Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Informatik
Computer Science

Distributed Systems – Assignment 2

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Agenda

- Tasks
- Background info
  - REST
  - Web Services (WS-*)
- Detailed tasks
- Submission

The Exercise

- Objectives
  - Use the phone to connect to Wireless Sensor Networks (WSN)
  - Learn and compare two different technologies for accessing sensor data over the Web: REST and WS-*
  - Make your phone part of a WSN by exporting sensed values through a Web Server
  - Use cloud services to visualize sensor data

- Dates:
  - Exercise begins: Now (October 15, 2010)
  - Exercise is due: 9:00am, October 29, 2010

The Tasks

- Assignment is divided up into **5 tasks**
  - **First Task:** Experimenting with RESTful Web Services
    - Create an HTTP request “by hand”.
    - Connect to Sun SPOTS using REST and retrieve the temperature value.
  - **Second Task:** Experimenting with WS-* Web Services
    - Connect to Sun SPOTS using WS-* and retrieve the temperature value.
  - **Third Task:** Assessing Web Service Technologies
    - Compare REST and WS-* and answer a form (**individual**).
  - **Fourth Task:** Cloud Services
    - Visualize retrieved measurements using the Google Visualization API.
  - **Fifth Task:** Your Phone as a Server
    - Implement your Android Web Server that exports phone sensor values.
    - Write a **report** on your Web Server architecture (**individual**).
  - **Feedback Form:** Workload and technology study (anonymous).

Background

- REST and WS-* technologies

Resource Oriented Embedded Devices

REST in a Nutshell

- Resources
- Their names (URIs).
- Their representations (JSON, XHTML).
- Links between them.
- A uniform interface (HTTP).

Resource Design

- Thanks to their atomicity services on embedded devices are quite adapted to Resource-Oriented Architectures.
- Root: http://vswot.inf.ethz.ch:8081/
- Resources:
  - Spots: http://vswot.inf.ethz.ch:8081/sunspots/
  - Spot 2: http://vswot.inf.ethz.ch:8081/sunspots/Spot2
  - Light Sensor: http://vswot.inf.ethz.ch:8081/sunspots/Spot2/light
  - Led Actuator: http://vswot.inf.ethz.ch:8081/sunspots/Spot2/actuators/led/

Representation Design

- HTML as default, ideal for browsing
- JSON, ideal for parsing:

```
[
        {"name": "spot 1", "location": "kitchen", "id": 1299},
        {"name": "spot 2", "location": "living room", "id": 1288},
        {"name": "spot 3", "location": "...", "id": 1812}
]
```

Uniform Interface

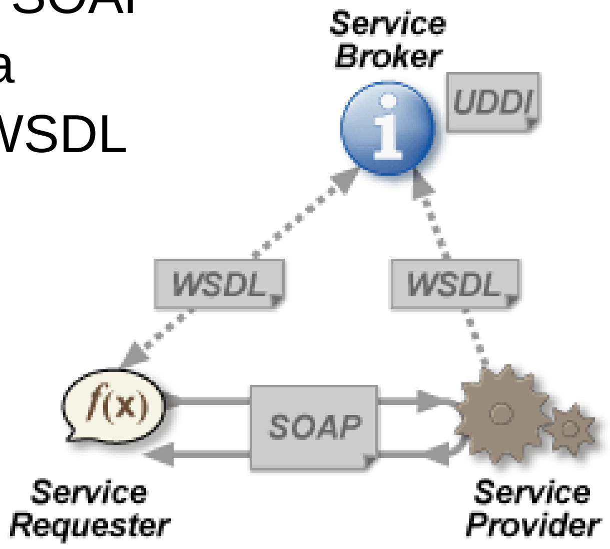
- HTTP Verbs: What do you want to do?
  - GET: retrieve the representation of a resource:
    - Current consumption of an electricity sensor.
  - PUT: update a resource:
    - Turn a device on/off.
  - DELETE: remove a resource:
    - Delete a threshold on a senors, shut a device down.
  - POST: create a subordinate:
    - Create a new feed to trace the location of a tagged object.
- HTTP Headers: What type of data are you sending me/requesting?
  - Metadata:
    - Content type: application/json, text/html, etc.
  - Status:
    - 200 OK, 201 Create, 400 Bad Request, 401 Unauthorized

WS-* Technologies

- Web Service (WS-*) technologies were intended to solve three main problems
  1. Interoperability → different OSs and programming languages
  2. Firewall traversal → standard HTTP port
  3. Complexity → lower learning curve than previous technologies, such as RMI and CORBA

What are Web Services?

- An application component that:
  - Communicates via open protocols (HTTP, SMTP, etc)
  - Processes XML messages framed using SOAP
  - Describes messages using XML Schema
  - Provides an endpoint description using WSDL
  - Can be discovered using UDDI



Web Service Architecture

Terminology

- XML – eXtensible Markup Language
- JSON – JavaScript Object Notation
- SOAP – Simple Object Access Protocol (communication standard)
- UDDI – Universal Description, Discovery and Integration specification (mechanisms to register and locate WS based applications)
- WSDL – Web Services Description Language (used to describe the services offered)

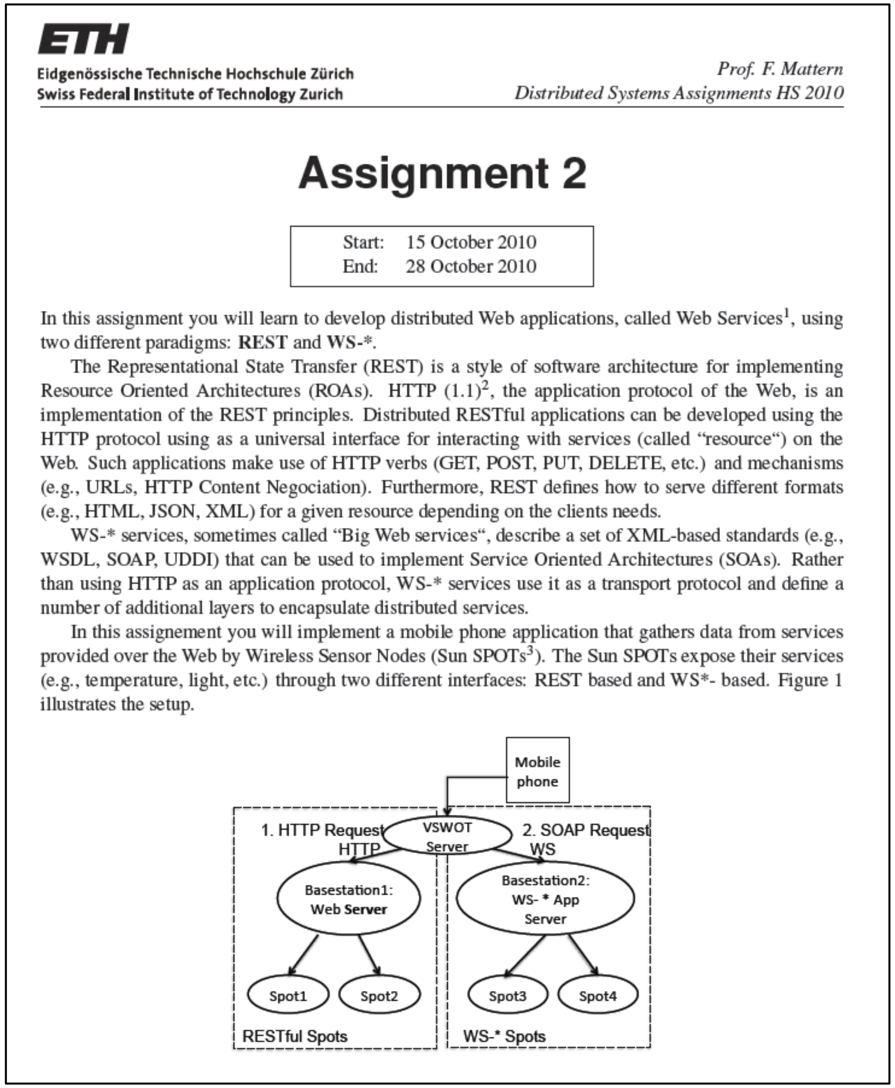
Web Services

- Services are defined using six major elements:
  - **types**: provides data type definitions used to describe the messages exchanged.
  - **message:** represents an abstract definition of the data being transmitted. A message consists of logical parts, each of which is associated with a definition within some type system.
  - **portType:** a set of abstract operations. Each operation refers to an input message and output messages.
  - **binding:** specifies concrete protocol and data format specifications for the operations and messages defined by a particular portType.
  - **port:** specifies an address for a binding, thus defining a single communication endpoint.
  - **service:** is used to aggregate a set of related ports.

Links:

- SOAP message example:
  http://www.w3schools.com/soap/soap_example.asp
- WSDL: http://www.w3.org/TR/wsdl
- Web Service tutorial:
  http://www.w3schools.com/webservices/ws_intro.asp

Tasks



Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Prof. F. Mattern
Distributed Systems Assignments HS 2010

Assignment 2

Start:	15 October 2010
End:	28 October 2010

In this assignment you will learn to develop distributed Web applications, called Web Services[1], using two different paradigms: **REST** and **WS-***.

The Representational State Transfer (REST) is a style of software architecture for implementing Resource Oriented Architectures (ROAs). HTTP (1.1)[2], the application protocol of the Web, is an implementation of the REST principles. Distributed RESTful applications can be developed using the HTTP protocol using as a universal interface for interacting with services (called "resource") on the Web. Such applications make use of HTTP verbs (GET, POST, PUT, DELETE, etc.) and mechanisms (e.g., URLs, HTTP Content Negociation). Furthermore, REST defines how to serve different formats (e.g., HTML, JSON, XML) for a given resource depending on the clients needs.

WS-* services, sometimes called "Big Web services", describe a set of XML-based standards (e.g., WSDL, SOAP, UDDI) that can be used to implement Service Oriented Architectures (SOAs). Rather than using HTTP as an application protocol, WS-* services use it as a transport protocol and define a number of additional layers to encapsulate distributed services.

In this assignement you will implement a mobile phone application that gathers data from services provided over the Web by Wireless Sensor Nodes (Sun SPOTs[3]). The Sun SPOTs expose their services (e.g., temperature, light, etc.) through two different interfaces: REST based and WS*- based. Figure 1 illustrates the setup.

Marks

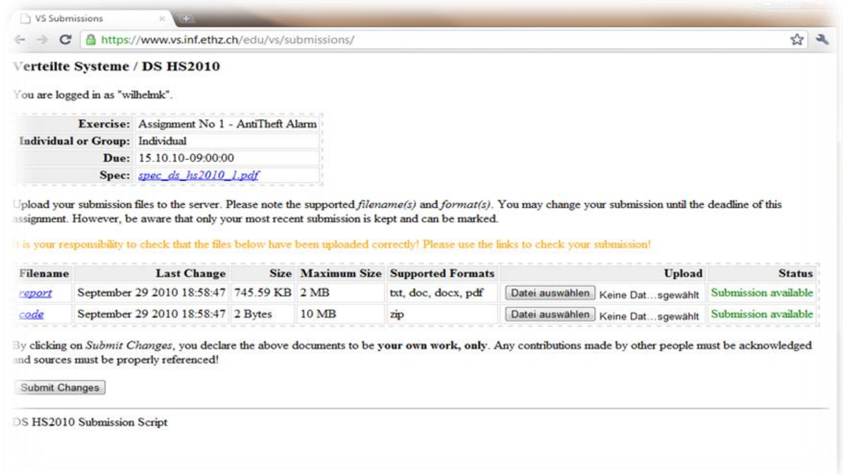
- Tasks 1-3 and reports: 4.0
- Tasks 1-5 and reports: 5.0
- All Tasks and reports: up to 6.0

Partially solved exercises are marked individually.

Submission

https://www.vs.inf.ethz.ch/edu/vs/submissions/

- You should submit the code and report through the above URL
- **NETHZ Login**
- Note:
  - Max file sizes
  - File types
  - Multiple submissions possible!



erteilte Systeme / DS HS2010

ou are logged in as "wilhelmk".

Exercise:	Assignment No 1 - AntiTheft Alarm
Individual or Group:	Individual
Due:	15.10.10-09:00:00
Spec:	*spec_ds_hs2010_1.pdf*

pload your submission files to the server. Please note the supported *filename(s)* and *format(s)*. You may change your submission until the deadline of this ssignment. However, be aware that only your most recent submission is kept and can be marked.

t is your responsibility to check that the files below have been uploaded correctly! Please use the links to check your submission!

Filename	Last Change	Size	Maximum Size	Supported Formats	Upload	Status
report	September 29 2010 18:58:47	745.59 KB	2 MB	txt, doc, docx, pdf	Datei auswählen Keine Dat…sgewählt	Submission available
code	September 29 2010 18:58:47	2 Bytes	10 MB	zip	Datei auswählen Keine Dat…sgewählt	Submission available

y clicking on *Submit Changes*, you declare the above documents to be **your own work, only**. Any contributions made by other people must be acknowledged nd sources must be properly referenced!

S HS2010 Submission Script

- Assignment form (individual, specify your **NETHZ Login)**:
  https://spreadsheets.google.com/viewform?hl=en&formkey=dFQ4WGM2Tkt2T0s0dWlCOXAwVXE0MUE6MQ
- Feedback form (individual, anonymous):
  https://spreadsheets1.google.com/viewform?hl=en&formkey=dGQzOVpGZGRBRW9iemNkb0hQbDNqZlE6MQ