Course Outline

• 6 CFUs

• Topics:
  • Mobile application programming (Android)
  • Cloud computing

• To pass the exam:
  • Individual working and documented application
  • Answer to a couple of general questions
Technologies today

Language
- HTML 5
- Java
- JavaScript
- Java Server Pages (JSP)
- Python
- PHP

Run-time support
- .NET
- Spring
- Hibernate
- JBoss
- Geronimo

Protocols
- JSON
- REST
- SOAP

Development
- PhoneGap
- Eclipse
- Appcelerator
- Apache Axis2
- SOAP-UI
- J2EE Manager
Technological convergence

INTERNET

Mobile cellular Networks, wi-fi

Telephone network
New trends

• Cloud ➔
  • basically used as an extension of the resources of the device (memory space, virtual machine, sw modules, etc.)
  • The goal is to make the computer look like ‘bigger’

• Application that runs on mobile devices ➔
  • Mobility (context-awareness)
  • Sensors
    • Where (lat,lon) the device running the application is located
    • Other Sensors, e.g., acceleration, orientation, camera

• Connection and synergy between Cloud and Mobile applications is possible
Some example of application: QRCode
Example
Another examples: media are changing

Same applies to books, newspapers, encyclopedia, etc.
Example: Augmented reality
Example: social-based applications

- Twitter
- Facebook
- Blablacar
- Uber
Mobile application and cloud computing

Cloud can play the role of ‘backend’
Access to cloud resources (CPU, storage, DB) using RPC-like calls
… but cloud is more than this (see later)…
Example

real time data on transportation available from ATAC via XML-RPC

http://www.agenziamobilita.roma.it/progetti/open-data/
http://www.agenziamobilita.roma.it/it/progetti/open-data/api-real-time.html
New trends: Mobile cloud computing

- wi-fi direct (comm. feature)
- reflection (language feature)
- security aspects
- application partitioning
- subtasks allocation
- DTN and social behavior
- voice recognition
- pattern recognition
- augmented reality
- games (e.g., chess)
- ...

code offloading

computation and result

cloudlet (nearby resources)
Example: transient cloud

Another example*

- Task offloading over a DTN with task replication
- Real mobility traces
- Social behavior can help

(*)Collaborative Mobile-To-Mobile Computation Offloading, Beraldi et al., 3rd International Workshop on Collaborative Cloud (CollabCloud 2014), Miami October 2014
Building distributed applications: run-time big view

Distributed applications run on distributed system which virtualizes resources.

- Higher abstractions:
  - Process (threads)
  - File, Virtual Memory

- Active role (no need controlling SW, which is 'embedded', hard wired)
  - Receive and respond to external events (interrupts)

- Passive role
  - Need to be 'controlled'

Computers communicate through remote protocols (i.e., HTTP) over wire protocols.

Local Communication, Socket connect through Operating System.

SW (Software) interacts with HW (Hardware) through SW (Software).

Computer

Operating System

CPU, Memory, HW device

Remote Protocol (i.e. HTTP)
Example of wire protocols

- SOAP for Web Service
- IIOP for CORBA
- ORPC for DCOM
- JRMP for Java RMI
- REST for Web Service
- JSONP
Middleware and SW stack

Application layer

Middleware layer / run-time support

Operating System

HW
Example: Tic Tac Toe

- Monolithic application
  - All the logic is in a single program
- Client Server
  - The server dynamically generates the page to be displayed
- Web API
  - Provides primitive operations to an application (that can run on a mobile device, for example)
Example: monolithic app

- Monolithic

  e.g., JavaScript, or any language
Example: client/server


Put an X at position 7
Simple technological mapping of a web based application… (1/3)
GET / HTTP/1.1
Host: www.republika.it
Connection: close
User-Agent: Web-sniffer/1.0.37 (+http://web-sniffer.net/)
Accept-Encoding: gzip
Accept-Charset: ISO-8859-1,UTF-8;q=0.7,*;q=0.7
Cache-Control: no-cache
Accept-Language: de,en;q=0.7,en-us;q=0.3
Referer: http://web-sniffer.net/

TCP/IP connection 3306,…
Simple solution for mobile app

- Send the current state
- Reply with the new state

Interface (remote functions)
Introducing cloud

• Cloud roles and boundaries
  • Cloud Provider
  • Cloud Consumer
  • Cloud Resource Administrator

• Cloud Characteristics
  • On-demand usage
  • Ubiquitous access
  • Resource pooling (Multitentancy)
  • Elasticity

• Cloud Deployment models
  • Private cloud
  • Public cloud
  • Hybrid cloud

• Delivery models
  • IaaS
  • PaaS
  • SaaS (and Web-API)
Introducing clouds: example altervista

- Self-service interface
- Accessing complex building blocks, or ‘functionalities’
A Web API allows to design and develop an application that exploits software modules accessed via Internet via a simple wire protocol.
Web API: example
Example: Google apis

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<thead>
<tr>
<th>Service</th>
<th>Status</th>
<th>Notes</th>
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<tbody>
<tr>
<td>AdSense Management API</td>
<td>OFF</td>
<td>Courtesy limit: 10,000 queries/day</td>
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<td>Analytics API</td>
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<tr>
<td>Calendar API</td>
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<td>Freebase API</td>
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</tr>
<tr>
<td>Google Affiliate Network API</td>
<td>OFF</td>
<td>Courtesy limit: 1,000 queries/day</td>
</tr>
</tbody>
</table>
Oauth 2.0: securing access

1. register the application
2. access
3. redirect
4. send token access and get info
5. get info from the source
Web API: programmatic point of view

Programmatic Service Access (many methods)

Web URL (standard HTTP methods)

web browser

Application
Example: mashup applications

\[ s = A\text{.methodName}(\text{par}_1) \]
\[ \ldots \]
\[ z = B\text{.methodName}(s, \text{par}_2) \]
Example: mashup applications (1/2)
Example: mashup applications (2/2)

HTTP

- Server Web
  - "mashupper"
    (e.g., dynamic pages Php)

XML-RPC

SOAP

REST

WEB API
Web API and Interoperability

Client Application (Technology A)

Client Application (Technology B)

Client Application (Technology C)

WEB-API
Web API and Interoperability

- Dropbox is a free (up to 2GB), web-based cloud storage mechanism
  - file backup service
  - data sharing
  - Data sync among different clients
  - Mobile applications

Windows

Linux

MAC

REST / JSON calls

Freemium business model

iPhone

iPad
Questions?