

## A Survey on Architectures of Mobile Operating Systems: Challenges and Issues

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**Abstract:** *In the early years of mobile evolution, mobile devices are enabled only with voice services that allow the users to communicate with each other. But now a days, the mobile technology undergone various changes to a great extent so that the devices allows the users not only to communicate but also to attain a variety of services such as video calls, faster browsing services, 2d and 3d games, Camera, Banking Services, GPS services, File sharing services, Tracking Services, M-Commerce and so many. The changes in mobile technology may be due to Operating System or Hardware or Network or Memory. This paper presents a survey on evolutions in mobile developments especially on mobile operating system Architectures, challenges and Issues in various mobile operating Systems.*

### 1. INTRODUCTION

A Mobile operating system is a System Software that is specifically designed to run on handheld devices such as Mobile Phones, PDA's. It is a Platform on top of which the application programs run on mobile devices. Each Operating System follows its own Architecture. Mobile devices evolved the way users across the globe leverage services on the go from voice calls to smart devices which enables users to access value added services anytime and anywhere. At present, the mobile devices are able to provide various services to users but still suffers from issues include Performance, security and Privacy, Reliability and Band width costs. In this paper, we pointed out the issues, challenges, Advantages and Disadvantages of various Mobile Operating systems in terms of their Architectures.

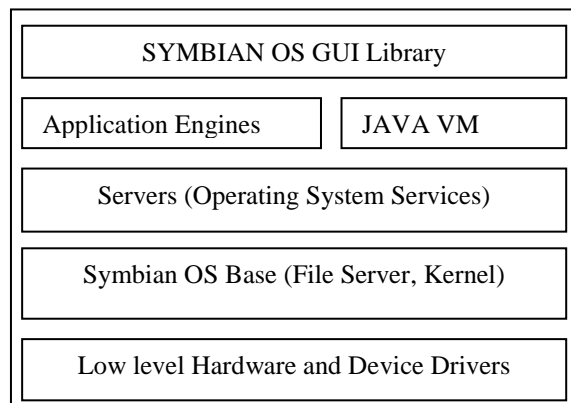
### 2. MOBILE OPERATING SYSTEMS

In this paper, we categorized the Mobile Operating Systems into Discontinued Platforms and Current Platforms.

Discontinued Platforms	Current Platforms
Symbian OS	Android
Palm OS	IOS
Maemo OS	Windows Phone
Meego OS	Firefox OS
	Black Berry OS

**2.1 Symbian OS:** This Operating system was developed by NOKIA.

#### Architecture:



The System Kernel, File Server, Memory Management and Device drivers are located in the Base Operating System Layer. The Kernel manages system resources and responsible for time-slicing the applications and system tasks. The topmost layer of symbian provides the frameworks and libraries for constructing user interface controls and utilities. The Application Engine layer provides services that support generic types of applications and OS Services layer provides servers, Frameworks and libraries that implement core Operating system support for graphics, communications, connectivity and Multimedia. Java VM Provides a set of APIs for mobile devices on the topmost of the OS.

#### 2.1.1 Advantages:

- A. Designed from scratch for mobile platforms

- B. High Quality Games
- C. Easier and Faster Connectivity.

**2.1.2 Disadvantages:**

- A. Continuous Shifts in GUIs
- B. Frequent hangs and late responses.

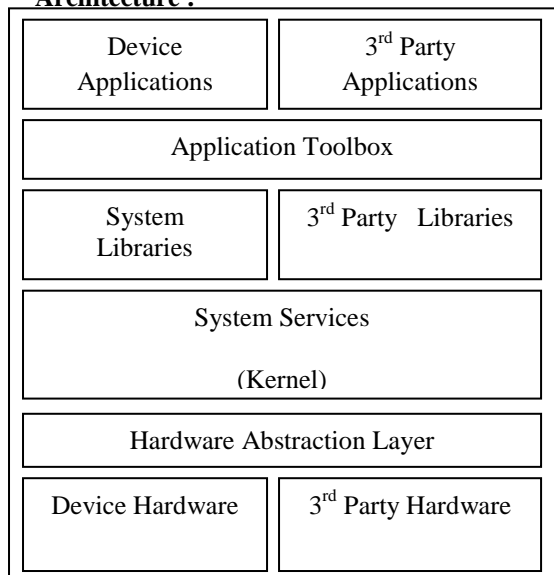
**2.1.3 Features :**Multi Tasking, Good Performance, Security Mechanisms

**2.1.4 Challenges:**

- A. No support for Touch Screen Devices.
- B. Application distribution is difficult.

**2.2 Palm OS:** This operating system is especially designed for PDAs and handheld devices.

**Architecture :**



System libraries let the developers easily extend the functionality of OS. Hardware layer is finely tuned and optimized to support a very specific range of H/W, CPU, Controller Chips and Smaller screens of Palm OS Based devices. 3<sup>rd</sup> party libraries provide support for 3<sup>rd</sup> party applications such as games, graphics drawings.

**2.2.1 Disadvantages**

- A. No Keyboard
- B. No full text Recognition

**2.2.2 Advantages**

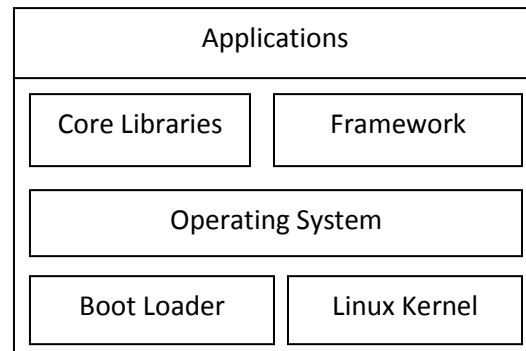
- A. Hand writing input recognition
- B. Expansion Support
- C. Memory Management

**2.3 Maemo OS:**

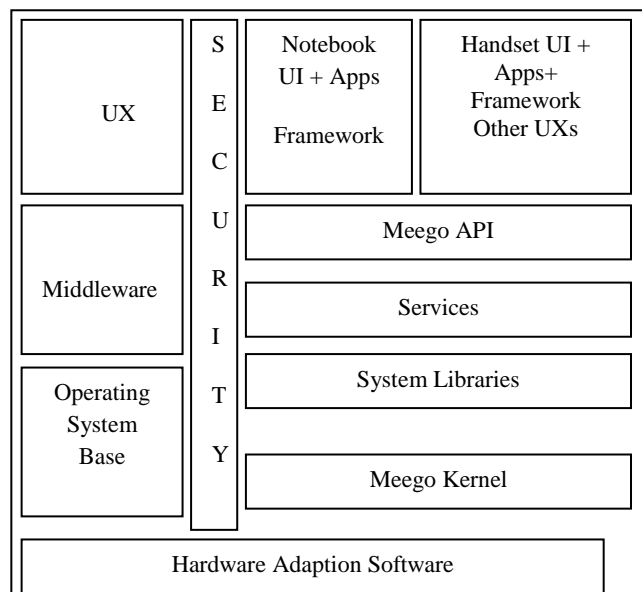
The applications are built on the top of the Hildon framework. Simple applications link with libraries GTK+, Glib in order to use GUI elements and complex applications use other core library services. The bootloader takes care of H/W initialization and loads the Operating system kernel during boot process. Linux kernel is the central software

component, which provides the hardware abstraction layer for the system devices, memory and process management, networking services. Maemo is based on standard GNU C Library. Also there is c++ library and Open SSL Library that provides cryptography for applications.

**Architecture:**



**Architecture:**

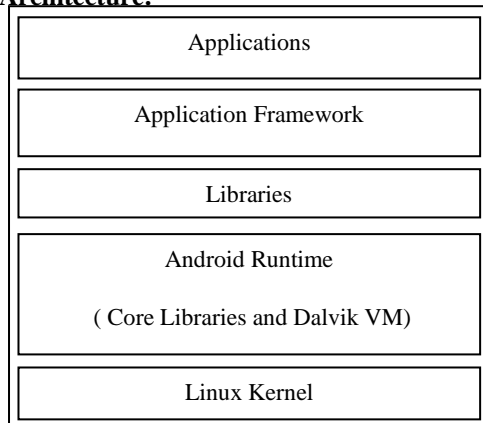


**2.4 Meego OS :** It is an Open source Linux based Operating system for smart phones and tablets, developed by Nokia and Intel. The OS Base layer contains linux kernel and core services along with Hardware adaption software required to adapt Meego to support various hardware architectures. Middleware layer provides a hardware and usage model independent API for building native applications and web applications. Meego uses a Scalable security framework that provides security through role based access control that applies to a wide range of systems. Meego API Provides user interface toolkit for developing applications. Handset UX and Notebook UX on the top layer provides user experience for handheld devices and netbook devices respectively which are built on optimized UI framework.

**2.4.1 Advantages:** Flexibility

**2.5 Android OS:** The most popular mobile operating system today in mobile market.

**Architecture:**



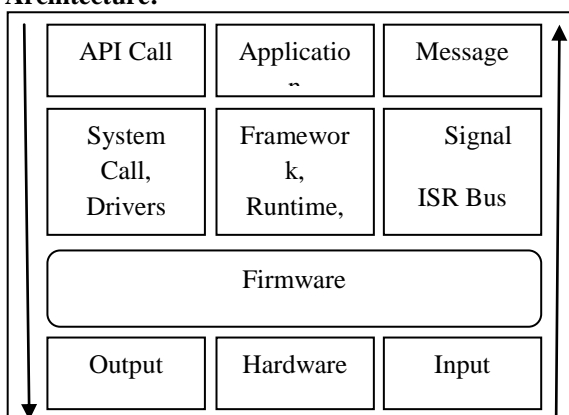
Linux kernel acts as an abstraction layer between the hardware and the rest of the software stack. Android runtime includes core libraries and Dalvik VM Core libraries have a set of libraries to provide the functionality of JAVA PL. Every application runs on its own Dalvik VM which executes files in .dex format. Android has a set of c/c++ libraries used by various components of operating system. It ships with a set of core applications that offers developers the ability to build various applications with an open development.

**2.5.1 Advantages:** Multitasking, Ease of access to thousands of applications, Diverse Phone options.

**2.5.2 Disadvantages:** Needed Continuous Internet Connection, Advertising, Range of applications can still be expanded.

**2.6 IOS:** A mobile operating system developed by Apple Inc. and distributed exclusively for Apple hardware.

**Architecture:**



Hardware refers to physical chips soldered to iPhone circuitry. Firmware refers to chip specific code that is either contained in with memory in/around the peripheral itself or within the drive for said peripheral. Processor refers to ARM Instruction set

and interrupt descriptor table as setup by OS during boot process. iPhone OS is the kernel, drivers and services that sits between user space and Hardware.

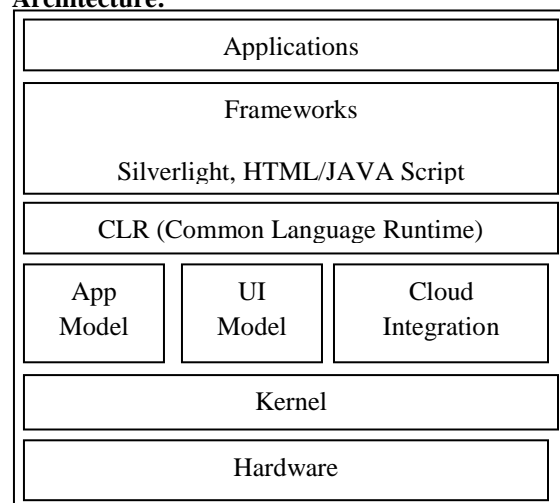
Runtime is composed of dynamic link libraries as well as underlying C libraries. Frameworks/API has API calls which are Apple distributed headers with iPhone SDK. The Application stored in iPhone has to be purchased through App Store, This App was compiled to native code by compiler and linked with runtime by the linker. The application runs entirely within user space environment set up by the iPhone OS

**2.6.1 Advantages:** Direct Twitter Integration, Advance Voice Recognition, Facetime to make Video calls.

**2.6.2 Disadvantages:** No flash Support, Dependent on Apple hardware, App Approval process is largely a black box to developers, facetime is exclusive to IOS powered devices.

**2.7 Windows Phone OS:** Developed by Microsoft.

**Architecture:**

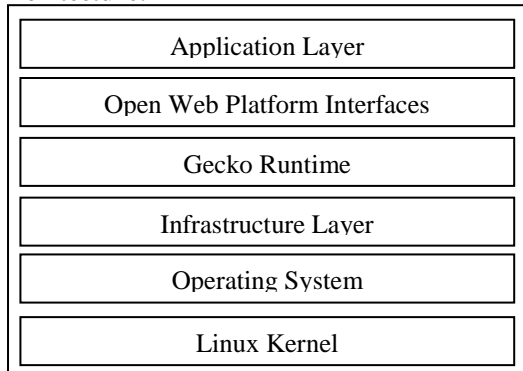


The Hardware is composed of ARM 7 CPU, Direct X 9 Capable GPU, 256 MB RAM, Capacitive multi touch display with required Physical buttons. Kernel Handles low level device driver access as well as basic security, networking and storage. The three libraries App Model, UI Model and Cloud Integration Model sit above the kernel for application management and notifications. Application facing APIs include silver light, HTML/Java Script and CLR that supports C#.Net and VB.Net applications.

**2.7.1 Advantages:** Multitasking, Feature additions, Multimedia, Camera Technology.

**2.8 Firefox OS:** Developed by Mozilla Corporation exclusively for web based mobile devices.

### Architecture:



Application layer consists of user interface implementation based on building blocks and JS libraries. Web Platform Layer provides runtime and middleware that provide capabilities needed by the application layer. Infrastructure layer provides the lower level Operating system services, libraries and other infrastructure services based in linux and other open source software. It also provides security and privacy. "Gecko Runtime" is the application runtime of firefox operating system.

**2.8.1 Advantages:** Dynamic App Search, Can be upgraded in parts.

**2.8.2 Disadvantages:** Appearance and Performance.

**2.9 Black Berry OS :** The Blackberry operating system has a Java Based kernel and utilizes ARM 7 architecture with an Intel X Scale Processor. It supports multi tasking operating system and its device memory cannot be allocated to supplement allocation memory. IN this OS, Memory Management is divided into three sections namely Application Memory, Device Memory and Memory Card (Optional).

**2.9.1 Advantages:** Faster web browsing, Handy for reading mails, and Multi tasking.

**2.9.2 Disadvantages:** Memory Manager doesn't release memory even after the applications are closed which leads to slowdown of the device. Application Distribution is more difficult. Dependent of RIM/Hardware

### 3. CONCLUSION

The survey reports that although each of the operating systems has their own Operating system Architecture, most of the operating systems are working with Linux based Kernel at lower level. As the current Mobile Operating systems are offering a wide range of services, care should be taken with the following issues: Performance, Scalability, Reliability Application Distribution and Application maintenance and Networking service by keeping the Next Generation Networks in view.

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