Proceedings of the
4th UK Amateur Packet Radio Conference

Held at the Poacher's Pocket, Warndon, Worcester

7th May 2005

List of Delegates:

Callsign	Name	Home Town	Other Info
G0CER	David	Coalbrookdale	Packet user
G0CNG	Chris	Bloxwich, W Mids.	Maxpak chairman, node & bbs sysop
G1PLT	Paul	Exeter, Devon	
G0EWH	Richard	Stourbridge	Fourpak treasurer & packet user
G0HHH	Geoff	Kidderminster, Worcs.	Packet user
G0KFS	Albert	Bloxwich, W Mids.	
G0LGS	Stewart	Cheltenham, Gloucs.	Node & bbs sysop
SWL	Matthew	Cheltenham, Gloucs.	
G0SYR	Bryan	Caterham, Surrey	Node sysop
G0WKL	Richard	Petersfield, Hants.	Sunpac chairman
G3ZFR	Roger	Coventry	Sysop gb7cov
G4AFJ	Geoff	Kirkby Mallory, Leics.	Packet user
G4APL	Paul	Caterham, Surrey	Node & bbs sysop
G4FPV	Steve	Malvern	Fourpak chairman, node & bbs sysop
G4ZXI	Nick	Headcorn, Kent	
G6KOY	Kevin	Bloxwich, W Mids.	
G6KUI	Peter	Derby	Node & bbs sysop
G6TJZ	Peter	Bristol	Node & bbs sysop
G7BNK	David	Walsall	
G7RAZ	Mike	Wisbech, Cambs.	Node & bbs sysop
G7VBJ	David	Sutton Coldfield	
G8JAD	John	Gravesend, Kent	
G8PZT	Paula	Kidderminster, Worcs.	Fourpak secretary, node & bbs sysop
M1CQO	Jon	Bridlington	
M1FDE	Anthony	Chelmsford, Essex	
M3OAC	Glynis	Malvern, Worcs.	

Agenda

1. Opening Address & Apologies
2. UK Network Update
3. UK Network Maps
4. Network Management Forum
5. A Voice Over Packet Radio Experiment
6. Living With A Radio Amateur
7. XRouter Developments
8. The Future Of Packet Radio
9. Any Other Business
10. Closing Address

1. Opening Address & Apologies

Proceedings began at 10:15am with a few words from Paula G8PZT, the conference organiser, who welcomed everyone, and invited nominations for the posts of chairman and minutes secretary. There being no nominations, Steve G4FPV agreed to act as chairman, and Paula volunteered to take the minutes.

The chairman then drew delegates' attention to the fire exits and toilets, explained the "two-for-one" lunch offer, and announced some for-sale items.

Paula then read out the following list of people who had sent their apologies and hoped we had a good day: G0FTD, G0TWN, G1KQH, G1YGY, G3LDI, G4DIE, GM4LNH, G4WYW, G6HJP, G7NBP, and M1CUK

2. UK Network Update

Representatives from various parts of the UK were invited to give a short summary of the current state of packet radio in their area.

2.1. SUNPAC Area

Richard Martin G0WKL, chairman of SUNPAK in Dorset, explained that the group currently ran 3 nodes, one at Salisbury, one on the Isle of Wight, and one on Portsdown Hill above Portsmouth. Those nodes served 3 BBSs and one DX cluster. All the nodes had been working for the last year.

Prior to that, SUNPAC had been through a bad patch during which it had lost almost all its support, but they were back up and running, and all ports on all their nodes were currently fully operational. The system was almost totally RF-based. There were one or two Internet connections, but the group were particularly keen to maintain an RF network, as that's where their interests lay.

His assessment was that packet radio in the SUNPAC area was stable, certainly not in decline, and nothing much was changing. Their network mainly used XRouter software, with which they were satisfied, and the main use was BBS linking, and linking to the DX cluster in Wool. All the access ports were getting plenty of use.

There were quite a lot of users, but they tended to remain silent until something went wrong. There was a shortage of volunteers, and people prepared to contribute in terms of finance and resource. Richard felt that there was actually an increase in users, and he had recently been approached to give talks to local radio clubs.

The group had communications with groups to the north and east. The only disappointing thing was that the node at Weymouth had closed recently, but someone was apparently trying to re-open it in Dorchester. One worry was that it was costing more and more to maintain the remote sites, and the group seemed to be in constant negotiation with farmers.

Paul G1PLT commented that the node, to which the Exeter node used to link, had been off for the last three years, reputedly due to a TNC fault in one of Sunpac's nodes, so the Exeter node had 2 metres, 70cm and 23cm sitting idle, as there were no links.

G0WKL re-iterated that all Sunpac's nodes were fully operational. G4FPV suggested that maybe the problem lay at Weymouth, which wasn't one of Sunpac's nodes [editor's note: the EXExx node in Exeter did in fact link to the WEY2 Weymouth

one], and that, if the Weymouth node was to be reactivated, links to Exeter could be re-established.

Paul G4APL, who had recently been helping the Weymouth group, stated that the WEY2 and WEY23 nodes had been closed two weekends previously, the site being re-used for a two metre repeater. He had upgraded the firmware on the WEY2 and WEY3 TNCs. WEY3 would be relocated lower in Weymouth, and WEY2 a few miles to the west of Weymouth where good two-metre signals from the Exeter node GB7EX were received. Both nodes would be operated at personal locations.

Steve G4FPV commented that linking on 2 metres had always been taboo, but with the current 70cm embargo we had to be flexible. User levels were such that 2m linking was better than nothing at all.

2.2. Gloucestershire Repeater Group Area

Stewart G0LGS, treasurer of Gloucestershire Repeater Group reported on the state of packet in Gloucestershire and surrounding areas. He felt that things had been going down hill in the last year or more. The number of users had been going down, consequently some systems such as GB7GC had been turned off, and on others such as GB7LGS the user ports had been turned off. The group had seen costs for at least two of the sites double twice (to 200 pounds per year) in the last 2 years, and as a result they planned to close them, as they no longer had the users to support the expenditure. The links would be re-organised to preserve the network.

Steve G4FPV, also a GRG officer, interjected here that a large national company, not a small business such as a farmer, owned the sites in question so the group was in a difficult position when trying to negotiate.

G4AFJ commented that he knew of a well-sited farmer who had the masts of 4 (soon to be 5) mobile phone companies on his property, and was getting forty thousand pounds per year rental!

Stewart continued, stating that the usage was going down and he couldn’t see that changing. There were still some DX cluster users, but the Internet was now carrying the inter-cluster traffic.

Steve wished to reassure everyone that, although the group was closing some of the user access ports, they were not removing access altogether. The group policy had previously been to provide a large number of local-coverage sites, some running only a few hundred milliwatts. With fewer users, they had gone back to using a smaller number of wider coverage access ports. This saved the group having to pay rental costs and run around maintaining equipment.

2.3. MAXPAK area

Chris G0CNG, chairman of MAXPAK, the group responsible for the Black Country and north Birmingham, reported on the state of their network. The GB7MAX BBS, located in Bloxwich with the BLOX node had both Internet and RF connections. In addition, the group ran two major node sites, at Wolverhampton and at Sedgeley.

The site rental for the Wolverhampton node was only 60 pounds per year and the authorities were very supportive. The node was running on a 386 laptop, and the Xrouter software was extremely reliable. There were 23cm 2400 Baud RF links to Newcastle and Kidderminster, 9k6 links to Bloxwich and Corley and Kidderminster, plus a 9k6 user port on 144.975.

The Sedgeley site had received very little attention over the last couple of years. It had ports on 432.675 and 144.8625. At Bloxwich, 144.9375 and 432.675 were fairly well used, plus an experimental 9k6 port on 144.825 was used by a couple of users.

GB7MAX had around 40 regular users, plus others who came in from time to time. The GB7WAL BBS had a user base of 27 and exchanged mail on 70.4875 with GB7MAX. MaxPak group membership had slightly shrunk compared with a few years ago and currently stood at 36. These tended to be more local than in the past.

Richard G0EWH asked what effect the two newly allocated VOIP frequencies on 144.8125 and 144.8375 MHz were having on his144.825 port. Chris replied that he was having no problem, due mainly to high ground between him and the VOIP stations.

2.4. Kent IP Group area

The next speaker was Nick G4ZXI, one of the two remaining members of the Kent IP Group. The group had disbanded 2 years previously, and together with John G8JAD he had been keeping a couple of nodes running in Kent. The nodes ran both IP and Net/Rom, and there was a link to GB7CIP in Caterham. This was now an Internet link, as all the intervening radio links had been lost.

Their coverage area was the central Weald of Kent, and the north Kent / south Essex coasts. There was only one active user on 9k6 in central Kent, but they were picking up some new users in the north Kent area. Nick also ran the Sutton Valance Net/Rom nodes, which were heavily used for DX cluster. Activity in Kent had declined, but they were trying to promote it. UI-View was operating at Nick's QTH in Headcorn, and at Sutton Valance. Nick was also about to start an Echolink VOIP gateway. There used to be a very active user base in Kent, but it had dropped off with the arrival of broadband.

2.5. Coventry area

Roger G3ZFR reported that the Coventry node and BBS were still going strong, but many of the surrounding nodes had closed. The LANPAC group had folded a few years back, and much of the equipment was still available if anyone was interested in carrying things on.

Roger still had around 10 RF ports on his system. There were 3 user ports on 4 metres, 2 metres, and 70 centimetres. 4m didn't get much use, but 2m and 70cm did. There were links on 70cm to Wolverhampton, 23cm to Lickey Hills (Roger didn't know how much, if any, use was being made of this one), and 70cm 9k6 to Jim G3OJI in Napton. Jim used to provide the main trunk to the southeast, but no longer had any links in that direction. Several people had expressed an interest in linking to him, but nothing had so far happened. So if anyone could "see" Napton from the southeast, and would like a link, please get in touch.

G4AFJ, representing the GB3CF repeater group, offered space on their mast if anyone was interested. In the northerly direction, Roger still had a working link to a private house on a hill near Bardon Hill. This used to be the link to the Rugeley node, but was now used only for user access by G1KQH. The Bardon node could be relocated to Markfield without too much administrative effort, but it really needed people in the Leicester Repeater Group interested enough to get it all up and running. So there were

two opportunities for anyone who wanted to get involved, one to the north and one to the south.

Roger's system had about a dozen regular users, plus a few casuals. The majority of the operation was users going in on 70cm RF ports and sitting on DX clusters all day long.

On the subject of links to the south, Paul G1PLT asked if Roger could see GB7VW from his QTH. Roger didn't think so, but there was a possibility from Markfield.

Roger indicated that within the next year the Marconi site in Coventry was going to relocate a few hundred yards away. Roger did not intend to relocate the packet nodes to the new site, so they would close.

3. UK Network Maps

Bryan G0SYR, sysop of GB7CP presented some maps of the UK Net/Rom network, as seen from his viewpoint in Caterham, Surrey, which he had compiled by connecting around the network and examining node and route tables. It was sometimes difficult to tell if routes were RF or Internet, so he warned that there might be a few errors. It was also difficult to make a geographically accurate map of the packet network, so they tended to be distorted for better visibility. He also stressed that the maps showed only the Net/Rom network, and didn't show the IP or Flexnet sections. He had also omitted the nodes that were deliberately hidden.

Firstly, he presented the map showing only the RF links, pointing out that there were good sections in Scotland, the SUNPAC area, the Midlands and the Severn Valley. There wasn't much in the southwest, although there might soon be, as there was a new BBS GB7COW, which was radio linked to via G0RQL to south Wales. There was some RF linking around GB7LDI in Norfolk.

Then Bryan presented the map showing both the RF and Internet links on a single map. Since last year there hadn't been a great deal of change, perhaps 5 percent. Some of the Scottish nodes were now linked by Internet, instead of radio.

Bryan explained that the network had built up in 3 phases. There were the original radio links, which in the second phase were then added to by the IP network, originally centred on BBC in London, CRV at Lancaster University, UNI in Swansea, and COV in Coventry. CIP had since taken over from BBC. The Thames valley IP connectivity had been lost. Netrom was then carried over the IP network between those gateways. The third phase happened when Xrouter and broadband arrived, making it easy to link via the Internet without having to run Linux, so there was a huge expansion of Internet linking. Around half the nodes were now Xrouter.

It was noted that, without the Internet links, some of the RF sections of the network would be completely isolated, and probably unsustainable. Also noted was the fact that most DX cluster interlinking now took place on the Internet.

Anthony M1FDE pointed out that in Essex there were quite a few RF nodes, typically TheNet X1J, which didn't have any fixed links at all. Raynet had set them up on high spots for emergency use.

Bryan had recently tried to assess the "usefulness" of the network, i.e. how reliable and connectable were the nodes in the table. His node table comprised around 200 callsigns, which represented around 100 different nodes plus their chat servers and

PMS's etc. He used a simple BBC micro program to automatically connect on a cycle to all the nodes in the table. He had found that on average around 80 percent of the connections were successful.

4. UK Network Management Forum

4.1. RF Node Network Issues

Paul G1PLT stated that he had been assessing the network in the southwest. The north of Devon was quite well served by NHTOR, which tended to get used mainly for DX cluster. The users were not interested in extending the networks.

He was concerned that the people responsible for emergency planning seemed to be putting up nodes in the amateur bands without any planning! By placing them on hilltops they were hearing France, but not the local traffic. He felt that this forum could try and co-ordinate some of the traffic that needed to be passed, and that grants may be available from councils for this purpose.

Paula G8PZT asked if there was anyone present who could link to Napton from the southeast. No one came forward.

Someone complained about the sometimes-obscure NetRom aliases, which give no clue where the node was.

Regarding the embargo on 70cm, Steve G4FPV asked people not to formally relinquish 70cm frequencies, because once lost, they could not be regained. Some of those frequencies could be legally re-used for other purposes.

4.2. AXUDP Routing Issues

Paula G8PZT stated that there was a proliferation of AXUDP linking, because it was so easy to do. As a result, a lot of unnecessary routing information traffic was being shunted around, on links that more or less duplicated each other. She wondered if it would be possible for sysops to limit the amount of AXUDP linking, and perhaps choose their partners more geographically?

Paula acknowledged that KIDDER did not set a good example in this respect, and this served to illustrate the difficulties in trying to limit the growth. She often received requests for AXUDP links, and didn't like to decline, although she had now begun to do so if there were existing links providing the same connectivity. And if you struggled to reach your neighbour over congested, slow RF links, whilst other sysops enjoyed fast AXUDP links to him, it was tempting to duplicate the RF link with an AXUDP one.

Roger G3ZFR stated that it was the route qualities that needed co-ordinating. You only needed one person to use the wrong qualities, and it would upset the whole network.

Steve G4FPV said it was a re-iteration of the issues that were hammered out in the very early sysop meetings. A lot of good work had been done, sorting out these very issues.

Bryan G0SYR stated that in the days of radio-only links, the route quality was tied to the speed of the link, and this idea had been continued with the AXUDP links, so sysops had been setting the route qualities far higher than those of the radio links. He

suggested using a quality of 100 for all AXUDP links within the UK. If everyone used the same value, the routing would use the shortest number of hops. He also suggested that the links to other countries should use much lower quality values, so we would see those links, but not the networks beyond them. We didn't want our tables filled up with foreign nodes.

Paul G1PLT said that we have to address the issue as a strategy, and then put it into place. Bryan said that the difficulty was getting everyone to agree on the strategy. Fortunately, a node that didn't conform to the strategy could easily be treated as if it was not in the UK. It could be allowed to remain in our network, but not as part of the main structure.

As the coffee break was long overdue, the chairman suggested concluding this topic and moving on to the next one. Paula replied that it was an important issue, and should be continued later under AOB.

4.3. BBS issues

Paula G8PZT had been requested, by G6URM, to ask if there was anyone interested in helping to establish an RF-linked BBS in the Plymouth area. Paul G1PLT stated that in Exeter they had 23cm, 70cm and 2m links, and dependant on what happened with linking to the east, the 23cm port could possibly be redeployed to link with Plymouth. Contact G1PLT or G8GON if interested.

Steve G4FPV felt that people were using the Internet to forward traffic over long distances, simply because they could, and the hitherto structured forwarding system was breaking down. Were we forwarding traffic correctly? People complained of losing personal mail, yet the links were largely still in place.

Someone pointed out that there had been a recent problem whereby personal mail from GB7NND and from Belgium was being lost. Eventually it was traced to a BBS closing down and another sysop not noticing that fact, so mail got stuck. Once found, the problem had been easily resolved.

COFFEE BREAK

5. Presentation: A Voice over Packet Radio Experiment

Paula G8PZT described her experiments with transmitting voice signals via packet radio. The idea arose as a result of her DSP experiments, and a desire to do something radically different with packet radio. She asked people to bear in mind that this was by no means state of the art, just a silly amateur experiment.

Digital Speech Basics

Firstly Paula outlined of the basic steps involved in digital audio transmission. An audio waveform would be sampled at regular intervals, the amplitude values being converted to binary numbers by an analogue to digital converter. In a computer soundcard these numbers were typically 8 bits wide, ranging between 0 and 255 with 127 representing the baseline. The sample stream would then be encoded into packets for transmission over the desired medium. At the receiver, the packets would be decoded, and a digital to analogue converter would reconstruct an approximation of the original waveform.

The faster the waveform was sampled, the higher the frequency that could be reproduced, but the more data was transmitted. The Nyquist rule stated that the waveform must be sampled at twice the highest expected frequency, or higher. Paula chose a sample rate of 8000 samples per second because that gave an audio bandwidth of 4 KHz, perfect for speech.

8000 samples per second, at 8 bits per sample would give a data rate of 64 kilobits per second. That was much too high for most existing packet links, Paula's initial aim being to use 9k6 full duplex. Due to frame overheads and bit stuffing, a 9k6 link wouldn't sustain a payload rate of more than about 8000 bits / sec, so an 8 to 1 reduction in data rate was required. Could this be done by suitable choice of sample rate and resolution?

Halving the sample rate would halve the data rate, but the audio response would be degraded to 2 kilohertz. This was intelligible, but sounded muffled and unpleasant, requiring more concentration. Further reduction in the sample rate resulted in signals that were virtually unreadable.

Halving the number of bits per sample instead, the audio would remain fairly intelligible, but distorted, there being only 16 quantisation levels to represent the whole signal from full positive to full negative. Providing the signal level remained high, the distortion was tolerable, but if the level dropped, the signal got more distorted, as it was composed of fewer steps. If the peak signal didn't reach the first step, it just disappeared. The dynamic range between full output and no output was only 18db. Delta modulation would give a reduction in bits with less distortion and more dynamic range. Basically it involved coding the *difference* between one sample and the next, instead of the absolute value. It could be done simply, but for best results quite complex coding was required.

By halving both sample rate and resolution, a data rate of 16 kilobits per second could be achieved, but at the cost of poor bandwidth, severe distortion and poor dynamic range. And the data rate would still be too high! Clearly it wasn't possible to transmit raw speech waveform data, even in reduced form, and some form of data compression was required.

Data Compression

There were many highly complex and computationally intensive voice-coding schemes, for example GSM, which was developed for mobile phones. Most of these were described mathematically with no source code, so if one didn't understand the maths, one had no chance of implementing them. It would require highly optimised code to achieve such encoding on a Pentium 166. As a matter of interest, GSM achieved excellent quality, but still required a data rate of 13 kilobits per second; too high for 9k6 packet.

Although a speech waveform was complex, requiring a high data rate to reproduce faithfully, it was highly repetitive. A single oscillator; namely the vocal chords, excited a resonant filter system comprising the chest, throat, oral and nasal cavities, plus head sinuses. The excitation frequency and filter characteristics were under muscular control, to form speech. Muscles didn't move quickly, so over short intervals, such as ten milliseconds, nothing much would change, and the whole system could be represented for that interval by just a few coefficients. So it wasn't actually necessary to send the speech waveform itself. Instead, it could be analysed over a short interval to extract some coefficients that described the waveform. Those

coefficients could be transmitted, and the receiver would use them to synthesise an approximation to the original waveform.

As a very simple example, a 10ms block of pure sine wave, at 8000 samples per second, would require 80 * 8 bit samples. But this waveform could be modelled by just two coefficients, frequency and amplitude. Given those two values a perfect, noise and distortion free copy of the sine wave could be synthesised at the receiver, with very little data actually transmitted. In reality, the waveforms were more complex than a pure sine wave, requiring more coefficients, but the principle was similar.

There were many ways of decomposing a complex speech signal into a few coefficients, and Paula outlined some of them as follows: Since voiced speech (e.g. vowels) consisted of a single frequency plus its harmonics, the coefficients could describe the fundamental frequency, its amplitude, and a function describing the relative amplitudes of all the harmonics. As this worked only for voiced speech, it also required a noise channel to generate the unvoiced components.

Alternatively, the coefficients could specify the characteristics of a semi-resonant filter, plus some pulses which, when applied to that filter, would "ring" it to reconstruct the original waveform. As the filter characteristics changed relatively slowly, the next frame could be predicted from the current one, and only the changes needed to be sent. This type of system could be adversely affected by packet loss.

Finally, the brute force approach was simply to perform a short-term spectral analysis, and transmit the amplitudes of the most relevant spectral lines. As Paula was not a mathematician, and didn't want to write reams of complex code, this was the method she chose for her experiments.

Speech Synthesis

Given a set of spectral amplitude coefficients, the receiver need some way of turning them back into a real signal. A relatively simple way to do this was to add several sine waves, whose amplitudes, frequencies and phases are controlled by the received coefficients. This method could achieve excellent speech using 16 sine waves. As the number of sinusoids was reduced, the speech became more "Dalek"-like, and the intelligibility suffered, but even with just 4 sinusoids, it was around 70 percent and the speaker's identity was recognisable.

Practical Codec

Paula then went on to describe the details of her simple codec. The input waveform was spectrum analysed by Fast Fourier Transform in 16 ms blocks comprising 128 samples. This resulted in 64 spectral lines, spaced at 62.5Hz intervals. From these it chose the 8 that best described the signal. That algorithm was crude, and could be improved. For each line, the amplitude, phase and frequency were quantised and encoded into 16 bits. Thus for each frame, 128 bits were sent in 16 milliseconds, a data rate of 8000 bps.

15 such blocks (240ms) were assembled into 240-byte UI packets and buffered for transmission using a 9600 Baud KISS TNC. The reason for using unconnected mode was to minimise the effect of lost frames. With a normal ax25 connection, a lost frame would cause a stop and retry situation, which would cause a backlog to build up, and an unacceptable gap in the audio. With unconnected mode, the lost packets would simply be ignored, and the audio would degrade more gracefully. At the

receiver, the gap could be filled by silence, or by repeating the previous block of audio. Connected mode *could* be used if the link bandwidth was a lot higher than the data rate.

At the receiver, the frames were unpacked, and the coefficients were used to control the frequencies, amplitudes and phases of 8 software oscillators, which were mixed together to give the output signal. A small amount of temporal smoothing was applied at times.

Results

Paula warned everyone not to expect anything wonderful, then played some audio clips showing different voices recorded via the previously described system. The speech had a robotic quality, and there was an intrusive "babbling" sound in the background, emphasised by the AGC on the tape recorder (the audio from the soundcard had been overdriving the input). Once the ears became accustomed to the sound, the speech was reasonably intelligible, and Paula admitted that she had spent several hours listening to QSOs via the system, often forgetting it was there. Although the speech was totally synthetic, the speaker's voice could easily be recognised. On some of the snippets, a little temporal smoothing was applied, which reduced the robotic quality, but increased the background babbling

Future Development

The algorithms used were by no means the best. More complex ones could achieve better speech quality at a far lower bit rate, even down to 1.2 kilobits per second. Paula wanted to go even lower than that, for use over 1200 baud links.

But for now, there was a lot more than could be done with the existing algorithm. Speech quality could be improved by better selection of the spectral lines, by dealing properly with non-stationary speech segments, and by temporal smoothing. The block size was quite small for a low-rate codec and could easily be doubled, halving the bit rate. It could be halved again by discarding the relatively unimportant spectral line phase information. The coefficients could be coded much more efficiently, and further reduced using compression techniques. And there was no point in transmitting silence. The data rate could be reduced to 2Kbits/sec without it sounding any worse.

Ultimately, analysing and synthesising the speech itself, rather than its waveform or spectrum could be used to implement an extremely low-rate codec.

Possible Applications

What was the point of all this? Well, basically to find new uses for packet radio, and keep the hobby moving forward. Paula proposed a few wacky ideas: She had recently joked that we could make use of the relatively idle RF packet links to link repeaters using digital voice, as a way of getting round the 70cm embargo which prevented analogue linking. Although the idea probably had no merit, it *would* be technically feasible if the data rate could be reduced and the quality improved.

To use voice-over-IP systems such as Echolink, EQSO, IRLP or WIRES, required an Internet connection, or one had to be within range of a gateway station. There were situations where neither was available, whilst a packet node was. It would be nice to have an Echolink style VOPR client for use in these situations. With a low enough data rate, we could even take advantage of digipeaters.

Since much of the worldwide packet network now used the Internet as its backbone, many inter-node links were easily able to support voice over packet. We could therefore have a trunked voice network in which the peer stations were both digital and wireless. The point of digital was that it would support simultaneous voice and text, which was not possible with regular voice gateway stations.

Typing wasn't much fun. It should be possible to speak a message, and have it reliably delivered via the network to someone's voice mailbox in non-real-time, just like a packet message.

There must be other possibilities. All it needed was a little imagination.

Conclusions

As a result of her ongoing experiments, Paula concluded that VOPR was not only possible, it was relatively easy to do at 9k6 without too much computing power. It should also be possible to do it over 1200 Baud links, although it wouldn't offer telephone quality. With a little imagination, there could be a number of possible applications, and development of such systems could benefit packet radio, giving it an additional purpose, and stimulating the development of more and better links. It was worth a try!

6. Talk: Living With A Radio Amateur.

As light relief, Glynis Wilsden, partner of Steve G4FPV, gave a humorous talk about what it was like to live with a radio amateur. The talk was illustrated by various "visual aids", and showed how strange our hobby sometimes looked to those who have to put up with us.

"This is G4FPV mobile listening through CG, does anyone copy?"

"G4FPV mobile, this is G0LGS. Hello Steve, Stu here. Yes a good clear 5 and 9. By the way, I went up to FOD the other day and tuned it slightly. We might need to put a filter in, and check the alignment of the antenna"

"G6AWT joining the group, am I getting in OK? I was just listening the frequency. Can you remember whether the Yagi antenna at Cleeve Hill was horizontal or vertical? If they're not matched, it might have something to do with it. If it's not too windy I might get up there and have a look. By the way, I've hired the cherry picker to deal with Ullenwood."

This was her introduction to Amateur Radio. What was it all about? She gathered it was something to do with hills and high points, in beautiful places so it happened, and decided to go along to take a look for herself.

When she did go to these high places, "they" all squashed into a tiny little box full of equipment, and she had to go off wandering around, calling back every half hour to see how much longer she'd got.

Meeting Steve had started with a mutual interest in brass bands. Now it was radio bands and wavebands. Then there was the Alice band, she said, checking Steve's hair. When he washed his hair and went out fairly promptly, his headset made a flat strip all across his head, and Glynis would have to ruffle it up before anyone saw him.

Had you ever visited Radio World? She thought it was bad enough shopping for a washing machine! Single band, dual band, multi-band, Mains or battery, HF or VHF,

and hundreds of other combinations. Then there were all the buttons on the front. Buttons 1 to 10 were ok, but what were all the others for? Now you could get programmable radios. Button 1 for 'CG, button 2 for 'NW, button 3 for 'WH. Surely it was more fun to tune them in yourself?

How did you remember all these repeater callsigns? CG - Cheltenham and Gloucester Cow and Gate of course. NW - Worcester North. (slowly) N.W. Worcester North, North Worcester? No, Nationwide, get it the right way round! WH – Now they were switched on. It was Swindon, but, White Horse? That was OK; we could get through that one. VA – Vale of Aylesbury – or Victoria and Albert if it helped. Kidderminster? Well, everyone called it "Kiddy" – KD, Kid-Dee, get it?

Be careful of those Hertz things. Megahertz was when you fell over and cut yourself badly. Kilohertz were really bad news.

Incidentally, it was only when they drove *past* Cheltenham on the M5, that they ever avoided dropping into Maplins.

Then there were the experiments. If he was going to put up a washing line, couldn't it be a bit lower down where she could reach it? Having suffered two near decapitations whilst climbing the stairs, she opened the shack door, and a wire draped across it fell down. Then there was a roll of wire on the hook inside the bathroom door. But she didn't mind the flat wire, because it didn't hurt if she trod on it in bare feet.

In the bottom of the airing cupboard lived the old computers, which all needed attention she gathered, or would come in handy when one died or something. Whilst putting some clothes in the airing cupboard, which was what she thought airing cupboards were for, one of the "water pipes" dropped off the wall. Then she found out it was a white end-fed antenna!

When they came to choose the house, Glynis liked the area. Her friend was just round the corner. Then there was the garden, the décor, and the fantastic view from half way up the Malverns, looking out across the Severn plain. Steve shared the enthusiasm saying, "Wow! There'll be a fantastic takeoff from here! We could put an aerial on the garage roof."

On the subject of the garage roof, they were currently having a new pyramid-shaped roof installed. Glynis thought it would be nice to crown this pyramid with a weather vane, with perhaps a sheep on it. But had you ever seen a weather vane with a 40-foot end-fed antenna attached? The new roof had more storage space – for *radio equipment* of course! They *still* wouldn't have room for the cars.

When mobile, Steve used a hands-free headset. When dropping Glynis off at art club meetings, he would lean over to give her a romantic farewell kiss. She would have to gently push the mouthpiece down in order to receive his passionate attentions.

The signal strength scale, with its weak, fairly weak, strong etc. sounded like it was describing tea!

"This", said Glynis, pulling a Morse practice key from her props box, "lives on the kitchen table." Whenever Steve went past, he would tap something out and Glynis had to try and decode it. Glynis said she had a message for Steve, and proceeded to tap out a very personal message in Morse code. The rest of them wouldn't get it, she said, tongue in cheek. A slightly embarrassed Steve pointed out that there were a lot of people with G0 on their badges.

Glynis thought she'd have a go at learning Morse code, and had devised some picture cards to help her remember the characters, such as the one she demonstrated, depicting a bus with the "dash"board and three sets of wheels for the dots, which she demonstrated. She hadn't got very far with it, and had decided that it was probably easier to lean the dashes and dots!

Pulling another item from her box, Glynis held up a ferrite ring, and described the alternate uses she'd found for them. Such as a weight for a bathroom light cord, a pastry template, a serviette ring, an eggcup and so on.

When it came to wiring a plug, somehow radio amateurs just *knew*. But Glynis had to think. Charlie Brown was the "live wire", yellow and green was like the daffodils in a field, so that was the earth, and the neutral must be the one left over.

Glossary of radio terms: Interference - Well she wouldn't go into that; some people got arrested for it. Frequency - wasn't that how often you did it? Electromagnetic compatibility meant falling in love for life. Ohm - sweet Ohm. Capacitors were those things that lived in boxes in the shack, but occasionally wormed their way across the table. Resistors – people who loved chocolate, but managed to say no. Capacitors had colour bands, but one needed strong glasses to see them – the strength of which seemed to match the readability scale.

Glynis continued with a short story using all the phonetic alphabet; "When you visited Lima last November, did they X-ray your baggage Mike? Mine was a Kilo overweight." We eventually arrived at the Alpha Hotel in Quebec with its own golf course. We were greeted by Charlie, who was wearing a uniform with a delta logo on the pocket. He took us down a long corridor with a strange echo, to the Sierra Room, our conference suite for the day. "I'm going to India next week, on business with my Yankee friend Victor. Next month my papa's taking me to visit a Zulu tribe in Africa." That evening we joined the in-house party. "Bravo!" shouted Oscar, as he watched Romeo and Juliet dancing the Tango, their glasses of whisky perched on the edge of the table.

Had you found yourself using 73 or Q codes on the telephone?

When they had originally viewed the house, bedroom two had pale yellow and delicate pastel blue wallpaper, with matching bed linen. Now, she did her painting in there, and Steve had his radio station, and monitors for "*doing* the mailbox". That's what sysops do in the evening; they "*do* the mailbox". There were boxes of things that would "come in handy one day". Glynis would only vacuum half way across the room. Had you ever tried searching the vacuum cleaner bag for something you'd picked up by accident, when you weren't sure what you're looking for? When Steve lay on the floor, and Glynis thought her luck was in, he'd get up a few moments later and say, "I've found the M3 I was looking for!" (She gathered that was a nut).

"Yes Steve", said Glynis, speaking into a handheld rig, "You have found the M3 you were looking for. G4FPV, this is M3OAC, are you copying me? Or am I copying you?" If you ended up living with a radio amateur, it was best to join in and enjoy this wonderful hobby and all the new friends you made!

7. Xrouter Developments

Paula G8PZT reported that, due to poor health, she hadn't had much chance to work on this project during the past year, but she certainly hadn't lost interest in it. A few minor bugs had been fixed, memory usage was being addressed, ax25 addresses were now initialised slightly differently, and a remote host API had been added.

Because there may be situations where the main node callsign must not be visible on a specific port, a port call would now override the node call on that port, instead of being additional to it. The sysop now had control over which ports the PMS and chat server were visible on. These modifications might require a few additional lines in the configuration file, but they would give sysops more choice and better security.

The AGW TCP/IP host API, which many people already used with Xrouter, was inefficient and had limited capabilities. It only catered for a small subset of AX25 operations, and from a programmer's perspective it was awkward due to the myriad frame types. The protocol wasn't easily extendible without breaking it for the existing clientsBecause it was someone else's protocol, all Paula could do was slavishly emulate it, and it didn't give her scope to develop new things.

So Paula had created a new protocol and implemented it in Xrouter. For want of a better name she'd called it Remote Host Protocol, RHP for short. Like AGW, it used a TCP/IP link between Xrouter and any number of remote clients, but it used a socket-like paradigm, although not exactly Berkeley standard. There were only a handful of frame types, which had meaningful names such as "open", "accept", "close", and "data".

The RHP system could handle all the usual protocols, such as AX25, Netrom, TCP/IP and GlobalNet, and was extensible, allowing future protocols to be added. The sockets supported a variety of modes, such as raw, stream, sequenced packet and several types of datagram, allowing access to all protocol layers. It was even possible to open an ASCII stream to XRouter's command line. Application addresses were fully independent of XRouter's.

This interface would support any of the usual ax25 stream applications such as PMS, BBS or DX cluster, plus UI applications such as an APRS digipeater or Igate, plus TCP/IP and UDP applications. So for example it was possible to write your own web server, DNS server, FTP server etc. or even a Voice over IP client for amprnet.

Raw mode allowed remote monitoring of any port at any protocol layer, and the implementation of non-standard protocols. And it was even possible do all those things on a DOS machine, using XSOCK to provide the TCP/IP stack.

The point of RHP was for XRouter to handle all the complex parts of packet networking, allowing the programmer to rapidly develop applications that would run on remote machines, regardless of operating system.

The project was in the testing phase, but due to the lack of programming time, and the need to fully test sections of XRouter that had been rewritten, Paula didn't expect to release it until the summer

LUNCH BREAK (1.15 – 2.30)

8. Discussion – The Future Of Packet Radio

Paula had prepared a sequence of questions to stimulate and guide the discussion, but the PC kept switching to power save mode, blanking the projector screen! So the discussion tended to wander, and may not fit too well with the headings in the section below.

8.1. Is Packet Really In Decline?

G0KFS felt it *had* declined, but was now on a relatively even keel, sometimes up, sometimes down. Another person felt it was starting to make a comeback. The problem had been that many of the BBSs had closed, so users have gone away. There was interest, as long as there were people willing to run the BBSs and keep the links going.

Paul G1PLT made a number of points: For a while it might be nice to experiment with running a mailbox, but eventually the sysop tired of users taking it for granted and complaining when things went wrong, forgetting it was an experiment. We had a large influx of new licensees who were potential packet users, but we hadn't got a network for them to use. We were not good advertisers of our own work. So where would they get their information from in the first place? How would we disseminate it? And how would we actually get it there?

Someone highlighted the problem of where to find up to date guidance about how to get on packet. The RSGB packet books were out of date, and based on old DOS software, which was no longer in use.

Geoff G4AFJ felt that packet in Leicestershire had collapsed. There were a few users and he. Having access to a good site, he was very keen to do something to help, but didn't have the know-how. He felt they needed someone to capitalise on his interest and guide him through the stages of getting something on air. He surmised that a similar situation might exist in other areas.

Geoff went on to say that, although radio amateurs hid in sheds "communicating" around the world, they were particularly poor at communicating within their local area. He congratulated the conference organisers for keeping the event going, but said that since the first one he had heard no more publicity about it, possibly because we were only advertising it on the packet network. Had he not seen the advert in RadCom and heard it on GB2RS, he would not have known about the event [so my publicity worked then! – g8pzt]. The publicity machine existed and we should use it.

Finally, Geoff felt that packet radio had taken a wrong turn, and instead of rising to the challenge of doing it by radio, we had taken the easy way out and used the Internet.

Someone said that we could do with some decent articles in RadCom about how to set up packet. Geoff G4AFJ asked if it was possible to get someone to write a monthly page in RadCom about packet. Someone else pointed out that a bi-monthly "Datacomms" column existed. Paula G8PZT felt that column had to cover all datacomms modes, and it tended to concentrate on the newer ones. Packet was being ignored. She had long held the view that a dedicated packet column was required.

Someone suggested submitting articles about packet to the regular newspapers, as had been done in the USA some while ago. Practical Wireless and Short Wave Magazine should also be targeted. Richard G0EWH replied that he regularly sends copies of the

Fourpak newsletters to both RadCom and Practical Wireless, and had been told that PW's packet column was to be discontinued.

An interesting catch-22 situation was highlighted, whereby printed articles often directed readers to their local packet BBS if they wanted to find out more about how to get onto packet, and where to get the software!

Steve G4FPV asked how many of those present belonged to a regular (not packet) radio club? A fair number did, so he suggested that they should offer to give talks about packet.

Paul G1PLT said that he had done many talks at radio clubs, and the HF devotees always became interested at the mention of DX Clusters, and that was a way to hook them. Any talk must be at a very basic level, detailing only what equipment is required, how to connect, and what systems are available in the local area. Then, for those who want to take it further, offer yourself as a mentor.

Geoff G4AFJ asked if anyone would be prepared to deliver a "beginners guide to packet radio" as one of the lectures on one or both days of the Donnington rally in late September. One of the most popular dual band rigs was the TH-D7E, which had an inbuilt TNC, so it might be useful to show people what they can do with it. It's all a bit mystifying to those who aren't already into packet. Please contact Geoff if you are interested.

Roger G3ZFR commented, in response to G1PLT's earlier comment about sysops becoming fed up with users "messing about", that the messing around was actually part of the excitement. He went on to say that packet had been largely run by those who wanted to be sysops. There were some users who were still using packet exactly as they had used it in the early days, and were perfectly happy with it. BBS sysops basically fell into two categories. Firstly the keen technical people who were more interested in trying to do something better with each month, and trying to improve their system. They quickly got bored with something that didn't change. The other type of sysop didn't want any change because he was happy with it, and change might break something. Many of the latter sysops had gone. The technical ones would want to move on to something more advanced. If things stagnated, people got bored.

Geoff G4AFJ said that the packet radio movement needed to realise firstly that there was a lack of new lifeblood coming into packet, and secondly, to do something about it, such as educating the new M3's about packet.

Roger G3ZFR said that a lot of the sysops started, not by being formally "educated", but by working their way up, firstly running a PMS, then a BBS as a PMS and so on. That wasn't happening now.

Paula G8PZT observed that were plenty of new licensees who wanted to know about packet and wanted to join us, but didn't know where to start. Education was the problem.

The consensus was that packet had declined but that decline had levelled off.

8.2. What are the reasons for decline?

Someone listed the following reasons: Mobile phones, Internet, Broadband, expensive site rental, and insufficient speed. Paul G1PLT said that most people these days wanted "plug and play" The latest statistics showed that peoples' attention span was very short.

A packet user remarked that high speed wasn't essential. When it was working properly, 1200 bauds was tolerable for reading bulletins and more than enough for using the DX cluster. It was related to the amount of traffic, and at the present state of traffic we could probably get away with 1200 bauds.

Paul G1PLT asked how many new licensees there were within the catchment area of Fourpak? Paula G8PZT guessed around 50 or so. He went on to ask what percentage of those would try packet if we put on a demonstration station? Paula made a wild guess of ten percent. So G1PLT said, why not go out and do it?

On behalf of several people who couldn't attend the conference, Paula G8PZT asked why there were so few bulletins? Roger G3ZFR replied that there were too few users left, and they had nothing left to say. Anthony M1FDE said that a lot of amateur radio discussion now took place on the Internet, instead of packet, and asked if such discussions should be gated to packet. Paul G1PLT replied that they used to be gated in both directions. At one time there was more traffic being gated from packet to the Internet; now it was the other way round.

Pete G6KUI said that there were plenty of people reading bulletins but very few writing them, and asked how many of those present had written a bulletin in the past week? G3ZFR said he released roughly 2 bulletins a week from GB7COV. Steve G4FPV said he couldn't remember the last time he released a locally entered bulletin.

Paula asked G1PLT what content we should be gating? Paul replied that we should gate whatever is the topic of the time, such as wireless networking. Paula asked where such discussions were taking place – were they in newsgroups, or mailing lists, and which ones? The answer was special-interest mailing lists, such as AGW, Xrouter etc. rather than general newsgroups.

Someone remarked that we weren't getting many bulletins from outside the UK, or at least not as many as one would expect. Paula replied that in fact there were more foreign originated bulletins than UK ones. The ratio had changed; most of our bulletins used to originate in the UK, now only a fraction did. The reason we weren't deluged with overseas bulletins was probably because we didn't see many of the foreign-language ones. Chris G0CNG stated that he sees plenty of ZL-originated bulletins on GB7MAX.

Geoff G4AFJ said that he used to like downloading bulletins to read offline, but that was difficult on a congested packet channel, because it was so slow and he might lose the connection. On the Internet he didn't lose the connection. From a user's point of view, it was much less tedious reading things via the Internet because it was quicker. However, if the traffic density was low, 1200 Baud packet was acceptable on a good link.

Several people asked if Geoff had tried an automated client such as Winpack, Pearl or NNTP, which remove the tedium from collecting mail. He hadn't, and suggested that as the basis of another article for the magazines. Several people spoke up in support of Winpack, and Geoff admitted that he hadn't been aware of its capabilities. Someone else commented that there hadn't been much information published about packet radio in the last 5 years, so newcomers weren't aware of what was possible.

Anthony M1FDE wondered if the best way to tackle the knowledge problem was to create a website and invite people to contribute "how-to" pages. Paul G1PLT suggested that most of the information already existed in BBS archives. Someone commented that one needed to understand DOS in order to navigate BBS file trees.

Paula G8PZT replied that several BBSs had the capability to display files in "file areas" which required no knowledge of DOS. Someone suggested it could be made "point and click", more like Windows. People nowadays were computer-literate, but not DOS-literate.

Paul G1PLT wondered if it would be a good idea to re-issue some of the early packet radio content? Several people agreed that it would. He also suggested that whoever writes the "how-to" articles should try and remember how they felt as an absolute beginner. Some of the original content was extremely technical and needed to be re-formatted into an easily digestible form. We needed "external" education, i.e. letting people know that packet still existed, and internal education, i.e. providing people with the information they wanted.

There was also the difficulty of obtaining packet hardware. Packet TNCs were expensive items if you only wanted to try out packet. There had recently been a USB "20 dollar TNC" design in QEX magazine, but it didn't support KISS.

Paula G8PZT said it wouldn't matter how many cheap TNC articles were published, because very few people actually build anything these days. Connecting a radio to a soundcard via a ready-made interface was probably all most people could achieve.

Anthony M1FDE suggested having a batch of the 20-dollar TNCs made for sale via RadCom. G1PLT replied that there would be problems with the CE marking. They would have to be sold as "kits", which could comprise a complete unit without the chips fitted.

Paula suggested that the easiest way around the TNC problem was to educate everyone how to use a soundcard and a cheap ready-made interface. At least they could try packet for little outlay, and if they didn't like it they could always use the interface for one of the other modes, or sell it on for use in a VOIP gateway. Paul G1PLT commented that soundcard systems tended to grind to a halt after a period of operation. Paula replied that no one would seriously consider using a soundcard (or Windows) for a serious node application, but for the average user who wants to run Winpack and AGW for a couple of hours a day, it would be fine.

Anthony M1FDE asked why it wasn't possible to run a serious node on Windows-based system? Was it because there was currently no adequate Windows-based node software? Paula replied that was partly the reason, but Windows itself seemed to require rebooting every few days. Anthony felt that Windows XP and possibly Windows 2000 were stable enough, but if one wanted to run a BBS or use a USB TNC on such a system, there was no software to allow it. AGW wasn't stable enough.

Steve G4FPV said that the operating system on which the node or BBS was running was irrelevant, as it was hidden behind the radios and the propagation path. The critical thing was what the user saw. If the user had a point and click interface to the packet system, he could click on an icon representing a BBS and it would connect and expand into file or message reading areas, where he could simply click to view the required content. So perhaps it was the user front-end software that was the most important. Someone suggested that "killer app" was the expression Steve was searching for!

Someone commented that there was more client software for DOS than for Windows, but people were all using Windows XP now (which wouldn't run DOS programs). He only knew of one client, Winpack, suitable for that platform. Someone else mentioned Sally. Paula asked how many Windows programmers were present? The lack of

response, she suggested, was the answer. We only had a handful of people in this country capable of writing packet client software for Windows. G1PLT commented on the huge investment required in order to use the latest ".NET" language.

Someone said that on the IP network they used Windows to drive the TNC, interfacing JNOS to Windows with shim software. Paula G8PZT replied that the problem with using the Windows IP stack over radio was that its MTU and timings were unsuitable and required tweaking (which was not a job for a computer novice). If the same machine were used for several purposes, it wouldn't behave optimally. Anthony M1FDE commented that on the later versions of Windows, the MTU could be set differently for each port.

Paula's view was that, if TCP/IP were to be viable for the average packet user, we needed dedicated ham radio client software with its own IP stack, which was completely self-configuring. Trying to use non-amateur programs, such as Internet Exploder and Outlook Express, for packet, a purpose for which they were not designed, was a little awkward, because it was then tricky to use the machine for other purposes. For example, Paula sometimes used Outlook Express for packet mail, but she had to be careful not to use her packet address for sending email and vice versa. We needed self-contained software, written by amateurs, optimised for amateur purposes. As a first step towards this, she had begun migrating her programming skills from DOS to Windows.

Anthony M1FDE stated that current BBS software, designed for talking text to users, wasn't very machine-friendly from the point of view of writing graphical client software to use them. A client should be able to ask the BBS what services were available, before deciding whether or not to log in, but currently it wasn't possible to get any information from a BBS without logging in. There should be a new BBS protocol to suit graphical applications.

Paula G8PZT had been thinking along the same lines, and felt that it was time to break away from the old fashioned model, in which the user and BBS laboriously exchanged text over a single stream. The client should be able to request "services" from the BBS and have them delivered asynchronously over many streams. G1PLT commented that TCP/IP already worked like that. Paula acknowledged that, but was concerned that the user required understanding of TCP/IP in order to make it work.

Steve G4FPV felt that, although it might be inelegant, it *should* be possible to implement a graphical interface using the existing BBS software. What could be done at the user interface was limited mainly by the imagination. Pete G6KUI said that it couldn't all be done at 1200 baud, but people weren't prepared to use anything other than that speed.

Someone commented that, although it was slow, most users would do something else, such as make a cup of tea, while bulletins were being downloaded.

Paula G8PZT said it didn't really matter how slow it was. One didn't have to read the mail in real time, and we needed to change the delivery method to reflect this, perhaps using a multicast rather than "pull" model, with clients that were "always on". A lot could be squeezed down a 1200-baud link if one was prepared to wait. Pete G6KUI replied that users wouldn't accept that. They wanted the mail instantly available when they switched on, rather than wait for an hour.

Paul G1PLT said that the Thames Valley group had tried an experiment whereby personal mail had priority and was exchanged in real time, with bulletins being

multicast in the background. But one of the biggest problems was that, if the hub server went down and the user had to use a different one, that working model was lost. When designing new access models, we must ensure it would work when a server was lost.

Nowadays, commented Anthony M1FDE, most nodes were backed-up by the Internet, so the access point was irrelevant.

Paula G8PZT said that user access should be as "roaming" as possible, with particular services available via any node. Users should not have to be tied to one particular BBS or node. We had been stuck since 1987 with the "server and dumb terminal" model, and she felt it was time to think laterally, about all the weird and wacky ways we could deliver services to users. G4AFJ suggested collecting mail headers by packet, but automatically using an Internet connection to collect the mail bodies if channel traffic was heavy.

In order to solve the speed problem, someone suggested using split frequency with the access point transmitting on one frequency and listening on different frequencies.

Paula G8PZT said this was something she strongly believed in and had been trying to promote for some years. Since the very beginning of packet, the thing that had held it back was the erroneous belief that all traffic could share a single frequency. It *could* do so, but the resulting efficiency was abysmal. We needed to overturn the idea of packet being a simplex mode, because in restricted bandwidths, such as we use on the amateur bands, it could only really work efficiently in full duplex. From their very first steps on packet, users had always treated it as a simplex mode. In future we needed to convince new users that duplex was the norm.

She acknowledged that in-band full duplex was too difficult for the average user (and many sysops) to achieve, but cross-band duplex was relatively easy. Ideally, both the users and the access point would operate *full* duplex, but in practice most of the benefit was obtained by converting just the *access point* to full duplex. The user could simply use split frequency half duplex, which many rigs these days would do easily.

All sysops should be able to manage cross-band full duplex, but technically competent sysops could additionally provide in-band full duplex. There was nothing to prevent them from having multiple receivers on several bands if necessary. By removing the need for the access point to stop and listen for frame acknowledgements, it could shovel data out a lot faster. A missed user ACK would not hold up everyone else's data.

Pete G6KUI said there was no problem doing this, as the software was already capable of it. Steve G4FPV acknowledged that, but re-iterated Paula's point that we needed to convince the *users* that it was a good idea.

G6KUI asked if any BBS was busy enough nowadays to warrant using full duplex? Someone answered no, but the point was that we wanted to increase the potential throughput, to entice users onto packet.

Paul G1PLT suggested Paula should look at the Pacsat protocol, which already covered the use of both full duplex and multicast.

Steve G4FPV said we must try to think in terms of "access points" rather than "BBSs", because the principles applied to both node and BBS access. On his node, he had a couple of users almost permanently connected to the DX cluster. One of the users was quite distant, and when anyone came on locally he had noticed a dramatic

slowdown as the distant station went into a retry situation. He felt that full duplex would make a significant improvement.

Roger G3ZFR suggested that, alongside the regular callsign, Xrouter should allow an alias or secondary callsign on a particular frequency such that a connection to that callsign would result in the replies being returned on another port. The user could then choose either the standard simplex service or the superior duplex service. Someone replied that such complication was unnecessary, since the TNC could simply be connected to separate receiver and transmitter units on any desired frequency [but I think he missed Roger's point of a dual standard - ed].

Anthony M1FDE asked if the point was to simply to get bulletins? After all, they could be read via the Internet. Shouldn't we be concentrating on using radio to do the things that can only be done with radio, such as APRS position reporting, instant messaging from any location and so on.

Whilst Paula G8PZT agreed with the need to promote the things that only radio could do, she cautioned that not everyone has or wants the Internet, and many are strongly opposed to its use. Those people would want to receive their bulletins via radio, as would she if she was in a location that had no Internet access, such as a car, a field day site or a remote Welsh cottage.

Returning to the PACSAT protocol, Paul G1PLT said that it made more efficient use of the channel in cases where several users were requesting the same data, because stations only needed to request the missing bits. As the protocol already existed he implied we should use it, rather than waste effort on original thought.

Steve G4FPV said that he had in the past put a lot of thought into this problem, with regard to DX clusters. If there were 6 users on an RF access port, each spot was multiplied 6 times, which in a busy contest could saturate the port. There had to be a better way. Anthony and Paul simultaneously replied that was what multicast was for.

G6KUI said that the cluster users didn't need to be connected at all, unless they wanted to send something. G4AFJ said at least one person had to be connected. Steve said that the cluster people complain that the channels aren't fast enough, whilst at the same time using inefficient methods. What they needed was better software [presumably UI multicast – ed], which perhaps tracked a serial number on each spot, allowing those who missed a spot to request a retransmission. [At this point Anthony said something about needing a new protocol in AX25, but I missed it - ed]

Paula said that several years ago she was working on a general multicast protocol for access points. Roger G4IDE had been thinking about something similar and they had corresponded on the matter. But the project had fallen by the wayside as other interests arose. It could be reactivated if required. G1PLT felt that it would be a good idea to try it, as part of her duplex experiment.

Returning to the duplex issue, Paula went on to say that, not only did we need to persuade the *users* that packet should be duplex; we had to persuade the *sysops* too. We were complaining that the users were deserting packet because it wasn't fast enough, but if we changed it from simplex to duplex, all we had to do was tell the users to set a certain frequency for transmit and another one for receive, instead of using the same for both. The improvement would be dramatic, without needing to change modulation technology. People didn't question the need to use two frequencies to work satellites, so why shouldn't packet be like that?

G4FPV said that all it would take was a simple configuration change at the node. The problem with doing it in-band on 2 metres was that the packet allocation was very narrow and the duplexing requirements would be much more stringent than for 600KHz spaced voice repeaters. G6KUI interjected, saying that the node output had to be in the packet band, but the input could be anywhere in the band. Steve continued, saying that we easily could avoid such duplexing problems because most dual band handies would work cross-band duplex, so all the user had to do was connect their dual band handy to a dual band collinear and operate cross band.

Echoing Roger's earlier point, Steve said that there might need to be some way of detecting if the user was operating simplex or cross band. Paula replied that there was no need; just make it permanently duplex. G1PLT suggested advertising the receive frequencies in the ID beacon.

Someone said that the PMR rigs he used had always been single band. Someone else replied that, in that case, he would need to use two radios.

Someone asked if a node needed an NOV to receive on 70cm. The answer was no. That was the beauty of it – the node didn't need an NOV to transmit and neither did the users, providing their station was attended, which they usually were.

Pete G6KUI mentioned the problem of transmitter dissipation. If the transmitter were active for long periods it would cook. Paula said those who ran VOIP gateways solved this issue all the time, transmitters sometimes being active for hours without a break. A simple computer fan, stuck to the heat sink with sticky pads, would be totally effective. G1PLT suggested the use of an MB5 motherboard temperature checker, which had external sensors. A sensor could be placed on the transmitter. G4AFJ said that the simple answer was to turn the transmitter down to 25 or 50 percent power and "blow" it with a fan. Paula said that the GB3KD repeater used a mobile rig with a small 12-volt fan and would operate continuously without getting warm.

Someone pointed out that the node software might need modifying to allow long periods of PTT active state.

Geoff G4AFJ said that, whatever we did, we needed to co-ordinate it. If we were recruiting new users, we couldn't have them finding a mix of the new and the old. G4FPV said that there would have to be a transitional phase.

Attempting to summarise the discussion, the chairman returned to the suggested discussion points.

8.3. Was packet worth saving?

The very fact that so many had bothered to attend suggested that it was. Anthony M1FDE said that it depended what aspects of it were worth saving, and we wouldn't necessarily all agree on that point.

8.4. What could we do to save packet?

The discussions had highlighted the need for publicity, education, new services, improved systems, and better software.

8.5. Where was packet going?

Experimentation. We should be experimenting with all these new ideas.

8.6. How could we improve its appeal?

Steve suggested graphical front ends, even if they only hid an old system.

8.7. What were packet's selling points?

Someone said that was a very good question. If someone asked what packet was, what would one tell him or her to make it sound interesting? Someone said they told people it was like email by radio. Steve remarked that it was free of charge too.

Someone else pointed out that it was purely for amateurs and there was no spam. Paula felt that the lack of spam was a very important selling point. Steve felt that packet provided a unique mode that other messaging systems didn't yet do, namely the bulletin, with targeted distribution.

Paula G8PZT mentioned the fact that it was possible to operate packet in very noisy environments, where speech would be difficult. Also in very quiet environments where speech would disturb others. The written word allowed one to re-read anything that was missed, and to carefully compose one's reply. For those like herself whose illnesses made it difficult to keep up with verbal conversations, the slower pace of written communications was ideal. And it was also ideal for the microphone shy.

8.8. What new services could we offer?

Paula felt it was the key to keeping new users. To stimulate their interest, and keep them experimenting, we needed new services. At the moment, all we had were BBSs, DX clusters and chat servers, the latter having been unsuccessful. Was that all we could dream up?

M1FDE suggested making the chat servers bigger so that they covered all of the nodes, giving a better chance of finding someone on there. G4FPV pointed out that Xrouter chat was already networked. Paula said we needed critical mass; there weren't enough people using the system to keep conversations going. Bryan G0SYR said that many people didn't understand how the mode worked. He was permanently logged in, and some of the comments were hours apart, but all he had to do was scroll back and answer them. People unfamiliar with the mode tended to log in, see nothing going on and disconnect immediately.

Someone said that, years ago, people used to play chess on packet. G1PLT suggested multi-user dungeons. An innovative new service Paula had implemented was a data connection to the GB3KD voice repeater, allowing RF users to participate in the Echolink text chat and receive other data from the repeater. G1PLT replied that there was an existing node, GB3TD, which allowed logins by voice. It had to learn your voice though.

Another thing Paula was interested in was supplying real time weather data. XRouter maintained weather data from the 5 nearest APRS weather stations, and this was in use at her node. The data was also collected from the node and made available in voice and text on GB3KD repeater. She wanted to extend this to include other weather services, and data pertinent to radio hams, such as the 'A' index, MUF, and thunderstorm data. Maybe each service wouldn't have many users, but the more services we can provide, the more users we can hook.

Geoff G4AFJ suggested that a voice repeater could tell you when you had an email waiting, and even read it out to you. There was much laughter, as people recalled the content of spam emails. Paula also suggested broadcasting "DX" alerts when propagation became abnormal.

Roger G3ZFR asked Paula why Xrouter chat had remained separate from the worldwide "Ping-Pong Converse" system. She explained that Xrouter chat was optimised for speed and robustness over radio links, plus ease of implementation [it was developed in response to observing how abysmally the ping-pong system worked over poor radio links]. It used an anarchic topology, which might not integrate seamlessly with Converse. However, it was a dual-standard client, and it was possible for sysops to connect Xrouter into the Converse system and have both systems available. Channels 1 to 32767 were Xrouter chat, and channels 0 to –32768 corresponded to channels 0 to 32768 on Converse. G1PLT suggested publicising that fact, as there were other sysops interested in linking the two. Someone confirmed Paula's concern that Converse was prone to loops, but the feeling was that it could be managed, and full interconnection ought to be possible.

8.9. Development task force?

Paula G8PZT said that we all came together once a year and talked about things, but didn't act upon them. Was there any merit in the idea of a group of us, who were interested in the future of packet, getting together, deciding what needs to be done, and actually doing it? Some of us were software authors, some were good with hardware, and others were good at publicity, so between us we ought to be able to make things happen. There was some support for this idea. Someone suggested using a Yahoo mailing list to keep in touch. Roger G3ZFR said there was already a "datacomms-uk" list, which ought to be used. Anthony M1FDE suggested that the information should be gated to packet. Geoff G4AFJ asked that the details be circulated to the email addresses of everyone present, and Paula agreed to do so.

TEA BREAK

9. Any Other Business

9.1. WiFi Packet

Paula G8PZT had been requested by a non-attendee to raise the topic of 2.3GHz "WiFi" packet for discussion. Paul G1PLT reported that a G0 [callsign not heard correctly] in Exmouth had for the last 5 years been running a free access point between channels 1 and 7. This was primarily for radio amateurs but was open to anyone, and worked up to 10 miles out to sea. Power was 1 watt, but he also had a little PA system. Although USB "dongles" had been available for some time, the range couldn't be extended very far. But within the last year, 25 metre extensions had become available so the dongle could be located at the top of a mast if desired. For non-licensed use the maximum output power was only 100 milliwatts, but as radio amateurs we could use far higher powers. One of the biggest problems he had encountered if he ran higher power was "grief" from the users of the official hot spots. Paul also mentioned the Flight Refuelling web site as source of expertise on the subject. Paula pointed out that the site hadn't been updated for several years, but G1PLT said that the hot spot was still active.

Paula asked who was using this WiFi stuff, and what for? Paul replied that from Exeter he was experimenting with much higher powers, up to 70 watts, to try and reach the Exmouth access point, 18 miles away. Access was only possible under wet

band ducting conditions. As anyone could get into the access point and use the provider's Internet connection, Paula asked what made it packet radio? Why was it any different from a commercial BT access point for example? Someone replied that the amateur callsign is converted into a MAC address and used for security purposes. With directional aerials a good range could be obtained, and there were no more complaints about speed. G1PLT recommended a wok as a parabolic reflector. Paula said that Fourpak had discussed WiFi and had concluded that our area was too big to cover from the existing sites. G1PLT suggested covering the area as cells.

Anthony M1FDE asked the questions, "Why does it have to be amateur radio? Why shouldn't we involve other people, outside amateur radio?" It was a paradox. On the one hand we wanted people to learn about radio, but if they hadn't got a licence we didn't want them. In his view that wasn't right.

Someone posed the question, "Does someone have to be licensed in order to read bulletins?" G1PLT replied that amateurs were not allowed to transmit to unlicensed stations. Versions 802.11b and 802.11g were much easier to control than the original 802.11a, and there were plenty of interesting tools for Linux machines.

Pete G6KUI suggested, with reference to the earlier discussion about full duplex, using 2.3GHz WiFi as an output, with input on 2 metres at a slower speed.

Anthony M1FDE complained about the requirement for amateurs to ID their WiFi systems in Morse or speech. It would be nice to be allowed to ID in ASCII. Paula asked how one would do CWID on a spread spectrum system such as WiFi? G1PLT said that it should ID on the centre frequency of the channel, but it was very difficult.

Paula remarked that Anthony had in the past been quite keen on promoting WiFi for amateur purposes, and asked if he had been doing anything with it lately? Anthony replied that he still had an access point atop his house but hadn't used it much, and he didn't know if anyone else had used it either.

9.2. AXUDP Linking (continued from morning session)

Paula said she didn't know how to solve the problem whereby everyone had a slight mistrust of the network and wanted to link to directly to their friends. This resulted in a lot of duplicated effort in some directions, a lack of links in others, and made it difficult to control horizons and table contents. She felt we needed to trust our neighbours to forward our traffic, so that we only had to think about *our local area*, not the entire network. In effect, to treat AXUDP linking as if it were radio, each of us linking only to a handful of our *nearest* peers, not jumping over them. This would create a more robust mesh, loosely geographically organised.

The question was, how should we set about rationalising the linking? Should we rely on individual sysops to do the right thing? Should we use these meetings to plan the network for them? Should someone such as the DCC plan it for us? Or should we just leave it alone?

Pete G6KUI asked if it really mattered that unnecessary routing information traffic was being propagated? After all, it was only using Internet bandwidth, not wasting RF resources. Paula pointed out that some people were charged by the megabyte for their Internet traffic, especially overseas traffic. The network topology was so chaotic that some inter-UK traffic was actually passing through New Zealand nodes, which were being charged a premium for it. Pete replied that the answer was to lower their route

qualities to keep the traffic away from them [this wouldn't work, because by default XRouter uses the fastest path, irrespective of the assigned quality - ed].

Paul G1PLT suggested modifying the protocols to improve the routing [I've transcribed this as best I can – ed]. The software could examine the address packets to see how many stations were being dealt with. The more it was attached to, the less likely it was to accept the packet. If it had a direct route it would take that one first. If it couldn't do that it would take the one with two routes and so on. It would be very easy to implement. But it had to be dynamic, because routing changed as nodes went on and off. You didn't have the advantage of someone saying, "Hey, I haven't got this route any more", or "At the moment this route exists" or "Another one has just emerged that's better". You had the sudden discovery problem, which happened with all networks, and you also had the sudden burst of data problem. The only way to deal with that was "keep it simple, keep it stupid".

Anthony M1FDE suggested changing the software to make all links dynamic, so the formal links ceased to exist. Paula replied that she had already begun to do so, as it was the only solution she could see for the longer term. But it might not be popular with sysops, because they would no longer be part of a formal network. The reason for trying to rationalise the links was to avoid having to force the issue by a major software change.

Bryan G0SYR said that, although the map looked complicated, if the links to New Zealand were ignored, it only took 2 or 3 hops to reach any node in the UK. He felt that the proliferation of links was not a problem, and probably wasn't particularly wasteful either.

Returning to Bryan's earlier suggestion of using a quality of 100 for all AXUDP links, Paula felt that was too low. There were RF links with qualities of 150 or 180, yet those links were vastly inferior to AXUDP. If the AXUDP quality was set too low, traffic was in some cases forced onto RF, ignoring a superior AXUDP link.

Wasn't that the point, someone asked? Wasn't it supposed to be packet *radio*? Paula replied that forcing traffic onto slow and congested RF links just for the sake of principle, when far superior Internet links existed, was deliberately depriving the user of a good service. Bryan said that it was possible to choose in ones area. He suspected that in many areas they would like to keep the radio links.

Paula acknowledged the fact that some segments of the network were necessarily RF only, there being no Internet connection, and stated that she was fully in favour of segments of the network choosing to be RF-only. In segments of hybrid RF / Internet links, she didn't wish to turn off the RF links, because they would continue to work when the Internet didn't. But in such segments, if two nodes were both connected to the Internet, and could forward a packet in 0.2 seconds, why wait 5 seconds for the packet to go by 1200 baud RF instead? Bryan's answer was "Because it's radio".

There were, Paula said, two opposing viewpoints. On the one hand there were those who wanted to use RF linking no matter how poor the service. On the other were those who believed that, from the user's point of view, quality of service was paramount, irrespective of the transport medium. The user wanted reliable connections, and he wanted fast connections. We could not feasibly achieve that with RF linking alone.

If those users wanted fast, reliable connections, Bryan G0SYR asked, why were they still using1200 baud access? Paula felt Bryan was missing the point, and attempted to

illustrate the case where a user in the Midlands issued a connect request to a node in Scotland. Even though the user's link to his local node was only 1200 baud, he would quickly receive a response to say it was trying to establish the link. The local connection felt responsive. But if the connection attempt took 5 minutes, because it was forced to use RF links, the user would give up. Bryan replied that it wouldn't take 5 minutes because there wasn't a radio path over that sort of distance. There were many Internet paths to choose from, so it would go via the Internet.

Roger G3ZFR said that, even if the radio links were assigned a quality of 150 and the Internet links only 100, beyond 2 radio hops the Internet would win anyway [but that's assuming there was a *single* internet hop bypassing *two* radio hops. If the choice was between 2 radio hops and 2 Internet hops, *radio* would win - ed]

Anthony M1FDE asked why, if the users wanted their traffic to go via the Internet, were they accessing via radio? Why didn't they didn't simply connect via the Internet?

Paula G8PZT re-iterated that the users didn't care *how* the traffic was routed. They just wanted it routed. They wanted it routed fast, and they wanted it routed reliably.

Attempting to illustrate the folly of forcing the RF links to take priority, Paula cited the case where her 2400 baud RF link to Wolverhampton had a higher quality (80) than her Internet link to Bloxwich (50), which was the alternative route to Wolverhampton. When the aerial developed a fault, the radio link performed very badly, but it wouldn't fall back on the alternate route because the assigned quality was lower.

Paul G1PLT asked if it was possible to dynamically change the quality values? Paula replied that XRouter did have that option. Tt worked very well, but sysops didn't like it, because it showed them how poorly their radio links sometimes performed! Thus they usually locked in the route qualities.

Roger G3ZFR said the main thing was to encourage sysops to cut down the route qualities to overseas nodes, so that we didn't import foreign nodes into our tables.

Paula agreed, urging sysops to set foreign peers to the usual MinQual value of 10. But her main concern was to get the routing within the UK correct. For inter-UK links we couldn't set the Internet route qualities far below the radio qualities, otherwise the Internet links wouldn't be used. Conversely, we couldn't set the Internet link qualities much higher than the radio link qualities otherwise the *radio* links wouldn't be used. We *had* to find a compromise, agreeable to *both* of the opposing interests.

Bryan said we had to make a decision whether we wanted to use the radio or the Internet. Paula said that if one went to a packet radio club and asked the users what they wanted from the network, they would invariably say that they wanted fast, reliable connections. If the question was put another way, such as "Do you care whether your traffic is routed via Internet or radio?" the answer comes back, "Whichever method gets the traffic though fastest and most reliably". That's what the users want. Sysops on the other hand seemed obsessed with linking on RF at any cost. Why such an obsession? Bryan replied that there wouldn't be any point to the hobby if there were no need for the radio; we might as well just switch off all the radios.

Paula stressed that there was more to packet radio than simply the inter-node links. No matter how the network was linked, we must still use radio at the user access

points. It was still packet radio. Someone commented that we would become simply user access points.

Roger G3ZFR said that all we needed was for the sysops whose nodes had both radio and Internet links to be sensible in setting the route qualities. The sysops with only RF links could set their qualities how they liked; it wouldn't really matter. That was true, Paula said, providing it wasn't taken to extremes, such as the RF-only sysops setting radio link qualities way above the nationally agreed Internet qualities.

Anthony M1FDE asked why it wasn't possible to have the RF used until the capacity limit was reached, then divert further traffic to the Internet? Roger G3ZFR noted that it would require "a bit more software". [At face value this sounds like a good idea, but there are several orders of magnitude difference between the speeds of the RF and Internet links, so the packets can't be randomly distributed between them. The circuits can, but that means the first few users get a slow circuit, subsequent users getting fast ones. Which user wants a slow link when they can have one 50 times faster? - ed]

Paula said that Anthony was seeing it from a sysop's point of view. She was trying to bring the *user's* point of view to the conference. The user wanted fast, reliable connections. By sticking doggedly to the principle of giving radio links priority we were not giving the users what they wanted. Why were we so pedantic?

Because, Bryan G0SYR replied, doing it by RF was what kept us (sysops) interested, and several people said at once, "Because we're radio amateurs".

Pete G6KUI asked what was the point of having the RF links if we were using the Internet links all the time? The RF links might as well be shut down.

Paula said she had RF links to nodes at Malvern, Clee and Gloucester, none of which had Internet connections. In those cases radio was the only means of linking, and she had no problem with that. The point was, to bring "the network" to a particular place, one had to use the *best* means available. In some cases that was RF, and in others it was the Internet. Where a choice was possible, we needed to use the method that gave the best service for the users. We, as sysops, seemed to have forgotten about the users. We spent too much time thinking about networking and not enough time thinking about the user experience.

Pete G6KUI asked for what purpose were those users going the long distances? Mainly real-time one-to-one chat, Paula replied, but with the loss of BBSs, in some cases BBS access too. Some of her users were also regularly away from home, having skeds via the network, collecting their mail and dropping notes into their friends' PMS's. When she was on holiday in Cornwall, she wanted to chat to users in Kidderminster, check her node, and exchange mail using her home BBS, there being no other BBS within a hundred miles. Her nearest access point was the North Hessary Tor node, a 60-mile RF hop. In the days before North Hessary Tor was linked to Plymouth, and thus via AXUDP link to the rest of the network, connections to Kidderminster took around 2 minutes to establish over the pure RF links, and would fail as soon as any traffic was passed. Now they took no more than a couple of seconds and were robust.

Geoff G4AFJ asked why the RF links should take so long to establish a connection? Paula said mainly because they were heavily congested. Roger G3ZFR added that they would take a long time even when not busy, because there were so many hops. Paul G1PLT said that, when they had an IP link to Scotland, they used to be able to get a PING there and back in under 2 seconds, but as soon as any traffic was carried,

the trip time dilated substantially, going up to 10 seconds or more. Roger added that it would go up even more if a packet was lost and a retry occurred.

Paula felt that the discussion had strayed away from AXUDP route management, back to the hoary old question of RF versus Internet linking, which we didn't need to be debating these days. Internet linking was a fact of life. It worked, and in most cases was providing a much better service than we used to have. We were never going to get the lost RF links back, because we had been priced off the good sites. Bryan had shown that the remaining RF links were still going strong, and there was a strong commitment to keep them going where possible. Our task was to make the two linking methods, work together seamlessly, hence the attempt to get some agreement on recommended topology and NetRom route qualities. Some sysops hadn't a clue what route qualities to use, and the full range from 10 to 255 had been seen. Stewart G0LGS added that some sysops weren't even prepared to discuss changing them. If we could make a sensible recommendation on AXUDP route quality, Paula continued, everyone would have a decent starting point, and she could put it into Xrouter's documentation and default configuration.

Bryan G0SYR explained that the reason he suggested a quality of 100 was because it was a medium value that limited AXUDP node visibility to around 3 hops. Most of the country could be reached in 3 Internet hops, so we wouldn't be losing anything. Locally, if someone had an RF link with a quality of 120, it wouldn't short-circuit the Internet links, because there were so many of them. Nearly all their traffic was going via the Internet anyway, except where there weren't any Internet connections, on the south coast for example, where they are actually using their radio links. We were still using the Internet to *reach* their area, but *within* their area they didn't want the Internet to short-circuit their radio links.

Paula said that if the Internet and radio links were configured to the same quality, there was no problem; each link being treated on its own merit. But, with the network being no longer geographic, large chunks of the network being short-circuited by a single Internet link, the routing had become unpredictable. Bryan said he didn't see why? Anthony M1FDE said it would be nice if the network looked like it used to look when it was RF-only.

Bryan G0SYR said that the problem with linking only to our near geographic neighbours was that it would still take 5, 6 or 7 hops to reach Scotland from the Midlands. It wouldn't necessarily be a problem, just much more complex. It would take more hops to reach most destinations.

Paula said that was a good point, which meant that perhaps we didn't need to do anything about the proliferation of AXUDP links after all? Not unless the bandwidth usage was an issue, said Stewart G0LGS. Steve G4FPV said that, if all the AXUDP links were set to an agreed quality, the network should sort itself out and choose the best route.

G1PLT pointed out that we hadn't mentioned the temporal metrics. Paula replied that we were concerned only with "quality" metrics because it was only the route qualities that were important when interfacing with the purely NetRom segments of the network. Personally, and admittedly wrongly, she had assigned a quality of 10 to most of her XRouter neighbours. This removed NetRom qualities from the equation and routed purely in the time domain.

Bryan G0SYR neatly explained why such an extremely low figure was equally as wrong as the excessively high figures initially used. Hidden behind a Linux node, his XRouter node could not receive temporal metrics. Thus although the Plymouth node was only 3 hops away, it wasn't in his nodes table because Paula's node only broadcast the temporal metrics, the NetRom quality being too low to reach him.

Paula explained that the original reason for setting the quality so low (in fact it was originally zero), had been a knee-jerk reaction to take the AXUDP neighbours completely out of the NetRom network because at the time many sysops were strongly opposed to Internet routing, and probably still were. Now we'd had time to assess its effect, we needed to bring the qualities up to a level at which the two networks worked seamlessly together.

Bryan pointed out that there were some nodes that did exactly the opposite, and there was still a node with 20 links all set at a quality of 250. Paula didn't know if it was always the case, or if it was under sysop control, but some "Xnet" nodes had been observed to assign route qualities above 250 to their AXUDP neighbours. Where a mesh of AXUDP nodes existed, in which one was running Xnet, all traffic would be routed via the Xnet node unless (a) the other nodes set their qualities the same as Xnet, or (b) they set the quality very low and used time metrics instead. There were also other problems, such as Xnet manufacturing bogus metrics. Bryan said that, fortunately all those Xnet systems were outside this country, so we could still link to them, but at very low quality. We could utilise those links without importing any of the problems they generated.

Returning to the question of a recommended quality for AXUDP links, Paula said she wished to arrive at a consensus. Steve G4FPV emphasised that it should *not* be 255. It should be well below that figure, and at a guess should be no more than 200. Somewhere between 100 and 150 would give the right sort of graceful degradation hop by hop, so that the network would always find the shortest path in terms of the number of hops. Roger G3ZFR added that individuals might wish to reduce that figure on all their links, to reduce the number of nodes in their tables. Nobody wanted 500 nodes in their tables.

Paula said that personally she was in favour of 120 or 150, whilst those who preferred RF links would rather see a figure as low as 20, and some would prefer 250. Paul G4APL said that if he used a value of 100, he would have upwards of 700 nodes in his table, so he'd been forced to reduce the quality to 25. He highlighted the case of a neighbour who had made a slight change to control nodes table size, which had resulted in a major routing change. Bryan said that if just one node in the network didn't follow the recommendation, everything was thrown out. Fortunately, this was no problem providing all that node's neighbours treated it as an overseas node. It didn't stop anyone connecting to that node, but it stopped it influencing the rest of the network.

Paula took a wild guess that there were roughly 30 AXUDP equipped nodes in the UK network. If all those sysops were juggling the qualities up and down all the time, we spent most of our lives chasing them around. We had to bring stability to the network by agreeing a figure and sticking to it. Was 100 the right value, or was 120? Both G0SYR and G4FPV replied that it didn't matter which, as long as it was round that region. Paul G4APL stated that 100 would give a horizon of 4 hops and 120 would give 5 hops. At Sysop 5 they had agreed 100 for 2 metres and 120 for 70cm.

Paula cautioned that, if we were going to limit the network to 4 hops, we had to organise the links to ensure that nowhere in the UK was more than 4 hops away.

Bryan G0SYR stated that, as things stood at present, it was quite unusual to need to go more than 4 hops, precisely because of the random nature of the interconnections. There may be the odd place that was difficult to reach, such as those that were more than 4 radio hops away from an AXUDP node, but one may not expect to see them in the table in any case. It may not be *possible* to get the whole of the UK into one node table.

Paula said that she did not want to see the table full of Internet nodes, causing the RF segments to be excluded. That was a danger if we set the AXUDP qualities too high.

Paul G1PLT pointed out that there were around 11 "key" nodes in the network, which could control the rest of the network. So why not target those nodes?

As everyone seemed to agree that a value somewhere in the middle of the NetRom quality range was acceptable, Paula recommended 120. XRouter sysops would be advised to use that figure as a starting point.

Steve G4FPV, referring to G0SYR's map of the pure RF network, pointed out that the pockets of network, extensive though they may be, were isolated from each other. There was no long distance RF connectivity. It was not possible for example to connect from the south coast to Scotland by an RF route. That connectivity *had* to be provided by the Internet. The latter *couldn't* steal traffic from the radio links, because there were no radio links to steal it from Bryan replied that there might be certain local circumstances whereby the sysops wouldn't wish to short circuit the radio links. Stewart G0LGS added that, conversely in some cases the sysops at local level might wish to do so. Bryan said it had to be the choice of those involved.

Paula G8PZT drew attention to the difficulty of fitting all the UK nodes, BBSs, chat servers, PMSs etc. into a 200-slot node table. If the table size was capped, and the number of available nodes exceeded that value, the "least connectible" nodes would be omitted. Steve G4FPV interjected that those tended to be the ones furthest away. Not necessarily, Paula replied. They tended to be ones that were furthest from an AXUDP node, such as those in the middle of RF segments. In our non-geographical hybrid network, physical distance was now largely irrelevant. "Distance" tended to equate to "hop count". Nodes which were physically local might be a long way away in terms of hops, thus by any metric they would be less connectible, and less likely to be included in a capped table. We didn't want our RF nodes to be squeezed out of the tables by Internet ones.

Roger G3ZFR pointed out that a BPQ node, if limited to a table size of 120 in an environment of more than 120 nodes, would simply include the most recent 120, not the lowest quality ones. This could result in important nodes dropping in and out of the table. He wondered if XRouter suffered the same problem? Paula assured him that Xrouter maintained the most connectible nodes, which tended to be the ones with the highest route quality.

Bryan G0SYR felt that "capping" the table was not a good way to run a node. He was convinced that it led to a lot of extra "upping and downing" and "sorting out". Table size had to be limited by quality and minimum quality so that the table had room to grow and shrink. Steve G4FPV said that there should always be headroom between the number of nodes in the table and the maximum table size. Paula agreed, saying that she had limited her table size to 250, and by manipulating qualities and hop

limits, she aimed to get no more than 200 nodes in the table at any time. The dropping of the least connectible nodes when the table got full was never intended to be a management tool.

Anthony M1FDE asked what the X1J nodes, which only had small tables, should do to limit their table sizes. Paula replied that they should lower their route qualities. If the neighbour was XRouter it could to limit the number of nodes broadcast to the X1J node. Anthony went on to say that it might be acceptable to exchange massive nodes broadcasts over the Internet, but sysops didn't want the RF links clogged up by them. Paula replied that was precisely why XRouter had the "MinTxQual" parameter, to allow sysops to limit the size of nodes broadcasts on RF ports. The management of a hybrid network wasn't straightforward.

Bryan G0SYR asked if Paula had a recommendation for the route qualities to use for overseas neighbours. Paula joked that it should be zero, but went on to suggest a value of 10, because we wanted foreign nodes to be visible only on their immediate neighbours in the UK. They should not propagate, because we couldn't afford the space in our tables.

10. Closing Address

It being almost 5:30 pm, the chairman Steve G4FPV thanked everyone for coming, especially those who had travelled great distances, and wished everyone a safe journey home. He observed that everyone had enjoyed chatting over coffee and dinner, and said he hoped it had been a successful day.

Geoff G4AFJ thanked Steve and the Fourpak team for organising the conference, pointing out that these events didn't just happen. A spontaneous round of applause followed, and the delegates gradually departed after further informal chat.

Revision 1