



International Standardization in Software and Systems Engineering and the Global IT Market

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CONTENT

- **What is a standard?**
- **Types of standards**
- **International standardization**
- **Value-add of international standardization**
- **International IT standardization**
- **Software and system engineering**
- **The global IT market**
- **SC7 Standards and the Global IT Market**
- **Conclusions**

Introduction - Standardization

What is a Standard?

Guideline documentation that reflects agreements on products, practices, or operations by nationally or internationally recognized industrial, professional, trade associations or governmental bodies

or

is accepted as a de facto standard by industry or society.

Types of Standards

- **Organization Standards**
 - Such as internal company standards
- **Market Standards (De Facto)**
 - Such as Microsoft Windows
- **Professional Standards**
 - Developed by Professional organizations (such as IEEE)
- **Industry Standards**
 - Developed by industrial consortia (such as the OMG)
- **National Standards**
 - Developed by national standards organization
- **International Standards**
 - Developed by formal international standard organization

International Standardization

(Technical standards)

- **International Telecommunication Union (ITU)**
 - **Founded: 17 May 1865**
 - **Scope: international organization within the United Nations System where governments and the private sector coordinate global telecom networks and services.**

- **International Organization for Standardization (ISO)**
 - **Founded: 1947**
 - **Scope: The mission of ISO is to promote the development of standardization and related activities in the world with a view to facilitating the international exchange of goods and services, and to developing cooperation in the spheres of intellectual, scientific, technological and economic activity.**

- **International Electromechanical Commission (IEC)**
 - **Founded: June 1906**
 - **Scope: the leading global organization that prepares and publishes international standards for all electrical, electronic and related technologies.**

Normal (ISO) Standardization Process

The normal process for international standardization is:

- **Stage 0 (preliminary stage):** A study period is underway.
- **Stage 1 (proposal stage):** An New Project is under consideration.
- **Stage 2 (preparatory stage):** A Working Draft is under consideration.
- **Stage 3 (committee stage):** A Committee Draft /Final Committee Draft is under consideration.
- **Stage 4 (approval stage):** An Final Draft International Standard is under consideration.
- **Stage 5 (publication stage):** An International Standard is being prepared for publication.

Available Processes

- **International standards can come into being through different processes:**
 - **as a proposal that is then developed in working groups (3-5 years);**
 - **as a proposal with a base document which can be internally *fast-tracked*, e.g. processed through a compressed schedule (about 2 years);**
 - **as a proposal with a complete document that can be fast-tracked by JTC 1 (one four months ballot) (< 1 year);**
 - **as a proposal with a complete document that can be proposed by external (but recognised) organisations and fast-tracked as a 4 month ballot - known as the PAS process (1-2 years).**

Time to market

The perception that the development of formal international standards always takes an exceeding amount of time is basically wrong.

When it is the case, this is for usually one (or a combination) of the following:

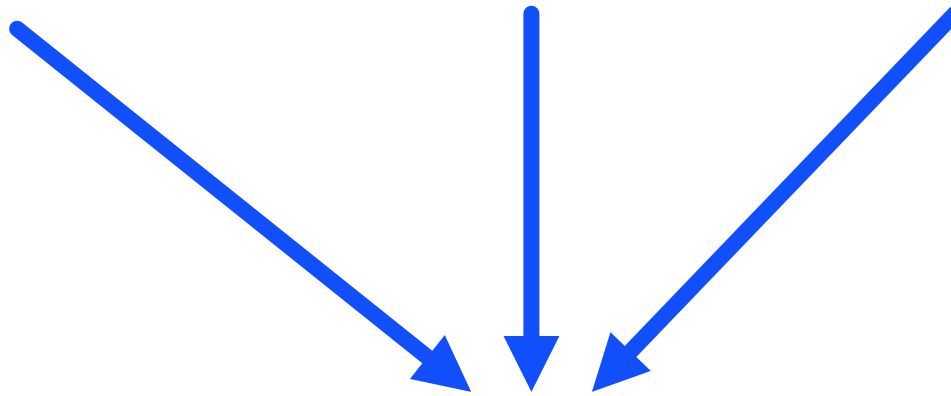
- The topic is new and it takes time to come with a unified international view**
- International consensus on the topic is weak due to positions that are difficult to bring together**
- Management of the development process is sub-optimal**

Internationalization of Standards

National
Standards

Professional
Standards

Industry
Standards



**International
Standards**

Consensus

- **Key concept in the development of International standards**

- **ISO defines consensus as [4]:**

General agreement, characterized by the absence of sustained opposition to substantial issues by any important part of the concerned interests and by a process that involves seeking to take into account the views of all parties concerned and to reconcile any conflicting arguments.

Consensus

In a nutshell, this means:

- **That all the parties involved were able to voice their views.**
- **That the best effort was made to take into account all of the above views and resolve all issues (meaning all comments tabled during a ballot).**
- **That nearly all or (ideally) all the parties involved can at least live with the final result.**

Value add of International Stds

In addition to the Brand:

- **They represent an international consensus attained through a very rigorous and uniform process**
- **International standards usually represent set of conventions and/or technical requirements or practices that are relatively stable**
- **The development process makes it relatively difficult and costly for special interests to take over a given standardization project, especially if the topic is controversial.**

ICT Standardization

In 1988, ISO and IEC put together a Joint Technical Committee, Joint Technical Committee 1 (JTC 1) with the following mandate:

Standardization in the field of Information Technology.

Information Technology includes the specification, design and development of systems and tools dealing with the capture, representation, processing, security, transfer, interchange, presentation, management, organization, storage and retrieval of information

| Technical Areas | JTC1 Subcommittees and Working Groups |
|---|--|
| Application Technologies | SC 36 - Learning Technology |
| Cultural and Linguistic Adaptability and User Interfaces | SC 02 - Coded Character Sets SC 22/WG 20 – Internationalization SC 35 - User Interfaces |
| Data Capture and Identification Systems | SC 17 - Cards and Personal Identification SC 31 - Automatic Identification and Data Capture Techniques |
| Data Management Services | SC 32 - Data Management and Interchange |
| Document Description Languages | SC 34 - Document Description and Processing Languages |
| Information Interchange Media | SC 11 - Flexible Magnetic Media for Digital Data Interchange SC 23 - Optical Disk Cartridges for Information Interchange |
| Multimedia and Representation | SC 24 - Computer Graphics and Image Processing SC 29 - Coding of Audio, Picture, and Multimedia and Hypermedia Information |
| Networking and Interconnects | SC 06 - Telecommunications and Information Exchange Between Systems SC 25 - Interconnection of Information Technology Equipment |
| Office Equipment | SC 28 - Office Equipment |
| Programming Languages and Software Interfaces | SC 22 - Programming Languages, their Environments and Systems Software Interfaces |
| Security | SC 27 - IT Security Techniques SC 37 - Biometrics |
| Software and Systems Engineering | SC 07 - Software and System Engineering |

The Global ICT Market

Markets Size (10⁹ US \$)

ICT Vendor 2002

| | |
|---------------------------------------|--------------|
| Telecommunications equipment | 380 |
| Computer Systems Hardware | 240 |
| Software Licenses | 70 |
| Project Oriented IT Services | 250 |
| Semiconductors | 150 |
| Support/Management IT Services | 350 |
| TOTAL | 1 440 |

Reference: R.Fulton, COM-15-1667, Predicts 2002 – What’s Ahead for the IT Industry, Gartner Research, Research Note, 2002-01-08

http://www.adabasnatural4ever.com/industry_news/media/predicts_2002_whats_ahead_for_the_it_industry.pdf

Computer Game Market (billions of \$ US)

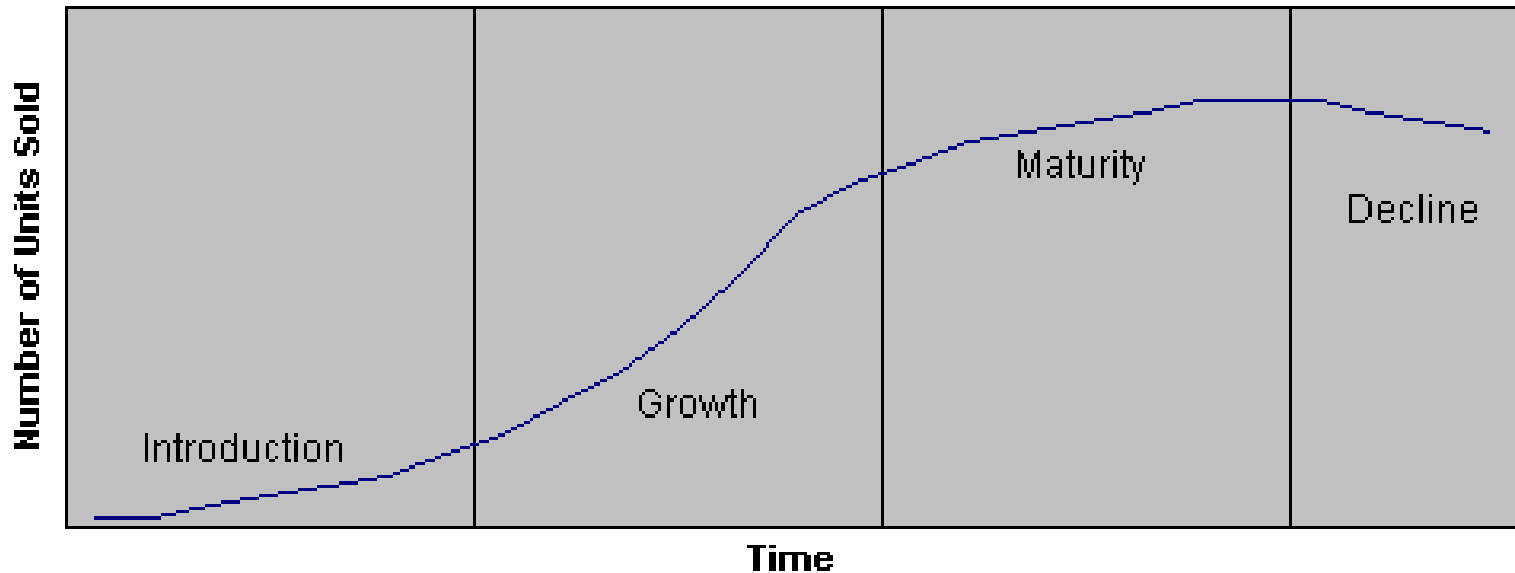
| | 2000 | 2001 | 2002 | 2003 |
|----------------------------|-----------|-----------|-----------|-----------|
| Games Software | 13 | 15 | 17 | 19 |
| Cinema box-office receipts | 18 | 18 | 19 | 20 |
| DVD/Video | 18 | 21 | 26 | 30 |
| CDs | 35 | 33 | 32 | 32 |

From: Console wars, Jun 20th 2002 , The Economist http://www.economist.com/displayStory.cfm?Story_ID=1189352

ICT Technology Evolution

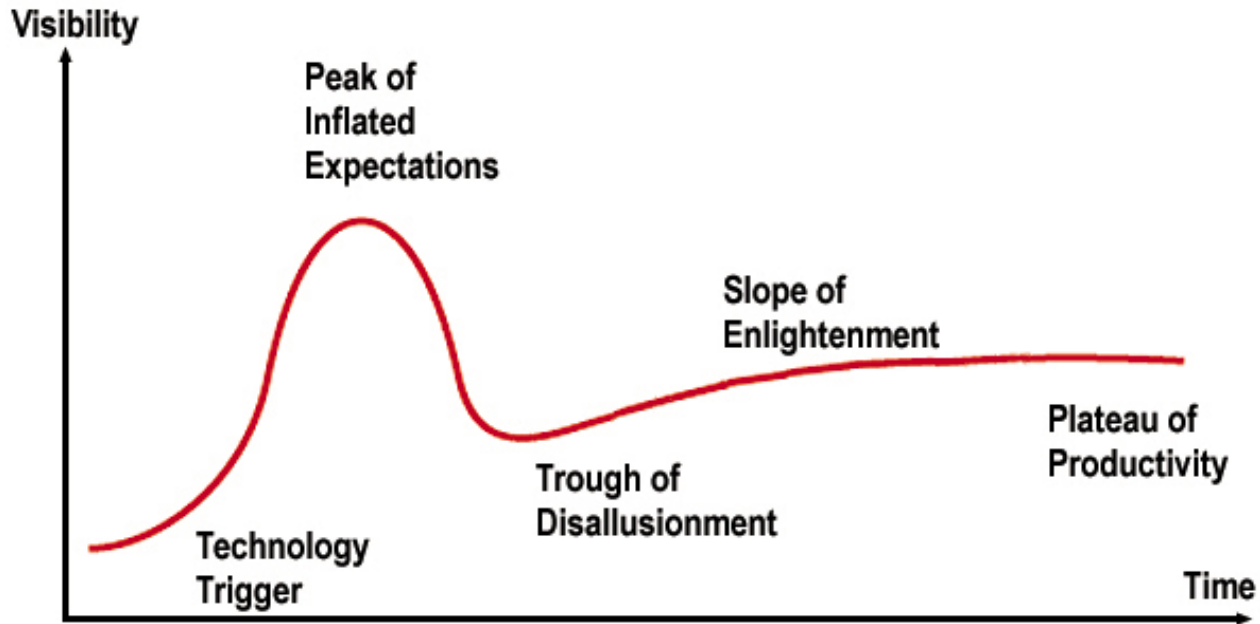
Classic S Curve

Product Life Cycle



<http://www.sfu.ca/~mvolker/biz/pushpull.htm>

Technology Hype Cycle



-Gartner Group

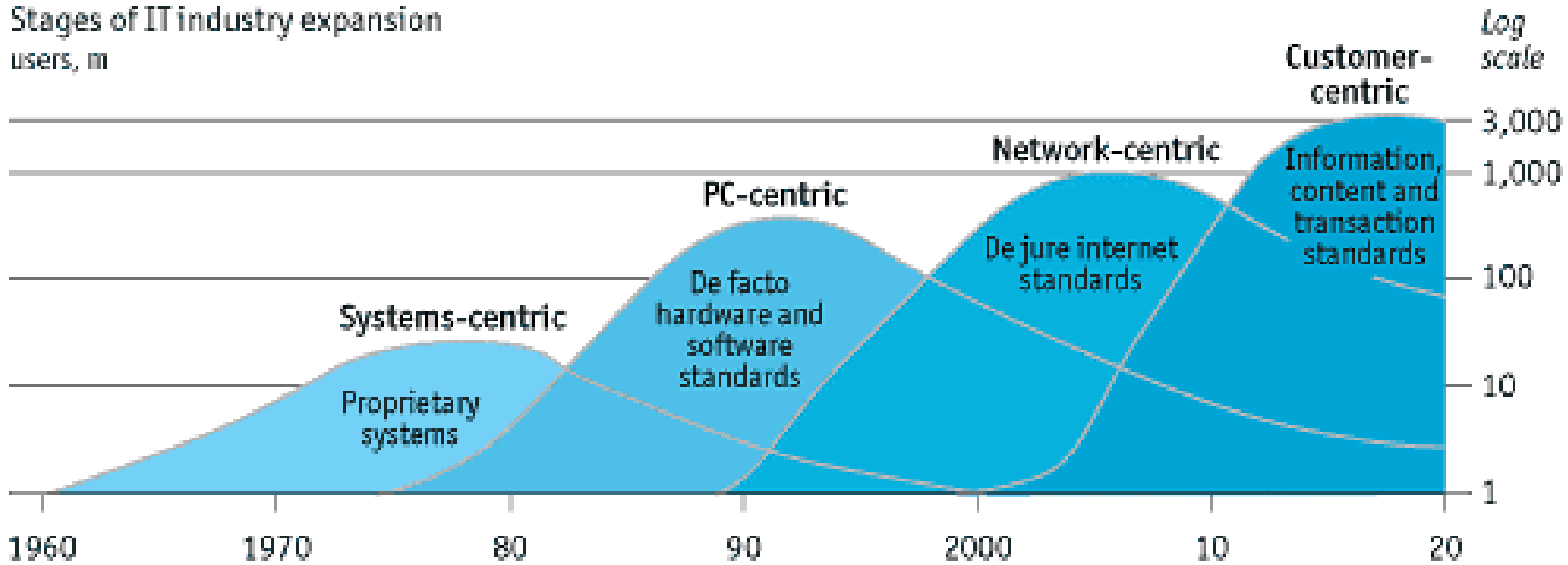
http://www3.gartner.com/1_researchanalysis/mrr/1201mrr.pdf

<http://www.logophilia.com/WordSpy/hypecycle.asp>

<http://www.anvil.eu.com/Documents/PositionPaper5.htm>

What next?

Stages of IT industry expansion
users, m

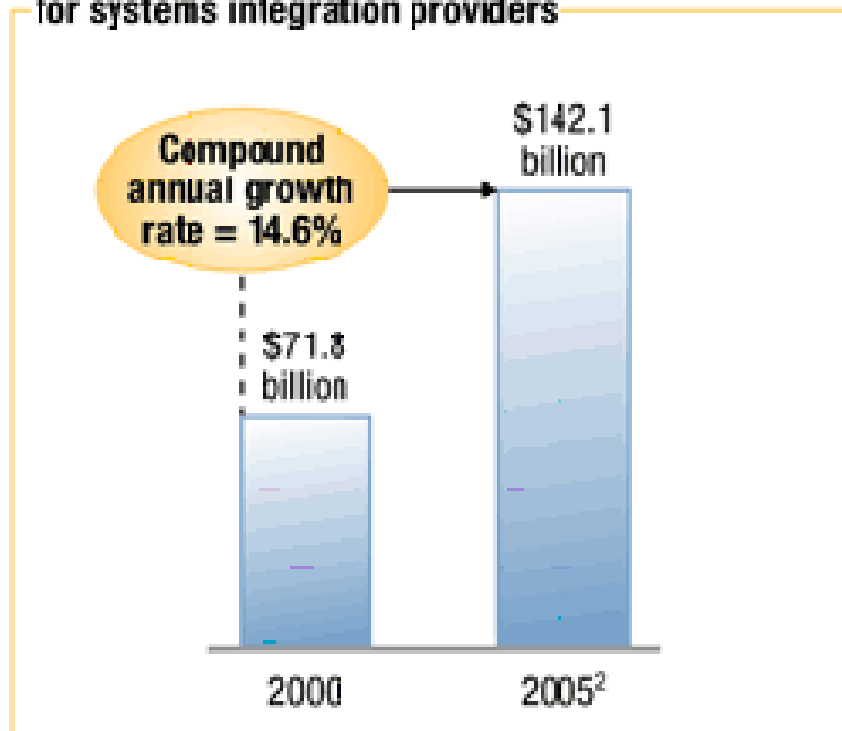


Source: David Moschella

From: *The fortune of the commons*. In *Coming of Age - A Survey of the IT Industry*. The Economist, May 8th 2003

Systems Integration

Projected worldwide revenues
for systems integration providers



From « [When computers learn to talk: A Web services primer](#) », S. Patil et S. Saigal, The McKinsey Quarterly, no 1, 2002, Web exclusive

ICT Evolution Drivers Summary

■ Technology

- **Software engineering is getting more mature**
- **Continuous evolution of IT technologies driven by Moore's Law**

■ Markets

- **A lot of software is bought – not developed**
- **Some IT services are becoming commodities, other remain high value add**
- **The Internet is making geography less relevant for some IT services**

■ Standards

- **A growing international consensus on software and systems engineering good practices is formalized.**

JTC 1/SC7

JTC 1/SC7 MANDATE

*Standardization of processes,
supporting tools and supporting
technologies for the engineering of
software products and systems*

**SOFTWARE and SYSTEMS
ENGINEERING**

Project
Management

Industrial
Engineering

Quality
Management
(ISO TC 176)

**APPLICATION
DOMAINS
(many TCs)**

Computer
Sciences and
Engineering

Dependability
Engineering
(IEC TC 56)

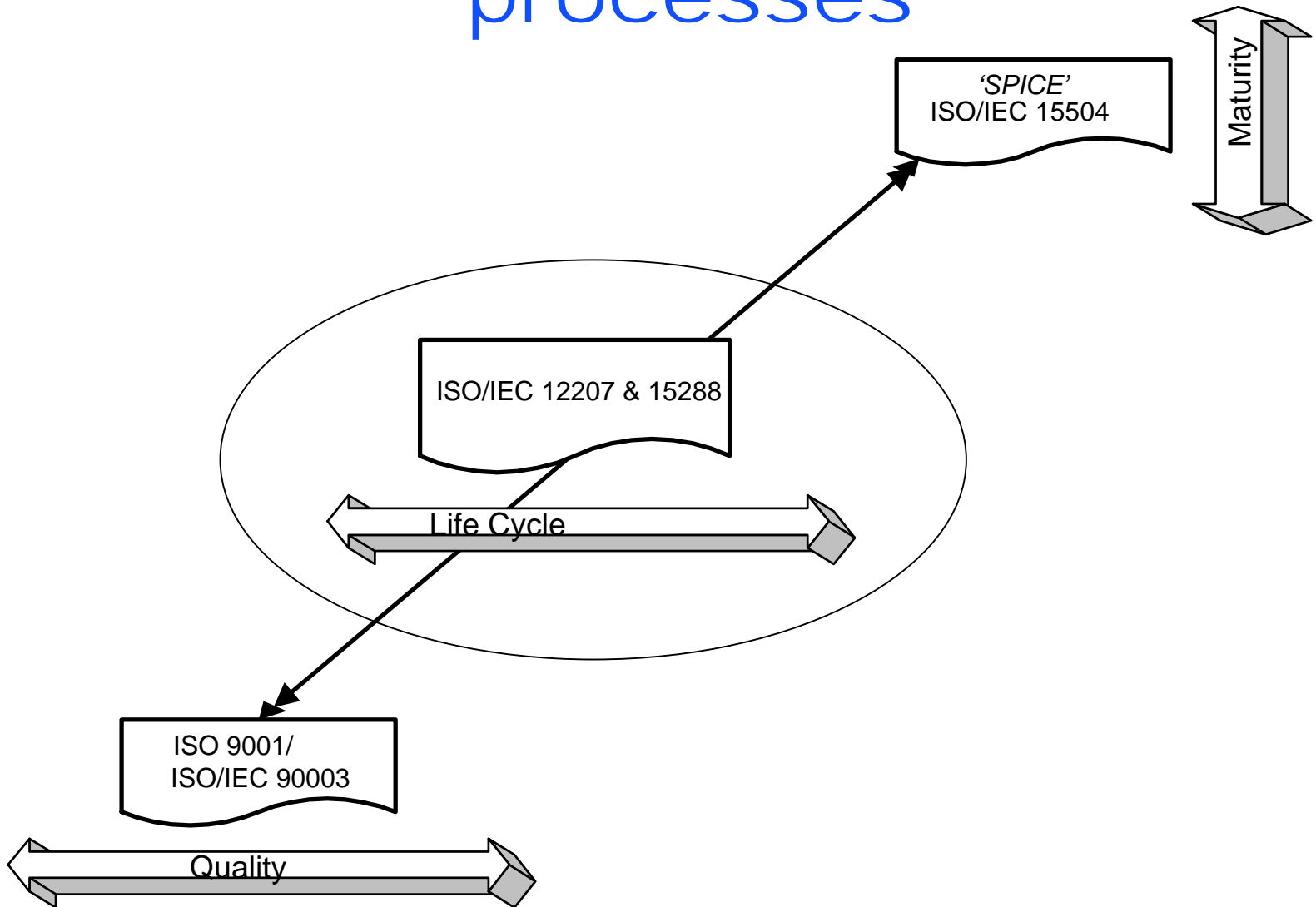
Safety
(IEC TC65),
Security, other
mission-critical

- **Software and system engineering processes**
- **Software system products**
- **Enterprise architecture**
- **Software engineering environment**
- **Software and system engineering formalisms**
- **Software engineering body of knowledge**
- **Management of software assets**

Software and system engineering processes

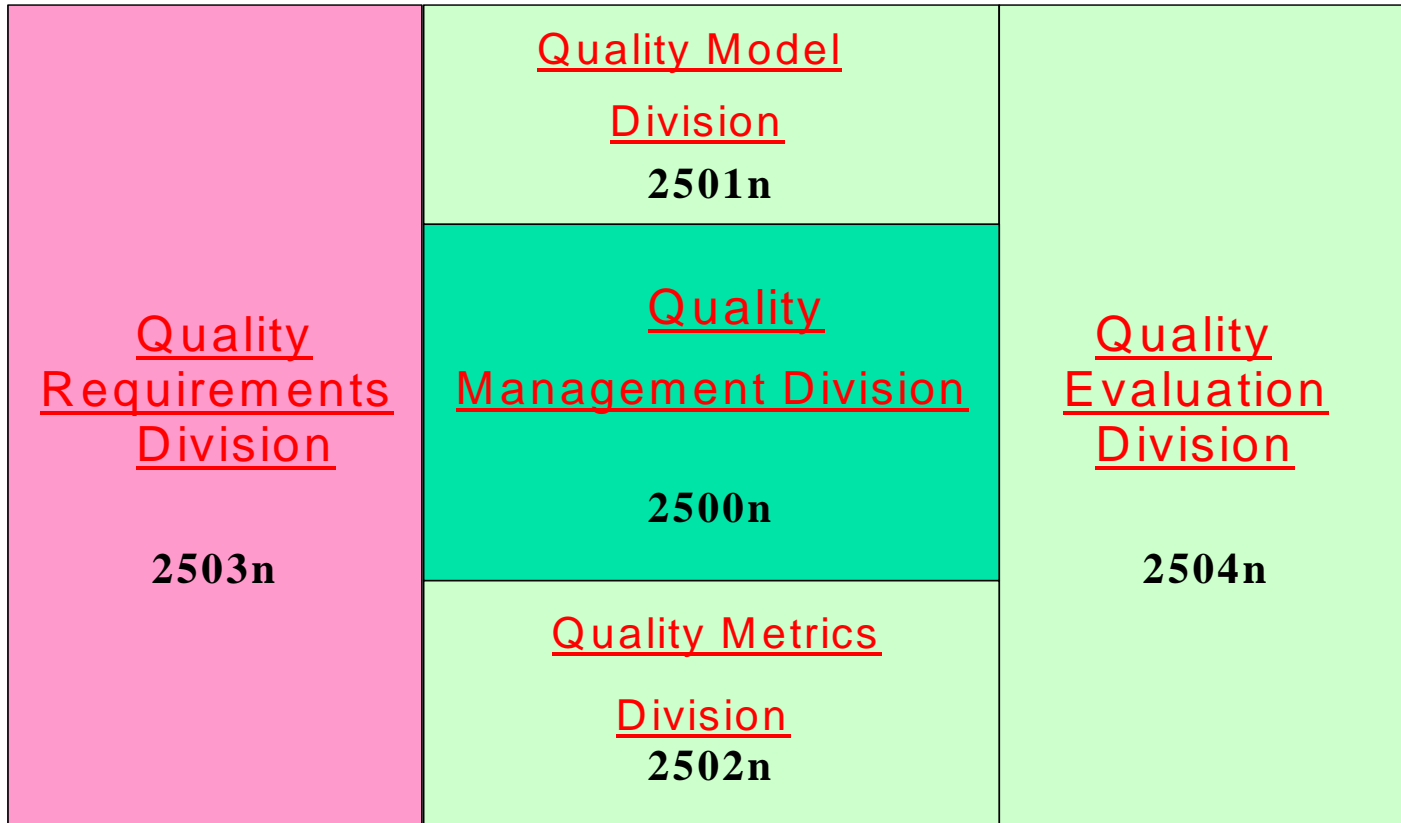
- **Standards which describe good software and system engineering practices, as well as standards to consistently assess organisational software and system engineering practices against a given benchmark**
- **18 published standards**
- **9 active projects**
- **Key standards:**
 - **ISO/IEC 15288 - Systems Life-Cycle Processes**
 - **ISO/IEC 12207 - Software Life-Cycle Processes**
 - **ISO/IEC 15504 series -**
 - **ISO/IEC 90003 -**

Software and system engineering processes



Software system products

- **Standards which allow purchasers and buyers to size and document software products as well as to express, measure and evaluate the quality of the software that is produced and its contribution to the final product or application system**
- **17 standards**
- **16 active projects**
- **Key standards:**
 - **ISO/IEC**



Enterprise architecture

- **In partnership with the Object Management Group (OMG), we are developing and are improving on Open Distributed Processing (ODP) standards to integrate IT and business system definition and provide the software and system engineering tools to implement enterprise information systems**
- **11 standards**
- **10 active projects**
- **Key standards:**
 - **ISO/IEC 14750 ODP – Interface Definition Language**
 - **ISO/IEC 14771 ODP – Naming framework**
 - **ISO/IEC 14753 ODP – Interface references and binding**
 - **ISO/IEC 14752 ODP – Protocol support for computational interactions**
 - **ISO/IEC 13235 ODP – Trading Function**
 - **ISO/IEC 14769 ODP – Type repository**

ODP Standards

■ Goals of ODP standards

- **portability of applications despite heterogeneity**
- **interworking between ODP systems**
 - exchange information *meaningfully*
 - use functionality *conveniently*
- **distribution transparency**
 - hide the consequences of distribution for applications

■ Reference Model for Open Distributed Processing

A specification framework (and standards framework) covering all aspects of distributed systems

- “enterprise”, system, technology
- **comprehensive and coherent object-oriented modelling concepts**
- **Viewpoints and viewpoint specifications:**
 - enterprise
 - information
 - computational
 - engineering

ITU-T Rec. X901-904|ISO/IEC 1746 Parts 1-4

Software engineering environment

- **Standards which make it easier to use software engineering environments and to re-use and re-deploy the data contained in them**
- **2 standards**
- **1 active project**
- **Key standards:**
 - **ISO/IEC**

Software and system engineering formalisms

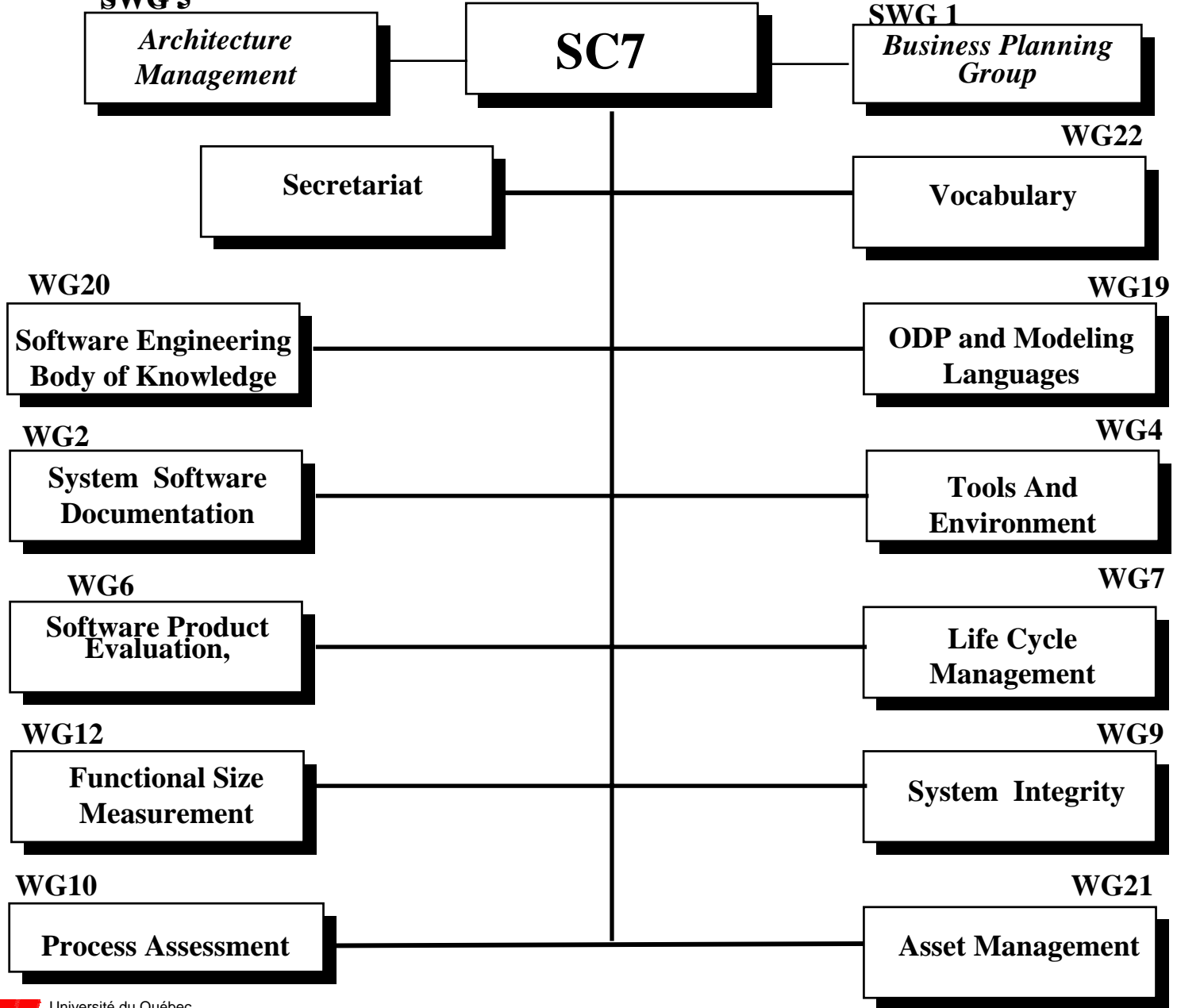
- **Standards for formal representations and modeling of software and systems**
- **5 standards,**
- **1 active project**
- **Key standards:**
 - **ISO/IEC**

Software engineering body of knowledge

- **We are working with the Institute of Electrical and Electronics Engineers Computer Society on their guide to the Software Engineering Body of Knowledge (SWEBOK), with the objective to publish it as a ISO/IEC Technical Report**
- **1 active project**

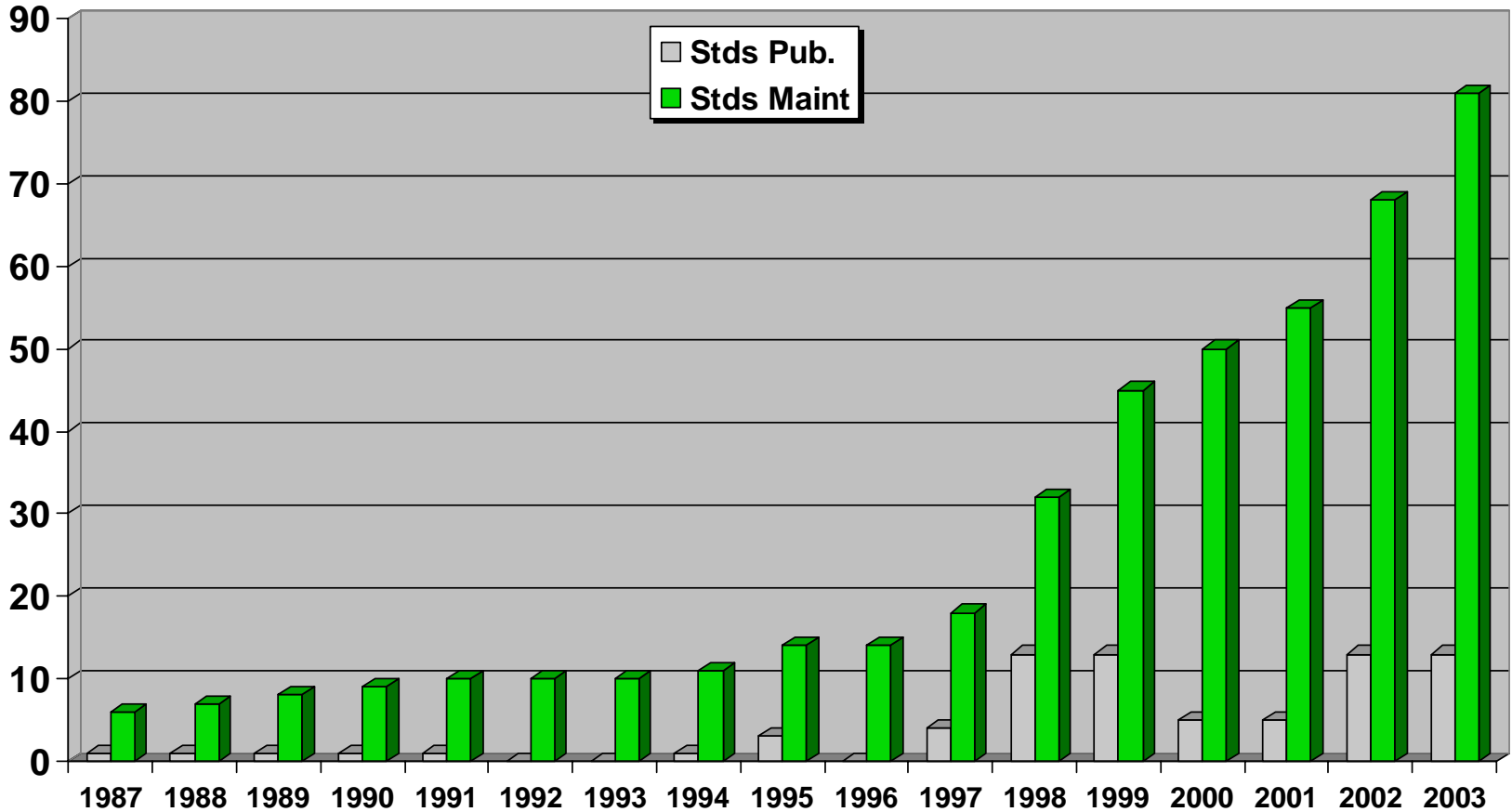
Management of software assets

- **We are working on the development of a standard that will describe the basic requirements of a software asset management environment**
- **1 active project**



SC7 Production (est.)

(No new NWI assumed - exclude dependability, include PAS)



Tools and Methodologies

CDIF

15474
15475
15476

ODP

10746
13235
14750
14752
14753
14769
14771
15414
15935

Modeling

15437
15909
19501

Software Implementation

8807
12119
19500

Tools and environment

14102
14471
14568
15940
18018

SC7 Legacy standards

806 – 5807 – 6593 - 8631
8790 – 11411 –

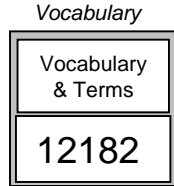
Product

Product Measurement

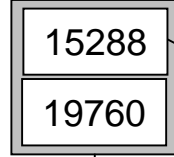
9126
14598
25000

Product packaging

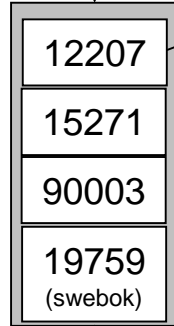
9127



Systems Engineering

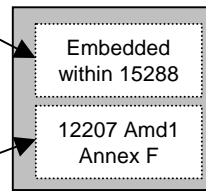


Software Engineering



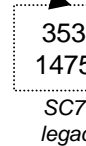
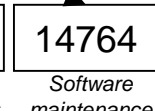
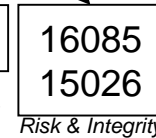
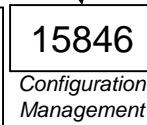
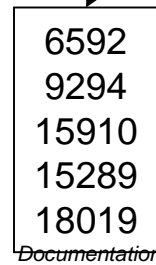
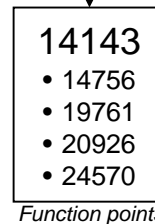
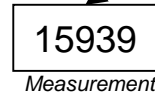
Implementation and Assessment

Process Reference models



Process Assessment

15504



DRAFT
From SC7/SWG5

SC7 Evolution

What's next

- **Completion of program of work**
- **Development of systems engineering standards**
- **Harmonization of process standards**
- **Partnering with IEEE Computer Society and INCOSE**
- **Harmonization and consolidation with IEEE Software and Systems engineering standards**
- **Expansion and rationalization as required**



SC7 Standards and the Global IT Market

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'OFFSHORE' IT

| | |
|----------------------|--|
| LEADER | India |
| CHALLENGERS | Canada, China, Czech Republic, Hungary, Ireland, Israel, Mexico, Northern Ireland, Philippines, Poland, Russia, South Africa |
| UP-AND-COMERS | Belarus, Brazil, Caribbean, Egypt, Estonia, Latvia, Lithuania, New Zealand, Singapore, Ukraine, Venezuela |
| BEGINNERS | Bangladesh, Cuba, Ghana, Korea, Malaysia, Mauritius, Nepal, Senegal, Sri Lanka, Taiwan, Thailand, Vietnam |

The offshore IT race. *SOURCE: CARTNER INC as quoted by the Globe and Mail in IT jobs contracted from far and wide , North American companies are saving money by 'offshoring', John Saunders, The Globe and Mail, 2003-10-14, <http://www.theglobeandmail.com/servlet/story/RTGAM.20031014.gtrjobs14/BNStory/einsider>*



CONCLUSIONS

Conclusions

- **There is a substantive body of international standards Software and System Engineering,**
- **These standards that already influence professional practice.**
- **Software development and IT systems operations represent a significant, and growing, part of the Global IT market.**
- **These standards are thus important for international ICT commerce.**

Conclusions

- **International standardization can occur quite fast**
- **It is thus important to:**
 - **Know about existing international standards**
 - **Be aware of work in progress**
 - **Influence the work in progress**



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