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# Executable System Level Models with SystemC

A Joint Approach of the University of Rostock and TWT

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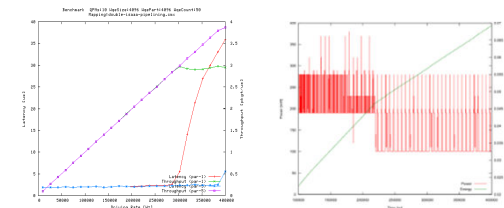
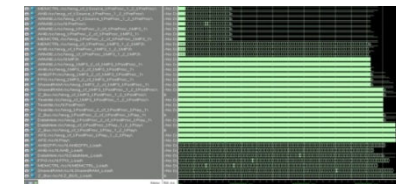
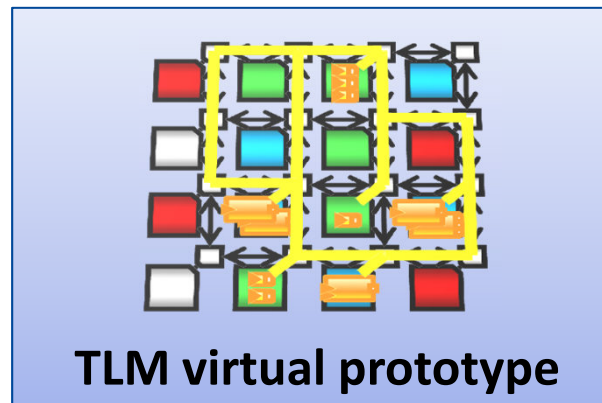
*Stefan Rieger (TWT)*



15/04/2013

## What is SystemC?

- Open Source C++ Class Library
- Event-driven simulation interface
- Concurrent, communicating processes
- System-level (transaction level) as well as hard- and software modeling



## What is SystemC ?

- SystemC is a modelling language initially developed to build hardware
- Due to the power of the language it has been further developed as a language to model the behavior of a system independent of implementation
- At an very early stage it is possible by means of this language to evaluate the system
  - Specification / Timing
  - Hardware (single core, multi core, quad core)
  - Software
  - Type of onboard unit (OBU)

## SystemC Modelling Approach for Tool Evaluation

- Subset 026 → Subset of the Subset (D2.5)
- Braking curves (Uni Rostock)
- Communication Management (TWT)
- Using SystemC in a way to obtain a formal model
- TLM Transaction level modelling (High level)

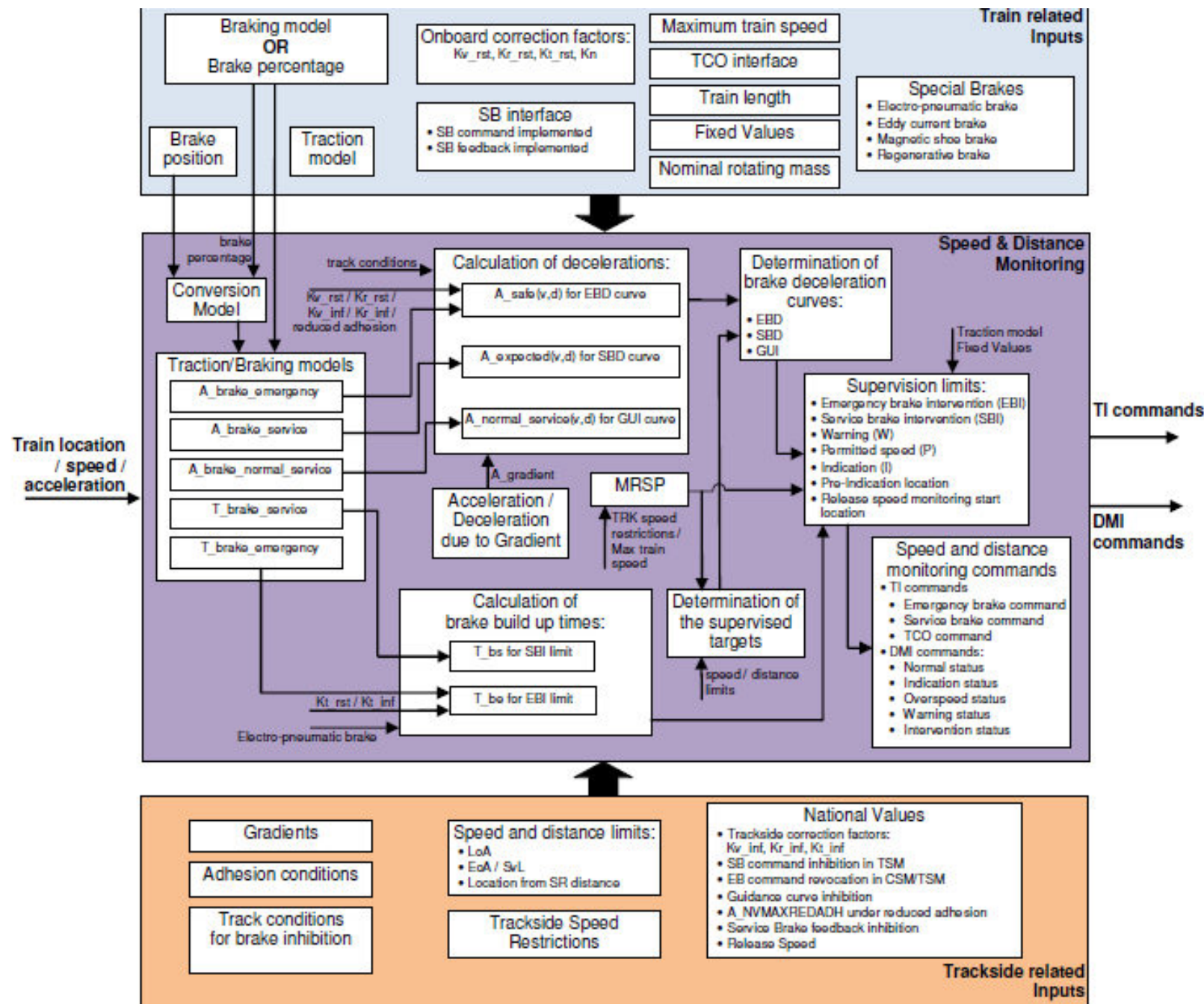
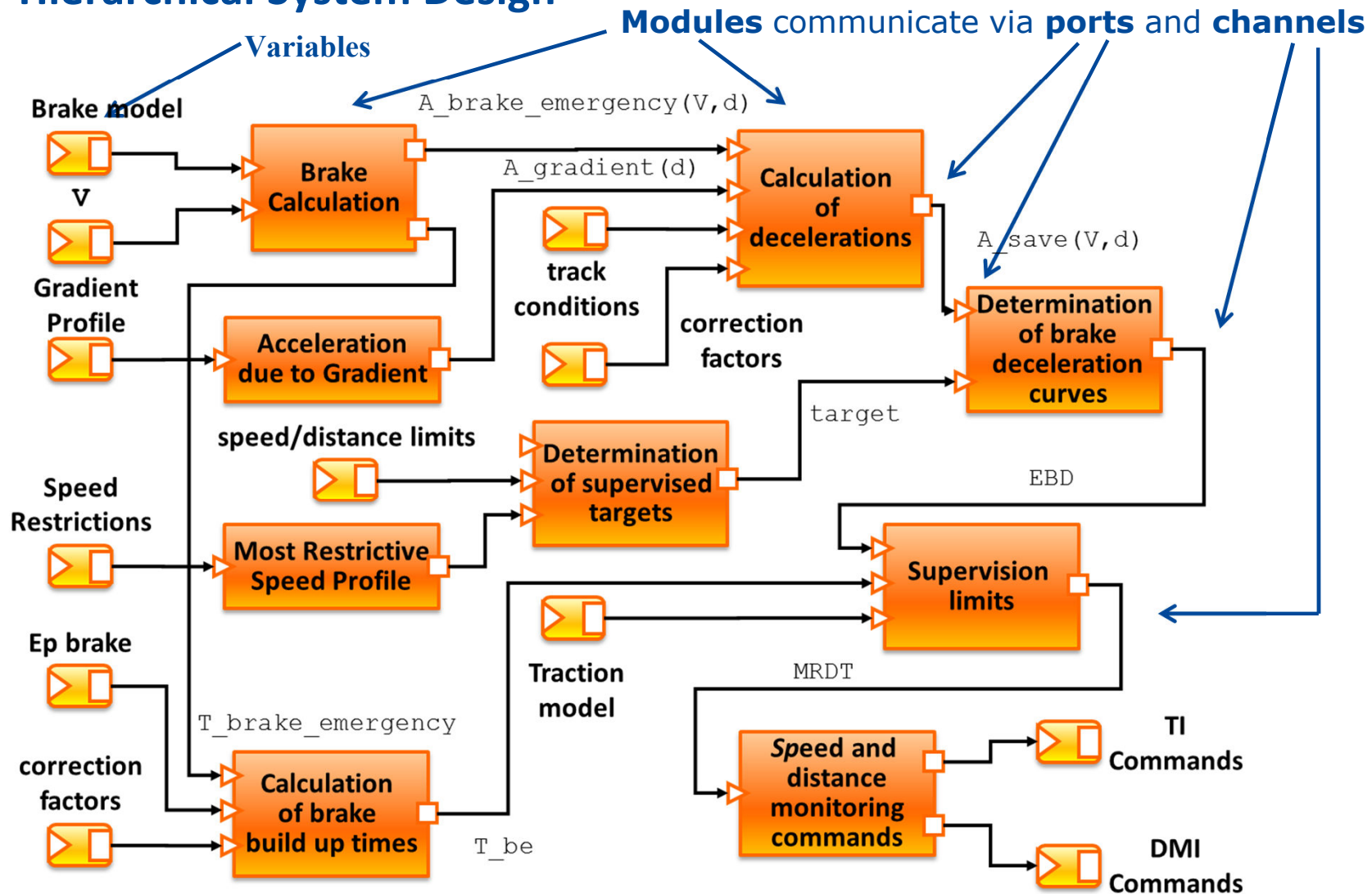


Figure 28: Speed and distance monitoring overview



## Hierarchical System Design



## Prototype Models in WP7

- **University of Rostock: Braking Curves**
  - Current state: Design of the Model of braking curves
  - In discussion interfaces with Scade and FormalSpec
- **TWT: Management of Communication**
  - Current state: Model of communication setup
  - Arbitrary many OBUs (Trains), RBCs or RIUs
  - Concurrent communication setup

## Prototype for Management of Communication (by TWT)

### Current state of the model:

- Model of communication setup
- Arbitrarily many OBUs (Trains), RBCs or RIUs
- Concurrent communication setup
- Switching of ETCS levels
- Still many aspects missing

```

Terminal - srieger@alexandria-virtual: ~/projekte/SVN_GIT/OpenETCS/030_Arbeitspakete/WP7/Prototyp
Datei Bearbeiten Ansicht Terminal Gehe zu Hilfe
srieger@alexandria-virtual:~/projekte/SVN_GIT/OpenETCS/030_Arbeitspakete/WP7/Prototyping/SystemC_3.5_Model/build$ ./main

SystemC 2.3.0-ASI --- Jan  3 2013 18:17:11
Copyright (c) 1996-2012 by all Contributors,
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OBUCommUnit1: ETCS level is 2
OBUCommUnit1: Sent connection request to RBC7.
RBC7: Incoming connection from OBU1 accepted. Sending system version.
OBUCommUnit1: Received supported system version, connection with RBC7 established.
RBC7: Connection with OBU1 established.
OBUCommUnit2: ETCS level is 3
OBUCommUnit2: Sent connection request to RBC7.
RBC7: Incoming connection from OBU2 accepted. Sending system version.
OBUCommUnit2: Received supported system version, connection with RBC7 established.
RBC7: Connection with OBU2 established.
OBUCommUnit3: ETCS level is 3
OBUCommUnit3: Sent connection request to RIU8.
OBUCommUnit4: ETCS level is 2
OBUCommUnit4: Sent connection request to RBC7.
OBUv2: ETCS level is 2
RBC7: Incoming connection from OBU4 accepted. Sending system version.
RIU8: Incoming connection from OBU3 accepted. Sending system version.
OBUCommUnit4: Received supported system version, connection with RBC7 established.
OBUCommUnit3: Received supported system version, connection with RIU8 established.
RBC7: Connection with OBU4 established.
RIU8: Connection with OBU3 established.
OBUv2: Sent connection request to RBC7.
RBC7: Incoming connection from OBU6 accepted. Sending system version.
OBUv2: Unsupported system version from RBC7 received.
OBUv2: Disconnecting
RBC7: Terminating connection with OBU6 as requested.
OBUCommUnit1: ETCS level is 1
OBUCommUnit1: Disconnecting
RBC7: Terminating connection with OBU1 as requested.
RBC7: Sent connection request to OBU5.
OBUCommUnit5: Incoming connection from RBC7 accepted.
RBC7: Connection with OBU5 established.
OBUCommUnit1: End of mission
OBUCommUnit2: End of mission
OBUCommUnit3: End of mission

```

Simulation run of the model



## Pros

- Open Source framework & IEEE Standard 1666
- Integrated simulation kernel -> **executable models**
- Integrated **model of time**
- **Concurrency**
- Powerful tracing & early performance estimation
- Reusability & Maintainability
- Full power of C++ (if necessary)
- Covers multiple abstraction levels in system design

## Cons

- Control-flow can get complex (due to concurrency)
- Not fully formal (currently there is no formally defined semantics)

**Thank you for your attention!**

**QUESTIONS?**