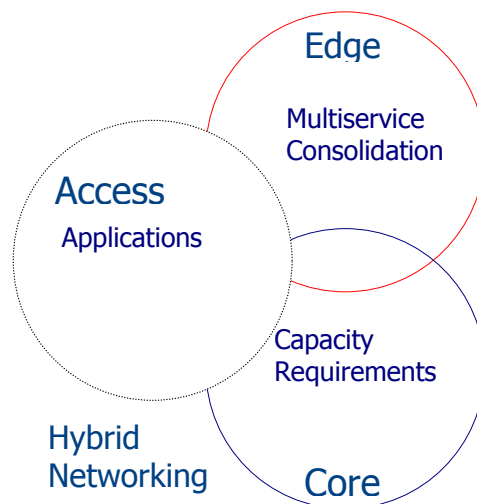
The hybrid approach applies to the communications gear aggregating and transporting this user traffic, as well. Many will be familiar with a description of the wide-area network as three interconnected spheres of activity:

- Aggregation/access
- Multiservice edge
- Transport core.

GDC's networking model addresses these environments, hybridizing the technologies most appropriate for each.

GDC's hybrid model is *not* one-size-fits-all; it is *not* the replacement of one technology for another, simply because a technology has more currency in the marketplace. The model also recognizes that, unlike the traditional network model, there are instances when end-application access need not pass through a network's edge components to reach the transport core. No doubt, there are genuine reasons why existing networks require change. Exchanging one communications protocol for another is *not* one of those reasons. We agree with real-world enterprises and private network operators that there are several driving reasons to reconcile the economics of networking with the organizational needs of connectivity:

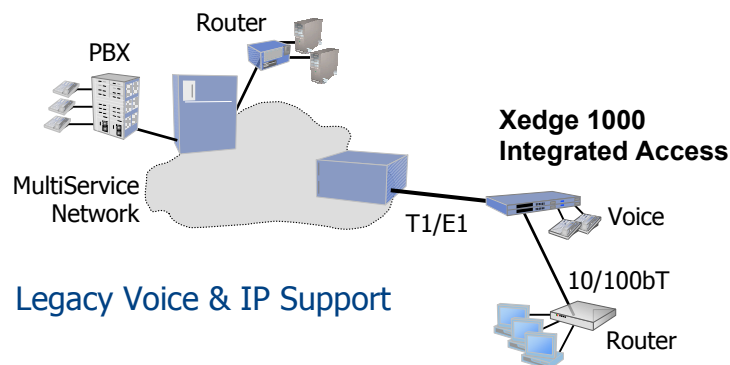
- Access Application Support Needs
- Multiservice Edge Networking Needs
- Straightforward Capacity Needs



## Access Application Support

Along with traditional services for voice, serial data, and file transfer, the need to support applications presented to the network as Fast Ethernet and Gigabit Ethernet IP traffic has taken on great significance for network operators. Because of the rates at which these protocols run, many first assume that network capacities must inevitably be increased. Closer examination shows that this is often not the case. This is especially true when 100M & 1000M interfaces proliferate in organizations with many remote sites (e.g., SOHOs, school systems, geographically dispersed enterprises).

An example – a large transportation entity has a large number of remote sites requiring voice and router connectivity. While the routers' uplink physical interfaces are Fast Ethernet at 100M, actual IP flow content across those interfaces is markedly lower, peaking at no more than 512K. Whether the actual uplinks are privately owned or leased from a service provider, it will be economically prohibitive to “up-speed” all the remote sites. In this instance, using a more traditional solution of integrated access, modified to accommodate the remote router traffic, is a sound solution. GDC's Xedge 1000 integrated access T1/E1 TDM IAD offers a right-priced, flexible solution.



In such cases, where actual bandwidth needs are well-defined, using TDM access technologies makes sense. Adding the complexity of packet transport (and not gaining any real statistical advantage over such relatively low-speed links like T1) is overkill for these kinds of access points.

## MultiService Edge Networking

While access equipment solutions interconnected to private network edge devices primarily differ in the methods by which they access the edge, the edge platforms themselves are best distinguished by the varieties of potential access types connecting to them. ACU's broadband switch family enables private network operators the most efficient use the network bandwidth available to them.

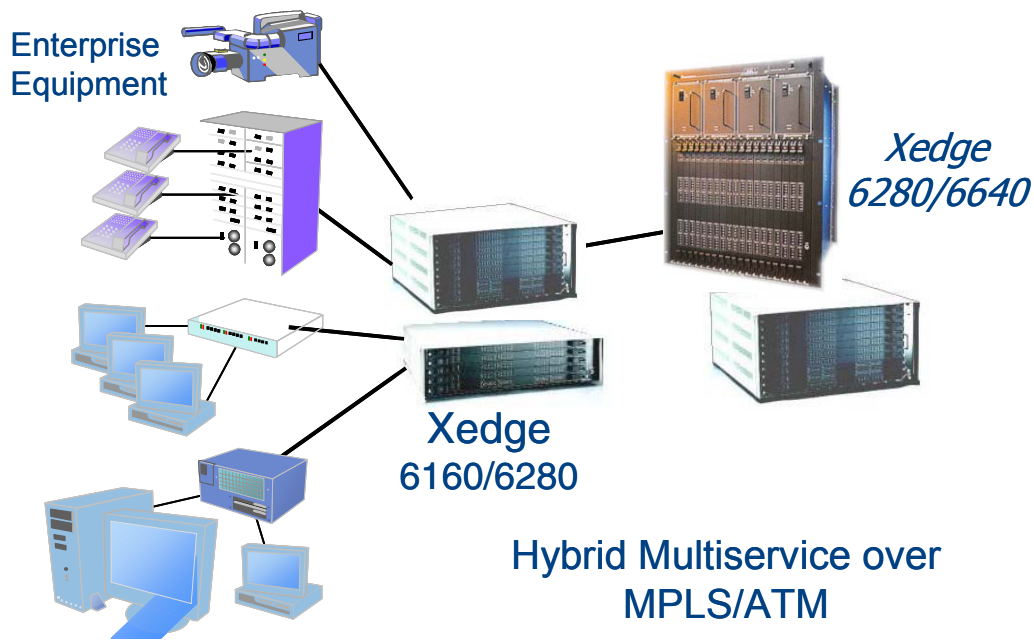
As many remote sites converge on the edge, and as the edge device sends traffic out to the private core, the value of explicit QoS on such traffic, the advantages of statistical multiplexing, and the sophisticated methods such edge devices employ in manipulating traffic within the constraints of high-priced, leased facilities, become evident. In many instances, simplicity is the key advantage when selecting access products for multiple sites. At the edge, when connecting to expensive leased facilities, advanced packet traffic management is a key advantage to seek out.

The Xedge 6000 series provides enterprise users and service providers with an integrated family of products to meet all of their ATM networking requirements. Xedge multiservice switches scale from the Xedge 6645 and Xedge 6640 and Xedge 6280 backbone switches all the way to the Xedge 6160 multiservice access concentrator. They offer standards-based solutions for the growing community requiring broadband's flexible, equitable methods of transport for a wide range of user applications over shared, and thereby most valuable, network resources. The result is a comprehensive strategy, delivering voice, video, and data on a single, integrated platform; easy plug-and-play migration from frame relay and

TDM applications to ATM cell, or MPLS, applications; and simpler management and control of the network in general.

### **Xedge6000 Hybrid Feature Support**

Xedge6000<sup>Plus</sup> MultiService WAN switch offers a broad range of support for the requirements of evolving hybrid enterprise applications. As an integrated platform, it supports the industry's most extensive range of circuit speeds scalable from 75bps-622Mbps; PDH network speeds to 34/45M, and SONET/SDH speeds to 622M & 2.4G. The same platforms can switch, bridge and route 10/100/1000M Ethernet interfaces. The ability to handle low-speed legacy circuits and CoS/QoS-assigned IP flows (with E-Line and E-LAN support) on a single managed platform dramatically simplifies network design, and operational & manpower costs.



The ability to support channelized and clear-channel T1/E1 streams, and unstructured T3/E3 as well, provides the greatest flexibility in access product support. Couple this with integral native services for Ethernet, TDM, Frame Relay, ATM across an MPLS or ATM enabled WAN, and the enterprise network can efficiently, and predictably, provide data services across costly WAN links.

Traditional voice telephony applications (with sophisticated call handling and proxy signaling capabilities) also reside in the Xedge6000Plus feature set. So, voice originating in TDM/PBX environments, and voice generated from IP sources, can equitably share wide-area network bandwidth, alongside the data applications noted above.



## Xedge Hybrid Edge Benefits

- ❑ Network consolidation using a common MPLS, VLAN, or ATM backbone to support voice, data, and video applications
- ❑ Migration of legacy services using Pseudowires across packet networks.
- ❑ Optimized use of bandwidth with up to eight to one statistical gain for voice traffic on Xedge node and backbone facilities
- ❑ Full Metro Ethernet Forum (MEF) E-Line/ELAN services
- ❑ High reliability and availability using platforms proven in some of the world's largest enterprise and service-provider broadband networks

## Straightforward Capacity Needs

After the simplification and cost controls applied to access solutions, and after the intelligent manipulation and management of traffic when high-bandwidth facilities are very costly or difficult to obtain, there are conditions when use of very high-speed facilities is cost-justified—applications may simply demand it, or the facilities may be owned by the enterprise itself.

In situations like these, a group of user applications may be ideal candidates for “raw” high-speed transport. This is not to say that the necessary pre-conditions of network resilience and robustness can be discarded—far from it. As more and more traffic flows across high-speed services, exacting metrics for network performance become more important. This is especially the case when these transport services are also carrying traffic that cannot tolerate a lessening in the Quality of Service previously assigned to it.

The fact remains, however, that large flows of non-real-time, enterprise IP/Ethernet traffic can be supported effectively by high-capacity systems. In this scenario, such IP traffic may actually bypass hybrid Xedge multiservice nodes, and connect directly to high-speed equipment. The nature of Ahead's core transport thus becomes a hybridizing of Ethernet traffic contending for bandwidth share, alongside QoS-designated, prioritized traffic delivered to high-capacity services via Xedge6000.

## Xedge 3100/3101 High-Capacity Provisioning Platforms

GDC delivers Xedge 3100 & 3101, transport platforms supporting OC-3/OC-12, and OC48 or STM-1/-4/-16 line rates, Fast Ethernet, Gigabit Ethernet, & ATM, with the resilience and sub-50 millisecond recovery of SONET & SDH.

Xedge3100 supports a wide range of SONET/ SDH/PDH interfaces from high-speed interfaces of OC-192/STM-64 and OC-48/STM-16 to optical/electrical interfaces of OC-3/STM-1, DS3/E3, 1.5Mbps, and 2Mbps. It provides a full suite of SONET/SDH functions including mapping, multiplexing, cross-connection, various protection schemes such as MS-SPRING, SNCP, MSP, DNI, etc. Second-generation MSPP technologies like Virtual Concatenation *VCAT*, Link Capacity Adjustment Scheme *LCAS*, and Resilient Packet Ring *RPR*, add flexibility and granularity to IP/Ethernet transport.

Xedge3100



Xedge3101 provides rich and diversified data client interfaces including IP/Ethernet, ATM, and Nx64k (V.35), and analog voice interfaces. Xedge3101 is an MSAP operating at OC-3/ OC-12/STM-4. It is designed to satisfy medium-to-large capacity multiservices access requirements for enterprise and service provider networks. Many subscriber modules are interchangeable with the Xedge3100.

Xedge3101



With these two configurable platforms, 100/1000bT Ethernet services may be directly connected to SONET/SDH topologies for transport, efficiently using high-speed rings or other network designs to deliver IP flows across the wide-area expanse of an enterprise. These same platforms will connect to OC-3/STM-1 links carrying mission-critical and delay-sensitive traffic from Xedge6000 nodes, sharing the hi-cap paths.

### Managing Hybrid Networks

Operating and maintaining wide area multiservice networks can be expensive. That is why any equipment added to the WAN should not exacerbate operational budgets. All of the Xedge devices mentioned in this overview are SNMP manageable, and a key platform to be used in the management of the Xedge network elements is ProSphere, a flexible and scaleable network management system. ProSphere is an umbrella platform independent client server system that can communicate with various Xedge network elements via SNMP as well as automatically discover the same equipment. As a JAVA based application suite, ProSphere can visually display alarms occurring anywhere within this hybrid network simplifying remote monitoring of mission critical networks. ProSphere takes the mystery out of complex multiservice networking by offering operational templates and point and click graphical operations. Simply put, ProSphere saves operators time and money.

## **GDC Offers Solutions for Key Integrators & Prestige Customers**

GDC's blue chip customer base includes, state and county governments, commercial railroads, transportation entities, utilities, petrochemical enterprises, and schools and hospitals. GDC's approach to selling is full collaboration with the customer-integrator at an early stage in the network planning and design cycle. This approach establishes a strong technical relationship between GDC, its customers, and the parties responsible for network operation, maintenance, and logistic support.

GDC's Private Wide Area Network customers include: Union Pacific Railroad, Burlington Northern Santa Fe Railroad, Mayo Clinic, NASA, Sandia Labs, U.S. Air Force (Cape Canaveral/ Vandenberg AFB Range Automation), Petrobras (Brazil State Oil Company), Los Angeles Department of Transportation (LADOT), Milan Airport (Italy), Boeing Sea Launch Project, Maryland Department of Transportation, Montgomery County FiberNet Network, AG Edwards, U.S. Department of State, State of California Water Resource Authority, NATO.

## **Hybrid Networks: Saving Dollars for Mission Success**

The pervasive deployment of hybrid networks is not a marketing mirage. The overwhelming evidence is that the multifaceted private/public WAN infrastructure is hybrid in nature. For very practical reasons hybrid networks defy one size fits all product or protocols. At the end of the day what matters most to private network operators is getting a return on investment for a technical solution that will also support the success of the primary enterprise mission whether that is launching satellites, monitoring highway traffic, moving freight, educating students, or delivering water and power to customers. These enterprises need reliable technology that lowers overall costs for running network operations. As a company that believes that the evolution of hybrid networks requires some fresh and thoughtful payback analysis, Ahead Communications can help planners create a solution that serves the best interests of the enterprise.

## **Professional Services and Support**

General DataComm provides professional design, training and support services as part of its system solution offering. Performed by senior design engineers with hands-on experience implementing networking applications as varied as distance learning, telemetry data acquisition, or managing a large multi-department private network for municipalities, GDC experts can turn a challenge into a cost benefit. GDC provides a responsive and experienced team of network designers and capacity planners, trainers, help desk experts, product repair specialists, as well as accomplished field installation and maintenance experts to make direct benefit to its customer's long term planning and networking needs.