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

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August 26th 2011
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

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

www.etsmtl.ca

Engineering for Industry
Department of Software and IT Engineering
Quiz

- There are about ‘Y errors’ per 1000 lines of code
- It takes about ‘Z minutes’ to find each error
- It takes about ‘U hours’ to correct each error
Answers

• There are about ‘5 to 15 errors’ per 1000 lines of code
• It takes about ‘75 minutes’ to find each error
• It takes about ‘2 to 9 hours’ to correct 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

Maritime Transport System
- Global positioning receiver system
- Display System

Ground Transportation System
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)
…studies have shown that software specialists spend about 40 to 50 percent of their time on avoidable rework 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
Software Defect Injection

System Development Phase

(Selby 2007)
Software Defect Detected when Injected in Same Phase

Defects Detected / Defects Injected (%)
Hooke’s Law
\[ F = -kx, \]

Newton's law of universal gravitation
\[ F = G \frac{m_1 m_2}{r^2} \]

NEWTON’S LAW
\[ F = ma \]

Boyle-Mariotte’s Law
\[ p_1 V_1 = p_2 V_2 \]

Curie’s Law
\[ M = C \cdot \frac{B}{T}, \]

Snell’s Law of Refraction
\[ \eta_1 \cdot \sin(\theta_1) = \eta_2 \cdot \sin(\theta_2) \]

OHM’S LAW
\[ I = \frac{V}{R} \]

Coulomb’s Law
\[ F = k_e \frac{q_1 q_2}{r^2} \]
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

01/09/2011

SC7 Secretary, Paris, May 2011
SC7 Standards Collection

Governance
- 9001 Quality System
- 29151, 38500

Foundation
- 24765 Vocabulary
- 24774 Process Description

BOK and Professionalism
- 19759 SWEBOK
- 24773, 29154 Certification

Life Cycle
- 15288
- 19760
- 26702
- 90005 Systems Engineering
- 24748
- 29110

Assessment and Certification
- 12207
- 90003
- 15271 Software Engineering
- 19770-1 Asset Mgmt

Product Characteristics
- 9126
- 14598, 14756

Software Quality
- 25000 Series (13 Parts)

Software Quality SQuaRE
- 14143
- 19761
- 20926
- 20968
- 24570
- 29881

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

Measurement
- 15939
- 29155

Modeling
- 14568
- 15474
- 15475
- 15476
- 19506

Interchange
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 Cradle to Grave

01/09/2011
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

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.**

<table>
<thead>
<tr>
<th>Number of employees</th>
<th>Number of Software Enterprises</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>1 to 25</td>
<td>540</td>
<td>78 %</td>
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<tr>
<td>25 to 100</td>
<td>127</td>
<td>18 %</td>
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<tr>
<td>Over 100</td>
<td>26</td>
<td>4 %</td>
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</tbody>
</table>

50% of enterprises have less than 10 employees

* OECD: Organisation for Economic Co-operation and Development
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

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

- **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 by large organisations for 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 Needs and Problems
2. Basic and Applied Research
3. Development
4. Commercialization
5. Diffusion and Adoption
6. Consequences

• Phase 1 - Recognition of Needs and Problems (2004)

• Phase 2 - Basic and Applied Research
  – Survey of VSEs worldwide (2006)

• Phase 3 – Development (2006-2010)

• Phase 4 – Commercialization (2010)

• Phase 5 - Diffusion and Adoption (2006 -)

• Phase 6 - Consequences (2011 - )
2. Research

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 - Moprossoft
  - 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.
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

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of Responses</th>
<th>Country</th>
<th>Number of Responses</th>
<th>Country</th>
<th>Number of Responses</th>
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</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>2</td>
<td>Finland</td>
<td>13</td>
<td>New Zealand</td>
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<tr>
<td>Australia</td>
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<td>4</td>
<td>Peru</td>
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<td>Russia</td>
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<td>Brazil</td>
<td>72</td>
<td>India</td>
<td>57</td>
<td>South Africa</td>
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<td>Spain</td>
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<td>Canada</td>
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<td>Italy</td>
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<td>Chile</td>
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<td>Japan</td>
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<td>Thailand</td>
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<td>Colombia</td>
<td>109</td>
<td>Korea (South)</td>
<td>4</td>
<td>Turkey</td>
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<tr>
<td>Czech Republic</td>
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<td>Luxembourg</td>
<td>3</td>
<td>United Kingdom</td>
<td>2</td>
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<tr>
<td>Dominican Republic</td>
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<td>Mexico</td>
<td>20</td>
<td>United States</td>
<td>3</td>
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<tr>
<td>Ecuador</td>
<td>9</td>
<td>Morocco</td>
<td>1</td>
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</tbody>
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01/09/2011
Why don't VSEs use Standards?

- Not required: 24%
- Lack of support: 14%
- Lack of resources: 15%
- Too time-consuming: 10%
- Standard(s)*: 9%
- Other: 14%

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

• 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 - )
3. Development

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 critical software 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 impact on safety or could cause large financial or social losses (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.
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

‘How to do’

All TRs are available at no cost from ISO
Preparation Steps for the Basic Profile

1. VSEs’ Characteristics
2. VSEs’ Needs and Competencies
3. IS 29110-2
   VSE Framework and Taxonomy
4. IS 29110-4-1
   Basic VSE Profile Specification
5. TR 29110-5-1
   Management and Engineering Guide

ISO/IEC 12207
ISO/IEC 15289
IS 29110-4-1
ISO/IEC 15289 Elements
ISO/IEC 29110
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.
ISO/IEC 29110 Part 5 – Table of Contents

Foreword
Introduction
1. Scope
2. Normative references
3. Terms and definitions
4. Basic VSE profile management and engineering guide
   4.1 Introduction
   4.2 Project Management (PM) process
   4.3 Software Implementation (SI) process
   4.4 Roles
   4.5 Product description
   4.6 Software tools requirements

Annex A (informative) – Deployment Package

Bibliography
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.
Part 5 - Project Management (PM) Process

• **Purpose**
  – To establish and carry out in a systematic way the tasks of the software implementation project, which allows complying with the project’s objectives in the expected quality, time and costs.

• **Seven Objectives**
  – **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.

<table>
<thead>
<tr>
<th>6.3.1 Project Planning Process</th>
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<tbody>
<tr>
<td>a) the scope of the work for the project is defined;</td>
</tr>
<tr>
<td>c) the tasks and resources necessary to complete the work are sized and estimated;</td>
</tr>
<tr>
<td>d) interfaces between elements in the project, and with other project and organizational units, are identified;</td>
</tr>
<tr>
<td>e) plans for the execution of the project are developed; and</td>
</tr>
<tr>
<td>f) plans for the execution of the project are activated.</td>
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<table>
<thead>
<tr>
<th>6.3.7 Measurement Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) the information needs of technical and management processes are identified.</td>
</tr>
</tbody>
</table>

[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

- Project Planning
  - Statement of Work
  - Verification Results
  - Validation Results
  - Project Repository
  - Project Repository Backup

- Project Plan Execution
  - Meeting Record
  - Correction Register
  - Progress Status Record
  - Project Plan

- Project Assessment and Control
  - Change Request

- Project Closure
  - Software Configuration
  - Acceptance Record

Levels:
- Basic
- Intermediate
- Advanced
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.
### Comments Analysed by WG24 to develop the Set of Documents

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<td>TR 29110-1 Overview</td>
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<td>IS 29110-2 Framework and taxonomy</td>
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<td>TR 29110-3 Assessment guide</td>
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<td>TR 29110-5 Basic Profile Management and engineering guide</td>
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01/09/2011
Agenda

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

• 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 - )
4. Commercialization

ISO Standard Development Processes

- ISO edits and publishes
- 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 not involved in commercialization activities

• Needs of VSEs (from Survey)
  – Not completely fulfilled 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 readily usable information and made freely available
      – e.g. detailed process descriptions (steps), templates, checklists, etc.
  – Linked to ISO/IEC 29110 Part 5 - Annex A
Agenda

5. Diffusion and Adoption (2006 - )
   - Development of the Means to Accelerate the Adoption and Utilization of International Standards by VSEs (2006 - )
6. Consequences (2011 - )
Commitment Curve and the Adoption of a Technology - Standard

Degree of Support

Commitment Phase

Acceptance Phase

Preparation Phase

Contact

Positive Perception

Understanding

Internalization

Institutionalization

Adoption

Installation

Awareness

Unawareness

Confusion

Decision not to implement

Aborted after initial implementation

Aborted after extensive implementation

Connor 1992

Time
5. Diffusion

Rate of Diffusion/Adoption

<table>
<thead>
<tr>
<th>Percent of Adoption</th>
<th>Strategies</th>
</tr>
</thead>
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<tr>
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<tr>
<td></td>
<td>Strategy Y</td>
</tr>
<tr>
<td></td>
<td>Strategy Z</td>
</tr>
<tr>
<td></td>
<td>No Strategy</td>
</tr>
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</table>

(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
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


10. References

11. Evaluation Form

Deployment Packages are free!
Deployment Packages for the Basic Profile

- Construction and Unit testing
- Verification and Validation
- Integration and Tests
- Architecture and Detailed Design
- Product Delivery
- Requirements Analysis
- Version Control
- Self-Assessment

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## Deployment Packages for the Basic Profile

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

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

01/09/2011
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 tailor able 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:
  – 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
5. Diffusion

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)
  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
Monthly Visits of the Public Web Site

Dashboard

Comparing to: Site

- Visits: 359
- Pageviews: 1,298
- Pages/Visit: 3.62
- Bounce Rate: 44.01%
- Avg. Time on Site: 00:02:36
- % New Visits: 49.58%

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ISO 29110 Public Web Sites

- **Belgium**: in construction
- **Brazil**: in construction
- **Canada**: [www.iso29110.ca](http://www.iso29110.ca) (in construction)
- **Finland**: [https://wiki.tut.fi/CoSE/VSE](https://wiki.tut.fi/CoSE/VSE)
- **Ireland**: [http://www.lero.ie/project/iso29110](http://www.lero.ie/project/iso29110)
- **Japan**: [www.vse.jp](http://www.vse.jp)
- **Thailand**: [http://www.center4vse.net/](http://www.center4vse.net/)
5. Diffusion

ISO 29110 on Wikipedia

5. Diffusion

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.
5. Diffusion

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

5. Diffusion and Adoption (2006 - )
6. Consequences (2011 - )
6. Consequences

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

6. Consequences

- 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
# Development of the Entry Profile

<table>
<thead>
<tr>
<th>Objective ID</th>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM.01</td>
<td>The <em>Project Plan</em> for the execution of the project is developed according to the <em>Statement of Work</em> and reviewed and accepted by the Customer. The tasks and resources necessary to complete the work are sized and estimated. Progress of the project monitored against the <em>Project Plan</em> and recorded in the <em>Progress Status Record</em>. 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 <em>Acceptance Record</em>.</td>
</tr>
<tr>
<td>PM.02</td>
<td>The <em>Changes Requests</em> are addressed through their reception and analysis. Changes to the software requirements are evaluated for cost, schedule and technical impact.</td>
</tr>
<tr>
<td>PM.03</td>
<td>Review meetings with the Work Team and the Customer are held. Agreements are registered and tracked.</td>
</tr>
<tr>
<td>PM.04</td>
<td><em>Risks</em> are identified as they develop and during the conduct of the project.</td>
</tr>
<tr>
<td>PM.05</td>
<td>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.</td>
</tr>
<tr>
<td>PM.06</td>
<td>Software Quality Assurance is performed to provide assurance that work products and processes comply with the <em>Project Plan</em> and <em>Requirements Specification</em>.</td>
</tr>
</tbody>
</table>

**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

01/09/2011

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

• Develop the Remaining 3 Profiles
  – **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

* 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 Diagram]

  - 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 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 - )
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

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- Reifer, D., Industry Software Cost, Quality and Productivity Benchmarks. DACS Newsletter, Volume 7, Number 2, 2004