Research Paper

Enterprise Mobility Best Practices

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ABSTRACT: *Enterprise mobility has a long way to go with unexplored and untapped areas. And its market is too big to ignore. Ubiquitous mobile and internet usage have transported enterprise mobility towards ocean of opportunities. A massive growth has been observed in the sale of smartphones and tablets. With capabilities beside quad core processor, decent memory and bigger screen size, smart devices are ideal for personal and professional use. Gadgets owned by the target user – employees, partners, distributors, contractors and customers – are smarter than the technology options provided by the enterprises, which is a huge challenge for the enterprises. Organizations are trying hard to come up with an efficient, secure, and usable catalyst across multiple platforms to meet the expectations and demands of the target users. This paper defines Enterprise Mobility and its best practices.*
Keywords: EAS, Enterprise Mobility, EMM, MAM, MDM

I. INTRODUCTION

Enterprise mobility is a term applied for complete range of mobile solutions, designed for business to be used by enterprise users (Partners, Customers, Distributors, Contractors and Employees)

Needlessly, it can be said that "All the solutions working within enterprise which possess mobile component comes under ENTERPRISE MOBILITY". Thus, all the VoIP solutions (hardware & software), mobile data and voice plans, mobile applications etc. would also be a part of enterprise mobility. Where majority of chunks of mobile applications are developed to serve enterprise objectives at distinctive business levels.

Enterprises would require mobile centric services, consulting and respective solutions from SME (Subject Matter Expert). Broadly enterprise mobility can be classified in three stages.

[I.] Mobility Strategies: Well-defined enterprise policies are required for identification of any strategy. Enterprise policies are important in view of security and management perspective. Also, it gives direction for solutions design and their offerings. Mobile offering is a part of overall enterprise strategies, which is required to be identified and well-defined before planning further actions. These strategies are the enablers for transforming enterprise, to exploit market business opportunities. Mobile strategies would drive the path for enterprise mobility.

[II.] Mobility Solutions: Enterprise would necessitate different catalysts as per business flow and execution cycle. These catalysts may or may not possess mobile offering. However, in today's era, it is unavoidable to plan solution without mobile perspective. Enterprise mobility focuses on mobility roots for the containment of mobile products, solutions and services.

[III.] Mobility Management: Designed and implemented solution's management emphasize on certain aspects. They are infrastructure requirement, their setup, processes & resources for execution etc. Mobile can be one of the cause for security menace which requires concentrated approaches and catalysts to maintain enterprise data secure and manageable.
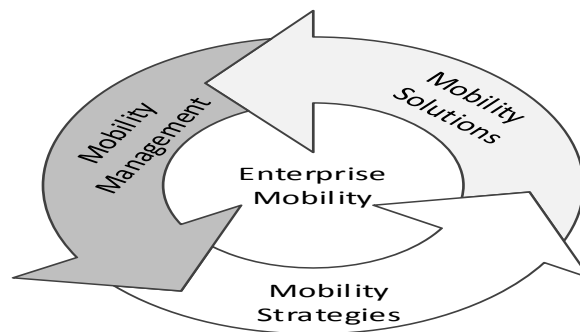
Diagram illustrates the three distinctive stages of enterprise mobility in circular direction. These three classified stages work in a circular way in enterprise while execution. Strategies are built over the time. They get mature with end user feedbacks, results and business oriented reports. Solutions are also updated over the period with versatile innovations, emerging technologies and market trends. Management feature and support are outcome of emerging and evolving essentials from strategies and solutions.

II.   BEST PRACTICES

It is challenging to bound enterprise mobility with technologies, solutions, platforms, frameworks and domains. And it is complex to define guidelines for unbounded surface. Though, there are some best practices or approaches which can be considered while working for any enterprise mobile solution. Following are the nine best practices for pathway to enterprise mobility.
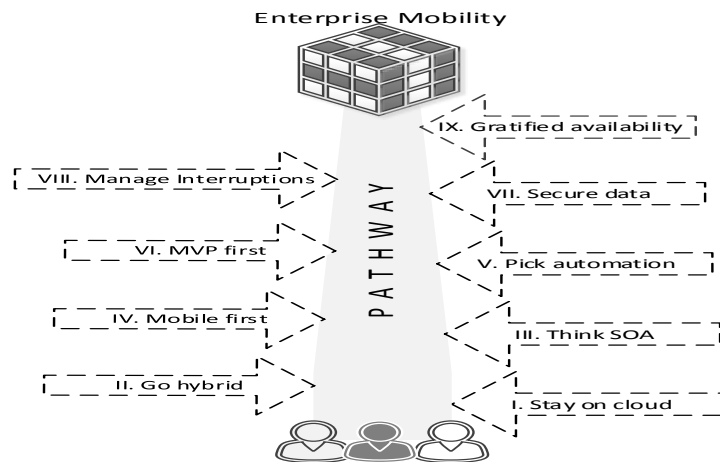
III.   STAY ON CLOUD

Technologies for Enterprise Mobility is not limited or bounded anymore. There can be traditional old approaches or legacy systems working for enterprise, or it may be an emerging ecosystem. Following are the three approaches for solution components deployment:

[I.] On-premise: In this scenario, deployment is done under enterprise secured network, data base store, and access. Everything comes under enterprise network and premises. Here enterprise manages all the deployed components. It can be outsourced also, but with well-defined policies and security mechanism. This approach requires infrastructure setup and management at enterprise premise. These on-premise systems can be customized as per enterprise system state.

[II.] Cloud: One of the popular and proliferating approach with emerging demand is cloud computing. Cloud hosting means accessing data and services via online rather than accessing data and services from in-house network. This basically facilitates enterprise data and applications hosted on cloud. These cloud system are customizable & scalable as per enterprise objectives. Cloud computing avails software components as a service to client or users. These clouds can be private cloud to enterprise, or even separate hosting on public cloud. Combination of private and public cloud can also be feasible options for enterprises. SAAS

(Software as a Service) is a wide consideration for enterprise. There are multiple technical aspects with cloud computing, besides distributed database, multi tenancy etc.

[III.] **Hybrid:** It's not always feasible for enterprise to go with on premise or cloud hosting for all systems required for their execution. So combination of both as per enterprise system state is known as Hybrid. This gives advantages of both the hosting approaches and reduces dependency on one solution approach. Hybrid approach introduces versatile flexibilities to enterprise, besides secure data and services hosting, at on-premise, while adequate information can be shared via cloud hosting.

Infrastructure setup is the big bottleneck for enterprise mobility solutions, and one of the major concern from enterprises. Cloud computing have revolutionized the way of software application implementation and infrastructure support. Proliferating cloud computing can be married with growing enterprise mobility. Together they can serve the imperative objectives of enterprise for scalability, extensibility, and flexibility. Enterprises can leverage their own private cloud or host their services on public cloud. Enterprise mobility solutions can also opt for already existing Software as a Service (SAAS) based Enterprise Mobility Management (EMM) solutions. Enterprise mobility with cloud will be the driver in future for enterprises.

IV. GO HYBRID

Mobile applications broadly can be divided into two forms as "System Applications" and "Third Party Applications". System applications are those applications, which comes in-built with mobile operating system or platforms. However, third party applications are those applications, which are implemented and installed by developer community.

System Applications: Application implemented with NDK (Native Development Kit), which can be integrated with mobile platforms or OS are system applications. Each platform provides NDK or other approaches for implementing system applications. Applications provided by default from platform on devices are system applications, which are either implemented by platform community or partner vendor. For example, Android provides NDK which supports system applications implementation via C/C++ programming language, while Android SDK (Software Development Kit) supports native application implementation via Java programming language. System applications are efficient enough to program application at hardware level interactions and optimizations likewise memory, process, execution etc.

Third Party Applications: There are several development approaches for implementing third party mobile applications. It can be classified in three types as, Mobile native applications, Mobile web applications, and Mobile hybrid applications

Mobile Native Applications: They are also known as "Thick client" applications. These applications are implemented via mobile device platform native technologies (Android, IOS, Windows Phone or Other). Here are the imperative characteristics for mobile native application:
[I.]   An executable file installs and resides at the mobile device
[II.]   Executed directly by mobile operating system
[III.]   Able to use mobile platform or operating system API's
[IV.]   Distributed via platform specific application store or via enterprise distribution mechanism

Mobile Web Applications: They are also known as "Thin client" applications. These applications are implemented with web technologies (HTML, CSS and Java Script). Some imperative characteristics for mobile web application are:
[I.]   Applications are executed by the device browser of mobile operating system
[II.]   Application can leverage only limited device features for application implementation
[III.]   Application doesn't carry any executable file which can be installed or removed from mobile OS

Mobile Hybrid Applications: Hybrid applications are neither native applications nor web applications. They are implemented with web technologies and packaged as applications for distribution. These applications can access native device features and API's. Basically hybrid application is native mobile application which hosts a web browser control within its main UI screen. Here are the imperative characteristics for mobile hybrid application:
[I.]   UI implementation using web technologies (HTML, CSS and Java Script)
[II.]   Applications are capable to use mobile platform or operating system API's
[III.]   An executable file installs and resides at the mobile device
[IV.]   Application can be distributed via platform specific application store or enterprise distribution mechanism

There are many frameworks and tools for hybrid application development. Major selling point for hybrid application is cross platform development. Following are the features which can be leveraged with mobile hybrid application:

[I.] Integration of Open Source frameworks with HTML5
[II.] Liquid layouts for multi-screen UIs
[III.] Local storage, multimedia handling, semantics and forms, graphics, etc.
[IV.] A single code-based architecture model for multi-platform presentations
[V.] Hybrid framework that bundles the HTML5 based view layer, with native platform containers, to create deployable builds

Other Applications: There are other distinctive ways of information communication to mobile devices, like SMS (Short Message Service) and IVR (Interactive Voice Response).

Improved and enhanced mobile technology stake grant feature-rich hybrid application development for mobile. Enterprise adoption over Bring Your Own Devices (BYOD) introduces diverse mobile platforms, devices and form factors to be covered while mobile application development. Hybrid is the cost effective and rapid development approach for mobile applications. They can be managed and scaled due to platform independent codebase approach. It is recommend to go hybrid until it is not compulsory to implement native mobile application due to any business or technical reason.

Hybrid mobile applications are the amalgamation of best of breed from native (iOS/Android/WP) and web technologies, frameworks, tools and platforms. Hence, solution architecture, design, and development approach plays pivotal role for mobile hybrid application UI / UX, responsiveness and feature richness.

V.   THINK SOA

Servicer oriented architecture (SOA) is a design pattern for application development. It is not specific to mobile or any technology. It is implementation approach, which emphasizes on service implementation in application architecture. Where a service is independent, loosely coupled and self-contained functionality of a system. It can be integrated with many technologies, frameworks and protocols as per system design.

It is a design pattern and can be used with big data, social, cloud, mobile or other applications. A system can harness many self-contained services which can be repetitively executed by business systems. These services interact with enterprise data sources, components and other modules as per system design. SOA is widely used with mobile and cloud based applications for rapid development and enhancement. It facilitates scalability, manageability, extensibility and robustness in the application architecture. For enterprise it is important to harness pluggable and independent modules / components. SOA is the architecture approach to provide agility for transformation of system as and when needed. It is recommend to design and implement enterprise mobility solution with SOA thoughtfulness. For cloud based mobile application SOA is a rescuer for rapid developments and enhancements.

VI.   MOBILE FIRST

Mobile first is an approach, which emphasizes on design philosophy for mobile applications, or even complete solution approach. There was a time where mobile was considered just as an extension to current working system. It was considered as good to possess kind of offerings. In such approach, applications or solutions were designed with web portal or desktop executable in mind, where some limited features as per priority were extended on mobile for end users.

With proliferating space, mobile has took over user's major time and focus on day-to-day activities. Even mobile are sold more than number of babies born in a day. It occupies personal as well as professional life.

"Mobile First" design philosophy emphasizes on mobile perspective. It is recommend to start designing and thinking for small screen first, then move towards bigger screens. Consider a scenario where complete solution is designed with mobile perspective. Where important workflow with user preferences for system, user's behaviour and interaction-model with heterogeneous mobile platforms are analysed first. On the basis of study result, respective solution approach is designed. Here, design considers mobile UI / UX flow, interactions, behaviour, responsiveness, performance and application overall designs. User delightful experience can be achieved with consideration of certain parameters likewise grid-based visual layouts, visual designs, ratio-based responsive designs, calculated chromes, and contrast ratios. Mobile applications can be designed in two approaches as "Adaptive design" and "App-centric design".

Adaptive Design: This design approach emphasizes more on platform specific guidelines over application design. Here application flow, UI components, interactions models are designed as per platform guidelines. Mobile platforms (Android, IOS, Windows Phone and other) possess their own design guidelines and recommendations. In this approach, same application may look distinct with platform specific mobile devices. It also requires to consider diverse form factors, screen resolutions (Smart Phone, Tablet, and Phablet) and even different OS version specific guidelines (if any).

App-Centric Design: This design approach emphasizes on application branding and flow. It is not driven as per mobile platform specific guidelines. In this approach, mobile application looks same on all mobile platforms. Though, it also requires consideration of diverse form factors, screen resolutions (Smart Phone, Tablet, and Phablet) and common factors on different platform specific guidelines. This design philosophy gives uniqueness to application objective with branding.

Application user interaction and design are the important factor for success of any application. Application ease of use and intuitiveness are the primary factors as per application UI / UX. And mobile is an unavoidable part of enterprise solutions due to its huge adoption over the society. It is recommended for enterprise solution to go with mobile first approach. This requires to think first on small screens. Hence, mobile application and solution are designed and implemented for small screen, afterwards followed by desired bigger screens. Application UI / UX can be designed with application-centric or adaptive designs. However, it is recommended to consider platform specific guidelines while designing.

This approach is also important for overall solution architecture perspective. In general solutions are designed and implemented for full featured web / desktop client, subsequently mobile client applications are extended. This may introduce some architectural limitations at mobile client application in the form of screen design, user interaction, application performance etc.

Mobile first has introduced several benefits and opportunities to explore untapped territory. Significant betterment on ROI can be observed after adoption of mobile first philosophy.

VII.   PICK AUTOMATION

Any task or exercise which requires repetitive execution is an opportunity for automation. At first thought, automation may be an additional consumption of time and money. However, in long run it facilitates extensibility, scalability, and flexibility to the solution.

Under the horizon of enterprise mobility, feature-rich application demands performance analysis and validation of mobile application to verify device CPU, network, memory, battery consumption, application responsiveness etc. It is challenging and time consuming to perform manual testing and verification on diverse mobile platform devices and form factors for diversified geographies, networks and languages. Test automation tools can be a savior to overcome manual testing of these myriad options of platforms, devices, form factors, geographies, networks etc.

VIII.   MVP FIRST

MVP stands for Minimum Viable Product. It is always a point of concern for enterprise to prototype first version of solution with adequate features and investments. MVP first approach is important to cater versatile mobile domain, it may not worth to invest time and money for full featured application at first release. It is recommended to design and implement MVP for first release of application. This helps for control and management of budge. Solution can be designed with integrated analytics tools for user's behavior. And further application and solution releases can be done as per user's real time behaviors, feedbacks, and suggestions which is extremely required for success of any application.

IX.   SECURE DATA

Enterprise data security is one of the primary concern from CIO's, and an important factor for solution design and development. Enterprise application solution should consider proper security mechanism and respective handling. It would consider data on move as well as data on rest at device. Secure enterprise gateway can be implemented as per enterprise maneuver with adequate firewall, secure network communication, preferred network etc. This would also require well defined policies to enforce with enterprise users. EMM suite solutions can be considered for security enforcement at devices.

Data storage on device can be avoided till it is not required. Stored data can also be made secure with storage at application secure sandbox in encrypted format. Memory management at mobile application is also an important perspective for data storage and security. It is recommended to consider micro level memory management for enterprise applications. This would help to avoid any unwanted data storage while application session or offline feature management. Mobile platforms also provides programming guidelines for memory management and it is expected to be followed for enterprise mobile applications.

X.   MANAGE INTERRUPTIONS

There are many interrupts for mobile applications which would demand to be managed gracefully for enterprise grade mobile applications. For example low battery, network availability, application suspend / resume, incoming call, text message, and push notification etc. An enterprise mobile application is expected to manage all such interrupts. They are important for data security and application usage. Mobile platform also provides programming guidelines for interrupt handling and they should be followed while application

development. For example proper memory object cleaning and state management with low battery notification, thread safe process execution, images / audios or other resources release while application suspend. Application state and Interrupt graceful management is required to avoid premature exit of enterprise applications.

XI. GRATIFIED AVAILABILITY

Enterprise mobile application availability and distribution is the final outcome of all exercise. This plays pivotal role for success of solution. Hence, it has to be planned while designing of solution. There are various consumer application stores (Apple Store, Google Play, and Windows Phone Store etc.). Application distribution strategy depends on type of application. For consumer application it can be planned with consumer application stores. However, for enterprise users it has to be planned accordingly, may be Enterprise Application Store. Enterprise specific application distribution platforms are known as Enterprise Application Store. Enterprise prefers to leverage private application stores due to security and user access management. Following are some of the features for any EAS, but not limited to:

[I.]   Application version / life management
[II.]   Submission, certification etc.
[III.]   Defined guidelines for deployment, approval
[IV.]   User profile and access management
[V.]   Distribution management
[VI.]   Cross platform support
[VII.]   Billing management
[VIII.] Alerts, notification, updates (OTA)
[IX.]   Security
[X.]   Analytics & reports
[XI.]   Mobile device / application management
[XII.]   Rating, review & feedback

EAS can be hosted on cloud or on-premise as per system prerequisite. Store features and support may vary as per trends like BYOA (Bring Your Own Application), BYOD (Bring Your Own Device) etc. Enterprise application store is the platform to reach out enterprise users (partners, distributors, contractors, customers or employees). It can even help to increase ROI (Return on Investment) of application portfolio. In absence of EAS, enterprise users have to deal with multiple consumer stores. Application can also be embedded with device before launch in the market by having an alliance with renowned device manufacturer likewise Samsung, Apple, and Nokia etc.

Enterprise has to identify and plan as per device environment like Bring Your Own Device (BYOD), Choose Your Own device (CYOD) or Corporate Owned Personally Enabled (COPE). And corresponding integration of EMM suite solutions like Enterprise Application Store (EAS), Mobile Application Management (MAM) or Mobile Device Management (MDM). In general user may not agree for MDM solution on personal device. Though, MAM solutions can be planned if enterprise opted for BYOD or CYOD. MDM solutions can be planned with COPE, where enterprise applications can be preloaded with devices. Even device customization can be done as per enterprise objective. Renowned application stores (Apple store, Windows Phone store etc.) also facilitates enterprise grade application distribution features, these can also be considered while designing solution.

XII. CONCLUSION

Mobile applications have changed the focus from what's on the web, to the applications on mobile device. Mobile applications are no longer an option; they are now an imperative need, even a measurable ROI (Return on Investment) for enterprises. Many factors play a crucial role in enterprise mobile strategy. Namely device management, online / offline behavior, timely upgrade, data security, extensibility, scalability, and multi-platform supported application. Enterprises objective to consider all these factors while finalizing a strategy and execution is all about Enterprise Mobility.

References

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