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# Regulatory Issues Addressed in ACTS

**This paper aims to increase the awareness of relevant regulatory authorities and other interested parties of the European Union's Advanced Communications Technologies and Services (ACTS) program. In particular, it points out results that could assist or otherwise influence the development of policies in the converging telecommunications, broadcasting and IT sectors. It briefly introduces ACTS, discusses the perceived background to the developing regulatory environment, and goes on to identify the major existing regulatory issues.**

We have identified the following regulatory issues:

- Open infrastructures
- Access to services and content
- Charging and accounting
- Numbering and addressing
- Consumer protection
- Social needs

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ACTS results that affect these issues are identified and described.

In this respect, considerable work has been undertaken to evaluate access networks architectures to support broadband multimedia and interactive services, including options for segmenting access networks into feeder and distribution elements to achieve the necessary economies in implementation. Co-operative management of networks and services in a multi-provider environment has also been investigated. ACTS continues to address strongly the evolution of mobile networks and standards.

ACTS has tested a large range of prospective multimedia services over a number of infrastructures, evaluating interactive options and the technologies for «return path» connectivity. An open architecture for services introduction and their management has also been addressed, and essential open standards for software and technology were explored. Significant progress has been made in developing options for billing in a broadband, multi-service environment, including understanding customer attitudes to alternative billing schemes.

A group of ACTS projects has addressed security requirements, including fraud, in the electronic marketplace and the closely related topic of the integrity of networks and services.

The ACTS program will continue until the end of 1999, and further results will emerge. Another EU Information Society Technologies Program will pursue into the next millennium, projects seen as crucial to the future development of the information society within Europe in the next millennium.

## Background to Developing Regulations

A general trend can be seen towards competition in telecommunication networks and services. In addition, telecommunications, broadcasting and IT are converging with the advent of interactive multimedia services. Different types of distribution networks (e.g. fixed and wireless switched networks and broadcast networks) offer various degrees of interactivity, so that the same, or similar services can be delivered by a variety of platforms and infrastructure types. The capabilities of both the final delivery link to the customer and the core networks themselves, as well as innovation in the service provider area, are proceeding at different rates. This could lead to the development of new delivery bottlenecks. Globalization of network infrastructures and the services provided over these networks is increasing. Under these circumstances, regulation and standards development needs to be more uniform, in effect, and the technological neutrality of regulation generally, maintained, in order to guard against the development or exploitation

of artificial bottlenecks, or other forms of control.

The Internet is introducing different paradigms to those of the traditional world of telecommunications and broadcasting. These include billing terms quality and the ability to search extensively for material and information.

The fast-growing mobile communications sector is having an impact on user's ability to contact others, and creating demand from them for convergence in the facilities and services provided by fixed and mobile connections. This has led, for example, to the Universal Mobile Telecommunications System (UMTS), the third-generation mobile successor to GSM) initiative within Europe. These developments are helping to drive forward innovative service offerings and lowering prices for consumers. Market developments are causing convergence in the value chains of the different vertical markets in the communication sector. The combined chain covers content origination, content and service packaging, services provision (including navigation/brokering), infrastructure provision (distribution network), and terminal vending. Major players with market power have the ability (on their own or via partnerships) to acquire bottleneck control of the interface between any two elements of the value chain. Critical areas are access to the distribution networks and access to the customer via the capabilities embedded in set-top boxes. Regulators are increasingly acting to promote market entry and to limit the ability of existing players to exploit unfairly a dominant position.

The increasing scope of services on offer, and the increasing numbers of suppliers in the marketplace, mean that there is a continuing need to protect consumers from fraud, deception and the infringement of their personal privacy. The social needs of particular communities and disabled or other disadvantaged individuals will also need protection in the public interest. Regulators have a role to play in ensuring that issues, such as consumer

protection and social needs, continue to be dealt with fairly in a changing and converging environment.

### Regulatory Issues

This section identifies key issues inferred from discussions with regulatory representatives and from analyses of relevant recent literature [1] with the aim of providing a blueprint for identifying ACTS results that might be of interest to the regulatory community. These issues fall into two areas already identified: those associated with competitive market development and those relating to consumer and social needs.

On this basis, major regulatory requirements for market development will continue to be the needed for the following:

- Open infrastructure – Enabling “any-to-any” communications between users connected to different or dissimilar networks, as convergence proceeds. The development of appropriate industry-wide standards is important to ensure the implementation of the regulatory requirements for the interconnection between distribution networks and for the connection of terminal equipment. These interface standards must be designed to include facilities for adequate policing to remove barriers to interconnection between competing operators and service providers. Policies on local loop unbundling and equipment colocation for wide-band services will need to be backed up by appropriate technical capabilities and standards. Unbundled interfaces will be needed at points based on markets needs to enable the further development of competition. Compatibility of terminal equipment is likely to be of increasing importance, given the growing range of competing, and differently engineered, access networks. This could limit the ability of consumers to move between networks. A wide range of issues is unique to the set-top box and its connection into the networks and the ability of different players to control elements of its operation. An understanding of the practical options for the further development and extension of a number portability concepts in a converging environment is also of interest. Limitations in the availability of radio spectrum restrict the extent to which competition is possible among the providers of mobile services.

- Access to services and content – Enabling users to access and communicate

with the service providers of their choice. End-to-end service interoperability in a converged environment will rely on the ability of applications to communicate, requiring wider interaction between the standards organizations active in the broadcasting, telecommunications and IT sectors, and the development of standards that make it easier for innovative services to be developed and deployed. Search and navigation (and brokering) is seen as an important area. Here, open competition among providers is important; to support this provision, any network function available to one network operator must be open to third parties. There are also concerns of search and navigation facilities being tied directly to the content with which the provider of the service is linked, which implies an ability to unbundle technically the required interfaces. Conditional access systems installed in consumer set-top boxes should not be allowed to inhibit competition. Mechanisms need to be available that enable different content providers to utilize a single set-top box, where practicable, both to prevent effective market foreclosure by the first provider and to improve choice in respect to the increasing range of broadcast and interactive services expected to develop. In this regard, principles of third-party access to conditional access systems embodied in the current Television Standards Directive (95/47/ EEC) may need to be extended to cover interactive services controlled by such systems, or to take account of proprietary navigation systems (e.g. Electronic Program Guides – EPG's) and software operating systems and their interfaces (e.g. proprietary Application Programming Interfaces – API's). Copyrighting information and content, together with licensing fairness, is an issue in situations where service providers wish to make use of other services on offer to provide more value-added services.

Other important issues relate to:

- Billing and pricing – Different types of infrastructure, emerging new transportation mechanisms and the more widespread use of signaling interactions in some types of calls and/or sessions suggest that a range of billing and pricing approaches will develop. Indeed, innovation in pricing structures is as important as that in technology if user acceptance is to grow. The widespread use of on-line services could influence

prices for the use of networks and/or lead to an overload that could have an impact on the direction of development of local access architectures to cope more efficiently with the expected large growth in non-voice traffic. Hence, it is important to understand that if current arrangements in the various electronic communications sectors can be sustained, and how the different approaches might evolve. It is also important to understand the interactions between prices and the quality of service.

- Numbering and addressing – The Internet is already being used for voice telephoning and activities are underway to develop the necessary inter-working between traditional telephone systems and Internet domains. Given convergence, and the ability for a increasing range of multimedia services to be delivered over different networks with different numbering and/or addressing protocols, the evolution of numbering, and the issues it will pose for national numbering administrations, are areas of concern. From a regulatory stand-point, the important questions revolve around ownership of the numbering and/or addressing function, which is an inherent bottleneck that could be used to provide unfair competitive advantage.

On the consumer and social fronts the following issues are important:

- Consumer protection – Consumers need to maintain control over the material they access or are offered, have their privacy protected and not be defrauded. This implies that mechanisms need to be available to enable users to filter content, and set criteria for its reception, so that they do not receive material inappropriate for their needs. Calling Line Identity (CLI) services are now becoming available to telephone customers, and a proposed EU directive relating to data protection within the Telecoms already provides rules for this area. Some personal privacy issues are still being debated on the ability of network operators or calling and called parties, to control what CLI information is made available to the the party answering. Similar issues must still be addressed on Internet-type services and new interactive services. Fraud perpetrated as a result of electronic commerce is also an area where the consumer needs reassurance.

– Social needs – In most countries, Universal Service Obligations (USO) have been developed in the telecommunications sector to ensure that a basic level of service is available to everybody, along with public service broadcasting obligations in the media sector. Convergence will provide an increasing range of useful multimedia and other services that could lead to political pressure being created to include within certain requirements that would help assure an appropriate degree of social equality. Additional services might only be supported if they can be packaged and provided in a cost-effective manner. Requirements for the provision of emergency telephone services over new distribution infrastructure or via new multimedia terminals have to be assessed.

### Relevant ACTS Activities

This section describes some of the ACTS developments that are relevant to the issues for the regulatory community previously described. It is not intended to present an exhaustive response to the issues, but rather a commentary on a number of areas within ACTS with some indication of their relevance to the regulatory debate. The references cited contain further detail.

### Open Infrastructures

#### Access Network Evolution

A number of ACTS tests [2] have examined strategies for the evolution of the access network to support broadband, multimedia, and interactive services. The implementations (system configurations) that have been successfully tested include all-fiber full-service access networks and a range of hybrid-fiber and copper solutions.

Two major trends can be identified:

- Consolidation of network nodes with the use of optical fibers to increase the reach of the access network to 100 km or more.
- Evolution strategies that allow «investment on demand» for advanced services.

Future access network architectures seem to split the network into two distinct segments:

- A feeder segment, which links the consolidated network nodes to flexibility points close to the customer.

– A distribution segment, which connects the flexibility points to the network termination on the customers premises.

The two segments need not use the same technology. Indeed, one project shows how a common feeder infrastructure can be used to serve both fixed and mobile distribution segments [3].

Technical studies also suggest that the economics of the two segments are rather different. [4] In the feeder segment there can be considerable sharing of resources and even a degree of resilience (features not traditionally associated with the access network). Infrastructure can therefore be cost effectively deployed to meet relatively rough projections for average demand. In the distribution segment, which is effectively the last few hundred meters from the customer premises to the flexibility point, there is little opportunity for resource sharing. Cost effective deployment therefore has to be based on demand from individual customers for advanced services.

Standards are emerging for the open interconnection of broadband access and core networks because of ACTS activity. The VB5 Interface is approaching stability and will deliver this open interconnection for fixed networks. [5] A proposed Iu Interface, specifications for which are being developed, extends this to include the option of interworking between fixed and mobile networks. [6]

However, as network architectures evolve to extend the reach of the access network from a few kilometers to upwards of a hundred kilometers, it is not clear that these interfaces will offer a sufficiently open environment. It raises the question of whether there is a need for a further open interface within the access network, for example at the flexibility point a few hundred meters from the customer.

#### Network Management

While considerable effort has always been invested in developing interfaces and signaling systems to enable the set-up and release of calls across network operator boundaries, it is only relatively recently that emphasis has been placed on the co-operative management of networks and services in a multi-domain and multi-provider environment.

A cluster of ACTS projects addressing communications management [7] is working closely with the Network Manage-

ment Forum and related initiatives in EU-RESOM. Particular activity within these projects is the definition and validation of the X interfaces for the exchange of management information across network or domain boundaries (e.g. for fault handling, accounting, changes to routing algorithms, and the adding and deleting of subscribers). Thus, interface standards are developing that should assist regulators if there is a need to act on the question of access to network management features in the future.

#### Future Mobile Communications Systems

A major achievement of the earlier RACE programs was the development of the GSM standard for digital cellular mobile systems. RACE II saw the beginning of work on the next generation of mobile telecommunications – the Universal Mobile Telecommunications System (UMTS) – and this work has progressed rapidly in ACTS.

The main distinction of UMTS in relationship to the second generation systems is the hierarchical cell structure designed for graduated support of a wide range of multimedia broadband services within the various cell segments by using advanced transmission and protocol technologies.

ACTS projects played an active role in developing and validating the standards for UMTS, and continue to do so. [8] Their results, in the form of concepts and simulations, have been fed into the relevant working groups within ETSI and the ITU. Notable contributions have been in the areas of network architecture, hybrid multiple access schemes, wireless Local Area Networks and mobile broadband services.

The ACTS mobile projects created an ad-hoc group, the UMTS Task Force, to identify a European strategy for the introduction of UMTS. Its recommendations were largely endorsed by the European mobile industry and the result was the UMTS Forum, which was charged with providing a high level strategic direction for the development of European personal and mobile communications. The work of the Task Force resulted in contributions to the regulatory and policy debate leading up to the 1998 Council Conclusions and proposed decision.

#### Access to Services and to Content

ACTS tests have examined and validated the delivery of multimedia services (inclu-

ding interactive services) over a number of different infrastructures, both fixed and mobile.[9]. It remains to be seen whether this promotes vigorous competition or creates problems for interworking and interoperability. In general, however, there is strong support within the ACTS development community for open delivery standards at all service-related levels, such as those promulgated by DVB (Digital Video Broadcasting), DAVIC (Digital Audio-Visual Council) and Internet standards. A guideline is now available from the ACTS community describing unfolding EU legislation and some of the regulatory issues that designers and developers need to take into account.[10] Return path channels for interactive services (terrestrial broadcast and cable delivery) have been evaluated and results submitted for standards adoption; [11] return path capabilities over satellite distribution links are also being evaluated for interactive multimedia applications, providing a potential alternative to the use of terrestrial return paths [12]. A Guideline [13] has been developed to assist service providers and network operators to integrate future-oriented specifications into their requirements for set-top boxes. This takes into account any possible evolution in which the Set-Top Box (STB) gives diversified access to various types of network and services. In order to ensure that intellectual property rights for content are respected where appropriate, solutions have been developed and applied for copyright and access protection for video signals and multimedia content [14]. ACTS projects have also addressed the development and implementation of an open services architecture. This covers all aspects of the management of multimedia and multi-party communication services. Important open standards for software and technologies have been explored. There has also been an assessment of the impact of Intelligent Agent technology in close conjunction with the TINA-C (Telecommunications Information Networking Architecture Consortium – a world-wide group comprising public network operators, major Telecoms and computer vendors). ACTS has also been developing "middleware" concepts – the software that sits between the network infrastructure and services and/or applications to isolate the two regimes more fully than at present. If developed appropriately, middleware will assist "open-

ness" at the infrastructure and/or services interface.

Key ACTS contributions include:

- Re-usable open components (objects) which can be used to construct communication services [15].
- Open distributed processing software required to support the execution of the service architecture components, in particular a TINA-compliant Distributed Processing Environment based on Common Object Request Broker Architecture (CORBA) [16] and components for open distributed transaction processing.[17]
- Processes, methods, tools and development support environments required to develop and deploy communication software [18].

All this work should assist the more rapid introduction of new services, both by network operators and third-party service providers.

### ***Billing and Pricing***

Traditional communications networks offer little or no opportunity for negotiating Quality of Service. The network is dimensioned for a particular Quality of Service and, in principle, if the resources are not available, your call is not connected. In this type of environment, a cost-based approach to charging and pricing makes sense.

ATM networks, on the other hand, offer a range of Quality of Service options running from guaranteed delivery at the bit rate required for the service through to "best effort" delivery. The "cost" is the same for all the options but pricing could be based on the relative market demand for the various options. There are parallels in other industries. "Economy" class seats on airlines all have the same cost factor for the provider but the price charged to the customer depends on a complex mixture of service quality and availability. This also presents interesting opportunities for arbitrage.

ACTS projects [19] have explored the charging strategies, which are appropriate for the various types of ATM services. Some strong messages emerge. Distance is less important than bit rate and Quality of Service. The message from these projects is that should be based on volume and quality, together with an access charge. There can be an element of arbitrage based on resource availability but not to the extent that the end-user's bill should be affected in unpredictable ways.

A possible model is the UK electricity industry. Power stations compete, second-by-second, to sell wholesale capacity to distributors who, in turn, compete for individual customers on the basis of monthly, quarterly or annual price packages.

Multi-service networks, such as ATM networks, clearly require new strategies for charging and billing. Conventional cost-based approaches offer no incentive to the customer to select the quality of service needed by a particular application. This will result in no demand for a "best effort" service (i.e. a "get what quality is available"). which would allow more efficient loading of the infrastructure.

Interactive multimedia services, which involve network providers, service providers and content providers, present even more complex charging and billing problems. One of the players in the value chain could buy into, package the services from the others, and present a single bill to the end user. Again, various strategies for options have been considered by the ACTS projects.

Customer attitudes to charging and billing strategies have been investigated. Not surprisingly, major concerns are predictability and auditing. In an ATM environment or in a complex value chain, this is much harder to achieve than in telephone and low speed data environments. The problem is that charging and billing strategies, which make it possible to achieve high network loading and "bargain basement" services, can also result in unwelcome surprises on the bills. They also create opportunities for arbitrage or predatory pricing.

The dilemma for operators is to gauge what combination of billing attributes will offer them sufficient incentive to invest in advanced services yet still offer customers those services at a sufficiently attractive price to stimulate rapid growth in the market.

Internet-related research and development activity is now an integral part of ACTS. However, only some early thought [20] has been given to the evolution of billing and pricing in this domain, or on how convergence of services and networks will influence such evolution.

### ***Numbering/Addressing***

There is virtually no activity within the ACTS program on the evolution of numbering and addressing schemes. A number of service trials make general recom-

mendations that telephone-type numbering plans should be used and that the complexities of IP addressing should be hidden from the user.

### **Consumer Protection**

A group of ACTS projects is addressing topics related to the quality, security and safety of communication services and systems. The projects address security requirements arising from an electronic market place, [21] advanced security features including fraud detection, and mechanisms for next generation mobile networks [22]. Work is underway to harmonize the security and safety features by producing common criteria for evaluating secure and safety critical networks [23]. In addition, the closely related topic of integrity of networks and services is being addressed [24]. A possible area of common interest among some of these projects is the use of Trusted Third Party (TTP) services.

A number of electronic commerce tests explored how to implement appropriate levels of consumer protection (proof of identity, payment security, etc). A major contribution to the definition of an open architecture for secure electronic commerce over insecure networks has been made [25]. This supports multiparty security for the full spectrum of electronic commerce participants and additionally supports in an integrated method for key public security services such as: digital signatures, certification and credentials, contract signing, electronic payment and fair exchange.

The ACTS electronic commerce projects have made a significant input to the EU Memorandum of Understanding on electronic commerce for small businesses, and a new project [26] aims to bring together the various contributions and validate them through a trial of an integrated platform for electronic commerce. Social and economic aspects, in relation to e-commerce, have also been investigated, and issues identified [27]. It raises the issue of whether the strong economic performance of established traders in conventional marketplaces is likely to be replicated in cyberspace markets.

### **Social Needs**

A number of ACTS Projects [28] address the provision of advanced services to remote regions. They clearly show the potential economic benefit of such services to end-users. They do not, however, offer

technical solutions to the problem of providing services economically to thinly populated or remote areas.

Other projects [29] address the use of advanced services by the disabled. These show that suitably designed services can play a major role in empowering disabled people and allowing them to engage effectively in social and economic activity. In particular, recommendations for adaptation of GSM terminal equipment to assist different classes of disabled user have been developed [30]. In many cases, "suitable design" actually produces a product or service that is more easily usable for everyone.

In a wider context of "social needs" ACTS is also addressing so-called sustainable development (supporting the ability of one generation to meet their needs without compromising the next generation), and the ways that information and communications technology can make a significant contribution to achieving an environmentally, economically and socially sustainable society [31].

### **For the Future**

The ACTS program will continue to run until the end of 1999, and many projects have yet to deliver their results. Hence, the electronic version of this briefing paper [32] will be updated from time-to-time. The EU is now considering its 5th Framework program, which is to include an Information Society Technologies (IST) program that will reflect the convergence of information processing, communications and the media, and will push forward activities that are being identified as crucial to the future development of the information society within Europe. Opportunities exist for future regulatory requirements to be addressed, given appropriate inputs from the regulatory community via their national representatives or appropriate EU regulatory committees.

### **More Information**

More detailed information about ACTS outputs generally is available from ACTS-LINE (<http://www.actline.org>) website.

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**Dr. David Newman** has a doctoral degree from Reading University, UK. Between 1963 and 1992 he was employed at BT and held various positions in the company. He was Division Manager for optical communications research, and then responsible for the division of Switched networks. As a general manager of Networks systems department (1989–92), he was responsible for visionary services taking into technology, regulation and market needs. In 1993, he was responsible for network information services for setting up the directorate level initiatives. In 1995, he became deputy technical director, Office of Telecommunications (OFTEL, UKs regulatory body) and was responsible for formulating the regulatory policies in a converging telecoms/IT environment. Since 1998, he is working as a senior consultant in Telscom. He is a well known personality in the telecom world. His expertise in regulation policies and telecom deployment strategies will be of high value in global vision development and business case development for information society.

**Dr. Sathya Rao** has degrees in electrical communication engineering from Bangalore University and the Indian Institute of Science. He moved to Switzerland in 1980, where he gained his doctoral degree from Neuchâtel University. In 1986, he joined Ascom, where he led much of the work on ISDN systems and broadband communications. He was one of the core members of the team responsible for defining the European research framework on advanced communications, ie RACE and ACTS. In 1995, he founded Telscom, providing consultancy services and support to advanced communication research work. Telscom has grown ever since into a company which is involved in ATM system development and internet and ATM solutions for business needs. Sathya has published 3 books on broadband networking issues as an editor and is an editor-in-chief of the journal "Interoperable Communication Networks (ICON)". He has many patents and publications to his credit. Sathya Rao and his company have an established record in organising international and European conferences. Under the patronage of the European Commission, he has organised many international workshops, and distributed seminars using the ATM networks and applications across European centres.

## Zusammenfassung

### In ACTS angesprochene regulatorische Fragen

Ziel dieses Vortrags ist die Stärkung des Bewusstseins entsprechender Aufsichtsbehörden und anderer interessierten Parteien bezüglich des Programms ACTS (Advanced Communications Technologies and Services) der Europäischen Union und insbesondere bezüglich der Ergebnisse, die die Entwicklung politischer Richtlinien auf den sich einander annähernden Telekommunikations-, Rundfunk- und IT-Sektoren unterstützen oder anders beeinflussen könnten. Er gibt eine kurze Einführung in ACTS, erörtert den wahrgenommenen Hintergrund des sich entwickelnden regulatorischen Umfelds und identifiziert auch die wichtigsten bestehenden regulatorischen Fragen.