Distributed Systems 2014 – Assignment 2

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Web Services

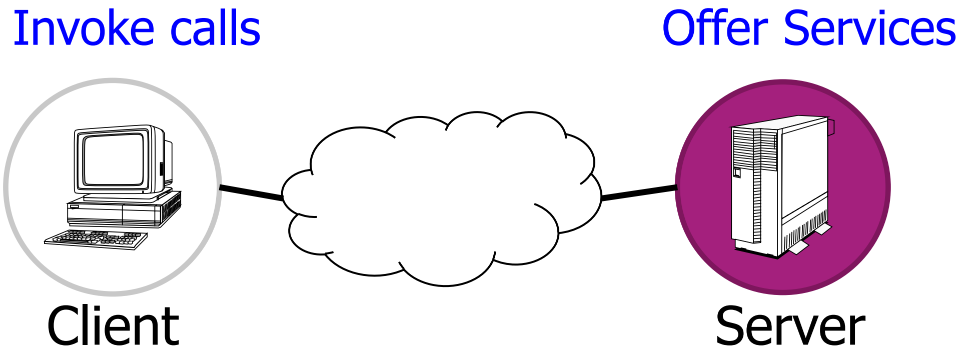
Overview

- Quick walkthrough of Web application architectures
  - WS-* **W**eb **S**ervices
  - **Re**presentational **S**tate **T**ransfer (REST)
- Exercise 2
  - Overview
  - Tasks
  - Hints & Anchors

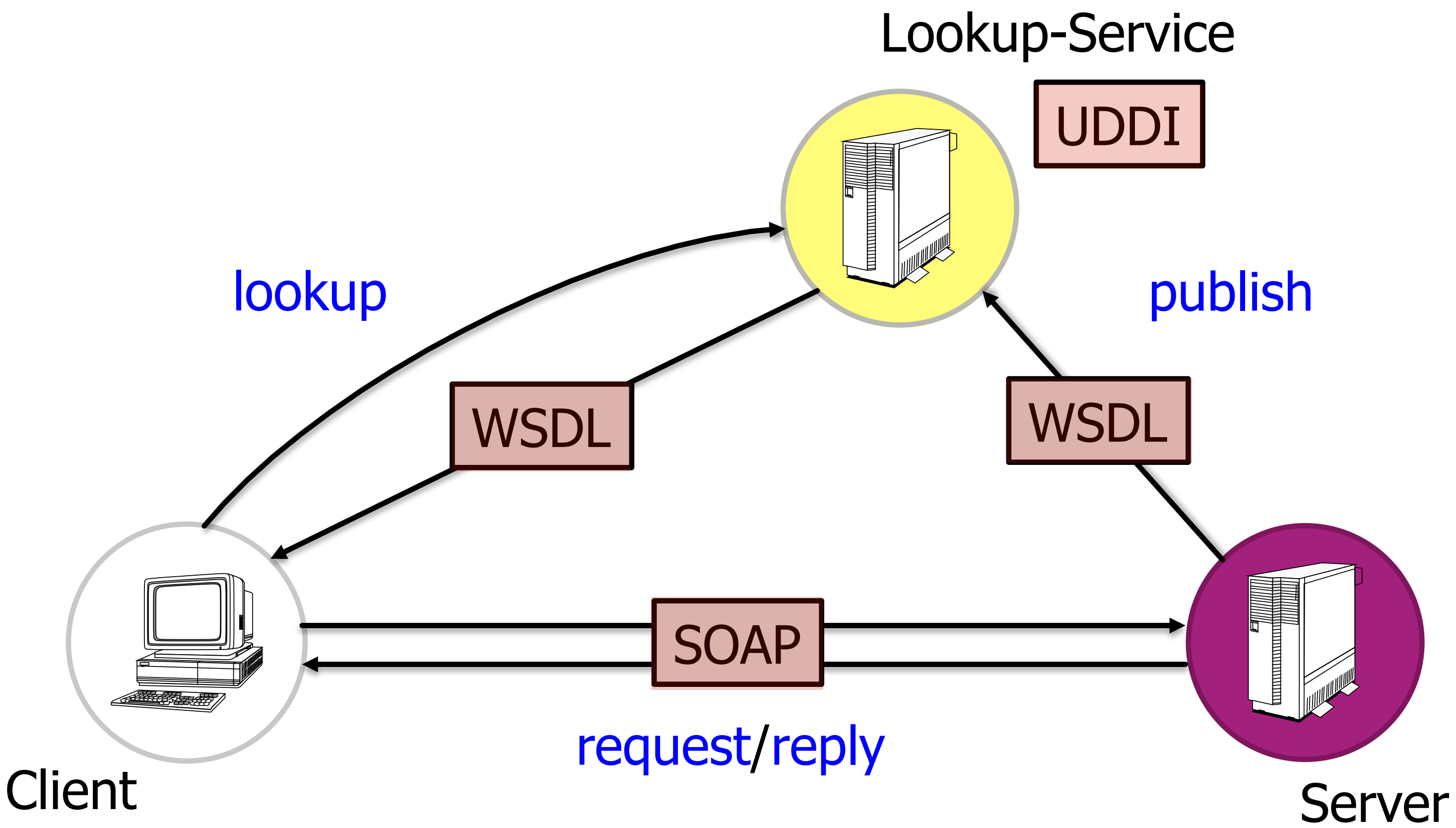
Web Services

- Definition:

" A Web service is an application component accessible over open protocols"

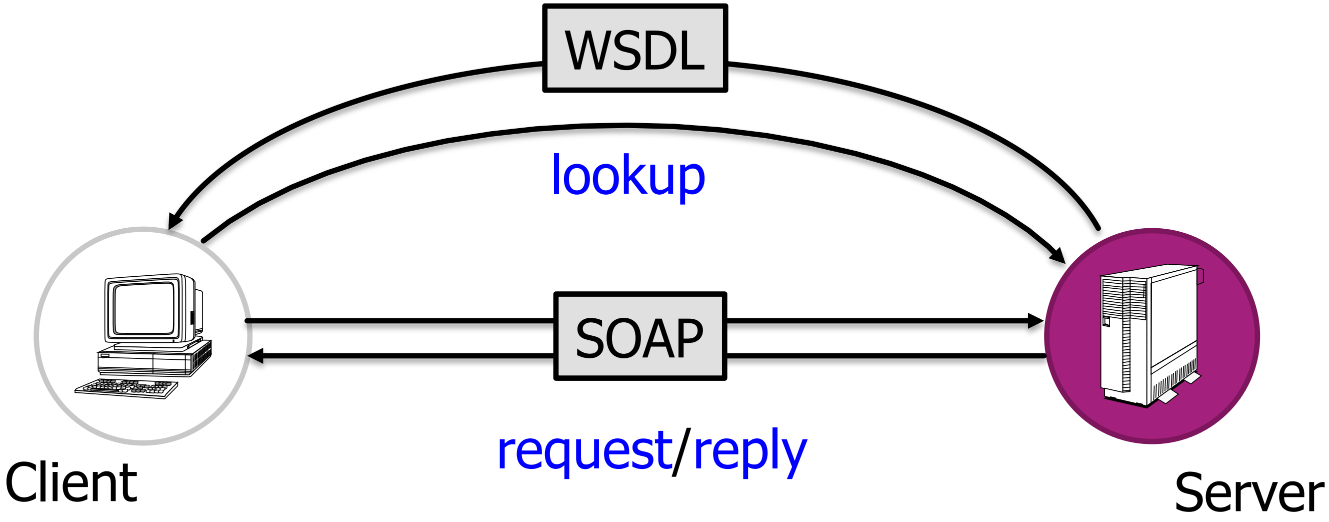


Web Services in a Nutshell



Web Services in a Nutshell

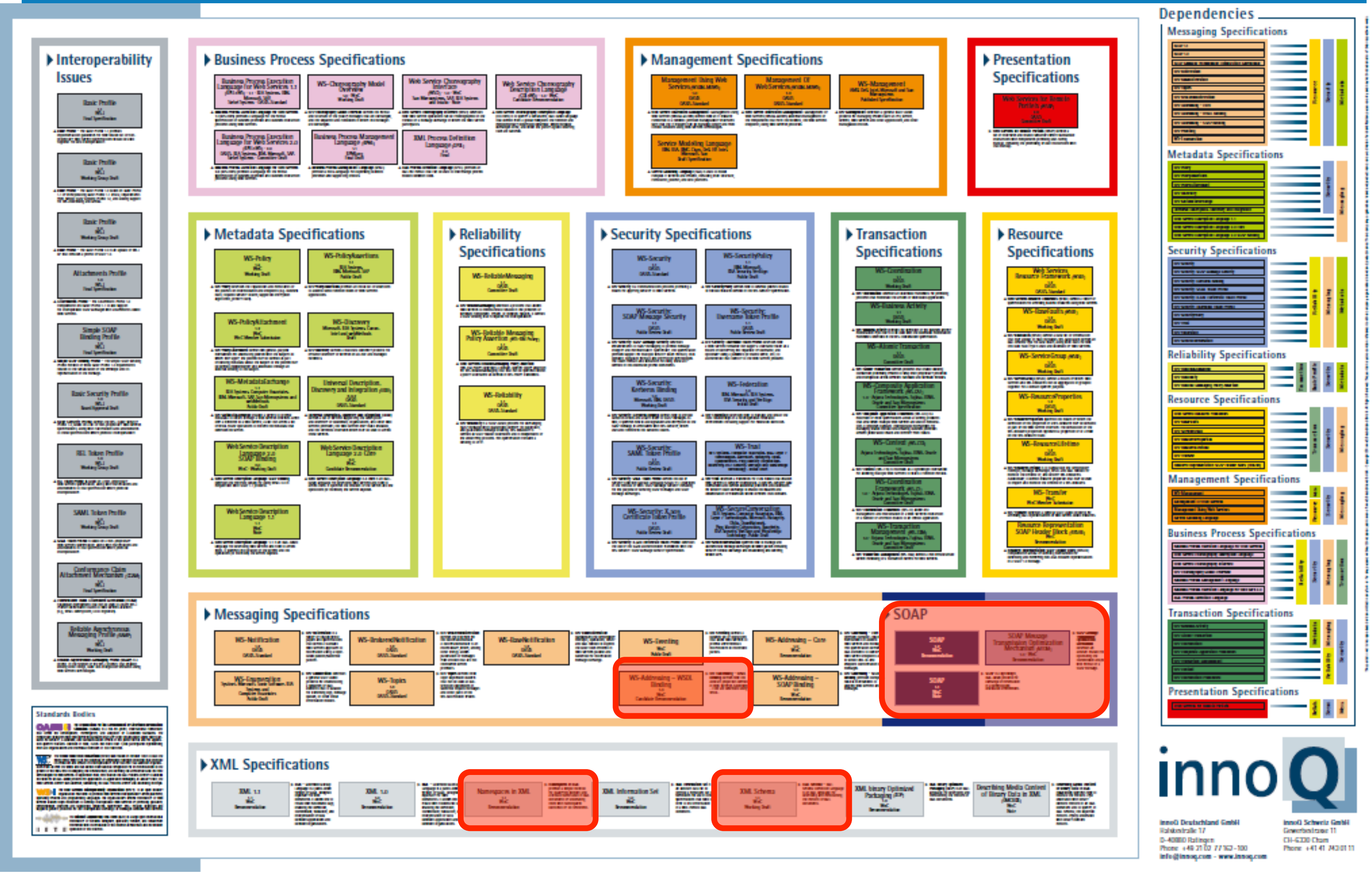
- For the exercise, we let the service publish its WSDL without going through a UDDI...



Web Services - WSDL Overview

- WSDL: **W**eb **S**ervices **D**escription **L**anguage describes:
  - What a Web service can do
  - Where it resides
  - How to invoke it
- Explore WSDL
  - Example: http://vslab.inf.ethz.ch:8080/SunSPOTWebServices/SayHello?Tester

Types, Messages, PortType, Binding, Service, Port, Definition



[http://www.innoq.com/soa/ws-standards/poster/innoQ%20WS-Standards%20Poster%202007-02.pdf]

Programming WS-* Clients

- Most IDEs provide code generators

- Server-side
  - Java annotations
  - Automatic generation of WSDL file

- Client-side
  - Parsing of WSDL file
  - Automatic generation of client stubs

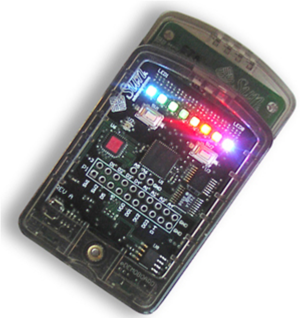
REST: Representational State Transfer

- REST is a lightweight architectural style for designing networked applications
  - HTTP 1.1 implements the REST architectural style
  - It uses HTTP for CRUD (Create/Read/Update/Delete) operations

- Platform independent
- Language independent
- Open standard-based

[http://geekandpoke.typepad.com/]

REST Architecture



[http://code.google.com/p/hcsfsp/]

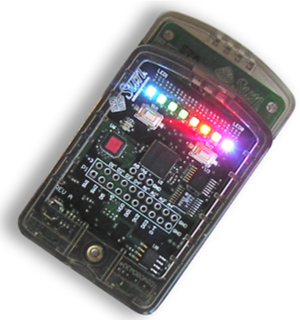
- **Resources:** Identified by logical URIs
  - State and functionality are represented using resources

    e.g., a sensor node: http://vslab.inf.ethz.ch:8081/sunspots/Spot1

- **A web of resources**: Resources are linked
  - Similar to the interconnection of Web pages in the WWW
  - When relevant, resources should link to additional information
    - Resources should be kept simple

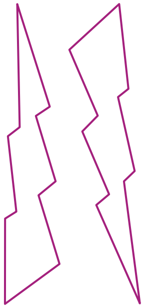
- **Stateless** communication protocol:
  - Each new request must carry all the information required to complete it

Assignment 2 – Overview



[http://code.google.com/p/hcsfsp/]

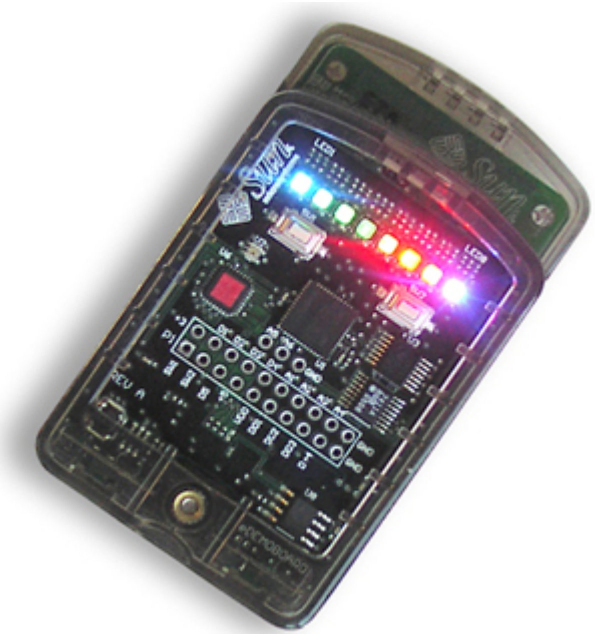
- Objectives:
  - Learn to develop distributed Web applications
  - Use the two different paradigms seen in the lecture:
    - Representational State Transfer (REST)
    - Web Services (WS-*)



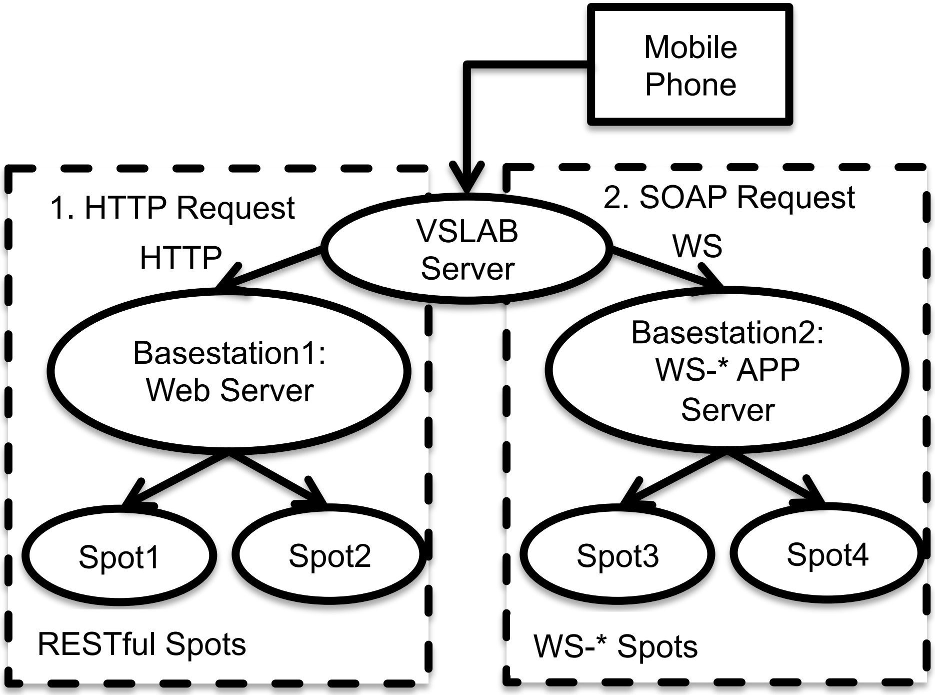
- Dates:
  - Exercise begins: Now (October 6, 2014)
  - Exercise is due: 9:00 am, October 20, 2014

Assignment 2 – System Setup

- Access Sun SPOTs through WS-* and REST
- Sun SPOTs: Wireless sensor nodes (temp, acc, light,...)



[http://code.google.com/p/hcsfsp/]



Assignment 2 – Task 1

Experimenting with RESTful Web Services (2P)

- Create an HTTP request
  a) “manually” (i.e., without the use of an HTTP library)
  b) using *org.apache.http.**
- Use HTTP content negotiation to get machine-readable data
- Connect to a Sun SPOT and retrieve the temperature value
- **Hint:** Use AsyncTask to do network operations (be careful with accessing UI Elements!)
- **Hint:** Use the HTTP header “Connection: close” to avoid blocking behavior

Assignment 2 – Task 2

Experimenting with WS-* Web Services (2P)

- Explore WSDL, create SOAP requests
- Connect to a Sun SPOT and retrieve the temperature value.
- **Hint:** Apply hints from Task 1
- **Hint:** Use the Android verion of the kSOAP2 library
  - http://code.google.com/p/ksoap2-android/
- **Hint:** Important classes are: SoapObject, SoapSerializationEnvelope
- **Hint:** You do not have to implement the decoding of the WSDL file

Code Skeleton

- Interfaces for Sensors
  - Separate UI from logic
  - Increase of code reuse
  - Each subtask is a new class that implements the Sensor interface

Assignment 2 – Task 3

Network Traffic Analysis (1P)

- Learn how to use tools for network traffic analysis (e.g. Wireshark)
- Debugging tool for distributed software

Assignment 2 – Task 4, 5

Your Phone as a Server (3P)

- Implement a Web server on your phone that allows to access the sensors and actuators of the phone
- **Hint:** Use a Service to implement the server
- **Hint:** Use Intents and BroadcastReceiver, or Bound Services, to communicate between Service and Activity
- **Hint:** When you are using an existing WiFi network, make sure the ports you are using are not blocked!

Task 5: Mini-Test (2P)

Deliverables

- See exercise sheet for details
  - code.zip
  - answers.zip
  - wireshark.zip

Assignment 2 Hints - Relevant Terminology

- Internet Media Types
  - text/html, text/xml
  - application/xml, application/json

- ROA – Resource-Oriented Architecture
- REST – Representational State Transfer

- SOA – Service-oriented Architecture
- SOAP – Simple Object Access Protocol
- WSDL – Web Services Description Language

REST Hints

- http://www.infoq.com/articles/rest-introduction
- RESTful Web Services (Leonard Richardson und Sam Ruby)
  - Available at D-INFK library

- Apache HTTP library (simplest sample code alive... ☺)
  - http://svn.apache.org/repos/asf/httpcomponents/httpclient/trunk/httpclient/src/examples/org/apache/http/examples/client/ClientWithResponseHandler.java

Noteworthy Tools

- Firefox extensions
  - HttpRequester
  - Poster
  - RESTClient
  - SOA Client
- Chrome extensions
  - Simple REST client

Noteworthy Tools

- Android Debug Bridge (adb tool)
  - You can find the adb tool in <sdk>/platform-tools/
  - http://developer.android.com/tools/help/adb.html
- Android Emulator
  - http://developer.android.com/tools/devices/emulator.html
- Setting up a port forwarding
  - `adb forward tcp:port1 tcp:port2`
  - forwards the local port port1 on the machine to port2 on the emulator.
  - Example: `adb forward tcp:12345 tcp:8088`