

Software Development for Mobile Devices



Operating System Diversity

- Many Operating Systems
 - Google Android
 - Apple iOS
 - Microsoft Windows Phone
 - Nokia Symbian
 - Linux
 - RIM BlackBerry OS
 - HP/Palm WebOS
 - BREW
- Differences in Programming Languages and Application Architectures



Stakeholders of Mobile Applications

- Device Manufacturers
- Network Operators
- Application Developers
- Consumers/Customers
- Content Providers



Development Platform vs. Deployment Platform

- Development Platforms
 - Windows, Linux, Mac OS X
- Deployment Platforms
 - Android, iOS, Windows Phone, Blackberry, BREW, Java ME, Symbian



Emulator/Simulator

- Initial Testing on Device Emulators or Platform Simulators.
 - Advantages
 - Help Perform Development and Testing on PC
 - Makes developer's life easier
 - Disadvantages
 - Simulator is Not Real Device
 - An Application Running on Simulator may Require Further Tweaking when Installed on Real Device
 - Emulators Do Not Capture All Device Capabilities and Features
 - Results of Usability Testing Done on Simulator may Not be Correct



Variety in Hardware Capabilities

- Devices Vary Greatly in their Hardware Capabilities
- Bluetooth and Wi-Fi may be Supported in one Device and Not in Other
- Camera may be Optionally Supported
- GPRS may be Supported. EDGE may Not be Supported



Limited Processing Power

- Mobile Devices have Limited Processing Power
- High Complexity Applications may Perform Poorly on a Mobile Device and May Also Kill Overall Device Performance
- New Mobile Devices with Better Processing Power are Increasingly Becoming Popular



Limited Memory

- ▶ Devices have Extremely Small Memory when Compared with Normal Desktop Computers
- ▶ Many of the Handsets just have a Few Hundred of KBs Available for Applications
- ▶ Application Size (Footprint) must be Kept Small
- ▶ Application Data Size should also be Small



Limited Battery Power

- All Applications Consume Battery Power
- Good Application would Consume only Minimal Required Resources
- Items that Consume Battery Power Most are:
 - Backlight
 - Voice Call
 - Data Traffic
 - Intensive Computational Activity



Limited Data Bandwidths

- GPRS/EDGE Data Bandwidth is too Small when Compared with Broadband (DSL / WiMAX) Facility Available to Desktop Computers
- Techniques like Data Caching, Compression may be Used to Optimally Use Network Resources



Features of Some New Mobile Handsets

	iPhone 4	Nokia N9	BlackBerry 9860	Samsung Galaxy SII
Display (pixels)	640 x 960	480 x 854	480 x 800	480 x 800
RAM	512 MB	1 GB	768 MB	1 GB
Processor	1 GHz	1 GHz	1.2 GHz	1.2 GHz
Data	GPRS, EDGE, 3G,WLAN, Bluetooth, USB	GPRS, EDGE, 3G,WLAN, Bluetooth, USB	GPRS, EDGE, 3G,WLAN, Bluetooth, USB	GPRS, EDGE, 3G,WLAN, Bluetooth, USB



Mobile User Characteristics

- Mobile Users Move
 - Users may be moving while using the application
 - Users may move between instances of using the application
- Mobile Users are Interruptible and Easily Distracted
- Mobile Users are Always Available to Remote Friends, Family, Colleagues, and Clients
- Mobile User may Use Application in Multiple Contexts
 - Driving in Rush Hour
 - Walking in Crowded Market
 - And many other context



Variety of Input Mechanisms

- Mobile Handsets have Variety of Input Mechanisms:
 - Small Numeric Keyboards
 - QWERTY Keyboards
 - Stylus
 - Touch Screen
- Users Often Interact with the Device with Single Hand
- A Well Designed Application must Give Extra Consideration to Input Mechanism Supported on the Target Devices



Small Screen Size

- Most of Mobile Handsets and PDAs have Very Small Screen when Compared to Normal Desktops
- Limited Information can be Displayed
- Screen Sizes Widely Differ Across Devices



Small Screen Size and Steps Required to Access a Feature

- ‘Clicks’ are Precious in Mobile Space. Save Clicks
- Depth of Navigation is a Significant Problem
- It is Harder to Maintain State. Therefore, Deeply Nested Menus are Not Recommended



Multiple Design Specifications for Single Application

- Single Application may Have Multiple Design Specifications—Why? There could be Many Reasons such as:
 - User Experience on Keyboard Based Device is Quite Different from Touch Screen Device
 - A QWERTY Keyboard Device Performs Well for Text Input as Compared to Numeric Keypad



Application Usability

- Application Usability Factors are of Critical Importance in Mobile Application Development
- Capabilities of Application Users may not be Known Upfront
- There are Significant Chances that Many End Users of Application are Not Skilled at Using Mobile Phones



Intended Goal of a Device vs. Type of Application

- Developers Want to Keep on Adding Features in Devices
- If Not Done Carefully, Add-On Features may Affect User Experience Badly
- Don't Make the Device into Something it was Not Intended to Be.



Ability to Operate in Various Modes

- Mobile Devices can Operate in Various Modes from Data Connectivity Perspective
 - Offline
 - Occasionally Connected
 - Online



Native vs. Browser Based Applications

- Browser Based Applications
 - A Browser Based (also called web-based) Application Resides on a Server and is Accessed Using Web Browser of Client Device
- Native Applications
 - A Native Application Resides on Mobile Device
- Highly Interactive Applications are Generally Native Applications



Application Interference with Basic Operations of a Device

- How Does Application Affect Core Operations of a Mobile Device like
 - Voice Call
 - Messages Communications
- An Acceptable Application would Never Hamper Basic Operations of Mobile Handset



Target Handsets

- Target Handsets must be Known Early in Development Life Cycle
- Variations in Target Handset Must be Known for Proper Application Design and Architecture Definition
- Project Scope, Plan, and Cost Depend on Number & Types of Target Handsets



Target Handsets

- Better Maintain a Database that Contains Technical Details, Known Bugs, Release Information of Target Handsets
- Technical Details Include: Screen Resolution, Input Methods, Memory, Processor, Supported APIs and Any Other Device Information Required for Project to be Carried out etc.
- Device Profiles can be Taken from Sources like WURFL, DeviceAtlas



Target Handset Market Size

- It is Important to Know “How Many Users are Using the Target Handsets?”
- Knowing Target Handset Market Size Helps in Estimating Potential Revenue
- Market Statistics Keep on Changing, Keep them Updated



Acquiring Target Handsets

- ▶ Phones Available in the Market can Quickly be Purchased
- ▶ Acquiring Upcoming Phones:
 - Join Manufacturer and Operator Developer Programs to Keep Updated on Upcoming and Discontinued Phone Models
 - Where Available, Get a Pre-Production Phone Model
- ▶ Risks of Development for Upcoming Phones:
 - Phone Release may be Delayed or Even Cancelled
 - Phone Features are Finalized Very Late (Near Release Date)
 - Phone may not Get Response from the Market as Expected
 - Project Plan Needs to be Flexible Enough to Accommodate above Risks



Application Code Management

- ▶ Multiple Versions of the Code may have to be Produced
 - One Version for Bluetooth Enabled Device and Other for Infrared Enabled Device
 - One Version for Screen Size 240*320 and Other for Screen Size 480*600
- ▶ Better Categorize Target Handsets in various Groups/Families
 - Each Group/Family of Devices Share Common Characteristics
- ▶ 'Core Application Code' is Common Across Devices
- ▶ 'Device/Group Specific Code' is Specific to each Device or each Group
- ▶ Maintenance of Multiple Versions of the Code is Extremely Difficult



Network Operator Constraints

- Applications may also be Launched Through Portals of Wireless Network Operators
- Many Network Operators Set Constraints on Applications e.g.
 - Customize Application UI to Reflect Operator Branding
 - May Not Allow Communication on Certain Ports
 - May Allow Downloading the Signed Applications Only



Network Operator Constraints

- Sometimes Network Operators Customize the Devices Available on Network:
 - Operators may Ship Device with New Applications Installed which Consumes Device Memory
 - On-Device Memory Available for Applications When Released by Operator may Not be Same as Announced by Manufacturer
 - Operators may have Applied Extra Constraints on Application Installation on Device



Data Security

- Data Security over Network
Communication Channel is Critical
- How Does Application Interact with Underlying Platform? Can it Delete some Sensitive User Data?



Application Testing

- Testing on each Device (or at least one device from each Family) is Required.
- Testing on Simulator has Advantages but Testing on Actual Handset is a Must
- Application Successfully Tested on a Simulator does not Guarantee same Behavior on Real Device
- Perform On-Device Testing as Early as Possible



Application Testing

- Depending upon the Type of Application, Testing may Need to be Done in Multiple Situations such as:
 - Availability and Unavailability of Network Signals
 - Availability and Unavailability of Data Services
 - Availability and Unavailability of Location Data



Application Signing

- In Many Cases, Testing and Signing are Required from Certified Testing Authorities Before an Application can be Launched Commercially
- Developers are Allowed to Use Developer Certificates (Temporary Certificates) for On-Device Testing During Development



AppStores

- Applications may be Required to be Launched through Certain Stores Only
 - Apple AppStore, Android Market, Ovi Store
- Application Stores may Impose their Own Requirements



Platform Independence— Not a Reality in Mobile Domain as Yet

- Write Once and Run Anywhere is Still Not a Reality in Domain of Mobile Devices



Mobilize, Don't Miniaturize

- Simple Transformation of a Full-Sized Computer Application to the Mobile Environment almost Always Results in a Suboptimal Mobile Experience.
- Attempting to Construct an Application that Works the Same on Both PC and Mobile Platforms will Most Likely Reduce its Quality in Both Places.



Mobilize, Don't Miniaturize

- Mobilizing is :“Reconsider the Entire Purpose of the Application, Rather than only Changing Display Technologies or Interaction Mechanisms”
 - User Needs at Desktop vs. at Mobile Device
 - Is Application Also Suitable for a Mobile Device?
 - Is Application Suitable Only for a Mobile Device?
 - Which Devices are Being Used by Users?
 - Are there any Network Operator Specific Constraints?
 - Which Features & Services Users May Require in Future?
 - What are Additional Capabilities of Mobile Handsets that may be Used to Completely Reinvent the Application?



Conclusion

- It is not Possible to Treat all the Factors Discussed in Previous Slides at Equal Priority when Developing an Application for Mobile Devices.
- Tradeoff is the Only Solution—Decide which Factors are Important and Prioritize Them

