The QOS Conundrum

Joanie Wexler

Carriers tighten SLAs, but differentiated IP service offerings remain scarce.

When it comes to network service quality there's some good news: Service-level agreements (SLAs) for packet networks are getting more robust. Many carriers are adding new SLA metrics to their packet network service offerings, for example, or tightening their existing SLA guarantees. Most offer some measure of commitment on the following network variables: availability, latency, jitter, packet loss and mean time to repair (MTTR). And they offer them across a mix of packet services, including IP virtual private networks (IP VPNs), frame relay and ATM.

Overall, then—at least on paper—network service quality seems to be improving.

Where there is the least activity, however, is in the area of differentiated IP service classes, based on prioritization among traffic flows. With the fervent promotion of IP as the ultimate convergence protocol for the past several years, the industry has long been expecting to see the emergence of ATM-like classes of service (COS) accompanying IP offerings, in private IP-VPN services and, eventually, public Internet services. However, these have not materialized—even though COS have become available for frame relay, and carriers such as AT&T and WorldCom have made voice-over-IP (VOIP) retail business service announcements.

The QOS services landscape looks something like this:

n ATM services remain a straightforward, robust alternative for companies looking to buy separate service classes for different application traffic, such as low-latency voice and video; interactive data, such as enterprise resource planning (ERP) systems; and best-effort data, such as email or file transfers. Because mapping IP to ATM COS is reportedly not easy, many carriers say they are waiting until their backbones have migrated to Multiprotocol Label Switching (MPLS) to offer IP service classes.

n Frame relay services continue to gain in popularity as they serve many worldwide data and, in some case, intranet voice needs. SLAs are becoming more stringent, and some providers, such as Infonet Services, Qwest and Sprint, offer customers differentiated service classes with their frame services.

n IP VPN services offered on a single carrier's IP backbone generally carry SLAs that apply to a customer network as a whole, rather than per site or per access link. The SLAs are becoming stronger, but are often not as stringent as their ATM and frame relay SLA counterparts; users still cannot purchase "platinum, gold, silver and bronze" IP-VPN service classes that provide preferential treatment to specified traffic.

n SLAs and differentiated service classes across a multi-carrier public Internet service do not yet exist. Carriers cannot guarantee what they cannot manage, and the industry still sorely lacks the business and settlement agreements that would enable an Internet-based, service-class experience.

"Many service providers are struggling financially, and it is all they can do to build out their infrastructures to keep pace with bandwidth demand," observed Dave Passmore, research director at The Burton Group (Sterling, VA). "We're seeing a lot of traffic engineering going on to meet SLAs, but putting time and money into additional or larger points of presence currently yields a bigger payback than QOS."

Enterprise Demands

Some customers who feel they are being well served by frame relay or some other service shrug off the lack of IP service classes. An IT manager at a large health care products company, for example, isn't yet sold on the concept of differentiated service classes for IP network services, even though he agrees that QOS in the form of stringent SLAs for data networking is important in order to match bandwidth needs to budgets.

"Long term, I'm a believer in convergence, but short term, I don't think the economies are there," says Jeff Winston, vice president of information technology at Allergan Inc., a global health-care company based in Irvine, CA, that makes eye care and specialty pharmaceuticals. Allergan uses Infonet's frame relay services worldwide and Winston said that, for now, frame relay—with strictly negotiated SLAs—is meeting his company's needs. Allergan sites across the globe tap the company's SAP ERP application server in the U.S., and Winston uses Infonet's Virtual Circuit

Joanie Wexler is an independent networking editor/writer in Campbell, CA. She can be reached at joanie@jwexler.com.

TABLE 1 A Sampling Of IP Service SLAs		
Carrier/Service	**Network Metric Covered**	**Guarantee**
AT&T IPServices	Network availability	99.99%, including managed CPE and access links
	Latency/delay	60 ms average (domestic); 120 ms (transatlantic), network-wide
	Packet loss	.7% or less, average, network-wide
CoreExpress Extranet Service	Network availability	99.9%, including CPE and access links
	Latency/delay	150 ms maximum
	Packet loss	1% or less
Equant Intranet Connect (IP VPN service)	Network availability	100% (in 80 countries)
Equant Integrated Voice and Data (iVAD) for Intranet Connect	Call setup*	95% under six seconds*
	IP fax transmission speed*	95% at 9600 bps or greater speeds*
Sprint Internet VPN	Network availability	99.9% with traditional access
	Latency/delay	70 ms (Sprint backbone only)
WorldCom TotalAccess (IP VPN service)	Network availability	99.8% for networks with three to nine sites
		99.9% for networks with 10 or more sites
	Latency/delay	120 ms maximum roundtrip intra-region
		300 ms maximum roundtrip inter-region
WorldCom Private IP Premium Service	Network availability	100% if WorldCom procures access link
		99.8% if customer procures access link
	Latency/delay	60 ms domestic
	MTTR	2 hours on-net
		4 hours off-net

* Slated for availability mid-year   Source: Carrier-provided data, February 2001

Even 'nets that converge their voice and data traffic may not need multiple classes of service

(VC) Interactive Class frame relay service to ensure that response times are up to snuff.

For now, Allergan isn't considering integrating voice over its frame relay intranet. "I don't think that voice over frame relay is economical, because PVCs are pricey," Winston said. "And in terms of IP-VPNs, some of the advanced features are not yet there that would make it attractive to run voice over them, such as customized dialing plans."

While there are signs that convergence is becoming more important to some companies, they don't necessarily require a special carrier service to handle differentiated traffic. For example, the United States Postal Service Office of Inspector General (USPS OIG) is merging its voice traffic worldwide onto its WorldCom frame relay service (as well as on to its LANs), and plans to use its PSTN-based PBXs only for backup and off-net calling.

The postal agency is trying to achieve several goals with voice/data convergence, according to telecommunications manager Robert Duffy. One is to save about 40 percent in PBX port costs and third-party software upgrades, as new users are provisioned with an IP address rather than a hard-wired connection to a PBX. The "soft" IP-PBX running on the agency's NT servers will route calls to the "hard" PBX in the event of a router failure or in the case of an off-net call, requiring only a one-port connection.

The agency also wants its hundreds of mobile investigators to have the benefit of "follow-me" type phone services, enabled by IP addresses instead of phone numbers. Finally, the bureau is enabling a common, integrated encryption mechanism for both voice and data.

To ensure QOS for its traffic, the OIG is leveraging the Weighted Fair Queuing (WFQ) and Weighted Random Early Discard (WRED) features in its Cisco 3600 series multiservice routers, rather than relying on purchasing a special service class from WorldCom.

Carrier Activity

The carriers serving the international market seem to be pushing service classes the hardest, in part because international calling often yields the greatest return for VOIP. For example, Infonet, which provides three service classes for its frame relay service, says it will offer IP service classes this fall, after it finishes building its MPLS backbone. "We are planning four service classes, each of which carry an associated SLA for delay, packet loss and jitter," said Paul Frankel, vice president of marketing for Infonet's global intranet services.

Equant, also another multinational carrier, announced four IP service classes for its Intranet Connect IP-VPN data service during the past year, although it has not yet published specific SLAs that accompany each class. By mid-year, said Jon Floyd, Equant's IP marketing manager, each of Equant's four service classes will have independent SLAs associated with it. Last summer, the company launched VOIP services in 57 countries and, at press time, said it was about a month away from offering special VOIP SLAs.

Carriers such as WorldCom are also looking to beef up their network guarantees. For its single-network TotalAccess IP-VPN services, WorldCom currently offers SLAs on just two network metrics: availability and latency. TotalAccess runs over WorldCom's Internet backbone, which it gained with the acquisition of UUNet.

More complete SLAs are coming for TotalAccess in the very near term, according to Tom Bregman, senior product manager for WorldCom IP-VPNs. He says that maximum-packet-loss guarantees are poised to roll out in the second quarter, and that WorldCom will improve its intra-regional latency guarantee of 120 milliseconds to 90 milliseconds and its inter-regional latency guarantee of 300 milliseconds to 150 to 200 milliseconds (Table 1).

WorldCom also offers an alternative called Private IP, which runs over the carrier's ATM backbone and leverages MPLS technology for security. According to George Kushin, WorldCom's director of IP product marketing, there is a "premium" service, which guarantees 100 percent availability, provided WorldCom procures the local-exchange access link on behalf of the customer, and 99.8 percent availability if the customer procures the access link. Kushin says WorldCom plans to add an "enhanced premium" class in the second quarter of this year to set priority bits to differentiate VOIP traffic; no "best effort" service is available.

More IP service classes could be on the way, according to Ray Glynn, vice president of sales at NetReality (Santa Clara, CA). NetReality, which has long sold enterprises a traffic-shaping device called WiseWAN, began selling to the carrier market last year.

"Carriers are realizing that one size will not fit all customers," said Glynn. He claimed that Wise-WAN has been evaluated by several carriers in the context of a managed network service—the carrier would install a customer-side WiseWAN on the user premises as well as in its POP. Glynn expects that by this fall, several carriers will have launched IP services based on NetReality's equipment, enabling them to assign bandwidth to customer traffic on an application basis.

> **The carriers' dilemma:**
> **Traditional voice service**
> **is so cheap,**
> **VOIP would be a**
> **"premium" offering**

Jim Metzler, an associate at Ashton-Metzler & Associates, a Boston-based consulting firm, warns enterprises to make sure that their SLA-based services offer guarantees running from CPE to CPE—not just portions of the service provider's network. "If you don't have end-to-end QOS, you don't have QOS," he said.

Chicken-And-Egg Challenges

By now, we've all heard that "bandwidth is becoming a commodity," and, if that's true, service providers will need to differentiate themselves with value-added services, service classes or other incentives. Genuity, one of the nation's largest Internet service providers, says it currently faces no QOS delivery challenges, because it keeps its network capacity far ahead of user bandwidth requirements. A company spokesperson said that while Genuity has long-term plans to offer service classes, the offerings might be more than a year away. "Business issues and settlement considerations are the sticking points," the spokesperson said.

Qwest has a similar story. A company spokesperson said, "Qwest doesn't really break out [IP] classes of services, because we have enough fiber and bandwidth to ensure that every customer's traffic is routed at the highest priority."

A Catch-22: Large enterprises in the U.S. are accustomed to paying under 3 cents a minute for traditional long-distance service. But, presumably, if they migrate to an integrated VOIP service, they would have to purchase the highest (read: most expensive) class of service for their voice traffic, which carries the most stringent response-time demands.

"So, for service providers, there is not much head room for premium-quality services," noted David Passmore. "Carriers need to price their VOIP services so they are cheaper than PSTN services, but high enough so that they can make money. Most haven't yet figured out what those pricing models should be. Someone has to be a pioneer and take some arrows in the back."

He added that it might wind up being the smaller users—those without the traffic volume to negotiate super-low per-minute PSTN rates—that end up being the early VOIP adopters.

Another challenge, according to Passmore, is that service providers are already struggling to speed up the service-activation process, which has long been criticized for taking way too long—often a matter of months—for vanilla connectivity services. "Think how hard it will be for them to provision multiple COS within those service offerings—particularly since there are back-end [operations support system] issues associated with provisioning new services."

> **What makes the Internet inexpensive,**
> **also makes it hostile to better QOS**

In addition, traffic differentiation takes a toll on enterprise resources. While many network managers agree that it is important to build organizational policies as to the relative treatment of different traffic flows, many have not yet gotten around to it. Managed network services will require the carriers to configure the CPE to properly prioritize traffic according to customer policies, and that of course presumes that customers have taken the time to get their policies in place. So far, the industry has not seen a large amount of action on that front.

Third Parties To The Rescue?

The most challenging hurdle is how enterprises can leverage the relatively low cost of public Internet services while ensuring QOS for mission-critical or delay-sensitive traffic. By definition, the Internet is a best-effort service, which may not provide adequate and consistent response times on an application from one session to the next. To a large degree, that is also precisely what makes the Internet inexpensive. Conversely, turning to an IP-VPN service that runs exclusively across a single provider's backbone is, in many ways, analogous to purchasing a more expensive frame relay or ATM service, based on closed user groups with limited connectivity.

ISPs are still fiercely competitive with one another, and not particularly eager to strike business and settlement agreements. The very idea of premium traffic being handed off from a user's primary ISP to a competitor and maintaining its QOS status with no reimbursement doesn't fit their "paradigm."

One potential solution, at least for some applications, is the emergence of third-party overlay networks that "plug in" to the various ISP back-bones and pass traffic directly from the source backbone to the destination backbone. This side-steps traditional ISP peering points, which are often ripe spots for congestion.

Players in this space, include InterNAP Network Services Corp. and CoreExpress. InterNAP targets enterprises with large ecommerce sites requiring fast user response times. Via its 24 worldwide private network access peering points (P-NAPs), InterNAP routes Web requests directly to the backbone supporting the commerce site. By contrast, CoreExpress (St. Louis), offers a carrier-neutral service based on its own nationwide fiber backbone called CoreExpress Extranet to companies with dedicated connections to Tier 1 ISPs.

CoreExpress connects to ISPs such as AT&T, UUNet, Sprint and Genuity in nine locations throughout the U.S., explains Gregory Davis, vice president of marketing. Companies and business partners that use different ISPs for Internet connectivity plug into the CoreExpress network to gain extranet capabilities, rather than having to change out their ISP and reconfigure their CPE, he explained. The company said it can have extranet connections up and running in about two days; it will track how many packets traverse each backbone and take care of the settlement issues among ISPs.

CoreExpress's standard offering is 150 milliseconds roundtrip (CPE to CPE), with 1 percent maximum packet loss and 99.9 percent network availability—not bad for many data applications, but not high enough for adding delay-sensitive traffic to the mix. It does not offer service classes based on traffic prioritization, as Davis explained: "When ISPs offer service classes at the edge of the Internet, we'll be able to integrate with them and extend them across the backbone, but we don't see them doing it until 2002."

Another saving grace could arrive in the form of content delivery networks (CDNs). CDNs are Internet overlay networks that are being built primarily to enable high-quality multimedia entertainment and content-rich service delivery through the use of distributed network elements such as load-balancing, caching and Web request redirection systems. (For more on CDNs, see this issue, pp. 38–44).

As with the IP connectivity arena, today's CDN services, from companies such as Akamai Technologies and Digital Island, use proprietary technologies and do not interoperate. However, a couple of industry alliances—the Content Alliance headed by Cisco and the Content Bridge alliance, headed by Inktomi and Adero—are working to settle both the technical interoperability issues and the business settlement challenges in conjunction with the Internet Engineering Task Force (IETF). The CDN model, once in place, might carry through to other types of business IP services.

Conclusion

Most large carriers offer prioritized service classes based on ATM technology, and many offer COS in their frame relay portfolios. While the network-wide SLAs associated with "private" IP-VPN services are getting stronger, there is a dearth of service class availability in public Internet services. The conundrum is that the Internet is inexpensive largely because it is unmanaged—but that also means it's not overly reliable.

Meanwhile, most service providers and enterprises have not been motivated to converge voice traffic onto their IP services; they have their hands full keeping up with provisioning and connectivity requirements. And large U.S.-based enterprises with substantial volume discounts are finding their PSTN services inexpensive enough to not clamor for converged services, at least not yet.

For differentiated IP services to materialize and offer value, the service providers will have to figure out how to price services attractively while still enabling themselves to turn a profit. Similarly, technical and business peering and settlements issues must be overcome through the efforts of industry alliances, standards groups and new companies serving as ISP-agnostic third parties□

Needed: Business models for pricing differentiated service classes

---

Companies Mentioned In This Article

Akamai (www.akamai.net)

Allergan (www.allergan.com)

Ashton-Metzler & Associates
 (www.ashtonmetzler.com)

AT&T (www.att.com)

Cisco (www.cisco.com)

CoreExpress
 (www.coreexpress.com)

Digital Island (www.digisle.net)

Equant (www.equant.com)

Genuity (www.genuity.com)

Infonet Service Corp.
 (www.infonet.com)

Inktomi (www.inktomi.com)

InterNAP Network Services Corp.
 (www.internap.com)

NetReality (www.net-reality.com)

Qwest (www.qwest.com)

Sprint (www.sprint.com)

The Burton Group (www.tbg.com)

United States Postal Service Office
 of Inspector General
  (www.uspsoig.gov)

WorldCom (www.wcom.com)