Panel #2

VENICE
FALL 2024

SoftNet 2024 Congress

Theme:
Software-Now – Developing, Simulation, and Validation Challenges

Panel #2

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Moderator

Prof. Dr. Hans-Werner Sehring, NORDAKADEMIE gAG, Germany

Panelists

Prof. Dr. Simona Vasilache, University of Tsukuba, Japan

Prof. Dr. Radek Kočí, Brno University of Technology, Czech Republic

Prof. Dr. Luigi Lavazza, Universita` degli Studi dell'Insubria, Italy

Prof. Dr. Carlo Simon, Hochschule Worms, Deutschland

Jos van Rooijen, Huis voor Software Kwaliteit, Nederland

Dr. Hayk Aslanyan, CAST, RAU, Armenia

Panel Moderator

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Before we hear the panelists' positions, let me give you some background on myself,

… and my opinion on the topic.

Hans-Werner Sehring
NORDAKADEMIE

- **Me**
  - Professor for Software Engineering at NORDAKADEMIE "Hochschule der Wirtschaft" (University of the economy)
  - Scientific and practical background
- **Research interest**
  - Model-driven Software Engineering
  - Domain modeling
  - Software specification
  - Programming language specification

- **For the topic of the panel**
  - In practice, software is tested as part of a quality assurance process.
  - We all know that in fact we should proof correctness.
  - Idea from formal program semantics: if proof is constructive, then it is a software generator.

Panel Moderator's Position

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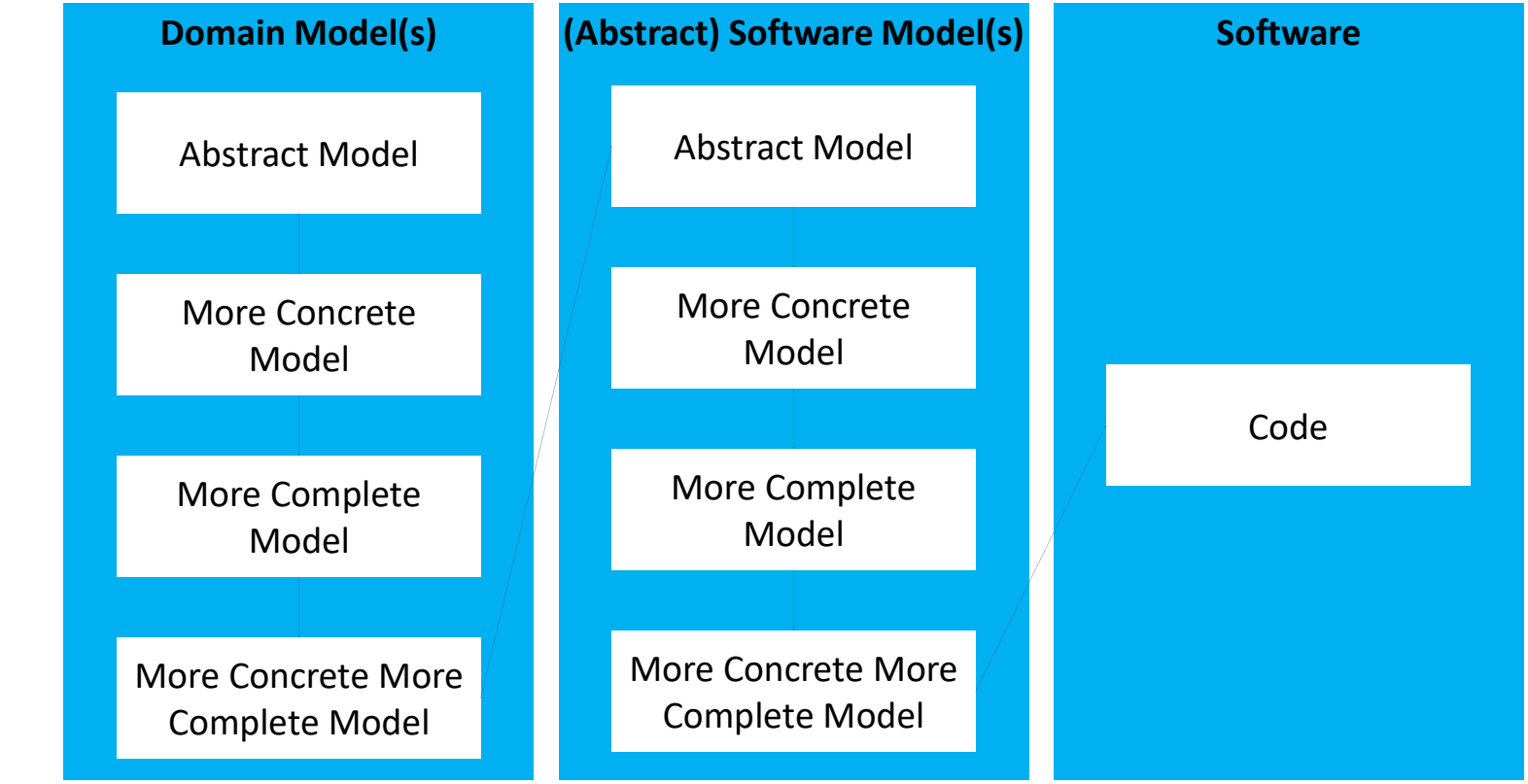
Idealized MDSE Captures Three Domains: Subject Domain, Software Specification, and Code



Hans-Werner Sehring
NORDAKADEMIE

Panel Moderator's Position

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A perspective von Model-Driven Software Engineering:
When code generation is proofably correct, quality is granted?

Hans-Werner Sehring
NORDAKADEMIE

Subject domain semantics

- Was the **problem** modeled correctly?
- Are all **requirements** specified? Are all **constraints** considered?
- Plus: with Generative AI there is a trend to go back to **prosaic descriptions**.

Software design

- Does the software **specification** address all requirements and constraints?
- Is it practical? With most projects being agile, there is direct **feedback** from implementations.

Code

- Are software generators working correctly? Including code catering for non-functional requirements?
- How about deployment, changing environments, evolution, etc.?

Therefore, even when software was built correctly through a correct generation process…
… there still can be domain modeling and software design flaws. How are these tested (in isolation)?

Panelist Position

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Software-Now - Developing, Simulation, and Validation Challenges

Carlo Simon
Univ. Worms, Germany

Product

- Traceable requirements
- Definition of Done
- Separate testing from development
- Product Backlog vs. Sprint Backlog

People

- Skilled labor shortage -> Career changer
- Stay up-to-date
- Use AI generated software
- “Low code”-worker

Domain

- Production, Logistics
- Maintainable vs. hard constraints
- Users as part of the team
- Development of AI applications (LLM prompts)

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- **Software-Now - Developing, Simulation, and Validation Challenges**
- **After so many years, the development process is still a problem**
  - **Even with the available technology, setting up an efficient, effective and evolvable development process is huge problem**
  - **How to write requirements**
    - **Requirements "culture"**
    - **Impedance mismatch among business analysts, GUI designers, developers, testers**
  - **How to structure the development organization**
    - **By product vs by competence**
    - **By contract vs by (reusable) components**
    - **…**
  - **What process model?**
    - **Agile everybody?**
  - **What tools**
    - **Scouting**
    - **Configuration / customization**
    - **Lock-in**

Luigi Lavazza
Univ. Insubria

Panelist Position

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Luigi Lavazza
Univ. Insubria

- **Software-Now - Developing, Simulation, and Validation Challenges**
- **After so many years, the development process is still a problem**
  - **How designers (mock-ups, prototypes) fit in the requirements definition process**
    - Clash with front-end developers
    - Suboptimal technical choices
    - Cost issues
  - **Organization Structure**
    - To effectively support projects
      - The usual dilemma: BUs vs competence centers
    - To support transition
      - E.g., monolithic to microservice-based

Panelist Position

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Luigi Lavazza
Univ. Insubria

- **Software-Now - Developing, Simulation, and Validation Challenges**
- **After so many years, the development process is still a problem**
  - **Tools**
    - **What tools are available?**
    - **How do they fit in the process?**
      - **As-is**
      - **To-be (hopefully, some improvement is envisioned)**
    - **How much do they cost? (also in terms of learning curves)**
    - **How easily can we switch to different tools, if needed?**

Panelist Position

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Simona Vasilache
University of
Tsukuba, Japan

- **Software (engineering) education: must keep up with *all* developments**
- **Students' interests**
  - **Front-end / back-end development**
  - **Machine learning, data engineering, AI etc.**
- **Q: Software developer OR Software engineer ?**
- **Agile development – highly popular with students**
  - **Attractiveness of startups *("The Lean Startup" – Eric Ries)***

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Simona Vasilache
University of
Tsukuba, Japan

- **Testing: costly and complex phase in the software development process**
- **Challenge: educating students (→testers) with the right skillset**
  - **Software testing concepts included in coursework OR**
  - **Full dedicated courses**
  - **Puzzling question in class:**
    "What is the difference between verification and validation?"
- **Problems**
  - **Testing and maintenance: least glamorous activities**
  - **Students (and everyone else?!) perceive testing as *dull, difficult, non-creative***

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Simona Vasilache
University of
Tsukuba, Japan

- Various approaches to <u>software testing education</u>
  - Increasing motivation for learning about testing (teamwork?!)
  - Software testing concepts in introductory programming courses
  - Real projects that use industry-tested tools
  - Gamification
    - Fun and/or easy-to-implement games in the classroom
- "Test-driven development" (TDD)
  - Strong opinions, both for and against!
- Future: using AI
  - Why bother with learning about testing?! ☺

Panelist Position

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Jos van Rooijen
Huis voor Software Kwaliteit

- **Consultant software testing / Quality Supervision**

- Software testing is still really traditional
- Innovation and research is below par
- The (so called) innovation concentrates:
  - How to apply test in a new development method
  - Test tooling
- Hardly none testing techniques to beat future challenges we have to face, like:
  - Self driving cars
  - Code development by hand of AI (how to prove the code)
  - Dependencies of medical devices
  - Smart devices connected to everything and everywhere
  - Etc.

Panelist Position; The context

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Threads

Development inside quality engineering

Chances

The context

Future of software testing

Social development

?

Development of Information Technology

Panelist Position

Some challenges per perspective:

Developments Quality Engineering:

- Increasing dynamics. Development of information systems is never finished. So testing is also never finished!
- Increasing complexity
- Bugs appears on different levels. Configuration, integration or parametrisation

Threads:

- Low chance, high impact
- Aging
- Complexity
- Self learing information systems; we don’t know any more how the information system works
- Lack of cooperation between the industry and academia

What are the measures we have to take?

- What kind of techniques / approaches we have to develop?
- Is there something available?
- Traditional test approaches are not applicable anymore

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- **Does AI influence the way software develops?**
  - Code generation
  - Test Generation
  - What about requirements or design activities?
- **Does AI influence developers?**
  - Will there be a need for as many (low-level) programmers?
  - In general, can AI replace junior positions?
  - If so, where will developers get experience for senior positions?
- **Challenges**
  - It will be necessary to prepare (and teach software engineers) for changes in development processes
  - Less emphasis on programming
  - More emphasis on analysis and design
  - Need to be able to interact appropriately with AI and be able to evaluate AI results
  - Combination code generation and formal verification (or other methods) can reduce the need for programming while maintaining confidence in the code

Radek Kočí,
Brno University of Technology

Panelist Position

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Hayk Aslanyan
CAST, Armenia

- **DEFECTS IN PROGRAMS**
  - **On average, a developer creates 70 bugs per 1000 lines of code**
  - **15 bugs per 1,000 lines of code find their way to the customers**
  - **Fixing a bug takes 30 times longer than writing a line of code**
  - **75% of a developer's time is spent on debugging**
  - **In the US alone, ~$113B is spent annually on identifying & fixing product defects**
  - **…….**

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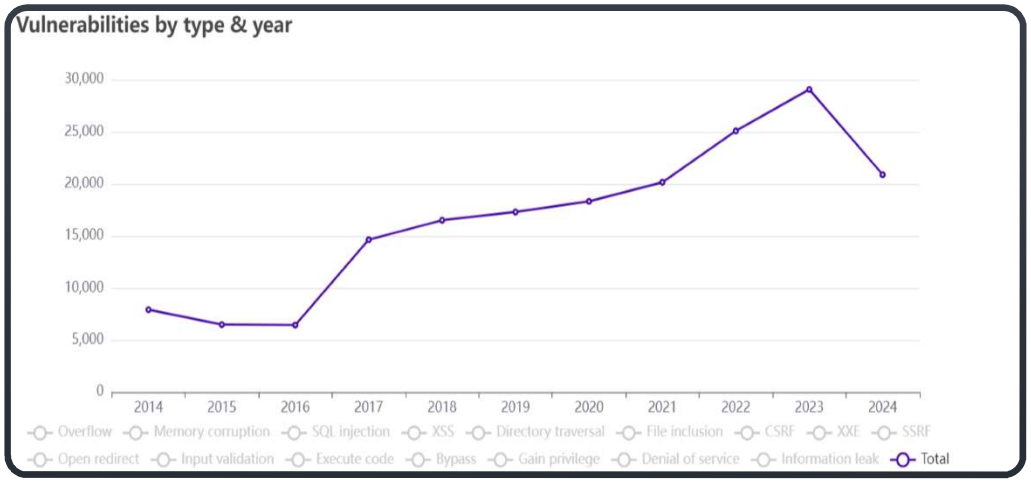

https://www.cvedetails.com/

Hayk Aslanyan
CAST, Armenia

CVE cam be duplicated multiple times.

Examples:

- ***OpenSSL HeartBleed*** (leak of encrypted information), CVE-2014-0160
- ***Equifax Data Breach*** (147m. personal data leak), known CVE-2017-5638 in Apache Struts

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SECURITY MUST BE CONSIDERED IN ALL STAGES OF SOFTWARE DEVELOPMENT:

- **REQUIREMENTS GATHERING STAGE.** PREPARE AN **APPLICATION RISK PROFILE**. THE DOCUMENT DESCRIBES POSSIBLE ENTRY POINTS FOR ATTACKERS AND CATEGORIZES SECURITY RISKS BY THE SEVERITY LEVEL, INCLUDING THEIR IMPACT AND LIKELIHOOD.
- **SOFTWARE DESIGN STAGE**. **THREAT MODELING** WHEN HIGH-LEVEL SOFTWARE ARCHITECTURE IS DESIGNED, AND POSSIBLE DATA FLOWS AND DATA ENTRY POINTS ARE ESTABLISHED. IT INCLUDES:
  - *DECOMPOSING THE APPLICATION ARCHITECTURE INTO FUNCTIONAL COMPONENTS*
  - *DETERMINING THREATS TO EACH OF THE COMPONENTS*
  - *CATEGORIZATION AND PRIORITIZATION*
  - *PLANNING COUNTERMEASURES FOR POSSIBLE ATTACKS*
- **SOFTWARE DEVELOPMENT STAGE.**
  - *SECURE CODING PRACTICES*
  - ***STATIC ANALYSIS***
  - ***DYNAMIC ANALYSIS***
  - *REGULAR PEER REVIEW*
- **SOFTWARE DEPLOYMENT AND SUPPORT STAGE.**
  - *PENETRATION TESTING*
  - *CREATING AN INCIDENT RESPONSE PROCEDURE*
  - *SETTING APPLICATION SECURITY MONITORING (MANUAL AND AUTOMATED)*
  - *SUBMITTING YOUR APPLICATION FOR EXTERNAL VALIDATION*
  - *ESTABLISHING A FEEDBACK PROCESS AND TOOLS FOR USERS (TO REPORT VULNERABILITIES)*

Hayk Aslanyan
CAST, Armenia

STAGE IS YOURS!

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