CONTENT DELIVERY NETWORKS

CACHE INJECTION

Operators are turning to content delivery networks to ease the Internet traffic burden, and that could result in new services and revenue streams. **By Roy Rubenstein**

Content delivery networks are set to play a major role in how operators tackle the relentless growth of IP traffic across their infrastructure. Deploying a CDN that stores popular content close to users also promises new revenue opportunities, enabling operators to sell use of their CDNs to content providers and to deliver new services such as multi-screen video.

But CDNs pose their own challenges for operators: key among them, it remains unproven whether content providers will embrace operators' CDNs, build their own or use those of specialist providers. In addition, not all traffic is suitable for CDNs for technical or commercial reasons—one market research firm estimates the proportion to be as high as 60% of all traffic (see box p.10).

"The business case [for CDNs] is very uncertain, but operators are clear that they have to do something," says Rob Gallagher, principal analyst and head of broadband and TV research at Informa Telecoms and Media.

A CDN can be viewed as a collection of algorithms that reside in the network to keep track of all the content requested by users. "It tracks usage and demand of content, it knows the network topology and where the users are, and then moves content about the network, from centralised storage to distributed caches far closer to the user," says Jim Guillet, director of marketing at Alcatel-Lucent. As well as saving network capacity, such content placement provides end users with an improved service experience by reducing network latency.

Organisations that already use CDNs include media and entertainment content providers—such as Google, Facebook and traditional broadcasters—enterprises that are looking to improve their Web site performance, and ISPs.

Akamai Technologies has been providing its CDN to ISPs and enterprises for over a decade, and more recent key CDN players include Limelight Networks, EdgeCast Networks and Level 3 Communications. Now telcos are entering the market with their own CDNs, as a service offering and as a way to cope with their own traffic burden. "It is very hard to find a major operator, or even a tier-two operator, that isn't committed to some kind of CDN strategy," says Gallagher.

Acquisitions could be one route to creating CDN scale. Last month Level 3 agreed to acquire Global Crossing for US$1.9 billion, creating a combined company with connections to 70 countries and extending Level 3's CDN assets out from its US stronghold to Latin America and Asia.

Rapid traffic growth requires significant network investment, yet operators benefit only marginally from the revenues Internet traffic is generating, says James Segil, president of EdgeCast Networks (Technology Trends, April 2011). "Operators are the mule that has to carry everything," says Segil.

AT&T says 30% of core traffic on its network is cacheable content destined for its customers, and says a CDN approach is currently the only way to manage traffic growth cost-effectively. Moreover, an AT&T/Exabyte study forecasts network traffic is likely to expand by 50% per year over the next 10 years.

According to analysis from Juniper Networks, CDNs can have a significant impact on Internet traffic: "For a wireline residential service provider offering 10-Mbit/s broadband links, implementing a CDN saves between 30%–50% of Internet traffic," says David Noguer Bau, head of service provider marketing at Juniper.

Storing content closer to users also benefits their service experience. Video traffic is sensitive to bandwidth fluctuations and network latency, and the closer the content the fewer congestion points the traffic must cross. New protocols such as HTTP adaptive streaming work by the end device such as an iPad requesting content in segments while assessing the bandwidth conditions available. If conditions are good the device can request higher resolution video segments.

"If content is closer to the consumer there is less latency and points of contention such that the whole adaptive mechanism works that much better," says Guillet at Alcatel-Lucent.

"If there was no bandwidth problem, you could argue that all these third-party CDNs could easily serve CDN traffic in centralised places in the network," says Santosh Krishnan, vice president of business development at Verivue. "But now that bandwidth is exploding there is a compelling reason to bring CDN technology even closer to the user."

Verivue provides CDN platforms to service providers. In April, Polish operator Telekomunikacja Polska, part of the France Telecom Group, announced it had deployed Verivue's CDN technology after three years of trials, says Krishnan.

At the core of a CDN are the origin servers and storage: popular content is sent by the origin servers to the CDN edge where the media servers and edge caches reside. "It is not cost-effective to store all the content at all the edges," says Derek Gough, director of product management at Level 3 Communications. "We can intelligently populate the caches with 'short-tail' content that is the most popular." Content is cleared from the cache once it ceases to be popular, but a copy remains in the origin storage should it become so again.

The degree of cacheing efficiency that can be achieved using a CDN is striking. For example, Akamai caches 95% of Facebook's traffic through its CDN, according to Michael Howard, principal analyst at Infonetics Research.

Operators' CDNs differ from the global specialists in that their reach is confined to their networks, often spanning one or several countries at most. But operators have the advantage that they can place the

edge caches closer to the end user, while also owning the underlying network.

"Akamai has a distributed solution with equipment co-located in a lot of operators' networks, but they are not necessarily at the edge of an operator's network," says Eli Fuchs, product line manager for CDS/CDN at Cisco Systems. In contrast, an operator could extend the CDN to the network edge where traffic from relatively few households is aggregated, making for even greater efficiency and cost savings. For now, though, operators' CDNs typically have their equipment located at major points of presence (POP) and not at the thousands of edge central offices that aggregate access traffic.

In North America, a cable operator has 30 or 40 video hub offices—a typical first stage deployment. A similar model applies to telcos. BT Wholesale is looking to use its CDN to promote its broadband network as an attractive alternative television distribution platform. "We started with our content platform to support on-demand [TV] consumption, but our end-game is to establish a set of very rich services as part of a broadband network," says Simon Orme, strategy director, content services, at BT Wholesale.

BT's Content Connect CDN spans 20 POPs across the UK. Deciding where content is placed is a trade-off between the network efficiencies that result and ensuring that there are sufficient users to merit the economies of scale for popular content storage. "The way we have constructed the architecture is that as traffic grows we can continue to deploy [content] deeper and deeper [towards the end user]," says Orme. This will coincide with BT distributing its broadband remote access servers beyond its 20 POPs.

Cable operators are using CDN technology to deliver video to various devices such as PCs, handsets and tablets. Time Warner Cable has launched a live TV service that delivers 30 high-definition cable networks to an iPad. "That is an http-based video delivery technology and to deliver that cost effectively they are using CDN technology," says Krishnan at Verivue.
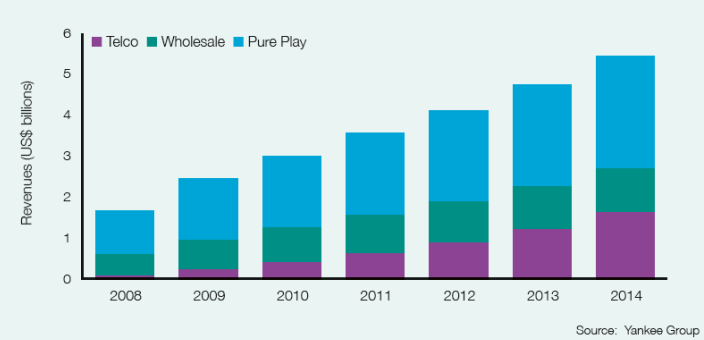
BT is pitching its CDN marketing

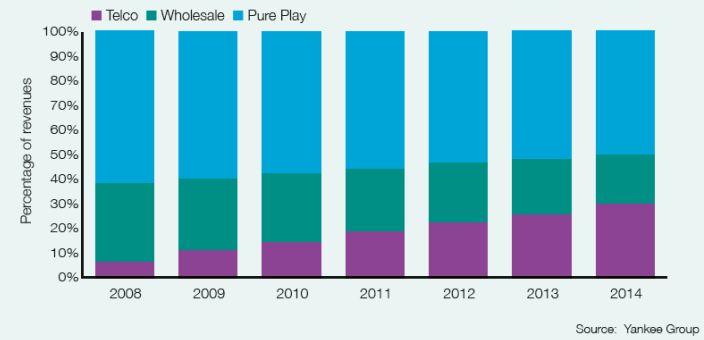### Highest capacity international Internet routes, 2006-2010

Source: TeleGeography
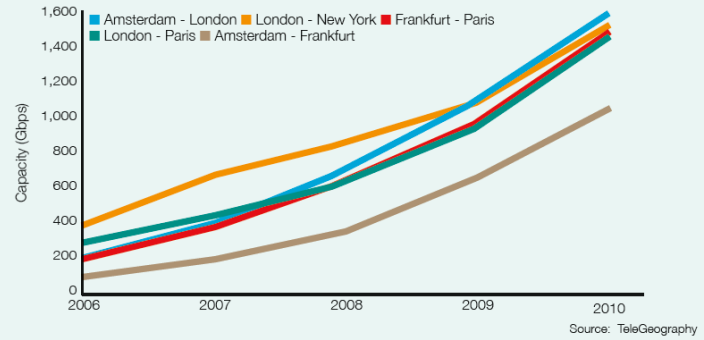
'It is very hard to find a major operator that isn't committed to some kind of CDN strategy'

Total global CDN revenues forecast

Source: Yankee Group

Percentage share of total global CDN revenues

Source: Yankee Group

Commercial imperatives: why CDNs aren't the whole solution

Content delivery networks are not the only way operators can achieve traffic optimisation and cost savings in their networks. Operators can also use established transparent cacheing technology, and some are already doing so to save on traffic transit costs and to bypass a direct relationship with content publishers. Transparent cacheing technology identifies and stores content on the operator's network, typically at the edge, yet to the end user it appears to be coming straight from the content provider. In contrast, a commerical CDN stores content for payment and with the consent of the content provider which has coded that content.

The predominant issue, however, is that the bulk of traffic may not be available for storage in a CDN. "Figures vary, but you could be looking at 90% of traffic today on networks that can't be cached [in a CDN] for technical or commercial reasons," says Informa's Gallagher. The reasons include content not being popular enough to store economically; or, for example, in the case of popular YouTube video content, Google is building its own CDN which will remove that content from operators' commercial strategies unless they strike agreements.

"Operators will have to build a system where they can charge for content but also deal with content where no financial relationship exists," says Gallagher. Informa estimates that popular videos that operators can charge for using their CDNs may account for just 40% of traffic in five years' time. "You are still left with a big 60% of content which could not be [CDN] cached," says Gallagher. "And so now what you could transparently cache to make savings is anything from 20% to 60%—a lot are saying 30-40%—but it is vastly unknown as no relationship exists between providers of such content and the CDN or network operator."

EdgeCast's Segil agrees that transparent cacheing is a valuable complement to CDNs, but he claims the technology is only able to capture 5% of cacheable Internet content. In contrast he says 60% of all traffic is cacheable, and that commercial CDNs can capture all of that. Nevertheless, transparent cacheing is gaining currency with operators, says Gallagher. "With some major operators there are dual RFPs: you'll have a managed CDN part for charging and a transport cacheing part for content that they cannot charge for." And at least one operator has issued a large RFP requesting transparent cacheing immediately. "The operator will deal with the more complex issue of whether it can charge for CDN services later," says Gallagher.

EdgeCast believes operators interested in transparent cacheing are using the technology as a "band aid" to alleviate traffic growth pressures, while they determine their CDN strategy. "The good thing about transparent cacheing is that you don't need to build out a sales force and a business model for CDNs to go out and sell the services," says Segil.

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activity at branded TV content providers in the UK. "We have signed up customers but we haven't made any public announcements," says Orme.

AT&T's CDN is used by several media and enterprise customers, but the operator also highlights increasing demand for delivering more dynamic content such as e-commerce transaction Web sites. "For sites where dynamic content is a significant component of a Web page, cacheing is not a viable solution," says Sam Farraj, assistant vice president, AT&T Digital Media Solutions. In such instances improving the connection between the site requesting the content and the origin server is important, and AT&T recently launched its Content Acceleration service to address this.

Akamai highlights how it is applying cacheing and dynamic acceleration for gaming. Cacheing is used to speed up downloads of new games and game-console updates, while acceleration is needed for multi-player gaming.

Noguer Bau at Juniper argues that in future users will choose their broadband provider not just on price and speed but also on service experience. "The Internet of the future will not be as we know today," he says. "There will be plenty of bottlenecks because of the lack of investment, so [service] experience will be a factor."

But if CDN technology is set to play a central role in operators' networks, challenges remain. One hurdle for operators is how to compete with established CDN players given the geographically constrained nature of their deployments.

"It is a still a challenge to the [operator] newcomers to present themselves to content providers as something comparable to Internet CDN players because of this isolated network geography issue," says Orme at BT. As a result, much work is going into CDN interoperability in order to establish a global CDN infrastructure. "This is being driven almost entirely by the operators," he says.

"Like an airline alliance, you can do the same thing for CDN as long as everyone has the same underlying software," says Segil at EdgeCast. "We are providing such software and the marketplace that is going to be enabling that."

Level 3's Gough highlights the challenge of making CDNs scalable. Broadband subscriber numbers and the access links continue to grow, as does the format of video traffic—from standard definition to high definition and even 3D. "The size of the challenge—the growth in content and the duration it is being watched—has been dramatic," says Gough. There are also events such as sporting finals that magnify demand for content for short periods: Last year's World Cup caused a 30-times increase in traffic for certain broadcasters, he says.

Despite the challenges, placing content delivery intelligence alongside fixed and mobile broadband traffic aggregation within operators' central offices promises new business opportunities, argues Howard at Infonetics. "Once telcos have several major central offices that look like mini data centres, not only will they offer cloud services but they are also going to have servers and storage such that applications run there," he says. "A critical piece is that in those locations they will now know everything a fixed or mobile user is doing on their broadband connection."

In contrast a Google or an MSN will only see what a user is doing in their environment. Howard does not expect telcos to compete with Google by selling advertising, but having such user insights could well lure the Internet giants into striking agreements with them.

BT's Orme also identifies this as a promising development. "One thing content providers are incredibly keen to get their arms around is analytics: what users are doing when and where, in as near real-time as possible," he says.

Such insight could be the silver lining for operators when it comes to CDNs. "The potential opportunity is there," says Orme. "But there are so many operational and legislative issues to solve first." ■