Design and Implementation of Mobile Applications

2015-16

Luciano Baresi
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• Professor @ DEIB

• Previously
  — Researcher at Cefriel
  — Visiting researcher
    • University of Oregon (USA)
    • University of Paderborn (Germany)

• Research interests
  — Software engineering
    • Dynamic software architectures
    • Service- and cloud-based systems
    • Mobile applications

home.deib.polimi.it/baresi
Our course
Our Course

• Taught in English

• No text book
  – Several ones could be interesting
  – Online material better than any book
  – Slides are available through my web page
    http://home.deib.polimi.it/baresi/dima.htm
When/Who

- Wednesday: 8:30-10 (D12)
- Friday: 13:30-15 (EG6)

- Teaching assistants
  - Giovanni Quattrocchi

- External guests (from industry)
Key ingredients

• Mobile application design
• Android
• iOS
• A bit of Wearables
• Other approaches
  — PhoneGap, Titanium, Xamarin, Tizen
Final exam

• Project negotiation (not before end of November)
  – You propose an idea
  – Some proposals will be available

• Some comments
  – Novelty of idea is not key
  – 1 or 2 people (exceptionally 3 persons)
  – Expectations are becoming higher and higher
    • Complexity, graphical layout, testing, quality of documentation
Final exam

• Project discussion (six dates per year)
  – Design and documentation (printed or by email)
  – Presentation (brief introduction and design decisions)
  – Demo (real device or simulator)

• Some comments
  – No marketing strategies
  – Professional design document
  – Synergies are encouraged
What I would like to get

• A well-engineered significant app
  — Some screens (significant application flow)
  — Multiple threads
  — Interaction with external services (not just Facebook)
  — “Nice” look and feel

• Some comments
  — Earlier does not mean higher grades
  — Details matter

• You keep any possible right on the app
A bit of history
Dr. Martin Cooper of Motorola, made the first US analogue mobile phone call on a larger prototype model in 1973
Phablets

Smartphones
5-inch and less

Phablets
Between 5-7 inches

Tablets
7-inches and above
Enterprise-Grade Cloud Services
Create rich app experiences without having to worry about back-end functionality

Identity  Integration  Orchestration  Messaging  Sync  Storage
... and some numbers
The world in 2017

2017 forecast base (m)

- Population
- Adults
- Literate adults
- Mobile
- Smart phones
- PCs
- Tablets

2012 vs Growth to 2017

Source: GSMA, World Bank, Enders Analysis
GLOBAL DIGITAL SNAPSHOT
A SNAPSHOT OF THE WORLD’S KEY DIGITAL STATISTICAL INDICATORS

TOTAL POPULATION
ACTIVE INTERNET USERS
ACTIVE SOCIAL MEDIA ACCOUNTS
UNIQUE MOBILE USERS
ACTIVE MOBILE SOCIAL ACCOUNTS

7.210 BILLION
3.010 BILLION
2.078 BILLION
3.649 BILLION
1.685 BILLION

URBANISATION: 53%
PENETRATION: 42%
PENETRATION: 29%
PENETRATION: 51%
PENETRATION: 23%

FIGURE REPRESENTS TOTAL GLOBAL POPULATION, INCLUDING CHILDREN
FIGURE INCLUDES ACCESS VIA FIXED AND MOBILE CONNECTIONS
FIGURE REPRESENTS ACTIVE USER ACCOUNTS, NOT UNIQUE USERS
FIGURE REPRESENTS UNIQUE MOBILE PHONE USERS
FIGURE REPRESENTS ACTIVE USER ACCOUNTS, NOT UNIQUE USERS

We Are Social • Sources: Wikipedia; InternetLiveStats, InternetWorldStats; Facebook, Tencent, VKontakte, LiveInternet; GSMA Intelligence
@wearesocialsg • 6
MOBILE CONNECTIONS
MOBILE CONNECTIONS BY REGION, COMPARED TO TOTAL REGIONAL POPULATIONS

GLOBAL AVERAGE: 98%

NORTH AMERICA: 101%
CARIBBEAN: 91%
SOUTH AMERICA: 126%
AFRICA: 79%
MIDDLE EAST: 124%
SOUTH ASIA: 77%
EAST ASIA: 98%
WEST EUROPE: 125%
CENTRAL ASIA: 112%
SOUTHEAST ASIA: 119%
EAST EUROPE: 139%
OCEANIA: 109%

Source: GSMA Intelligence, Q4 2014. Wikipedia for population data.
MOBILE PHONES

BASED ON THE NUMBER OF CELLULAR SUBSCRIPTIONS / CONNECTIONS (NOT UNIQUE USERS)

TOTAL NUMBER OF MOBILE SUBSCRIPTIONS

MOBILE SUBSCRIPTIONS AS A PERCENTAGE OF THE TOTAL POPULATION

PERCENTAGE OF MOBILE CONNECTIONS THAT ARE PRE-PAID

PERCENTAGE OF MOBILE CONNECTIONS THAT ARE POST-PAID

PERCENTAGE OF MOBILE CONNECTIONS THAT ARE BROADBAND (3G & 4G)

7.1B

98%

77%

23%

39%

Sources: GSMA Intelligence, Q4 2014. Wikipedia for population data
A snapshot of the country’s key digital statistical indicators

**Total Population**: 60.8 million

**Active Internet Users**: 36.6 million

**Active Social Media Accounts**: 28.0 million

**Mobile Connections**: 82.3 million

**Active Mobile Social Accounts**: 22.0 million

**Urbanisation**: 68%

**Penetration**: 60%

**Penetration**: 46%

**Penetration**: 36%

**Penetration**: 135%

*Figure represents total national population, including children*

*Figure includes access via fixed and mobile connections*

*Figure represents active user accounts, not unique users*

*Figure represents mobile subscriptions, not unique users*

*Figure represents active user accounts, not unique users*

*Sources: Wikipedia; InternetLiveStats, InternetWorldStats; Facebook, Tencent, VKontakte, LiveInternet; GSMA Intelligence*
CLICK HERE TO READ OUR DETAILED ANALYSIS OF ALL THESE NUMBERS: BIT.LY/SDMW2015
Number of mobile app downloads worldwide from 2009 to 2017 (in millions)

- 2009: 2,516
- 2010: 4,507
- 2011: 21,646
- 2012: 63,985
- 2013*: 102,062
- 2014*: 138,809
- 2015*: 179,628
- 2016*: 224,801
- 2017*: 268,692

Source: Sign Up for Account © Statista 2014
Worldwide mobile app revenues from 2011 to 2017 (in billion U.S. dollars)

- 2011: 8.32 billion
- 2012: 18.56 billion
- 2013*: 26.68 billion
- 2014*: 34.99 billion
- 2015*: 45.37 billion
- 2016*: 58.21 billion
- 2017*: 76.52 billion

Sources:
Sign Up for Free Basic Account
© Statista 2014
The Average Smartphone User Has Installed 26 Apps

Top 10 countries with the highest average number of installed apps per smartphone user*

<table>
<thead>
<tr>
<th>Country</th>
<th>Paid Apps</th>
<th>Free Apps</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Korea</td>
<td>2.7</td>
<td>37.4</td>
<td>40.1</td>
</tr>
<tr>
<td>Switzerland</td>
<td>9.4</td>
<td>30.4</td>
<td>39.8</td>
</tr>
<tr>
<td>Sweden</td>
<td>8.9</td>
<td>30.4</td>
<td>39.3</td>
</tr>
<tr>
<td>Singapore</td>
<td>6.3</td>
<td>31.2</td>
<td>37.5</td>
</tr>
<tr>
<td>Japan</td>
<td>17.5</td>
<td>18.9</td>
<td>36.4</td>
</tr>
<tr>
<td>Australia</td>
<td>10.9</td>
<td>22.5</td>
<td>33.4</td>
</tr>
<tr>
<td>Denmark</td>
<td>6.3</td>
<td>26.6</td>
<td>32.9</td>
</tr>
<tr>
<td>United States</td>
<td>7.5</td>
<td>25.3</td>
<td>32.8</td>
</tr>
<tr>
<td>Norway</td>
<td>9.3</td>
<td>23.2</td>
<td>32.5</td>
</tr>
<tr>
<td>France</td>
<td>3.5</td>
<td>28.7</td>
<td>32.2</td>
</tr>
</tbody>
</table>

*as of March 2013; n=1,000 for all countries

Source: Google's Our Mobile Planet
## Smartphone OS Market Share, 2015 Q2

<table>
<thead>
<tr>
<th>Period</th>
<th>Android</th>
<th>iOS</th>
<th>Windows Phone</th>
<th>BlackBerry OS</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015Q2</td>
<td>82.8%</td>
<td>13.9%</td>
<td>2.6%</td>
<td>0.3%</td>
<td>0.4%</td>
</tr>
<tr>
<td>2014Q2</td>
<td>84.8%</td>
<td>11.6%</td>
<td>2.5%</td>
<td>0.5%</td>
<td>0.7%</td>
</tr>
<tr>
<td>2013Q2</td>
<td>79.8%</td>
<td>12.9%</td>
<td>3.4%</td>
<td>2.8%</td>
<td>1.2%</td>
</tr>
<tr>
<td>2012Q2</td>
<td>69.3%</td>
<td>16.6%</td>
<td>3.1%</td>
<td>4.9%</td>
<td>6.1%</td>
</tr>
</tbody>
</table>

Source: IDC, Aug 2015
It's Apple vs Google vs Everyone In The Mobile Payments War

http://blog.paymentsystemscorp.com/blog/bid/147386/It-s-Apple-vs-Google-vs-Everyone-In-The-Mobile-Payments-War
Security is a Barrier

We often hear that the main barrier for mobile enabling enterprise services is security concerns. With mobile devices being used over open connections, devices getting lost, apps being installed on employee devices, constant hack attempts, the ability to reverse engineer code, the vulnerability of connected devices (IoT) and other security threats the organisations simply don't think that the opportunities outweigh the risks yet.
This is not just software

- Different screens (from small large ones)
- Different OSs and different versions
- Scarce resources (memory, disk, battery)
- Unreliable and mutable connectivity (GSM, WiFi)
- Data transfer: costly, slow, high latency
- Priorities (what if a phone call comes in?)
- Inter-app communication
- Development model (cross compilation)
- Distribution model (store)
Complex devices

- Accelerometer
- Gyroscope
- Digital compass
- Global Positioning System (GPS)
- Barometer
- Ambient light
- Proximity Sensor
Mobile Applications

- Software that can be pushed to a mobile device or downloaded and installed locally to serve some needs
  - **Browser-based** applications are developed in a markup language
  - **Native** applications are compiled solutions (device has a runtime environment)
  - **Hybrid** applications exploit the best of both worlds (a browser is needed for discovery)
Mobile app design

• A mobile app should do one thing and do it well
• A mobile app should be as simple as possible, but no simpler
• Further constraints
  – Standards compliance
  – Usability design
  – Minimalist design
  – Different versions (families of applications)
Many different languages

- Objective-C/Swift (iOS)
- Java (Android)
- C# (Windows Mobile, cross-platform development)
- HTML5 (Tizen, cross-platform development)
- JavaScript (cross-platform development)
- C++ (Tizen)