



THE UNIVERSITY OF  
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# ISYS90048 Managing ICT Infrastructure

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## Teaching Session 04a

- Demonstrate an understanding of the need for the achievement of interoperability in enterprise-wide ICT infrastructures
  - Overview and relevance of ICT standardisation
  - Interoperability and interoperability frameworks
- Demonstrate an understanding of the role and importance of ICT service provision and acquisition in the responsibilities of an ICT infrastructure manager



## Standards

- Definition: What are standards?
  - A measure of quality
  - They address the needs of interoperability
  - Ensures safety and reliability
  - They are referenced by regulators and legislators for protecting user and business interests and in support of government policies
- **Standards are there to make things work: safely, efficiently and reliably**
- Business benefits:
  - Open up market access
  - Provide economies of scale
  - Encourage innovation, provide business confidence
  - Increase awareness of technical developments and initiatives
  - Customer confidence
  - Reduce market risk, level playing field



## Standards

- Industry standards are generally the minimal accepted requirements followed by that particular industry
- A standard enables effective coordination of activities between independent developers, carriers, manufacturers or users of technologies
- A standard enables agreement to be reached on the solutions of recurrent problems
- Standards seeks to:
  - Protect public health and safety
  - Assure the public of conformance to minimum standards of quality
  - Increase the efficiency of design, manufacturing and use
  - Increase the effectiveness of interoperability
  - Improve economic performance





## The Standardisation Process

Standards may arise through the following processes:

### 1. De facto / market driven choice

- One or more developers propose, design and market products that conform to a given specification
- Due to the extent of market penetration, the market players may decide which of one or more competing specifications is to be chosen as the de facto standard
- In a risky marketplace, de facto standards can arise through alliances being formed between established players and new entrants; it is less risky to ally with an established product base than to try to go it alone
- No regulatory or formal standardisation body is involved in the development of the standard
- *De facto: existing in fact but not legally recognised by law*



# The Standardisation Process

## 2. Formal standards

- The specifications of the standard are derived by a recognised standards body
  - For example, the voluntary body International Standards Organisation (ISO)
- A standards body may have a more or less defined membership
- For example, the TCP/IP standards have been developed through RFCs (requests for comments)
  - Someone proposes a standard, which is published and a RFC issued
  - Responses enhance the standard until it becomes acceptable
- Standards bodies have increasingly become more focussed on anticipatory standards of emerging technology
- Frequently such a body will coordinate the ratification of a de facto standard



## The Standardisation Process

### 3. De jure/Regulatory standards

- These standards are developed and ratified by government agencies and are enforced through regulations
  - For example, most of the standards in Occupational Health & Safety regulations
- Relevant where public safety or large economies of scale are present
  - For example, electrical standards & telecommunications standards
- Relevant where early clarification is essential for competitive advantages and as an essential part of the national economic strategy





## Standardisation: Positive Effects

- Promote greater market efficiency and hence market expansion
- Facilitate international adoption and hence trade
- Encourage competition by commoditisation of artefacts/objects
- Reduce barriers to new developers by allowing them to capitalise on established, standardised designs and methodologies
- Reduce barriers to new market entrants especially manufacturers who wish to mass-produce established designs
- Encourage faster diffusion of new technologies and foster innovation by reducing the length of innovation cycles
- Reduce market risk and generate better returns by enhancing consumer confidence
- Protect consumers from unsafe or unproven technologies and practice
- Enhance interoperability between products and processes





## Standardisation: Negative Effects

- Standards can be developed by the first entrants and favour their own design, despite inefficiencies or lack of global applicability
- Can consume effort & time & inhibit further development of new technologies
- The standardisation process does not ensure that the best, most efficient or effective design wins
  - The outcome can be adoption of an inferior design
    - Eg: the SMTP (Simple Mail Transfer Protocol) standard for mail interchange has several glaring security weaknesses that have been tolerated because it has widespread usage



## Relevant International & National Standards Bodies

- International Standards Organization (ISO)
  - ISO 14000 Environmental Management Standards – Recycling
  - ISO 9000 Quality Management Standards
  - ISO 27001/2 IT Security Standards
- Technological Standards : Internet Engineering Task Force (IETF)
- World Wide Web Consortium (W3C) – deals with language and protocol standards for the Web; also software development
- Institute of Electrical and Electronic Engineers (IEEE) – deals with electricity & communication standards (IEEE 801.x)
- American National Standards Institute (ANSI)
- Standards Australia (SA)
  - Established in 1992 by the Australian Government
  - Develops and maintains over 7000 Australian standards
  - Consists of committees of interested parties, governments, industry and professional bodies, academics and consumers
- Standards New Zealand (SNZ)
- Joint Accreditation System of Australia and New Zealand



## Interoperability and Standards

- Why are they important?
  - Complex ICT systems must communicate and interwork on all levels
    - This is interoperability
  - ICT standards facilitates interoperability between products in a multi-vendor, multi-network and multi-service environment
    - Standardisation for enterprise interoperability is vital
  - Both are vital for today's connected world
  - For example: ensure Interoperability and reduce integration complexity



## Interoperability

**Definition:** Interoperability describes the extent to which systems and devices can exchange data, and interpret that shared data

- Interoperability relates to the interaction between systems and their ability to exchange and use information





## Interoperability cont

- An Interoperability Framework: a set of standards and guidelines that describes the way in which systems and organisations have agreed to interact with each other
  - The LISI Reference Model: LISI or ‘levels of information systems interoperability’
  - The ATHENA Interoperability Framework (AIF)
  - The European Interoperability Framework (EIF)
    - A generic framework applicable to all public administrations in the EU and lays out the basic conditions for achieving interoperability
- Interoperability is usually one of the Enterprise Architecture Principles that define the underlying general rules and guidelines for the use and deployment of all ICT resources and assets across the enterprise



## Interoperability Issues & Challenges

- Incompatibility and data conflicts
- Lack of interoperability can jeopardise competitive advantage
- Compliance
- No true open platform



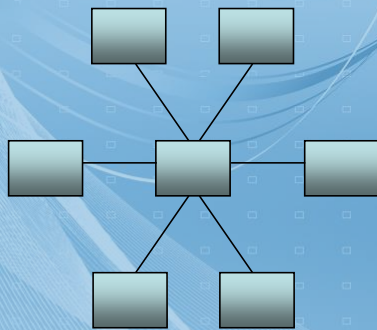
## Interoperability Principles

- Accessibility: Interfaces, Web Accessibility Guidelines, use of multimedia, stylesheets, simple language
- MultiLingualism: Clear, unambiguous language, Reinforce text with explanatory diagrams or images, automatic translation systems
- Security: Conduct Risk Assessment , security policies are adopted and enforced, Identification, Authentication, Non-repudiation, Confidentiality
- Privacy: Compliance with the Federal *Privacy* Act (1988), personal data protection, compliance with Freedom of Information acts
- Open Standards: minimum characteristics of open standards is met,
- Open Source: Open Source products are publicly available, specifications source code is available
- Interfaces: Standardise the interfaces between systems, standardisation of the interfaces is sufficient for systems to be interoperable
  - This requires a whole-of-enterprise or whole-of-government approach to standardisation and interoperability
- Multilateral: See next slide

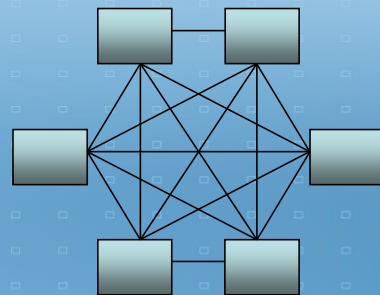


## Interoperability Principles: Multilateral

- Seek multilateral interface solutions, rather than bilateral solutions
- Multilateral solutions involve N interfaces between N distinct systems and 1 common system
- Bilateral solutions can involve up to  $N*(N-1)/2$  interfaces between N distinct systems



Bilateral Solution



Multilateral Solution





## Interoperability types

### 1. Organisational Interoperability:

- Organisational interoperability is defined as where the organisational components of a system are able to perform seamlessly together

### 2. Semantic Interoperability

- The ability of computer systems to exchange data & information with unambiguous, shared meaning and that the meaning is understandable by every user, application and service that uses that data & information
  - Semantic interoperability is a prerequisite for the front-end multilingual delivery of services to users

### 3. Technical Interoperability

- Technical interoperability covers the technical issues of linking computer systems and services
  - Key aspects include open interfaces, interconnection services, data integration and middleware, data presentation and exchange, accessibility and security services, communication protocols, data exchange and message passing



## References

- Gasser, U & Palfrey, J. (2007) “When and how ICT Interoperability Drives Innovation”, Berkman Publication Series, Harvard University Research Centre for Information Law, Nov 2007. 28 pp.
- European Commission (2017). European Interoperability Framework. 47 pp.
- Intel Corporation. The Role of Standards in driving Cloud Computing Adoption. 6 pp.
- National Computing Centre (NCC), (2005). *Developing a successful governance strategy, A Best Practice guide for decision makers in IT*, 68 pp.



## Videos

- ICT Standards (6.40 min)  
<https://www.youtube.com/watch?v=tWZRbfww1Us>
- Interoperability (2.27min)  
[https://www.youtube.com/watch?v=iKF\\_W8emgRE](https://www.youtube.com/watch?v=iKF_W8emgRE)