UNIT 1 INTRODUCTION TO MOBILE APPLICATIONS

Structure

1.0 INTRODUCTION

As we have witnessed a revolution in the consumer space toward mobility, most analysts have identified that mobile devices are the major gateways to Internet as compared to desktop browsers. Mobile device is replacing all traditional channels to access the information. To align with this trend, enterprises too are designing the digital applications to cater to wide array of mobile devices and platforms.

Mobile application development involves the process of developing the applications for mobile devices such as Personal Digital Assistants (PDA), tablets and smart phones and other mobile devices. Native mobile apps are designed to run on a specific mobile platform, sometimes specific mobile operating system and supported hardware.

Mobile applications are part of main stream digital strategy for Business to Consumer (B2C) enterprises. Most of the enterprises are now adopting "*mobile-first*" strategy wherein the digital applications are designed, developed and tested for mobile devices; mobile users attain the primary focus in the digital strategy. Disruption in mobility space has major impact on the revenues for the enterprises. Mobile apps are shaping user experiences and are providing real-time information and offer more engaging experiences for the users.

Mobility based digital strategy considers various things such as user experience, performance, interactivity, device form factors, device limitations, location needs and personalization.

Key Drivers for Mobile Applications

The following are the key drivers of mobile apps:

- **Innovation** in mobile space such as proliferation of smart phones, higher bandwidths offered by 3G (Third generation) and 4G (Fourth generation) technologies are coupled with higher capacity storage technologies with higher speed chips would keep powering mobile devices.

- **Consumer behavior**: Customers are more used to mobile devices and is easy for them to access information on the move.

- **Personalized content delivery**: Enterprise can leverage the location and sensors to offer more contextualized, relevant and personalized content, offers and advertisements.

- **Mobile ecosystem**: An explosive growth in Mobile Applications stores such as Apple store, Google Play store, Windows marketplace store was coupled with availability of games, utilities and other apps.

- **Social Networking**: With the popularity of web 2.0 and social media technologies such as Facebook, Twitter users are increasingly using the location based features in the social media platforms.

Impact of Mobile Apps on various domains

Mobile apps are impacting various industry verticals and functional domains. Given below are high level changes enabled by mobile apps across industries:

- **Retail and Consumer Packaged Goods (CPG) Industry**: Mobile apps provide location based store locator, targeted promotions/offers/coupons, service reminders, mobile bidding, in-store tools, cross sell/upsell tools and comparator tools. Basically, mobile apps play key role in driving the traffic, increasing the sales and drive the brand loyalty. On B2B front, mobile apps have redefined lead management, CRM functions, efficient tracking, field force automation and such. Mobile apps have also lead to improvement in store merchandize, supply chain and inventory managements.

- **Banking industry**: Mobile apps enable convenient ways to carry out transactions such as account balance, payment, localized alerts, tap-to-pay, branch locator, and payment coupons. Mobile apps would also enable mobile banking, mobile wallet and provide "on-the-go" features.

- **Logistics**: It is easier to track shipments, get updates, manage warehouse, and fleet using mobile apps.

- **Healthcare**: Mobile apps can easily connect patients, doctors and insurance providers as well as provide wellness management solutions.

Besides the above mentioned enterprise scenarios, mobile apps have revolutionized consumer space with various mobile apps related to gaming, utilities, social media, video streaming and many more.

Attributes of Mobile applications

The following are the key attributes of mobile applications:

- **Ubiquity:** Mobile applications are always available and connected and enable users to access information anytime anywhere

- **User friendliness:** Mobile applications provide responsive and interactive user interface with essential information. They utilize the

camera, sensors, media output, touch/multi-touch/voice interface for providing simplified actionable information.

- **Location awareness:** Mobile applications provide location sensitive information using Global Positioning System (GPS) and other sensors.

- **Minimalistic:** The content and features in mobile apps are minimal which are essential for the functionality.

1.1   OBJECTIVES

After going through this unit, you should be able to

- understand key concepts of mobile app development,

- know the opportunities and challenges of mobile apps,

- know the details of PC based apps as well as web based apps,

- know the content and key protocols of mobile apps

- know the evolution of mobile apps, and

- Comparison of mobile apps and web apps and upcoming trends in mobility space

1.2   CONSIDERATIONS AND CHALLENGES FOR MOBILE APP

The main considerations for mobile apps are given in Figure 1.1

Utility of Mobile App	Types of Apps	Principles	Mobile Users
• Engagement • Productivity • Revenue • Conversion • Loyalty	• Hybrid • Native • Mobile Web	• User experience • Security • Management • Hosting	• Consumers • Business • Partners • Employees

Figure 1.1: Mobile App Considerations

The main considerations for mobile app design are listed below:

- Intended utility of the mobile app

  o   Consumer engagement with richer user experience

  o   Productivity through efficient flows

  o   Driving incremental revenue through user stickiness

  o   Customer conversion

  o   User loyalty through targeted and personalized offers

- App Architecture

- Native vs hybrid vs web based on the requirements
- Middleware requirement for centralized configuration
- Offline vs online capability for storing data

- App Development Principles
  - User experience through richer controls and interactive components
  - Compatibility on various devices and platforms
  - Performance for each screen and task
  - Security for data
  - Productivity enhancement tools

- Target users
  - Consumers for B2C apps
  - Business for Business to Business (B2B) apps
  - Partners for B2B apps
  - Employees for Business to Employee (B2E) apps

- Testing
  - Device testing
  - Performance testing
  - Various testing scenarios

The main challenges in mobile app strategy are given below:

- Diversity of devices and heterogeneous technologies: There are various mobile platforms and devices. The app should provide optimal experience in all the scenarios.
- Security: Mobile app should ensure data security during transmission and during storage.
- User experience: Mobile app should provide optimal user experience leveraging the device capabilities to provide highest engagement possible.
- Network: Mobile app should be designed to work in regions with network, latency and bandwidth challenges.
- Compliance to diverse standards, OS, mobile platforms and devices.

1.3 PC BASED APPLICATIONS

Personal Computer (PC) based applications are software programs developed to run on specific operating system and hardware platforms. These were the pioneer applications that were used during the initial days of software development. There are mainly two types of PC based applications, namely, standalone PC applications and client server applications.

1.3.1 Standalone PC Applications

Standalone PC applications are independent software programs which would run on an OS. These applications do not typically use network resources or support multi-user mode. Utility programs such as word processor, calculators,

and media players fall into this category. Each of the applications had a good user interface for the PC user to interact.

1.3.2 Client server applications

In client server applications, each terminal PC had a client software which is connected to a centralized server software. The client program would get input from the end user and would submit the details to the server software through a dedicated session established through the network. These applications were also referred to as "thick clients".

Database software, networked games, banking software, network file system are some of the examples of this category of applications.

☞ Check Your Progress 1

1) ……………………. is an attribute related to mobile app availability.

2) …………………………… are independent software programs which would run on an OS.

3) ………………… and ………………….. are two key components of client server applications.

4) Main target users for mobile apps are ……………………… .

5) Native vs hybrid is related to ……………………………….. consideration.

1.4 WEB BASED APPLICATIONS

Internet enabled applications that are mainly rendered on desktop browsers are categorized as web applications. Most of the modern web applications follow layered Model-View-Controller (MVC) architecture which supports loose coupling and flexible modular components.

A typical MVC based web application is depicted in the Figure 1.2:
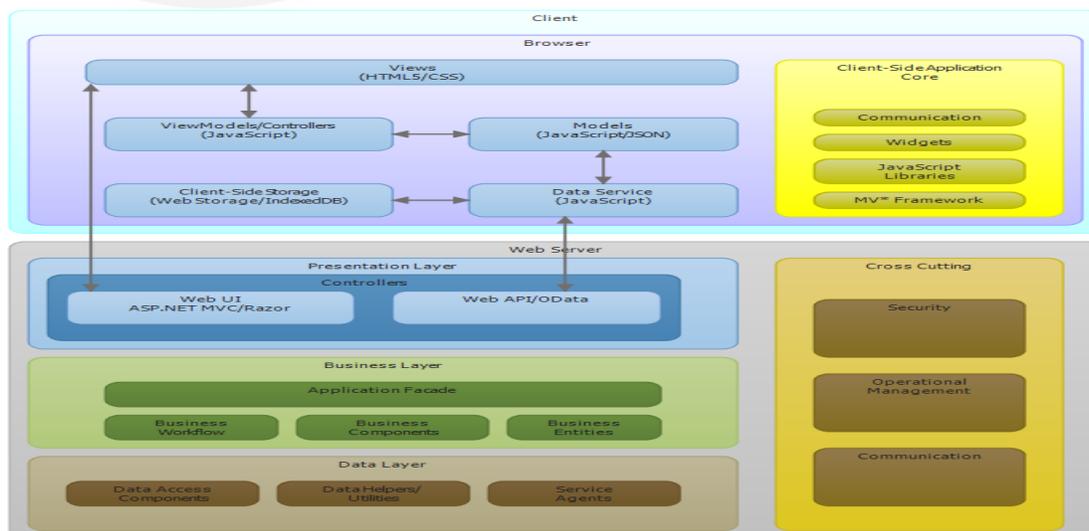

Fig. 1.2: MVC Web Application

The key layers of the MVC framework are shown below:

- **Presentation layer (View layer):** User experience components such as portlets, widgets, pages, User Interface (UI) modules, buttons, and forms are present in this layer. Modern web applications normally use JavaScript components to build the UI modules. The UI modules will mainly render the view portion of the application. *View* components communicate with back end through services. Modern web applications use Representational State Transfer (REST) based light-weight services.

- **Business layer:** This layer consists of business components which implement business logic and business rules. The layer mainly consists of rules engine, search, business objects, workflows, business process management (BPM), caching frameworks and other entities. All business modules expose services to presentation layer.

- **Data layer (model layer):** This layer mainly consists of persistence handling components such as database access components, Data access objects (DAO), query components, Object Rational Mapping (ORM) frameworks and such.

Besides these layers we also have security components (responsible for authentication and authorization) in security layer and utilities components to handle cross-cutting concerns.

A complex n-tier enterprise web application is depicted in Figure 1.3. We could see various layers for enterprise search, content management, e-commerce with various enterprise interfaces.
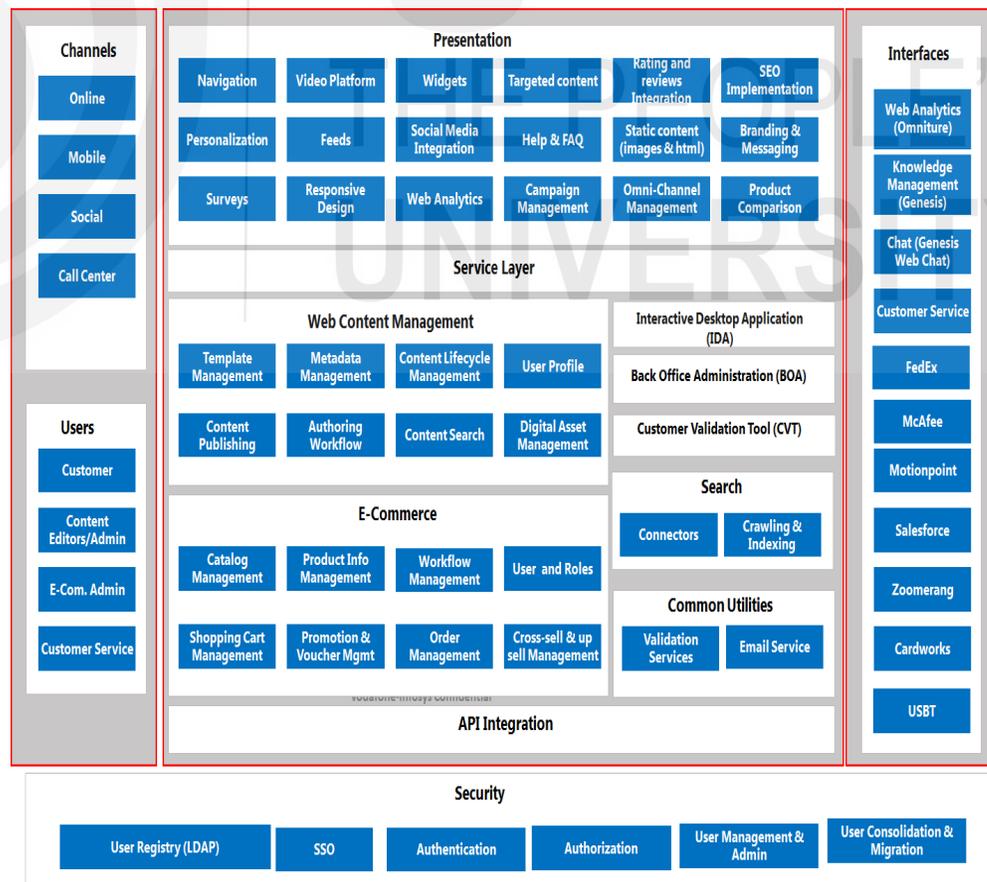

Fig. 1.3: N-tier Enterprise Web Application

The multi-layered architecture is mainly based on MVC architecture:

1.4.1 Presentation Layer

This involves the presentation components like portlets and other user experience components. Key components are explained below:

- **Personalization:** Role-based access and other fine-grained access control to provide personalized user experience.

- **Widgets:** Wherever required jQuery based client-side widgets would be developed to provide client-side functionalities. This would help enhance overall user experience and improve the page performance. Real-time report data display/refresh, pagination, search functionality are typical scenarios where this AJAX-based feature can be employed.

- **Multi-device support:** Responsive design and device recognition features will be leveraged to cater to various mobile devices.

- **Page layouts:** Flexible page layout to cater to various web pages.

- **Information architecture and navigation models:** This consists of context menus, bread crumb, left navigation, site map, site hierarchy for the web site.

1.4.2 Web Content Management Layer

Web content management layer consists of mainly following modules:

- Content authoring using authoring templates.

- Content tagging with relevant metadata and tags.

- Content publishing to various targets and in various formats.

- Asset management of various digital assets, documents and multimedia files.

- Workflow for managing the content approval, publishing and update processes.

1.4.3 E-commerce Layer

Ecommerce modules usually consist of modules related to catalog management, order management, modules for shopping cart, promotion, cross sell and up sell, and product information management.

1.4.4 Integration Layer/Services Layer

The solutions use business service layer for integration with external system. Integration strategy is based on Service Bus Architecture, in which the middleware can act as a service bus linking multiple applications that require services of each other through a central service layer. The service bus becomes a point of data interchange and manages the communication with each peripheral application independently. All service invocations will be done through ESB layer. JMS component will be developed to send and receive the messages to the ESB message destination. Application/System services will be developed and exposed to the ESB layer.

1.4.5 Security Layer

Security layer consists of modules related to authentication, authorization and single sign on.

1.5 EVOLUTION OF MOBILE BASED APPLICATIONS

A brief overview of various stages of mobile app development is depicted in Figure 1. 4.
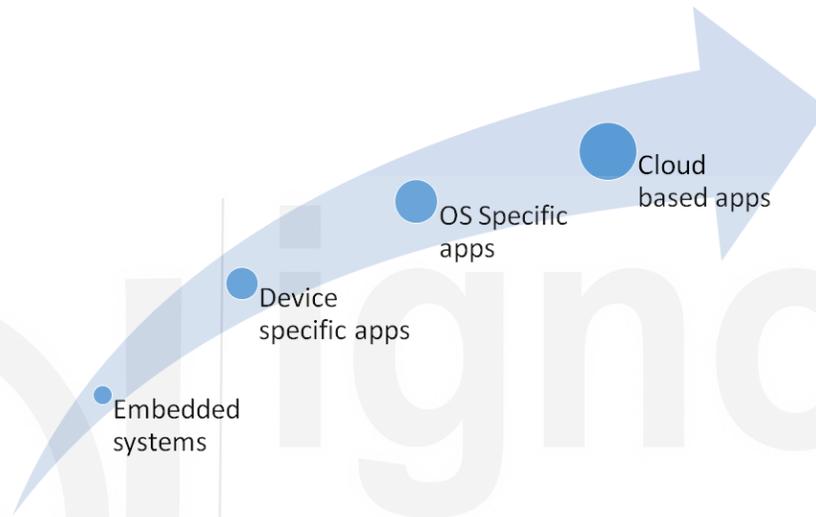

Fig. 1.4: Evolution of mobile app

The core features of the various stages of mobile app evolution are detailed below:

- **Embedded systems:** In this category, we has embedded systems such as calculators on various devices. The embedded systems had limited functionality.

- **Device specific apps:** The applications specific to the device are part of this category. For instance, device specific games and other utility apps fall into this category.

- **OS specific apps**: Operating system specific apps such as games, media players fall into this category.

- **Cloud based apps**: In this category, we have always available cloud based apps.

1.6 COMPARISON OF A MOBILE APP WITH A WEB APPLICATION

A high level comparison of mobile app with web application is given in following table1.1:

Table 1.1 : Mobile App Vs Web Application

Criteria	Web Application	Mobile App
User experience	Provides good experience optimized for desktop browsers.	Mobile apps can leverage full device capabilities and offer rich experience to users. Mobile apps provide rich branding experience to users.
Performance	Web applications provide good performance based on performance optimizations.	Native mobile apps provide high performance.
Location awareness	Web applications provide relatively less location awareness	Mobile apps provide location sensitive and contextual information
Development cost	We can have single code base and hence relatively lesser development and maintenance cost.	We need to potentially have multiple code bases to cater to various mobile platforms and hence relatively higher maintenance cost.
Access mechanism	Web applications are mainly accessed by desktop browsers and mobile browsers.	Mobile apps are accessed by mobile browsers and mobile devices.
User intuitive features	Web applications use limited amount of device features.	Mobile apps provide intuitive features using device's camera, sensors, GPS etc. and provide notifications to users.
Interactivity	Web applications provide interactive interfaces through widgets.	Mobile apps offer high level interactivity through touch interface.
Applicability	Web applications are normally used as Information display platforms	Gaming, location-specific applications such as car rental apps, store locator apps, reporting apps.
Personalization	Web applications offer personalization features through server side preferences.	Mobile apps provide high degree of personalization through various context parameters such as location, history etc.
Common use cases	News, blogs.	Games, social media and location related services.

1.7 CONTENT AND PROTOCOL IN MOBILITY

The content for mobile apps are designed to be adaptive. The adaptive content uses rules to adapt itself based on the context. Context includes various parameters such as device, location, time, form factor, mobile platform, screen resolution, personalization parameters, preferences and such. Adaptive content hence provides a superior information delivery experience for mobile users.

Let us look at couple of examples of adaptive content in the context of mobile apps. For a regular product page, we would be having product long description and product short description. If the product content is designed to be adaptive, the long description would be rendered on desktop browsers and tables which have higher page real estate and only short description will be delivered on smart phone with lesser screen layout. Similarly, role based content filtering, location and time based content filtering can be done using adaptive rules.

Responsive design mainly caters to the flexible page layouts and screens. A combination of responsive page design and adaptive content would be idea for mobile scenarios.

The main protocols used in mobile apps are as follows;

* **Wireless Application Protocol (WAP)**: It provides specifications and rules for wireless communication devices such as smart phones. WAP is optimized for low-memory , low-bandwidth mobile devices.

* **Representational State Transfer (REST)**: Responsive mobile web applications communicate with server using light-weight REST service calls. Normally, JSON data is used in REST service for data exchange.

1.8 TRENDS IN MOBILITY SPACE

The following are some of the trends in mobility space:

* HTML 5 based responsive apps: HTML 5 technologies would help developers to develop pure responsive web applications that cater to all mobile devices.

* Bring your own device (BYOD): Employees can bring their own mobile devices to work and work simplification.

* Internet of Things (IoT): Provides real-time data through sensors and other connected devices to the mobile. *Wearable* is increasingly gaining traction and the data published from wearable will be consumed by mobile devices.

* Mobile device management (MDM): Managing configuration, security and policies of various devices.

* Mobile application management (MAM): Managing version, delivery and provision of various apps.

* Increased variety of communications such as touch, voice, facial/gesture recognition, video, scanning, Near Field communications etc.

* Location based real-time alerts and notifications and other innovative features such as route optimization.

* Mobility as a service (MaaS): MaaS is to accelerate time to market and reduce complexity.

1.9   BRIEF NOTE ON MOBILE APP PLATFORMS

Let us look at two popular mobile app development platforms: iOS and Android.

Android

Android is an open-source mobile development platform that is based on Java and is maintained by Google. The key features supported by Android are SQLite based light-weight storage, SMS and MMS messaging, multi-lingual support, mobile browser. Other key features are multi-touch support, multi-tasking, voice features, external storage and such.

Android development needs Android SDK, libraries, emulator and Eclipse IDE. Testing can be done using Android testing APIs. We can deploy Android apps to Google Play store.

Apple iOS

iOS is the mobile OS for Apple devices. The development on iOS happens using objective C. iOS supports many features such as iMessage, iCloud, Siri etc. iOS provides in-built apps such as mail, notifications, contacts calendar, bookmarks, sync etc.

iOS development includes iOS SDK (XCode), iOS Simulator, XCode IDE, and other frameworks for building iOS apps.

For mobile web development, we could use numerous JavaScript frameworks such as SenchaTouch, jQuery Mobile, jQTouch and software such as PhoneGap that are used for mobile web development.

☞ **Check Your Progress 2**

1) …………………………….. Layer is responsible for presentation components in MVC architecture.

2) ………………………….. Layer is concerned with centralized services access.

3) Light weight service invocation in mobile apps can be done through …………………………. .

4) ……………………… is popular open source mobile platform.

1.10   SUMMARY

In this unit, we started discussing the main considerations and challenges in mobile app development. We then discussed the PC based applications including stand alone and client server applications. We then had a detailed discussion on web based application which is designed using MVC architecture. We also looked at various stages of mobile app development. We compared the mobile apps with web applications and looked at content and protocols of mobile apps. We summarized brief trends and overview of key mobile platforms.

1.11 ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress 1

1) Ubiquity.

2) Standalone PC applications

3) Client terminal and Server software

4) Consumers, business and employees

5) App architecture

Check Your Progress 2

1) View layer

2) Integration/services layer

3) REST calls

4) Android

1.12 FURTHER READINGS

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