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The Short Future of Public Broadcasting: Replacing DTT with IP?

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Abstract

According to recent European estimates, the life expectancy of broadcasting as a free-to-air television platform is not more than 15 years. BBC, Yle and the UK regulator Ofcom have reached this conclusion in their reports about the future of news, media distribution and digital terrestrial television (DTT). Although broadcasting is seen necessary until 2030, all three assume that DTT can – under certain conditions – be replaced with delivery using internet protocol (IP). However, it seems that the idea of IPTV taking over DTT is just a sophisticated version of "black box fallacy", driven by the expected growth of the new media ecosystem. The problems in replacing a socio-technological system have largely been neglected.

Introduction

A number of recent reports suggest the life expectancy of broadcasting as a free-to-air television platform may be no more than 15 years. The public service broadcasters (PSBs) in both the UK and Finland, BBC and Yle and the UK regulator Ofcom – have each reached this conclusion in discussions about the future of news (BBC, 2015a), media distribution (YLE, 2014) and digital terrestrial television (DTT) (Ofcom, 2014a). Although broadcasting will be necessary some years yet, all three suggest that after 2030 DTT could be switched off and – under certain conditions – completely replaced with internet protocol (IP) -based solutions for public service media (PSM) delivery. The predicted sunset of broadcasting after 2030 corresponds with the suggestions of the chairman of the European Commission High Level Group (HLG) on UHF frequency use (Lamy 2014).

Meanwhile, European public broadcasters and governments have been emphasising that broadcasting as a public service and as a platform will continue to be important over the coming years. The BBC Trust suggests that ‘IP is unlikely to deliver more than 20% of all video by 2020’ while, looking a little further ahead, the BBC argues that ‘on current trends, the UK will not be internet-only in the next ten years’ (BBC Trust, 2015: 4; BBC, 2015b: 58). The public broadcasters’ body the European Broadcasting Union regularly asserted the viability of broadcast distribution, particularly in the approach to the 2015 World Radio Conference (EBU, 2015a, 2015b). Finland, however, is an exception: its government has been in favour of releasing broadcasting spectrum for mobile use, while Yle has plans to reduce the number of its broadcast channels (Pursiainen, 2015; YLE, 2016).

These estimates arise in a midst of significant transitions of spectrum from broadcasting to mobile broadband following the digitalization of terrestrial television. In 2010, the European Commission set an ambitious goal for member states to complete the analog TV switch off (ASO) by 2012 and to clear the 800 MHz band as the digital dividend for mobile use by 2013. While most of the 27 EU states completed the switchover by the end of 2012, only 15 had begun using the 800 MHz spectrum for 4G mobile broadband by 2013 (EC 2014). A number of Northern European countries also identified the 700 MHz band as “the second digital dividend” (e.g. Finland in 2012 and the UK in 2014) even while others in Southeastern Europe were still in the process of either switching over to DTT (Romania) or clearing the 800 MHz band (Bulgaria) (EC, 2014).

It is to be expected that the North European PSBs would consider scenarios beyond digital broadcasting, but it is notable that the first PSB reports considering DTT switch-off are not emerging from countries such as Belgium or Germany, where the proportion of the households dependent on terrestrial television is very low and its viability has been questioned (Reimers, 2013). Instead, these views are heard first from PSBs in the UK and

Finland. A number of factors may explain this. Firstly, they have had more freedom and resources to develop their online services alongside radio and TV (Brevini, 2013b; Syvertsen et al., 2014). In addition, both the BBC and Yle were obliged to sell their transmission infrastructure to finance the transition to DTT, so for them DTT is now just one platform among many (Galperin, 2004; Brown, 2005). Further, while the BBC continues to be funded by a license-fee, Yle income is now based on a hypothecated personal tax rather than broadcast receiver ownership. In other words, the notion of removing broadcasting from PSBs (or, perhaps, public service media organisations) has been developing in a certain socio-economic environment established by national media policies.

There have been claims about the end of spectrum scarcity through digitalization and fiber optic networks for more than 30 years (de Sola Pool, 1983; Peacock Committee, 1986). The death of television has been discussed for 25 years (Gilder, 1990) while the end of broadcasting has been a serious academic concern for at least 18 years (Given, 1998; Tracey, 1998). But since the development of the concept of cost-efficient high-capacity IP-based networks for all communication as *next generation networks* (NGN) by 2003 and the global financial crisis in 2008 which shook also the media markets , more frequent predictions of the death of traditional TV have been given by some largest technology companies. The accuracy of these reports has been questionable – for example, Microsoft predicted that by 2010 more media would be consumed via the internet than broadcasting (2009: 7) – not least because they often simplistically extrapolate recent changes in technology, consumer behaviour and business models as determinants of and explanations for future change (see, for example, Cisco, 2011; Ericsson, 2014). Here, the idea that technology, behaviour and the organisation of corporations might be socially shaped is forgotten (Webster, 2014). Of course, such industry reports are rarely intended to offer a robust, empirical analysis of future trends but rather a desired vision of the future. If Cisco (2011), for example, claims that conventional television will be gone by 2030, it matters more that this message is heard and believed than how valid it is. Path-dependency and the role of corporate decision making are well-understood factors in explaining technological change, such that overblown claims from influential organisations can themselves become, in part, self-fulfilling (Goggin, 2012: 91-93; Winseck, 2011:13; Hesmondhalgh, 2007:135). The obsolescence and “creative destruction” of older technologies as well as related industry structures and government regulations is in any case necessary for increasing convergence and building a neo-liberal knowledge-based economy. (Winseck, 2012: 25-29; Jessop, 2005; Webster, 2014)

This article is an effort to include the wider role of society in the discussion about the future TV platforms. Mere abstract observations of technology, consumer behaviour and business models alone are inadequate grounds upon which to base predictions about TV platforms. Instead, none of these factors is independent of politics, social or cultural forces, such as a belief in the importance of public service, which must also form part of such debates. Using a theoretical perspective combining new institutionalism and political economy of communication (Brevini, 2013b; Galperin, 2004), we identify and examine some of the key potential and existing problems in replacing one socio-technological system, broadcasting, with a different one. We have divided these obstacles into two categories, one emphasizing technical and economic concerns and the other public policy issues.

Questions and potential problems I: technological and economic viewpoints

> ‘Much contemporary discourse starts and ends with what I call the Black Box Fallacy. Sooner or later, the argument goes, all media is going to flow through a single black box into our living rooms (or, in the mobile scenario, through black boxes we carry around with us everywhere we go).’ (Jenkins, 2006: 14)

If broadcasting is to be replaced with IP delivery, then in countries like the UK and Finland in which large numbers of homes currently rely on the terrestrial television platform, the cellular network, alongside wired broadband networks, will be expected to deliver free to air television through multicast technologies such as enhanced Multimedia Broadcast Multicast Service (eMBMS), permitting reception on mobile as well as fixed devices. Questions about the capacity of such networks and the efficiency of their use have become central to debates about the allocation of radio spectrum.

Capacity and coverage: cellular/mobile networks

Although the 'mobile' telephone has existed for decades, its capabilities were limited and it remained a niche product for much of that history. From the 1980s, with the development of cellular networks and the re-use of frequencies (a technique long used in terrestrial broadcasting) it became possible to extend usage of cell phones to large numbers of people, such that the vast majority of the world's population are now regarded as cell phone users (Manninen, 2002: 298).

The mobile phone networks use extensive arrays of low power, short range radio transmitters, each creating a geographically-defined 'cell' in the network. Frequencies may be re-used in non-overlapping cells and so the capacity of the network depends upon the size of the cells: building more transmitters means, effectively, the smaller the cell and the greater the capacity of the network overall. However, increasing capacity in this manner inevitably costs more, and so a balance between capacity and price is struck, based on presumed demand and return on investment. Decisions must also allow for the peak in traffic at times of high demand, when services may be slowed by the number of simultaneous users, and the cost of unused capacity at times of low demand. As examples, in countries like Finland and the UK, such considerations result in tens of thousands number of base stations and cell transmitters.

The capacity of the cellular network also depends on the allocation of frequencies for the networks to use: in general, more frequencies offer greater capacity. However, the particular range of frequencies used is significant: lower frequencies travel further than others at low power and also penetrate buildings better, providing better indoor reception. The higher frequencies travel less far and so the resulting large number of transmitters needed means sparsely populated areas are often judged uneconomic and may experience slow rollout of cell phone services, or may not receive coverage at all. Many countries assigned the high UHF band for cellular use some years ago: they are now beginning to similarly allocate the lower UHF frequencies recently vacated by the transition to digital terrestrial television (DTT), with implications for coverage. For example, the high UHF 3G services of some UK networks cover just one quarter to one third of rural homes some 15 years after the licences were awarded; in contrast, the allocation of lower frequencies is anticipated to enable faster rollout of 4G services (Ofcom 2014d: 83-90).

Capacity and coverage: broadcasting

In contrast with cell phone architecture, television and radio transmission has traditionally relied upon a small number of high power transmitters supplemented by a larger number of lower power ‘relay’ transmitters filling in the gaps left by the main transmitters. For example, in the UK 80 main TV transmitters serve around 90 per cent of households, but it requires more than 1000 to reach a further 9 per cent. Frequency re-use is employed but the larger transmission areas means efficiency gains are limited and so digital terrestrial television (and radio) services can accommodate around 50 to 60 channels. The DTT network is efficient in one sense – the small number of main transmitters, once installed, have only limited on-costs while serving large populations in densely-populated areas and can cope with unlimited levels of demand at peak times. The large number of additional relay stations, however, represent a significant cost for operation and maintenance. So, while all broadcasters aim for cost efficiency, PSBs are obliged to provide universal coverage whereas commercial broadcasters are not. In the UK, for example, only the PSBs transmit from the denser array of relay stations (Ofcom, 2014d: 113).

As alternatives to the terrestrial broadcasting platform, satellite and cable delivery have limitations. Satellite reception requires either an individual dish or a relay infrastructure, and not all homes are suitable for either; furthermore, satellite transmission represents a large investment for the platform operator and so in most cases satellite television requires viewers paying by subscription. Cable TV is also usually organised as a paid-for service, the operator charging consumers in order to repay the significant investment required to install the infrastructure. Since cable must be laid to every home that it serves, cable TV services are normally restricted to urban centres – in the UK, cable is available to less than half of all households, for example. Thus, terrestrial transmission, once initial investment in transmitters has been made, provides services to those who either may not have other means of reception available to them, or who otherwise would have to pay an often-costly subscription to the television provider. Any consideration of alternatives to terrestrial transmission therefore raises questions about reach and universal access.

Convergence and the 'black box fallacy'

The proposition of a universal transmission technology – IP-based, say – delivering everything, text, sound, video, is superficially an attractive one, an ultimate form of 'harmonisation' perhaps. This implies a new era of converged devices – the universal 'black box' – able to receive content in all forms over a single, universal standard. Such 'convergence' is presumed to be a consequence of digitisation of TV coupled with the emergence of high speed data standards such as 4G. This focus on *technological* convergence emphasises the relative novelty of these developments and, it is argued, this novelty should drive changes in infrastructure arrangements. Rather than thinking in terms of convergent technologies, however, the current position is more the result of continual change, both of technology *and* of the industries that develop and shape it. Goggin, for example, describes the uneven progress in mobile television as being 'as much forged at the interface of Internet and mobile media *cultures* as it has at the joining of broadcasting and telecommunications infrastructures' (Goggin, 2012: 120).

Despite assumptions about convergence, we actually witness an increasing proliferation of devices being suited, paradoxically perhaps, to greater diversity of platforms, as Mueller anticipated a decade ago (2004: 314-5). The TV and the smartphone are certainly able to receive the same content but each is used in different ways: TVs tend to be used more for long form, linear watching, usually delivered over broadcast platforms; small devices are suited for short term attention, where portability means wireless connection is most appropriate, this via a home-based Wi-Fi extension of a wired broadband network, a public Wi-Fi hotspot or a cellular data network. This multiplicity of platforms reflects the diversity of the media and communications sector, an industry which itself is not fully converged. For example, few consumers depend entirely on 3G/4G/LTE for all their communications needs. Thus, three quarters of UK homes have fixed broadband connections, with the consequence that most 'wireless' data traffic takes place using Wi-Fi links to fixed broadband connections at home, work, school or college rather than via a mobile operator (Ofcom, 2014c: 317).

The vision of ever greater convergence and the universal black box has a long and recurrent history. Yet evidence that convergence has taken place is absent. For example, the expanding cable television systems in the 1970s were expected to be universal data networks as much as television pipes, supported by government policies seeking to place themselves in the vanguard of the information revolution (Carey and Elton, 2009). The TV set was no longer to be passively watched but now it would become an information resource. Despite expectations of transformations in information consumption, however, the use of these technologies was slow to change, the networks' primary purpose (and source of revenue) being TV watching. The changes in consumer behaviour and cultures of consumption that *have* occurred have not primarily been due to technological change, but rather the restructuring of businesses and related shifts – sometimes dramatic – in government policy in favour of economic liberalisation, privatisation and deregulation. Current debates about changing consumer behaviour, individualised consumption and, thus, a more commercial approach to allocation of radio spectrum are in fact less novel than often assumed and less technological in their explanation.

Questioning growth

There are reasons, then, to question the presumption of an ever-increasing demand for data capacity requiring the allocation of more spectrum from broadcasting to a 'converged IP'. Beutler and Ratkaj (2014) suggest that insufficient research has been carried out into the equation between more data and increased spectrum allocation. For example, they suggest that reconfiguration of IMT networks to operate smaller cells, as described earlier, could increase capacity without necessarily requiring more spectrum. Further, as noted above, much wireless traffic is consumed via Wi-Fi networks, often at home, rather than cellular networks. This 'Wi-Fi offload' – the proportion of traffic generated by cellular devices actually carried through Wi-Fi links to fixed broadband – is a significant factor in forecasting mobile data traffic. Current evidence suggests more than 70 percent of all smartphone traffic travels via home Wi-Fi as consumers tend to reserve higher bandwidth activities for the home or workplace, engaging only in lower bandwidth activities while outside (Ofcom, 2014c: 320; Analysys Mason, 2015). Uncertainty over offload compounds the problem of producing traffic forecasts, which, Ofcom notes, ‘vary widely’. For example, its own commissioned study suggested traffic growth between 2012 and 2030 could be anything between 23 times and 297 times (Ofcom, 2014b: 3; Real Wireless, 2012: 62). While such variations in forecasts are understandable in a new market, the uncertainty does suggest claims that the broadcast model of audiovisual delivery is losing ‘relevance’ or becoming ‘antiquated’ are premature.

Capacity crunch

Whatever the uncertainty over the precise nature of data traffic growth, it will of course increase substantially. So far, much of this article has highlighted debates about the most appropriate means of distributing audiovisual content as part of that growth. However, in some senses, this is just a small part of a much larger question: can any network, however configured, accommodate the levels of growth some predict? Concern is growing that the capacity limits of *all* networks, wired and wireless, may soon be reached. Even the optical fibre cables that have replaced copper in much of the communications infrastructure – including that supporting the mobile networks by linking base stations for example – have capacity limits. While one response is to deploy more optical fibre more quickly, any derived capacity increase would be ‘linear’ in nature while data traffic is presumed to increase exponentially. Thus, this may simply delay a little the reaching of the limit, dubbed ‘capacity crunch’ (for example Ellis, 2014). The superficially simple solution of deploying ever greater volumes of physical infrastructure also raises concerns about consumption of resources and energy, and so instead emphasis should be on using existing capacity more efficiently (for example Wang and Manner, 2013). In this respect alone, it is by no means obvious that replacing broadcasting with IP networks offers any advantages.

Questions and potential problems II: policy and regulatory viewpoints.

> 'Public broadcasting is not about technology. It is about an idea, which happens to employ a technology, of how one creates and feeds society and its culture.'
> (Tracey, 1998: 16)

Media policy objectives and regulation of electronic communication services in Europe have traditionally been based on technologically separated sectors. As long as public service companies retained a monopoly position, these companies alone represented the entire broadcast sector and even after the introduction of private broadcasting, they usually remained among the major companies. During these decades, national legislation and regulations were developed to define the remit of public service organizations in terms of broadcast technology. This meant that although the idea of public service was not based on technology but on a wider set of social goals and cultural values, the characteristics of broadcasting were the preconditions shaping and defining its tasks and responsibilities in a national context. This is why the tasks and responsibilities of the PSB remit may prove quite difficult to transfer into a non-broadcasting environment in an international context.

PSB coverage and universal access

Most European PSBs have occupied a very specific role in developing and implementing DTT respectively in their home countries, and the BBC and Yle are no exception. As mentioned earlier, national governments required both companies to sell their broadcast distribution networks in order to finance the transition to digital television while both continue to have particular obligations concerning DTT provision. The current BBC

Agreement (2006) requires the company to maintain its principal television services on DTT, while, more recently – in 2012 – in Finland Yle became required to provide nationwide terrestrial digital television services on both DVB-T and DVB-T2 standards up to 2026. This is in addition to the law obliging Yle to provide “versatile and comprehensive television and radio programming with the related additional and extra services for all [citizens] under equal conditions” (Act on Yleisradio, 1380/1993). However, none of this means that PSB obligations can never be changed, but if the universality principle were abandoned or severely compromised, it is questionable whether the result could then be defined as public service. On the other hand, if national governments continue to require universality, meeting that requirement in an economically rational and cost-efficient way without broadcasting and DTT might be impossible.

PSM universality online and net neutrality

Unlike in the broadcast environment, there is no assured access to public service content in the internet. Until recently, most Europeans did not even have any legal protection for their right to use the full open internet. National laws protected net neutrality – equal treatment of network traffic – only in the Netherlands (2012), Slovenia (2013) and Finland (2015), while all the largest member states relied on internet service providers (ISPs) to comply with either self-regulatory codes of practice or just regulatory guidelines (EC, 2014). Now, these will be replaced by the new EU telecoms law agreed in October 2015. However, some argue that the law is a result of political compromise, and “fails to establish the principle of net neutrality and instead it centres on the regulation of traffic management by network operators” (Horten, 2015). At the time of writing it is still unclear whether certain traffic management practices are permitted or whether these would be in contradiction with the EU legislation on the freedom of expression. Another mechanism guaranteeing universal access to PSB services would be a must-carry type positive discrimination, but given trends in EU policy decisions, it is hard to imagine this being support.

Broadband is not a Universal Service Obligation (USO) in the EU

It would be impossible to successfully stream video content like live TV without a fast enough broadband connection – and even downloading large digital video files may take ages when the internet connection is slow. So considering the importance of fast broadband for EU Digital Agenda 2020, one would imagine that access to broadband services would also be an integral part of the EU ”Citizens Rights Directive”. However, the official EU definition of broadband is just 144kbps while the European universal service obligation (2009/136/EC) does not have any reference to broadband at any speed. The European Commission has decided not once but on two occasions not to include broadband in USO (Venturelli, 1998; Nuciarelli et al., 2014). In Finland, the availability of 1 Mbps internet access was made part of USO in 2010 and the minimum speed was raised to 2 Mbps in 2015, while in the UK, the idea of making 2 Mbps broadband internet part of the USO has been discussed for years, but with limited results. Even then, such speeds are rather low for a good quality video.

Public broadcasting is legally prioritized activity

Terrestrial broadcasting and public service broadcasting in particular still has a special position in both the UK and Finnish legislation as the broadcast licenses are not granted through a spectrum auction. Although auctions are claimed to be more transparent, clear and efficient system for allocation of frequencies compared with granting licenses through a political process (i.e. a ‘beauty contest’) the UK and Finland have both been considering another kind of market system – administered incentive pricing (AIP) – to encourage broadcasters to use spectrum more efficiently. However, broadcasters are not yet charged market-based fees reflecting the opportunity cost of using the spectrum but rather the cost of spectrum management. In the UK, the BBC was also to be subject to the AIP system, but this plan is now on hold at least until 2020 (Sims et al., 2015: 85-86). In Finland, Yle was excluded from AIP as the Act on Yleisradio Oy (1380/1993) obliges the Ministry of Transport and Communications to “take into account the operating requirements of public service”. However, the Ministry does not have much power to protect the PSB interests outside the broadcast domain and national borders.

PSB has free access to spectrum but not anywhere else

As noted above, the current system guarantees PSB a free access to an amount of publicly owned spectrum which is necessary for fulfilling the public service remit. In a vertically integrated system, where the PSB also owned and operated the broadcast network, it was able to run the distribution services in house at cost price. But if the distribution networks are owned and operated for profit by listed companies the PSB cannot control the price of its broadcast distribution even though it has free and secured access to spectrum. In a situation where a PSB would abandon the system built for utilizing the publicly owned spectrum and instead use only telecom networks, the distribution of public service content would be totally dependent on auctioned and privatized spectrum. PSBs would then either be subject to full market rates or governments would have to introduce some complex subsidy system for existing broadcasters. In a worst case scenario, the network operators would become new gatekeepers to PSM content, while people would be paying for the content twice: first for the production (public funding from citizens) and then for the delivery over the network (operator payments from consumers).

EU allows state aid for public broadcasting

One of the aftermaths of the failure of the European analog HDTV project was the adoption of the principle of technological neutrality in the EU as one of the five basic policy principles for a new regulatory framework (Lembke, 2002; Kamecke and Körber, 2008). The idea of regulation which does not impose a specific technology but lets the market rather than the state decide on the success or failure of a system may sound simple, but in practice the European Commission has violated its own principles. As Brevini (2013a) has pointed out, the EU Communication on State Aid to Public Service Broadcasters (EC 2009) is not technologically neutral. It has much more restrictive approach towards PSB online activities than broadcasting. In its earlier decisions about PSB online, the Commission was reasoning that the new online activities should be “closely associated” with radio and TV, which form the foundation of the PSB remit. Similarly, the Communication of 2009 does not question the existing broadcast services, but requires an “ex ante test” for significant new services (Brevini, 2013a; Donders and Moe, 2011). According to a strict interpretation, a PSM corporation no longer offering broadcast radio and TV would not be eligible for state aid. One can only speculate what the outcome of any subsequent review of the EU Communication might be.

Increased vulnerability in time of emergency

One of the first lessons learned by American journalists while reporting the events of the September 11 2001 was that mobile cellphone networks were of no use because of congestion. So many people were trying to use their devices at the same time that network cells became overloaded. Even though the capacity of the mobile networks has improved in the last decade or so, the number of mobile devices and users also has increased. As the basic structure of the networks remains the same, congestion is still a problem in times of emergency – as seen after the bombings at the 2013 Boston Marathon. (Stone, 2013)

Dedicated broadcast networks like DTT can never become congested by the sheer number of users, but were linear terrestrial television services delivered in the same commercial networks as mobile voice and data, there would be a risk that all three major communication services could be lost at times of technical disruption, major emergency or sabotage (NKOM, 2015). Snowfall in November is by no means any kind of emergency in Central Finland, but in 2015 a heavy snowfall cut down over 400 mobile network base stations for several days after their emergency batteries ran out of power during a long break in electricity supply (Nieminen, 2015).

User security & surveillance

It is to be expected that both commercial and governmental organizations are using communication systems for surveillance purposes. Any form of effective organization requires surveillance of some kind, which means that organization and observation are actually "conjoined twins" (Webster, 2014: 280). In traditional mass marketing, distributing identical messages to the largest possible audience was effective perhaps, but as soon as flexible customized production and marketing emerged, there was also a need for consumer surveillance through transaction-generated information. In broadcasting, companies have very few direct transactions with their audiences, but in telecommunications the systems are inevitably producing consumer information for surveillance purposes (Samarajiva, 1996). Every networked device needs an IP address and, in mobile use, location information. While a regular broadcast receiver without any in-built feedback channel lacks the capacity to provide any information of its use, new "smart" devices with internet connection are able to record user behavior and deliver it to third parties often without the user's knowledge. In addition to commercial surveillance, governments are also using the interactive networks to monitor their citizens. The UK government alone has paid the major British telecoms companies more than £37 million for data on customers and their activities in the past five years. (Thomas, 2016) The use of IP in *all* communication therefore broadens the scope for comprehensive and continuous surveillance.

Discussion

> 'Some forecasters have suggested that the convergence of telecommunications and broadcasting will take the form of one integrated digital network serving all purposes. But large-scale communications activities will always justify specialized facilities that are optimised for their particular use.' (de Sola Pool, 1983: 38)

The allocation of spectrum has always involved balancing demand with supply. The decisions taken ultimately impact upon the capacity of different sectors within media and communications to operate services. However, there is little that is dictated technologically in such decision making. The reason for the use of certain frequency bands for broadcasting, with small numbers of high power transmitters, is more historical than economic: broadcasting could also be organised on the basis of larger numbers of low power transmitters, increasing capacity but at a cost. Thus allocation of spectrum and the consequences for capacity is an intensely political decision.

For the telecommunications operators, technological change and growing demand for content mean it is self-evident that capacity limits will be reached, and more spectrum is needed. For broadcasters, that claim is disputed and furthermore, they say, public service considerations require continuing protected spectrum. Such tensions are ongoing and explicit: in the title of an article by the EBU's Beutler and Ratkaj (2014) – 'Crystal ball, tea leaves or mathematics' –questioning the IMT industry's forecasting; or, more prosaically, in the EBU

Technical Director's observation at its May 2015 wireless workshop, '[lamenting] the weak representation from the mobile operator sector' and its apparent lack of interest in addressing broadcasters' concerns (EBU, 2015a). Furthermore, it should be noted, that 'capacity' is not simply a function of the amount of spectrum allocated to a particular use, but also its configuration. Thus, in the early 1990s, capacity was found for a fifth UK terrestrial television by the straightforward reorganisation of frequencies already in use; and 200 community radio stations have launched in the last decade without any additional allocation of radio spectrum, even though historically such stations were resisted on the grounds of insufficient frequencies. Ever-developing data compression techniques mean more content can be carried in any given space. So it is rarely possible to determine when a particular allocation of spectrum has truly reached its limit. It is in this context, then, that the claims and counter claims from the IMT and broadcast industries must be considered.

In fact, the technological distinction between telecoms and broadcasting was never absolute: both industries have always used a combination of cable and radio transmissions. For consumers too, cable services relayed radio and TV broadcasts to homes, while wire-free telecoms were widely deployed in, for example, taxi firms and emergency services. This congruence between wired and wireless platforms has accelerated in recent decades, most obviously with the mass adoption of mobile phones but also with the widespread use of computer technologies in households. Early scholars in the 'convergence debate' such as de Sola Pool (1983: 23-28) argued that while 'convergence of modes' based on digitalization and fibre optic networks might make traditional sector specific communication policies obsolete, he also argued this did not imply a universal, digital super-system for delivery would follow (1983: 38). Convergence is not automatic, and is certainly conditioned by far more than technology – contrary to the arguments emerging in the industry forecasts, whose rather naïve interpretation of convergence has repeatedly been challenged (for example, Mueller, 2004; Jenkins, 2006). Broadcasting offers its own examples. So, while European PSBs played a central role in developing digital broadcasting systems, digital convergence was not an outcome since it was never an aim (Ala-Fossi, 2012). Certainly, from a technological perspective, both television and radio are simply different forms of linear broadcasting, and one might therefore have expected the opportunity of digitisation to lead to a single digital broadcast platform. Instead, they have emerged as different, and largely incompatible, systems: DAB digital radio networks cannot deliver live video while large-scale use of DVB-T for distribution of audio content would not be cost-effective.

Convergence, if it happens, instead depends on a host of specific circumstances. Public broadcasters in Finland and the UK, for example, find themselves in two different stages of convergence. After two failed experiments with digital radio broadcasting (DAB in 1998-2005; DVB-H 2006-2012) Finland has abandoned digital radio altogether and allocated its frequencies instead to digital TV. So, having eliminated one platform from its array (for political and economic reasons) the idea of also abandoning DTT and replacing *all* broadcasting with IP distribution may well look like a logical and straightforward scenario in that country. On the other hand, from the UK perspective, the idea of switching off DTT in the near future appears contradictory, not least because both the BBC and Ofcom continue the expansion of DAB digital radio broadcasting, expanding coverage to match FM and thus further diversifying platforms (Lax, 2014). The costs of such investment underline the continuing ‘efficiency’ of the terrestrial transmission mode for broadcasters: ‘traditional broadcast’ accounts for 87 per cent of the BBC’s total distribution costs, but delivers almost 98 percent of BBC TV viewing (BBC Trust, 2013: 39).

Any new debate about the use of spectrum must address these different perspectives between public and private interests. Ofcom, for example, notes that a transition from broadcast to IP-based delivery would involve ‘untested’ relationships between public broadcasters and private ISPs, perhaps requiring ‘further protection’ for the former (Ofcom, 2014a: 21). As we have discussed, predictions that broadcast networks will be replaced with IP delivery are frequently based on the assumption that consumer behaviour alone will ultimately decide which of the new technologies will prevail. However, without protection, broadcasting’s association with public service obligations, and its related funding mechanisms, may sit uneasily in this scenario. When such debates are based upon assumptions about inevitable convergence and universal interoperability, and lead apparently naturally to calls for further deregulation, sustaining delivery of public service content may become more challenging. An all-IP environment in which commercial operators dominate infrastructure and traffic may lead to a continual challenge to public service broadcasting as uneconomic in not maximising audiences, as unrealistic in seeking to reach all citizens and, simply, as out of touch with consumer behaviour. The separation, technologically, of a broadcast platform from an all-IP world, and so requiring distinct policy and regulation (for instance in the separate allocation of spectrum) may be one way of ensuring its survival.

Conclusions

Predictions of the end of terrestrial broadcasting are not yet of course fully-formed strategic policies. While some of the forecasts being made by sections of the industry may be for purely tactical purposes, the debates take place in an intensely political context, both domestically and internationally. In the UK, for example, at the time of writing (January 2016) the BBC is in discussion with the government over renewal of its ten-year Charter, including the future of the licence fee. So, if the BBC’s Head of News really believes that by 2030 “the TV aerial will have gone the way of the typewriter” (BBC, 2015a: 2), then he is in effect anticipating BBC funding reform. In the case of Yle in Finland, where the TV licence fee has recently been replaced with a personal tax, constructing a scenario in which DTT is abandoned may have been a negotiating position in the dispute over the cost of DTT delivery. Finnish broadcasters had just lost their court case over DTT pricing and Yle had been obliged to continue simulcasting all its terrestrial TV channels on both Standard (SD) and High Definition (HD) until 2026. Now, in 2016, with Yle funding and its remit under a parliamentary review, Yle's new strategy (2016-2020) aims at reducing the number of broadcast channels, the shortest possible transition to HD and development of the online service Yle Areena into "the most important distribution channel" of television (YLE 2016), which can be seen as proactively adapting to future cuts in funding. More widely, recent developments in European spectrum policy, including allocation of frequencies at the 2015 World Radiocommunication Conference (WRC-15) – in which pressure to re-allocate spectrum currently reserved for broadcasting to possible mobile data use was unsuccessful – demonstrate that broadcasters and their lobbying organisation such as the EBU will continue to argue broadcasting's case for some years yet.

Nevertheless, the spectrum battle witnessed in the lead up to WRC-15 has intensified and is now a global competition within and between states. For example, not all broadcasters favoured continued protected spectrum (for example Yle), while the USA, Canada, some Asian countries and – alone in Europe - Finland all favoured deregulation (Pursiainen, 2015). The anticipated demand from international mobile communications companies, together with concerns about 'capacity crunch', mean that broadcasting is now under pressure like never before. However, as we have suggested above, even if an all-IP future were *technologically* possible, there are reasons why it might not be desirable. Questions over universal service obligations, gatekeeping roles of private, commercial infrastructure companies and even associated concerns about privacy and data security do not currently feature strongly in the debates. Yet to ignore such concerns may mean that much of the public service role of broadcasting becomes, bit by bit, lost forever.

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