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Vic Hayes
Father of Wi-Fi

No one "invented" Wi-Fi. But as founding chairman of the IEEE 802.11 Working Group for Wireless LANs, Hayes led the decade-long effort to tame the wild west of incompatible and competing wireless protocols by shepherding spectrum allocation issues to establish the Wi-Fi standard, earning him the name of "Father of Wi-Fi."

Hayes was born in Surabaya, Indonesia, just before Pearl Harbor and the Japanese invasion of the soon-to-be former Dutch colony. Hayes' father worked for the General Netherlands-Indies Electricity Company (ANIEM). Mobilized December 1941, his father was taken prisoner in March 1942. Hayes lived with his family as "outside-camp" people until being reunited post-war. In 1950, Hayes' family was repatriated to the Netherlands. In 1961, Hayes received his engineering degree from the University of Amsterdam, and then served two years in the Dutch Air Force as a radio and radar officer.

After leaving the service, Hayes joined Friden Holland, later Singer Business Machines, which made Flexowriters, paper tape-based typewriters. Eventually, Hayes would play a key role in engineering the first commercial integrated circuit-controlled billing and accounting machine.

In 1974, Hayes joined NCR's Engineering Laboratory in Utrecht, and authored numerous NCR Corporate Engineering Standards on data communications, including protocols to emulate IBM terminals to give NCR computers access to the large mainframes of IBM, HDLC and X.25 packet level protocols. Hayes also represented the company in standards bodies such as the Dutch Standards Institute, the European Computer Manufacturers Association, where he was chair of the LAN Task Group, and he chaired the Dutch delegation to the ISO/IEC JTC 1/SC6 committee. These experiences made him an ideal 802.11 group chair.

The effort to establish a system of wireless communication began May 9, 1985, when the FCC set aside spectrum in the 915 MHz, 2.45 and 5.8 GHz bands for unlicensed spread spectrum-based wireless communications. NCR realized such wireless communication would let its retailer customers create a radio link between its cash registers and back-end mainframes without having to drill holes in floors for cables.

During the development of two prototypes by the NCR Engineering Laboratory in 1990, the company wanted to establish an industry standard for local wireless networking. Hayes took the chairmanship of the IEEE Token Bus 802.4 working group but the task group members concluded that protocol was unsuited for a radio medium. In 1990, it was decided to establish the IEEE 802.11 WLAN working group and Hayes accepted the chairmanship.

The first meeting was in 1990 in Oshawa, Canada. The committee's first technical problem was two incompatible modulation techniques: frequency hopping and direct sequence, each with its pros and cons. Direct sequence required a lot of chip-based mathematics. Frequency hopping was easier to implement, but less robust. Within the working group, the small companies wanted frequency hopping, the bigger companies wanted direct sequence. The committee was stuck at about 50-50.

The solution was to allow both modulation schemes. The 802.11 standard was approved in June 1997 and published in November 1997, with 1 Mbit/s using frequency hopping and 1-2 Mbit/s using direct sequence. Extensions to the standard established direct sequence as 802.11's primary modulation scheme for 802.11b, which increased Wi-Fi's data rate five-fold, and orthogonal frequency division multiplexing (OFDM) for 802.11a were approved in 1999.

Hayes convinced European authorities of the need for radio spectrum for WLANs in Europe, which resulted in the assignment of 83.5 MHz of bandwidth within the 2.4 GHz spectrum for Wi-Fi and 100 MHz of bandwidth in the 5 GHz area for high-performance WLAN networks.

Hayes chaired the 802.11 Working Group until 2000. He then served as Regulatory Ombudsman in the Executive Committee of IEEE Project 802 Standards Committee for two years. In 2001, he chaired a regulatory subcommittee within the Wi-Fi Alliance that served as a technical and legal watchdog for spectrum issues.

For his singular contributions to the creation and establishment of the IEEE 802.11 Wi-Fi standard, Hayes has received a multitude of honors including the IEEE Standards Medallion, the IEEE leadership Award, the IEEE's Hans Karlsson Award, and awards from the Wi-Fi Alliance.

Hayes and his family and live in Utrecht, the Netherlands. Hayes is a senior research fellow on the Faculty of Technology, Policy and Management at Delft University of Technology.