

# TOWARDS A PERVASIVE DIGITAL PRODUCTION AND DISTRIBUTION ENVIRONMENT IN THE MEDIA AND COMMUNICATION

## A WORLD IN TRANSITION

by Cesare A. Massarenti\*

\* University Milano-Bicocca, Department of Sociology and Social Research, Milano, Italy

\* Polytechnic of Torino, Department of Cinema and Communication, Torino, Italy

\* University Babes-Bolyai, Faculty of Theatre and Television, Cluj, Romania

e-mail : cesare.massarenti@unimib.it

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### Summary:

During the past thirty years, the transition to digital has changed both the way the media and communication industry creates and provides content and the way end users access information and interact with it. The entire organization of content production, processing and distribution is undergoing major changes and workflow is being redesigned with the use of sophisticated database technologies, allowing for the development of a new multi-channel content delivery and multiple revenue streams paradigm. The spread of interactive functionalities, the widening variety of access devices, the emergence of social networks and the progressive approach to the semantic web are redefining the relationships between traditional content providers in the media and audiences, whereby a “reader” can become an “author”. Content can be accessed by means of many complementary devices, in a personalized time and space frame. Issues of convergence and interoperability, together with issues concerning intellectual property and copyright, are underlying the development of novel narrative structures and modes of content fruition.

**Keywords:** media, communication, database technologies, audience, multi-channel content delivery, interactivity, access devices, convergence, interoperability.

**Jel Classification:** L82

## 1. – The Framework.

In the US, Western Europe, and a few other countries three paradigmatic phases of communications and media policy may be distinguished: the paradigm of emerging communications industry policy (until the Second World War); the paradigm of public service media policy (1945-1980/90); and the current phase (from 1980/90 onwards) in which a new policy paradigm is searched for.

In the first phase, communications and media policy primarily referred to the emerging technologies of telegraph, telephony and wireless. Communications policy in that era was mainly pursued for reasons of state interest and financial corporate benefits. After the Second World War, media policy was dominated by socio-political rather than economic or national strategic concerns. In this paradigmatic phase, lasting until 1980/90, the ideal of public service broadcasting was at its height, notably in Western Europe, Japan and many other countries. From 1980 onwards, however, technological, economic and social trends fundamentally changed the context of media policy. In many countries, governments opted for policies of breaking monopolies in media and communications and privatizing as much as possible. The old normative media policies have been challenged and policy-makers are searching for a new communications policy paradigm. In this new paradigm, there seems to be a shift in the balance of component political, social and economic values that shape the definition of the public interest that media and communications supposedly serve or in the very perception of what media are about.

Notwithstanding attempts and successful endeavours by several governments and supranational institutions, such as the European Commission, to draw regulatory boundaries and set the stage for the development of

relationships between private and public concerns regarding the media, this entire economic sector has undergone and will continue to face very profound structural changes, and is also under pressure by emerging technologies that are being introduced and by changes in behaviour by the audiences/consumers of media products.

New technologies are having a deep impact and influence on the directions of the shift: a new environment is taking shape in the communication system and all media are facing the necessity to bring about changes in their organization, approach to audience, relationships with traditional as well as new players, economic models.

The transition from a fundamentally analogue world to a digital one can be seen in perspective as the root of change, for it concerns all media at all levels; among other consequences, it makes possible forms of technological convergence that are influencing to a great extent mutations in content delivery and fruition.

The very meaning of what are media and communication is being redefined, and these developments have a common point of reference within the framework of the construction of the Information Society as a fundamental step towards the Knowledge Society.

To provide an example and a perspective, going back in time and considering television, in 1932 David Sarnoff, then the president of RCA, wrote an article titled "Where Television Stands Today" for the April issue of *Modern Mechanics and Inventions*. The founder of the NBC television network predicted that a new world of cultural and educational opportunities would be opened to the home. And he took the opportunity to describe the potential of this new medium:

"But even more appealing to the individual is the hope that television may, at least in a measure, enable man to keep pace with his thoughts. The human being has been created with a mind that can encompass the whole world within the fraction of a second. Yet his physical senses lag woefully behind. With his feet he can walk only a limited distance. With his hands he can touch only what is within reach. His eyes can see at a limited range and his ears are useful at a short distance only.

"When television has fulfilled its ultimate destiny, a man's sense of physical limitation will be swept away, and his boundaries of sight and hearing will be the limits of the earth itself."

Craig Birkmaier (14) notes that while Sarnoff was correct in his assertion that television would bring the world into our living rooms, the medium he helped to create did little to deliver on the promise that TV would sweep away man's boundaries of sight and hearing. TV has delivered a highly filtered view of the world — through the eyes of television production teams who attempt to capture an event or story and present it in a coherent manner that informs and/or entertains.

Our physical limitations have not been swept away. We still cannot direct the camera to see what we want, as we could do with our eyes if actually there. We have learned that the television medium is a powerful tool to convey the thoughts of those who control what we see. To date, it has not delivered on Sarnoff's promise to help us form our own thoughts.

In the era of television broadcasting, the Olympics have always been one of the premiere events shown on the TV screen in the family room. During the two weeks of Summer Olympics coverage, the TV network with the rights to the games dominates the TV scene.

During the Golden Age of TV broadcasting in most countries, families would gather around the electronic hearth and watch what amounted to an up close and personal news report of the games, with limited live event coverage. The gargantuan task of covering multiple venues — there were 28 sports in the 2008 edition of the games, with events spread out over 17 days — creates literally thousands of hours of content. Much like the shooting ratios for a documentary, this mountain of content was once distilled into about 200 hours of broadcasts.

The International Broadcast Operations Center of any Olympic games is anything but a one-world operation: there are dozens of countries creating their own worldly view of the games, focused on the athletes from their nation and their performances.

For decades, TV coverage of the Olympics has focused on filtering through this massive quantity of content to give the viewers back home a limited and often biased look at what is going on. The contrast between watching the distilled version of the games on TV and attending a live event was stark. Unlike live coverage

of most sporting events, where TV coverage is often better than being there, the traditional edited down TV version of the Olympics is far less satisfying and engaging. For the few sports that earned live coverage, the experience could be exciting. For the rest, newspaper reports were often more timely.

But this is a new millennium, and digital distribution technologies are changing the traditional face of the television medium. The 2008 Beijing event was the first Olympics where the potential existed to view almost all of the events in a manner that approaches being there.

Likely David Sarnoff would be proud and amazed to see how far the medium of television has progressed, although he might not recognize some of the new forms it has taken — the 500 channel universe of multichannel subscription TV (cable and DBS) and the demand-based world of video delivered via the Internet.

In what some are calling the most ambitious single media project in history, the NBC network flooded the airwaves and cyberspace with over 3600 hours of coverage from Aug. 8 to 24, 2008. The vast majority of these hours of Olympics coverage were being delivered via live streaming video on NBCOlympics.com. Of the total hours of event coverage, 1400 hours were broadcasted on NBC and sister stations, with in addition, for the first time, of high-definition coverage on USA HD and Universal HD cable channels.

To deal with the inevitable overlapping conflicts, the hour time difference between Beijing and most of the United States, but also of Europe, and the desire to relive and/or share the experience with others, much of the 2200 hours of live Internet streaming coverage was also made available at later times as VOD (Video On Demand).

This organizational set-up to make possible for viewers to virtually be there is only part of the story. The entire project is something akin to a huge research project or test lab for what TV may become in the next decade.

CNN released a report on NBC's Olympic efforts. According to Alan Wurtzel, NBC's research chief, "Besides giving advertisers a clearer picture of how much consumers are paying attention to the games, NBC hopes its research provides a comprehensive picture of how people are supplementing TV viewership with tools such as video streaming, video on demand and mobile phones." The CNN report provides additional details of the various measurement techniques that were used to track what NBC called a "Total Audience Measurement Index (TAMI)", which takes into account TV, online, video on demand and mobile phone usage.

What major broadcasters may learn from NBC's very complex and costly research project is that a new generation of viewers is seeking more from the world of digital media than the programming formulas that worked so well when there were only a handful of TV channels. Today, the broadcast networks are in competition with hundreds of channels of linear TV, VOD, DVDs, video games and the virtual world of the Internet.

This specific case is only the tip of the iceberg when we consider the changes that have started in the late 1960s and early 1970s in the world of media and communication, and that will become ever more pervasive and diversified in years to come.

## **1.1. - Transition from analogue to digital in the media.**

## From Pathé's film coloring atelier in 1902



*Figure 1 - Many workers, organized in assembly lines, each painting small, different portions of 35mm film frames to produce color prints for projection from black & white positive film copies. Les Gobelins 1995.*

## To a single operator in 2005



*Figure 2 - One of the most advanced models of computer controlled non-linear editing and special effects, color processing of both film and video for optimization of play-out and/or archiving, with the possibility of editing and processing also stereoscopic programs, with a single creative operator. Quantel Ltd. 2005.*

The top Fortune 1000 companies have grown their storage infrastructures to hundreds of terabytes (TB), with the largest companies having multiple petabytes (PB or  $2^{50}$  or  $10^{15}$ ) of memorized data. In less than a year, Web 2.0 Internet start-ups and other companies storing rich media content have consumed more storage than those companies have accumulated over their lifetimes.

Social networking, application hosting, auctions, photo sharing and video distribution all consume much more storage than any of the older transactional type applications. The difference is that many Web 2.0 applications tend to be participatory and collaborative applications, where the users are the ones generating or creating much of the content. The change from provider-generated content to user-generated/created content makes predicting storage growth far more challenging than in the past, bringing about major challenges in cost structure and ROI models. Moreover, ownership of content has become a crucial issue, possibly making database and database asset management technologies the central element of any endeavor and economic activity in communication and the media.

In addition to consuming vast amounts of storage, these new applications often have different input-output (I/O) profiles compared to transactional applications, which tend to be primarily small-block, random I/O-oriented. Web 2.0 applications tend to store larger, more variable digital content. Access patterns can also vary between read-intensive (video distribution) to almost exclusively write-intensive (remotely hosted backup) and anything in between. The storage architectures that support high-performance transactional applications are almost always not a good fit for new applications in film or video and the other rich media.

As for scalability, it would not be correct to state that traditional monolithic arrays cannot scale up to petabyte-plus configurations; the real concern is the efficiency and cost (capital and operational) required to reach these levels. Not everything scales gracefully when 10-to-20-year-old storage architectures strain to

accommodate the scalability requirements of these new applications. And management paradigms that worked quite well with tens of terabytes don't scale well when managing multiple petabytes or more.

Moreover, there is a very strong tendency towards distributing the same or similar content over many different channels, each one of them generating a specific stream of revenues. This puts additional demands on database systems, which must insure play-out over different networks to different users' devices, often simultaneously, such as in the case of many television programmes, which are delivered over multiple platforms at the same time, albeit in different formats and packaging.

All media sectors have undergone very profound changes over the last ten-twenty years, during which they had to learn how to adapt their *modus operandi* and their business models to the pervasive use of digital technologies and to the spread of the Internet and its applications; these changes are about to take another turn and go even further with the current penetration of applications in mobility over mobile phones (e.g. smartphones), iPods and MP3 players in general, e-books, portable game consoles, car navigators, and slate computer and similar devices to be introduced in the market in 2010. Access to any kind of information has become the new paradigm, which is formally characterized by a communication continuum across many access devices, time and space, with the crucial addition of possibilities of interaction, which implies a high degree of personalization (1 – Massarenti e Mezza, 2007).

Whereas digital technologies were already implemented in administration and other areas of the organizations, the real crunch came when these technologies started entering the areas of production, processing and distribution of content, almost always requiring a profound revision of the workflow procedures and processes, accompanied by training and/or re-training of highly specialized technical and creative personnel. The end result is the transition to a new internal and external organization of media companies.

Furthermore, most media companies have had to adapt and adjust to the emergence and widespread use of interactive technologies, quite often wrongly identified only with Internet. For companies that had been founded, and had been operating for decades or even longer periods on the one-to-many model of communication, interactivity represented, and in many cases still represents a major strain: dialogue with the users/audience was/is very difficult to understand at all levels in this context.

Audio and music were the first sectors of the media to enter the digital age, followed by the editing, graphics, special effects areas of television; photography and print started the transition almost a decade later; cinema made a first start in the mid-1980s with the use of special effects, but a decisive change came only after 2003-04 (at least in Hollywood, in France, in Japan). On the other hand, games have developed almost entirely in a digital environment; the introduction of iPods and the iTunes downloading service has brought a radically new model to the distribution of recorded music; e-books are beginning to provide an additional distribution channel for printed material; car navigators are not simply devices for orientation in mobility, but are adding functionalities that are more and more turning them into full communication devices. Among the traditional media sectors, signage is the last one to start moving to digital, and the transition is quite difficult because operations and organization have practically not changed during the last sixty years. More recently, multimedia and cross-media have emerged as newer types of communication projects, requiring even more complex production and distribution strategies.

Thus, all media have to take into account several common elements:

- ownership and control of content are the dominant items;
- business models are built more and more around multi-channel content delivery;
- transition to digital techniques and technologies implies a re-thinking and a re-organization of management, workflow, production and distribution processes;
- database systems become the heart of all operations related to content and to its control;
- database management system technologies become the main tools for the organization of delivery/play-out over networks to users' devices, for the control and the distribution of revenues;
- products originated in one medium can be repackaged to cross over to other media, thus requiring coordination of multiple production flows and encoding for different distribution channels;
- interactivity implies providing and/or accepting dialogue with the audience, as well as the creation of business models adapted to this context;
- permanent training of personnel represents a fundamental investment in the short, medium and long term;
- beyond monitoring the direct competition, it is necessary to set up and maintain a very close monitoring of issues not necessarily and immediately related to the medium in which a given

company is operating, since crossovers among media are becoming more and more frequent and widespread.

## **1.2. - Digital Media and Global Media Business.**

Recent data (IDC, Jupiter, OVUM - November 2009) indicate that at this stage of the transition from analogue to digital technologies in acquisition, processing and delivering digital media revenues represent over 10% of global media business worldwide.

The reasons for the growth over the last three-to-five years can be attributed mainly to the strong expansion of the use of Internet and mobile devices in users' access to media as well as in the developments of Social Networking.

According to a research published by Strategy Analytics in November 2008, current forecasts show that global revenues from digital media will exceed revenues generated by filmed entertainment for the first time in 2008.

This report - "*Global Media & Entertainment Market Forecast, 2004 – 2012*" (2 – Strategy Analytics, 2008) - predicts that total worldwide revenues from media and entertainment - including television & filmed entertainment, recorded music, games software, and advertising - will exceed \$845 billion in 2008, with more than 10 per cent, or \$90 billion, coming from online and mobile channels (publishing is not included in the report). In comparison, the global filmed entertainment market will generate \$83.1 billion in revenues in the same year.

The research concludes that total revenues from all online channels will grow on average at 18 per cent annually until 2012, while revenues from traditional media channels will grow at only 3 per cent a year over the same period of time. The industry as a whole will experience a growth of 5.8 per cent in 2008, but this will decline to 4.5/4.0 per cent in 2009-10 as a result of global economic conditions.

Martin Olausson, Director of Digital Media Research at Strategy Analytics, said "The fact that digital media revenues now exceed those from movie theatres and home video supports the large online investments made by most major media companies."

David Mercer, VP Digital Consumer Practice, suggests that "Like most industries, the media sector faces a challenging 2009-2010. However, while revenues from traditional routes to market stagnate, digital business models still provide the growth opportunities that are vital to the industry's future prosperity."

It must be underlined that forecasts published in 2008 and in 2009 by the most important analysts and research groups are in close agreement about the role that will be played by Internet and by the growth of mobile communication, with large market shares taken by devices that allow access to media content in mobility (e.g. smartphones, iPods and similar devices, e-books, car navigators, game consoles and slate computers/tablet computers about to appear on the market).

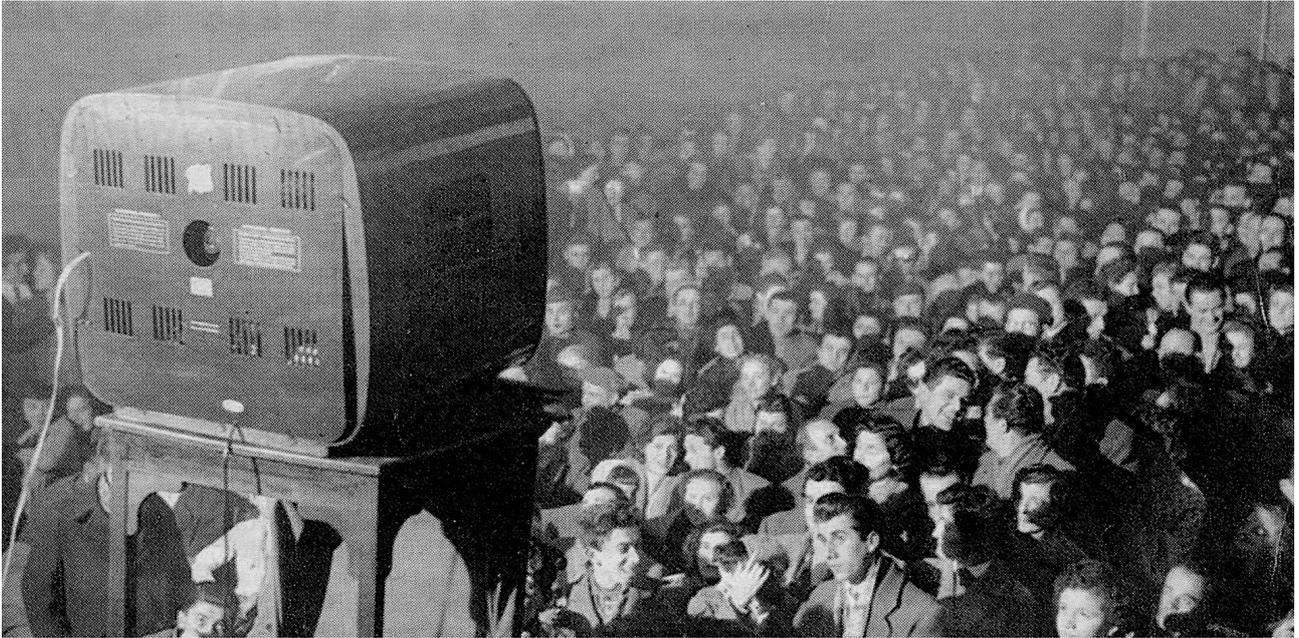
However, in the US advertisement on TV still widely outranks ads on the Web, as indicated by a survey for Deloitte's Media Democracy; according to this report, made public at the end of 2008, TV advertising is twice as effective as online ads; some 84 per cent of consumers said TV ads would influence them to buy a product, against just 45 per cent for online. So, despite advertisers getting more guarantees, monitoring and lower CPMs (Cost Per Mille page impressions), users apparently still find it easier to ignore web ads.

About 64 per cent of respondents said any kind of Internet ads are more intrusive than newspaper ads and 26 per cent said they're prepared to pay for web content just to avoid online ads. Half said they would click on web ads if they were targeted or offered free content. Against the often held assumption that web ads are more effective than newspaper ads - as testified by the migration of ad spend from print to web - respondents rated newspapers just as likely as online to influence their consumer habits, with 45 per cent saying it influences purchases, but magazine ads more effective, with 54 per cent.

More comments and remarks are brought forth by Manish Bhatia, Nielsen Online President, Global & US Sales, speaking on December 19<sup>th</sup> 2008 at the annual IAB forum (Interactive Advertising Bureau), as can be seen in the video "*Some Good News: Digital Media's Core Strength*" (3 – Bhatia, 2008).

## **2. - Content and Distribution.**

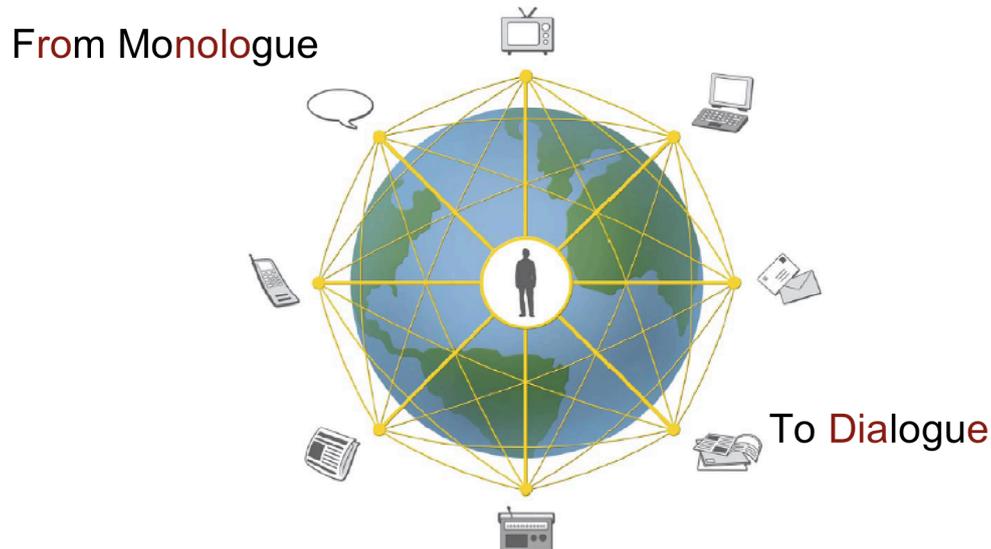
### **2.1. - Multi-channel Content Delivery.**



*Figure 3 - Audience in 1956 in a movie theatre in Italy watching the television show "Lascia o Raddoppia" (the Italian version of the "The \$ 64,000 Question" quiz show of CBS) on a 15" Black&White CRT display. RAI-TV broadcast. Corriere della Sera 19 October 2008 p. 33.*



*Figure 4 - Audience on December 4, 2008, in a movie theatre in New York watching the first National Football League game in high definition stereoscopic broadcast from San Diego on a 40-ft screen. NBC broadcast. Broadcast Engineering December 2008.*



*Figure 5 - The media world is moving towards user-centric systems and forms of communication, which are contributing to changing narrative structures. Source: our elaboration.*

A sentence that is heard and written about quite often states that “Content is King”. If this were to be taken literally, the implication would be that media companies which own and control content dominate or should dominate the market. The media market though has become very composite and the flow of content delivery is quite complex and diversified, with different actors intervening at different stages of the process, including companies that have never produced content in the past.

The main characteristics that have emerged during the transition from analogue to digital are on the one hand the multiplication of platforms and channels that allow delivery of content to the audiences, including possibilities for interactive features; on the other hand, the audience of each single, specific, traditional medium has exploded into a wide variety of audiences which tend to access content by means of a variety of devices. Thus we cannot speak simply of *television*, but we must use the plural “*televisions*”, since tv programmes can be distributed over different platforms and channels, and this implies deep changes in all the processes preceding distribution, from generation of content to processing to encoding for each channel, and allowing for modes of interaction. These modifications in operational modes carry with them the necessity of introducing and managing major changes in business models.

# A MULTIMEDIA WORLD

## DIGITAL VIDEO TECHNOLOGIES

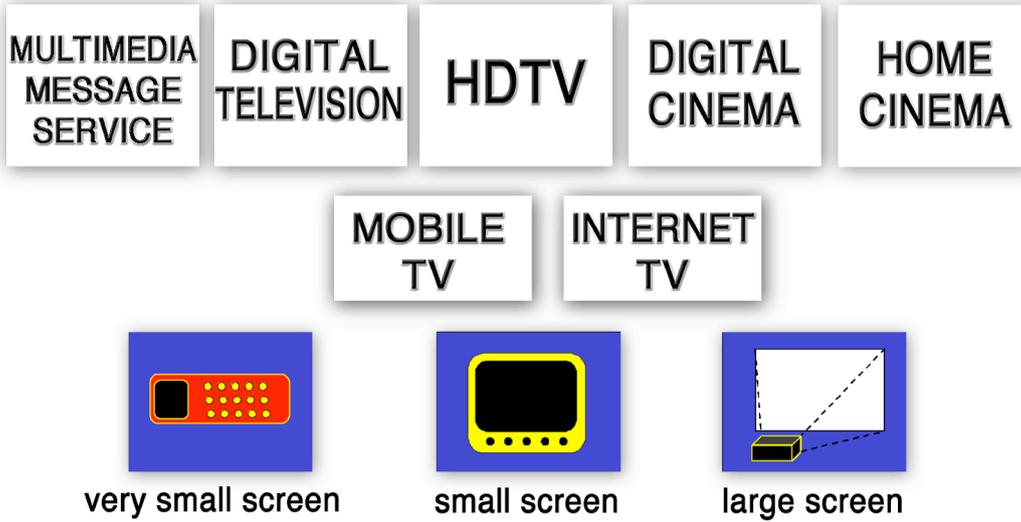


Figure 6a - From Television to Televisions. Source: our elaboration.

Audio-Visual Content			
Terrestrial	Cable and Fiber	Satellite	Physical Medium
Analogue Radio-TV DVB-T – Digital Video Broadcasting-Terrestrial DVB-H – Digital Video Broadcasting-Handheld HDTV – High Definition Television DAB-T – Digital Audio Broadcasting-Terrestrial GSM – Global System for Mobile Communication GPRS – General Packet Radio Service UMTS / 3G – Universal Mobile Communication System / 3rd Generation WiFi (Wireless Fidelity) WiMAX (Worldwide Interoperability for microwave Access) LMDS - Local Multipoint Distribution system RFID – Radio Frequency Identification NFC – Near field Communication	DVB-C – Digital Video Broadcasting-Cable HDTV – High Definition Television Ethernet Networks (LAN and WAN) HFC – Hybrid Fiber Coaxial FTTB – Fiber-to-the-Building FTTH – Fiber-to-the-Home xDSL – x Digital Subscriber Line High speed broadband (Gigabits per second) Electric Power Lines Internet Dial-up Digital Cinema Super Hi-Vision Television ISDN - Integrated Services Digital Network Analogue Radio-TV	DVB-S - Digital Video Broadcasting-Satellite HDTV - High Definition Television DAB-S - Digital Audio Broadcasting-Satellite I.P. Multicast - Internet Protocol Multicast Digital Cinema Super Hi-Vision Television Analogue Radio-TV	DVD - Digital Versatile Disc Blu-ray Disc – High Definition video and data storage MiniDV Cassette - Digital Video Cassette – consumer/prosumer HDV Cassette - Digital Video Cassette – High Definition TV Many types of video cassettes for broadcast video recorders-players Many types of audio cassettes for broadcast and radio recorders-players Memory Stick (MP3, iPod, etc.) CD-ROM - Compact Disc Read-Only Memory CD - Compact Disc Desk and portable Hard Disk Drive Audiotape – many types VHS - Video Home System Betacam SP cassette
Solution is widely available			
Solution is available, but not yet mainstream			
Solution is available, but in early stages of deployment or in advanced field testing stage			
Solution in phasing-out stages			
In the laboratory and limited field testing demos			

Figure 6b - From Television to Televisions. Source: our elaboration.

Multi-channel content delivery, although already practiced in a limited way in the analogue world, has become a major issue in the media both in production processes and in creating opportunities for additional revenues. Multi-channel presents two main forms: in one case content is created from its inception and on purpose to be distributed according to multi-channel modes; in the other case existing content is re-packaged and/or added to new content in such a way as to take advantage of multi-channel distribution modes.

In the first case we can include, for example, very important sports events (such as the Olympic games described above) that are distributed live on all television platforms - analogue and digital terrestrial, cable, satellite, streaming television on the Internet; standard definition and high definition television; short packages for mobile devices; - and later on DVD, photo albums, games for consoles, VOD, etc. In the second case we can list, for example, feature films that are first distributed in the movie theatres domain, then on television (on all platforms, including Internet and mobile devices), on DVD with additional material and possibly interactive modalities, etc.

Also, more and more traditional content producers - publishers, film and television producers and broadcasters, radio broadcasters, recorded music companies and producers of events, games software companies and manufacturers of game devices, advertisers - are vying to enter distribution platforms and channels that are quite different from their traditional venues and markets.

In addition, many companies that until a few years ago were operating solely as telecommunications carriers of voice and data have become distributors of recorded music, films and television programs on the Internet by using their broadband connections (using some kind of xDSL lines). Some of these companies have started producing content for information and/or entertainment on their own.

In the near future, newer generations of e-books, with colour displays and video capability, as well as slate computers will bring other changes to the market; and there is a distinct possibility that access devices that are presently produced and marketed as fully separate objects might be merged into multifunctional single objects. If this were to happen, distribution processes and ownership and control of content will have to adapt to the new environment, as Google, Apple and Oracle have already demonstrated to be the case.

Companies that were originally producers of software or of computers, telecommunications groups and, more recently, also some mobile phone and hardware manufacturers are beginning to produce and/or distribute content; among these, the following can be listed as notable examples:

- Nokia is making available on its phones, as a free service, very detailed maps of most cities, becoming a de facto publisher of maps and entering a market that has been dominated by traditional maps publishers (such as Rand McNally, De Agostini, Michelin, etc.) and owners of specialized websites, such as [www.viamichelin.com](http://www.viamichelin.com) and many others that provide directions on the web;
- Google is active in this domain with the web site <http://maps.google.com/>, as well as in many other sectors that are not derived by its core business, but represent extensions of the core business's capabilities
- both Michelin and Google, as well as other companies and several institutions, produce additional revenue through advertising and e-commerce channels, by providing links to hotels and restaurants, in fact entering the markets of tourism and mobility in general;
- computer and consumer electronics manufacturer Apple has become a major distributor of recorded music with the launch of iTunes, released in January 2001, bringing about a major change in the recorded music industry.

Yet another type of association has brought together Netflix (an online independent content distributor which provides DVD rental service of films, offering flat rate rental-by-mail and online streaming to customers in the US) and LG Electronics (a South Korean manufacturer of displays, mobile phones and other consumer electronics products) which are introducing TV sets that can screen Netflix movies directly from the Web without an external box. Netflix, which is seeking to equip all home-entertainment displays with instant movie-viewing capability, has set up other partnerships, including one with Microsoft for Xbox 360, to embed the movie software in its game consoles. Netflix subscribers who buy one of these devices can connect it to their TVs to watch movies that can be downloaded from the Internet instantly, as part of their monthly rental plan. Subscribers can choose from about 12,000 movie titles and television episodes for instant viewing - an option the company introduced in 2007. Netflix's entire library consists of more than 100,000 titles.

Another example of agreements between companies that have traditionally been operating in separate sectors is the partnership established in December 2008 between broadcaster Al Jazeera and mobile

phones manufacturer Sony Ericsson to bring headline news directly to mobile phones, with news available in both English and Arabic.

A similar type of agreement has been applied by mobile phone operators and content producers, such as broadcasters and publishers.

Chips manufacturer Intel and software producer Adobe Systems are collaborating to extend the widely used Flash application to TV sets by developing porting and optimization of Adobe Flash technology for the Intel Media Processor. The result is expected to provide consumers with richer and more seamless web-based and video viewing experiences through advanced Intel-based cable set-top-boxes, Blu-ray high definition disc players, digital TVs and retail connected audio-visual devices.

In another sector, Sony's PlayStation3, besides games, can play standard DVDs, Blue-ray discs and television programs, also in high definition television mode: this game platform is a multi-channel device on its own, as more recent models of mobile phones and computers already are.

Looking beyond these examples and into future developments of crossovers, integrations and convergence, on 20 November 2008 Nokia announced the creation of the Nokia Research Center (NRC) in Hollywood, which paves the way for the Finnish company to search for and define new forms of media within the mobile domain. Nokia Research Center Hollywood will work with members of the media & entertainment industry, including new technology companies and creative talent, together with leading universities in the region to drive long-term research activities.

Rebecca Allen, Laboratory Director of NRC Hollywood commented that "This initiative will further strengthen Nokia's leadership position in the convergence of Internet and mobility. Hollywood includes a very wide variety of academic institutions, innovative media businesses and unique creative talent, and it offers the right ingredients for research into topics that will be vital for Nokia's business in the future. The link with the movie industry is naturally strong; however the entertainment concepts that will be undertaken at the NRC Hollywood laboratory are even more diverse. The laboratory will explore new entertainment experiences that combine the physical and digital worlds, which will include the development of enhanced reality/virtual reality environments. This will imply the development of new user interfaces that fully explore the role of the human body and human motion for more natural forms of interaction. Mobile devices will play a central role in this."

The new NRC Hollywood laboratory will research on many technologies surrounding the media industry: film, music, games, web and TV. In addition to recruiting from and collaborating with the Hollywood entertainment, media and art communities, the laboratory plans to further collaborate with the leading universities in the region such as the University of California Los Angeles (UCLA) and the University of Southern California (USC). Furthermore, it must be noted that the NRC will continue ongoing collaboration with some of the best universities and research institutes in the world, including the Massachusetts Institute of Technology and Stanford University in the US, the University of Cambridge, UK and Tsinghua University, China. At the beginning of 2008 Nokia Research Center announced a joint research program with two Swiss Federal Institutes of Technology in Lausanne and Zurich (EPFL and ETH Zurich) and opened a laboratory on the campus of Helsinki University of Technology in Finland (for more information, see 4 - Nokia Research Center, [www.nokia.com/A4136001?newsid=1271865](http://www.nokia.com/A4136001?newsid=1271865)).

The creation of NRC also indicates what economic models could be pursued by a hardware manufacturer like Nokia moving in this direction, which places it at the earliest stages of the production-distribution processes, enhancing its possibilities of influencing entire sectors of the media: it looks beyond the present state of mobile communication to encompass proposals of new communication modalities and content creation/distribution, thus establishing a framework for future business developments.

The August 2009 agreement between Yahoo and Microsoft to jointly support the search engine "Bing" to try to compete with Google is a prime example of cross-sector projects. The same can be said of Apple's acquisition of Lala, which can open for Apple the market of music streaming, which is not part of the iTunes economic and technological model.

From all these examples it is possible to understand the extent to which, by means of digital encoding of information, it is possible to multiply the packaging of content to distribute it over many different channels in a coordinated way and increase the revenues by adapting the original material for several access devices at costs that are a fraction of the cost sustained for the production of the original content.

Thus, multi-channel has become a term that takes a third meaning, besides the two mentioned above: it includes both production/distribution of content and devices that allow access to content.

## **2.2. - Traditional Media and Social Networks.**

Social Networks websites, such as MySpace, YouTube, Facebook, Second Life and many others, can be considered also under the umbrella of distribution of content.

However, it is necessary to distinguish two main types of content and distribution: on the one hand there is content created by the users (user created content, in a strict sense), which is uploaded by the author(s) and made freely available to all users; on the other hand there is content that has been produced by professionals and is simply uploaded by a user who is not an author of that specific content (user generated content, in general terms), but the content is still being made freely available to all visitors of the website.

Material included in the second case has been and still is the object of very hard debates and many lawsuits have been initiated by the rightful owners against the companies which control social networking websites and/or the developers of the software that allows for such use of content. At the same time, many important content producers, especially in the sectors of recorded music, film and television series, realize that users of social networks can represent a very large, additional audience and that the very form of networking, by the formation of specialized groupings on the web, can be a vehicle for stronger ties to content for a wider audience at practically no cost.

Since the middle of 2007, after very strong initial oppositions between some of the most important content producers and social network companies, several forms of agreements are beginning to take shape: in some instances social network companies agree to remove contentious content from the database, while in other cases the two parties agree on splitting revenues derived by advertisements or e-commerce opportunities linked to content, which represent the most important source of revenues for the social network companies. In several cases, though, no agreement has been reached by the parties, and Peer-to-Peer (P2P) websites that allow free download of any material, included content covered by copyright, continue to flourish.

## **2.3. - Distribution and Audiences.**

Distribution is another variable that plays a major role in the progressive widening of audiences and of their fragmentation, but it has a very important impact also on time-to-market in the media.

Limiting the examples to television and print, it can be noted that generalist broadcast television has been losing audience since the mid-1980s, when the first cable and then satellite channels were launched. Since 2000 this trend has been more and more notable, attaining estimated figures of about 25% in less than eight years in the major western-type countries. The transition to digital television platforms (Standard Television-SDTV, High Definition Television-HDTV, web and Internet Protocol TV-IPTV, mobile TV in its various data formats) brings about a multiplication of specialized channels, and the consequence is an even greater splitting of the advertisement budgets dedicated to television, which goes in hand with the fragmentation of the audience.

If the overall investment in advertisement on television is generally increasing at a rate of about 1,5-3% per year in several countries, it must be underlined that the budgets are decreasing for generalist TV to the advantage of specialized channels, which are viewed by audiences that constitute more defined targets. When generalist channels are considered, only High Definition Television channels have seen and continue to see a remarkable growth in revenues from advertisement: this depends largely on the much higher quality of image and sound perceived by the viewers and by the fact that higher income users have been able to purchase HDTV sets, both elements justifying higher investments by advertisers.

Print and publishing are very much in the same situation as TV, but losses in advertisement and sales revenues for the generalist press are greater. However, for this sector of the media, the more profound issues concern the relationship between distribution of printed material and distribution via Internet.

Circulation of the printed edition of the New York Times is about 1,04 million copies per day on average (ranked 45<sup>th</sup> worldwide by average daily circulation); in 2008 the domain nytimes.com (ranked in 59<sup>th</sup> place worldwide by number of unique visitors) attracted more than 146 million visitors, with over 14 million visitors in August 2008. In October 2008 the company's chairman declared that the newspaper might continue to be published only online in about five years, since the cost of distributing the printed version is so much higher than that of keeping a website, advertisers' investments in the printed version are much more volatile than in the past, and the use of Internet is changing so fast. Los Angeles Times' and Le Monde's executives made substantially similar observations.

Moreover, the owners of the Christian Science Monitor have announced in the fall of 2008 that the daily newspaper will be available only online from 2009.

A prominent example of online news, besides the news service proposed by Google and many other websites, is provided by one of the most widely read online daily newspapers - <http://english.ohmynews.com/> (5) -, owned and managed by Mr. Oh, a former South Korean journalist of the printed press. This online paper can count on the contributions of several hundreds of journalists from around the world and offers news at both the local level as well as more generalist-type news and commentaries; it provides a capillary coverage of world news at a fraction of the cost of other organizations, such as the BBC.

Most newspapers and magazines have another link with the web in typical Web 2.0 modes: blogs and bloggers.

Many publishers allow some of their employees/journalists to have a blog on the publication's website, but most bloggers are totally independent of traditional media organizations. Blogs constitute a de facto original form of distribution of information, opinions and commentaries, often in competition with the "official" media players. This particular channel is still in its early developments, but it has already made an impact on newsgathering and distribution by widening the sources and proposing a business model, based on free access, highly targeted advertisements or voluntary support by the visitors, that is very different from the traditional press. Bloggers though go well beyond the print world and are active in all media sectors.

The combination of these elements is modifying in a very deep way the issue of time-to-market in the media, not only in print, tv or the radio. The entire process of producing, processing and distributing content is characterized by a shortening of all steps in the workflow, and in several instances some steps are completely overridden by procedures that are possible only in the digital domain: for example, in several cases, repackaging of content can be done entirely automatically, such as distribution of snippets of news and sports by means of mobile devices. In this case the snippets can be extracted in an automatic way from the longer elements that are being distributed over other types of television or print channels.

### **3. Content and Audience.**

#### **3.1. - Audience Composition and Fragmentation.**

In many instances the audience of traditional media is orders of magnitude smaller than the audience of certain widely visited websites, such as Google, Yahoo, MySpace, Facebook, Twitter, and many others.

For example Google and Yahoo account for well over 100 million visitors per day, on average. The three most visited social networking websites account for ranges between 70 and more than 85 million visitors per day, on average, while the largest newspaper circulation is slightly above 10 million copies per day (Yomiuri Shimbun of Japan).

On the other hand, as another example, television viewers of the 2008 Summer Olympic Games were 81 million during the men's 4 x 100 swimming relay, while 1,7 million watched the event on the web. It is noteworthy that for NBC (the US network that had the exclusive for the games) primetime television coverage was also a hit and that Internet usage helped drive the audience. At least in this instance the Internet did not cannibalize the audience for the network. Instead it appeared to be fueling interest and driving people to the network's primetime schedule. However, the relationship with viewers was not totally smooth. NBC held off placing some content on the web until after it had been aired on broadcast television, instead of offering it in streaming mode: thus, since real time programming was limited to the East Coast of the US, the West Coast audience was especially frustrated by the time-zone delay in broadcasting that prevented them from viewing major events until several hours after they had occurred. A careful analysis of TV viewing and web visiting ratings data of the Games indicates that the network may have been too cautious in holding back the content from the Internet. Half of the online users stated that they wanted to catch up with events they may have missed, and another 40 percent wanted to be able to replay something they had first seen on TV.

This example can help to clarify the existing debate and uncertainties about the developments of audiences, their preferences, interwoven and possibly overlapping fragmentations. It must be underlined that NBC had three revenue streams from advertising during the Games: a lower-level rate for the web, a middle-level one for standard television broadcasting, and a high-level one for broadcasting in high definition (the Beijing Games were recorded entirely in high definition for the first time).

Content, access and behavior are also quite different for audiences relating to traditional media or new media: in traditional media, the one-to-many communication model is prevalent and the content producer is

in full control. On the Internet, on the other hand, content can be packaged into any media format and access by visitors to a given website is the result of a personal choice, including what the visitor does with the content. He/she can behave according to the one-to-many model, in a passive “spectator” mode, or engage in non-linear access to content, following the links as he/she chooses, or engage in a variety of interactive behaviors, to the extent of becoming an “author” by uploading new content of his/her creation, for example on some social network or P2P website.

### **3.2. - Audience Fragmentation and Eigenbehavior.**

These instances bear an important consequence on the number of visitors to a given website, but much more important is the phenomenon of segmentation of the audience along lines drawn by personal interests affinities, and expectations. Segmentation is certainly present in the traditional media, both in terms of allocation of time and in expression of interest implied by the choice of a given communication channel.

But on the web segmentation is defined in a much more direct and precise way, taking on notions of self-segmentation of groups, where aggregations tend to develop according to modes that are very close, or identical to “eigenbehavior”, as studied, among others, by N. Eagle and A. Pentland of M.I.T for aggregations of daily behavioral patterns (6 – Eagle and Pentland, 2007) or by Luis M. Rocha of Los Alamos National Laboratory for self-organization (7 – Rocha, 1996).

These studies are models that allow to predict activities of small groups and are based upon the hypotheses that if discrete observations of an individual’s idiosyncratic behavior can appear almost random, typically there are repeating and easily identifiable routines in every person’s life, including access to and use of websites. These patterns become more apparent when the behavior is temporally, spatially, and socially contextualized. On the web, it is possible to trace an individual’s behavioral patterns in an unequivocal way, and within a well-defined context. The identification of repeating structures underlying typical human behavior represents these structures as eigenbehaviors, the principal components of an individual’s behavioral dataset, which can be classified by the traces of navigation and the patterns of aggregation in social networking environments.

Studies of audiences concerning traditional media have been carried out for decades according to statistical methods and techniques related to large numbers (frequency, mean, median, standard deviation, variance, etc.) and media buyers’ choices about placement of advertisements in the media were almost only based on secondary analysis of large samples of large populations (no matter how reliable the original data could have been and how the sample had been selected). The increasing segmentation of audiences and the changing behavioral patterns, also brought about by interactive technologies, make these kinds of studies partially obsolete, for they cannot predict aggregations of small groups or allocation of time and cognitive or economic resources by individuals or small groups; in other words, they cannot predict the rise, stabilization and demise of aggregations in a mixed media environment.

Predicting and understanding aggregation patterns is of fundamental importance for web-based activities, as it drives investments in technology, content production and distribution, and advertising.

More appropriate statistical methods and tools are those related to small numbers of occurrences or events, such as the Poisson distribution and, under certain circumstances, stochastic models. Also, these should be used in strict relationship with graphs and matrices to help understanding the mapping of aggregations and individual behavioral patterns with the groups over time, in order to show the dynamics of the processes.

However, these methods, given the very strong connections existing between traditional media producers and distributors, companies investing in advertisement, advertising agencies and media buyers, all accustomed to statistical methods dealing with large numbers and frequencies, will not be easily adopted, and highly fragmented audiences might continue to be studied with inappropriate methods and techniques for many years to come.

### **3.3. - Audience and Narrative Structures.**

One of the most interesting aspects of audience fragmentation is not so much the reasons why fragmentation comes about, which is pretty well understood, but the way aggregations among individuals begin on the web and in mobility, small groups form and possibly become larger, stabilize, dwindle and eventually cease to exist; what influence can have pressures, imitational behaviors, negative and positive, direct and inferred sanctions, how expectations work in this new context. These behavioral patterns are largely still to be studied, but they concern in a very deeply rooted manner how will be built the “use” of the traditional and new media, how will develop the relationships between the different players, including what is now called “audience”.

The emergence of these new forms of communication is beginning to influence content creation and its very structures by the authors and designers, whoever they are, and expectations by the audience and media players. In particular, with the cohabitation of traditional and new forms of communication, content is being developed both according to traditional schemes and narrative lines, but also as a result of the use of interactive technologies; in this instance, new narratives are taking shape and narrative structures are built more and more taking into account navigation in interactive spaces: navigation and interaction thus become themselves the narrative, or at least an integral part of the narrative.

#### **4. - Multi-channel Content Delivery and XML Encoding.**

Although in a digital world, in general terms, the costs of re-packaging and re-use of material for multi-channel content delivery should not be high when compared with the cost of producing the original content, multi-channel can often provoke costs that should not be borne, if certain types of operations and encoding were used from the very beginning stages of a media project.

An important example is provided by the use of XML (Extensible Markup Language) encoding of information. The purpose of this language is to aid information systems in sharing structured data, especially via the Internet, to encode documents, and to serialize data. XML can be understood also as a “publishing” tool.

Since the early-mid 2000s and more and more in the near future, XML has been and will be a key element in the development of the semantic web (8 – Berners Lee, 2008) and (9 – Massarenti, 2008). In the case of multi-channel, XML encoding - and the use of metadata - helps streamlining the process of preparing a given material for delivery in several different manners, at several different times, diminishing in a remarkable way the overall costs of processing while maintaining a high level of quality control. In many cases, totally automated or highly automated procedures can be used to prepare a given content for alternative deliveries.

Examples can be mentioned for print, recorded music and television:

- it is often the case that books are the result of re-packaging of previously published articles or essays by a given author; if the original documents were XML encoded, the composition of the book could be performed almost entirely automatically; for the book editor it would be sufficient to provide basic pieces of information, such as page size, type(s) to be used, organization of chapters and a few more parameters; appropriate computer programs would then re-package automatically the original elements for book composition and publication;
- most so-called CD compilations of music and songs by a given artist could be obtained almost automatically from existing material, if this had been XML encoded; if the original material had to be processed to reduce noise and generally enhance the audio quality, it would be sufficient to add XML encoding and metadata to the processed material to have it ready for multiple, future re-uses obtained by means of automated processes;
- to a very larger extent, sports events and news are types of content that are very frequently re-packaged for many different distribution channels; just to mention only the operations of an original broadcaster and owner of the rights, a given event can be aired in toto once in real time, on several TV platforms concurrently, including streaming on the Internet; in addition, the broadcaster may extract highlights or snippets to be aired at other times of the day and/or in conjunction with other programs; also, the original program could be packaged into a DVD, leased to other broadcasters, etc.; if the original material had been XML encoded with the addition of appropriate metadata, all subsequent operations could be performed almost entirely automatically by pulling the selected clips from the database and automatically editing a new, re-packaged content, to be distributed through different channels;
- in all preceding examples, copyright information can be embedded into the XML encoding and the metadata, so that it would be possible to control automatically also this aspect of distribution.

The overall gain in performance can be very important, as well as the containment and control of costs. Nevertheless, even though the use of XML and metadata clearly provide many advantages to media operators, their systematic implementation is still poor; in part this is due to the fact that encoding for XML and metadata implies an additional, although marginal cost, in the beginning stages of production, in terms of time needed for encoding, definition of a system of classification of the material, and, in general, training of personnel to the correct use of the methodologies and ontologies. But this cost is amply paid for by smooth workflow procedures and re-use of the encoding many times over.

Moreover, XML encoding is of paramount importance to allow for full control in the distribution of content in real time (some form of “streaming” mode) and off-line (e.g. VOD); when the entire block of the content is distributed separately from partial blocks (“chunking”), but each channel produces separate streams of revenues (e.g. news on TV and on mobile phones).

If XML presents unquestionable advantages, allows for better organized workflow and brings notable cost reductions in the long run - it allows for transfer of data across different networked applications; it can represent common computer science data structures (records, lists and trees); its self-documenting format describes structure and field names as well as specific values; it is platform-independent, thus relatively immune to changes in technology - it is still difficult for many end-users to understand its capabilities. The best use of these data seems to be made by companies producing 3D animation films (Pixar, Dreamworks, etc.), which embed the data at all stages of the production process and use the encoded material to “publish” many different variations of the original material for many different uses by diversified audiences, thus increasing revenues across the board.

## **5. - From Content Origination to Delivery: Issues of Convergence and Interoperability.**

With the transition to digital, all media are subject to profound changes in how content is originated, processed and distributed. As it has been underlined above, the possibilities that are opened by multi-channel content delivery and the resulting multiple revenue streams are one of the most important elements in the drive to redefine production processes and business models.

Presently, in most processes the use of analogue material is still mixed with digital sets of data, and there is also coexistence of many different types of digital data. Platforms that were built for and used in one specific media environment tend to converge towards other uses for other media.

In this context, print, TV, movies, Internet video, photos, and music could morph into one big stream of digital entertainment that can be accessed by the audiences on any device, anywhere, anytime, but certain conditions must be met (10 – Forman and Saint John, 2000) and (11 – Massarenti, 1987).

### **5.1. - Convergence.**

In the 1980s up to the end of the 1990s convergence was a major item of concern for committees in academia, institutions, information technology and telecommunications companies, media content producers and distributors. Afterwards interoperability became the major area of concern, as it was widely realized that convergence would be hampered by lack of interoperability at system levels.

# CONVERGENCE - PRODUCTION PROCESSES

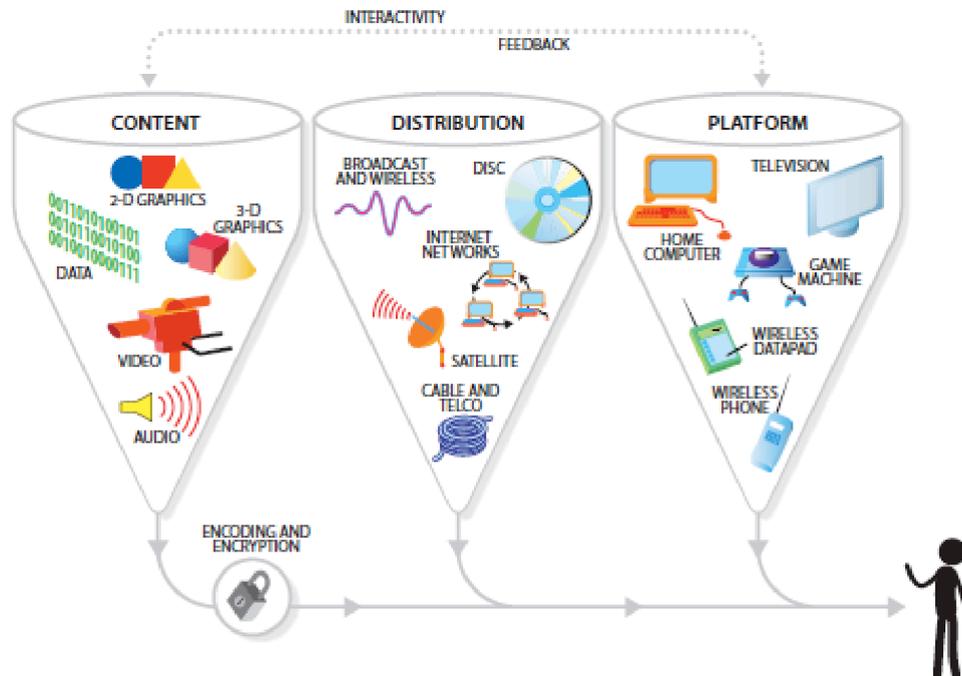


Figure 7a - Convergence and integrated interactive features. Scientific American, November 2000 pag. 52.

# CONVERGENCE - HOME ENVIRONMENT

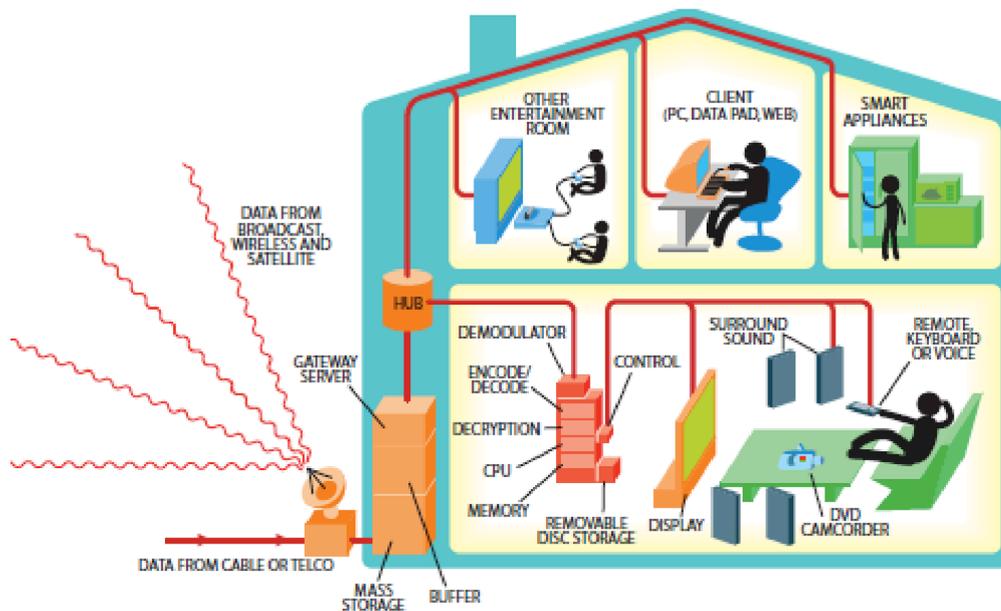


Figure 7b - Example of convergence in the future home, with digital access to multiple platforms. *Scientific American*, November 2000, page 54.

### 5.1.1. - Convergence and the Green Paper of the European Commission.

The European Commission published on December 3 1997 its “GREEN PAPER ON THE CONVERGENCE OF THE TELECOMMUNICATIONS, MEDIA AND INFORMATION TECHNOLOGY SECTORS, AND THE IMPLICATIONS FOR REGULATION” (12 – European Commission, 1997).

At that time, this document stated that “there is widespread agreement that convergence is occurring at the technological level. That is to say that digital technology now allows both traditional and new communication services - whether voice, data, sound or pictures - to be provided over many different networks. Current activity in the market suggests that operators from the sectors affected by convergence are acting on the opportunities provided by technological advances to enhance their traditional services and to branch out into new activities. Telecommunications, Media and Information Technology sectors are seeking cross-product and cross-platform development as well as cross-sector share-holding.” ... “Such developments represent concrete examples of an Information Society in Europe. They show its potential to touch the lives of every citizen. They also highlight a significant change in the range and diversity of traditional telecommunications and media services.”

The Commission noted also that the term convergence eludes precise definition, but it is most commonly expressed as:

- the ability of different network platforms to carry essentially similar kinds of services, or
- the coming together of consumer devices such as the telephone, television and personal computer.

This latter expression of convergence was one most often cited in the popular press - it could be easily understood by consumers and had the added interest of reflecting a wider struggle between computer, telecommunications and broadcasting industries for the control of future markets. Despite this popular image however, any convergence of consumer devices is still less real than network convergence. Telecommunications operators are offering audiovisual programming over their networks, albeit with mixed economic results, and have become major players in the provision of Internet access, as well as providers of backbone infrastructures. Broadcasters have provided data services over their networks for several years and these services will be enhanced by the deployment of digital transmission of both radio and television, and by the addition of various modes of interactivity.

Also the development of social networks websites has contributed to enhance forms of convergence, widening its scopes.

Within this framework, a new value chain can be envisaged:

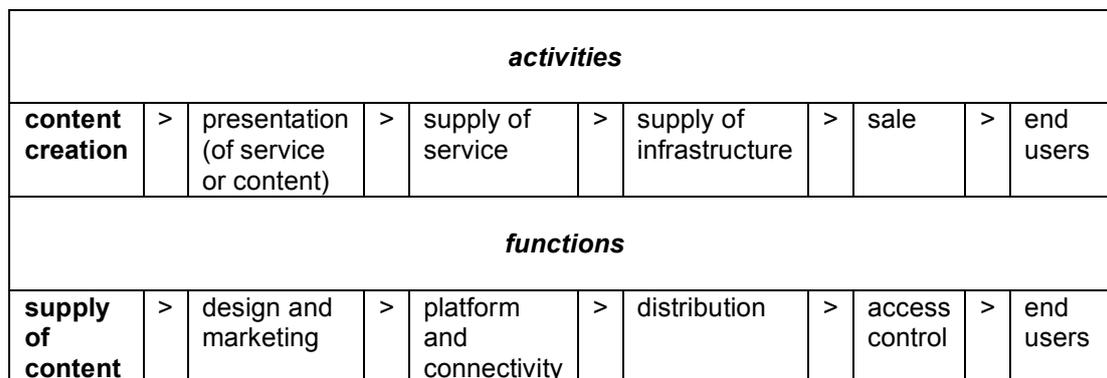


Figure 8 – The new value chain. Source: *Green paper on convergence, European Commission, Brussels, 3 December 1997, Chapter I.1, page 2.*

### 5.1.2. - Broadcasting and Telecommunications.

The EC Green Paper on Convergence can be seen as the starting point for a broad development of convergence between broadcasting and telecommunications. The convergence requires in general

broadband networking. Television has been broadband since the beginning, first analog and now digital. Telecommunications has in general been narrow band. Some years ago wired broadband like xDSL and cable become available to the public. Now broadband wireless technologies like DVB-H (Digital Video Broadcasting-Handheld, for mobile phones), HSDPA (High-Speed Downlink Packet Access, for higher data speeds on mobile phones, part of the UMTS-3G generation), etc. are operational and their use is spreading in many countries.

These are enablers for a rapid move towards service convergence.

However, roadblocks can be identified in various types of non-interoperability: missing technologies, missing agreements between market players, legacy issues in regulation and missing harmonization of the spectrum: the overall result is an increase in the costs of implementation and deployment.

Convergence can in principle take place over any wired and/or wireless system, but it requires that the networks are capable of transporting specific parameters. In the past the telecommunications and television broadcast systems have been almost completely isolated from each other, but convergence may take place in:

- Content and services
- Core network domain
- Across access network domains
- Distribution and e-business systems
- Terminals and access devices
- User interfaces.

Broadcasting is generally defined as scheduled service to everybody in a region (the one-to-many model), whereas telecommunications has been a point-to-point connectivity services for voice and data. Fixed line telecommunications with latest development in xDSL or cable or very high speed broadband have already opened the doors for content services which till recently had been a monopoly controlled by TV broadcasters.

A number of new broadband wireless technologies have been developed and their deployment is under way. Many of them are or can be agnostic to content. To a great extent, they will form the basis for the wireless convergence.

Most of the items addressed by the Green Paper are still valid, but developments have only been partial so far. In the late 1990s many of presently available technologies were missing or in the very early stages of development or implementation. At this time most needed technologies are in place, but roadblocks can still be recognized in regulation and in spectrums issues: e.g. same content and same services are treated differently depending on which network will be used; broadcasting is strongly regulated compared with telecommunications, while WiFi (Wireless Fidelity), WiMAX (Worldwide Inter-operability for Microwave Access) and Internet are only very partially regulated or even not at all.

### **5.1.3. - Technological developments and new players.**

However, technological developments, the entrance of new players on the market and the reorganization of many existing players since the early 2000s has made it necessary to reconsider the main paradigms of convergence by putting the market at the center of the processes and of the possible aggregations.

It must be underlined that the understanding of convergence on the market wants to exemplify processes that encompass the entire economic sector of the media, and multi-channel is embedded in the processes.

## TECHNOLOGICAL CONVERGENCE

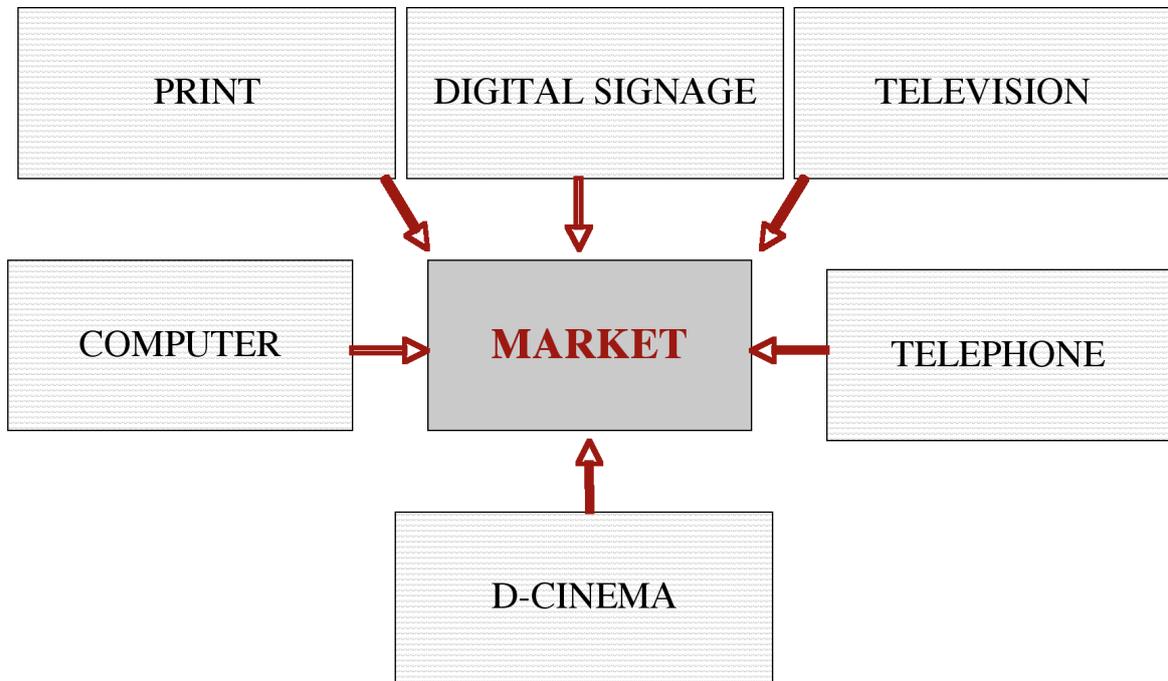
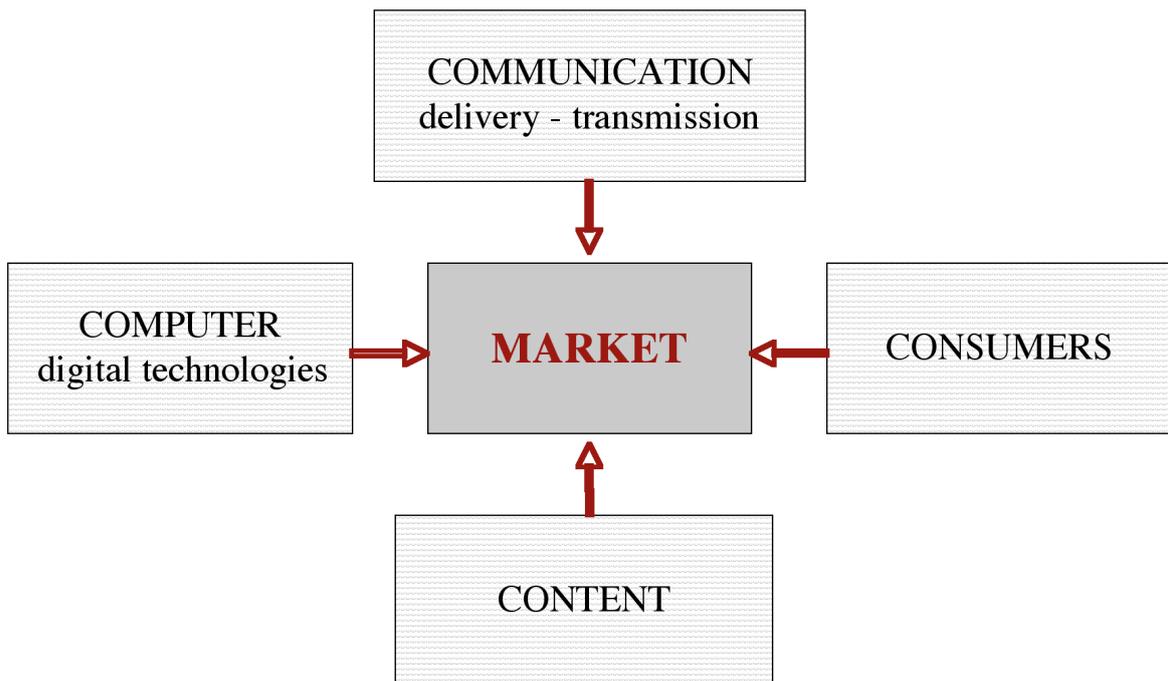


Figure 9a - Technological convergence in the media. Source: our elaboration.

## GLOBAL CONVERGENCE



*Figure 9b - Global convergence in the media. Source: our elaboration.*

Convergence has been embraced by the media and IT sectors, but this has come at costs that could not be foreseen in the mid-1990s.

Most companies did not realize at that time the extent to which they should modify their internal structures and organization of production processes as well as how they should rethink entirely their strategies of marketing and sales, and their position in the market(s), including branding. Several attempts were made at merging companies that appeared to be able to expand their markets and market shares by offering convergent services: most of these attempts failed when the companies involved in the process were not able to merge mentalities and corporate cultures. The merging and subsequent separation of America-On-Line and Time Warner is a notable example.

On the other hand, a few companies, such as Google, which was founded in the fall of 1998 at the height of the investments in new ventures in web-based companies and thrived even during the slump of the early 2000s, while many others were failing or having major difficulties, were able to propose a business model that embedded convergence without making an issue of it: both technological and global convergence were the underlying structure supporting the entire business.

Apple can be mentioned as another example of planned technological convergence coupled with market convergence.

More recently, Oracle, by far the most important and largest provider of database management systems, which are at the heart of almost everything digital, can be considered as a member of this very small group of companies that is contributing in a fundamental way to changing the entire digital environment in the media and communication.

Since the mid-2000s, several types of convergence have appeared on the market, which can be referred to both definitions of convergence by the EC stated above; many TV programmes, or at least parts of them, are carried on several TV platforms, Internet, and mobile phones; this applies widely to news and sports. It is important to note, though, that the same service provided on different platforms can be, for example, a television programme, but not all platforms carry the very same programme: variations, editing, shortening, etc. are common examples.

More is to come with the progressive spreading of smartphones, the deployment of complex networks of digital signage projects, the extended use of game consoles, iPods and car navigators in mobility. E-books and slate computers can be considered to be part of the next development.

#### **5.1.4. - Quality of Service.**

An often forgotten factor in convergence is that the Quality of Service requirements differ from network to network.

When a single network is used, the service provider can take measures related to QoS, but if more networks will be cascaded, there is no responsibility by the service provider anymore.

Also, QoS involves relevant issues related to its costs, and different market players have differing views about sustaining these costs.

#### **5.2. - Interoperability.**

Interoperability or lack thereof is a major issue and object of concern in all media, communication and related technologies, because this is what makes several types of convergence come to fruition, and is a major factor in decreasing or increasing costs over the entire production-distribution processes.

For example, terminals in mobile communication can have several different signals already today with a strong trend of expansion. This means that same services can be carried over more than one network.

	Creating platform		User platform
<b>Non interoperable platforms</b>	Windows	-----	Windows
	Linux	-----	Linux
	Apple	-----	Apple
	Sun	-----	Sun
<b>Interoperable platforms</b>	Windows	-----Java bytecodes-----	Windows
	Linux	-----Java bytecodes-----	Linux
	Apple	-----Java bytecodes-----	Apple
	Sun	-----Java bytecodes-----	Sun

Figure 10 – Example of non interoperable and interoperable platforms. Source: our elaboration.

Network service convergence requires interoperability on almost all levels. If a straightforward interoperability is not build into the system, convergence can in many cases still be achieved by using conversion mechanisms, although conversions usually are costly and diminish the overall quality of the content delivered to the end user.

Interoperability is defined in different ways according to the environment and context to which it is related.

### 5.2.1. - Definitions of Interoperability – Telecommunications.

For example, in the telecommunications sector the term is defined as follows:

- a - the ability of systems, units, or forces to provide services to and accept services from other systems, units, or forces, and to use the services that are exchanged so that they can operate together efficiently;
- b - the condition that is attained, between communications systems and electronic systems or between communication equipment and electronic equipment, when information and services can be exchanged in a direct and satisfactory manner between them and/or with/between their users;
- c - the level of interoperability should be defined with reference to specific cases.

### 5.2.2. - Definitions of Interoperability – Software.

In the case of software the term is used to describe the ability of different programs to exchange data by means of common procedures, to write and read the same file formats, and to use the same protocols.

The absence of these characteristics brings about very frequent cases of lack of interoperability between products that are designed and produced without criteria that obey to established standards or, at least, to interchange or conversion conventions.

This is the typical case of set-top-boxes (STB): the products used for the reception of standard digital terrestrial television are not interoperable with those that can accept TV signals of standard digital satellite or cable television; thus users who want to view programs of multiple platforms must purchase and install different objects, even though all three TV signals are standard digital TV signals, compressed with the same algorithms, but transmitted using three different protocols by different broadcasting companies, which do not want to standardize either protocols or services.

The same observation applies to most services provided by mobile phone operators.

### 5.2.3. - Definitions of Interoperability - The European Commission.

For the European Commission (*European Interoperability Framework for Pan-European eGovernment Services*, <http://europa.eu.int/idabc>, Brussels 2004) (13 – European Commission, 2004) interoperability “means the ability of information and communication technology (ICT) systems as well as of the business processes they support to exchange data and enable the sharing of information and knowledge.” A context

for interoperability can be defined as a set of policies, standards, and guidelines which describe the way in which organizations have agreed, or should agree, to do business with each other. Therefore an Interoperability Framework is not a static document and may have to be adapted over time as technologies, standards, and administrative requirements change.

It must be underlined how the EC's definition goes beyond the boundaries of the Information Society, which represented the reference arguments regarding convergence in the 1990s, to step into the context of the Knowledge Society.

#### **5.2.4. - Two main types of Interoperability.**

It must be recalled that in the preceding definitions no distinction is being made between the two main types of interoperability:

a - interoperability within a given system, or intra-system interoperability (e.g. telecommunications, or television, etc.)

b - interoperability between different systems, or inter-systems interoperability (e.g. telecommunications *and* television, etc.)

Whereas in the first instance many difficulties and obstacles still exist and are maintained in moving towards interoperability, the second type is quite underdeveloped because it is often in sharp contrast with highly complex strategic, economic, and cultural issues: it concerns directly the very hard competition that involves all the sectors of the traditional media, of the new media and companies based on the Internet, and of telecommunications groups for the control of the media themselves, of content, and of revenue streams.

The second type of interoperability is the most difficult one to develop and to be attained, but it is also a fundamental condition if costs of production and delivery of services are going to decrease both for providers and for end users.

#### **5.2.5. - Interoperability and the market.**

A very important point is that at the end of the production processes, on the users' side, lack of intra-system or inter-systems interoperability is very likely to prevent the delivery of a product or service, or deliver the item at higher costs and lower quality.

If debates on interoperability seem to be mostly focused on technical and technological issues, it is necessary to realize that interoperability is, more often and more importantly, an issue related to organization of the market.

In other words, it has strong impacts upon elements such as property (do the competing players wish to share the data?), staff (do companies really want to train creative and technical personnel to new technologies and work methodologies, does personnel really want to be trained, what about managers?), and usability. If we take into account these three issues, the expression "*interoperability of business processes*" would be more appropriate.

All things considered, the limited intra-system interoperability and even more so inter-systems interoperability bring about considerable restrictions to the possibilities for communication and use of the media that could already exist for multiple modes of access and for a wide variety of access devices. A tangible consequence of this situation can be found in user interfaces that are difficult to manage and a lack of ability by many systems to offer functional modalities requiring little or no knowledge of the specific technical characteristics of a given device and/or of the access to the system. Most computer and mobile phones interfaces, for instance, fall into this category.

#### **5.2.6. - Interoperability and interfaces.**

The end result is higher costs of equipment, workflow that cannot be smoothly organized, processes that have to be continuously adapted to a given program rather than having an overall pattern that can be applied widely. This is especially true for more important broadcasters and large media companies; if production is only local, there are less problems, but there is no such thing as no problems.

A direct consequence of this state of the matter is the transportability of an interface across access devices. Convergence and interoperability can be fully appreciated by the users only when access will be provided by means of interfaces that will be able to provide access to content on all available devices, with the same kind

of navigation and narrative structures. The interface on any given access device will be adaptable by the system and/or by the user at any given time according to the specific use of content.

### **5.2.7. – Examples of non-interoperable devices.**

Whereas early versions of CR-ROMs and DVDs proposed by competing companies were rendered compatible and interoperable by agreements reached to propose to the market a common standard, there are several current examples of non-interoperable devices that offer the same or very similar capabilities to access content.

Over a period of several years and until February 2008, an outstanding example has been provided by the standoff between the two industrial groups proposing DVD players, which were designed to play high definition video, with a marked improvement over standard DVD quality. Toshiba with some allies offered a device called HD DVD (High-Definition/Density DVD), whereas Sony presented a device called Blu-ray. The technical differences were quite important, but in the end it was the choice made by the largest and most influential movie producers that determined the outcome in favor of Blu-ray.

In more recent years, and especially since the end of 2008 and the beginning of 2009, e-books have taken center stage in the transition to digital of a very large part of the print world: press, with newspapers and magazines, and books. These electronic devices should be able, in principle, to offer access to a vast amount of information and data that derive from the world of print, and access should be made very easy by means of downloads directly to the device, without transiting through a computer, at a cost to the user that would be considerably lower than the amount that would be paid for a print copy of the same item. Also, e-books would be able to receive downloads from newspaper and magazine publishers, besides books. Thus the economic model could very similar to what are traditional characteristics of the print world: pay-per-copy and subscription.

At the time of this writing, e-books are available from only four companies, although many more will be announced during 2010. They all have black and white displays and cannot reproduce video or other kinds of animated images. All the available models are not interoperable: an item that is bought from one of the “stores” can be read only on the e-book device sold by the same “store”: a book bought on the Amazon.com website can be read only on Amazon’s e-book, called Kindle, and it cannot be read on a Sony reader or on any other device of the same family.

Availability of color and animated images will arrive in the near future, and these two factors will bring into the realm of potential suppliers of content many other players, besides companies which belong to the print sector.

It must be noted that, among other characteristics and potential developments, e-books could change in very profound manner the way texts for the educational market will be written, distributed and, above all, renewed over time.

Also, while high definition DVD devices were produced only by traditional electronic companies, e-books are provided by a very diverse array of vendors, from Amazon – an e-commerce company – to Sony – a company which is both an electronic and a media company – to Barnes & Nobles – a major chain of bookstores in the USA, and more to come.

Moreover, the e-book devices being offered to readers do not differ only from a technical viewpoint, but also the encoding of the content is non-compatible.

There is also the distinct possibility that certain models of future smartphones and/or slate computers could offer the possibility of being used as if they were e-books. If this were to happen, providing content for “e-book”-type devices could involve the entire media industry, in all its sectors, bringing about inevitable changes in production processes and economic models.

The same arguments apply to the current developments in 3-D cinema and 3-D television: three non-interoperable systems of shooting in 3-D for stereo viewing in the cinema and at home are being used, as there are three different and non-interoperable types of “glasses” to view this type of content.



*Figure 11 - e-book by Plastic Logic.*

## **6. - From here to there.**



Figure 12 - A frame from Abraham Zapruder's 8mm film of President Kennedy's assassination, 22 November 1963, in Dallas, Texas.



*Figure 13 - Video cameras and mobile phones owned by tourists and local residents recorded many images of the tsunami that hit a wide area of Indonesia, Thailand, Sri Lanka and India on 26 December 2004. These images were sent to various television stations, and were broadcasted worldwide. During the first days following the event they provided the only available material for broadcasting. This image was recorded by a tourist at Krabi, Thailand.*



*Figure 14 - An image of the bombing in the London tube on July 7<sup>th</sup> 2005, recorded by the owner of a mobile phone.*

Database and database asset management systems have become of paramount importance in the media and communication in all phases of production and distribution, and represent the main platform in workflow and increased automation procedures.

Since the mid-1990s, and more so during the past five years, the multiplication of possible channels for distribution and access to content which generate multiple revenue streams has forced upon the media companies of all sizes profound changes in the organization of the entire production process, from origination to processing to play-out, with the additional difficulties brought about by the necessity to take into account a variety of interactive systems and the direct or indirect competition by social networks.

This period of change has just begun in earnest and it will take several years for the entire industry to adjust to the new environment(s). However, it is necessary to express a cautionary remark: new technologies and new ways of producing and accessing content will continue to appear in possibly higher degrees of complexity in the near and less-near future; this will translate into more and faster changes to be faced by the industry and to be taken into account, and the availability of new skills will become a basic necessity for change and growth.

The human factor, at all levels – creative, technical, managerial, financial – already is and will be ever more a critical element.

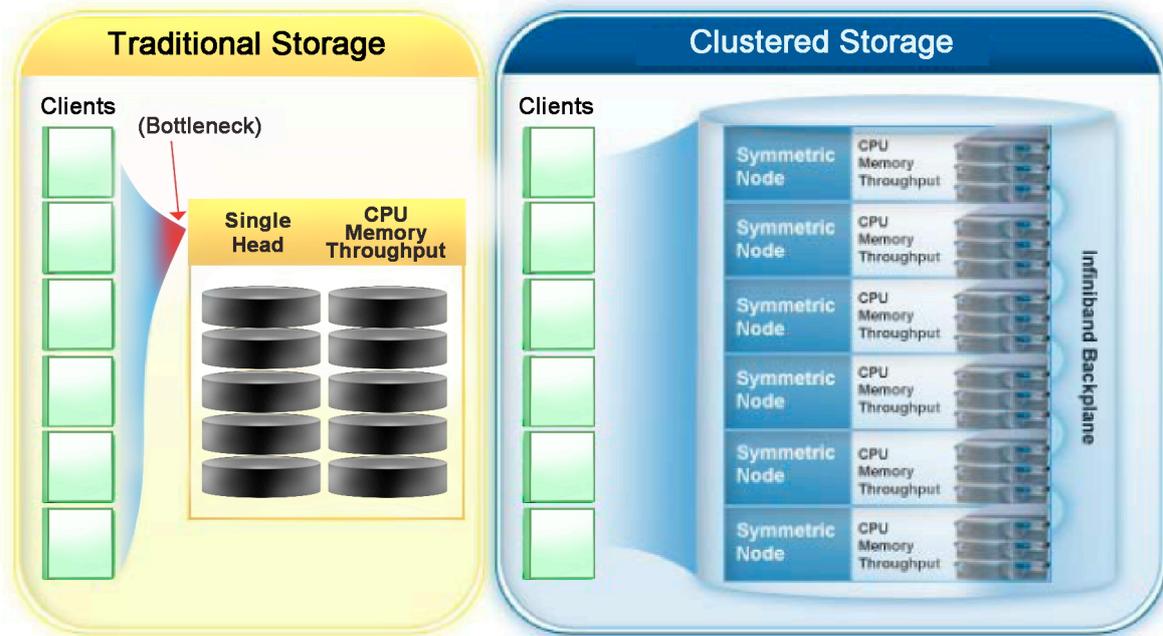


Figure 15 – Traditional and Clustered Storage. Source: Isilon Systems.

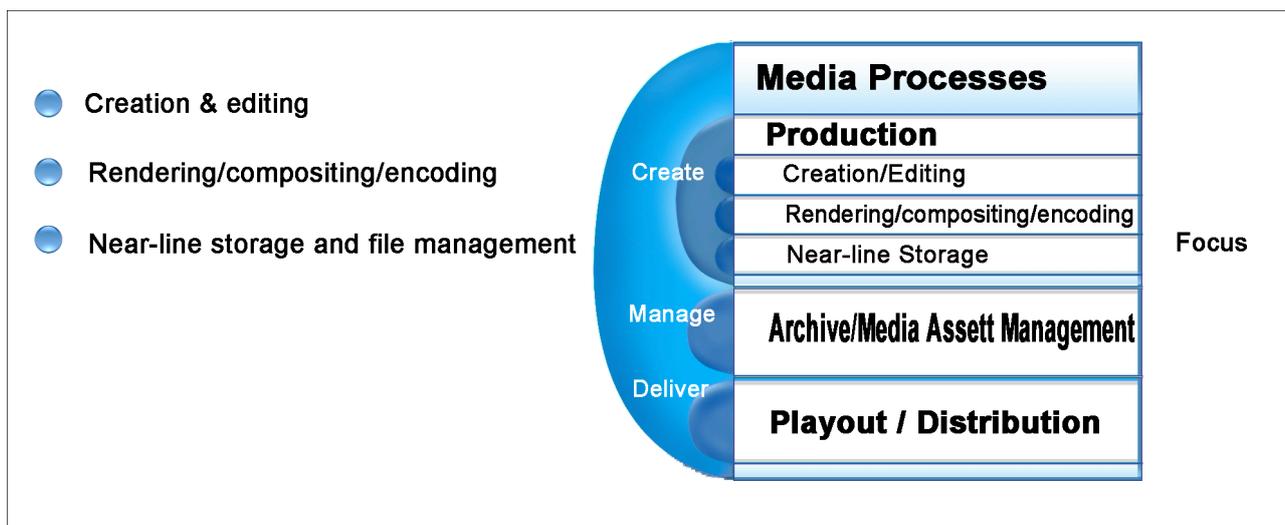


Figure 16 – A global view of Media Processes. Source: Isilon Systems.

## RESOLUTIONS 1

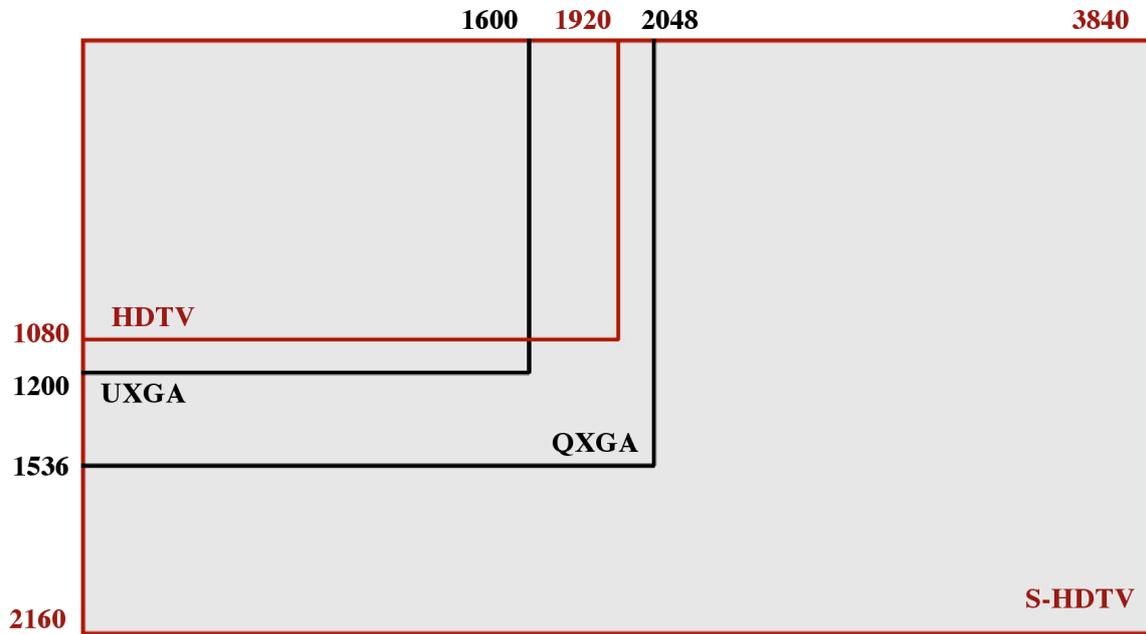


Figure 17a – Video and Computer Resolutions 1, currently available. Source: our elaboration.

## RESOLUTIONS 2

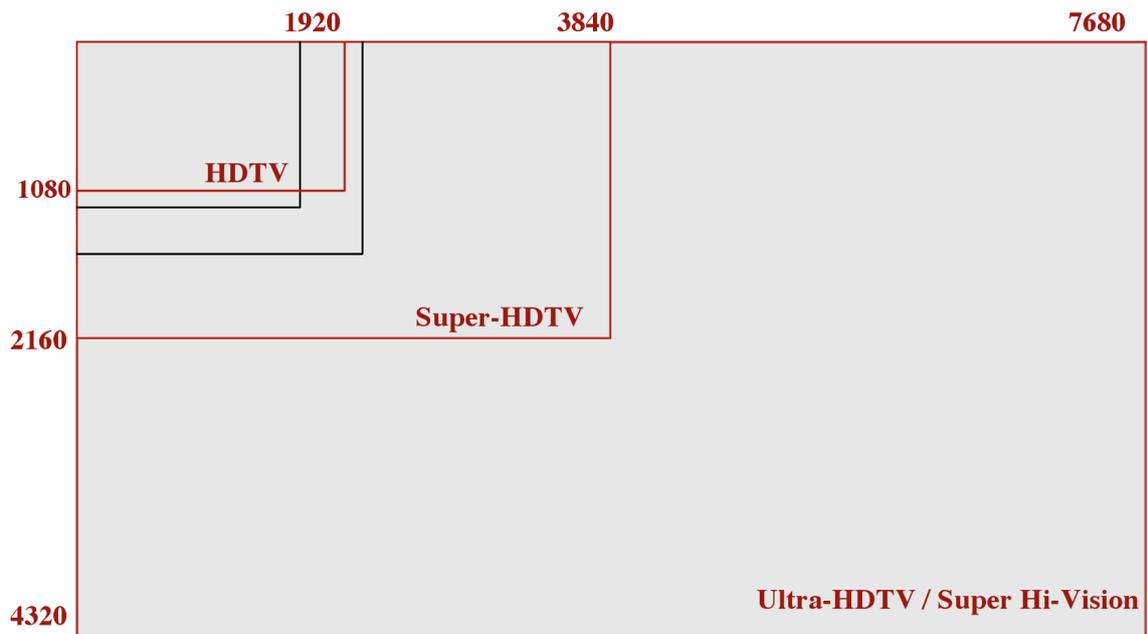


Figure 17b – From currently available Resolutions to future Super Hi-Vision. Source: our elaboration.

## RESOLUTIONS 3 - FILM AND VIDEO

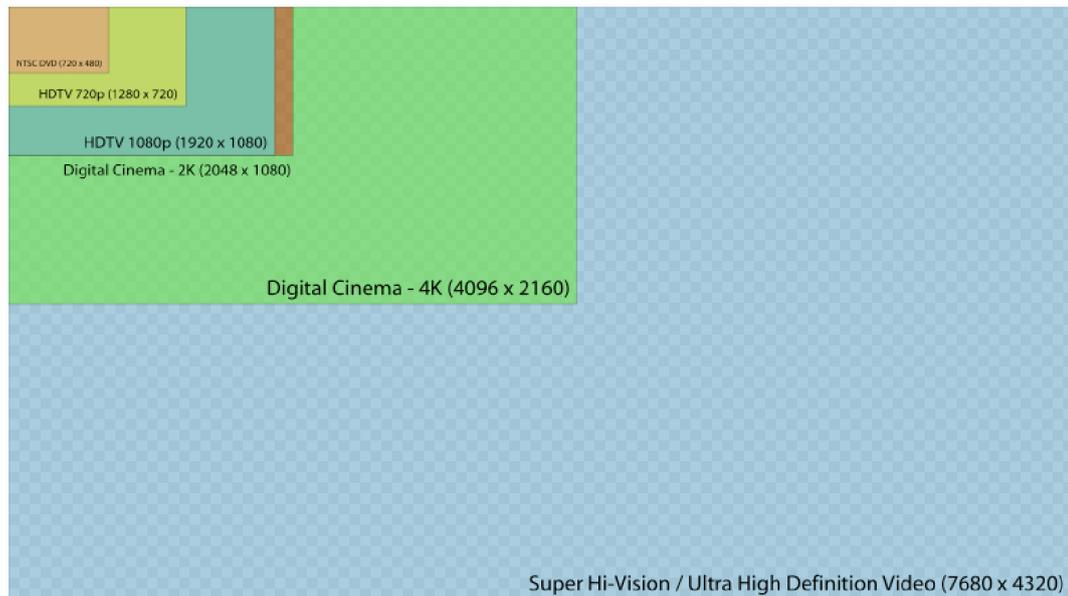


Figure 17c – Comparison in absolute pixel numbers of Video, Film and future Super Hi-Vision Resolutions. Source: our elaboration.

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