This is an electronic version of the Elsevier-published article:
S. Papagiannidis;J. Berry;F. Li. Well beyond streaming video: IP6 and the next generation television. ***Technological Forecasting and Social Change*** **2006, 73(5), 510-523.**
doi:10.1016/j.techfore.2005.06.003

Well beyond streaming video: IPv6 and the next generation television

Abstract

The Internet has provided a plethora of commercial opportunities, the majority of them arising from advances in software and networking. As the technology evolves in an ever increasing pace, new opportunities are bound to be created. This paper examines how one of these technologies, the 6^{th} version of the Internet Protocol, may affect the Internet and the opportunities associated with it, by looking at one specific emerging application: Internet Television (IPTv). In particular, the paper examines the possible impact and implications of multicasting on television broadcasts. Television and cable broadcasters have looked for ways to exploit the potential of narrowcast for a long time, but conventional narrowcast business models have been hampered by the geographic and technological limitations in reaching audiences big enough to be economically viable. The Internet, however, is naturally disposed toward one-to-one communications and high levels of interactivity thus providing a significant platform from which to broadcast.

The television industry has been selected in order to highlight that emerging Internet technologies can significantly affect well-established industries and markets and create new opportunities when carefully exploited. More specifically by reducing entry barriers it can allow SMEs to enter markets that traditionally required large investments. The paper discusses the implications for policy makers and regulatory bodies, entrepreneurs wishing to start new channels, established television broadcasters and finally the viewers themselves.

Keywords: Internet Protocol version 6, Internet Television, Next Generation Internet, Emerging technologies

Introduction

Networks such as the telephone system depend on a central infrastructure to support inexpensive terminals, a clearly preferable topology from an economic point of view. In the case of the Internet this is inverted: users have expensive, intelligent, terminals with the central network forwarding data from one terminal to another using the Internet Protocol (IP). "Because of the resulting intelligence users at the periphery are empowered to create new applications without any network functionality or intelligence to act as a roadblock. … It might have cost more, but everyone benefited enormously from the massive innovation". [1]

The success of the Internet Protocol was key to the success of the Internet as a network, as it was reliable and scalable enough to allow for growth but also flexible enough to encourage innovation.

This paper discusses the current status of the Internet Protocol (version 4) before considering the potential implications of the transition to the Protocol's sixth version. The paper then continues by examining the business implications of the transition with a particular focus on innovation and opportunity generation. The paper then presents the case of one such opportunity: television broadcast using the Internet Protocol (IPTv). The discussion of IPTv assumes the Internet as the transmission platform, although IPTv could also be broadcast over private networks.

The television industry had been selected in order to highlight that emerging Internet technologies can significantly affect well-established industries and markets and create new opportunities, when carefully exploited. More specifically, by reducing entry barriers, the Internet can allow SMEs to enter a market that traditionally requires significant investments. The paper concludes by discussing the implications for policy makers and regulatory bodies, entrepreneurs wishing to start new channels, established television broadcasters and finally the viewers themselves.

Internet Protocol (IP)

In the 1960s the Advanced Research Projects Agency of the Department of Defence in the United States established the famous Arpanet as a response to the launch of the first artificial satellite by the Soviet Union. Since then, the aim of the network, to create a ‘network of networks’, has not changed. What has changed is the focus of the applications using the network’s connectivity; from being an academic and government tool, the vast majority of Internet users are now personal and commercial.

The Internet as it is known today is based on the Internet Protocol (IP); more specifically on its 4^{th} version. IP has been proven to be significantly reliable, as it managed to cope with the ever increasing demand. Still, the growth of the Internet and increasing demands for online applications brought IPv4 to its limits. As a result, action had to be taken, not only to address the approaching limitations of IPv4, but also the extent of its functionality. The end product was IPv6 (the data packet header version 5 was already given to the Internet Streaming Protocol).

In contrast with IPv4, which uses a 32-bit address space (about 4 billion addresses), IPv6 employs a 128-bit address space, resulting in 3.4×10^{38} addresses. This vast address space allows assigning of 10^{23} addresses to every square meter of our planet! This should be enough to cope with the demand posed by devices seeking Internet connectivity (e.g. computers, PDAs, mobile phones, etc) for the foreseeable future. IPv6 uses logical groups to index addresses, greatly simplifying the delivery of data packets. Auto-configuration is another important feature of IPv6 as it allows devices to connect to the network in a “plug-and-ping” (ping: a protocol that sends a message to another computer and waits for an acknowledgement; often used to ensure that communication can be established between the two computers; c.f. plug-and-play) manner, reducing administration overheads. Auto-configuration becomes even more important when one considers the mobility of many of the Internet-connected devices (e.g. mobile phones), which they may need to be reconfigured every time they join a different network segment.

In IPv6 the use of security, based on the IP Security Protocol (IPSec) is mandatory. IPSec’s powerful encryption provides message integrity. It can ensure accurate authentication (i.e. that packets really originated at the site specified) and non-repudiation, preventing senders from later claiming they did not send the packet. This built-in security makes conducting transactions over the Internet safer than ever, reinforcing the trust and confidence that are required in a networked environment [2].

IPv6 provides full Quality of Service information (QoS), which is essential when dealing with data that has to be delivered in a timely manner, for example for real-time multimedia applications.

Finally, IPv6 adds ‘anycast’ to the existing types of available communication, i.e. unicast, broadcast and multicast. A packet sent to an anycast address is delivered to the closest node. If the closest node is unavailable, then the packet is delivered to the next closest node and so on. ‘Unicast’ is a one-to-one type of communication (e.g. delivery of a web page or video-on-demand), while ‘multicast’ is a one-to-many (i.e. the same data is sent once by the source and delivered to multiple destinations). 1/256 of the available IPv6 addresses are multicast addresses. Many applications use multicast: for example it can be used to update copies of replicated files or databases, send voice, video or data packets to all members of a computer-mediated conference or disseminate intermediate results to all participants in a distributed computation [3].

Multicast is very important for multimedia transmissions. Sending the content once reduces the workload of the server and the bandwidth required, thus reducing operational costs.

The transition to IPv6

The Internet Architecture Board designed IPv6 "to enable high performance, scalable Internetworks that should operate as needed for decades" [4], i.e. they designed a protocol not only to address many of the issues raised by the use of IPv4 in the last 20 years, but also to add extra functionality, creating new networking opportunities. Although, initiatives to promote and test IPv6 exist, for example 6bone.net (http://6bone.net), large scale deployments, like China's CERNET2, are the exception and not the rule. Among the reasons given for not moving towards the new protocol Carpenter [5] mentions "the operational cost of conversion, operational conservatism, the lack of strategic incentives in a fundamentally short-term industry and the cost of not converting which is spread too thinly and is not understood properly by decision makers".

It should be noted, in relation to the migration from IPv4 to IPv6, that the Department of Defence of the United States [6] announced in December 2003 one of the first large scale deployments of IPv6. They introduced the Internet, and with the adoption of IPv6 they will help it evolve to the next level. A year later (December 2004) CERNET2 became operational in an effort by the Chinese to become leaders of the next-generation Internet [7]. Such projects could boost competition and speed up the transition to IPv6.

Potential impact of IPv6: reliability and scalability

"Given the remarkable growth of the Internet, and business opportunity represented by the Internet, IPv6 is of major interest to business interests, enterprise Internetworks, and the global Internet as it presents all networking interests with an opportunity for global improvements, which is now receiving the collective action that is needed to realize the benefits." [4].

These opportunities are not the outcome of the information asymmetries related to the network itself (as the protocol is a public standard), but the outcome of the potential applications that the entrepreneurs in each market may envisage. An interesting question is whether knowledge that market opportunities may exist due to the next generation Internet will "create" entrepreneurs or whether entrepreneurial intention will have to first be formed, before the search for and ultimate discovery of opportunity will begin [8], which would imply that IPv6 will have to be first fully deployed before entrepreneurs start looking for opportunities. Either way, if opportunities are aspects of the environment that represent potentialities for profit making [9], then the next generation Internet could be regarded as an "opportunity tank".

It can be argued that the opportunities, especially cost-related, that the next generation Internet will provide to SMEs are of greater relative importance than the opportunities to larger organisations. For example, the World Wide Web allows even the smallest businesses to establish a web site and market their products on a global scale, reducing time to market and overheads to a minimum. This would have been impossible without the Internet. A large organisation though, with enough resources, could have launched a global marketing campaign and still fulfil their goals.

Guaranteeing the smooth operation, scalability and performance of the Internet is key to SMEs (and all other businesses with online arms of course!). IPv6 will help achieve these goals. IPv6 can provide the reliability, scalability and continuity of a network that has delivered significant benefits to SMEs [10, 11]:

- Product promotion, through direct and indirect advertising.
- New sales channel: online sales, international markets.
- Direct savings: lower costs in communication with customers and suppliers, increased productivity.
- Time to market: immediate distribution.
- Customer service
- Brand image
- Technological and organisational learning: obtain know-how through discussions with other on the Internet.
- Customer relations
- New business models: create new business opportunities, competitor's performance benchmarking, effectiveness of information gathering, better service and support from suppliers, etc.

The above benefits affect almost all aspect of an organisation and could be summarised by Mustaffa and Beaumont's [11] conclusion while discussing the effect of electronic commerce on small Australian enterprises: "it is true that e-commerce will change business procedures: e-commerce can abolish geographic and time barriers to business; can accelerate business processes; facilitate changes in supply chain arrangements (accentuating competition and/or creating co-operation); improve communication with customers, suppliers and employees; create new promotional mechanisms and help create customer histories”.

If these benefits were to be threatened by a network that could not cope with demand, then SMEs would find themselves in a very difficult situation, not only because their operations and processes would be threatened, but also because customers have much higher expectations since the introduction of the Internet..

“The Internet allowed companies to create value through one-to-one marketing, it allowed cost-effective integration of electronic trading into a company's core business and thirdly sellers to learn about their best customers, one customer at a time, and provide customized service.” [12] As a result, changes in the Internet Protocol may trigger changes in how companies create value. Although marketing and communicating with customers is not directly related to IPv6 (but with the applications that run ‘on top’ of it) IPv6 can be proved to be a cost-effective solution not only for electronic trading as Biswas and Krishan [12] mention, but for a number of other functions as well. One case, that of Internet Television, is presented below, after a more detailed discussion of the implications of two of the main IPv6 improvements, the large address space and the built-in security.

Address space

On 3rd July 1969, the University of California at Los Angeles (UCLA) issued a press release announcing that UCLA was to become the first station in a nationwide computer network [13]. That network was ARPANET, the first step towards the Internet. At the end of the statement Leonard Kleinrock (he created the basic principles of packet switching, the technology underpinning the Internet) was predicting that there would soon be a day when computers would become more sophisticated and that “computer utilities, which, like present electric and telephone utilities, will service individual homes and offices across the country” [13]. 35 years later Kleinrock [14] believes that his prediction that “Internet technologies will be everywhere” has been fulfilled. Of course, this holds true mainly for computer-like devices or mobile phones, but not for the vast majority of electrical appliances (e.g. fridges!). IPv6’s large address space and auto-configuration will enable virtually any device to get connected to the Internet. As a result, IPv6 could serve as a universal communication protocol, at least in the edges of the network [15].

This new level of connectivity will create new opportunities that could transform existing mechanisms of delivering goods and services and even create new ones.

For example, one market where IPv6 attributes may found applications is health care. Health care applications like real-time telemedicine (i.e. the provision of remote medical consultations through the use of real-time analysis of medical diagnostic procedures involving motion) or remote control telemedicine (i.e. the control of medical instruments from a distance) require a protocol that can provide authorization, authentication, non-repudiation, encryption, auditing, and directory services [16]. IP-enabled sensors could be used to monitor and report the results they gather directly to the doctor, who can then take the appropriate actions. IPv6 can provide these devices with exactly what they need: an address and security.

One can easily list a number of similar examples. These developments in the application and use of the Internet will create new opportunities as well as help reformulate `older problems' [17]. IPv6 can help entrepreneurs exploit these opportunities by carrying out innovation via new combinations of technologies [18]. Also, if entrepreneurship is a process that begins with the recognition of an opportunity [19], then recognizing the potential of IPv6 and the next generation Internet may provide entrepreneurs with a starting point.

Although one would expect that due to their abundance of knowledge and technological know-how large firms are able to recognize and exploit opportunities more easily than SMEs and individual entrepreneurs, this does not always hold true. For example, Park, citing Christensen [20, 21], argued that the "combination of organizational knowledge and organizational culture in large firms can negatively impact upon their ability to recognize the future value of emerging markets", after examining high-tech firms.

This argument could find more empirical support from the study undertaken by Malerba and Orsenigo [22]. By studying 49 different technology clusters in six different countries they identified two technological classes:

- *Schumpeter Mark I,* for which innovative activity is distinguish by "creative destruction" with technological ease of entry and a major role played by entrepreneurs and new firms in innovative activities [18], and
- *Schumpeter Mark II,* for which innovative activity is characterized by "creative accumulation" with the prevalence of large established firms and the presence of relevant barriers to entry for new innovators [23].

Hence, if opportunities are generated, depending on the market, SMEs can drive the innovation process and benefit from leading the exploitation of these opportunities. IPv6's address space can potentially affect (direct or indirectly) most markets and, in many of these, allow SMEs to come up with new value-creating mechanisms.

Security

Security is only as good as the weakest link in the chain, which in a technological sense can usually be traced to software bugs and the human factor (or 'user error'). As security issues related to human behaviour can only be addressed through education, the focus in this section is on how the technology itself can become more secure. IPv4 does not have a mandatory security scheme in place and as a result the task and responsibility of keeping data safe falls on the programmer's shoulders. Hence, security is directly linked to the security built by the programmer into the solution.

Having to incorporate security on every application separately increases costs, time to deploy and concerns about the protection provided. More importantly, it raises concerns from the customers' point of view that make them reluctant to conduct transactions over a potentially unsafe channel. Larger organizations can invest in security measures and undertake security screenings, but this may not hold true for SMEs and especially micro-businesses, which do not have the necessary budgets [24].

By introducing a security layer at the network level the Internet becomes a safer place not only to undertake commercial transactions, but also to communicate. This does not imply that new ways of exploiting networks may not be found. It means that these methods will have to deal with the network itself making the hacker's job a more difficult one.

Internet Protocol Television (IPTv)

This section provides a more detailed example of how multicasting within the context of IPv6 can help those entrepreneurs operating in the video broadcasting market establish and operate an Internet Television channel, by minimising the broadcast costs. The discussion is undertaken within the established technological framework and does not assume that any technology, other than that of IPv6, is required for these channels to start broadcasting. This point is of particular importance as these channels could start broadcasting as soon IPv6 is deployed on a large scale. Of course, IPv6 can not guarantee scalability or reliability by itself; advances in other technologies, for example gigabit-based networks and more powerful routing devices, will play their own role.

A definition

The growth rate of the Internet and the rate of adoption of popular technologies suggest that if the technology to start an Internet-only TV channel becomes widely available the rate that these channels will appear will increase accordingly. These would be added to the many TV channels broadcasting part of or even whole programmes over the Internet (for example hundreds of TV streams can be found at sites like www.tv4all.com).

It is interesting to point out that when television was introduced it took more than 10 years to reach an audience of 50 million viewers. When IPTv is launched in a larger scale it will instantly be available to an audience that will reach hundreds of millions of Internet users worldwide. Those who set up initial IPTv channels will probably seek to fulfil very niche markets which will require smaller investment, will be easier to target and can be used as test-beds for more generic broadcasts. IPTv does not have to be driven by commercial agendas. Similarly to Internet users broadcasting their own radio shows or simply their favourite music, Internet users could also broadcast their own TV shows, although such an undertaking is usually much more complex than broadcasting audio. As a result, one would also expect a great number of IPTv broadcasts.

In the context of this paper, Internet-only TV channels are defined as channels that broadcast continuous streams only on the Internet. For this reason, “channels” which serve video-on-demand purposes are not counted. The definition does not impose limits on the number of viewers that can be served, as this number depends on the aims of the channel and its target audience. It also does not distinguish between services that offer a single channel and those which offer channels bundled together to form packages.

Transmitting IPTv

“There are large differences between the properties and functional capabilities of television and the Internet.” [25] For example, where one satellite transmission can potentially reach many millions of viewers, the Internet cannot provide this scale of coverage in an efficient way. Through satellite transmissions, even if viewers never watch the same channel at the same time, they can potentially do so without any impact on transmission.

This is not the case on the Internet. The networking and hardware infrastructure required to accommodate even a few thousand users makes providing such access a major challenge, which has habitually prevented Internet-based channels from reaching the audiences that traditional channels reach. However, a broadcast can be received by a viewer irrespective of their location, provided an Internet connection can be established and enough bandwidth is available to allow for acceptable quality.

This is usually limited by two factors. First of all, most households in which viewers of IPTv will be watching a programme will have either modem or broadband connections. Modems cannot be considered as viable means of receiving IPTv as their transfer rates, i.e. the amount of data that can be received in a certain time, are too low. Broadband can provide enough bandwidth for IPTv, but the experience is usually far from ideal. Small display sizes, low sound and picture quality and long pauses for buffering are not uncommon. Although broadband broadcasts have faster connections, they can still only reach the level of quality decided by the broadcaster. The broadcaster may choose to limit the size and the quality in order to allow for more connections. As these connections consume bandwidth it follows that the less bandwidth allowed per connection, the more viewers can be accommodated. This is a major obstacle to scaling up any TV transmission.

Multicast can provide an elegant solution to the problem, as a broadcaster has to send the data only once. The broadcast is then replicated and distributed by the routers, saving a lot of bandwidth that the end-to-end connections would have otherwise required. As a result, an IPTv broadcast could serve viewers globally without requiring an expensive infrastructure. Although it is very difficult to predict what specific bandwidth requirements IPTv will require, the current infrastructure should be adequate to at least cope with initial demand.

Differentiation

The first TV broadcasts over the Internet were usually simply extensions of non-IPTv ones, such as ‘traditional’ network TV channels, premium channels and pay per view channels. IPTv broadcasts will be serving content of a wider range than that of traditional stations. “Diversity is related to consumption of media that have passed through their ‘mass’ audience phase and have now become specialized (e.g. magazines)” [25]. IPTv could boost diversity and bring new types of content may find their way to the viewers’ screens. For example, they may be localised regionally or narrow in terms of their topic channels, e-learning with broadcasts of the teacher sent to the students and so on.

The cost of the infrastructure and the limits placed on bandwidth dictate the availability of any channel in a specific region. For example, in an ethnic minority area, cable operators may introduce foreign channels for which there exists enough demand to justify the investment. Even so, channel differentiation can only be attempted within the limits that the available bandwidth defines, which implies that not every taste can be covered. In many cases, although there may be sporadic interest for a specific type of programme the demand may not be enough to justify the launch or even the relay of a channel. The Internet can attract all those interested in a particular subject and create enough momentum for a channel to be established.

A significant advantage of IPTv is the number of interactions it can accommodate. Viewers will be able to access a wide variety of additional information while watching their favourite programmes, similar to digital TV. For example, viewers will be able to vote, access statistics about the players in the game they are watching, find the weather in the city shown on the holiday programme and so on. These services will be free or made available only for users subscribing to them.

Being able to differentiate their broadcasts, providers will be able to attract audiences that until now have never had their interests met and offer them an array of services that they will find attractive.

Pricing

A number of pricing models for multicasts have been proposed [26-31]. These usually base their approach on the amount of data transferred during a multicast session, the number of users receiving the transmission, the multicast transmission paths, the number of carriers and the willingness of the user to pay for the data received. The end user is then expected to pay part of the total cost. As these cost-sharing algorithms might have to deal with extremely large user populations, it is crucial that they not do not impose significant computational and communication burdens on the network [26].

Such pricing models are unlikely to be implemented by Internet TV channels as they contradict the viewers' traditional TV experience (viewers are not charged by how much TV they watch) and their Internet experience (users are usually charged a flat fee irrespective of what they download). Channels could charge a fixed subscription to cover their costs, but this would not be an ideal solution, from the network's utilisation point of view, as there would be no incentive to limit wasteful traffic [29]. Credit card payment is expected to be the preferred method of payment, as IPTv will be attracting users from many different countries. Traditional billing through paper-bills would have been very efficient as it would have increased the transaction costs and introduced unnecessary delays.

If the IPTv station is to pay for the bandwidth, then although the current nascent market position of IPTv does not enable detailed statistical and financial analysis, it is believed that further research will show that there will be a direct connection between the bandwidth cost and subscription levels.

It is also questionable whether, at least initially, there will be any free IPTv channels, supported by advertising revenues, similarly to the "traditional" free to view channels. If these channels target very niche markets, then they may attempt to capitalise on the interest that these markets will express for their broadcasts. This may follow the trend seen by subscription-based services that offer Video-on-Denand (VoD). It is probable that this will be the case for most multimedia content on the Internet which will not stay free as [32]:

a) protection technologies will mature and content owners will use them

b) delivered quality will eventually match what users expect and asking money for entertainment content will become acceptable.

Revenue streams for Internet based channels could be the same as traditional channels, mainly based on advertising and subscriptions. As the pricing structure for advertising revenues is based on the size and demographic makeup of the audience, channels that provide specialised content should be very attractive to advertisers. In VoD, it is possible to tailor-make the sequence of the clips which are broadcast [33]. This allows for the insertion of specific advertisements which can match the viewer's profile. In multicast this is not possible, although techniques to allow for stream multiplexing at the viewer's end may be employed. The advertisement clips will have to match the group's profile. This is still much more targeted advertising than that which can be achieved on a traditional broadcast channel. Following the same principle, viewers may be willing to pay higher subscription fees in order to receive content that matches their interests.

An additional revenue stream may come from 'timeshifting': subscribers ordering programmes which have not yet been/have already been broadcast. For example, a viewer may choose to order the last episode of his favourite series that he missed. Once ordered, the episode will be sent to the viewer via unicast (this is very similar concept to that of pay-per-view, although the range of the programmes available in a per-per-view scenario is usually limited) or near-VoD.

Near-VoD (for example ordering movies that start at specific times) may be another alternative approach, combining the effectiveness of multicasting and economies of scale. “The hope is that multiple requests for the same program will be made in a short period of time. These requests are then batched and a single program stream is used to service the entire group.” [34] In this way it becomes economically viable for a channel to broadcast a programme, as there will be a higher probability it will be servicing a bigger number of viewers.

For all the above types of broadcasting, users could be given the option to record the broadcasts, an option that could either be free or could incur a fee.

Access

The global nature of the Internet means that the user can access information from anywhere provided an Internet connection can be established. The same principle goes for IPTv, although price may be an issue. For example, the viewer will have the option to watch a channel from any Internet-connected device using a password or a digital certificate, i.e. any IP, or only from his own home, i.e. a specific IP. The streams that a user will have access to could simply correspond to the familiar "basic" or "premium" packages common to cable television service, in which channels are bundled together. A viewer may also subscribe to a station serving only one stream, their own channel, rather than to ‘IPTv carriers’, who will be offering bundled channels.

Customisation and Privacy

If a user is to be authenticated in order to watch TV, it follows that the IPTv stations will have an exact profile of his watching habits. This raises questions of privacy. The channels will be able to create exact profiles, rather than just approximations, based on small samples of a few hundred or thousand viewers.

On the other hand, this could help provide a customised offering that will match the viewer's profile. More interestingly, the use of software that could act as a 'director' for the viewer could insert clips specific to his interests, for example advertisements. The software will stream the channel as normal through multicast, but it will also download relevant advertisement clips separately that could be inserted in real-time. Hence, although everyone will be watching the same channel, the advertisements will be different.

It is questionable whether users will feel comfortable knowing that the stations will always have an exact picture of what they are watching and this is a critical issue when considering usage and user interaction with IPTv. Data Protection issues are key and there will need to be a significant number of test cases before the openness and transparency of information gathered is sanctioned.

Personalisation techniques could also be applied to TV listings. "Where we have tens of TV channels today, tomorrow we will have hundreds and soon after that it will be thousands."[35] Personalised TV listing services can filter broadcasts based on the viewers' preferences [35, 36].

Cultural issues and geographical localisation

Broadcasting globally does not necessarily means appealing to the entire global TV audience. To start with there are language barriers, although these can perhaps be overcome by a similar mechanism to subtitles, which translate the programme to the most popular languages. Such a mechanism would greatly extend coverage, but would require significant resources. More importantly, cultural issues may arise from even the most innocent broadcasts. What is taken for granted in one place may be considered an insult in another. This could make any effort to produce a programme a serious challenge. On the other hand, it could help bring viewers closer to what is broadcast, e.g. to a hobby or a culture, by exposing to them to a variety of programs about that topic.

Also, even though the Internet is a global network, the Internet can provide a medium over which localised broadcasts can be served. An example of such case, although only VoD rather IPTv, is NRK in Norway [37]. The station provided clips of its local news broadcasts over the Internet in order to better serve viewers who had an interest in this localised content, but did not have any means of receiving it. This service was one of the first regular real time news on-demand services, where a television station on a daily basis digitized a full news transmission and made it available to the public over the Internet. Still, a major issue that the station had to face was intellectual property rights “as NRK did not always have the rights to redistribute news footage from international sources”.

Monitoring and control

In order to establish a new TV channel an organisation must obtain a licence to transmit the broadcasts. These broadcasts are often closely monitored by government agencies. In 2000, Sussman estimated that “in nearly two-thirds of the world’s nations, laws inherited from print-press censorship and updated to restrict radio and television regular domestic messages” [38]. In addition, traditional channels must obey the rules of the country in which they are broadcast at risk of legislative activity.

When it comes to sharing information on the Internet, little investment and limited government regulation is required [39]. If IPTv broadcasters are seen differently from other individuals or organisations broadcasting information using text or audio based formats then regulation may be tighter. Regulating IPTv channels and broadcasts will quickly become an enormous task which will become even more complicated, if monitoring is undertaken at a country level. Different counties have different rules many legal issues are bound to arise. “To regulate the Internet internationally would require the impossible task of framing a treaty signed by every country”. [38]

Finally, an attempt to enforce rules and regulations on a medium that has always been considered to be a channel for free speech could complicate things even further. A balance between rights and duties is very difficult for a free society [40].

Impact on existing broadcasters

For many, “the Internet was never a new kind of television with infinite channels of centralised programming to passively watch” [41]. Multicasting could alter the fundamental economics of the broadcast business by allowing for the development of something very close to that scenario, different only in the attention and involvement (as opposed to the ‘passivity’) of each individual user/viewer with the content in front of them.

New technology does not necessarily change those things that drive human beings, which are, at heart, the drivers of any economy. What people want, their tastes and needs do not change. How these are satisfied (how fast, how much and in what environment) does change. This brings into play a number of factors – both positive and negative – which could change the underlying structure of broadcasting for traditional broadcasters.

Global issues of rights, laws, morals and customs can make a marketplace already made vulnerable by the ubiquity of the Internet and the World Wide Web even more sensitive. The impact of wider, yet more targeted and more freely available distribution of information should not be ignored, nor should the increasing ability to pinpoint who specific viewers are, what they do, buy and watch (and equally important, do not do, buy and watch) which will both attract advertisers and appal data protection enthusiasts. Marketing will no longer require a market, just an individual, and because of that may need to become a completely different discipline. Mass markets and the traditional revenue models of the broadcast environment go out of the window as "narrowcasting" starts to make an impact. Usability becomes key; why should users tolerate complex software, slow interactivity (or even an absence of interactivity) when a multitude of options are open to them with the click of a button? Content is king – but the kingdom is rapidly splintering in a war between physical atoms and digital bits.

Conclusion

Trying to answer why the Internet was so successful Leonard Kleinrock (one of the people working for ARPANET) wrote: "By design, accident, or luck, the Internet was able to tap into an enormous and universal desire when it made it possible for communities of people to communicate and interact quickly, inexpensively, easily, and broadly" [14]. IPv6 has many decades of experience to build on, although at the same time the expectations, both commercial and personal, are higher than ever.

This paper presented a few of the issues that will be resolved when the 6th version of the Internet Protocol is fully deployed on the Internet. It also presented examples of potential implications that the new protocol may have on SMEs. The paper continued by providing a more detailed example, that of Internet Television, which could benefit from the additional functionality that IPv6 will introduce. The IPTv discussion was undertaken within the current technological framework in an attempt to demonstrate that it may not be that far away, provided there is a large-scale deployment of IPv6. Possible scenarios of how IPTv may work were presented from both the viewers' and the broadcasters' points of view. Whilst it may be difficult to predict whether IPTv will blend with "traditional" television or whether it replace it altogether, it is held that "society will adjust to the new communication culture, which will be substantially different from the television-era culture" [39].

Established markets, like the television industry, that were left relatively unaffected by the Internet, may be heading for major transformation, which will be catalysed by the next generation Internet. This transformation may lead to a second wave of "dot coms" which will attempt to capitalise on the availability of new opportunities. We hope that this paper can help maintain a level of opportunity alertness, by reminding both researchers and practitioners that the Internet, although more than 35 years old, has yet to show its full potential.

Future Research

Further research needs to be carried out to explore the impact of the evolution of the technologies that underpin the Internet, such as the Internet Protocol, to commercial and personal applications.

With regard to the broadcasting industry, future research is required to assess the business and cultural implications of the Next Generation Internet, separately for each industry. More specifically, when it comes to television broadcasting there are five important questions to answer:

1. How will the next generation Internet affect the television industry?
2. What are the plans of traditional broadcasters?
3. How will Internet-only TV broadcasters position themselves in the TV industry?
4. How will viewers react to the changes, if these occur, in the television industry?
5. How will groups of viewers and societies in general react to unrestricted television broadcasting?

Answers to questions like the above may only be possible after the required technology is deployed on a large enough scale.

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VITAE

Dr. Savvas Papagiannidis

Dr. Savvas Papagiannidis graduated from the Physics Department of the University of Newcastle upon Tyne. Upon completion of his PhD he joined the e-business Group at the Business School, in the same University. Savvas has started a number of e-business ventures and also worked as a freelance Internet developer. His research interests include management of internet and emerging technologies, high-technology related entrepreneurship and e-business models. He can be contacted at savvas.papagiannidis@ncl.ac.uk.

Miss Joanna Berry

Joanna Berry is a PhD Researcher in the University of Newcastle upon Tyne Business School, and in 2003 got an MBA with distinction from the same. Following a Masters degree in Law at St Anne's College, Oxford University, she worked in South Africa, returning in 1987 and working in the advertising, marketing and publishing industries. During this time Joanna also set up and ran three of her own database and digital businesses in London. Her research interests include the digital broadcast, music and entertainment industries, with a particular emphasis on new supply chain and business models. She can be contacted at joanna.berry@ncl.ac.uk.

Prof. Feng Li

Prof Feng Li is Chair of E-Business Development at the University of Newcastle upon Tyne Business School. His research has centrally focused on the interactions between information systems on the one hand, and strategic and organisational innovations on the other. A particular focus of his current research is on the internet and e-business, and Emerging strategies, business models and organisational designs in the new economy. He has worked closes with companies in banking, telecommunications, car manufacturing and electronics industries through research, consultancy and executive management programmes. His recent work on internet banking and on telecom pricing models and value networks has been extensively reported by the media. He can be contacted at Feng.li@ncl.ac.uk