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Patent Strategies for Wireless Technologies

The story thus far: the time for wireless technologies has come in full force. But how can entrepreneurs and investors take advantage of this wireless frenzy? Here we give a brief overview of wireless technologies and point out a less-publicized inadequacy of the emergent wireless Internet. Along the way, we offer some suggestions from the standpoint of IP, particularly from the standpoint of patent strategies.

The development of wireless technologies divides into three periods: the early period of radio (FM and AM), the "classical" period of cellular systems (analog systems such as AMPS, and digital systems such as GSM), and the nascent period of an emerging wireless Internet.

The early period of wireless technology centered on a simple infrastructure of a transmitter and a receiver. The transmitter sent signals as radio waves to be intercepted by the receiver. Limited propagation range was often extended by an antenna at an intermediate base station.

The "classical" period of wireless technology began with the emergence of cellular systems. A cellular system differs from a radio system in that multiple base stations are used to reuse the precious natural resource of wireless bandwidth. Cellular systems are often classified in generations (e.g., 1G, 2G, 2.5G, 3G, and 4G). 1G cellular systems such as AMPS's are analog telecommunication systems. 2G cellular systems include digital telecommunication systems necessitated by an increasing number of cellular phone users. TDMA and in recent decade the emergence of CDMA are

multiplexing technologies developed with the digital cellular systems in mind. Various wireless technologies were developed in response to the problems arising from designing various facets of the digital cellular systems. For example, advances in technologies of encoding/decoding, encryption/decryption, channel coding/channel decoding, and modulation/demodulation were spurred by the problems of digital cellular systems. An entire industry of digital signal processing, or DSP, was created because of digital cellular systems.

The "classical" period of cellular systems extends from the 1960's to the present. As such, technologies in this period have been increasingly dominated by the telephone manufacturing companies. Due to the maturity of their technologies, innovations in cellular systems are likely to be incremental – not to mention dominated by them.

One of the most pressing challenges in cellular systems is to harmonize or unify the various formats/protocols of cellular systems around the world. Innovations are likely to be along the lines of SOC (for better integration and lower power consumption), more efficient algorithms, and efficient manufacturing techniques. In addition, because of technological maturity and saturation, a business model of a start-up in cellular systems naturally gravitates toward volume selling to the system integrators. Thus, for a start-up working in this space, the IP landscape appears to be full of patent land mines. Building an IP portfolio is likely to require careful thinking about possible cross-licensing issues even at a formative stage.

Accordingly, a viable patent strategy in this space should emphasize defense against prior art. That is, patenting inventions related to cellular systems requires extensive prior art searches in preparation for drafting claims. Without adequately researching prior art patents and possible licensing options, a start-up is likely to find its novel ideas drowning in a sea of prior art patents. A viable patent strategy thus involves extensive due diligence in avoiding patent land mines and aggressive searches for partnerships/licensing possibilities.

Fortunately, several legal options are available to a company to actively reduce the legal risk of patent infringement in this crowded space. For example, a company can ask a patent attorney to render an opinion letter stating non-infringement of prior art patents, or an opinion letter arguing for invalidity of prior art patents.

It's interesting to note that although cellular systems and the Internet were both created around 1969, for years there was no interaction between them. Only in recent years did they converge to generate sophisticated PDA's, which entice people to access the Internet wirelessly. In other words, in the nascent period of wireless technologies, mobile devices are the main players. A market has formed in this nascent period to ameliorate the never-ending thirst for data – any time and anywhere.

The boundary between the "classical" and nascent periods is somewhat blurred; nevertheless, this discussion will be based on the simplification that the nascent period began with the emergence of a wireless Internet (circa 1998). Moreover, a distinction will be made between a wireless Internet allowing portability and a wireless Internet allowing mobility. We should then suggest that the transition from a portable wireless Internet to a mobile wireless Internet is non-trivial, requiring drastic changes in wireless infrastructure.

Fortunately, the wireless market is neither mature nor crowded. Various standards have yet to find the acceptance required to reach maturity, and ample room exists to allow companies big and small to seize business opportunities with patents. Advances at various levels of network granularity are yet to be standardized. However, rather than taking the well-beaten path of dissecting the various technological advances in this nascent period of the wireless Internet, we would like to focus on some of its less publicized weaknesses and problems.

Specifically, the wireless Internet infrastructure today is largely portable but not mobile. "Portable", in Internet terms, means that a user must sever his connection session before moving to a new location, then later reestablish another connection

session. For example, a portable device such as a laptop needs to access the Internet through an access point having a fixed location and IP address. When moved to a different location, the laptop needs to access the Internet through another access point having a fixed location and a different IP address. As such, the user can access the Internet anywhere but not anytime. On the other hand, a mobile connection means that, regardless of the location, a user can be connected anywhere, anytime and all the time. However, the wireless infrastructure in the nascent period thus far is designed to support commerce through portability. The wireless infrastructure such as TCP/IP protocol, software, routers, and switches is inadequate for supporting a mobile wireless Internet, wherein a mobile device does not necessarily connect to the Internet through fixed-location access points.

More specifically, the infrastructure of the Internet and specifically the web (using HTTP protocol) has been mainly based on the client-server model (see Figure 1A). With the rise of the web using HTTP protocol, and with explosive numbers of people connecting to the Web, e-commerce has emerged using the infrastructure of an n-tier model wherein the client interacts with a database through the intermediary intervention of multiple servers (see Figures 1B-C). Moreover, e-commerce infrastructure has become increasingly sophisticated wherein two databases, each as part of an n-tier model, can exchange information (see Figures 1D). For example, two companies in a supply chain can access each other's databases to efficiently coordinate purchasing and inventory control. In recent years, companies have added wireless capabilities on top of these infrastructures (see Figure 1E). However, even as the Internet underwent a recent and ongoing "wireless facelift" to enable wireless Internet access, the wireless access mode still supports portability rather than mobility. No major infrastructure overhaul needed for a mobile wireless Internet has been implemented.

Presently, fierce battles are being fought between Microsoft's .Net technology and Java/XML (J2EE) technology to become the infrastructure for e-commerce applications spanning multiple n-tiers. Successful software vendors such as BEA have placed their bet on the J2EE platform rather than the .Net platform from Microsoft by developing

application servers using J2EE technology. However, both .Net and J2EE technologies rely on a portability-centric wireless Internet. As such, both .Net and J2EE might become out-dated for supporting the emergent m-commerce (mobile-commerce) because these two technologies are designed for portability rather than mobility.

Conceptually, the technological problems encountered thus far in building a portability-centric wireless Internet are straightforward. They are considered "solved" in the sense that similar solutions are being provided by various companies. Thus, problems in portable wireless technologies are well understood. There is a discernible direction to find solutions, and people try to solve the problems with straightforward techniques. As such, various solutions are likely to be proposed without fanfare, and boredom can quickly set in.

On the other hand, arguably, the real impact of wireless technology has not yet been revealed in this nascent period of wireless technology. As mentioned above, even as the Internet is moving toward wireless, its infrastructure is limited to supporting portability rather than mobility. Thus, the exciting thing about the nascent period is the phase transition that the Internet is about to undergo from portable wireless to mobile wireless.

Specifically, proliferation of mobile devices connecting to the Internet will be the dominant driving force of innovations in this nascent period of wireless technologies. However, the Internet infrastructure will have to be profoundly changed to accommodate mobility rather than just portability. A entirely new set of problems will be created when people demand mobility when accessing the wireless Internet. This is a wide-open area where large corporations and start-ups can compete on equal ground in pondering what happens when the wireless Internet reaches entropy (see Figure 1F). Naturally, many technical problems related to mobile (rather than just portable) wireless access of the Internet need to be ironed out first. Still, these problems create a fertile ground of opportunities. Entrepreneurs with the ingenuity to solve these problems will be handsomely rewarded.

At the moment, these new problems in developing a mobile wireless Internet with mobile nodes are not well understood. In fact, with the proliferation of PDAs, the layout of the Internet will be continually shifting. It is not even clear which network infrastructure will be relevant to build mobility into a wireless Internet. The comfort of using multiple n-tiers model (such as .Net and J2EE) will vanish. TCP/IP based protocols need to be modified. Web caching and P2P can take on a higher order of complexity. Many have begun to consider these problems, but no real conceptual breakthrough has been proposed yet.

For the time being, some developing techniques such as mobile IP, mobile software agents and satellites have been offered to address certain problems of a mobile wireless Internet.

Mobile IP is an attempt at achieving a mobile connection by maintaining one IP address for the mobile device while moving around. However, mobile IP has not been satisfactory because its behind-the-scene processing actually introduces latency and overloads the mobile connection.

Mobile software agents might be worth a second look. In the early days of the web, mobile agents didn't gain support partly because the premise of the web is to attract users to stay connected to a site. As such, major portals didn't see the value in a technology that allows a user to spend less or no time at a site. Now, with precious little wireless bandwidth available, and with the shift from e-commerce to m-commerce, mobile agents might begin to play an increasingly important and inevitable role.

Satellite systems can be used to guarantee the anywhere aspect of the mobile user in a location outside of a cellular system. Satellite systems have not caught on so far because of their high cost. However, with the proliferation of mobile consumers, the high cost of maintaining satellite systems can be offset by the vast number of users and becomes economically feasible.

Whether providing innovations for portable or mobile wireless Internet, a startup needs to have an offensive patent strategy in aggressively building its patent portfolio. Translation: even the various components auxiliary to the major innovation of a start-up need to be patented comprehensively.

In this space, a start-up must quickly establish a niche with patents by taking advantage of an often-overlooked leverage in the patent law. Specifically, patent law allows a person to patent an idea without actually having implemented the idea in physical form. Thus, a start-up can aggressively patent ideas not yet materialized to leverage its innovative concepts.

In practice, while implementing nothing in practice, a start-up would anticipate possible applications of its innovations in both the vertical and horizontal markets by incorporating its innovations into patents. In so doing, a start-up can quickly carve out a niche in the market and increase market share.

Side-bar A

Bluetooth is a short-range wireless communication standard that is supported by many companies world-wide. However, because the Bluetooth member companies are required to share their Bluetooth patents with each other without charging royalty, a viable patent strategy remains unclear. Moreover, given the low cost per unit requirement of Bluetooth components, licensing from other Bluetooth technologies can quickly erode profit margin.

Side-bar B

Harmonizing cellular systems around the world is one of the pressing issues facing vendors and service providers of cellular systems. There is a conflict of interests here. The vendors want to create proprietary standards to lock-in continual revenue. On the other hand, the service providers prefer an open systems interface standard that offers more choices from competing vendors. The patent strategy for a vendor is to actively participate in the standardization process by incorporating patents in the standardization process. In so doing, the vendor creates potential licensing opportunities. Moreover, in so doing, the vendor hedges against other vendors monopolizing the market with proprietary standards.

Figure 1A

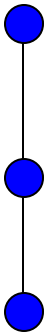

Figure 1B

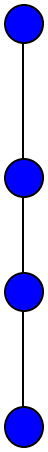

Figure 1C

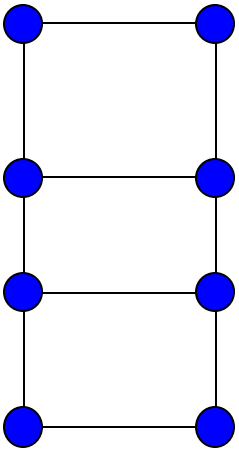

Figure 1D

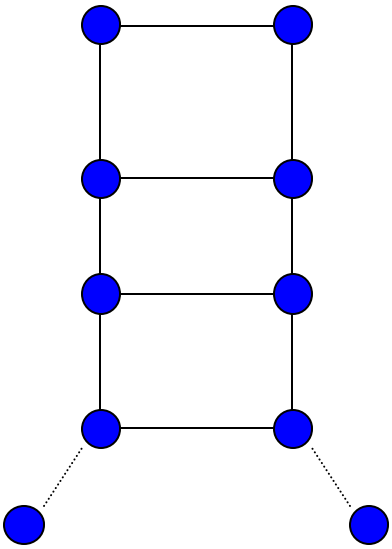

Figure 1E

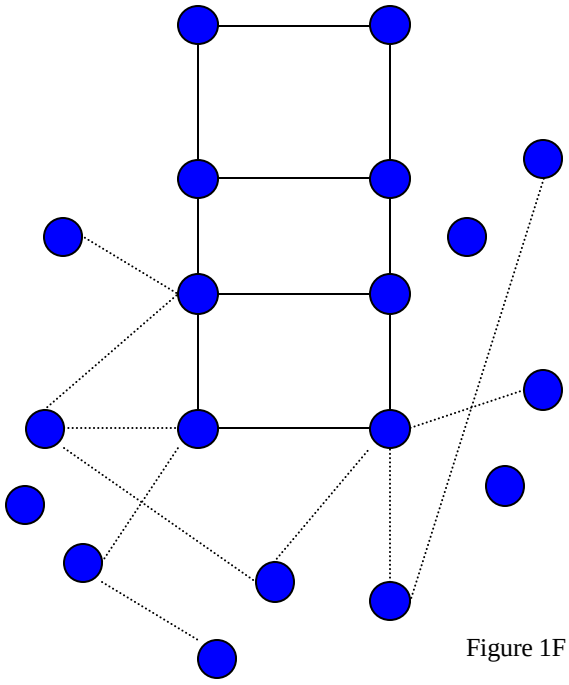

Figure 1F