

The Path to a High-Speed Wireless Internet

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Extended Abstract

It is common in research that unconnected groups working at the frontier of a field independently converge around the same time on a similar set of groundbreaking goals. This was the case in the late 1980's when several research projects on high-speed wireless local area networks (WLANs) were born.

There was negligible customer demand for such networks! But across the 1980's decade, computers had evolved from mains powered minicomputers, to desktop and luggable PCs, through to battery powered laptops and handheld PCs. Further, the first true mobile phone, the analog Motorola MicroTAC 9800X, was released in 1989, and development of the first GSM digital mobile phone standard was underway. The researchers who started WLAN projects anticipated a future in which people would make use of multiple portable connected computing devices without being restricted by wired network cables to a desk area. The networking would be unplugged.

Computer networks at the time were widespread in office environments. These were mostly wired networks operating at or below 10 Mbit/s transmission rates. By 1989, 100 Mbit/s networks were available. The more ambitious WLAN research projects set their target data rates at or above 100 Mbit/s, some three orders of magnitude faster than available wireless networks at the time.

The next decade of WLAN research and development would usher in the era of mobile computing.

While early WLAN research projects considerably advanced knowledge in the field, one in particular proved to be particularly significant in the development of high-speed WiFi - an Australian project carried out by a joint team from the national research organisation, CSIRO, and Macquarie University. The outcomes of this project included a landmark WLAN system patent [1], a complete working WLAN system [2], and a spinout company, Radiata Inc., which designed and demonstrated a two-chip CMOS implementation of the IEEE 802.11a 5GHz standard PHY layer in Sep. 2000 and soon after was acquired by Cisco Systems Inc [3]. Three members of the CSIRO/Macquarie team were recognised by the IEEE with a Technical Field Award "For pioneering contributions to high-speed wireless LAN technology" [4]. The WLAN patent described a system that transmitted and received on a half-duplex channel using multiple sub channels and included, among other elements, FFT, cyclic extension, Forward Error Correction, interleaving, data packetisation and antenna switch.

An important factor in the CSIRO/Macquarie team's early recognition of the superiority of the multichannel system design was the fact that the lead team members in both organisations had previously worked together and separately on the design and construction of large synthesis radiotelescopes with digital receiver systems. That background had taught them how to design and build complex systems, including the development of novel, efficient, high speed chip implementations of the FFT and error correction codecs.

After repeated elimination by standards bodies of multichannel proposals for high-speed WLANs, the merits of the approach were accepted with the 1999 ratification of the IEEE802.11a standard. Subsequent IEEE802.11 physical layer standards use multichannel signaling, albeit with the addition of powerful diversity extensions.

References

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