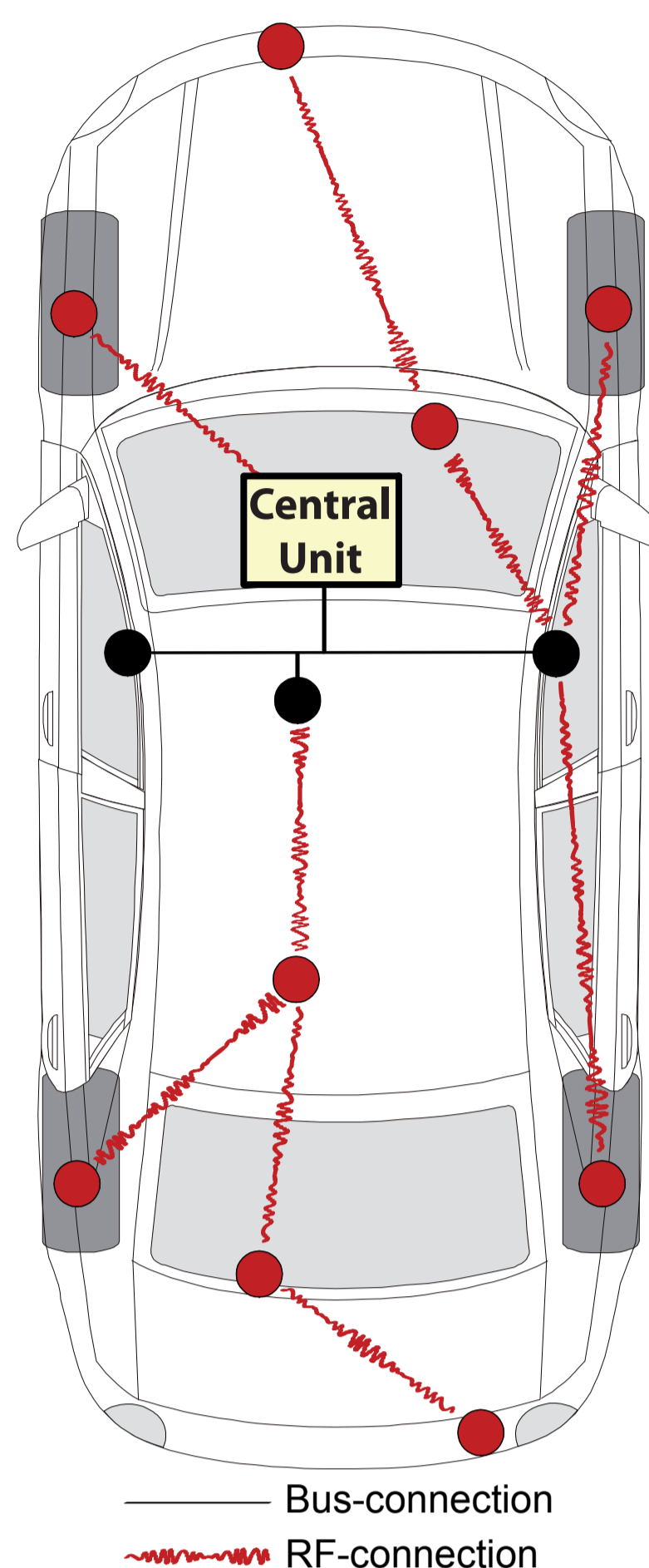


Power Profiling for Wireless Sensor Networks

Jan Haase, Joseph Wenninger, Mario Lang, Javier Moreno, Markus Damm, Christoph Grimm
Vienna University of Technology, Institute of Computer Technology, Austria

Overview: Networks consisting of many autonomous sensors are gaining importance. Most wireless sensors have small batteries and must therefore be designed to consume very little power.

An approach for **whole-system simulation** for ultra-low power wireless sensor networks is presented. To be able to estimate the power consumption of the whole network, the simulation framework must not only simulate the sensor nodes themselves, but also the overall system consisting of sensor nodes and other elements which can be much more sophisticated. It therefore includes an Instruction Set Simulator (ISS) for better accuracy. To speed up the simulation, Transaction Level Modeling (TLM) is used, with SystemC as the base for the simulation framework.



Application scenario: automotive WSN

Application: Tire Pressure Monitoring System (TPMS)

Battery replacement is often not feasible

A central unit collects & processes the data.

Some nodes are attached to the car's bus system (e.g. CAN).

Some sensors act as transition nodes in a multi-hop network

Energy constraints \Rightarrow Power simulation

Mixed wireless/wired networks

\Rightarrow Capability to model busses needed.

Protocol influence on power consumption has to be determined, too.

Using a TLM-like approach for WSN simulation

APPROACH Messages are modeled above base band level. A TLM-like approach is used where the messages are treated like transactions.

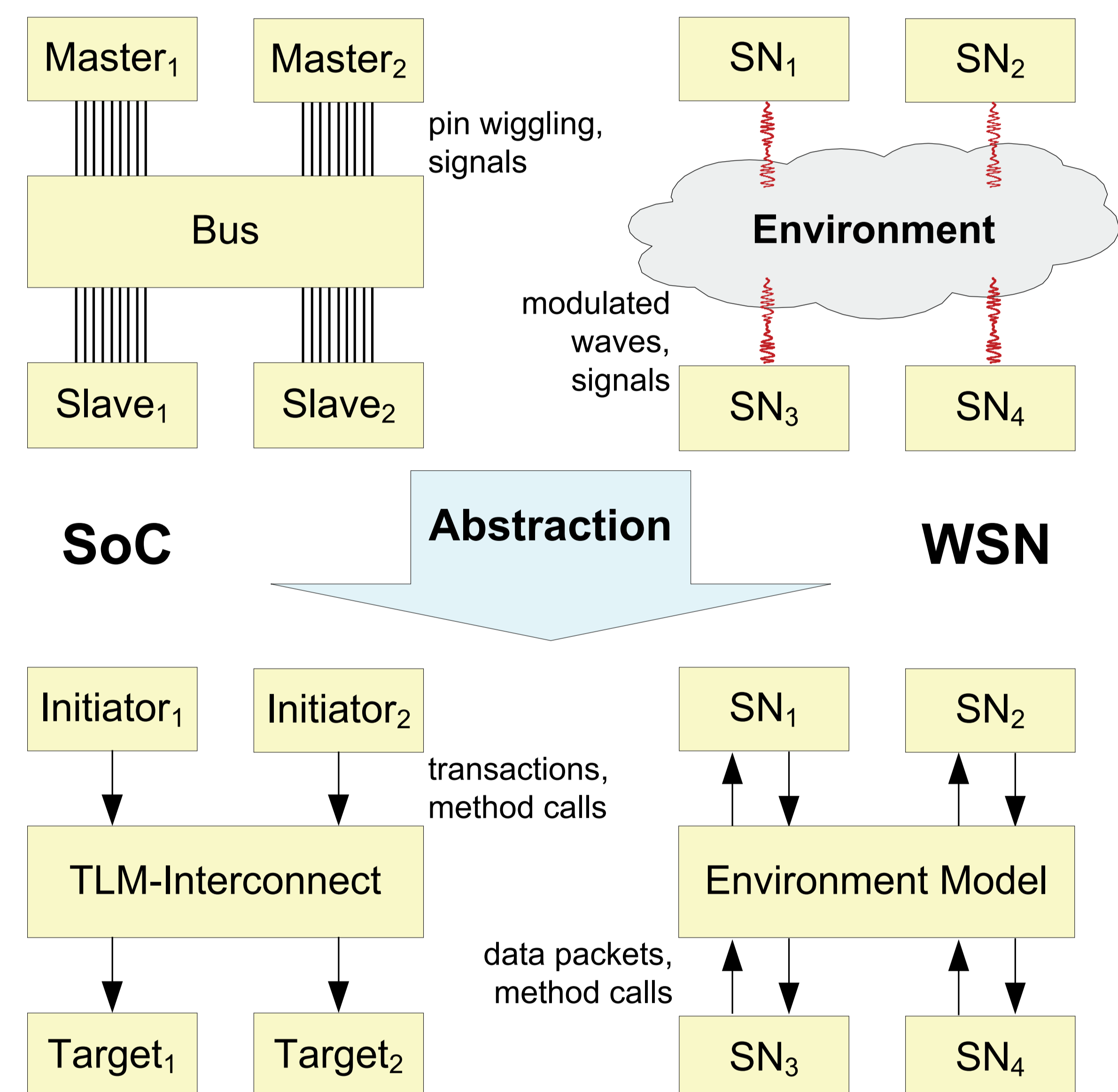
BENEFITS For the implementation, SystemC and TLM 2.0 are used.

APPROACH Straightforward implementation regarding the wireless/wired application scenario.

BENEFITS Enhancement of Simulation Performance.

BENEFITS Easier integration of nodes modeled in TLM.

BENEFITS New viewpoint: „Power consumption of a transaction“



DEMONSTRATION

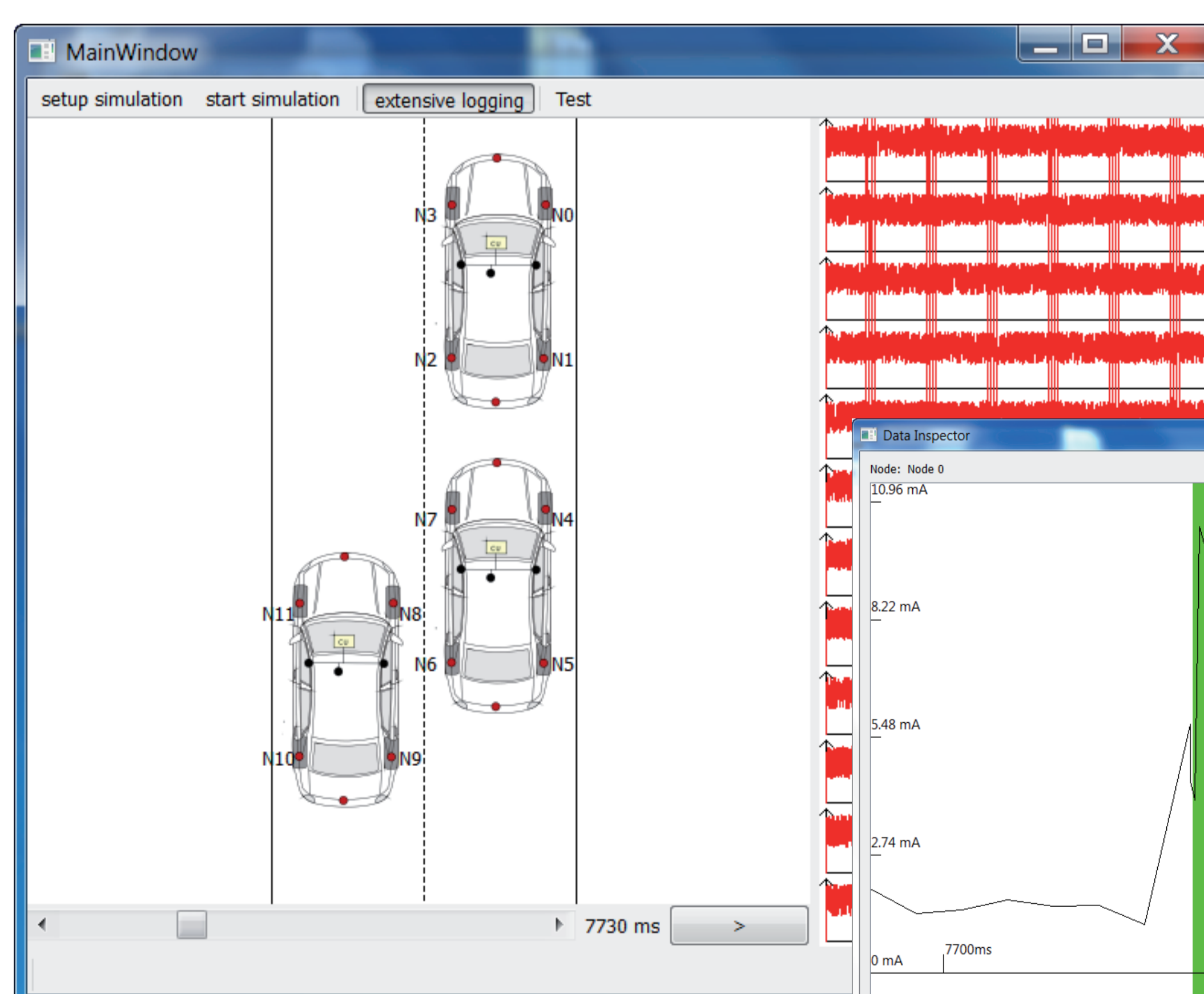
Cars passing, having 4 TPMS nodes each

Summing up energy consumption per message (instead of per module)

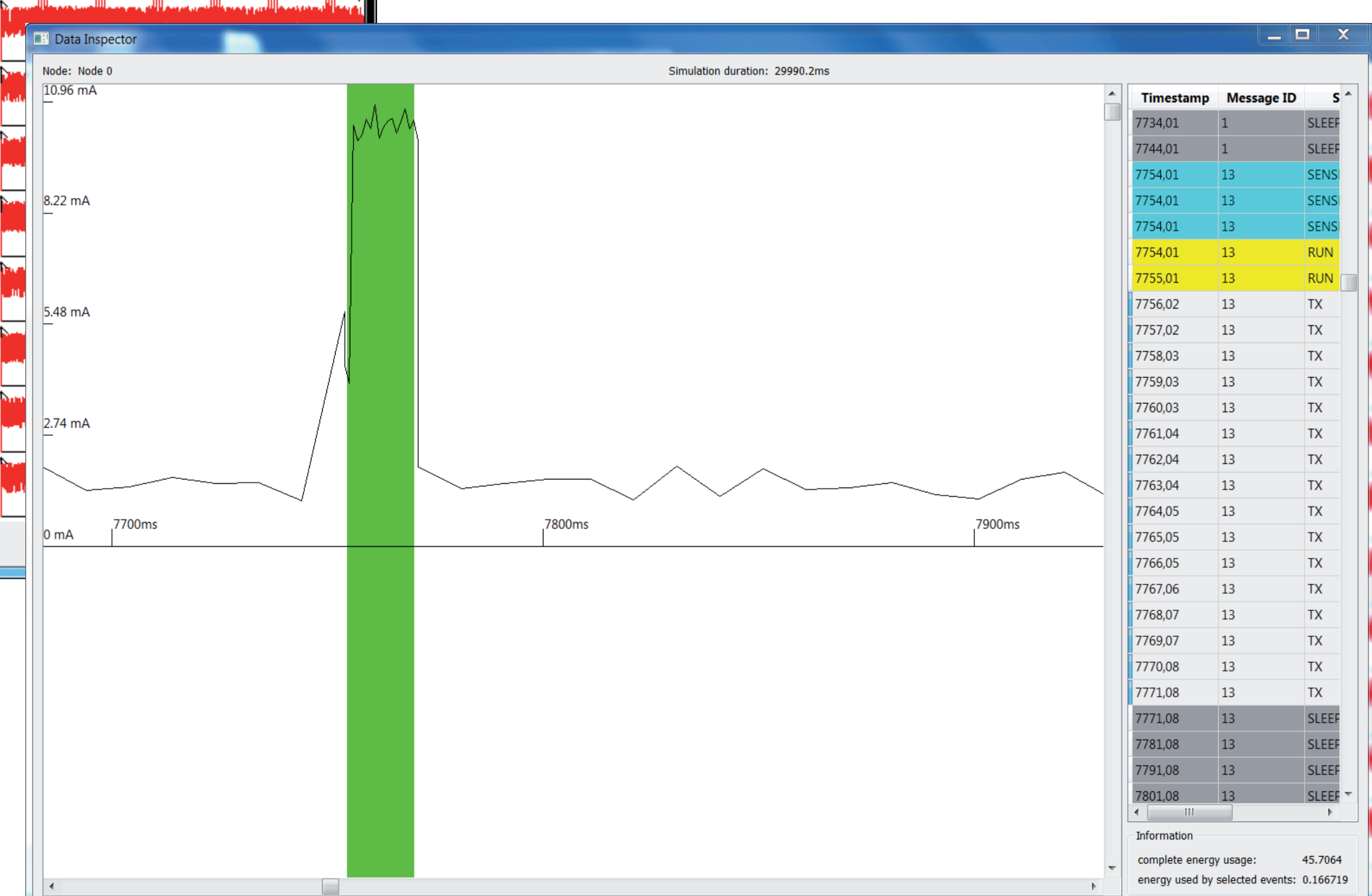
Easy reconfiguration of simulation parameters

Simulation runtime much faster than simulated time

Contact: Jan Haase,
Vienna University of Technology,
Institute of Computer Technology
Gußhausstraße 27-29/E384,
1040 Vienna, Austria,
haase@ict.tuwien.ac.at



SIMULATION VISUALISATION



This work is conducted as part of the Sensor Network Optimization by Power Simulation (SNOPS) project which is funded by the Austrian government via FIT-IT (grant number 815069/13511) within the European ITEA2 project GEODES (grant number 07013).