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Some Implications for Regulation of ICT and Media Convergence

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The **World Dialogue on Regulation for Network Economies (WDR)** facilitates an international dialogue to generate and disseminate new knowledge on frontier issues in regulation and governance to support the development of network economies. The Dialogue Theme for 2002 is: *The Next Step in Telecom Reform: ICT Convergence Regulation or Multisector Utility Regulation?* WDR research teams produce a series of discussion papers and reports on the theme to support the ongoing dialogue.

This paper is one of that series.

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Executive summary

Definition

The term convergence in the areas of ICT and media refers to the coming together of IT, telecoms, broadcasting and other media, technologically, market and policy wise. It is the sectoral convergence of the hitherto more separate ICT and media areas, which is in focus, even though there certainly are also changes taking place vertically in the different sectors.

Focus

The paper examines the relationships between technology and market developments and policy and regulatory initiatives. The issue is, therefore, not solely the implications of market and technology trends on policy and regulation, but also the reverse implications of policy and regulatory frameworks on technology and market developments. The paper analyses the convergence tendencies at a technological, market level and policy and regulatory level. It is, however, the policy level, which is the centre of attention in the paper.

Aim of paper

The paper is intended to establish a useful framework for understanding convergence issues, raising questions and fostering discussion. Consequently, the outcome of the paper is not an firm conclusion putting forward a specific model for convergence regulation. It is rather a set of open questions and issues and an overview of the different regulatory possibilities that countries have.

Technological aspects

The analysis on the technological aspects of convergence shows that digitalization is the major driver but far from the only factor, which can make convergence happen. It is explained that different parameters like network architecture, capacity, quality of service, and way of use all influence the convergence processes. It is also shown that convergence is not necessarily realized in one integrated network and that the utilization of the synergy between different networks can be a more efficient way of providing convergence services.

Market aspects

The market analysis shows that far from all integration developments in the ICT and media areas can be attributed to convergence on a cross-sectoral basis. Many of the developments that, in some accounts, are characterized as convergence trends are in reality mergers between companies in the same market segments or companies in the same sectors. However, the analysis also documents that cross-sectoral convergence actually does take place, but that the forms are different in the different layers of the value chains. Convergence in content production includes all of the four sectors dealt with (telecoms, IT, broadcasting and other media), while convergence in distribution is most prominent between telecom and broadcasting sectors. For equipment production, it is the IT and telecom sectors that are converging.

Barriers

The overall conclusion from the technology and market analyses are that convergence developments constitute important actual trends but that these developments do not move as fast as sometimes imagined. There are barriers at both the technological and the market levels.

Regulatory aspects

There are also regulatory barriers. It is, however, not only a question of barriers but also of creating the right policy and regulatory frameworks for the development of technical and market convergence and all the benefits to the users that these developments can facilitate. It is, furthermore, a question of balancing the different societal interests in, for instance, strengthening technology development and market penetration, and, on the other hand, limiting tendencies towards monopolistic market power.

Regulatory issues

The paper presents a number of policy and regulatory issues with relation to convergence:

- How to create of a framework that improves the general social benefits in terms of new services and possibilities?*
- How to balance the benefits and market power problems in media synergies?*
- How to secure the broadest possible access to networks and content?*
- How to establish a sufficiently technology neutral regulatory framework?*
- How far to go in the establishment in a converging content regulation?*
- What content issues with regard to privacy protection, consumer protection, intellectual property right, etc. to include in convergence regulation?*
- The degree to which infrastructure and content regulation can be separated?*
- How to establish the best possible institutional regulatory structure?*

Scenarios

Taking these questions into consideration the final section sketches a number of possible regulatory scenarios: limiting regulation to the distribution of scarce resources, general competition regulation, merging infrastructure and content regulation, and cross-sectoral regulations in both the infrastructural and content layers.

Developing countries

The possible differences between economically developed and developing countries are also discussed in the paper. It is concluded that generally there is not a fundamental difference between economically developed and less developed countries. Convergence from a technological point of view and from a market perspective may have come further in developed countries, although this is not necessarily so. Developing countries have a possibility to bypass technological developments that developed countries have come through, and from a policy and regulatory point of view, the problematic for developing and developed countries is fundamentally the same.

1. Introduction

This working paper is intended to establish a useful framework for understanding convergence issues, raising questions and fostering discussion. The paper examines the relationships between technology and market developments and policy and regulatory initiatives with regard to convergence of ICT and media industries. The issue is not solely the implications of market and technology trends on policy and regulation, but also the reverse implications of policy and regulatory frameworks on technology and market developments.

The paper is divided into five sections. Section 1 provides a general introduction to the theme. Next there is a presentation of how far convergence has developed from a technological point of view. Section 3 discusses market developments, followed by a discussion of policy aspects in Section 4. Finally, the paper concludes with five possible regulatory scenarios.

In addition, the paper briefly touches upon the organizational restructuring of policy and regulatory institutions, working in the field of ICT and media industries. It should, however, be born in mind that there is no direct relationship between changes in policy directions and organizational structures. It is highly possible to deal with convergence issues in separate institutions, just as it is possible to deal with separate issues in one institution. But there may be efficiency gains in dealing with converging industries in one or a limited number of policy and regulatory institutions instead of spreading activities.

This issue of efficiency gains is of central importance everywhere but is of even greater importance in countries with limited administrative resources as in the case of many developing countries. In relation to convergence issues, there is not generally a fundamental difference between economically developed and less developed countries. Convergence from a technological point of view and from a market perspective may have come further in developed countries, even though this is not necessarily so. Developing countries have a possibility to bypass technological developments that developed countries have come through, and from a policy and regulatory point of view, the problematic for developing and developed countries is fundamentally the same.

1.1 Conceptualization

The sectors traditionally involved in ICT and media convergence are IT, telecoms, broadcasting and other media dealing with information and entertainment. Figure 1 illustrates the sectors involved and the levels of activities from equipment / hardware and transport / software to content / service provision. Each of the different sectors can be conceived as encompassing all three levels although the levels are not entirely comparable. However, Figure 1 illustrates that there are many possibilities for convergence at a horizontal level between different sectors as well as vertical integration between different levels. It also illustrates that divergence and disintegration are possible. Sectors that formerly have witnessed (some degree of) vertical integration may experience new lines of divisions of labor between different actors in the field. Convergence / integration and divergences / disintegration go hand in hand.

Figure 1: Convergence / integration and divergence / disintegration

	IT	Telecom	Broadcasting	Other media
Content/ services	Software based content	Telecom based services and content	Broadcast programs	Film, music, newspapers, etc.
Transport/ software	Generic software	Network services	Transmission	Cinemas, video rentals, etc.
Equipment/ hardware	Hardware	Telecom equipment	Broadcast equipment	Reproduction of films, printing, etc.

1.1.1 Technology neutrality

There is thus both a horizontal and vertical aspect, and both aspects are subject to discussion in the working paper. The horizontal level has hitherto been primarily concerned with convergence at the equipment / hardware and transport / software levels (in communications called infrastructure and associated services, in the terminology of the European Union¹). Often countries have dealt differently - in terms of, for instance, licensing procedures and interconnection rules - with fixed telecom networks, mobile networks, and cable and terrestrial broadcast networks. At present, there is, however, a general shift in the rules and procedures in many countries towards an equal treatment (convergence) of different information and communication infrastructures. The EU is a case in point with its emphasis on technology neutral regulation.

1.1.2 Content issues

The horizontal level also includes the possible implications of convergence at the content layer. Types of content that, formerly, were dedicated for specific sectors can be conveyed on different infrastructures because of the common digital form. This presents new possibilities for end users and new industrial potentials for producers, but it also presents regulatory problems that have to be approached. One of the problems is related to the provisions for public service in the broadcast area. Should such provisions be extended to the Internet web, or should convergence on the content level lead to an abolition of public service rules? Another issue relates to the extended access to different kinds of illegal or harmful information, for instance racist propaganda, which the Internet facilitates. What are the possibilities of countries to retain control of this? Yet another problem is related to the provisions for media responsibility that exist today for print and broadcast media but do not apply to Internet.

1.1.3 Infrastructure and content together?

There is also a vertical aspect – not only in the sense that there are numerous examples of industries integrating or trying to integrate equipment and transport and content provision, but also in the sense that some countries integrate infrastructure regulation and content regulation. India is an example of this. The planned new Communications Commission of India (CCI), the Indian communications regulator, will integrate infrastructure and content regulation in one institution². The UK is another example, in which the government is uniting five existing regulatory bodies dealing with communications into one regulator, OFCOM, with

¹ See, for instance, European Commission: The 1999 Communications Review, COM (1999) 539, Brussels.

² “The Communication Convergence Bill, 2001”. See, for instance, <http://indiantelevision.com/indianbroadcast/legalreso/ccb2k1.htm>.

authority in both infrastructural and content questions³. Singapore and Malaysia are also examples of countries that have assembled the regulation of infrastructure and content.

In the case of horizontal convergence, it is a matter of converging regulation and possibly converging regulators. In the case of vertical integration, it is mostly a matter of integrated regulators, as infrastructure and content regulation are two rather different fields, although integration of content and infrastructure provision may have implications not only for the industrial structure but also for the content itself. The EU, for instance, draws a sharp line between infrastructure (and associated services) and content. It is, however, a question whether this is possible without leaving aside important issues.

1.2 Is convergence something new?

Often convergence is described as something relatively new. But industrial convergence and regulatory dealings with convergence issues have existed for many years⁴. In many countries, there has been a deliberate policy to keep different communication fields apart for the reason of limiting media concentration. Formerly, companies have also had the intention of covering several media fields, and the question of benefits of synergies between different media areas versus the problems of too strong media power is not new. What is relatively new is the technological foundation that digitalization of all media provides for convergence developments and synergies between media area. What is also relatively new is the general trend towards liberal policies that has been seen during the past 20 years. Together, these developments constitute a new basis for the development of convergence and for the balancing of the benefits of synergies versus the problems of media concentration and power.

The trend towards liberalization of telecoms is in part an expression of a convergence policy. The introduction of data communications on telecoms networks was an important technological basis for the regulatory changes in telecoms and the basis for the industrial interests behind the first initial moves in this direction. Companies, first in the US and later elsewhere, argued for changes in the regulatory structure, as they wanted a greater liberty to use the telecom networks for data communications. The newer questions that are put forward today under the heading of convergence first and foremost deal with the development of Internet into a powerful communication infrastructure and the possibilities for integrating two-way one-to-one telecoms and one-way one-to-many broadcast and print media.

1.3 The main issue

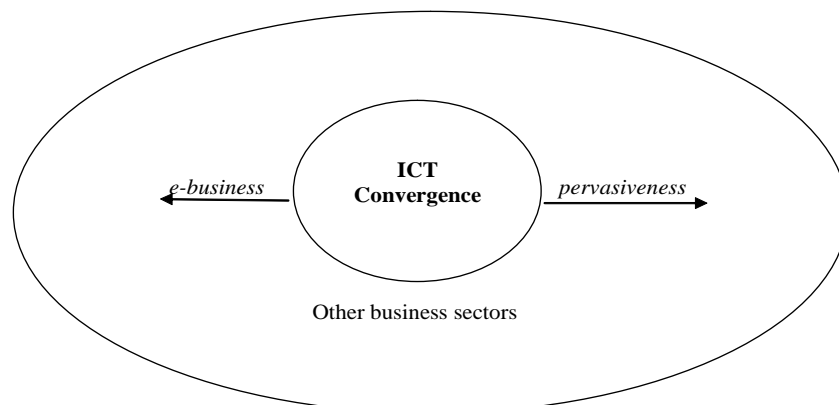
The main issue in the convergence discussion is, therefore, concerned with the possibilities for exploiting the industrial opportunities in creating a new dynamic ICT sector encompassing hitherto separate sectors⁵. Apart from the broad diffusion and usage of the new media and communication possibilities (universal access) and the protection of consumers in new media markets, this is the overall issue for convergence policy: to establish a framework for the growth of a dynamic communication and information industry. It is in this perspective that most convergence policies are seen. Regulatory policies with respect to telecoms and broadcasting have, of course, always had an influence on business developments. But with the growing importance of the ICT sector and the even greater importance in relation to other industries and social developments, regulations of converging communication and information industries have a central importance in the economic development strategies of governments. Figure 2 illustrates the implications of ICTs on other business and social activities in terms of e-business solutions and the pervasiveness of ICTs.

³ See Department of Trade and Industry: A New Future for Communications, 2001, <http://www.communicationswhitepaper.gov.uk>.

⁴ This has been documented by, for instance, Dwayne Winseck: Re-convergence: A Political Economy of Telecommunications in Canada, Hampton Press, 1998.

⁵ See e.g. the UK case, op.cit.

Figure 2: Implications of ICTs on other business and social activities



2. Technology trends

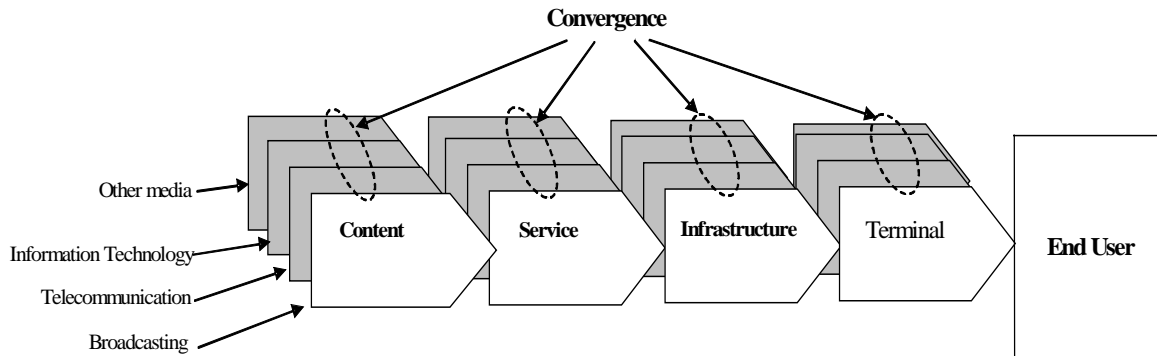
This section provides an overall analysis of the technological aspects of the ICT and media convergence processes. Focus is on the role of technological changes and developments in the creation of new conditions for production, aggregation, delivery and consumption of communication services.

The major technological changes that have facilitated the convergence processes are digitalization and computerization. Digitalization enables new possibilities for development and creation of services within and beyond the framework of traditional communication sectors. It is, for example, likely that services that go beyond the traditional broadcasting services, like Internet services, will have a certain weight on the broadcasting market in the future, as demand for these services is increasing with the penetration of the Internet. When transmission capacity for end-users site reaches that needed for transmission of video services, the Internet can be one of the platforms for interactive TV services.

Emerging new infrastructures with more capacity, development in the traditional networks enabling these to offer more and more capacity to the end users, and the development in compression and coding technologies resulting in less bandwidth requirement for audio and video services have diminished (yet not removed) the technically based limitations for different networks ability to provide different types of services.

The following analysis is structured around the value chain of communication networks depicted in Figure 3, so that different subsections deal with the technological aspects of convergence in different parts of the value chain.

Figure 3: Convergence in the value chain



The analysis aims at illustrating the technological drivers, but also barriers, for the convergence processes in different parts of the value chain.

2.1 Infrastructure

Traditionally, different infrastructures have been used to transmit and deliver specific information and communication services. Examples regularly mentioned in the literature include: dedicated telephony infrastructures for transmission of Plain Old Telephony Services (POTS) and broadcasting networks for casting Plain Old TV Services (POTVS). These infrastructures have been dimensioned and optimised to meet the specific requirements of their respective services.

The technology of information and communication services has, however, been subject to radical changes during the last 20-30 years. Technological developments have resulted in the emergence of new infrastructure and better integration of services across infrastructures mainly due to digitalization.

Integration and convergence occurs at different speeds in different levels of the network. Core networks have other characteristics than access network resulting in different conditions for their level of convergence. The focus of the following is on the access networks.

Apart from digitalization, there are other important factors that impact on the convergence processes:

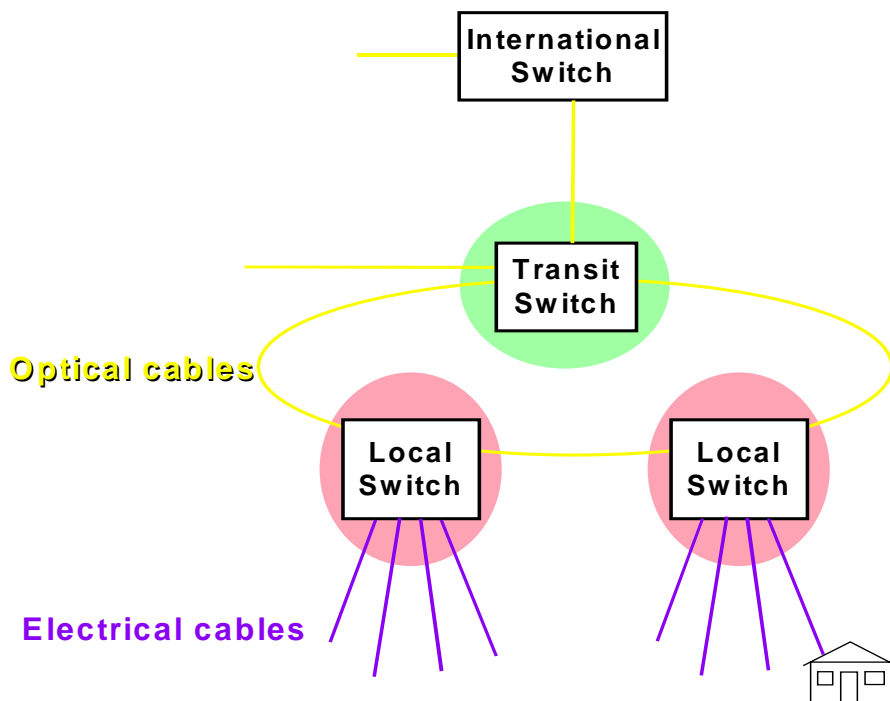
- Network architecture
- Capacity requirements of the services
- Quality of Service (QoS) requirement of the services
- Way of use requirements of the services.

2.1.1 Network architecture

We can roughly distinguish between two types of networks: telecom networks and broadcast networks. Traditionally, broadcast networks do not have the return path necessary for interactive services. Digital broadcast networks, however, have a return path, either integrated in the network or using other networks.

Traditionally, telecom networks are built to provide point-to-point services resulting in network architectures where the network resources between the user and the first switch in the networks are not shared (see e.g. Figure 4). This enables the service providers to offer customized services to individual users. However, the cost of operation and maintenance of these networks are high and that the increase of capacity at the end users' site is developing slowly, making it impossible in the short term to integrate all kinds of services. In the long term, the development in audio / video compression technology and new access technologies will make it possible to offer new services in these networks.

Figure 4: Switched network, POTS network is depicted as an example for a switched network



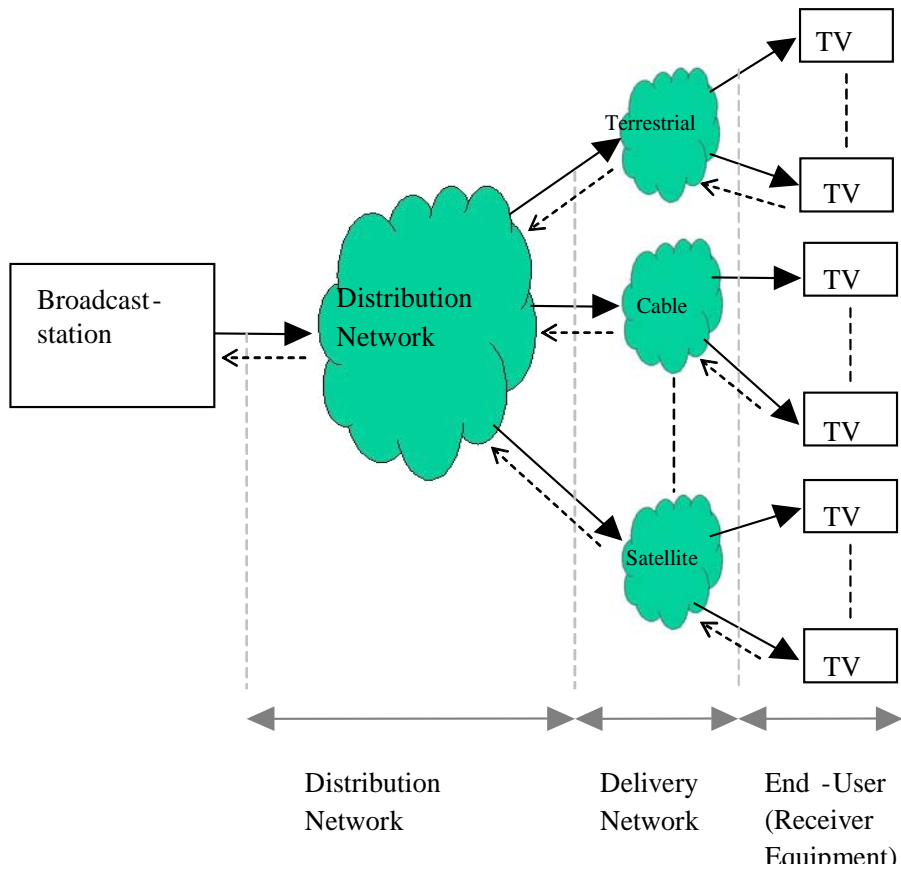
In broadcast networks (see Figure 5⁶), users are connected to distribution points in the network and share the network resources. The capacity allocated to a broadcast service is dimensioned to give a good technical quality of the services, however, the Capacity per User (CpU) is very low. These types of networks are not optimized for point-to-point services but are well-suited for services with common interest.

Transmission of broadcast services over switched / routed networks is not necessarily an efficient way of utilizing network resources. Especially when 'broadcast service' denotes a service that is transmitted to many users and these 'many users' demand the service. All switches and routers in the network will then do a simple job of connecting the same input to many outputs, which is an in-efficient way of using a switched / routed networks.

To a certain degree, this is in line with the experiments in the UK in early 1980s, where the cable companies implemented switched cable networks. The cable companies observed that the vast majority of users watched the same kinds of programs for most of the time, reducing the function of the expensive switches to a wire connecting these inputs to all outputs.

⁶ The dashed arrows in the figure indicate the possibility for interactivity in digital broadcasting

Figure 5: Broadcast network



A precondition for Internet TV (TV over the Internet) being comparable to traditional (digital) TV is an exponential increase in transmission capacity to the end users' sites. By using a simple assumption that two or three services must be available for a households (different family members must have the opportunity to watch different programs, at the same time, and be able to record a program on VCR), the necessary capacity will be about 40-60 Mbit/s in the case of HDTV and 8-12 Mbit/s in the case of SDTV.

For along time to come, the broadcasting networks with their one-to-many structure will be the most optimal way of transmitting broadcasting services to the end user. However, when capacity is sufficient to provide broadcasting services over the Internet other parameters like the way services are used can limit the provision of broadcasting over Internet. If a service is used by the majority of people, it is waste of resources to provide it through a switched / routed network, as it can easily be broadcast to all people using broadcast networks.

A scenario might be that web TV (web on broadcast TV) co-evolves with digital TV and exists as a complementary and competitive platform to other delivery networks. As a complementary platform, special types of services that will not to be provided on other platforms can be provided on the Internet. And as competitive platform, services like special narrow types of services provided on cable and satellite delivery networks can be provided on the Internet and compete with these infrastructures.

2.1.2 Capacity / bandwidth

The capacity or bandwidth of different networks varies considerably. To provide convergence services, different networks must be able to transmit “the same kinds of services”. Video services have the most demanding capacity requirements and are one of the major components in all ‘convergence services’. In the following we try to examine the capacity requirements of video services.

Table 1 shows different capacity requirements standardized for broadcast Digital TV. A bandwidth of 4 Mbit/s corresponds to regular PAL quality in analogue world and is denoted as Standard Definition TV (SDTV). It is quite certain that traditional broadcasters will not accept a quality less than SDTV.

Looking at the current capacity available at the end-users’ site (regular modem up to 56 Kbit/s, ISDN up to 128 Kbit/s, and even available DSL technologies of up to 512 Kbit/s), it is obvious that allocation of 4 Mbit/s for a TV service is not currently possible on the Internet.

Table 1: Levels and profiles of MPEG-2⁷

Levels	Simple Profile (SP)	Main Profile (MP)	SNR Scalable Profile (SNRP)	Spatially Scalable Profile (SSP)	High Profile (HP)
High (HL) 1920X1152 pixels		MP@HL 80 Mbit/s			HP@HL 100 Mbit/s
High-1440 (H14L) 1440X1152 pixels		MP@H14L 60 Mbit/s		SSP@H14L 60 Mbit/s	HP@H14L 80 Mbit/s
Main (ML) 720X576 pixels (Rec 601)	SP@ML 15 Mbit/s	MP@ML 15 Mbit/s	SNRP@ML 15 Mbit/s		HP@ML 20 Mbit/s
Low (LL) 352X288 pixels		SP@LL 4 Mbit/s	SNRP@LL 4 Mbit/s		

The capacity problem is not only relevant for the access network. Even if the access networks in some residential areas are increased to be able to provide the required capacity, it is far from certain that the backbone network is upgraded accordingly. There are firms specializing in provision of new infrastructures, which offer LAN types of networks of 10 and even 100 Mbit/s to residential premises. But their backbone capacity can not match this development.

⁷ Dambacher P.: “Digital Terrestrial Television Broadcasting- Designs, system and operation”, Springer, 1997.

Regarding video services over the Internet, other coding schemes are used that do not offer acceptable broadcast quality but are feasible for narrowcast purposes, where the picture quality is not as important, and other Internet related added values compensate for the lack of quality to some degree.

2.1.3 Quality of Service

Traditionally, QoS has been associated with the ability of telecom networks to guarantee a predefined level of quality for specific services when these are established and transmitted from point A to point B. These QoS-concepts are meticulously described in ITU / CCITT recommendations and have been among the arguments for establishing dedicated networks for different services, as this makes it easier to optimize the networks with respect to the QoS-parameters. A simple example is POTS, which demands specific quality levels for end-to-end delay, delay variation and noise when the connection is established. QoS requirements are not applied only in the transmission part but also in other levels of communication. An example is the establishment phase of a POTS connection, where a set of other QoS parameters like the blocking rate and that the number of lines in the access network and the capacity of the core network are needed.

Video services, especially interactive video services, are very sensitive to end-to-end delay, delay variation and noise / interference, etc. As far as a dedicated network is deployed for the distribution of video signals, these QoS parameters can be kept under control. When integrated networks are used, where video services are one of the services in the network, then different methods must be used to guarantee some minimum QoS parameters.

One method to guarantee a given level of service is that every service negotiates parameters over the network (delay, loss-rate etc.). This method is now current for connection-oriented networks as ATM-networks (Asynchronous Transfer Mode), but is still a challenge in connectionless networks as the Internet. Another approach is the establishment of a prioritizing scheme that can be applied to IP types of networks and will be applied to IPv6.

Meeting the QoS requirements of different services in integrated networks is considered as one of the barriers to the convergence process.

2.1.4 Way of Use

Another import aspect is the way in which services are used. One of the major differences in Way of Use is mobility versus fixed use. There will certainly be substitution between mobile and fixed networks but some services will only be relevant in mobile networks.

An example frequently used in the literature is radio services. These services are consumed mainly in mobile and portable environments. In this case the Way of Use is one of the major reasons for establishing mobile networks for provision of radio services. The question of the necessity of dedicated networks for provision of radio services or the possibility of using, e.g., mobile communication networks for the provision of radio services is another question that is determined by a combination of other parameters.

2.2 Content / Service

Digitalization of content is one of the major drivers of convergence. In the digital world, the same content can be transmitted across different networks, and different services can be offered based on the same content. The synergy achieved goes far beyond the electronic communication forms and includes among others the printing press.

The above mentioned capacity-per-user problems and the problems associated with return paths in broadcasting networks will influence the development of data services that will be available in the broadcasting networks.

The following provides examples of interactive services are offered in broadcasting networks without using a return path:

- Download of software: The broadcasting networks are mostly used in the daytime and evening hours. The transmission capacity in the nighttime can be used to download, e.g., new versions of software to the set-top-boxes.
- Download of newspapers: In a similar way, newspapers can be downloaded to the set-top-boxes.
- Internet on TV: Access to the Internet as it is known in the communication networks will not be possible because of capacity-per-user problems of digital TV networks. The solution can be to broadcast a limited version of Internet.

When using return paths, the traditional interactive services can be offered within broadcast networks. The spread of TV services within the Internet is the major example of the reverse process, namely provision of services that traditionally belong to broadcast sector within the communication networks.

2.3 Terminal

Terminal convergence denotes the coming together of consumer devices such as the telephone, television and personal computer.

Penetration of TV is much higher than PC. Providing interactive services, including Internet, on TV can potentially benefit especially the 'information poor' and thus reduce the 'information gap' in the society. This is an important implication of convergence, as a part of the society will only benefit from the new values of the information society if they receive the data services on TV.

The PC itself is developing into a real competitor to TV as an access device to broadcast services. Additional low cost TV tuner cards are needed to be able to see traditional broadcast services on PC. On the other hand, PC is a perfect medium for consumption of Internet services and is a perfect medium for convergence.

Also here the way of use will be a vital parameter that determines if PC and TV will substitute or replace each other.

The development in the last four to five years shows, however, that the development is not only turning towards the coming together of consumer devices but towards another development with a variety of different access terminals for dedicated services and applications.

2.4 Heterogeneity versus Integration

One of the major barriers for convergence relates to the transport and delivery part (i.e. the infrastructure part) of the value chain. It is shown that digitalization being a major parameter still is only one amongst several parameters that influence the convergence at the infrastructure level. It is important, however, to have a clear distinction between convergence and integration at the infrastructure level and to emphasize that the success or failure of convergence is not directly connected to the capability of one infrastructure to integrate all services.

None of the infrastructure available can integrate all the services in their current state. While integration of the back-bone parts of the networks have had better conditions to evolve, integration of the last mile coverage has shown to be dependent on many different parameters. However, some infrastructure have better potential to be upgraded to integrate all the services. Cable TV networks are an example. On cable networks, it is possible to offer several broadcasting services of acceptable quality and at the same time deliver Internet and basic communication services. Also new LAN types of networks in residential areas (and different wireless solutions on the market) have optimal performances. However, when

upgrading cable TV networks and establishing new networks, huge costs must be paid in one way or another.

One way of implementing convergence and delivering 'convergence services' is to utilize the synergy between different networks and consequently to utilize the strength of different networks. In this way, different components of the same service can be transported over different networks. This organization of heterogeneous network can be totally seamless for the end-user and seam like an integrated network.

There is, therefore, a certain choice between an integration model and a heterogeneous model. This choice depends partly on the characteristics of the types of communication in question and the characteristics of different kinds of networks and partly on the history of network developments in the different countries. There is a certain path dependency in the possible choices countries make, hinging on the former history of network development.

2.4.1 Developing country perspectives

The overall technological aspects of convergence in developing countries are not different from developed markets. There are, however, some specificities and certain possibilities for developing countries to leapfrog network developments that developed countries have gone through. While in developed markets, the convergence process (both in integrated and heterogeneous network versions) mainly facilitates a platform where the same service is delivered through different infrastructure, for developing countries, it mainly facilitates increased penetration of services. In developed countries, convergence facilitates more competition, in developing markets it facilitates complementarity.

One of the main aspects of convergence is that different services can be transmitted within different networks. This can be used in developing countries to extend the penetration of basic communication services. For example, cable TV networks can be used to offer telephony and Internet services. This possibility of reuse of infrastructure is only possible if an adequate regulatory framework is established, facilitating efficient utilization of available resources in different networks.

Another important aspect concerns geographical regions where communication infrastructure is not available. This gives more freedom in the design of the future networks, because the demand for other services than telephony can be taken into account from the beginning.

In many developing countries mobile communication is seen as a replacement for fixed telephony. The development of new generations of mobile networks can be utilized to offer mobile Internet and other advanced services. This is important for the provision of 'convergence services' in developing countries as the penetration of PCs is low (and is likely to remain low due to the costs of PC, electricity, etc.) in these regions.

In many developing countries the broadcast frequencies are under-utilized. Establishing digital TV networks in these countries will give the providers the possibility to go beyond the traditional broadcast services. For assignment of broadcast frequencies, it is important to consider that other than broadcast services can be offered over these networks. This is important both for regulators working to extend advanced services and for market actors that can find new business opportunities in digital broadcast services.

Furthermore, the technological development that enables using power line communications (PLC) is interesting in the developing countries as communication services can be offered without the need for laying new wires to cover the last-mile. In many developing countries the power lines are extended to the residential areas. And if not so, the combination of delivery of electricity and communication services will give new incentives for this development.

2.5 Regulatory Implications

There are a variety of technological parameters that influence the convergence processes. Digitalization is the major driver but far from the only factor, which can make convergence happen. Different parameters such as network architecture, capacity, QoS, and way of use influence the convergence processes. Convergence is not necessarily realized in one integrated network and utilization of the synergy between different networks can be a more efficient way of providing convergence services.

However, the technological changes and developments described raise some important regulatory questions.

On the one hand:

- Adjusting regulation to a specific state of technological development will be inadequate in a world where technological developments are changing the picture of communication network rapidly. Many resources are wasted in technology specific regulation, one example being the extensive amount of efforts that have been used to assign frequencies for digital radio that from some of the actors are considered as a none-efficient way of providing digital radio. Detailed and sector specific regulation can either block technological developments by locking the development in certain paths or can be overtaken by technological developments. Another danger regarding sector specific regulation is the waste of the possible synergy that can be obtained. It would be more appropriate to set general rules that are independent of the actual state of technology development. Using this approach it will be easier and more transparent to regulate communication services in the convergence processes. When regulation is general, the provision of different services in different networks and across the traditional sectoral boundaries will relate to the same set of rules.

On the other hand

- There are so many specificities in the service provision in different networks, making it necessary to have detailed types of regulation that are adjusted to the different sectors. Using this approach, the abilities of different communication networks in their service provision will be utilized more efficiently seen from a social perspective.

There is thus a schism between technology neutral regulation and regulation that takes the specificities of different technologies and networks into account.

3. Market trends

In this section, current trends in convergence of markets are discussed. The industry has been reshaped through a series of alliances and mergers. This has resulted in a more globalized ICT and media industry and created new relations both between various layers in the value chain and across industries. **Vertical integration** between different levels in the value chains and international integration of national markets are also important aspects in many alliances and mergers.

Convergence is a result of combination of the technological trends described above and of purely financial and strategic considerations, which are independent of the convergence of the underlying technologies. Until the 1970s, large industry conglomerates saw diversification as part of their strategy. Companies spread their activities on a wide range of industries, and quite often there were no or very weak links between the departments. This strategy fell out of fashion in the 1970s and was replaced by a trend towards concentration on core competencies. According to this strategy, involvement in other sectors should only take place if it possible to create symbiotic advantages through cross-sectoral activities.

3.1 Vertical Integration

Vertical integration related to integration of the three layers depicted in Figure 6, and can take place within all of the four mentioned sectors.

Figure 6 Vertical Integration

	IT	Telecom	Broadcasting	Other media
Content / Service	↑	↑	↑	↑
Transport / Software	↕	↕	↕	↕
Equipement / Hardware	↓	↓	↓	↓

3.1.1 Telecom

The telecom markets were highly vertical integrated up to 1980. The telecom operators focused on delivery of end-to-services and they either produced their own equipment or had a close relationship to national equipment suppliers. In the '80s much of equipment production was divested from service operations. This was partly a consequence of the emerging liberalization of the telecom sector. The equipment manufactures want to sell their products to the incumbent as well as the new entrants. Too strong links with one operator will limit this potential and manufactures therefore benefits from a position as independent companies. Many operators maintain however substantial R&D departments mainly in software and service development, in order to create a competitive edge through provision of the most advanced and innovative services. So in innovation some integration between production of technology and service production still persists.

3.1.2 IT

The IT sector also experienced a kind of divestiture as hardware and software gradually became still more separated. From the outset hardware manufactures (e.g. IBM) developed their own software, but later on software production were outsourced to independent companies and soon software became a separate industry.

3.1.3 Broadcasting

For terrestrial broadcasting, equipment production and service production have in general been two separate activities. However, distribution and content production is highly integrated. In satellite and cable there is some vertical integration between content, distribution as well as equipment production. The basic distribution by cable or satellite maybe separated from content production, but most broadcasters act both as gatekeepers and producers of content although they also buy content from others.

This does not imply that the different platforms will be used for provision of the same services - a certain specialization will remain. But the former boundaries between IT, telecom, broadcasting and other mass media companies are going to be redefined and less visible. Even if a broadcasting company will choose to remain basically as a broadcaster, it will be necessary to become visible on other platforms as well. New service integrating elements from IT, telecom, broadcasting or other mass media will constantly be developed. These new services will not always be a source of creation of new companies but will contribute to the blurring of boundaries between the different industry sectors.

Service convergence implies that content providers will become cross-sectional in the sense that they provide content to more than one sector. Most content providers are, however, still rooted in one sector and their new activities are mainly in the new sectors. This is seen most clearly in content provision to the Internet. Both newspapers and TV broadcasters have developed their own web-sites, where they exploit the economies of scope related to provision of the same content to different platforms.

These activities may expand in such a way that this will lead to a convergence between providers of content to the Internet and either newspapers or broadcasters. But it is also possible that provision of news services to the Internet will develop into separate entities that may be spun off as independent companies. Or the market will be taken over by completely new companies that have content provision for the Internet as their core business.

An important barrier to the development of cross-sectional content providers is that it is not enough to provide the same content on different platforms. In order to remain competitive, content must be designed in a way that takes the potentials and limitations of each platform into consideration. As long as the technical capabilities vary across platforms and networks, there will always be a scope for development of content designed for a particular platform.

3.3.1 Convergence between telecom and broadcasting

Another trend is the entry of telecom operators into the broadcasting sector. In Denmark, for instance, the incumbent operator TDC tried to establish its own TV channel in the mid 1990s; Telecom NZ has bought a stake in Rupert Murdoch's Sky Network Television; and British Telecom has recently applied for a broadcasting license.

Example: BCE Bell Canada

One of the most convergent content providers is probably BCE Bell Canada. This company is not only Canada's largest telecom company, it also owns the best selling newspaper, the Globe and Mail, the largest commercial television network, CTV, wireless data and telephone services, satellite television services, the popular Lycos/simpatico Web portal, the Teleglobe global Internet protocol and data network, Workopolis job finding database and many other online media activities. Thus, BCE is active in content production in all of the four sectors and in distribution of both broadcast and telecom services.

These examples deal both with horizontal and vertical integration. The philosophy is to ensure content to the networks. For example, BT seeks to distribute its broadcasting service via its own broadband network. But in all of the examples, the input is provided by entering content provision in other sectors.

Not all of these attempts have been successful. TDC had to realize that broadcast and telecom are two quite different types of businesses and their TV channel was closed down due to lack of subscribers. It has also been questioned whether the strategy of BCE has paid off in terms of generation of revenues⁸.

⁸ Geof Wheelwright: 'North American Convergence Plays - Canadian convergence in doubt', Communications Week International, 24 September 2001 <http://www.totaltele.com>.

3.3.2 Convergence between IT and broadcasting

Some of the larger IT companies have shown their interest in broadcasting. Providers of content as well as software and hardware to the IT sector have a strong interest in promotion of a pc-based approach towards digital television. On the content side, Microsoft is involved in development of the American cable TV industry and they have also acquired WebTV Networks for nearly half a billion dollar⁹.

Many of these initiatives can not only be seen as a result of technical convergence. They must also be seen in a financial perspective. Many telecom operators had an overflow of capital after liberalization and were looking for new investment opportunities. It was not always possible to find attractive investments within the telecom sector. The hype surrounding ICT shares at stock markets provided easy access to more capital and contributed to the overflow of capital within the sector. One example is the merger between **America Online** and **Time Warner**. As Michael Noll expresses it: "AOL had to transform its overvalued stock into real property before the bubble burst, consequently Time Warner became the victim of AOL's lust".¹⁰

3.4 Convergence in distribution

3.4.1 Telecom and broadcasting

The most important trend in convergence of distribution networks is between the telecom networks (which also provide the infrastructure for many IT services) and the broadcasting networks

The telecom networks are used for telephony as well as data-services. Broadcasting services are still mainly distributed on separate networks, but broadcasting can also take place via the Internet. On the other hand, cable-TV networks can offer telecom services as well. In the UK, cable operators have upgraded their cable networks to provide telephony, and cable modems are used to offer Internet access in many countries.

In some countries, the incumbent operators have from the very beginning been among the major cable-TV operators. This has tended to slow down convergence as telecom operators have been hesitant to introduce new services in the cable network (such as cable-modem access to the Internet) that compete with services delivered in the telecom networks. In the US, **AT&T** has through its acquisitions of TCI and MediaOne become one of the two major cable-TV operators. AT&T has since the divestiture in 1984 lacked a direct network access to its customers. Through this acquisition it seeks to regain direct access.

3.4.2 Divergence: Mobile operators

There is, however, also a trend towards divergence. Mobile communication, for instance, emerges as a new sector. The largest player on the market for mobile communications, Vodafone, is an independent company with focus on mobile businesses. In addition some of the fixed operators, e.g. BT, consider divesting their mobile activities.

⁹ J.F. Moore & S. Koprice: 'A digital Television Ecosystem', in D. Gerbarg (ed.) The economics, technology and content of digital TV. Kluwer, 1999.

¹⁰ A. Michael Noll: Perspective – AOL/Time Warner and the Convergence Myth, <http://www.totaltele.com>, 5 February 2001.

3.4.3 Divergence: Internet operators

Another emerging sector is Internet operators. But this sector is dominated by the incumbent telecom operators, particularly in Europe. The most successful independent Internet operator is WorldCom. WorldCom has later become a telecom operator through its acquisition of MCI, and the markets for provision of Internet and other wired telecom services is still deeply integrated.

3.4.4 Divergence: Networks & operators

A third possible trend of divergence is separation of supply of telecom services and operation of the physical network structure. Today a number of telecom operators base in part their operations on access to other operators' network through leasing and interconnection agreements. In addition, a number of infrastructure providers have emerged. These are often public utility companies, which are in possession of their own telecom infrastructure but do not have any intentions of entering the retail market for telecom services. The financial crisis following the UMTS auctions may be the decisive factor in this development, as some of the incumbent operators may be forced to sell off their infrastructure in order to reduce their debts. Among others, BT has received offers for their infrastructure from at least two different consortia. Although these offers have been rejected, analysts say that BT (as well as other debt burdened telecom operators such as KPN, Deutsche Telekom and France Telecom) must decide whether they want to be pure network operators or service providers in the future.¹¹

3.5 Convergence in equipment production

Convergence in equipment production is not a new phenomenon. Many industrial corporations such as **Philips** and **Siemens** are involved in many different industrial activities in most of the ICT and media sectors. The reasons for this is the above-mentioned strategy of conglomerization and the synergies between equipment production of different types of electronic equipment that also existed before the digitalization

In the past decade, convergence is most visible in the IT and telecom sectors. The liberalization of the telecom sector has made it possible for new entrants to start up production of telecom equipment. At the same time, the technical convergence between IT and telecom equipment has made it easier for IT manufactures to enter the telecom market. One example is **Cisco** who supplies routers to private data networks as well as public telecom networks (in particular IP-networks).

Convergence is not only a matter of utilization of synergies in development and production. It is also a question of development of new types of equipment providing features originating from different industries. This is clearly seen in development of terminals for digital TV. These terminals do not only combine broadcasting and IT technologies in their technical design. The services they provide are also a result of the convergence between the different industries. One example is the set-top box recently introduced by **Nokia**. The box offers both a return channel that can be used for Internet connection and a large hard disk where broadcasting programs can be stored.

3.6 Regulatory implications

Regulation at the ICT and media markets has largely been a matter of regulation of four different industries, which easily could be distinguished from each other. Even though cross-sector ownership existed, the industries were separate in the sense that they produced different products, and the possibilities for substitution between products from different sectors were very limited.

¹¹ Michelle Donegan: 'Local Loop Selloffs - all eyes are fixed on local network assets', Communications Week International, 10 September 2001. <http://www.totaltele.com>

Convergence does not develop at the same speed and in the same direction everywhere. There are important national differences. In general, convergence goes hand in hand with the introduction of new digital technologies and new services like Internet and digital broadcast. But this does not imply that convergence will develop more slowly in developing countries although it may take different forms. This depends on the penetration and sophistication of the different types of infrastructures, on ownership and on regulation.

Convergence is shaping the present development of the ICT and media industries in a way that challenges this institutional set-up. The market trends can be described as follows:

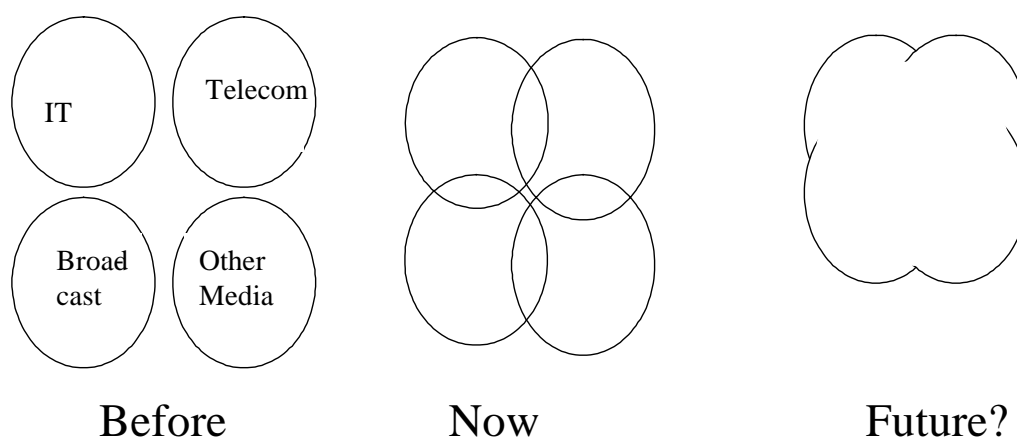
- Company and market structures are formed by other factors than convergence such as financial considerations and corporate strategies (conglomeratization vs. focus on core competencies).
- A large number of mergers and alliances have been made. Most of these mergers and alliances have taken place between actors within the same market segment, and may rather be attributed to internationalization than to convergence. Still, a number of cross-sectional and vertical mergers have taken place.
- Vertical integration has mainly taken place between content production and distribution. At the same time there has been a trend towards disintegration of service production and manufacturing particularly in the telecom sector. It is possible that a further disintegration in the telecom sector will take place through a separation of network provision and telecom service provision.
- Many companies have set up new activities in other sectors in order to complement their core business. Content providers such as newspapers and broadcasters become multi-channel content providers, although they keep their main activities within one sector. Telecom companies go into content provision (including broadcast) in order to ensure content to their networks.
- Convergence takes different forms in the different layers of the value chain. Convergence in content production includes all of the four sectors, while convergence in distribution is most prominent between telecom and broadcasting sectors. In equipment production it is the IT and telecom sectors that are converging (Figure 3).
- New ICT and media sectors are emerging. These sectors may in a certain phase be dominated by companies from other sectors but can develop to sectors that in spite of a deep integration with services from other sector may become dominated by independent companies. The most obvious candidate is the mobile industry. In spite of a considerable overlap between the markets for fixed and wireless services, operators tend to separate their mobile operations into independent activities, which later may be spun off as new independent companies.

Figure 8: Trends in convergence

	IT	Telecom	Broadcasting	Other mass media
Content / services				
Transport / software				
Equipment / hardware				

Convergence among the former industry sectors has torn down the former boundaries and created an entirely new market (see Figure 9). This is certainly not a single market for all ICT and media products. The new ICT and media markets can better be described as a web of a large number of highly integrated submarkets. There is a high degree of substitution between products from different markets. Many companies provide products or services at more than one of these markets, but no company is present at all markets. Each company has its own profile of core competencies and key market segments. The old industry sectors still persist and so do the companies belonging to these sectors. But still more companies provide services and products across the former boundaries. At the new ICT and media markets, it becomes still more difficult to draw exact borderlines between the sectors, their companies and their products. Therefore it also becomes more difficult to maintain different regulatory regimes for the different industries.

Figure 9: Possible steps in the convergence process



In this environment it become more important than ever to coordinate the sector specific regulation, which has been practiced in each of the former industry sectors. On the other hand there are substantial differences between the various submarkets in terms of services, market structures and cost profiles. The fact, that it is impossible to draw a clear borderline between the new sub-markets, does not imply that the needs for regulation are the same.

Furthermore internationalization complicates national regulation, particularly in the content and distribution layers. Content can be produced anywhere and distributed everywhere via international networks. Furthermore, domestic production will, in particular, in small open economies and in developing countries be highly integrated with international markets. The major actors will often be foreign companies and the convergence at the domestic ICT and media markets will depend on international rather than on national developments and priorities.

4. Policy issues

From a policy and regulatory point of view, convergence in the ICT and media areas raise a number of issues. There are issues that are related to all three levels (equipment / hardware,

transport / software and content / services) in the convergence model (Figure 1). The ones that will be dealt with here take up the issues of the general societal importance of convergence policies, the balance between benefiting from industrial synergies and the problems of media concentration, and access to networks and content. Other issues are related to the infrastructural levels (equipment / hardware and transport / software), where the overall question is to what extent it is possible to subject all infrastructures to the same regulation. At the content level, there are a large number of issues that have to be resolved, including the question of whether all content areas can be treated in similar ways regarding, for instance, what it means for public service provisions in the broadcast area and what it means for media responsibility rules. Other questions deal with privacy protection, security, consumer protection, intellectual property rights, and illegal information. Furthermore, there is the issue of the possibilities and problems regarding the separation of regulations of infrastructure and content. Finally, there is the organizational issue as to whether all these questions should be dealt with in one common regulatory institution.

4.1 General societal importance

The general societal importance of convergence policies lies in the large and growing importance of ICT and media industries in societies in terms of size of the sectors themselves and the broader social implications. ICT devices are part of products in many sectors, and information and communication systems constitute infrastructures for many functions in society. Information and communication infrastructures are, for instance, crucial in importance for the many service activities that play an increasing role in social developments. Most countries have, therefore, devised information / network society visions and plans to be prepared for and take advantage of the potentials in the new information and communication technologies and services. Countries strive to establish the best possible economic and regulatory framework conditions for the development of dynamic information and communication industries and innovative usage of ICTs.

4.2 Benefits and problems in media synergies

The balancing of benefits and problems in relation to synergies and market power is not a new issue. Public policies have been seeking to strike such balances in many areas for a long time, and a large number of countries have for years had regulations limiting cross media ownership. However, technological developments including digitalization of different media areas, political developments in direction of increasing liberalization and a less stringent view on economic power concentration, and an increasing business internationalization, leading to larger corporations and a political support for such tendencies, have altered former balances between benefits and problems. There is today a political trend towards loosening the restrictions on media concentration, including cross media ownership provisions, in order to promote synergies between media and technology areas. However, the issue is still there. New balances have to be struck in view of benefits and drawbacks in loosening the ties on media concentration.

4.3 Access to networks and content

Access to networks and content is also an important issue. Most countries have some kind of universal service rules in telecoms. Countries often also have provisions for access to public service broadcasting. The question is whether and to what degree such access provisions should be extended to new networks and services, reflecting developments relating to convergence, i.e. broadband, Internet, public information services, etc. The arguments in favor have centered on the issues of limiting the social divides and the advantages of a broad

take-up of new technological possibilities, including both democratic aspects and the industrial growth potentials in a broad diffusion. Arguments against have mostly been concerned with creating a situation where the mass of users support the most advanced first users of new technologies and the dangers of supporting technologies that quickly are made redundant by new and more powerful technologies. However, many countries have gone somewhat beyond the mere provisions for universal service in basic telephony and there is generally open-mindedness in relation to the possible inclusion of new technologies, services and content in some sort of universal access provision.

4.4 Technology neutral regulation

With respect to information and communication infrastructures, there is a general trend towards uniting the regulations of the different infrastructures. Most countries have operated with different rules applying to fixed networks, mobile networks, and broadcast networks. But with the convergence between these networks and the possibilities for conveying similar services over different networks, the foundation for differences in rules tends to disappear. Countries are, therefore, seeking to establish similar regulations for different communications infrastructures and base their regulations on a principle of technology neutrality. However, there are some problems attached to this approach. In many countries, there are special requirements and user protection rules regarding telephony provided on PSTN. But telephony can also be provided on Internet – yet, Internet telephony is not subject to the same rules as PSTN telephony, which a totally technology neutral regulation would require. Also, the competition situation in the different infrastructure areas may be very diverse with, for instance, more competition in the mobile area than in the fixed network area. Such a situation may require differences in regulation in the two areas.

4.5 Converging content regulation

Similarly, it is an open issue to what extent regulations in the different content areas should converge. In the broadcast area, most countries have public service provisions of some kind, though they may be very different. Some broadcasters have responsibilities for providing services under certain quality obligations but have, at the same time, a number of privileges in terms of, e.g., frequencies for terrestrial transmission. In other media areas, for instance print media, there are no such arrangements, and when content can be used across different infrastructure platforms, the question is what the implications are for the specific public service provisions in the traditional broadcasting area. It will surely be more difficult to maintain a central position for public service broadcasters, but will public service provisions have to disappear? Conversely, is it possible and desirable to extend public service provisions to the Internet web in the sense that public service broadcasters that also have web services become obliged to develop web pages with a public service type of content?

Another example of a similar question relates to the media responsibility rules that print and electronic mass media often operate under. Authors / journalist and the editors in chief are in most countries responsible for what is printed and broadcast. However, such rules do seldom apply to information on the web, and the issue is whether it is possible and desirable to uphold such rules in a situation with a growth of information spread over the web, or whether it is possible to extend rules for content responsibility to new media platforms.

4.6 Other content issues

Privacy protection gets a new dimension in a converged Internet environment. Not only is it much easier to transmit files with personal information, it also becomes much easier to collect information on people and their interests and buying habits by means of automatic registration. Security problems involve both the security of information transmitted on networks, i.e. that information is not disclosed and not tampered with, for instance, and the security of payments made on electronic networks. Consumer protection is also an important issue. When buying goods and services on networks, consumers must be protected against low quality products, late delivery or pure and simple fraud. In some countries, there are actually stricter rules protecting customers in e-commerce, but this does not apply to the great majority of countries, and there are certainly problems in relation to international transactions. Intellectual property rights constitute an example of another area, where a converged Internet environment creates many new problems. The Internet provides new possibilities for spreading cultural products – which is a great advantage. But for the holders of intellectual property rights, these new possibilities create new problems with respect to protecting their rights against infringements. Finally, illegal information such as racist utterances and child porn can be spread much wider on the Internet, and the question is how to protect citizens against such information and how to hinder people from spreading it in an international Internet context.

All these issues have existed for many years. They have not been created by the development of convergence in the media and Internet areas. However, convergence and Internet create a new environment in which these known issues acquire new dimensions. Parts of the issues and the regulatory rules that they result in are, therefore, connected with the issue of media convergence, and rules taking account of this should be developed. However, this does not necessarily mean that these issues should be part of a united convergence regulation nor that they should be dealt with by one united regulatory authority.

4.7 Converging infrastructure and content regulation

Having looked at issues that relate to all three levels from equipment / hardware and transport / software to content / services or that relate to either the infrastructural part or the content part, the question is then whether infrastructure issues and content issue should be dealt with in a common regulatory framework or whether it creates problems to separate the two groups of issues. In the overview of issues presented, there are three types of issues that are related to all three levels, i.e. general information society policies, synergies vs. concentration, and access to networks and services, but neither of these issues requires a common regulation.

In discussions on the separation of infrastructure and content matters, it is often mentioned that there are companies covering the whole chain from infrastructure to content provision and that, therefore, it is more appropriate if these companies are regulated by one common regulation. There are companies that can leverage their power in one area to another, and it is true that there will be questions regarding the delimitation between infrastructure and content provision, in the sense that a software tool may encompass both infrastructure and content elements. However, it seems as if these problems are at the fringes of the issue and are small in comparison with the overall benefits of differentiating between infrastructure and content problems. There is also the question of the influence of initiatives in one area on the other. When, for instance, the terrestrial broadcast infrastructure is dealt with in the same way as the telecoms infrastructure, it may be difficult to uphold the preferential status of public service broadcasters. But this is mainly a question of coordinating the two sides of the media and communication regulations. However, there are problems of adjustment to be discussed in relation to a separation of infrastructure and content regulation.

4.8 Regulatory institutions

Finally, there is the issue of common or separate regulatory institutions. As mentioned in the introduction of the present report, there is no necessary direct relationship between the interdependence of the questions dealt with and the institutional setting. However, there may be advantages in terms of better co-ordination between initiatives in the different areas and in terms of using manpower resources more efficiently and avoiding duplication of work. But there may also be problems of large and less agile organizations and of an unclear reporting structure to other state institutions. A regulatory institution with a large area of responsibility may have to report to different departments / ministries, which may create confusion. Thus, this is a very open issue where many solutions are feasible.

5. Scenarios

There are at least three important dimensions to take into account when determining the possible scenarios for the development of regulations and regulatory institutions in the field of communications and media. One dimension deals with the purposes of regulation; another concerns the sectoral scope and the extent of regulation; and a third one relates to questions regarding infrastructure and content. On the basis of these dimensions, a number of stylized possible scenarios can be constructed.

5.1 Purpose of regulation

The purpose of regulation is generally analyzed in two categories: 1) Remedying market failures – in telecoms, for instance, the establishment of an asymmetric interconnection regulation to limit the market power of the incumbent operator. 2) Promoting a social agenda – in telecoms, primarily, the setting up of rules for universal service.

In telecoms, the market failure issue includes the problems attached to scarce resources, first and foremost frequencies, but also access to numbers and names, and the question of rights of way. A third purpose could, therefore, be added regarding access to scarce resource. Furthermore, an additional purpose could be to advance certain industrial developments and to create a dynamic business environment for certain industrial potentials.

Four different purposes, constituting part of the basis for regulatory scenarios in the field of communications and media, can thus be depicted:

- Remedying market failures in terms of barriers to competition
- Regulating access to scarce resources
- Promoting universal access / service
- Advancing industrial development

5.2 Sectoral scope and extent of regulation

Regarding the sectoral scope and extent of regulation, regulations can be more or less sector specific or general in character and more or less extensive in terms of issues covered. In most countries, telecoms have hitherto been regulated sector specifically, with general competition regulation as only a remote framework. As part of the sector specific set of regulations, interconnection regulation (competition regulation), scarce resources, and universal service have been the main building blocks. With the ongoing convergence between different media areas, the question of a converging regulation is raised. The scope of regulation can be extended from telecoms to encompass also broadcasting and possibly other sets of media regulations. Finally, regulations can be broadened out to a multi-sector regulation including not only telecoms and broadcasting, but also water, gas, etc.

There are, therefore, in reality five levels of possible regulations:

- General industrial regulation, e.g. competition regulation and consumer protection
- Regulation of parts of the telecoms issues, most likely a separate regulation of scarce resources
- Telecoms specific regulation
- Regulation of the converging communications and media fields
- Multi-sector regulation

5.3 Infrastructure and content

Concerning infrastructure and content, there are three issues. One deals with the convergence of infrastructures and the possibilities of a technology neutral regulation. In many countries, it is an outspoken aim to establish a technology neutral communications infrastructure regulation. However, it is still not a finally settled question whether and to what extent technology still 'matters', i.e. whether and to what extent it is necessary to maintain some differences in regulations between the different infrastructures for fixed or mobile telecoms, cable and terrestrial broadcasting.

Second is the convergence of services and content and the possibilities for a cross-sectoral approach. As services and content merge and can be delivered on a number of different platforms, it is an open question whether and to what extent different kinds of services and content should be regulated similarly.

A third issue concerns the relationship between infrastructure and content. Is it possible to separate the two, or are there so many linkages that infrastructural questions and content-related question must be dealt with in the same set of regulations?

Three issues are thus on the agenda:

- Technology neutral infrastructure regulation
- Cross-sectoral content regulation
- The possibility of separating infrastructure and content regulations

5.4 Five regulatory scenarios

Though the presentation of the three dimensions seems to indicate that they can be inter-related in a three-dimensional model, this is not really possible. The individual dimensions are not clearly one-dimensional and there is some cross-linking between some of the points in the different dimensions. They, however, present a universe in which a number of possible scenarios for regulations and regulatory institutions can be described. Far from all possible combinations are presented here – only the most important ones.

1. Leave developments in the communications and media fields to the market, to an as large degree as possible. This entails limiting regulations to a distribution of scarce resources and a general competition regulation of a certain character.
2. For many countries this will be a status quo scenario – the different communications and media fields are regulated separately, and telecoms, for instance, is subject to a traditional regulation of scarce resources, interconnection, and universal services.
3. Greater interdependency between the regulations of the communications and media infrastructures, however, technology still ‘matters’ and there are some differences in the regulations of the different infrastructures, e.g. with respect to the analysis of significant market power in the different areas.
4. Technology neutral regulation across the different infrastructural platforms, with an explicit goal of creating a dynamic environment for the growth of a converging industry and to promote the growth of certain industrial developments. However, infrastructure and content regulations are kept apart.
5. Infrastructure and content regulation are merged with cross-sectoral regulations in both the infrastructural and content layers. In this scenario, there is also an emphasis on developing a dynamic industrial development in the converging communications and media fields.

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