Mobile Application Development Project

MTAT.03.266

Fall 2017

Satish Srirama
satish.srirama@ut.ee
Course Purpose

• Practice the mobile application development
• Apply well-known techniques to develop applications for the mobile devices
• Glance of research at Mobile & Cloud Lab

• https://courses.cs.ut.ee/2017/MADP/fall
Questions

• Have you ever programmed for mobile devices?
  – This course assumes you have experience with at least one mobile technology
  – Or you are taking MTAT.03.262 Mobile Application Development course

• Which mobile platforms have you used already?

• How comfortable you are with programming?
  – Java?
    • External APIs?
  – Web programming?

• Have you heard of cloud computing?
Related Courses

- **MTAT.03.262** Mobile Application Development (3 ECTS)
  - Friday 14.15 - 18.00, J. Liivi 2-122
- **MTAT.03.280** Mobile and Cloud Computing Seminar (3 ECTS)
  - Thu. 14.15 - 16.00, Ülikooli 17 - 220
- **MTAT.08.036** Large-scale Data Processing on the Cloud (3 ECTS)
  - Wed. 10.15 – 12.00, Ülikooli 17 - 218
- **MTAT.08.027** Basics of Cloud Computing (3 ECTS)
  - Spring 2017
Grading

- No written exam
- Just deliver a project
  - Max 3 persons per group
- Activities
  - Design the application
  - Develop using the platform of your choice; Android is preferred
  - Deliver the project with detailed reports
To pass

• One must attend 80% of the sessions
• Submission of project report
• Final presentation and demonstration
• Max 5 min Video which will be uploaded to youtube
• Source code properly managed
Grading - progress

• Prototype 1 (20%)
  – Presentation (5%)
  – Progress (10%)
  – Punctuality (5%)

• Prototype 2 (20%)
  – Split same as Prototype 1

• Final Presentation (60%)
  – Presentation (10%)
  – Demo (20%)
  – Report (10%)
  – Video (10%)
  – Managed Source (10%)
Outline

• Mobile Application Development
• Introduction to the projects
• General discussion and forming groups
Lecture 1

MOBILE APPLICATION DEVELOPMENT
**The Seven Mass Media**

First Mass Media Channel - **Print** from the 1500s
Second Mass Media Channel - **Recordings** from 1900
Third Mass Media Channel - **Cinema** from 1910s
Fourth Mass Media Channel - **Radio** from 1920s
Fifth Mass Media Channel - **TV** from 1950s
Sixth Mass Media Channel - **Internet** from 1990s
Seventh Mass Media Channel - **Mobile** from 2000s

[Tomi T Ahonen]

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country or region</th>
<th>Number of mobile phones</th>
<th>Population</th>
<th>Phones per 100 citizens</th>
<th>Data collection date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>World</td>
<td>6,800,000,000+</td>
<td>7,012,000,000</td>
<td>67</td>
<td>2013</td>
</tr>
<tr>
<td>01</td>
<td>China</td>
<td>1,206,553,000</td>
<td>1,348,568,836</td>
<td>69.2</td>
<td>September 2013</td>
</tr>
<tr>
<td>02</td>
<td>India</td>
<td>667,600,000</td>
<td>1,220,680,359</td>
<td>70.72</td>
<td>30 April 2013</td>
</tr>
<tr>
<td>03</td>
<td>United States</td>
<td>327,577,529</td>
<td>310,868,000</td>
<td>103.9</td>
<td>June 2013</td>
</tr>
<tr>
<td>04</td>
<td>Brazil</td>
<td>266,440,423</td>
<td>192,379,287</td>
<td>135.4</td>
<td>August 2013</td>
</tr>
<tr>
<td>05</td>
<td>Russia</td>
<td>256,116,000</td>
<td>142,905,200</td>
<td>155.5</td>
<td>July 2013</td>
</tr>
<tr>
<td>06</td>
<td>Indonesia</td>
<td>236,800,000</td>
<td>237,566,363</td>
<td>99.68</td>
<td>September 2013</td>
</tr>
<tr>
<td>07</td>
<td>Pakistan</td>
<td>128,583,076</td>
<td>178,854,781</td>
<td>72.45</td>
<td>September 2013</td>
</tr>
<tr>
<td>08</td>
<td>Japan</td>
<td>121,246,700</td>
<td>127,628,085</td>
<td>55.1</td>
<td>June 2013</td>
</tr>
<tr>
<td>09</td>
<td>Nigeria</td>
<td>114,000,000</td>
<td>165,200,000</td>
<td>69</td>
<td>May 2013</td>
</tr>
<tr>
<td>10</td>
<td>Bangladesh</td>
<td>110,076,000</td>
<td>165,039,000</td>
<td>73.8</td>
<td>September 2013</td>
</tr>
</tbody>
</table>

---

**Report: Mobile cloud to grow beyond $11 billion in 2018**

Written by CopperEgg // July 1, 2012 // No Comment // Cloud Performance

The proliferation of smartphones, tablets and other mobile devices is contributing to change in the private sector, as businesses continue to leverage these gadgets in an attempt to enhance efficiency and potentially gain a competitive advantage. According to a new report by Global Industry Analysts, the evolution of mobility is also changing the cloud computing landscape, pushing the mobile cloud market to generate more than $11 billion in revenue by 2018.

---

**Verizon's Stratton: The Future Of IT Is Mobile And Cloud**

9/ + Comment Now + Follow Comments

Satish Srirama
Popular consumer mobile applications

• Location-based services (LBSs)
  – Deliver services to users based on his location

• Mobile social networking
  – Most popular social networking platforms have apps for mobiles

• Mobile commerce
  – An extension of e-commerce

• Mobile payment
  – Near field communication (NFC) payment
Popular consumer mobile applications - continued

• Context-aware services
  – Context means person's interests, history, environment, connections, preferences etc.
  – Proactively serve up the most appropriate content, product or service
• Mobile instant messaging (MIM)
  – Skype for mobiles
• Mobile e-mail
• Mobile video
Variety of languages and platforms to choose from

<table>
<thead>
<tr>
<th></th>
<th>Programming language</th>
<th>Debuggers available</th>
<th>Emulator available</th>
<th>Integrated development environment available</th>
<th>Cross-platform deployment</th>
<th>Installer packaging options</th>
<th>Development tool cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adobe AIR</td>
<td>Action Script, HTML, CSS, JavaScript</td>
<td>Yes</td>
<td>Yes</td>
<td>Flash Builder, Flash Professional</td>
<td>iOS (iPhone, iPad, iPod touch), Android, BlackBerry</td>
<td>The native distribution format of each platform</td>
<td>Flash Builder, Flash Professional - Commercial licenses available Adobe AIR SDK (command line tool)</td>
</tr>
<tr>
<td>Airplay SDK (Now Marmalade)</td>
<td>C, C++</td>
<td>Yes</td>
<td>Yes</td>
<td>Visual Studio, XCode</td>
<td>All native: Android, BlackBerry, BREW, iOS (iPhone), Maemo, Palm/webOS, Samsung bada, Symbian, Windows Mobile 6.x and desktop, OSX</td>
<td>The native distribution format of each platform</td>
<td>Commercial licenses available</td>
</tr>
<tr>
<td>alcheMo</td>
<td>Java</td>
<td>Yes</td>
<td>Yes</td>
<td>Visual Studio, Eclipse, XCode</td>
<td>Android, BREW, iOS (iPhone), Windows Mobile</td>
<td>The native distribution format of each platform</td>
<td>Commercial licenses available</td>
</tr>
<tr>
<td>Android</td>
<td>Java but portions of code can be in C, C++</td>
<td>Yes, in Eclipse</td>
<td>Yes</td>
<td>Eclipse, Project Android, plugin for NetBeans</td>
<td>Android only, because of Dalvik VM, March 2009</td>
<td>Free</td>
<td>Free</td>
</tr>
<tr>
<td>Appcelerator</td>
<td>JavaScript</td>
<td></td>
<td></td>
<td>Sathish Srinivasan, internal SDK</td>
<td>Android, BlackBerry, planned</td>
<td>This native distribution format of each platform</td>
<td>Apache 2.0 License, commercial licenses</td>
</tr>
</tbody>
</table>

http://en.wikipedia.org/wiki/Mobile_application_development
http://en.wikipedia.org/wiki/Mobile_operating_system
Popular platforms – Market share

http://en.wikipedia.org/wiki/Mobile_operating_system
The devices we use
GENERAL TOPICS OF INTEREST
Mobile Web Services

• Provisioning of services from the smart phones
• Invocation of web services from smart phones
• Mobile web service discovery
• Addressing mobiles in 3G/4G networks
• Push notification mechanisms
• Mobile positioning
  – Indoor and Outdoor

{srirama, chang}@ut.ee,
Mobile Cloud Computing

• One can do interesting things on mobiles directly
  – Today’s mobiles are far more capable
  – We can even provide services from smart phones

• However, some applications need to offload certain activities to servers
  – Processing sensor data

• Resource-intensive processing on the cloud
  – To enrich the functionality of mobile applications
Mobile Cloud Access Schemes

Delegation

[Flores & Srirama, JSS 2014]

Code Offloading

[Flores et al, IEEE Communications 2015]
Code offloading

• Decision making
  – When is it ideal to offload a task from mobile to cloud?
  – Fuzzy logic
  – Linear Programming

• Code offloading still have adaptability issues
  [Srirama, CSIICT 2017]

  – Incentive mechanisms for code offloading

srirama@ut.ee
Adaptive Workflow Mediation Framework

• Task delegation is a reality!!!
  – Cloud providers also support different platforms
• Mobile Host allows invocation of services on smartphones
• So Peer-to-Peer (P2P) communication is possible
• Extended the Mobile Host to also support workflow execution [Chang et al, ICSOC 2012; MUM 2014]
  – To address challenges of discovery and quality of service (QoS) [Srirama et al, MW4SOC 2007]
  – Tasks can move between mobile and middleware

{srirama, chang, jaks}@ut.ee
Internet of Things (IoT)

- “The Internet of Things allows people and things to be connected Anytime, Anyplace, with Anything and Anyone, ideally using Any path/network and Any service.” [European Research Cluster on IoT]
- More connected devices than people
- Cisco believes the market size will be $19$ trillion by 2025

{srirama, chang, jaks, liyanage}@ut.ee

9/12/2017

Source: Cisco IBSG, April 2011
IoT - Scenarios

• Environment Protection
• Smart Home

[Kip Compton]
[Perera et al, TETT 2014]

Internet of Things – Challenges

- How to provide energy efficient services?
- How do we communicate automatically?
- How to interact with ‘things’ directly?

[Chang et al, ICWS 2015]
[Chang et al, SCC 2015; Liyanage et al, MS 2015]
Cloud-based IoT

Remote Cloud-based processing

Connectivity nodes & Embedded processing

Sensing and smart devices
Research focus for the semester in IoT

• We have established IoT and Smart Solutions Lab with Telia company support

• Interesting topics
  – Discovery of IoT devices
  – Working with IoT based devices
  – Study of available IoT platforms
    • Amazon IoT
    • Open IoT

• IoT-based smart cities

{sirama, chang, jaks}@ut.ee
Fog Computing

- Design, Deployment and Management of Fog and Edge Computing for IoT Systems
- Cisco fog computing
Scenario: Disabled Person Trying to Avoid Crowd in Urban Areas

- Let us assume everything we discussed so far works!
Real-time IoT Service Discovery

[Chang et al, SCC 2015]

Discovery Servers

Smart Objects

Discovery Servers

Smart Objects

Discovery Server

Smart Objects

SCORPII Utility Cloud Side

Discover

SCORPII Mobile Host

Discover

SCORPII Mobile Host

Discover

SCORPII Utility Cloud Side

Timestamp 1

9/12/2017

Satish Srirama
Discovery Workflow

- Workflow approach selection
- Fuzzy sets and Cost Performance Index
Research Roadmap - IoT

Energy-Efficient and Cost-Efficient Connected Things
- Smart Healthcare;
- Environmental Monitoring;
- Smart Cities etc.

Reliable Adaptive Middleware
- Elastic Cloud Processing;
- MapReduce & Apache Hadoop Ecosystem;
- Machine Learning;
- Stream Data Processing;
  - Service-Oriented Computing;
  - Process Management;
  - IoT Platforms & Fog Computing;
- Mobile Computing;
- Wireless Sensor & Actuator Networks;

Big Data Acquisition & Analytics
- Domain Specific Service Provisioning
  - Smart Healthcare;
  - Environmental Monitoring;
  - Smart Cities etc.
WE ALWAYS WELCOME NEW IDEAS!

email: srirama@ut.ee

http://mc.cs.ut.ee
Course Schedule

• Today we introduce you the projects
• Lecture 2 (19.09)
  – Second meeting to finalize the topics
• Lecture 3 (26.09)
  – Deadline for choosing a project
  – Presentation by students about their topics
  – Deliver a preliminary report of the project
    • Meaningful report explaining (architecture, design, similar solutions etc.)
• Remaining schedule will be notified later
Project selection

- Projects are available at https://courses.cs.ut.ee/2017/MADP/fall/Main/Projects

- Responsible persons
  - Satish Srirama (srirama AT ut DOT ee)
  - Chii Chang (chang AT ut DOT ee)
  - Jakob Mass (jaks AT ut DOT ee)
THANK YOU
BPM & IoT

- Recent trend with designing IoT applications as BPM models