

# The Technological Foundation for An Open Mobile Ecosystem

For over a decade, growth in wireless communication and devices has been hampered by a lack of open standards and programmable devices. But quickly evolving innovation in wireless communication will transform wired networks and mobile devices, providing more flexibility to consumers in terms of choice of operators, equipment, and applications. This mobility explosion is driving investment and innovation in mobile technologies. Three sets of innovations will form the foundation of a mobile ecosystem of platforms, applications, services and providers:

- Powerful and inexpensive mobile devices
- User-programmable mobile devices
- Open wireless networks





## Powerful and Inexpensive Mobile Devices



Smart phones and other communication devices that provide powerful computing capability are becoming more popular and cheaper by the day. In fact, the mobile phones that we carry in our pockets today are more powerful than the most powerful desktop computer of the 1990s. According to Nielsen research, the use of smart phones in the United States doubled in the past year. In Japan, the third generation (3G) of mobile phone standards, which enable high-speed data exchange, has reached 90% penetration. iPhone-like devices from Samsung, LG, and other manufacturers already sell for \$79 to \$199. We expect that the price for smart phones will continue to drop, and demand for these phones will grow across the world. iPhone and BlackBerry are becoming popular among business users in India, China, and other emerging economies.

## User-programmable Mobile Devices



Mobile devices are becoming programmable by users, making it easier to build large, diverse developer communities. More than 100,000 developers downloaded the iPhone SDK in the first four days of the release. Within a month of release, already 1000 applications had become available. By the end of November 2008, about 10,000 iPhone applications were available in the application store.

Many applications are free, as are thousands of purely web-based applications for iPhone that don't require any special application downloads. Ironically, Apple's iTunes service, which also provides iPhone applications to users, vets every application before making it available—a classic walled garden.

Nokia, the world leader in the sale of smart phones, recognizes that mobile phones are morphing into personal web devices. Most Nokia phones use open source operating systems like Linux and Symbian (Symbian was proprietary software before Nokia purchased it). Together with a consortium of other mobile technology companies, Nokia made Symbian available as an open source system. This is good news

for developers who can now create applications for the Symbian operating environment. As a result, we can expect to see a flood of interesting new mobile applications and services on Nokia devices.

Internet giant Google also recently made its foray into the world of mobile computing with its version of an open source mobile operating system, Android. Google has also gathered a consortium of technology companies and wireless carriers to create the Open Handset Alliance. Members of the Alliance are developing handsets, applications, and services optimized to work on Google's Android system.

## Open Wireless Networks



As powerful web-enabled programmable devices proliferate, they will no longer depend solely on enabled wireless networks from specific carriers and community providers. With the diffusion of these new devices into the marketplace, they will provide a platform for an open mobile ecosystem. This ecosystem will be fundamentally different from what we have today, as it will not be constrained by devices and operators. Users will not be tethered by the restrictions that wireless operators and phone manufacturers currently enforce, and will have more choices to customize their cell phones.

Devices will operate portably across different kinds of wireless networks such as mesh networks, WiFi, and WiMax.



## International Spotlight: The Battle Over Standards in China

The Chinese government has committed itself to setting its own standards for mobile technology to ensure that Chinese companies can make more profit than international competitors, control large markets, and avoid costly licensing fees. Most experts agree that, apart from supporting the industry, the Chinese government wants to have a say in setting global standards so it can embed monitoring technology.

Currently China has two major 2G wireless networks: China Mobile's GSM network and China Unicom, which supports both GSM and CDMA technology. China has set its own new TD-SCMA standard for 3G wireless requiring handsets to have multimode chipsets to support multiple standards.

The Chinese government has also battled with international organizations concerning wireless LAN standards. The International Organization of Standardization rejected the Chinese LAN standard, WAPI, in 2006 after the Chinese government refused to allow experts access to evaluate their proprietary encryption scheme. The international organization believed that the encryption scheme was a back door the government left open for the purposes of surveillance.

Regardless, two Chinese wireless network integrators recently agreed to use WAPI as their preferred standard. Once China implements WAPI technology at a large scale, a new Chinese brand of communication technologies will emerge that, over time, can become competitive and pose serious challenges to other international standards like WiFi and WiMax.

## Wi-Fi

Wi-Fi's commercial success over the last decade has occurred almost entirely outside the legacy frameworks governing wireless communications. Operating in an unlicensed microwave band reserved for experimental use, Wi-Fi is a powerful demonstration of the innovation possible when new players from the information technology sector are permitted to aggressively enter the wireless hardware market. Traditionally viewed as the "junk" spectrum, 2.4 GHz is now the band most consumers associate with flexible, free, and high-performance wireless communication.

Over the next decade, we will increasingly look back at Wi-Fi as a sort of quaint ancestor of a multitude of highly-optimized wireless "species," each occupying a portion of a widening pie of the unlicensed spectrum made available through a broad political coalition of free marketers and commons activists. These will include:

- New flavors of Wi-Fi, such as 802.11n coupled with MIMO, which use smart antennas to exploit multi-path propagation of microwave signals to increase bandwidth.
- ZigBee, a low-bandwidth, very low-power protocol optimized for sensors.
- UltraWideband, a very high-bandwidth LAN protocol designed to operate in a light, non-interfering method on existing licensed frequencies.
- Wi-Max, a wide-area version of Wi-Fi, originally intended to be unlicensed, but near-term deployments are mostly limited to licensed use. A number of carriers worldwide are deploying wireless networks.

## Mobile Mesh Networks

Today, almost all wireless networks are merely edge extensions of large, legacy wired infrastructures that aggregate and transport traffic along fiber backbones.

On the other hand, mobile mesh networks use mobile devices or base stations rather than fixed ones, thus reducing dependence on wired infrastructure. Rather than extensive cabling to connect every wireless node to the wired backbone, some nodes serve as relay stations for more outlying nodes, working like a digital bucket brigade. This technology is used in military applications to support highly mobile troops, but consumer mobile meshes took a big leap forward with the introduction of One Laptop Per Child's XO laptop, which incorporates mobile mesh technology.

Over the next decade, mobile mesh technology will evolve, driven by two factors. First, since the costs of upgrading infrastructure can be moved to the device rather than absorbed in network infrastructure upgrades, mesh technology is especially suited to a fast-changing wireless technology arena. Second, mobile meshes are ideally suited to vehicles, which are becoming increasingly important nodes in personal media and communications ecologies.





## Forecasts

The following are forecasts which we have shown in the form of short videos. These videos bring the forecasts, our visions of the future, to life. Below are descriptions of each. You can view them at [www.iftf.org](http://www.iftf.org).

### Moving to ...

#### < Increased Transparency

As the ability to stream data and information in real time across multiple channels becomes more pervasive, we will move towards increased transparency. People will record and share their lives and the lives of those around them, providing power to grass roots voices in the process. It will often pit governments and those in control against voices coming from the bottom up, and the two sides will play a cat and mouse game with each other trying to make sure their version of the story is the one we hear.



#### Amplified Networks >

The power of a mobile device in everyone's pocket will lead to increased global interaction in communities of all kinds: faith, culture, politics, diasporas, and more. This amplification of networks will provide people and communities with increasingly affordable presence and connectivity. A look at the lives of three different mobile individuals helps give us some perspective on how amplified networks are improving the quality of people's lives.



#### < Networking the Environment

Embedded sensors and pervasive computing will equip things and environments with their own persistent streams, allowing us to engage with our environments on a more human scale. By giving voices and personalities to objects in our environment, we will bring sentience and presence to the inanimate.



#### Formalizing the Informal >

As the cost of mobile connectivity and devices continues to decline, the mobile phone will become an indispensable social tool for those at the bottom of the pyramid. The mobile phone will emerge as an important source of identity with the mobile number acting like a social security number for the poor across the globe. It will also provide opportunities to those at the bottom of the pyramid to participate in local, regional and global economy through mobile banking, mobile health and other commercial transactions.



#### < Homeward Bound

Migration from rural areas to urban areas is a worldwide trend. In developing nations, mobile technologies are often the only way migrants can stay in touch with their families and social networks back in their hometowns.





## About the ...

### Technology Horizons Program

The Technology Horizons Program combines a deep understanding of technology and societal forces to identify and evaluate discontinuities and innovations in the next three to ten years. Our approach to technology forecasting is unique—we put people at the center of our forecasts. Understanding humans as consumers, workers, householders, and community members allows IFTF to help companies look beyond technical feasibility to identify the value in new technologies, forecast adoption and diffusion patterns, and discover new market opportunities and threats.

### The Institute for the Future

The Institute for the Future is an independent, nonprofit strategic research group with 40 years of forecasting experience. The core of our work is identifying emerging trends and discontinuities that will transform global society and the global marketplace. We provide our members with insights into business strategy, design process, innovation, and social dilemmas. Our research generates the foresight needed to create insights that lead to action. Our research spans a broad territory of deeply transformative trends, from health and health care to technology, the workplace, and human identity. The Institute for the Future is located in Palo Alto, California.

