Distributed Systems 2017 – Assignment 2

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Web Services

Overview

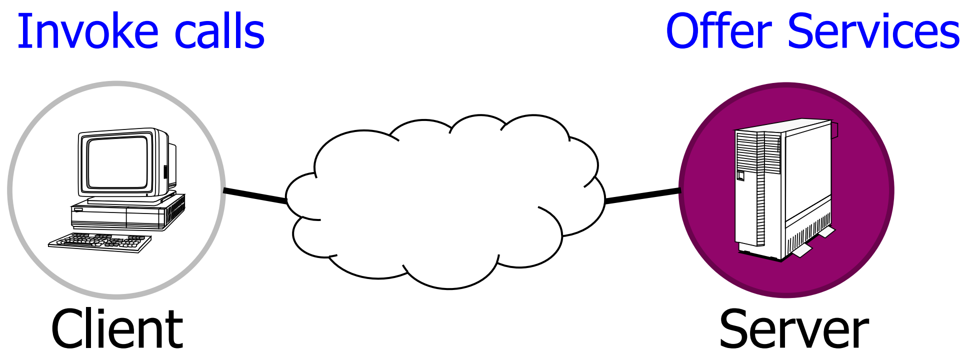
- Quick walkthrough of Web application architectures
  - WS-* **W**eb **S**ervices
  - **Re**presentational **S**tate **T**ransfer (REST)

- Exercise 2
  - Overview
  - Tasks
  - Hints & Anchors

Web Services

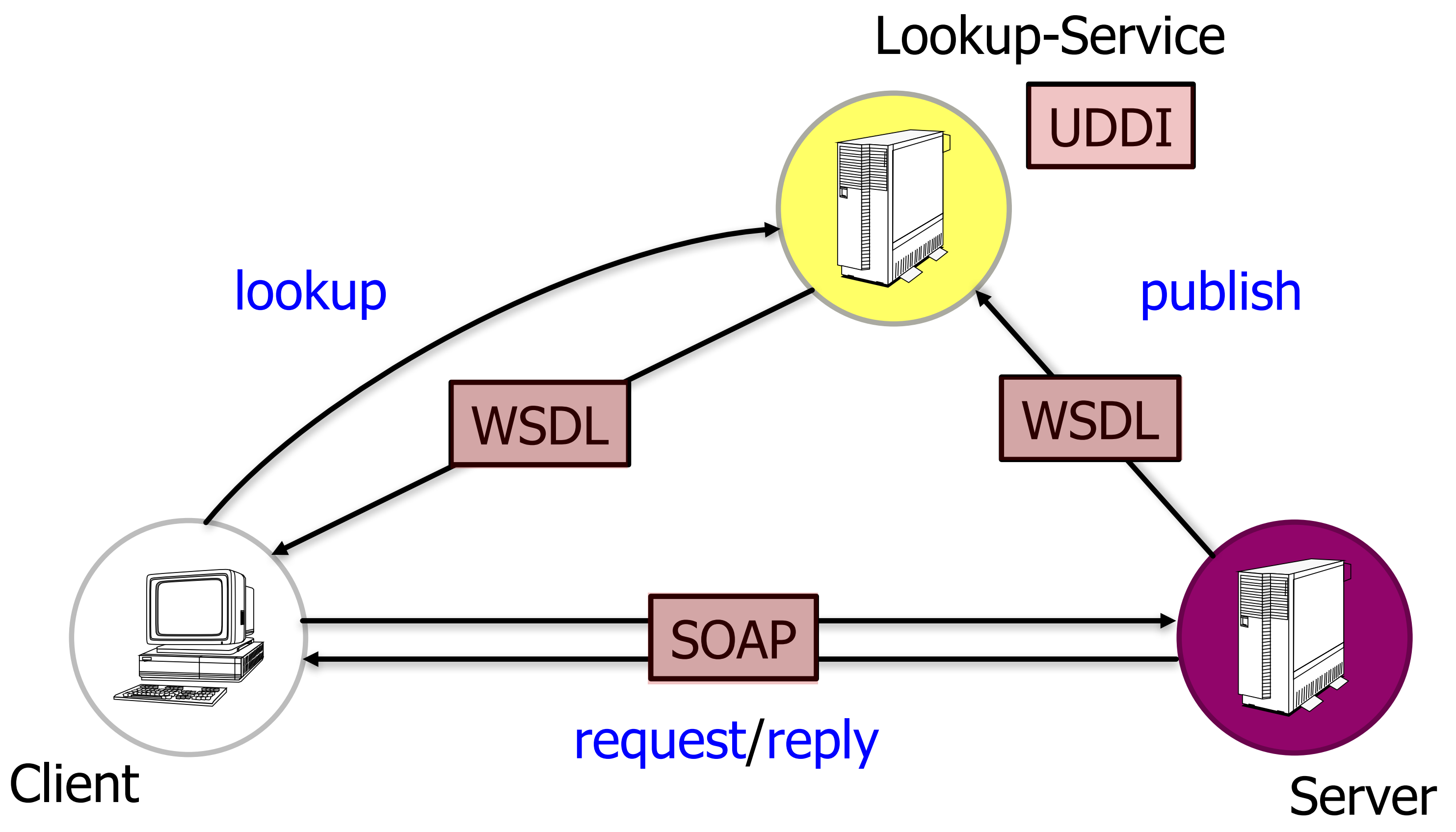
- Definition:

“A Web service is an application component accessible over open protocols”



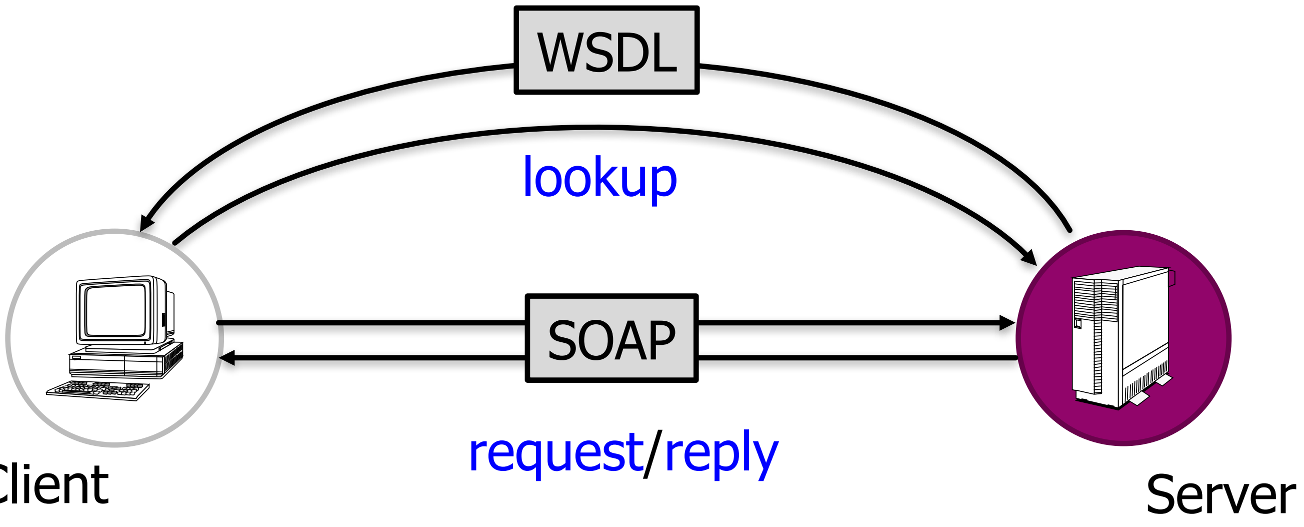
Web Services in a Nutshell

Service-Oriented Architecture (SOA)



Web Services in a Nutshell

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



Web Services – WSDL File

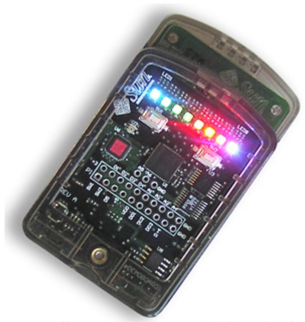
- WSDL: **W**eb **S**ervices **D**escription **L**anguage describes:
  - What a Web service can do
  - Where it resides
  - How to invoke it
    - Which transport protocol
    - Function names, argument and return types
  - → Can be seen as an API

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 methods for CRUD (Create/Read/Update/Delete) operations

- Platform independent
- Language independent
- Open standard-based

REST Architecture


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

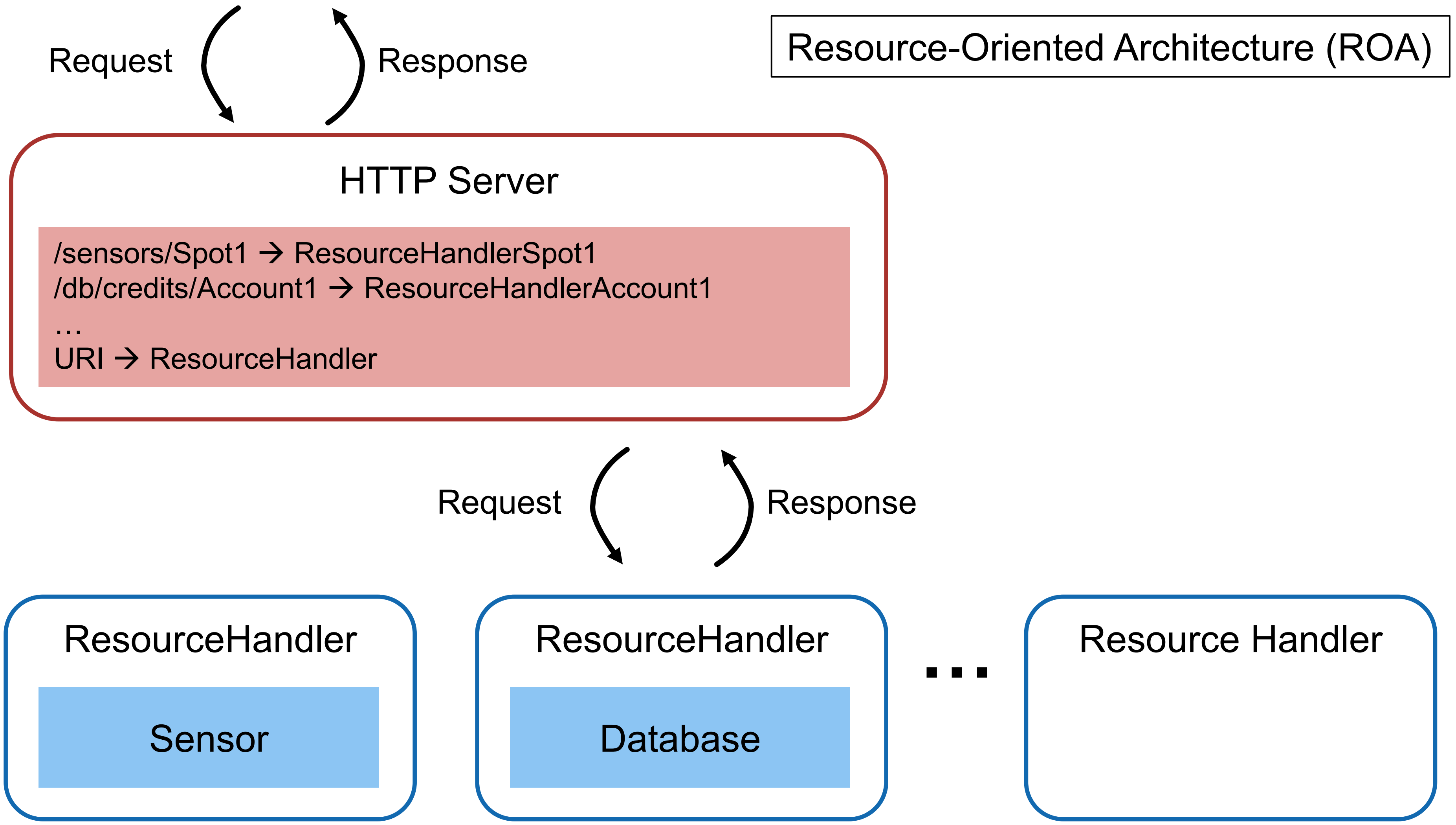
- **Resources:** Identified by URIs
  - State and functionality are represented using resources

    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

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

RESTful Server Structure

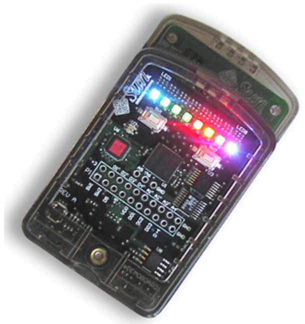


SOA vs. ROA

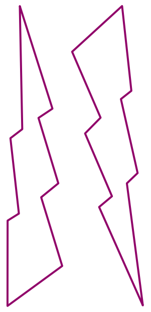
- Service-oriented architecture (SOA)
  - Web services are offered as functions
  - Clients “invoke” functions and pass arguments → RPC paradigm
  - Closer to traditional programming concept

- Resource-oriented architecture (ROA)
  - Web services are offered as resources
  - Clients interact with resources
  - Closer to traditional Web concept

Assignment 2 – Overview


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

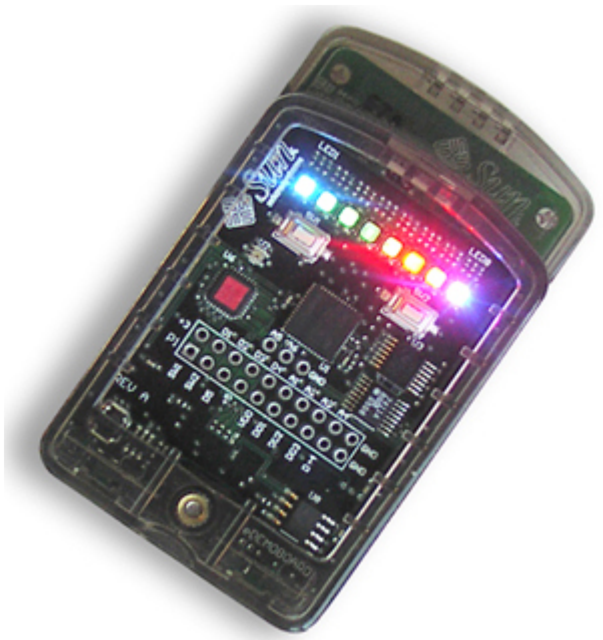
- Objectives:
  - Learn to develop distributed Web applications
  - Use the two different paradigms seen in the lecture:
    - Representational State Transfer (REST)
    - Web Services (WS-*)



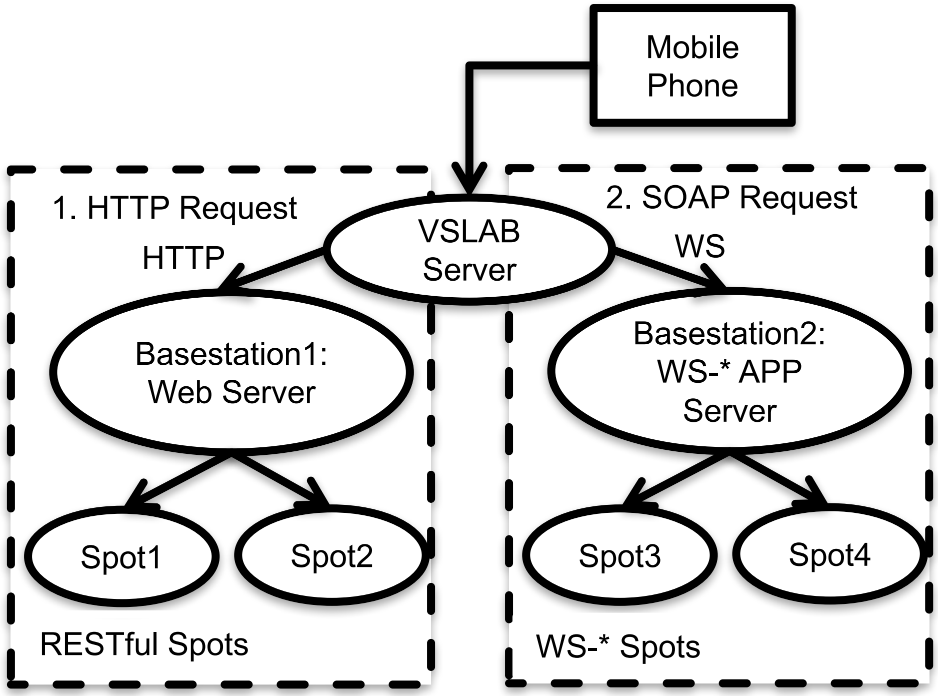
- Dates:
  - Exercise begins: Today (October 13, 2017)
  - Exercise due: 11:59 p.m., October 24, 2017

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 *java.net.HttpURLConnection*
- Use HTTP content negotiation to get machine-readable data
- Connect to a Sun SPOT and retrieve the temperature value
- **Hint:** Use the HTTP header “Connection: close” to avoid blocking

Assignment 2 – Task 2

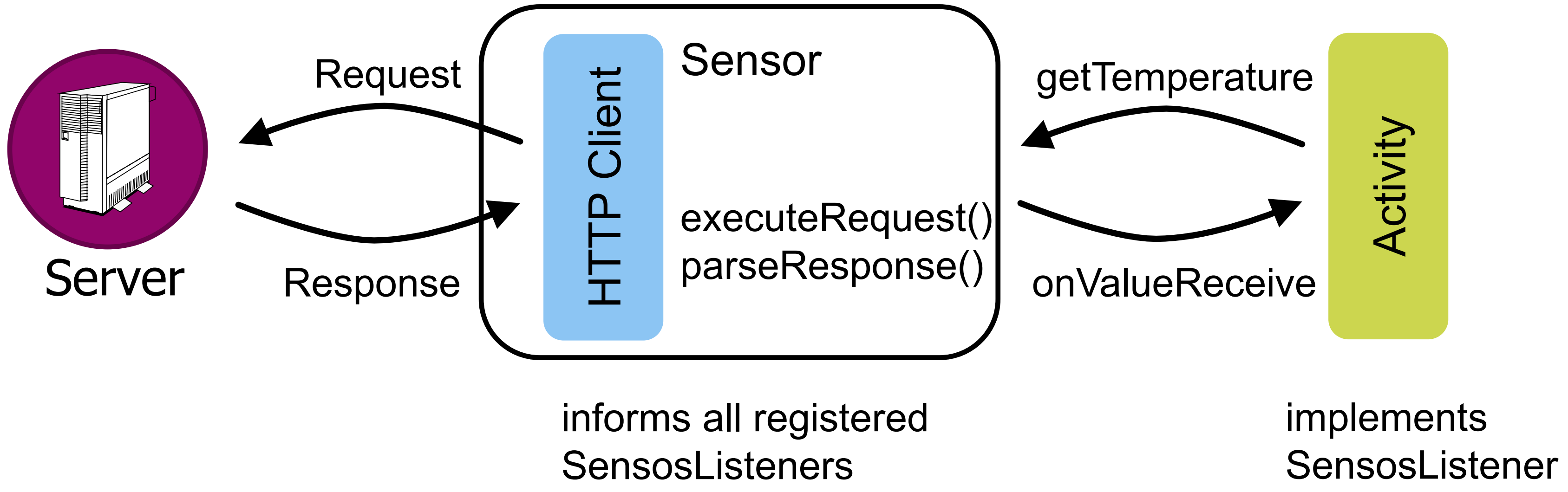
Experimenting with WS-* Web Services (2P)

- Explore WSDL, create SOAP requests
- Connect to a Sun SPOT and retrieve the temperature value.
- **Hints:**
  - Use the Android version of the kSOAP2 library[1,2]
    - Important classes are: SoapObject, SoapSerializationEnvelope
  - You do not have to implement the decoding of the WSDL file

[1] http://simpligility.github.io/ksoap2-android/
[2] Use the library version provided on our Web site

Code Skeleton

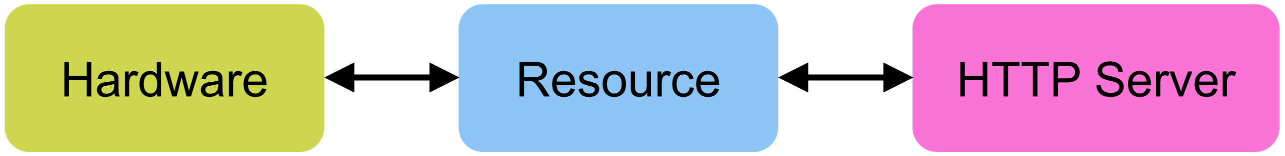
- Interfaces for Sensors
  - Separate UI from logic
  - Increase of code reuse
  - Each subtask is a new class that implements the Sensor interface



Assignment 2 – Task 3

Your Phone as a Server (4P)

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



Deliverables

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

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

Noteworthy Tools

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

Android SDK 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`

How to use the tools

- REST
  - Browser, HttpRequester, Wireshark
- SOAP
  - Browser, HttpRequester, Wireshark