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IPTV Guide

Delivering audio and video over broadband

William Cooper
Graham Lovelace

iptv-report.com

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Consultancy services

Both informitv and Lovelace Consulting provide advisory and strategic consultancy services, assisting organisations to exploit opportunities in converged communications media.

For more information see:

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Foreword

This *IPTV Guide* was first published in conjunction with the *IPTV Explained* conference held at BAFTA in London in December 2006. It aims to provide a brief introduction to the distribution of audio and video programming using internet technologies.

Based on their influential independent report, *IPTV: Broadband meets broadcast—The network television revolution*, informitv and Lovelace Consulting have produced this exclusive executive overview of internet protocol television and the emerging market for delivering audio and video over broadband data networks.

The *IPTV Guide* explains in simple terms precisely what internet protocol television means and what it means for your business.

This concise guide is the distillation of many years of research and consulting experience. It is intended to introduce the key concepts and main themes in order to provide a common understanding as the basis for further discussion.

Every organisation affected by the network television revolution will need to evolve their own strategies to deal with the threats and opportunities it presents.

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PART

1

1 Introduction

> *"As broadcast television overtook radio, then newspapers, so internet-delivered video content will overtake broadcast television. And advertising will follow suit, causing shifts in traditional business models.* [1] *"*

Lord Currie
Chairman, Ofcom

> *"Ultimately the internet's going to be the most important medium we operate in and it's going to be an important way of delivering TV and radio.* [2] *"*

Mark Thompson
Director General, BBC

> *"In ten years' time the majority of all programmes will be consumed in an on-demand way, whether through personal video recorders such as Sky+, or video-on-demand over the internet.* [3] *"*

Andy Duncan
Chief Executive, Channel 4

Predicting the future has always been fraught with risk, but never as much as today. The ever-quickening pace of technological change is forcing businesses across the modern communications landscape to respond to myriad threats and opportunities.

Nearly a decade ago, Microsoft founder Bill Gates warned that amid the rush there is a "real tendency to overestimate how much things will change in the next two years; but also, and dangerously, a tendency to underestimate how much things will change in 10 years".[4]

He also predicted a time when television programming would be delivered via what he then called the "information highway". He said viewers would order programmes, stored on computer servers and watch them when they wanted, first on computers and eventually on televisions.

Viewers would have complete control, he wrote. "Even if a show is being broadcast live, you'll be able to use your infra-red remote control to start, stop, or go to any previous part of the programme, at any time. If someone comes to your door you'll be able to pause the programme for as long as you like."[5]

Such a possibility is now of course an everyday reality for anyone with a digital video recorder like TiVo or Sky+, or a media centre. Microsoft is now finally delivering on its media promise with the launch of television services by major telecommunications companies using its software.

These television services are not delivered through a satellite dish, aerial or cable, but across a broadband data network over a telephone line.

Known as IPTV, or internet protocol television, it represents the long-predicted convergence of broadcasting, telecommunications and information technology.

This guide aims to provide a brief overview of what is meant by IPTV and what it means for you.

Last year when writing *IPTV: Broadband Meets Broadcast—The network television revolution*, we peered into the crystal ball and envisioned a future when a form of television would offer "tens of thousands of live streams, hundreds of thousands of on-demand programmes, and virtually every movie ever made".[6]

That vision, of an interactive medium putting just about every item of audio-visual entertainment you might ever be interested in "at the touch of a button, wherever you are", took a mid-term view. "Television will change more in the next five years than in the previous five decades," we said.

While we have no way of knowing with certainty what the full outcome of the network television revolution will be, with hindsight we can already say that we underestimated the speed of its arrival. The future of television is already with us today.

That future is represented not just by the television services that are now being rolled out by telephone companies but by the burgeoning broadband video services that are appearing on the web.

There is still much confusion about what internet protocol television actually means. For some it is strictly limited to the sorts of services now being offered by telecommunications companies and broadband service providers. In our view it includes any television or audio and video services that are delivered using internet protocols. That includes services delivered over the public internet, which some people prefer to refer to as internet television or broadband video.

What is clear is that IPTV is a hot topic, and every player at every level in the industry value network needs a strategy in order to respond to the threats and opportunities presented by a new digital revolution.

The first digital revolution began a decade ago with the mass adoption of the internet and the world wide web and the launch of digital television services delivered via cable, satellite and terrestrial networks. These two

remarkable developments in communications coincided, but failed to converge.

Much was said and written about convergence in the first digital revolution. Several attempts were made to marry broadcast television with the internet, but even as analogue television began to cede to digital, the medium and the TV screen remained resolutely detached from the PC and the global network of the internet.

Today, as we enter the second digital revolution, that long-heralded marriage has begun, aided to the altar by the rise of ever-faster broadband connections and more efficient compression technologies and driven by powerful competitive forces that are now reshaping the communications landscape. The telecommunications network is the nexus for the convergence of television with the internet and the next generation of digital video services.

Historically, television was either transmitted from a tower, or distributed over a cable system, or beamed directly from satellite. Now, television and other audio and video services as well as high-speed internet access can be delivered over broadband data networks over a single connection to the home. That could be over a cable television system, but it could equally be a telephone line.

Telephone lines that once merely carried voice communications are able to provide broadband data services capable of delivering both live and on-demand television programmes, in standard and high-definition formats, to set-top boxes connected to television screens, as well as to personal computers and other devices.

Exploiting the full potential of digital delivery, this new form of distribution will fundamentally affect the way television is viewed, change channels of distribution and disrupt the traditional broadcasting business, as the conventional boundaries of television and telecommunications industries collide and collapse. The transition from four or five terrestrial networks to multichannel television will continue with an exponential

expansion of channels and a proliferation of programmes available on demand.

The choice of channels and programmes will further explode as viewers roam beyond the national borders of broadcast television and access live and recorded programmes from around the world, reflecting every conceivable interest. Viewers will further benefit from increasing control, watching what they want, when they want, where they want, on the device of their choice.

The vision driving this second digital revolution is not new. Futurologists have long predicted a time when any programme, made at any time, anywhere in the world, could be available online on a free or pay basis, so long as it has been digitised and is stored on a server. That vision is today becoming a reality, thanks once again to the rising speed and availability of broadband and continuing improvements in digital video compression.

The delivery of television programming over telecommunications networks has the potential to eclipse the dominance of broadcast television, transform its consumption and regulation, creating a new generation of media players.

Telecommunications groups around the world are competing against cable television providers offering a 'triple-play' discounted bundle of television, telephony and high-speed internet access. Both telephone and cable television companies are now in competition with broadband service providers that are unbundling their lines and offering their own combination of video, voice and data services to customers.

It is certainly a confusing competitive market. Compounding the confusion is a range of forecasts predicting global household penetration and market value of these services by the end of the decade.

Many forecasts focus on digital television services delivered via broadband telephone lines to set-top boxes. These services generally resemble cable television. Subscribers pay a monthly fee to receive programmes and can pay for some shows on-demand.

Household penetration and IPTV market value forecasts for 2010

Source	Global households	Market value
ISuppli, August 2006	63m	$27bn
Gartner, September 2006	36m	$13.2bn
Informa, October 2006	36m	$12.2bn

These figures ignore the take-up and market value of broadband video services streamed over the internet to computers or the value of any advertising they might attract.

The broader picture is of half a billion homes connected to broadband networks, able to stream and download audio and video programming across the internet.

In our view, this could have a much greater impact on the traditional television and video market. It will create a global distribution platform for programming providers and a more efficient method for delivering niche programmes to a worldwide audience.

PART

2

2 IPTV

> *"We call it IPTV. And no doubt this is where the world is going.*[7] *"*
>
> **Bill Gates**
> Chairman, Microsoft

IPTV is a rather unhelpful term for television and video services that are delivered over data networks rather than other forms of digital broadcasting.

The IP in IPTV simply refers to internet protocol, a networking technology that underpins the internet and is increasingly used as a *lingua franca* for communication across data networks in general.

IPTV — internet protocol television — refers to the delivery of digital television and other audio and video services over broadband data networks using the same basic protocols that support the internet.

The association with the internet may suggest that this is simply an extension of the web video experience seen on personal computers and to an extent this is technically correct. It is also an assumption that service and technology providers are keen to dismiss.

IPTV can deliver live and on-demand digital television and video services via set-top boxes and other devices to television sets or other displays, in

standard and even high-definition formats, at a quality that is indistinguishable from broadcast television or comparable to a DVD.

A distinction should be drawn between service providers that use internet protocols over privately managed networks to deliver a very high quality of service to subscribers and broadband video services that simply use the open internet on a best efforts basis to reach a potentially global audience. The difference is not so much technical as one of business model.

Service providers

Telecommunications companies and broadband service providers around the world are launching digital television propositions as part of a package of subscription services that generally combine video, voice and data over their fixed telephone lines and in some cases mobile networks.

In many cases these 'Telco TV' services resemble cable television and they are generally competing directly with cable or satellite television providers for customers and subscription revenues. Not surprisingly, therefore, their offerings are somewhat similar, comprising a combination of live television channels and premium programming with video-on-demand services.

Telco TV represents an evolution of television rather than a revolution. In order to differentiate themselves from existing platforms, these new entrants need to compete on price, programming and performance.

In competing on price, these new service providers typically bundle video, voice and data services at an attractive price point. They may also aim to offer more flexibility around pricing options for individual channels or programmes. In order to offer a competitive service they may need to provide functions such as a digital video recorder as standard.

Broadband video

Although audio and video have been available on the web for many years, the quality of experience has generally been comparatively poor. Users were unlikely to see online video as a substitute for television.

With the growth in adoption of broadband and the rising speed of connections, coupled with the improved performance of computer processors and the increasing capacity of storage, online distribution of video has become a much more practical proposition.

There may be a significant difference in the quality of experience between a dedicated subscription service and a web site such as YouTube. The open internet is not currently capable of providing the same quality of service to stream live television to millions of viewers.

Users may be prepared to put up with occasional interruptions or delays, particularly if they can access material that is particularly relevant to them, especially if it is freely available.

It is also already possible to download video files that are comparable in quality to broadcast television or a DVD.

The main issue has been that online video is still generally seen on a personal computer display rather than a living room television, but there are a number of devices that will connect a network to the television set to provide a more televisual experience.

Broadband video services are an example of disruption in that they provide competition to existing services that may initially be technically inferior but the user benefits are sufficient that they have the potential to displace if not replace traditional distribution channels.

Comparisons

A key distinction between the service provider and broadband video models is the degree to which viewers can roam.

Most service providers will offer a walled garden service. The user is confined to the choice of channels and on-demand services that are offered and the services may only be available to subscribers.

In contrast, many broadband video services are provided on an open access basis. In many cases material can be uploaded by anyone and viewed by anyone, anywhere in the world.

The two models can therefore be characterised as a closed network service provider approach that resembles cable television and an open access broadband video service that resembles the web.

Service providers versus broadband video

Service providers	Broadband video
Controlled network	Public internet
Generally available on a TV	Generally available on a PC
Quality of service guarantees	Best efforts basis
Broadcast channels	Streams
Video-on-demand	Downloads
EPG	Web site
Pay-TV	Free (advertising supported)
Walled garden	Open access

Whether delivered over closed or open networks, the distribution of television and other audio and video services over broadband connections will complement and ultimately compete with the viewing experience obtained from digital satellite, terrestrial and cable television.

The boundaries between the service provider and broadband video models were initially stark but they are already blurring and will ultimately merge, driven by the same forces of convergence that enabled them both.

PART

3

3 Convergence

> *"Convergence really means the freedom for consumers to use any service under any circumstances they choose to.*[8] *"*

Ben Verwaayen
Chief executive, BT

> *"The boundaries between media and adjacent sectors, such as broadband and telephony, are disappearing and this is creating an unprecedented change in the landscape.*[9] *"*

Rupert Murdoch
Chairman, News Corporation

Convergence is an inevitable consequence of the transition from the analogue to the digital domain. Once in digital form, a telephone call or a television programme can be delivered over the same digital network.

In the analogue world, sounds and images are stored and transmitted in a form that has some direct correspondence to the original. In analogue communications, a signal is varied continuously according to the volume or frequency of a sound or the brightness or colour of an image. As a result, analogue signals need to be kept separate, to avoid them interfering with one another. They also suffer from losses whenever they are stored or copied.

In the digital domain, sounds and images, together with text, graphics and other information, can be encoded in ones and zeros and stored and transmitted as binary digits or bits. In this form they can be stored on the same disk or transmitted over the same network without interfering with one another. It is also possible to create an unlimited number of perfect copies from the same original.

Broadcast

Analogue broadcasting originally provided a highly efficient means of delivering the same signal to an unlimited number of simple receivers. Television was simply an extension of radio. The limited radio-frequency spectrum was divided up into a small number of channels, each of which could carry a single stream of audio or video. The audience tuned to a particular channel to listen to or watch a particular programme. The programmes were organised into a relatively restricted linear schedule which was published and promoted so that people knew what was on and when it would be transmitted. The audience was encouraged to continue watching the same channel rather than switching over to a competing one.

The technology of transmission imposed the form and function of radio and television programming in the linear schedules of a limited number of competing channels. The broadcast networks were primarily concerned with the one-way delivery of multiple channels of scheduled programming to many receivers at the same time.

The transition to digital transmission was largely driven by the need to create more channels, to provide premium and special interest programming. By converting signals into digital form, they could be encoded and compressed more efficiently, enabling more services to be distributed within the capacity of a given communications channel. The quality of reproduction was also more consistent, but the basic structure of radio and television as discrete linear channels was unchanged.

Internet

The internet arose as a communications phenomenon in the late twentieth century as a result of connecting computers together using a set of common standards, based on developments in digital networks.

Computer networks tend to communicate by transmitting data in bursts or packets. Such networks are known as packet-switched networks.

Each packet typically contains a payload of a few hundred bits of data, together with a header that specifies among other things a destination address. The packets are sent separately across the network, rather like parcels in the post. They may take different routes to their destination and arrive at different times. They may even get lost on their way and have to be re-sent. Then, at the destination they are re-assembled into the correct sequence using information in the head to reconstruct the data. That data might represent numbers, text, graphics, photos, audio or video.

Packet-switching enables different types of data to be efficiently delivered over the same infrastructure and allows many different devices to be connected to the same network.

The internet was created by enabling communication between devices connected across different networks, using a common transmission standard known as internet protocol. This created an open network, a network of networks.

Based on this foundation, the world wide web added a set of simple standards, hypertext mark-up language and hypertext transport protocol, respectively known as HTML and HTTP, together with the concept of a Uniform Resource Locator, or URL, to provide a global addressing scheme for documents or any other type of information.

Initially used to access static pages of information, the web became increasingly dynamic and soon added support for streaming audio and video, based on standards such as Real Time Streaming Protocol or RTSP.

Despite their promise, the earliest attempts to provide streaming audio and video services suffered from slow connections which severely limited the quality of the media and the user experience.

However, the power of the internet has increased as a result of two compelling factors.

Moore's Law, named after Gordon Moore, the co-founder of Intel, famously suggests that the power of digital processors tends to double every 18 months. This prediction has largely held true since it was first stated over 40 years ago. Similar technological trends apply to storage and network capacity. These have resulted in an extraordinary rise in the ability of consumers to process, store and communicate information and digital media.

Metcalfe's Law, named after Bob Metcalfe, co-inventor of Ethernet, the local area networking technology, less famously states that the value of a network increases by the square of the number of devices or customers to which it is connected. The more people that connect to the network, the more valuable it becomes.

This 'network effect' also accounts for the seemingly spontaneous growth of services that are delivered over open networks that offer almost universal access.

Internet search engines, portals and other online services can rapidly reach a critical mass. They become more popular and useful as more people use them and can achieve market dominance in a matter of months.

The network effect is all the more powerful with services that employ social networks in which users invest their own time and resources and which are driven by popularity systems of links, ratings and recommendations.

Telecommunications

Telecommunications providers have also been moving to digital networks which offer greater efficiency and consistent quality with lower operational costs.

Unlike broadcasting, telecommunications services generally involve point-to-point communication and are bi-directional.

The earliest telecommunications services were circuit-switched. They required a continuous circuit to be established between two points on the network.

When telecommunications companies first moved to digital networks, enabling many more calls to be carried on the same physical wires, they used technologies that aimed to establish virtual circuits between their subscribers.

When their residential customers first wanted to connect computers over their phone lines, they needed to use dial-up modems that converted digital data into sounds that could be sent over the Public Switched Telephone Network or PSTN.

Once the core networks were digital, it was possible to offer services such as the Integrated Services Digital Network, or ISDN, which offered higher speed digital communications, but were still too limited to provide high-quality video.

The development of Digital Subscriber Line, or DSL, technologies was partly driven by an ambition to deliver video services over the 'last mile' of copper wires to the home.

Telecommunications companies like British Telecom and cable companies like Time Warner experimented with providing video-on-demand services over their networks in the mid-nineties, but the technologies of the time were more limited and the costs were significantly higher.

After the initial excitement subsided, numerous other trials by telephone and cable companies reached the conclusion that while the technology worked the cost of providing and maintaining services was too high.

Digital television in the form of satellite, terrestrial and cable services provided a more cost-effective means of delivering multichannel television, while personal computers connected to the internet could access a compelling range of information, education and entertainment services and fulfil the promise of electronic shopping and banking.

Broadband

Consumer demand for continuously available high-speed internet access that does not tie up the telephone line has resulted in the rapid adoption of broadband connections. This has been driven by a new range of content, applications and services, such as music downloads, video streaming and multiplayer gaming.

Many markets have also been stimulated by regulatory intervention and market liberalisation, opening up former monopoly-operated telecommunications companies to competition.

DSL Telephone service providers have been able to offer higher speed data connections by providing a Digital Subscriber Line or DSL connection. This involves installing equipment in their local exchanges that uses spare frequencies on the 'local loop' line to the customer to provide a continuously available data connection without disrupting the traditional dial-up telephone service.

The most common configuration is Asymmetric DSL, or ADSL, in which the downstream capacity to the customer is significantly higher than the upstream capacity. Symmetrical configurations are also possible, known as SDSL. Higher speed connections can be provided over shorter line lengths using a very high bit-rate standard known as VDSL. Collectively all these approaches are sometimes referred to as xDSL, or simply DSL.

Downstream speeds of 2 Mbps are now widely available, while speeds of up to 8 Mbps are becoming more common. Over shorter line lengths faster speeds of 12 Mbps or even 24 Mbps are possible with new variants of broadband standards. Over much shorter line lengths, of up to a few hundred meters, speeds of anything up to 50 Mbps or even 100 Mbps can be supported.

At these speeds, the capacity of copper cable begins to look like less of a restriction for the delivery of video services, which require a bandwidth capacity of around 2 Mbps for standard definition television, although operators are aiming to deliver services at even lower rates.

Digital Subscriber Line technologies

Type	Max speed downstream Mbps	Max speed upstream Mbps
ADSL	8	1.0
ADSL2	12	3.5
ADSL2+	24	3.5
VDSL	52	12
VDSL2	100	100

Source: International Telecommunication Union standards

Cable Broadband services can also be provided over a digital cable television network using a high-speed cable modem. This performs a similar function to a DSL modem, but is instead designed to work over the same co-axial cable used to provide television services. The standard for such devices, known as DOCSIS or Data Over Cable Service Interface Specification, was developed by CableLabs in the US and is now an International Telecommunication Union standard. This supports downstream data rates to the consumer of anything up to 38 Mbps, or 50 Mbps in the European version. Even higher speeds can be achieved by combining channels through what is known as channel bonding. This means that digital cable operators already have the basis of a high-speed broadband data network.

Fibre Fibre-optic technology offers extremely high capacities, capable of carrying thousands of simultaneous audio and video streams. In some cases telecommunications providers are installing fibre-optic connections to the nearest hub or the end of the street, known as Fibre-To-The-Node or Neighbourhood (FTTN), or Fibre-To-The-Curb (FTTC), or even directly to the home (FTTH). These technologies are sometimes generically known as FTTx. The speeds available for domestic users are generally limited only by the capacity of the local network that links devices to the fibre connection. This is typically a standard network connection, offering 10 Mbps, 100 Mbps, or even 1 Gbps. Although this sounds fast, it is only comparable to the speed of the fastest office networks. However, it is more than adequate for distributing multiple video services, including high-definition video.

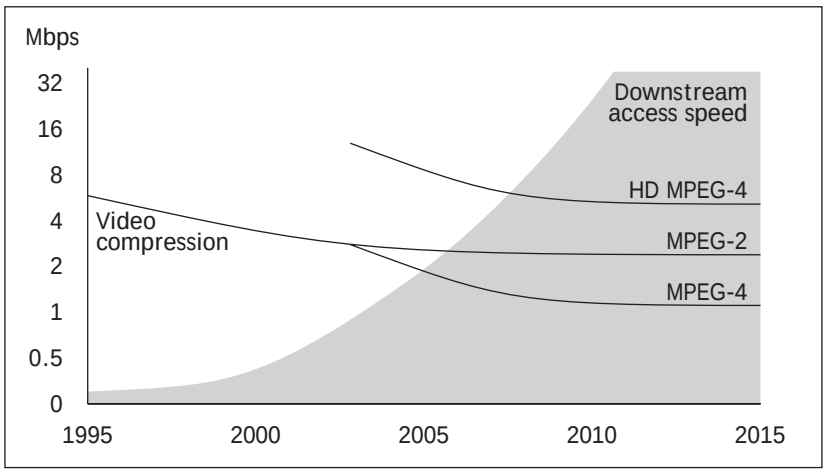
Compression

The significant increase in broadband speeds has also been accompanied by improvements in video compression systems. This now makes it feasible to squeeze television down telephone lines.

Over the past decade, digital television has been transmitted using the international video compression standard known as MPEG-2, developed by the Moving Picture Experts Group. Conventional digital television is typically transmitted at between 3 Mbps and 5 Mbps. DVDs are normally encoded at between 6 Mbps and 8 Mbps.

MPEG-4 More recently, MPEG-4 has been developed to provide an even more efficient compression scheme and has been adopted by several broadcasters for high-definition television. This advanced video compression scheme has been adopted by the International Telecommunication Union in the form of H.264 MPEG-4 AVC. Standard-definition video encoded using MPEG-4 can now be delivered in at around 2 Mbps and high-definition requires 8 Mbps or more.

Video compression and access speeds



Source: informitv, industry trends and forecasts

VC-1 The Microsoft Windows Media format involves a proprietary compression scheme in many respects comparable to MPEG-4. This has found favour in some quarters, particularly for online use, as it benefits from support by many personal computers and provides a digital rights management solution that appears to satisfy the requirements of many content owners. In order to promote it as an open standard, Microsoft submitted its compression scheme to SMPTE, the Society of Motion Picture and Television Engineers, which subsequently approved it as a specification known as SMPTE VC-1.

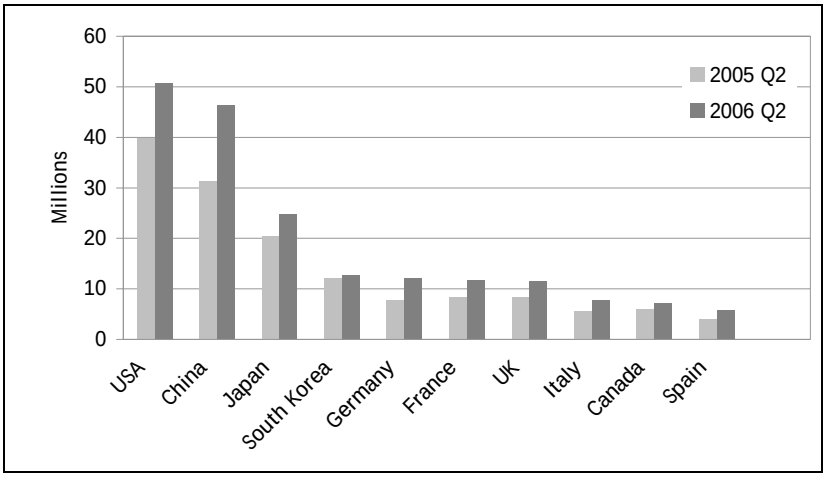
The majority of telecommunications providers have opted for the open MPEG-4 standard, although the Windows Media format is still widely used for downloads destined for computers and other devices.

Availability

The rise in broadband speeds and the improvements in digital video compression have been accompanied by a dramatic rise in the number of homes with broadband access.

There were nearly a quarter of a billion broadband lines around the world by the middle of 2006, according to broadband market research company Point Topic, an increase of 36% on the previous year.

Top 10 countries by number of broadband lines



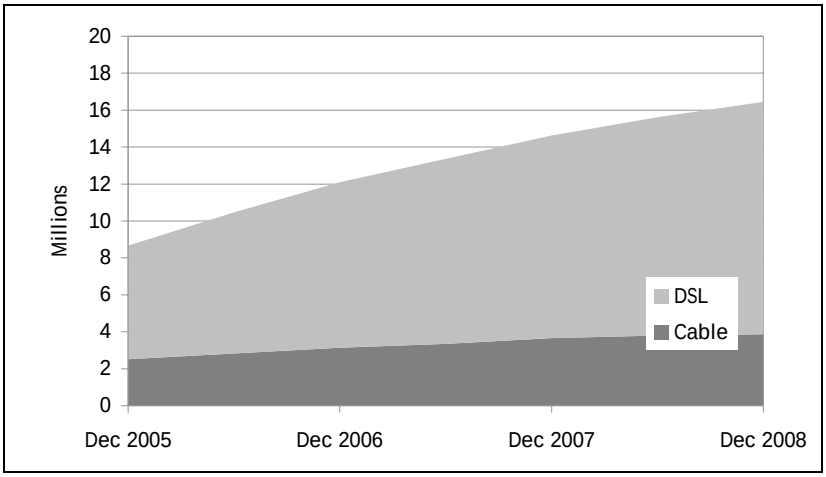
Source: Point Topic

Around two thirds of these broadband connections were based on DSL technologies while the majority of the remainder used cable modems.

The United States has more than 50 million broadband lines, with more than half of them provided by cable. China, with 46 million lines, is the world's fastest-growing broadband territory and is soon expected to become the largest single market. Japan is also a significant broadband market with nearly 25 million lines, followed by South Korea with around half that number. The largest European countries are rapidly growing their broadband base, led by Germany and France. After a slow start, the United Kingdom has become one of the most competitive broadband markets.

According to Point Topic there were around 8.6 million consumer broadband connections in the United Kingdom at the start of 2006. That is forecast to nearly double to 16.5 million by the end of 2008. The majority of these connections will be by DSL telephone lines, with relatively slow growth from cable.

UK broadband consumer connections forecast



Source: Point Topic

Countries with the highest broadband penetration by population are led by Iceland, with 30 broadband lines per 100 people, followed by the Netherlands and Denmark. Switzerland is catching up with South Korea, overtaking Hong Kong, all with over 25% penetration, together with Finland and Sweden.

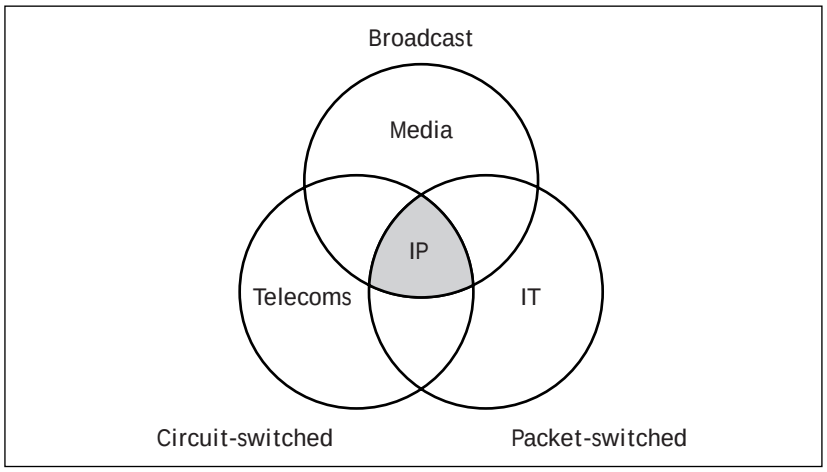
The penetration by households presents a different perspective. South Korea, Iceland and Hong Kong have over 80% of households with broadband. Israel has over 70%, ahead of Singapore and Taiwan, while the Netherlands, Switzerland and Canada have over 60%.

Competition

Convergence is causing the boundaries that once separated the media, telecommunications and information technology sectors to collapse. These three previously very separate sectors are now converging in the digital domain.

At the heart of the intersecting rings of media, telecommunications and information technology, the worlds of the television, telephone and computer are no longer separated but are unified by a single digital communications medium.

Convergence in communications



The intersecting worlds of telecoms, media and information technology.

As a result, services are converging at the network level on the common communications platform of internet protocol. Video, voice and data can now be carried in packets on the same networks. Services can be bundled and blended together to create combined service offerings.

Telecommunications services are no longer the exclusive province of traditional telephone operators that have long enjoyed a virtual monopoly.

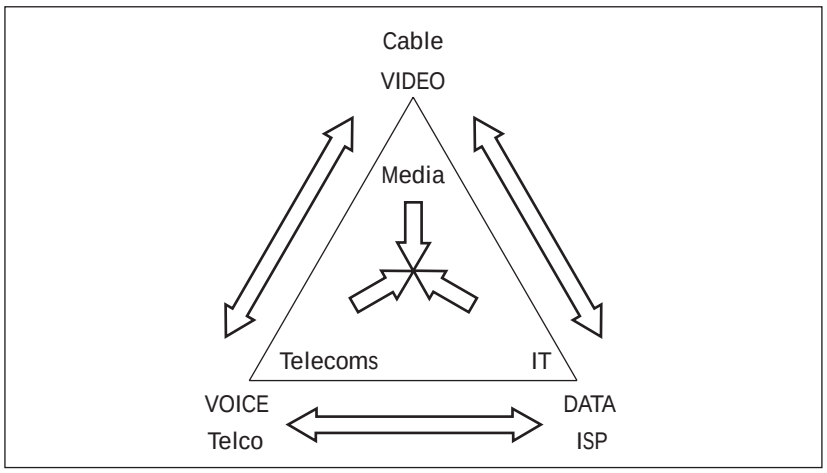
Telcos have seen the cash cow of their fixed-line voice revenues eroded by cable television companies offering digital television bundled with telephone services and high-speed internet access.

New entrants to the telephone market have also begun using internet protocol networks in the form of Voice-Over-IP, or VOIP, services to offer very low cost or even free telephone services over the internet.

Meanwhile, mobile operators have been taking customers and revenues away from fixed line services.

Telecoms market liberalisation has opened up former monopoly carriers to further competition, allowing other companies to offer services over their networks or place their equipment in local exchanges and rent the line to the customer, a process known as local loop unbundling.

Triple-play convergence



Other telecommunications companies, including cable television and broadband service providers, are able to compete in the same territory, offering a 'triple-play' of video, voice and data services on the same subscriber bill. By partnering with mobile network operators they are also able to provide a 'quadruple-play' or multiservice offering.

As a result, the traditional telcos now find themselves locked in a competitive battle with cable operators and broadband service providers, both of which are now able to offer triple-play services.

In the face of this increased competition, the risk to telcos is that the provision of voice and data services rapidly becomes a commodity that diminishes in value as digital network capacity becomes more abundant.

In response to these competitive pressures, telecommunications groups around the world are investing billions to upgrade their infrastructure to next-generation network or NGN platforms, based entirely on internet protocols, in order to provide converged services more cost-effectively.

Their strategy is to offer enhanced services to retain their customers by increasing loyalty and reducing churn, while increase average revenues per user, or ARPU, from diversified services.

In order to prevent themselves ending up as a utility service, or ‘dumb pipe’ used by third parties, telcos are developing their own triple-plays, differentiating their service offering with digital television and video-on-demand services delivered down telephone lines.

PART

4

4 Service providers

> *We want to bring simplicity to our customers, the first step towards digital paradise!*[10]

Didier Lombard
Chairman, France Telecom

> *People's expectations are high when it comes to TV. They don't take kindly to people messing with their TV sets.*[11]

Dan Marks
Chief Executive, BT Vision

Every major telecommunications provider has either launched or is currently evaluating an internet protocol television service. Internet protocol television is no longer a science project. Around the world there are already deployments of services with many hundreds of thousands of customers.

Consumers have the same expectations of such services as they do of television in general. They do not expect interruptions to service or for their televisions to crash. Telephone companies are expected to provide the highest levels of availability.

While such service providers employ internet protocols, they do so over closed networks to deliver television or video-on-demand to a restricted

group of users, generally those that have paid a monthly subscription to receive video, voice and data services. While they may include high-speed internet access as part of their package, video services are strictly segregated over a separate managed data network.

This model of television service, sometimes termed 'Telco TV', is similar to cable television, with the important distinction that it is delivered over the telephone line rather than a co-axial cable, which brings both advantages and disadvantages.

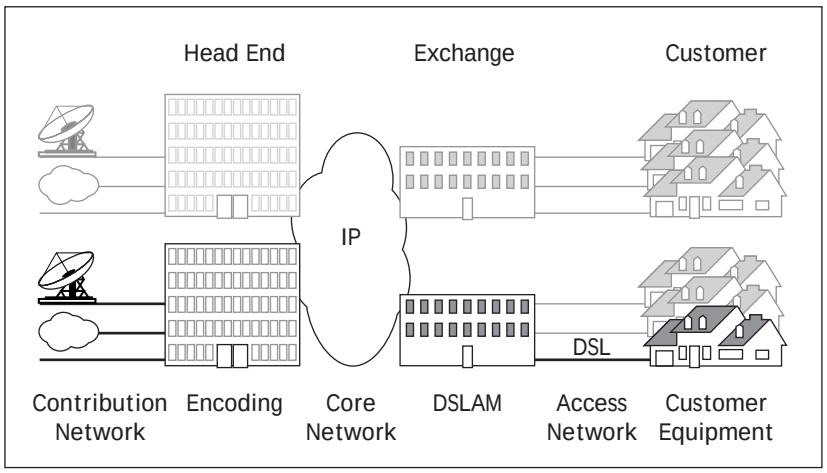
It may seem absurd to consider delivering television down a telephone line, but the distinction between a co-axial cable and twisted-pair phone connection is merely a difference in wiring. Although they have different properties, they are both capable of delivering digital data.

Sending a television signal down a copper cable that was not designed for the purpose may appear technically challenging, but then broadcasting it through the air or beaming it from a satellite in geostationary orbit above the earth are not without their technical achievements.

Cable television traditionally works by transmitting channels down a shared co-axial cable similar to a television aerial. The radio-frequency signals are amplified and distributed in much the same way. All the available channels are generally broadcast simultaneously and there is a limit to the number of channels or video-on-demand services that can be supported. In order to display a particular programme, the receiver tunes to a specific channel.

In a telco television system, the copper cable to the home is not capable of carrying all the available channels at once. Instead, only the channel or channels that are actually being viewed or recorded are sent over the wire to the home. There is no fixed limit on the number of channels that can be made available in the network. In order to receive a particular programme, the receiver sends a request to the network and receives a specific stream in response.

Broadband television distribution network



Overview of a basic DSL broadband television distribution network

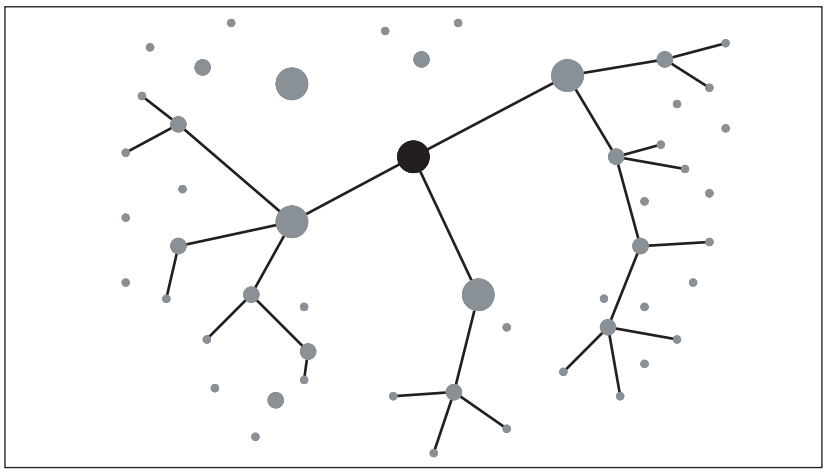
In other respects, a telco television system is very similar to a cable television network. Live television channels are received from multiple sources, either off-air from satellite or terrestrial broadcasts, or over direct contribution feeds, at one or more digital head ends, where they are compressed and encoded into digital data streams.

Multicast Within the core network that connects the head end to the local exchange, live television channels are carried as multicast streams. A multicast stream is sent to a multicast group internet address. Each packet in the stream is identified with this multicast destination address.

When a user selects a live channel, a request to join the group of viewers associated with the relevant multicast address is sent from the set-top box to the equipment in the local telephone exchange.

The protocol used to join a multicast group is called the Internet Group Management Protocol or IGMP. The switches in the network create a distribution tree to replicate the packets in the multicast stream to reach only those destinations associated with the multicast group. This means that a single instance of a multicast stream can be efficiently replicated and delivered to any number of devices on the network. The stream is only delivered to where it is needed at any given time, which makes more efficient use of the network.

Multicast distribution



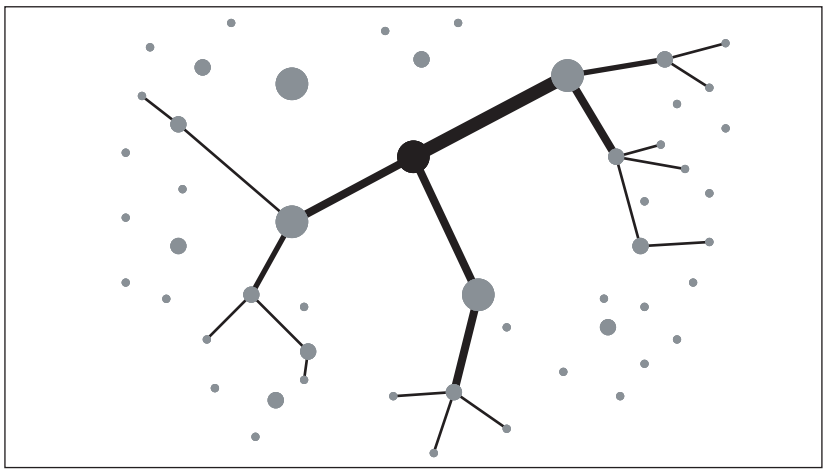
A multicast stream can be replicated and delivered to multiple devices

The number of multicast streams that can be made available at one time is limited only by the capacity of the core network. The total number of streams that can be offered is virtually unlimited.

Multicast services are possible in private networks, such as those of service providers or organisations that manage their own network infrastructure. It is not currently possible to support multicast services over the public internet. The main BT network in the United Kingdom is not currently multicast enabled. This may change as carriers move to next generation networks. In the mean time it is possible to emulate some of the characteristics of multicasting using certain peer-to-peer streaming systems. Generally, however, the public internet is inherently less reliable for live streaming than private networks.

Unicast In contrast to live television channels, a video-on-demand service is unique to each viewer and must be delivered as a unicast stream. A unicast stream is sent to a single internet address in response to a request from the receiver. Each packet in the stream is identified with this specific destination address.

Unicast distribution



When a user selects an on-demand service, a request is sent from the set-top box to a video server. The packets of the unicast stream are sent to the requesting destination in response. This can provide an individual video-on-demand service to each user. The user may be able to pause, rewind or advance through the stream.

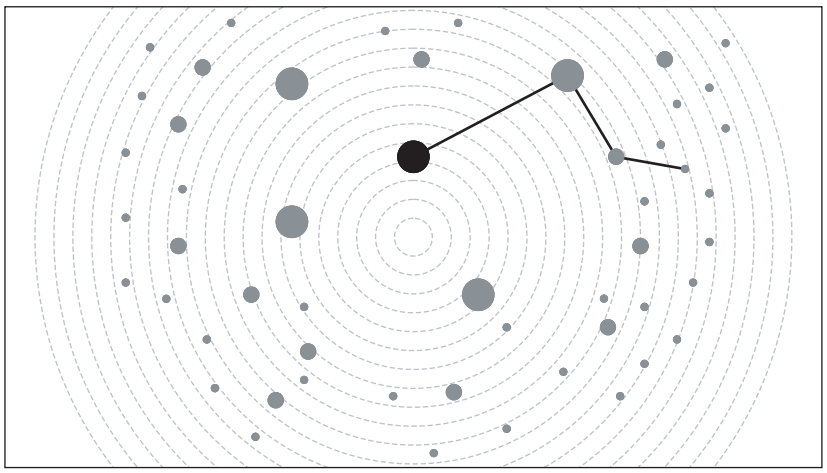
Each unicast stream requires additional capacity in the core network, placing additional demands on the serving infrastructure. The number of concurrent unicast streams that can be delivered is generally limited by the capacity of the network and the serving infrastructure.

There is effectively a unit cost associated with each concurrent unicast stream that is delivered. Unlike broadcasting, which has fixed transmission costs, each video-on-demand session represents a cost to the service provider.

Streams delivered over the public internet are typically unicast. This tends to limit the number of simultaneous streams that can be supported, although there are different approaches that can be used to support larger numbers of users for broadband video services.

Hybrid Conventional broadcast digital satellite, terrestrial and cable television transmissions can also be combined with video-on-demand and other services delivered over broadband to provide the best of both worlds.

Hybrid distribution



Broadcast channels are delivered over the broadcast network while the data network is used to deliver on-demand programming. This is a hybrid model.

The benefit of this approach is that it is not necessary to carry all the broadcast television channels in the data network and it does not require a multicast enabled network. In addition, it is not necessary for the service provider to obtain the specific rights to carry the broadcast channels over the data network. Existing services can be received through a satellite dish, traditional aerial or cable connection.

The disadvantage of this approach is that it is limited to the broadcast channels that can already be received on other platforms and it requires the user to have an additional satellite, aerial or cable input. Additional integration is also required to provide a consistent user interface across both the broadcast and broadband services.

The hybrid approach may be adopted by existing satellite, terrestrial or cable operators to offer additional video-on-demand services. It simply requires a broadband connection to the set-top box, which is already available in the case of digital cable services. The hybrid model may also be used by telecommunications operators or broadband service suppliers that wish to combine with existing free-to-air broadcast services or partner with a pay-television platform provider.

The BT Vision service in the United Kingdom is a hybrid service, combining access to the Freeview digital terrestrial television channels available through an aerial with video-on-demand services available over broadband.

DVR A personal digital video recorder or DVR includes a hard disk that can typically store around a hundred hours of programming locally. This allows the user to pause and rewind live television or to record programmes for later viewing.

A digital video recorder can be used with either broadcast or broadband distribution. The service provider will generally offer the digital video recorder as part of a subscription package, but it may also be available retail.

Although there is a cost involved in providing each customer with a set-top box including a digital video recorder, it reduces the burden on the network by distributing storage to local devices.

A service provider may also reserve part of the storage capacity to allow them to push popular programming to the device for possible later viewing.

An alternative model is a network based personal video recorder, where centrally managed storage is shared by a large number of users. Although there are some benefits to this approach, there is a question as how well it can scale to accommodate the demands of millions of users.

There may also be copyright issues with this approach, which may require permission from the programming providers and this may not be available for all programmes. However, this can allow users to catch up with programmes that they may have otherwise missed, with the benefit that they do not need to set a recording in advance.

Middleware The software used to integrate the many elements of a service is known as middleware. The term has broader meaning here than simply the operating software in the set-top box and generally extends to include the user interface and associated operational support systems and billing support systems which together make up the service platform.

An ecosystem of hardware and software providers and systems integrators has evolved to exploit the emerging market opportunity. A distinction can be drawn between those systems that are presented as a complete end-to-end solution and those that are integrated from best-of-breed components from separate suppliers. Various hardware and software providers may partner to provide pre-integrated systems.

Microsoft has been successful in signing up a large number of top-tier telcos to use its IPTV Edition software platform which provides a sophisticated user interface.

Other systems are available from companies such as Alcatel-Lucent and Siemens, as well as specialist independent companies like Orca and Kasenna.

Interface The Electronic Programme Guide or EPG provides a crucial user interface to the service and is a major distinguishing feature for the service provider. The speed and ease of use of the interface and even the design of the remote control are critical to the user experience. Providing intuitive navigation of the various live channels and on-demand services can be a considerable challenge. No matter how appealing the visual design may be, the success of a service depends to a large extent on how the various options are presented and whether the user is able to use them. Some services may rely on simple web-based interfaces that may be comparatively simple to develop but may be slow to use.

Programming The choice of channels and the range of video-on-demand services are equally critical to the success of a service. In order to compete with existing platforms, service providers must offer a sufficiently compelling programming proposition. Many markets may already have a strong line-up of free-to-air channels or dominant satellite or cable pay-television platforms.

Operators will typically try to tempt subscribers with premium programming, an approach that has been successfully employed by other pay-television platforms. However, acquiring exclusive sports rights and movie distribution deals can be a complex and expensive business. It is also

a business in which telecommunications companies may have limited experience compared to established operators.

Most telco television platforms will initially offer a walled garden service. Viewers can only access programming for which the service provider has previously negotiated a distribution deal with rights holders.

Marketing A key challenge for new entrants in the television and video market is developing a marketing proposition to provide the right product at the right price and communicate the benefits to consumers in order to attract subscribers.

Telecommunications companies and broadband service providers will be competing against established pay-television operators, using technology that for most consumers is untried and unfamiliar.

Television services need to be sold on the benefits and not on the delivery technology. Viewers do not really care whether television comes through a dish, a cable, a fibre or a telephone line. They care about programmes.

In order to compete effectively, new television services will have to provide not only the programmes with which viewers are already familiar, but programmes and services that are not available on other platforms.

Choice, convenience and control are key factors for the consumer. A wide choice of channels and premium programming are desirable, as are access to niche programming that is not easily available elsewhere. The ability to record or timeshift, remotely access or placeshift, and view video-on-demand are also important in providing convenience and control.

The most overwhelming consumer concern is cost. Viewers want cheaper television and the ability to break down bundles, buying just those channels they want to watch on an *à la carte* basis.

Irrespective of other new features, surveys have consistently shown that the main factor that will influence the decision of a consumer to switch their television service provider is price.

Strategies A detailed examination of different market entry strategies around the world suggests there is no common formula that can be applied to every territory.

Winning strategies need to be aligned to specific market conditions. In particular, they will depend upon the nature of the competition, including the range and quality of free-to-air television channels, the relative strength of existing pay-television operators and the level of multi-channel adoption. The consumer propensity to pay will also be dependent upon other local economic factors. The penetration and growth of the broadband market may also relate to the level of communications competition, dependent on the degree of market liberalisation and regulatory intervention.

The regulatory environment may also determine whether services are treated as cable franchises that may require licences or simply broadband services that do not.

While telecommunications operators are investing billions in next generation networks, many analysts remain somewhat sceptical about how successful they will be in signing up new subscribers for television and video services.

In many cases, the decision by telcos to enter the entertainment market and provide television and video services may be a defensive play to attract and maintain broadband subscribers in the face of falling revenues from fixed line voice services.

The vast majority of the population already has television and in many cases the pay-television market is already saturated and highly competitive.

The real consumer demand is currently for faster and cheaper broadband high-speed internet access. Television and video services may be an additional attraction, or simply a distraction.

PART

5

5 Broadband video

> *"Broadband fundamentally changes everything in terms of people's media consumption habits.[12]"*

Jean-Paul Edwards
Head of Media Futures, OMD Group

> *"Within a few years there will not be a meaningful distinction between delivery to the TV and the PC.[13]"*

Martin Goswami
Chief Executive, Aggregator

While telecommunications providers are rolling out their own subscription services, intent on reproducing a form of cable television, media companies and internet sites are successfully delivering broadband video services over existing networks.

Video material can be delivered over the public internet to a potentially global audience. This can include live streams, short clips, or even full-length programmes as high quality high-definition files.

This form of 'over the top' distribution is provided on a best-efforts basis, but with broadband access speeds rising, it is good enough for many purposes. Network providers may see this as programme distributors getting a free ride on their expensive infrastructure. End users may simply

see it as one of the benefits of the broadband services to which they have subscribed.

Telecommunications service providers and their suppliers are often at pains to point out that their IPTV service are very different from internet television or broadband video, although the reality is that technically they are very similar.

While video has been available on the web for many years, the rise of broadband has created an explosive growth in the use of online video.

Video sharing sites such as YouTube are an early example of this phenomenon, allowing users to upload video clips and publish them to a global audience.

Many people also use video sharing services to distribute and acquire full programmes off the internet. Episodes of most major series on American networks are available online shortly after transmission.

Much of this activity relates to the illicit distribution of copyright material. Studios and networks are anxious to prevent the large-scale piracy that affected the music industry. As a result they have been quick to offer legal options, either supported by advertising or on a retail basis. The apparent success of these services has prompted further experimentation and innovation.

Broadband video distribution represents a classic form of 'disruptive technology'.[14] Such innovations are often ignored by established market players since initially they may perform more poorly than incumbent technologies. In spite of that underperformance the innovation is embraced by some end-users who spot certain distinct benefits. As the number of users rises and the new technology improves, the incumbent technology, and those firms that cling to it, is progressively challenged.

In the United Kingdom, the BBC was one of the first broadcasters to recognise the potential for broadband distribution of its programming. Its initial experiments in digital downloads were largely responsible for opening up new rights windows for 'catch-up' services which allow users to

watch a programme online or on-demand up to a month after its first transmission.

The roll-out of a full service has been delayed pending approval from the governing body of the BBC. Meanwhile, satellite broadcaster BSkyB has launched a similar service and Channel Four has made the vast majority of its scheduled output available online. They will almost inevitably be followed by other major broadcasters in the United Kingdom.

The innovation in online distribution and business models is taking place at a faster pace than technical innovation and faster than the telecommunications companies can roll out their new networks and acquire subscribers to their television and video services.

However, the trends in the rise in processing power, availability and speed of networks and the falling cost of storage make it technologically inevitable that audio and video will become as easily managed, distributed and stored as text and graphics are today.

The public internet is currently unable to provide quality of service guarantees and does not generally support multicasting. This limits the ability to deliver high quality live video channels to large numbers of users.

As network capacity rises and the speed of access increases, the requirement for quality of service provisions may arguably diminish. It is possible to deliver live channels as unicast streams but it is not a particularly scalable proposition. Multicast streams are supported across the managed networks of certain broadband service providers or organisations and to a certain extent it is possible to emulate multicasting.

There is no real reason to presume that it will not be possible to deliver high quality live video to large numbers of users across the public internet in the future. After all, many users currently receive internet radio services.

In the meantime, it is perfectly possible to download recorded material as files rather than streams. Full broadcast quality and even high-definition programmes can be downloaded over the public internet. This does not

require quality of service mechanisms. The time taken for a download depends upon the size of the file and the speed of the network connection. Programmes can be downloaded as files slower or faster than real time. Currently it may take several hours to download a programme, but with faster network speeds that could be reduced to a matter of minutes. At this point it becomes much more of a practical proposition for the average consumer.

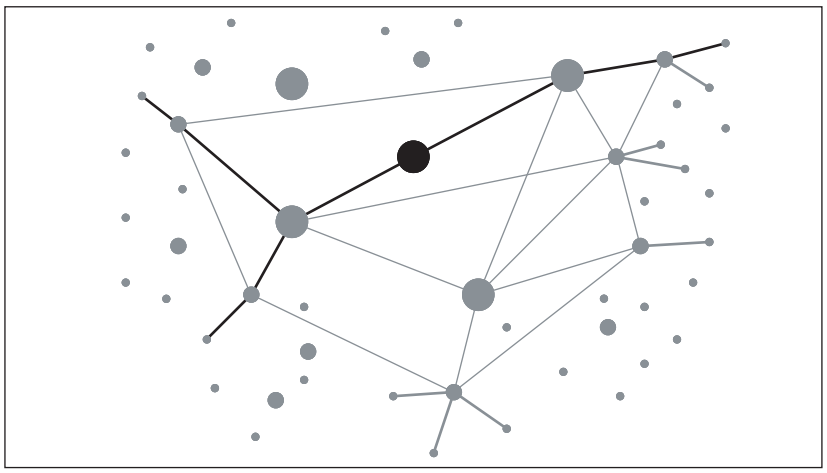
Just as it is currently possible to download and store thousands of music tracks to a portable device, so it will be the same for television programmes and movies. Consumers will be able to build up large libraries of video material on inexpensive local storage, far more in fact than they will probably have the time to view.

Compared to the fixed price economics of broadcasting, whereby it costs the same to transmit a channel irrespective of how many people are watching, there is a marginal cost in delivering video over the internet. Nevertheless, that cost continues to fall and it is already significantly cheaper than producing, distributing and displaying a physical product such as a DVD. The costs are such that rather than being broadcast it might actually be cheaper for some programmes that attract relatively small audiences to be distributed over broadband.

However, many broadcast programmes reach millions of simultaneous viewers. The main issue for broadcasters is how to achieve similar numbers online. Conventional server based streaming and download services do not scale well to handle millions of simultaneous users. The cost of the necessary infrastructure is prohibitive.

Peer-to-peer The cost of delivery can be considerably reduced by using peer-to-peer distribution. In this case, file downloads or even live streams are delivered across a network of users. Each node in the network acts as both a client and a server. This means that a user that has already received a file can serve part of it to another user. A user may therefore receive separate fragments of a file from several other users.

Peer-to-peer distribution



This spreads the load across the network and can enable distribution to a very large number of users. Very large files can be distributed efficiently to millions of users without placing an inordinate load on any single point in the network.

In order to support peer-to-peer distribution, a proportion of the users need to contribute their storage, processing and network resources in exchange for their participation.

This is the principle employed by the popular BitTorrent file sharing protocol that has been widely used to share illicit copies of television programmes and movies. There are tens of millions of users of software that employs the BitTorrent protocol and BitTorrent data constitutes a significant proportion of all internet traffic. The creators of the original open source BitTorrent software have founded a start-up company that has reached deals with major movie studios to provide a legitimate digital distribution platform.

BitTorrent is just one example of a peer-to-peer distribution system. A commercial software product from Kontiki, now owned by the online infrastructure company Verisign, has been used by the BBC and will form the basis of broadband download systems employed by most major broadcasters in the United Kingdom.

A similar peer-to-peer approach can even be applied to live streams. There are various software systems that are in use that can deliver streaming audio and video on a peer-to-peer basis.

The creators of the Skype internet based telephone system, which has millions of users worldwide, have been working with a team of software engineers on The Venice Project. This is an initiative to create a large-scale video distribution platform based on peer-to-peer technology. It aims to provide a new way of watching television on the internet.

The peer-to-peer model is seen by many experts as a way to provide the scalability necessary for large scale media distribution over digital networks. The internet is after all a form of peer-to-peer system. There is no single server or site that lies at the heart of the internet. Its power lies in its distributed nature, exploiting the network effects that mean its value rises with every connection.

Even the Google search engine is a massively parallel system, which ultimately relies on data distributed across millions of web servers.

Search While electronic programme guides have sufficed for current service provider offerings of a few hundred channels, new navigation paradigms will be necessary to find millions of programmes available across thousands of channels.

The role of search engines and aggregation sites will become increasingly important in allowing users to find video material. Some brands may have the strength to serve as primary portals, but in many cases users are likely to locate material using third-party services.

There are opportunities for intermediaries to aggregate the enormous amount of programming available and make the navigation, selection and delivery of relevant material a user-friendly experience for the consumer. The success of the Apple iTunes online store is a successful example of such a service.

Distribution Digital distribution offers the potential to reach a global audience that considerably exceeds that of existing broadcast networks.

There are already a quarter of a billion homes with broadband access, a figure that is likely to double in the next few years.

This opportunity is far greater than that provided by the operators of closed service provider networks, none of whom are likely to have more than a few million subscribers each in the foreseeable future.

It is therefore likely that rights holders will begin to see their primary opportunity to fulfil their distribution online, either directly or through other wholesalers and distributors. In many cases these are unlikely to be existing broadcasters or telecommunications companies.

Over time, digital delivery of audio and video could largely replace the distribution of physical product such as CDs and DVDs. The trend in the music market towards digital downloads provides an indication of how this market could develop.

Long-tail The long-tail distribution curve has long been recognised to reflect the relative popularity of items where there is an abundance of choice.

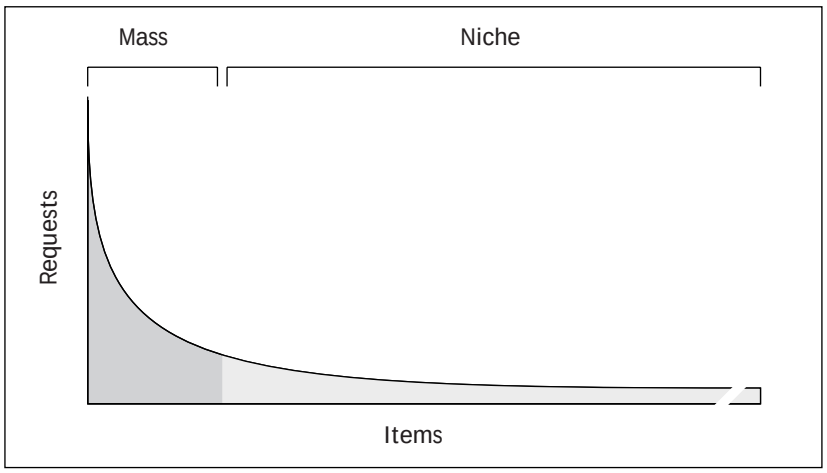
It describes a statistical distribution pattern dominated by a small number of very popular items or hits with mass appeal, with a much greater number of less popular items with niche appeal. The large number of niche items forms a long tail.

Such distributions are familiar in the publishing industry, where a handful of hits constitute the majority of profit.

In an online world, where shelf space is virtually unlimited, the long-tail extends almost indefinitely to the point where a large number of items may receive only a single request.

The term 'long tail' was first popularised in 2004 by Chris Anderson, the editor of *Wired* magazine,[15] and ironically he subsequently produced a best-selling business book on the subject.[16]

Long-tail distribution



The 'long tail' as popularised by Chris Anderson

The area under the curve of the long-tail distribution is such that while a service featuring the 10 most popular items might be desirable and commercially successful, a service capable of offering hundreds of thousands, if not millions, of less well-known items, will become even more valuable.

The success of Amazon.com is attributed to the fact that it is able to carry a far broader range of books than a conventional bookstore. Amazon has been able to turn the long tail into a highly successful market by exploiting the massive reach of the web and using it as a sales channel.

Those broadcasters and rights holders with large programming archives will similarly be able to exploit the long tail, opening their vast back catalogues to a global market. In fact, the on-demand distribution of niche material is likely to prove a far more efficient means of delivering programming than linear broadcasting to mass audiences.

Advertising While the traditional interruptive model of spot advertising on linear television channels seems to be threatened by audience fragmentation and advertising avoidance, online services can offer individually targeted relevant advertising messages that can potentially be personalised to the individual user. While these are also possible on service provider platforms, online services offer a global market in which it can be

cost effective to target very small niche audiences. The success of Google with simple textual advertising demonstrates the power of such a model which many will undoubtedly seek to apply to video advertising.

DRM Illicit distribution and piracy are concerns for many copyright holders in relation to online distribution. Digital Rights Management can be used to limit access to a specific instance of material to authorised users on certain devices, in some cases within particular time limits.

Digital rights management systems involve encrypting material and providing a licence key that can only unlock it under certain conditions that can be imposed by business rules associated with the licence. These may include particular time windows. For instance, a specific instance of material may be played three times within a 24 hour window after which it will expire.

Microsoft has built digital rights management into its widely distributed Windows Media Player platform and this has been used by many media companies to protect music, movies and television programmes distributed online.

No encryption system can be guaranteed to be completely secure, particularly if it is reliant on software. The Microsoft system has already been compromised. As a result, some companies were obliged to suspend their services while patches could be applied to update the software.

Hardware systems can offer a greater level of protection because they are based on sophisticated technology that may be more difficult to circumvent.

The fact remains that if a sound can be heard or an image can be seen it can be copied, albeit perhaps at a reduced quality. The media industry has survived for many years without digital rights management, which is a technological solution to a social and a business problem.

Much of the material that rights holders are anxious to protect through complex digital rights management regimes has already been broadcast free-to-air without any encryption. Many of the apparent issues with the

copyright of material are actually symptomatic of business models that have not yet adapted to digital distribution. While there is an obvious need to protect commercial revenues and the rights of artists, restricting digital distribution disregards the considerable benefits of being able to maximise the audience.

The distinction needs to be drawn between illicit distribution of copyright material to those that have a real interest in its content, fair use copying by those that have already legitimately acquired material, and commercial piracy. These are matters that ultimately need to be addressed through existing and new legislation and civil and criminal sanctions.

Watermarking A complementary approach to the issue of copying digital media is to apply an invisible watermark or fingerprint to allow the forensic detection of the source of a copy. Such systems are robust to recompression and other manipulation, allowing the source of a copy to be determined even from a low-quality reproduction.

Another approach can simply be to brand material with a visible watermark or ident such that the originating source is obvious, limiting the potential for commercial use.

Format Much of the broadband video material that is currently available online is currently destined to be displayed on a personal computer screen, simply because that is the device that is connected to the internet.

For this reason the most popular video streaming and file formats tend to be those associated with the world of the computer rather from broadcasting.

The Microsoft Windows Media format has become almost a *de facto* standard for distributing video material that requires digital rights management. The limitation is that it is restricted to the Microsoft Windows computer platform and certain compatible devices.

The Flash format has become increasingly popular as a cross-platform solution for video streaming. The video compression and quality is not the

best available and there is currently no secure digital rights management. Nevertheless, it is a user-friendly format for online services.

In time, it is possible that open standard formats, such as MPEG-4, will become more popular for online video distribution, but this will require better support on computer platforms and possibly an acceptable open digital rights management regime.

Devices There are a number of devices such as media centres and media extenders as well as games consoles that will connect the broadband network from the telephone line to the television to display material on the main screen in the living room. There will also be a range of set-top boxes and other multifunction consumer electronics products that will be sold retail to address this requirement. These are already available in the form of set-top boxes from companies like TiVo and Akimbo. Apple has announced such a device which could possibly do for the television what the iPod did for the personal music player.

Portable media players are likely to become increasingly popular as it becomes easier to transfer video material to such products. It is already possible to store up to a hundred hours of material on some of these devices, although playback is still limited by battery life.

Meanwhile, products such as the Sling Media Slingbox enable users to redirect or 'placeshift' audio and video services from their home back over their broadband connection to a remote computer or mobile phone. Such restrictions remove restrictions of geographic territory. Early adopters of such dedicated devices will be the first to benefit, but ultimately this could become a standard feature of broadband video services.

Opportunity The opportunity to exploit broadband video is extraordinary and is likely to transform the broadcasting and movie distribution industry in much the same way that online services created an explosion in publishing. Yet books and newspapers continue to exist although some forms have become virtually obsolete. The risk for broadcasters and media companies is to ignore the threats and opportunities that lie at their gate.

PART

6

6 Implications

The delivery of television and other audio and video services over broadband data networks is the next step in the transition to digital distribution and presents profound threats and opportunities for existing players in the media and communications market.

The next generation of television and video services will continue to see a move from the characteristics of analogue media to those that define the digital era. The technology of digital distribution will inevitably affect media production and consumption.

The first digital television revolution was mainly a conversion from analogue to digital acquisition, recording, transmission and reproduction. It provided more channels, more choice and better sound and pictures, but it did not fundamentally change the form and function of broadcast television.

The network television revolution involves the convergence of communications networks and a divergence of devices that will significantly change patterns of media production, distribution and consumption. It will result in a shift of power from broadcasters and platform operators, who once controlled the means of television distribution, to producers and consumers.

Major trends from analogue to digital

Analogue era	Digital era
Film, tape	Data streams, files
Signals	Packets
Scheduled	On-demand
Push	Pull
Channels	Programmes, clips
Schedule	Search
Closed networks	Open networks

The ‘push’ of broadcast television will give way to the ‘pull’ of online services, as viewers increasingly watch whatever they want, whenever they want, wherever they are.

The often repeated marketing mantra is to provide anything, anytime, anywhere, on any device. This is the logical extension of the trends towards more media choice and the ability of consumers to access, store and replay programming on their own terms. Actually delivering on such a promise remains a considerable challenge.

It is not only a technical challenge but also a business challenge in terms of traditional rights models that have historically been defined in temporal windows, geographic territories and particular platforms.

Telcos

There are over a billion televisions and fixed phone lines in the world but there are currently only a few million homes that receive television over their telephone line. There are some ambitious forecasts. BT Vision hopes to gain two to three million subscribers in Britain. Worldwide, even the most optimistic analysts only expect around 60 million subscribers by the end of the decade. It is therefore important to keep a sense of perspective. Telecommunications companies nevertheless have considerable revenues and market capitalisations, with a significant subscriber base that they can exploit.

Most deployments by telecommunications providers to date have largely reflected a traditional conception of television based on a range of existing

channels together with some premium programming and video-on-demand services. This is a conventional cable television business model, which is not surprising as existing pay-television platforms are the perceived competition.

Video-on-demand is seen by some as the killer application, but the experience of cable operators has shown relatively modest take-up of premium services, particularly movies. Among the most popular services are those that provide the ability to catch up on previously broadcast programmes or view any episode from a series. Although the costs of providing video-on-demand services continue to fall, it may simply not be cost effective to provide the majority of programming to millions of viewers in this way.

Traditional telecommunications providers do not necessarily have experience in offering entertainment services, or in packaging and promoting them. They will be competing directly with other platform operators that have considerable experience in this field.

Broadcast

The traditional model of broadcast television is already under threat. The advertiser-funded base is being eroded by the proliferation of channels and the fragmentation of audiences, and further exposed by advertising avoidance as a result of digital video recording.

As anyone with a digital video recorder will recognise, it changes the way you view television. Watching mixed-genre channels of scheduled shows, often interrupted by advertising, will be gradually replaced by more selectively viewing particular programmes.

As television viewing becomes more asynchronous, the linear channel schedule will be less important than the programmes themselves. As a result there will be less of an affinity with or allegiance to particular channels. They simply become sources of programming and will be more reliant on their brands for differentiation.

The communal experience of watching the same programme at the same time as other viewers will not entirely disappear. Television will continue to provide a set of shared cultural references and a topic of conversation.

Live television will still attract an audience, particularly for news, sport, events and national occasions. Television channels will increasingly appeal to this live dimension, creating events providing exclusive coverage and exploiting formats that encourage real-time viewing and audience participation.

Pre-recorded programming will be viewable by many means. Television channels will remain a reliable method for distributing programmes to a mass audience, but viewers will increasingly turn to programmes that are more relevant to their individual interests. They will tend to store them to watch at a time of their choosing, stream them on-demand or download them for later viewing.

As viewers become more discerning and demanding, television will have to compete with other forms of video viewing and other activities.

Major broadcasters, channels and programme makers with strong identities will be able to transfer their brand equity into this new environment. Those most at risk are the mixed-genre channels that in the spectrum-scarce world of analogue broadcasting sought to provide something for everyone and deliver a mass audience for advertisers. With a proliferation of channels and programmes, the licence or franchise to deliver a single channel of mixed programming will have diminishing value.

Broadcasters will increasingly need to become publishers and distributors in other digital media and develop a more direct transactional relationship with consumers. For many, this will require a new emphasis on customer service, technical support and customer relationship management.

Broadband

Meanwhile, broadband is booming. The availability of services and the speed of access continue to rise. Within a few years we might expect to

see half a billion broadband homes. This represents a significant addressable market for global broadband video distribution.

The choice of viewing will move from a few hundred channels to thousands of live streams and hundreds of thousands of archive programmes. Many of these programmes may be available directly from producers, distributors or aggregators and may not even reach traditional broadcast television channels.

While service providers will aim to operate closed networks, there will be a wealth of material available on the open market. Initially this will be available from individual services, but ultimately there will be global aggregation and syndication of programming and new networks will emerge based on broadband distribution.

Opportunities

This presents enormous opportunities for rights holders and programme producers to reach consumers directly, putting them in a more powerful negotiating position and ultimately enabling them to bypass broadcasters entirely.

With the ability to reach diffuse audiences anywhere in the world, the real potential for producers and distributors may lie in their back catalogues and the long tail of niche programming. For many, this may present almost intractable rights problems. Those best positioned to exploit this prospect will retain the global rights to distribute their material across any platform.

For companies that currently distribute material on DVDs, network delivery will become a viable alternative to the provision of packaged product, either on a rental or retail basis.

For public broadcasters it becomes possible to make material freely available, rights permitting, to a wider audience, as well as being available for sale.

For advertisers there is the ability to target individuals accurately with relevant messages, combining the power of television with the accountability of online advertising.

Many leading broadcasters around the world are urgently experimenting with the new distribution opportunities. These range from gaining carriage deals with telecommunications groups for their new services to pursuing a range of online streaming and download options on their own web sites or in conjunction with aggregators.

The result is currently chaotic. There is a confusion of formats, technologies and business models. What is clear is that there appears to be a consumer demand for broadband video. However, consumers are unlikely to embrace a world in which each programme involves different technology and usage rights.

Ironically, many of the complex digital rights models currently being proposed are actually more restrictive than being able to tape a programme off the television, keep it on the shelf or lend it to a friend.

Outcome

In the near term, internet protocol television over service provider networks will become a fourth distribution platform after satellite, terrestrial and cable television. Broadband video streams and downloads will become complementary to broadcast television. Both forms will displace, but not replace, traditional television.

In the longer term, distribution of digital video over broadband networks could ultimately become the norm. Data access will be seen as a utility. Service providers will no longer be defined by their technology of delivery and will compete on quality of service, user experience, customer care and price.

The value network for media and communications will become increasingly complex and dynamic, and any organisation involved in or dependent on these areas will need to evolve a strategy in response.

In order to survive and thrive in this world, traditional television channels will need to become media brands and publishers. In many cases they will be competing with producers and distributors that will be able to reach viewers directly. Advertisers will also be able to engage directly with consumers and offer relevant communications. New networks will emerge to enable global distribution. Consumers will be closer to the promise of being able to access any programme, anytime, anywhere, on any device.

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Glossary

Key acronyms and abbreviations relating to broadband television and video.

ADSL **Asymmetric Digital Subscriber Line**
Standards that provide a broadband digital data connection over a telephone line. Later versions providing higher speeds include ADSL2 and ADSL2+. *See* DSL, VDSL.

ATM **Asynchronous Transfer Mode**
Digital signal protocol for the transport of data over a broadband data network, based on fixed-length packets.

ATSC **Advanced Television Systems Committee**
Body that developed an advanced television system standard adopted primarily in North America as a digital replacement for the analogue NTSC standard created by the National Television Standards Committee.

AVC **Advanced Video Coding**
Digital video compression scheme forming the International Telecommunication Union ITU-T H.264 and the International Standards Organisation ISO/IEC MPEG-4 Part 10 standard, known as H.264/MPEG-4 AVC. *See* MPEG.

CD **Compact Disc**
Optical disc format used to store digital data, originally developed for storing digital audio.

CLEC **Competitive Local Exchange Carrier**
Telephone company in the US that competes with other established carriers, generally the incumbent. *See* ILEC, LEC, RBOC.

DBS **Direct Broadcast Satellite**
Satellite television system that broadcasts directly to the home, received through a small satellite dish, as opposed to a larger dish antenna. *See* DTH.

DOCSIS **Data Over Cable Systems Interface Specifications**
Standard for a cable modem used to deliver broadband data over cable television system networks, originally developed by CableLabs in the US and subsequently standardised internationally.

DSL **Digital Subscriber Line**
Generic term for a telephone line that provides broadband digital data connection over a telephone line. *See* ADSL, VDSL.

DSLAM **Digital Subscriber Line Access Multiplexer**
Device located at a telephone exchange that provides a digital subscriber line service, separating the voice and data components and aggregating data connections to a high-speed network.

DTH **Direct-To-Home**
Satellite television system that broadcasts directly to the home, sometimes used in distinction to similar channels that may be received through a cable television system. *See* DBS.

DTT **Digital Terrestrial Television**
Digital broadcasting system used to transmit television from terrestrial transmission towers to a conventional aerial. The digital terrestrial television standard used in the UK and many other countries is known as DVB-T. The system used in the US is known as ATSC. *See* ATSC, DVB.

DVB **Digital Video Broadcasting**
Industry-led consortium responsible for open standards for the delivery of digital television. The main digital transmission standards include DVB-S for satellite, DVB-C for cable, DVB-T for terrestrial broadcasting, and DVB-H for handheld devices The equivalent body in the US is the ATSC. *See* ATSC.

DVD **Digital Versatile Disc**
Optical disc format used to store digital data in MPEG-2 format, originally developed for storing digital video, providing greater storage than a compact disc. *See* CD, MPEG.

DVR **Digital Video Recorder**
Consumer electronics device allowing television programmes and other audio and video material to be stored on a hard disk in digital format. Also known as a personal video recorder. *See* PVR.

EPG **Electronic Programme Guide**
User interface providing on-screen access to channel listings, programme information, or pay-per-view events. Also known as an interactive programme guide. *See* IPG.

ETSI **European Telecommunications Standards Institute**
European standardis organisation for information and communication technologies.

FTTx **Fibre-to-the-node/curb/home/premises/user**
Generic term for a high-speed fibre-optic data connection to the neighbourhood, road, home, premises or user.

HFC **Hybrid Fibre Co-ax**
System providing a shared network based on a combination of fibre-optic links to local hubs and co-axial cables connected to customers, used to provide analogue or digital cable television and to provide broadband data services.

HTML **HyperText Markup Language**
Standard markup language for web pages and other information viewable in a browser, which together with HTTP and URI standards forms the basis of the world wide web. *See* HTTP, URI, WWW.

HTTP **HyperText Transfer Protocol**
Standard providing request-response transmission of data, based on internet protocols, initially developed to provide access to information on the world wide web. *See* IP, WWW.

IEEE **Institute of Electrical and Electronics Engineers**
International non-profit, professional technical organisation, that publishes standards (often pronounced 'eye-triple-ee').

IETF **Internet Engineering Task Force**
Open, volunteer organization, with no formal membership, charged with developing and promoting internet standards.

IGMP **Internet Group Management Protocol**
Standard used to establish the membership of multicast groups, used for changing channels in an internet protocol television system. *See* IPTV.

ILEC **Incumbent Local Exchange Carrier**
Local telephone company in the US that was in existence at the time of the breakup of AT&T in 1984. *See* CLEC, LEC, RBOC.

IP **Internet Protocol**
Standard for communicating data in packets over a digital network, providing the basis of the internet and many office and home local area networks, often in conjunction with other protocols such as TCP and UDP which form the internet protocol suite. *See* LAN, TCP, UDP.

IPTV **Internet Protocol Television**
Delivery of digital television and other audio and video services over broadband data networks using the same basic protocols that support the internet. *See* IP.

IPG **Interactive Programme Guide**
User interface providing on-screen access to channel listings, programme information, or pay-per-view events. Also known as an electronic programme guide. *See* EPG.

ISO **International Organisation for Standardisation**
Global federation of national standards bodies that publishes international standards.

ITU **International Telecommunication Union**
International organisation established to standardise and regulate international radio and telecommunications that publishes international standards, known as Recommendations.

LAN **Local Area Network**
Computer network covering a local area, such as an office or home, which may use many protocols, including IP. *See* IP

LEC **Local Exchange Carrier**
Local telephone company in the US, as opposed to a long-distance carrier, often distinguished into Incumbent Local Exchange Carrier and Competitive Local Exchange Carrier. *See* CLEC, ILEC, RBOC.

MPEG **Moving Picture Experts Group**
International standards for encoding and compression of audio and video, including MPEG-1, MPEG-2, and more recently MPEG-4, also known as AVC. *See* AVC.

MHP **Multimedia Home Platform**
Standard for an open middleware system for interactive television and similar services, developed by the DVB project, which also provides the basis for OCAP. *See* DVB, OCAP.

MP3 **MPEG audio layer 3**
Standard for encoding and compression of audio. Also used to refer to files of audio recordings in this format. *See* MPEG.

MUX **Multiplex**
Combining several data streams or signals for transmission on a shared communications channel. Also used in digital terrestrial television to refer to a group of channels sharing a single transmission channel. *See* DTT.

NVOD **Near Video-On-Demand**
Broadcast of the same material on more than one channel with staggered start times to allow the user to join a programme at a convenient time. Used as an alternative to true video-on-demand. *See* VOD.

OCAP **OpenCable Applications Platform**
Standard for an open middleware system for interactive television and similar services, developed by CableLabs in the US, specifically for use in the cable environment, based on the DVB MHP. *See* DVB, MHP.

Pay-TV **Pay-Television**
Subscription television service for which customers periodically pay a fee, as opposed to a free-to-air service.

PPV **Pay-Per-View**
Service which requires a one-off payment in order to view a particular programme or movie.

PVR **Personal Video Recorder**
Consumer electronics device that allows television programmes and other audio and video material to be stored on a hard disk in digital format. Also known as a digital video recorder. *See* DVR.

QAM **Quadrature Amplitude Modulation**
Method of carrying data on a carrier wave by modulating the amplitude of two waves that are out of phase with each other by 90º, known as quadrature carriers. Used to transmit analogue or digital signals.

QOS **Quality Of Service**
Requirement to provide guarantees around the reliability of delivering data, as opposed to best effort delivery which may result in data packets being lost, delayed, arriving out of sequence, or being corrupted, causing unpredictable delays.

RBOC **Regional Bell Operating Company**
Regional telephone company created in the US as a result of the break-up of the AT&T Bell System in 1984, sometimes referred to as a 'Baby Bell'. *See* CLEC, ILEC, LEC.

RTP **Real-time Transport Protocol**
Standard for the delivery of audio and video over an internet protocol network, based on the User Datagram Protocol, used in streaming media and voice over IP applications. *See* IP, UDP, VoIP.

RTSP **Real Time Streaming Protocol**
Standard which allows a client to control playback functions in streaming media systems on an internet protocol network, often used in conjunction with RTP. *See* IP, RTP.

SIP **Session Initiation Protocol**
Standard for managing an interactive voice or video communication session in an internet protocol network, typically used conjunction with Real-time Transport Protocol for voice over IP services. *See* IP, RTP, VoIP.

SMTPE **Society of Motion Picture and Television Engineers**
International professional association, based in the US, representing engineers working in the motion imaging industries, that publishes technical standards (often pronounced 'simptee').

STB **Set-Top Box**
Device that receives, decodes and decompresses digital data and provides audio and video signals for connection to a display in the home, typically operated by an infra-red remote control. May include a digital video recorder. *See* DVR.

TCP **Transmission Control Protocol**
Standard used in the internet protocol suite that allows connections to be created to allow the reliable delivery of data over an internet protocol network. *See* IP.

UDP **User Datagram Protocol**
Standard used in the internet protocol suite that allows efficient delivery of data that may be time-sensitive, without providing any guarantees for delivery, often used for streaming media services in an internet protocol network. *See* IP.

URI **Uniform Resource Identifier**
Identifier consisting of a string of characters that provide a name or address that can be used to refer to a resource. A Uniform Resource Locator is a form of URI. *See* URL, WWW.

URL **Uniform Resource Locator**
Form of Uniform Resource Identifier that identifies a resource and how to locate it, often used to identify pages on the world wide web. *See* URI, WWW.

VC-1 **Video Codec 1**
Digital video compression scheme proposed as a Society of Motion Picture and Television Engineers standard, based on Microsoft Windows Media Video version 9, often characterised as an alternative to the H.264/MPEG-4 AVC standard. *See* AVC, SMPTE.

VDSL **Very high bit-rate DSL**
Standards that provide a high speed broadband digital data connection over a telephone line. The later VDSL standard offers speeds of up to 100Mbps. *See* DSL.

VOD **Video-On-Demand**
Service that allows the user to select from a range of programming stored on a remote server and enables user control of the selected stream in a similar manner to a video recorder, including pause and rewind. *See* NVOD.

VoIP **Voice over Internet Protocol**
Service that allows voice conversations to be routed over an internet protocol network and may enable calls to originate from or terminate on the public switched telephone network, often using Session Initiation Protocol. *See* IP, SIP.

W3C **World Wide Web Consortium**
International consortium that develops standards for the World Wide Web. *See* WWW.

WiFi **Wireless Fidelity**
Standards for wireless local area networks based on IEEE 802.11 specifications, using unlicensed radio spectrum in most countries.

WiMAX **Worldwide Interoperability for Microwave Access**
Standards for wireless local area networks based on IEEE 802.16 specifications, offering higher speeds and longer range.

WWW **World Wide Web**
Information space in which the items of interest, or resources, are identified by global identifiers called Uniform Resource Identifiers. The web is often mistakenly used as a synonym for the internet, but is a service that operates over the internet using internet protocols. *See* HTTP, HTML, IP, URI.

XML **eXtensible Markup Language**
Standard for a general-purpose markup language that can be used to create special-purpose markup schemes, capable of describing different types of data, allowing information and documents to be shared and facilitating communication between different digital systems.