

Debugging Wireless Sensor Network Simulations with YETI and COOJA



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MICS



Debugging Wireless Sensor Networks

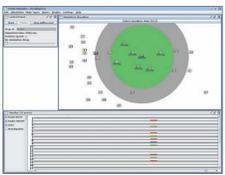
Motivation

Debugging sensor network applications is difficult and time consuming. User-friendly development tools are often missing. We present the integration of the COOJA network simulator into the YETI development environment.

WSN Development Phases

- Simulations
- Prototype experiments on the table (1-10 nodes)
- Testbed experiments (10-200 nodes)
- Deployment

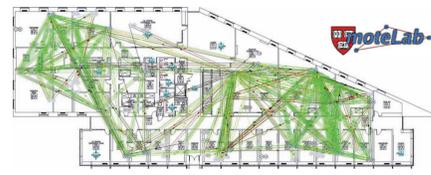
1. Simulations



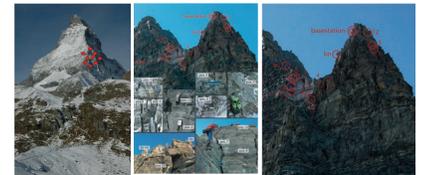
2. Desk Experiments



3. Testbed Experiments



4. Deployment



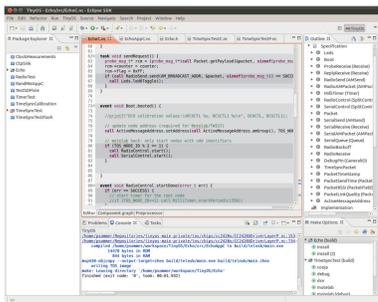
Development and Simulation Tools

YETI

<http://tos-ide.ethz.ch>



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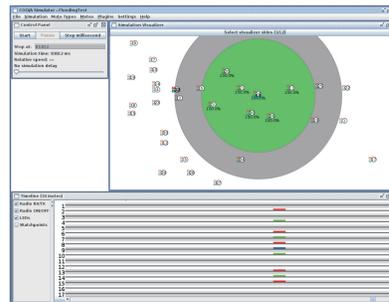
YETI is a TinyOS plugin for Eclipse:

- Integration with the TinyOS toolchain
- Syntax highlighting
- Code completion
- Error detection
- Component graph
- Debugging support using CDT



COOJA

<http://www.sics.se/contiki/>



COOJA is a network simulator:

- Part of the Contiki operating system
- Emulation of the MSP430 at the instruction level using MSPSim
- Event-based simulation of WSN networks
- Different radio propagation models
- Event timeline (radio, LEDs)
- Flexible plugin system

Debugging Architecture

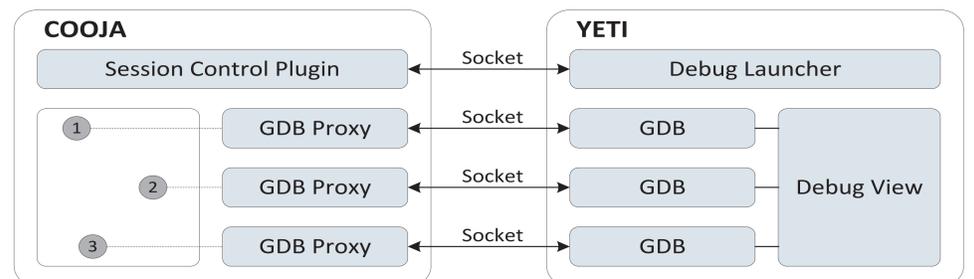
GNU Debugger (GDB) Remote Protocol

- Eclipse spawns a GDB instance for each node in COOJA
- Command/response protocol using TCP sockets
- GDB support already integrated in Eclipse CDT

Session Control Protocol

- YETI queries COOJA for information about the current simulation (e.g. number of nodes and binary images)
- Add/remove nodes to/from the debugging session

Connecting YETI and COOJA

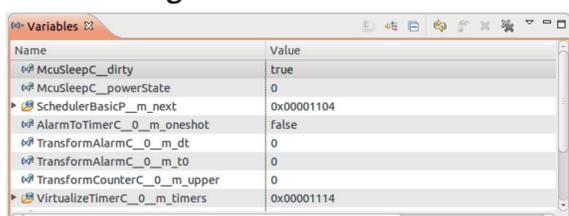


User Interaction

The user can attach YETI to a WSN simulation running in COOJA

- Insert/remove breakpoints for all nodes or on a per node basis
- Inspect/modify content of registers and memory

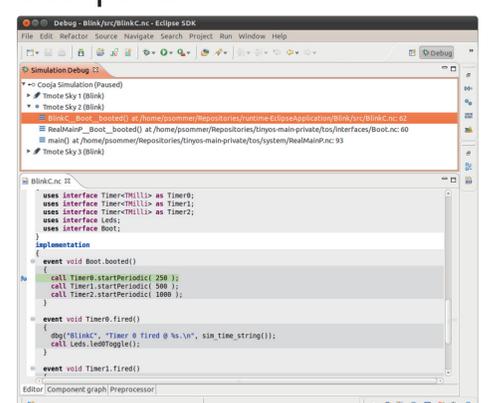
Read/write global variables



Read/write registers



Breakpoints



References

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- [2] N. Burri, R. Flury, S. Nellen, B. Sigg, P. Sommer, and R. Wattenhofer. YETI: An Eclipse Plug-in for TinyOS 2.1. In SenSys, 2009.
- [3] J. Eriksson, F. Osterlind, N. Finne, N. Tsiftes, A. Dunkels, T. Voigt, R. Sauter, and P. J. Marron. COOJA/MSPSim: Interoperability Testing for Wireless Sensor Networks. In SimuTools, 2009.
- [4] P. Levis, N. Lee, M. Welsh, and D. Culler. TOSSIM: Accurate and Scalable Simulation of Entire TinyOS Applications. In SenSys, 2003.
- [5] B. L. Titzer, D. K. Lee, and J. Palsberg. Avrora: Scalable Sensor Network Simulation with Precise Timing. In IPSN, 2005.