FADCA GATOR LINK 1 PACKET RADIO LINKING NETWORK

Howard Goldstein, N2WX
681 Cardinal St. SE
Palm Bay, Fl 32907

Ted Huf, K4NTA
1829 N.W. Pinetree Way
Stuart, Fl 33494

BACKGROUND

The GATOR LINK 1 concept was devised in the summer of 1984 by a group of members of the Florida Amateur Digital Communications Association (FADCA) as a method of linking packet radio digipeaters into a system that would provide wide area communications without the problems involved in single frequency digipeating. It was recognized that while AX.25 Level 2 provided a means of linking digipeaters, as packet radio activity grew, it would be more difficult to use this feature because of collisions.

RF EQUIPMENT

After a look at 23 cm as a possible band for linking, it was decided to use 1.25 meters because of the availability of equipment. The basic radio for the high speed side of GATOR 1 will be the Hamtronics FM-5 220 mHz. transceiver. The FSK modification done by Steve Goode will be incorporated to permit 9600 baud operation, GATOR 1 nodes will communicate point to point with up to three other GATOR 1 nodes. For this reason, directional antennas will be used, On the two meter side of a GATOR 1 node will use the normal two meter FM transceiver,

FREQUENCIES

A frequency plan using 145.01, .03, .05, .07 and .09 will provide 150 mile co-channel protection of two meter digipeaters in Florida. This will help relieve the common problem of digipeater to digipeater interference, All of the high speed 1.25 meter operation will be on 221.4 mHz. The Florida Repeater Council has coordinated 145.01, 221.4, 221.72 and 221.78 mHz for 20 kHz bandwidth and 220.57 mHz. for 100 Khz bandwidth state wide packet radio operation, FADCA has asked the FRC for additional coordination of 145.03, .05, .07, and .09 mHz. for state wide use with FADCA to serve as the coordinating body for all packet radio frequencies in Florida, No action has been taken by the FRC on this request yet.

COMPUTER EQUIPMENT

The brains of a GATOR 1 node will be the Xerox 820 computer with a FAD board, One af us (Goldstein) designed the FAD board, which uses a Zilog Z-8530A serial communications controller, This two port device will use one port for the 1200 baud two meter link and the other for the 9600 baud on 1.25 meters. The FAD board which is available from TAPR was first described in the June 1984 issue of the Florida Amateur Digital Communications Association newsletter, the FADCA>BEACON.

The modified Xerox 820 serves as a two meter digipeater for extending the range within a local area network, as well a5 a link into the GATOR 1 network from two meters and a relay station along the GATOR 1 network- Modifications to the 820 include removal of the GP PIO, disk controller and video chips, The modification includes the use of 2764 eproms. A FADCA Bell 202 type modem designed by Jerry Ruimby, N4AJH will be used on the 1200 baud side. And because of our commitment to provide emergency communication if needed, every effort will be made to provide GATOR 1 nodes with back up power. Figure 1 is a block diagram of a typical GATOR 1 node,

PROTOCOL HISTORY

The following is derived from the description of the proposed GATOR LINK 1 protocol that was published in the June 1984 issue of the FADCA>BEACON, originally written by one of us (Goldstein),

One of us (Huf) designed a system to assign addresses to these switches that nut only looks like an AX.25 level 2 address field, but also is easy for the end user to deduce without hard-to-find materials, Therefore, each GATOR 1 switch is identified by the area code (ala Fell) it serve5 in, addition to the airport designator (ex. 813TPA, 404ATL). When a switch hears a 1200 baud frame who's next outstanding address sub field matches it's own, it assumes that it is meant for relay and attempts to route it to an adjacent switch that is virtually closer to the destination along the connection it maintains with up to 3 of these GATOR 1 switches,

HOW IT WORKS

The information field in frames received from a high speed connection are parsed for their ultimate destination and get sent either to a switch closer to the destination area, or are passed to the

1200 baud transmit buffer if the local address matches the destination address.

EXAMPLES

Two examples of how an end user might set up a connection using the GATOR 1 system: MIAMI FL TO JACKSONVILLE FL. the user specifies: CONNECT N4UF VIA 305MIA 904JAX. Assuming the 305MIA switch hears me, it wi 11 take every one of my frames, set the H (has been repeated) bit on 305MIA and insert it into a virtual circuit with an adjacent switch that is nearer the 904 area code. Note that the routing is implicit, i.e. the path that the frames traverse is implied by the destination of each frame, and not by the user.

ORLANDO TO WEST PALM BEACH: CONNECT WA4HXZ VIA K4AHO 3050RL 305WPB WA4ARE-1. This example assumes that the AHO digipeater is needed in Orlando to reach the 3050RL switch, The same condition exists between WA4HXZ and 305WPB in this example.

The software machine that is the GATOR 1 switch was designed to fit into the 1K or so bytes left in the 2716 EPROM pair, and to run concurrently with the regular 1200 baud (low speed) digipeater code on the Xerox 820 (see Fig. 1 for block diagram), The A channel of the 8530 is used for the high speed side and the B port for the existing low speed channel. In this fashion interrupt priority is given to data flowing on the A channel, as servicing here must be accomplished much faster because the data rate is higher,

GATOR 1 PROTOCOL

The high speed links, i.e. the connections between adjacent GATOR 1 switches, use a virtual connection protocol similar to AX.25 level 3, but simplified. Each GATOR 1 switch will strive to maintain a connection with its neighbors by polling the current connection state and, should the connection be down, sending GATOR 1 connect frames to the appropriate switch, Once the connection&) have been established with adjacent switches, they may now exchange data.

Frames passed between the switches are from 3 to 4096 octets long (excluding flag and CRC bytes). The shortest frames contain the source and destination CID (city ID) octets and a single command or status octet. Longer frames contain these plus an information field, which may contain multiple sub fields, each containing a complete copy of the relayed AX.25 level 2 frame,

CONCLUSION

We realize that by proposing a linking facility that isn't "morally" consistent and doesn't even use the AX.25 Link-Layer it might seem we have rejected its use, This is not the case – in no way do we mean to discourage the proliferation of AX.25. Instead, the proposal simply reflects the current situation where there is no alternative for linking connections between different stations along anything but digipeat paths. The dilemma is in finding talented developers not of vaporware, but of software, and powerful and environmentally robust hardware that is inexpensive. If the latter situation was remedied, maybe some of the vaporware one hears about would congeal into something that works. Until then, the pragmatic aura of reality obscures all but that which exists, But here we find a very simple, talking alligator. It said something. ...Braaap????

FIGURE 2

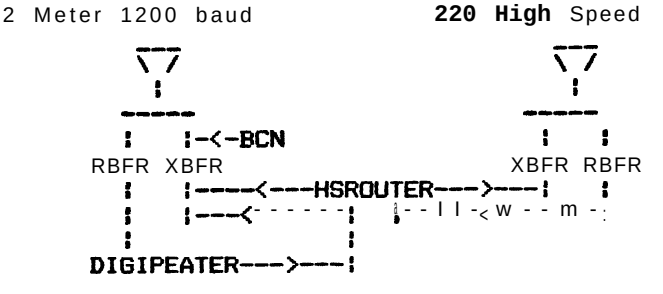
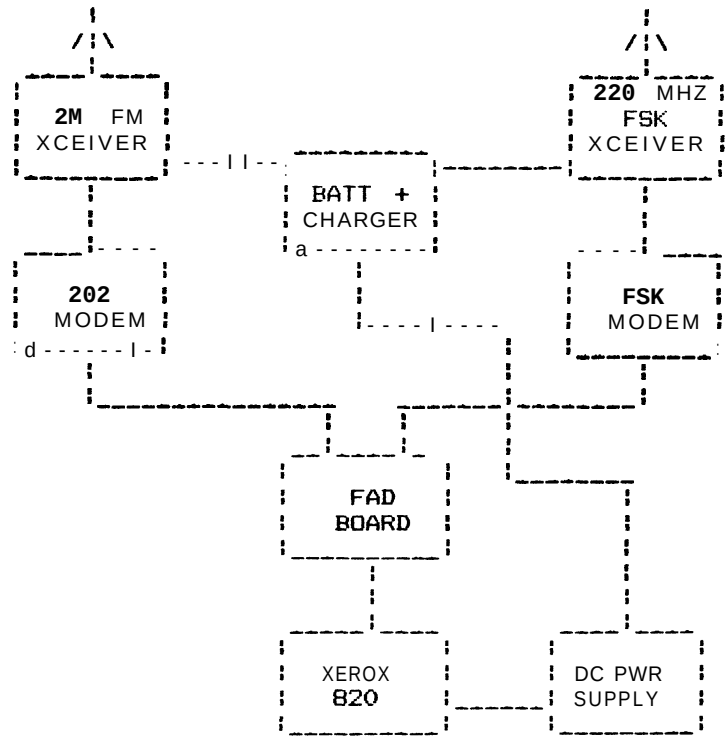


FIGURE 1



TYPICAL GATOR 1 LINK STATION

FIGURE 3

```
|FLAG|DEST CID|SRC CID|CMD/STAT|INFO|CRC|FLAG|
     where:     DEST CID,
                SRC CID are unique octets assigned
                 to a switch as its address
                INFO only where the CMD specifies an info frame,
                    formatted 1 i ke:
                  Offset      Comments
                  +0,+1        Length of following sub field (L)
                  +2• ..L+l    Data in sub field
                  {L+2,L+3      length of second sub field
                    .........3   info, ad nauseum up to 4096 octets


   CMD/STAT octet:
    |7|6|5|4|3|2|1|0
    u u | | | | s s------s s
        | | | |          0  0 - Info frame (I)
        | | | |          0  1 - Ack of Info (A)
        | | | |          1  0 - Connect request (S)
        | | | |          1  1 - Connect request ack'd (C)
        | | | ---------- POLL/DONT POLLS when rcvd, returns an ACK if cnctd
        | | ------------ Connected/Connected*
        | -------------- V(S)  }--Mod 2 seq-defined only for I frames
        ---------------- V(R)  }--Modulo 2 sequence number valid only
                                   for I and A frames
                         u - reserved, s e t to 1
```

TABLE Al

Link state	Frame received									
	I w/P	I wo/p	A w/p	A wo/p	s w/p	s wo/p	C w/p	c wo/p		
0 setup					Cl	Cl	1	1		
1 xfer	Al	A1	Al		Cl	Cl				
2 wtng/ack	A2	A1	A2	A1	Cl	Cl				

TABLE A2

Link state	Condition		
	Tl expires	T3 expires	N2 exceeded
0 setup	S0		
1 xfer	A2*	A2*	
2 wtng/ack	A2*		S0

* INDICATES THE FRAME IS SENT WITH THE 'POLL' BIT SET

The format of actions in A1 and A2 are:

[T]s where T is the type of frame to respond with [optional], and
s is the state to enter after the indicated frame is sent