Mobile Video Optimization: Concept and Benefits

Content awareness can save mobile operators 30-50% of required bandwidth

Thanks to smartphones and mobile Internet devices, data use has exploded in recent years. A key driver: video. Popular content includes YouTube, video on demand such as Netflix, and a channelized form of Over-the-Top (OTT) content.

This paper addresses ways to enhance video services by optimizing video content. Specifically, we'll look at deep packet inspection (DPI). Referred to by Tellabs as 'content awareness', DPI offers mobile operators a host of applications to enhance their service offerings and increase revenues. We also discuss the market drivers that lead to a specific service for content enrichment and adaptation for video content.

Data Growth

Internet data consumption is on the rise. An Analysys Mason June 2010 Report states that 90% of the 1600 PB/monthly traffic (Fig. 1) will be generated from indoor access points. The increased traffic will come from either mobile broadband in developed markets to ADSL or other forms of broadband lines in developing markets.

Cisco VNI paper Q4 2010 also highlights the contributions of video and smart mobile devices to the growth of data consumption (Fig 2). Using these smart devices, developed markets lead Internet data consumption. Developing markets will soon follow.

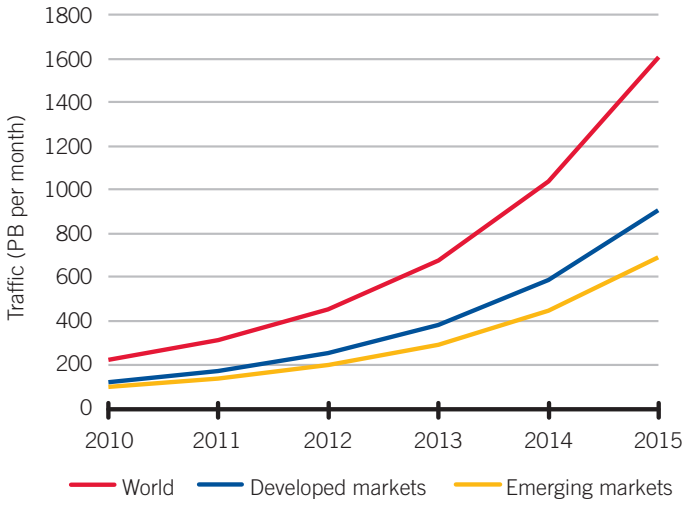


Figure 1: Projected Traffic Growth, Analysys Mason Report — June 2010

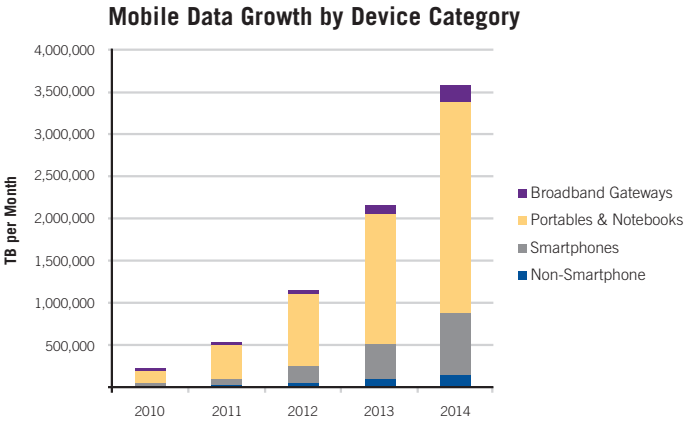


Figure 2: Mobile Data Growth by Device, Cisco VNI paper — October 2010

Content-Aware Technology and Application Market Overview

Content awareness brings valuable visibility to the mobile network that provides Internet connectivity to the mobile user device. Content-aware technology analyzes and understands a packet's contents. It also recognizes the type of application or service to which a packet belongs. For example, the technology has the ability to see the header and the payload, most notably Layer 4 through Layer 7. The data contained in these layers is adapted to the user device and modified to optimize delivery. So, a mobile service provider can throttle-back HD quality video for use on a mobile device. As a result, the bandwidth required for delivery is reduced.

The Gateway GPRS Support Node (GGSN) connects a mobile network to the global Internet via the Gi interface. It offers IP (Internet Protocol)-level connectivity to the mobile user device. GGSN can't see Layer 4 through Layer 7 of the application and cannot discriminate between applications. Instead, GGSN relies on application service requests to determine the type of wireless connectivity and access to allocate to that application.

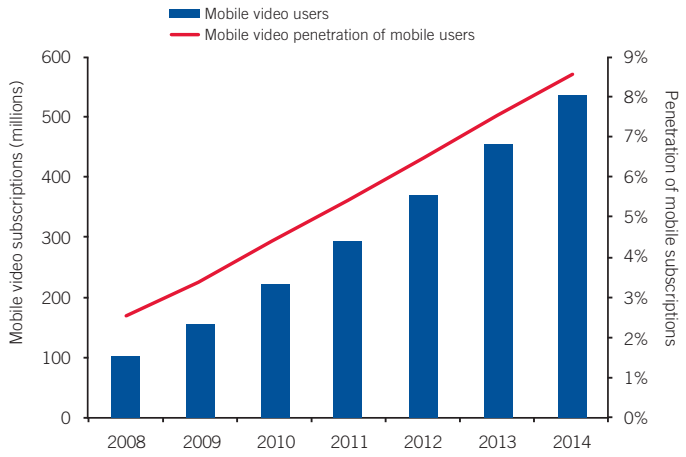
Content-aware technology can log these applications and characteristics. Operators can then use that information to improve network efficiency.

Video is one application that can benefit from content awareness. Inspecting packets from Layer 4 through Layer 7 reveals valuable information for mobile network operators. Understanding packet content enables GGSN to offer appropriate services for the video application and enhance the efficient use of network resources.

Video Content Market

Users have new viewing options beyond television, portable DVD players and MP4 players. Non-linear formats of video such as OTT are widely available, and the Internet is a force behind digital entertainment content. These new video sources can be attributed to widespread broadband Internet access. Whether at home, work or school, more people use PCs, laptops and smartphones to access video content.

Increased consumption of video data has created new markets. Applications such as YouTube, which enables the sharing of user-generated video content, have significantly contributed to this growth. While broadband operators want to take advantage of this opportunity, mobile broadband providers face video data overload. A Pyramid Research report forecasts about 534 million video subscriptions by the year 2014 (Fig. 3). Subscriptions to 3G networks and increasing availability of video services will contribute significantly to the healthy growth in this sector.



Source: Pyramid Research Mobile Data Forecasts, Q1 2009

Figure 3: Global Mobile Video Users and Penetration Rates

Content Enrichment and Adaptation Functions

Video content requires the transport of very large amounts of data compared with other types of content (e.g., web pages, audio.) Combined with the explosive (current and predicted) increase of video traffic, wireless mobile networks operators are challenged with the need for more bandwidth.

Mobile video optimization, when deployed as a network function, alleviates the pain of video content delivery over mobile networks. It intercepts and adapts the delivery and content of the video traffic payload, relieving network congestion. At the same time, it improves the subscriber Quality of Experience (QoE).

Mobile Video Optimization Techniques

Content-Aware Video Bit Rate Throttling (Just In Time Video Delivery)

- Delivery of OTT video and video on demand is largely done via HTTP over TCP/IP. TCP/IP is unaware of the specific type of payload it is carrying. So, it attempts to deliver the entire video file as fast as possible, regardless of the video's viewing rate. As a result, the user's video player buffers the video content and plays it at the encoded video viewing rate (e.g., 15 or 30 frames/sec). Such content unaware video delivery causes 2 significant inefficiencies in the network:
  - If the user stops viewing the video prematurely, all buffered video content delivered to the device is wasted.
  - All concurrent video sessions of multiple users, regardless of viewing rate, equally share the total available bandwidth. Some sessions have more bandwidth than they need while others are bandwidth starved, resulting in poor viewing quality.
- Content Aware Video Bit Rate Throttling optimization delivers video consistent with the viewing rate. It analyzes the encoded video stream and estimates the video content in the buffer of the subscriber device. As a result, users terminate fewer videos prematurely and less content is wasted. At the same time, concurrent video sessions share bandwidth more efficiently.

Smart Video Trans-rating for Bandwidth Reduction

- Video trans-rating modifies the input video stream. It changes the video bit rate, typically lowering it, to save bandwidth. Smart Video Trans-rating saves bandwidth and improves QoE. This optimization technique includes:
  - *Content Aware Video Trans-rating*. Frames and bit rate in the video stream are analyzed and reduced if necessary without noticeably degrading viewing quality. Network operators can support more users without affecting QoE.
  - *Device-Aware Video Trans-rating*. When a mobile subscriber requests a video, the video source server often delivers the video with a screen resolution too high for the device. When the client player in the device reduces the resolution to fit the device screen, the extra bits delivered are wasted. Device-Aware Video Trans-rating reduces the bit rate of the video to fit the specific device, saving bandwidth.
  - *Network-Aware Video Trans-rating.* Real-time RF conditions are estimated and the video bit rate adapted to match the varying bandwidth conditions. When network conditions are poor, the video bit rate is reduced to minimize or eliminate potential stalls while still maintaining good video frame quality. Absent network congestion, this technique maintains the video bit at its original rate.

These combined video trans-rating techniques provide multiple benefits to mobile network operators. Foremost, they save 30-50% of needed video bandwidth and improve user QoE.

Business Value

The optimization techniques outlined above also provide business value to a mobile network operator. For starters, the mobile network operator can generate new revenue by making video content accessible beyond legacy devices. In addition, operators can optimize costs while successfully delivering video content to users.

Revenue Generation Opportunities

The improved video experience creates opportunities for new services and revenues. For example, the mobile network operator can define new network policies to address video download and streaming activity.

A sample use case is a tiered service plan. A mobile network operator can offer users video downloads or streamed content at a particular pre-configured rate as part of a monthly plan. The user can sign up for a tiered video service plan for long-form video, i.e. gold, silver or bronze. In turn, The mobile network operator can charge the user for downloading or streaming video content and offer better service by prioritizing the video traffic accordingly.

Users predominantly consume short-form video content — less than 6 or 7 minutes of playtime. A mobile network operator can have a similar offering for short-form video to optimize the network. The operator can deliver short-form video at a rate to keep traffic at a base station or a wireless network at the optimized level. The result is an opportunity for the operator to increase revenue. For example, operators could offer users a pre-determined amount of better-quality downloads at a certain price. If the user is an avid video consumer, video optimization techniques empower mobile networks to create a new revenue stream.

Efficient Use of Network Resources

When video content usage increases, the mobile network becomes congested. The mobile network operator has to plan for growth of video content and invest in the expansion of the mobile network. The optimized use of network resources helps the mobile network operator stay competitive and offer better services to end-users.

Data usage is consistently increasing. Even with the roll out of HSPA+ or LTE, users will consume more data.

To get the most out of their network, mobile network operators can optimize the content a user accesses. The techniques discussed above enable a mobile operator to maximize the use of their network and its resources.

Improve User Quality of Experience

With the roll out of high-speed networks, users have high expectations when it comes to data or video downloads. They demand constant and consistent video streaming or download. Yet video content varies widely, from YouTube to on-demand content from Hulu, Netflix, etc. Video coding varies as well — from Flash to MP4 to HTML5. In format, video ranges from today's http progressive download to potentially http adaptive streaming in the future. The handset and software play a role in offering the right content at an expected "quality of experience."

Content-, device- and network-aware video solutions must all work together to offer a consistent experience to users. Adapting the video content stream to suit the user device and managing network congestion efficiently makes a consistent experience possible.

Conclusion

The mobile network is growing exponentially to carry voice, video and data applications across the globe. The massive data growth is partly due to an increase in mobile video content use, forcing the mobile network operator to increase network capacity. Video data delivery on today's mobile network has a few deficiencies. These fuel unnecessary bandwidth consumption and degrade the user experience and network performance.

Content-aware bit rate throttling and smart trans-rating help optimize mobile video performance. The operator can save at least 30% in network bandwidth usage, delay network CapEx and OpEx spending, and provides additional video streams. Perhaps most importantly, it can create new opportunities for the operator to grow additional revenue streams.

Next Step:

Visit www.tellabs.com/mobile to access more white papers and case studies on how Tellabs is advancing the smart mobile internet. If you have a question about Tellabs mobile solutions, please email ask@tellabs.com.

North America

Tellabs
One Tellabs Center
1415 West Diehl Road
Naperville, IL 60563
U.S.A.
+1 630 798 8800
Fax: +1 630 798 2000

Asia Pacific

Tellabs
3 Anson Road
#14–01 Springleaf Tower
Singapore 079909
Republic of Singapore
+65 6215 6411
Fax: +65 6215 6422

Europe, Middle East & Africa

Tellabs
Abbey Place
24–28 Easton Street
High Wycombe, Bucks
HP11 1NT
United Kingdom
+44 871 574 7000
Fax: +44 871 574 7151

Latin America & Caribbean

Tellabs
Rua James Joule No. 92
EDIFÍCIO PLAZA I
São Paulo – SP
04576-080
Brasil
+55 11 3572 6200
Fax: +55 11 3572 6225