Chapter 7
The Whole World is Going Mobile

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ABSTRACT

The Internet is growing ever more mobile – meaning, that an ever greater proportion of Internet devices are mobile devices. This trend necessitates new designs and will produce new and even unpredictable conceptions about the very nature of the Internet and, more fundamentally, the nature of social interaction. The engineering response to growing mobility and complexity is difficult to predict. This chapter summarizes the past and the present ways of dealing with mobility, and uses that as context for trying to understand what needs to be done for the future. Central to the conception of future mobility is the notion of "always available" and highly interactive applications. Part of providing acceptable service in that conception of the mobile Internet will require better ways to manage handovers as the device moves around the Internet, and ways to better either hide or make available a person's identity depending on who is asking.

INTRODUCTION

Technology marches forward and provides ever more useful (and complicated) wireless devices for our entertainment and profit. Handheld devices commonly have more storage and computing power than the roomful of equipment popularized as futuristic in so many science fiction movies. Even more impressive is the capacity for convenient wireless access to information around the world, at the click of a finger. And yet, the wireless revolution has just begun. Both licensed and unlicensed band communications have been growing at a prodigious rate, and, to the surprise of many industry experts, the IEEE 802 Wireless family now appears to be the dominant wireless family if measured by total traffic over the air (Brodkin, 2012; Brustein, 2014). If measured by direct profit from subscribers, however, licensed-band cellular wireless channels have a tremendous advantage.

Users are confronted with a confusing array of applications, configuration choices, underlying technologies, pricing schedules, product features, and upgrade options. Unfortunately, it is often the case that applications such as voice or interactive video that work on one radio technology may fail

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on another radio technology, or have prohibitive cost. More often than not, applications work differently or fail entirely depending upon the underlying operating system, but aside from this "bug", the main reason typical customers/users care about the operating system is because of some perceived status imputed to it. That status is not really based on technology. We observe that these "bugs" of inconsistent user interface and availability are mostly built-in to the application suite offered with the products, and vendors perceive that fixing such bugs would enable the customer to use competitive products. In other words, these bugs are seen as a way to segment the market, presenting a competitive advantage, forcing customers to choose one product that seems least inconvenient for the desired uses. This effect is even more prominent when considering uses for licensed-band communication technologies and products (i.e., smartphones for cellular networks).

There are several technology vectors that will work against this enforced market segmentation.

- Multifunction / multiradio devices will dominate the market, and users will be frequently confronted by the abovementioned bugs
- Conservation of battery power is one of several issues motivating the dynamic selection of the closest access point as well as reductions in signaling requirements during "idle" times. Note that "always-on" applications generating frequent "keepalive" messages have severe impact on battery consumption.
- The availability of "media-independent" protocols which can provide wireless communication and handover services that are not closely tied to the specific wireless technology.

Wireless devices naturally provide continuous opportunities for user mobility, and people love the freedom provided by radio communications. The natural feeling of freedom and convenience afforded by wireless Internet access has raised customer expectations, and one result will be the continued increase in the number of Internet access points. We can expect to see near-ubiquitous coverage of urban areas by both licensed and unlicensed-band radio access points, with the choice increasingly made based on convenience, rather than dictated by application limitations or contract limitations.

Unfortunately, what seems natural to the user is not very naturally provided by traditional Internet protocols. As a result, there have been numerous attempts to provide a natural user experience with the assistance of the application. In particular, applications running on unlicensed band radio channels have been instrumented with features to help with handover and session continuity from one access point (or base station) to the next. This trend has been driven particularly because of the lack of operating system support for mobility management, which would typically eliminate the need for the disparate application-layer mobility management solutions. The result is that some applications can survive movement to new locations (i.e., new network attachment), and other applications cannot. When the application does survive, the results are still quite variable, including temporary lock-up, request for reauthorization, loss of streaming video, and restarting transfers for files and webpages.

As real-time applications (such as virtual reality) become popular, this handover behavior will increasingly be seen as amateurish and annoying. Application-based mobility management is typically different for each application, with different characteristics and surprises. Vendor-centric mobility management (i.e., mobility management not interoperable and supported only for sessions while running on a particular vendor's equipment), as practiced in today's cellular networks, can respond somewhat more quickly, but is usually encumbered with accounting protocol gadgetry that limits performance. Moreover, suitable handover