



MDD and its impact on testing...

A nanotech case study



Bryan Bakker

EuroSTAR virtual conference

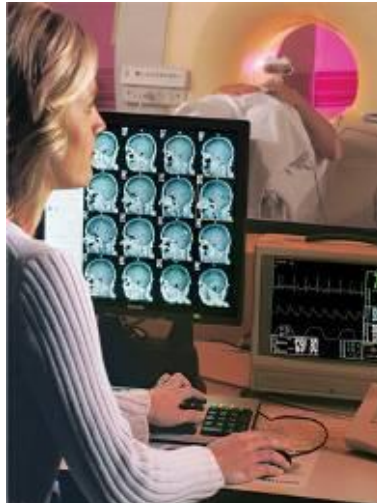
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- Intro
- ASD
- MDD and Testing
- Experiences

About Bryan Bakker



- Test Expert
- Certifications: ISTQB, TMap, Prince2
- Member of ISTQB Expert Level on Test Automation
- Tutor of several test related courses
- Domains: medical systems, professional security systems, semi-industry, electron microscopy
- Specialties: test automation, integration testing, design for testability, reliability testing

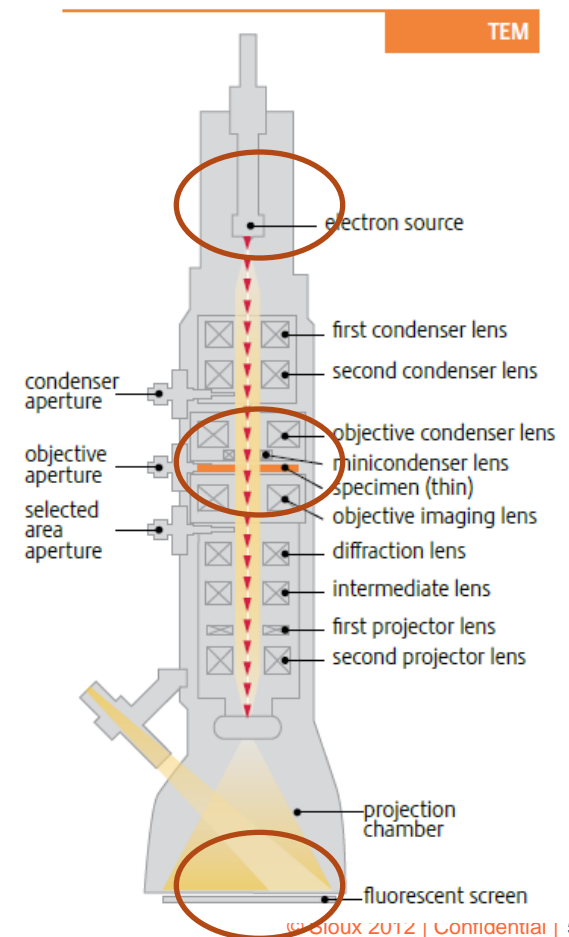


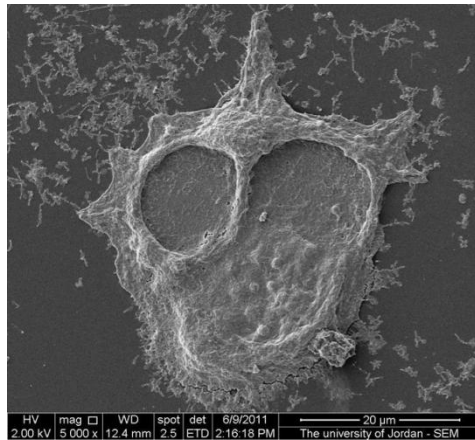
MOSCOW





- World leader in electron microscopes
- Light microscope: 1000x → 200nm (limited by the wavelength of light)
- Electron microscope: 4Mx → 0.05 nm
- Nm = a billionth of a meter (10^{-9} meter)

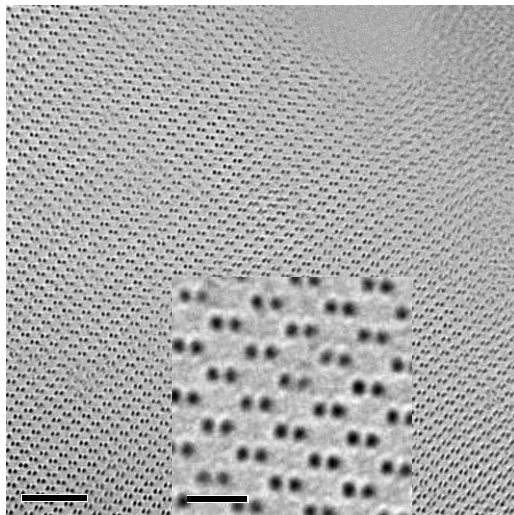




Breast cancer cell.
Magnification 5.000x

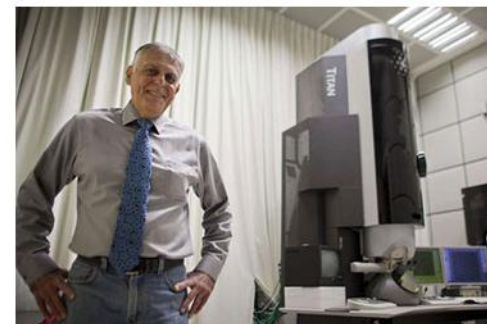


Salmonella bacteria.
Magnification 80.000x



Atomic structure of Ge
(Germanium). Distance
is 0.5 nm

Prof. Daniel Shechtman Wins Nobel Prize in Chemistry with Titan TEM



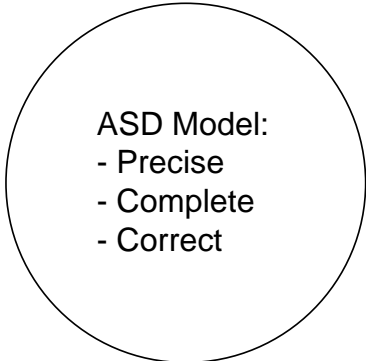
"The Titan Microscope, which is considered the most advanced of its field, is a high resolution electron microscope that can easily detect atoms and is used for discoveries."

- Professor Daniel Shechtman,
Recipient of the 2011 Nobel Prize in Chemistry

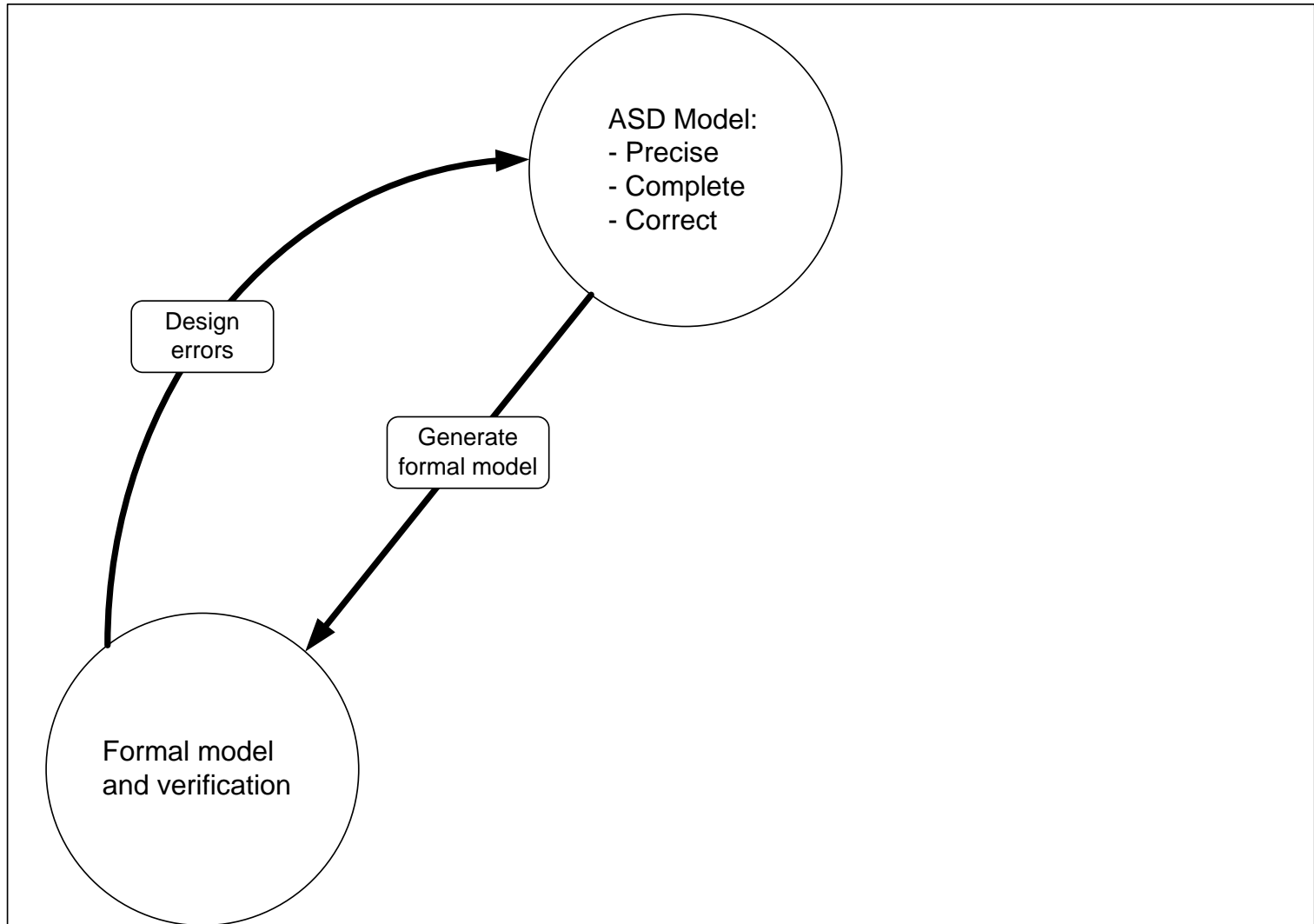
- Model Driven Development technology
- Component Based Development
- Models are verified mathematically at design time
- Extensive model checker:
 - Deadlock
 - Live-lock
 - Starvation
 - Race conditions, etc

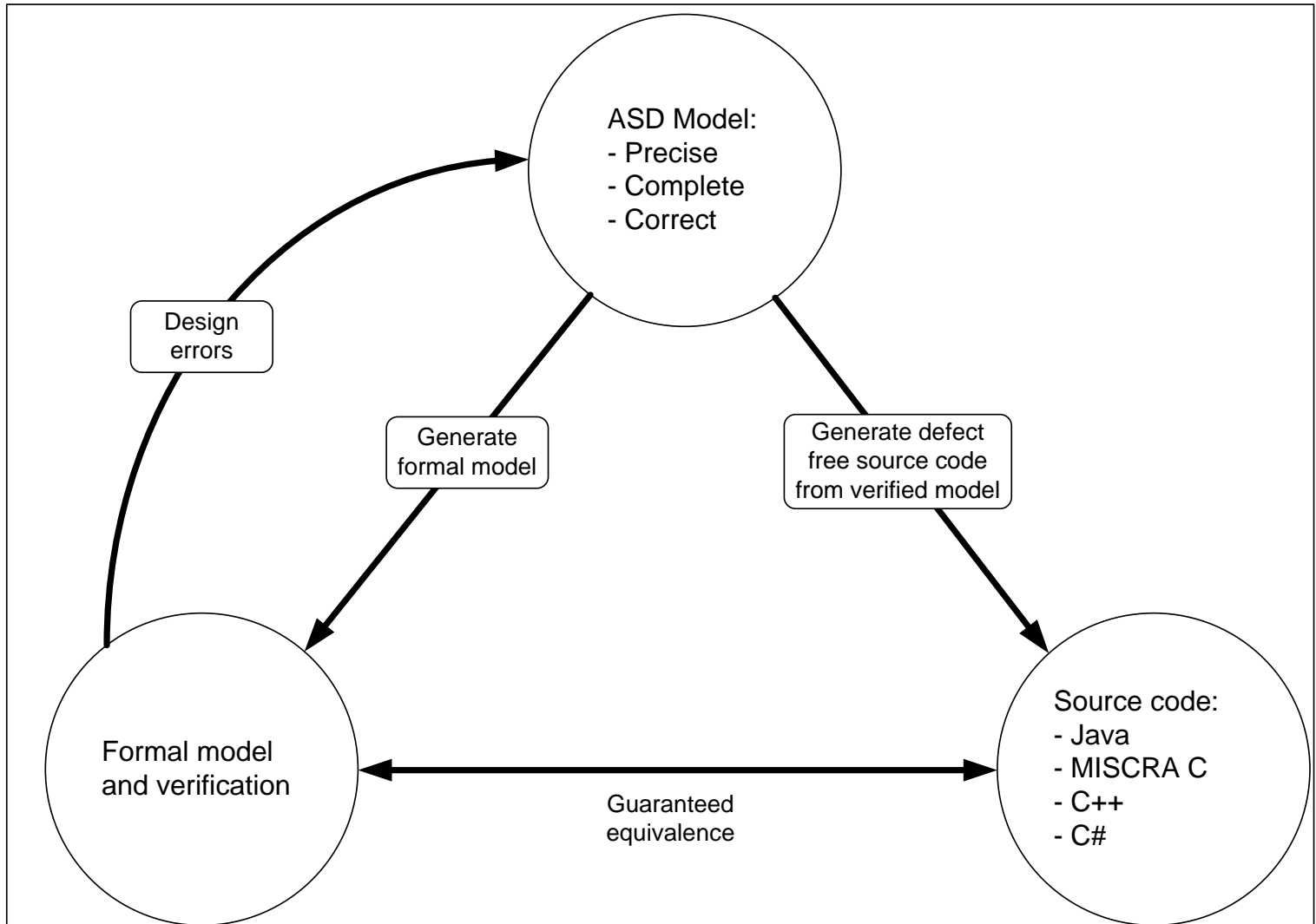
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ASD Model:
- Precise
- Complete
- Correct

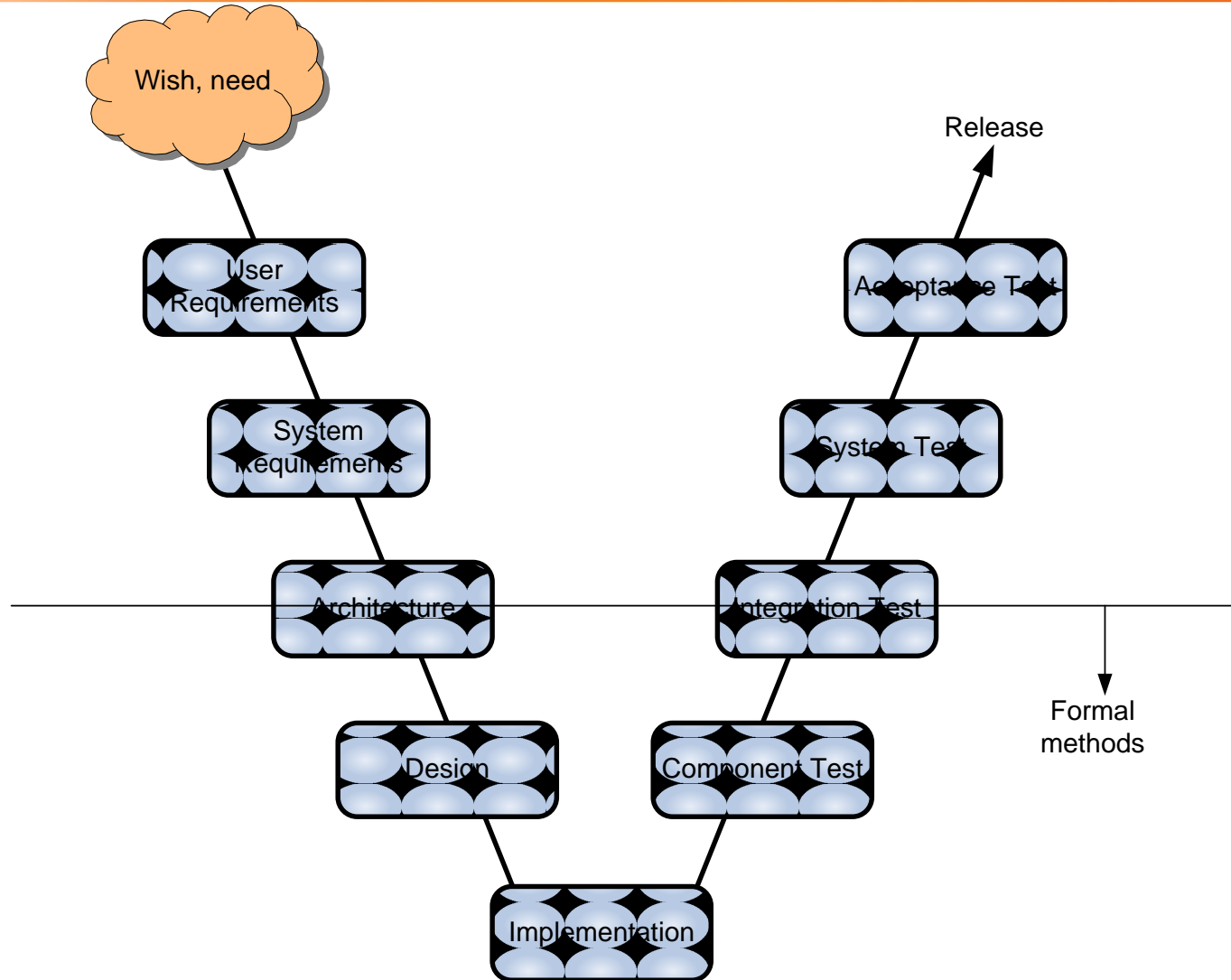




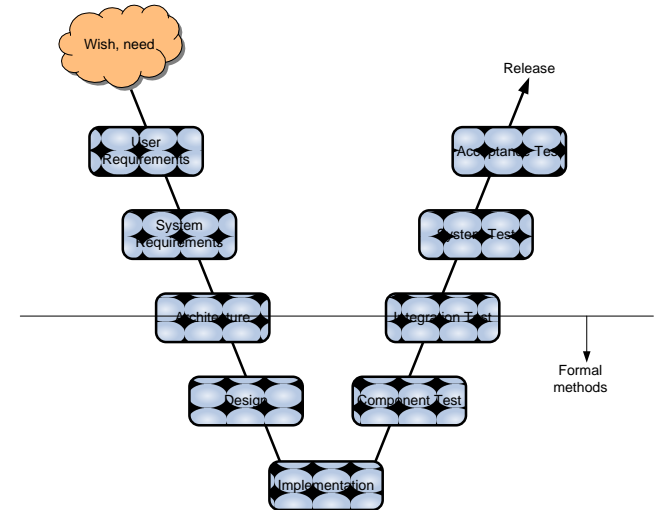
- Interface model:
 - Specification of interfaces of components
 - “What”
- Design model:
 - Implementation of interfaces
 - Internal implementation
 - “How”
- Also the outside interfaces are specified
 - Interfaces to not-modelled components

- Typically used to model behaviour described in:
 - State machines
 - Sequence diagrams
 - Algorithms
- What is modelled?
 - All normal functionality (good weather)
 - All exceptional functionality (bad weather)
 - All illegal behaviour

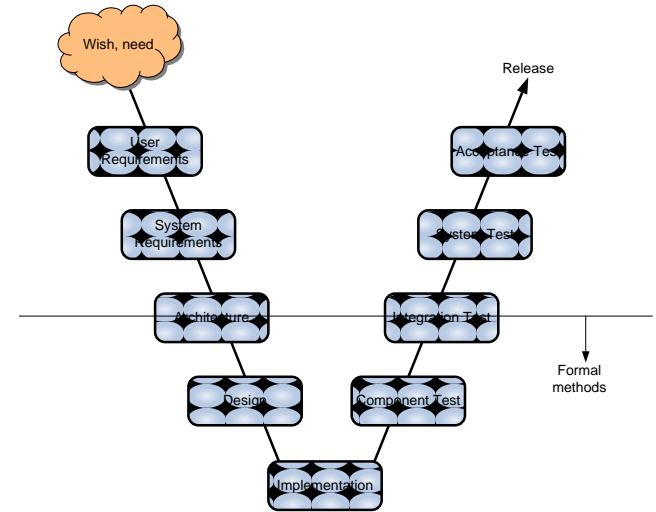
MDD and Testing



- Formal methods typically:
 - Applied at Design level
 - Only in Software
 - For part of the software



- Part of the component tests are not needed anymore (Software Engineer)
- Test activities of Test Engineer:
 - From integration level and up
 - Are still needed
- But:
 - MDD has impact on quality of deliverables

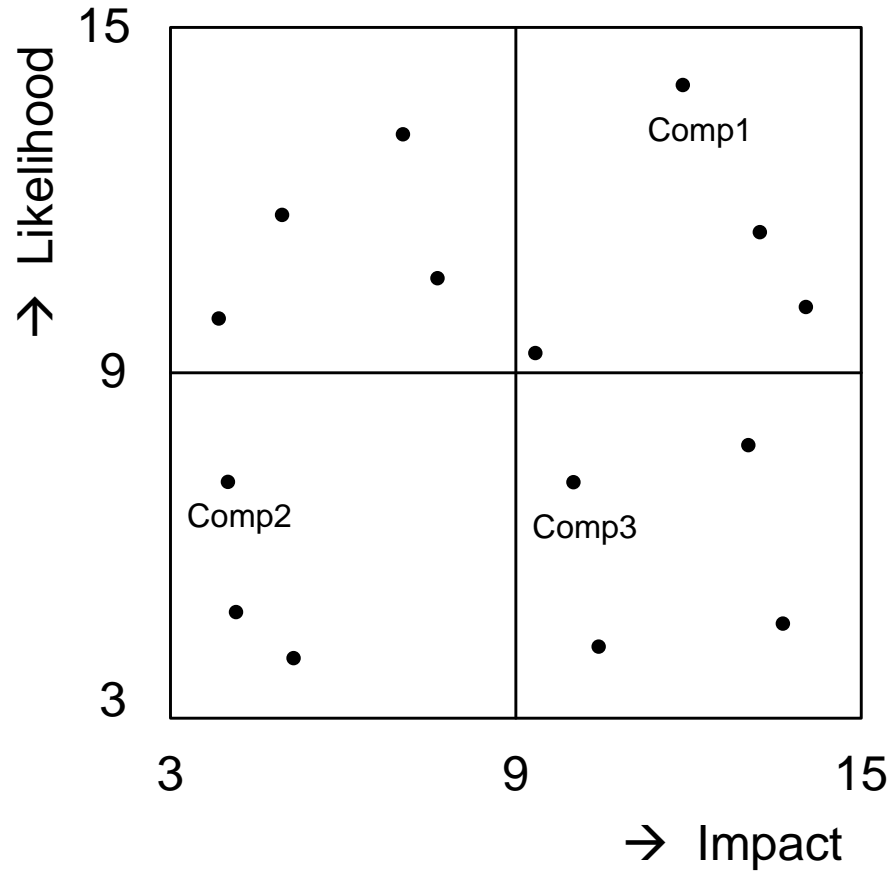


- Testing is still necessary
- Integration (with other SW, with HW)
- System testing
- Model incorrect → Rubbish in, rubbish out
New insights, so model will change
- Functionality must still be verified (and errors are found)
- Programming errors or integration issues:
 - In handwritten code
 - On boundary between generated and handwritten code (hard to analyse)
 - Not in generated code!

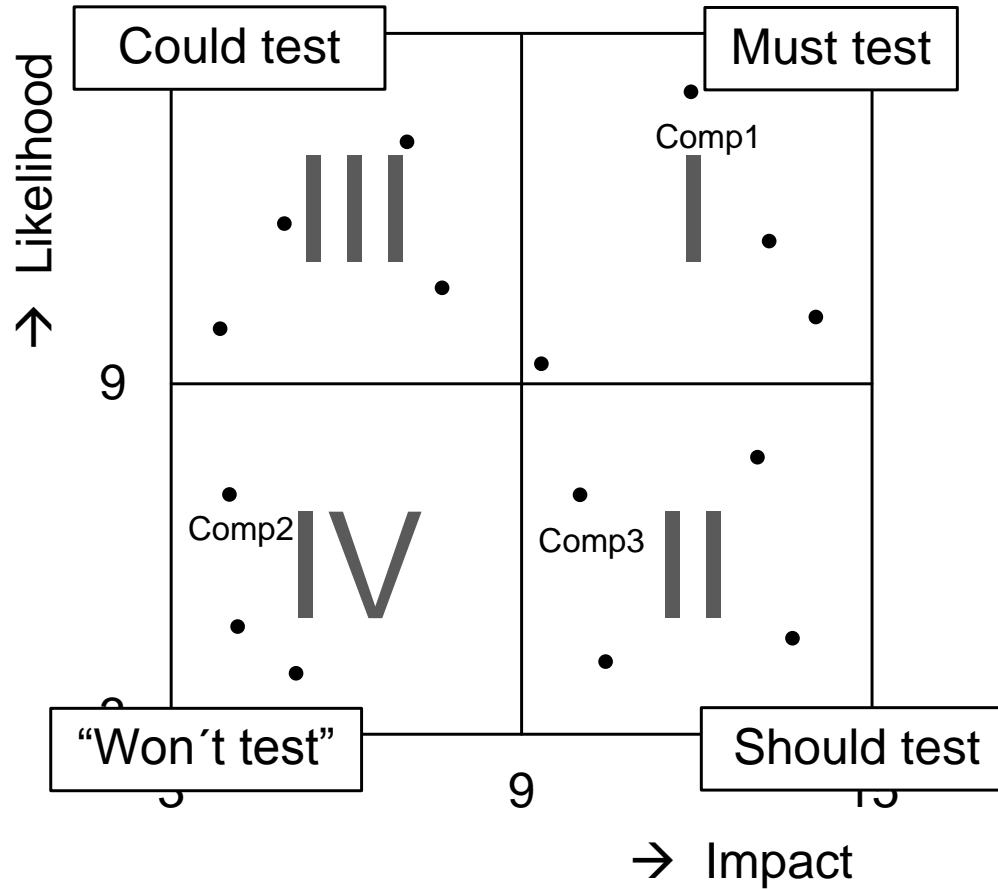
- Reliability of generated code: very high!
- But crashes can still occur... (but not in generated code)

- Reliability tests
 - HW failures/wear detected much earlier
- Integration and system test
 - not hampered by reliability issues
 - big improvement, less cycles

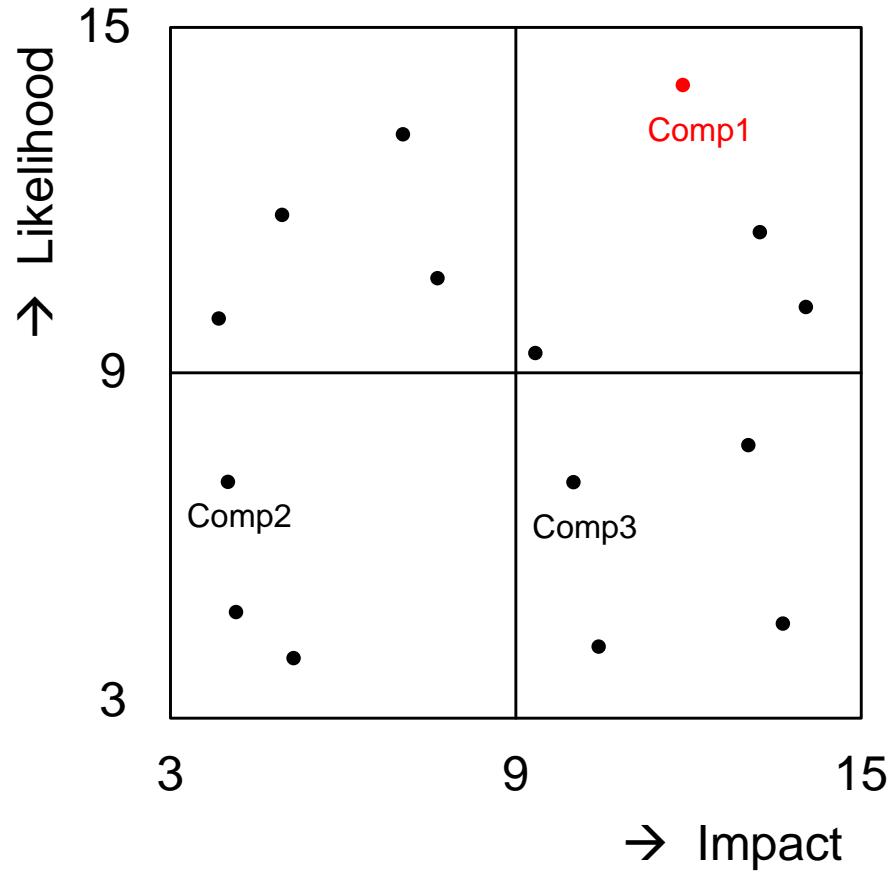
Product Risk Analysis



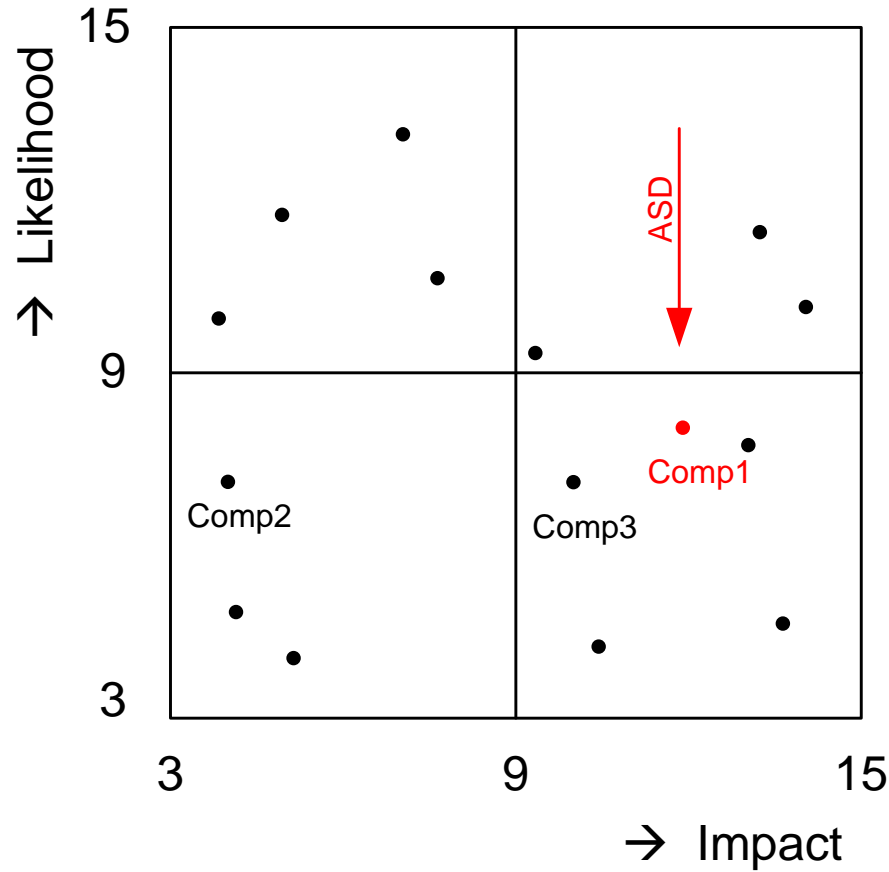
Product Risk Analysis



Product Risk Analysis



Product Risk Analysis



- Component tests (white box) could be skipped
 - Internal working is correct
 - Although functionality can be incorrect
- Integration and system testing a lot smoother
 - Less interface issues
 - Less reliability issues
- Reliability testing → reliability measurement

- Integration and system test more efficient (less cycles)
- Architecture and design takes more effort
- More re-designs with ASD are planned





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