



ACCESS™ White Paper

Mobile Linux® - Going Native

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Introduction

In-Stat projects strong growth for smartphone platforms and even stronger growth for smartphone applications, but much depends on the extensive development of high value applications.

As applications developers are making decisions on which developer ecosystems to join and support, there are several viable alternatives that can make the choice tough. Each has advantages and limitations from the perspective of an applications developer. The purpose of this white paper is to succinctly lay out these alternatives and their pros and cons with special emphasis on examining the potential for the use of Linux in the mobile environment.

Mobile Linux has the potential to offer unique benefits to users and become a significant, if not dominant, smartphone OS. However, this future is not inevitable. Mobile Linux faces some challenges, including the potential for a fragmentation of standards.

If some issues are not resolved, Mobile Linux could become a postscript in the growth of smartphones. And, failure in the mobile realm could injure the Linux reputation in other environments. By bringing attention to its pros and cons, the hope is that the community of users and developers can attain the full benefits that the smartphone and a Linux OS can offer.

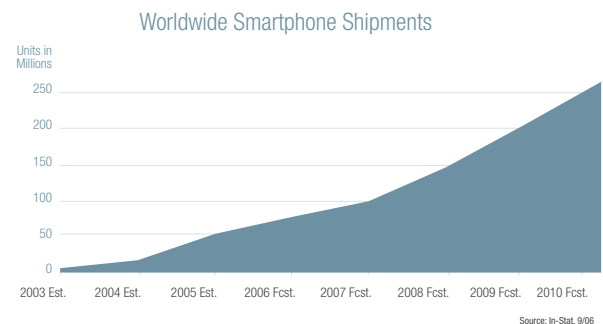
Smartphones - The Next Computing Platform

Figure 1 shows that smartphone unit volumes grew phenomenally from 2003-2006; experiencing a 100% CAGR over the period. In 2006, In-Stat estimates that manufacturers built and shipped over 80 million units. In-Stat projects that smartphone units will grow at a 40% CAGR through 2010.

These devices, which function as combination mobile phones and handheld computing devices offer users the benefits of a single device and real-time information in a convenient form factor.

Smartphones have actually begun to replace – and will increasingly displace -- laptops as the primary computing device for mobile workers. Smartphones are a lower-cost and lighter-weight solution to a wirelessly enabled laptop where a mobile application does not involve extensive keyboard entry.

Figure 1. Smartphone Unit Shipment – 2003 to 2010



In addition, businesses are increasingly taking direct responsibility for wireless services used by their employees, which is driving demand for low cost, easy to manage smartphones. While consumers have widely adopted mobile communications, only about half of businesses have embraced wireless services in the interest of productivity for their employees.

Finally, wireless operators know that smartphone subscribers use many more services than the typical feature phone user. The result is higher average revenue per user (ARPU), much of which falls directly to the bottom line for the wireless operator.

The result is that there is a burgeoning marketplace for independent developers to write custom applications for users. As equipment and service prices drop and as functionality, particularly with third -party applications, increases, excuses not to adopt smartphone applications fade away.

Applications on Smartphones

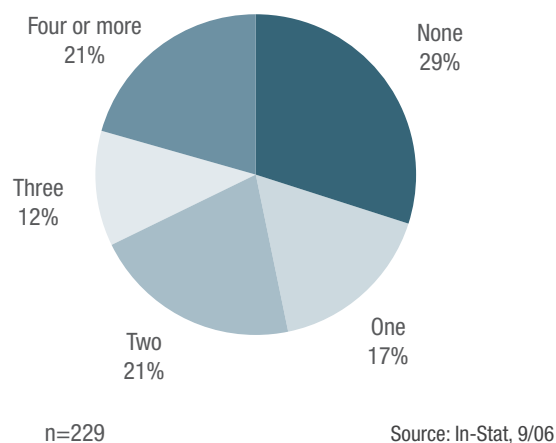
The definition that In-Stat uses for a smartphone is a cellular phone that uses a smartphone operating system. While somewhat circular, this definition is appropriate and effective because all smartphone operating systems also have an ecosystem of developers that write applications for that environment using well-documented tools.

The essence of the definition of a smartphone is that it is intended to use applications developed by independent third-parties. In contrast to most cellular phones where a device manufacture will define an application and contract out its development, smartphones involve outside developers speculatively writing applications.

At this stage of the smartphone market, most users tend to stay with the default mobile browser and often the mobile email application. However, an increasing number of users are customizing their phones and adding new applications.

Figure 2 shows that US users of smartphones downloaded relatively few applications when compared to PC users. Almost one-third, 29%, used nothing but default applications, and the median was 2 applications.

Figure 2. Number of Applications Installed or Added by US Smartphone Users in 2006



However, as the smartphone market segment grows and the number of applications has been increasing, the number of smartphone applications downloads has been growing faster than the hardware sales shown in Figure 1. In-Stat projects that this will continue for the foreseeable future.

Smartphone OS Developers Ecosystem

The common characteristic of all smartphone OS's is that they are identified as such by their

developers and that they have an ecosystem. The ultimate goal of any company that strives toward the development of an ecosystem is to produce a profitable development environment that manages the sometimes conflicting goals of creativity and compliance with standards. Achieving this goal involves multiple aspects:

- Standards setting and ongoing revisions
- Compliance testing (including enforcement mechanisms when there is failure to comply)
- Joint marketing and promotional efforts

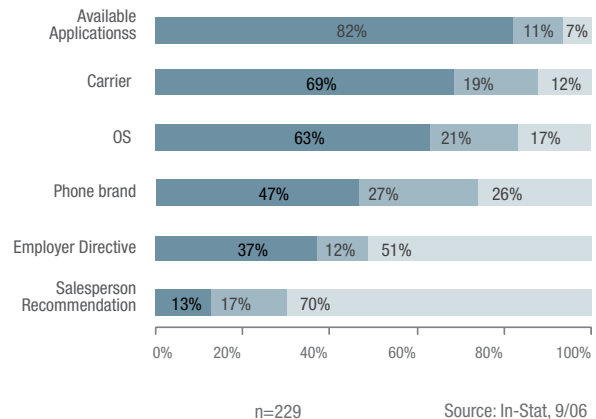
In practice, there are multiple overlapping developer ecosystems that sometimes compete and sometimes complement each other. In addition to the ecosystems for smartphone OS's and some of the development application environments (DAEs), some wireless operators have developer ecosystems.

What Users Want on Mobile Devices

All of the discussion of ecosystems, sales channels, and support obligations are secondary to satisfying the needs of the end-users. Figure 3 shows what a sample of 229 US smartphone users stated were the key factors in their decision to buy this device.

The most important decision by a significant margin is the number and type of applications that are available. This is consistent with the role of a smartphone as a customizable application platform.

Figure 3. Reasons Given for Selecting a Smartphone



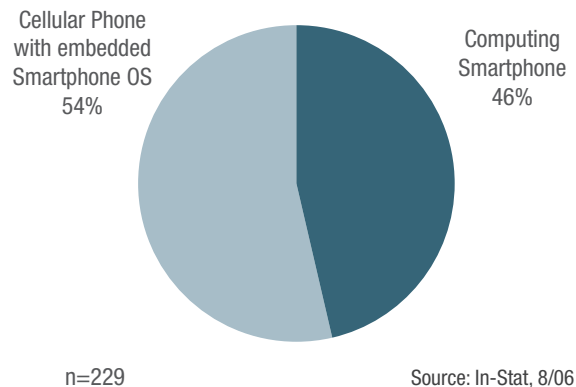
The Confusion Associated with Mobile Linux

There are many reasons to expect that Linux will succeed, and perhaps even dominate, the smartphone environment. Many regulators want to encourage non-proprietary operating systems within their jurisdiction. The nature of Linux is such that it can have a small memory footprint, and many individuals and organizations contribute to the platform, reducing development costs. There are well-established Linux ecosystems and many end-users and their employers are favorably predisposed to consider Linux.

At the same time, there are a number of challenges that could hamper the developers of Mobile Linux from achieving full potential. First, a smartphone OS can serve either as a computing platform to which the user can choose to download third party applications or as an embedded OS. In the case where the user is able to download applications, most of the benefits accrue to the user. Acquiring a platform that allows them to customize their experience is very valuable to many users.

In the latter case of using a smartphone OS as an embedded platform, most of the benefits accrue to the manufacturer. While the user gets a more customized phone sooner, the use of a smartphone OS as an embedded operating system is primarily a manufacturing convenience. A problem arises when a manufacturer that is using the smartphone OS as an embedded platform promotes the fact that it has a smartphone OS. As Figure 4 shows, this was the case for a majority of the smartphone licenses sold in 2006.

Figure 4. Percentage of Smartphone OS's Implemented as Embedded OS and as Computing Platforms



The problem is that some, if not most, of the customers buying the de-featured smartphone that cannot download the applications that are available with that OS will be disappointed. While some can run applications designed for DAE's, such as Java™ and Brew™, these are limited when compared to applications designed for a smartphone OS. This includes:

- Limited support of high-resolution screens or other non-PC standard sized screens

- No Cell ID to support user authentication for security
- Limited file access, including the databases used on the device. This includes contact databases, but more significantly local and remote applications databases.
- No multithreading capability, which allows multiple applications to share smartphone resources simultaneously.

A comprehensive feature-by-feature comparison of Java, BREW, and Linux is beyond the scope of this white paper. However, it is fair to say that Java and Brew are suitable for casual games and “worklike” applications, while it would be ill-advised to develop a real-time diagnostics application for telemedicine for anything other than a native application. Applications that run in a “sandbox” are nice, but future users of smartphones will come to expect the performance and capabilities of applications designed to run in native mode.

Furthermore, most mobile phones, not just smartphones, can run applications for Java or Brew. If all a user wants is an application that can run one of these DAE's, he can save the expense and trouble of buying a smartphone.

Finally, users become confused when some models can download applications and others cannot. This creates confusion, and prospective customers that are confused do not buy.

The second challenge for the growth of Mobile Linux is that there is a risk of fragmentation to the definition of “Mobile Linux.” Over the past few years, a number of independent organizations have

formed to promote the use of Linux in the mobile environment, including the LiMO Foundation, Linux Phone Standards Forum (LiPS), the Consumer Electronics Linux Forum (CELF), and the Open Mobile Alliance (OMA).

Ideally, these organizations will ultimately come up with a unified set of standards. Anything other than this will result in incompatibilities. This will force applications developers to use the common commands, relegating Mobile Linux to be little more than a DAE.

Incompatibility among Linux implementations is an issue about which all Linux proponents should be concerned. One of the primary benefits many parties attribute to Linux, and UNIX-like platforms in general, is platform independence. Unsuccessful implementation of standards across Mobile Linux initiatives would be very visible, and could “poison the well” for all Linux/UNIX implementations. At least, uncertainty will again cause prospective customers to shop for other, less baffling alternatives.

Requirements for Mobile Linux to Succeed

For Linux to reach its full potential in the mobile environment, there are three groups that will need to support its adoption. The first is the creation of an effective ecosystem for Mobile Linux. The logical place to start is a combination of the existing Linux/UNIX ecosystem along with the Palm OS (Garnet) developers. The combination of these entities is likely

but not assured. The ACCESS Linux Platform™ is designed to make this happen more easily and efficiently.

Also critical is the acceptance and then request by the Information Technology (IT) department of the customers to use Linux as an OS. The expectation is that the tools and techniques for supporting Mobile Linux are similar to supporting Linux in other environments. It is essential that this be true.

As long as the ecosystem is strong and customer IT departments are supportive, it is likely that carriers will fall in line – the third requirement. Unlike most of the computing industry, carrier support is an important consideration. While the support for smartphones is different from most phones, the carriers still have strong influence on the device choice.

Conclusion

The unit sales of smartphones as a category will grow. The primary question that remains has to do with the smartphone platforms on which the future will be built.

Mobile Linux offers users many significant benefits, mostly the flexibility associated with what promises to be a large and diverse ecosystem. However, all interested parties must find common ground on direction and marketing messages, or risk the confusion of prospective customers.