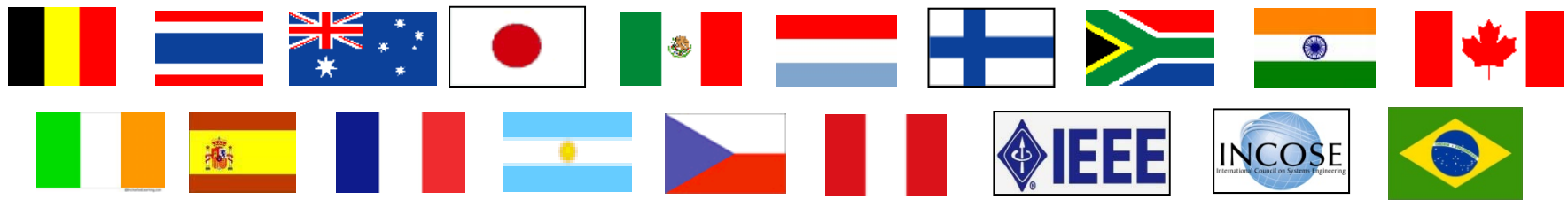# The Development and Diffusion of International Standard ISO/IEC 29110 for Very Small Enterprises Involved in Software Development

Professor Claude Y Laporte, Eng., Ph.D.
Editor, ISO/IEC JTC1 SC7 Working Group 24
Universidad Nacional Autónoma de México
August 26th 2011

Department of Software and IT Engineering

Content

- **Introduction**
- **Needs for Standards for Very Small Entities (VSEs)**
- **Development of ISO 29110 Standards and Guides**
- **Pilot Projects**
- **Next Steps**

VSEs = Very Small Entities are enterprises, projects or departments having up to 25 people.

ISO/IEC JTC 1/SC7 = International Organization for Standardization/ International Electrotechnical Commission Joint Technical Committee 1/Sub Committee 7.

École de Technologie Supérieure (ETS)

Engineering school with over 5400 students, 130 professors, 24 general senior lecturers

About 2000 paid industrial internships in over 800 companies each year (about 10,000 $ per internship)

Undergraduate Programs

- **Software Engineering**
- **IT Engineering**
- Construction Engineering
- Production Engineering
- Electrical Engineering
- Mechanical Engineering
- Logistics and Operations Engineering

- Graduate Programs
  - **Software Engineering**
  - **Information Technology**
  - Other programs

- **650 students**
- **19 Professors** in the department have a mean industrial **experience** of **10 years**.

150 students

www.etsmtl.ca

ÉTS
Engineering for Industry
Department of Software and IT Engineering

3

Quiz
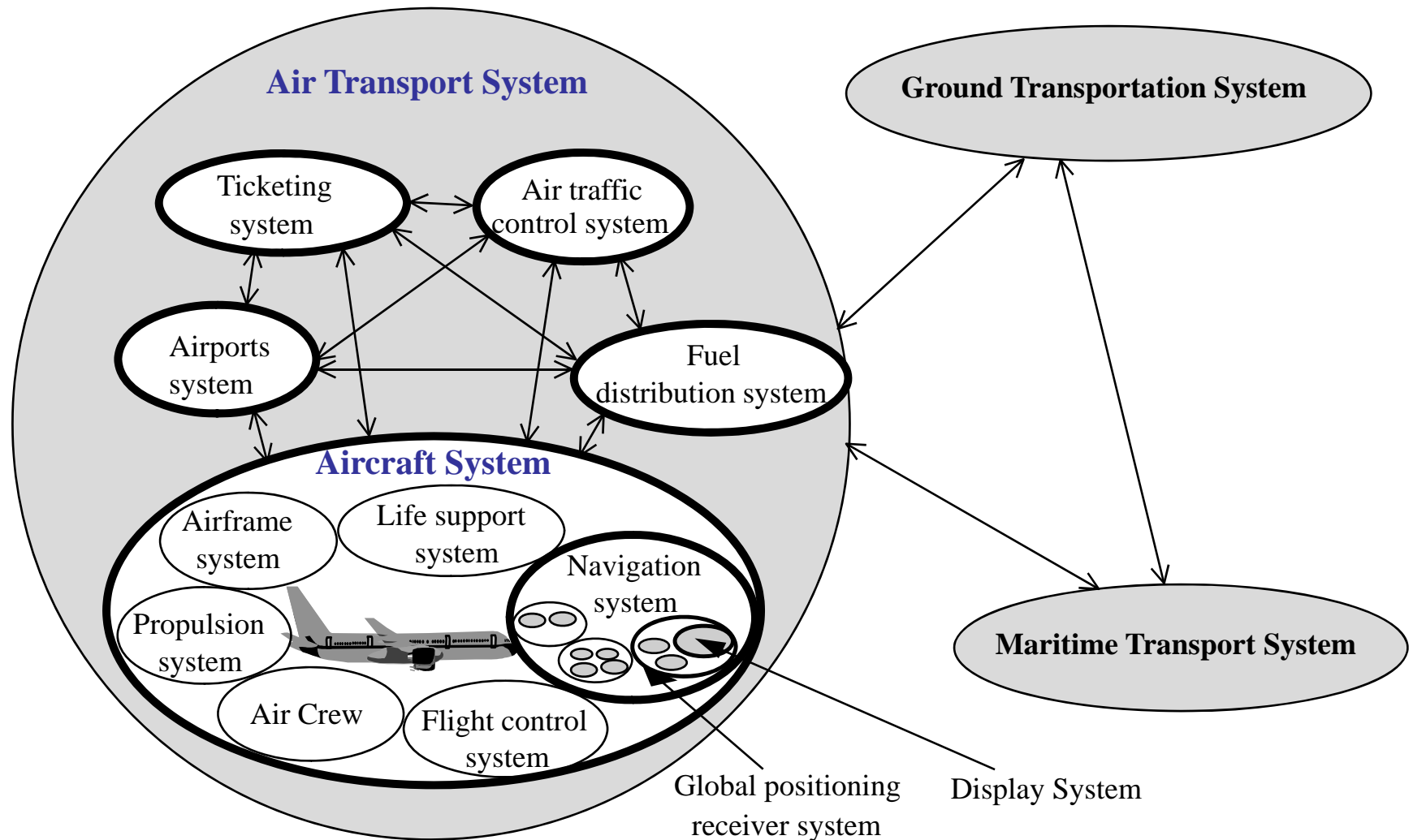
- There are about 'Y errors' per 1000 lines of code
- It takes about 'Z minutes' to <u>find</u> each error
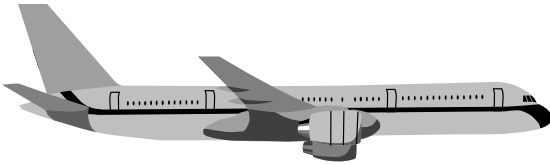- It takes about 'U hours' to <u>correct</u> each error

Answers

- There are about '5 to 15 errors' per 1000 lines of code

- It takes about '75 minutes' to <u>find</u> each error

- It takes about '2 to 9 hours' to <u>correct</u> each error

Example of a Modern Air Transport System

Air Transport System

Ticketing system

Air traffic control system

Airports system

Fuel distribution system

Aircraft System

Airframe system

Life support system

Navigation system

Propulsion system

Air Crew

Flight control system

Global positioning receiver system

Display System

Ground Transportation System

Maritime Transport System

ISO 15288

Boeing 787 Software Development

- Boeing spent roughly $800 million for the development of the software for the 777's 1,280 onboard processors and more than 4 million lines of Ada code

- A quick calculation shows the number of staff-years required to develop the software for the 787 using the benchmarking data (Reifer 2004):

  - $800 million (for the Boeing 777) X 5 (for the Boeing 787) = **$4 billion**

  - Number of lines of code (for the airborne domain) = $4 billion/$200 per line = **20,000,000 lines of code**

  - Number of staff-months = 20,000,000 lines/100 lines per staff-month = **200,000 staff-months**

  - Number of staff-years (based on 10 months of work per year) = 200,000/10 = **20,000 staff-years**

(Long 2008, Reifer 2004)

AIR JAM: The U.S. Federal Aviation Administration spent $2.6 billion trying to upgrade its air-traffic-control system, only to cancel the project in 1994. Gridlocked skies are still with us today.
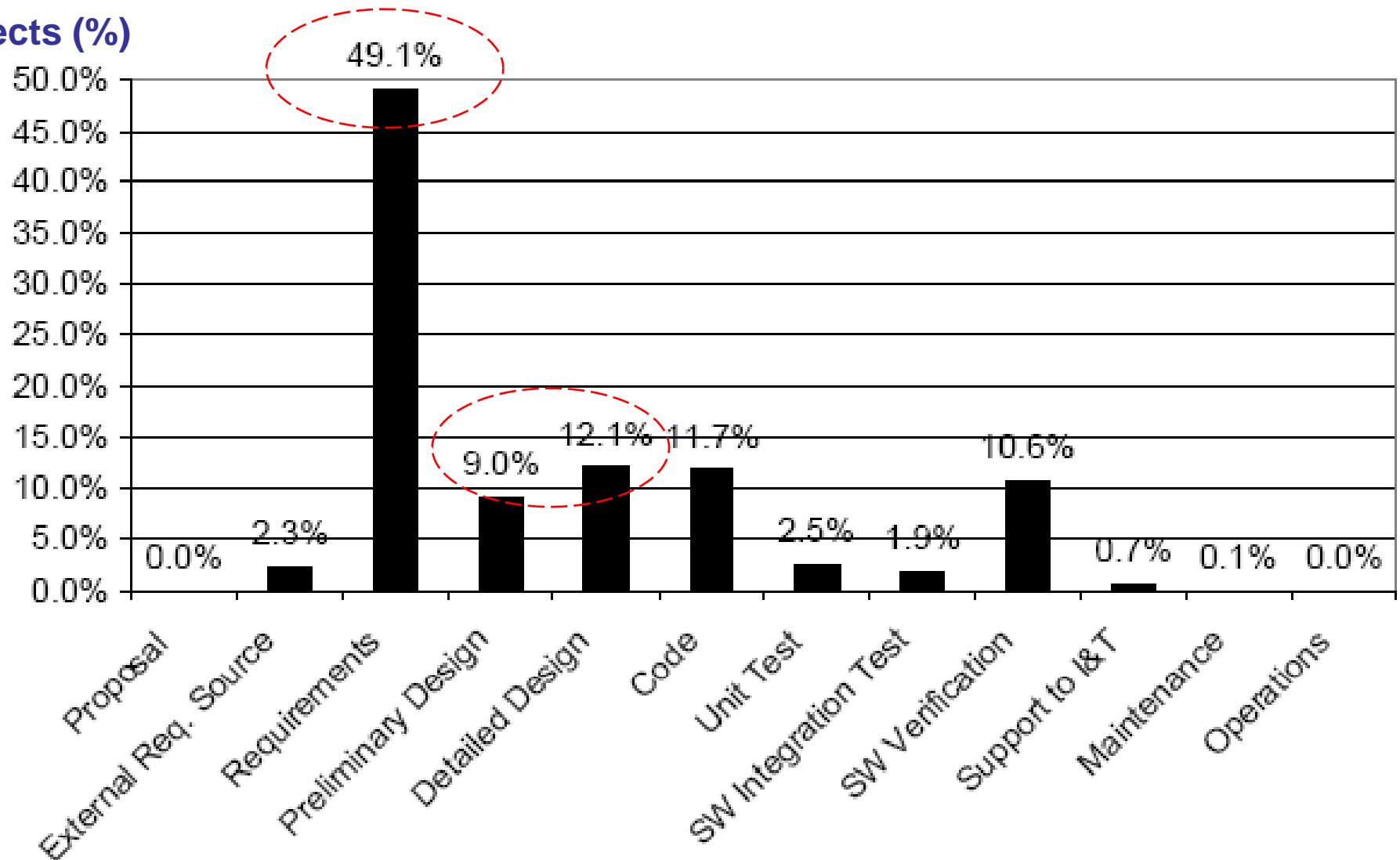
…studies have shown that software specialists spend about <u>40 to 50 percent</u> of their time on <u>avoidable rework</u> rather than on what they call value-added work, which is basically work that's done right the first time…

Dr. Robert Charette,
Why Software Fails
IEEE Spectrum, September 2005.

Software Defect Injection

Defects (%)

50.0% — 49.1% (Requirements)

- Proposal: 0.0%
- External Req. Source: 2.3%
- Requirements: 49.1%
- Preliminary Design: 9.0%
- Detailed Design: 12.1%
- Code: 11.7%
- Unit Test: 2.5%
- SW Integration Test: 1.9%
- SW Verification: 10.6%
- Support to I&T: 0.7%
- Maintenance: 0.1%
- Operations: 0.0%

System Development Phase

(Selby 2007)

Software Defect Detected
when Injected in Same Phase

Defects Detected / Defects Injected (%)

System Development Phase

(Selby 2007)

01/09/2011

10
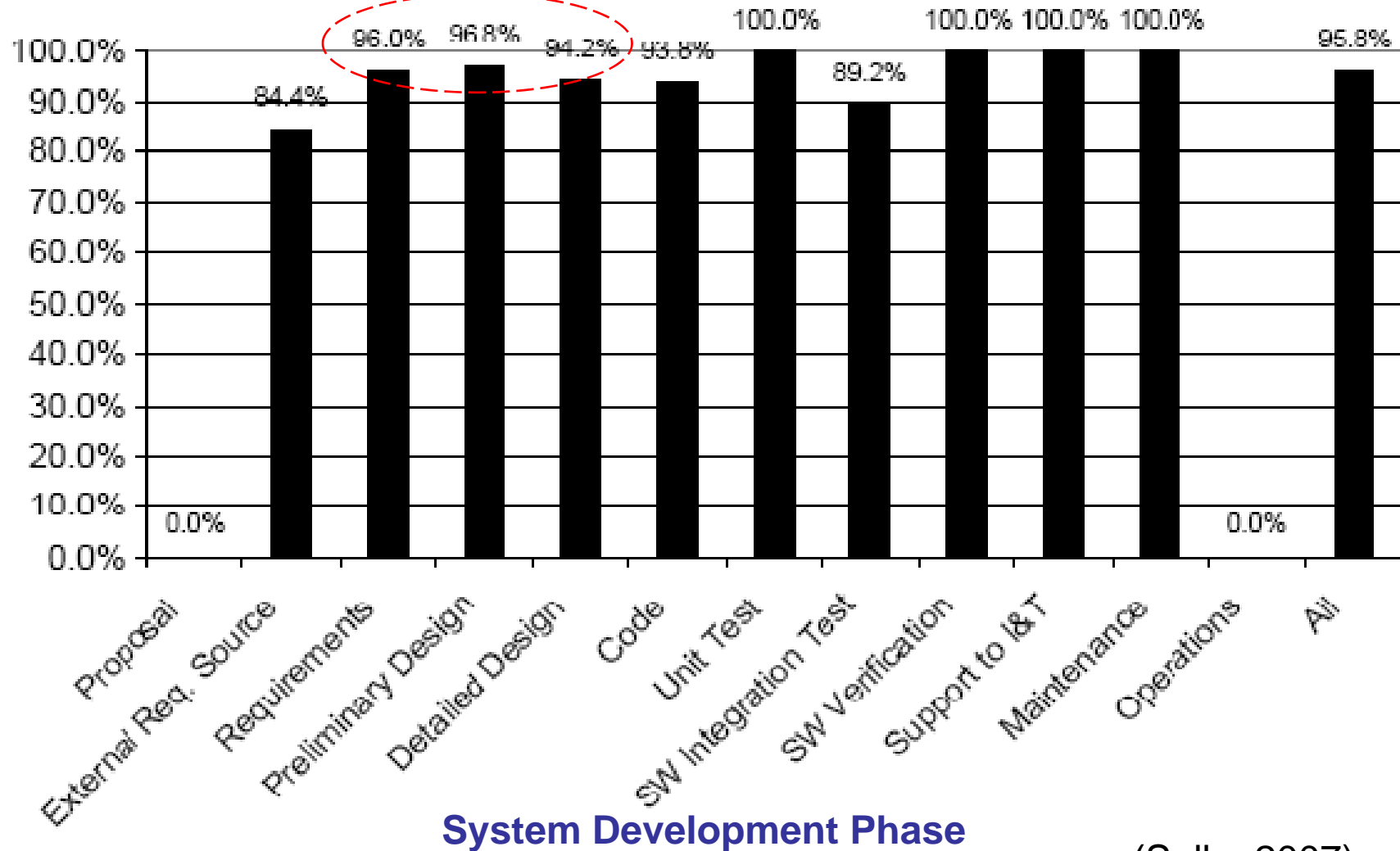
Hooke's Law

$$F = -kx,$$

Newton's law of universal gravitation

$$F = G\frac{m_1 m_2}{r^2}$$

NEWTON'S LAW

$$F = ma$$

OHM'S LAW

$$I = V / R$$

Boyle-Mariotte's Law

$$p_1 x V_1 = p_2 x V_2$$

Curie's Law

$$M = C \cdot \frac{B}{T},$$

Coulomb's Law

$$F = k_e \frac{q_1 q_2}{r^2}$$

Snell's Law of Refraction

$$\eta_1 \cdot \sin(\theta_1) = \eta_2 \cdot \sin(\theta_2)$$
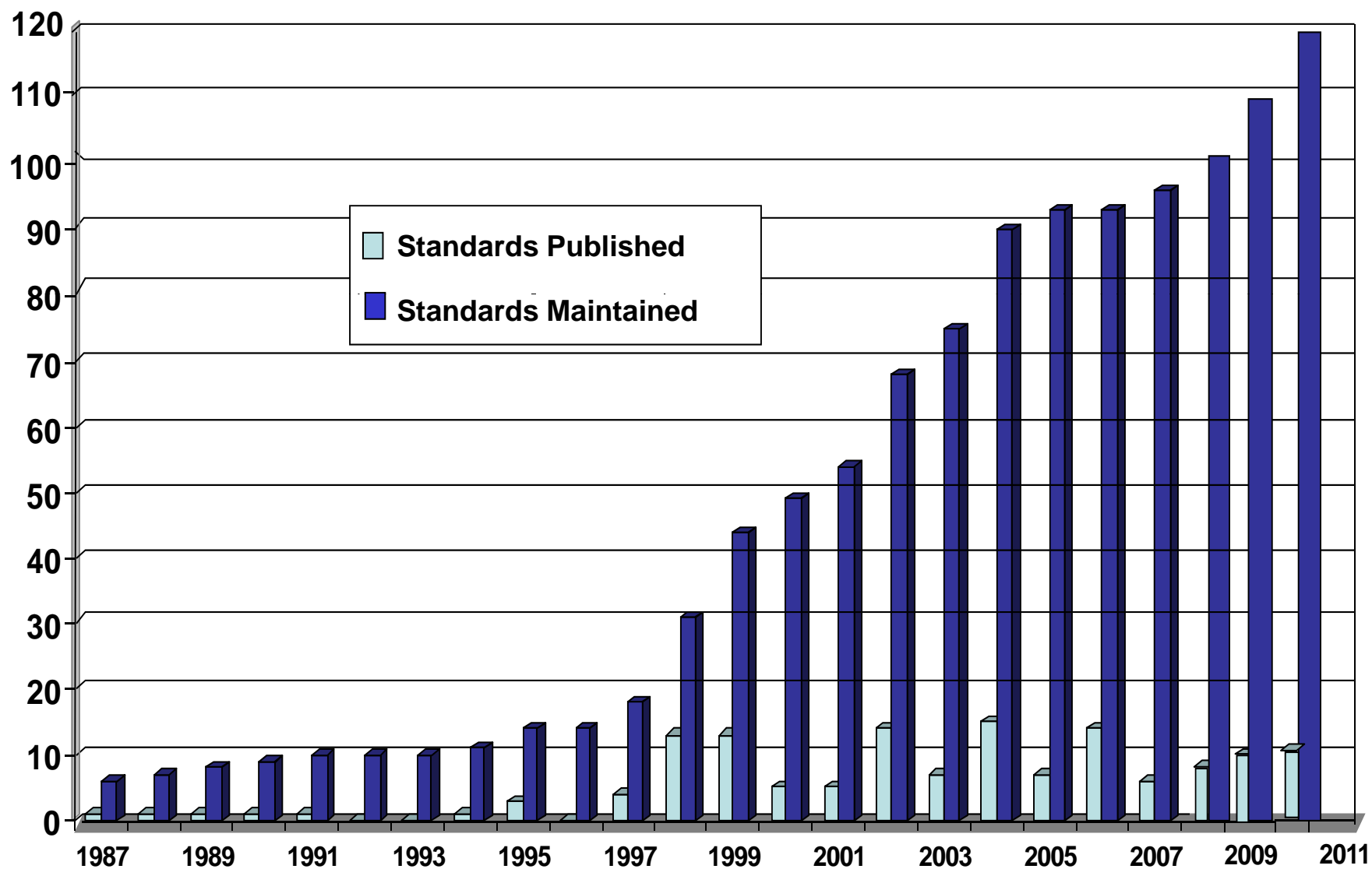
Definition of 'Standard'

- Mandatory requirements employed and enforced to prescribe a disciplined uniform approach to software development, that is, mandatory conventions and practices are in fact standards.

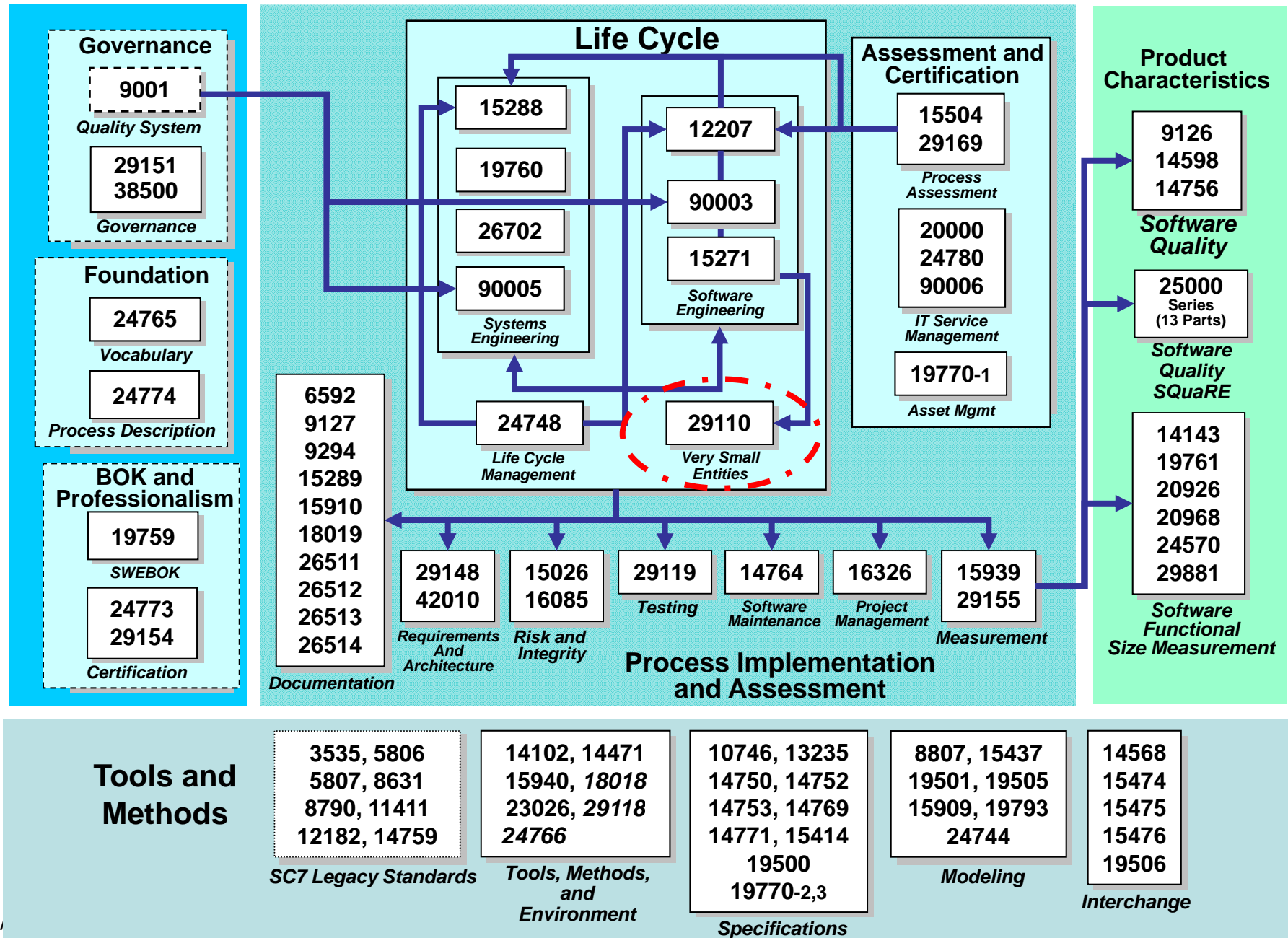 (ISO/IEC 24765:2010, Systems and Software Engineering Vocabulary)

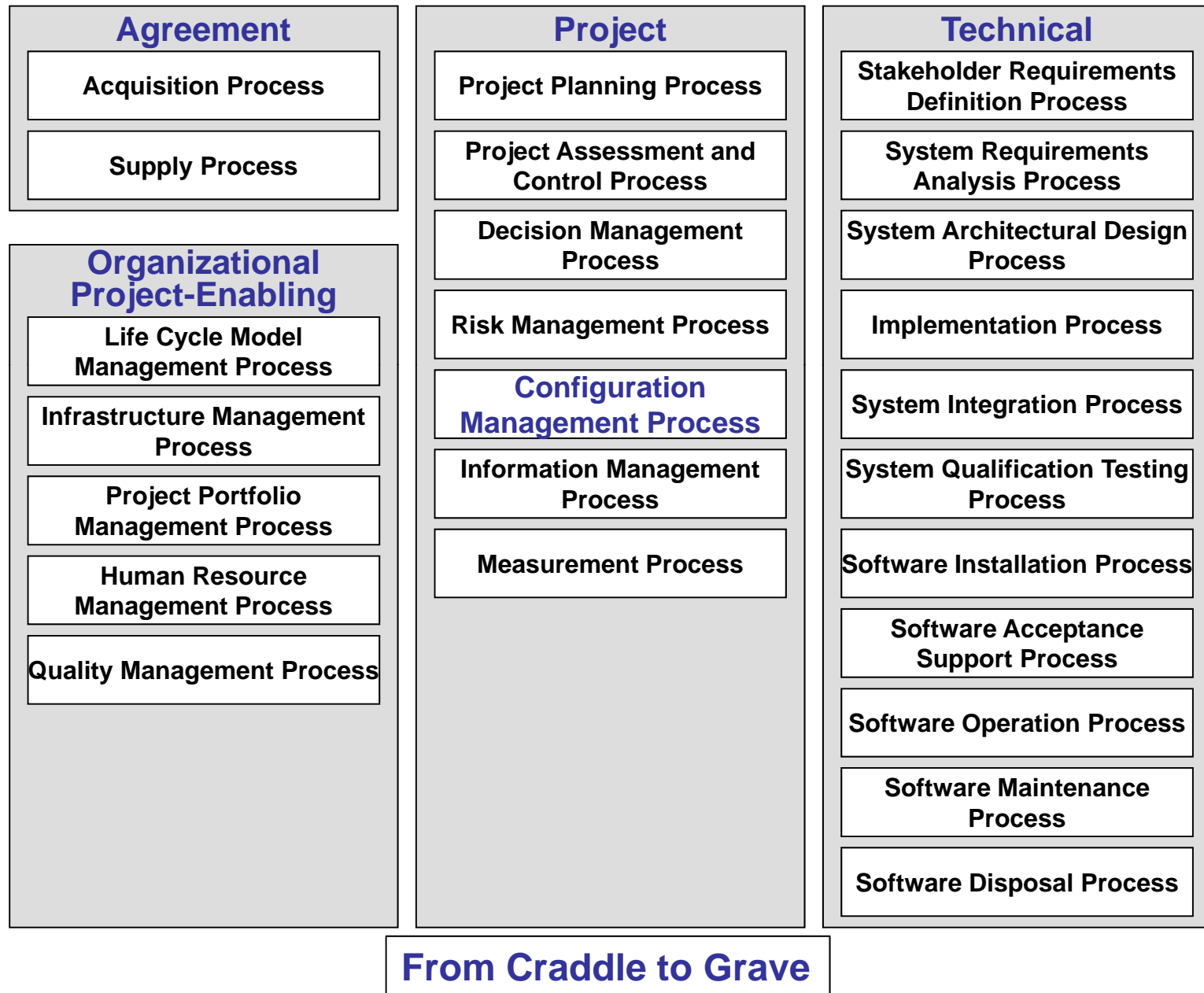 http://pascal.computer.org/sev_display/index.action

**Standards Produced
and Maintained by SC7**

SC7 Standards Collection

Governance

9001
Quality System

29151
38500
Governance

Foundation

24765
Vocabulary

24774
Process Description

BOK and Professionalism

19759
SWEBOK

24773
29154
Certification

Life Cycle

15288
19760
26702
90005
Systems Engineering

12207
90003
15271
Software Engineering

24748
Life Cycle Management

29110
Very Small Entities

Assessment and Certification

15504
29169
Process Assessment

20000
24780
90006
IT Service Management

19770-1
Asset Mgmt

Product Characteristics

9126
14598
14756
Software Quality

25000
Series
(13 Parts)
Software Quality SQuaRE

14143
19761
20926
20968
24570
29881
Software Functional Size Measurement

6592
9127
9294
15289
15910
18019
26511
26512
26513
26514
Documentation

29148
42010
Requirements And Architecture

15026
16085
Risk and Integrity

29119
Testing

14764
Software Maintenance

16326
Project Management

15939
29155
Measurement

Process Implementation and Assessment

Tools and Methods

3535, 5806
5807, 8631
8790, 11411
12182, 14759
SC7 Legacy Standards

14102, 14471
15940, *18018*
23026, *29118*
24766
Tools, Methods, and Environment

10746, 13235
14750, 14752
14753, 14769
14771, 15414
19500
19770-2,3
Specifications

8807, 15437
19501, 19505
15909, 19793
24744
Modeling

14568
15474
15475
15476
19506
Interchange

01/ 14

ISO/IEC 12207 Life Cycle Processes Standard

Agreement
- Acquisition Process
- Supply Process

Organizational Project-Enabling
- Life Cycle Model Management Process
- Infrastructure Management Process
- Project Portfolio Management Process
- Human Resource Management Process
- Quality Management Process

Project
- Project Planning Process
- Project Assessment and Control Process
- Decision Management Process
- Risk Management Process

Configuration Management Process
- Information Management Process
- Measurement Process

Technical
- Stakeholder Requirements Definition Process
- System Requirements Analysis Process
- System Architectural Design Process
- Implementation Process
- System Integration Process
- System Qualification Testing Process
- Software Installation Process
- Software Acceptance Support Process
- Software Operation Process
- Software Maintenance Process
- Software Disposal Process

From Craddle to Grave

Software Configuration Management Process of ISO 12207 – Describes 'What to do'

- **Purpose**
  - To establish and maintain the integrity of the software items of a process or project, and make them available to concerned parties.
- **Outcomes**
  - As a result of the successful implementation of the Software Configuration Management Process:
    - a software configuration management strategy is developed;
    - items generated by the process or project are identified, defined, and baselined;
    - modifications and releases of the items are controlled;
    - modifications and releases are made available to affected parties;
    - the status of the items and modifications is recorded and reported;
    - the completeness and consistency of the items is ensured; and
    - the storage, handling, and delivery of the items are controlled.

Software Configuration Management Process of ISO 12207 – Describes 'What to do'

- **Activities and Tasks**
  1. Process implementation (Activity)
     - This activity consists of the following task:
       - A software configuration management plan shall be developed. The plan shall describe:
         » the configuration management activities; procedures and schedule for performing these activities;
         » the organization(s) responsible for performing these activities; and their relationship with other organizations, such as software development or maintenance.
       - The plan shall be documented and implemented.
     - NOTE The plan may be a part of the system configuration management plan.
  2. Configuration identification
  3. Configuration control
  4. Configuration status accounting
  5. Configuration evaluation
  6. Release management and delivery

The Importance of VSEs
An Example from Japan

Manufacturer

Prime (60)

Suppliers (600)
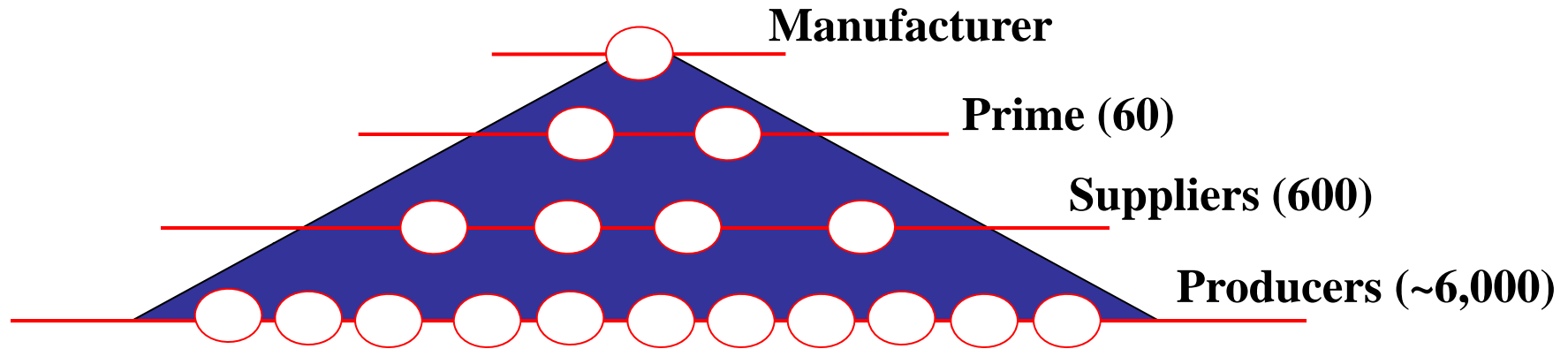
Producers (~6,000)

A software defect from one of the producers went into a product and resulted in a loss of over $200 million by the manufacturer

Adapted from: Shintani, Small Settings Workshop, Software Engineering Institute, 2005

Size of Enterprises

- **European Union**
  - 93 % are micro enterprises (less than 10 employees)
- **Micro enterprises account for 70 % to 90 % of enterprises in OECD* countries (57 % in USA)**
- **Greater Montréal Area - Software Enterprises.**

Number of employees	Number of Software Enterprises	Percentage
1 to 25	540	78 %
25 to 100	127	18 %
Over 100	26	4 %

50% of enterprises have less than 10 employees
Source: Montreal International, 2006

* OECD: Organisation for Economic Co-operation and Development

01/09/2011

Observations, Vision and Strategy

- **Observations**
  - Most software engineering standards have not been designed having in mind VSEs;
  - VSEs' negative perceptions of software engineering standards are primarily driven by negative views of cost, documentation and bureaucracy;
  - In many VSEs software processes are ad hoc and chaotic;
  - Worldwide, VSEs' software products are very important to the economy.
- **Vision**
  - VSEs worldwide are using, in their daily development activities, software engineering standards, adapted to their needs, which guide them develop required products, constantly improving their performances and their competitiveness.
- **Strategy**
  - Participate actively to the development of international software engineering standards adapted for VSEs;
  - Promote the development of means to accelerate the adoption and implementation of new standards by VSEs;
  - Promote the development of educational material to teach the standards to undergraduate and graduate software engineering students;

Development of International Standards for VSEs

- **Phase 1 - Recognition of Needs and Problems.**
  - Began in Australia at an ISO Plenary meeting (2004)
- **Phase 2 - Basic and Applied Research**
  - Survey of Process Improvement Initiatives (2005)
  - Survey of VSEs worldwide (2006)
- **Phase 3 - Development**
  - The Development of International Standards for VSEs (2006 - 2010)
- **Phase 4 – Commercialization (2010)**
- **Phase 5 - Diffusion and Adoption**
  - Development of the Means to Accelerate the Adoption and Utilization of International Standards by VSEs (2006 -)
- **Phase 6 - Consequences** (2011 -)

(Rogers, 2003)

SC7 Plenary Meeting - Australia – 2004

- Canada raised the fact that small enterprises require standards adapted to their size and maturity,
- A meeting of interested parties was held with 8 delegates from national bodies (Australia, Canada, Czech Republic, South Africa, and Thailand)
  - **Consensus reached:**
    - Make the current software engineering standards more accessible to VSEs;
    - Provide turn key material that require minimal tailoring and adaptation effort;
  - **Approach selected:**
    - Establish a Special Interest Group (SIG) to develop:
      - Statement of requirements;
      - The outline of key deliverables, and the associated process to create them
        » e.g. how to create profiles;
      - Terms of Reference for the group;
      - Prepare a Proposal for the next Plenary meeting in Finland.

A Few Hypothesis on the Use of Software Engineering Standards by VSEs

- **Reasons for not Using Standards**
  - Not written for or difficult to use by VSEs,
  - Current SE standards do not specifically address VSEs' needs,
  - Current SE standards requires critical mass (staff, budget, time) to implement,
  - Compliance with existing standards difficult to achieve,
  - Net benefits not obvious,
  - Most VSEs do not have the expertise to implement standards.

- **Benefits of Use** (but not seen by VSEs)
  - Reduction of risk (business, cost, schedule, quality),
  - Enables measurement of productivity and quality,
  - VSEs are often developing important components for customers.

Standards are often developed <u>by</u> large organisations <u>for</u> large organisations !

SE= Software Engineering

Establishment of Working Group 24

- **Two Workshops in Thailand – 2005**
    - Sponsored by the Thai Industrial Standard Institute and the Thai Software Industry Promotion Agency,
    - Representatives
        - Australia, Belgium, Brazil, Canada, Czechoslovakia, Finland, South Africa, South Korea, USA and Thailand.

- **SC7 Plenary Meeting in Finland – May 2005**
    - Proposal to establish a new Working Group (WG) was tabled
    - Twelve countries offered their support to staff WG 24
        - Belgium, Canada, the Czech Republic, Ireland, Italy, Japan, Korea, Luxembourg, South Africa, Thailand, the United Kingdom, and the United States
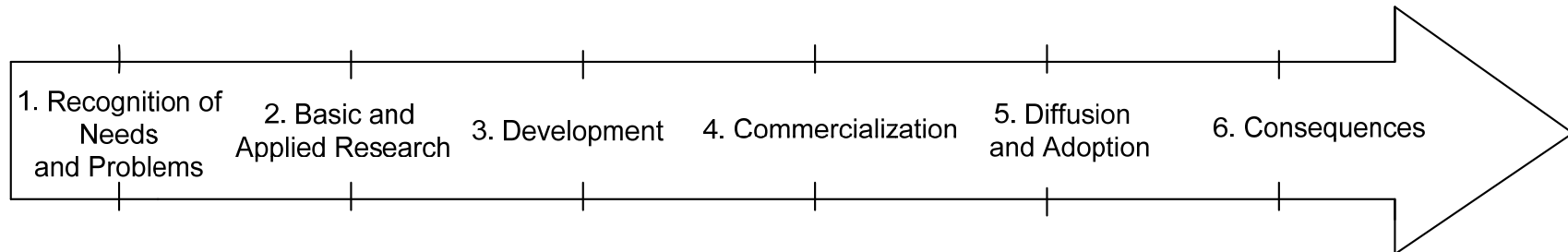
- **Working Group 24 (WG 24) was approved - Fall 2005**
    - Mr. Tanin Uthayanaka (Thailand) was appointed Convener.
    - Mr. Jean Bérubé (Canada) was appointed Secretary.
    - Mr. Claude Y. Laporte (IEEE Computer Society) was appointed Project Editor

Agenda

```
1. Recognition of      2. Basic and                                          5. Diffusion
Needs              Applied Research   3. Development   4. Commercialization   and Adoption   6. Consequences
and Problems
```

- **Phase 1 - Recognition of Needs and Problems (2004)**
→ - **Phase 2 - Basic and Applied Research**
  - Survey of Process Improvement Initiatives (2005)
  - Survey of VSEs worldwide (2006)
- **Phase 3 – Development (2006-2010)**
- **Phase 4 – Commercialization (2010)**
- **Phase 5 - Diffusion and Adoption (2006 -)**
- **Phase 6 - Consequences (2011 -)**

Initiatives to Help SMEs and VSEs

- **Europe**
  - Ireland - Centre for Software Process Technologies (CSPT)
  - Belgium - Centre d'Excellence en Technologies de l'Information et de la Communication (CETIC)
  - Ireland (LERO)
  - Luxembourg - Public Research Center Henri Tudor
  - UK – National Computing Center
  - European Software Institute
- **Australia** - Software Quality Institute (Rapid)
- **Latin Countries**
  - Mexico - Moprosoft
  - COMPETISOFT Project – 13 Latin American countries, Spain, Portugal.
  - Columbia – ParqueSoft Foundation
- **Asia**
  - Thailand - Association of Thai Software Industry
  - Hong Kong – Productivity Council
- **North America**
  - Software Productivity Center (SPC) - Vancouver
  - Software Engineering Institute - Improving Processes in Small Settings (IPSS)

SME = Small and Medium Enterprises

- Non-profit organization established in Columbia in 1999
- Purpose
  - Create and develop enterprises providing goods and services to the information technology
- Integrates 11 sites in Columbia
  - Cali, Popayán, Pasto, Buga, Tuluá, Palmira, Buenaventura, Armenia, Manizales, Ibague, Villavicencio, Medellin, Sincelejo and Pereira.
- Houses more than 200 VSEs
  - Over 120 VSEs under the same roof in Cali
  - 1000 Software Engineering Professionals,
  - About 200 professionals provide support in technical, administrative and business development processes
    - Q.A., Test, Finance, Communication, Contract, Publication, etc.
  - Cost of expertise is pay-as-you-use and shared between VSEs.

www.parquesoft.com

Survey of VSEs

- **Objectives**
  - Identify VSEs' utilization of standards
  - Identify problems and potential solutions to help VSEs apply standards and become more capable and competitive.

- **Method**
  - Web-based Survey
  - Questionnaire translated in 9 languages
    - English, French, German, Korean, Portuguese, Russian, Spanish, Thai and Turkish.
  - Invitation to participate in survey widely broadcasted via:
    - WG 24 Network of contacts
    - Centers and initiatives focused on SMEs/VSEs
      - e.g., SIPA (Thailand), CETIC (Belgium), Parquesoft (Colombia)

Over 435 Responses from 32 Countries

Country	Number of Responses	Country	Number of Responses	Country	Number of Responses
Argentina	2	Finland	13	New Zealand	1
Australia	10	France	4	Peru	4
Belgium	10	Germany	1	Russia	4
Brazil	72	India	57	South Africa	10
Bulgaria	3	Ireland	10	Spain	4
Canada	10	Italy	2	Taiwan	1
Chile	1	Japan	3	Thailand	59
Colombia	109	Korea (South)	4	Turkey	1
Czech Republic	3	Luxembourg	3	United Kingdom	2
Dominican Republic	1	Mexico	20	United States	3
Ecuador	9	Morocco	1		

Why don't VSEs use Standards?

- 24% Not required
- 9% Lack of support
- 28% Lack of resources
- 14% Too time-consuming
- 15% Standard(s) *
- 10% Other
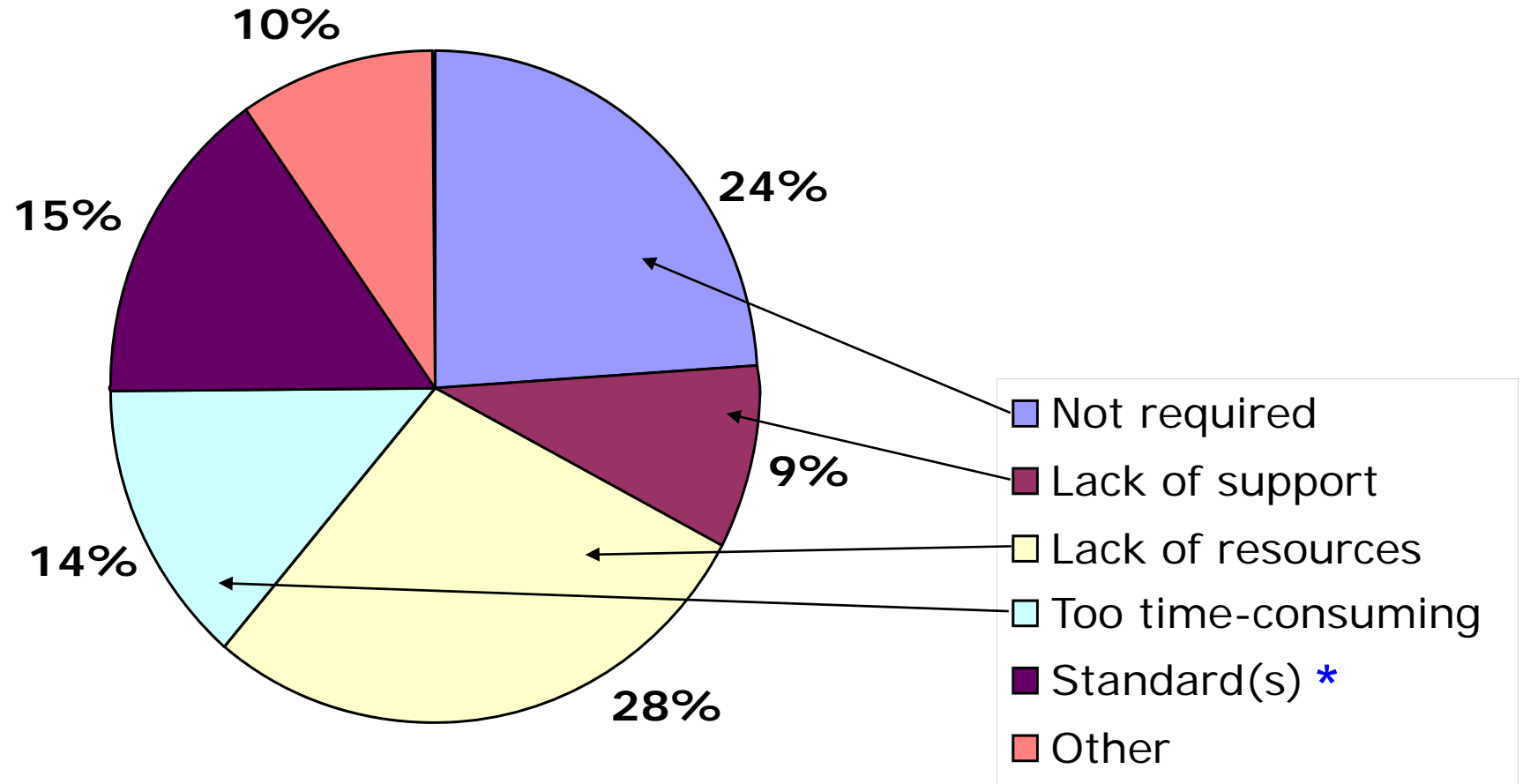
* Difficult, Bureaucratic, not enough guidance.

Requests from VSEs

- **Certification and Recognition**
  - Over 74% indicated that it was important to be either recognized or certified
    - ISO certification requested by 40%.
    - Market recognition requested by 28%
    - Only 4% are interested in a national certification

- **Needs Regarding Documentation**
  - 62% are asking for more guidance and examples
  - 55% are requiring 'lightweight' standards that are easy to understand and apply and come with templates

Subset of Requirements to Develop Standards for VSEs

- R 08 - Use of the set of workproducts must be <u>affordable</u>.
  - i.e. consultant services should not be necessary.
- R 15 - The set of workproducts should provide the <u>whole spectrum of documents</u>
  - From standards to education material
- R 29 - The set of workproducts should propose to <u>choose a lifecycle</u>
  - Provide examples of lifecycles
- R 33 - The set of workproducts should propose <u>definition of documents.</u>
  - For example templates (e.g. requirements templates - use cases)
- R 37 - The set of workproducts should include <u>compliance table checklists</u>
  - e.g. an Assessment Guide
- R 52 - The guide should provide <u>examples</u>
  - e.g. plans, workproducts and other deliverables.
- R 57 - The guide should be available <u>free</u> on the web
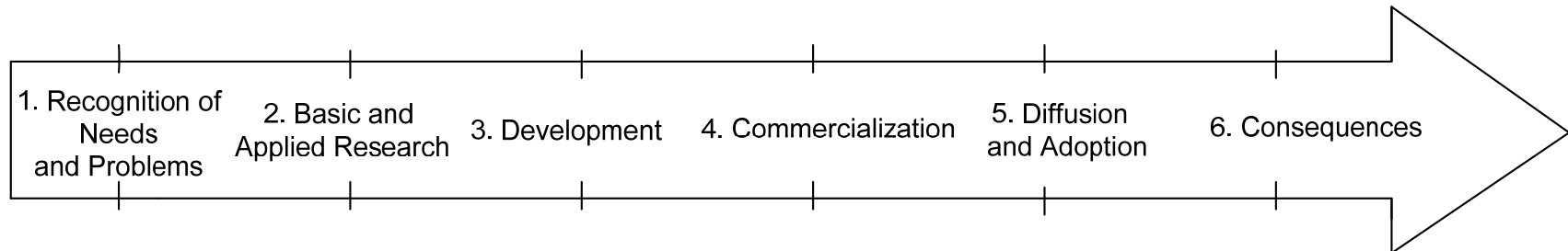
(BK1-032 2005)

Agenda

- **Phase 1 - Recognition of Needs and Problems (2004).**
- **Phase 2 - Basic and Applied Research (2005-2006)**
- **Phase 3 - Development**
  - The Development of International Standards for VSEs (2006 - 2010)
- **Phase 4 – Commercialization (2010)**
- **Phase 5 - Diffusion and Adoption (2006 -)**
- **Phase 6 - Consequences (2011 -)**

Spectum of Appoaches

Waterfall
Few risks, sequential
Late integration and testing

CMM

Low Ceremony

ISO
29110

High Ceremony

Little documentation
Light process

Well-documented
Traceability
CCB

XP, Scrum,
Adaptive
Development

CMMI

Iterative
Risk-driven
Continuons Integration and testing

(Kroll, 2003)
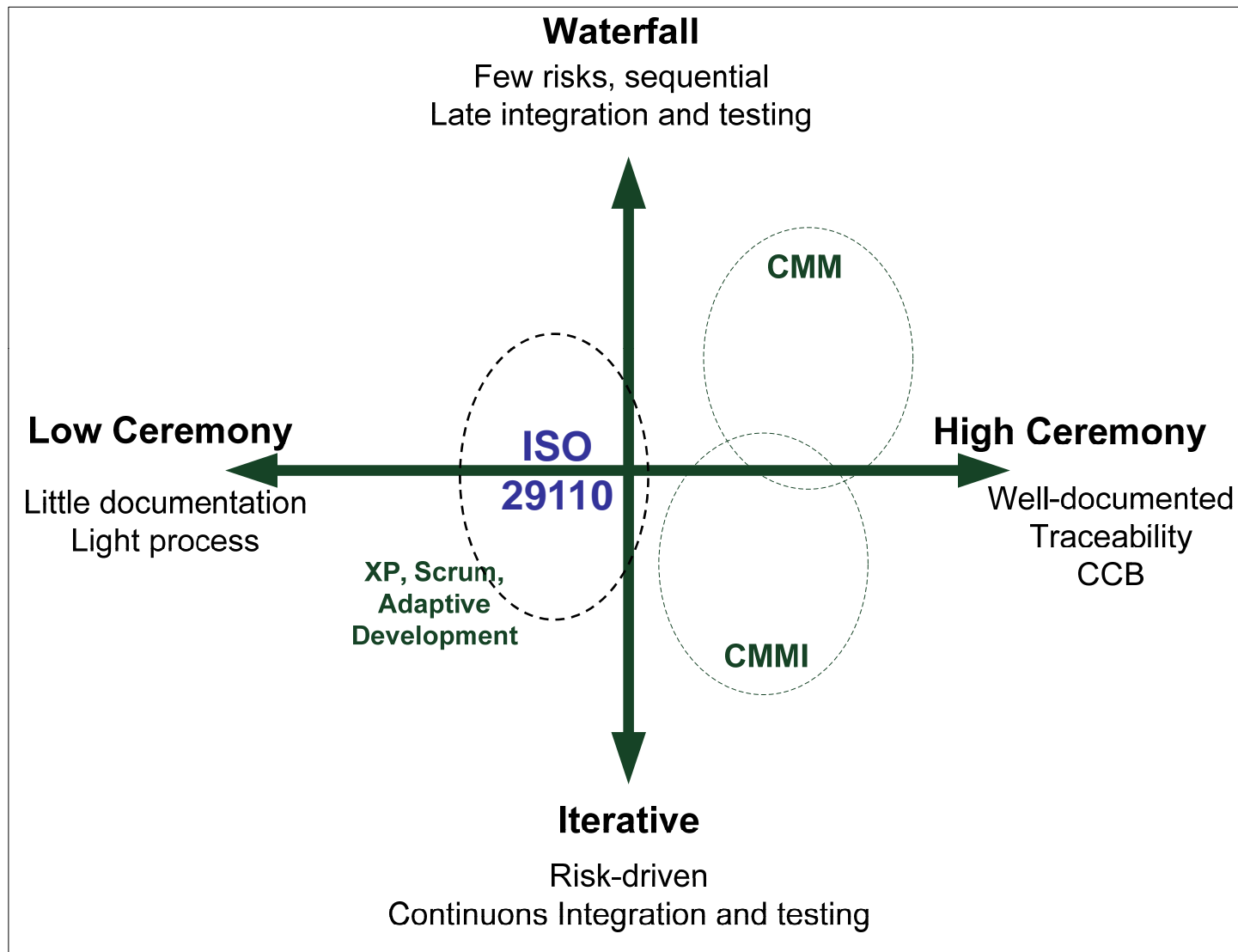
The Strategy of WG 24
To develop standards and guidelines for VSEs

- Use the notion of '**Profile**' to develop a roadmap and standards to meet the needs of VSEs.

  - A profile is an '**assemblage**' from one or more base **standards** to accomplish a particular function.

- Focus first on VSEs developing **Generic software** (i.e. non critical software),

- Use the Mexican national standard **MoProsoft** as a referential to start the development of profiles,

- Use two types of standards, as the input, for the development of standards for VSEs:

  - **Process standards**, such as **ISO 12207**, that define the activities required to achieve identified objectives or outcomes;

  - **Product standards**, such as **ISO 15289**, that define the structure and content of artefacts produced by the processes

The "Generic" Profile Group

- Applicable to VSEs that do not develop <u>critical software</u> products*.

    – Does not imply any specific application domain.

In the future new domain-specific profiles may be developed

> * **Critical software**: software whose failure could have an <u>impact on safety</u> or could cause <u>large financial or social losses</u> (IEEE 610.12)

The Generic Profile Group

- **Four Profiles within the Generic Profile Group**
  - **Entry** - Targets VSEs typically developing 6 person-month projects or start-ups VSEs;
  - **Basic** - Targets VSEs developing only one project at a time;
  - **Intermediate** – Targets VSEs developing multiple projects within the organizational context;
  - **Advanced** – Targets VSEs which want to sustain and grow as an independent competitive software development business.

Advanced

Intermediate

Basic

Entry

ISO/IEC 29110
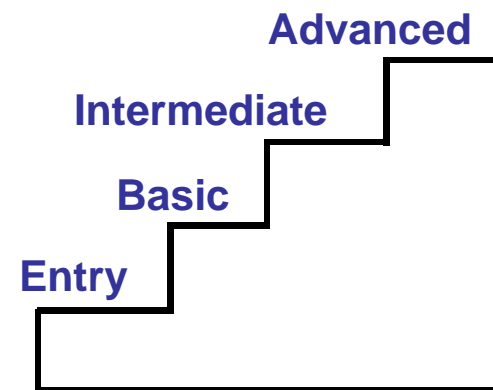
Set of 29110 Documents Targeted by Audience

29110 Overview (TR 29110-1)

Mainly for VSEs

29110 Profiles (IS)

Framework and Taxonomy (IS 29110-2)

Specifications of VSE Profiles (IS 29110-4)

Specification - VSE Profile Group m
(IS 29110-4-m)

For Standard producers, tool vendors, methodology vendors

List the Requirements
(i.e. '**What** to do')

29110 Guides (TR)

Assessment Guide (TR 29110-3)

Management and Engineering Guide (TR 29110-5)

Management and Engineering Guide VSE Profile m-n
(TR 29110-5-m-n)

For Assessors and VSEs

For VSEs

'**How** to do'

ISO/IEC 29110

All TRs are available at no cost from ISO

Preparation Steps for the Basic Profile


```
  ┌─┐              ┌─────────────────────┐
  │1│─ ─ ─ ─ ─ ─ ─>│     VSEs'            │
  └─┘              │  Characteristics    │
                   └─────────────────────┘
                              │  derives
                              ▼
  ┌─┐              ┌─────────────────────┐        ╭───────────────────╮
  │2│─ ─ ─ ─ ─ ─ ─>│  VSEs' Needs and    │        │  Base Standard     │
  └─┘              │   Competencies      │        │  ISO/IEC 12207     │
                   └─────────────────────┘        │   ╭───────────╮    │
                              ▲  responds         │   │ Elements  │    │
                              │                   │   ╰───────────╯    │
              based on        │           included ╰───────────────────╯
  ┌─┐   ╭──────────────╮  ╭───────────────╮            ┌─┐
  │3│─ ─>│ IS 29110-2  │<─│ IS 29110-4-1  │            │4│
  └─┘   │ VSE Framework│  │ Basic VSE     │            └─┘
        │ and Taxonomy │  │ Profile       │        ╭───────────────────╮
        ╰──────────────╯  │ Specification │        │  Base Standard     │
                          ╰───────────────╯        │  ISO/IEC 15289     │
                              ▲  implements  included│   ╭───────────╮    │
                              │                   │   │ Elements  │    │
  ┌─┐   ╭────────────────╮                        ╰───────────────────╯
  │5│─ ─>│ TR 29110-5-1  │
  └─┘   │ Management and │
        │ Engineering    │
        │ Guide          │
        ╰────────────────╯
```
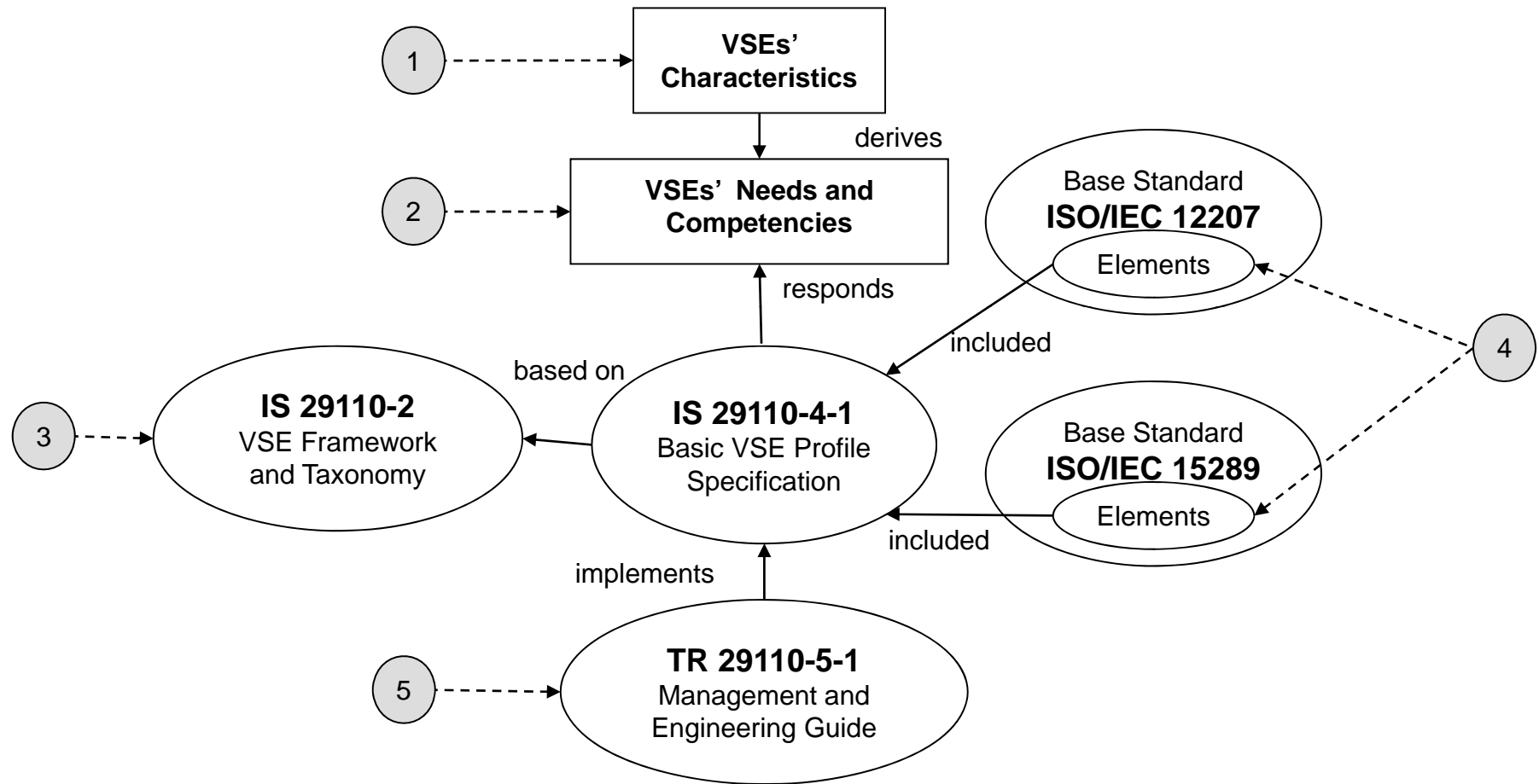
ISO/IEC 29110 Part 5-1-2 Management and Engineering Guide

- Part 5 provides a Management and Engineering Guide for the Basic Profile described in ISO/IEC IS 29110 Part 4-1.

| Statement of Work | → | **Project Management** |

Software Implementation → Software Configuration → **Basic**

Advanced

Intermediate

Entry
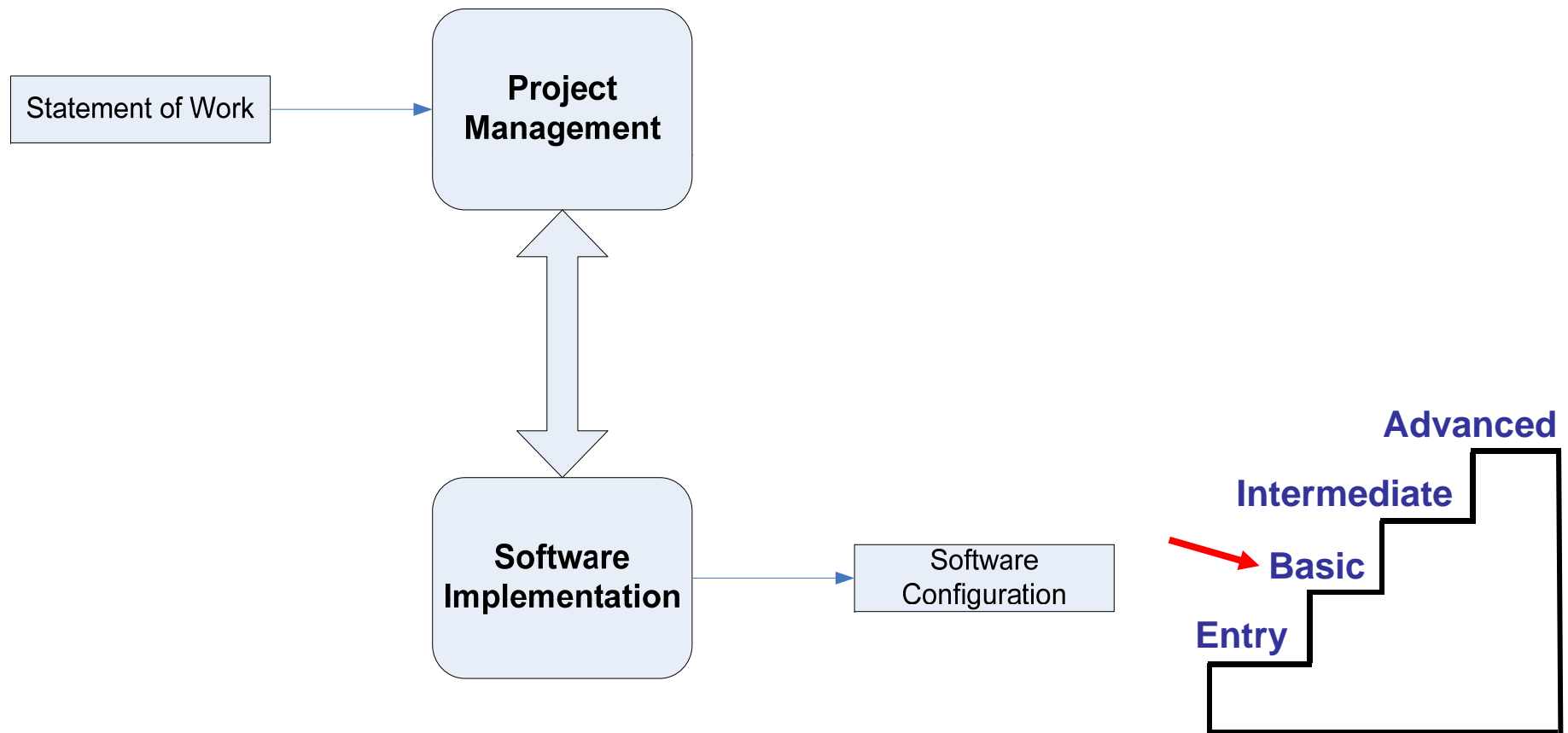
ISO/IEC 29110 Part 5 – Table of Contents

Process Structure Description and Notation

1. Name
2. Purpose
3. Objectives
4. Input Products
5. Output Products
6. Internal Products
7. Roles involved
8. Process Diagram
9. Activity Description
   - **Role** - Abbreviation of roles involved in the task execution.
   - **Task** - Description of the tasks to be performed.
   - **Input Products** - Products needed to execute the task.
   - **Output Products** - Products created or modified by the execution of the task.

ISO/IEC 29110

Part 5 - Project Management (PM) Process

- **Purpose**
  - To <u>establish and carry out in a systematic way the tasks</u> of the software implementation project, which allows complying with the project's objectives in the expected <u>quality, time and costs</u>.

- **Seven Objectives**
  - **<u>PM.O1.</u>** The Project Plan for the execution of the project is developed according to the <u>Statement of Work</u> and <u>reviewed and accepted by the Customer</u>. The <u>tasks and resources</u> necessary to complete the work are <u>sized and estimated</u>.

  6.3.1 Project Planning Process

  a)   the scope of the work for the project is defined;

  c)   the tasks and resources necessary to complete the work are sized and estimated;

  d)   interfaces between elements in the project, and with other project and organizational units, are identified;

  e)   plans for the execution of the project are developed; and

  f)   plans for the execution of the project are activated.

  6.3.7 Measurement Process

  a)   the information needs of technical and management processes are identified.

  [ISO/IEC 12207, 6.3.1, 6.3.7]

Project Management (PM) Process – 7 Objectives

1. **PM.O1.** The Project Plan for the execution of the project is developed according to the Statement of Work and reviewed and accepted by the Customer. The tasks and resources necessary to complete the work are sized and estimated.

2. **PM.O2.** Progress of the project is monitored against the Project Plan and recorded in the Progress Status Record.

3. **PM.O3.** The Change Requests are addressed through their reception and analysis. Changes to software requirements are evaluated for cost, schedule and technical impact.

4. **PM.O4.** Review meetings with the Work Team and the Customer are held. Agreements are registered and tracked.

5. **PM.O5.** Risks are identified as they develop and during the conduct of the project.

6. **PM.O6.** A software Version Control Strategy is developed. Items of Software Configuration are identified, defined and baselined. Modifications and releases of the items are controlled and made available to the Customer and Work Team including the storage, handling and delivery of the items.

7. **PM.O7.** Software Quality Assurance is performed to provide assurance that work products and processes comply with the Project Plan and Requirements Specification.

Part 5 - Project Management Process – 4 Activities

ISO/IEC 29110
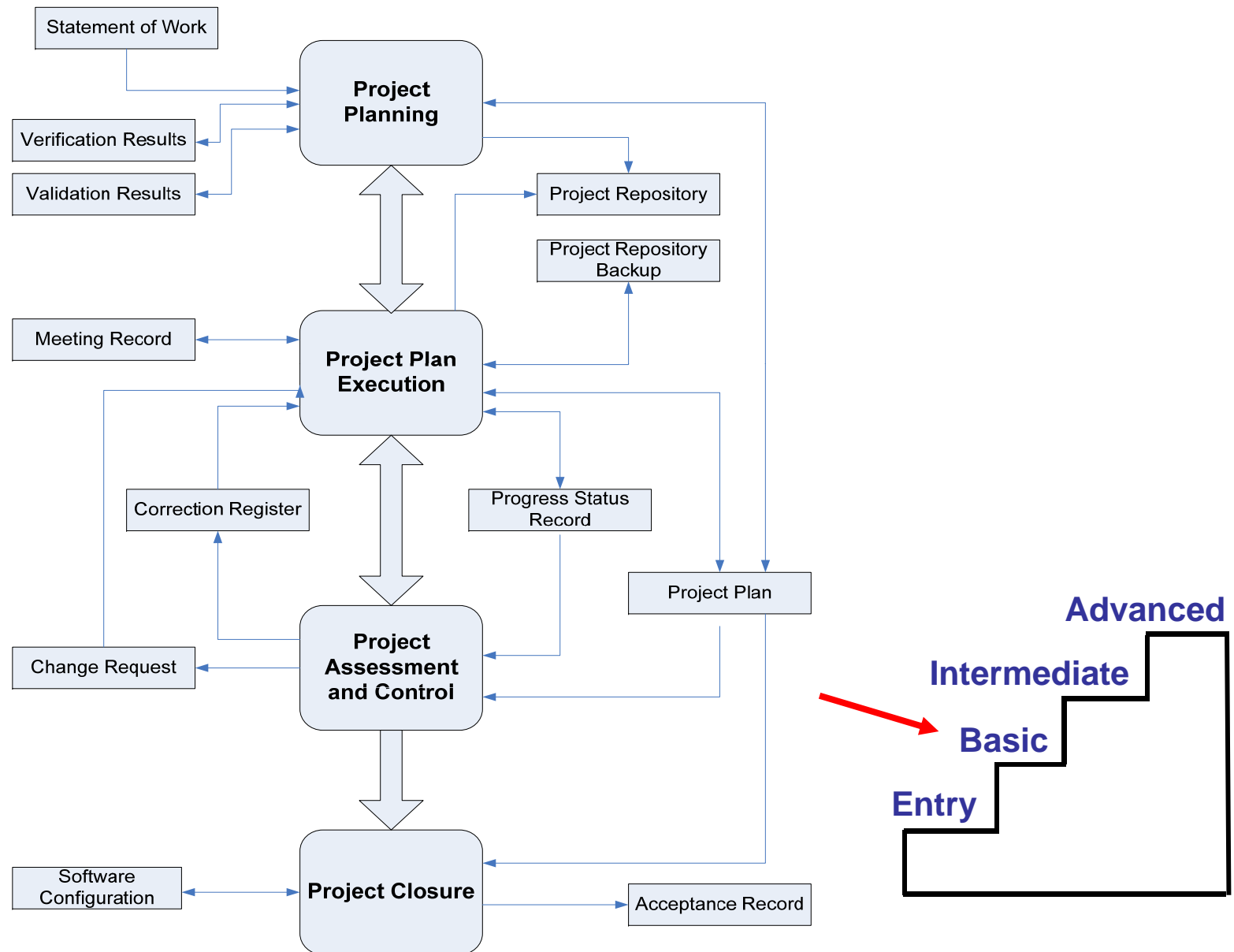
Software Implementation (SI) Process – 7 Objectives

1. **SI.O1.** Tasks of the activities are performed through the accomplishment of the current Project Plan.

2. **SI.O2.** Software requirements are defined, analyzed for correctness and testability, approved by the Customer, baselined and communicated.

3. **SI.O3.** Software architectural and detailed design is developed and baselined. It describes the software items and internal and external interfaces of them. Consistency and traceability to software requirements are established.

4. **SI.O4.** Software components defined by the design are produced. Unit test are defined and performed to verify the consistency with requirements and the design. Traceability to the requirements and design are established.

5. **SI.O5**. Software is produced performing integration of software components and verified using Test Cases and Test Procedures. Results are recorded at the Test Report. Defects are corrected and consistency and traceability to Software Design are established.

6. **SI.O6.** A Software Configuration, that meets the Requirements Specification as agreed to with the Customer, which includes user, operation and maintenance documentations is integrated, baselined and stored at the Project Repository. Needs for changes to the Software Configuration are detected and related Change Requests are initiated.

7. **SI.O7.** Verification and Validation tasks of all required work products are performed using the defined criteria to achieve consistency among output and input products in each activity. Defects are identified, and corrected; records are stored in the Verification/Validation Results.

ISO/IEC 29110

Part 5 - Software Implementation – 6 Activities

ISO/IEC 29110   47
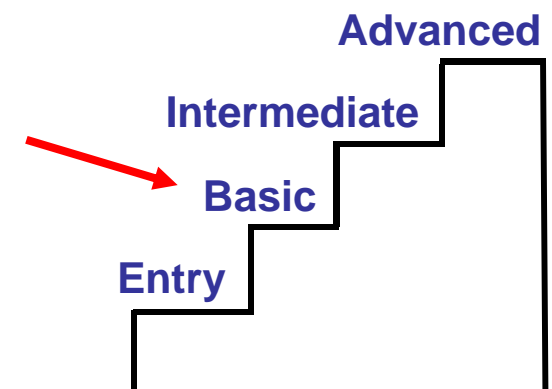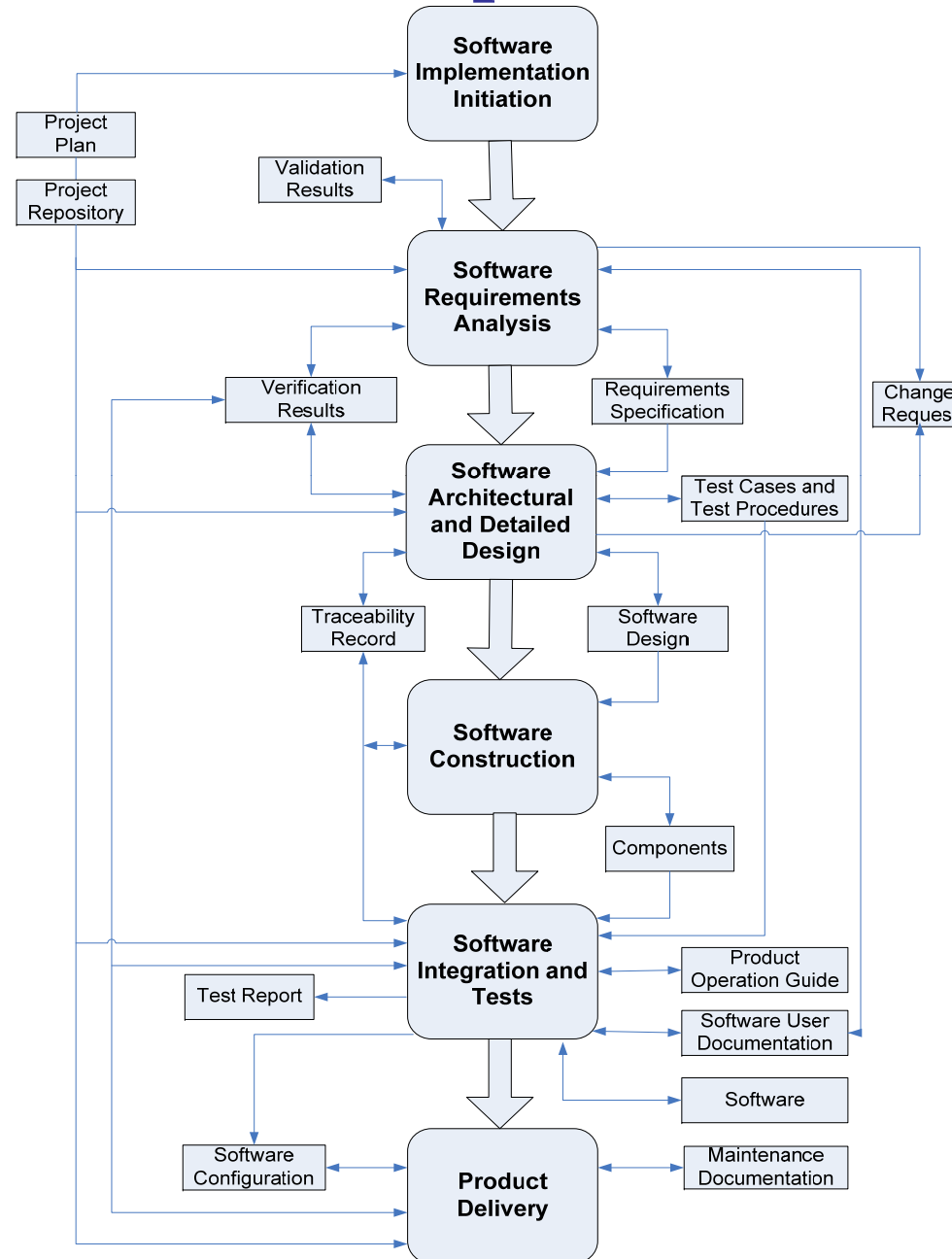
Comments Analysed by WG24 to develop the Set of Documents

Title of Document	Berlin 2008	Mexico 2008	Hyderabad 2009	Lima 2009	Washington 2010	Total
TR 29110-1 Overview	71	61	60	37	9	238
IS 29110-2 Framework and taxonomy	33	94	52	48	17	244
TR 29110-3 Assessment guide	18	38	40	31	8	135
IS 29110-4 Basic Profile specifications	52	54	54	84	9	253
TR 29110-5 Basic Profile Management and engineering guide	63	208	53	98	10	432
Total	**237**	**455**	**259**	**298**	**53**	**1302**

Agenda

- **Phase 1 - Recognition of Needs and Problems (2004)**
- **Phase 2 - Basic and Applied Research (2005-2005)**
- **Phase 3 – Development (2006-2010)**
- **Phase 4 – Commercialization (2010)**
- **Phase 5 - Diffusion and Adoption**
  - Development of the Means to Accelerate the Adoption and Utilization of International Standards by VSEs (2006 -)
- **Phase 6 - Consequences** (2011 -)

ISO Standard Development Processes


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        ┌────┐                                    ┌──────────────────┐
        │ NP │                                    │ Existing Standard │
        └────┘                                    └──────────────────┘
          │                                         /            \
        ┌────┐                              ┌──────────────┐  ┌──────────────┐
        │ WD │                              │ ISO Standard │  │  Non  ISO    │
        └────┘                              └──────────────┘  │  Standard    │
      ┌────┼────┐                                 │           └──────────────┘
  ┌──────┐ ┌──────┐ ┌──────┐               ┌ ─ ─ ─ ─ ─ ┐            │
  │  CD  │ │ PDAM │ │ PDTR │               │  Defect   │       ┌──────────┐
  └──────┘ └──────┘ └──────┘               │  Report   │       │Fast Track│
     │        │        │                   └ ─ ─ ─ ─ ─ ┘       └──────────┘
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                                                │              └──────┘
  ┌──────┐ ┌──────┐ ┌──────┐             ┌──────────┐         ┌──────┐
  │  IS  │ │ FAMD │ │  TR  │             │  COR     │         │  IS  │
  └──────┘ └──────┘ └──────┘             └──────────┘         └──────┘
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─────── SC7 develops

─ ─ ─ ─ ISO edits and publishes
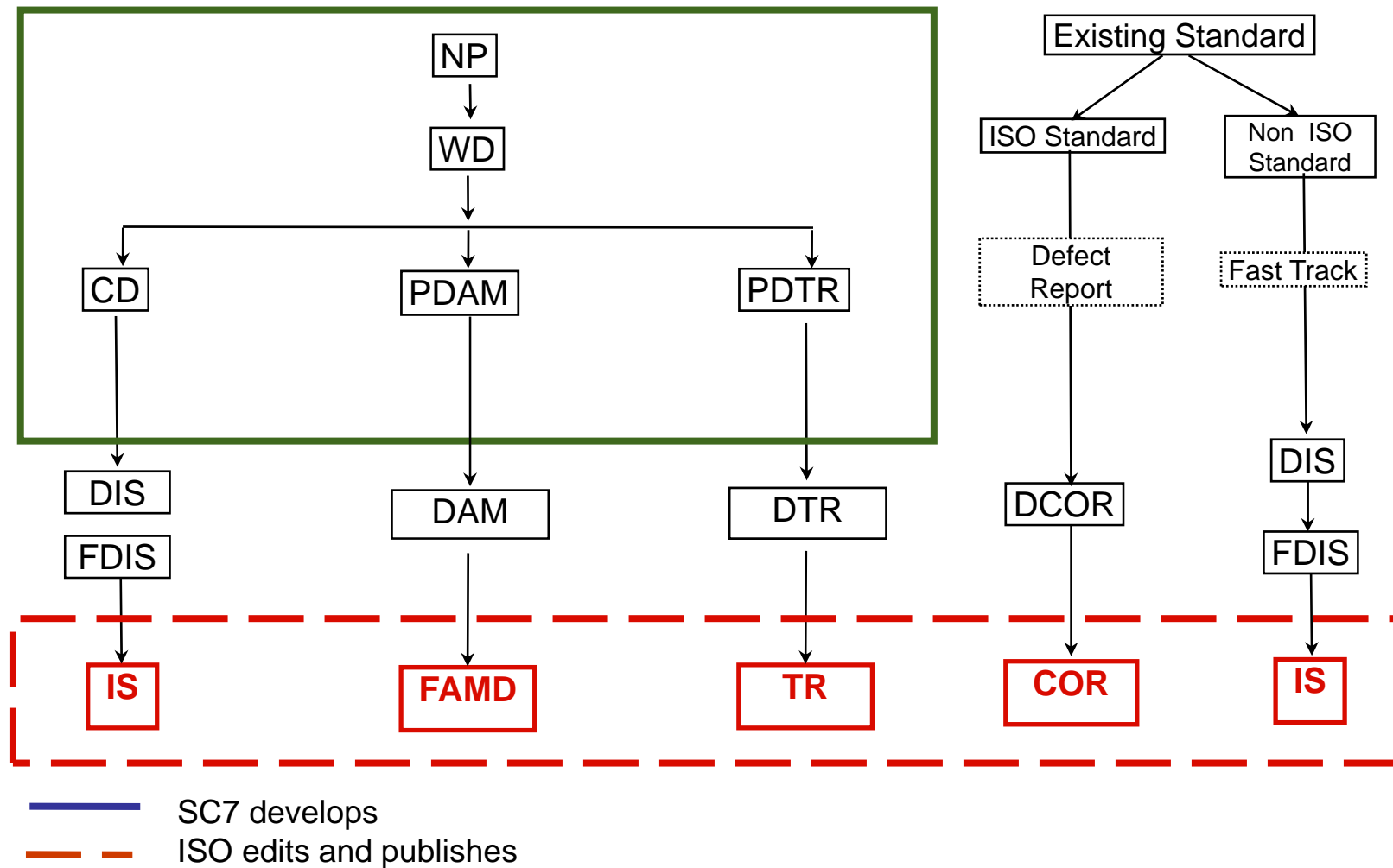
Adapted from: SC7 Secretariat Training
for ISO Editors, Hyderabad 2009

Publication by ISO and Diffusion/Adoption

- **Commercialization begins when ISO publishes the Standard**
  - ISO Working Groups are <u>not involved</u> in commercialization activities

- **Needs of VSEs (from Survey)**
  - <u>Not completely fulfilled</u> with ISO/IEC 29110 Part 5 - Engineering and Management Guide
  - VSEs requested readily usable processes

- **The Concept of Deployment Packages (DPs) – (Moscow Meeting)**
  - To accelerate diffusion and adoption worldwide
    - By providing <u>readily usable</u> information and made freely available
      - e.g. detailed process descriptions (steps), templates, checklists, etc.
  - Linked to ISO/IEC 29110 Part 5 - Annex A

Agenda
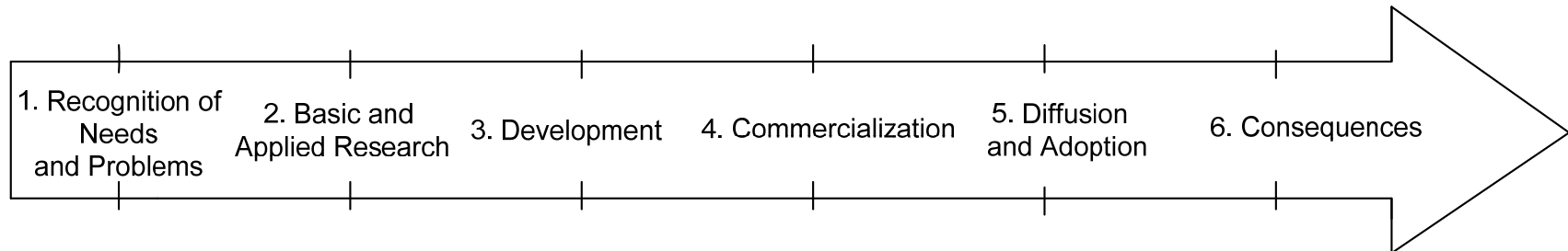
- **Phase 1 - Recognition of Needs and Problems (2004)**
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    - Development of the Means to Accelerate the Adoption and Utilization of International Standards by VSEs (2006 -)
- **Phase 6 - Consequences (2011 -)**

Commitment Curve and the Adoption of a Technology - Standard

Degree of Support

Commitment Phase

Acceptance Phase

Preparation Phase

Internalization

Institutionalization

Adoption

Installation

Positive Perception

Understanding

Awareness

Contact

Unawareness

Confusion

Negative perception

Decision not to implement

Aborted after initial implementation

Aborted after extensive implementation

Time

Connor 1992
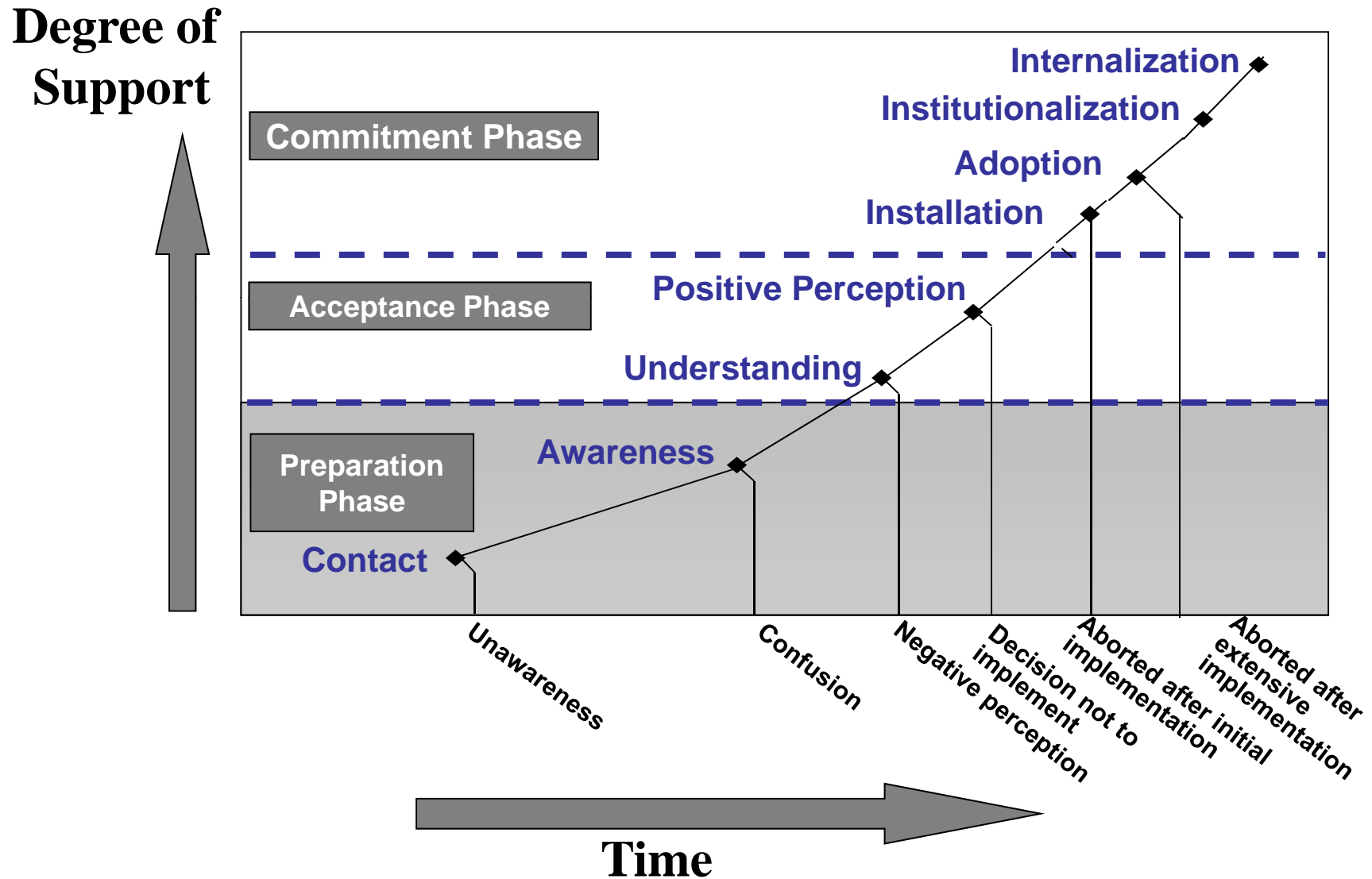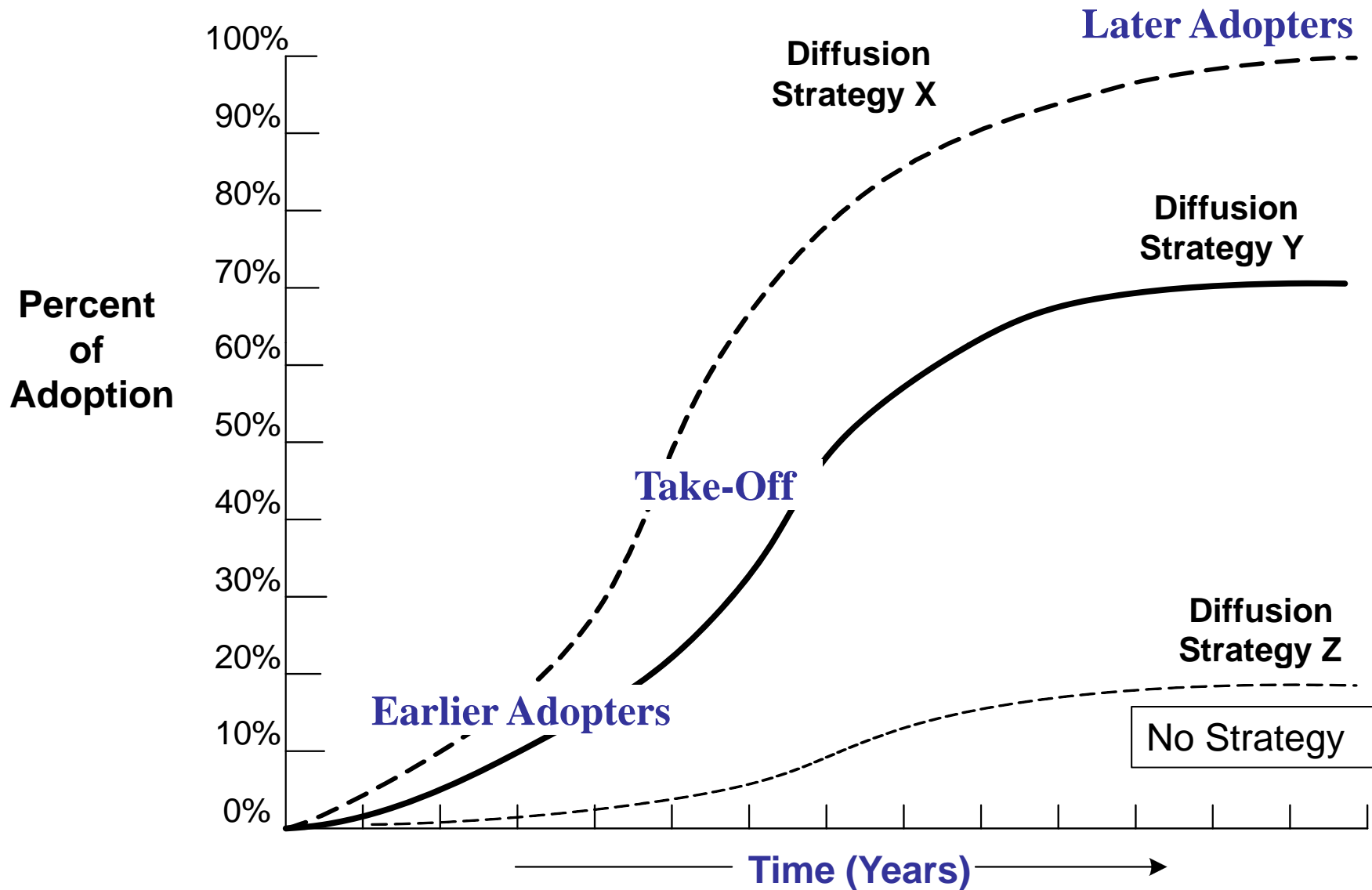
(adapted from Rogers 2003)

Network of Support Centers for VSEs

- **Objectives**
  - Help accelerate the development of ISO standards for VSEs
  - Accelerate deployment of ISO 29110 Standards
  - Accelerate the development and application of Deployment Packages

- Belgium (CETIC)
- Brazil (Riosoft)
- Canada (ÉTS)
- China *
- Colombia (Parquesoft)
- Finland (Tampere University of Technology)
- France (UBO University)
- Haiti *
- Ireland (LERO)
- Luxembourg (Tudor Research Center)
- Mexico (UNAM)*
- Thailand (Institute of Software Promotion for Industries)
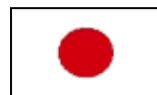
* In discussion

55

Deployment Packages

- A Deployment Package (DP) is a set of artifacts developed to facilitate the implementation of a set of practices, of the selected framework, in a VSE.

  – A deployment package is not a complete process reference model. Deployment packages are not intended to preclude or discourage the use of additional guidelines that VSEs find useful.

- By deploying and implementing a Deployment Package, a VSE can see its concrete step to achieve or demonstrate coverage to Part 5.

- Deployment Packages are designed such that a VSE can implement its content, without having to implement the complete framework at the same time.

- Each DP is reviewed and edited by at least 2 persons
  – Ana Vasquez (Mexico)
  – Claude Y Laporte (Canada)
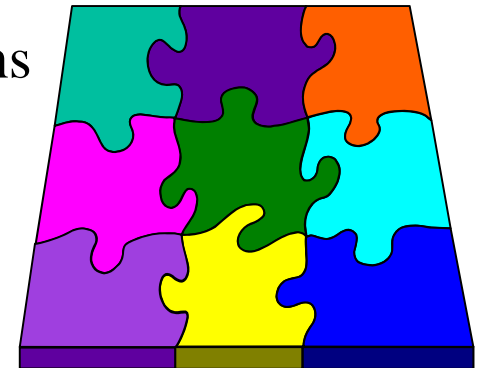
Content of Deployment Packages

1. Technical Description
    Purpose of this document
    Why this topic is Important ?
2. Definitions
    Generic Terms
    Specific Terms
3. Relationships with ISO/IEC 29110 Part 5
4. Description of Processes, Activities, Tasks, Steps, Roles and Products
5. Template
6. Example
7. Checklist
8. Tool
9. Reference to Standards and Models: ISO 9001, ISO/IEC 12207, CMMI
10. References
11. Evaluation Form

Deployment Packages are free !

Deployment Packages for the Basic Profile
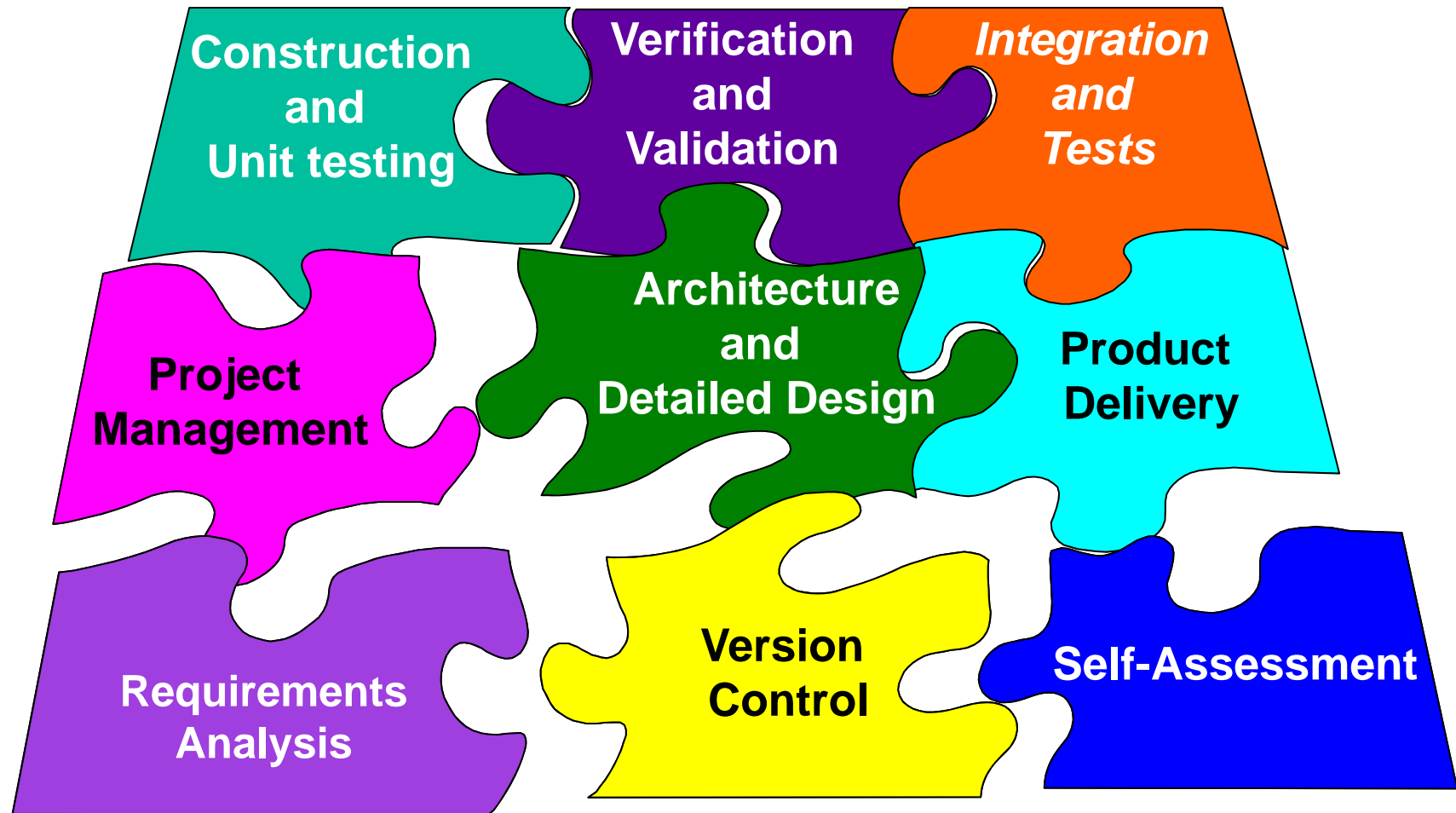
Deployment Packages for the Basic Profile

Title of Deployment Package	Developed by
Requirements Analysis	Belgium, Canada
Architecture and Detailed Design	Canada
Construction and Unit Testing	Mexico
Integration and Test	Columbia
Verification and Validation	Canada
Version Control	Thailand
Project Management	Ireland
Product Delivery	Canada, Thailand
Self-Assessment	Finland

- **Additional DP**: Select and Conduct of Pilot Projects (Canada, Uruguay)

Pilot Projects

- **Definition**
  - A method for exploring the value of a new technological concept via an objective study conducted in a somewhat realistic setting (adapted from Glass 1997).
- Successful pilot project is also an effective means of building adoption of new practices by members of a VSE.
- To be credible, the pilot projects should satisfy the following requirements (Fenton 1994):
  - The pilot project experiment has to be designed correctly,
  - The pilot project has to be performed in a real situation.
    - It is not a toy project, i.e. an artificial problem in an artificial situation,
  - The measurements have to be appropriate to the goals of the experiment,
  - The experiment has to be run for long enough.

> * To develop a solid business case to promote the adoption of ISO 29110 by VSEs internationally

Select and Conduct Pilot Project Deployment Package

- **Purpose**
  - To provide tailorable and usable guidelines and materials in order to select and conduct pilot projects in VSEs.

- **Overview of the 4 Tasks**
  - Task 1 - Assess the opportunity to conduct a pilot project *
  - Task 2 - Plan the Pilot Project
  - Task 3 - Conduct the Pilot Project
  - Task 4 - Evaluate the Results of the Pilot Project

Task 1 - Assess the Opportunity to Conduct a Pilot Project

- **Goals**
  - The pilot project coordinator and the management of the VSE assess the opportunity to conduct a pilot project.
  - If the conclusion of the assessment is positive, the commitment of VSE's management to conduct the pilot project is obtained.

- **Steps**
  - Step 1: Sign the Confidentiality Agreement (optional)
  - Step 2: Define the characteristics and context of the VSE
  - Step 3: Define the problem(s) to be addressed
    - e.g. Perform an assessment using the Self-Assessment DP and tool
  - Step 4: Select the technology to pilot
  - Step 5: Select the project which will pilot the technology
  - Step 6: Examine the cost and benefits of the pilot project
  - Step 7: Obtain the commitment of VSE's management

Pilot Projects Support

- **Support Tools for the Deployment Package**
  - Assessment Tool Spreadsheet
  - Pilot Project Plan Template
  - Pilot Project Report Template
  - Confidentiality Agreement Template

- **Description of Pilot Projects***
  - Projects Completed
  - Projects Underway
  - Projects Planned

Pilot Projects Completed in Canada - 1

- **Pilot Project in a Computer Aided Design (CAD) Software Support Organisation**
  - Distributes and supports three types of software products:
    - Computer Aided Design, Computer Aided Manufacturing and Computer Aided Engineering.
  - Products serve mainly the aerospace and the automobile industries.
  - Defined the tasks of 4 developers and undertook to improve the following processes:
    - Project management, Software configuration management, Issue tracking and Requirements management
- **Project conducted at a School Board of the Montréal Area**
  - Provide a stimulating environment for student learning.
  - It represents 54 primary schools, 14 secondary schools, 2 general training centers and 4 vocational training centers.
    - Over 8,000 employees,
  - IT department with a staff of 4: 1 analyst and 3 developers.
  - Studied, translated and implemented 3 DPs:
    - Software Requirements, Version Control, Project Management

Pilot Projects Completed in Canada

- **Software Engineering Graduate students – SQA Course** *
  - **Insurance Company**
    - French global insurance companies group headquartered in Paris.
    - IT staff of 11 in Montréal
  - **Support Organisation for Notaries**
    - Support the notary profession's transition into a virtual environment
      - 3,200 notaries in Québec
    - Organisation of 70 people
    - IT staff of 8
  - **Geographic Information System Modeling Company**
    - Leader in modeling and mapping software and technology
    - Organisation of 1000 employees
    - IT staff of 6 in Montréal
  - **Support Organisation for Lawyers**
    - Organisation of 200 employees: IT staff of 5
  - **University Research Laboratory**
    - Research Laboratory of a Business School
    - ERP simulation (e.g. SAP)

* In each team, one student is a staff of the Organisation

Pilot Projects Completed in Canada

- **Acme Software for Building Maintenance**
  - VSE of 8 in Canada and 3 in France.
  - Will pilot verification practices : code review and requirements inspection
- **Acme Insurance**
  - About 300 staffs.
  - QA department of 20
  - Will pilot configuration management practices
- **Acme Security**
  - Develop security platforms
  - VSE of 29 employees
  - Will pilot requirements practices in the R&D group of 9 software developers
- **Acme Web Site Development**
  - Develop internet sites
  - VSE of 25 employees
  - Will pilot test practices
- **Acme Communications**
  - VSE of 25 employees spread in 2 cities
  - IT staff of 2
  - Will pilot requirements practices

Pilot Projects Underway

- **Belgium (CETIC)**
  - VSE of 25 people have developed a solution for managing Tram / bus / subway tickets in Brussels.
  - Pilot project started in June with a process assessment phase aiming to identify strengths and weaknesses in development related processes.
  - CETIC is preparing, with this company, the improvement actions mainly based on the following Deployment Packages:
    - Requirement Analysis, Version Control, Project Management

- **France (UBO)**
  - A VSE of 14 employees producing pedestrian counters
  - VSE of 2 IT staffs

- **Ireland (LERO)**
  - VSE of 10 people who are involved in designing software solutions for a range of business types and in addition they have created an in-house development platform.

Pilot Projects Underway in Haïti and in Canada

- **Pilot projects in Montréal and Haiti**
  - Graduate student from Haiti
  - Evaluated in 2 VSEs in Haiti
  - As a professor in Haiti
    – Teach 29110

- **Pilot Project to Transfer ISO 29110 to Colleges**
  - ISO 29110 will be taught to college students learning IT
    - Training of college professors
    - Preparation of teaching material

Pilot Projects Completed in Canada

- **Research Laboratory in Medical Imagery and Orthopedic**

  - Implementation of 29110 Draft Entry/Basic Profiles processes for Master and PhD students

  - Most projects are conducted by 1 graduate student

- **Telecommunication Research Chair**

  - Implementation of 29110 Draft Entry Profile processes for Master and PhD students

  - Most projects are conducted by 1 graduate student
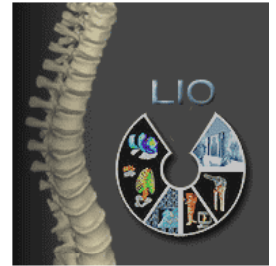
Education Interest Group

- Concept: Deployment Packages for Education

- Proposed at the Hyderabad meeting (May 2009)
  - To help educators teach the future ISO standards for VSEs by developing and providing at no cost educational material,
  - To sensitize undergraduate and graduate students to the ISO standard for VSEs.

- Courses to Support ISO 29110 Standards and Technical Reports
  1. Introduction to ISO/IEC Software Engineering Standards (Ireland)
  2. Introduction to the ISO/IEC 29110 Standards, Technical Reports and Deployment Packages for VSEs (Canada)
  3. Development of a Software engineering Process using ISO/IEC 29110 TR Part 5 – Engineering and Management Guide
  4. Software Development Using ISO/IEC 29110 TR - Engineering and Management Guide (Czech Republic)
  5. Self-Assessment of an ISO/IEC 29110-Based Software Process
  6. Conduct Deployment of ISO/IEC Standard in a VSE (Canada)

5. Diffusion

A Public Web Site

- Members of WG
- Introduction
- Survey of VSEs
- Network of Centers
- Deployment Packages
- Pilot Projects
- Educational material
- Publications

École de technologie supérieure
Génie logiciel et des technologies de l'information
Professor Claude Y. Laporte, Eng., Ph.D.   Français

Home

- Members of the Group
- Introduction
- Survey of VSEs
- VSE Network of Centers
- Generic Profile Group
- Deployment Packages
- Pilot Projects
- Education
- Publications

Welcome to the Public Site of the ISO/IEC JTC1/SC7[1] Working Group 24

ISO/IEC 29110 - Life Cycle Profiles for Very Small Entities (VSEs)

Industry recognizes Very Small Entities (a Very Small Entity is an enterprise, organization, department or project having up to 25 people) for their contribution of valuable products and services. As software quality increasingly becomes a subject of concern, and as process approaches are maturing and earning the confidence of companies, the use of ISO/IEC JTC1/SC7 international standards is spreading in organizations of all sizes. However, these standards were not written for VSEs and are consequently difficult to apply in such settings. A Working Group, Working Group 24, has been established to address these difficulties by developing profiles and providing guidance for compliance with ISO software engineering standards. A survey was conducted among very small entities on their utilization of standards, as well as to collect data to identify problems and potential solutions to help very small enterprises apply them.

The guides are based on subsets of appropriate standards elements, referred to as VSE Profiles. The purpose of a VSE profile is to define a subset of ISO/IEC standards relevant to the VSE context, for example, processes and outcomes of ISO/IEC 12207 and products of ISO/IEC 15289. The ISO/IEC 29110 Set of Documents, targeted by audience, has been developed to improve product and/or service quality, and process performance (see table 1). When a new profile is needed, ISO/IEC 29110 Parts 4 and 5 can be developed without impacting existing documents.

Table 1. ISO/IEC 29110 Target Audience

ISO/IEC 29110	Title	Target audience
Part 1	Overview	VSEs, assessors, standards producers, tool vendors and methodology vendors.
Part 2	Framework and taxonomy	Standards producers, tool vendors and methodology vendors. Not intended for VSEs.
Part 3	Assessment guide	Assessors and VSEs
Part 4	Profile specifications	Standards producers, tool vendors and methodology vendors. Not intended for VSEs.
Part 5	Management and engineering guide	VSEs

Note: Part 5-1-2 (Basic Profile) is available at no cost from ISO:
http://standards.iso.org/ittf/PubliclyAvailableStandards/index.html

Terminé

Monthly Visits of the Public Web Site
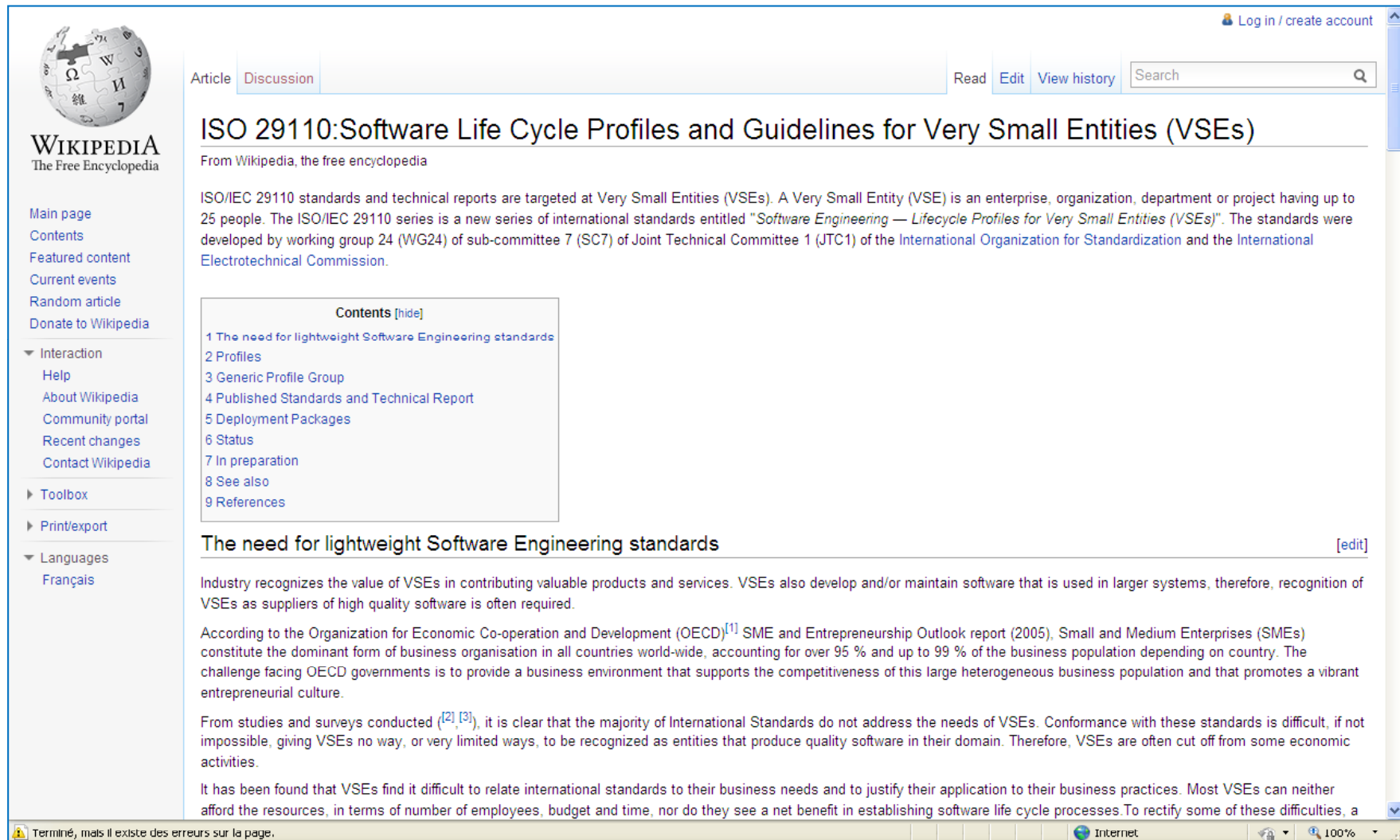
ISO 29110 Public Web Sites

- **Belgium:** *in construction*

- **Brazil:** *in construction*

- **Canada:** www.iso29110.ca (*in construction*)

- **Finland:** https://wiki.tut.fi/CoSE/VSE

- **Ireland:** http://www.lero.ie/project/iso29110

- **Japan:** www.vse.jp

- **Thailand:** http://www.center4vse.net/

ISO 29110 on Wikipedia

http://en.wikipedia.org/wiki/ISO_29110:Software_Life_Cycle_Profiles_and_Guidelines_for_Very_Small_Entities_(VSEs)

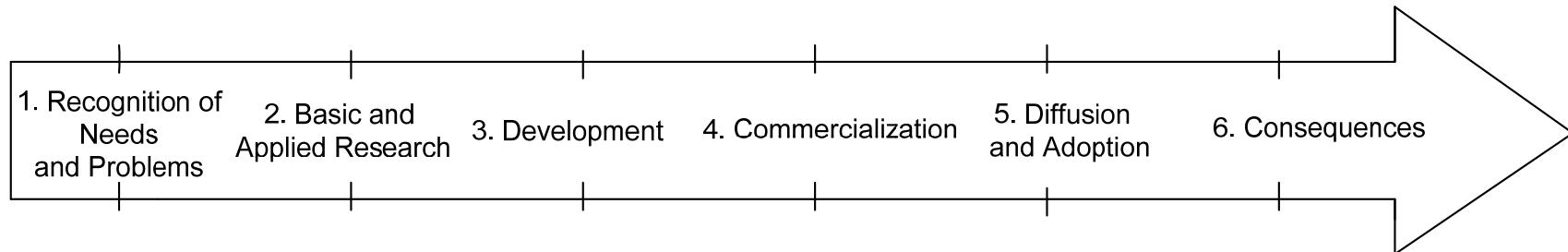# Technology Transfer Center for VSEs at the ÉTS

- **Mission**
  - To accelerate technology transfer to small and very small structures in Québec developing software products or software-based systems, or to provide IT services to make them more competitive, both at the national level and internationally, by developing and deploying software engineering practices tailored to their needs.

- **Objectives**
  1. Identify, promote, and disseminate best practices in software engineering and services for very small entities;
  2. Accelerate the process of technology transfer in software engineering for VSEs;
  3. Provide information and technical and strategic information to managers of VSEs, outsourcers, and Government of Québec agencies;
  4. Participate in the development of international standards for VSEs;
  5. Promote international standards for VSEs in Québec;
  6. Promote research in software engineering for VSEs;
  7. Promote training and development courses on ISO standards for VSEs.

Publications - Communications

- Elements of ISO/IEC 29110 are introduced in many chapters of 2 French textbooks on Software Quality Assurance
  - e.g. Chapter about standards, risks, reviews, etc.
- INCOSE Workshop (Phoenix, Arizona, Feb. 2011)
  - Presentation to Systems Engineers
- Project Management Institute (Montréal, April 2011)
  - Presentation to Project Managers
- French Association of Systems Engineers (Paris, May 24th)
- IEEE 730 Standard – Software Quality Assurance
  - An annex was written about ISO 29110 standard
    - Description of VSE, needs.
    - Overview ISO 29110, profiles, processes.
    - Coverage of ISO 12207 SQA activities to 29110 Basic profile

Agenda

- **Phase 1 - Recognition of Needs and Problems (2004)**
- **Phase 2 - Basic and Applied Research (2005-2005)**
- **Phase 3 – Development (2006-2010)**
- **Phase 4 – Commercialization (2010)**
- **Phase 5 - Diffusion and Adoption (2006 -)**
- **Phase 6 - Consequences (2011 -)**

Consequences

- Promoters of an innovation are often optimistic
  - Change agents and agencies tacitly assume that the consequences of innovations will be positive.
- Consequences of an innovation usually manifest themselves over extended periods of time (e.g. months, years)
- Possible consequences (undesirable, direct or indirect, anticipated or unanticipated) by:
  - **Imposing** the standards on all the VSEs in a country or on all a customer's VSEs
    - e.g. from a large enterprise or a government agency
  - **Motivating** VSEs to adopt the standards
    - Government support: Awareness, training, certification, etc.
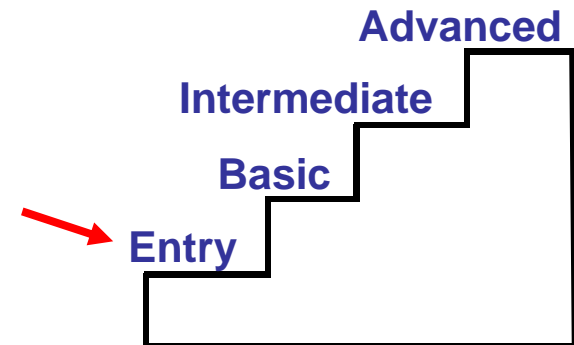 - **Not imposing** the standards on VSEs (*laissez-faire*)

Example of Thailand

- Thailand is now using the new software engineering standard ISO29110 in piloting software procurement related in Thai government agencies.

- There are around 200 government agencies interested in this direction.

- Within 3 years, Thailand hope to mandate ISO29110 as the minimum requirement for all Thai government related for software and system procurement.

Dr. Anukul Tamprasirt, Nov 29th, 2010

Development of the Entry Profile

- – Targeted VSEs
  - Projects of six person-months effort or less
  - Start-up VSEs

- – Approach used to develop the profile
  - Identified objectives to be removed/modified from the Basic Profile
  - Removed/modified activities and documents
  - Developed 2 Deployment Packages to support the profile
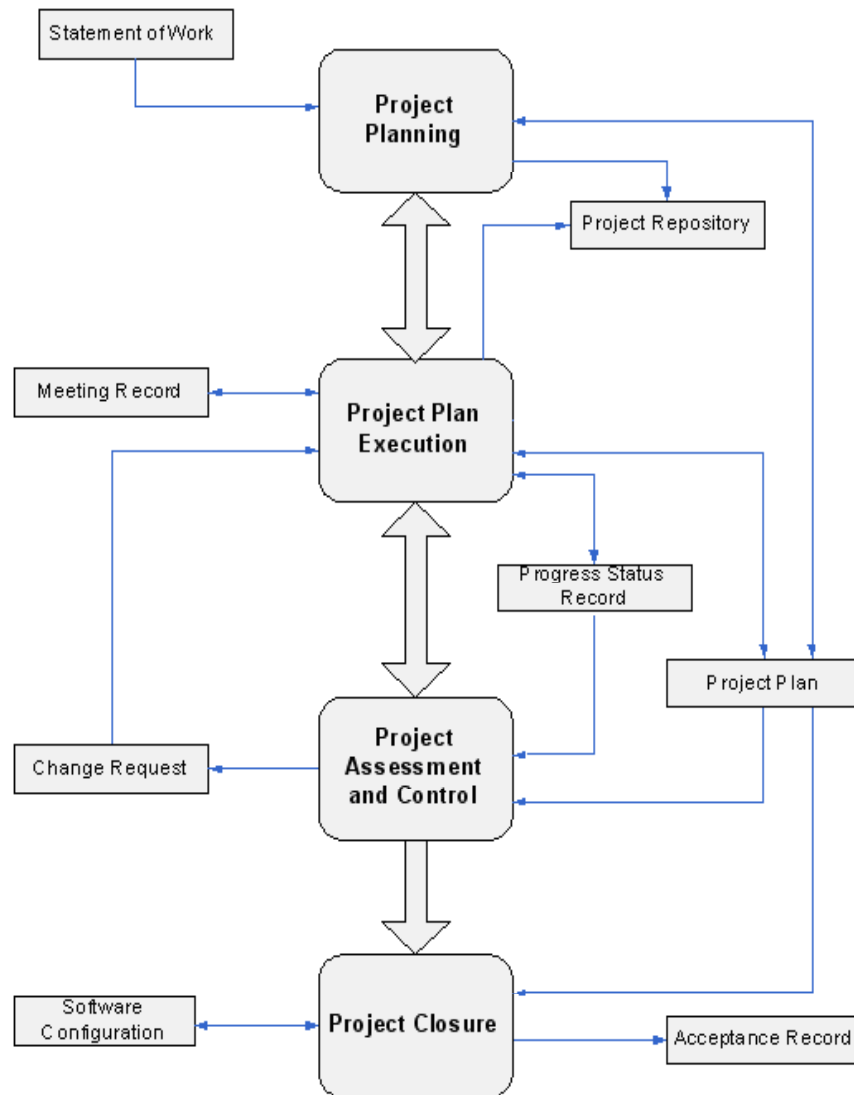 - Developed an Eclipse plug-in

Advanced

Intermediate

Basic

Entry

Development of the Entry Profile

| Objective ID	Objectives
PM.01	The *Project Plan* for the execution of the project is developed according to *the Statement of Work* and reviewed and accepted by the Customer. The tasks and resources necessary to complete the work are sized and estimated.
PM.02	Progress of the project monitored against the *Project Plan* ~~and recorded in the Progress Status Record. Corrections to remediate problems and deviations from the plan are taken when project targets are not achieved.~~ Closure of the project is performed to get the Customer acceptance documented in *the Acceptance Record*.
PM.03	The *Changes Requests* are addressed ~~through their reception and analysis~~. Changes to **the** software requirements are evaluated for ~~cost, schedule and technical impact.~~ **impact**.
PM.04	Review meetings with the Work Team and the Customer are held. Agreements are registered and tracked.
PM.05	~~*Risks* are identified as they develop and during the conduct of the project.~~
PM.06	~~A software *Version Control Strategy* is developed. Items of *Software Configuration* are identified, defined and baselined. Modifications and releases of the items are controlled and made available to the Customer and Work Team. The storage, handling and delivery of the items are controlled.~~ **Items of Software Configuration are identified and controlled.**
PM.07	~~Software Quality Assurance is performed to provide assurance that work products and processes comply with the *Project Plan* and *Requirements Specification*.~~

Legend: Information added or modified to the Basic Profile is shown in blue while information deleted is shown like this: ~~strike out~~.

Draft Entry Profile

Project Management Process

Software Implementation Process

* To be discussed at the WG24 meeting in Ireland (November 2011)
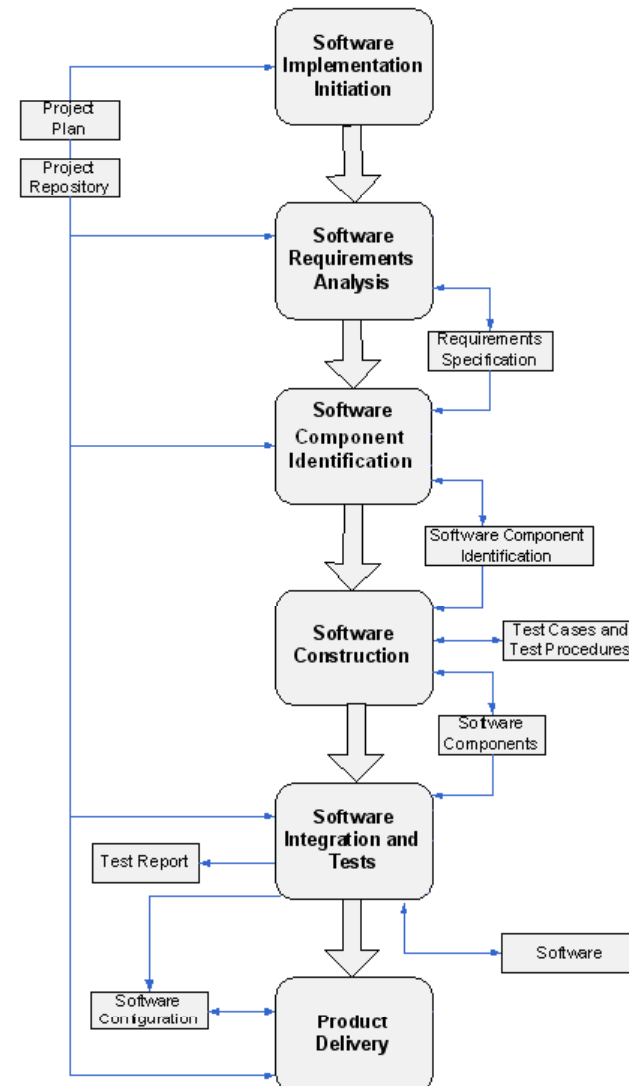
ISO 29110 - Next Steps

- Develop the Remaining 3 Profiles

  Advanced
  Intermediate
  Basic
  Entry

  - **Entry**: six person-months effort or start-up VSEs
  - **Intermediate**: Management of more than one project
  - **Advanced**: business management and portfolio management practices.

- Development of a certification process

- Update the set of Basic Profile Deployment Packages

- Develop a set of 'Expert Mode' Deployment Packages (2-3 pages)

- Development of video-clips

- Development of self-learning course modules to support DPs

- Development of SharePoint modules to support DPs

- Develop Profile Groups for other domains

  - Critical software: e.g. medical, aerospace, automotive
  - Scientific software development
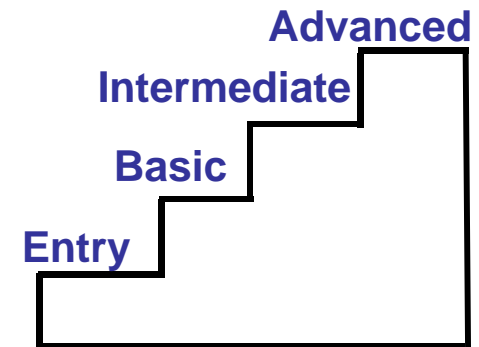
Intermediate and Advanced Profiles *

- **Intermediate Profile**
  - For VSEs developing multiple projects within the organizational context taking advantage of it.

- **Advanced Profile**
  - For VSEs which want to sustain and grow as an independent competitive software development business.
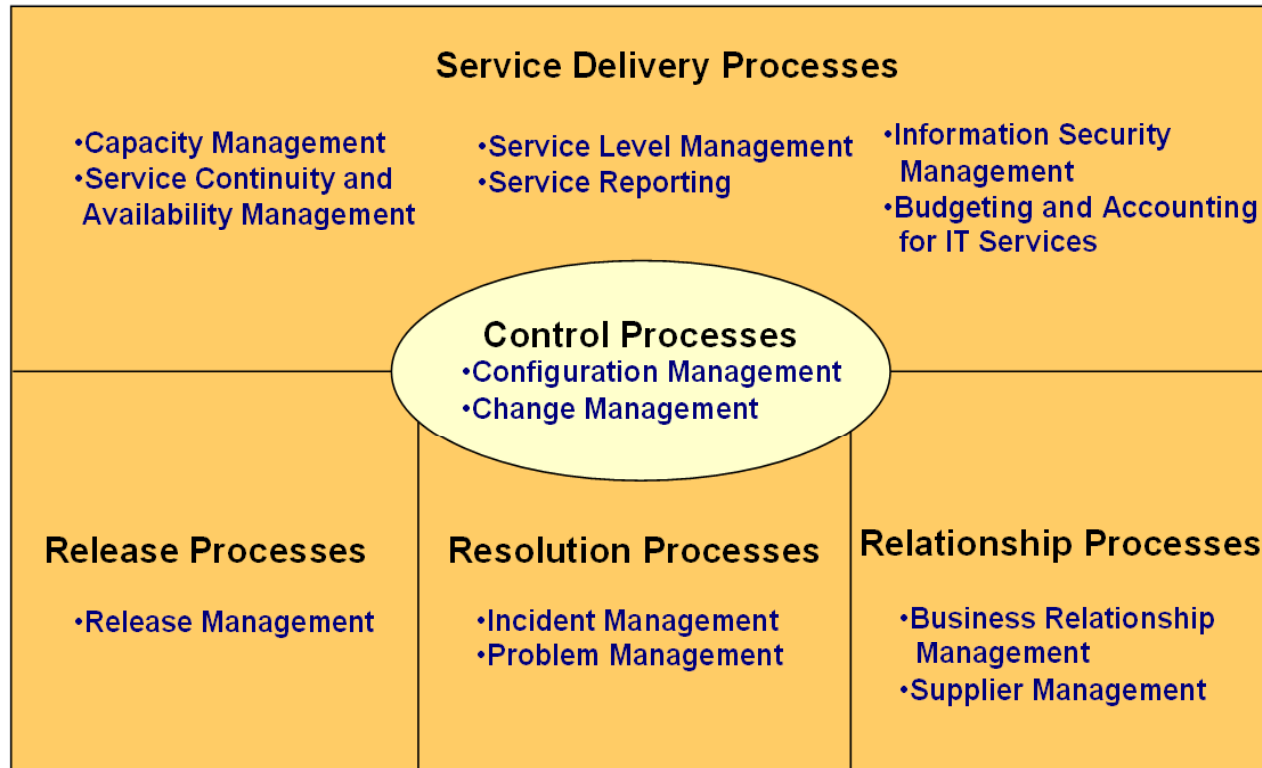
- **Examples of additional practices**
  - Additional QA practices,
  - Configuration management (e.g. versus version control)
  - Testing
    - Improved Integration and Acceptance testing
  - Other Practices
    - Supplier management
    - Measurement

Advanced

Intermediate

Basic

Entry

* To be discussed at the WG24 meeting in Ireland
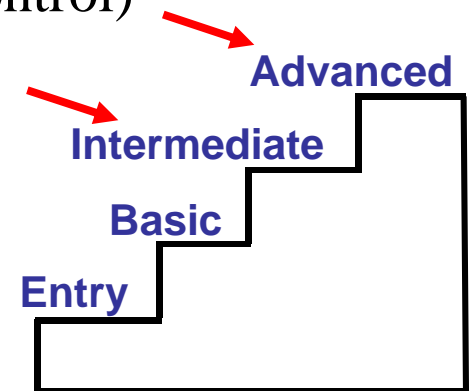
Application of ISO 20000 to VSEs

- IT Service Management
  - Defines the requirements for a service provider to deliver managed services of an acceptable quality for its customer.

Service Delivery Processes

- Capacity Management
- Service Continuity and Availability Management
- Service Level Management
- Service Reporting
- Information Security Management
- Budgeting and Accounting for IT Services

Control Processes
- Configuration Management
- Change Management

Release Processes
- Release Management

Resolution Processes
- Incident Management
- Problem Management

Relationship Processes
- Business Relationship Management
- Supplier Management

- Development of a set of Deployment Packages
- Pilot projects are conducted in 3 VSEs

Development of Profiles and DPs in Systems Engineering

- Project done under sponsorship of INCOSE/AFIS
  - International Council on Systems Engineering (INCOSE)
  - Association Française d'Ingénierie Système (AFIS)

- Goals
  - To improve or make product development efficient by using Systems Engineering methodology,
  - To elaborate tailored practical guidance to apply to VSEs in the context of prime or subcontractor, of commercial products,
  - To develop Standards to 'match' ISO 29110
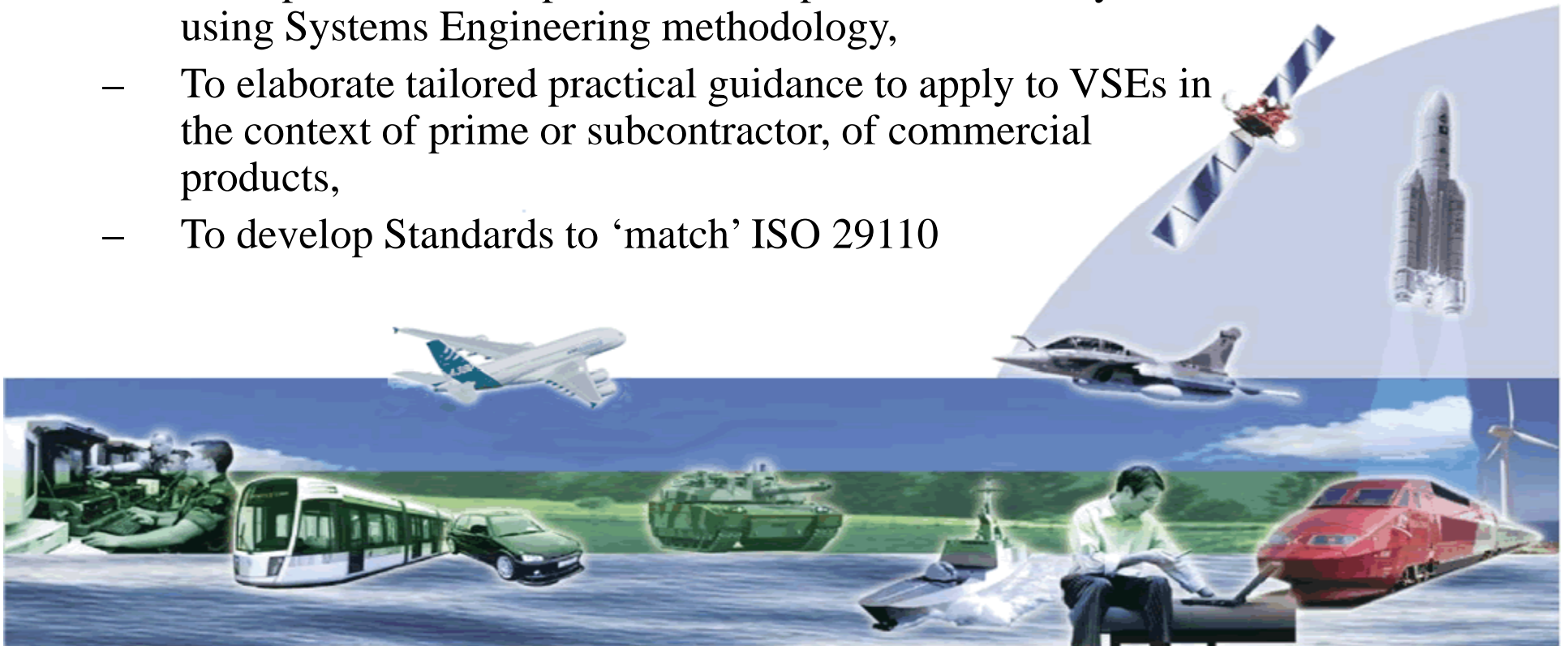
Conclusion
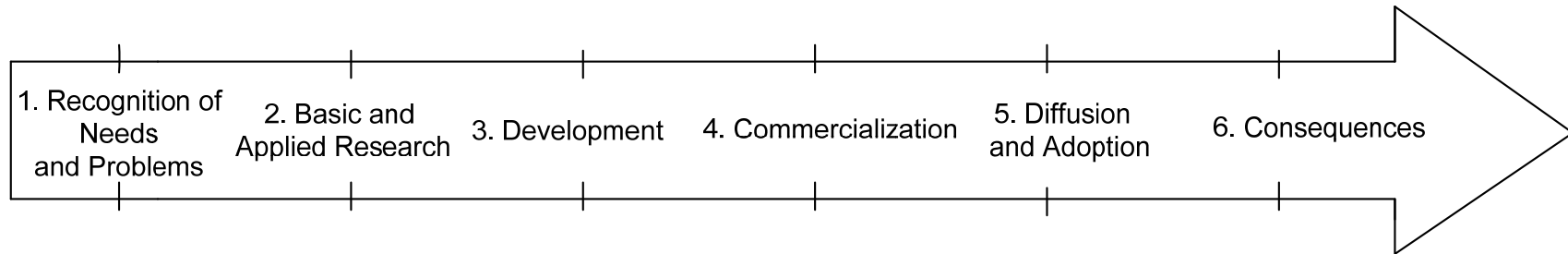
- **Phase 1 - Recognition of Needs and Problems (2004)**

- **Phase 2 - Basic and Applied Research (2005-2006)**

- **Phase 3 – Development (2006-2010)**

- **Phase 4 – Commercialization (2010)**

- **Phase 5 - Diffusion and Adoption (2006 -)**

- **Phase 6 - Consequences (2011 -)**

Why
For Who
Who
How
When
What

Thank you for your attention

Questions?

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  - **Web: www.logti.etsmtl.ca/profs/claporte**

- **Public site of WG 24**
  - **Free access to Deployment Packages, presentation material and articles:**
    - http://profs.logti.etsmtl.ca/claporte/English/VSE/index.html

- **Technical Reports available at no cost from ISO:**
    - http://standards.iso.org/ittf/PubliclyAvailableStandards/index.html

References

- ISO/IEC JTC1/SC7 N3288, New Work Item Proposal – Software Life Cycles for Very Small Enterprises, Mai 2005.
- ISO/IEC 12207:2008, Information technology – Software life cycle processes, International Organization for Standardization/ International Electrotechnical Commission: Geneva, Switzerland.
- ISO/IEC 29110:2011 - Lifecycle Profiles for Very Small Entities (VSEs), International Organization for Standardization/International Electrotechnical Commission: Geneva, Switzerland.
- ISO/IEC 15289:2006 - Systems and software engineering - Content of systems and software life cycle process information products (Documentation)
- Conner, D., Managing at the Speed of Change, Willard Books, 1992.
- Kabli, S., Conception, réalisation et mise a l'essai de trousses de déploiement pour faciliter et accélérer l'implémentation de la norme ISO/CEI 20000 par les très petites structures, ÉTS, 2009.
- Laporte, C.Y., Alexandre, S., O'Connor, R., A Software Engineering Lifecycle Standard for Very Small Enterprises, in R.V. O'Connor et al. (Eds.): EuroSPI 2008, CCIS 16, pp. 129–141.
- Long, L., The Critical Need for Software Engineering Education, Crosstalk - The Journal of Defense Software Engineering, January 2008, pp 6-10.
- Reifer, D., Industry Software Cost, Quality and Productivity Benchmarks. DACS Newsletter, Volume 7, Number 2, 2004
- Rogers, Everett M., Diffusion of Innovations, fifth edition, Free Press, New York, 2003.
- Selby, P., Selby, R.W., Measurement-Driven Systems Engineering Using Six Sigma Techniques to Improve Software Defect Detection, Proceedings of 17th International Symposium, INCOSE, June 2007, San Diego.