Irrepressible Frame Relay

Joanie Wexler

Perhaps the most successful data network service in history, frame relay continues to prosper despite plenty of competition.

Old WAN services never really die, says networking industry veteran and consultant Bill Flanagan—with one exception. He maintains the only one that has actually gone extinct is Morse telegraphy. Frame relay shows no signs of going the way of the dots and dashes anytime soon, despite threats from various flavors of IP virtual private network (VPN), metro Ethernet, ATM and MPLS services.

Frame is not just maturing and enduring, but gaining new options, as shown in Figure 1. Subrate DS3 and multilink frame relay (MFR), for example, now enable incremental capacity upgrades between T1 and T3 speeds (also see *BCR*, May 2003, pp. 38–40). Meanwhile, hybrid frame relay/IP-VPN services provide an IP migration path for companies that want IP's site-to-site, meshed connectivity without giving up their frame relay expertise.

Frame-to-Internet gateway services—with or without a managed firewall component—are also fairly recent developments that let users put private frame relay traffic and Internet connections on the same access circuit. And access options also have expanded, enabling mobile and remote workers to get on the corporate frame network via private mobile wireless, IP dial and Digital Subscriber Line (DSL) access networks.

According to research firm Vertical Systems Group, frame relay revenues grew about 14 percent between 2001 and 2002 (Figure 3). Infonetics Research, another research firm, predicts that user spending on frame relay services will total $16.7 billion this year. According to Infonetics, frame will finish second only to its 13-year nemesis, leased-line services, commanding $23 billion of user dollars (Figure 2).

Of course, frame's double-digit revenue growth won't last forever. Already, business customers are beginning to add new types of WAN

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FIGURE 1 Availability Of Selected, Enhanced Frame Relay Services

Provider	Frame Relay Access to a Layer 3 Private IP-VPN	Frame-to-Internet Gateway/with Network-Based Firewall	DSL Access to Frame	Subrate D3 Frame	MFR*	Other
AT&T	Yes (MPLS)	Yes/Yes	Yes	Yes	No	Managed DSU plus inside wiring from LEC termination point to wiring closet
Equant	No	Yes/Yes	Yes	Yes	No	Private GSM/GPRS access (non-U.S.) Global private and Internet dial-access to frame
Infonet	Yes (MPLS)	Yes/Yes	Yes	Yes	Due in August 2003	
MCI	Yes (MPLS)	Yes/firewall coming Q104	Due Q303	Yes	No	Service interworking among frame, ATM, Private IP-VPN and IPSec VPN sites, due late summer 2003 Global IP dial access to frame
Sprint	Yes (options based on ATM/virtual router technology and on IP-over-DWDM)	Yes/Yes	Yes	Yes	Due in August 2003	Frame access to network-based IP-VPN and public Internet services

*Multilink Frame Relay (standards-based inverse muxing at Layer 2)

FIGURE 2 Projected Worldwide End-User WAN Service Expenditures (in U.S.$B)

Service	2003	2007	CAGR
Frame Relay	$16.7	$16.6	0%
Leased Lines	$23.2	$24.2	+1%
Ethernet	$ 1.2	$ 8.3	+62%
ATM	$ 4.8	$ 2.8	–13%

Source: Infonetics Research

connections as their application mixes shift and as new sites without legacy gear join their networks. But for many enterprises with large volumes of data traffic to shuttle around, frame relay is doing the job just fine, thank you very much.

Diehard Frame Fans

Organizations that are sticking with frame relay typically have static site configurations and place top priorities on network reliability and security. "We want reliable, secure communications. Frame relay is the workhorse for that," said Jim Nordentoft, director of network services and field support at Unitrin Services Co., a nationwide insurance and financial services company based in Chicago that uses MCI frame relay services.

Unitrin only routes IP traffic, including encapsulated IBM 3270 traffic, yet Nordentoft said he has "no initiatives that are really pushing us to migrate from frame relay to new technologies."

Similarly, the telecom manager of a large east coast-based insurance company, who asked not to be named, said his firm is continuing to use frame relay for data and has no plans to do otherwise. "We do not run any voice-over-IP (VOIP) over frame relay," he added. "We have dedicated networks for that."

Enterprises need a good reason to make big network changes, and the business case just isn't there for many enterprises, despite the migration to IP applications, observed Rosemary Cochran, principal at Vertical Systems Group. Vertical estimates that 84 percent of the traffic carried by frame relay networks is IP, a potential driver toward IP-VPNs. But 42 percent of businesses still run some non-IP traffic, the firm notes.

"Cost is utmost," Cochran said. "If you make an IP-VPN behave like a frame relay network, with all the bells and whistles you need for security and service-level agreements, you'll pay the same or very nearly what you were paying [for frame]. It doesn't play out."

Christopher Tarbuck, networking director at SchlumbergerSema, the information technology (IT) arm of global oil-and-energy firm Schlumberger Ltd., agrees, at least when it comes to prices for Multiprotocol Label Switching (MPLS)-based IP-VPN services within the U.S. "In the U.S., MPLS-based services are considerably more expensive than frame relay services," Tarbuck said. "They should be cheaper [because of the single-PVC nature of the services], but it doesn't add up that way."

Still, Schlumberger prefers to use MPLS' quality-of-service (QOS) for its extremely time-sensitive exploration applications, so the company has resorted to building its own global MPLS network. The company has leased clear-channel circuits of varying sizes around the world and linked them with Cisco 12400 Series routers to create its own private MPLS backbone, which it uses for internal traffic and for supplying commercial services to other companies.

Yet regional pockets of commercial frame relay services also hang off the Schlumberger MPLS backbone in parts of the world—including in the U.S.—where the performance levels are stable and predictable enough to meet Schlumberger's strict requirements, Tarbuck said.

The business case just isn't there yet for most enterprise companies to move to IP-VPNs

Sources Of Growth

Frame relay growth is coming from new ports being added to existing networks, from speed/capacity upgrades and from the consolidation of ports and permanent virtual circuits (PVCs) to higher speeds, according to Vertical Systems Group's Cochran.

Unitrin, for example, recently consolidated its multiple T1-speed frame relay WAN links into two host locations. Now each has a DS3 frame relay link that, for the time being, is throttled back to 3 Mbps until bandwidth requirements increase. This is an example of "subrate DS3" service—an Internet access service option long available for incremental leased-line bandwidth growth that is now being applied to frame relay.

Similarly, Safelite Auto Glass, a maker of windshields based in Columbus, OH, also recently increased the speeds of its AT&T frame relay data center connections to DS3. Last year, Safelite had two, redundant T1-speed frame relay access links into the data center connecting 63 outlying locations via 56-Kbps PVCs, explained Jim Gormley, Safelite's director of operations services. "If one T1 were to break, it would flip over to the other."

However, Safelite recently re-architected its entire field network, such that point-of-sale and other terminals now communicate directly with

TABLE 3 Comparative Worldwide WAN Service Revenues

	2001	2002	%Year-to-Year Change	Expected CAGR 2002—2007
Frame Relay	$12.7B	$14.5B	14%	10.4%
ATM	$2.4B	$3.2B	36%	19.9%
Private Line	$25.8B	$25.7B	–0.2%	–2.3%
Dedicated IP-VPN*	$357M	$791M	122%	60.6%

*Carrier-based, dedicated-access VPN services using native IP connections

Source: Vertical Systems Group:"Emerging Networks Service 2003"

Frame relay SVCs hit the market ahead of the applications that could use them

resources in the data center, rather than with distributed resources at the outlying sites. The result was more WAN traffic, necessitating the DS3 at the data center, as well as 256-Kbps PVCs for the outlying locations.

Who's Turning To IP-VPNs?

Greenfield companies, small firms and users of IP-telephony tend to be early adopters of IP-VPNs. So are large companies that frequently add, close or change sites and that support large volumes of mobile and remote workers. Such firms might turn to public Internet-based services to gain the widest reach, according to Jay Pultz, research vice president at Gartner, Inc.

Extreme Networks, a maker of enterprise LAN switches, for example, has moved its data traffic from a worldwide frame relay network of about 40 sites to a managed, Internet-based IP-VPN service from Virtela Communications. Virtela offers a multihomed service connected to several different Internet service providers (ISPs)—with 100 percent end-to-end network availability guarantees when the access links used are fractional T1s, full T1s or T3s.

"We are a worldwide company, we are expanding rapidly and we need to insert and move locations easily," said Paul Hooper, Extreme's vice president of IT. "For the type of nomadic authentication capability we need—from home, hotels and between sites—frame can never compete with an ISP model."

Hooper says that Extreme is saving about 50 percent on its network costs with Virtela, compared with frame relay network service, although most of the savings are in management and headcount, rather than in monthly service charges.

Gartner's Pultz warns users to be careful about making comparisons between consumer- and business-class services. "Smaller organizations think they can pay $20 a month, as they do from their homes, for Internet-based VPNs, but they are not really that cheap," he said. "On the other hand, IP-VPNs generally are less expensive [than frame relay], by about 40 percent, although you don't usually get the same service level [in terms of performance and uptime]."

Organizations requiring peer-to-peer communications for latency-sensitive applications such as VOIP, video, multimedia and workgroup collaboration are apt to benefit from IP services. These applications also could use frame relay switched virtual circuits (SVCs), which allow dynamic peer-to-peer frame relay connections. However SVC services can be hard to find, according to industry observers, because they were ahead of the applications that could use them.

"For data-only networks, hub-and-spoke frame relay configurations paralleled and satisfied customer traffic patterns," noted Steve Taylor, president of Distributed Networking Associates in Greensboro, N.C., and editor/publisher of Webtorials.Com, an educational networking website. "When the meshed networking requirements started to ramp up, IP-VPNs had gotten off the ground to fill the bill," he said.

Who's Going Hybrid?

Companies with pockets of requirements for meshed connectivity and those running converged voice/data over IP on their LANs are adding IP-VPN sites rather than frame relay. These folks are also building hybrid WANs, including frame, IP, and possibly still some ATM services.

"Enterprises are risk-averse," said Gartner's Pultz. "As such, most don't like making binary decisions, such as moving from an X network to a Y network. They prefer the hybrids."

Sound options for such companies are the relatively new "IP-enabled frame relay" or "private IP" services, which retain the frame relay user-to-network interface (UNI) in the access network and can serve as a migratory step to IP. IP-enabled services provide a full mesh network without each site having to establish separate PVCs with every other site. Instead, each site runs a single frame relay PVC to the edge of the carrier's IP network. From there, connectionless IP routing enables meshed connectivity across the backbone.

Customers running VOIP in addition to IP data will likely purchase a second, high-priority PVC at each VOIP-enabled site, to make sure that the real-time traffic is placed in a low-latency service class across the backbone.

All the major carriers offer these frame/IP hybrid services except international carrier Equant, which offers separate frame and IP services and says it doesn't see a need for a "middle" migratory step. In contrast, Sprint offers three IP-enabled frame options on two separate network platforms, though none is based on MPLS.

Two of these run on Sprint's IP-over-dense wave division multiplexing (DWDM) backbone. The newer of the two is called SprintLink Frame Relay, which uses Cisco Systems' Layer 2 Tunneling Protocol Version 3 (L2Tv3) to tunnel users' frame relay packets through the backbone. This service does not appear to the customer to be very different from a traditional frame relay service.

The second option on this backbone is Sprint Network IP-VPN, which is more akin to IP-enabled offerings from MCI and AT&T (both of which now call their services Private IP) in that a single frame relay PVC provides access to the carrier's IP network, which supplies meshed IP connectivity among multiple sites. The Sprint Network IP-VPN offering also includes a network-based firewall service and Internet gateway from a single frame connection (SprintLink Frame Relay does not).

The third Sprint option, IP Intelligent Frame Relay, runs on Sprint's ATM core network and uses virtual router technology to partition customer traffic. Virtual routers logically

subdivide a physical router into multiple virtual routers, each running a separate instance of the routing protocol in use and each containing its own routing table, memory and other resources.

IP Intelligent Frame Relay behaves much like the Sprint Network IP VPN described above. Combining IP Intelligent Frame Relay with one of the other two may also appeal to Sprint users who want WAN backbone diversity from their carrier.

Carrier Moves

Despite the maturity of frame relay and competitive promises of newer technologies and services, many carriers continue to invest in their frame networks. Equant, for example, is enhancing both its worldwide frame relay and IP-VPN offerings—indicating that frame relay still has as much clout as the newer IP-VPN services at the company.

"We will make the same enhancements on both our IP-VPN and frame service offerings unless there is some strange reason to add a service to one and not the other," said Gopi Gopinpath, senior vice president of data and IP products.

For example, the company recently added a managed application performance analysis service, whereby Equant will analyze traffic patterns, evaluate the impact of adding new applications and make network design recommendations. The service is available with both IP-VPN and managed frame relay services.

Late this summer, MCI plans to offer a global service that adds MPLS IP-VPN connectivity to its frame-to-ATM service interworking offering, along with a gateway to the public Internet. The offering represents one component of MCI's Convergence Networking strategy, announced at the Networld+Interop conference and trade show in April. In this strategy, gateway equipment in MCI's backbone will allow customer endpoints to run frame, ATM, IP-VPN or public Internet access connections and interoperate with one another. The service represents an informal extension to the service interworking capability specified in the Frame Relay Forum's FRF.8 implementation agreement, which has long enabled frame sites to exchange data with ATM sites and vice versa. MCI's approach will simply add more types of end points to the mix.

"Our customers seem to want to stay with their frame networks but leverage opportunities with the Internet," explained Danellie Young, manager, VPN and data services group at MCI. The forthcoming network gateway service should help business customers do that while having seamless service regardless of the technology installed at each location, she added.

Although fees for the service have not yet been determined, Young said MCI will use traditional per-site, per-port, per-PVC pricing based on speed. There will be no separate charge for the value-added interworking capabilities, she added.

For its part, AT&T is focusing on global expansion following the dissolution of its international Concert initiative with BT. It expects the migration from Concert to its own network infrastructure (now under construction) to be complete by the second quarter of 2004, according to Grant Elliott, product director for global high-speed data services at AT&T.

AT&T also recently added a managed DSU service to its frame relay offering that includes an inside wiring service. Customers pay for the DSU, but are not billed (directly) for the wiring, configuration and testing.

"When the local-exchange carrier brings a wire into a building, it terminates in a certain jack," explained Randy Fisher, product manager for AT&T's PLUS family of data services. "Customers traditionally have had to contract separately for getting the wiring from that jack to the data center. So they've had one person delivering the access circuit, one person delivering the inside wiring, and one person delivering the equipment."

AT&T's service provides a single technician to handle all these tasks. "We're offering a smoother installation that likely saves time, and one that allows a single technician to coordinate placement and test the configuration," said Fisher.

Competition From The RBOCs?

The frame relay WAN market could see some shakeup later this year as the former regional Bell operating companies (RBOCs) continue to gain regulatory approvals to enter the nationwide long-distance and data markets.

Theoretically, the RBOCs could build comparatively inexpensive new nationwide networks. Available to them are the latest multiservice switch products that enable the continued delivery of legacy services such as frame relay and ATM but also support MPLS for newer IP services—all from a single, small-footprint platform. For example, Qwest Communications says it plans to enter the frame relay WAN market as regulatory approvals allow and to "use MPLS to converge frame relay, IP, ATM and other services" on a single backbone, according to company spokeswoman Claire Maledon.

Currently, regulated companies like Qwest can offer such services outside their regulated territories, but must use a network subcontractor if customer networks fall within their regulated territories. "We look forward to competing fully in the nationwide arena with frame relay and other business services," Maledon said.

Gartner's Pultz also points to Verizon, which is building an MPLS backbone, slated to be operational this year, and noted that nationwide frame relay services will likely emerge from that endeavor.

Options For 'Bandwidth Creep'

Meanwhile, frame relay customers are seeing new options for incremental speed increases, such as

MCI's new service will interwork frame relay, ATM, IP-VPN and public Internet endpoints

MPLS services are more expensive than frame relay in the U.S.

subrate DS3 and MFR. AT&T is launching its subrate DS3 service this month—whereby users must invest in a T3 access link, but, like Unitrin, can limit the size of their bandwidth pipe and pay only for that amount. Most other large carriers already offer such services.

MFR, the frame relay counterpart to Inverse Multiplexing over ATM (IMA), achieves similar incremental bandwidth-growth goals, albeit in a different way. MFR services aggregate the bandwidth of multiple physical T1s across a logical Layer 2 frame relay link.

US LEC Corp., a multiregion competitive local-exchange carrier (CLEC), also just introduced MFR services, offering enterprises access to both frame relay and Internet access services at incremental speeds up to 12 Mbps, according to the carrier.

US LEC is the first carrier in the U.S. to offer such a service. Sprint, however, is expected to follow suit next month, as is global carrier Infonet. Deutsche Telecom was in beta test with MFR services at press time. MCI says MFR is "in development," but has not offered a time frame when a service might go commercial, and AT&T says it currently has no development plans for MFR. A variety of customer premises equipment (CPE) that supports MFR is available, including routers from Adtran, Cisco, Larscom, QuickEagle and Tasman Networks.

MFR not only provides a less expensive way of getting additional bandwidth for above-T1 speeds than jumping to a full T3, but it also contains a measure of built-in redundancy. The temporary loss of any single T1 results in that traffic failing over to the aggregate bandwidth of the remaining live T1s.

Martini, Anyone?

Additional frame relay enhancements are forthcoming from the MPLS/Frame Relay Alliance, which merges the former Frame Relay Forum and MPLS Alliance. Together with the International Telecommunications Union-Telecommunications Sector (ITU-T) standards body, the alliance is developing X.84, a standard for the carriage of frame relay services through MPLS networks, with the goal of helping the industry replace ATM WAN cores with MPLS.

X.84 will formalize and extend the Internet Engineering Task Force (IETF) "Martini" draft, which specifies how to transport Layer 2 protocols in tunnels through MPLS, by adding end-to-end PVC status signaling. "If one end of my PVC goes down, the network must receive a signal that the route is not good and that my local management interface is no longer functioning on a virtual private circuit," explained Andrew Malis, chairman and president of the MPLS/Frame Relay Alliance and chief technologist at multiservice switch manufacturer Vivace Networks. He predicts the signaling efforts are likely to be complete in September and could yield commercial services as early as later this year.

Roger Ruby, co-marketing chair and acting board member of the MPLS/Frame Relay Alliance and a senior product manager at router maker Quick Eagle Networks, points out that the group is also working closely with the ATM Forum and the Metro Ethernet Forum for enabling Ethernet, frame relay and ATM network interworking over MPLS so that "users can put in the last-mile technology that best fits each site." Network interworking, unlike service interworking, tunnels protocols between like end points. Service interworking, such as MCI's Convergence Networking strategy discussed above, performs translations so that end points using different protocols can communicate directly with one another.

Such interworking advances will likely help companies like Schlumberger, which is currently running MPLS on its CPE wherever affordable. The company supports 100 offices outside the continental U.S., including offshore, high-risk and difficult-to-reach locations such as Nigeria and Siberia, and maintains thousands of nodes around the world for delivering valuable information quickly to its clients.

"We'd like to go to MPLS everywhere for the ability to set per-application network priorities, but there's a price versus benefit issue in the U.S., where MPLS costs considerably more than frame," said Tarbuck, noting that his company supports 150 sites in the 48 U.S. contiguous sites. "The ability to transfer information quickly is vital to what we do," he continued. "It can cost $100,000 per day to have any kind of delay on an off-shore oil platform. Response-time is our number-one priority."

Among the company's vital applications are 3D exploration and visualization capabilities. "There are not that many seismologists in the world. [With the right network], we can do analysis in London in the morning and in Caracas in the afternoon," he added.

Bill Flanagan, principal of Flanagan Consulting in Dulles, Va., predicts that native MPLS services will be pushed out to the edge of the customer network to deliver user capabilities akin to those that he deems a "missed opportunity" with frame relay SVCs. "If the alliance combines MPLS and frame relay signaling, a 64-Kbps access link could use the signaling to establish [dynamic] virtual circuits," he said. Such signaling could facilitate customer self-provisioning, he added, which would not only get customers served faster, but also get carrier revenues flowing quicker, too.

Conclusion

Amid a data services landscape rich with options, frame relay is not only persevering, it is gaining enhancements—incrementally higher speeds, interoperability with other services and additional

access options. Many organizations with heavy data traffic requirements and client/server traffic patterns between a central data center and distributed branch offices see no compelling reason to make changes to their data services until the need increases for direct connections among branch offices. Some, though, do wish to reduce the number of PVCs they must buy by purchasing an "IP-enabled" frame relay service.

On the horizon, MPLS technology holds promise as a new backbone convergence protocol that will enable users to use the technology of their choice at each site. A new generation of MPLS-based switches will also likely enable the former RBOCs to affordably expand their frame relay networks into new territories as they receive regulatory approval, so customers should have more service providers to evaluate by next year.

And if Flanagan has his way, an MPLS UNI will also emerge, which could revolutionize the degree of control users have in provisioning their own services and bandwidth. But Flanagan would probably be the first to point out that even such attractive options as these will not likely kill frame relay altogether. After all, old services never die□

Companies Mentioned In This Article

Adtran (www.adtran.com)
AT&T (www.att.com)
Cisco (www.cisco.com)
Deutsche Telecom (www.telekom3.de)
Equant (www.equant.com)
Extreme Networks (www.extremenetworks.com)
Gartner, Inc. (www.gartner.com)
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Vertical Systems Group (www.verticalsystems.com)
Virtela Communications (www.virtela.net)
Vivace Networks (www.vivacenetworks.com)
Webtorials.Com (www.webtorials.com)

Even an MPLS UNI probably wouldn't put frame relay completely out of business