Panel on SIMUL/VALID 2014

Nice, France, October 13, 2014

Topic: Modeling Challenges for Systems Simulation and Validation

Moderator

Przemyslaw Pochec, University of New Brunswick, Canada

Panelists

Sheri Jackson, IBM, USA

Tomas Potuzak, University of West Bohemia, Czech Republic

Jean-François Santucci, University of Corsica, France

Klaus Hörmaier, Infineon Technologies Austria AG, Austria

Moderator's opening remarks (P. Pochec) (1)

Modeling challenges

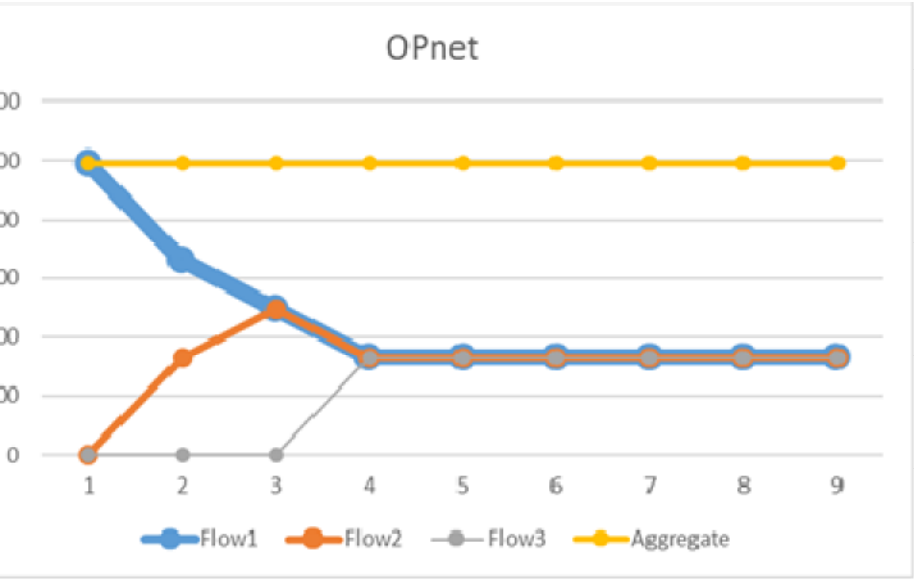
- Models only approximate real systems
- Need for validation
- Need for tuning in the final model

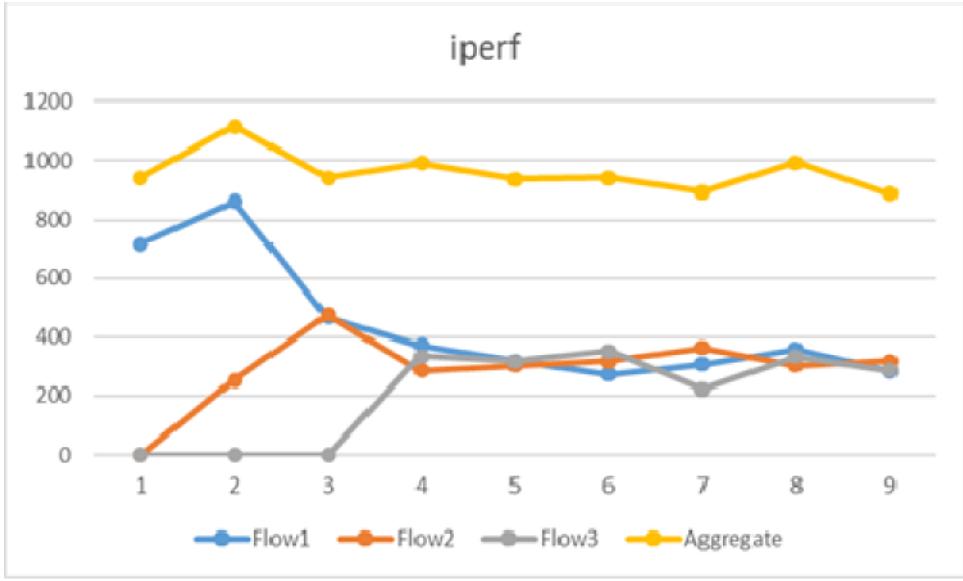
Sample scenario: three TCP flows in a data communication network over a bottleneck link

- The Opnet simulation model shows idealized scenario with equal division of bandwidth
- The throughput measurements for each flow using iperf show approximately equal division of the available bandwidth and also show random variations in the bandwidth used by each flow

Moderator's opening remarks (P. Pochec) (2)

Sample scenario results[1]: three TCP flows in a data communication network over a bottleneck link





ziz Alshehri, "Investigation of Quality of Service for Individual Users on a Campus Network", MCS Report, NB, in preparation.

Panel Conclusions

- Models need to be validated throughout entire modeling process
- Data required for validation may be difficult to acquire (logistics, legal challenges)
- Test selection optimization techniques are required for validating complex systems
- Validation of Hardware/Software codesigned systems is particularly challenging

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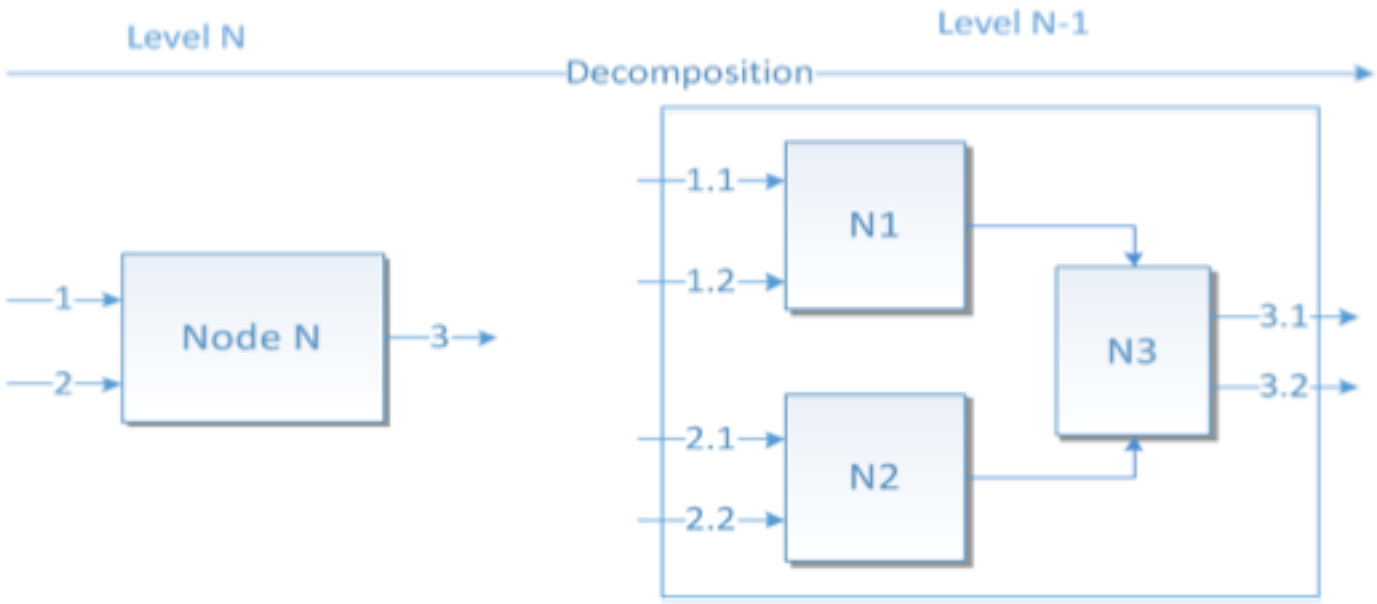
Panel :Modeling Challenges for Systems Simulation and Validation

Abstraction Hierarchy Simulation and 'Test and validation' of simulation models at the early stages of the Design

Abstraction Hierarchy and Systems Simulation

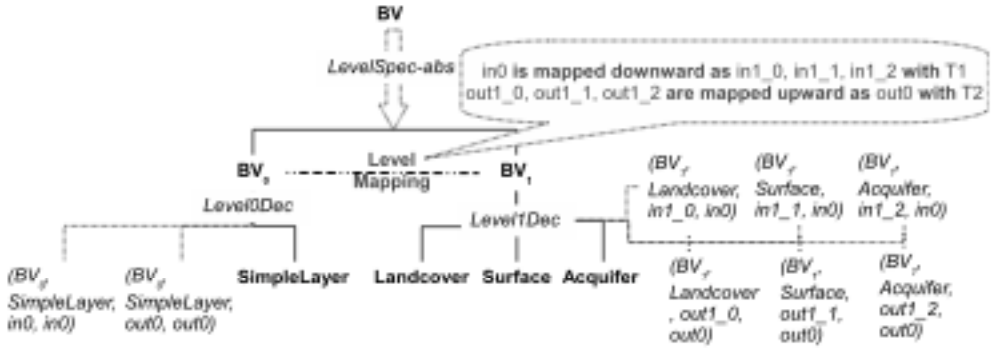
- What is abstraction hierarchy?



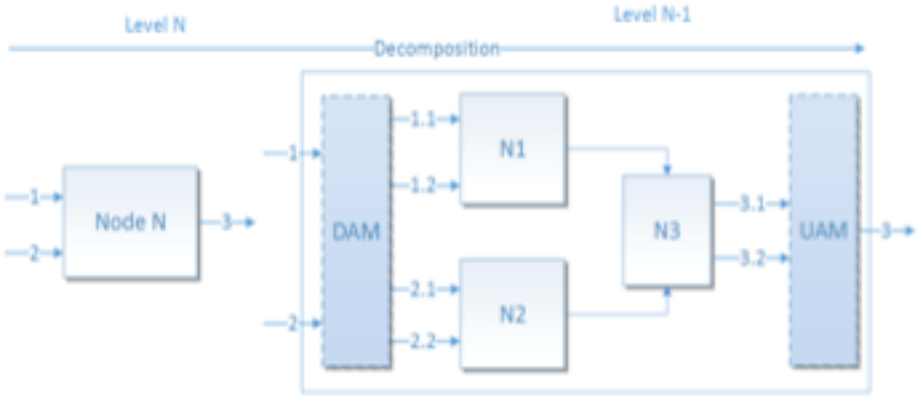
  - Simulation of differents models of the same system
  - Simulation involving several levels of abstraction

Abstraction Hierarchy and Systems Simulation

- How to perform simulation at several levels of abstraction?

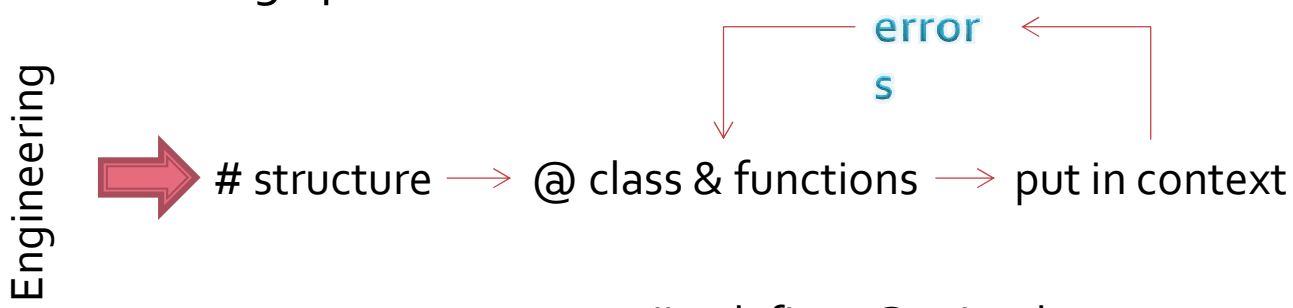


- Simulation at different levels o f abstraciton



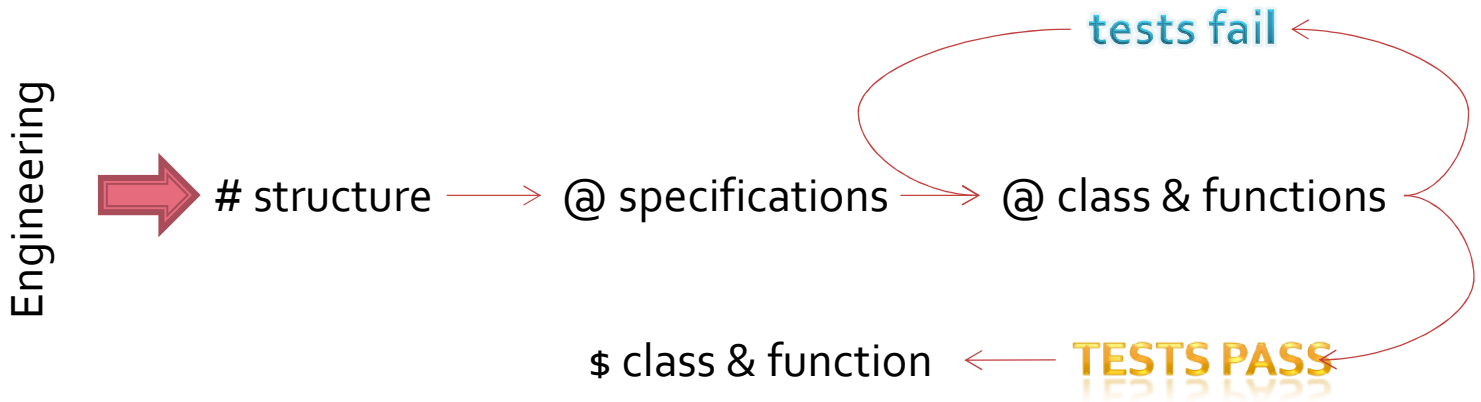
‘Test and validation’ of simulation models at the early stages of the Design

- Difficulty in testing and Validating models
- Analogy with Sotfware Enginnering : Test and Validation at the early stages of the design process

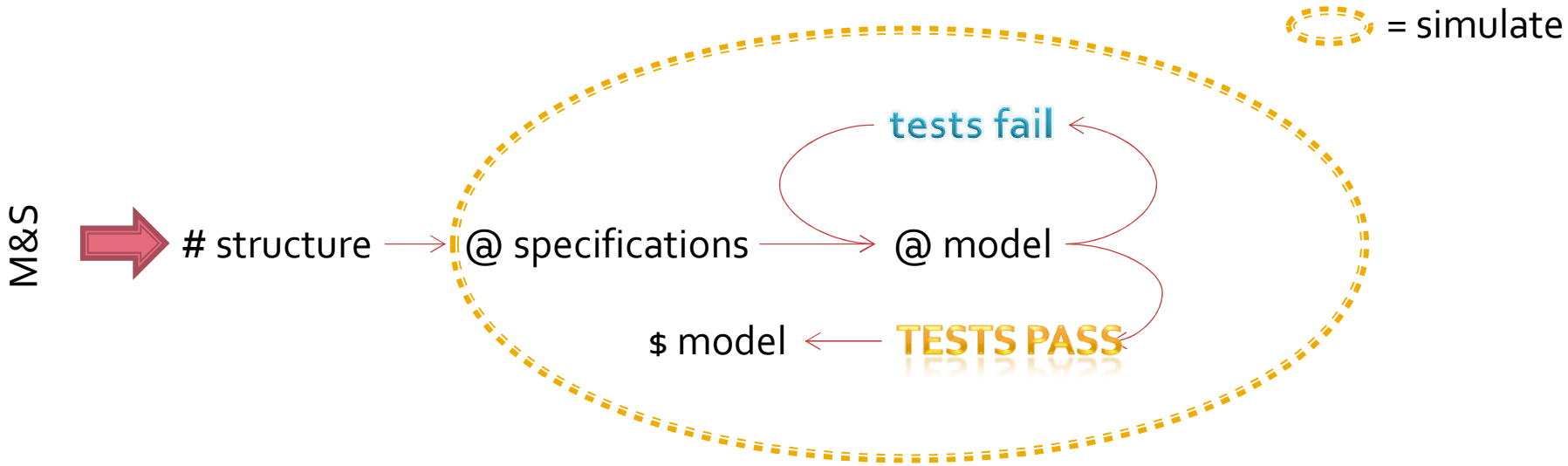


- Test procedures at the early stage of the design : Test Agile methods

ANALOGY WITH AGILE TEST METHODS



= define, @ = implement, $ = refactor



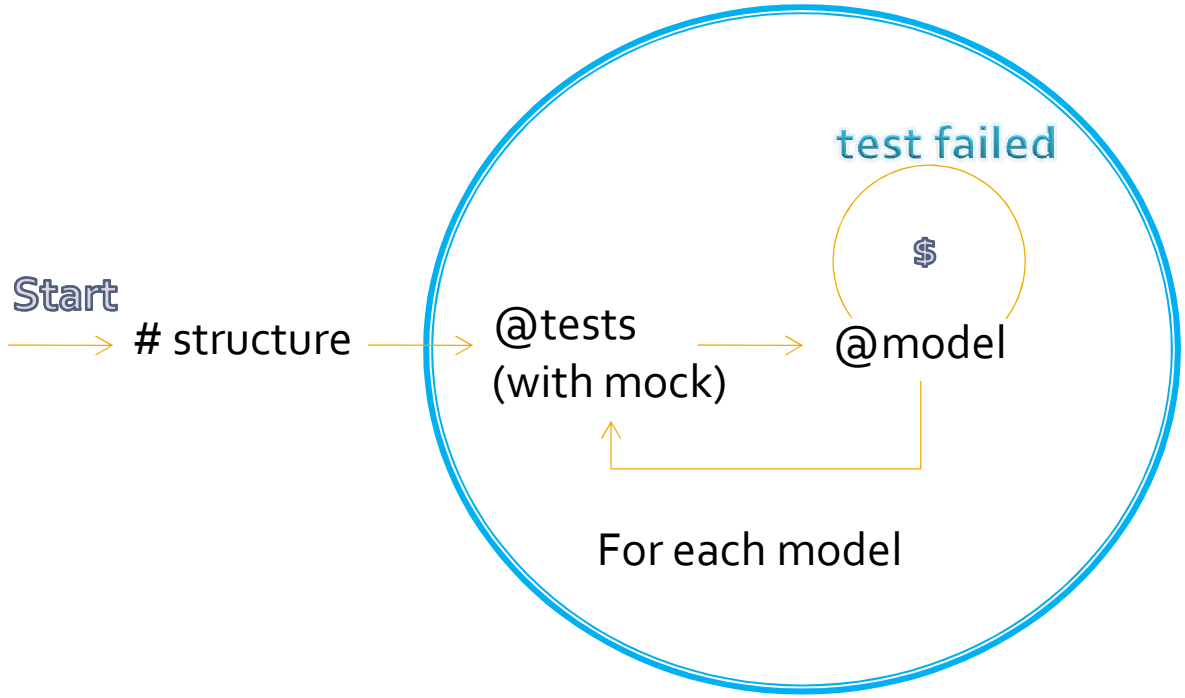
'Test and validation' of simulation models at the early stages of the Design

- Test Simulation Models with Agile Methods:
  - (1) Définition of a semi-formal format allowing to write the test specifications at the early phase of the design process;
  - (2) Generation of tests scenarios;
  - (3) Execution of these test scenarios using simulation

= simulate

‘Test and validation’ of simulation models at the early stages of the Design

- Use of Patch and Mock concepts



= define, @ = implement, $ = refactor, ◎ = simulate

Conclusion

- To improve Modeling and Simulation of complex systems:
  - Abability to perform Simulation of models described at different levels of abstraction: definition of transfert functions
  - Possibility to perform the test and validation at the early phases of the design of models: generation and execution of test scenarios during the Design phase of the models – use Software Engineering technics – Agile Methods, mocking objects, etc…)

 = simulate

Hardware accelerated verification and safety requirements

Klaus Hörmaier

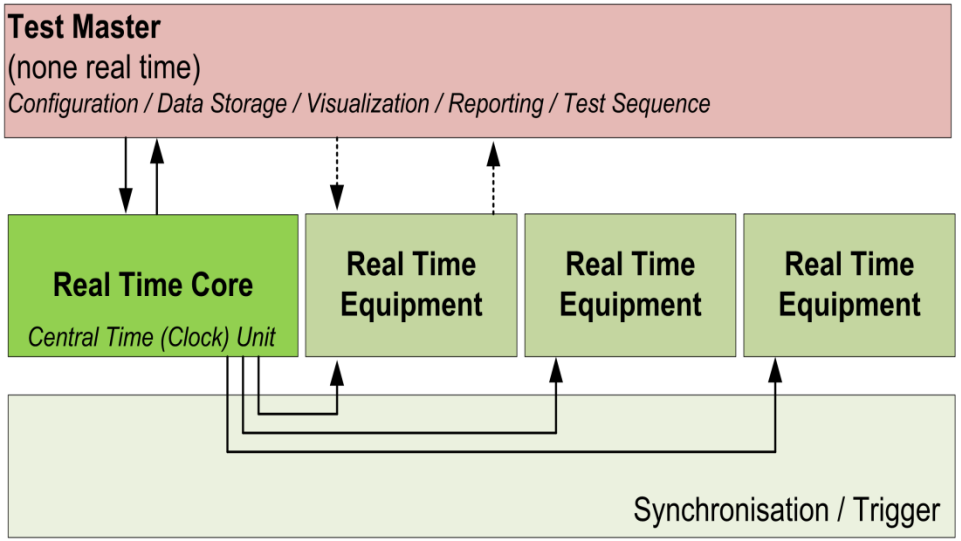
13. October 2014 - Nice

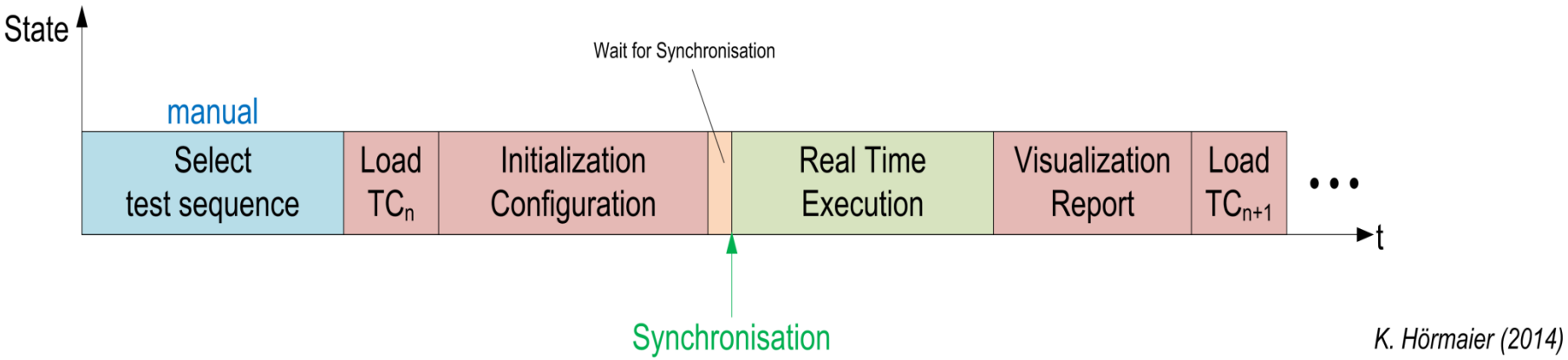
Hardware acceleration

- Simulation time can be high in mixed signal designs (analogue and digital)
  - 100 ms real time might takes 1 h of simulation time
- Testing on hardware (real time execution)
  - Hardware has to be tested anyway

Concept of partial real time testing

- Stimuli and Monitoring have to support real time.
- Reuse of the simulation test bench.
  - Assertions (Checkers) are implemented in e.g., C





K. Hörmaier (2014)

Safety verification

- For a verified system, the correct implementation of requirements has to be tested.
- Safety requirements are often negative Requirements
  - E.g., The system shall not open the door except the system is in position Y and the system is in normal mode.
- How to test negative requirements?
- Can negative requirements be modelled?

Questions

- Can test adaptors help to transfer test benches from simulation to hardware testing?

- Can a test model or test adapter be the test documentation?
  - Report include the verdict (Pass / Fail) but for an Audit more information is needed like how the requirement was tested.

- How much additional information shall be added to the model (hardware supported, work around, …)

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Problems of Acquiring of Complex Data Necessary for Model Creation and Validation in Detailed Road Traffic Simulation

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Detailed Road Traffic Simulation

- Long-term research
- Goals
  - Precise modeling of all aspects of urban road traffic
  - Vehicles, traffic lights, pedestrians, public transport (including the passengers)
  - Predicting of consequences of planned or sudden exceptional events affecting the road traffic
- Requirements
  - Precise model of road traffic →Necessary to obtain large amount of very diverse data for its creation and validation

Required Data to Obtain I

- Relatively easily obtainable data
  - Publicly available data (usually online)
  - Automated data processing possible
  - Structure of road traffic network
  - Public transport timetables
- Difficultly obtainable data
  - Not available at all or cooperation of local authorities required
  - Numbers of vehicles in traffic lanes, traffic lights cycles, number of pedestrians in crossings, number of passengers in vehicles of public transport, etc.

Required Data to Obtain II

- How to obtain data?
  - Induction loops, records from surveillance cameras (not all data, local authorities cooperation required)
  - Manual recording using cameras (large amount of manpower required, limited time frame, limited view angle)
  - Flying drones with cameras (better view angle, can be semi-autonomous, multiple drones per operator)
- How to process data?
  - Image processing – vehicles and pedestrian counting, traffic lights cycle analysis – manual or automated – frequent errors in both cases → problematic to create and validate traffic model

VALID 2014

Sheri Jackson, IBM STG
Conference Panelist

System Test Challenges

- Interop and Complex test labs world-wide
- System test focus: customer-like, end-to-end solution integration testing
- Key area: Innovation
  - IBM System Storage Interoperation Center currently publishes 180+ million supported configurations
  - Test Smarter
  - We would like to use time efficiently, control risks we are taking, and know what we tested.
  - Too many combinations to deal with

Example Solutions

- CTD (Combinatorial Test Design), minimizes the number of test cases to achieve a specified coverage goal (e.g, pair-wise coverage)
  - Modeling with FOCUS is biased towards finding the more complex errors
  - Modeling plus CTD results in time savings due to the elimination of tests
  - By improving efficiency and coverage, CTD-based testing enables finding errors that are more rare and more complex than present testing
  - Early detection of defects is facilitated by deploying FOCUS/CTD
- Distance Matrix and Trace Coverage, modeling of SAN topology and environment settings
  - Automated way to extract SAN data for configurations and test environments
  - recommendations to update and greater utilization of switches
  - Educate Systems test teams on SAN best practices
  - Future use – Helpful in Critical Situations or Client recreates