Network-centric Middleware
for Service Oriented Architectures across
Heterogeneous Embedded Systems

Andreas Wolff, Jens Schmutzler,
Stefan Michaelis, Christian Wietfeld
Andreas.Wolff@uni-dortmund.de

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Overview

• Motivation & Requirements for Embedded Web-Services

• The µSOA Approach

• MORE Middleware Architecture

• Deployment Example

• Conclusions & Outlook
Exemplary End-user scenario: Environmental monitoring

Processing Level

Relay Level

Sensor Level

Mitigation Manager (Fire brigades, forest department, ...)
Subscribe information of certain sensors

Challenge: Energy, communication link and real time constraints
Requirements for embedded Web-Services

• Real-life Scenarios
  – Environmental Monitoring & Mitigation Management
  – Remote Chronic Care Support
  – ...

• Common requirements
  – Distributed and connected via Internet using integrated Web-Services
  – Heterogeneity of devices
  – Embedded system conditions

• Aims of the MORE project:
  – Generic Middleware for resource constraint scenarios
  – Reduce deployment time, Reuse of services
Resource constraints of Embedded Systems

Example Relay Level:

- **Wireless Module TC65**
  - Technical Specifications
    - **ARMSP430** (8MHz)
    - 8x ADC interfaces
    - 2x DAC interfaces
    - 2x serial interfaces with the ITU-T V.24 protocol
    - USB 1.1 full speed
    - Memory: 400 KB (RAM) and 1.7 MB (Flash)
    - Wireless Technologies
      - 25 MHz to 2.4 GHz IEEE 802.15.4 Chipcon Wireless Transceiver (CC2420)

Limited Processing power
Limited Memory
Limited Energy
Measurement of the impact of running simultaneous tasks on a Embedded System (TC65)

Execution Delay nearly doubled

One concurrent task

Exemplary Periodic operation

Measurement test cycles
Processing standard SOAP leads to unacceptable delays & energy consumption

- High Energy consumption due to long parsing times
- Reduced real-time capabilities

**Exemplary SOAP Message (600 bytes)**

Platform:
Siemens TC65 Wireless Module
J2ME kXML 2.0 Pull Parser
Solution Approach: µSOA

Available implementations

Network-centric Middleware for Service Oriented Architectures across Heterogeneous Embedded Systems
MORE Service Oriented Architecture

- Classical Layered View & Service Oriented View
- Core Management Service
- Different Service Connectors
MORE enabled deployment

- Processing Level
- Relay Level
- Sensor Level

**Group Management Services**
End users specify, which sensors are of interest to them (spatially explicit information)

**Communication Services**
Communication of and between nodes

**μSOA Proxy Service**
Low energy consumption of sensors by efficient handling of measuring / broadcasting intervals

**Measurement Services**
Sending measured data to the transmitting device / georeferenced information
Conclusion

• MORE middleware: development and validation of new concepts to enable Web-Services for Embedded Systems

• Service-oriented Architecture and exemplary use case scenario of a mitigation management system:
  – Fusion of sensors with Web-Services
  – Reduced deployment time and reuse of services

• Outlook:
  – Validation of experimental system by real end users
  – In-depth performance evaluation: focus on reliability and scalability
Thank you for your attention!

For further information, please contact: Andreas.Wolff@uni-dortmund.de

www.ist-more.org
Backup: MORE Acronym

Network-centric Middleware for Group communication and Resource Sharing across Heterogeneous Embedded Systems
MORE Group Management Service

- Control of dynamic groups in MORE
- Policy based Group Management
- Policies enable a higher reliability and in combination with group communication cost effective efficiency gains