Optimizing the video experience for XenApp and XenDesktop deployments with CloudBridge

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Video content usage within the enterprise is growing significantly. In fact, Gartner forecasted that by 2016, large companies will stream more than 16 hours of video, per worker, per month.† One reason is the migration to video-based training classes aimed at reducing travel costs. Also, to meet government requirements for routine training in certain HR topics and to communicate corporate policies on insider trading and conflicts of interest, among others, many enterprises have developed video- based classes.

Marketing departments are now recording product announcements and product training classes to distribute to sales teams and partners. Enterprises are even adding internal video content sites for sharing business-related materials. Further, as companies host how-to videos for their enterprise products on consumer sites (e.g., the CitrixTV channel on YouTube) and the new genre of edutainment videos (e.g., TED) expands, the distinction between recreational and work-related websites has blurred.

While video provides a richer training, marketing and collaboration experience, it comes with large bandwidth demands. Transmission of video to branch and mobile workers consumes large amounts of costly WAN bandwidth and may clog the WAN pipe. Moreover, in the case of mandatory training and compliance videos, the same content is watched over and over by multiple branch employees, leading to repeated downloads. Similarly, if a popular video goes viral within the enterprise, the same video files will traverse the WAN link from server to branch multiple times. These scenarios result not only in a poor viewing experience and but also in slower response time for office-critical applications such as email.

Citrix CloudBridge™ presents a solution by offering control with connection-level visibility and prioritization and reduction of bandwidth consumption using caching and compression.

Video over XenApp/XenDesktop: HDX MediaStream

Users' experience with latency-critical real-time applications, including video content, hosted on Citrix XenApp® and Citrix XenDesktop® in the enterprise datacenter, is often adversely impacted by latency and congestion on the WAN. This situation can cause inconsistent rendering of video and excessive waiting time while the video buffers.

To mitigate these effects, Citrix enhanced XenApp and XenDesktop with HDX™ MediaStream, which offloads content fetching and/or video rendering on the client. Despite this technology, the effects of latency may persist. To further optimize the video user's experience, CloudBridge video acceleration features add value on top of HDX MediaStream in XenApp and XenDesktop environments.

The three features of CloudBridge that optimize video users' experience are:

1. Video caching
2. Disk-based compression
3. Quality of Service (QoS)

In this paper, we discuss each of these features and how to configure them, and present relevant use cases.

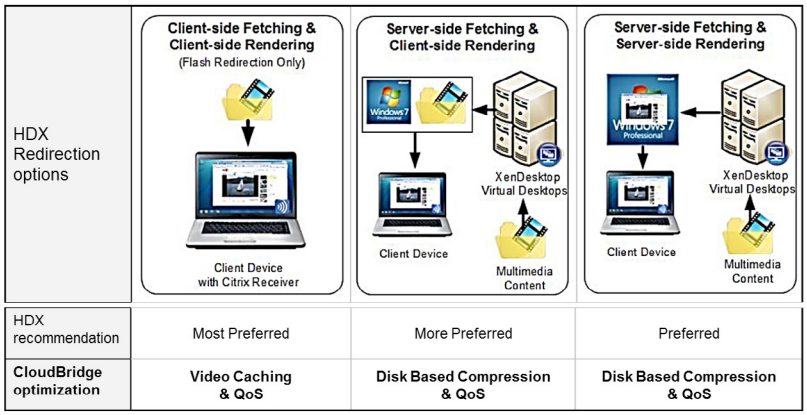

Figure 1: HDX Flash redirection scenarios and relevant CloudBridge optimization techniques

For more details about HDX MediaStream, please refer to the Citrix white paper, HDX Optimization and Best Practices.

Depending on the HDX Flash redirection option used in HDX MediaStream-enabled environments, CloudBridge provides different sets of optimization techniques. The mapping for redirection scenario and optimization technique is shown in Figure 1.

CloudBridge video acceleration

1. Video caching

When a user at a branch office provisioned with a properly configured CloudBridge appliance plays a video from the video server hosted in the datacenter or on the public Internet, the request for video content will result in caching of that video on the local CloudBridge device. Once cached, the video will be served from the local CloudBridge appliance in response to all subsequent requests until the content is flushed or marked as stale. Local caching has two main advantages: 1. performance is faster and the viewing experience improves dramatically because the video is served at LAN speed; and 2. WAN link usage for redundant transfers is minimized.

CloudBridge video caching supports all video content transmitted over HTTP, including videos played directly within the browser or played in a XenApp/ XenDesktop environment with HDX Flash redirection enabled.

Video caching allows customers to:

- Enable or disable caching on specific video content sites or video servers
- Control the maximum size of video objects to be cached
- Bypass the caching engine in the case of pre-defined traffic to control the load on the CloudBridge appliance

Video caching in a client-fetched, client-rendered HDX redirection environment
In the previous section we discussed the three HDX redirection modes that can be used depending on client capacity and network topology. To preserve the best user experience the recommended method for video content delivery is client- fetched, client-rendered HDX Flash redirection mode. In this section we explain how CloudBridge video caching can be used to cache content in client-fetched, client-rendered mode. Note that configuration and management of the video caching feature are performed on the branch office CloudBridge appliance.

Figure 2 shows User A and User B who are running a XenDesktop session on a laptop and an iPad tablet, respectively. As HDX Flash redirection is enabled, both users first access the XenDesktop server for authentication through an ICA® connection, and then try to access a video through native HTTP.

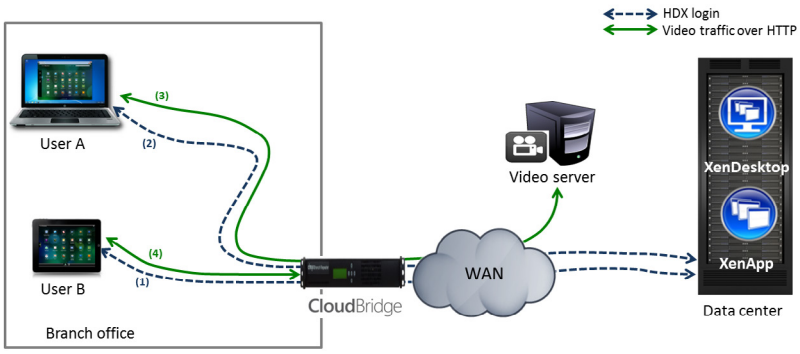

Figure 2: Video caching in client-fetched, client-rendered HDX Flash mode for XenDesktop users

The numbered arrows in the figure illustrate the traffic flow steps:

(1) User A establishes an ICA connection to XenDesktop.

(2) User B establishes an ICA connection to XenDesktop.

(3) First, User A accesses HTTP video over a slow WAN link.

(4) Subsequently, User B fetches HTTP video content directly from the local CloudBridge video cache over a fast LAN link. Note that little or no WAN bandwidth is used.

Video caching performance results

As discussed earlier, video caching accelerates downloads because the cached copy is served locally. Figure 3 shows some of our lab results when using video files of different sizes. From the graph, it can be seen that the time to download is accelerated by up to 48 times in the case of a cache hit when compared with no caching in the network.

These tests were done over 10 Mbps simulated WAN link with 50 ms round trip- time and 0.01% losses.

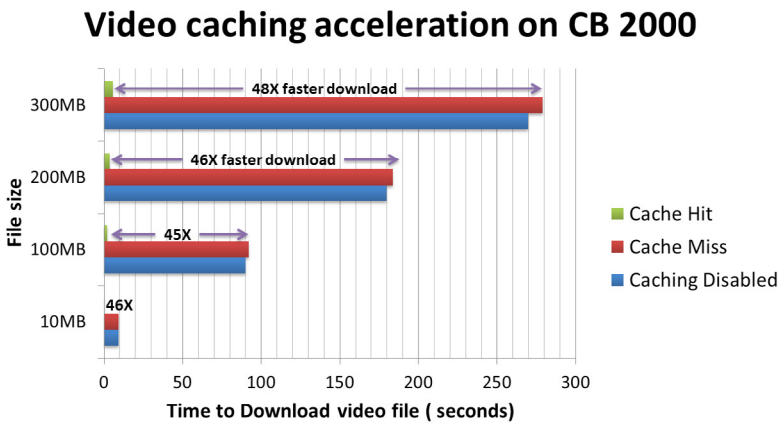

Figure 3: Reduction in time to download using video caching acceleration on CloudBridge 2000 appliance

The slight increase in time to download during a cache miss case when compared to a cache disabled scenario is due to overhead of disk-write operations.

2. Disk-based compression

Disk-based compression reduces bandwidth requirements between appliance pairs residing on opposite ends of a WAN connection. CloudBridge maintains a compression history of traffic traversing the WAN. CloudBridge utilizes block- level pattern-matching algorithms to identify and eliminate duplicate traffic. Information about the matched data is stored on the CloudBridge appliances on the datacenter and branch sides of the WAN. Block-level compression of this type can match and eliminate very large blocks of identical data. It is especially effective when identical video content is accessed by multiple users. Repetitive accessing of the same video results in very high compression ratios and more-efficient use of the WAN. So when sent multiple times, the entire block of data can be replaced by a pointer to the data already in the receiving appliance's compression history, resulting in significant bandwidth savings. Since pattern matching works on a very granular level it can also remove redundant data transmitted across different files and applications.

Disk-based compression for video traffic in XenApp/ XenDesktop environments

Figure 4 shows User A and User B who are running a XenDesktop session on a laptop and an iPad, respectively. CloudBridge appliances are present on both the datacenter and the branch sides of the WAN. The solution's disk-based compression feature comes into play to remove any duplicate traffic flowing across the WAN.

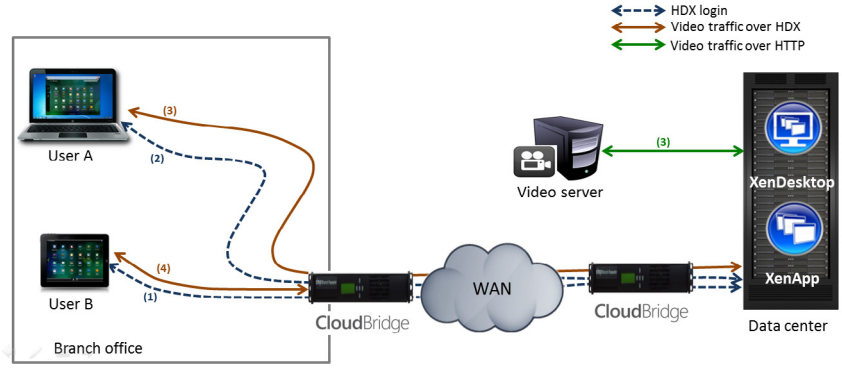

Figure 4: Disk-based compression in server-fetched HDX modes for XenDesktop users

The numbered arrows in the figure illustrate the traffic flow steps:

(1) Users A establishes an ICA connection to XenDesktop.

(2) Users B establishes an ICA connection to XenDesktop.

(3) First, User A requests the video. This request goes over the ICA connection. XenDesktop fetches the video from the video server over HTTP and sends it, encapsulated in the ICA channel, to User A. During this transmission, a local copy of the video file is stored on the disk of both CloudBridge appliances.

(4) Subsequently, when User B requests the same video, the CloudBridge pair recognize that blocks of data are already available in their disk and can be directly served from the branch-side CloudBridge appliance.

3. Quality of Service

The enterprise WAN is a costly resource and traffic passing through it should be monitored and adjusted to align with companies' policies and objectives. The bursty nature of video content is difficult to predict and can affect business- critical applications. This means that a mechanism to preserve both the video and application experience is a requirement. The CloudBridge Advanced Traffic Management feature serves as a tool for managing WAN utilization and preserving user experience.

The QoS module of CloudBridge helps enterprises achieve these goals through:

1. Visibility, monitoring and reporting of WAN traffic

2. Classification, prioritization and DiffServ/TOS bit marking

Table 1 shows examples of how the granular control capabilities in CloudBridge

Category	Classification criteria	Priority
Training and compliance videos	IP address match with HR training video server	Very high
Work-domain related video	URL match with department- specific internal video server	Medium
Recreational content	URL match with external websites	Very low

Table 1: Sample QoS settings for classification and prioritization of XenApp/XenDesktop video traffic. The classification criteria and priority shown can be enforced by defining application classifiers, traffic shaping policies and service classes on CloudBridge.

Prioritizing video in MultiStream ICA with CloudBridge QoS engine

Where supported, MultiStream ICA splits the ICA protocol into the four basic components: real time, interactive, bulk and background traffic. You can assign QoS values, from high priority to low priority or best effort, to each of these streams. The video traffic is categorized under real-time traffic in MultiStream ICA.

CloudBridge will automatically query the XenApp or XenDesktop farm to see if MultiStream ICA is supported. If supported, CloudBridge will automatically apply different ICA priorities to each of these streams based on the traffic shaping policy configured. However, without CloudBridge the MultiStream ICA traffic will traverse the WAN as a single stream and the absence of desired prioritization will cause real-time applications like video to suffer.

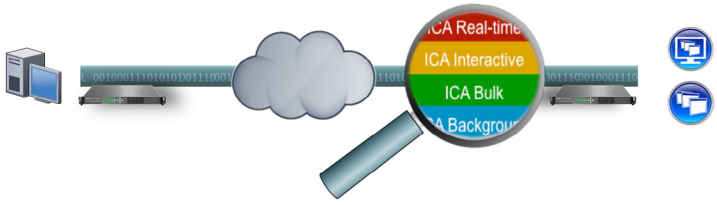

Figure 5: MultiStream ICA with CloudBridge QoS engine

Summary

Video caching, disk-based compression and QoS are key features of CloudBridge that help enterprises significantly improve video viewing experience in XenApp and XenDesktop environments while drastically reducing WAN bandwidth usage.

Following are highlights of CloudBridge video acceleration:

- Enhanced viewing experience with reduced latency
- Elimination of duplicate video traffic and unclogging of the network
- Ability to configure caching for enterprise video servers
- Acceleration of XenDesktop HDX Flash re-direction mode by caching video traffic
- Intelligent URL re-write detection mechanism to boost the caching hit rate
- Fully validated for YouTube, Metacafe, Vimeo and Youko
- Selective caching configuration
- Video content identification, classification and shaping to manage bandwidth consumed by video
- QoS for MultiStream ICA

To learn more about the video acceleration features of CloudBridge, please visit: http://support.citrix.com/proddocs/topic/cloudbridge/cldb-cloudbridge.html. Video caching was introduced as a feature of CloudBridge in firmware release 7.0 while disk-based compression and QoS have been available with the earlier releases as well. Also if you have questions about the solution, please contact the CloudBridge Product Management team at CloudBridge-PM@citrix.com.

Notes

† MarketScope for Video Content Management and Delivery. Gartner. April 13, 2012.

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