

Techno-Economics in Communications and Media: Looking Ahead into Selected Key Aspects

White Paper of the COST Action IS0605 Econ@Tel

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Abstract

The goal of the COST Action IS0605 “Econ@Tel” is to develop a strategic research in the cross-disciplinary field of Telecommunication Economics. This includes a multitude of different dimensions, which include: (a) a training network among key people/organizations in order to enhance Europe’s competence in the field of telecommunications and media economics, (b) the support of related research and development initiatives, and (c) the provisioning of guidelines and recommendations to European players (end-users, enterprises, operators, regulators, policy makers, content providers) for the new converged broadband, wireless, content delivery networks to citizens and enterprises. COST IS605 and its partner countries’ coordinates partially the development of research methodologies as well tools from engineering, media, and business research. Regulatory issues helping or hindering the adoption of economically efficient services are identified. Thus, COST IS605 mobilizes the “critical mass” and diversity of economists, business research experts, engineers, networking experts, and scientists working in communications and content economics.

Thus, this white paper presents a selected collection of dedicated views of 22 action members from 11 countries in terms of key future aspects at stake identified as such over the years 2008 to 2009 for the benefit of the European players. It also sometimes identifies disruptive research directions for future work. It does not, therefore, constitute a state of the art in telecommunications techno-economics, as usually these players will be familiar with current aspects. Furthermore, it does not claim to be fully exhaustive, but addresses many areas in those COST IS605 goals as stated above.

Keywords

Telecommunication Economics, Telecommunications, Media, Communications Technology, Regulation, Business Models, Societal Influences, COST IS0605 (Econ@Tel).

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0. INTRODUCTION

Telecommunication Economics does address in this COST Action IS0605 a range of aspects, which have been typically dealt by separate groups of experts. Those aspects include at this stage the following ones:

- Business Aspects
- Social Aspects
- Regulations
- Network Technologies
- Media and Content Aspects

While for each of those areas the following sections will show a detailed contribution of single or multiple authors, the interconnection of those areas become more and more important. *E.g.*, although the network technology of fiber optical transmissions has matured over the last decade, its deployment varies from country to country and relevant business models are emerging slowly. Reasons for such a situation are manifold, however, the socio-economic interrelation between technologies, business models envisioned, and the usage of such services by humans (either as companies or as private users) become key aspects, as soon as a more detailed investigation is undertaken. Therefore, a slightly broader view on networking, telecommunications, and its operations is complemented by the goals of business modelers and possibly regulatory experts, to ensure that the knowledge of approach-inherent problems is identified.

Thus, although the structure of this white paper follows simply for presentation reasons the sequential format of those five areas, their interrelation as well as necessary holistic views are identified in many cases and the need for a better understanding becomes obvious.

1. KEY BUSINESS ASPECTS

To start with business aspects, this section investigates the role of user innovation as an important area for business models. It continues in the fields of access, by addressing fragmentations of access terminal types and ubiquitous mobile Internet access. Next generation access network deployments as well as fiber optic network deployments investigate on relevant business views. The customer profiling does enable a certain business model. Uncertainty in telecommunications and future trends in innovation diffusion forecasting complete the business aspects under investigation.

1.1 User innovation (contributed by S. Ramos, Spain)

There are symptoms of a paradigm shift in innovation where the traditional models are not enough to maintain a competitive position in the Information and Communications Technology (ICT) sector. Two main innovation trends emerge: open innovation and user innovation. Particularly user innovation (developed from/by consumers and end users, rather than industry) is of relevance to understand current and future changes in ICT industry. For this reason, understanding the new role of users in innovation and analyzing the motivation of users to participate in innovation will be key topics in the near future.

*1.2 The fragmentation of access terminal types and of the terminals industry
(contributed by L.-F. Pau, Denmark)*

Developments in the terminals user interfaces, network capabilities and network access aggregation are pushing ahead for new developments in wireless, Digital TV as well as broadband access. At the same time, the industry has deep device usability issues around searching/finding, buying and accessing content, as well as around affordability. Also, a third fragmentation happening is linked to operating systems for mobile terminals, with proprietary Operating Systems (OS), platform-based OS, and so-called open source OS with side-constraints on content and advertisement streams. The result is a triple fragmentation at functional/performance level, as well as one at supplier/distribution level as better or cheaper alternatives emerge.

1.3 Ubiquitous mobile Internet and its impacts (contributed by H. Chen, Netherlands and S. Ramos, Spain)

Mobile is evolving at a very fast pace and its affecting both industry and users behavior. Europe has led the extension of mobility to every citizen achieving a spectacular success in users' penetration. However the transition to Mobile Internet and Mobile 2.0 seems to be leaded by a new generation of firms, agents and innovative users. In this sense, the European mobile landscape is likely to differ from the current one so it is of relevance for Europe and its industry to follow this evolutionary or disruptive development and to try to address the key elements affecting.

As the mobile Internet is taking off with the wide deployment of HSxPA (High Speed X Packet Access) networks, data intensive applications and the smart phones, what are the impacts on individuals (user behaviors), companies and communities and to the whole society? How to qualify and quantify the impacts and changes? Are we more efficient in daily life or in doing business? Or does it bring more stress by bringing work into personal life? Does it change our travel pattern? Does it enable us a better living environment (e.g., less CO₂ emission by using real time traffic planning)?

1.4 Next Generation Access Networks deployment, investment and the role of Public Administrations (contributed by S. Ramos, Spain)

Given the need to upgrade and extent network capabilities (both in fixed and mobile) and the deep economic turmoil that is affecting industry investment and growth, the role of Public Administrations will be of crucial importance in areas such as deployment in non-market areas, ease of use and occupation of public/private domain, and demand fostering.

1.5 Wireless VOIP (contributed by L.-F. Pau, Denmark)

One "taboo" topic is the actual deployment of Voice-over-IP (Internet Protocol) in future wireless networks and the corresponding fixed-mobile convergence, with full security and management, coupled with the "letting-loose" the huge capacity hidden in the current 3G (third Generation) wireless infrastructure's cluster computing capabilities. Will the current communications operator model be able to survive or not and which business models will emerge? What can wireless operators do to move beyond ARPU (Average Revenue per User)?

1.6 Business models for the deployment of fiber optic networks (contributed D. Katsianis, V. Kyriakidou, Th. Sphicopoulos, Greece, M. Pickavet, S. Verbrugge, J. Van Ooteghem, Belgium)

The rollout of new fiber access networks or the upgrade towards Fiber-to-the-Home (FttH) is happening in most Western countries at a much slower rate than expected. The final step in migrating to an all fiber (last mile) access network is one bridge too far for most telecom operators. Nevertheless, FttH is considered as the solution for access networks in the long run. In order to analyze the different technical and business aspects regarding future proof strategies for the rollout of FttH, a strong focus must be put on the business and techno-economic evaluation. What are best practices for the rollout of FttH? What lessons can be learned from previous and current network rollouts? Which technical solutions are most future proof and will lead to a better competitive market? Which value networks will have the most potential? Which parameters will determine the viability of the business case for an FttH rollout? Could enhanced methods for evaluating an FttH business case (*e.g.*, real options and game theory) lead to better results and conclusions?

Broadband penetration is continuously increasing in European countries and operators have to face end users' demand for higher bandwidth. Fiber optical networks are considered as the most future-proof access technologies. New infrastructures and equipment are required in order to deliver broadband services to end users. The development of fiber optical networks in many countries, and specifically in Municipalities, has enhanced the adoption of broadband services and can be the solution of the provision of real broadband connections.

Apart from huge investments needed for an FttX (Fiber-to-the-X) network there are questions with equal importance than financial issues. There is a lack in bibliography according to the basic concept of building and operating broadband networks. These infrastructures should be operated in an effective way so that business modeling must be applied. The study of recent developments could help decision makers to understand in a better way the strategies for the development of such kind of infrastructures, the impact of these networks from a techno-economic perspective and the impact of Internet Service Providers' competition in the development of broadband networks. Based on this analysis a benchmarking could be applied, especially in emerging markets where such kinds of initiatives are at the initial stage.

1.7 Communications and media customer profiling (contributed by L.-F. Pau, Denmark)

Communications, media and MVNOs (Mobile Virtual Network Operator) have for a long time, at different levels, tried to analyze customer usage data, but face a threat/opportunity now that open source business intelligence tools give users and third parties cheap similar capabilities. In other words, competitive service offerings may be crafted also by users and third parties, thus paving the way to service personalization being crafted by users. It is likely that a debate will grow about third party access to anonymised CDR/IPDR (Call Detail Record/Internet Protocol Data Record), so that they can use extract-transfer-load open source tools with often a MySQL base.

1.8 Modeling uncertainty in the evolution of telecommunication networks and services (contributed by B. Sapiro, Italy)

The telecommunications sector is today an extremely variable environment under the effect of powerful technological thrusts. It is permeated by a basic uncertainty deriving from its intrinsic features.

Scenario engineering incorporates uncertainty into the forecasting process and lets the planner have a broader and more creative vision of the future, in order to steer present actions in the light of future developments, to keep a constant communication between organizations and the evolving outside world, to anticipate changing points and to turn them into advantages. Challenges include coordination of research experiences, synoptic view of different techniques, and rationalization of the use of work tools, adaptation to the advanced technological level of new cooperative research environments, visual communication, and integration of qualitative and quantitative methodologies.

1.9 Future trends in innovation diffusion forecasting (contributed by Ch. Michalakelis, D. Varoutas, Th. Sphicopoulos, Greece)

The academic and practical interests, regarding modeling of innovations diffusion and demand forecasting in high technology markets and especially to the telecommunications sector, are mainly related to the effects of the main factors that influence diffusion. The most important of them are the effects of marketing mix variables, the multinational diffusion of services and the diffusion modeling of multigenerational products and services.

More specifically, the future trends for research regarding high technology products diffusion include a study of the effects of marketing mix variables, such as price and advertising, over the diffusion process, evaluating their performance over the telecommunications sector. Furthermore, the development of methodologies included, which provides forecasts with limited or no data. Corresponding approaches target to the early prediction of the diffusion process and the corresponding parameters (market potential and diffusion rate) and to the elimination of the forecasting uncertainty, on the same time. Given the rapid technological substitution, this research direction is of major importance, into the context of demand estimation. Additionally, the diffusion of multigenerational products and services is studied. As mentioned above, given the short intergeneration time, the time that elapses between the introductions of successive generations of a high technology product, development and application of corresponding methodologies is of high interest for research. Finally, multinational diffusion is of importance. Since high technology products are usually introduced into multinational markets, study of multinational diffusion, either simultaneous or with a time lag, constitutes another important direction for future research.

2. KEY SOCIAL ASPECTS

Social aspects address the user and user groups in different geographical areas of our world. Thus, they form a key piece of chain to be addressed for a successful technology, which does specifically address those user's dedicated needs. Therefore, the pure access to telecommunication services in rural areas is discussed in contrast to a convergence envisioned for the digital divide. While the access of broadband for all is studied, the universal access in terms of policies is considered as well. In terms of the green Information Technology CO₂ emissions are debated for communications. Finally, health care applications and their requirements for mobile access and related pricing models are outlined.

2.1 Access to telecommunications in rural areas (contributed by L. Lambrinos, Cyprus)

Of major concern is the availability of advanced telephony services in rural areas which are often neglected by telecommunication operators due to the high infrastructure development costs. Through the use of long-range wireless links one may offer such services to small communities or people living in temporary accommodation who will benefit from them in

many ways (e.g., more frequent communication with relatives and public services). Experimental work has shown that facilities that are taken for granted in urban areas (e.g. voicemail) can really make a huge impact to their users when they first become available more so if their associated costs are very low.

The deployment of such mechanisms for telemedicine purposes is also under consideration; non time-critical data can be transferred over opportunistic networks. An obvious benefit is the low communication cost. Additionally, the processing of such data is easier as it is already in an electronic form.

2.2 Digital divide convergence (contributed by Ch. Michalakelis, V. Kyriakidou, D. Varoutas, Greece)

The estimation of the digital divide convergence is an interesting and timely topic especially in light of international, national and regional initiatives. The analysis of the underlying factors as well as the development of new methodologies and tools for the estimation of digital convergence is of critical importance for shaping strategies and policies. Especially the estimation of the time for such a convergence is of importance for allocating investments and proposing new measures. An analysis framework taking into consideration the diffusion of broadband services across the wider European area is foreseen. Such an approach may rationalize the convergence process and forecasts

2.3 Affordable wireless access for all (contributed by L.-F. Pau, Denmark, Z. Kirtava, Georgia)

There will be a day where emerging markets will no longer provide to all economies of scale on the pricing of wireless terminals, while the majority of users everywhere in the world will want affordable tariffs in their environments on a purchasing power per minute basis. This will result both in less marketing expense exposed distribution channels, in tariff packages for the *needy*, and on repurposing universal service fees. The *needy population* represents groups and layers of society, European and others, which have greater demand for communication despite of limited means to pay high rates for it: poor, homeless, unemployed, disabled, isolated Individuals (lonely elderly), migrants, etc. It makes sense to compare communication tariffs between different European countries for these *needy* in order to shape up regulations and business models. The results should be tailored packages of services and usage bundles, possibly subsidized by universal service obligation charges levied by the regulators, allowing them to connect and jump back into the above-poverty society. In this way too, the service suppliers would raise their social image and achieve penetration amongst the last untapped segment in saturated markets.

2.4 Universal Access to broadband services (contributed by M. Falch, Denmark)

Broadband access is becoming a necessary tool for participation in the information society. A key social issue is therefore to ensure universal access to this service. This work discusses appropriate policy measures for achieving universal access to broadband services in Europe. Access can be delivered by means of many different technology solutions. This means a greater degree of competition and affects the kind of policy measures to be applied, as other policy measures than the classical universal service obligation are in play. Available policy measures include universal service obligation, harmonization, and demand stimulation, public support for extending the infrastructure, Public Private Partnerships (PPP), and others.

2.5 Reducing the CO₂ emissions of communications and content infrastructures (contributed by L.-F. Pau, Denmark)

Current generation infrastructure designs and operations emit huge amounts of CO₂ (Carbon Dioxide), rated to be in the 500 Million tons range/year (according to Mc Kinsey). As processing complexity and content diversity grow, the growth rate is unfortunately increasing. It is necessary to invent eco-friendly protocols, data formats, semiconductor and power technologies, while access terminals themselves rely more on renewable energy sources.

2.6 Mobile health care area (contributed by H. Chen, The Netherlands, Z. Kirtava, Georgia)

Mobile communication applications/services in the area of health care. How to introduce mobile health care services in a multi-operator environment with different network technologies that have different/changing QoS (Quality-of-Service); how to introduce mobile health services in a low bandwidth environment or remote area? From a business perspective, what are the business models? What are the pricing models concerning different categories of mobile health services? Service features should be designed allowing possible applications of mobile telemedicine in countries with limited technological basis, affordability or bandwidth, most possibly for emergency care and remote monitoring.

3. KEY REGULATORY ASPECTS

Regulations do play in a union, such as the European Union, an important role, especially to avoid the preventive misuse of technology, mechanisms, or business schemes. Thus, a number of different fields are affected. The basis for an electronic world is the regulation on homogenous identity handling and its interoperability. Based on those, the question can be posed if mobile banking is operated by banks or communication operators. In general, the European information society and its related Information and Communication Technologies (ICT) require a debate for a converging European policy area. Finally, more detailed regulations on spectrum management are presented.

3.1 Electronic identity interoperability (contributed by L.-F. Pau, Denmark)

Today, the public services, utilities, communications industry, the banking industry, the media industry, the health sector, all pursue inconsistent citizen identifications by electronic means. Furthermore, the legal validity of such identification is often national or restricted to corporate recognition, thus damaging service deployment across public and private actors alike. As a consequence the level of recognition given by sovereign states or treaties of citizen's electronic identity, such as the European treaties, is often more a dream than a reality. And the levels of security and authentication linked to an electronic identity are at best hazardous. It is high time to define multi-party multi-level citizen electronic identification schemes for interoperability and cost reductions, to which the communications infrastructure would offer a key enabler tied to legal provisions.

3.2 Mobile banking by banks or by communications operators? (contributed by L.-F. Pau, Denmark)

While mobile payments are proliferating by SMS (Short Message Service), RFID (Radio Frequency Identifier), remote tags, and closed services, the issue of the alignment of banking regulations/directives and communications regulations/directives is always ignored. Why are

operators not getting a limited banking license to serve users with on-line payments/transfers, and why are banks not getting limited M2M (Machine-to-Machine) communications licenses for their terminals? Realizing that the security and OPEX (Operational Expenditures) cost structures of operators are not inferior to banks, regulators should enable competition and technology upgrades for user's benefits.

3.3 The European Information society and relevant ICT technologies (contributed by E. Bohlin, Sweden)

A framework initiative for European information and media policy was launched in 2000 by the EU (European Union). This was the i2010 initiative. It is aimed at all aspects and activities in the EU of the application of ICT's (Information and Communication Technology) and media, in support of the move to the 'Information Society'. In concrete terms, it has consisted of a range of policy actions, regulation and a comprehensive program of research and development, with many positive outcomes. However numerous challenges also remain, such as variations between Member States in the take up and use of ICT's and their impact across European Society, and how to address issues such as the digital divide. In the light of these parallel developments and issues concerning ICT's, there is an opportunity to debate how to further the development of a common European Information Society in 2009. Effectively such a debate must address a key question for Europe:

What are the most important policy questions that the EU faces with regard to ICT and the information society to around 2015?

The way to answering these questions will need to include a broad ranging, interdisciplinary and socio-economic approach. Society's dependence on ICT will be shaped, slowed or accelerated by policy questions in at least five or six key areas:

- The contribution of ICT's to the economy - at a macro-economic level, the real impacts of ICT's may be extremely difficult to discern, but has been captured in various estimates since some time.
- Trust, privacy and security – application of ICT's, especially in services, is being held back by lack of trust in online use of services such as banking and retail purchasing.
- Dependence, resilience, reliability, failsafe, disaster recovery and liability – this major area for concern has, until now, been a policy 'black hole' or no-go area. What is needed is a policy framework governing use and protection of ICT's, particularly in our infrastructure - including the consequences of failure in critical circumstances.
- Effects of ICT's on society and the family – we need to understand where and how ICT's affect society, in psychological, cultural and relationships terms. This can be viewed through the family. If ICT's fail the society and the family, this is a subject for major concern.
- Sustainability of ICT's – the major use of ICT's has two sides – as a growing major consumer of energy and as a way for revamping every sector to change their pollution and energy consumption characteristics by means of major new business process innovations. Policy issues may need to further than current legislation (RoHS and WEEE).

3.4 Spectrum management policies and uses for the "digital dividend" (contributed by J. L. Gomez Barroso, Spain)

The radio spectrum is a scarce resource of enormous economic importance. It is estimated that the total value of electronic communications services that depend on use of radio spectrum in the EU exceeds € 250 billion, which is about 2.2% of the annual European GDP (Gross

Domestic Product) in 2007. Spectrum allocation decisions will almost always involve trade-offs between different potential uses. This is because spectrum is a resource which is scarce; a resource for which demand is in excess of supply. As scarcity increases, spectrum management is changing around the world, with more emphasis on market mechanisms and flexibility for users and less resort to regulation.

The allocation of the “digital dividend” resulting from the television “analog blackout” will define the characteristics and sustainability of wireless/mobile technologies markets and, in general, of future Information and Communications Technologies (ICT) markets. It also offers an ideal opportunity to introduce some criteria attempting to increase the efficiency in the usage of the spectrum. The allocation mechanism is a key task in this process. The USA has already auctioned part of its digital dividend. Moreover, some European countries have announced their intention of awarding this scarce and core resource by means of auctions.

4. KEY TECHNICAL ISSUES

Key technical issues covered by this COST Action IS0605 are addressing the following trends: further de-centralization of the global networks (i.e. strong proliferation of overlay networks that mainly deploy peer-to-peer technology), future wireless networks issues (the most future-proof technologies that will provide broadband ubiquitous services), further development of home networking to enable gigabit access in a personalized way, all this by cross-sectional view on policy based management and security metrics to finally enable tangible and quantitative risk management in these environments. Finally, although this area also addresses some economical and societal issues, technology is in its focus.

4.1 Economic traffic management mechanisms (contributed by B. Stiller, Switzerland)

Due to the fact that the Internet traffic is doubling approximately every 18 month, and up to 80% of this traffic is stemming from Peer-to-Peer applications, this traffic - created by overlay network-based applications – needs to be managed effectively by telecommunication operators (telco) and Internet Service Providers (ISP) and efficiently by the respective network and traffic management mechanisms.

Since the number of overlay-based applications grows and the diversity of such applications increases, a paradigm shift from centralized offered services to services offered by end-nodes is happening today. Since the use of mechanisms based on incentives for controlling and managing network traffic of overlay applications in the Internet is still in its early stages, feasible and effective mechanisms are required to show that such mechanisms have the paramount property of scalability with respect to the number of participating players (*i.e.*, providers, consumers, and peers).

The approaches being worked at are part of “Network Management Architectures and Economics”, since they combine the technological as well as economic questions of traffic transport across multi-provider domains. So-called Economic Traffic Management (ETM) mechanisms are embedded into a newly designed architecture, which will be applicable to the Internet in its current and future state without changing key characteristics of it. Initial results show that ETM mechanisms can be defined, *e.g.*, based on locality information, which is available from the Border Gateway Protocol (BGP) and which can be utilized to update and optimize the peer selection process for resources searched for. Further steps are investigated in that direction in the context of COST605 and the FP7 (Framework Program 7) EU-funded STREP SmoothIT (No. 216259). Thus, the objective “Role model investigation” is addressed

by re-visiting the end-users, telecommunication operators/ISPs, and overlay network provider's tasks. Furthermore, “advanced network and service management functionality” is derived, which is based on incentives, which those three roles determined will supply and support. Finally, “effective technology support” is provided by respective accounting technology, which in turn serves as the input to pricing and tariffing.

4.2 Metrics for security and IT/IS risk management (contributed by D. Trcek, Slovenia)

Security has been one of top priorities in the field of IT/IS (Information Technology/Information Systems) for more than a decade with its core being risk management. Despite various established risk management methodologies that have been around for decades, the IT/IS area has a specific aspect, not to mention the lack of appropriate metrics. Therefore one key issue is to provide metrics for IS security management (and consequently privacy). Another is to provision appropriate solutions to enable decision makers to deal with IT risk management not only in a reactive, but also in an active and pro-active manner. Having such metrics and methodologies is essential for business decisions ranging from economical justifications of new security and privacy implementations to customized services, appropriate costs calculations, and also new business models.

4.3 WiMAX, LTE, and future wireless networks: beyond the hype (contributed by L.-F. Pau, Denmark, M. Pickavet, S. Verbrugge, J. Van Ooteghem, Belgium)

Users and not just suppliers anymore, want to move beyond the hype of unregulated WiMAX (Worldwide Interoperability for Microwave Access) platforms, and pretended delays with LTE (Long-term Evolution), to understand what they really can deploy and which experience or new services this will bring. This includes the dependability, robustness, and actual cost of these technologies and the sunset of fixed narrowband access. By an ironic reversal of history, very central to the work and scenarios is how and how well quality voice services can be provisioned over such data communications centric wireless networks.

Multiple issues arise when looking at future wireless networks from technical as well as economic perspective. What are best practices for offering wireless broadband services to the potential customers? Which technical solutions are most future-proof (utilizing available networks, upgrading technology, installing new wireless networks or a combination)? Which actors will be driving investments in wireless broadband networks? What new business models and value networks have potential to enhance competition (*e.g.*, municipality initiatives, high level MVNOs (Mobile Virtual Network Operator) and multi-homing networks)? Which wireless broadband network models will lead to viable business cases for every actor?

4.4 The future of Gigabit Home Networking (contributed by M. Fokas, Th. Rokkas, D. Katsianis, D. Varoutas and Th. Sphicopoulos, Greece)

The home networking market is rapidly evolving today offering new business opportunities to a variety of players. From a techno-economic point of view the following trends seem to shape the future of home networks:

Broadband proliferation: We have reached the stage where a majority of households understand that having a broadband connection is as much an essential part of their lives as plumbing and electricity. Not all will utilize its full capability, but broadband ubiquity opens up possibilities for business, government, schools, and health care providers to offer services

to consumers. Individuals are offered greater choice and businesses are able to reach their customers based on new distribution possibilities.

Complexity: Multiple devices wish to share the broadband connection. Games consoles, PCs, telephones, and IPTV (Internet Protocol-based TV) sets all want a broadband connection, so the consumer needs to be able to share that connection between all devices, simultaneously. They need a way to simply turn on the device and obtain access to network based services. Data can cross a wide variety of physical media, from radio to power line, from twisted pair to fiber. And the customer wants it just to work, without having to understand all the complexities in how to get it to work.

Mobility: Customers want to access broadband services from any appropriate appliance in the home, which means that devices must be integrated with the home environment and services need to be adapted to the capabilities of the home network. New services can be created by combining the different capabilities of devices in the home e.g. using the different displays and speakers to enable video rich communication. The customer also wants the capability to exchange multimedia content simply and easily between devices. Service providers are well situated to deliver and capitalize on these applications.

Need for Quality-of-Service (QoS): As operators look to offer these broad entertainment and other services to their subscribers, the network in the home becomes increasingly important. The quality and quantity of bandwidth within the home will be critical to delivering a compelling service that will attract and retain subscribers. IPTV and related video services demand high bandwidth and exceptional performance including low latency to a level that has not previously been a concern for home networks. One realization for operators that hope to profit by enabling these applications has been that the bandwidth requirements for running these applications across the network inside the home can quite easily exceed those that bring the service to the house.

Competition between technologies: Operators have a variety of networking technologies to choose from to make the distribution of entertainment services within the home possible. It is likely that no one technology will provide a “one size fits all” solution and it is therefore imperative for providers to fully understand all of the options available to them. Striking a balance between performance, future growth potential, ease of installation and other factors will be the key to fruitful deployments.

Personalization: There is a need to have personalized interaction with services and content across terminals and places. Users want the choice of services from multiple service providers combining and blending them at will to create new value. Parents want to limit their children’s access to some services. To accomplish this, new enablers need to be created in the broadband network, extending from single-sign-on to presence based services, to user profiling. The personal integrity of the user also needs to be maintained.

4.5 Policy-based management in networks (contributed by A. M. Hadjiantonis, Cyprus)

In our everyday activities we are surrounded by myriads of networked devices and gadgets. Beyond the ubiquitous mobile phone, wireless capabilities are becoming increasingly embedded in various form factors. SmartPhones and Mobile Internet Devices (MID) are bridging the gap between a mobile phone and a personal computer or laptop. The common denominator that drives the evolution and convergence of such devices is our increasing need for continuous information access. Access to search engines, real-time email communication, even mobile social networking, are some of the new necessities we experience. This explosive proliferation of wireless devices and networks creates new opportunities for economic network management and drives the need for improved management frameworks.

From a technical perspective, an interesting direction towards efficient and economic network management is the adoption of the Policy-based Management (PBM) paradigm. In technical terms, policies may be considered as a set of rules to administer, manage, and control access to network resources. From another perspective, a policy is viewed as a definite goal, course or method of action to guide and determine present and future decisions. The PBM paradigm can provide the means to integrate self-management capabilities and policies can capture the high-level management objectives to be autonomously enforced to devices. In a rapidly evolving multi-player environment, policies can express the interests of different players and facilitate their cooperation. PBM can be a future-proof solution and can provide the flexibility to adapt to change. At the same time, the users' requirements for control and privacy can be encapsulated in policies, and with minimum intervention their devices can operate autonomously.

5. KEY MEDIA AND CONTENT ISSUES

This area addresses such important issues like personalization in general, including the technical means of access, not only the content itself. Further, in terms of content, mobility certainly puts new challenges in further content delivery (most challenging currently being mobile TV), not to mention bridging all kinds of "digital divide" issues. The latter require addressing of such important issues like how to ensure knowledge for all, what contents should be paid and in which way, not to mention copyright legislation and its appropriateness for the new era.

5.1 Personalization (contributed by L.-F. Pau, Denmark)

Personalization of "you" generated content, the expected provisioning of custom demands (by individuals as well as companies), and the competition between traditional media industry and community portals, both change upside down the ambitions of some operators, as mobile TV, mobile advertising, business processes, and community content will drive the value chain faster than transport services. Will be preferred outlets be the PC, TV, the set-top box, the "Live box" broadband access, the wireless terminal or yet new access modalities? On top of this, clients will mandate personalized tariffs just covering their demands of service and content bundles.

5.2 Hitting usage limits (contributed by L.-F. Pau, Denmark)

While so-called converged services are being promoted, mixing and allowing to share voice, data and video, they have created an economy of abundance of content, while user time gets on the contrary saturated by the multiplicity of offers. Internet usage in some European countries often exceeds 25 hours/month (30 hours/month for 15-24 year segment). Reverse segmentation is emerging where users choose the content they want. Convergence has created a reversal of scarcity, where the value of content is replaced by the value of access and search services, with a premium to heavy investors. Portal companies typically invest more than 15% of their sales and get profitability margins of 25%, while content creators and distributors only invest about 3% of sales and get profitability of about 10%. Unfortunately for Europe, the communications operators have usually not seen this trend, so Europe has no major champions worldwide in multimedia content and marketing. It is maybe time to re-mobilize again around this goal like for GSM in the 1980's.

5.3 Mobile content (contributed by J. L. Gomez Barroso, Spain)

The price of terminals, their features, the price of mobile data transmission and the data rates available per user are key factors for the development of mobile content. However, making the mobile content market behavior exclusively dependant on progress in these elements is too simplistic a vision. It would be equivalent to considering that pure supply side enhancements are enough to succeed in mobile content. In order to focus on those other factors for success, it is important to turn to the basis of the mobile content ecosystem. The heterogeneity and fragmentation of mobile content derive from four main sources: the diversity of content suitable for mobile usage, the production-delivery-consumption structure of content businesses, players' different origins and cultures, and the diversity of circumstances for this usage. A not-so-distant future might be imagined where the mobile platform would be able to unify different players' approaches to mobile content and also simplify today's extremely complex topology of the mobile content domain. However, even in this case, the first and fourth sources of heterogeneity would remain unchanged: the diversity of content types and the diversity of personal involvements with mobile content. In particular, the mobile content personal realm (personalized content local and context-aware content, user-created and user-generated content) is largely unexplored and requires further research.

5.4 Mobile TV and DVH-H (contributed by L.-F. Pau, Denmark)

Who will pay to build all those DVB-H (Digital Video Broadcast Handhelds) networks across Europe? At an estimated cost of 500 Million € to build one such network in a mid-sized country, who is going to provide all the necessary investment and content?

5.5 Universal libraries and the access rights to knowledge (contributed by L.-F. Pau, Denmark)

Over the last years, several large universal library or encyclopedia initiatives have reached fruition with little notice given in the engineering world. However, by opening up more knowledge, will the Internet pave the way to the 18th century enlightenment, or to the apocalypse of public knowledge controlled by private interests? Copyright is probably to be redefined in this context, access to knowledge regulated, while technical means for information control protocols will have to be designed, whereby public information ownership will become anonymised whereas private information ownership should be strengthened by privacy enhancing technologies.

6. SUMMARY AND PRELIMINARY CONCLUSIONS

Although this white paper states a variety of issues that may seem diverging, this outlines an expected situation, because the COST ECON@Tel action is addressing mid-term and also long-term future issues, of which many are currently hard to predict in all levels of details. This fact does not relate only to technology, but it relates to business issues, legislation issues and behavioral issues of users as well.

Thus, such a situation should not be seen as a drawback, but as the challenge of the Action. It is reasonable to expect that (due to the very rapid development in this area) many issues will be well resolved even during the Action's duration, while others will provide a good basis for further research.