PACKET RADIO SOFTWARE APPROACH - 1984 ONWARDS

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ABSTRACT:

The future of the software approach is 'crystal balled' by the author of 'Synchronous Packet Radio - The Software Approach' (Vols. 1, 2, & 3) and 'The Gunnplexer Cookbook - A 10 GHz Microwave Primer.' Topics discussed include:

- Bringing the software approach to the top of the learning curve.
- New generation microprocessors influence on the software approach.
- Low power requirement applications of the software approach to remote terrestrial repeaters and spacecraft.
- Implementing the software approach on very low-cost microcomputers.
- Future packet predictions year 2000 AD.

APPROACHING THE TOP OF THE LEARNING CURVE:

In 1982 the software approach was at the 35% level of the typical learning curve. Here in early 1984, the software approach is about at the 85% level of the learning curve.

With real-time zero insertion in the transmit mode, real-time synchronous to parallel byte conversion in the receive mode, and virtual real-time CRC generation and checking already accomplished, the last remaining bridge to cross is concurrent keyboard message input while in the receive mode decoding incoming synchronous packets.

The voluntary constraint of insisting that the software approach work on a first generation, personal microcomputer such as the circa 1976 Model I TRS-80 without hardware modification, ruled out the possibility of using the Z-80's interrupt modes. Had this been possible, the last bridge to cross would have been an easy one.

There is yet another approach to concurrent keyboard input while in the receive mode that the author used in 'Advanced Baudot Radio Teletype for the TRS-80' that was written in 1981. That is, using the idle countdown time between each mark and space sample to accomplish the keyboard scan and keyboard input processing. Using 100 speed Baudot TTY, this is indeed an easy programming task. At 1200 baud and up packet, it is a fascinating challenge. This is the approach we may use later this year.

NEW GENERATION MICROPROCESSORS:

With the introduction this year of the new Zilog Z-800 8/16 bit microprocessor starting off with a 10 MHz clock and planned growth to a 25 MHz clock in a year or so, the software approach's current baud rate limitation of 1200/2400 baud (and 4800 baud using a 4 MHz clock) will be increased considerably.

A 10 MHz clock Z-800 with its internal 256 byte RAM cache memory (even with relatively slow ancillary chips) will easily run 9600 baud synchronous packet using the software approach. Considerably higher speeds will be possible as the Z-800 matures.

New generation Very High Speed Integrated Circuit (VHSIC) chips developed under the Department of Defense' VHSIC program are now beginning to come off the production lines. These digital processing chips operating in the GHz region, many of which are gallium arsenide medium scale integrated circuit chips, will extend the speed of the software approach to regions undreamed of today. Truly, the sky appears to be the limit.

LOW POWER REQUIREMENT APPLICATIONS:

The software approach reduces the chip count requirement of a packet operating system many fold. The entire terminal node controller (TNC) is eliminated which includes the TNC's microprocessor, SDLC/HDLC controller, vast EPROM, dynamic RAM, UART, and considerable numbers of ancillary support chips.

The power supply requirement of the software approach is significantly less than that of the packet approach using a dedicated terminal node controller. Two obvious applications for a low power drain synchronous packet system are:

1. Remote packet repeaters that utilize solar cells, wind generators, fuel cells, or fueled generators for local Power (forgot water wheels/turbines),
2. Spacecraft repeaters (about as remote as you can get) which rely solely on solar cells for power.

By using the new CMOS version of the Z-80 microprocessor, CMOS dynamic RAM, CMOS

ROM to hold the software approach program, and CMOS ancillary chips, the power drain of a remote packet repeater would be determined almost solely by the repeater's transmitter RF output requirements.

If you have a very tight power budget to work with, we suggest that it might be wise to consider the software approach. Though not yet available in the CMOS version, the GLB Electronics PK-1 packet radio controller, which uses the software approach in EPROM for both the Vancouver and AX.25 protocols, draws a total of only 200 milliamps at 12 volts DC. CMOS could reduce the power drain 1 to 2 orders of magnitude,

SOFTWARE APPROACH ON LOW-COST MICROS:

Should be an easy task for most experienced assembly language programmers using any one of the popular cross assemblers on the market today. Most all of the low-cost micros have at least one port already decoded for cassette input and output.

The software approach only requires a single port and if only a single bit is available (some very low-cost micros require that the user manually turn the cassette on and off), the software approach may still be implemented if the user is willing to manually switch from transmit to receive and vice versa.

Low-cost micros come with varying amounts of memory, Most that we know of can be expanded to a minimum of 16K and include some version of Basic in ROM. Many can be expanded up to the 48K memory level.

16K of RAM memory is about the minimum that the 'economy' version of the software approach would require for home station operation. If only the automatic forwarding function of AX.25 is used (strictly for packet repeater operation), then the program could be probably shoe-horned down to about 4K of memory by a truly 'tight code' programmer.

The economy version would do away with many of the niceties and convenience options that the 48K MEM disk I/O version offers, yet would be adequate for the newcomer with a modest budget. Further, this very low-cost approach would probably lure many newcomers into the packet fold.

We are NOT suggesting that the 'chiclet' key type of micro be used for packet, but rather the next level of low-cost micro, at least with a normal size typewriter keyboard might be implemented with the software approach loading into 16K of memory via cassette.

We encourage you enterprising packeteers out there in amateur radio land to have a go at this worthwhile project. Just imagine tens of thousands of low-cost microcomputer sows' ears magically turned overnight into AX.25 silk purses by your stalwart programming prowess. It would be a giant step forward for packet. If you do not choose to do it, there are some commercial firms who will.

CONCLUSION:

Seriously, the future of packet radio (which is tomorrow) has room for all varieties of radio amateurs whether they are appliance operator inclined, of the moon bounce variety, or even quadrature phase shift keying oriented on 1296 MHz and up. Not only is there room for all kinds, packet radio needs all kinds to reach the level of acceptance it deserves in a timely fashion,

Packet radio in the year 2000 AD? Only 16 short years away. Here are our same of our 'if wishes were horses' packet predictions.

1. Fully authorized on all the low bands using 300/600 baud MSK. Synchronous packet totally replaces asynchronous Baudot, ASCII, and AMTOR.

2. VHF bands using 9600 baud and up MSK. 19.2K baud packet is the standard much like 1200 baud packet today.

3. Low altitude orbit amateur satellites a thing of the past (like predicting the demise of buggy whips after the automobile went into mass production),

4. Level/layer 3 packet fully implemented via terrestrial and satellite links. Hopefully, this will occur long before the year 2000 AD.

5. 2300 MHz amateur band serves as uplink to geo-stationary satellites with multiple access and intra-satellite packet forwarding capability. Down-link broad beam in 1215 MHz band and spot beam in 5650 MHz band or higher.

6. Other microwave amateur bands: 'Crystalmatic frequency stabilization" system allows 10 GHz and 22 GHz solid-state narrow-band packet communication systems to be used for amateur point to point packet communications. This is already available today using low power Gunnplexers.

7. The software approach? Still alive and well because it is a cost effective approach to amateur packet radio communications. The intellectual challenge is a side benefit for those who like to understand what they are doing and who like to climb mental mountains because they are there.