

Mobile Applications – Interpreting the 5th Cycle

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ABSTRACT: Using the analogy of an existing smart car, this paper explores “Power to the Edge”, where the edge is commercial mobile computing. The world is poised for a 5th Cycle of computer capability, this time focused on the burgeoning phenomena of mobile computing. This era may render the laptop obsolete. A number of organizations have forecasted trends. Using these trends we project the future nature of mobile applications that are already growing in volume exponentially. Looking at the dark side as well, we examine existing security and privacy issues and we explore the negative consequences of global mobile computing as a powerful Internet force enabler.

The next time you buy a car, it is liable to be wireless. When in proximity of the car, an electronic fob triggers the vehicle to permit keyless access. It also allows the car to start keylessly with the push of a dashboard button. If present, the operator’s mobile phone can then be synced to the car allowing hands-free calls via simple voice commands. This action further enables an emergency call from the car in case of a collision. If a media player is present, it too syncs via Bluetooth to permit playing music, audiobooks or podcasts through the car’s audio system. If the engine is sluggish, a status report can be generated, momentarily appearing in the car owner’s email. If the sky appears threatening, a live color weather map can be summoned to display radar tracking of nearby or regional storms, indicating relative severity and wind conditions. Real time location-driven maps appear on demand via the onboard Global Positioning System (GPS) receiver. When navigating via GPS, traffic alerts in the route of travel allow for instantaneous rerouting around bottlenecks. At any time, one can request driving directions to nearby gas stations, hotels, local airports, nearby attractions or restaurants by specialty. When cruise control is engaged, electronically steered radar engages to sync the car to the speed of the vehicle in front. Meanwhile rear-mounted radars indicate if other moving vehicles are lurking in the blind spots. Each of these capabilities involves some form of wireless data transfer. The car literally connects its operator both from a sensory and kinetic standpoint. While this type of integrated technology is commercially available today¹; it represents just the beginning of a rapidly evolving wireless era.

The Department of Defense, pursuing “Net Centric Warfare,” popularized the term “Power to the Edge”. The prevailing notion was that through interaction with the individual marine, soldier, sailor or airman, commanders would achieve greater agility in the electronic battlefield². The wired car demonstrates that “Power to the Edge” is already emergent and commercially viable. No longer are mobile phones just voice telephones; they are rapidly becoming integrated data brokers. The implications are broad and significant. The technology and the wide range of applications it launches will determine how we: conduct warfare, manage disasters, dispense services, provide education, monitor our health and wellness, react socially, control our identity and literally live our individual lives in an increasingly cyber-public ecosystem.

Bell Labs conceived the notion of mobile networks in 1947. Japan launched the first analog mobile network in 1979. The first commercial handheld phone in the U.S. appeared in 1983³ and cost over \$8,000 in today's dollars. Rampant growth followed, although recent indications suggest a domestic leveling effect. By December 2009, the United States had 286M mobile subscribers⁴ for 91% of the population. Despite such a surge, we are, as a nation, already behind the wireless power curve. Lacking a backlog of old technologies, foreign nations continue to gain a significant tactical edge. The world contains some 4.6B active mobile phones at the start of 2010⁵. As of June 2010, there were 775M Mobile subscribers in use in China⁶, which covered only 58% of the population. China's overall wireless subscribership was growing at a rate of 15.4% by the third Quarter of 2009⁷. The overall Asian-Pacific region, houses 39% of the broadband market and supports 42% of all Internet users. This region also has the largest number of cellular phone users in the world⁸. In Zimbabwe, cell phone users outnumbered Internet users in 2008.⁹ Cell phones play a major role in Zimbabwe's agriculture where aristocratic farmers manage land wirelessly from afar.¹⁰ The first mobile call in the United Kingdom (UK) was made on 1 January 1985. According to the UK office of Communications "The majority of people in the UK use mobile services. Innovation is flourishing: we are using more text and data services; mobile internet access is taking off; and devices can do more while costing less."¹¹

The major global mobile operating system is Symbian, written in C++ in 1980 for the Psion. Acquired by Nokia, this OS still enjoys global predominance over Research in Motion (RIM), Apple and Windows. Symbian's 2008 market share decreased to 47.3% due to pressure from new smart phone counterparts.¹² Apple and its tightly controlled App Store and Google and its free-for-all Droid open apps environment will continue to battle domestically in the short-run¹³. In the longer view, however, the applications environment for mobile devices is still in its infancy. To truly appreciate this pending software juggernaut, it is necessary to assess the overall trends that the industry will harness, feed and spawn.

An informal poll requested leading market analysts to cite their individual top five trends in the mobile Internet¹⁴. They converged on the key notion that the mobile device will be ubiquitous, soon outstripping traditional computing in capability, utility and popular favor. As mobile devices become increasingly small and powerful, many experts expect that they will make the laptop obsolete. Other key trends were cited frequently.

- 1) "Mobile commerce, fueled by rampant mobile advertizing, will come to dominate and transform global business including monetary transfer practices.
- 2) Voice over IP (VoIP) and IP based data transfer will become the norm as the cost of 3G, 4G and Wi-Fi transmission will decrease.
- 3) Data transmission will become more important than voice transmission in mobile cloud-based eco-systems, and augmented reality will grow in acceptance as devices connect to one another and become location aware.
- 4) Smart-phones will morph to accommodate more innovative input and output mechanisms.
- 5) Mobile browser-based applications will eventually become over desktop-based applications."

The investment house Morgan Stanley cites five convergent technologies that are attributable to the rapid rise of the mobile Internet. These technologies are: 3G, social networking, video, VoIP and increasingly capable mobile devices. This convergence helps establish eight key themes surrounding the mobile Internet¹⁵. They are:

- 1) “Wealth creation and destruction is crucial in new computing cycles – We are now in the early innings of mobile Internet cycles, the 5th cycle of the last half century.
- 2) Mobile is ramping up faster than desktop Internet did, and will be bigger than most people think.
- 3) Apple is leading in mobile innovation and impact, for now – Depth of app ecosystems, user experience and pricing will likely determine the long-term winners.
- 4) Game-changing communications and commerce platforms (Social Networking and Mobile) are emerging very rapidly.
- 5) Growth and monetization roadmaps are provided by Japan mobile systems and the desktop Internet.
- 6) Massive data growth drives carrier and equipment transitions.
- 7) Compelling opportunities exist in emerging markets.
- 8) Regulators can help advance or slow mobile Internet evolution.”

The British Office of Communications further predicts that¹⁶:

- 1) “Mobile applications will become more independent from mobile networks;
- 2) The importance of network intelligence will diminish;
- 3) Mobile internet speeds will become faster; and
- 4) Mobile handsets will continue to become more sophisticated.”

A mobile application (or “app”) is a computer program that runs on or is supported by a mobile handset. The trends cited above suggest that the unprecedented ramp up in mobile apps will continue unabated but may take new, unexpected directions. Moore’s Law remains intact as devices adapt smaller form and function, always featuring increased capability. The future devices will yield a virtual playground for innovative mobile applications that serve a growing edge appetite. New research suggests the global market for mobile applications will explode over the next two years. A study done for Getjar, the world's second biggest app store, said the market would grow to \$17.5B in the next two years. The study claimed downloads would climb from 7B last year to 50B by 2012 - a 92% year-on-year increase¹⁷.

Together, the foregoing predictions refine our view of what future mobile apps are liable to provide. One thing is certain: today’s apps, impressive as they may appear, are only a modest beginning. The following passages serve to extrapolate anticipated capability from the predicted trends. They are purposefully left unattributed, although ample evidence exists to support the ideas illustrated.

Future apps are liable to be browser-based at the edge and draw heavily upon cloud resources. Over time, rigid frameworks will give way to more adaptive architectures.

Future apps are likely to have significant mobile commercial implications. Mobile computing will grow to become a 24/7 commodity. Mobile computing will become an information utility, analogous to running water and electricity; it will be assumed that all “normal” people will utilize extensive hand-held mobile computing.

The edge will mature to a full-scale, always-on, bazaar-like marketplace offering a myriad of real and virtual products, often using mobile currency. Location will play a growing and significant role in mobile computing and both subtle and “in your face” proximity marketing will become ubiquitous. Social networking will continue to expand and fully embrace mobile technology. Rampant social sharing will become a predominant mobile app driver.

Unfortunately, mobile user profiles may play into the significant security gaps that will be created by wholesale sharing. User profiles may both permit enhanced security by coalescing and shielding like user communities, while still fostering large scale targeted advertising based upon personal preference. Still, many who sense that they are at risk will choose to opt out. Such an act may result in severe social consequences.

Object oriented representations will support a vast and burgeoning augmented reality market. Growing demand for augmented reality and relevant data mining will further the need for agent-based computing and artificial intelligence tools, ultimately operating in the cloud among interacting users and a vast array of related data devices which support them. In one sense, virtual and mobile applications will not inherently require a “where.” But, thanks to GPS, if an application needs to know where a device is, that will also be available.

Electronic books, alongside videos of all types will become important mobile consumer commodities. Mobile data mining for discovery, as a cloud operation, will provide far more user-contextualized information. Data mining will supply relevant content that has the potential to become actionable knowledge in light of a user’s inferred profile and stated preferences.

The appearance of structure at the edge will remain important even though the majority of cloud data will be inherently unstructured. It is estimated that the majority of the world’s data is currently unstructured, and the ratio of unstructured to structured data is growing.¹⁸ Moreover, the nature of existing “structured data” poses legitimate concerns in terms of effective mobile manipulation beyond RFID. Image recognition and three-dimensional image rendering will play an increasing role in mobile apps as video and image technologies continue to mature. These technologies will eventually merge with unstructured data mining to support powerful multimedia discovery capabilities.

Armed with smaller, better power supplies, mobile devices will morph. As devices become more utilitarian from an input/output standpoint, virtual displays and interactive voice technology will continue to gain market share. Open access to mobile eco-systems will expand as enlightened regulators press for net neutrality. This may generate some growing pains, as new revenue stream schemes come and go. OEMS and data carriers will continue to be serious competitors in the mobile app world. Today’s network wars will succumb to economic battles among competitive content providers. Devices will morph further to chase content.

Amid all this optimism, however, there are some ominous signs. Despite a rosy economic outlook for mobile computing, the mobile app world suffers from the woes of cyber-security. Aside from the social networking risks mentioned above, the literature is impoverished in this realm, suggesting that the significant security problems are so far largely unaddressed.

The core security problems here are two-fold: the physical security of the handheld device, and the security of the applications and data on the device. Further, there are issues related to the security of the wireless information sent to and from the device, as well as the ability to track the location of the device using GPS technology. These issues present a large array of possibly ways in which a promising and positive technology can be used maliciously. For example, as personal location information becomes commonplace, cyber-stalking will be facilitated. Businesses will be eager to use such information for marketing, but criminals, disgruntled workers, angry spouses, and ex-employees will also want to locate people for less savory reasons. People worried about government intrusion into personal matters have something to fear from increased reliance on mobile technology. Hackers may find a fertile playground in wirelessly available, lightly protected mobile devices.

Even assuming that security is better addressed in the future than it has been up until now, the rise of ubiquitous mobile computing will have some important social implications. In the third of his ground breaking 1990's sociological trilogy, "The Information Age: Economy, Society and Culture: Volume III, End of Millennium", Manuel Castells expends some 50 pages addressing the affects of global Internet commerce on criminal or corrupt activity¹⁹. This activity will not require breaking through mobile security, but will merely use the technology for criminal purposes. As an anticipated significant amplifier of human activity, the implications of the mobile edge may well serve to amplify Castells' social observations with increasing urgency.

Prophecies about sociotechnical systems and their effects on people are notoriously inaccurate. Still, our experience with today's mobile devices makes several things clear. First, having increasingly powerful computing and telecommunications devices changes the way people interact. In almost any public area in the world today, you can observe fewer people interacting directly with each other, and more people interacting with a mobile phone. There are many debates about the positive and negative effects of these kinds of changes, but there should be no serious debate on whether or not there are significant effects.

Second, it has already been demonstrated that there will be ebbs and flows in our understanding of how human values interact with sociotechnical systems. For a time, it seemed like young people had simply abandoned any desire for personal privacy. However, lately some Internet vendors have discovered that even young people notice when their information is shared without their permission. One interesting trend to watch in the next few years is whether data sharing becomes more visible or less visible as mobile devices become more powerful; if vendors are forced to make such sharing more visible, users are likely to clamor for more control. Conversely, if data are shared under many layers of hardware and software, users may become less aware and less concerned as their control over personal information deteriorates.

Third, because mobile devices require a complex and expensive infrastructure to function, large corporations and governments will continue to be major players in this sociotechnical system. (With sufficient money and determination, you are able today to get off the electrical grid; but it is far less practical to set up very own personal communications network, and still be able to phone out for a pizza.) Because large entities are involved, public policies matter in this evolution of mobile devices. While that can be discouraging for engineers who want to avoid the messy world of politics, it also means that the public can have a say in the direction these systems go, and not just as customers. It remains to be seen if people will engage in debates about these policies, or will merely observe as commercial titans battle it out. The Federal Communications Commission is already engaging large Internet firms in initial closed-door sessions to discuss potential governing legislation²⁰. At least in the ongoing controversy over Net Neutrality, many people and groups have weighed in, and hopefully that trend will continue.

Industry leaders and observers agree that the era of the mobile device and its applications is upon us and will continue to gain momentum. How we morph to adapt to this technology, and how we insist that it adapts to us, will help determine the course of mobile computing. This technology will become an important aspect of how we react as enlightened citizens to increasingly pressing global issues.

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