

Distributed Energy Measurements in Wireless Sensor Networks

Live Energy Measurements in WSN Testbed SANDbed

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Energy Measurement

Motivation

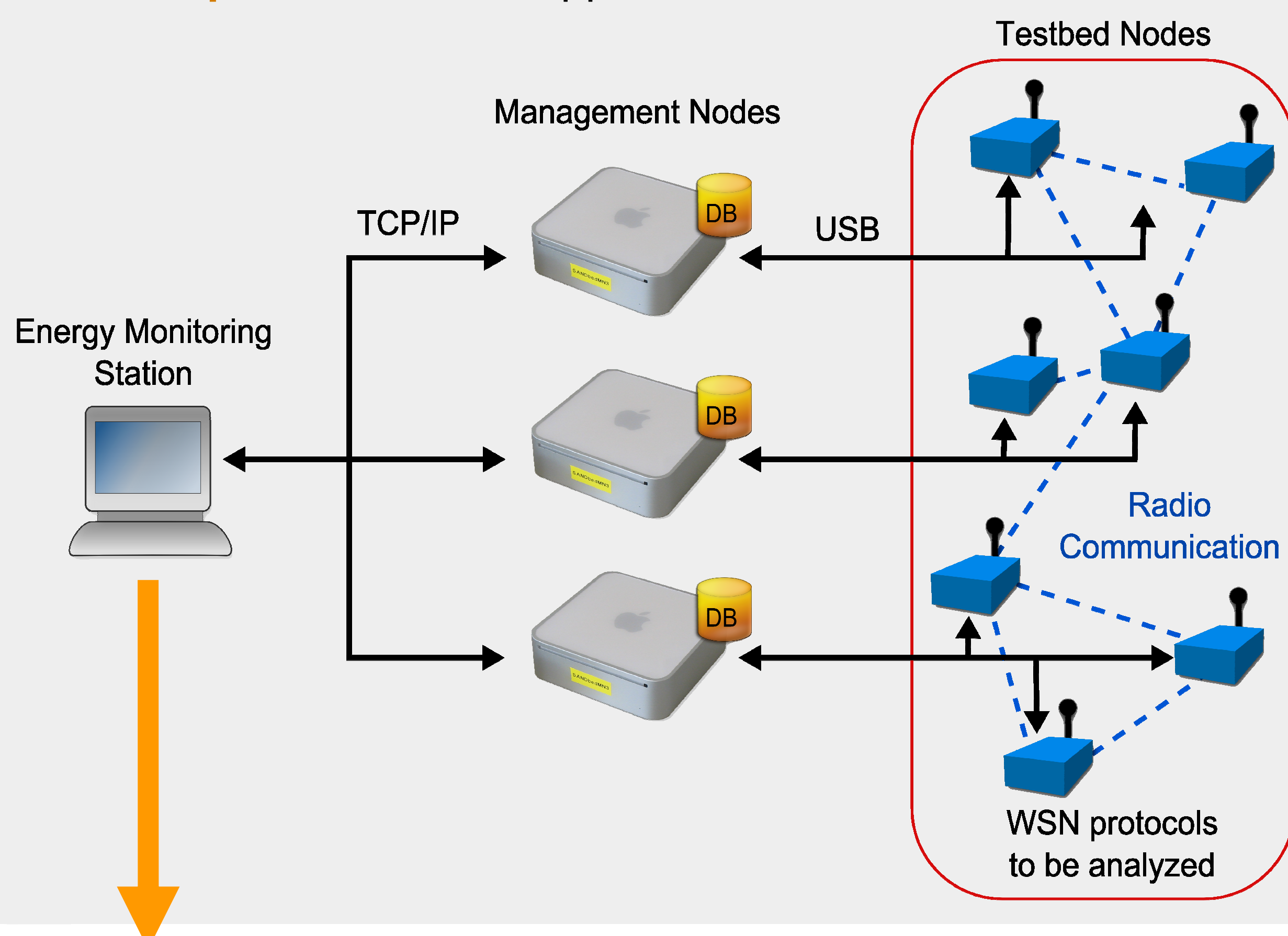
- Energy constraints significantly influence the operation of wireless sensor networks, but actual power consumption is difficult to determine

Research goals

- Distributed and side-effect free energy measurements using real sensor nodes
- Dedicated monitoring and management hardware to gather and transport energy measurements
- Evaluation and optimization of WSN protocols concerning energy efficiency

Measuring Energy in SANDbed

- SANDbed (Sensor Actuator Network Development Testbed)** is an integrated testbed system for WSN monitoring and management
- No adaptation** of WSN-applications and sensor nodes needed



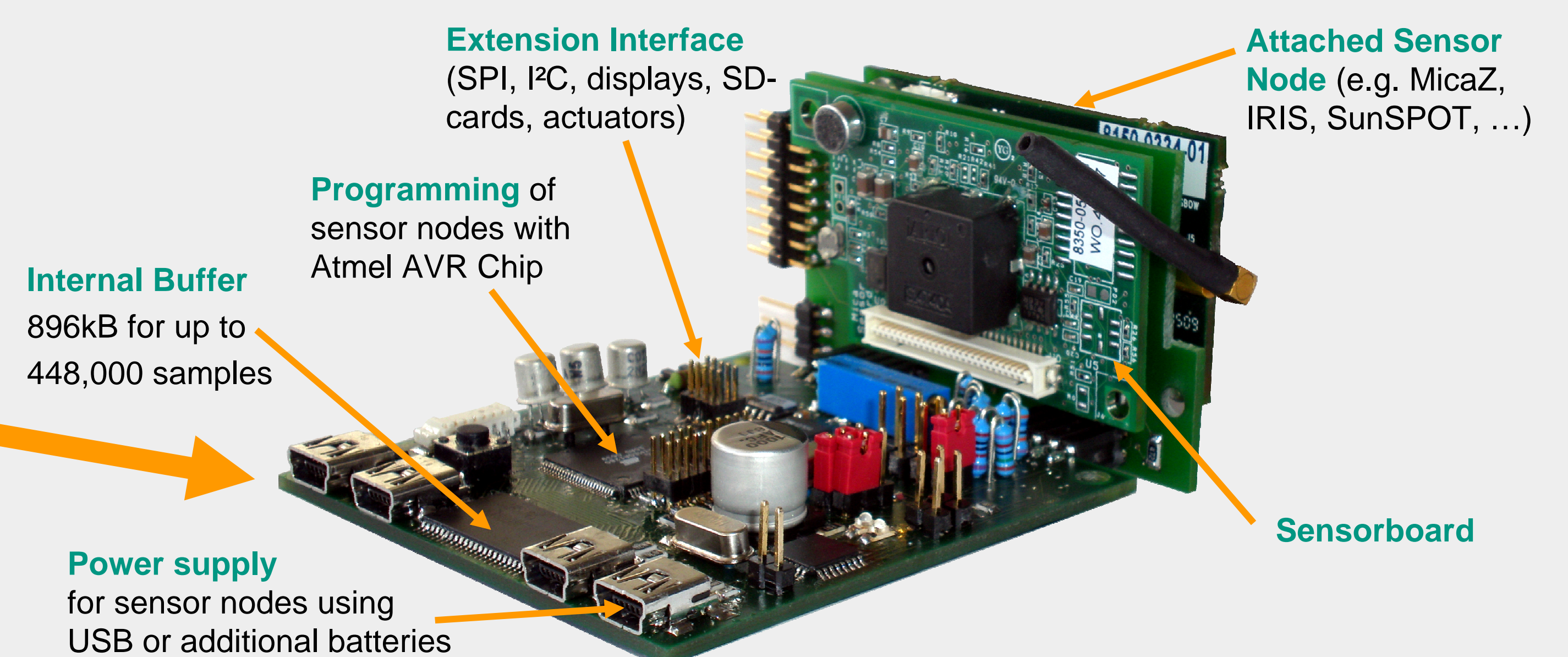
Sensor Node Management Device - SNMD

Energy monitoring capabilities

- Measures current and voltage precisely with 16bit resolution and a sampling rate of 20kHz live and up to 400kHz buffered
- Selectable measurement range: 0-100/200/500mA and 0-10V

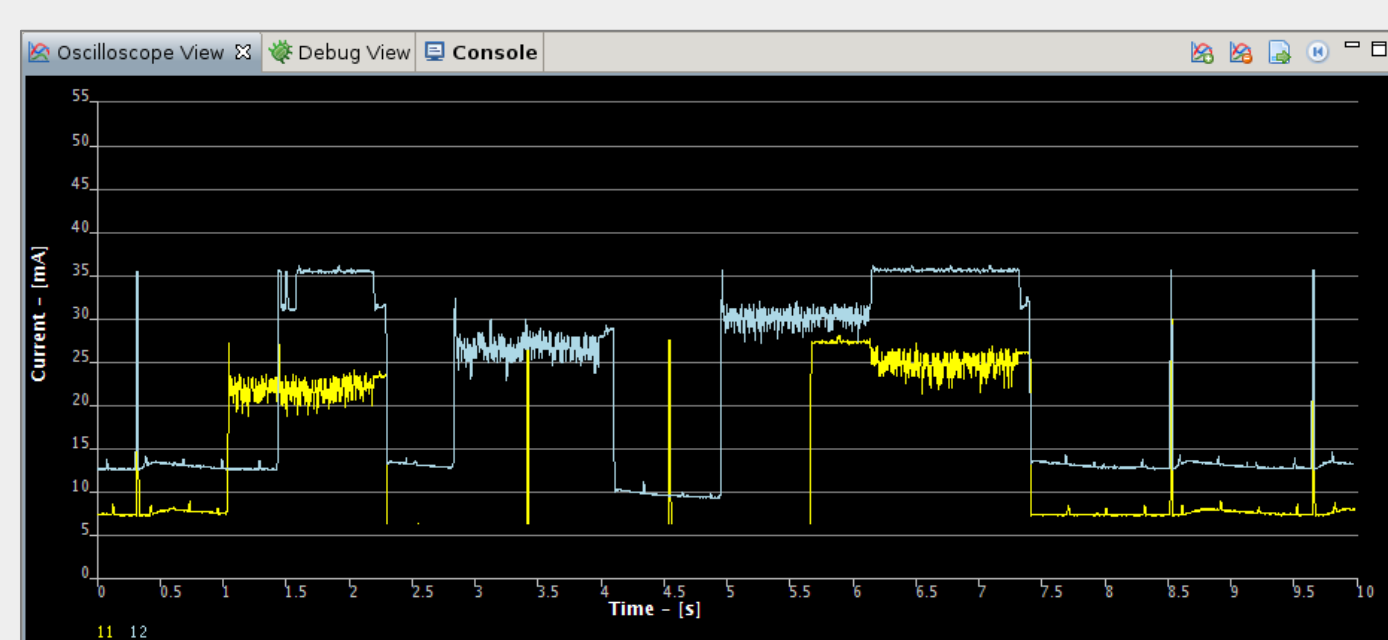
Management capabilities

- Emulation of various power sources
- Environment simulation for sensor measurements

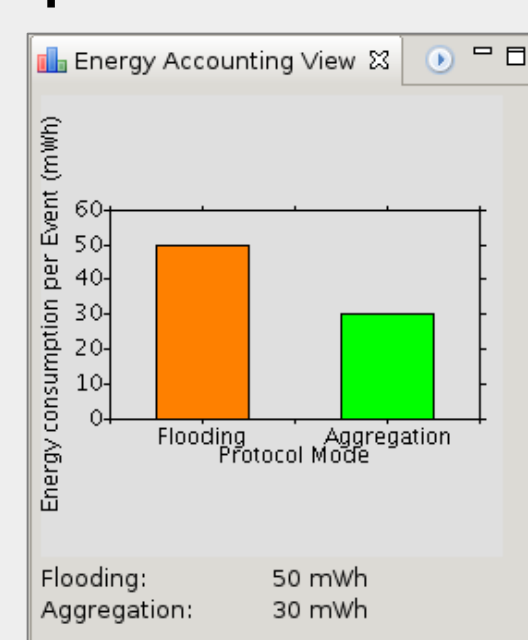


Evaluating Energy Efficiency in SANDbed

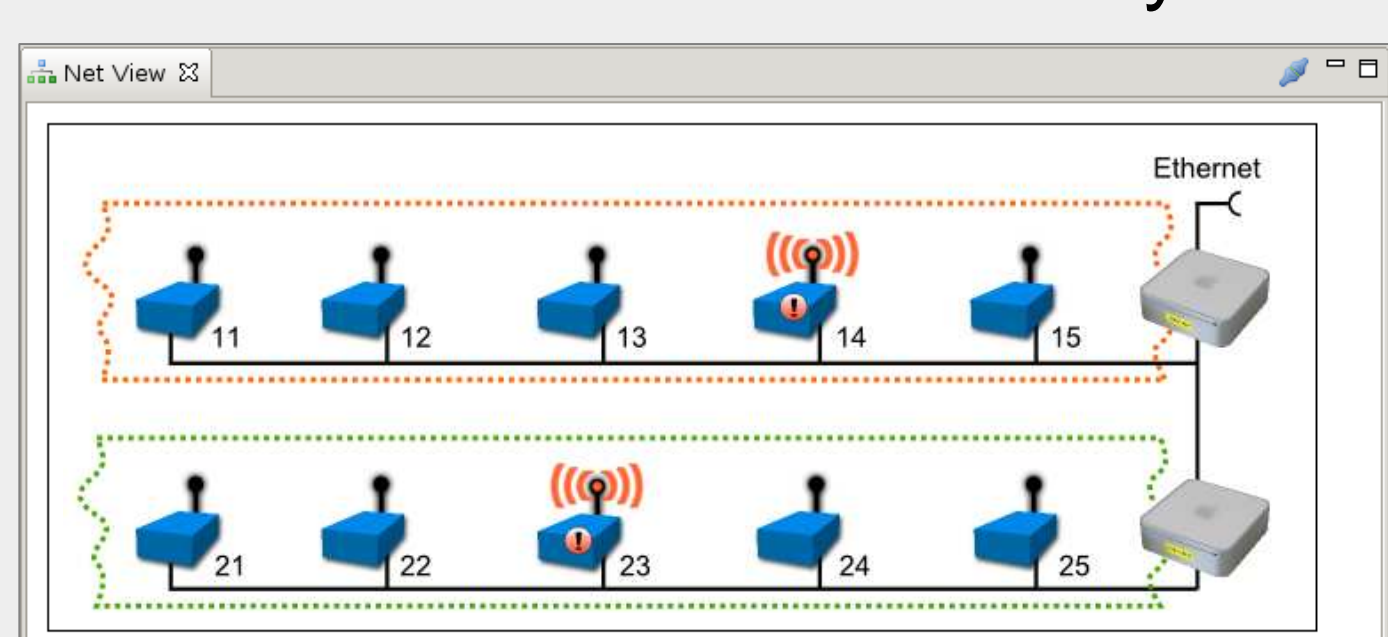
- Oscilloscope View** shows live energy measurements



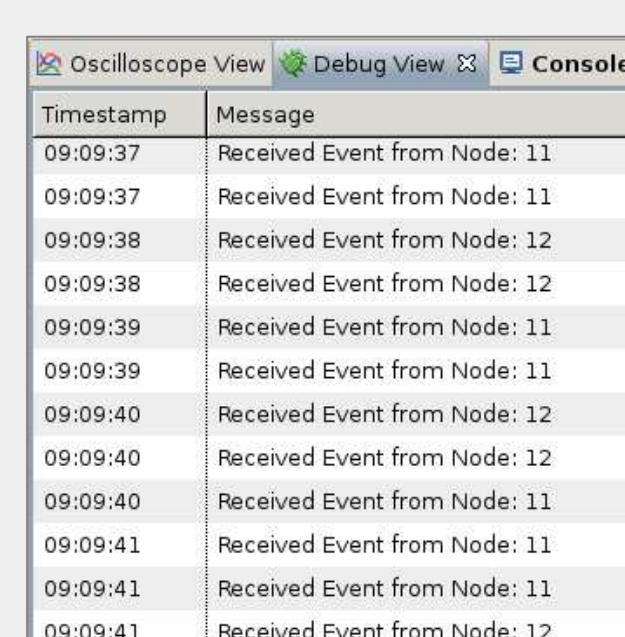
- Summarized Energy Accounting View** for protocol comparison



- Net View** visualizes events and broadcast activity



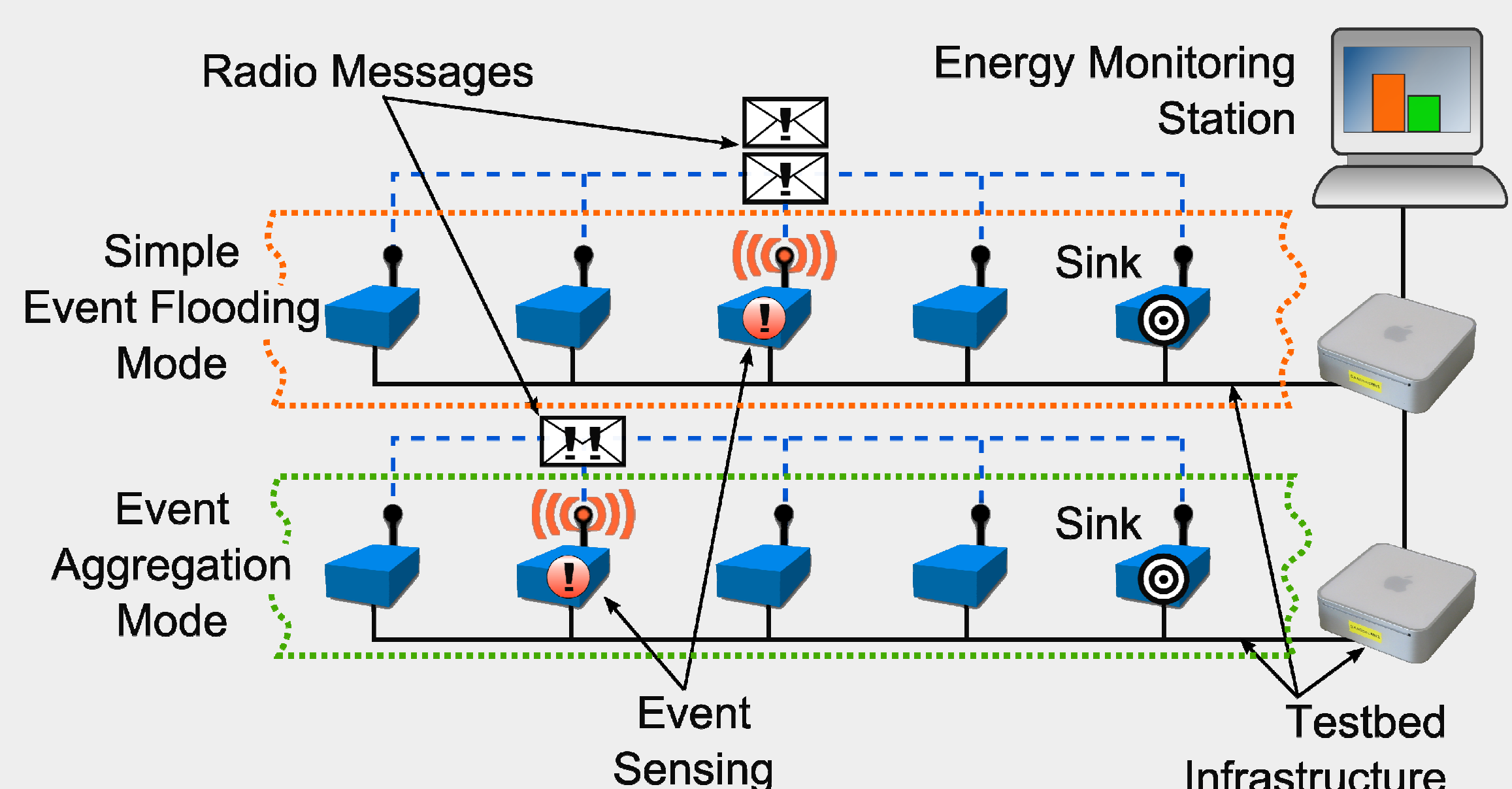
- Debug View** logs serial node output



Timestamp	Message
09:09:37	Received Event from Node: 11
09:09:37	Received Event from Node: 11
09:09:38	Received Event from Node: 12
09:09:38	Received Event from Node: 12
09:09:39	Received Event from Node: 11
09:09:39	Received Event from Node: 11
09:09:40	Received Event from Node: 12
09:09:40	Received Event from Node: 12
09:09:40	Received Event from Node: 12
09:09:41	Received Event from Node: 11
09:09:41	Received Event from Node: 11
09:09:41	Received Event from Node: 12

Demonstrator Setup

- SANDbed is used to compare the energy consumption** of two different event forwarding modes on top of B-MAC
 - Simple Event Flooding Mode
 - Event Aggregation Mode
- Simple event detection scenario
- Audience can trigger events by shadowing light sensors



References and Acknowledgements

- [1] A. Hergenröder, J. Horneber, and J. Wilke. SANDbed: A WSN Testbed for Network Management and Energy Monitoring. Hamburg, Germany, Aug. 2009. 8. GI/ITG KuVS Fachgespräch "Drahtlose Sensornetze".
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