Arizona Packet Radio, Past Present and Future (?)

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Abstract

A brief history of packet radio in Arizona is presented. The current status of the network is described with a map showing node locations and major links, and a detailed node list is available in the Appendix. We speculate on the future, arguing that the Internet, while responsible for the decrease in the current user population, can also provide opportunity for future applications. An application particularly suited to Arizona is the provision of Internet e-mail gateways for the many vacationers, winter visitors, and campers who frequent the state. We are optimistic that other applications, not foreseeable in their exact nature, will certainly emerge.

Keywords

Packet Radio, Arizona, Internet, Gateway, E-mail, BBS

Introduction

Despite having been the birthplace of TAPR, the TNC1 and TNC2, Arizona has not been host to a particularly well developed packet network. While TAPR evolved into an international organization with strong leadership and a membership with rich technological skills, the local user organizations never quite achieved the organizational capacity to put up a broad high capacity network. Nevertheless, some early organizations made substantial contributions to the Arizona packet network. This paper describes briefly the history of packet radio in Arizona, provides a snapshot of the present, and speculates on the future.

The Past

A group in Scottsdale who founded the Arizona Packet Radio Association (AZPRA) in the 1980's initiated the first statewide organization. AZPRA succeeded in linking the two major metropolitan areas, Phoenix and Tucson, with a 9600 baud backbone connection on 220MHz. The two sites linked were Mount Lemon, serving Tucson, and White Tanks Mountain, serving Phoenix. User access to these nodes was at 1200 baud on different simplex frequencies. As is often the case with our mountain top

user nodes, the simplex frequencies offered links to other mountain top nodes in turn. These adventitious connections were a mixed blessing because long-haul traffic on the user frequency often led to congestion and slow response time for local keyboarders.

The Maricopa County Repeater Group made another notable effort in the early days. This small organization succeeded in establishing a remarkable array of 1200 baud user nodes and 4800 baud, 6 meter, backbones stretching from east to west across the central belt of the state. User nodes were on Greens Peak near Springerville, Pinal Peak near Globe, in Phoenix on the Valley National Bank building (the tallest building in Phoenix), on Mingus Mountain near Prescott, and on Hayden Peak near Kingman, Arizona. The backbone continued to Mt. Potosi near Las Vegas, Nevada, and Big Bear Mountain in central California, permitting keyboard access to the Los Angeles basin (See Appendix, Attachment 1). The nodes on Pinal Peak and in Phoenix were regenerative duplex repeaters, thus avoiding the "hidden transmitter" problem. The Phoenix node continues to provide reliable service to the metropolitan area, with the original hardware!

The first 9600 baud user activity in Arizona grew out of the need for the TCP/IP users to get away from the ax25 community and achieve higher transfer rates. There was considerable friction between the AX25 users and the TCP/IP fans in the early years, leading to the construction of a separate network over a portion of the state. This was unfortunate, since the effort could have been better spent in a cooperative effort, but it seemed unavoidable at the time. 9600 baud users are still almost all TCP/IP oriented, but the network they built is now broadly used for mail forwarding, ax25 keyboarding, DX Cluster backbones, etc.

Another factor that helped shape networking in Arizona is the DX Cluster. As with TCP/IP, the early cluster traffic rode on existing nodes, but with the potential for channel overloading at times, the DX community proceeded to build there own network. More recently, some backbone links and user nodes are being shared between. DX Clusters, TCP/IP, BBS forwarding, and AX25 users.

In recent years, another organization, the Arizona Network Intertie Group (AZNETIG) did establish an effective backbone with several user nodes in the central part of the state (See Appendix, Attachment 2). In 1993, Daniel Meredith, N7MRP, founded AZNETIG with the former assets of AZPRA and the goal to revitalize packet radio, as well as attempt to bring together the "movers and shakers" with regular coordination forums. The first such coordination meeting occurred in Casa Grande and the turnout was unprecedented for the State. The entire State of Arizona was represented at the meeting and the beginnings of frequency and idea coordination were finally underway. Meetings have continued throughout the 90's, though participation and excitement has waned as time has progressed. Regional organizations, formal or informal, in Tucson, southeastern Arizona, the White Mountains, and elsewhere also made significant efforts to provide connectivity in their areas. But many of these efforts were dependent on one or two individuals who carried the ball to the goal line (or the radio to the mountaintop).

While there was activity surrounding network nodes and links, the BBS scene was off and running, pushing packet radio technology to the limits. The sudden flurry of activity began in early 1992 with the introduction of low cost TNC's and radios that offered plug-n-play packet interfacing. The excitement caused network operators to expand and upgrade the networks, particularly the creation of additional backbone paths at 9600 baud to handle the BBS and user traffic. The Phoenix area had so much activity

that at one point there were a total of 6 full-time, full-service BBS's. Each of the BBS operators claimed stake on a portion of the user share by offering multiple frequency access, which included HF, VHF, MVHF, and UHF. The strain on the networks from the BBS forwarding forced the BBS and network operators to begin working hand-in-hand, rather than as individual entities. The BBS operators became integral to the networking process and were involved in all networking meetings taking place around the state. The result was an agreement to forward NTS and personal traffic 24 hours a day, yet bulletins would only be forwarded during the off-peak hours of midnight to six o'clock in the morning. In addition, the BBS operators agreed to fully support the networks that were used to pass traffic, thus relieving much of the maintenance and financial burdens often associated with mountaintop radio sites. As time progressed, so did the software the BBS operators used. The introduction of the French "FBB" BBS software provided compressed forwarding, as well as many customizable features allowing BBS operators to differentiate their systems. Notably, Phoenix also became the home of the F6FBB Support BBS for the United States and also served as a telephone gateway to packet radio in Arizona via N7MRP's station. Times have since changed and with the advent of the easy access to the Internet, the bustling BBS days have all but disappeared in Arizona, leaving very few stations for users to access.

Unfortunately, Arizona has never seen the emergence of organizations such as the Texas Packet Radio Society (TPRS) or the NorthEast Digital Association (NEDA). Perhaps one reason why Arizona seems to be organizationally challenged is that our "basin and range" topography makes long range communication easy for individual node operators to achieve. We do not need multiple hops to talk across a hundred miles. One ham can put a node on a mountain top, serve a lot of users with it, and tie to another mountain top 50 or more miles away with the same 145.01 MHz frequency, the distant node having been put up by another individual ham or informal group of users.

This obviously is not good engineering practice, because it produces a textbook example of opportunities for the "hidden transmitter" problem. For example, the LMN node is at an elevation of 9 157 ft. on Mt. Lemon in the Santa Catalina range north of Tucson. It sees much of Tucson as well as the valley surrounding Phoenix, and the small towns in between Phoenix and Tucson. It also talks to other mountain top nodes such as BISBEE (78 mi.), SONORA in Mexico (117 mi.) , JACKS in New Mexico (125 mi.) , and UNION (156 mi.), and even sees ELDEN, 200 miles to the north, although that path is not usable. Some of these nodes see each other as well as LMN, but obviously, nodes to the south of LMN do not see those to the north. The several ground level nodes that LMN sees, and many of the users, do not see each other. Under conditions of light traffic, LMN works. When congestion begins to build, not much gets through.

The current or past sysops of these mountain top nodes cannot be faulted for this situation, for before these nodes came into existence there was nothing. We do not mean to "point fingers", since most all of us who have put up mountain top nodes have, at one time or another, contributed to the problem. The solution for user nodes is to go to full duplex regenerative digital repeaters on mountaintops, which is easier said than done.

In the recent past, the APRS community has installed a number of digipeaters in Arizona. We leave the discussion of that activity to David McCarthy in another paper to be presented at this conference.

In the face of all of these struggles to maintain a packet environment in which all classes of users could achieve their goals of having fun with packet radio, Arizona nevertheless had a growing population of

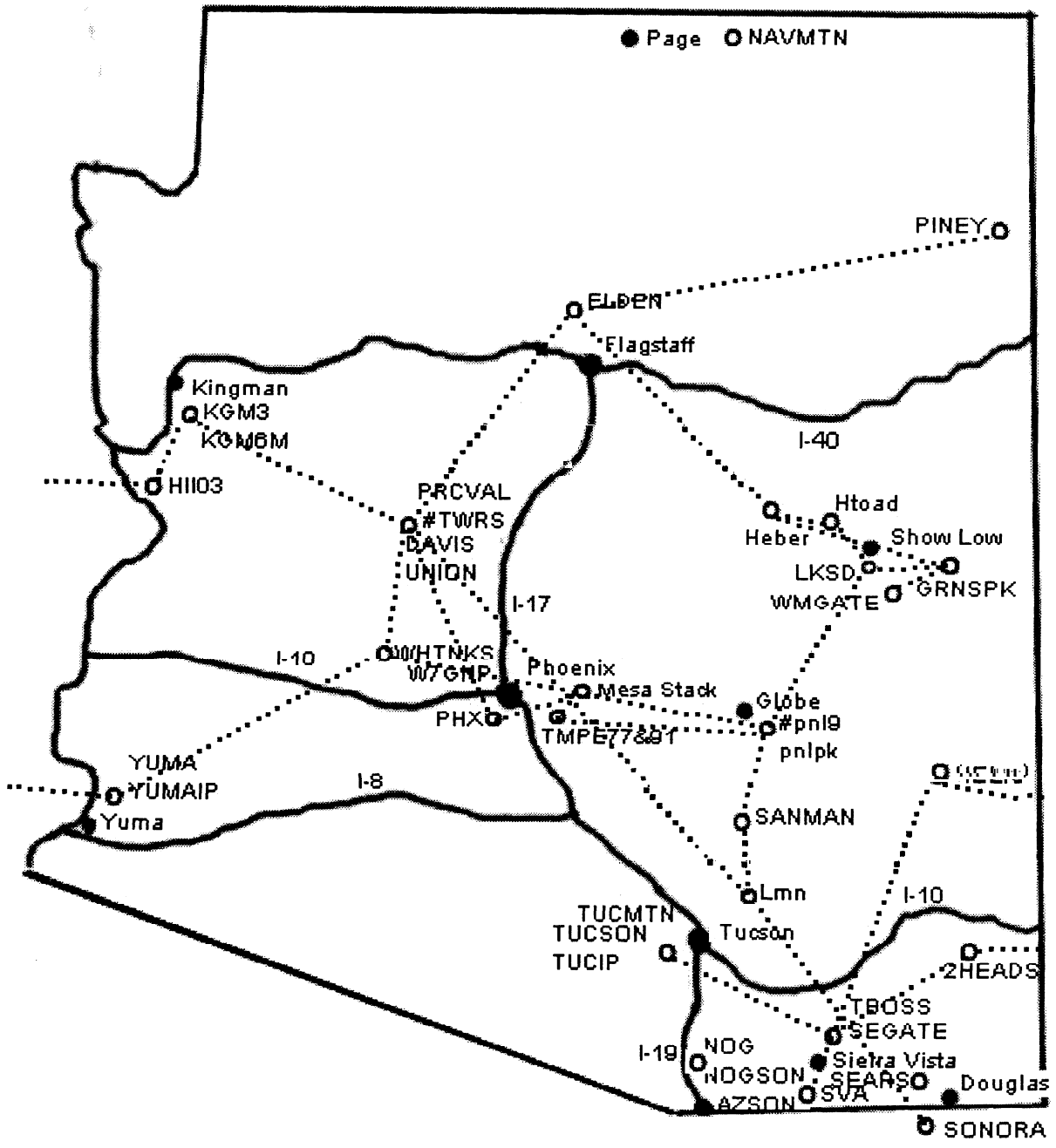
users until the infamous Internet arrived! In the blink of an eye, our problems with congestion disappeared. Even some: of the sysops lost interest due to the dearth of users for their nodes and bulletin boards. One new dimension was added to packet radio, namely, the Internet Gateway/Wormhole, but the general packet user population still lags far behind where it was a few years ago.

The Present

The packet network in Arizona is presently a patchwork quilt that works for the dedicated practitioner. Some of the backbones are broken, replaced by internet wormholes, some of the user nodes are broken or missing, and there are no user nodes over 9600 baud in speed. But we are optimistic for the future, as described in the next section. Figure 1 below shows the location of nodes and some of the long haul radio links. Many of the: details had to be left off the figure for simplification, but a complete list is provided in the Appendix.

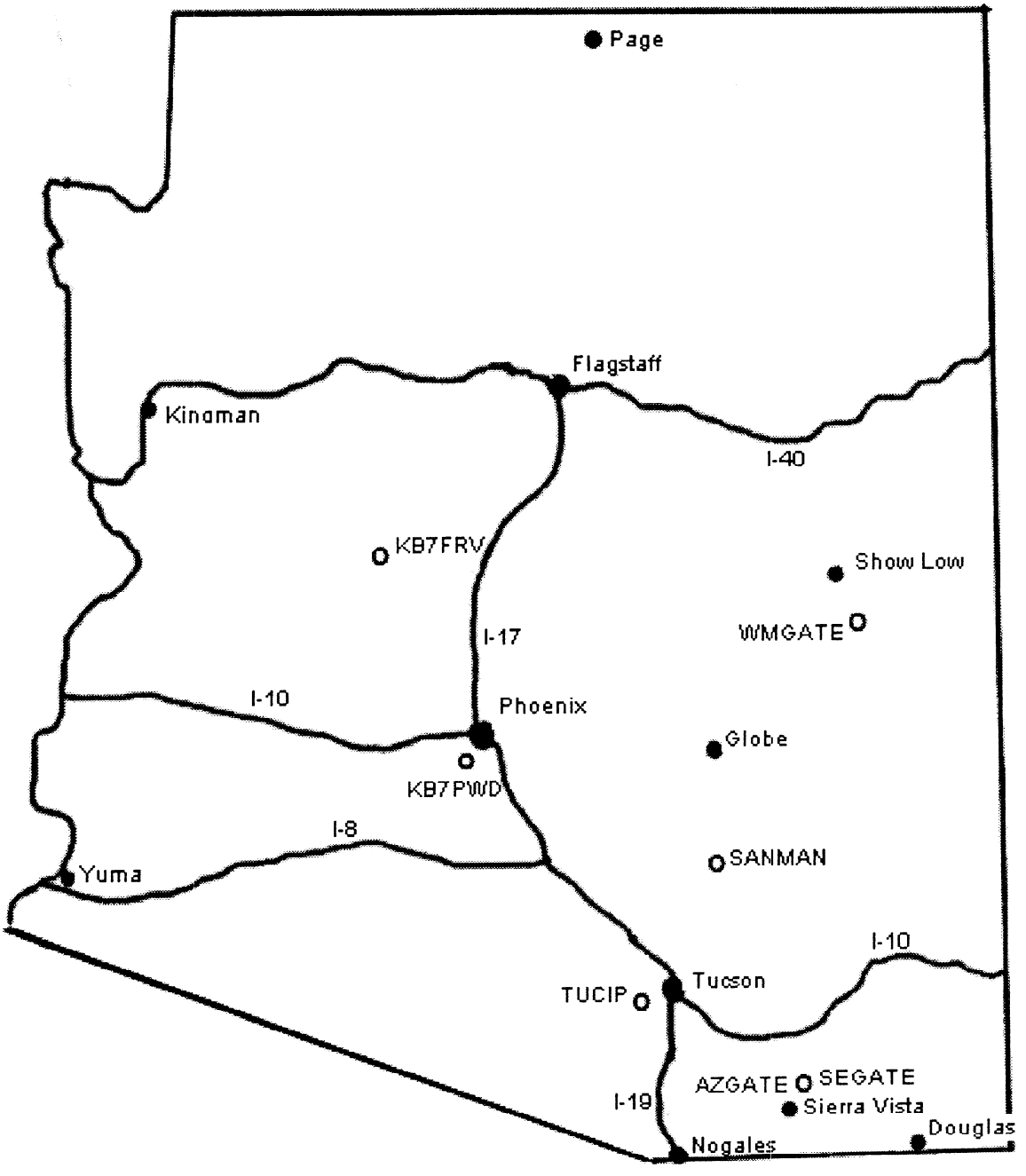
Most of the long links shown in Figure 1 unfortunately are NOT on dedicated backbones. For example, the current links from LMN, as described earlier, are all on the 145.01 user frequency, although a previous backbone linked LMN with WHTNKS and improvements are in the works. In reality, many of the long links are now made by Internet wormholes. Figure 2 shows the locations of these gateways. While we see these gateways as valuable resources for forwarding e-mail to and from the Internet (as discussed below:), we would like to see our long haul links reestablished and increased in bandwidth.

Figure 1



Packet Radio Nodes and Selected Links in Arizona

Figure 2



Packet Radio Internet Gateways in Arizona

The Future

Most node-ops and network gurus have voiced despair at one time or another that packet radio users will ever again return to the medium in numbers sufficient to justify repairing or improving the current infrastructure of nodes and backbones. We believe packet radio does have a future, and offer the following observations for our optimism.

Although the commercial world offers increasing amounts of wireless digital capability for a price and in pre-packaged form, there will always be hams who want to "roll their own", either because they think it is cheaper, or to satisfy their creative need to do it differently. We see several applications where packet radio can play a role alongside the Internet.

APRS is of course a shining example of an application, which suffered no competition from the Internet, and which can in fact benefit from the geographical breadth offered by integration with it. As more functionality is added to APRS (for example, short messaging), and specialized hardware is developed (witness the new Kenwood HT/TNC) we expect the APRS user community to expand greatly. The burgeoning of APRS is not speculation for the future, it is here now!

The next application we think has immediate potential for expansion in Arizona is e-mail gatewaying. This requires no new technology and little in the way of network improvement. As we all know, Arizona is a prime tourist and seasonal visitor destination. Besides the influx of short term tourists during the summer vacation period for destinations such as the Grand Canyon, the White Mountains, and the Flagstaff area, we have a veritable army of winter visitors arriving each fall from the northern U.S and Canada. As more and more of these travelers adopt e-mail as an important medium for communicating with their friends, children and grandchildren, the hams among them will jump at the chance to use packet radio to launch e-mail when they are on the road or settled into winter quarters. Another group that will use this resource are the locals who head for the high country to camp out in the summer time. Finally, we have a small but significant number of permanent residents who live so far out that they have neither electricity from mains nor telephones. Some of these are hams that use packet to send and receive Internet mail.

An example of how this can work is provided by the HEBER BBS in the White Mountains near Show Low. This is an area with many summer homes, RV parks, and USFS campgrounds. The area is served by a full-duplex regenerating digital repeater on Greens Peak (GRNSPK:KG7BZ-2 145.13MHz -600). The node is sponsored by the Navapache Electric Co-op, which also provides the Internet Gateway facilities. George Strickroth, WA3PNT, is the sysop at HEBER, GRNSPK and WMGATE are tended by August Johnson, KG7BZ, and Dave Epley, N9CZV, is the liaison with Navapache Electric.

To send Internet mail via this system, a visitor just connects to HEBER and addresses mail in the usual way. A rewrite file at HEBER detects that this is neither ampr.org nor packet BBS mail, and rewrites the address to route the traffic through WMGATE, the local gateway. When the mail arrives at its destination, the reply address shows as "username"@heber.ampr.org. When the recipient uses the "Reply" button, the MX record at the ampr.org DNS at ucsd.edu routes the message to the WMGATE SMTP server via the Internet, and WMGATE sends the traffic back over the radio link to HEBER via GRNSPK.

Thus all a visiting ham has to do is send out a message to his or her correspondents informing them of the temporary address and advising them not to send pornographic or obscene material, or long attachments. So far, there have been no problems of this sort other than an occasional long attachment sent by accident. Because of the temporary nature of most of these activities, there has little problem with commercial spam.

All we need to serve these needs are good BBS systems reachable from the areas of the state frequented by winter visitors, vacationers, and campers (in other words, just about everywhere), reliable well-connected gateways to move the traffic, an easily-mastered user interface, and a modest public relations effort to get the word out to the amateur public. We believe that if the amateur public came to know they could depend on sending and receiving Internet e-mail from just about anywhere in Arizona, we would see a resurgence in packet radio use here that would carry over to other packet application as well, and would be a credit to amateur radio in general. We think this is readily attainable in Arizona, and in fact it largely exists. As shown in Figure 2 above, gateways are scattered throughout the state, and most include or are associated with BBS systems. We have not checked to see how many of them are set up like HEBER, but certainly they can be. Our task for the immediate future should be to determine how many of these gateways permit easy e-mail accessibility to the Internet, and promote their utilization by visiting amateurs.

Extending the idea of Internet e-mail gateways to web content as well, we speculate that the availability of high speed spread spectrum radios, such as currently under development by TAPR, will ultimately provide Internet access with enough bandwidth to permit web surfing from your RV or tent. Considering that this is a little "ham" in everyone, certainly someone will want to surf the intemet from a tent, and at least it will be via amateur radio rather than a commercial carrier. Our challenge then will be to provide high bandwidth nodes for users to access the Internet and each other.

Finally, we predict what we cannot predict. That is, we think packet radio will generate some new applications that we, at least, cannot foresee at the moment. "If we build it, they will come." The past has shown that new and emerging products are often developed out of Amateur Radio's advancement of the State of the Art. We look forward to witnessing a continuation of this process in Arizona, as we saw with the emergence of TAPR and the TNC in Tucson, years ago.

In summary, in about 15 short years we have seen the birth, adolescence, and some would say, the early passing of a new amateur radio mode. We maintain that the news of its demise has been grossly exaggerated. The suspected villain, the Internet, may yet turn out to be a good vampire, if we just have the courage and stamina to enter the doors it opens to us.

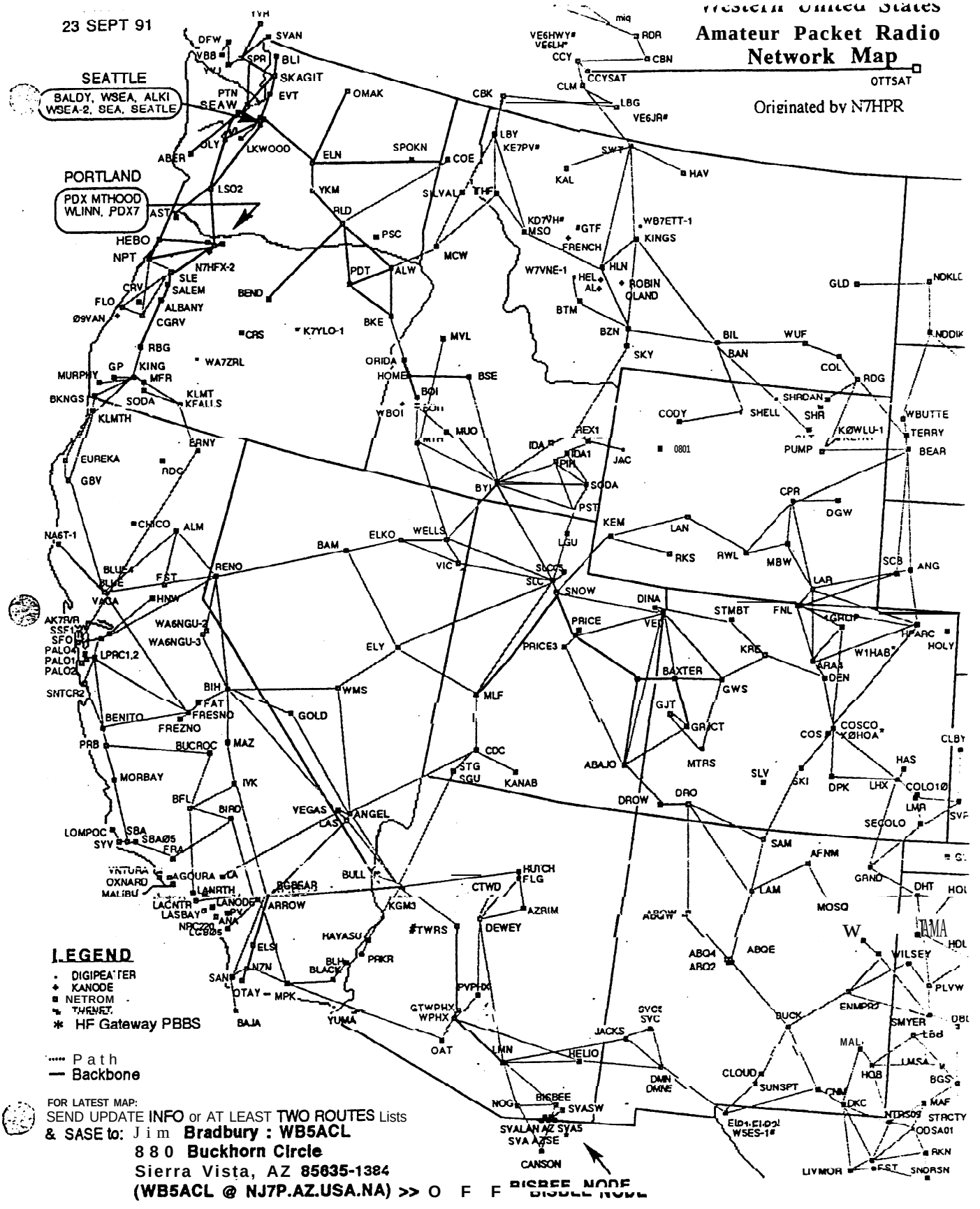
References

Bradbury, Jim, WB5ACL (1991, September 2 1). Western United States Amateur Packet Radio Network Map.

Meredith, Daniel, N7MRP (1997). Arizona Network Inter-tie Group: Arizona Packet Map.

Appendix

Attachment 1 - Packet Map of 1991, WB5ACL
Attachment 2 - Packet Map of 1997, Arizona Network Inter-tie Group
Attachment 3 - Packet List of 1999, KF7TP


23 SEPT 91
Western United States
Amateur Packet Radio
Network Map
Originated by N7HPR
SEATTLE
BALDY, WSEA, ALKI
WSEA-2, SEA, SEATTLE
PORTLAND
PDX MTHOOD
WLINN, PDX7
LEGEND
DIGIPEATER
KANODE
NETROM
TWNET
HF Gateway PBBS
Path
Backbone
FOR LATEST MAP:
SEND UPDATE INFO or AT LEAST TWO ROUTES Lists
& SASE to: Jim Bradbury : WB5ACL
880 Buckhorn Circle
Sierra Vista, AZ 85635-1384
(WB5ACL @ NJ7P.AZ.USA.NA) >> OFF

Arizona Network Intertie Group

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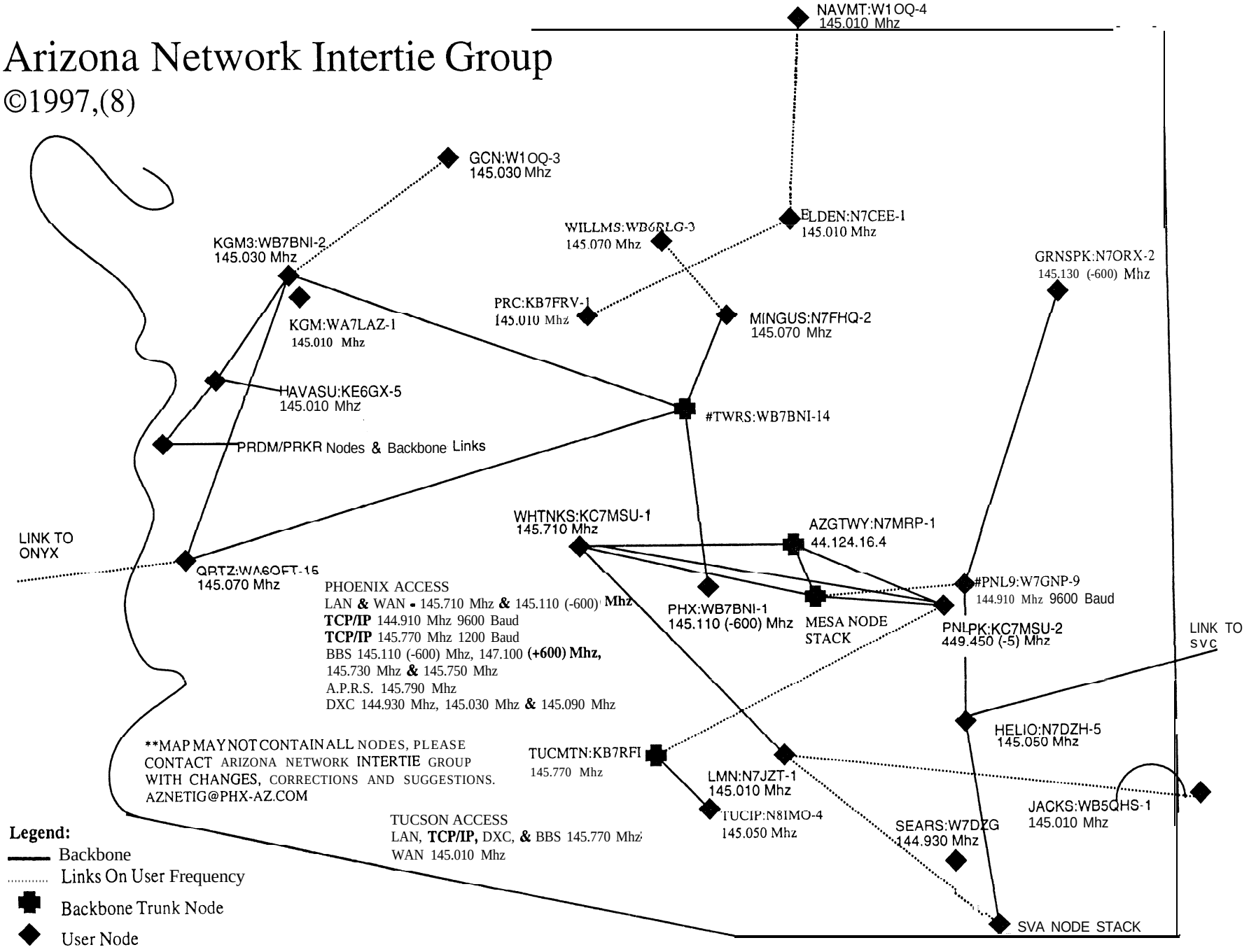

ATTACHMENT 3
ARIZONA PACKET RADIO NODES
by Keith E. Justice, KF7TP

NOTES:
1. Does not include APRS and DX Cluster nodes.
2. Obvious bogus routes were deleted, but no doubt some remain.
3. With the exception of NAVMTN and those shown as out of service, all nodes were accessed by radio from LKSD in August, 1999. Some Internet wormholes were used for intermediate links.
4. Terminal nodes, e.g. ones that do not go anywhere else, are not shown. My apologies to sysops of nodes I missed.
5. Nodes are listed alphabetically within broad geographical regions.

WHITE MOUNTAINS

Node: GRNSPK:KG7BZ-2 Location: Greens Peak near Springerville
Type: X1JR4 Digital Regenerator Repeater Freq: 145.13 (-600) Speed: 1200
Routes:
  0 HEBER:KC7RAE-6 192 45
  0 LKSD:KF7TP-3 192 43
  0 HTOAD3:N7KQ-13 192 22
  0 WMGATE:KG7BZ-12 192 45

Node: HEBER: KC7RAE-6 Location: Heber
Type: TNOS/LINUX Switch/BBS
Ports: .013 Freq: 145.13 Speed 1200 IP 44.124.34.36
       .010 Freq: 145.01 Speed 1200 IP 44.124.40.4
       .910 Freq: 144.91 Speed 1200 IP 44.124.32.36
Routes :

Neighbour	Port	PQual	Obsocnt	Dest
GRNSPK:KG7BZ-2	.130	192	5	58
LKSD:KF7TP-3	.130	192	4	50
HTOAD9:N7KQ-9	.910	200	6	53
ELDEN:W7MOT-8	.010	192	5	15
WMGATE:KG7BZ-12	.130	192	6	85
HTOAD3:N7KQ-13	.130	199	6	35

Comment: Sysop is WA3PNT. Node uses his wife's call

Node: HTOAD3:N7KQ-13 Location: Clay Springs
Type: X1JR4 Freq: 145.13 Speed: 1200
Routes:
  1 HTOAD9:N7KQ-9 255 36
  0 HEBER:KC7RAE-6 188 33
  0 LKSD:KF7TP-3 188 15
  0 GRNSPK:N7ORX-2 188 22
  0 WMGATE:KG7BZ-12 188 47
Comment: Hardwired to HTOAD9

Node: HTOAD9:N7KQ-9 Location: Clay Springs
Type: X1JR4 Freq: 144.91 Speed: 9600
Routes:
  1 HTOAD3:N7KQ-13 255 28
  0 HEBER:KC7RAE-6 190 53 !
  0 #PNL9:W7GNP-9 190 17
Comment: Hardwired to HTOAD3

Node: LKSD:KF7TP-3 Location: Lakeside
Type: JNOS/DOS Switch Freq: 145.13 Speed: 1200
Ports: 01 Freq: 145.13 Speed 1200 IP 44.124.34.4
      .91 Freq: 144.91 Speed 9600 IP 44.124.32.4
Routes :

Neighbour	Port	Qual	Obs	Dest	Tries	Retries	Perc	Irtt
HEBER:KC7RAE-6	13	192	6	108	0	0	0	%
GRNSPK:KG7BZ-2	13	192	5	54	0	0	0	%
HTOAD9:N7KQ-9	.91	192	6	89	0	0	0	%
WMGATE:KG7BZ-12	13	192	6	84	0	0	0	%
#PNL9:W7GNP-9	.91	192	6	19	34	5	87	%
HTOAD3:N7KQ-13	13	192	5	81	0	0	0	%

Node: PINEY:N7JVO-2} Location: Piney Hill, near Fort Defiance
Type: X1JR4 Frequency: 145.01 Speed: 1200
Routes:
  0 GALLUP:W5OXK-1 192 3

```
  0 FLV:KJ5KL-2 192 1
  0 ELDEN:W7MOT-8 192 21

Node: WMGATE:KG7BZ-12 Location: Lakeside
Type : TNOS/LINUX Internet Gateway Freq: 145.13 Speed: 1200
Ports:   imo     :  Link to N8IMO  Internet Gateway
         vhf     :  Freq. 145.13 Speed: 1200
Routes :
   Neighbour        Port  PQual Obsocnt Dest
   HEBER:KC7RAE-6   vhf     192     6     7
  GRNSPK:KG7BZ-2    vhf     192     6     5
   TUCIP:KV4OA-4    imo     230     4    74
    LKSD:KF7TP-3    vhf     192     4     7
  HTOAD3:N7KQ-13    vhf     192     3     7
```

METROPHOENIX

```
Node: #MESIP:KF7TP-4 Location: Mesa
Type: X1JR4 Frequency: 438.975 Speed: 9600
Routes:
  1 MESVHF:KF7TP-2 255 16 !
  1 KF7TP-5 255 0 !
  1 MESDXC:KF7TP-6 255 1 !
  1 MESTCP:KF7TP 255 39 !
  1 MESPHX:KF7TP-11 255 49 !
  0 #WHTNK:W7MOT-13 192 24

Node: #PHX Location: Central Phoenix
Type: TheNet Frequency: 6 Meter Backbone Speed: 4800
Routes:
  1 PHX:WB7BNI-1 248 34 !
  0 #TWRS:WB7BNI-14 240 8 !
Comment: Hardwired to PHX

Node: #PNL4:W7GNP-4 Location: Pinal Peak, near Globe
Type : X1JR4 Frequency: 439.350 Speed: 9600
Routes:
  1 #PNL9:W7GNP-9 255 50
Comment: Link to HELIO is not working.

Node: #pnl9:W7GNP-9 Location: Pinal Peak, near Globe
Type: X1JR4 Frequency: 144.91 Speed: 1200
Routes:
  0 HTOAD9:N7KQ-9 192 80
  1 #PNL4:W7GNP-4 255 47
  0 LKSD:KF7TP-3 192 82
  0 TMPE91:W7GNP-5 192 14
  0 MESVHF:KF7TP-2 192 18

Node: #PNLPK:W7MOT-14 Location: Pinal Peak, near Globe
Type : X1JR4 Frequency: 438.975 Speed: 9600
Routes:
  1 PNLPK:W7MOT-7 255 1
  0 #MESIP:KF7TP-4 192 43
  0 #WHTNK:W7MOT-13 192 2
Comment: Hardwired to PNLPK.  Temporarily out of service as of 8/8/99

Node: PNLPK:W7MOT-7  Location: Pinal Peak, near Globe
Type: X1JR4, Digital Regenerator Repeater Frequency: 449.450-600 Speed: 1200
Routes:
  1 #PNLPK:W7MOT-14 255 46
Comment: Hardwired to #PNLPK.  Temporarily out of service as of          8/8/99

Node: #WHTNK:W7MOT-13 Location: White Tanks Mountains, west of Phoenix
Type: X1JR4 Frequency: 438.975 Speed: 9600
Routes:
  1 WHTNKS:W7MOT-6 255 47
  0 #MESIP:KF7TP-4 192 23
  0 AMRC:K7ARC-1 192 1
Comment: Hardwired to WHTNKS

Node: MESDXC:KF7TP-6  Location: Mesa
Type: X1JR4 Frequency: UHF DXC Backbone Speed: 1200
Routes:
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```
   1 MESVHF:KF7TP-2 255 15
   1 #MESIP:KF7TP-4 255 2
   1 MESPHX:KF7TP-11 255 47
   1 MESTCP:KF7TP 255 32
 Comment: Hardwired to Mesa Stack.  Backbone, no direct user connects.

 Node: MESPHX:KF7TP-11 Location: Mesa
 Type: X1JR4 Frequency: 145.11 Speed 1200
 Routes:
   1 MESDXC:KF7TP-6 255 1
   1 #MESIP:KF7TP-4 255 24
   1 MESVHF:KF7TP-2 255 24
   1 MESTCP:KF7TP 255 56
   0 PHX:WB7BNI-1 192 1
 Comment: Hardwired to Mesa Stack

 Node: MESVHF:KF7TP-2 Location: Mesa
 Type: X1JR4 Frequency: 144.91 Speed: 9600
 Routes:
   1 MESDXC:KF7TP-6 255 1
   1 #MESIP:KF7TP-4 255 2
   1 MESPHX:KF7TP-11 255 46
   0 TMPE91:W7GNP-5 192 20
   0 #PNL9:W7GNP-9 192 21
   1 MESTCP:KF7TP 255 46
   0 CPHX77:KB7PWD-3 192 17
 Comment: Hardwired to the Mesa Stack

 Node: PHX  Location: Central Phoenix
 Type: TheNet Digital Regenerator Repeater Frequency: 145.11-600
 Speed: 1200
 Routes:
   1 #PHX:WB7BNI-11 248 7 !
   0 MESPHX:KF7TP-11 192 28 !
 Comment: Hardwired to #PHX

 Node: TMPE91:W7GNP-5  Location:  Tempe
 Type: X1JR4 Frequency: 144.91 Speed: 9600
 Routes:
   1 TMPE77:W7GNP-3 255 30
   0 #PNL9:W7GNP-9 192 18
   0 MESVHF:KF7TP-2 192 23

 Node: TMPE77:W7GNP-3  Location:  Tempe
 Type: X1JR4 Frequency: 145.77 Speed: 1200
 Routes:
   1 TMPE91:W7GNP-5 255 29
 Comment: 145.77 is the 1200 baud TCP/IP frequency in Phoenix

 Node: W7GNP Location: North Phoenix
 Type: JNOS TCP/IP only, no NetRom
 Ports:
 .77  Freq:  145.77 Speed 1200 IP: 44.124.4.254
 .--  --
 Commen9FrGateway1beSpeed91200Iand44.124.2.9bTCP/IP subnets.

 Node: WHTNKS:W7MOT-6  Location: White Tanks Mountains west of Phoenix
 Type: X1JR4 Frequency: 145.71 Speed: 1200
 Routes:
   1 #WHTNK:W7MOT-13 255 47
   0 YUMA:WA3PNT-4 192 36
   0 UNION2:KB7FRV-2 192 1
 Comment: Hardwired to #WHNTK
```

WEST

```
 Node: YUMA:WA3PNT-4  Location: Telegraph Pass east of Yuma
 Type: X1JR4 Frequency: 145.71 Speed: 1200
 Routes:
   0 WHTNKS:W7MOT-6 192 31
   0 UNION2:KB7FRV-2 0 1 !
   0 YUMAIP:WA3PNT-6 192 54

 Node: YUMAIP:WA3PNT-6  Location: Yuma
```

```
Type : TNOS BBS/SWITCH
Ports:
LAN      :  LAN - a local LAN IP 44.124.48.10
.710    Freq:  145.71 Speed 1200 IP 44.124.48.253
.050    Freq:  145.01 Speed 1200 IP 44.124.52.4
.350    Freq:  439.350 Speed 9600 IF 44.124.56.4
 010    Freq:  145.010 Speed 1200 IP 44.124.58.4
Routes :
   Neighbour        Port   PQual Obsocnt Dest
  BLACK:KA6DAC-2    .050    192      6      7
  10XNOD:W7RFI-6    .350    200      6      4
  YUMAIP:WA3PNT-6   LAN       0      6      1
  YUMAIP:WA3PNT-6   .710      0      6     57
  MPK:KA6DAC-1      .050    192      6     18
  YUMA:WA3PNT-4     .710    192      6     17
  UNION:KB7FRV-1    .010    192      6     71
```

NORTH

```
Node:  #KGM6M:WB7BNI-15 Location: Hayden Peak, near Kingman
Type:  TheNet Frequency:  6 Meter Backbone Speed: 4800
Routes:
  1 KGM3:WB7BNI-2 248 1 !
  0 #TWRS:WB7BNI-14 240 2 !
Comment:  Hardwired to KGM3

Node:  #TWRS Location: Towers Mtn, near Prescott
Type:  TheNet Frequency:  6 Meter Backbone Speed: 4800
Routes:
  0 #KGM6M:WB7BNI-15 240 4 !
  0 #PHX:WB7BNI-11 240 14 !

Node:  DAVIS:K7HS-7  Location:  Davis Mtn near Prescott
Type:  X1JR4 Frequency:  2M DXC Backbone Speed: 1200
Routes:
1   UNION:KB7FRV-1  255  82
Comment:  DXCluster backbone, hardwired to UNION

Node:  HII03:KB7YKY-2 Location: Lake Havasu City
Type:  TheNet Frequency: 145.03 Speed: 1200
Routes:
  0 SNOW03:WY6I-3 192 7
Comment:  Provides a route to California nodes.

Node:  KB7FRV BBS Location: Prescott
Type:  FBB BBS/Switch with Internet Telnet Gateway
Ports:  Freq:  145.01 Speed 1200
        Freq:  145.71 Speed 1200
        Internet  Gateway

Node:  KGM3 Location: Hayden Peak, near Kingman
Type:  TheNet Frequency: 145.03 Speed: 1200
Routes:
  1 #KGM6M:WB7BNI-15 255 6 !
Comment:  Hardwired to #KGM6M. In heard list: HII03:KB7YKY-2 Node, has links to Calif.

Node:  NAVMTN Location: Navajo Mountain, east of Page
Type:  X1JR4 Frequency: 145.01 Speed: 1200
Comment:  This node could not be reached from LKSD

Node PRCVAL  Location:  Prescott Valley
Type:  BBS/Switch Frequency: 145.01 Speed: 1200
Comment:  Temporarily out of service in August, 1999

Node:  UNION:KB7FRV-1  Location : Mount Union near Prescott
Type:  X1JR4 Frequency: 145.01 Speed: 1200
Routes:
  1 DAVIS:K7HS-7 255 83
    YUMAIP:WA3PNT-6 197 17 !
  0 ELDEN:W7MOT-8 192 17
  0 LMN:N7JZT-1 192 13
  0 KGM:WB6RER 192 1
  0 COTTON:N7SBW'-1 192 4
  0 FIRE:KC7CHY 192 1
```

```
  0 SCTSDL:KC7AKP-5 192 1
  0 HUMBT:KC7PJO-3 192 1
  0 HEBER:KC7RAE-6 192 61
  0 PINEY:N7JVO-2 192 3
  0 PRCVAL:WD6ETH-2 192 7

Node: UNION2:KB7FRV-2 Location: Mount Union, near Prescott
Type: X1JR4 Frequency: 145.71 Speed: 1200
Routes:
  0 WHTNKS:W7MOT-6 192 16
  0 YUMA:WA3PNT-4 0 1 !
Comment: Links Yavapaie Co EOC with State EOC and Yuma EOC.  BBS and Switch via KB7FRV in
calls heard but not routes.
```

TUCSON

```
Node LMN  Location: Mount Lemon, north of Tucson
Type: JNOS Frequency: 145.01 Speed: 1200
Routes :
  SVA:N7OO-1            1      192   6   37
  SCTSDL:KC7AKP-5       1      140   5    1
  SANMAN:N7CK-3         1      192   6    2
  BISBEE:K7RDG          1      140   3    5
  SONORA:XE2FE-1        1      140   6    1
  JACKS:WB5QHS-1        1      192   6    7
  UNION:KB7FRV-1        1      140   6   14

Node: SANMAN:N7CK-3 Location: San Manuel
Type: JOS/LINUX Internet Gateway
Ports:
Available ports:
sva    :  AXIP Port to Sierra Vista(AZGATE)
ftl    :  AXIP Port to Ft. Lauderdale, FL
tucson :  AXIP Port to KVOA, Tucson
uhf    Freq:    449.450 Speed 1200 IP 44.124.18.8
01     Freq:    145.01  Speed 1200 IP 44.124.66.32
big    Freq:    145.15  Speed 1200 IP NIL
Routes :
   Neighbour             Port Qual Obs Dest Tries Retries Perc Irtt
     LMN:N7JZT-1         01     192   6   1   790   140     84 %
   TUCIP:KV4OA-4         tucson 220   6   9  1117   17      98 %
   FTLGW:W4BKX-5         ftl    220   6   1   128   0       100 %
  AZGATE:N7OO-15         sva    220   6  22   283   3       98 %

NODE: TUCIP:KV4OA-4 Location: Tucson
Type: TNOS Internet Gateway
Available ports:
wm     :  -> AXIP Port to White Mountains, AZ (c wmgate)
simi   :  -> AXIP Port to Simi Valley, CA (c simi smivly)
segate :  -> AXIP Port to Sierra Vista, AZ (c segate)
sva    :  -> AXIP Port to Sierra Vista, AZ (c azgate)
lcr    :  -> AXIP Port to Las Cruces, NM (c nmsugw)
sanman :  -> AXIP Port to San Manuel, AZ (c sanman)
nwla   :  -> AXIP Port to Northwest Louisiana (c ipcpw)
reno   :  -> AXIP Port to Reno, NV (c wadg)
delrio :  -> AXIP Port to Del Rio, TX (c riogw)
phx    :  -> AXIP Port to Phoenix
2m     :  -> AX25 Radio port, TCP/IP LAN (145.050)
223    :  -> Mail backbone port, Tucson
Routes :
   Neighbour             Port Qual Obs Dest Tries Retries Perc Irtt
  GBNODE:W5GB-8    (BPQ) lcr    200   6    4 2421  185     92 % 1074266232
  TUCSON:WB7TLS-1  (BPQ) 223    230   5    2 2202  317     87 %
  TUCSON:WB7TLS-1  (BPQ) 2m     192   5    2 4     64       5 %
  SEGATE:W7DZG-4   (BPQ) segate 200   5    3  339  14      96 %
  SANMAN:N7CK-3          sanman 220   6    4  220  2       99 %
  7C4008:W6SWE-5         2m     192   6    1 0     0        0 %
  WMGATE:KG7BZ-12        wm     230   6    2  364  29      92 %
  AZGATE:N7OO-15         sva    230   6   67  286  22      92 %

Node TUCSON:WB7TLS-1  Location: Tucson
Type: BPQ BBS/Switch
Ports:
  1 Freq: 145.05 Speed 1200 IP: NIL
```

```
  2 Freq: 220MHz Backbone Speed 9600, IF: NIL
Routes:
  2 KV4OA-4 10 3!
  1 KA7TXS-2 10 1
  1 N7MDT-1 100 6
  i N7OO-2 100 32
  2 W7DZG 255 6
  1 KV4OA-4 10 1!
  1 K7EAR-5 10 2
  1 W6SWE-5 10 1
```

SOUTHEAST

```
Node:#HELIO:K7EAR-4  Location:  Heliograph Peak west of Safford
Type: X1JR4 Frequency: 439.350 Speed: 9600
Routes:
  1 HELIO:K7EAR-5 255 83
  0 SEARS:W7DZG 192 8
  0 2HEADS:KA7TXS-4 195 8
Comment.:  Hardwired to HELIO

Node: 2HEADS:KA7TXS-4  Location:  Dos Cabezas Peak  south of Safford
Type : Unknown Switch
Ports:
Port 1: Freq:  144.930 Speed 1200 IP ?
Port 2: Freq:  439.350 Speed 9600 IP ?
Routes:
  2 W7DZG 192 7

Node: AZGATE:N7OO-15  Location:  Sierra  Vista
Type:  TNOS Internet Gateway
Routes  :
   Neighbour         Port   PQual Obsocnt Dest
   KSOLA:NWOI-6       ks      230      6       9
  WAGATE:N7NEI-8      wa      230      6      14
  NIHRAC:K3YGG-2      md      230      5       i
   TUCIP:KV4OA-4      tus     230      6       4
  SANMAN:N7CK-3       sml     230      5       1
  OREGON:WB7AWL-10    or      230      5      19
   HFXNS:VE1SMU-3   n s      230      5      13
   UTDXC:NG7M-8       utdx    230      4      19
   ALWGW:KB5CDX-8     wal     230      4      16
  IPCAPE:WOPLW-2      mo      230      6       1
    HARC:VE3THA       ve3     230      6       8
   LINUX:VE3MCH-10    ont     230      5       4
   QMNGW:IWOQMN-10    it      230      5       5
   BENCA:WH6IO-7      ca      230      5       6
   AZLAN:N7OO-6       ax0     230      5       4
Available  ports:
fla    :   Port to MIAMI:AE4EJ-1 in Miami, FL
tus    :   Port to TUCIP:KV4OA-4 in Tucson, AZ
la     :   Port  to #TAXLA:WB0TAX-14 in Elm Grove, LA
or     :   Port  to OREGON:WB7AWL-10 in Talent, OR
mo     :   Port  to IPCAPE:W0PLW-2 in Cape Girardeau, MO
md     :   Port  to NIHRAC:K3YGG-2 in Bethesda, MD
wa     :   Port  to WAGATE:N7NEI-8 in Seattle, WA
ont    :   Port  to LINUX:VE3MCH-10 in Hamilton, Ontario
wal    :   Port  to ALWGW:KB5CDX-8 in Walla Walla, WA
ns     :   Port  to HFXNS:VE1SMU-3 in Halifax, Nova Scotia
ks     :   Port  to KSOLA:NW0I-6 in Olathe, KS
it     :   Port  to QMNGW:IWOQMN-10 in Perugia, Italy
sml    :   Port  to SANMAN:N7CK-3 in San Manuel, AZ
dx     :   Type  'dx'  for the N700 DXCluster (Western US area)
utdx   :   Port  to NG7M-8 in Clearfield, UT
ut     :   Port  to UUGATE:WA7SLG-3 in Salt Lake City, UT
ca     :   Port  to BENCA:WH6IO-7 in San Francisco, CA
       :   Port  to HARC:VE3THA in Halton, Ont
ax1
ax0    :   Link to 145.01

Node: AZLAN:N7OO-6  Location: Herford
Type : X1JR4 Frequency: 145.01 Speed: 1200
Routes:
  1 SVA5:N7OO-2 248 19
```

```
  1 SVA:N7OO-1 248 91
  0 AZGATE:N7OO-15 230 58
Comment: Hardwired to SVA5 and SVA

Node:  AZSON:N7MDT-4  Location: Gold Hill, near Nogales
Type: BBS/Switch Frequency: 145.01 Speed: 1200
Routes:
  0 N7MDT-1 255 5
  1 N7JZT-1 192 5!
  1 XE2FE-1 192 1!
Comment: Hardwired to NOGAZ

Node: BISBEE:K7RDG Location: Mule Mtn, near Bisbee
Frequency 145.010 Speed: 1200
Comment: Hardwired to SEARS.  Apparently out of service in August, 1999.

Node:HELIO:K7EAR-5  Location: Heliograph Peak west of Safford
Type: X1JR4 Frequency: 145.05 Speed: 1200
Routes:
  0 NOG:KA7TXS-2 192 68
  1 #HELIO:K7EAR-4 255 83
  0 SVA5:N7OO-2 192 52
  0 NOGAZ :N7MDT-1 192 5

Node: NOG:KA7TXS-2 Location: Red Mtn near Nogales
Type: TheNet Frequency: 145.05 Speed: 1200 Speed: 1200
Routes:
  0 HELIO:K7EAR-5 192 58
  0 TUCIP:KV4OA-4 192 57
  0 CRC:W7SA-5 192 52
  0 7C4008:W6SWE-5 192 1
  0 NOGAZ:N7MDT-1 192 4
  0 TUCSON:WB7TLS-1 192 2
Comment: Solar Powered

Node: NOGAZ:N7MDT-1 Location: Gold Hill near Nogales
Type: BBS/Switch Frequency: 145.05 Speed: 1200
Routes:
  0 N7MDT-4 255 5
  1 W7SA-5 192 5
  1 KA7TXS-2 192 5
  1 KV4OA-4 192 0
  1 W6SWE-5 192 0
Comment: Hardwired to AZSON

Node SEARS:W7DZG Location: Mule Mtn neaqr Bisbee
Type: JNOS Switch, BBS
Ports:
UHF  Freq:  438.925  Speed 9600
BBONE Freq: 439.350  Speed 9600
VHF  Freq:  144.930  Speed 1200
220  Freq:  220MHz   Speed 9600
Routes :
   Neighbour            Port Qual Obs Dest Tries Retries Perc Irtt
  2HEADS:KA7TXS-4       VHF   144   6    1 0     0        0 %
  2HEADS:KA7TXS-4       bbone 192   6    1 2     2       50 %
     DX1:N7BXX-1        VHF   192   5    1 0     0        0 %
  TUCSON:WB7TLS-1       220   128   2    2 2221  738     75 %  TBOSS:KK7RV           UHF
192   6    2 0     0     0     %
  SEGATE:W7DZG-4   (BPQ) UHF   192   6   47 125   9       93 % 15

Node: SEGATE:W7DZG-15 Location: Sierra Vista, Arizona, USA DM41VM
Type: TNOS Internet Gateway
Available ports:
fyrom  :  -> AXIP Port to N1NGN Former Yugoslav Republic Of Macedonia
nh     :  -> AXIP Port to AE1T- in Plymouth New Hampshire
boston :  -> AXIP Port to KB1BWD in Boston MA :  -> AXIP Port to HG5BDU in Budapest,
Hungary
tucip  :  -> AXIP Port to N8IMO in Tucson, AZ
slo    :  -> AXIP Port to S55TCP in Slovenia, Europe
sanman :  -> AXIP Port to N7CK in San Manuel, AZ
zg     :  -> AXIP Port to 9A0TCP in Zagreb, Croatia
nwla   :  -> AXIP Port to KB4CPW in Northwest Louisiana
zurich :  -> AXIP Port to HB9AE in Zurich, Switzerland
italy  :  -> AXIP Port to IW0QMN in Perugia, Italy
```

```
uhf    :   -> AX25 Radii port, TCP/IP LAN (438.925)
vhf    :   -> Unused 1200 BPS PORT
Routes  :
   Neighbour              Port Qual Obs Dest Tries Retries Perc Irtt
   LJUTCP:S55TCP-6        slo     220    6    18 474    45       91 %
   TBOSS:KK7RV            uhf     220    6     1 25     8        75 8
   IPCPW:KB4CPW-8         nwla    220    6     5 10     0        100 %
   TUCIP:KV4OA-4          tucip   220    6     7 33     0        1.00 %
   ZHGATE:HB9AE           zurich  220    6    41 277    24       92 %
   ZGTCP:9A0TCP           zg      220    6    12 111    25       81 %
   QMNGW:IWOQMN-10        italy   220    6     5 23     4        92 %
   SEARS:W7DZG            uhf     200    6     2 104    7        93 8

Node: SIGBOX:N1NGN  Locatoin: Southeast Arizona
Type: NOS BBS/SWITCH
Ports:
Freq:  144.930 Speed 1200
Freq:  145.010 Speed 1200
Freq:  145.050 Speed 1200
Freq:  438.925 Speed 9600
Freq:  14.105 (USB)Speed 300
Comment:  Apparently off the air in August, 1999

Node: SVA:N7OO-1  Location:  Near Sierra Vista
Type : X1JR4 Frequency: 145.01 Speed: 1200
Routes:
  0 LMN:N7JZT-1 243 43 !
  1 SVA5:N7OO-2 248 20
  1 AZLAN:N7OO-6 248 99
Comment:  Hardwired to SVA% and AZLAN

Node: SVA5:N7OO-2  Location: Hereford
Type: X1JR4 Frequency: 145.05 Speed: 1200
Routes:
  1 SVA:N7OO-1 240 98 !
  1 N7OO-4 240 0 !
  1 AZLAN:N7OO-6 240 97 !
Comment:  Hardwired to AZLAN and SVA

Node: TBOSS:KB7ZGA Location: Sierra Vista
Type:  JNOS Switch
Available ports:
hf
930
440    Freq: 438.925 Speed:  9600
2m     Freq: 145.010 Speed:  1200
Routes:
   Neighbour              Port  Qual Obs
   SEGATE:W7DZG-4    (BPQ)  440     192    4
   SEARS:W7DZG              440     192    5
```