Combining CDN & Transparent Caching into a Dynamic Duo
Online video traffic continues to spiral ever upward. Consider the following numbers from Cisco’s Visual Networking Index:

- By 2016, global data consumption is predicted to reach 1.3 zettabytes. For context, that is the equivalent of streaming 38 million DVDs in a single hour.
- The number of online video viewers will reach 1.5 billion by 2016.
- Average global IP traffic in 2016 is expected to reach 150 petabytes per hour, the equivalent of 278 million people simultaneously streaming an HD movie.

While the rise of online video is a boon for end users who now have access to a seemingly endless catalog of video programming over a range of IP-enabled devices, it is wreaking havoc with service providers who must continuously upgrade their networks to accommodate this surge of data.

What’s more, these service providers have limited options to deal with the problem.

They cannot offset their capital expenditures by passing along corresponding cost increases to end users; ISP subscribers would balk. Without a way to generate enough revenue to cover network build out, operators must instead focus their attention on reducing costs. To that end, many are looking to reduce transit costs by caching at the edge of their networks and are turning to either Content Delivery Networks (CDNs) or Transparent Caching solutions to accomplish this goal.

To date, service providers have typically utilized one solution or the other but that may begin to change. A converged approach that combines the best of CDN and Transparent Caching technologies may be the ideal means to cache the most traffic — both managed and unmanaged — and achieve the greatest cost savings for network expansion.
With this whitepaper, we will reveal the benefits of utilizing CDN and Transparent Caching in tandem to reduce network video delivery costs and how using a single analytics system across those installations can maximize these benefits. Built-in factors like those below give operators a natural competitive advantage over pure-play commercial CDNs:

**Problem**
The Internet is being called upon to do things for which it was never designed, foremost among them to stream enormous volumes of video content.

It’s important to recall that the Internet was originally designed as the Arpanet packet-switched network to carry text messages and not to transmit rich content like video, images or gaming. Given the Internet’s structural limitations then, the shorter the distance that online video needs to traverse, the better.

To shorten those distances, many service providers are caching and streaming video content from the network edge, improving viewers’ quality of experience (QoE) by reducing start-up delays and empty-buffer stalls while maximizing bitrate and video resolution. AT&T has stated that locally cached content travels about 90% less distance across its network than content peered from upstream.*

But deploying a caching solution has typically required operators to make an either/or choice: use a content delivery network and optimize managed content only or use a Transparent Caching system to optimize both unmanaged and managed content.

Unfortunately, making this kind of choice often results in a partial solution to the larger problem.

**Current Approaches to Solving the Problem**

**Content Delivery Networks**
CDNs reduce the load on a service provider’s network by duplicating popular content from participating providers, storing it on geographically distributed edge servers located close to end users, then redirecting client requests to the closest edge server. By serving content close to the end user, the operator can greatly reduce the strain on its network backbone and significantly decrease transit costs.

Importantly, CDNs do all of the above as part of a formalized business relationship with content providers.

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<td>CDNs work with a wider range of protocols — “legacy” true streaming protocols as well as HTTP adaptive streaming — and content- protection schemes than Transparent Caching options.</td>
<td>CDNs only manage content from providers with which they have formalized relationships. Failure to get a large number of the most important providers on board can greatly limit the impact of the CDN on network optimization. This may especially limit CDN’s potential for operators whose small subscriber bases or geographical footprints diminish their appeal to potential CDN customers.</td>
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<td>Content Delivery Networks also enable operators to generate revenue from their network by selling the service to content owners.</td>
<td>Necessitates network configuration to accommodate different application and protocol requirements.</td>
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<td>The explicit participation of content providers in a CDN arrangement ensures that they will work with the operator toward successful caching of their content.</td>
<td>CDN operations may require more complex hardware and costly software licenses to accommodate more protocols, manage SLAs and billing, etc.</td>
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* Presentation at 2011 IP&TV World Forum
Transparent Caching

Transparent Caching systems — referred to alternatively as Transparent Proxy — also reduce an operator’s network load and function in much the same way as a CDN. The big difference is that service providers can deploy Transparent Caching solutions without the knowledge or consent of content owners and publishers, essentially intercepting client requests and redirecting users to cached content. Transparent Caching is also largely a cost reduction tool; it has no direct mechanism for carriers to generate revenue although it can indirectly contribute to earnings by:

- Identifying content owners that are potential customers for a commercial CDN
- enabling premium ISP services with enhanced QoS and QoE
- Identifying prospective marketing partnerships with content providers
- Identifying popular services for which the operator can offer in-house versions

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<td>Transparent Caching solutions apply more broadly to all content from all providers, regardless of their active participation.</td>
<td>Content owners have a lot invested in their content and usually want to exercise total control over it — from how it is used and by whom to its freshness. There is debate as to whether content owners should be concerned about Transparent Caching, but it undoubtedly fills many with unease. Some even try to block Transparent Caching via HTTP tags and dynamic URLs. This sows uncertainty that Transparent Caching will actually de-duplicate the most important content.</td>
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<td>A Transparent Caching solution can be deployed more quickly and easily because it does not require a commercial agreement, nor company-wide participation by departments like sales, marketing, legal, etc.</td>
<td>Transparent Proxy may not accommodate “legacy” streaming protocols like those supporting Flash, Windows Media and QuickTime. In particular, Transparent Caching may not work properly with secure, encrypted HTTPS traffic, employed by publishers to restrict the most valuable content to those with proper credentials and authentication. Because value and popularity often go hand in hand, this can significantly restrict the effectiveness of Transparent Caching.</td>
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Benefits of Combined CDN and Transparent Caching

While each has its advantages and disadvantages, a combined CDN and Transparent Caching solution may offer the best balance of flexibility and cost savings.

- A CDN can provide service providers with the most extensive, reliable caching of content from participating content owners, including on-net services (like Pay TV services operated by the service providers themselves).
- Transparent Caching does its part by caching unmanaged OTT content from the full range of content providers that aren’t participating in the collaborative CDN effort.
Basic
The most basic means to realize the benefits of this combined solution is to simply run unconnected side-by-side CDN and Transparent Caching systems. As long as the independent systems do not interfere with each other, the operator can enjoy benefits from each system — but not gain any further synergies.

To maximize this arrangement, operators can harness the analytics and reporting capabilities to present a unified view of these otherwise separate caching systems, taking the first steps toward centralizing their management and control.

More Advanced
The next step forward would be partial resource sharing, in which each system is primarily utilized to handle the traffic for which it is optimized — CDN for managed, Transparent Caching for unmanaged — but can also serve as overflow capacity for the other at peak times.

Advanced
More advanced installations would involve partial or complete resource-sharing of common components. The most comprehensive sharing model would involve only having one set of caching resources with a complex control system, plus an analytics and reporting element that spans both caching models. This architecture assures the most efficient use of components (e.g. no need to build out full capacity for both systems) all while reducing TCO by eliminating redundant elements.

The analytics capability can amplify the combined benefits between the caching modes and unlock the value of a converged solution. For example, one can analyze traffic patterns to uncover new business opportunities — like which content owners most frequently cache assets and therefore appear to be good prospects for commercial CDN service. A carrier could also approach content providers whose content is distributed via Transparent Caching and offer them CDN services too.

Challenges to a Combined Solution
A combined CDN-Transparent Caching strategy offers compelling benefits. However, there are some very real challenges to making it pay out.

- Deploying either solution involves a significant amount of technical complexity; combining the two only heightens this complexity.
- With more moving parts to oversee, a converged approach can also add to a service provider’s operational and managerial workload.

To establish an ROI and justify the investment then, operators who embrace this dual strategy must be able to:

- Understand the overall effectiveness of caching and its contribution to network optimization
- Determine the overall impact of caching on QoS, plus the impacts on each type of traffic
- Spot opportunities for cross-utilization of caching assets: quantify the incremental savings
- Quantify the overall savings accrued from both
- Quantify the contribution of each type of caching to cost savings
**Solution**

To fully harness the power of a CDN-Transparent Caching solution requires a single, unified view into all caching activity. By doing so, service providers can:

- Identify and measure which kind of traffic is routed via which type of caching system
  - Are there particular days and times when traffic tends to overflow onto the complementary cache complex?
  - Is load sharing impacting the ability to cache the most beneficial content?

Compare performance, impact on quality, and savings across CDN and Transparent Caching operations

- How do the cache-hit ratios vary between managed and unmanaged content?
- How much does the caching of each type of content impact the overall quality of experience?
- Which type of caching does the most to reduce peak traffic levels (and, thus, capacity requirements)?

Track quality improvement & savings trends over time

- What is the overall reduction in capacity requirements?
- Is there continuous improvement in cache ratios, load times, etc.?

Service providers employing a converged approach will need a powerful, unified analytics layer to deal with advanced resource sharing between caching types and to provide input to routing and control rules. Even when the caching methods are operated separately, unified reporting can deliver on much of the promise that a converged caching solution holds.

Citrix® is uniquely capable of providing a unified view into caching activity — in aggregate or segmented in detail by CDN or Transparent Caching operations. Our patented architecture can process huge volumes of highly diverse data in real-time, enabling detailed, multidimensional analysis of network performance data.

**Conclusion**

As online video traffic continues to soar, network operators are left to wrestle with how to contain this onslaught without breaking the bank. Few revenue generating options are available to offset the large infrastructure investments needed to keep pace, so most operators are focusing on the cost side of the ledger.

To date they have sought to reduce transit costs by caching at the edge of their networks using either a Content Delivery Network or a Transparent Caching solution. When utilized in tandem, however, these solutions can achieve cost reductions and caching levels that surpass those of either technology on its own.

With this in mind, many service providers are considering just such a dual strategy. But they will fail to realize the potential that a converged offering can yield unless they can get a unified view into all the caching activity.
Doing so provides operators with valuable insight necessary to measure the contribution of each technology, track improvements and optimize their performance.

Citrix’s field-proven analytics and reporting software delivers this capability. It can handle large volumes of different data types and provide multidimensional analysis in real-time, allowing service providers to maximize the benefits of converged caching.

For more information on Citrix’s online video analytics and reporting, please visit www.citrix.com.

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