# A PACKET ASSEMBLER/DISASSEMBLER FOR AMATEUR PACKET RADIO NETWORKING

Howard Goldstein, N2WX
681 Cardinal Street SE
Palm Bay, Florida 32907-4116

## Abstract

This paper describes the operation af the pratatype Packet Assembler/Disassembler (PAD) functian within the Tucson Amateur Packet Radio TNC 2 the author installed at a tall tawer site near Melbourne, Florida. PADs are usually considered ta be devices. which interface "dumb" asynchronous terminals to packet switched networks. The prototype TNC 2 PAD performs this functian far remote users an the AX.75 netwark af which it is part, while at the same time enabling a new method af establishing nan-level three cannectians which affers Improved performance aver "digipeated" cannectians using the same path.

## Intraductian

The capacity af the common 1200 Baud VHF circuit is outpaced in many areas by rapid growth in the user base. As the price of assembled and tested Terminal Node Controllers (TNCs) drap below the $150US mark, this situation can only get worse.

The amateur community taak a pasitive step tawards addressing this prablem through the adoption of versian 2.0 of the AX.25 link layer pratacal. But in arder ta achieve any real net improvement far a system comprising multiple users af a single frequency, thaughts af changing again the link layer may nat hold forth a marginal benefit capable of justifying the tremendous cast that such a change wauld embody.

This author feels that many cangestian problems are successfully addressed thraugh the elimination of what we've called "digipeated" links, and their replacement by a netwark layer - notably, the AX.25/X.75 network layer (1,2,3). Accepting this, one's next question might be "How daes the user base access this reformulated network?"

It is expected that same users will have an AX.25 network layer interface withrn their TNCs. They wan't need an additional PAD facility - their level 3 capability already implies that ane exists, so it is far the benefit of those whose TNC does not include a network layer interface (they'll be referred to as "L2 users" in the balance of this paper) that the PAD was developed.

## PAD modes

This prototype PAD has a "NETWORK" made and an "INTERMEDIARY" mode. Which made is used is determined independently far each link, and reevaluated whenever the link is reset.

### Network made

NETWORK made provides the gateway between an amateur X.75 "trunking" network, or lacal AX.25 level 3 users, and L2 users. All of these protocols are similar and this simplifies the transliteration between the different pratacals and the services each offers.

### Intermediary made

INTERMEDIARY made is virtually a "dummy network" far local L2 users. Where twa L2 users are unable to establish a direct connectian with each other, they may choose to use the PAD ta set up a smart "call", rather than using the dumb digipeat made. Such a choice wauld convey the advantages of lacal hap by hap acknowledgments while allowing same mechanism ta allocate physical link capacity fairly.

## PAD aperatian

The PAD presents an interface which is. essentially transparent ta the made in use. There are faur major states (see figure 1) associated with the PAD<->L2 user interface the user needs ta be concerned with.

The selectian state a? is entered whenever an L2 user links with the PAD. The PAD remains in this state until the L2 user specifies a destinatian callsign, an aptianal endpoint switch address, and up ta three optional endpoint digipeaters. If the endpoint switch address is omitted, and the destinatian station is nat linked with the PAD's switch, the INTERMEDIARY made is invoked and a level 2 connect attempt is initiated. Otherwise NETWORK made is assumed and a level 3 channel is selected, and if a free channel is available a call request packet is generated.

State a3 is the basic data transfer state, and is entered upon establishment of an end to end "connectian". The connectian could result from a netwark: call request packet, an L2 user's request to talk arnginating an the same PAD but a different link, or the acceptance of this user's request to talk with another station (i.e. the a? to a3 transition).

State a4 insures that ane or bath L2 user endpoints receive infarmatian about the cause of a PAD mediated connectian "failure" just prior to tearing down the users' links. A transition to the idle al state occurs when this information is acknowledged by the user and the link layer disconnect attempt state is entered,

## Other cansideratians

Far operations an a single frequency, explicit (i.e. not directly windaw related) flaw control af a sending L2 user is invoked either upon exceeding an absolute buffer allocation or predictively, at the time when the first byte of a new information field wauld exceed the allocation.

There is same overhead associated with the predictive flaw, but the author believes it is much less than the (implied) overhead resulting fram callisians (when the pad is equipped with only ane part, or INTERMEDIARY made is in use) between acknowledgements from a remote, and the transmission of new data that can not even be buffered until the such acknowledgement is received by the PAD.

Network control, additional physical parts, and other embellishments will be added as time and hardware allow.

## Acknowledgements

Deepest thank go to William Hartman N4DNW, 3. Gordon Beattie N2DSY, and Thomas Moulton W2VY, without whose help this project would never have came to fruitian.

## References

(1) T. Fax WB4JFI, AX.25 Network Sublayer Protocol Recommendation, "Third ARRL Amateur Radio Computer Networking Conference" proceedings (Newington: American Radia Relay League)

(2) J. G. Beattie N2DSY, T. A. Moulton W2VY, Proposal: Recammendatian AX.121 NA, "Fourth ARRL Amateur Radio Computer Networking Conference" proceedings (Newington: American Radio Relay League)

(3) X.75 is an Internet Protocol (IP), comparable in operation and packet farm at to X.25 level 3

PAD MESSAGES

gator 2 pad 03100305724 part B
enter: call [,digi i [,digi2 [,digi3 3 3 3

to?

-*- signon -*-

*** pad: connection reset

-*- successful connection or reset -*-

*** pad: call cleared, dte originated
*** pad: call cleared, dte busy
*** pad: call cleared, retry limit exceeded far either call or data
*** pad: call cleared, either the station you requested is also using this pad or an unrecognizable TO? entry was received

-*- failure messages -*-

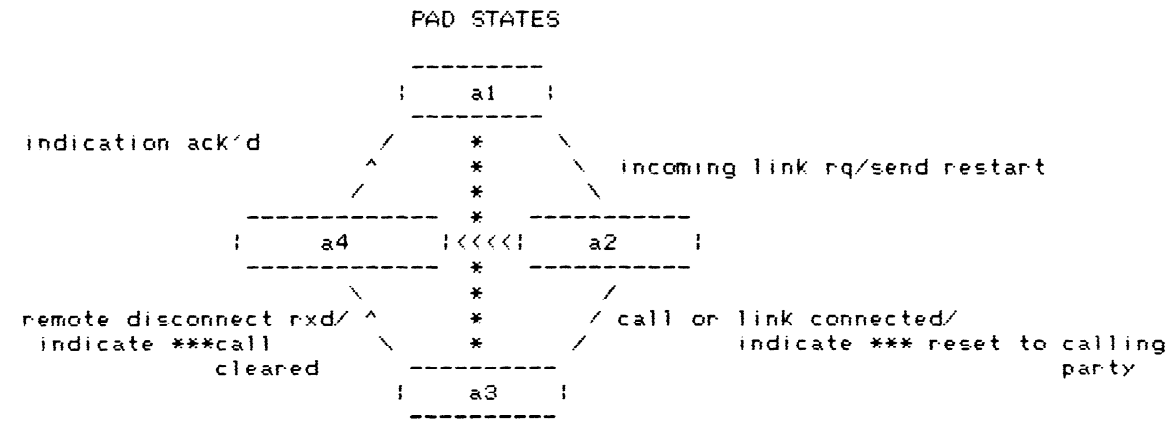


FIGURE 1