Automotive Software
Tips for benchmarking

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Automotive SPIN Italia
(www.automotive-spin.it)
Talk agenda

• Automotive software: overview
• State of the practice
• Empirical Study Methodological Approach
• Empirical Study Results
• Conclusions
ISTI – Information Science and Technologies Institute is located at the CNR Research Area in Pisa

103  Research staff (Researchers, Technologists)
59   Technical and Administrative staff
53   Research Associates
96   Graduate Fellows, PhD Students, Post-doctoral Fellows, Theses, Stages

System & Software Evaluation Center
Automotive Software

- Very high innovation rate in the last decade
- Interoperability issues
- **Functional** safety issues dramatically increasing
- Cyber-security and functional safety is the true challenge today
Automotive software industry: state of the practice

• Literature: studies based on questionnaires and surveys involving stakeholders (management, engineering, quality staff)

• Lack of empirical studies based on real data from real projects
Automotive SPICE: a process assessment model

Level 5 Optimizing
- PA 5.1 Process Innovation
- PA 5.2 Continuous Optimization

Level 4 Predictable
- PA 4.1 Process Measurement
- PA 4.2 Process Control

Level 3 Established
- PA 3.1 Process Definition
- PA 3.2 Process Deployment

Level 2 Managed
- PA 2.1 Performance Mgt.
- PA 2.2 Work Products Mgt.

Level 1 Performed
- PA 1.1 Process Performance

Level 0 Incomplete

The level of achievement (rating) of PA1.1 is determined by the level of achievement of a set of process-specific practices (called Base Practices – BP).

Automotive SPICE PRM

<table>
<thead>
<tr>
<th>ACQ.3 - Contract agreement</th>
<th>ACQ.15 - Supplier qualification</th>
<th>SUP.1 - Quality Assurance</th>
<th>SUP.10 - Change request management</th>
<th>ENG.5 - Software design</th>
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</thead>
<tbody>
<tr>
<td>ACQ.4 - Supplier monitoring</td>
<td>MAN.3 - Project management</td>
<td>SUP.2 - Verification</td>
<td>PIM.3 - Process improvement</td>
<td>ENG.6 - Software construction</td>
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<tr>
<td>ACQ.11 - Technical requirements</td>
<td>MAN.5 - Risk management</td>
<td>SUP.4 - Joint Review</td>
<td>ENG.1 - Requirement elicitation</td>
<td>ENG.7 - Software integration test</td>
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<tr>
<td>ACQ.12 - Legal and administrative Requirements</td>
<td>MAN.6 - Measurement</td>
<td>SUP.7 - Documentation</td>
<td>ENG.2 - System requirements analysis</td>
<td>ENG.8 - Software testing</td>
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<tr>
<td>ACQ.13 - Project requirements</td>
<td>SPL.1 - Supplier tendering</td>
<td>SUP.8 - Configuration management</td>
<td>ENG.3 - System architectural design</td>
<td>ENG.9 - System integration test</td>
</tr>
<tr>
<td>ACQ.14 - Request for proposals</td>
<td>SPL.2 - Product Release</td>
<td>SUP.9 - Problem resolution management</td>
<td>ENG.4 - Software requirements analysis</td>
<td>ENG.10 - System testing</td>
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Empirical Study Scope & Objectives

• The processes in the scope of this study are:
  – Project management process (MAN.3)
  – Quality assurance process (SUP.1)

• The objectives of this study are:
  – to identify the most frequently weak practices on the basis of a set of indicators taken from the outcomes of 23+ Automotive SPICE assessments performed in Europe and Asia.
  – to analyze those weak practices to understand common causes.
Empirical Study Methodological Approach

Step 1:
Classification of the organizations assessed in terms of product domain, organization size, location, and type of assessment.

Step 2:
Analysis of the assessment results aimed at identifying those Base Practices having frequent low rating (i.e. achieving a rating N or P according the Automotive SPICE Measurement Framework).

Step 3:
Investigation on the rationales of Base Practices weaknesses and clustering, when possible, following similarity criteria.
Study Results: Project Management

Base Practices more frequently weak:
- MAN.3.BP.3: Determine and maintain estimates for project attributes;
- MAN.3.BP.10: Monitor project attributes
- MAN.3.BP.6: Define and maintain project schedule;
- MAN.3.BP.8: Establish project plan;

Resulting Gap Clusters:
MAN.3.GC1 - Operative scheduling definition and control is informal [BP.6].
MAN.3.GC2 - Poor project planning update and dissemination [BP.8].
MAN.3.GC3 - Lack of estimations [BP.3].
MAN.3.GC4 - Poor effort management [BP.8, BP.10].
Study Results: Quality Assurance

Base Practices more frequently weak:
- **SUP.1.BP2:**
  Develop and maintain an organization structure which ensures that quality assurance is carried out and report independently.
- **SUP.1.BP3:**
  Develop and implement a plan for project quality assurance based on a quality assurance strategy.
- **SUP.1.BP6:**
  Assure quality of process activities.

Resulting Gap Clusters:
- **SUP.1GC1** - Quality assurance organizational lacks [BP.2, BP.3]
- **SUP.1.CG2** - Poor quality assurance for processes [BP.3]
- **SUP1.GC.3** - Poor quality assurance planning [BP.6]
Study Results: SW Engineering

• Data related to Software Testing processes are under analysis;

• Some preliminary results:
  – Statistics show weak practices in
    • testing strategy definition (for all level of testing – unit, integration, functional test)
    • Traceability: incomplete traceability among sw requirements, sw design, test cases
  – Statistics show strong practices in
    • Software test cases definition and execution
    • Software test results reporting
Conclusions

• Taking advantage from Automotive SPICE assessments to identify common weak (and strong) practices;
• Assessment data repository potentially very large (thousands of Automotive SPICE assessment performed) potential for valid statistic results
• Real data from real projects
• Utility of results
  – Setting up improvement actions
  – Benchmarking
Thank you

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