ETSI 45th General Assembly meeting
Nice, 5-6 April 2005

Source: **Dr. Rudi Bekkers (Dialogic NL) on behalf of the Dutch members of ETSI**

Title: **On the increasing importance of technical interoperability and ETSI's role in it**

Agenda item: **15**

Document for:

Decision	
Discussion	**X**
Information	

Late submission	

1 Decision/action requested

The General Assembly is invited to discuss the issues and recommendations contained in this document

Introduction

Briefly stated, interoperability is the linking of systems, networks or services so that they can work together successfully. The concept is by no means new: in the past it has been implemented in all kinds of ways. One thinks of linking intercontinental telephony networks, mobile and fixed networks and, more recently, cable telephony services and the conventional telephony network. In the past, questions concerning interoperability arose not only in relation to telephony: for example, the considerable technical efforts put into the ability to show cinematographic material on television are an example of interoperability *avant la lettre*.

In future, however, it seems that interoperability will gain considerably in importance. Given the increasing diversity of systems and applications, interoperability makes possible the development of a mass market and avoids the undesirable side effects of fragmentation. The new European framework directive is already a response to the growing importance of interoperability. This discussion document details why the need for interoperability is increasing but also why achieving interoperability is becoming more complex. It also outlines the role which the European Union, national governments and standardization bodies can play in promoting interoperability.

What is interoperability?

The concept of interoperability has different meanings for those concerned. It is often used loosely. Even if definitions are given, they often diverge greatly. Although the importance of interoperability is also gaining in importance in the regulations, definitions of the term are entirely lacking in a number of important documents, such as – strangely enough – the

European framework directive. In other policy documents the concept is defined implicitly at best.

It is therefore a good idea first to consider briefly a number of different explicit and implicit definitions:

- A proper definition of interoperability is lacking in the European Framework Directive. One can deduce from the text that interoperability relates to 'the portability of interactive content between forms of delivery, and the complete functionality of this content on advanced digital user equipment.'[1] This designation seems to have been prompted mainly by the questions relating to interactive television, which is expressly covered in the final version of the Framework Directive.
- A clear definition of the concept of interoperability is also lacking in virtually all the other relevant European directives and documents. The well-known European Bangemann report (1994) does in fact state that 'collaboration between services and applications which use [telecommunications] networks' falls within the definition.[2] The report states clearly that interoperability is something different from the interconnection of networks and that these two concepts are complementary.
- The Dutch Telecommunications Act as revised in 2005 (implementing the European Framework Directive in The Netherlands), a section is dedicated to the interoperability of services. . In it, interoperability is interpreted as a collective term for all measures that must be taken to bring about end-to-end connections.[3] According to this – wide – interpretation, interconnection also comes under interoperability. This means that interoperability also takes in the behaviour of market parties, such as whether or not a market party gives access to its network. This definition was drawn up mainly from the point of view of the role of the national authority in regulating the actions of market parties.

- EICTA describes interoperability as '*the ability or two or more networks, systems, devices, applications or components to exchange information between them and to use the information so exchanged*.'[4] Its White Paper shows that the term is mainly directed towards (interactive) content, and less towards networks and network links. Interoperability is here mainly an application-level matter.[5]
- The Open Mobile Alliance (OMA) states that by interoperability it means collaboration '*across devices, geographies, service providers, operators, and networks, while allowing businesses to compete through innovation and differentiation'.*
- The following definition, among others, can be found within ETSI: '*The ability to provide successful communication between end-users across a mixed environment or different domains (including instances when an end-user is roaming between domains), networks, facilities, equipment, etc. from different manufacturers and (or) providers with no requirement for user or operator configuration. "Communication" in this context means communication between end-users or between an end-user and a service provider' (ETSI OCG-ECN&S).* This definition is strongly network-centric.

---

1 Directive 2002/21/EC of the European Parliament and of the Council of 7 March 2002 on a common regulatory framework for electronic communications networks and services ('the Framework Directive').

2 See M. Bolhuis (2003). 'De introductie van the begrip interoperability in the herziene Telecommunicatiewet: Enkele voorbeelden van interoperability tussen ICT-services and the toezicht daarop'. ['*The introduction of the concept of interoperability into the revised Telecommunications Act: Some examples of interoperability between ICT services and their supervision'*] *Computerrecht* [Computer Law] 2003/5, pp. 295-301.

3 See also Knol et al. (2005). *Telecommunicatierecht: tekst & commentaar* [Telecommunications Law: text and comments] (second impression). Deventer: Kluwer.

4 EICTA Interoperability White Paper.

5 EICTA (2004). *Interoperability White Paper*. Brussels.

- Finally, the term interoperability is sometimes used in the context of testing successful cooperation between implementations from different suppliers. This is an activity which follows on naturally from so-called conformity tests.[6] At ETSI, interoperability tests of this kind are carried out under the name Plugtest.

Given the diverse meanings of the concept of interoperability, it would seem sensible to define what is meant by the concept in this document. We distinguish here two different forms: ***inter-standard interoperability, and conformity and interoperability tests***.

We define **inter-standard interoperability** as *'the ability to link two or more systems, networks or services which differ essentially in technical respects, so that they can successfully provide an electronic communications service or can exchange and process information'.* This definition refers in particular to the linking of systems which are based on *different* standards or technical specifications.

We define **conformity and interoperability tests** as *'the activities by which implementations are tested against the standard and by which successful cooperation between different implementations of the same standard is tested in practice'*.

In these definitions we are focusing on the *technical* ability to link networks and services, not on access rules and market behaviour.[7] In that sense our use of the term interoperability differs from that of some regulators. We therefore also describe the types of interoperability in the above two definitions as **technical interoperability**.

Why is technical interoperability gaining in importance?

A number of developments are contributing to the increase in the importance of and demand for technical interoperability:

A. Increasing diversity of (transmission) systems;
B. Increasing pluriformity of services;
C. More and more different user devices;
D. Networks are increasingly being built from building blocks;
E. Convergence, bundling of services and triple play, and
F. The structural unpredictability of markets.

A. Increasing diversity of (transmission) systems. Increasingly, there are families of systems. There is now broad recognition that worldwide 'families' of technologies have come into being in the context of 3rd-generation mobile telecommunications (IMT-2000) and of digital television services. Increasing diversity is leading to greater demand for interconnectivity. Technical interoperability is a necessary condition for this.

Competing technologies are sometimes similar (different 3G systems, for example), but then again sometimes they are not (if, for example, they use different media, such as ADSL, cable Internet and FttH). In relation to telecommunications we also, of course, have fixed, wireless, mobile and satellite-based systems. In future many more categories will be added, such as networks for very short distances (Personal Area Networks). In the area of call distribution too more and more technologies are emerging. In the past cable and satellite were added to traditional dissemination via earth-based transmitters; now new technologies are being added such as DVB, ADSL(2) and FttH networks.

It is expected that in future proprietary standards, industry standards and standards developed by forums and consortia will be increasingly common. Ex-post standards could also become more and more important in relation to formal standardization bodies, partly as a result of increasingly small 'windows of opportunity'. These developments, and the diversity

[6] Conformity tests: testing devices by reference to the standard for which they have been designed.
[7] The availability of technical interoperability is, though, an important *enabler* for achieving interconnection.

associated with them, are leading to a need for greater effort in the area of interoperability, including at an early stage of development ('ex-ante interoperability').

The proliferation of more and more technologies is taking place on all functional layers, These layers can be classified in all kinds of ways. As an example, we distinguish here between an application layer, a services layer, a session control layer and a transport layer (which comprises both the core network and the access network). Technologies depicted next to each other (in Figure 1) are substitutes for each other: they compete in the market. Technologies positioned vertically and diagonally to each other are mutually complementary.[8]

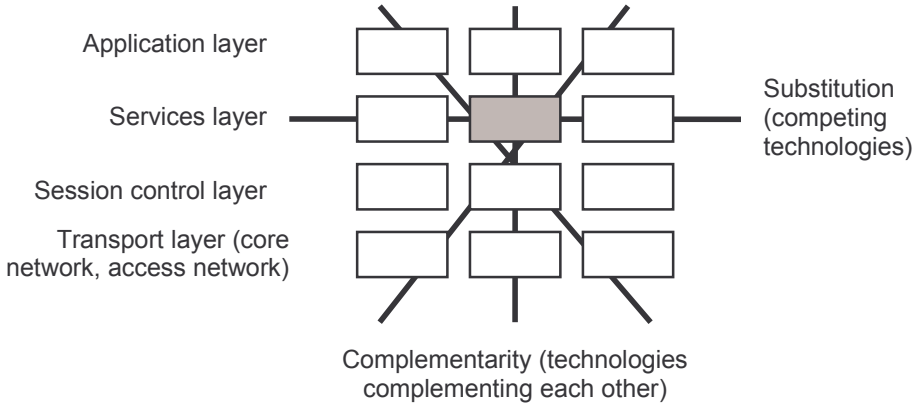

Figure 1: Substitution and complementarity.

As an extension of this, market players are also increasingly using different revisions or versions of a standard. For example, the procedure relating to Internet standards consists of four steps. This also creates four specifications[9], which might be mutually incompatible. An illustration of this is the SIP protocol: while Microsoft has implemented the Internet draft of this technology in its operating systems, other market parties prefer to use the eventual standard. These two versions are not mutually compatible. It also happens with standards from other bodies that there are several versions or revisions which are not interchangeable.

B. Increasing pluriformity of services. In a relatively short space of time the long-standing existing services such as speech communication and traditional television distribution have been supplemented with all kinds of new services and applications, such as:

- E-mail (in all kinds of forms and with all manner of protocols[10]);
- Short message services (SMS);
- Chatting and messaging;
- Voice over IP;
- Interactive (television) content;
- Discussions via Usenet discussion groups;
- Dissemination of news and other current information via RSS feeds;[11]
- Streaming media, whether or not combined with digital rights management (DRM) systems;
- Peer-to-peer (p2p) applications such as Skype.

---

8 Incidentally, it is not always possible to draw a hard line between what is substitution and what is not. Wireless and wired transmission systems are not automatically substitutes, though both can be located on the physical layer. With WLAN technologies versus 3G systems we enter a rather greyer area.

9 After the so-called Internet draft three formal maturity levels follow: the proposed standard, the draft standard and the Internet standard (see RFC 2026 - The Internet Standards Process).

10 For example, SMTP/POP3, MAPI, the Microsoft Exchange protocol, but also web-based e-mail programs.

11 Although the RSS services have now become common knowledge, there is still no clarity as regards the meaning of the abbreviation: 'RDF Site Summary', 'Rich Site Summary' or 'Really Simple Syndication'.

This list is only a snapshot. We are also seeing the advent of all kinds of new application areas, such as domotica (home automation), personal medical applications and multimedia home networks. We are also expecting to see a great many more developments in the areas of localization services, planning and personal information services and alert services. More services also mean more demand:

1. for those services via more and more networks and the ability to access them at more and more locations, and
2. for services to be linked meaningfully (such as PSTN services with VoIP services and with p2p Internet telephony services).

C. More and more different user devices. Not long ago a GSM telephone was simply a GSM telephone, differing at most in respect of the optional features that were supported by the device. Nowadays many telephones have advanced software platforms; in an average shop one can now find devices with Symbian OS (including the UIQ and the Series 60/80/90 variants), Windows Pocket PC / Mobile / Smartphone and Palm OS, whether or not combined with Java. But a smartphone can only be useful if it can work successfully at application level with other systems, services and applications.

Besides these 2G/3G peripherals a wide range of other equipment is available, ranging from fixed and wireless telephones (which support more and more services), computers, PDAs and games computers (often already with an ethernet connection). All kinds of other types of devices, many of which have been in existence for a long time, are also now being equipped with communications options, i.e. are being 'networked': music systems, video recorders, household appliances, but also, for example, cars. Partly for this reason, man-machine communications and machine-machine communications will become increasingly important.

D. The increasing practice of building networks from building blocks. The age of system standards such as GSM, with a standardization body designing and laying down a complete system and nearly all its functions from new, is past. Nowadays new systems make extensive use of existing modules and protocols. You can even talk about a market for building blocks. This approach imposes new demands on interoperability.

E. Convergence, bundling of services and triple play. A renewed amalgamation of services and networks is taking place in the convergence of telecommunications, broadcasting and IT. Service suppliers are increasingly seeking ways of drawing and retaining consumers in the form of bundled services. This trend can be seen among both joiners and incumbents. An example is 'triple play', the provision of telephony, Internet and television services as a bundle. This bundling demands properly integrated service provision. The catchment areas of the networks deployed in that context also do not always have exactly the same form; in certain areas the service provider therefore falls back on other networks (and different kinds of networks). This development is feeding the demand for interoperability. Providers' wishes to provide services across borders, or cable operators' or DSL providers' wishes to be able also to access customers outside their own physical catchment areas require interoperability. The same applies to more advanced services such as seamless roaming. Moreover, operators have a very direct reason to strive for convergence: satisfactory introduction can result in lower capital expenditure (CAPEX) and operating costs (OPEX).

F. The structural unpredictability of markets. Market demand and technical developments are more capricious than was long assumed. It is increasingly difficult to estimate either of them a long time ahead. This unpredictability leads to competing standards, forums and consortia and renewed interest in ex-post standardization, at the expense of ex-ante standardization based on planning for the longer term. These developments are also feeding demand for interoperability.

Can't the market itself solve the problem?

A range of connected developments is leading to increasing calls for interoperability. This is an irreversible process: whether the developments outlined are regarded as desirable or not, they are happening fast and with considerable consequences. The question is then whether interoperability is a problem. Why must we assume that the market parties will not solve interoperability problems – when they occur – of their own accord? Why is there an explicit role for governments and standardization bodies?

Below we discuss three ways in which market parties (including suppliers and operators) can themselves address the topic of interoperability:

A. Implementation of multiple protocols in end-user devices
B. Widespread implementation of the Internet Protocol, and
C. Operators or service providers solve the interoperability problem themselves.

After that we go into the extent to which these activities are or are not sufficient.

A. Implementation of multiple protocols in end-user devices

One way of dealing with the growing diversity of technical specifications is to implement several protocols and specifications in the end-user devices. Examples are the multiband mobile telephones (e.g. dual-band or tri-band) and multistandard mobile telephones (e.g. GSM + cdmaOne). This development is also happening in the computer world, generally in the form of plug-ins. For example, an Internet browser can if necessary load various plug-ins so that it can deal with different music coding formats (WMA, RealAudio, etc.).

The drawback of this solution is that it is often associated with extra costs. Technical implementation can result in extra costs, certainly if the technologies to be supported differ greatly from each other (in the case of a handset, for example, this can result in a more expensive RF front-end). The technologies used will also impose different requirements on the available computing capacity. In addition the licences needed to use intellectual property can result in considerable extra costs if several standards have to be supported at the same time. Finally, it is often not enough to integrate several standards in a peripheral device: aspects such as the number plan and the linking of the networks involved often have to be worked out. In the context of mobile networks, work of this kind has been carried out by, among other bodies, the GSM Association's Global Roaming Forum (GGRF).

In short, multiple protocols in end-user devices are an important step in dealing with increasing diversity, but significant objections remain, depending on the precise situation.

B. The widespread implementation of the Internet Protocol (IP)

General acceptance of the Internet Protocol (IP) as the preferred protocol for data exchange is an important step towards making services and networks interoperable. But, particularly for more advanced and demanding services, this step is far from being sufficient. Support for IP traffic via the connected network is insufficient for setting up a high-quality, paid video service. Speed, delays and all kinds of other technical properties also play a role. More specifically:

1. At a higher level detailed agreements are needed to coordinate services with data formats (examples in that direction are the vCard format for electronic business cards, as supported by, among others, Microsoft Outlook and many PDAs).
2. At a lower level agreements are needed on all kinds of performance parameters (QoS) and transport properties (examples are permitted delay, throughput, multicast options, virtual LAN definitions).
3. There are many questions surrounding numbering and identity of users, which can be recorded at all kinds of levels. Because of the hard linking of IP numbers to physical locations, these numbers are not always equally suitable as user identity. In addition,

addresses are often linked to services (telephone, e-mail, chat). This link creates questions regarding the linking of different types of services.

4. There is a growing need for information exchange in the areas of numbering, identification and authentication (including digital signatures), payment and metering. Security also demands additional attention.

C. Operators or service providers will solve the interoperability problem themselves

(Lack of) interoperability is certainly not a new problem. In the past, market parties have often tackled interoperability problems themselves. Cable operators, for example, made sure that their telephony systems could be connected to PSTN networks, and international operators provided their own solutions to the problems created by different telephony systems in the US and Europe (such as the A-law versus μ-law versions for PCM coding).

These examples, however, are relatively simple compared with the interoperability questions we are faced with at present. The solution costs are increasing. Many users (operators, system integrators) are not willing or able to bear such development costs themselves. Many operators have hived off their own research centres. Smaller parties in particular, who depend for interoperability on their connection to other parties' networks and services, cannot manage to produce technical solutions themselves.[12] In addition costs would be duplicated enormously if all manner of market parties reinvent the wheel by working out their own solutions. Greater complexity is also leading to greater pressure to take technologies into account early in the development process by effecting links (in other words: *ex-ante* interoperability). This is not to say, incidentally, that market parties do not feel a strong impetus to be actively involved in creating forms of interoperability. By, for example, gaining access to the right APIs or middleware, market parties can add substantial value to their telecommunications services. They regard this as an important opportunity at a time when they are in danger of becoming downgraded to mere suppliers of bandwidth: a commodity market in which conveying IP packets differs little from conveying water and electricity. It is not very attractive to operate in that kind of market.

The foregoing shows that market parties can contribute in various ways to resolving a lack of interoperability. Each way has its own limitations, however. This brings us to the following interim conclusion:

There is a need for selective effort from, among others, standardization institutions, the EU and national governments in the area of technical interoperability, which market parties cannot themselves provide. Without this effort, the telecommunications sector will be faced with major problems in the medium term, certainly as far as user acceptance is concerned.

Now is an appropriate time to ask whether full interoperability is in fact necessary. We do not think so. Technical interoperability ought only to be available where there is substantial market demand. In other words, interoperability must not be put in place automatically for all conceivable combinations. But an absence of technical interoperability must not be the reason why final services for which there is great demand do not come into being. In that case there could be a role for the developers of technologies, such as standardization bodies but also national governments, to contribute towards this in some other way.

---

12 Market parties are expected to be more successful in solving the problem of interoperability themselves in a so-called 'walled garden' environment than in an open environment: they will heavily reduce the number of technologies used. Now that bandwidth is increasingly being taken for granted, however, the 'walled garden' concept will in time have to give way to the more open structure that consumers are already familiar with from the Internet.

Motives for standardization bodies and governments to promote interoperability

In many cases, market parties will not themselves arrive at adequate solutions in the area of technical interoperability. This means that a role is reserved for various other actors who can contribute in their own ways to solving the problem, within their scope, responsibilities and limits. We will concentrate here specifically on (national) government and standardization bodies, but the European Union and other organizations can also contribute.

Motives for standardization bodies

An important motive for standardization bodies to contribute to technical interoperability solutions is to enhance the attractiveness of their activities to their members. Focused efforts in the area of interoperability enhance the utility of standards to members. In addition, the risk of deadlocks declines (the situation in which a standard gains little popularity and early adopters are faced with large changeover costs). The body also becomes more attractive to its members if specific expertise in this area is built up and exchanged.

A second motive is that of the organization's image relative to other organizations. In a certain respect the typical telecommunications market is becoming less attractive now that bandwidth is increasingly becoming a commodity. The added value is shifting more and more to higher layers in the chain.[13] Standardization bodies find it more attractive to focus on functions which add a lot of value.

A third motive – now that the time of system standards is past and systems are increasingly made up from a box of protocols – is that demand for interoperability is expected to increase. The required gateways/converters, middleware and APIs will become markets in themselves. More and more standardization bodies, forums and consortia are busy producing these building blocks. Coordination between the various building blocks is becoming more and more important. A role for a kind of standards integrator is thus coming into being. Interoperability questions are a central element in this.

A fourth motive is that interoperability is becoming increasingly pivotal in the regulatory framework. Efforts in that area result in a good link to the European and national regulators.

Finally. ways of achieving innovativeness and work on break-through technologies (including disrupting technologies) are increasing. It is simpler to devote attention to such developments if one is not repeatedly faced with the nuisance of the undesirable consequences of fragmentation as a result of the introduction of new technologies.

Motives for national governments

In our opinion an important task is reserved for national governments. This picture is also confirmed by the European regulator: the Framework Directive states that encouraging interoperability is one of the ways in which national regulators must contribute to the development of the internal (telecommunications) market.[14] We briefly cover below a number of reasons why this is a public interest.

An important motive for national governments to contribute, or have others contribute, to interoperability is linked to the so-called network effect. This is a phenomenon whereby the attractiveness of some services, such as telephony services, increases with the number of

---

13 Value is also shifting to components such as chips. See also ETSI document GA44_36, New challenges for telecommunications standardization as a result of a changing environment. Report prepared by Rudi Bekkers on behalf of the Dutch group of ETSI members (NELO), September 2004.

14 '[National regulatory bodies] encourage the setting up and development of trans-European networks and the interoperability of pan-European services and end-to-end connectivity'. Framework Directive, Section 8, subsection 3b.

consumers who take the service. Metcalfe (among other things the founder of Ethernet and of 3com) described this strikingly in the following way: the value of a network increases quadratically with the number of users.[15] Large networks are thus attractive, but value can also be created by linking (large and small) networks. If, for example, a mobile telephony network is still small, if it has interconnection with all the other fixed and mobile telephony networks the user can nevertheless reach all the other telephone users and the value of the network is high. Economists call a link of this kind a gateway or, if modifications are needed, an adapter. It goes without saying that it is in the public interest to maximize the value of telecommunications networks and services to end-users, and hence to encourage interconnection and interconnectivity. Precisely now that all kinds of new fixed and mobile networks are being created (FttH, wireless broadband, ad-hoc/mesh networking, cognitive radio systems), it is important to link these new systems to the existing networks as far as possible, in order to maximize their value to the end-users.

A second motive for governments to take action to promote (technical) interoperability is that a lack of ways to link networks can result in undesirable organization of the market. If networks are not (or cannot be) linked, this strengthens the dominant position of large, existing parties. The desired competitive market will not then come into being. The absence of technical compatibility options can be seized on by parties with substantial market power to evade access obligations. In other words, access obligations are of little effect if the technical potential for interoperability is lacking.

The third motive concerns the desire for a technology-neutral policy. Policymakers are becoming increasingly convinced that policy support for certain technologies is a risky approach, requiring that the winners be identified in advance – 'picking the winners'. In practice this turns out to be difficult, certainly for a government. In addition, the consequences of wrong choices are great (one has only to think of the European initiatives for high-definition television).

Finally, we touch on one or two other arguments:

- Interoperability can be helpful in relation to launching application areas that governments consider important, such as e-government. In this context one thinks of the European Interoperability Framework (EIF) and the IDA eLink middleware design. Areas such as e-health and e-learning are also highly important[16]
- The concept of interoperability fits well into present European regulation.
- The degree to which technical standards operate as a barrier to access to markets often plays a part in international trade agreements. A high degree of interoperability can partly eliminate this source of friction.

The need for a framework to identify further action by ETSI

There is a role for standardization bodies in promoting technical interoperability in both manifestations, i.e. ***inter-standard interoperability and conformity and interoperability tests***. ETSI, with its strong position in 3G and other areas, and with its present Plugtest activities, seems to be well positioned for such a role. One of the biggest challenges, however, is to decide what are suitable activities in that area. The purpose of this discussion document is to serve as a first step in that direction, but a great deal of work still needs to be done in this area.

---

15 More precisely: in a network with *n* users, the value of networks to one user can be expressed as *n-1*. The total value of the network to all users is therefore n^2-*n.*

16 See European Commission (2004), European interoperability framework for pan-European e-government services.

As stated, we can distinguish various forms of technical interoperability, on all kinds of dimensions. Just as with standardization, we can distinguish ex-ante and ex-post technical interoperability. In Table 1 we distinguish a number of main forms.

Ex-post interoperability, freestanding	By or on the instructions of the user (also operator). Particularly in the case of ex-ante standardization.	Ad hoc
Ex-post interoperability, integrated	By suppliers or standardization institute. In the case of both ex-ante and ex-post standardization.	Ad hoc or systematic
Ex-ante interoperability	By standardization institute.	Systematic

Table 1: Main forms of interoperability.

The first two forms in the table concern ex-post interoperability; the activities are only undertaken once designing the standards has been completed. Systems can be linked later by developing gateways (such as converters or APIs). This can be done in combination with both ex-ante and ex-post standardization.
We think that discussion of technical interoperability should certainly focus on the third form: ex-ante interoperability or anticipatory interoperability. Specific attention is devoted to bringing about interoperability with other systems, both at the same layer and at other layers, during the design of the standard. The so-called food chain model, as proposed by Alistair Urie, provides good ways of locating our two concepts of technical interoperability in the various stages of standardization activities. To do this we have slightly modified certain elements in the model. Here we designate the last stage in standardization as conformity and interoperability testing (was: 'interoperability'; Figure 2).

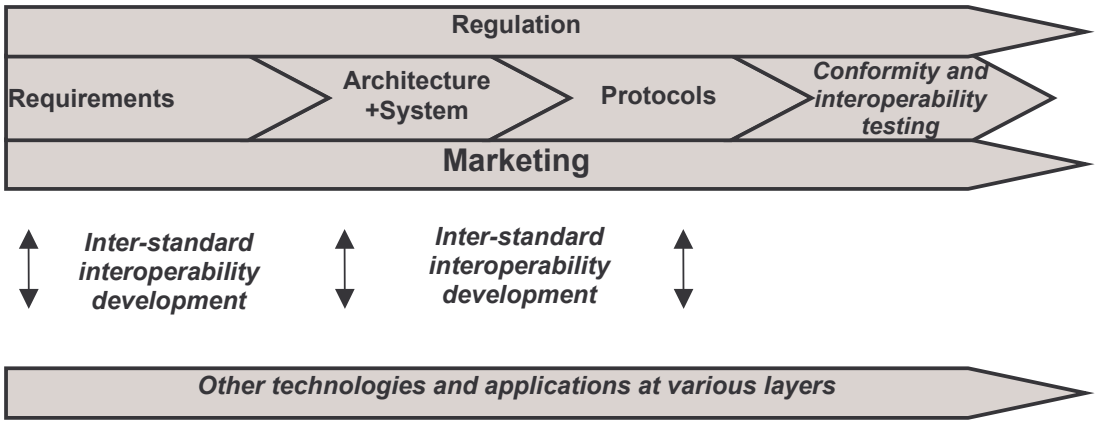

Figure 2: 'Food chain' model. Elements in italics have been added or altered.[17]

Inter-standard interoperability is an activity which plays a role at all stages of the standardization process. In the case of the *requirements* this is done by taking specific account of desired links, both those with systems at the same layer and those at layers above or below. One can think in terms of the layers referred to above in Figure 1 (the application layer, services layer, session control layer and transport layer). In doing so, one must specifically take into account applications and services at higher levels (e-government services, for example).

The difficult aspect here is that these other technologies are often developed in other organizations. Interoperability takes on a more detailed form in the *architecture and protocol stage*. It is there, if necessary, that the parallel development of additional middleware, APIs,

[17] Source: Alistair Urie (Alcatel), *The standardization eco-system: Understanding organizational complexity*.

profiles, etc. can be undertaken. Good collaborative links with other standards bodies will play a crucial role in solving the inter-standard interoperability (examples are 3GPP and IETF).

The next step is to identify the right areas where additional efforts need to be made in the area of interoperability. All kinds of questions come into play here, such as:

1. In what other present and expected systems does the interoperability question play a role?
2. Should one aim for full interoperability or is it sufficient to create a common subset?
3. Towards what level or layer can the activities best be directed?
4. Is a unilateral effort sufficient or is there a need for intensive technical coordination with the sponsor of the other technology involved?
5. What other activities and initiatives in the area of interoperability have already been undertaken (e.g. Liberty Alliance Project, the Open Mobile Alliance (OMA) and the Parlay Group)?

The question of what technical form is suitable also arises, including: (a) modifying or enlarging existing interfaces, (b) developing new interfaces, (c) developing profiles, and (d) developing middleware and (e) developing APIs.

Recommendations

I indicate above why demand for interoperability is increasing and why there are definitely roles for standardization bodies (including ETSI) and national governments in meeting this demand.

As:

1. The call for interoperability is increasing, as a result of developments both in the market and in the technology;
2. Achieving interoperability is becoming increasingly complex;
3. Interoperability is becoming an increasingly central concept in the regulatory framework;
4. Interoperability is an ideal strategic issue for standardization bodies, not just a concluding activity in a long chain of activities;
5. Individual market parties or small groups of them often do not succeed in achieving the desired interoperability;
6. A role for a standards integrator is arising, with building blocks from all kinds of standardization bodies, consortia and forums being combined into one system and with interoperability questions forming a central element;
7. ETSI seems well positioned to take on a significant role for achieving interoperability,

We ask the General Assembly of ETSI to consider the following:

a) The active development of activities in the area of inter-standard interoperability, oriented towards existing standards of both ETSI and third parties;

b) The systematic integration of interoperability activities into the development of standards (which can be described as ex-ante or anticipatory interoperability);

c) Further strengthening conformity and interoperability tests. One of the purposes of strengthening these tests is to create a solid basis for the inter-standard interoperability activities referred to above.

To achieve this we recommend the following steps:

1. Carrying out a survey among the chairmen of all the Technical Bodies to chart the most important vertical and horizontal interoperability requirements now and in the future. Attention needs to be paid, in the context of specific standards and areas of application, to aspects which include:
    a. provision, fragmented or otherwise, at all layers (competing technologies, applications at higher levels and technologies at underlying levels),
    b. the most suitable form (such as modifying existing interfaces, developing new interface, profiles, middleware or APIs), and
    c. existing activities and initiatives in the area of interoperability;

2. Holding exploratory discussions with a number of selected stakeholders (suppliers, operators, services developers, governments) and, based on those discussions, identifying the most important interoperability requirements now and in the future. The same topics must be covered here too;

3. Investigating the most suitable organizational structure for the development of interstandard interoperability, and identifying the skills required. A combined top-down and bottom-up procedure should be devised in the form of a dialogue with all those concerned at ETSI so as to give form to the interoperability activities. A framework developed for that purpose could be a useful tool;

4. A detailed study of funding possibilities for interoperability activities. Activities in the area of inter-standard interoperability are a public interest: enhancing access to and the usefulness of applications and avoiding the undesirable ancillary effects of fragmentation. Obviously, these activities should therefore be financed from general funds. In addition, they have an important role in achieving the objectives of the European Union, such as the agreements made in Lisbon and the follow-up to these. One could therefore also negotiate with the EU specifically on this aspect in order to discuss its willingness to contribute. As far as the conformity and interoperability tests are concerned, however, the participating companies have a very identifiable direct interest. This means that one can expect these companies to have a certain willingness to contribute financially (perhaps more than is the case at present).