Amateur Packet - A Brief Chronology: Phase 1 (1970-1986)
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Packet radio is a relatively recent phenomenon, becoming a full-fledged "mode" within the ranks of ham radio operators in the 1984 to 1985 timeframe. Yet in spite of its rapid growth, many Radio Amateurs will be surprised to learn that packet radio has been around since 1970. In that year engineers at the University of Hawaii experimented with radio to send and receive computer data in short self-contained informational bursts called packets.

The researchers used packets because they realized it wasn't necessary for a computer to communicate with another computer on a continual basis. Computers could communicate at appropriate times between tasks, leaving time between transmissions for other computers to transfer data.

The University of Hawaii system, referred to as ALOHA, used a pair of radio channels. One channel-dubbed a multiaccess channel- permit a number of remote radio-equipped terminals to reach a central radio-equipped computer. A second radio channel-called a broadcast channel-let the central computer transmit responses back to the terminals out in the field. The system worked!

Drafted by the Military

Spurred by the success of ALOHA, the U.S. Department of Defense studied packet radio to see what its feasibility would be for military computer communications. Under the government's Defense Advanced Research Projects Agency, or DARPA, the state-of-the-art of packet radio communications advanced.

DARPA extended ALOHA to include mobile packet radio users. Each user in a DARPA network of mobile stations (called the PRNET) shared the same frequency. Each mobile also had the ability to relay or repeat packets from tactical site-to-site on a flexible basis, as DARPA's dynamic network was intended to be effective in combat, where some stations might be lost and few would remain in fixed geographical locations for very long. The PRNET was intended to keep the various tactical computer units coordinated and "talking" to each other, regardless of combat conditions.

Much was learned about packet radio from these experimental efforts. However it wasn't until the widespread advent of the so- called personal computer that packet radio was scrutinized by a handful of forward thinking Radio Amateurs as a serious means of communications for the average electronics enthusiast.

Early Adopters

Amateurs Radio operators comprised a considerable chunk of the personal computer marketplace in the early 1970s. Tinkerers and “electronikers” across the land were building, buying, and experimenting with small microprocessor-based systems. Ed Roberts, the inventor of the Altair, was one of these hams. The term "personal computer" was still a number of years away. But a variety of market researchers and industry watchers (including Arthur D. Little researchers) accurately identified FCC- licensed ham radio operators as a major segment of microcomputer "personal" users in what would become a growing market.

While computer hobbyists learned about the wonders of software and microprocessor hardware, some progressive hams began to think about how packet radio technology could be adapted to Amateur Radio. In September of 1978, non-Baudot digital transmissions were legalized for hams in Canada, opening the way for on-the-air tests of Amateur Radio networking experiments. In January of the following year, in Vancouver, Doug Lockhart, VE7APU, described a relatively simple hardware and software system for sending and receiving bursts of data using radios and computers.

The Vancouver Amateur Digital Communications Group, or VADCG, was born shortly thereafter, and VE7APU's add- on system came to be known as the VADCG Terminal Node Controller (TNC) or simply, the "Vancouver Board." In 1981, VADCG began to distribute the Vancouver Board. It included a high quality printed circuit for hams that wanted to build the VADCG TNC, connect it to a small computer as a peripheral, and get on the air.

FCC Gives The Nod

Significantly, in the United States, the spokesman and lobby of the American radio ham, the American Radio Relay League, pressed the Federal Communications Commission for permission to give U.S. hams the opportunity to legally send and receive computer data. In March of 1980, the FCC legalized ASCII transmission, and by year's end, the first U.S. digital repeater-- or digipeater--was placed on the air in San Francisco. It used homemade hardware and software based on the VADCG protocol (a protocol is a set of “rules” by which packet- linked computers communicate).

It's significant that these first Amateur Radio packet experimenters adopted, as a de facto standard, a Bell Systems standard landline modem specification. The tones specified in Bell’s 202 documents were suitable for transmitting packets by means of ordinary voice radios. In

some ways this was a good beginning step for Radio Amateurs, as it ensured compatibility. Amateurs would be sending tones that could be decoded easily, and everyone would use the same tones.

Looming Incompatibility

At the same time, a variety of homebrewed software versions supporting the Vancouver protocol began to appear. But, hardware and software that used Bell 202 tones was incapable of “connecting” via packet radio. In San Francisco, in Washington, D.C., and in Vancouver, different versions of "Vancouver" protocols were in use. For the first time, incompatibility became a problem.

Some visionary hams realized that if Amateur Radio packet were to grow, stations in a ham-built network, and stations between networks, would have to use the same conventions or protocols. Packet stations in different areas of the country would not be able to communicate with each other unless protocol standardization was universal.

In 1982, a series of meetings of packet radio enthusiasts culminated in the hammering out of a protocol that would set the stage for further developments. The use of a universally agreed-upon protocol would establish a standard that of manufacturers and vendors could comply with, permitting hams equipped with compatible systems to communicate.

Making Modifications

The Amateur Radio protocol was based on an existing commercial definition established internationally at the time by the International Standards Organization. The ISO referred to its protocol as X.25. The uniquely modified Amateur rendition emerged as AX.25 and was officially adopted and sanctioned by the American Radio Relay League on October 26th, 1984 as the packet radio "language" of choice for the ISO Link Layer. In the U.S., the definition also satisfied the FCC.

Many stormy meetings, peppered with technical explanations and exhortations about why and how each part of the protocol should be implemented, transpired before AX.25 could come to be. Terry Fox, WB4JFI, head of the ARRL’s newly formed Ad Hoc Committee on Amateur Radio Digital Communication, finally cast the exact specifications for AX.25. The Ad Hoc Committee's core of excited Amateurs set the stage for a phenomenon that would have far-reaching implications--an entirely ham- built and financed digital radio network.

The Pioneers

Key hams participating in finalizing the spec were Phil Karn, KA9Q; Paul Rinaldo, W4RI; Den Conners, KD2S; Doug Lockhart, VE7APU; Paul Newland, AD7I; Eric Scace, K3NA; Wally Linstruth, WA6JPR; Lyle Johnson, WA7GXD; Hank Magnuski, KA6M; Marshall Quiat, AG0X; & Gordon Beattie, N2DSY.

The protocol divergence problem was solved. What's more, AX.25 promised support for more than the maximum 128 users (stations) permitted in one radio network by then current VADCG implementation. It was estimated by Harold Price, NK6K, that at the time, the total of all hams using packet in the U.S. and Canada still numbered no more than 200. Few foresaw the explosion to come, but there were, those who dedicated their energies to promoting Ham packet radio networking.

A significant early vendor was Bill Ashby and Sons. Ashby regularly advertised in ham magazines, offering a Vancouver protocol TNC known as the "Ashby board." Another vendor was Richcraft Engineering Co. Richcraft was owned by W4UCH. The company tried to popularize a CP/M operating system "software approach" to packet radio that didn't require specialized packet hardware (called HDLC controllers) on the printed circuit board. GLB Electronics also jumped into the fray. It won popularity with a low-cost Z-80 microcomputer-based TNC called the PK-1. Like Richcraft, it was a "S/W-only" TNC.

These small companies helped propel Amateur packet radio into one of the fastest growing technical endeavors within the community of worldwide Radio Amateurs. But, it's noteworthy that a variety of newly formed packet clubs joined the fray too.

Among them were the Radio Amateur Telecommunication Society (affectionately referred to as The RATS), the Amateur Radio Research and Development Corporation (AMRAD), the Pacific Packet Radio Society (PPRS) and the Amateur Satellite Corporation (AMSAT). But it was the presence of the Tucson Amateur Packet Radio (TAPR) club that made the difference.

The Work Of a Few

The Tucson Amateur Packet Radio club came into being when a handful of enthusiastic Radio Amateurs, numbering not more than twenty, rallied one fateful weekend at the University of Arizona's Computer Science Building. They met to see if they could develop a low-cost packet radio system for transferring microcomputer programs by radio.

Notably, their work was distinguished by a high degree of professionalism as they went about developing and documenting their

project. Many of these early TAPR pioneers were engineers and technicians working for nearby semiconductor maker Motorola. The Tucson club's efforts were presented in a series of papers at The First American Radio Relay League Computer Networking Conference, hosted in 1982.

Around the country budding packet radio operators, or "packeteers" as they proudly referred to themselves, looked towards TAPR group as the leader in "the packet radio revolution." When TAPR developed-- and effectively marketed--an advanced TNC kit of its own design in 1983, the Amateur Radio packet radio movement gained tremendous momentum. TAPR offered the average ham an exceptionally high quality TNC, with an assembly manual and parts kit that rivaled those of commercial vendors.

The TAPR Brapper

The ubiquitous "tapper board" took the world by storm in 1984. Packet QSOs using as many as eight digipeaters were commonplace. Hams were excited. They were making history. It wasn't unusual for many to pile into cars for long trips to pow- wow with fellow enthusiasts. The network had to be built.

The author routinely connected his Xerox- 820-based packet bulletin board system (one of the first PBBSs to hit the air on the east coast's 2-meter Eastnet) from his QTH on Long Island, New York to an Ontario, Canada PBBS. These packets, carrying "e- mail" in a day when most people had never heard of the term, were routed across hundreds of miles and through multiple digipeaters. Data was stored on dual 8-inch floppy disks that held 186 Kbytes each.

Harold Price's research indicated that TAPR shipped an average of 120 TNCs every month for fifteen months during this era. Although this isn't a huge sum by some standards, Amateur Radio packet signals were heard for the first time in many parts of the country, especially in densely populated urban and suburban areas. By 1986, the Heathkit Company bought the rights to TAPR's design, and a few of other commercial Amateur Radio vendors followed suit.

Shortly thereafter, Howie Goldstein, N2WX, a student at The Florida Institute of Technology, published code for surplus Xerox-820 microcomputer boards. This evolved into an even lower cost Z-80-based TNC, and once again TAPR produced a series of high quality kits for hams based on N2WX's software. The design and firmware for these TNC-2s was eventually licensed to multiple commercial vendors, most notably MFJ and PacComm. Some of these companies, recognizing a strong potential market, began to build Z-80-based TNC-2s offshore in Hong

Kong and Taiwan. According to Price, hams spent nearly two million dollars for TNCs in the single year following the TNC-2s introduction. Amateur packet radio was a reality.