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EICTA interoperability white paper

EICTA

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Content

GLOSSARY

API . . . . Application Programming Interface

CE . . . . . Consumer Electronics

DRM . . . Digital Rights Management

ICT . . . . Information and Communication Technologies

IP . . . . . Internet Protocol

IPR . . . . . Intellectual Property Rights

IT . . . . . Information Technology

OSS . . . . Open Source Software

RAND . . Reasonable and Non-Discriminatory terms

SOAP . . Simple Object Access Protocol

XML . . . Extensible Markup Language (XML)

ebXML . . Electronic Business XML

EXECUTIVE SUMMARY

Interoperability is key to increasing user confidence and value: With interoperable products and services, the user does not need to choose a specific technology or replace equipment as often. For a user, interoperability exists when services and devices can be assumed to work together in the expected way and are able to "talk" – communicating by exchanging information and data.

Interoperablity = satisfied user

The digital format of information and connectivity of user devices to multiple sources of content result in
- The promise of richer services through convergence; but also in
- An increase in technical complexity and variety of technologies, contributing to
- A greater risk of fragmentation delaying or blocking mass market adoption

Interoperability needs more attention than ever

Therefore, EICTA considers that building, maintaining and support of interoperability by all market participants is more important than ever.

Interoperability is defined as: The ability of two or more networks, systems, devices, applications or components to exchange information between them and to use the information so exchanged.

EICTA's main messages in relation to interoperability are as follows:
- Industry has wide experience in the delivery of interoperable solutions and is increasing its efforts to meet the growing challenge
- Interoperability has a major positive impact on innovation, growth, employment, efficiency and competitiveness
- Interoperability is in the interest of all stakeholders in the value chain – and requires active measures from all of these stakeholder groups
- While interoperability may not be a prime consideration when new technologies are introduced and used by groups of early adopters, achievement of broad-based interoperability based on open standard specifications becomes progressively more important as a larger market develops
- For an interoperable competitive multivendor environment, interoperability is best facilitated by interface specifications adopted by standards organizations (including industry forums) that meet the criteria for "openness"
- Both proprietary products and open source products can deliver good multivendor interoperability using open standard interface specifications
- Governments should develop public procurement policies that promote interoperability, in particular by purchasing solutions compliant with open standards developed and supported by industry and thereby ensuring that government installations contribute to interoperability. Public administrations should aim to operate highly flexible, vendor independent, interoperable ICT architectures, which are responsive, open to new technological developments and value-driven.
- Public authorities should maintain technological neutrality and provide incentives to continue to innovate. Any procurement decisions should be made on solid business rationale such as degree of interoperability, cost, functionality, security, innovation, support for open standards and adaptability to future technologies.

1 SIGNIFICANCE OF INTEROPERABILITY

A quantum increase is occurring in the significance of achieving and having a good support for interoperability in the products and services of the digital online era. The full potential of convergence – and the boost to economies and to the citizens of the Information Society – can best be promoted by avoiding fragmentation of the markets for information technology-based services and products through concrete actions by all stakeholders. Online service sectors, software and hardware vendors, and governments should facilitate and encourage interoperability. Therein, the role of government is important, both as a policymaker, a facilitator, a service provider - and as a user or Information Society services.

An important way to avoid fragmentation is multivendor inter-operability based on open interface standards[1]. This EICTA paper introduces the main aspects of interoperability relevant for the European high technology sector, how interoperability can be achieved and what actions and policy principles should be observed in this context.

While much of the discussion surrounding interoperability is necessarily technical by nature, the attainment of intero-perability should ultimately be measured by the user's experience. What counts are products and services implemented in a way delivering interoperability – standards are one important step, necessary but not sufficient for interoperability. Rapid advances in technology and constantly evolving user expectations in an increasingly interconnected world can quickly outdate any technical definition of interoperability.

One of the main messages of EICTA is the imperative to support open standard specifications for multivendor inter-operability. In order to put the various steps into context, we can describe the link between the "user experience" and "open specifications" as follows:
- Satisfactory user experience of "it is interoperable" (=business need)
- Supported by interoperable implementations (product, service hardware and software that can exchange and use information),
- Achieved by adherence to interface specifications in those products and service software,
- Setting forth interface information (in the case of software: protocol, format descriptions) in a generic manner enabling any interested party to follow them,
- Adopted and maintained in and available from an open standard-setting process.

The above sequence is the preferred ideal for sustainable multivendor interoperability on a level playing field.

In the end, interoperability is achieved when the expectations of the user to exchange and use information among various devices and software applications from multiple vendors or service providers are met. As a general rule, technical barriers to interoperability should only be those resulting from limitations in technology and not barriers introduced or sustained for the purpose of removing interoperability by vendors or service providers[2]. Variations in user experiences also may result from the cost or sophistication of services or devices preferred by a particular user.

At the same time, in order to promote and award innovation, open standards should focus on those elements of functionality that are required to fulfil interoperability requirements. It should be possible to identify a proper scope for interoperability: what must be made interoperable to achieve the user benefits and critical mass for a particular market. Such an approach should leave room for innovative additions outside the interoperability scope (and competition based on those innovations) –and potentially also in parallel to it, when the interoperable alternative continues to be supported. The scope necessary for inter-perability is likely to change as a function of time, development cycle and maturity of industry: what is introduced as an early functionality outside the interoperability scope may become a function squarely within that scope. Standardization agendas and product roadmaps should be guided to reflect this evolution as a function of time. Both innovation and introperability are needed – they should not be regarded as trade-offs.

Interoperability has significance for all stakeholders in the value chain:
- to content and service providers: ability to reach the maximum audience;
- to developers of solutions: predictability that the software program will run on maximum number of environments: on multiple platforms, with other programs and supporting data and content generated by other applications or on other platforms;
- to vendors of servers, network and terminal (client) solutions:

1) An "interface standard" sets forth a generic description of interface information consisting of protocols, formats and/or application programming interfaces, APIs
2) An example of a different, and legitimate, purpose would be a measure imposed by government to meet national security objectives

global un-fragmented market – without the need to develop, distribute and maintain specific and uninteroperable versions market by market or service provider by service provider - powered by the end user satisfaction & success of service providers;
- to users: the ultimate user convenience of better and faster information flow in a technology and content environment: heterogeneous, multi-vendor solutions that take interoperability into account can be assumed to work together seamlessly, without user intervention or specialized equipment.

In addition, interoperability will enable creation of solutions with assistive technologies to allow persons with disabilities access to new products and services. Therefore, standardized "open" interfaces will help ensuring the integration of this user group in society and employment.

Whether interoperability is supported or not has a major impact on the national economy and competitiveness. Interoperability is the main counterforce to fragmentation, which potentially destroys the "network effects" opportunity in the new converging services to boost European competitiveness, productivity, growth of GNP and high employment. Interoperability also favourably influences trade both within Europe and with other countries as it supports the cross border movement of goods and services. Lack of interoperability frustrates cross border access to services when based on a dissimilar technical framework. Devices tailored to a special purpose - uninteroperable - environment lack markets elsewhere.

The importance of achieving interoperability must not be understood to prohibit market experimentation and innovation. Rather, it must be understood as a reason to invest into open standards generation, to support for standard adoption and implementation of interoperable solutions - and to monitoring of the "open" nature of solutions offered to a market requiring a high degree of interoperability. The relevance of interoperability varies significantly over the cycle of introduction of new technologies and later advances towards mass-market adoption and mature markets. In the early introduction of a technology, it is often highly proprietary in nature and its interoperability may not be a prime factor, as it may be utilized by groups of early adopters. However, for a later part of a market development, the achievement of broad-based interoperability and the basing of such interoperability on open standard specifications become progressively more important considerations.

Information increases in utility – and value – when it is accessible to more users than before – or in a larger variety of situations than before. Convergence of technologies – the promise of the wider accessibility to information over a variety of devices and connections – is a huge opportunity justifying investment into removing interoperability barriers.

2 DEFINITION OF INTEROPERABILITY

At a high conceptual level, information-related interoperability[3] can be defined as follows:

Interoperability

The ability of two or more networks, systems, devices, applications or components to exchange information between them and to use the information so exchanged.

Interoperability manifests itself in user satisfaction: such satisfaction is significantly about the increased availability of information and services as well as the absence of frustration and burdensome difficulties in user's attempts to carry out the intended operation. An interoperable solution meets the expectation that it can be assumed to work without user intervention in terms of facilitating information exchange between different platforms, computing networks, applications, devices and other systems entities. Interoperability is achieved if two (or more) networks, systems, devices or components can exchange information and use the information in the manner for which they have the basic capability.

Variations in the user experience may result from the service or device preferred by a particular user. Ultimately, to evaluate interoperability, it is important to look at the user's ability to receive access, store, modify, enhance, display and transmit information utilizing multiple devices and services. Importantly, interoperability is not just a theoretical construct: the objective is an end user experience that meets criteria for satisfactory performance quality.

The information that is the subject of the exchange and use in the definition of "Interoperability" can be information of any kind that is capable of being electronically conveyed, in digital form over communication networks: voice, pictures, documents, entertainment works, broadcast type streaming, security credentials, cookies, forms and user interfaces, executable software code etc.

Interoperability is here purposely defined as a technical capability. There are multiple other factors that influence the actual ability of a user to gain access to a particular service. These other factors[4] may very well merit attention and remedial action but they generally are outside the scope of this paper.

Actual ability to access a given service or certain content is not only a matter of interoperability – this depends on the rights of the user. A fee bearing service is only accessible against the applicable payment arrangement (whether by subscription or ad hoc) and a corporate database is only accessible to those showing company credentials. Service providers enter into commercial arrangements regarding the services and content available to their users/subscribers. These issues of commercial availability are outside the scope of this paper concentrating on interoperability.

Also, the user's choice of services and devices used is significantly a function of the location, situation and role of the user in each case. The limitations such as small weight, size of display, limited keyboard etc. inherent in a pocket device influence the expectation. Consequently, they also affect the interoperability requirement.

In other words, interoperability as a technical ability to exchange and use information should not be understood as mandating that any device or any user should in fact have the ability to process any kind of information – or that any service must offer any information to any user – but rather that interoperability exists in relation to a given category of information if it is intended to be exchanged and used.

The interoperability requirement is steeply on the increase as the service capability of small devices and availability of distributed computing and communication systems is rendering traditionally accepted restrictions obsolete. This increased expectation – partly generated by the glowing projections of the technology sector –makes users highly sensitive to and increases the negative cost of lack of interoperability. Therefore, achieving interoperability where it is intended has acquired a greater urgency for all stakeholders.

3) The qualification relating to "information" leaves out predominantly physical and mechanical aspects of interoperability, such as connectors for cabling, electric sockets, screws and threads etc. The physical layer ability to connect (and thus to enable exchange of information over a connection) is relevant in principle but largely addressed through standardized physical formats.

4) Examples include commercial availability, organization/business model compatibility, semantic consistency and technical infrastructure/skill capabilities of potential users.

3 INTEROPERABILITY AS A BUSINESS ENABLER

3.1 Multimedia Value Chains

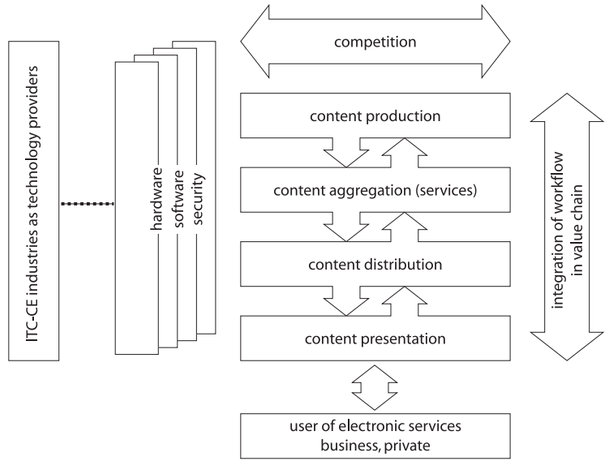
Relevance of interoperability must be seen in the context of business and market requirements in support of actual value chains. Well-established and operating value chains in a horizontal market based on competition form an important prerequisite for the Information Society. The value chains represent the needs for creation, aggregation and exchange of information (voice, data, A/V, also increasingly referred to as "multimedia content" or, even more simply, just as "content") and its usage, storage etc. These uses occur in both commercial and non-commercial settings, for instance within public administrations and between such administrations and citizens. Value chains depend on interoperability. It is in these contexts that the benefits of interoperability can be demonstrated. The basic structure of a multimedia content value chain is shown in the figure below. Examples for more detailed actual value chains are given in chapter 3.3.

Interoperability is an indispensable business enabler. It is a tool for a higher objective and not an objective in itself. Considerations should include the various aspects and levels, tools to achieve it, and indicators to measure it. However, everything has to relate back to business and market needs. A lack of interoperability can impair markets by creating fragmentation i.e. "silos" that do not speak to one another. Such fragmentation may result in failure to achieve mass market penetration, which occurs when users are able to assume other users to have the same capability.

3.2 Levels of Interoperability

Value chains depend on interoperability between their layers and elements. The dependencies between these layers and elements are capable of being described as "interfaces", i.e. a convention (and agreement, a set of rules) about the attributes shared between the layers and/or elements that otherwise are distinct from each other. An interface is logically similar to a connector or a bridge. Any complex information technology product typically provides for ("supports") multiple such dependencies and, correspondingly, multiple interfaces. In addition to physical and logical interfaces between adjacent layers (e.g. networks and terminals) and within a layer (e.g. between different devices and within computing networks), there are logical interfaces between non-adjacent layers (e.g. between content and terminals and services and terminals). Consequently, according to the complexity of a value chain several levels of interoperability can be distinguished, such as

- different kinds of content interoperability (exchange of content between service providers, targeting of content to multiple services and devices);
- service interoperability (services working across multiple devices; platforms and computing networks);
- device interoperability (devices that work with multiple services);
- device to device interoperability (devices working when connected together directly or via a network).



Satisfactory operation of a value chain requires end-to-end interoperability. Therefore, the end-points are key, i.e. the content origination and end-user levels. Ideally, from an extreme point of view, either all content has to be one format or end-user devices have to understand all formats. For cost reasons devices may not be able to support all formats, neither can service providers support all formats. Multiple formats in the same device also pose an exponentially increasing testing and adjustment challenge as the number of permutations (of possible dependencies) expands with redundant solutions. To achieve full and predictable interoperability, an acceptable solution would be for a maximum number of services and devices to always offer a baseline format, in parallel with other alternatives. Additionally, different formats can well coexist and with satisfactory interoperability when sufficient information is in fact available for the "export" or "rendering" and conversion of content from one format to another, i.e. for providers of solutions based on a particular format to build in compatibility with other formats.

Interaction scenarios are growing more complex: In distributed functionality, all elements working together to produce an end user experience must be able to interoperate. A combined service to the end user may draw upon enabling functionality offered by another service. Thus interoperability is needed not only between a service and a terminal but also between multiple computers generating components of the end user experience.

Industries need economies of scale to create affordable products and services. Both manufacturers and service providers need also to sell certainties to the consumer. From a consumer perspective an interoperable system is one, where the consumer is able to purchase a device and begin to use and pay for a class of services commonly used with that device in a simple, consumer-friendly manner without needing to choose before purchase, which particular services out of that class would be used. Or in consumer language: "Things just work the way I expect, without problems. If it doesn't work something is broken and needs to be fixed!". Responding to this consumer expectation creates the largest economies of scale and enables competition.

The complete value chain must collectively provide a joint, attractive and affordable offer to the consumer. In order to make this happen, interoperability problems have to be addressed both in the technical sense (standards) and in the economic/business sense (business models and distribution arrangements, pricing), to promote consumer confidence. Therefore, voluntary cooperative efforts are necessary in order to achieve:

- development and deployment of open standards in products and services;
- voluntary agreements to link the various business activities; and
- coherent and timely communication to the consumer.

If the necessary degree of cooperation cannot be achieved and interoperability is not achieved through any alternative means, governmental intervention may become necessary as a measure of last resort to prevent market failure.

3.3 Examples of relevant value chains

Determining whether business opportunities in the information and communications technology sector are being impaired due to lack of interoperability requires generating a comprehensive picture of interoperability in the different value chains. As Technology Providers, EICTA members are directly or indirectly involved in almost all layers. (EICTA's activities in the areas of Broadband, eEurope and Digital TV already include in their considerations content-to-consumer value chains.)

a) CE

In the TV broadcasting world the value chain typically consists of

- content producers
- content distributors
- broadcasters
- supporting service providers (e.g. multiplexing, conditional access etc.)
- network operators
- terminal manufacturers
- and consumers.

Content is key in this value chain. End-to-end interoperability requires standards for content coding and presentation, application presentation and execution, transmission formats, conditional access, copy protection, DRM and identity management. The

traditional broadcast structure is unidirectional with each layer connected to the next.

Broadband and the Internet have introduced a discontinuity in relation to this old model because IP networks allow direct communications from all stages in the value chain to consumers and to each other. In addition to network based broadcasting (whether satellite, terrestrial or cable), broadcasters are also using the Internet to disseminate their content. Consumers welcome this, as they can now access their favourite stations from all over the globe. If broadcasters offer interactive services requiring a return channel, any kind of network providing a connection to the server may be used. The increasing relevance of interactivity – which involves similarities with telecom type "Information society services", is an example of how the traditional value chains in the areas of IT, telecom/broadband and CE are beginning to converge.

b) Telecom

A typical telecom value chain - for services other than traditional voice service - consists of

- information society services (content production and distribution)
- electronic communications network and services (service provision and core and access network provision)
- terminal manufacturers
- and consumers

Information society services include "any service provided at a distance by electronic means on the individual request of a service receiver". End-to-end interoperability requires standards for e.g. content presentation formats, DRM and electronic signatures. Underlying requirements are robust security, privacy and accessibility, i.e. remarkably similar to those in the "broadcasting/Consumer Electronics" value chain. In fact, there is a significant and growing overlap between content offered through unidirectional broadcasting and that offered "on individual demand" over a communications network.

Electronic communication services ideally should be - for convergence to work - content, bearer technology and device platform agnostic and based on several underlying network technologies (fixed, mobile, satellite, cable) with well defined technical interfaces. Interoperability challenges are greater with respect to upper layers because of newer functionality, greater complexity and lack of mature consensus on the benefits, necessity and willingness to bear the financial or time burdens for interoperable functionality.

Terminals may be connected to several telecommunication networks and need to communicate with information society services. Terminals may be used for peer-to-peer services similar to information society services. As terminals may have constraints, scalability of services is important. A great variety of information society services are emerging. Therefore service enablers need to be standardized otherwise terminals will become too complex.

Users should have an unfettered access to information society services through electronic communication networks.

c) IT

In the computing environment, eServices delivered through computing networks need to adapt to users' requirements and equipment (and not the other way around) maintaining quality and service across different networks. To make that happen, interoperability within IT computing applications, systems and networks, in broad terms, has to be considered from different computing "layers" point of view. These layers are

- Application integration layer;
- Core services application layer
- Presentation layer

The Application integration layer is where multiple applications are integrated and it is the basis of the entire IT infrastructure.

The Core services application layer provides a "glue" for the application integration of various Internet-based services. It also serves as a basis for end-user applications. This "layer" of IT architecture allows creation and usage of new applications built on the top of existing user applications. It is therefore very important that open standards on data description language (XML), including file formats, schema and protocols (e.g. SOAP, ebXML etc.) are properly implemented. In other words, making eServices a reality, this layer must provide and facilitate sharing of information items. This in turn requires that content and service providers are compliant with the open standards and have implemented them properly at API level.

Thirdly, the Presentation web-layer provides the viewing" capability for a client device. IT productivity tools should be able to exchange information between them in a manner in which that information can be used and no content is lost. This includes office productivity objects, content, codes, e-mail files etc. Ideally, security patches of applications have to be interoperable as well, balancing also additional factors such as timeliness of release.

Identity management applications have to be based on open protocols and allow opt-in feature to enable services that are built on them, to be implemented in privacy-friendly manner. Digital rights management systems have to be interoperable and enable interoperability within and between networks.

3.4 Convergence issues

In the past the worlds of IT, telecommunications and CE were separated through technological constraints. With the digitization of content formats and transport mechanisms associated with increasing processing speed and storage capabilities, traditional boundaries are disappearing. Services tied to particular networks in the past are now able to disseminate their content via a variety of different networks. Conversely, each end user can get access to a much broader variety of services and content through networks available to them, independently of the location of either the user or location of the source of content or service. Traditional value chains are being rearranged and merged with formerly separated neighbouring chains.

Instead of a vertically organized chain of interoperability, in the emerging future a complex web of interoperability will have to be established. This involves, at least initially, a significant increase in the complexity and effort required to deliver interoperability. This complexity, together with time to market ambitions, increases the vulnerability of the ecosystem to fragmentation by uninteroperable solutions, potentially leading to very significant delays in market adoption, particularly in relation to achievement of mass-market acceptance. Ideally, if support for interoperable solutions across platforms emerges as convergence progresses, the fragmentation will abate but this is not expected to easily occur without conscious effort by all market participants.

5) See footnote 1, supra, for the definition

6) ISO/IEC Guide 2:1996; definition 3.2

4 WAYS TO ACHIEVE INTEROPERABILITY AND TO COMPENSATE FOR LACK OF INTEROPERABILITY

4.1 Ideally, single interface specifications for interoperability

Non-universal interoperability – interoperability within an "island" of users – may be achieved among people using the same solution. A single vendor implementation however brings broad-based interoperability only in the case of a single dominant solution, associated with competitive concerns similar to those related to the "proprietary specifications" discussed below. Prior to global connectivity and digital forms of information (together producing convergence), the limitations inherent in these "islands" of user groups were not as evident as they are today. The way, to bridge the gaps between islands is to implement **standard interfaces**[5] which can provide for interoperability.

In the case of different, competing interface solutions – parallel "standards" – a degree of fragmentation occurs. This can be partly compensated by re-authoring where possible (at the upstream/server end) and by multiple redundant software clients in the user devices. However, both re-authoring and redundant client software result in significant increases in cost and significantly reduce the accessible market size to developers and content providers. Portable devices are particularly sensitive to the additional cost and resource burdens resulting from client redundancy. Perhaps most importantly, the implementation and testing challenges for services and devices increase exponentially when multiple redundant functionalities must be supported. The added complexity may result in very long delays, even years, in the achievement of what would amount to a mass-market availability of interoperable services.

Therefore, putting interoperability as a first priority would argue for arriving at a single or at most very few standard interfaces for a given functionality. Adopting a single interface standard must, however, be done with a clear priority for open standards and not proprietary specifications, as is discussed in the next chapter.

4.2 Standards generally

The word "standard" conveys an expectation of uniformity. In the technical context, the generally accepted definition is the ISO wording[6], which reads as follows:

> **Standard**
>
> document, established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context
>
> Note: Standards should be based on the consolidated results of science, technology and experience, and aimed at the promotion of optimum community benefits.

A broader, dictionary definition of the noun "standard" includes "something established by authority, custom, or general consent as a model or example"[7]. The definition for the adjective "standard"[8] is descriptive of the broad colloquial use of the concept. Thus, unofficial "standards" may cover a variety of circumstances.

Public, official standards that have a degree of governmental or quasi governmental status, and are of varying degrees of voluntary or mandatory nature, are elaborated for a variety of reasons, including safety (e.g. electrical safety, marine and automotive safety etc.), consumer protection (e.g. disclosure of nutrient contents), environment, services, quality, etc.[9] Also voluntary, unofficial industry "standards" or proprietary specifications - without any official or governmental status – may serve many different purposes, including interoperability.

Both public, official standards bodies and industry-led, ad-hoc fora have valuable roles to play. EICTA recommends that governments recognize the contribution of voluntary, industry led fora in developing standards for interoperability. Such industry led fora should implement and enforce a process and governance policy that ensures the open nature of the specifications produced by such bodies.

This paper is only concerned with standards that serve the purpose of interoperability, the ability of devices etc. to exchange and use information. Further, this paper is primarily concerned with interface[10] based interoperability – EICTA distinguishes between open standards and proprietary specifications. A market-leading product or device should not be considered or confused with an industry "standard" even if it were used by most market participants. As this may be simply based on everyone using the same implementation, the phenomenon does not amount to a "standard" as this concept is used in this paper.

4.2.1 Standard interfaces

A **standard interface** is a technical description of certain generic requirements that a technical implementation of that interface must conform to – in order to produce the desired functionality. In the case of information interoperability[11], today's generic requirements broadly speaking refer to two categories of information, namely (i) data formats and (ii) protocols.

Data formats set forth the way information should be presented, packed into the digital package – for the successful unpacking and reading of the information, following the defined description of the format. To use an analogy, data formats represent the alphabet and dictionary for a particular language.

Protocols set forth the sequence and meaning of the information in the various data packages transferred in the course of the interaction between two interoperating elements. A given digital device may support dozens of protocols, both communication protocols and transaction protocols. As computing is becoming more distributed and interaction between applications (and other system resources) becomes greater and greater, the number of protocols relevant for particular implementations (products) is growing significantly. The concept of a protocol can be compared to the grammar for a particular language.

Data formats and protocols are the most important categories of Interface Information for software interoperability. It is significant to note that while software interface information conveys important information about a product – namely about the formats and protocols supported by that product – it does not disclose detailed design information, exact implementation description or software source code or the like[12]. Intellectual property aspects related to interface information are discussed in the context of openness, below.

4.2.2 Openness defined

A standard is "open" when it achieves sufficient level of freedom from control by a single actor or grouping of actors (and adequate information is made available to ensure equal opportunities to produce compliant hardware or services among all potential actors). The acid test for openness is whether the circumstances related to the standard actually enable the feasibility of independent multi-vendor implementations. These circumstances can be evaluated in the four dimensions defined in the box below.

Openness is not a black and white characteristic – there is no "one size fits all" perfect solution that would render all other approaches less than desirable. The governance of a given specification, its public availability, the degree of adherence of most of the market players and the IPR regime related to the specification all vary from standard to standard – particularly as there now is a plethora of ad hoc standardization efforts by interested industry participants. Not all standard fora are alike and not all produce fully open standards. Conversely, the world no longer can rely solely on the advance of standards through official standards bodies with governmental or quasi-governmental status.

> **Criteria for "open standard"**
>
> **Control**
> the evolution of the specification should be set in a transparent process open to all interested contributors;
>
> **Completeness**
> the technical requirements of the solution should be specified completely enough to guarantee full interoperability;
>
> **Compliance**
> there is a substantial standard-compliant offering promoted by proponents of the standard;
>
> **Cost**
> fair reasonable and non-discriminatory access is provided to intellectual property unavoidably used in implementation of the standard;

As the 4-point statement is a condensation of a large number of aspects, these four criteria are briefly elaborated here.

Openness in the **Control** sense includes at least the following:

- all interested and qualified parties can join the standard contribution process based on objective and non-discriminatory criteria;

7) Merriam-Webster online, http://www.m-w.com/

8) standard adjective **1 a**: constituting or conforming to a standard especially as established by law or custom <standard weight> **b**: sound and usable but not of top quality <standard beef> **2 a**: regularly and widely used, available, or supplied <standard automobile equipment> **b**: well-established and very familiar <the standard opera> **3**: having recognized and permanent value <a standard reference work> **4**: substantially uniform and well established by usage in the speech and writing of the educated and widely recognized as acceptable <standard pronunciation is subject to regional variations>

9) Commission working document "The role of European standardisation in the framework of European legislation and policies" (November 2003)

10) see footnote 1 for definition

11) The qualification relating to "information" leaves out predominantly physical and mechanical aspects of interoperability – see footnote 1, supra.

12) Physical and mechanical interfaces may in some cases – such as plugs, sockets etc. – be much more implementation-specific.

- substantive contributions are disclosed to participants;
- solutions required by the specification are selected on technical merit;
- no party or closed group can direct the contents of the specification to its commercial advantage;
- in case of a contribution "imported" to a standards process from the outside, that the foregoing criteria apply to the evolution of the specification going forward;
- the editing control or copyright in the specification document is not used as a means to prevent or direct the evolution or re-use of the specification;
- the standard is affirmed, ratified and maintained in an open consensus-based process;
- the standard is publicly available for evaluation.

Meeting the **Completeness** requirement means

- the technical description is sufficient to enable independent interoperable implementations based on the description and state of the art skills and competences
- no material gaps exist leading to conflicting implementations;
- the technical characteristics of the specification are mandatory for all implementers in a scope sufficient so that a satisfactory interoperable performance is achievable;
- the specification does not require utilization of a specific implementation whose interoperability-related characteristics are undisclosed (a so-called "black box").

The **Compliance** aspect of an open standard relates to

- adoption of the specification by a broad group of implementers so that interoperability is actually achieved through widely available implementations (products);
- implementations actually conform to the standard;
- different interpretations and unforeseen interrelationships that break interoperability are addressed through testing and modifications of implementations until actual interoperability occurs;
- extensions and enhancements to standard functionality are acknowledged as such (and not disguised or hidden), contributed to standard evolution when relevant for interoperability and not implemented in a way which undermines interoperability in the existing version or in continuing evolution of the standard.

The **Cost** requirement will be met when

- the specification documentation is available to any interested party at no charge or for at most a nominal charge proportionate to the cost of administering and publishing the document;
- the members of the standards body or industry consortium generating the standard have committed to licensing of all of their "Essential IPR"[13] – primarily patents - on fair, reasonable and non-discriminatory terms and conditions or grant a free license[14] to any party requesting a license on non-discriminatory and other reasonable terms and conditions;
- there is no reason to believe that there exist "essential" IPR held by non-members who would refuse licenses, discriminate in licensing or impose less than "fair and reasonable" fees or terms and conditions.

4.2.3 Open standards

Open standards are not synonymous with "open source" nor are open standards in contradiction with proprietary products. EICTA fully supports the importance of upholding vendors' ownership of their product designs. Hardware and software based upon code or operating systems that are "closed" or proprietary can, and do, interoperate through the use of open standard interfaces supported in those (proprietary) products. Further, the specifications of those interfaces do not need to disclose implementation level information such as source code – they should set forth generic requirements,

13)"Essential IPR" relates to intellectual property rights the use of which can not be avoided while complying with the specification. The "essentiality" of a patent is always specific to the description set forth in the specification, compared against the claims of the patent, and is determined much in the same way as an infringement question is determined.

14) The word "free" refers to the issue of monetary compensation (whether such compensation is called a royalty, a one-time licensing fee, etc.) i.e., that the patent holder will not seek any monetary compensation as part of the licensing arrangement.

not final designs. EICTA stresses the importance of making the proper distinction of these aspects.

Open standards are interface specifications evolving from processes and organizations, which meet and uphold the four main criteria for openness. These four criteria match the four dimensions of proprietary control discussed below. They represent the main aspects of standard-setting process and governance preventing the risks that otherwise may occur in connection with such control.

4.2.4. Proprietary specifications

As noted above, EICTA distinguishes between proprietary specifications and open standards.

A proprietary interface specification means that a party owns and/or exercises control over the standard specification and its use.

Proprietary single vendor solutions may over time become proprietary specifications with products available from multiple sources, e.g. due to technology licensing by the original vendor/developer. Further, a proprietary standard may become more open if the corresponding specification is contributed to an open standards process and the aspects of proprietary control are removed.

The aspects of control in proprietary specifications are manifold and can be grouped to four categories:

(a) governance: the single proprietor has sole decision power or at least veto power over the contents of and changes to the specification. This involves an ability to control the direction of the specification, to favour certain solutions over others. Furthermore, power over contributions and decisions involves a significant time advantage over non-participants, to align product programs to the as yet not public aspects of a specification in development;

(b) disclosure: a proprietary specification may be entirely or partially non-public. The practical implication is that access to the necessary information may be unavailable or may require a license agreement with the proprietor of the standard. Alternatively, the proprietor may prefer to disclose only parts of the interface and require the sourcing of a "black box" element – whose exact design is undisclosed – from that party;

(c) proprietary enhancements and extensions: a particular case of incomplete interoperability occurs when the standard covers a subset of functionalities available to all but there exists a superset of functionalities that is necessary for interoperability but may be unavailable for use by all:

(d) intellectual property: The proprietor of a standard may be the owner of "essential" IPR, use of which is unavoidable in solutions complying with the standard. Thus the owner may be in position to use licensing of such IPR not only to obtain a fair return for the use of such IPR but also potentially to gain unfair advantages.

These four dimensions represent the ways in which the control inherent in the proprietary nature of a proprietary specification can represent leverage, i.e. a risk to other market participants. This risk is negligible where the specification concerned is not important for interoperability. The concerns related to control grow significantly in case a specification is reasonably necessary for interoperability: if all need to use the specified interface, all market participants have a stake and an interest in how these four degrees of control are governed.

While proprietary specifications can contribute to interoperability particularly at the time of market introduction of new innovative solutions, there normally are no guarantees that a proprietary specification would become more open e.g. through its contribution to an open standards process. The wider the adoption sought for interface standard, the more important it is to ensure that proprietary control of the proposed solutions will be removed. As noted above, there are strong reasons to seek common standard interfaces – possibly just one – for functionalities that are necessary for interoperability. EICTA places a very high priority on all measures aimed at ensuring that such single standards meet the criteria for openness discussed below.

Additionally, EICTA strongly recommends that for important inter-operability-related functions, open standard implementation should be supported also where service providers and vendors were to prefer a proprietary implementation or a proprietary specification for particular commercial reasons. EICTA recognizes that market participants will choose such preferences based on their business priorities but cautions that the common interest in interoperability

15) This category of royalty free licensing undertakings is also sometimes called RAND-Z but there does not exist general agreement in the industry of whether "royalty free" is a subset of "RAND" approach or whether these two categories should be seen to be conflicting or competing approaches to this general question. Whether similarities or differences have greater significance depends on the perspective and underlying business interests from which this question is approached.

16) This issue is addressed in the WTO agreement about Technical Barriers to Trade, which sets forth the obligations of the signatories in this respect.

17) Commission staff working paper on role of European standardization, page 20

18) Commission website for open source information, with links to further resources, is located at http://europa.eu.int/information_society/activities/opensource/understanding/index_en.htm

means that proprietary alternatives should be supported only in addition to but not as substitutes for open standard solutions.

4.2.5 Intellectual property in open standard specification context

The purpose of a standard is to increase commonality between solutions - sufficient to achieve interoperability between independent and thus dissimilar implementations - and ensure that as many actors as possible use these interoperable solutions. The purpose of intellectual property protection is to secure commercial rewards by granting of time-limited monopolies to the developer/investor as the incentive to invest extensively in research and development. Thus there is a certain element of tension between the policy goals of public standards and those of intellectual property protection. These tensions, however, have been managed in a generally successful manner by established standards bodies in the development of "open" standards.

The most widely adopted solution to this tension is to require contractual commitments from the participants in the standards process to license their IPR in a standard to those who put compliant implementations of the standard specification in their products and services. Licensing undertakings very greatly in their form and detail. The most common approaches are either "RAND" licensing undertakings, where members either commit or are expected to license their Essential IPR on fair, reasonable and non-discriminatory terms or "royalty free" undertakings, where standard participants voluntarily go further than "RAND" and commit to license their Essential IPR on royalty free terms[15]. Licensing undertakings are complicated contractual arrangements that vary significantly from one standards body or industry consortium to another.

4.3 International dimension

As already noted, absence of standards for interoperability involves a risk for fragmentation, with its negative impact on all stakeholders. Similarly, inconsistencies and conflicts in national and regional standards fragment the market and are recognized as being among technical barriers to trade[16]. Also a standard made mandatory to the exclusion of other standards may amount to a barrier to trade and innovation. In the globally networked convergence market, international disparity is a significant deterrent to introduction and growth of new services to the worldwide audience of users. In other words, coherent international standards not only facilitate trade in goods[17], they also facilitate the global offering and global access to services available over electronic networks.

Therefore, conflicting national standards should be avoided and an international standard relied upon whenever one exists. Where a national or regional specification – or enhancements to a previously existing standard - is generated in advance of the international one, the new or incremental specification should be also contributed to international standard-setting and plans should be made to align the first mover standard with the outcome from the global process.

4.4 Open Source Software

Definition: Open Source software ("OSS") is software whose source code is published and made available to the public, enabling anyone to copy, modify and redistribute the source code without paying royalties or fees[18]. This definition includes 2 elements:

1 *Actual disclosure of the source code form of the computer program; and*
2 *The intellectual property rights licenses - (copyright license and, where applicable, "Essential" patent license) to use, modify and onward distribute such software and modifications thereof - are provided without payment by the software licensee.*

Many different license regimes coexist with a wide variety of contract solutions for the actual rights and obligations of licensees. Therefore, it is not possible to define a "typical" or even "most common" package of rights and obligations in an OSS license[19].

"Open source" and "open standards" are two distinct concepts. While they may be interrelated in some aspects, there is often confusion about their meanings and relative significance; even to the degree that the two are at times thought to be synonymous which they are not. Open source is primarily an implementation and not a "standard" or a "specification" as discussed above. Open standards can be well implemented by software irrespective of whether it is open source software or other software. Furthermore, not all "open source" software necessarily supports widely adopted open standards or is a guarantee of interoperability between different implementations. Theoretically, the modification rights and opportunities associated with open source are no guarantee of continued interoperability as they permit the creation of new versions which then quite possibly can be incompatible.

Open Source Software offers the following characteristics:

- The advantage of OSS is that the disclosure of source code allows any user to modify the code to ensure compliance with open standards for interoperability provided, of course, that the user comply with the license conditions relevant to the code the user has modified. Market experience with OSS to date does not demonstrate significant, irresolvable interoperability problems with the most widely used popular OSS applications. One rational explanation for this is that open source developers are gathering together to solve generic problems they share. Open Source is not only a piece of software but it is also a process to build and license code in order to solve common shared problems such as infrastructure problems.
- A natural source for Open Source developers are open standards which they then "natively" implement in the OSS software. The result is de facto support of open standards in OSS software. The process is not dissimilar to support of open standards in non-OSS products; while there is no reliable comparative data available, proponents of OSS model believe the OSS communities have a consistent preference to open standard implementation.
- Open standards support a certain degree of flexibility through interoperability of the solutions of multiple vendors. The flexibility associated with open source relates to significantly different aspects, such as to the actual implementation of a software program by sharing of a code base and, to sharing of relevant documentation, and to ability to modify the resulting program.
- Certain well-known examples of Open Source licensing enable distribution and usage of software without any restriction. This network effect is capable of accelerating propagation of standard usage and thereby can be a contributing factor to better interoperability. It is not universally applicable to all software that is regarded as "OSS", however.
- The accessibility of the source code and the design information as well as the rights to modify, onward develop and distribute OSS support reusability of good implementations. Also, the community of participants working with OSS may promote open debate resulting in an increased recognition of the benefits of various solutions and such debate may accelerate the adoption of solutions that are popular among the OSS participants. These characteristics of OSS support evolution of robust solutions and are often a significant boost to the market adoption of open standards, in addition to the customer-driven incentives for interoperability and open standards - which are equally applicable to non-OSS and OSS software offerings.
- Open Source Software enhances trust in interoperability through transparency[20]. When source code and compiler are accessible, users are able to verify that the software interoperates as it should and organizations have a solution whose security, privacy and transparency is not dependent on actions of and continued support by their suppliers[21].
- The open source rights model supports platform portability - the adaptability of a function to different operating systems or other platform elements. This can support wide dissemination on many platforms resulting in wide deployment of interoperable implementations.

Computing environments will remain heterogeneous including both commercial software and open source software – open source model does not invalidate the need to uphold the incentives for commercial software development. Also, it is relevant to note that OSS software is increasingly used for commercial purposes, such as the sale of services, hardware and other non-OSS software. It is unrealistic to think that the community effort inherent in the OSS development model alone is sufficient to respond to the global needs of software development. While OSS may become increasingly important as a part of the total software market, there iwll remain a need for commercial software offerings where source code is not disclosed – and in the financial rewards inherent in the proprietary and undisclosed design of the successful commercial software products.

The varying market strategies – responding to different opportunities and customer requirements – of commercial software or service providers result in different preferences about interoperability. A particular revenue model may be based on a market strategy of not being interoperable with other services or with other products. Due to the community development model of OSS, similar ambitions are less likely to influence OSS-based solutions towards purposely non-interoperable islands of functionality.

19) a comparative overview of certain key terms is found on page 4 of http://europa.eu.int/information_society/activities/opensource/doc/pdf/key_terms.pdf
20) For the same reason, source code access to non-OSS software may be provided by their vendors
21) in addition, interoperability testing is in wide use for both OSS and non-OSS software

5 ROLE OF GOVERNMENTS

National and local governments and other public authorities, e.g. institutions like the European Commission, are influential users of ICT infrastructure, influential providers of information services and additionally exercise regulatory powers that can have an impact on interoperability.

As a matter of industrial policy: Interoperability is a desirable outcome of technological and market development, and therefore also a justifiable public policy goal. As a general rule, supporting and encouraging international, industry led standards bodies which develop open standards for interfaces needed for interoperability, is an appropriate role for public authorities. Public authorities should, however, maintain technological neutrality and provide incentives to continue to innovate.

As a matter of government purchasing power: In their own purchasing activity, governments should develop public procurement policies that promote interoperability, in particular by purchasing solutions compliant with open standards developed and supported by industry and thereby ensuring that government installations contribute to interoperability. Public administrations should aim to operate highly flexible, vendor independent, interoperable ICT architectures, which are responsive, open to new technological developments and value-driven. The failure to look at actual requirements can result in outdated, costly mistakes that harm public services and discourage industry innovation. Room should be left for competitive market forces to bring new technologies to the market place in order to meet governments' evolving functional requirements and financial constraints. While governments should avoid developing or mandating standards, they can use their significant purchasing power to encourage industry to develop interoperable product offerings, especially ones that support open standards.

As providers of government services: Governments should deploy online services that utilize open interface standards. Special efforts should be taken to avoid imposing a single technology platform or a single vendor's technology on citizens or businesses, which access e-government applications and instead support an open standard that enables a multivendor environment.

Promoting harmonization: Among governments, close coordination is needed in relation to technologies and, perhaps more importantly, in relation to underlying processes and structures between different government entities and between governments of different Member States. With that, eGovernment can be based on a coherent interoperable technical infrastructure that supports a well functioning Single Market for devices, equipment and software for government purposes and for provision of eGovernment services to citizens and enterprises.

As a constituency for standardization: Public administrations should actively engage with industry in both de jure and ad-hoc standards making activities in order to make their user needs known. Based on that industry led standards setting efforts can account for the needs of the public sector in developing standards.

Public administrations should evaluate open source and commercial software solutions on an equal footing. Objective criteria such as degree of interoperability, cost, functionality, security, innovation, support for open standards and adaptability to future technologies should be used in selecting technology solutions. Mandates or preferences for ICT products based on their method of development should be avoided.

Consumer interest also has a role in public policy related to interoperability: Governments support, through the legal system, the individual consumer against abuses of market power by stronger commercial players. Governments can protect users against such abuses in the area of interoperability by, for example, declaring restrictive clauses in purchasing contracts to be invalid if they violate competition law or other legislation protecting the consumer's interest.

Vis-à-vis other policy goals: The benefits yielded by, and encouragement of, open standards should not cause policymakers to think that intellectual property protection is not an essential goal of any solid public policy that aims to foster research, innovation and high-tech industry. To the contrary, without strong intellectual property protections, the investments and innovations that lead to new products for all users (the growth of which is facilitated by open standards) would not happen.

With regard to the European Union legislation affecting industry, it seems that the necessary and sufficient legislation is in place. The interoperability exceptions in relevant Directives on copyright ("the Software Directive" and the "Copyright Directive"), as well as Competition law seem to provide an established and predictable legal framework. The standardisation article 17 in the new Framework Directive and other articles in the Framework and Access Directives for electronic communications with its comitology mechanisms show the high interest of policy and public authorities in interoperability. Within this legal framework, more targeted and specific policy measures in support of open standards may be justified in certain cases.

EICTA recommends that Governments, when investing into ICT infrastructure for eGovernment for citizens and for internal administration use, will:

- **Develop** public procurement policies that promote interoperability, in particular by purchasing solutions compliant with open standards developed and supported by industry and thereby ensuring that government installations contribute to interoperability. Public administrations should aim to operate highly flexible, vendor independent, interoperable ICT architectures, which are responsive, open to new technological developments and value-driven.
- **Focus** on interoperability of IT systems. Governments collect vast amounts of data but too frequently are incapable of effectively accessing and utilizing information from disparate, non-interoperable systems. A single platform or vendor's technology should not be imposed on citizens accessing e-government applications. Interoperability should be enabled through open standards developed by industry, as well as publication of specifications for application program interfaces, protocols and data and file formats. The specifications should be published without restrictions that would limit implementation.
- **Provide** a variety of interoperable technology choices particularly in e-government applications, for the use of citizens in connection with accessing, providing and utilizing government information and services. Governments have an interest in an open, healthy and competitive IT marketplace. Where open standards are not yet available, governments should ensure that their suppliers are committed to ensuring "openness" of the technology in a timely fashion.
- **Evaluate** open source solutions on an equal footing with commercial software solutions in public sector procurements. Base procurement decisions on objective criteria such as degree of interoperability, cost, functionality, security, innovation, support for open standards and adaptability to future technologies.
- **Reject** mandates or preferences for any ICT products based on their method of development. Mandates and preferences for a certain method of development can get in the way of rational business decision making. Any procurement decisions should be made on solid business rationale such as appropriateness to task, ability to interoperate and cost-effectiveness, regardless of the development methodology used. Open source and commercial software can coexist and complement each other in an ICT

6 CONCLUSIONS

infrastructure.

Industry has wide experience in delivery of interoperable solutions and is increasing its efforts to meet the growing challenge. There are a number of main findings in relation to interoperability:

- **Interoperability has a major positive impact to innovation, growth, employment and competitiveness.**

Interoperability is the main counterforce to fragmentation, which potentially destroys the "network effects" opportunity in the new converging services to boost European competitiveness, productivity, growth of GNP and high employment. Interoperability also favourably influences trade both within Europe and with other countries as it supports the cross border movement of goods and services. The importance of achieving interoperability must not be understood to prohibit market experimentation and innovation. Information increases in utility – and value – when it is accessible to more users than before – or in a larger variety of situations than before. Convergence of technologies – the promise of the wider accessibility to information over a variety of devices and connections – is a huge opportunity justifying investment into removing interoperability barriers.

- **Interoperability is in the interest of all stakeholders in the value chain – and requires active measures from all of these stakeholder groups.**

Interoperability gives to content and service providers the ability to reach the maximum audience. To developers of solutions it gives predictability that the software program will run on multiple platforms, with other programs and supporting data and content generated by other applications. Vendors of servers, network and terminal solutions will reap a global un-fragmented market – without the need to develop, distribute and maintain different variants depending on market. Interoperability will give end users a better and faster information flow and different vendor solutions that work together seamlessly.

- **While interoperability may not be a prime consideration when new technologies are introduced and used by groups of early adopters, achievement of broad-based interoperability based on open standard specifications becomes progressively more important as a larger market develops.**

Interoperability within an "island" of users may be achieved among users having the same solution. Standard interfaces that bridge the gaps between such islands can provide for interoperability. However, parallel interface standards can result in significant increases in cost and significantly reduce the accessible market size. The implementation and testing challenges for services and devices increase exponentially when multiple redundant functionalities must be supported. The added complexity may result in very long delays, even years, in the achievement of what would amount to a mass-market availability of interoperable services.

- **For an interoperable competitive multivendor environment, interoperability is best facilitated by interface specifications adopted by standards organizations (including industry forums) that meet the criteria for "openness".**

The control inherent in the proprietary nature of a proprietary specification represent a risk to other market participants in case a specification is reasonably necessary for interoperability when those specifications are not available: The wider the adoption sought for interface standard, the more important it is to ensure that specifications be made available without significant restrictions on implementation.

For important interoperability-related functions, open standard implementation should be supported also where service providers and vendors were to prefer a proprietary implementation or a proprietary specification for particular commercial reasons. The common interest in interoperability means that proprietary alternatives should be supported only in addition to but not as substitutes for open standard solutions.

- **Both proprietary products and open source products can deliver good multivendor interoperability using open standard interface specifications.**

Open Source Software (OSS) can support reusability of good implementations and is often a significant boost to the market adoption of open standards. Customer-driven incentives for interoperability and open standards are equally applicable to non-OSS and OSS software offerings. "Open source" and "open standards" are two distinct concepts. Open standards can be well implemented by software irrespective of whether it is open source software or other software. Access to source code can also enhance trust in interoperability through transparency and it also may support platform portability.

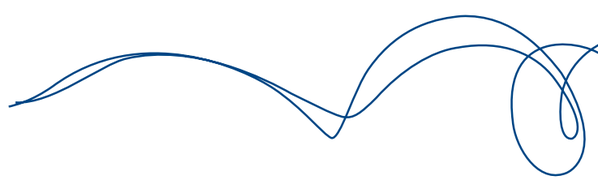
Computing environments will however remain heterogeneous including both commercial software and open source software – open source model does not invalidate the need to uphold the incentives for commercial software development. Also, it is relevant to note that OSS software is increasingly used for commercial purposes, such as the sale of services, hardware and other non-OSS software. There will remain a need for commercial software offerings where source code is not disclosed – and in the financial rewards inherent in the proprietary and undisclosed design of the successful commercial software products.

- **Governments should develop public procurement policies that promote interoperability, in particular by purchasing solutions compliant with open standards developed and supported by industry and thereby ensuring that government installations contribute to interoperability.**

Governments should develop procurement policies that promote interoperability through purchasing solutions, focus on interoperability of IT systems, provide a variety of interoperable technology choices in e-government applications, evaluate open source solutions on an equal footing with commercial software solutions in public sector procurements, and reject mandates or preferences for any ICT products based on their method of development. Public administrations should aim to operate highly flexible, vendor independent, interoperable ICT architectures, which are responsive, open to new technological developments and value-driven.

- **Public authorities should maintain technological neutrality and provide incentives to continue to innovate.**

Public administrations should evaluate open source and commercial software solutions on an equal footing. Procurement decisions should be made on solid business rationale such as degree of interoperability, cost, functionality, security, innovation, support for open standards and adaptability to future technologies.



EICTA MEMBERSHIP

EICTA, founded in 1999 is the voice of the Information and Communications Technology and Consumer Electronics Industry in Europe. It is composed of 51 major multinational companies and 32 national associations from 24 European countries. In all, EICTA represents more than 10,000 companies all over Europe with more than 2 million employees and EUR 200 billion in revenues.

The membership of EICTA:

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National Trade Associations:

Austria: FEEI; **Belgium:** AGORIA; **Czech Republic:** SPIS; **Denmark:** ITEK, ITB; **Finland:** SET; **France:** ALLIANCE TICS, SIMAVELEC; **Germany:** BITKOM, ZVEI; **Greece:** SEPE; **Hungary:** IVSZ; **Italy:** ANIE, ASSINFORM; **Ireland:** ICT Ireland; **Latvia:** LITTA; **Lithuania:** INFOBALT; **Malta:** ITTS; **Netherlands:** Nederland-ICT; **Norway:** ABELIA, IKT Norge; **Poland:** KIGEIT, PIIT; **Slovakia:** ITAS; **Slovenia:** GZS; **Spain:** AETIC; **Sweden:** IT Företagen; **Switzerland:** SWICO, SWISSMEM; **United Kingdom**: INTELLECT; **Turkey:** ECID, TESID.

(*) Upon approval by the EICTA General Assembly

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