A Measurement Approach Integrating
ISO 15939, CMMI and the ISBSG

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Agenda

- **Introduction**
  - State-of-the-art
  - Measurement & Historical Data
- **ISO 15939 – An overview**
  - Software Measurement Process
  - Information Needs & Products
- **ISO 15939 vs. CMMI**
  - Using Both
  - Methodology
  - Measurement Interest Areas
  - QA vs. V&V
- **CMMI – An Analysis**
  - From ML2 to ML5
  - An Overview
- **ISBSG – A Turnkey Solution**
  - Introduction
  - Analysis
  - Comparing with CMMI
- **Conclusions**
Introduction

State-of-the-art

- Software Engineering Performances can benefit from continuous improvements
  - Measurement is the way to objectively evaluate and assess processes against a baseline
  - “You cannot control what you cannot measure” (De Marco)
- Well-known and recognized sources of information are...
  - CMMI (Capability Maturity Model Integration) Measurement & Analysis (ME) process
  - ISBSG (International Software Benchmarking Standards Group) data repository and related glossary
Introduction

Measurement & Historical Data

- **ISO 15939 / CMMI**
  - They cover – with few differences (e.g. environment) - all the phases and activities for successfully implementing a measurement program but they do not provide measures, only guidance to define measures addressing specific needs

- **ISBSG r10**
  - It does not provide any process, but provides measures and historical data from more than 4000 projects that could be useful for making ISO 15939/CMMI more effective.

**Q:** ...so: for practical use in industry for more efficient measurement and better decision making, can we combine these best practices?
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ISO 15939 – An Overview
Software Measurement Process

• Four main activities, with a Core Measurement Process
• A Measurement Experience Base as the wheel for such a core process

Scope of ISO/IEC 15939
Legend
- Activity
- Data Flow
- Data Store
ISO 15939 – An Overview
Information Needs & Products

• Measurement Information Model (MIM) – Annex A
  ✓ MIM is an improvement of the basic GQM paradigm

• Subdivided into three steps
  ✓ Data Collection → including measurement methods and base measures
  ✓ Data Preparation → including the agreed-upon mathematical formula and related labels (e.g. measurement functions and derived measures);
  ✓ Data Analysis → including the analysis models, indicators and interpretation
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ISO 15939 vs. CMMI

Using Both

- Integrability
  - CMMI v1.2 offers guidance for filling the *empty space* left open in ISO 15939 §5.2.2.1 (*Information needs for measurement shall be identified*)
ISO 15939 vs. CMMI

Methodology

- ISO’s 15939 Information Needs are based on...
  - Goals, Constraints, Risks and Problems
- CMMI’s Information Needs are based on...
  - Goals, Practices in the SE/SW environment
- A CMMI Goal/Practice related to Measurement can:
  a) Generate data that could be analyzed in order to produce an objective basis for communication or decision-making
  b) Involves decision-making that would benefit from objective information
  c) Explicitly requires measurement as part of the measurement process
- Relevance Levels (till the more relevant):
  1. “mentioned” when the information need is based on the first and/or second criterion;
  2. “recommended” when the information need is expressed in terms of measurement without being explicitly required as a part of the measurement process;
  3. “required” when the information need is based on the third criterion.
ISO 15939 vs. CMMI
Measurement Interest Areas (MIA)

- **Goal:** to organize the extracted information needs, classifying them and group in a high-level manner
- **Sources:** ISO 12207 + CMMI
  - Life-cycle Areas (primary processes)
  - Supporting Areas (organizational & support processes)
ISO 15939 vs. CMMI

QA vs. V&V

Q: why QA and V&V are placed into different process groups?

• QA vs V&V
  – V&V ➔ in the scope of a software measurement process, verification and validation activities measure the quality of a specific software product in order to support decision-making surrounding improvement (correcting bugs, re-factoring) of this specific software product.
  – QA ➔ within the scope of a software measurement process, QA makes use of the measures with a view to evaluating actual process performance against the managed or defined process in order to support decision-making surrounding improvement of the organization as a whole.
  – QA + V&V ➔ both aimed at improving software product quality, but from significantly different points of view.
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CMMI – An Analysis
From ML2 to ML5 (1/3)

• CMMI: Staged Representation
  ✓ Maturity Levels (ML) allows to rate the maturity of an Organizational Unit
  ✓ 5 ML, from 1 (ad-hoc) to 5 (optimizing)

• Analysis goal
  ✓ Distribution of Information Needs along Maturity Levels
  ✓ Each Measurement Information Area was evaluated
CMMI – An Analysis
From ML2 to ML5 (2/3)
CMMI – An Analysis
From ML2 to ML5 (3/3)
CMMI – An Analysis
An Overview

Goal: to understand the scope of Software Measurement Process

- ML2 + ML3 together, not only ML2
  - It would be irresponsible to ignore V&V when implementing a measurement process
  - Approximated equivalence between CMMI ML2-3 and ISO 9001 certified companies (e.g. not possible to exclude PAs such as CAR & DAR)
  - Staged representation chosen, because easier to analyze
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ISBSG – A Turnkey Solution

Introduction

- ISBSG (www.isbsg.org)
  - Non-profit organization created in 1994,
  - Goal: to develop the profession of software measurement by establishing a common vocabulary and understanding of terms
  - Data repository (quite) yearly produced (current release: 10)
  - Organizational and Technical Data gathered
  - Questionnaire with 7 sections, 131 questions

- Advantages using ISBSG r10
  - Helps in faster implementations of the sw measurement process
  - Data from more than 4000 projects, both development and enhancement ones
ISBSG – A Turnkey Solution

Analysis

- Questionnaire Distribution
  - 131 questions, distributed into 7 sections
  - Project Management & QA are the more relevant MIA

![Bar chart showing the distribution of questions across different sections: Requirements, Analysis, Design/Implementation, Verification/Validation, Configuration Management, Project Management, Quality Assurance, Training. The Project Management and Quality Assurance sections have the highest number of questions, with each having approximately 40 questions.]
ISBSG – A Turnkey Solution
Comparing with CMMI

- **ISBSG-CMMI**
  - No-documented 1:1 relationships

- **Some ISBSG ‘highlights’**
  - Focuses strictly on “project management” and “quality assurance”
  - Lacks “verification and validation” data
  - Does not consider “analysis” at all, not even risk analysis

![Bar Chart Comparing ISBSG and CMMI Levels]
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- ISO 15939 & CMMI can be used together, stressing information needs
- ML2+ML3 should be always considered as a unique logical group from a measurement viewpoint
- ISO 15939 asks for a Measurement Experience Base (MEB) that ISBSG can instantiate into an ICT organization, where its own historical data could not be available or for external benchmarks
- ISO 9126-x (parts 2-3-4) can provide further measures (more than 200) about quality product measures and be a companion to ISBSG
Q & A
Grazie! Thank you!

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