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Study Group Report on Requirements

May 15, 2006

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Chronology of the Study

- May 27, 2005: The SC7 requirements study group was chartered in the Helsinki Plenary meeting (SC7 resolution 857).
- May 2005 – Sep. 2005: The study group circulated materials, and discussed them via email to plan the actions of the study group.
- Oct. 24 - 28, 2005: The study group worked on the key contents and the structure of the study report in conjunction with the SWG5, WG4, and WG7 during the Bari Interim meeting.
- Nov. 2005 - Apr. 2006: The study group conducted additional reviews, circulated materials, and discussed them via email to improve the study report.
- Apr. 15, 2006: The study group submitted the study report to SC7 Secretariat.

Objectives of the Study

- Investigate the possibility of additional standards or guidance in the area of Requirements.
- Assess how SC7 standards address requirements issues and come with recommendations.
- Make recommendations on changes to existing standards/guidance and/or the creation of new standards or TR.

Participants for the Study

- Eleven participants from eight national bodies
  - Jean Bérubé, Canada
  - Paul Croll, US
  - Juan Garbajosa, Spain
  - Mikael Gullberg, Sweden
  - Ian Hirst, Australia
  - Alison Holt, New Zealand
  - Cheryl Jones, US
  - Timo Käkölä, Finland
  - Byong Lee, Korea
  - Dan Lee, Korea
  - Ovidiu Noran, Australia

Market Needs of Requirements Standards (1/4)

The impacts of requirements errors are very critical:

- Multiple interpretations of requirements may cause disagreements among customers, users, and developers.
- It may be impossible to validate whether the software meets its requirements
- System may not satisfy needs of customers and users
- Time and money are wasted building a system of little value to the users.
  - **Cost of corrective actions including management**
  - **Recall of defective versions of shrink-wrapped software**
  - **Warranty costs**
  - **Product liability**
  - **Service costs to reinstall**
  - **Customer trust**
  - **etc.**

Market Needs of Requirements Standards (2/4)

- The most common reasons for project failures were identified from surveys conducted by the Standish Group in 1995 and 1996. (Those marked with an asterisk are directly related to requirements. – 51.6 %)
  - Incomplete requirements 13.1 % (*)
  - Lack of user involvement 12.4 % (*)
  - Lack of resources 10.6 %
  - Unrealistic expectations 9.9 % (*)
  - Lack of executive support 9.3 %
  - Changing requirements/specification 8.7 % (*)
  - Lack of planning 8.1 %
  - Didn't need it any longer 7.5 % (*)

Market Needs of Requirements Standards (3/4)

- Requirements engineering costs (Kotonya and Sommerville, 1998)
  - For large systems: 15% of total budget
  - For smaller systems: 10% of total budget
- Rework can consume 30 to 50% of total development costs (Boehm and Papaccio, 1988)
- Requirements errors account for 70 to 85% of the rework cost (Leffingwell, 1997)
- Requirements errors could consume 25 to 40 % of the total project budget (Leffingwell, 2003)

Market Needs of Requirements Standards (4/4)

- A seminar report of SC7 standards from Australian National Body (Feb. 21, 2006):
  - The requirements subject area was the one of most concern to industry attendees at a seminar we recently held on SC7 standards in New Zealand.
  - They especially wanted help for acquirers to write better requests for proposals and help for industry to respond to such requests.
    - **There seems to be demand for these 2 items.**

Current Status of Related Standards (1/2)

- The study group studied existing standards and other documents in the areas including:
  - WG4 Requirement Engineering Tool Requirements WD 24766
  - SWEBOK (TR19759) Chapter on Requirements
  - IEEE 830 and 1233
  - The harmonization work of IS12207 and IS15288 by WG7
  - IS25000 software product quality

Current Status of Related Standards (2/2)

- The technical reports on requirements engineering and the survey on requirements engineering tools of INCOSE
- TC184 documents
- The requirements engineering and management related parts of IS15504 and Capability Maturity Model® Integration (CMMI SM), Version 1.1 for Systems Engineering, Software Engineering, Integrated Product and Process Development, and Supplier Sourcing (CMMI-SE/SW/IPPD/SS, V1.1), Continuous Representation, CMU/SEI-2002-TR-011

Analysis of the Findings and Future Visions (1/6)

- The need and ways to harmonize and integrate system and software level requirements specification-related standards (IEEE830 and IEEE1233) into a new ISO standard:
  - IEEE830 focus on Software Requirements Specification whereas IEEE1233 focuses on System Requirements Specification

Analysis of the Findings and Future Visions (2/6)

- The need and ways to harmonize and integrate system and software level requirements process-related standards into a new ISO standard providing in-depth guidance for practitioners:
  - Requirements engineering process related aspects (including verification and validation aspects) of IS12207 and ISO15288 (software and systems lifecycle processes)
  - Requirements engineering process related aspects of TR19759 (SWEBOK)
  - Requirements engineering process related aspects of IS15504 and CMMI of the Software Engineering Institute, which already integrate both system and software levels

Analysis of the Findings and Future Visions (3/6)

- The need to guide system and software scoping :
  - Guidance for requirements elicitation and analysis to support in meeting Market needs/competitiveness (requirements engineering and management in dynamic business environments)
  - Valuation (quantitative/qualitative) of features by identifying and tracing back to the stakeholders (requirement sources)
  - etc.

Analysis of the Findings and Future Visions (4/6)

- Requirements engineering and management for software product lines (domain versus application requirements engineering and management) :
  - Current standards do not cover the engineering and management of software product lines almost at all
  - Yet, plenty of research in the area has been done, for example, by European ITEA-projects ESAPS, CAFÉ, and Families since 1999 and by SEI at Carnegie Mellon University

Analysis of the Findings and Future Visions (5/6)

- The need to guide for cross-life cycle requirements engineering and management:
  - Requirements engineering and management in spiral, iterative, and/or agile software development approaches
  - Requirements engineering and management for enabling functional size measurement of software
  - Prototyping for the fuzzy-front-end across life-cycle (from scoping to V&V)
  - etc.

Analysis of the Findings and Future Visions (6/6)

- The need to guide for requirements-traceable architectures for supporting end-to-end systems and software development life-cycle:
  - FDIS15940 (Software Engineering Environment services), FCD18018 (Configuration Management Tool Requirements), and WD24766 (Requirements Engineering Tool Requirements) would provide the base practices
  - Enabling traceability from customer requirements to final releases
  - Organizational design for managing the life cycle (roles and responsibilities involved in process enactment and improvement
  - Evolution of requirements (change management/impact analysis)
  - Risk management of requirements

Recommendations (1/4)

- The following three New Work Items are recommended. If one NWI should be initiated, requirements engineering process NWI will be done first:

- NWI-1 (Requirements process):
  - Requirements engineering process related aspects (including verification and validation aspects) of IS12207 and IS15288 (software and systems lifecycle processes), TR19759 (SWEBOK), IS14143 (Functional size measurement), and IS15504 and CMMI shall be harmonized and integrated into a new ISO standard providing in-depth guidance for practitioners.

Recommendations (2/4)

- NWI-2 (Requirements specification):
  - System and software level requirements specification related standards IEEE830 and IEEE1233 shall be harmonized and integrated into a new ISO standard.
- NWI- 3 (Requirements engineering and management for product lines):
  - Current standards do not cover the engineering and management of software product lines almost at all. Domain (versus application requirements) engineering and management are of interests to many countries and organizations.

Recommendations (3/4)

- Recommendation on the Assignment of WGs to the potential NWIs:

  - Alternative-1: assign the three NWIs to the existing WGs.
    - **NWI-1 (Requirements process) to WG7**
    - **NWI-2 (Requirements specification) to WG2**
    - **NWI-3 (Requirements engineering and management for product lines) to WG4 or WG7**
  - Alternative-2: assign the three NWIs to a new WG
    - **WG26 (Requirements WG)**

Recommendations (4/4)

- Recommendation on the Action Plan for the preparation of NWI ballot:
  - SC7 decision on the NWIs and the assignment of the WGs – during the Bangkok Plenary
  - Preparation of NWI ballot document – 2006 Plenary~2006 Interim
  - NWI ballot process – 2006 Interim~2007 Plenary