Adaptive Bit Rate (ABR) Optimisation – an overview

Adaptive Bit Rate (ABR) protocols that deliver video as a series of time sliced 'chunks' at a variety of ending bitrates such as Apple HLS, or the MPEG DASH have emerged over the past few years as the dominant form of Video delivery over the Internet. These ABR formats offer a number of benefits to Content providers, bringing an efficient means of delivering content to a broad range of devices, over disparate access networks and are compatible with CDN and Caching solutions.

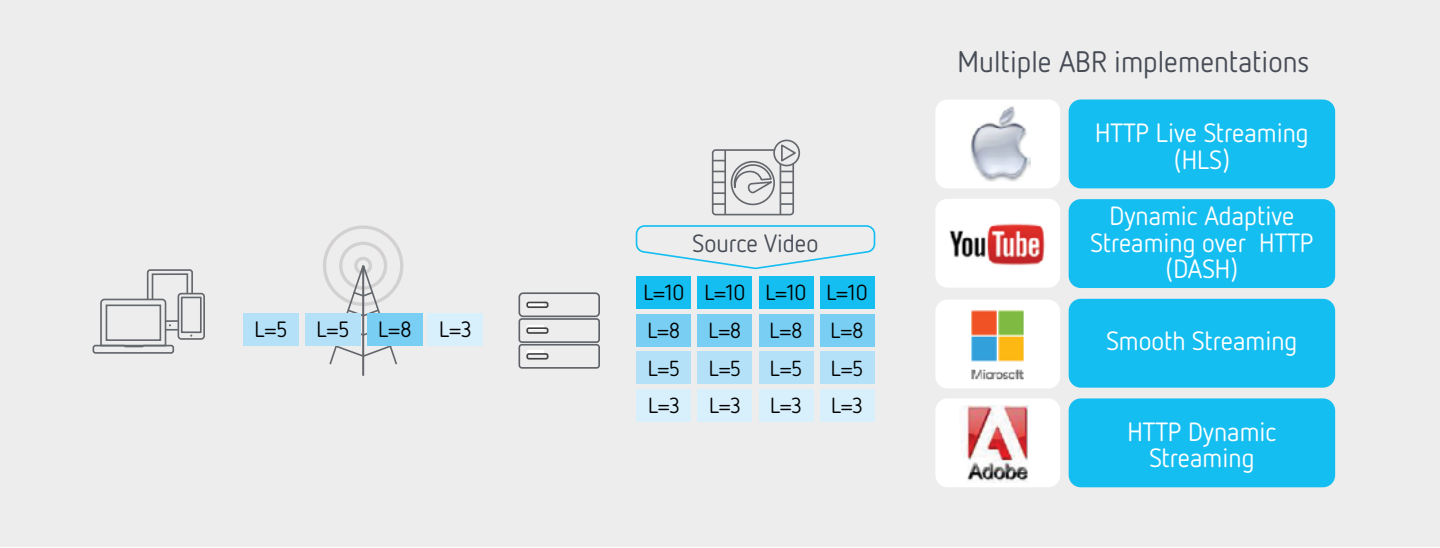


Figure 1: ABR Implementations

- Source video is uploaded to video service provider
- Video service provider pre-compresses source video to several new compression levels (L=1, 2, 3, …, 10)
- Client measures available bandwidth and selects a suitable compression level
- Client can switch to higher or lower compression levels if available bandwidth changes

Unfortunately, and contrary to common misconception, ABR does not always behave in an optimal way on Mobile networks. The adaptive behavior of DASH or HLS is intended to react to relatively slow and infrequent changes in available channel bandwidth, which is typically the case on fixed line DSL/Cable services and many WiFi networks. These characteristics do not generally apply to mobile network access, especially in areas of high density connections where clients may regularly see rapid variations in network congestion and cell switching due to mobility – this potential for frequent changes in available bandwidth can lead to some significant penalties for the subscriber user experience where regular re-buffering is experienced which is accompanied by consequent data plan usage (since clients typically re-buffer their entire queue of chunks before resuming playback)

Figure 2: Issues with ABR Video Delivery

ABR presents additional challenges for network operators, since the natural behavior of ABR clients is to strive for the highest possible bitrate content available from the source – with the advent of high speed 4G and 4G+ networks this can lead to very high-rate, long duration downloads being delivered to clients while a TV show or movie is watched, which in turn can lead to other clients and data services being 'crowded out' within the limited capacity of a cell.

Clients downloading HD video content at 100Mbps+ have been observed in some operators, even though in the majority of cases the subscribers are unable to discern the difference between more modest bitrate sources and UHD streams when viewed on their mobile device.

There is clear benefit to both subscribers and operators in the application of services to support ABR delivery, to ensure consistent media streaming while ensuring fair and equitable radio bandwidth usage. These systems are essential for efficient network planning, and become more critical still when market trends influence "all you can eat" access offerings to a range of different content provider material when considering the bandwidth hungry nature of ABR protocols when left unchecked.

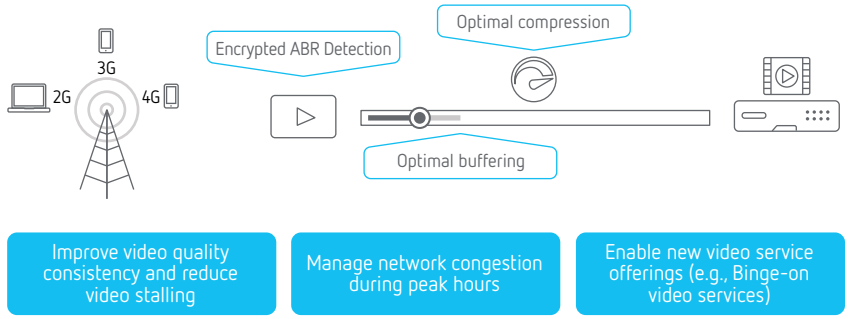


Figure 3: Principals of improving ABR video delivery

Using NetScaler to Manage Encrypted Video

A variety of approaches to managing ABR video have been explored over the past few years, ranging from manipulation of manifest files to transcoding of media chunks; with the emergence of first HTTPS and more recently UDP/QUIC these approaches have been rendered obsolete since they require inspection and modification of the cleartext content.

In addition, any ABR optimization solution must take into account the broad range of characteristics of ABR clients supporting many different content providers, for example:

- Some ABR clients use multiple TCP or UDP connections in order to serve a single client media stream
- Single TCP or UDP flows may be used to carry both ABR video content and other download content (media players, HTML or Images etc)

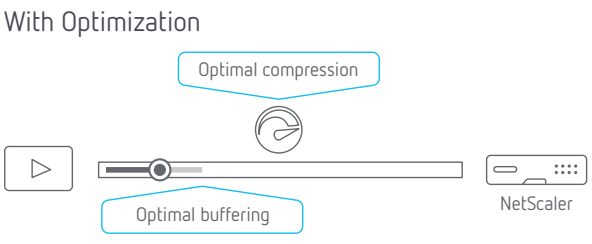
Content providers are known to change many aspects of their service frequently and without warning. Server IP ranges, DNS domains, and other 'static' characteristics cannot be used alone to determine whether content is ABR video.

Uniquely, the Citrix NetScaler solution adopts a solution for both ABR detection and policy control which can be applied across all transport protocols, both encrypted and unencrypted, TCP and UDP. This approach can handle the various complex scenarios, such as transport flows carrying a mixture of both ABR video and other content and the use of multiple transport flows to carry a single ABR stream.

The NetScaler ABR function detects video streams based on a combination of underlying traffic characteristics and connection signatures where available. This approach means that it is able to cover the widest possible range of sources, works over a variety of transports and is tolerant to changes in operation by the different content providers.

In order to effectively control ABR delivery to clients, NetScaler creates an artificial elastic limit to the network capacity – applicable to both TCP and UDP flows - in order to force ABR clients to deliver content according to the system defined policy. This elastic limit allows key metrics such as initial video start time to be maximized and can ensure the smoothest possible video delivery, for example short dropouts in network bandwidth caused by handovers or other events can drive a burst of additional capacity to allow the client to recover without forcing a resolution shift. Similarly not all video chunks have to be the same size since sequences with high levels of motion will require more data than static scenes – even when a common encoding rate is used.

This approach differs significantly from other solutions based on traditional network nodes (DPI or PGW) or TCP proxy solutions. Managing ABR with any of these more traditional methods generally means some significant compromises must be made in terms of operator expectations – examples of limitations are excess packet drops and retransmissions in the case of solutions based on rate limiters and an inability to support emerging protocols such as QUIC with TCP based solutions.



ABR Optimization Benefits:

- Eliminates waste of bandwidth during congestion episodes
- Improves video play consistency and reduces qualify fluctuation
- Enables new Binge-on like video services

Figure 4: highlights the benefits of managing encrypted video
ABR optimization can reduce total tonnage and peak traffic bandwidth by more than 50% without impacting user experience

Benefits and Results

The NetScaler solution has been proven to deliver significant value to both subscribers and operators which translate to improved customer experience and operational efficiency for Network operators, which can be summarized as:

- Significant ABR bandwidth reduction
- Increase in number of total network watched video minutes
- Increase in average viewing time
- Reduction in number of very short duration video plays (Aborted connected attempts)
- No increase in video start time

Figure 5 shows a real customer example to illustrate in detail how bandwidth can be reduced while user experience can be maintained and improved.

Customer results show that ABR optimization reshapes the quality level distribution to an optimal curve

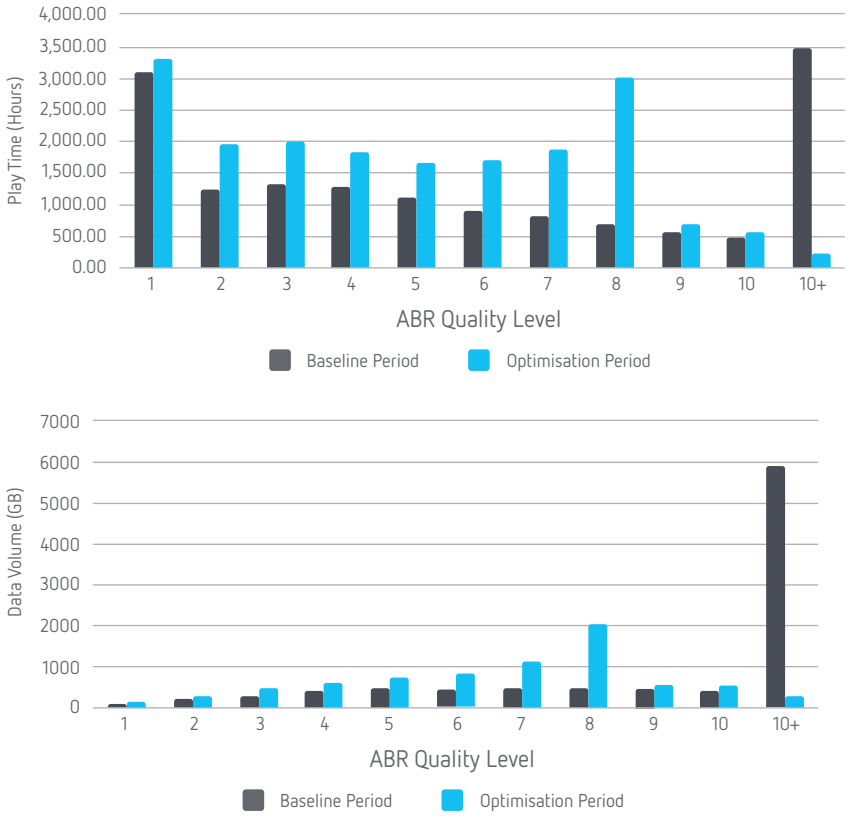


Figure 5

These benefits map directly into a number of business values which can be leveraged by operators:

Subscriber based controls over ABR Video volume can be used to rapidly deploy innovate offers such as zero-rated video tariffs without fear of overloading the network or impacting other customers.

These same controls can also lead to increases in video consumption and reduction in video stalling which are important differentiators when network benchmark testing is conducted.

Figure 6 shows real customer results of using NetScaler encrypted video management. The combination of data savings and increased customer consumption data shows how deploying this technology can have an immediate impact on both profitability and customer loyalty.

Case Study for Encrypted Video Optimization

50%
Decrease in bandwidth used

8%
Increase in average play duration

96%
Percentage of encrypted videos identified and optimized

Figure 6

Netscaler offers the unique capability to deliver these features in a software solution which can also include a number of other critical network functions. Consolidation of these functions in software on COTS hardware, and the integration with virtualization and management software, can drive down operational costs and enable the transformation of the network. Other network services which are available on NetScaler include

- TCP Optimisation
- Subscriber aware traffic steering and HTTP services
- cgNAT
- DNS services
- Other ADC services

Figure 7 shows the range of network services available for mobile operators in the NetSscaler software

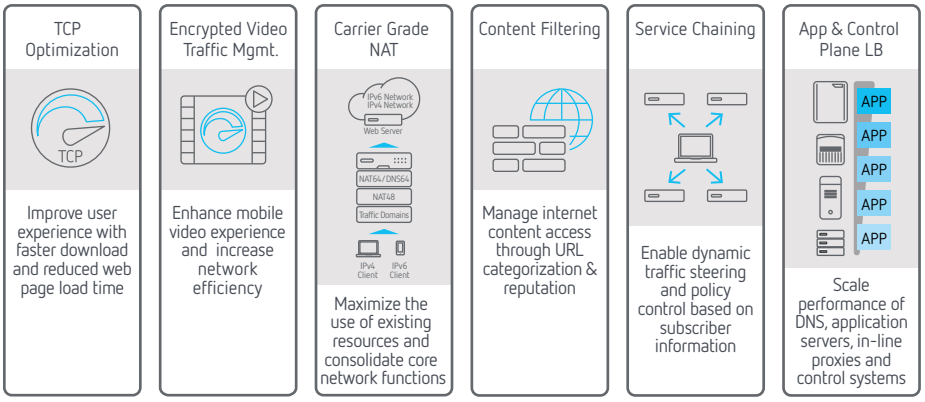


Figure 7

Enterprise Sales
North America | 800-424-8749
Worldwide | +1 408-790-8000

Locations
Corporate Headquarters | 851 Cypress Creek Road Fort Lauderdale, FL 33309 United States
Silicon Valley | 4988 Great America Parkway Santa Clara, CA 95054 United States