Cyber Foraging: Bridging Mobile and Cloud Computing

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Year	Representative server		Representative handheld	
	Processor	Speed	Device	Speed
1997	Pentium II	266 MHz	PalmPilot	16 MHz
2002	Itanium	1 GHz	Blackberry 5810	133 MHz
2007	Core 2	9.6 GHz (4 cores)	Apple iPhone	412 MHz
2012	Xeon E3	14 GHz (2x4 cores)	Samsung Galaxy 3S	3.2 GHz (2 cores)

This figure compares the processing power of representative computer systems in five-year increments from 1997–2012. As a rough estimate, processing power is given by the product of core count and clock speed. Although both server and mobile computers both show rapid growth in processing power, the performance gap between the two remains substantial for every time period examined.

Figure 1.1: Comparison of mobile and infrastructure processing power.

of its processor. For computers with multiple cores, the table calculates speed as the number of total cores multiplied by the individual processor speed (this is only intended to be a rough estimate of processing power). Both server and handheld computers have seen remarkable growth in processing power, first through increasing processor clock speed and later due to increased parallelism realized via multicore chips. However, in each year, there is a substantial performance gap between the capabilities of server and handheld computers. The gap is lowest for modern computers (2012), but these results due to not account for distributed systems in cloud data centers that can leverage many servers to perform compute intensive tasks.

Due to the gap between mobile and infrastructure processing power, compute-intensive applications can execute much faster on remote infrastructure than on mobile devices. On the other hand, interactive activities that demand few computational resources may execute almost as fast on a mobile computer as they do on a server. Further, performance is not impacted solely by processor speed; remote infrastructure may offer more memory and storage, the ability to parallelize computation across multiple cores and servers, or better network connectivity.

The second potential benefit is reducing energy usage. A mobile computer system operates on battery power. It must budget this finite source of energy wisely so that it can perform all the activities demanded by its users without exhausting the supply before an opportunity to recharge the battery arises. Designers therefore strive to make mobile computing systems as energy-efficient as possible, for example, by employing hardware power-saving modes or by reducing the scope or quality of activities performed by mobile applications. While these measures are essential to extending battery lifetime, they also noticeably degrade the mobile user experience; applications take longer to perform interactive activities and produce lower-quality results. Use of fixed infrastructure is an attractive alternative for designers. By offloading computation or data storage from a battery-powered computer to a remote computer with wall power, the operational lifetime of the battery-powered, mobile computer can sometimes be extended without degrading the user experience.