# Comparison of Modern Mobile Platforms from the Developer Standpoint

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**Abstract**

In this paper we attempt to compare modern mobile platforms (Symbian, MeeGo, iPhone, Android, Windows Phone 7, Palm, Blackberry, Bada) from the developer standpoint. We provide minimal and/or recommended hardware requirements (where available), along with information about OS architecture & components, SDKs, UI toolkits and application store facilities.

**Index Terms:** app store, mobile platform, UI toolkit, SDK, hardware specifications

## I. Introduction

We compare 7 popular mobile platforms on the market today from the developer standpoint. In this section, brief information about each platform is presented.

### *A. Symbian*

Symbian (latest version is called Symbian$^3$, with Symbian$^4$ in the works) is a modern mobile platform, running Symbian OS developed by Symbian Foundation (Nokia, Sony Ericsson, Motorola, and others). Quite recently, Symbian OS has become open-source. Until 2009, Symbian had no application store. Now it has Ovi Store.

### *B. Maemo/MeeGo*

MeeGo is a platform for a wide range of mobile devices (mobile computers, e.g. Nokia N900; netbooks; automotive) currently in active development. Its software part, open-source MeeGo OS is a joint Nokia-Intel effort in merging the Maemo and MOBLIN operating systems (both based on Linux, but on different distributions). MeeGo OS for netbooks is now available for early technology adopters and application developers. MeeGo offers two application stores: one from Intel (AppUp), and one from Nokia (Ovi).

### *C. iPhone*

iPhone platform is created by Apple. Most of its internals are a best-kept secret, with only insubstantial information leaking to the press and homebrew system enthusiasts [1]. iPhone platform has a decent SDK and the most famous application deployment facility – App Store.

### *D. Android*

Android is maintained by Open Handset Alliance (headed by Google). Android operating system is open-source, and is developed in the “release early, release often” manner. It is available on a wide range of different devices, to provide good experiences for users in different market segments.

### *E. Windows Phone 7*

Windows Phone 7 is a totally re-worked platform first unveiled by Microsoft in 2009. It supports running .NET applications (developed for Silverlight or XNA Framework), and has attractive horizontal-scrolling interface [2] and very strict hardware requirements [3]. It also has

application store (Windows Marketplace) and integrated Bing search [2]. Unfortunately, though its OS is based off Windows CE, installation and running native applications is prohibited; and multitasking is limited.

*F. Palm*

Palm platform is now represented by devices running Palm webOS (based off Linux) with applications running in the web browser.

*G. BlackBerry*

BlackBerry platform is maintained by Research in Motion (RIM). Hardware specifications are a secret, but some speculations can be made. Its software part BlackBerry OS is a closed-source OS developed by RIM and supporting running Java-like sandboxed applications, sold through an online store. BlackBerry platform is wildly popular in the United States, and almost unheard of in European countries.

*H. Bada*

Bada platform is created by Samsung. Its aim is to provide a convenient C++ API wrapper over GNU/Linux or another (possibly, proprietary) OS. There is a built-in application store facility called SamsungApps.

## II. Comparison of Platforms

In this section we present detailed comparison of every platform's main features, as well as the list of its advantages and disadvantages. It is important to note, however, that for many rather new platforms (Bada, Windows Phone 7, MeeGo) and closed-source platforms some information is unavailable.

Main vendors supporting the platforms have been summarized into Table I.

TABLE I
MAIN SUPPORTERS OF MOBILE PLATFORMS

| **Mobile Platform** | Symbian | Android | iPhone iOS | Windows Phone | Maemo/ MeeGo | BlackBerry | Palm Web OS | Bada |
|---|---|---|---|---|---|---|---|---|
| **Vendors** | Fujitsu, Nokia, Samsung, Sharp, Sony Ericsson | HTC, Samsung, LG, Motorola, Acer | Apple | HTC, Samsung, Toshiba, HP, Sony Ericsson | Nokia, Intel | RIM | Palm | Samsung |

*A. Hardware Requirements*

Platform hardware requirements are hard to obtain. Only Symbian, Android and Windows Phone 7 present an almost complete picture of hardware that is needed to run them. This can be explained by the fact that MeeGo and Bada are relatively new platforms; and BlackBerry, iPhone and Palm platforms are proprietary with no sensitive information given out to the public.

1) *Symbian*. Symbian OS requires a CPU that supports ARM v5TE or greater [4] as it is the baseline instruction set for all Symbian software. It also requires a full Memory Management Unit to support virtual memory. The image size for Symbian could be anything between 20 Mb for the reference UI (Techview) to around 50-80 Mb for a full product ROM image, making the flash memory size to be in the order of 100 Mb or more.

2) *Maemo/MeeGo*. Exact hardware requirements are unknown, because MeeGo is aimed to work on a large variety of wildly different devices: mobile computers/internet tablets, netbooks, and in embedded scenarios such as on an automotive computer. But it is said that Nokia N900 would be able to run MeeGo [5]. So that can be regarded as the lowest hardware level on which it would still be possible to run the OS.

3) *iPhone*. Because Apple is not interested in other parties making compatible devices, only general hardware specifications are officially given [6]: ARM Cortex A8 processor, 512 Mb DRAM, 16+ Gb flash memory, Retina multitouch display (3.5", 960×640). More information (estimates of clock frequencies, chip manufacturers & models) on hardware used is summarized on the site [1], but most of it is unconfirmed, so we don't mention it here. [1] also provides results of 3D benchmark: triangle drawing performance for GPU. iPad and iPhone 4 the peak 3D drawing speed measured was observed to be around 6.5 million triangles/second.

4) *Android*. Currently only high-end devices have been announced. The hardware requirements for Android 2.1 were said to be CPU Clock > 1 GHz, 512 Mb RAM, Screen ≥ 3.5". But as it turned out, these were not minimal, but recommended hardware requirements. So real minimal requirements for Android devices are unknown.

5) *Windows Phone 7*. This platform provides concrete minimal hardware requirements [3]. These are tough, to give best user experience imaginable:

- capacitive multitouch display (recognizing up to 4 simultaneous touches) with one of the two resolutions: 800×480 and 320×480;
- 1 GHz processor (ARMv7 Cortex/Scorpion class or higher);
- 256MB RAM and 8GB of flash memory;
- DirectX 9-capable GPU;
- GPS receiver;
- 3-axis accelerometer;
- electronic compass;
- FM-tuner;
- at least 5-megapixel camera with flash.

Each Windows Phone 7 device would have 5 hardware buttons with the same functions across all devices. This is to ensure user interface consistency for all devices using the platform. It is a good thing to developers (one less thing to worry about).

6) *Palm*. No information is available.

7) *BlackBerry*. Official information is unavailable. But it is known [7], that the latest BlackBerries are based upon ARM7 or ARM9-compatible processors, where as old BlackBerries such as 950 and 957 models have used Intel i386 processors. In the latest GSM BlackBerries (9520/9550, 9700) a 624 Mhz processor is installed, along with 1 Gb of flash memory, 256 Mb of RAM and support for up to 32 Gb microSD memory cards.

8) *Bada*. We were unable to determine concrete minimal hardware requirements. Though, Samsung promises minimal requirements and maximum scalabilility — namely, the possibility of up/downgrade of the mobile device.

*B. Operating System and its Components*

1) *Symbian*. Symbian OS is a microkernel-based real-time mobile operating system. It is praised for its high performance ("perfect fit" for the hardware) and dismayed for its frequent instability, especially in the first releases for a particular device. It becoming open-source is good news: potentially, the patches for new versions can be rolled out faster than previously, with the help from the open-source community.

Symbian OS fully supports multitasking and has a built-in application installer with security measures (e.g. verification of app certificate, list of "capabilities" for each application installed). Web Browser is an optional component (based on WebKit in the latest versions of Symbian). It reasonably supports established web standards, such as HTML 4.0 and CSS Level 2.

2) *Maemo/MeeGo*. As MeeGo is based off Linux 2.6 monolithic Kernel, it has all the advantages and disadvantages of a regular Linux OS. Among the advantages are support for multitasking and multithreading, the well thought-out repository system (based on .deb

packages) and a large number of general Linux software which may successfully compile and run on the MeeGo devices.

It is possible to develop both client apps (preferredly, using Qt UI toolkit, version 4.7) and web apps running in the browser. Web Browser included in the distribution is based on WebKit, which supports bleeding-edge HTML5. MeeGo also supports OpenGL 2.0 ES for 3D graphics.

3) *iPhone*. iPhone OS (iOS) is modified Mac OS under the hood. But usage of only the Apple-defined public APIs (for user interface, usage of devices etc.) is a requirement for all applications willing to get a pass to the Apple Store. If developer is not willing to learn the native API best suited to Objective-C programmers, iPhone has excellent support for HTML5 web applications with its Safari browser using WebKit engine. Aside a few quirks (such as existence of *contenteditable* attribute in the DOM but no real support for web page in-place editing) the built-in browser works just like the desktop version of Safari. It should be noted that iOS 4 does not fully support multitasking. It supports background threads for tasks such as music playback and network polling. All other application threads are frozen when the application is deactivated.

4) *Android*. Linux 2.6 monolithic Kernel shaped to fit smartphone requirements forms the base of the system. On the higher architectural levels one could find the file system (YAFFS), standard libraries (including C standard library not unlike libc, that is specifically optimized for mobile devices) and standard UNIX utilities. On the top sits the Dalvik virtual machine, running Java-like code in a sandboxed environment. Dalvik VM runs all the user applications and the graphical UI. Dalvik is analogous in principle to Java VM, but has a different, incompatible class file format. For great speed, Dalvik VM is preallocated, and each time an application runs, preallocated VM's memory is copied (which is faster than starting up VM every time). Android has a vast number of graphical, audio and video libraries pre-installed, and even a database (SQLite). Web Browser uses LibWebCore engine based on WebKit. It supports all the same features that iPhone Web Browser does.

5) *Windows Phone 7*. Based off Windows CE, which is a modern and efficient real-time microkernel operating system for embedded and mobile devices. The whole shell is a native application, which in turn runs .NET applications (made with Silverlight, XNA framework, or regular .NET Compact Framework). A wide variety of audio & video codecs are included, as is Windows Media Player™.

Web Browser is said a ported version of Internet Explorer 7, with a limited support of modern standards, such as HTML5 and EcmaScript (ES) 5. Some modern facilities have been added to CSS and scripting at the request of the community [8]. Web Browser performance on a test device has been demonstrated to be acceptable and comparable with the one of iPhone and Android devices [9].

6) *Palm*. Architecturally, Palm webOS is an embedded Linux operating system that hosts a custom User Interface (UI) System Manager built on standard browser technology [10]. The System Manager provides a full range of system user interface features including navigation, launching and closing applications, events and notifications, Web and local search. Application is just HTML+CSS+JavaScript code, which runs in the browser with obvious security restrictions. webOS is based on the Linux 2.6 kernel, with a combination of open source and Palm components providing user space services, referred to as the Core OS.

7) *BlackBerry*. BlackBerry OS is a closed source operating system. We could not get any detailed information about its architecture and/or origins. BlackBerry runs java-like applications in a sandboxed environment.

In modern versions of the BlackBerry OS, WebKit-based web browser is present. It supports most of HTML5, DOM Level 3 and CSS3 standards, has widgets (including BlackBerry-specific, written in Java Intermediate Language (JIL)).

8) *Bada*. Samsung Bada has a four-layer architecture [11]:

- Kernel. Linux kernel or a proprietary RTOS kernel, depending on the hardware.
- Device Layer. Provides the core services: system & security management, graphics & windowing, data & voice transmission, audio & video management.
- Service Layer. Provides service-centric functions that are provided by application engines and web-service components interconnecting with bada Server.
- Framework Layer. Only this layer can export the C++ open API. The framework consists of an application framework and functions exported by the underlying layers.

In case of Linux-based kernel and libraries, Bada has partially implemented POSIX (e.g., no pthreads). Bada also has WebKit-based web browser called Dolphin.

*C. SDKs*

In this section, we briefly compare software development kits offered to the application developers on each platform. Programming languages used to create applications for the platforms compared, are given in table II. Symbian, MeeGo and Android support the greatest number of development languages and technologies. Development environments supported are listed in table III. For now, Palm Web OS and Android have the convenient SDKs, running on all major desktop platforms.

TABLE II
PROGRAMMING LANGUAGES SUPPORTED ON EACH PLATFORM

| **Mobile Platform** | Symbian | Android | iPhone iOS | Windows Phone | Maemo/ MeeGo | BlackBerry | Palm Web OS | Bada |
|---|---|---|---|---|---|---|---|---|
| **Languages** | C, C++/Qt, Java ME, Python, Ruby, Flash Lite | Java, C/C++ (w/limited access to resources), Python, Lua | Objective-C, C/C++ | .NET Languages (C#, VB.NET, F#, etc.), VB, C++, JScript | C, C++/Qt, Python, Ruby, Lua, Flash | Java | JavaScript | C++ |

TABLE III
DEVELOPMENT ENVIRONMENTS FOR EACH MOBILE PLATFORM

| **Mobile Platform** | Symbian | Android | iPhone iOS | Windows Phone | Maemo/ MeeGo | BlackBerry | Palm Web OS | Bada |
|---|---|---|---|---|---|---|---|---|
| **SDK Platform** | Windows XP Professional SP2; Vista & 7 for *some* SDKs | Windows XP, Vista and 7; Linux, Mac OS X | Mac OS X Snow Leopard 10.6.4 | Windows Vista & 7 | Linux | 32-bit Windows XP, Vista and 7 | OS X, Ubuntu, Windows | Unknown |

SDKs typically consist of development tools (development environment, compiler, packager, emulator or simulator). For those willing to test ready application in real-life conditions, on some platforms a service is offered.

- Free Remote Device Access (RDA) to Nokia's Symbian S60 devices and Maemo 5 devices at Forum Nokia[1]. Up to 8 hours of testing.
- Commercial applications by DeviceAnywhere[2] support iPhone, iPad and Android, offering immediate access to over 2000 devices for all mobile device testing scenarios. Minimal price is $13/hour.
- Remote Testing Labs (RTL) for Bada devices were available for some time [12], but now the status of the service is unknown.

[1] http://apu.ndhub.net/devices
[2] http://www.deviceanywhere.com

*D. Application Deployment (App Stores)*

Information on application stores is summarized in Table V. We used data from Distimo analytical company [13].

TABLE IV
SUMMARY OF APP STORES FOR MOBILE PLATFORMS

| **Store** | Ovi Store | Android Market | App Store for iPhone | Windows Marketplace |
|---|---|---|---|---|
| **Company** | Nokia | Google | Apple | Microsoft |
| **URL for Devs** | https://publish.ovi.com | http://developer.android.com | http://developer.apple.com | http://developer.windowsphone.com |
| **Launch Date** | May 26, 2009 | Oct 22, 2008 | Jul 11, 2008 | Oct 6, 2009 |
| **# Of Apps** | 27,000 | 70,000 | 225,000 | 1,014 |
| **Dev Revenue Share** | 70% | 70% | 70% | 70% |
| **One-off Billing** | Yes | Yes | Yes | Yes |
| **Subscription Billing** | No | No | Yes | No |
| **In-app Billing** | No | No | Yes | No |
| **Countries** | 240 free / 239 paid | 48 free / 14 paid | 90 free / 90 paid | 30 free / 30 paid |
| **Participation Fee** | €50 | $25 | $99 | $99 |
| **Submission Fee** | Unknown | For apps > 15 Mb in size, $2/user | 0 | $99/application, after first five free |
| **Supported platforms** | Flash Lite, Java, Maemo, Symbian, WRT Widgets | Android OS | iOS | Windows Phone |
| **Billing Methods** | Credit card, Operator billing | Google checkout, Operator billing | iTunes | Credit card, Operator billing |

| **Store** | Samsung Application Store | Palm App Catalog | BlackBerry App World |
|---|---|---|---|
| **Company** | Samsung | Palm | Research In Motion |
| **URL for Devs** | http://www.samsungapps.com/about/forDevelopers.as | http://developer.palm.com/ | http://na.blackberry.com/eng/developers/ |
| **Launch Date** | Sep 14, 2009 | Jun 6, 2009 | Apr 1, 2009 |
| **# Of Apps** | 808 | 1,452 | 9,808 |
| **Dev Revenue Share** | 70% | 70% | 70% |
| **One-off Billing** | Yes | Yes | Yes |
| **Subscription Billing** | No | No | No |
| **In-app Billing** | No | No | No |
| **Countries** | 78 free / 78 paid | 8 free / 8 paid | 67 free / 13 paid |
| **Submission Fee** | 0 | $99 | $200 |
| **Supported platforms** | Bada, Symbian, Windows Mobile | Palm Web OS | BlackBerry |
| **Billing Methods** | Credit card, PayPal | Credit card | Credit card, Operator billing, PayPal |

Additional information that we gathered about the application stores is provided in the following sections.

1) *Symbian*. Nokia's Ovi Store was launched along with the N97, Nokia's flagship device. At launch, the Ovi Store was available globally to an estimated 50 million device owners across more than 50 Nokia devices. Ovi Store is still in its initial phase of acceptance, with lots of complaints about the application approval delays and less-than-perfect end-user interface ([14], [15]).

2) *Maemo/MeeGo*. We tried to get an application developed at our Lab (15shki game[3]) to the Maemo repository. Though it was relatively simple to publish it at Maemo garage, proceeding to the main repository requires thorough testing of the app (including UI conformance), lots of patience and perseverance. This process guarantees that only high-quality software gets installed by the ordinary users[4] of the Maemo/MeeGo devices, but can be unsuitable for small development groups which have very limited financial and time resources. Encouraging open-source community participation in development of your apps is one of the viable solutions to this problem.

3) *iPhone*. The Apple App Store was launched along with the iPhone 3G, and was initially available in 62 countries. At the moment the Apple App Store is available in 90 countries. The applications are downloaded directly to iPhone or iPod Touch and the store front is also available within iTunes. App Store now has hundreds of thousands of applications (around 300,000, see Table IV), which raises a serious problem of ensuring application's popularity, and, therefore, steady stream of revenue. Extensive work with advertisers, software reviewers and enthusiasts must be done to establish a steady rating in the store. It should also be noted that App Store has very strict (and sometimes vague) requirements for applications, which tend to change often. Even popular applications can be permanently banned from the store.

4) *Android*. Google acquired the company Android in 2005, which was the basis for the Android OS that was launched in October 2008. Google Android Market is the pre-installed application store on Android.

5) *Windows Phone 7*. Windows Mobile Marketplace was launched along with the new generation of Windows Mobile (6.x). It now contains typical applications (social network clients, news/financial site clients, …) for the upcoming Windows Phone 7 as well.

6) *Palm webOS*. The Palm App Catalog was initially only available on the Palm Pre, and featured applications for the webOS platform.

7) *BlackBerry*. Research In Motion launched BlackBerry App World in the United States, United Kingdom and Canada. BlackBerry App World is available on all new BlackBerry handsets and went live on April 1, 2009.

8) *Bada*. The Samsung Application Store was initally launched in the UK, France and Italy for Omnia users, containing Symbian and Windows Mobile applications. In July 2010, Samsung will start supporting content for HDTVs in the store.

## III. User Interface Toolkits

In this section, we give a brief overview of user interface toolkits most frequently used to develop client applications for the platforms compared. (See Table V for summary).

1) *Qt*. Qt is an open-source cross-platform user interface toolkit [16]. Qt is written in C++ and offers a powerful extension of C++ syntax in form of *signals* and *slots* (which are used for event generation and consumption by any class descending from Qt root class, QObject), and also metaobject model, which permits querying objects for the properties, signals and slots they support.

[3] http://maemo.org/packages/package_instance/view/fremantle_extras-devel_free_armel/15shki/0.5.0-4

[4] Given that most of the Nokia N900 device users are tech enthusiasts, ensuring maximal stability and consistency (instead of getting new releases with new featuresearly, and often) might not be worth the efforts.

Qt is possible to use for Symbian development (using Eclipse-based Carbon IDE and Qt SDK for Symbian), Maemo/MeeGo development, along with desktop development for a wide range of OSs (Linux, FreeBSD, Windows, Mac OS X). Maemo/MeeGo and recent Symbian releases have Qt libraries pre-installed. For early Symbian versions a Qt installer is available, which ensures all the necessary libraries are set up.

With careful development of user interface (using a versatile mechanism of Qt Layouts), it is possible to create different platform versions of the application by simple re-comilation. Support of OpenGL ES 2.0 in the QOpenGL library allows for creation of compelling 3D interactive user experiences.

QtMobility library is also offered, which provides easy access to the mobility features, such as geolocation (GPS), accelerometer measurements, battery state and device system information. For a more detailed overview of it see [17].

2) *Silverlight*. Silverlight is a Microsoft .NET-based technology for light web and desktop applications. Its interface is primarily based on XAML (pronounced "zammel") — eXtensible Application Markup Language, an XML dialect suitable for declarative description of sophisticated interfaces.

TABLE V
MOST POPULAR MOBILE INTERFACE TOOLKITS AND THEIR FEATURES

| UI Toolkit | Markup | Resizing | Events | Device Features | Multi touch | 3D | Video | Per-sisten-ce | Plat-forms |
|---|---|---|---|---|---|---|---|---|---|
| Qt | Declarative (XML) for static code generation; imperative (C++) for static & dynamic interface | Auto, if QMainWindow class is used for the app & QLayouts are used | signals & slots | GPS, accelero-meter, battery, memory, processor info, light sensor, compass | since 4.6 | Open-GL ES 2.0 | Platform-defined | On-disk file | Symbian, Maemo/ MeeGo |
| Silverlight | Declarative (XAML) and imperative for static & dynamic interface | Automatic, if layout other than Canvas is used | delegate (ordinary) events and routed (bubbling) events | camera, microphone, GPS, accelero-meter, power notifications | since 3 | Direct X 9 | Windows Media Foundation (MPEG4, H.264, etc.) | On-disk per-app isolated storage | WP7 |
| UIKit/ CoreGra-phics | Imperative (Objective-C) | Automatic (Springs & Struts based layouts) | UIRespond er chain (bubbling) | camera, microphone, GPS, accelero-meter, power, compass | since 1 | Open-GL ES 1.1, 2.0 since iPhone 3GS | MPEG4, H.264 | On-disk per-app isolated storage | iPhone |
| Android UI | Imperative (Java) | Automatic (if not using SurfaceView for pixel-precise drawing) | event listeners & event handlers | camera, microphone, GPS, accelerome-ter, compass | since 1 | Open-GL ES 2.0 | H.263, MPEG4 SP, H.264 AVC | On-disk per-app isolated storage | Android |
| HTML5 | Declarative (HTML), imperative (JavaScript UI toolkits) | Automatic (if relative CSS size points are used and no fixed-size blocks are in the page) | bubbling DOM Events | No access | iOS, Andro-id, MeeGo | Canvas and webGL (Open-GL ES in Java-Script) | HTML5 <video> (H.264 AVC, etc.) | DOM Storage (on-disk secure cache) | iPhone, Android, Palm, Maemo/ MeeGo, WP7 (limited) |

XAML facilitates decomposition of the application into code and "look and feel", with coders working on the first part, and designers on the second (specialized tools, such as Expression Blend, created by Microsoft for that purpose, can be used).

XAML also supports powerful data binding syntax, making it possible to dynamically update objects' properties based on the changes of data sources (other properties, DB records and whatever).

For more complex interfaces, code-driven approach to interface building can be used instead, or in combination with XAML.

Event model of Silverlight is two-fold: firstly, it supports classical .NET event handling (with delegates); secondly, it can fire events all up the control hierarchy ("routing", or "bubbling" events), which is not unlike DOM Events in HTML. This gives greater control to the programmer.

Silverlight also has integrated facilities for 3D graphics, rich audio and video (supporting rendering of video on 3D surfaces), and (since version 3) supports microphone and camera of the mobile device.

3) *UIKit/CoreGraphics*. UIKit is the name of standard user interface library for iPhone, a stripped-down version of the Mac OS AppKit library. It offers all the standard facilities, including "bubbling" events which go up the event responder chain (up the control hierarchy). For 3D graphics, OpenGL ES 1.1 and 2.0 (since iPhone 3GS) are supported, including shader language. The inability to easily create custom interface layouts can be regarded both as advantage and disadvantage: on the bright side, it makes all iPhone apps have the similar, discoverable and predictable interface; on the dark side, it limits the creative potential of the user interface designers.

4) *Android UI*. Android UI is a typical example of Java UI toolkit, with similarities to Swing and AWT. For events, both event listeners and event handlers can be defined (the latter offer greater control over event handling). Android UI has built-in support of OpenGL ES 2.0, and unlike UIKit, supports user-created layout managers well.

5) *Adobe Flash/Adobe AIR*. Adobe Flash and AIR technologies promise to create a cross-platform, robust applications with interactive interface. Powered by EcmaScript implementation called ActionScript, Adobe Flash supports "bubbling" model for events, and many features of advanced EcmaScript 5.0 (this is a clear advantage of the technology). Among the main disadvantages are instability (until the most recent versions of the Flash Player), security problems, and generally poorer-than-native-apps performance. Support on all the platforms except iPhone, is a clear advantage to the developers. High-quality (but unfortunately, also high-priced) developer tools offered by Adobe are also on the advantages list.

6) *HTML 5*. Hypertext Markup Language is supported by browsers on all modern mobile platforms, with varying degree of compliance to upcoming HTML5, EcmaScript 5, CSS3 and DOM Core L3 standards. With good coding practices (such as extensive use of JavaScript frameworks for the application interface and behavior) comes the easiness of running the application across all platforms without a single modification. (You would almost surely need server(s) to host it, of course.)

## IV. Future Work

Our mobile developer platform comparison is currently in its initial phase. We are going to thoroughly look into user interface guidelines, find user manuals for each application store, and analyze the availability of the stores for developers from CIS countries (including proper localization of the interface, SDK materials and so on).

## V. Conclusion

We have considered the most currently popular mobile platforms. Among these there is a number of leaders in every aspect. We have found that:

1. The most open platforms are Maemo/MeeGo, Symbian and Android, accepting developers from all over the world. It is much easier to create compelling applications if operating system and its components are proven open source solutions, easy to modify and enhance if such need comes.
2. Third-party device manufacturers are best treated by Windows Phone and Symbian: all the hardware specifications are clearly laid out for them to follow. Android also has decent hardware requirements, but not overly detailed. MeeGo and Bada platforms will hopefully

follow suit as they mature. BlackBerry, iPhone and Palm platforms are simply not interested in third-party manufacturers, which is unfortunate.

3. The most popular underlying operating system used is Linux, and the most popular processor architecture is ARM (the earliest being ARMv5 suitable to run Symbian).
4. Most web browsers are based on the proven WebKit engine. It makes developing cross-mobile-platform applications much simpler if developers stick to standard HTML, CSS and JavaScript.
5. All the GUI toolkits support OpenGL ES. And the most cross-platform solutions are the Qt toolkit and HTML-based toolkits.
6. Most Symbian- and Maemo5-based can be freely tested at Remote Device Access provided by Forum Nokia, which is a great advantage for the platform. For Android, iPhone and iPad a paid service DeviceAnywhere exists. It was claimed that such service existed for Bada, but its status is now unknown.
7. Ovi Store and Apple Store are the most geographically diverse, with the first allowing to purchase applications in 239 countries. As for the number of applications, App Store is the clear leader, with Windows Marketplace & SamsungApps being in the end. It might be caused by Windows Marketplace price policy: if you would like to upload an application, it costs as much as participation in the store [17]. As for SamsungApps, reasons of its apparent failure are yet to be investigated.

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