

Operators and Users Win with Intelligent Content Networking



Executive Summary

The rapid growth of consumer Internet traffic, mainly due to increased viewing of video content via their broadband connections (known as “Over-the-Top” Video or OTT Video), is driving increased stress on service provider networks and business models. The frequency, duration, and resolution of content requests are increasing, which has a dramatic effect on bandwidth requirements. As we enter into the era of Hyperconnectivity, more and more devices are accessing this rich content anywhere, and at anytime. Demand is accelerating quickly as more content (for example mainstream movies and TV shows) is becoming available and broader set of Internet-connected devices are able to access it.

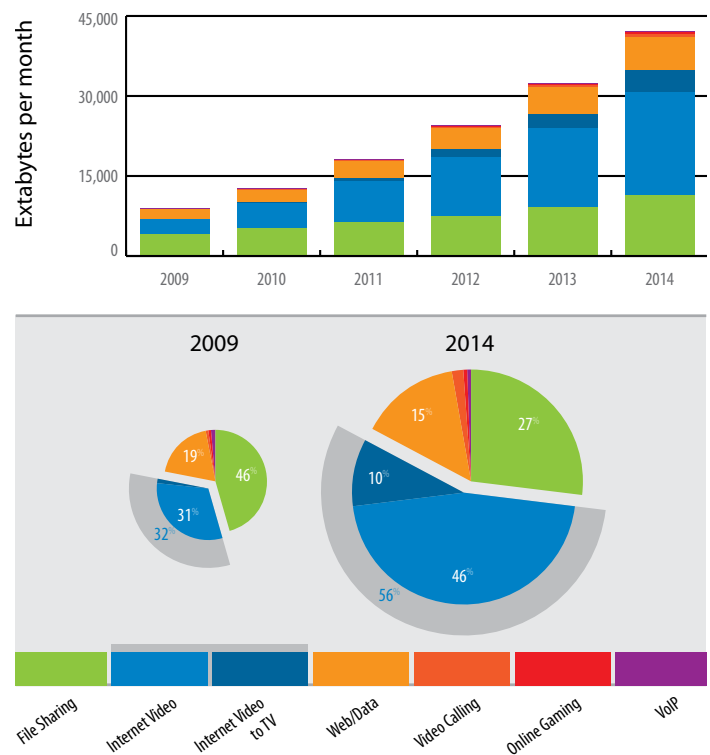
The ability to manage the delivery of certain content types and reduce bandwidth requirements over Middle Mile, core, and Internet transit networks can improve profitability for service delivery. Intelligent Content Networking reduces the strain on the network and improves the user experience by serving a broad range of popular, frequently accessed content closer to the subscriber, reducing service delivery and internet transit bandwidth requirements.

Video Takes Over

From peer-to-peer downloads to online gaming, from instant messaging to email, from web to video the amount of internet traffic is growing significantly as seen in Figure 1.

Video content is rapidly changing the composition of consumer internet traffic and is anticipated to make up nearly 60% of requests by 2014. The growth of video will continue as subscribers’ viewing habits change from broadcast to on-demand—at home and on mobile devices—and with higher definition and increased availability of mainstream content, such as movies and television series, being offered via the Internet.

Figure 1: “Residential Internet Traffic Breakdown: 2009-2014”
Cisco Visual Networking Index 2010



Is your network ready for next wave of Internet traffic?

The prevalence of IP-based video has greatly affected the makeup of the packets traversing a residential internet connection which now includes multimedia content, communications, and data; it is the primary communications link to many residences.

Irrespective of the type, OTT content puts significant stress on the network because it must traverse internet peering connections, core network infrastructure, Middle Mile connections, and finally the access network to be delivered. An individual subscriber's request for video content, where a user is highly utilizing their connection for a long period of time, has a compound effect on the network as subscribers' linear-based requests are aggregated, causing network congestion and sub-optimal quality of experience (QoE).

The traditional approach to address bandwidth growth, reduce congestion, and ensure customer satisfaction is via incremental network overlays and increased Internet transit capacity. This is effective to address bandwidth requirements, but it's not efficient from an economic standpoint as overlays drive additional CAPEX and OPEX. Considering that the average revenue per user (ARPU) will stay static (if not diminish with increased competition), this continued investment fuels a divergence of cost and revenue, leading to less profitable service offerings.

Over the Top (OTT) Content: Flash Video, Online Software Updates, Peer-to-Peer

- Flash video services (YouTube, Yahoo Video, MSN Movies)
- Software updates (operating system and anti-virus)
- Peer-to-peer file sharing (music, podcasts, movies)
- HTTP downloads (user manuals, product brochures)

Figure 2: Over The Top (OTT) Content: Flash Video, Online Software Updates, Peer-To-Peer

Secondly, as a subscriber's internet connection usage grows more bandwidth-intensive with OTT and other sources of video, the experience will deteriorate. This is based on time to download and view content as well as system response times for control commands (play, pause, etc.). As expectations continue to become more difficult to meet, more service complaints will be logged and subscriber churn will increase as they move to competitive service offerings.

An alternative content delivery approach, that is beneficial to both service provider and customer, is needed. This approach will need to deliver content effectively and efficiently, provide a high QoE for the end-customer, and limit the service providers' requirements to augment the network.

Intelligent Content Networking at your service

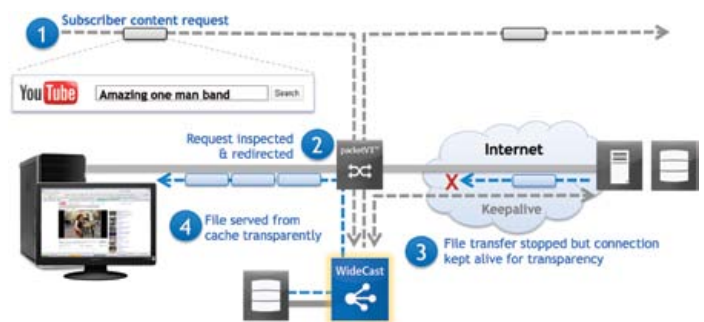
Intelligent Content Networking is a new approach that distributes frequently-accessed content closer to the subscriber, at the edge of the network, to expedite downloading or streaming and limit the impact of repetitive requests on the entire network. This approach allows for reuse of the locally cached content and provides:

- Subscriber value: an improved quality of experience. Content is rapidly accessible and system control requests are reacted to quickly based on the content being sourced from a much closer location
- Network Operator value: with a sizeable reduction in the bandwidth required to serve content over the network and internet transit points, this defers investment in network capex and opex.

How does it work?

Intelligent Content Networking focuses on data sessions established between Service Provider subscribers and Internet content sources, such as Web servers, CDN networks, P2P nodes etc., supporting all of the HTTP services and P2P protocols. As shown in Figure 3, applicable content requests are analyzed and classified on the basis of file type, and are assessed based on download frequency, size of file, last download, etc., to determine their caching potential. Frequently requested—popular—media files are held locally, whereas infrequently or rarely requested files will continue to be sourced from farther back in the network.

Figure 3: The Intelligent Content Networking Process



For subsequent requests, the content cache will determine whether the requested file has been previously stored and determine the integrity of the content to ensure that it is valid, up-to-date, and what the subscriber requested. If this is the case, it will stream or download the file to the requesting subscriber(s). By serving the data from the edge of the network, traffic over transit and peering links is reduced and delivery is accelerated.

In addition, the content cache, in conjunction with a network element that is tasked with redirection of user's requests for cacheable content, will let other forms of traffic bypass this redirection point.

Are there Concerns for Copyright Infringement?

Content delivery can be fraught with legal complexity; however the Digital Millennium Copyright Act—USA (DMCA) and other similar documents were authored to recognize caching of P2P and HTTP-streaming content for the purpose of network efficiency and without modification as legal and protected by law. Similar documents in the European Union (EU) also provide guidance, acknowledge the requirement, and protect network operators from liability for routing, caching and hosting 3rd party content.

The transparent caching strategy used within Intelligent Content Networking is fully compliant with the procedural "safe harbor" requirements of these legal acts. A transparent caching strategy works by intercepting the network traffic transparently to the browser. It short-circuits the retrieval process of the desired file if it is in the cache. Transparent caches are especially useful to service providers because they require no browser setup modification.

Figure 4: Synopsis of the Digital Millennium Copyright Act (USA)

DMCA Terms	BTI WideCast
The service provider is not the one who originally made the material available	Fully Compliant
Caching is automatic with intermediate and temporary storage of content in local servers	Fully Compliant
Service provider did not modify the content	Fully Compliant
Service Provider complies with industry standards regarding updating of the content	Fully Compliant
Service provider does not interfere with the content's access manners (ie passwords)	Fully Compliant
Service provider must remove infringing files upon gaining actual knowledge of infringement	Fully Compliant

The transparent caching approach provides several distinct advantages relative to proxy-based solutions where requests are terminated at the proxy cache and web servers are not aware of the request.

- With a proxy cache the web server loses all visibility to content requests or webpage hits

- Connections from a proxy cache will appear to originate from its IP address, leading to inaccurate utilization and popularity metrics (ie: YouTube video viewing statistics)
- Proxy-based caching methodologies cannot always guarantee if content is current or not

Based on these points, a proxy-based strategy could be considered in violation of the DMCA where "The provider must not interfere with the technology that returns 'hit' information to the person who posted the material" and "the provider must comply with rules about 'refreshing' material—replacing retained copies of material with material from the original location—when specified in accordance with a generally accepted industry standard data protocol."

What's the Value?

Intelligent Content Networking reduces the strain on the entire network by serving a broad range of popular, frequently accessed content closer to the subscriber.

Alleviating network congestion and propagation delay associated with delivering requested content to the subscriber means content is viewable faster, and without interruption—in some cases subscriber response time is 7x faster!

In many cases the investment in Intelligent Content Networking can be easily justified on an ROI basis against saved OPEX and CAPEX that would have been required previously to augment network capacity. Service Providers are finding that up to 70% of content is cacheable, and bandwidth savings realized are between 25–30%.

Intelligent Content Networking frees up bandwidth to deliver other services, such as VoIP and video conferencing more effectively. The quality of these offerings is higher as they are no longer contending with as much OTT content transiting the network concurrently. They also provide incremental, "value added services" revenue streams that compliment internet access services.

As Service Providers are providing improved QoE to their customers, Intelligent Content Networking approaches are opening up opportunities to increase ARPU by providing tiered services and partnering with OTT content providers to jointly offer enhanced service offerings.

Why BTI Systems?

BTI Systems understands networks. For over 10 years we've been supporting a diverse range of networks within service provider, utility, web and cloud service operators, and enterprise environments. We have the expertise to deliver mission critical information, communications, and content and are relied upon by over 350 customers globally.

The BTI portfolio has evolved to a best-in-breed packet optical network foundation offering optical service delivery, and a completely integrated Carrier Ethernet packet services layer. Our focus on enabling content-optimized solutions is a natural evolution complementary to our existing capabilities and ensures our customer's networks continue to evolve to address new application and service requirements.

Widecast™, is BTI's edge-based Intelligent Content Networking solution. It's a blade server and storage platform focused on network-based content serving and distribution that is tightly integrated with BTI's packet services layer. Widecast positions key network functionality and content at the fibered network edge—at the head end of the access network or literally at the subscriber's "front door" to effectively address OTT requests with network efficiency, operational savings, and a high quality of experience.

BTI optimizes Intelligent Content Networking for the edge of the network with our focus on fundamental principles when architecting network solutions: efficient service delivery, low power, compact form factor, and simplified management and operations.

Intelligent Content Networking from BTI— a WIN/WIN Solution

The key to addressing critical network requirements as we enter the era of Hyperconnectivity is to use an innovative approach for content delivery; with Intelligent Content Networking solutions, BTI provides a WIN/WIN for service providers and subscribers.

The service providers' high-speed internet services must leverage an efficient service delivery infrastructure to address high-bandwidth subscriber requests for content and information. An Intelligent Content Networking approach defers metro network build outs and reduces internet transit costs through a more effective content delivery model, using content caching technology tightly integrated with a packet optical networking solution.

The consumer demand for content is growing at an unprecedented rate and with it is the expectation that content will be readily available, timely in delivery, and easy to control. An Intelligent Content Networking approach provides an "at the front door" delivery model for popular content and ensures sufficient bandwidth to deliver longtail content, and other communications services, over the same Internet pipe effectively; providing an improved quality of experience for the subscriber.

Figure 5: Intelligent Content Networking Solution from BTI Systems

