The Wireless Internet

Geoff Huston

Despite appearances to the contrary, many of the components of the Internet-inspired technology revolution are not exactly new inventions. It is now 100 years since Marconi undertook the first successful tests of trans-Atlantic radio transmission, and perhaps, given this noteable anniversary, its appropriate that we look at what has been happening in world of the wireless Internet.

Much of this activity is not recent. IP itself was developed just over 30 years ago, and using IP over various forms of packet switching radio systems dates back almost as far. So if IP and radio are no strangers, why all the recent fuss about the wireless Internet? There is no doubt that the area of wireless Internet services is one of the most active areas of market interest at present. While various forms of online access, online commerce and other ISP-related market segments have gone into a holding pattern during the current business phase where caution has replaced euphoria, wireless Internet activities are still generating considerable interest. There is some feeling that the wireless Internet will transform the role of the Internet and the value of certain Internet-based services in the same way that mobile telephony rapidly transformed the role of the telephone and the associated area of short messaging services.

So what are we after? Well, for a start I'd like to enjoy the same level of mobile service I get with my phone: to be able to take it wherever I go, and have it work seamlessly. And not just at the other end of my trip, but even while I'm travelling the phone should continue to work. No matter in which country I'm in, my phone should still ring in response to the same phone number. It should not require large or heavy power systems, and it should be small enough to fit in my pocket. (It would also be good if it still worked after being dropped from a great height, or given an inadvertent coffee wash, but perhaps that’s asking a bit much!) Why can't the mobile Internet be just like that?

With a careful selection of business models and base technologies we probably can construct a seamless wireless Internet, but to see the industry consolidate within a single wireless technology model is a pretty ambitious assertion. At present, such a consolidation of approaches to wireless IP has not taken place, and we are seeing some jostling for market position between a a number of wireless technologies. In this article we will look at these technologies in a little more detail, and see where each of these is heading.

One way of classifying radio systems is in their radius of coverage.

Using this approach, the smallest radius is intended to be used by the Bluetooth system. Bluetooth, originally pioneered by Ericsson, is a so-called piconet architecture, intended to support a personal local network operating within a radius of a metre or so. It is intended to replace all those self-tangling wires and collection of different connectors that are a feature of today's electronics. Bluetooth can connect your earpiece to your phone, or your phone to your Personal Digital Assistant, or your laptop to a video projector or printer. Bluetooth operates at speeds up to 1Mbps in the 2.4Ghz band and uses an approach of ad-hoc network cells of up to 8 Bluetooth devices per cell. Bluetooth is not a technology intended for use within a carrier network or as an access technology for ISPs. Instead Bluetooth is seen as a way of integrating the functions of a number of personal devices, creating a "clip-on" architecture that uses the Bluetooth radio function as the "clip". The major advantage of Bluetooth is its ability to create ad hoc personal area networks of diverse devices. Security folk may well argue that one of the major drawbacks of Bluetooth is its potential ability to create unintended ad hoc impersonal networks of diverse devices. More seriously, it is not clear that there is a need for one distinct

wireless technology for highly local networks and a different wireless technology for longer distance applications.

The next technology that is associated with the wireless Internet is that of WiFi, the name given to the family of IEEE 802.11 wireless LAN technologies. 802.11 networks are not explicitly IP networks, but instead are an instance of the 802 Ethernet family technologies. To be a little more precise here, 802.11 is a wireless Ethernet rather than wireless IP. With an effective circumference of up to a kilometre or so, and a speed of up to 54Mps, the most obvious application of WiFi is the home or office suite network. 802.11 operates at speeds up to 11Mbps in the 2.4Ghz band and 54Mbps in the 5Ghz band. The most common applications for WiFi lie in wireless laptop and PDA networks. From its original application as a wire replacement office LAN technology, WiFi networks are entering the ISP world, appearing as public access systems in airport lounges, coffee houses, hotel lobbies and as public open space networks. The advantage of WiFi lies in its immediate availability - this is not a technology based on various forms of technology futures, but a technology that is already on a sharp uptake curve with a solid customer base in place. So its fast, its available today, its already being deployed, and its providing to be popular. The increasing volume of deployment is increasing the volumes of manufacture, which, in turn, is already turning WiFi into a relatively low priced consumer commodity technology. But its not all good news. The disadvantage of WiFi is that it uses a common spread spectrum band, so that a the deployment of WiFi networks becomes more common, so is the amount of crosstalk and bandwidth impairment. For WiFi one of the largest risks is that of massive popularity, in that overuse of the common spread spectrum band will cause impaired service. Of course there is always the possibility to shift to ever higher frequencies to alleviate this, but the issue here is that higher frequencies tend to have more limited propagation properties and reduced penetration, so that direct line of sight between the base station and the wireless device becomes necessary.

The third technology in this set is that of 3G. This is the third generation of mobile telephone technology, where the original analogue system is the first generation, and the use of a highly spectrum-efficient signal compression and digital encoding was the second generation. First and second generation systems use a fixed bandwidth allocation scheme for each mobile user. The 3G approach is to use adaptive bandwidth allocation, allowing all of the base station's capacity to be used if required. This implies a maximum speed of 2Mbps for a 3G device, although this capacity is reduced according to concurrent demands by other users as well as limitations if the device is moving across base stations. 3G is coming from a different background than the first two technologies, and the original service model is one of extending the functionality of the mobile handset or the personal digital assistant through the ability to access higher bandwidth data services.

So will we see all three technologies in widespread use in a mobile IP world? It is unlikely, and, given the early adopter market moves in the 802.11 area, it is possible to see the 802.11 WiFi technology becoming the predominant wireless IP technology. But perhaps we are not talking about one wireless world, but two. If you are looking at wireless as a transport extension of the high speed wired network, with full transparency of the Internet service model, then 802.11 is the technology that does appear to have gained market acceptance. But this is not true mobility, and WiFi is not, in its current incarnations, a suitable technology for very large scale high density mobile service. If we are talking about IP phones in your pocket, an IP connection to the electronics in your car and a mobility model that seamlessly roams across continents, then the necessary tradeoffs in technology tend to point towards the 3G approach as having the greatest potential. The wider coverage comes at a cost of lower throughput, and this implies that such a mobile wireless Internet is one that is somewhat different from the wired network. Such a system will not be able to deliver large volume content at consistently high speeds. The initial efforts to map the Internet to such a constrained service environment, the Wireless Access Protocol, or WAP, was not wildly successful. If 3G is going to fulfill all the optimistic predictions about its potential as a mobile wireless IP service platform, then its the service environment that requires the most attention, and its this aspect that we will examine in detail in the next article.

Further Reading

There is a wealth of further information on the Internet about each of these technologies. If you want to read more about these wireless technologies, the home pages of each is a useful starting point: For Bluetooth, its http://www.bluetooth.org, for WiFi its grouper.ieee.org/groups/802/11 and for the 3G a useful starting point is the Universal Mobile Telecommunications System (UMTS) forum at http://www.umts-forum.org.