Master Thesis:
Design and Implementation of a Gateway for
Web-based Interaction and Management
of Embedded Devices

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Goals and Motivation

- Embedded Devices and WSN
  - Proprietary protocols
  - Hard to program and difficult to use
- The Web is a scalable Information System
  - Large audience (browsers on mobile phone, etc.)
  - Static and dynamic content
  - Easy to use (even my grandma can use it)
- Solution: Place Sensors on the Web

Web of Things
The Web

- Resource oriented
  - Loose coupling, Scalable
  - Open, Standards
  - Composable, Reusable, Heterogeneous
- URI
- HTTP
- „Mashupability“

REST
REST (basics)

- Self-explaining Interface
  - PUT, POST, GET, DELETE
- Exposure via resource representations
  - Different formats, encodings
- Self-descriptive
  - Meta-data

Restlet
Architecture
Presentation and Control

Web

Gateway

Presentation

Eventing Web-Interface

Device Management Web-Interface

Search Web-Interface

Control

Eventing Subsystem

Device Management Subsystem

Search Subsystem

Device Abstraction

Drivers

Eventing Subsystem

Device Management Subsystem

Search Subsystem

Drivers
Device Abstraction

Web

Gateway

Presentation

Control

Device Abstraction

Device Interface

Indirect

Pass-through

Any Protocol

Proprietary

Open

Driver

HTTP

Devices

Distributed Systems

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Eventing

- Devices sense the environment
  - Temperature, Light intensity, Acceleration
- Traditional Polling can be inefficient
- publish/subscribe
  - Subscribe for a given topic (keyword)
  - Receive published notifications

1. subscribe(keyword)
2. device-level event
3. notify(event)
Hierarchical Grouping

- What wires together fires together
  - Group gateways according to a metric (e.g., Location, capabilities, etc.)
- Exchange control Information
- Enables limited search algorithms
Challenges

- Michaels' Simulator Framework
  - „Impediance“ mismatch
  - „Singleton“-problem
- Andreas' Contiki/TinyOS Subsystem
  - Synchronous vs. Asynchronous
  - Low-level vs. High-level
- Many third party libraries
  - Documentation, Source code
- Multi-threading
Contributions

- Integrate different devices
  - Real and/or Simulated
  - Accessable/Controllable with HTTP
- Device-level Events consumable as Web documents
  - XML, JSON
- Enable „mashups“, reuse and rapid prototyping
  - See the Demo
Questions???

... else Demo
Demo Setup

RFID Reader

USB

PSCS + RFID2OSC

OSC

TikitagDriver

Gateway