# Chapter 7
# Broadband as a Platform for Video Delivery: What to expect from Platforms and Applications

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## Introduction

Video consumer behaviour is changing. While broadcast TV is still popular for news and live events, consumers use a variety of platforms and different ways to view content. Video is an enabler for business, society and improving literacy in Africa. There is a shift towards media services that focus on the individual, are simple to use and deliver on-demand content in a way that meets user expectations for quality (Ericsson 2011).

The challenge to delivery of video content is the requirement for content delivery to multiple screens efficiently. Multiple screens include television, tablets, personal computers (PC) and mobile devices like smartphones. Centralised content distribution mechanisms and platforms are required to efficiently deliver video content to multiple devices. The availability of high-speed broadband technologies like LTE is making video delivery a reality in Africa.

This chapter outlines technology and systems that could enable efficient delivery of video content to multiple devices using broadband as the primary medium for delivery of the content. Three topics to be covered in this chapter include:

1. Broadband market overview including consumer trends
2. Network evolution to support video
3. Efficient content delivery

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## Broadband Market and Consumer Trend Overview

### *Video: The Biggest Driver for Internet Traffic Growth*

Global IP traffic grew 70 % year on year during 2012 to 855 petabytes a month with the highest growth rates experienced by the Middle East and Africa (101 %) and Asia Pacific (95 %). The average monthly traffic in 2014 will be equivalent to 32 million people streaming a high-definition 3D movie, continuously for the entire month. Global IP traffic will quadruple from 2009 to 2014. Overall, IP traffic will grow at a compound annual growth rate (CAGR) of 34 %.

It would take over 2 years to watch the amount of video that will cross global IP networks every second in 2014. It would take 72 million years to watch the amount of video that will cross global IP networks during calendar year 2014.

The sum of all forms of video (TV, video on demand (VoD), the Internet and P2P) will continue to exceed 91 % of global consumer traffic by 2014. Internet video alone will account for 57 % of all consumer Internet traffic in 2014. By 2014, 3D and HD Internet video will comprise 46 % of consumer Internet video traffic.

Video communications traffic growth is accelerating. Though still a small fraction of overall Internet traffic, video over instant messaging and video calling are experiencing high growth. Video communications traffic will increase seven-fold from 2009 to 2014. By 2014, Internet TV will be over 8 % of consumer Internet traffic, and ambient video will be an additional 5 % of consumer Internet traffic (Cisco 2013).

Important broadband market trends being seen globally include the following:

- Globally, data traffic exceeded voice traffic in 2010, and by 2014, 90 % of data traffic will be on mobile networks.
- Video is driving mobile traffic growth—by 2014, video will account for 66 % of global mobile data traffic.
- User expectations are rising—end users will click away or abandon if website or video fails to load within a short few seconds.

Within the concept of mobile broadband communications, video is seen as the new voice with online video being the biggest contributor to traffic volumes (Ericsson Mobility Report 2012). Figure 7.1 shows the dominance of video compared to other broadband data traffic.

### *Changing Consumer Media Consumption Patterns*

#### Video Snacks

Video snacks are a new form of media consumption evolving in parallel with the social networking phenomenon. In general, video snacks are of short and low

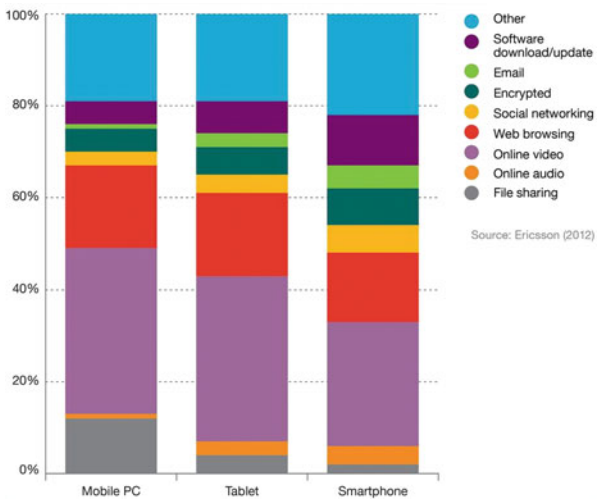


**Fig. 7.1** Application Internet traffic volume by device type (Ericsson Mobility Report 2012)

resolution. They are extremely inexpensive to produce or have been appropriated completely free of charge by the person who wishes to share them over the Internet.

### Internet Television

Internet television is a television-like experience over the public Internet. You can find examples of Internet television at most prominent broadcasters and content providers for example DSTV and fox.com. Almost every major television network offers some kind of online viewing experience for their most popular shows. This video content does not have a name that everyone agrees upon. Most people just call it "broadband video" or "online video".

### Download to Own

Download to own is a well-understood consumer behaviour. iTunes, Amazon-On-Demand and other download-to-own (or rent) services operate under the assumption that consumers will be willing to pay for files and to download, store and then view them. Of course, digital files are hard to protect from piracy. People with more money than time buy, and people with more time than money pirate.

### Video on Demand

Whether it is video snacking, Internet television or download to own, recent observations of the changes in video consumption lead to one overwhelming

conclusion—consumers like to consume video content and they like to be in control of their media consumption experiences. This consumer trend shows significant inclination towards on-demand consumption.

#### Video Applications

It is important to consider video applications that are also having a significant impact on consumers (webcams) and businesses (video conferencing). As travel becomes more and more difficult and expensive, you can expect two-way video applications to approach ubiquity in broadband environments.

Video is everywhere, and it is being produced and consumed at record levels. Video is becoming more personal, more interactive and more social. Both production and consumption are trending upwards and will continue to do so indefinitely.

## Network Evolution to Support Video Delivery

### *Broadband Technology Overview*

Broadband can be delivered in various ways, fixed and mobile for different applications with each technology delivering various speeds. The fixed access broadband uses technologies such as ADSL and fibre. We see fibre to the home delivering as much as 1 Gbps for example.

The focus for Africa will be on mobile: GSM/GPRS/EDGE, HSPA and LTE. We see wireless technologies such as LTE also delivering as much as 1 Gbps on the air interface. EDGE/Evolved EDGE and HSPA have also been improved to deliver speeds in the range of Mbps. So, the technology is no longer a limiting factor as we see high speeds also being supported on wireless technologies. Actual end-user throughputs may be up to ten times less than the theoretical speeds shown in Fig. 7.2 due to radio conditions, signal strength and network loading or capacity constraints.

### *Mobile Broadband Adoption in Sub-Saharan Africa*

When looking at broadband technology deployment in sub-Saharan Africa, mobile broadband based on WCDMA/HSPA and LTE will be the technology of choice for delivery of broadband. These deployments will be dependent on the deployment of terrestrial fibre for backhaul. Figure 7.3 shows 100 % WCDMA launches by 2013 in most countries in sub-Saharan Africa. The commercial launch of LTE services in

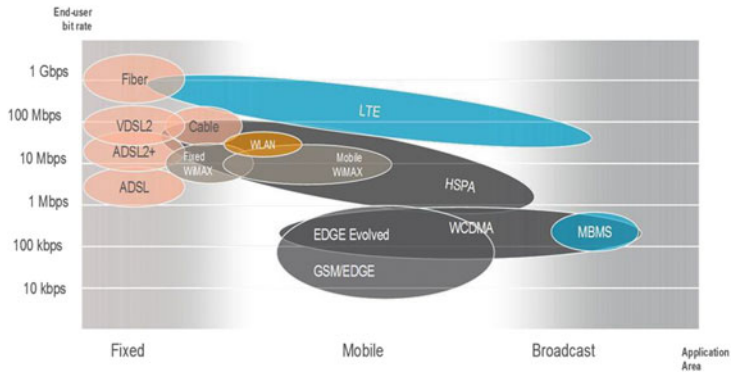


**Fig. 7.2** Broadband network technology overview

sub-Saharan Africa will happen as spectrum becomes available and as the business case surrounding it becomes viable.

Angola, Namibia and South Africa are early adopters of LTE.

## *One TV, Many Devices: Data Offload Strategies Using Wi-Fi*

The average home entertainment set-up in more economically advanced countries in sub-Saharan Africa is moving away from using separate screens in each room to video services supplemented by a number of mobile devices that provide access to these services from all over the home. Tablets in particular are growing into a popular device for viewing content in the home. This is partly due to the favourable conditions for mobile viewing within the home and the fact that many consumers of video content are looking to modernise their TV experience yet prefer not to invest in more than one new TV or add set-top boxes to their old TV sets. On-demand services that cater for more focused viewing situations, usually on impulse, are gradually changing the way of watching video (Ericsson ConsumerLab 2012).

Delivering efficient radio network capacity and coverage to cater for this increased demand for video services is central to most mobile operators' mobile broadband strategies, and Wi-Fi is a key element to satisfying the data appetites of a growing number of smartphone and tablet users in sub-Saharan Africa. With Wi-Fi fully integrated into mobile access and core networks—offering seamless, secure roaming, intelligent radio access-type selection, mobility and carrier-grade scalability and manageability—operators will be able to optimise the user experience and take advantage of a variety of flexible new business offerings. The new market reality of an all-you-can-eat wire-grade fixed broadband experience at home and office offers both a challenge and an opportunity to mobile operators who are positioning themselves to bring Wi-Fi access into the telecom mainstream and make the end user experience as convenient, responsive and seamless as possible.

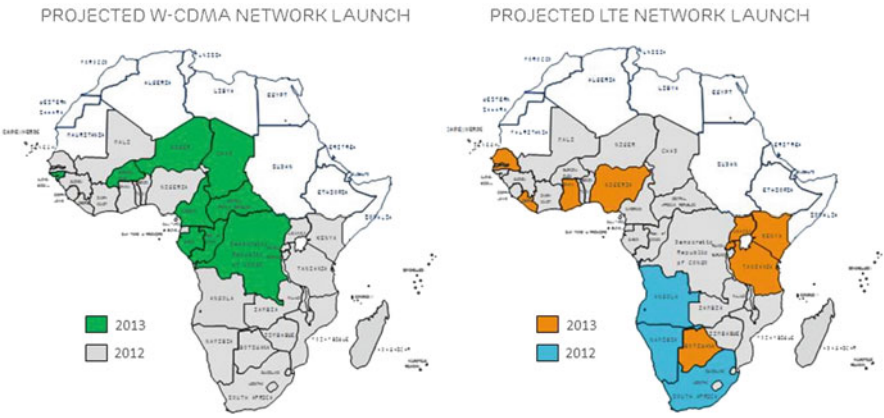


**Fig. 7.3** Mobile broadband data launch in sub-Saharan Africa 2012–2013 (Informa World Cellular Information Service 2013)

In typical high-traffic areas where deploying network resources is more of a challenge (for example, in homes with high video demand or public areas such as airports and hotel lobbies), it may not be feasible to densify or improve the macro network within specific time, cost or spectrum constraints. Operators can then add small, low-power cells to make use of both licensed and unlicensed bands, including the rollout of network-integrated Wi-Fi (Ericsson Whitepaper 2012a). With solutions that are scalable and integrated into the core network and that enable good visibility and management of the user experience, Wi-Fi can be used to deliver all the same services available from the cellular data network, maximising the entire user experience by delivering consistently high-performance broadband.

A seamless user experience requires end-to-end integration all the way from the mobile packet core network to individual cell or access point, encompassing controllers and management systems along the way, as illustrated in Fig. 7.4.

With Wi-Fi supporting seamless integration with both existing mobile core and fixed edge infrastructure, operators can leverage existing assets to improve the user experience while reducing their total cost of ownership (TCO).

## *Service Provider Strategy Around Video Delivery*

The consumer media consumption paradigm is changing at an ever-increasing pace. And the Internet is evolving into a media-centric environment. However, on the service provider's (SP) side, the media distribution paradigm is not changing anywhere near as quickly. This supply and demand mismatch is responsible for much of the angst SPs feel as they try to compete for today's media-hungry consumers. The good news is that most SPs across the globe have taken the step to upgrade their network infrastructure to next-generation networks (NGN).

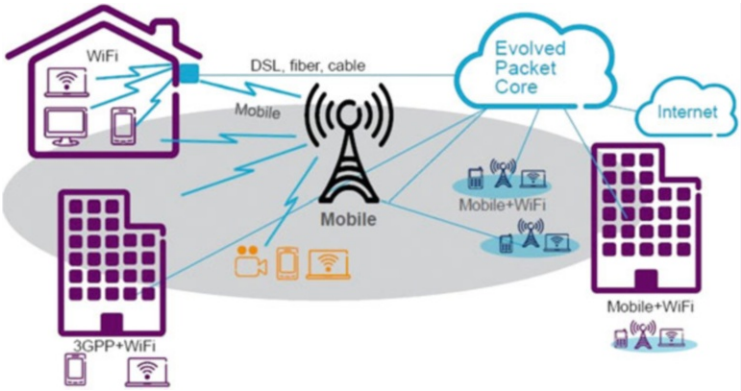


**Fig. 7.4** Wi-Fi access network integrated into the mobile packet core for efficient video broadband delivery (Ericsson Whitepaper 2012a)

CSPs know that their infrastructure has to be ready to meet bandwidth demands and that their service offerings must be bundled to reduce churn and increase revenue. Key insights into the future of profitable video distribution can be gained by studying advertising efficacy on Internet television. Publishers have demonstrated that you can accomplish a great deal by creating scarcity (reducing inventory) and increasing relevance by using full-episode Internet television players. The next logical step is the ability to deliver content to a targeted audience at a premium price. It will be a fundamental building block of any future service offering.

In a media-centric broadband world, service offerings will have to include more than on-demand content. Although one could fantasise about a lot of new, interesting ways to productise media, service providers don't have to work that hard. The best ROI is more likely to come from adding small conveniences that help the user experience. The importance of the "cool" factor cannot be overstated. If the experience is remarkable, consumers will consume.

Telcos know that their infrastructure has to be ready to meet bandwidth demands and that their service offerings must be bundled to reduce churn and increase revenue. The technology for a fully integrated multi-platform system exists. It just needs to be productised. Right now, there are literally hundreds of different products and services that are very appealing to consumers. They create a great deal of value, but so far, very few organisations have been successful in converting that value into wealth.

## Efficient Video Content Delivery

Media delivery networks (MDNs) enable efficient delivery of media like video. Content delivery networks (CDNs) enable the efficient delivery of all IP traffic through agreements with content providers.

### *Media Delivery Networks*

An MDN helps operators cope with the growth of video content. The media content equation contains three parameters: content consumers, content providers and content delivery. All three elements affect the way technology will develop to create a universal cost-beneficial media system. Handling the massive amount of over-the-top (OTT) or unmanaged traffic is a major business challenge for network operators (Ericsson 2011).

MDN includes three core functions: CDN, transparent Internet caching (TIC) and service and performance enhancers (S&PEs), shown in Fig. 7.5. In the MDN set-up, the network is enabled for delivery of video as opposed to traditional delivery of voice and data with video being prioritised over other data services allowing for improved network quality of service (QoS).

Local caching and adaptive streaming improves the end-user quality of experience (QoE) for delivery to multiple screens. MDN enables increased traffic and improved operator revenues. Network optimisation including compression, caching and streaming allows operators to decrease operational expenses.

Three potential MDN business models or use cases are shown in Fig. 7.6. In the "build" or operator-managed model, the operator owns or sources content and delivers the content directly to its subscribers. In the wholesale network model, one entity secures content from content providers, a managed service platform is set up and media distribution capacity can be sold directly to end users or to other service providers for further re-distribution to end users.

In the OTT services caching use case, the MDN's TIC capabilities allow the operator to minimise the cost of delivering OTT services. TIC is transparent to both the content provider and the consumer of the service. TIC helps the operator to significantly reduce peering and transit costs as well as reduce the need to invest in internal network upgrades to support growing volumes of OTT traffic.

Telcos have access to a whole host of customer data. They can supply information on what people have previously downloaded and when (day and time), combined with location information and possibly presence information as well. This could provide a powerful tool to proactively push information about video options to consumers even before they're aware that they might want them but at times when they are receptive to them. Such functionality also needs to be backed by an immediate and simple payment and access system so that the impulse to buy can be taken instantly to its natural end.

### *Content Delivery Networks*

Internet traffic is growing exponentially and continues to be dominated by video. As customers drive the demand for this disruptive trend, operators are forced to consider innovative solutions to manage the rapid growth in managed and

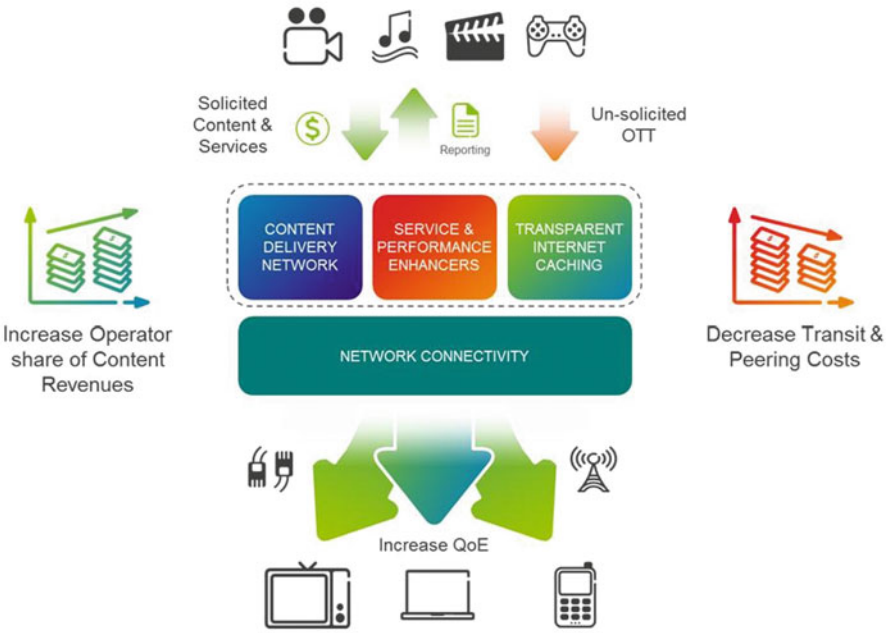


**Fig. 7.5** Media delivery network solution

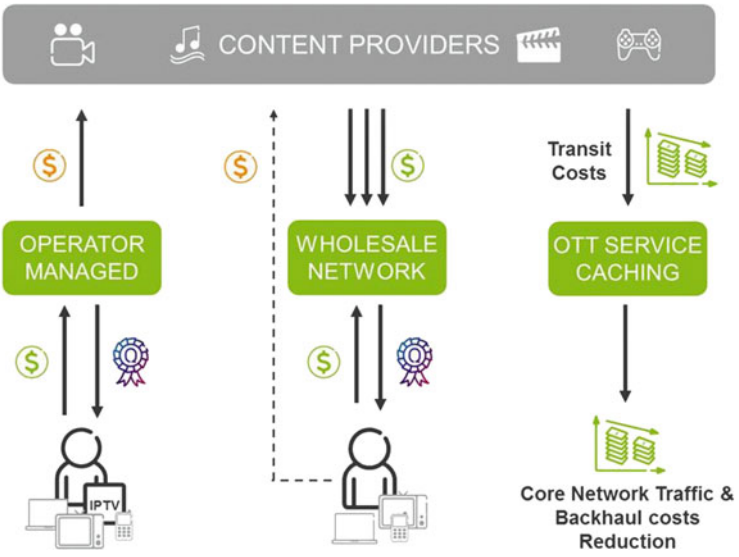


**Fig. 7.6** Media delivery network business models and use cases

unmanaged content, especially the massive growth of OTT services and applications. These services and applications can present network operators with several challenges including high peering costs, rising backhaul transit costs, mounting last-mile bandwidth demands and decreasing subscription revenues. A CDN is a service provider solution that enables the distribution of content based on agreements with the content owners across the Internet as far as an exchange point or in some cases further into an operator's network when a cooperative agreement has been reached (Ericsson Whitepaper 2012b).

This system is enabled by positioning Internet content servers as close to the end user as possible—either physically or in terms of network topology (number of hops). This solution represents a significant shift in investment focus to OPEX, enabling operators to enter the media value chain with profitable video delivery, thereby leveraging off their established customer relationships while offering content providers and enterprises cost-effective accessibility and guaranteed QoE across mobile and fixed networks. The benefits of this solution include innovative, user-aware video optimisation and delivery saving bandwidth, greater usage of network capacity and richer video broadband experiences.

Everyone can enjoy the benefits of this model—users get access to content and content providers gain a means of global distribution. The main problem though relates to delivery, which arises between the provider and the consumer. The root cause of the problem lies in the fact that the delivery model relies on the core Internet—designed for robustness rather and providing guaranteed QoS—to get content from one place to another. This creates bottlenecks both in terms of bandwidth and latency, as illustrated in Fig. 7.7.

Efficient Internet content delivery of services such as broadband video can be achieved through effective content distribution technology aimed at reducing bandwidth costs for operators. Several concepts such as traffic redirection, caching, multi-protocol delivery and content migration can be applied to both fixed and mobile network architectures to deliver optimised Internet-based content, enabling mobile, fixed or converged operators to create new revenue streams via wholesale content distribution and delivery, differentiate their services through S&PEs and reduce operational costs and capital expenditure. External content providers and operators can benefit from optimally designed CDNs through improved delivery of content through the operator's enhanced delivery capacity and through increased end-user retention due to improved QoS (Ericsson 2011). The functional architecture of an efficient CDN is illustrated in Fig. 7.8.

### *Efficient Video Delivery to Multiple Screens*

The challenge to delivery of video content is the requirement for content delivery to multiple screens efficiently. Centralised content distribution mechanisms and platforms are required to efficiently deliver video content to multiple devices.

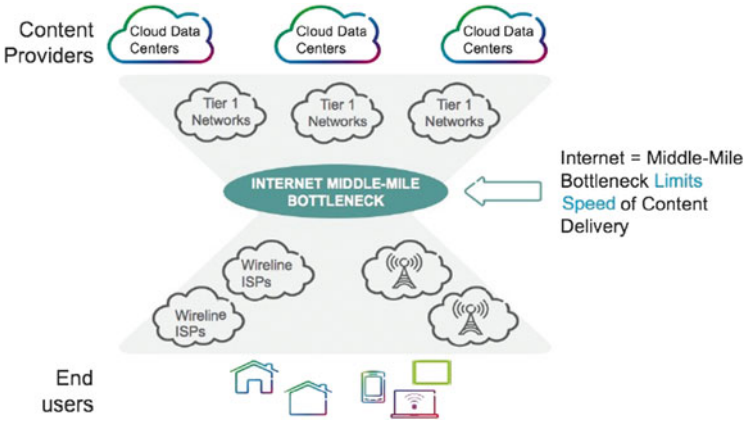


**Fig. 7.7** Problems with Internet delivery of content to end users

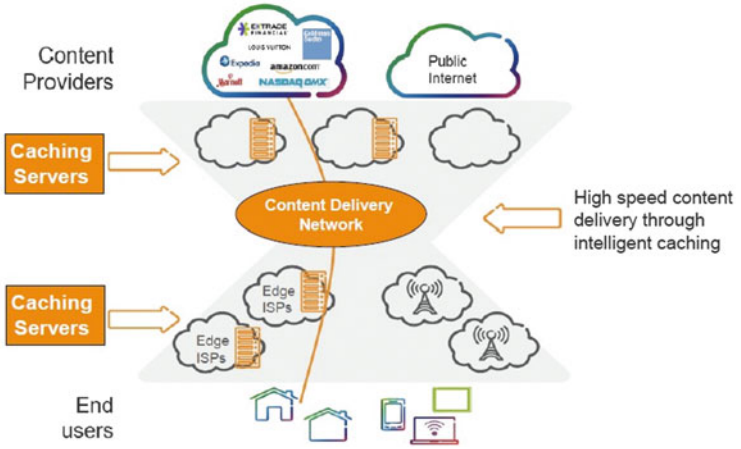


**Fig. 7.8** Efficient Internet content delivery architecture through CDN and caching servers

Linear video is delivered to television by terrestrial broadcast, satellite or IP-TV. The quality requirement set by the screen size and resolution determines the video bit rate. Adaptive streaming works by adapting the video stream bit rate in real time to the actual network throughput to a given endpoint without the need for "re-buffering". If the network throughput suddenly drops, the picture may degrade but the end user still sees a picture. Apple's HTTP Live Streaming (HLS), Microsoft Silverlight Smooth Streaming (MSS) and Adobe's HTTP Dynamic Streaming (HDS) are examples of HTTP adaptive streaming solution implementations.

Adaptive streaming makes changes at the server and the client to increase the overall QoE of the end user. To support adaptive streaming, the content is first encoded at multiple bit rates and resolutions which must be predefined by the

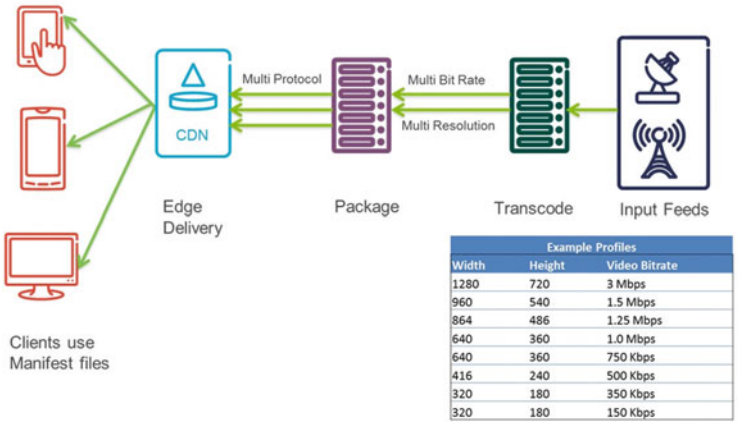


**Fig. 7.9** Video content over IP delivery using adaptive HTTP streaming

operator to provide an acceptable trade-off between quality and bit rate. Segmentation or packaging allows a client to switch from one stream to another seamlessly. The adaptive part of adaptive streaming is enabled at the client rather than the server. The client continually monitors the available bandwidth and the media being delivered and will dynamically switch to a higher or a lower bit rate session in order to keep the receive buffer within set limits (Adams 2013). A high-level implementation of an adaptive streaming solution is shown in Fig. 7.9.

## Conclusions

Research and data indicate that video traffic is the biggest contributor to mobile IP traffic. End users require multiscreen video capability (TV, PC, smartphone, tablet).

Broadband platforms in the form of fibre and mobile technology are making video delivery for business and personal applications a reality in Africa. Mobile broadband is becoming a reality in Africa with 3G launches planned in all sub-Saharan African countries in 2013 and LTE deployments following soon thereafter.

Different business models exist for media delivery enabling efficient and cost-effective solutions for service providers and content delivery solutions with caching and QoS features existing for efficient video delivery. Carriers are planning to integrate IPTV, mobile TV and Web TV/video offerings into a seamless user experience in and out of the home topped by new value-added services.

Technology convergence in media, new media offerings and ways to deliver content from the Internet are fast emerging as a sound way to distribute and consume content online. As such, Telcos/CSPs need to adopt innovative business models in B2B, B2C and OTT scenarios to boost revenue streams as well as

understand how to shape up the media consumption model and move up the media business value chain. The new media offerings and ways to deliver content OTT are fast emerging as a sound way to distribute and consume content online.

The rollout of next-generation broadband networks will increase competition in the supply of video content into the home. The manner in which the Internet and fibre infrastructure will be a "universal cross-connect" for the delivery of digital video content into the home must be understood. The vast amount of content (video, audio, photos, etc.) suggests that a new way to discover media and personalise the experience is needed.

When mobile and telco carriers decide to enter the video business, they need a distribution architecture that can handle change at unprecedented price points based on a solid business case. Constructing a viable business case with the use of various broadband technologies, commercial objectives and project managing a successful rollout will be keys to success.

## References

Adams, M. (2013). *Will HTTP adaptive streaming become the dominant mode of video delivery in cable networks?*, Retrieved April 1, 2013, from http://archive.ericsson.net/service/internet/picov/get?DocNo=28701-FGD101097&Lang=EN&HighestFree=Y

Cisco. (2013). *Cisco visual networking index: forecast and methodology, 2011–2016 White Paper*. Retrieved 29 March, 2013, from http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-481360.pdf

Ericsson. (2011). Managing the growth of video over IP. *Ericsson Review*, *1*. Retrieved 18 February, 2013, from http://www.ericsson.com/res/thecompany/docs/publications/ericsson_review/2011/Media-Delivery-Network.pdf

Ericsson ConsumerLab. (2012). *TV and video—an analysis of evolving consumer habits*. Retrieved 15 February, 2013, from http://www.ericsson.com/res/docs/2012/consumerlab/tv_video_consumerlab_report.pdf

Ericsson Mobility Report. (2012). *On the pulse of the networked society*. Retrieved 18 March, 2013, from http://www.ericsson.com/res/docs/2012/ericsson-mobility-report-november-2012.pdf

Ericsson Whitepaper. (2012). *Wi-Fi in heterogeneous networks—a seamless transition*. Retrieved 18 February, 2013, from http://www.ericsson.com/res/docs/whitepapers/wp-wi-fi-in-heterogeneous-networks.pdf

Ericsson Whitepaper. (2012). *Operator opportunities in cloud service delivery*. Retrieved 18 February, 2013, from http://www.ericsson.com/res/docs/whitepapers/wp-cloud-opportunities.pdf

Informa World Cellular Information Service, WCIS. (2013). Retrieved 18 March 2013, from http://www.informatandm.com/about/wcis/