White Paper

The Mobile Video Opportunity

Introduction

In 2009, mobile networks reached a milestone when the volume of data carried exceeded the volume of voice traffic for the first time. In the 2 years since then, mobile data has nearly tripled each year, leaving voice, once ruler of the airwaves, with less than 20 percent of mobile traffic by volume.

By the end of 2011 according to the respected Cisco® Visual Networking Index (VNI), the share of mobile data consumed by video is expected to exceed 50 percent for the first time, promoted by the widespread adoption of smartphones and the emergence of tablet computers. Thirteen percent (13%) of users with smartphones consume 78% of all data traffic, while tablet users, currently only 1 percent of all subscribers, consume four times as much data per device as smartphone users. A greater share of that traffic will be video traffic, driven by their large higher-definition screen format.

Cisco predicts that mobile video will continue to grow at a much faster rate than non-video mobile traffic, becoming 66 percent of mobile data traffic by 2015, while the total volume of mobile data itself will expand 26 times between 2011 and 2015. Voice will become a minuscule part of the overall traffic volume, yet will continue to provide the largest share of revenues. Without technology and business model changes data, and especially video, will consume most of the cost, and provide little of the revenue. Video provides the lowest level of profitability per byte compared with all other types of traffic.

Between now and 2015, mobile service providers must find and implement new ways of doing business to eliminate the disconnect between cost and service revenue, and in particular they must address the onslaught of mobile video.

What is Mobile Video?

The landscape of mobile video is changing. In 2011, the majority of mobile video is what is called Over-The-Top (OTT) content-video posted to a sharing site such as YouTube or Facebook, and downloaded free to view. This video is usually of fairly poor quality, created and formatted on a laptop computer or taken using a video camera or mobile phone.

The proliferation of these devices with mobile wireless interfaces, plus the free availability of video content, is the main driver of the surge of data and especially video data that is threatening the business model for established mobile service providers.

Lists of the most popular videos are surprisingly stable. The top 10 all-time downloads list (Figure 1) contains several songs from Justin Beiber, Lady Gaga, and Eminem, plus others from Katy Perry, Shakira, and Miley Cyrus, reflecting the youth of the majority of users. (It also contains babies in a bathtub and biting babies, with pet videos remaining popular.) Despite news stories about new videos “going viral,” most downloads come from the same sources (TV shows and popular music) as does popular culture in general.

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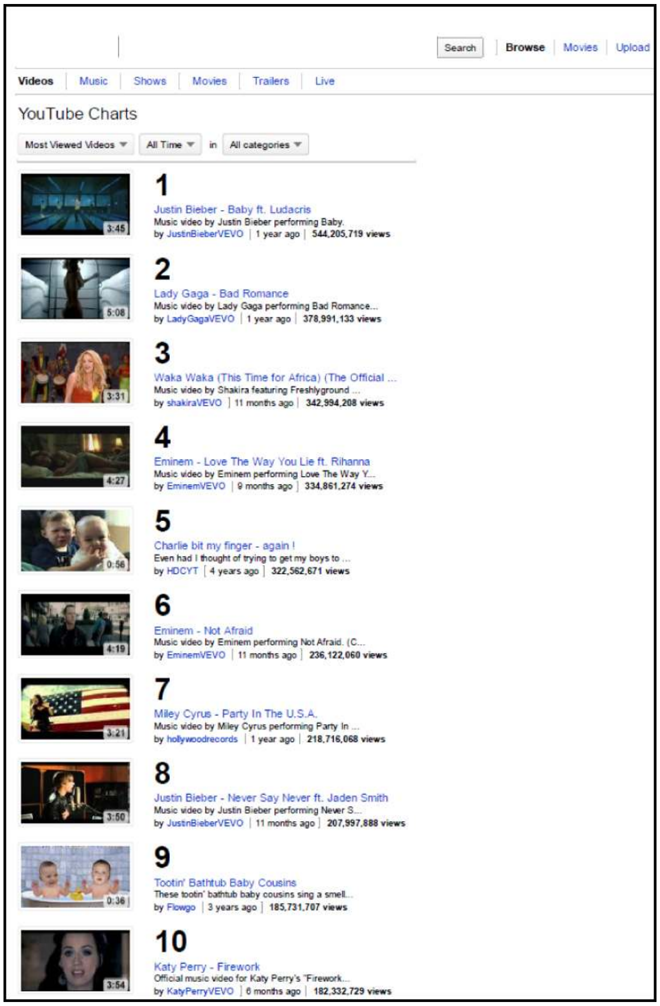
Figure 1. Top 10 YouTube Downloads



The same is true of the amateur videos most often downloaded-the top 10 list of all noncommercial YouTube downloads has remained almost completely static over the last 12 months, with only one change. In mid-2011, YouTube claims that nearly 48 hours of new video is uploaded to the site every minute. In April 2011, a YouTube software engineer stated that only 30 percent of videos accounted for over 99 percent of all views.

However, a new video consumption model is beginning to emerge: paid-for premium video content, from sites like Netflix, and Hulu. Founded in March 2007 by video industry companies NBC Universal, News Corporation, The Walt Disney Company, and Providence Equity Partners, Hulu is an online video service that offers popular TV shows from more than 260 content providers, including Fox, NBC Universal, ABC, Criterion, A&E Networks, MGM, MTV Networks, Comedy Central, and others. Because it was formed by industry insiders, it is more friendly to advertisers and carefully respects copyrights and content ownership.

Much of the content on Hulu is free, mainly replays of TV shows that were ad-supported and free when originally played on TV networks. Other premium content is pay-per-view-in essence it is the cable TV experience transported to the Internet, and through the Internet, to mobile subscribers with GUI-based devices. Due to certain technical and legal issues, Hulu is only available to users of iOS (the Apple iPhone and iPad) through a paid subscription service, while basic service is free for all other users.

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This is both a challenge and an opportunity for mobile service providers-a challenge because the cost of transporting and delivering video, whether OTT and free, or premium and paid for, is much greater than the cost of traditional services such as voice or text short message service (SMS), and an opportunity because there is high demand for a new type of video delivery service that meets subscribers' needs and wants. The challenge is to find a way to make the cost and revenues line up to produce return on investment (ROI) for shareholders.

Components of a Comprehensive Mobile Video Solution

How can a mobile service provider reduce the cost of mobile video, while at the same time enhancing the subscriber's watching experience? The methods discussed below provide a starting point:

Optimized Transport and Delivery

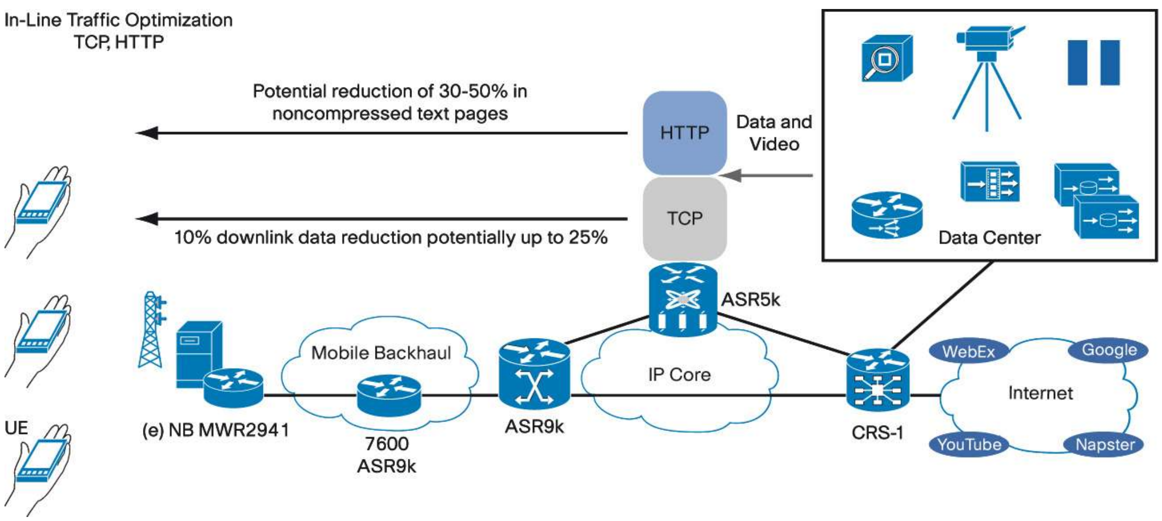
The efficient delivery of video payload is an often overlooked and underestimated attribute, but it creates some of the highest returns:

TCP and HTTP Optimization

Traffic packet optimization (Figure 2) provides clientless optimization for TCP and HTTP traffic. Optimization is performed by splitting the TCP and HTTP connections between client and server using a proxy. Network operators can expect a significant reduction in uncompressed HTTP traffic, as high as 25 percent under certain conditions.

One major benefit of optimizing at the TCP and HTTP levels is that no special client is needed-subscribers can continue to use their normal web browsers without change. With the Cisco solution, these techniques are provided in-line and can be enabled on-demand when congestion occurs.

Figure 2. HTTP and TCP Optimization



TCP optimization provides:

- 10 percent or more improvement in downlink throughput during congested periods
- Better performance by rapidly adapting the window size based upon wireless network conditions
- Minimized TCP retransmissions and acknowledgements
- Enhanced user experience with faster initial startup and noticeably less jitter during video playback

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Video Download Pacing

Most OTT videos are never watched all the way through. Over half are abandoned by 1 minute into the video, yet because the original server has no information about what the watcher will do, it will have downloaded the video at the fastest rate the network can support.

A system that could anticipate which videos will be abandoned and when could potentially save well over 50 percent of all of the bandwidth consumed by video downloads by not transmitting them over the most expensive and congested part of a mobile network-RAN.

Without mind-reading, that is of course impossible. But with video pacing, a gateway can pace the download so that it never gets too far ahead of the subscribers' "watch"-the location in the video where they are currently watching the content.

A video pacing gateway will "burst" a section of the requested video (say 10 seconds) normally, but will then cache and queue the rest, releasing it at the same rate as it consumed, based on the frame rate. This requires Deep Packet Inspection (DPI) for the gateway to inspect the payload, and make decisions about the pacing rate. If a 30-frame-per-second video is cached and forwarded at the same 30 frames per second, the download will always remain 10 seconds ahead of the "watch." Then if the "watch" is abandoned, as it is most of the time, the gateway will stop downloading and will flush the buffers, saving capacity for others by not downloading video that is never consumed.

Tiered Services and Quality of Service

In late 2010, Heavy Reading performed a survey of more than 50 mobile service providers, which found that the most desired service by operators was tiering, or the ability to segment their subscriber base and offer quality and speed of service tiered by subscription cost.

For mobile video, tiered subscriptions can be based on speed of connection (throughput) and on bit rate (quality) of the delivered content. Original download speeds may not successfully be connected to subscription tiers, because video requires a certain download speed to avoid stops and starts.

IP Broadband Backhaul

Until very recently, the majority of third-generation (3G) cell sites were still connected to the Radio Access Network (RAN) through traditional T1/E1 connections. While this is changing with migration to fiber, Ethernet, or wireless backhaul connections, the growth of video makes accelerating backhaul migration a must. T1/E1 connections have traditionally been easier for mobile service providers to install in a timely manner, and because dropping T1/E1 prices have caused the technology to be used longer than most observers expected, high-speed 3G and 4G cell sites can easily generate over 10 Mbps per sector, meaning that backhaul speeds must now be in at least the 30 to 100 Mbps range. With 4G ultimately promising peak speeds close to 100 Mbps per sector, even that may soon not be enough.

Content Adaptation

Content adaptation is the deliberate changing of the bit rate of a piece of video content to reduce its size and bandwidth requirements. Most video stored on the Internet is formatted for personal computers, because it was captured on a digital video recorder and edited on a laptop. Typical screen resolutions are VGA (640 x 480), SVGA (800 x 600), or TV standard resolution such as 720p, (1280 x 720) or 1080p (1900 x 1080). Sites like YouTube commonly also offer 360p (640 x 360), and routinely convert content into multiple screen formats and resolutions.

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However, most users fail to choose the appropriate screen resolution for their device, even if the capacity to do this is available. The basic iPhone only supports LDTV (Low Definition Television, or 480 × 320), for example, although the iPhone 4 has 960 × 640 resolution. This is not a concern for the user, as the device will internally convert the video stream to display on the screen. However, it does mean that the service provider may be paying the cost of transmitting a video file that is unnecessarily large.

Transcoding

Transcoding is the conversion of video files into other formats. This is usually done in cases where a target device does not support the format or has limited storage capacity that mandates a reduced file size, or to convert incompatible or obsolete data to a better-supported or modern format. For mobile service providers, transcoding allows the operators to reduce the size of video files before the RAN, while also adapting the content to match the device (if known). In many cases, the device type can be found in the provisioning data stored in a device database, which may be associated with the HSS or AAA.

Transrating

Transrating is a process similar to transcoding, in which files are coded to a lower bitrate without changing video formats; this can include frame rate conversion, but may use an identical frame rate with higher compression. This allows a service provider to fit a given video source into smaller storage space or over a lower-bandwidth channel. Depending on transrating levels it may result in a reduction of quality, but can also reduce file size dramatically. Many mobile devices don't have a high enough display quality to make the effects of transrating noticeable.

Content Distribution and Digital Rights Management

The management of content, especially premium content and its associated copyrights is an evolving challenge:

Cloud-Based Content Delivery

The application of cloud technology for video storage and delivery will have a major impact on the types of delivery mechanisms available to subscribers. In particular, it will make video content accessible to users from multiple devices over multiple access networks, and it is one of the core technologies behind session shifting, where a user can start to watch video content on one device or screen, and easily transfer it to another device or screen.

Cloud services abstract the user from the data-the user no longer needs to know where the data (or video) is stored, or even how to get it. The network handles all the details, in a manner similar to the way the Internet itself abstracts its content.

In the early days of the Internet, a user had to enter the full network address of a piece of content in order to access it, or connect to the host computer as a virtual terminal. With the advent of the web and the URL, coupled with search engines and Domain Name Servers (DNS), it has become easier to find content without knowing the IP address and the filename and root file structure being used.

Similarly, cloud-based delivery removes the need to know the location of any piece of content-a GUI can simply offer a menu of video content, which can be accessed through a device, either a mouse or a remote control. The same GUI menu can be offered on multiple devices, such as a TV set-top box, a laptop, or on a mobile device through either a specialized "app" or a web page.

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Multiscreen Services with Session Shifting

Because cloud-based services abstract the location of the content, it can be anywhere. The entire cloud appears as one network, even though the actual content may be hosted on many servers owned by different content provider companies. For cable TV and video companies, this offers the possibility of extending their services onto mobile devices. For mobile operators, it offers the ability to create their own branded video content services. And for service providers with both types of networks, it provides the ability to finally offer true combined services and fixed and mobile convergence integrated at the client device and in the network core.

This is achieved thought the use a client application that can reside on a mobile device or on a set-top cable or satellite decoder box or DVR. The clients coordinate with the controller through an agreed-upon protocol, and the controller reroutes the session as requested. The result is that a subscriber can move a video session from one device (such as a TV) to another (such as a computer or mobile phone) on request. This type of service implies a deep business and technical relationship between the cable (or satellite) video company, and the mobile service provider.

Digital Rights Management

As noted above, cloud-based video distribution permits the movement of sessions between devices. This requires the user's device to have client software that manages the session and handles the management of digital rights for copyrighted content. Digital Rights Management (DRM) is essential for premium paid-for content such as movies and copyrighted TV shows, as it helps ensure proper use of the content and compensation of copyright owners for their work.

When video content was broadcast over TV networks and cable (before the Internet), digital rights were controlled by controlling physical access. Premium content was only available to users who physically had cable decoder boxes. With the change to Internet- and cloud-based distribution, owners of intellectual property rights need to find a mechanism that permits appropriate use and prevents unauthorized use. DRM is the mechanism that can perform that task.

Video content that uses DRM is encrypted. This means that content adaptation cannot be applied other than by the owner of the digital rights, because the content adaptation engine or function cannot access the content to transcode or transrate. Nor can it be paced, because the pacing gateway cannot access the file to identify the frame rate or even the frames themselves.

Cisco Mobile Videoscape Solution

Cisco's Mobile Videoscape™ solution (Figure 3) brings technology developed for the television industry to bear on the mobile video problem. Subscribers will experience video services tailored to their needs and to their wallets. Service providers will see significant cost savings, and higher revenues per subscriber, while gaining alternative revenue sources through partnerships.

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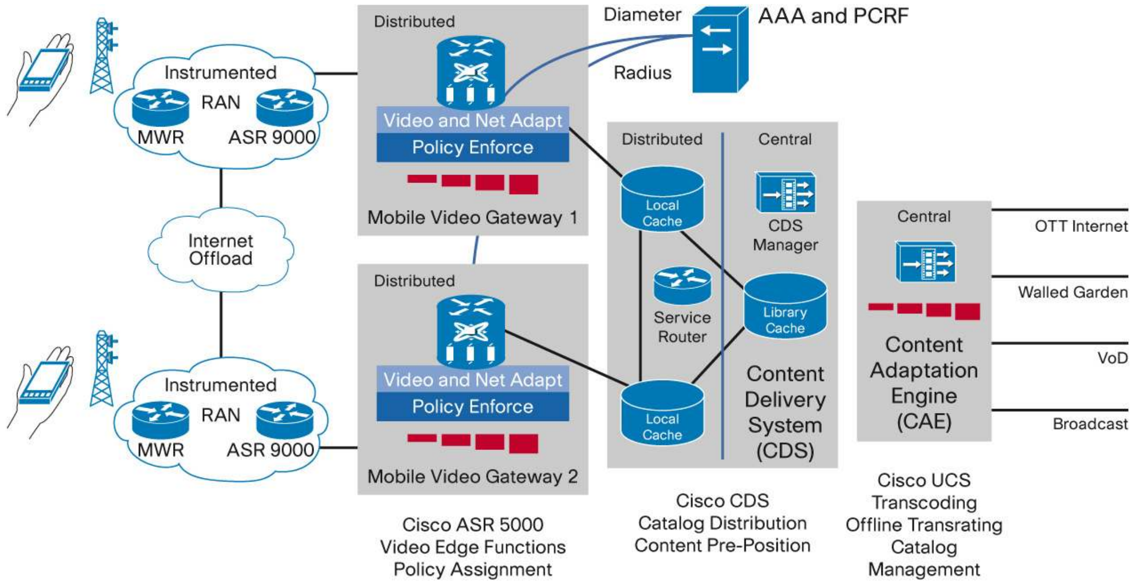
Figure 3. Cisco Mobile Videoscape



The Cisco Mobile Videoscape system architecture includes:

- For optimized video delivery, the Cisco Mobile Video Gateway (MVG) on the Cisco ASR 5000 Series Multimedia Core Platform
- For optimized video content delivery, the Cisco Content Adaptation Engine (CAE) on the Cisco Unified Computing System (UCS) server infrastructure
- For optimized content caching, the Cisco Content Delivery System (CDS), providing video content ingestion, caching, and distribution

Why Cisco?

With Cisco Mobile Videoscape, Cisco introduces a comprehensive, integrated, and intelligent solution to manage and monetize mobile video. This solution gives mobile operators a cost-effective way to reduce mobile video traffic, and offers opportunities to introduce and capitalize on new business models. For subscribers, it provides a better end-to-end mobile video experience that can be enjoyed on all types of screens.

For More Information

For more information about Cisco Mobile Videoscape, visit http://www.cisco.com/go/mobileinternet.

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