

وزارة المواصلات والاتصالات  
MINISTRY OF TRANSPORT  
AND COMMUNICATIONS



**Ministry of Transport and Communications  
of the State of Qatar**

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## **Government Mobile Services Framework**

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**Date of Issue: October 2017**

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## Definitions and Acronyms

1. The terms used by the this document, and their definitions are as follows:

“SHALL” - The associated definition is an absolute requirement of this specification

“SHOULD” - Indicates a recommended practice

“MAY” - Indicates that an item is truly optional

2. A “**mobile service**” is a service that can be accessed via a mobile device and is between an organization and a customer. Mobile services are part of digital services. Mobile services offer mobile capabilities to user in which other electronic services are not able to offer mobility since they are still bound to specific physical location.
3. “**QDG**” refers to Qatar’s Digital Government strategy for the year 2020 available at <http://www.motc.gov.qa/en/documents/document/qatar-digital-government-2020-strategy-%E2%80%93-executive-summary>.
4. “**Government Agency**” or “**Agencies**” refers to all ministries and public institutions under ministries or Council of Ministers in the State of Qatar.
5. “**ICT**” is an abbreviation for Information and Communications Technology.
6. “**W3C**” refers to World Wide Web Consortium (<http://www.w3.org>) where Member organizations, a full-time staff, and the public work together to develop Web standards.
7. “**WCAG 2.0**” stands for Web Content Accessibility Guidelines version 2.0 published by W3C that covers a wide range of recommendations and guidelines following which will make content accessible to a wider range of people with disabilities, including blindness and low vision, deafness and hearing loss, learning disabilities, cognitive limitations, limited movement, speech disabilities, photosensitivity and combinations of these.

## **1 Legal Mandate**

Article 18 of the Emiri Decree number (4) for the Year 2016 setting the mandate of Ministry of Transport and Communications (hereinafter referred to as “MOTC”) provides that MOTC has the authority to regulate road and maritime transport activities, to develop and enhance transport services, to study, supervise and follow up the execution of their projects, leading to accomplishing an expansion to the economical motion and serve the national development plan. Also to supervise, regulate and develop the sectors of Information and Communications Technology (hereinafter “ICT”) in the State of Qatar in a manner consistent with the requirements of national development goals, with the objectives to create an environment suitable for fair competition, support the development and stimulate investment in these sectors; to secure and raise efficiency of information and technological infrastructure; to implement and supervise e-government programs; and to promote community awareness of the importance of ICT to improve individual’s life and community and build knowledge-based society and digital economy.

The Qatar Digital Government Strategy further stipulates the requirement for Agencies to deploy mobile services to better serve the people and businesses. The Strategy entrusts Ministry of Transport and Communications with the responsibility of drafting such policies or guidelines for use by Agencies.

This document has been prepared taking into consideration current applicable laws of the State of Qatar. In the event that a conflict arises between this document and the laws of Qatar, the latter, shall take precedence. Any such term shall, to that extent be omitted from this document, and the rest of the document shall stand without affecting the remaining provisions. Amendments in that case shall then be required to ensure compliance with the relevant applicable laws of the State of Qatar.

## 2 Introduction

Worldwide, Governments are using mobile technology to deliver services that will keep up with the changing habits and expectations of people. Mobile is not just another delivery channel or a little computer, mobile opens up new ways for government to interact with the public. Government agencies around the world are expanding their digital platforms to create app-oriented content custom-tailored for smartphones and tablets. It's no longer sufficient for agencies simply to post policy or regulatory decisions, data and other information on a static website.

Residents, businessman and the workforce have grown accustomed to the user experience by using more intuitive consumer-based mobile technology and applications – and expect the same from the Government. Mobile services provides better and faster access anytime, anywhere. It also improves workforce productivity and increases administrative efficiencies through increased automation and information sharing.

By the end of 2017, market demand for mobile app development services will grow at least five times faster than internal IT organizations' capacity to deliver them, according to Gartner, Inc. Gartner forecasts mobile phone sales will reach 2.1 billion units by 2019, which will fuel demand for mobile applications and services. According to Gartner, employees in today's digital workplace use an average of three different devices in their daily routine, which will increase to five or six devices as technologies such as wearable devices and the Internet of Things (IoT) eventually become mainstream. Many of these employees are given the autonomy to choose the devices, apps and to allow this where Bring-Your-Own-Devices (BYOD) policies have been put in place.

The research company IPSOS<sup>1</sup> has reported that 87% of MENA Internet users access the web from home whilst Booz and Co<sup>2</sup> found that internet users in the GCC are also much more likely to access the web in public places and on the move than their counterparts in other parts of the region and globally.

The Qatar Digital Government strategy recognizes the far reaching potential of mobile technology to increase public sector and national efficiency through enabling more convenient, easy-to-use services, improving productivity and facilitating open engagement with its people, communities and businesses. One of the key strategic objective defined in our [Qatar Digital Government Strategy](#) is to “Better Serve Individuals and Businesses” with a KPI that 60% of services will be available through mobile. Mobile government services create opportunities to bridge the digital

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<sup>1</sup> IPSOS MENA, *Online Audience Measurement in the Arab World*, 2013. Accessible at: <http://www.slideshare.net/IpsosMENA/online-audience-measurement>

<sup>2</sup> Booz & Co., *Understanding the Arab Digital Generation*, 2012. PDF accessible at: [http://www.booz.com/media/file/BoozCo\\_Understanding-the-Arab-Digital-Generation.pdf](http://www.booz.com/media/file/BoozCo_Understanding-the-Arab-Digital-Generation.pdf)

divide, increase transparency, and encourage public participation. Developing mobile applications extends access channels and increases convenience for users.

Smartphones make up 75% of the mobile market—which makes mobile-friendliness a must for government agencies. Government must accelerate its customer service approach with anytime, anywhere efforts to keep up. More people are increasingly using mobile devices such as smartphones and tablets to access Government information and services. Government entities in Qatar are also embracing the potential of mobile by adapting websites and services for convenient access. Many of our agencies have optimized and deployed mobile versions of their websites and use SMS for notifications and alert services while increasing number of entities are providing mobile device-based applications. MOTC (QCERT) has also issued a [Bring-Your-Own-Device \(BYOD\) Security Policy](#) in March 2016 for compliance by Agencies.

Mobile is more than another delivery mechanism as it brings a new set of capabilities – such as GPS location services, cameras, remote control, that can be leveraged to redefine how, what, when and where services are delivered. These advanced functions allow organizations to rethink services and allow interactions within the users’ environment. People prefer the engagement and immediacy of mobiles. Mobiles fit into a person's lifestyle, moving with them, rather than demanding people meet them on the technology's terms.

Some usage examples include:

- (i) SMS or push messaging extends the reach of government services as a cost effective means for agencies to send personalized notifications or targeted information to specific individuals or groups. Push messages are notably applicable when urgent advice or quick action is warranted — in areas such as health and safety information, education, employment and grant opportunities, personalized notifications and news updates.
- (ii) Mobile forms and applications can also improve the availability and responsiveness of interactive and transactional services. These can reduce the need for face-to-face interactions and the submission of paper forms with a resultant savings of time and transportation costs by the public, as well as in processing costs by agencies.
- (iii) Interactive services include service requests, inquiries, comments and problems.
- (iv) Transactional services include self-service options related to licensing, visa applications, appointment booking, transactional services including e-payments and claims, etc.
- (v) The capabilities built into mobile devices, such as cameras and global positioning, has also opened up possibilities for more sophisticated user experiences. For example, location-aware applications can make use of a device’s location data to provide information and services

tailored to the user's needs and current location. Agencies can extend the benefits of their online channel by offering new services built around these capabilities or simply enabling existing online transactions for mobile devices.

The aim of this Mobile Services Framework document is to build a consistent, whole of government approach to adopting mobile technology in delivering government services that will help us to achieve our objectives outlined in the Qatar Digital Government strategy. Our goal is to better position our Qatar Government to continuously find and deliver new and innovative ways to extend its services to better serve and engage its people. It will set a coordinated approach across government to adopt mobile technology with the aim of achieving the strategic priorities of the Qatar Digital Government strategy.

This document has been developed to assist Government agencies in the design and deployment of mobile services based on international best practices and standards.

This document will be regularly reviewed, and where necessary, updated to ensure it remains aligned with our Qatar Digital Government priorities as well as in line with international trends and developments.

### **3 Scope and Application**

- 3.1 This document seeks to provide Agencies with a framework that helps in planning, designing and deploying mobile services including references to key international standards and best practices.
- 3.2 The document is mainly divided into two parts. First part covers standards and references, and agencies are required to apply where indicated mandatory. Second part consists of design guidelines that are not mandatory but are applicable to all agencies that are planning to deploy mobile services as part of Qatar Digital Government strategy to deliver Government services to the people.
- 3.3 Government Agencies are advised to take note that key mandatory provisions relating to the use of Government Shared Services including the National Authentication System for SSO access, e-Payment gateway, SMS gateway continue to apply to mobile services.
- 3.4 This document is to be read in conjunction with the following Policies and Standards issued by MOTC for compliance:
  - i) [Emiri decree on Government Use of Shared Services](#);
  - ii) [Government Website and e-Services Framework \(Version 2\)](#);
  - iii) [National Information Assurance Policy \(Version 2\)](#);
  - iv) [BYOD Security Policy](#);
  - v) [e-Accessibility Policy](#).



## 4 Standards and Guidelines

This section is divided into two parts. The first part contains set of standards that the government agencies are required to follow in developing their mobile services. The second part constitutes of recommended approach and design guidelines to help agencies deploy mobile services.

### Part 1: Standards

Implementing mobile solutions can be viewed as extending the current applications and services to mobile devices. However, agencies must now be prepared to support a variety of mobile devices (phones, smartphones, tablets, etc.) deployed on their government services. This section highlights some of the key standards that Agencies shall observe in the deployment of mobile services.

#### Standard 1: Language Standard (Mandatory)

- 1.1 All Government Agencies shall provide mobile services in at least Arabic and English languages. This includes delivery of services over mobile-web as well as mobile-app. The Arabic and English versions shall be similar in terms of content and layout wherein the Arabic version shall be right aligned and the English version shall be left aligned.

#### Standard 2: Interoperability Standards (Mandatory)

- 2.1 To ensure reuse and portability of information and services across applications, platforms and devices, Agencies shall adopt standards as provided in Government Reference Architecture and Standards, specifically the following:
  - 2.1.1 Text-based resources of device-based mobile applications, such as HTML, XML and CSS, are encoded in UTF-8. As of Unicode 10.0, the Arabic script is contained in the following blocks:
    - Arabic (0600–06FF, 255 characters)
    - Arabic Supplement (0750–077F, 48 characters)
    - Arabic Extended-A (08A0–08FF, 73 characters)
    - Arabic Presentation Forms-A (FB50–FDFF, 611 characters)
    - Arabic Presentation Forms-B (FE70–FEFF, 141 characters)

- Rumi Numeral Symbols (10E60–10E7F, 31 characters)
- Arabic Mathematical Alphabetic Symbols (1EE00—1EEFF, 143 characters)

For further information about the standard, please follow this link:  
<http://www.unicode.org/versions/Unicode10.0.0/ch09.pdf#G37489>.

2.1.2 Parts of device-based mobile applications that are in HTML or XHTML:

- Are built using HTML5 or later. HTML5 can also be written in XHTML syntax, known as XHTML5;
- Apply HTML5 elements and "[rel attribute](#)" values according to the HTML5 specification.

**Standard 3: Usability Standards for Mobile Websites and Web Applications (Mandatory)**

3.1 Agencies shall optimize websites and Web applications for mobile devices by:

- 3.1.1 Adapting the layout and design of websites and Web applications for small, medium and large screen sizes, and for different input methods, such as touch input and keyboard and mouse input.
- 3.1.2 Designing the content and interface of websites and Web applications for small, medium and large screen sizes and for different input methods, such as touch input and keyboard and mouse input.

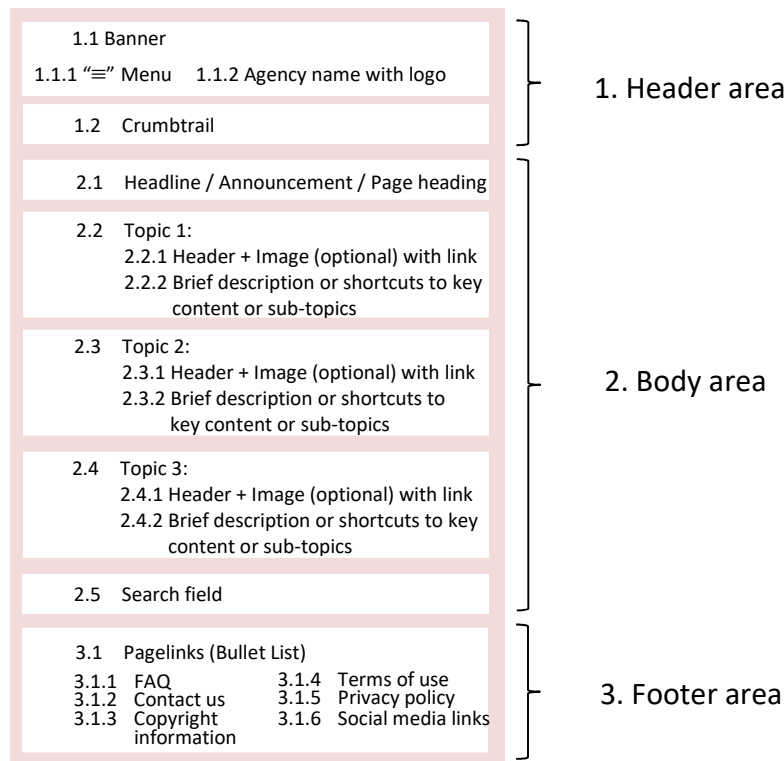
3.2 The layout for mobile devices in Section 3.3 below are applied when:

- 3.2.1 The screen (media query device-width) is less than 1024 pixels wide; or
- 3.2.2 The viewport (media query width) is less than 960 pixels wide.
- 3.2.3 If the media query width is more than that specified above, then the layout as provided in [Government Website and e-Services Framework](#) (Section 5) shall be applied.

3.3 Agencies shall adopt following layout principles for mobile websites and Web applications:

- 3.3.1 Each page shall have both header and footer.
- 3.3.2 Header shall consist of branding elements such as agency name and logo.

- 3.3.3 The webpages shall include crumbtrail to display webpage location.
- 3.3.4 Footer shall contain useful links including terms of user and privacy statement. Please refer [Government Website and e-Services Framework](#) (Appendices 1 and 2) for details.
- 3.3.5 The mobile layout shall be able to adapt to the changing device orientation so that it fills up the full screen width at all times.
- 3.3.6 All content must be right aligned for Arabic version and left aligned for English version.
- 3.3.7 Aspect ratio of full width images should be 16:9 and that of smaller images should be 4:3.
- 3.3.8 Agencies shall adopt the following general template for their mobile web pages:



*Note: Areas are not to scale and may be customized to suit requirements*

#	Area	Element	Description
1.1	Header	Banner	Agency's name with logo shall appear here. A dropdown navigation menu should also be placed before the agency's name and logo.
1.2		Crumbtrail	Webpage location within the website shall be displayed "<Agency name> home" should be displayed in the homepage
2.1	Body	Headline or Announcement or Page heading	Major headline or announcement may be displayed on the homepage while page heading name shall be displayed here
2.2 /2.3 /2.4		Topics	Main topics such as services or information will be displayed on the homepage with links to the respective webpages where subtopics or relevant items are displayed.
2.5		Search field	A search field shall be provided
3.1		Pagelinks	Useful links shall be provided

- 3.4 Agencies should refer to the [Mobile Web Best Practices](#) developed by the World Wide Web Consortium (W3C) which includes comprehensive guidelines for developing websites that work well on mobile devices.

#### Standard 4: Usability Standards for Device-based Mobile Applications (Mandatory)

- 4.1 Agencies shall develop mobile applications for Android and iOS platforms at the least for maximum user reach.
- 4.2 The application shall embody the following:
- 4.2.1 Agency's logo in form of Agency's name within the State of Qatar emblem;
  - 4.2.2 Application title as unique identifier;
  - 4.2.3 Version identifier.
  - 4.2.4 Following exceptions may apply to 4.2.1:
    - If the agency is not a Ministry in which case the Agency's approved logo shall be used;
    - If the application is purpose-built with approved branding.

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- 4.3 The application landing page shall provide available language options before proceeding to the home screen.
- 4.4 The home screen shall provide following options at the least:
- 4.4.1 Agencies' contact information including Government Contact Center number 109 for help;
  - 4.4.2 Help link to provide help with login, service usage etc.;
  - 4.4.3 Personalization options including user profile management;
  - 4.4.4 Mechanism for accessing the terms of use and privacy statement. Please refer [Government Website and e-Services Framework](#) (Appendices 1 and 2) for details.
- 4.5 The application screens shall provide the following options at the least:
- 4.5.1 Descriptive screen title for each screen of the mobile application, with the exception that it is a single-screen mobile application;
  - 4.5.2 Mechanism for returning to the mobile application's home screen, with the following exceptions:
    - The mobile application does not have a home screen;
    - Single-screen mobile application.
- 4.6 Agencies should plan and design the API based information exposure from existing Systems of Records for consumption by new mobile applications. API management and governance approaches should also be planned.
- 4.7 Agencies should plan for the mobile application life cycle management capabilities to account for pushing incremental updates to app users.
- 4.8 Agencies are recommended to plan for mobile application analytics as part of the platform capabilities to better understand customers' usage behavior and improve their digital engagement experience.
- 4.9 Agencies should adopt guidelines provided in [Guideline 2.2](#) of this document in order to design the app for optimal user experience.
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- 4.10 Agencies should refer to UI guides as provided in [Appendix A](#) that provides links to official user interface (UI) and user experience (UX) guidelines from the most common manufacturers.

#### Standard 5: Adopt Qatar Government-wide ICT Infrastructure and Services (Mandatory)

As required by [Council of Ministers Resolution No. \(18\)/2010 – Implementation of e-Government Policies](#), Government Agencies shall leverage and adopt Government-wide ICT Infrastructure and Services to ensure efficiency in operations, adherence to common standards and platforms, and secure connectivity and information exchange within the Government. The delivery of government services over the mobile platform will require the same access to Qatar’s Government Shared Services including that Agencies **shall** adopt, include:

- 5.1 **Government Contact Center:** For users’ convenience, a single telephone contact number for assistance in all e-Services should be provided. For this, Agencies shall appoint and use the [Government Contact Center](#) as the focal support for its e-Services.
- 5.2 **National Authentication Service:** In order that users are not required to register individually with each agency and authenticate separately for different e-Services, Agencies shall adopt [National Authentication Service](#) and adhere to Qatar’s e-Services Registration & Authentication Policy (Council of Ministers Resolution No. (18)/2010-Third Attachment). Agencies shall also publish on their e-Services webpage information about security levels and methods adopted as well as privacy statements, in order to gain users trust in transacting e-Services.
- 5.3 **Government Payment Platform:** Agencies shall utilize Qatar’s [Central e-Payment Platform](#) to ensure safe and efficient payment process. SSL Certificates should be installed onto the Agencies’ web server to initiate secure sessions with browsers during payment transactions. The online payment shall conform to the [National Information Assurance Policy v2.0](#) as well as the Banking Supervision Rules issued by the Qatar Central Bank particularly the clauses that regulate on-line payment.
- 5.4 **Government Data Exchange:** Mobile services deployed over web or apps shall ensure minimize data entry by users and obtain data from source for validation through integration with internal systems or with [Government Data Exchange](#) for inter-agency data requirements. Please refer to Qatar’s [Data Management Policy](#) available at MOTC’s website which includes provisions for the sharing of data across agencies to facilitate digital services.

#### Standard 6: Security Considerations and Standards (Mandatory)

- 6.1 Agencies shall ensure compliance with [National Information Assurance Policy](#) (NIA) in designing mobile services. Many of the same techniques that help secure wired devices can also be applied to portable and wireless technology. The National Information Assurance (NIA) Policy in general is designed to cover any information systems, including a section within the Policy covers Software Security.
- 6.2 Agencies should refer to [OWASP guidelines](#) that highlight top ten vulnerabilities for mobile applications. Agencies should also refer to [Mitre Top 25 Dangerous programming errors](#) as recommended by the NIA policy.

#### Standard 7: Mobile Accessibility (Recommended)

- 7.1 Agencies should ensure in mobile web and apps that methods of interaction are available for those that have disabilities. [Web Content Accessibility Guidelines 2.0 \(WCAG 2.0\)](#) promulgated by the World Wide Web Consortium (W3C) should be referred. It covers the basic concept and best practices in making mobile applications accessible to persons with disabilities.
- 7.2 Agencies should also state the website's accessibility level per WCAG 2.0.
- 7.3 Agencies should also refer to [e-Accessibility Policy](#) of Qatar.

## Part 2: Guidelines

This section provides recommended set of guidelines and approach to developing mobile web and applications.

### Step 1: Develop Agency Mobile Services Plan

The first step towards a mobile environment is the creation of a Mobile Services Plan for your Agency.

#### 1.1: Understand and define mobile users' needs and prioritize for deployment

- 1.1.1 While there is a huge potential to delivering various mobile services, the first step is to understand and define your users' needs. To do this, Agencies should first list down their target users and their requirements. For example: Who are they? What is the user need? What drives them? What are their demographics? For example, a narrowly focused user base could be targeted well with customized mobile services, while if your user base is broad, you would attempt to reach as many as possible. Mobile phone technology and functionalities have changed and evolved which also influence the consumption behavior of mobile users. As a government agency, your target users can be grouped as follows:



- 1.1.2 Grouping your users into two main categories is useful in formulating your Mobile Services Plan because each group has its particular needs and characteristics:
- Define what's the target users' needs and requirements and define what are the outcomes/ problems that you are trying to address.



- Can the users' needs be met through a website or a web application implementing responsive design or does the idea requires a specific feature of a mobile phone or platform?
- Is this user need of sufficient importance to your target user group and justify the lifetime cost of your proposed mobile services/application approach?
- Is there evidence of demand for this type of applications amongst your target users? You should have supporting data or information, e.g. similar applications that have proven popular with your target audience. For example, if a native application is to be developed, will the target user download and use it frequently.
- Is there supporting information and study to justify building a mobile application for the platform you are proposing to do this for? E.g. data that shows proportion of visitors to your content/service that currently access it using relevant devices.

1.1.3 Once you have identified the target groups' user needs, identify what may be the gaps and opportunities for mobile channel delivery, develop usage and case scenarios and list of initiatives for delivery. Prioritize the most important applications by assessing the needs and requirements against the degree of complexity. By knowing what is important, we can develop applications and services that deliver maximum business value and higher customer satisfaction.

## 1.2: Project Justifications/Assessments

- 1.2.1 As Agencies consider if mobile applications should be provided to better serve the users' needs, Agencies should follow an internal process for determining whether there is sufficient justification for each project implementation in view of the costs and time/efforts required to support each application.
- 1.2.2 Key questions to help guide you in this assessment include:
- i) What is the frequency of usage of your proposed mobile application? E.g. a user may use an application intensively throughout the day, or it may only be used occasionally.
  - ii) What is the nature of the service, e.g. are they input intensive?
  - iii) What is the need of the targeted audience e.g. the young and tech savvy?
  - iv) What is the transaction volume or value of the service, e.g. are they very heavily used with high volume or do they carry high financial value?

- v) What is the nature of the expectation of the users e.g. do users expect to access the services anytime, anywhere and on-the-go?
- vi) Does the application have features heavily dependent on unique mobile specific capabilities? E.g.: location services, camera, etc.
- vii) What is the sensitivity of the data that will be accessible by the mobile solution?
- viii) What are the potential consequences if there is any data leakage?
- ix) In case of internal users facing mobile applications, do we have a mobile device management capability in place?

1.2.3 The mobile services roadmap is a communication tool and an execution plan. It is important that such an implementation plan be developed in collaboration with all key stakeholders and business line. The plan should be reviewed and updated along with changes in user needs and technological developments.

### 1.3: Agree on Portfolio of Prioritized list of Projects and Timeline

- 1.3.1 Once the business owners have identified their projects which are required to be mobile enabled to support, the Agency's desired business direction, costs and associated benefits identified, a facilitation of decision over which projects will go ahead, and which will not, can be performed.
- 1.3.2 At this stage, the goal here is to use the information which have been collected at Step 2 above and make a prioritized list on which projects to go ahead and which will not and also determine the timeline.

Business Owner/ Department	List of Agreed Services	Timeline	Estimated Cost

### 1.4: Conduct Policy and Process Review

- 1.4.1 Effective mobile services development requires businesses to rethink business processes and how one can take advantage of the benefits that mobile technology offer.

Policies and processes need to be reviewed and streamlined because there are different considerations for mobile delivery.

- 1.4.2 Agencies should review the entire service delivery flow. This includes processes, exception handling and how it should synchronize with the online and other channels. For example, question the need for reviews, approvals etc., so as to remove non-value adding steps and reduce processing steps and time. Consider verification against backend database instead of asking customers to enter or input data or submit documents.
- 1.4.3 For the most impactful mobile apps, the business process associated with the applications should fundamentally alter or extend the existing business process offering, either with greater efficiency or new capabilities not associated with the current business process. The mobile applications should make the work faster and better for the customer/worker. Don't simply extend existing applications — make them better for the mobile channel. This may even mean making changes to the other processes automated in that application, and the integration with existing systems of record. Hence, you need to question the underlying assumptions and basis of the policies which may have changed over time.

#### **Step 1.5: Supporting Governance, Privacy and Data Protection Policies**

- 1.5.1 Agencies should consider privacy implications before selecting and deploying a mobile solution. Agencies must ensure the security of sensitive data and personal information attached to applications, and mobility complicates this objective. Mobile devices can be particularly susceptible to being compromised, and the inevitable breaches would undermine the people's confidence in mobile applications.
- 1.5.2 Privacy considerations can be evaluated by asking the following questions:
  - i) What are the privacy implications of tracking mobile devices?
  - ii) How will the mobile solution provide privacy and content notices to users prior to using the systems?
  - iii) What privacy risks and data breach risks are associated with solutions that have peripheral functionality (camera, video, geo-location, etc.)?
  - iv) How will the agency address privacy and safety risks of using location information?
  - v) How will the solution protect personal data in the case of personal use of government-furnished equipment devices?

- vi) What data do mobile applications collect and how is that data used? Can the mobile application leak sensitive data to a third party?
- vii) Is there a risk of a mobile device exposing information belonging to other users of the same mobile system?

1.5.3 Policies and procedures will be required for identifying, handling, and accessing personal data on personally owned devices. Agencies should consider putting in place policies and procedures to address who can access information about the location of a mobile user, when they can access (e.g. business hours). On its mobile website/applications, Agencies should include their privacy statements, including giving notice to mobile website/apps' visitors about how the Agency collects and uses personal information, thus ensuring the agency is complying with privacy laws and principles, and at the same time gains public trust and confidence. Agencies should also include on its mobile apps, its terms of use include any disclaimers, copyright clauses, privacy clauses, etc. (Please also refer to MOTC's Government Websites and e-Services Framework.)

## Step 2: Decide on the Implementation Approach

Unlike the standard desktop environment of Windows PCs, the mobile channel is characterized by a variety of operating systems and device types, all evolving at different rates. Within this rapidly evolving environment, success depends on quickly delivering applications with the quality and features that users demand, across a wide range of screen sizes, presentation formats and device capabilities.

The rapid growth of smart phones and release of new tablets (including iPads and Microsoft Surface, etc.) have made choosing the right mobility solution more complex. There have also been many advances in the technologies used for developing mobile applications. Choices now range from mobile web apps using HTML5 or frameworks like jQuery Mobile or Sencha to native apps for multiple iOS and Android versions, and Windows Phone to cross-platform frameworks such as IBM Worklight, PhoneGap, RhoMobile, Titanium Appcelerator, etc.

The mobile application architecture you choose dictates how quickly and cost effectively you can release new and updated mobile apps to your target user base. Many factors come into play when choosing the best mobile application environment for your app. Here is a quick overview of the mobile application types. Agencies need to understand what capabilities are important before investing in a particular approach.

## 2.1: Select Mobile Environment

One of the main decisions that Agencies will have to make is selecting the right mobile environment to reach your targeted audience. Mobile application implementation is effectively a trade-off between resources available and the user experience required. The relations between user experience and resources requirements for various mainstream implementations of mobile applications are illustrated in Figure 2 below.

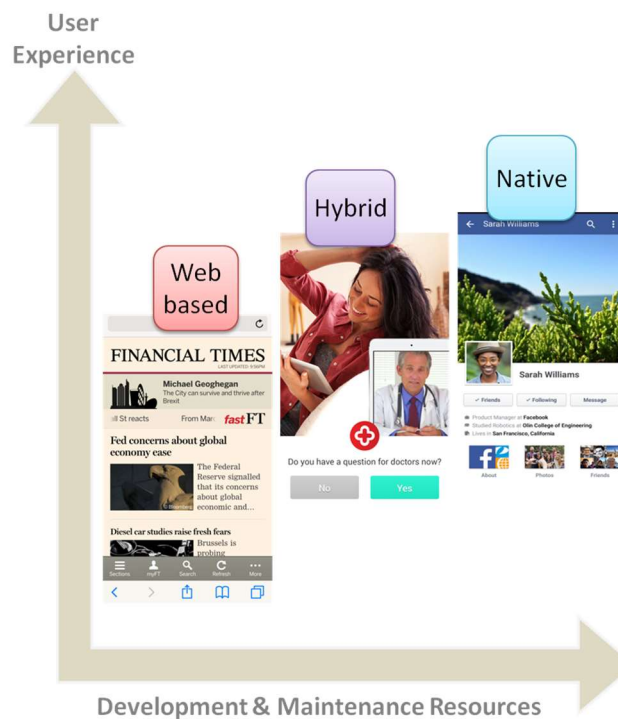


Fig. 2: Characteristics of Mainstream Implementations of Mobile Applications

### 2.1.1 Native Applications

Native apps are purpose-built software applications designed to run on specific mobile operating systems (OS), such as iOS, Android and Windows. These applications require a device-specific download from a marketplace, such as the Apple, Windows or Google store. An application developed for one OS cannot be directly reused for another OS. Thereby it takes the most amount of resources to support multiple mobile OS. However, as native codes can directly tap on device hardware and software features (e.g. GPS-

enabled location services, camera), properly designed native applications offer users the best experience in terms of speed and supported features.

Key benefits of native app is its access to device features and functionality which will allow you to deliver a very complex user experience such as gaming or multimedia applications. However, development costs can be high, and timelines can be long, due to extensive hand-coding. There is a need to build and maintain a different code base of the same app for each OS. Version distribution can be slow due to the app store approval processes. As separate applications have to be built for each mobile platform, Agencies will need to prioritize build-outs based on the device usage of your target audience.

#### 2.1.2 Web-based Mobile Applications

Agencies can optimize their Websites and Web applications for mobile devices by way of following:

- Modify your agency website to adopt responsive design so that it works better on mobile devices - this means the same version will run on both computers and smartphones;
- Develop a mobile version of your website. People who access your website via a mobile device will be redirected to this version at a separate URL (e.g. *m.xyz.gov.qa*). This way you can target your mobile website to the things people most want to do while they're out and about. You may provide an option to view your full website if they don't want to use the mobile version.
- Agencies should refer to the [\*Mobile Web Best Practices developed by the World Wide Web Consortium \(W3C\)\*](#) which includes comprehensive guidelines for developing websites that work well on mobile devices.
- Web-based mobile applications are positioned on the other end of the spectrum. A mobile web app can be accessed from any device running a web browser regardless of its underlying operating system; e.g. webmail. As the source files are stored on a server, Internet connection is required but downloading or installation is not necessary.
- They are web pages with added interactivity and device access functionality implemented using HTML5, Javascripts and CSS to emulate the look and feel of native applications. Web applications used to have significant drawbacks due to its

inability to access device resources such as contact book and camera, and the lack of support for gesture recognition and push notifications. Nevertheless, the scale has become less skewed with the introduction of HTML5. The latest web markup language supports many features that used to be exclusive to native applications. This is due to the high portability of HTML5 codes across various device OS and screen sizes, web-based mobile applications require the least amount of resources for code development and maintenance. One code base can run on devices that support HTML5 web browsing technology, which is compatible with virtually all web browsers used in smartphones and tablets.

- The benefits of developing a web based mobile app is that Agencies need to maintain only one code base and the app is available to users regardless of their device platform or underlying operating system. New versions and updates are instantly available and users do not need to install the app. However, such apps will have limited access to device native features and functionality.

### 2.1.3 Hybrid Mobile Applications

Hybrid mobile applications stand in between native and web-based mobile applications in terms of resource requirements and supported features. Hybrid apps, like native apps, run on the device itself (as opposed to inside a browser), but are written with web technologies (HTML5, CSS and JavaScript). More specifically, hybrid apps run inside a native container, and leverage the device's browser engine (but not the browser) to render the HTML and process the JavaScript locally. A web-to-native abstraction layer enables access to device capabilities that are not accessible in mobile web applications, such as the accelerometer, camera, and local storage. [Gartner recommends a hybrid approach](#) for business-to-employee mobile apps. Business to customer hybrid apps are also very popular, e.g. Gmail, Uber, Twitter, Instagram, Apple App store.

As shown in Figure 3, hybrid application implementation embeds HTML5 functionality in native containers. Consequently, hybrid applications have the flexibility of web-based ones and the ability to fully interact with device hardware and software objects, making it ideal for applications that require relatively shorter time-to-market and ease of enhancement. Please refer to related references HTML5 (<http://www.w3.org/TR/html5/>).

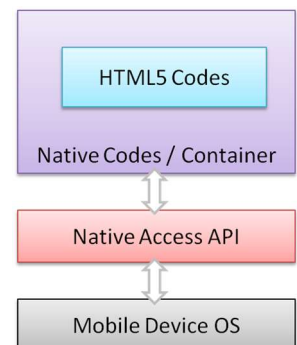


Fig 3. Hybrid Application with HTML Codes Embedded in Native Container



#### 2.1.4 Native vs Web-based vs Hybrid Apps

As is true with most technology selections, there's no one-size-fits-all answer when it comes to the type of mobile app to develop. In choosing the right mobile application platform, Agencies should consider the following factors and should ask the questions in making its decisions:

- Who is your target audience?
- Are they more likely to prefer a mobile web or a native app?
- What is the size of the user base and the type of Devices mostly used?
- What is the user requirement that only a native/hybrid app can meet, e.g. devices features and requirements?
- Do you need access to the device's sensors?
- Do you need to support older devices with poor performances?
- Do you need to support multiple operating systems as the costs increases with each OS that you support?
- Does meeting this need justify the lifetime cost of a native or hybrid app? Consider the cost and time of development
- Will the target users download and use the native apps regularly?
- What is the security level required in terms of access to data and information?
- What development resources do you have and which mobile technologies are they most familiar with?

A comparison of native, web-based and hybrid implementation of mobile applications is tabulated in Fig. 4 in terms of user experience, ease of distribution, resource requirements and level of security.

Native implementation is most suited for applications which require rich user experience, high level of user interactions and access to multiple device peripherals. However, one particular issue with resource requirement for native application development is that even among devices that use the same Android operating system, different device manufactures have their own customizations. This can present a significant challenge to developers as they need to test their native codes on the variety of makes and models of Android-powered smartphones and tablets.



		Mobile Application Implementations		
Considerations		Native	Hybrid	Web-based
User Experience	Online & offline	Yes	Yes	Limited (HTML5 cache)
	Gesture support	Easier	Easier	Harder (Javascript)
	Interactivity	Higher	Higher	Lower (Javascript)
	Latency	Lower	Higher	Higher
	Push notification	Easier	Easier	Browser dependent
	Device access (Camera, Contacts, GPS etc)	Full	Full	Most (HTML5)
	Launch in device	Dedicated icons / tiles	Dedicated icons / tiles	Browser bookmarks
Distribution	Discovery	Harder	Harder	Easier (Web search engines)
	Distribution	App Stores (Public, Dedicated)	App Stores (Public, Dedicated)	URL (Web browser)
Resources required	Approval	App stores	App stores	None
	Time to market	Longest	Moderate	Shorter
	Code portability	Lowest	Moderate	Highest (1 code base)
	Ease of bug fixes	Harder	Moderate	Easier
	Ease of adding new functions	Harder	Moderate	Easier
Security	Security concern	Lower	Moderate	Higher

Fig 4. Choice of Mobile Application Implementation Based on User Experience, Distribution, Resources & Security

Generally speaking, the mobile web route is faster and cheaper than the native app route, especially when the objective is to support a wide range of devices. With the rapid advent of HTML technology, web-based applications are catching up steadily with their native counterparts. A well-design web-based application with proper use of HTML5 caching, CSS and embedded JavaScripts should have very close look and feel as the

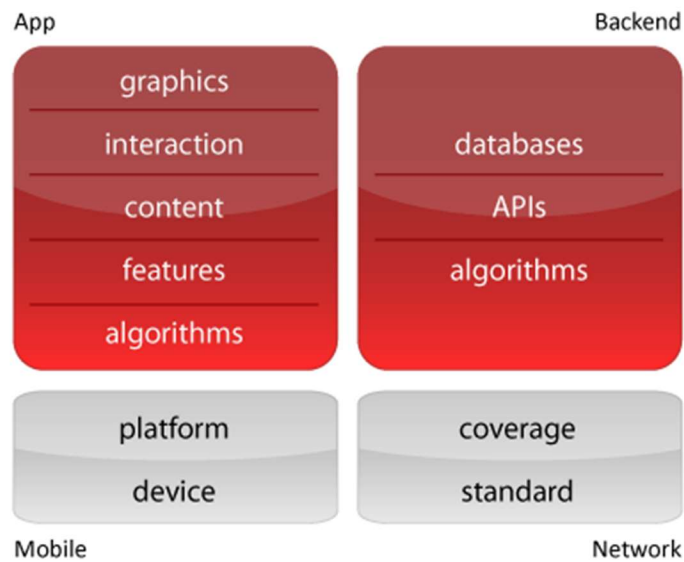
equivalent native application. Perhaps the biggest concern of web-based applications lies with its security. Malicious codes may gain access to device hardware and software objects through web browsers – legitimate applications may unintentionally enable native access for untrusted third-party codes.

Hybrid implementation remains a very attractive option that offers the advantages of both the powerful native applications and the flexible web-based implementation. Hybrid applications are characterized by their less frequent updates for bug fixes and functionality enhancement. Because of this advantage, many organizations tend to choose hybrid or purely web-based implementation for newly deployed mobile applications. They would subsequently switch to native implementation as the deployed applications have attained significant levels of stability and user adoption.

As mobile applications become more competitive and fragmented, some developers are turning to cross-platform open source development solutions. A number of mobile operating systems are now open source. The Open Mobile Consortium is a community of mobile technologists and practitioners working to drive open source mobile solutions for more effective and efficient humanitarian relief and global social development. Their goals are to implement joint mobile solutions in the field, maximize interoperability and data-sharing capabilities between technologies and streamline development, deployment, and use of open source mobile technologies. They share code, standards, plans, progress, and lessons learned.

## 2.2: Design App for Optimal User Experience

The most important thing to keep in mind when designing a mobile app is to make sure it is both useful and intuitive. Mobile user experience encompasses the user's perception and feelings before, during and after their interaction with a native app or mobile website. The perception of performance is based on start-up time, page-loading behavior, smoothness of transitions and animations, errors, and waiting times. The figure below illustrates these factors: the "app" (with its graphics, interaction, content, features and code) runs on a "mobile" device with certain technical capabilities (screen size, GPS, camera, etc.) and a platform (Android, iOS, etc.). The app connects over a "network," to access the "back end."



Source: <https://www.smashingmagazine.com/2011/07/seven-guidelines-for-designing-high-performance-mobile-user-experiences/>

Following factors should be considered in designing mobile app with the objective to provide optimal user experience.

- 2.2.1 *One screen, one task:* Reduce the effort users have to put in to get what they want. Every screen designed for the app should support a single action of real value to the person using it. Design each screen for one thing and one thing only, with no more than 1 call-to-action. This makes it easier to learn, easier to use, and easier to add to or build on when necessary. For example, the landing page of the mobile app may provide options to users to select from various service categories or services. Subsequent pages shall deliver one service each in a simplistic manner.
- 2.2.2 *Invisible user interface:* Focus on the content and remove unnecessary elements that does not support user tasks. Users should be guided to the content they're looking for quickly due to reduced attention span. Content becomes an interface. Google Maps is a great example — during a redesign phase Google removed all the unnecessary panels and buttons and Google said that the map is the interface.
- 2.2.3 *Breathing space:* White space or “negative space”, referring to the empty space between and around elements of a design or page layout is an essential element in mobile design. Not only is white space responsible for readability and content prioritization, it also plays an important role in the visual layout. Thus, it can simplify UI and improve UX.

- 2.2.4 *Make navigation self-evident:* Mobile navigation must be discoverable, accessible, and take little screen space. However, making navigation accessible is a challenge on mobile due to the limitations of the small screen and to the need of prioritizing the content over chrome. Tab bars and navigation bars are well suited for apps with relatively few navigation options. They are great because they display all major navigation options and with one simple tap user can instantly go from one page to another.
- 2.2.5 *One hand operation:* Adapt your design to the bigger screens. With the release of new smart phones, it is evident that screen sizes are going to keep expanding. Below are three basic ways of how people hold their phones:

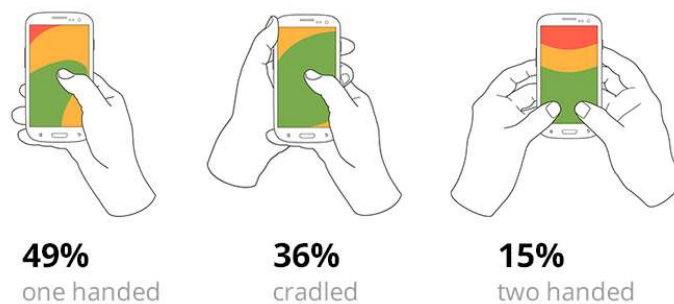


Fig 5. Basic ways of how people are holding their phones

85% of observed users worked with their phones using one hand. To further understand one-hand usage across different screen sizes, the following research may be referred. The heat map below shows sorts of the thumb zones applied to various display sizes. It can be seen that the bigger the display is, the less easily-accessible zone is.

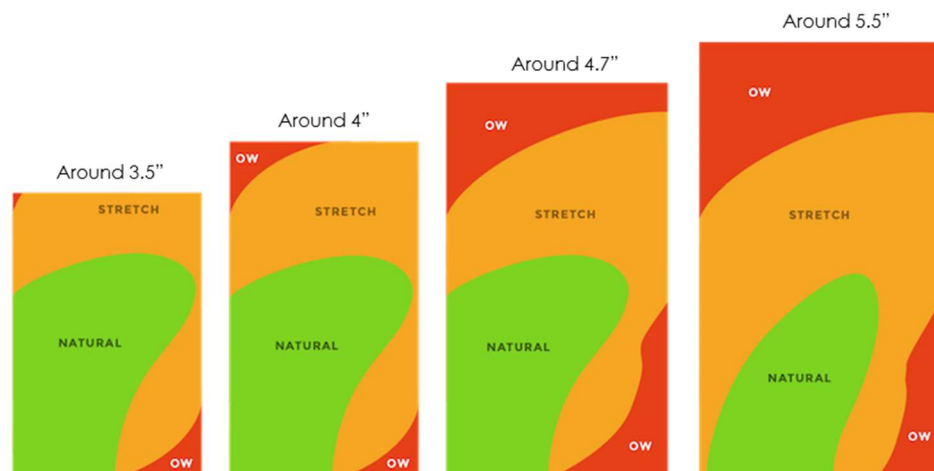


Fig 6. General thumb zones across different mobile screen sizes

It is necessary to adapt a design to improve the user experience. Try to make sure that the app can be easily (and fully) be used on a large screen with one hand. Place navigation options within the thumb's reach.

- 2.2.6 *Make app appear fast:* Try as much as possible to make the app fast and responsive. Do things in the background to make it look like actions are fast. Actions which are packed into background operations have two benefits - they are invisible to the user and happen before the user actually ask for them. A good example of this is uploading pictures on Instagram. As soon as the user chooses a picture to share, it starts uploading. Instagram invites the user to add tags as the picture uploads in the background. By the time when users will be ready to press a share button, upload will be completed and it'll be possible to share their picture instantly.
- 2.2.7 *Optimize battery life:* By taking steps such as batching network requests, disabling background service updates when connectivity is lost, or reducing the rate of such updates when the battery level is low, the impact of an app on battery life can be minimized, without compromising the user experience.
- 2.2.8 *Use push notifications wisely:* Users are bombarded with useless notifications every day that distract them from their day-to-day activities. "Annoying notifications" is the #1 reason people uninstall mobile apps (71% of respondents):

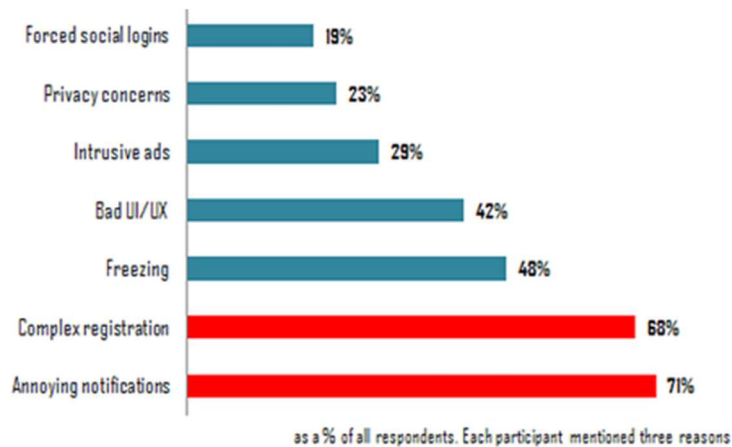


Fig7. Top 7 reasons why people uninstall mobile apps as per Appiterate Survey

Therefore, notifications should not be sent "for the sake of engaging them". Send them if and only if you think they are valuable to the user. The best way to establish an effective mobile app messaging strategy is to use different message types-push notifications, email, in-app notifications, and news feed messaging. Diversify your

messaging - your messages should work together in perfect harmony to create a great user experience. Select proper notification type based on urgency and content.



*Fig 8. Usage of appropriate notifications*

- 2.2.9 Follow industry user interface guidelines and government regulations (like 508) in the development of your mobile product.
- 2.2.10 Develop security and privacy guidelines with regard to what the app does/how it protects user data and government systems.
- 2.2.11 Agencies should refer to UI guides as provided in [Appendix A](#) for designing mobile apps. Every platform has its own UI and usability guidelines that every user is expecting on the mobile apps. The appendix provides various official user interface (UI) and links to user experience (UX) guidelines from the manufacturers.

### Step 3: Develop, Test, Launch and Maintain

Once Agency has developed its Mobile Services IT Plan and decided on the mobile implementation approach, whether you choose to outsource or in-house develop them, following agile-based mobile application development approach should be followed. The method has the following key characteristics:

- “Iterative” and “Incremental” method;
- The overall delivery is spread over various “sprints” each with a defined set of features/use cases;

- “Continuous Delivery” and “Continuous Integration” is employed to maximize the outputs of each phase and better manage scope, risk, and schedule impact.

The following diagram illustrates the key elements of the Agile method:

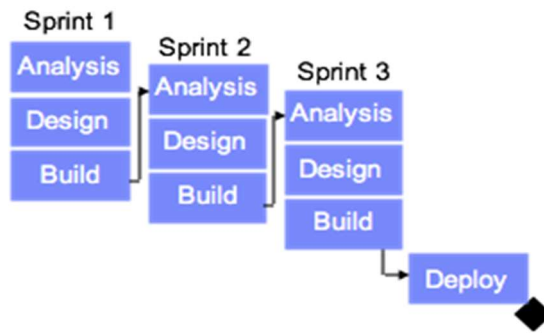


Fig 9. Usage of appropriate notifications

### 3.1: Discovery

- 3.1.1 During this phase, business specialists and system architects work hand-in-hand with identified key business stakeholders to identify and derive the user and system requirements, cost-performance analysis, select application implementation, and devise high-level functional flows which will fulfill all identified user and system requirements and constraints.
- 3.1.2 It includes data gathering of the business needs, integration points, business visual design considerations, existing process issues and optimization ideas. In this phase, the high level system use cases are defined and agreed upon and their prioritization throughout the project delivery, based on factors to be agreed then.
- 3.1.3 The user-interface (UI) designers will come up with high level UI designs that will maintain the Agency’s looks and feels while maintaining high level of usability. UI designers will need to discuss with business specialists and system architects for fine-tuning functional flows in order to maximize usability. At this stage, UI designers should come up with prototypes to showcase application interfaces and functional flows to stakeholders and potential users, whose feedback will be valuable in further enhancing usability. Detailed UI artifacts will be planned for and developed prior to each sprint.



### 3.2: Sprints Planning

- 3.2.1 There will be an initial “sprint planning” focused on the use cases for the mobile application, with direct applicability on the planning of each sprint. The detailed requirements will be defined at the beginning of each sprint and should be aligned with the high level requirements defined in the initial phase.
- 3.2.2 The proposed planning for the sprints might get changed after the ending of the initial sprint planning phase, when more clarity on the use cases, complexity and dependencies on the back-end are available. At the beginning of each sprint, the features will be further decomposed into tasks with acceptance criteria and added into backlog items. The change of any sprint duration will be agreed by the product owners and will be handled by the scrum master.

Sprints Typical Activities:

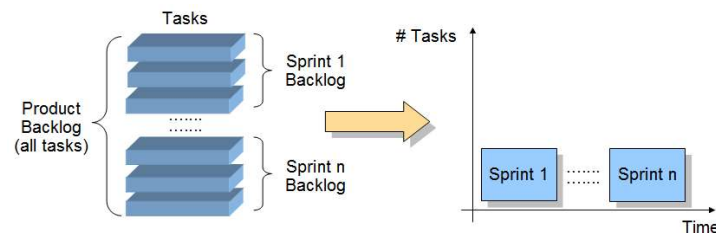


Fig. 10: SCRUM Approach Principles

### 3.3: Sprints Build and Test

- 3.3.1 All sprints start with a planning session, where the use cases are being selected from the product backlog and assigned to the sprint. The scrum master will evaluate the required duration that will be communicated to the product owner who will get business agreement. This constitutes the agreement of the functionality to be developed for that sprint.
- 3.3.2 Following the sprint planning session which will be attended by the product owners at the beginning of any sprint, detailed user interface development and design begins for the agreed sprint use cases. Each sprint will have a clearly defined number and scope for each user interface to be designed and developed.
- 3.3.3 The sprint use cases development will start based on the agreed timeframe. Test cases are planned based on the sprint business scope (selected use cases). Code developers will write the codes based on the specifications finalized in the previous phases. Choice



of client-side programming languages and development environments would depend on an array of factors including implementation choice, devices to be supported, as well as functionality, speed and security specifications. Coding for server-side components must take into consideration of loading (e.g. worst-case throughputs and concurrent usage) and security (e.g. data protection by way of encryption and VPN, identity management, proper handling of location information, use of firewalls and de-militarized zones) requirements.

- 3.3.4 At the end of each sprint, system integration testing (SIT) activities for the uses cases for the sprint are performed to ensure the developed functionality works in the customer environment. The agencies will be allowed access to the testing environments of all back-end solutions to be integrated with.
- 3.3.5 After SIT, the scrum master will conduct demo of the app(s) to the business product owner(s). The feedback will be incorporated in the subsequent sprint based on agreement between the product owners and prioritized accordingly in the sprint planning before the start of a particular sprint.
- 3.3.6 Upon functional testing and SIT execution, the test results are shared with the business. In the absence of severity one (1) defects, the use cases development is assumed complete and any remaining defects will be assigned to the next sprint or missing features will be added to the product backlog.

#### **3.4: UAT and Deployment**

- 3.4.1 User Acceptance Testing (UAT) is performed (full regression testing) by business users with the agency support for defect fixes for all the sprints. Mobile application under test (AUT) must be properly packaged for distribution. In the backend, suitable staging environment should be created in a non-production segment of the network. Beta test users are selected to approximately represent the demographic spread of the pool of intended users. Test users will be provided with user account details, as well as easy-to-follow instructions on the basic functions of the AUT. In addition, expectation of what need to be tested should be communicated to the users. Test cases will be devised to facilitate evaluation of system and server performance. Upon the completion of this test phase, responses and feedbacks are compiled for reference in the next iteration of code enhancement.
- 3.4.2 The business product owner is required to approve the product production deployment or provide comments in due time as per the project procedures.

- 3.4.3 After approval is granted, production deployment is performed by business IT team with the agency support. The mobile application is then signed and submitted to the respective application stores for approval. App stores could either be public or dedicated stores set up by respective agencies. It is recommended to conduct a soft launch for one final round of pre-launch testing before it is released to the intended users.

### 3.5: Maintenance

- 3.5.1 The released mobile application should be monitored for any unexpected glitches and issues. Bug fixes should be carried out and updates to be released at suitable times. However, Agencies should be reminded that the release of updates at excessively frequent intervals may annoy the end users who may choose to ignore or even disable update notifications.

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## ***Appendix A – References to UI guidelines***

List of references to various industry UI guidelines with hyperlinks:

- 1) [Android Best Practices](#)
- 2) [Android Best Practices for Performance](#)
- 3) [Android User Interface Guidelines](#)
- 4) [Apple Coding Guidelines](#)
- 5) [Apple UI Design Do's and Don'ts](#)
- 6) [Google Material Design guidelines](#)
- 7) [iOS Human Interface Guidelines \(iPhone, iPod and iPad\) – PDF version](#)
- 8) [Layout for Universal Windows Platform apps](#)
- 9) [UI Guidelines for BlackBerry 10 Smartphones – PDF version](#)
- 10) [Windows Touch UI Guideline](#)