Mobile Devices in Software Engineering

Week II

CMER
Centre for Mobile Education and Research

Overview

- **Architectural Design & Styles**
- **Interface Design**
- **Application Design Patterns**
- **Mobile User Interface Design**
- **Application State Management**
- **Application Certification**

Architectural Design

- As the challenges of mobile application development were discussed in the previous slides it is important to use an effective system architecture for your application

- There are four common system architecture styles that can be employed for an application, however depending on the type of application you will create it will usually limit your choice further

- Therefore, it is important to determine how your system will use the architectural style to its greatest benefit

Architectural Design (Cont.)

- There are a number of architectural styles that are available for system designers, however only the correct assembly of the styles will result in an efficient and effective system

- Designs offer for logical and physical separation of components

- Logical Layer separation means the separation of classes or assembly that are responsible for different tasks but can still located on the same machine

- Physical Layer separation means the separation of classes on different machines

Architectural Styles
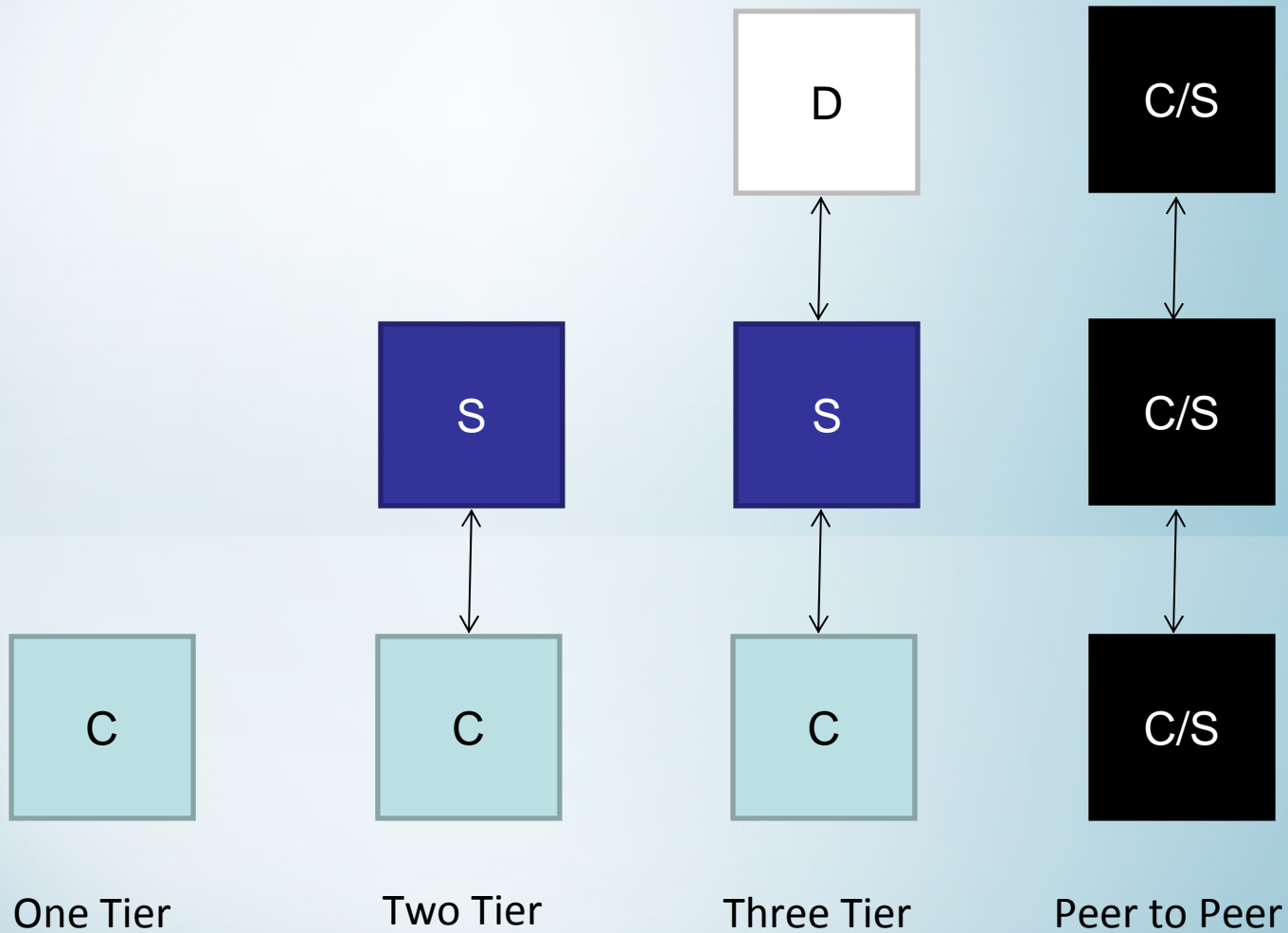
One-Tier

- **One Tier, also known as a stand alone application, holds all the necessary pieces to the application on the cell phone**
- **One Tier applications commonly have strongly defined logical layer separation**
- **Benefits**
  - **No dependence on network connections, no delay times, security only on local machine needed, etc.**
- **Drawbacks**
  - **Processing power limited depending on device, flexibility of applications is greatly hindered, etc.**

Two-Tier

- **Centralize content or processing power in one location and have mobile devices interact with server**
- **Physical Layer separation between the client and server, and a logical layer separation within the server**
- **Benefits**
  - **Applications can be very dynamic and flexible, more information can be used as processing complex calculations can be done on server, etc.**
- **Drawbacks**
  - **Security becomes more of an issue, connection is very important, possible delayed response times, bandwidth usage must be considered, etc.**

Three-Tier

- **Three tier applications are similar to two tier, but they separate the processing server from the database**
- **This approach increases the physical layer separation between components**
- **Benefits**
  - **Clear definition of components, portability of data and applications, lowered client hardware requirements**
- **Drawbacks**
  - **More possible points of failure, slower response times, increased hardware costs, bandwidth usage**

Peer-to-Peer

- **Relatively new architectural design style to mobile devices**
- **In peer to peer systems mobile devices act as both client and server**
- **Content can be shared more easily between individuals (see peerboxmobile)**
- **Benefits**
  - **Many connections between devices allow for rerouting of data to others, possible reduced bandwidth cost**
- **Drawbacks**
  - **Distance between sharing is limited unless incurring bandwidth costs, security can become a problem**

Interface Design

- **Applications that are successful and popular most commonly exhibit an easy to use interface**

- **Applications can contain all the necessary tools to attain a goal, but if those tools are difficult to find or cumbersome to use the application will not be successful**

- **There are a number of tools and tested strategies that assist with the design of a user interface which are also targeted for mobile devices**

Application Design Patterns

- **Mobile User Interface Design presents some challenges and obstacles that were discussed in the previous weeks slides and there are many design patterns for user interfaces**

- **Design patterns are good, well-practiced solutions for common problems such as designing effective user interfaces**

- **Design patterns can be found for screen design, application navigation, application management, and advertising**

Mobile User Interface Design

- **Screen design patterns that have been used in interface design:**
  - **List-based Layout**
  - **Fisheye List**
  - **Zoom List**
  - **Table-based Layout**
  - **Returned Results**
  - **Menu**
  - **Tab Navigation**
  - **Breadcrumbs**
  - **Error Messages**
  - **Carousel**
 - **Circular Scrolling**
  - **Mobile Fonts**

List-based Layout

- **Mobile devices commonly have a vertical screen layout, the length of the screen is larger than the width**

- **Horizontal objects like scrollbars, tables, and horizontal controls will look squished on this type of device**

- **In a list-based layout the design is done vertically, paragraphs of text wrap, links and controls should be on their own line**

- **This design is commonly found in web pages and screens other than the main screen of the application**

Fisheye List

- **A Fisheye list is a variation of the list-based layout, it however allows for the user to have more detail about a list option**

- **As the user scrolls through the list of topics an expansion opens and can give the user the an overview of the topic, or the information in that topic**

- **This can help users reduce the amount of clicks if they do not clearly know what selection they should choose by the title alone**
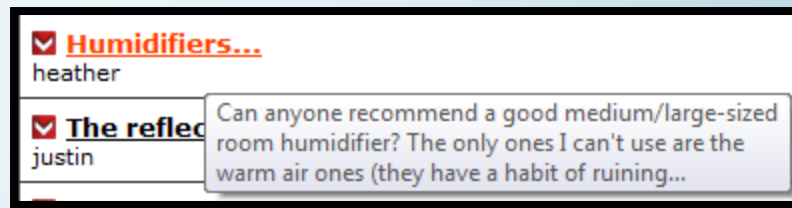
Zoom List

- **A zoom list allows a user to view the data inside the selection, this is best used when all the necessary data can be displayed in the summary section**

- **The summary however should never exceed more then four lines, the zoomed in summary should be of height multiples of the list item, the list item should give the user enough information to distinguish one item from another**

Table-based Layout

- **Like the name implies, the screen is arranged like a table grid**
- **Contains two or three columns with icons and optional descriptions underneath each icon**
- **This option is good for lists that are static and do not change**
- **Users can reduce the amount of clicks if they know the location of the icon with respect to their current selection**

Returned Results

- **This design pattern helps for search results, emails, news report lists**

- **The list length of results should depend on the amount of time required to retrieve or create that list when dealing with client-server systems**

- **Screens should contain next and previous navigational buttons to display more results if all the results will not fit on one screen**

Menu

- **In a menu the most common items used should be found at the top of the list**

- **Consider using numbers to navigate in a menu to reduce scrolling the list, if the client can remember the number of a frequently used item it can speed up their navigation**

- **If the number of items in a menu exceeds ten it is important to split the list to frequent and infrequent commands**

Tab Navigation

- **Number of tabs should be restricted to one row on a mobile device**

- **Tabs are useful for mobile devices that have touch screen capabilities**

- **Designers must be careful however with tabs, not all devices support tabs and are best suited to mobile devices with focus control and four way navigation**

- **Descriptions may be difficult on the tabs as it is displayed across the width of the device, consider using icons as descriptors in the tabs**

Breadcrumbs

- Breadcrumbs allow users to keep trace of the pages they visited and to easily navigate back to previous pages with a single click

- Breadcrumbs can come in the form of hyperlinks at the top of the page or a drop down list with previous pages in the list and a 'Go' button to take the user to the page

- The choice of breadcrumb style is dependent on the device capabilities

- Consider using this in complex systems with many pages or sections

Error Messages

- **Error messages should be as clear an concise as possible so that the customer knows the meaning of the problem**

- **Provide error codes at the end of each message which can be referred to in case of any issues**

- **Provide options to the user as to how the problem can be resolved if it requires additional information**

- **If possible provide the user with the ability to retry the task they were attempting to complete or save the progress they have made**

Carousel

- A carousel is a menu style that allows the user to visually browse through content

- Files are arrange in a circular pattern around the screen, when traversing the files all the files should shift and rotate much like a carousel turning

- The selected item should be at the center of focus on the screen and highlighted in some different manner then other files

- The size of the item should allow the user to know how close or how far they are from that item

- Users should be provided options to select, edit, etc. The item they have highlighted

Carousel

Circular Scrolling

- **If a scrollbar will not fit on the screen and a list of items take up more then one screen in size consider using circular scrolling**

- **Circular scrolling allows the user to proceed to the bottom of the screen and then continue to loop back to the top of the list selection and vice versa**

- **The information on the list should be alphabetically sorted to make it easier for the user**

Mobile Fonts

- The choose of font for a mobile device is important because of the restrictions on screen size and resolution

- Companies are now creating specialized font for mobile devices

- Essential font characteristics:

  - No ascenders above the capital letter height

  - Small letter should be at least 75% of the capital letter height

  - Straight even width lines

  - Descenders should not exceed 15% of the line height

Mobile Fonts (Cont.)

- **Other characteristics that would be nice for the mobile font to have:**
  - **Space efficiency, generally means narrow characters**
  - **Should not look compressed**
  - **Letters should not run together or contain large spaces which word seem like word breaks**
  - **Have same width even if using bold**
  - **Contain a true italic font which is sloped**
  - **Part of a complete family of fonts**

Mobile User Interface Design

- **The have been design patterns created for navigating through applications in your mobile device, they cover:**

    - **Game Navigation**

    - **Lists**

    - **Softkey and Button Management**
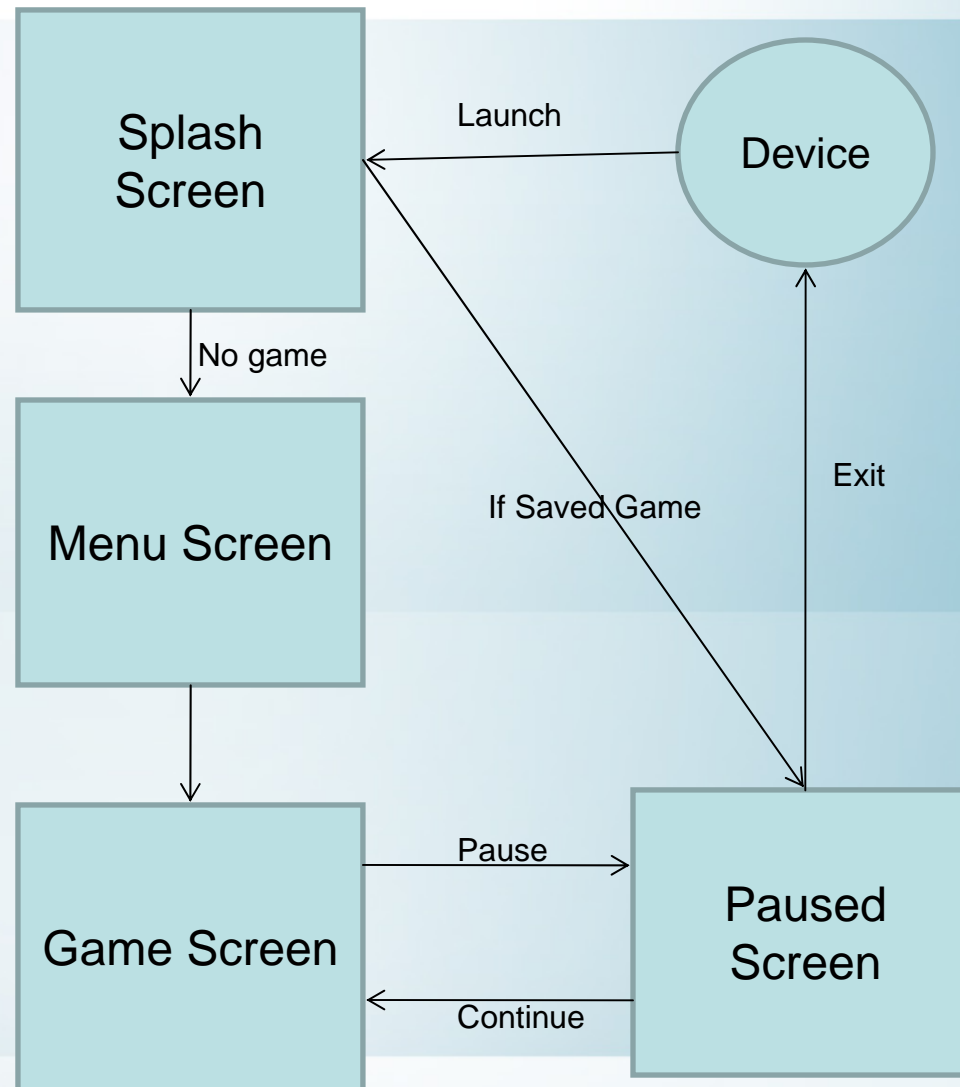
    - **Page Footer**

Game Navigation

- **Gaming is a large industry and games are found on almost every mobile device**
- **There is a certain format that most game designs follow to provide for consistency for the user**
- **There are design patterns available for games, they include:**
  - **Splash Screen**
  - **Menu Screen**
  - **Game Screen**
  - **Paused Game Options Screen**

Game Navigation (Cont.)


```
   ┌──────────┐         Launch        ╭──────────╮
   │  Splash  │ ◄──────────────────── │  Device  │
   │  Screen  │                       ╰──────────╯
   └──────────┘                            ▲
        │                                  │
        │ No game                          │ Exit
        ▼                                  │
   ┌──────────┐      If Saved Game         │
   │   Menu   │                            │
   │  Screen  │                            │
   └──────────┘                            │
        │                                  │
        ▼                                  │
   ┌──────────┐      Pause          ┌──────────┐
   │   Game   │ ──────────────────► │  Paused  │
   │  Screen  │ ◄────────────────── │  Screen  │
   └──────────┘      Continue       └──────────┘
```

Lists

- **Applications may contain lists of items, therefore we should have a standard set of keys for lists in our application**

- **There should be a minimum of three commands for the user, 'Next', 'Previous', and 'Done'**

- **If in an Options menu, 'Next' should be the first item, 'Previous' should be second, and 'Done' third**

- **You may also map the left soft key 'Next', right soft key as 'Done' and the Back button as 'Previous'**

List Navigation

- **For lists with alphabetic results of 25 to 100 entries consider grouping results by alphabet groupings on the numeric keypad, ABC, DEF, etc.**

- **Possibly add the number of items in parentheses besides the alphabetical listing**

- **For lists with alphabetic results of over 100 entries provide the user a text area to enter a search entry, when typing in the search area the list should filter by the characters in the search box, this will return faster results then scrolling through the long list**

Softkey and Button Management

- **The most common backward functions should be assigned to the Back button**

- **The most common action associated with View or Select should be assigned to the left soft key**

- **Other commands such as 'Save', 'Assign', 'Next' should be assigned to the left soft key if applicable**

- **All other commands can be assigned to a combination of the right soft key and other on screen commands**

- **The 'Exit' should be assigned to the End button**

Page Footer

- A page footer allows for consistent navigation within a web page or application that allows the user to return to certain locations

- A consistent set of links will be at the bottom of the screen

- Consider the following links:
  - Home
  - Search
  - Important Locations

Touch Screens

- **The sale of more touch screen devices means a change in graphical user interface design**

- **For touch screen devices consider using larger buttons and having a greater separation between buttons, this will reduce the amount of accidental clicks a user may encounter when using their mobile device**

- **If a touch screen ability is not available provide the user a clear way to access and use the component**

Application State Management

- As the applications you are developing are on mobile devices interruptions are inevitable
- For this reason application must manage data and their state when these interruptions occur
- Your application should consider:
  - User inputs must be saved during an interruption but passwords must not
  - Task related input should be discarded after the task is complete
  - The screen should be saved, so when re-entering the application the screen should reappear

Application Launch

- **There are certain steps that can be taken when an application is being launched on a device:**
  - **Check license status only when necessary and check a couple days before any expiration deadline**

  - **If the license needs to be checked regularly consider allowing the application a couple runs where the license must not be checked as there may be no network connection**

  - **Avoid asking setup questions each time the application launches other then the first time, do not ask the same questions repeatedly**

Application Launch (Cont.)

- **Steps continued:**
  - **Launch the application in modules, launch the first module and launch the other modules in the background while the user interacts with the first component**

  - **Store password information as long as needed keeping in mind the security requirements of the application**

  - **Insure that your application is certified**

  - **Save context, if the user must navigate away from the application allow them to return to the page they left off from**

Application Certification

- **Once you have created a mobile application and you wish to market it to vendors for commercial purposes it is a wise idea to have the application verified by a standards body**

- **The verification process will provide consumers and distributers a level of confidence in the application they are downloading or purchasing to have some criteria of quality**

- **Two common verification programs for mobile applications are Java Verified and Symbian Signed**

Java Verified

- **The Java Verified program is the largest program for verifying mobile applications**

- **The program takes uploaded applications and tests them to criteria that are set out by manufacturers and developers**

- **If your application is successful it will be showcased in the Java Verified program for developers and customers to see**

- **Information about the Java Verified program can be found _here_**

Symbian Signed

- **Symbian Signed is a designation provided by Symbian for the wireless community**

- **Symbian Signed is supported by network operators, handset manufacturers, and developers**

- **When an application is Symbian Signed it has met certain criteria that Symbian has set out which are accepted by the three groups that support the program**

- **The Symbian test criteria is available here**

References

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- http://www2.bc.edu/~gallaugh/research/ism95/cccsa.html

- http://patterns.littlespringsdesign.com/index.php/Main_Page

- http://www.javaverified.com/

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