Linux Moving to the Handset

By Paxton Cooper

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Linux is traditionally viewed as a server or desktop operating system, but the real success story for Linux may well be its adoption into the telecommunications industry.

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Nearly all leading telecommunications equipment manufacturers are shipping or planning to ship mobile infrastructure built around the open source operating system. In addition, many of the leading phone manufacturers are developing and shipping mobile phones powered by Linux. In fact, the announcement from telecommunications heavyweights NTT DoCoMo, Vodafone, Motorola, NEC, Samsung and Panasonic that they are planning to collaborate on a Linux platform for handsets is the most significant affirmation to date of Linux as a viable platform for next generation mobile phones.

Technology Drivers

Fueled by increasingly powerful and efficient semiconductor products, today's mobile devices are rapidly increasing in capability and complexity and thus, emerging as the next client device. While various reasons exist for this increased interest in Linux, two primary explanations top the list: 1) Advancement of Linux Technology &#151 Linux has evolved from the “will it work” to the “what is next” stage. It has proven itself as a mainstream embedded technology and a robust platform for the next generation of multimedia intensive handsets. 2) Differentiation Driven Industry &#151 Market commoditization is forcing phone manufacturers to dramatically differentiate their offerings. Linux allows total customization of the phone software and offers unrestricted innovation.

Linux Advancements

Today, Linux is running as the underlying OS platform in millions of devices. In 2005, handset OEMs in the Asian marketplace shipped 10 to 15 million phones with almost two dozen phone models based on Linux. Commercial vendors deliver embedded Linux products to be used in diverse product categories by worldwide technology product manufacturers. Fundamentally, the requirements of these types

of devices have been essential in driving the advancement of technology inside the Linux operating system. These requirements come from devices such as remote control devices, set top boxes, digital televisions, medical equipment, ATCA based gateways in the telecommunications infrastructure, handsets and process control systems.

As Linux was never designed for a specific application, commercial vendors need to proactively develop vertical market specific capabilities to optimize it for particular products and markets. This organic advancement of Linux technology has been prepared as a platform for next generation mobile devices. Requirements for smaller system size, power management, “hard real time,” and faster boot time which are critical for mobile phones are also common to many mass-market consumer electronic offerings. The evolution of Linux as a desirable platform for mobile phones really began with its adaptation for the mass-market consumer electronics, telecommunications and general embedded markets.

Mobile phones are rapidly evolving from voice only terminals to full multimedia clients. And, as handsets have turned mainstream, the market has flooded with competition. Manufacturers are competing on a feature basis and devices are becoming increasingly complicated to build. The primary reason for software content on these devices has exploded as manufacturers have added features such as graphics, ring tones, text messaging, browsing, cameras, Bluetooth, multimedia capabilities, etc. There has been an order of magnitude increase in the lines of application related code as opposed to communications processing code.

The increase in software complexity has forced manufacturers to seek out more robust software platforms that easily facilitate migration from voice focused devices to much more multimedia intensive clients. Where hardware and voice complexities with respect to network services was once the primary issue, complexities associated with multimedia and end user applications are now the center of attention. Where basic RTOSes (real-time OSes) were once sufficient for voice only phones with limited data services, more horsepower is needed to accommodate today’s feature phone and smart phone categories. An advanced, highly scalable Linux operating system delivers this solution.

Expensive, low-volume smart phones typically utilize separate applications and baseband processors and also include dedicated memory for each processor. Excess semiconductor parts add cost to the design as well as increase power usage leading to decreased battery life. To make matters worse, the dedicated baseband processor typically adds a second operating system requirement, decreasing development efficiency and adding cost to the project. These high-end devices typically feature an application-focused operating system as well as a hardened RTOS to handle the extreme response-time requirements of communicating between the protocol stack and the back-end infrastructure. Failing to meet response-time requirements leads to dropped calls; a behavior that is unacceptable to an operator whose customers will often blame the network rather than the device.

Recent developments in the Linux community initiated by MontaVista Software and

others have resulted in dramatically improved response time. These improvements have enabled optimized versions of the platform to meet the hard real-time requirements of baseband processing while also delivering rich application, gaming and multimedia capabilities on a single processor. Using Linux in so-called “single chipset” design allows handset manufacturers to deliver high-end functionality at significantly reduced prices.

Differentiation is the Key

Preferring to remain unfettered to restrictive proprietary software vendors, many larger handset manufacturers have turned to Linux, though not for the reasons one might think. While many assume the adoption of Linux was driven by a desire to reduce bill of materials cost, the most legacy operating systems used in the mobile market were already royalty free. Because Linux is not controlled by any one vendor and because developers have access to all source code, device manufacturers retain full control over their platform architecture and development schedules. This approach also provides manufacturers with greater control over the phone’s presentation and functionality, enabling the creation of truly differentiated products.

Unlike competing mobile operating systems, handset manufacturers are leveraging Linux as a common platform across a broad percentage of their portfolio. Because it’s easy to program and customize the Linux platform, handset manufacturers can quickly spin out new models with the latest technology and address the latest market trends. For example, Motorola has reportedly stated on multiple occasions that they expect Linux to be used across the majority of their portfolio, with other operating systems being used primarily in point devices. NTT DoCoMo, along with suppliers NEC and Panasonic have announced similar positions. Most recently, Panasonic announced intentions to discontinue development of second generation GSM (Global System for Mobile Phones) devices and focus exclusively on 3G (third generation) Linux-based handsets.

Given highly fragmented market requirements, the ability to address a variety of customers by making small modifications or extensions to a common platform can reduce many of the challenges facing handset manufacturers today.

As the handset market matures, mobile phone manufacturers are looking to dramatically differentiate their offerings. Commoditization is forcing the need for constant innovation in order to maintain a high ASP (average selling price) and high margin per handset. Innovative form factors, multimedia capabilities, and unique branded interfaces are just a few of the tactics manufacturers will take to set their offering apart. The challenge is that traditional proprietary operating system platforms stifle differentiation and make it costly and difficult to deliver an innovative product. These platforms are incredibly rigid, defined and do not permit the flexibility to modify the phone presentation.

With Linux, manufacturers see the opportunity to directly influence the software platform and achieve the degree of control they believe is necessary to continue growing their business. Linux provides manufacturers with a malleable, open

platform that can be tailored to meet standards and specifications for avoiding fragmentation while simultaneously providing customization. Other proprietary platforms offer little or no ability to drive differentiation, leading to commoditization and fragmentation. Linux is extremely scalable and can be used to build different types of mobile phones for different market segments.

Handset manufactures want to control the destiny of their business rather than depend on the goals of a third party. Linux provides this control as well as the freedom to create requested and popular end-products.

By using Linux in devices, mobile handset manufacturers can deliver unique, branded experiences to their users while addressing operator specifications and reducing overall development and certification costs. For this reason, many of the top handset manufacturers are beginning to view Linux as a universal solution that can be leveraged across a broad range of devices.

The adoption of Linux into the telecommunications industry is evidence of the operating system's growing popularity among equipment manufacturers. But this adoption should come as no surprise. Linux has proven to be a mainstream technology with its flexible features and innovative capabilities. With open source, manufacturers are able to support their company's future and dramatically differentiate their offerings. Only Linux can offer total customization and unlimited innovation.

About the Author

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