Assessment of Product Maintainability for Two Space Domain Simulators

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September 17, 2010
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Software Improvement Group Services

DocGen
- Automated generation of technical documentation
- Reduce learning time, assist impact analysis, support migration, ...

Software Risk Assessment
- In-depth investigation of software quality and associated business risks
- Answers to specific research questions

Software Monitoring
- Continuous measurement, feedback, and development consultancy
- Guard quality from start to finish

Software Product Certification
- Five levels of technical quality (maintainability)
- Evaluation by SIG, certification by TÜV Informationstechnik
Who is using our services?

- Financial and Insurance companies
  - ABN AMRO
  - ING
  - Rabobank
  - Achmea
  - Friesland Bank
  - LeasePlan
  - Interpolis
  - Bank Mendes Gans
  - GlobalCollect
  - Allianz

- Government
  - Rijksoverheid
  - Kadaster
  - ZwitserLeven
  - KAS BANK
  - Volvo

- Logistical
  - DHL
  - Getronics
  - TNT
  - Logica
  - RDW

- IT
  - KLM
  - Centric
  - Capgemini
  - Exact
  - IBM

- Other
  - ENECO
  - Essent
  - Swiss Lex
  - KPMG
  - NXP
  - Gasunie
  - Electrabel
1) Is relying on process enough to ensure good product quality/maintainability?

2) Can source code analysis (quality models + custom analysis) bring information to management?
Space Domain Simulators

**EuroSim**
- Developed by a consortium (Dutch Space, NLR, TASK24)
- Implemented in C/C++ (interfaces in Java, Ada, Fortran, ...)
- Development started in 1997
- Hard-real time (hardware components)

**ESA SimSat**
- Owned by ESA, developed in outsourcing (yearly bid process to choose company)
- Kernel implemented in C/C++
- GUI implemented in Eclipse RCP (Java)
- Development started in 2003
- Soft-real time (communications)

1. Used to validate space sub-systems
2. Simulate Galileo components
3. Follow ECSS software process standards
Quality Assessment

Quality model
- Risk profiles are used as quality indicators for non-system level metrics
- Overall model calibrated such that 5% of systems rank five stars, and 5% of systems rank 1 star.

Heitlager et al. [4], Baggen et al. [15]
Is relying on process enough to ensure good product quality/maintainability?

EuroSim maintainability ★★★★☆☆☆

Duplication: 7.1%

Unit complexity:

SimSat maintainability ★★★☆☆☆☆

Duplication: 10.4%

Unit complexity:

Lesson I - Rigorous process requirements do not ensure product quality

Tiago L. Alves, Software Improvement Group / University of Minho
“Assessment of Product Maintainability for Two Space Domain Systems” - ICSM’10 Industrial Track
Can source code analysis bring information to management? (EuroSim case study)

Lesson II - Quality models can reveal team problems

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Can source code analysis bring information to management? (ESA SimSat case study)

**ESA SimSat**
- Kernel: C/C++, responsible for the simulation, in maintenance for several years
- MMI: Java/Eclipse RCP responsible for the GUI, recently built

**Duplication**
- Kernel: 10%
- MMI: 11%

**Unit Complexity (moderate, high, and very-high risk)**
- Kernel: 14%
- MMI: 21%

**Lesson II - Quality models can reveal team problems**

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Can custom analysis bring information to management? (EuroSim case study)

Identify copyright statements to check for license violations
- Developed custom analysis
- Used text scanning matching for specific keywords
- Manually verified the results to check for false positives

No license violations were found!
- Yet, with the same analysis we discovered code ownership and code structure problems

Code ownership problems
- > 20 different copyright statements
- 3 open-source licenses found (open-source code mixed with production code)

Code structure problems
- No clear separation between 3rd-party code and production code

Lesson III - Tailored analysis are necessary for further investigation of quality
Lessons

1) Rigorous process requirements do not ensure product quality

2) Product quality models can reveal team problems

3) Tailored analysis are necessary for further investigation of quality
Challenges

Industry challenges

- Adoption of existent quality models
- Provide data to academia for further research

Academia challenges

- New/better metrics, analysis and quality models
- Catalog of analysis and possible diagnosis
- Cost-models for maintenance activities
Thank you!

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