Preface:
Since the late 1980's Paul G4APL and Bryan G0SYR have been involved with Amateur
Radio NetRom and later TCP/IP network management.

Liaising with SYSOP's around the London and home countries, to ensure that the CatRad
nodes (up to sixteen running TheNet during the period 1988 to 2001) over three sites
GB7CR GB7CP (In Caterham Surrey) and GB7HW near M40 Jct5 on the Chilterns (now
closed).
Now in 2002 we run all our TNC's in Kiss mode using Linux Server (GB7CIP/GB7CR) or
Xrouter(GB7CP) for all out TCP/IP and NetRom routing.

We have based our network management, as had other efficient Node site SysOP's on
the decisions made during the early Sysop meetings. Known as SYSOP5 and SYSOP6.

In our view this has worked very well for the UK for the past 13+ years

Paul G4APL has located some files on some old floppies with articles written by Mike
Tubby G8TIC back In 1988/1989 which are applicable to today's new Node SysOp's
around the UK and the rest of the world that are experimenting with Xrouter..

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Amprnet web site   http://gb7cip.ampr.org

>Mon Dec 31 16:02 1990
Stat   : PR
Posted : 90/12/31 15:18
To   : G4APL
From   : G4APL
@ BBS : G4APL
BID   :
Subject: TICNET2

**Date: 09 Dec 88 22:42:46 Z
From: G8TIC@
To: NETROM@GB**

Subject: Management of UK network nodes

MANAGING NETWORK NODES

If you run a network node (NET/ROM, TheNet or TheNode) then you should read this. At
the 5th National Mailbox and Network Node Sysop's meeting on 4th December at Oadby it
was decided that network nodes in the UK need co-ordination so that they function
together in a useful fashion and work efficiently.

This means that nodes need to be "managed" in the same sort of way that bulletin boards are managed. In order for connections between network nodes to operate correctly they must have the correct sort of links to their neighbours and work from common standards for "route qualities" (i.e qualities of the paths to neighbouring nodes).

John Wiseman G8BPQ and Mike Tubby G8TIC provided a paper at the meeting which presented a set of parameters to be tried at all nodes to get them to work with each other better. Note that there is no "right" way to run a node, we probably have not got the parameters 'perfect', but as long as EVERYONE uses the same values we will be make good progress.

This information should not apply to only "official groups" and people that run GB7xx callsign nodes, but to all people that run network nodes.

The following objectives were defined:

1.   That nodes appearing in a NODES list at any particular place should all be *reachable*

2.   Common standards should be used for all nodes.

3.   To make the network reliable and allow mailboxes to use it for forwarding mail.

4.   Where possible reduce inter-node traffic on 144.650

5.   To complete the change over to new parameters by 18th December. Note that this does *not* mean "do it on the 18th" - please do it when ever possible - the sooner the better as the network will benefit from it.

HOW THE "NEW" NETWORK WILL WORK

You will have to change more-or-less all the parameters in your node, and in future you will have to manually enter the qualities to neighbouring nodes if you want them to be use successfully, this means that nodes that come and go, for no particular reason, will have little affect on the rest of the nodes in the system - the network will be "hand crafted".

Automatic routing will be used as a backup, the automatic quality assigned to any node appearing in a node's tables will be low (initially 10). The sysop of a node will have to put the qualities to neighbours in using the ROUTES+ command.

Qualities between neighbouring nodes will initially be set to some pretty arbitrary values (phase 1) and then at a later date "fine tuned" (phase 2) for maximum throughput. We will need to develop methods of measuring the actual throughput between adjacent nodes for phase 2. Phase 2 is not covered in this bulletin.

The values used for qualities in phase 1 depend on bands. One school of thought would say that this is wrong and that the band is probably not important, only the actual throughput matters while the other way of thinking works on the band-for-band basis. We

are using the later – it will probably cause 70cms to get busier, and if you have 4M and/or 6M ports, they will get busier still!

RECONFIGURING YOUR NETWORK NODE - PART 1

Probably the best way of re-configuring your network node(s) is:

1.   Get a copy of the ROUTES table (you'll need this later).

2.   Log on as sysop (use SYSOP command).

3.   Issue the RESET command - this deletes all NODES and ROUTES entries and sets the PARMS back to default. Do this when there are no users on.

4.   Put the following parameters into the node using the PARMS command:

 PARMS 100 10 10 c 5 4 3600 16 60 3 5 180 4 4 900 p 10 5 m 10 100 18000 0 1 2 1

where:

   c is 250 on dual ported nodes or 240 on multi-ported (3 or more) nodes

   p is the p-persistance value selected from table 1

   m is the maxframe value (2 on 1200bps channels, and higher on high speed/quiet channels)

   table 1:

   Busy channels shared with users (i.e. 144 & 432)25 (10%)
   Quiet shared channels (i.e. 50 & 70 MHz)50 (20%)
   Multi-access node only Channels (23cms etc.)64 (25%)
   Point to point half duplex128 (50%)
   Full duplex255 (100%)

5.   Put in the routes to your neighbours using the following table as a guide for the quality values.

2m multi-access link (1200 bps)	100
70cm multi-access (1200)	120
6/4m multi-access (1200)	150
9600 multi-access	200
9600 half duplex point to point	220
9600 full duplex point to point	240
Anything faster	250

   You have to use the ROUTES+ command to do this, for example:

ROUTES 0 G9ZZZ-2 + 100

IT IS MOST IMPORTANT that the neighbour node that you lock in uses the same quality value as you. You will probably have to speak to the sysop of the node and check with him.

When adding nodes you can probably afford to be quite discerning. If you have unusable, or very marginal paths to other nodes, or if they are "the far side" of other MUCH stronger (signal wise) nodes then you should lock then in with a quality of ZERO. The network will then use intermediate nodes to get through to them.

If you have more than five or so nodes locked in to your table then you *may* have too many - are they all REALLY necessary? This really depends where abouts you are in he country and how many links work well.

Please remember that these values are somewhat preliminary - please use them, or agree sensible departures from them (with your neighbouring node sysop).

Please don't leave paths to neighbour nodes at 192!!!

6.   Wait and see what happens (i.e. come back tomorrow...)

RECONFIGURING YOUR NETWORK NODE - PART 2

After the network has started to settle down you will need to make a few minor alterations, and try some things out.

1.   Use the NODES * command to see how many nodes there are in the table.
        There should be less than 70, and hopefully even less.

2.   If there are more than 70 nodes in the table you should increase parameter 2, try
        say 20 or 30.

3.   Experiment! Ask your node to connect to another node in the table...   does it
        succeed? If it fails and you've tried it several times then if its a direct neighbour (i.e.
        in the ROUTES table) should it be there?
        If its a more distant node find the paths to it using its name, i.e.
        NODES NAME and then raise param 2 to exclude it from the table. Wait more time
        and try again.

4.   Look at your ROUTES list. If nodes appear with a quality of 10 then where are
        they? If they are a good link, or in a new direction and useable should they be in
        the table at a higher value? If so then contact the sysop, agree the quality value
        and lock the node in with ROUTES+. If the node is not useable contact the sysop
        and agree to lock each other out.

5.   Check the nodes around you. Have they changed over to the new parameters? If
          not then try and persuade him to.

We have a deadline of 18th December 19988for the change over - the network
should be settled in by then.

If you have any queries regarding setting up/tuning your network node(s) or want to
discuss this further please contact either John G8BPQ or myself.

We would also like your name and address if you run a network node as there is some
other paperwork that we would like to send you in order to start building a route planning
map.

Subject: Managing Network Nodes: Addendum

A note for NET/ROM node operators (this applies to NET/ROM only and *not* TheNet). If you run NET/ROM then when you come to re-configure your node you should not use the RESET command if you are accessing it remotely via the radio channel since your password set up in the node will be lost and you will then have to visit the site to
(1) put the password back in, and
(2) do the parameter changes.

If you run NET/ROM in your node at the moment - please seriously consider changing over to TheNet. There are many good reasons for doing this, these include:

-its free and public domain

-it crashes less often than NET/ROM

-it runs faster than NET/ROM

-future versions of TheNet may be a superset of your current NET/ROM and you may end up not fully compatible with the majority of network nodes.

I will configure your TheNet EPROM and program it for you if you are not able to do this yourself. All you need to do is send me a blank 32K EPROM.

Subject: **Network Nodes: We want feedback!**

Hi. If you run a network node (TheNet, NET/ROM or BPQcode) we would like some initial feed back on the progress of your node, throughput, reliability of path's etc. over the last ten days or so since nodes started to use the new parameters.

If you run a network node and haven't changed over to the new parameters yet - why not? If you are not aware of them still, at the Sysops-5 conference on Dec 4th 1988 it was agreed that network nodes need "managing" to get maximum utilisation from them. A set of parameters were agreed, and should be implemented by the 18th Dec 1988 as a "phase 1 experiment" to try to improve the system.

[contact details removed by g4apl as not relevant today November 2002)

We would be particularly interested in hearing about the following points:

Number of collisions/retries from your node. Have things got better since the p-persistance value was lowered? (we would expect the node to be slightly more "hesitant" in going to transmit, but get a better overall throughput because less 'collisions' should occur...)

Is traffic more balanced between the different radio ports on your node? (if you have more than one port)

Is the traffic more or less balanced between the "ROUTES" from your node.

Have you been able to decide easily how to "lock in" or "lock out" neighbour nodes, and have you been in touch with the neighbouring node's sysop to agree the value used for the route quality between you and him?

How many nodes are there in your table now? If there are more than can be reached reliably, have you increased param-2 to say 20 (or so) and tried the system again...

Finally, any other relevant points on managing your node...

Date: 15 Dec 88 17:41:16 Z
From: G8TIC@
To: NETROM@GBR
Subject: Network Node Sysops: Please Read!

Managing the UK network nodes: we could still do better!

Date: 14th Dec 88 at 11pm

I've been looking around the network nodes in the Midlands and South West for the first time really seriously since we started to change the node parameters around. Things are getting better but some people are still "doing their own thing" which is not helping all the other network nodes in the system.

Remember you need to do TWO things:

1.   Re-configure the node parameters to those recommended after the Sysops-5 conference.

2.   Manage your ROUTES table *manually*. You now have to put EACH radio link to a neighbour node into your table using the ROUTES+ command.

        This means that you will HAVE TO SPEAK to the sysop of the neighbouring node so that you can decide the "quality" of the link between your nodes.

        You need to consult your neighbour because it is **EXTREAMLY IMPORTANT** that the quality value in your table to your neighbour is the same as the quality that your neighbour uses to you.

        If you do not manage your ROUTES table then your node will only get to know about its immediate neighbour nodes and will never really establish itself as part of "the network".

Where we are going wrong:

At the moment some people have not changed their parameters over to the new values or not yet added ROUTES in...

I can't try all nodes and paths in the network, so you'll have to do the policing! It's in your interests as a sysop to get you neighbouring sysops doing the right thing - they affect your node!!

Get the telephone number of your neighbour sysops - you can usually use the callbook and a telephone directory. Talk to your neighbour sysop!
Agree path qualities and implement them together.

One or two node sysops have implemented PART of the recommendations only, I cannot understand why... no one can demand or force them to adhere, but IT IS REALLY BEST to implement the recommendations as they are, even if you do not agree with them. If you feel that you have a better way of doing things then WE WANT TO KNOW - if we can improve things then write about it, shout about it etc. and we'll debate it at Sysops-6.

Examples:

If you think that your node has too many entries in the NODES table then raise param-2 (min quality for auto update) to say 20, 25 or 30. DO NOT reduce param-1 (max. destinations) as this causes severe problems with the node it ever fills up - *always* leave param-1 at 100 - there can be no reason to change this!

Use level II digipeaters sparingly and sensibly, i.e. if you need a path between two nodes that isn't available via any other L3/L4 nodes then lock it in to the routing table with the ROUTES+ command but AT A REDUCED VALUE, e.g. say quality of 50 or so rather than 100. Again, use the SAME quality values at both ends of the link.

You should be using the ROUTES+ command to put in links to your neighbours, and if you have an unreliable or marginal node then it should be set to ZERO, i.e. locked out.

Remember that implementation date is "by" 18th December 1988. Some people still haven't started work on their nodes yet... they will become more and more isolated if they don't do it soon...

If you have any thoughts, suggestions or observations (no rude ones please) then send them to us.

[contact details removed by g4apl as not relevant today November 2002)

Msg # 22518 Type:B Stat:$ To: ALL   @GBR   From: G8TIC   Date: 20-Jun/0214

Subject: Handcrafting & the network 1

From: G8TIC@

Handcrafted routed routes DO WORK - and network management

Further to the recent bulletin from John G4MTP, I would like to stress that hand crafted routes between network nodes (and level 4 mailboxes)
REALLY DO WORK (but there are problems which have to be overcome...)

Many people (sysops of network nodes) do not realise the amount of effort needed to keep a complex system (such as our AX.25 network) in reasonable working order. If you put on a network node then you have a responsibility to your users and the other network nodes in which you are in range.
You cannot simply "switch on and forget" as many people think!

Handcrafted entries in the ROUTES table (which should really be called the neighbour
node list) need to be entered carefully and sensibly.
Each entry should only be there if it *really* works.

At sysops-6 (Leicester - December 1988) we "bashed out" a set of parameters designed
to improve the throughput by co-ordinating the network node parameters and getting
everyone to use a common set of standards.

These were agreed by the majority of representatives present and adopted.
They were a "first guess" and not likely to be "right" or 100% "correct", but they were
CO-ORDINATED, so if all nodes used them we could at least predict the operation of the
network and then take steps to further improve it.

Many people put in the values and still use them, but other node operators have "gone
their own way" and started to attempt to 'tune' their nodes or have totally changed the way
they operate without giving consideration to the full implications of their changes. If
changes to the way the "system" works are made arbitrarily then it will surely lead to
anarchy!

The way in which ROUTE qualities are used is the most important part of how the level 3
adaptive packet routing works (timers and other parameters can be altered by the local
sysop with smaller affect on the system as a whole). The current recommendations are
simply:

1.   that a node which has a direct neighbour on 144.650 uses a "quality" of 100 if it is
        a good quality link to it.

2.   similar to (1) on 432.675 but quality 120.

3.   other frequencies (eg. 144.675, 433.675, 70.4875, 50.650 etc.) which are 1200
        baud have quality of 150.

4.   maximum node (destination addresses) in your table (P1 = 100).
        This prevents you getting too short of buffers!

5.   min qual for auto update (P2 = 10). Attempts to stop you getting nodes which are
        too "weak" to reach into your NODES table in the first place.

6.   default qual for new/unknown node (P3 = 10). Stops new/unknown nodes from
        "damaging" the known routes by claiming that a highly questionable (untried) link is
        better than established (known) ones.

7.   default qual for async interconnect (P4 = 240). 240/256 causes the inter-TNC
        qualities to back off which stops infinite loops within a node.

Generally, the network node will now pass traffic between two adjacent nodes on the
quietest channel (the one(s) that you have assigned the highest qualities to).

The quality values 100/120/150 should be regarded as the highest values to be used on a
given channel, and only used for links to direct neighbours.

As the NET/ROM (TheNet) addressing structure is "flat" (i.e. not hierarchical) nodes only really need GOOD (fast, reliable, high quality - low error rate) links to direct neighbours. If each node sysop sets him self the task of 100% communication quality with his neighbour node(s) then the network will, to a large extent, take care of itself.

In this context "GOOD" links are no longer really possible on 144.650 or 432.675 since the level of activity is already too high. In fact the whole concept of CSMA links for network nodes is somewhat silly! The best way to improve a network node is to put direct radio links (even at 1200 baud) to your neighbour nodes on a quiet/unused channel (any band: 50/70/432/1296MHz will do! - 144 is already under great pressure!).

These radios should then be used only to connect the two ends of your inter-node link (i.e. no users on this channel, and preferable only the two nodes) - this costs radios, TNCs and antennas but will work, and need not be expensive (i.e. 4M Pye Westminsters etc.)

With our existing mixed network traffic/user access channels you do not need links further than one "hop" away in any direction since you have an intermediate node that you are jumping over - this node may well "know" a better route to the final destination.

Only lock in your NEIGHBOUR nodes - those more than one hop away should be set to ZERO. Anything more than a hop away probably doesn't work well anyway since each end will have "local users" who cannot hear the distant node and clobber its packets - this is the 'capture effect' or 'hidden station' effect.

The entries in your nodes ROUTES table will contain (when started up) quality 10 for each node that you can hear. As this is the minimum value for auto update (P2) it will be placed in your NODES table too, so that you can call it up. When you do a nodes broadcast it will be passed on to your neighbours but they will calculate a quality to it (through you) of

Qual to new node = your qual to node   x   node qual to you

this drops to less than 10 (typically 4 on a 144MHz path) and hence is not added to their table. This stops a new node from peculating round the network.

This action of stopping new nodes is not intended to be permanent, it protects against random appearances of nodes during lifts damaging the system as a whole, and prevents a node that hears nodes broadcasts from all over the country (ie. "all ears") from telling the rest of the network that it can communicate with them. The argument here is that if a node hears many other nodes it calls them "neighbours" and puts them in its ROUTES table - even if it has no real chance of passing any data to them - this is wrong and has to be avoided.

If described as above a node claims to have routes to many neighbours it can go on an "ego trip" and tell the rest of the network that it can contact twenty other nodes all at quality of 100. The rest of the network nodes then attempt to use it and the whole system fails - too much traffic trying to go too far.
Six small/reliable hops always works better than 3 big/unreliable ones on a busy channel.

Msg # 22470 Type:B Stat:$ To: ALL   @GBR   From: G8TIC   Date: 19-Jun/1731

Subject: Handcrafting & the network 2

When new nodes appear as neighbours in your ROUTES table you need to investigate them and take action. If the node is 'just passing' because of a lift in conditions it will naturally vanish again - do nothing. If the entry represents a new network node that has come online then you need to add a 'locked in' ROUTES entry for it before your node will use it to pass data.

Basically you should test the RF channel between your node and your neighbour and if you can pass packets over it reliably, and it is a neighbour then set it to quality 100/120/150, e.g. using the command:

        ROUTES 0 G9XYZ-2 + 100

If the node is further away than a direct hop neighbour then do you need it in your table at all? Probably not, especially if your node has other radio channels (70cms etc.) as there's probably a better path to it. You can do two things (a) lock it out all together by setting its quality to ZERO, or (b) set its quality to a low value, say 20-25 so that it is only used as a backup link if the better ones fail for some reason.

Which ever method you choose you should have the same value locked in at both ends of the RF link (i.e. your node and the other persons). You need to TALK TO THE OTHER sysop and agree the value between you.

 If, when you check/test the channel, you find that A hears B but B does not hear A you have a one-way path - this is quite common, LOCK OUT the circuit at both ends (i.e. set it to ZERO).

 If you need to "fiddle" a particular route to a node to get traffic to go via a preferred path then do it by lowering the qualities of other links, don't raise the quality of a direct link above 100/120/150 - we are trying to leave sufficient "space at the top" to assign higher qualities to 9600 baud links etc.

One of the reasons for the number of failures on circuits at the moment is the "quart in a pint pot" syndrome - 144.650MHz has a finite capacity, and in many places it has been reached. As more and more traffic queues to be transmitted on a channel the delays take longer, the delays tend to infinity and so no traffic gets through. John G8BPQ and myself recommended 60 seconds for the L4 timeout, with 3 retries this takes 3 minutes to fail.

In practice what happens is the retry is often being sent before the first attempt has arrived - this leads to extra traffic on the channel and we timeout too quickly. There are two solutions (a) buy more radios and put on more channels to make the data move quicker! (b) slow down the L4 timer to say 120 seconds.

Your network node parameters should be based on:

100 p2 p3 240 5 4 3600 16 p9 3 5 180 4 4 900 p16 10 5 p19 10 100 18000 0 1 2 1

 where:

    p2   min quality for auto update - normally 10

    p3   default quality for HDLC (radio) port - normally 10

    p9   is the L4 timeout (60 seconds original recommendations)
                       although we are now experimenting with 120

    p16   is the p-persistence, recommend

                25   on 144.650 & 432.675 busy CMSA channels
                64   on quiet CSMA channels
                255   on direct node-to-node links

    p19   L2 'maxframe' should be set to 2 on busy channels, and higher by
                       experimentation on direct links.

 Note that P2 and P3 should be kept to the same value. If your nodes table fills up quickly
(i.e. you have over 80 nodes, then try raising P3 and P3 to say 15 or twenty).

Most of the parameters and network management practices described above are empirical and based on heuristics/common sense. Parts of it can be proved mathematically, for example if there are nodes at two locations,

```
    AAA-2 ------144.650 (qual 100)----- BBB-2
      !                                    !
    240 (RS232)                         240 (RS232)
      !                                    !
    AAA-7 ------432.675 (qual 120)----- BBB-7
```

 a user on AAA-2 issues a connect to BBB-2, directly on 2M the quality is 100, but through the network the calculated quality is 240/255 * 120/255 * 240/255 = 106. The connection is routed the "long path" across 70cms - the quieter (hopefully) channel.

I'd welcome more thought/input on the subject we still have a long way to go.

 In summary:

1.   We must all operate our network nodes and level 4 mailboxes based on a common set of standards.

2.   Changes to the way the system works need discussion and agreement in advance *before* implementation.

3.   Network node sysops should recognise their responsibility to their users and adjacent nodes - this requires regular "management" activities.

4.   Single frequency nodes (especially on 144.650) are of little use, in the same sort of way that nodes on top of mountains are of little use!

5.   To make our existing system work better, as a node sysop, set yourself the task of getting 100% reliable (and fast) links to your DIRECT NEIGHBOUR NODES. Use non-144.650/non-432.675 channels to provide inter-node links.

      As a whole FAR TOO MANY of our RF channels are of marginal quality and we expect too much throughput.

6.   We should attempt to be able to get connections to all the destinations in our nodes table - or why are they there in the first place?

7.   A node with several good neighbour paths works better than one with many poor ones.

Mike G8TIC.

Msg# 1226 Type: B Stat: $ To: SYSOP @ GBR   From: G8TIC Date: 24-Jul 0341
Subject: Sysops-7: Changes to node parameters
From: G8TIC@

Changes to network node parameters

At the Sysops-7 conference we discussed changes to several node parameters, and decided to make the following changes as soon as possible:

P8 Maximum hop count. The number of hops that a packet can be forwarded before it is assumed to have "failed" to reach the required destination. Was 16, but we felt hat there are a number of PERFECTLY GOOD links which would work but require more hops.

New value recommended for P8 is 25. This *should* have no detrimental affect on the network at all and allow circuits which go through more circuits to work where previously they failed.

P9 Level 4 (transport circuit) timeout. The time between retries at level 4. This was set to 60 seconds, but various observations and experiments by G8AMD, G8TIC, G4FPV and G8VPQ showed that a longer retry period (90 to 120 seconds) resulted in less "failure" messages and better throughput. The trade off is that throughput is permitted to be "slower" bu more reliable, and that circuits that are not going to work will take longer to report this to the operator/user.

 Param 9 is now to be set to 120 seconds.

Other parameter changes were discussed. It was suggested that P5 be set to 3 and P6 be set to 2, and some discussion regarding reducing further the time between nodes broadcasts took place. It was decided to hold over decisions on these until Sysops-8.

We re-iterated (and agreed that) locked in inter-node routing performs much better that the "free-for-all" approach recommended by some.
Management of network nodes will continue using locked in routes and the parameters recommended by the Sysops conferences.

 In summary your network node should contain the following parameters:

 100 10 10 240 5 4 3600 25 120 3 5 .... as default.

The ROUTE quality values remain as per previous Sysops conferences as do the MAXFRAME values and PERSISTANCE values for various channels.

Please implement the changes to P8 and P9 as soon as practical. It was again stressed that it is important that all network nodes base their parameters on a common set of standards and manage their nodes in a similar fashion.

We would like feed back on these changes at Sysops-8, and any further ideas on node "tuning".
 [if necessary I will re-issue an updated set of notes from Sysops-7 for
node sysops who did not receive them previously]

Date: 11 Aug 89 17:46
From: G8TIC@
To: NETROM@GBR
Subject: Network routing loop problems

Careful observations of network nodes show that there are a number of classes of problems with the routing of packets through network nodes, below I attempt to explain them and solutions to them:

1. Internal routing loops - one

These appear to come in two flavours and are basically caused by the Same thing - these only affect multi-port nodes. Symptom is that packets Enter your node from the network (your node appears the best choice to a neighbour node) and never leaves your node.

Packets get switched between the individual ports and the hop count is decremented until the packet is discarded (hop count reached zero).
The reason is because each port on your node names another port (on your node) as the best way to the destination.

This is a problem if the Async port (RS232 interconnect) quality is Too high because there needs to be a fall off in the quality to a distant Node across the ports of your own node. When the async quality is 255 There is a problem since the maths gives answers like:

$$120 \ * \ 255/256 \ = \ 120$$

and hence it does not tailor off.

To fix this the inter-node async quality should be set no higher than 240 - this was a recommendation at Sysops-5.

2. Internal routing loops - two

The second flavour of internal routing loops is caused by too much choice... if your node has four or more ports connected via a diode coupler then you can get the situation where all choices for alternate routes out of your ports are via another port.
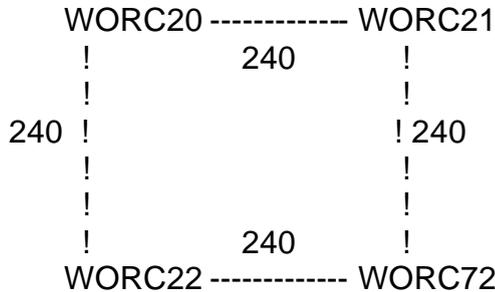
This tends to occur when the user's chosen destination that he's trying to reach has gone down (crashed or similar) sometime earlier and is in the progress of becoming obsolescent.

Each node has up to 3 choices of where to route packets to to get them To the required destination. In a four (or more) ported node each other Port on the async interconnect can be at higher quality than any of the Radio ports and hence the packet runs around you node until it exhausts the Hop count.

The solution is to REDUCE the connectivity between ports on your node, basically if you imagine all the ports on your node connected in a circle then any port could only communicate with its immediate neighbour.

Packets can still get from any port to any other port by passing Through intermediate ports. Because only two nodes now exist on the async interconnect it always leaves at least one free "slot" for a quality to come in over the radio port.

Example:

```
        WORC20 ------------- WORC21
          !            240          !
          !                         !
   240  !                        ! 240
          !                         !
          !                         !
          !            240          !
        WORC22 ------------- WORC72
```

in the above configuration there is NO connection from WORC20 to WORC72 or from WORC21 to WORC22, i.e. no diagonals.

To implement a circular node you can either remove diodes from the Diode coupler or lock out some of the nodes:

a.   To remove diodes from the coupler you would take out the diode that allows WORC20 to talk to WORC72 and take out the diode that allows WORC21 to talk to WORC22 - remove diodes from the TXD/RXD lines.

        You should leave the diodes on the CTS/RTS (or CTS/DTR) lines alone.

        This creates the circle in hardware.

b.   Alternatively you can implement the circle in software by "imagining" that the TNCs are in a circle and locking out the async connections on the diagonals, for example:

        ROUTES 1 G8TIC-7 + 0   would be done on the WORC20 node

c.   When nodes have five, six, seven ports etc. the software locking out takes more care and time to get right. As you really are trying to get bidirectional communications between a node and its pair of neighbours you can implement it in hardware with a pair of diodes at each TNC:

        Each TXD has a pair of diodes (cathode) connected to it, the anode of each diode goes to a neighbours RXD. This provides communications with the direct neighbour in each direction.

        Arbitration logic must still span "the neighbour but one" in each direction to stop the neighbour that you are sending to being clobbered from its 'other neighbour'.

        Steve G4FPV has designed a comutator to replace the diode arbitration which has several advantages.

>Mon Dec 31 16:57 1990

Date: 06 Oct 89 13:33
From: G8TIC@G8TIC
To: ALL@GBR
Subject: Do we need level-2 digipeaters any more

Just about every TNC in the UK has the ability to ack as a level-2 packet repeater, ie. Digi-peater, and it seems that most people have this function enabled as a matter of course.

It is well documented and proven that level-2 digipeating is inefficient and "hogs" the channel un-necessarily compared with level-3/4 systems - so why have them? Even more why advertise them with a 100 byte ID message every 5 minutes?

If your area needs covering with a digipeater then why not operate a level-3/4 network node, ie. TheNet, Net/Rom, or BPQ system? The facilities that you will then provide will be much more valuable to users, mailboxes and other network nodes alike!

The thing to bear in mind with any repeater, especially a level-3/4 digi is that you have a responsibility to your neighbour nodes - this means that you have to carefully pick route qualities and parameters in order to CO-OPERATE in the network otherwise the operation of the node can be detrimental.

The best network nodes are ones which have several radio channels, possibly on different bands, with good/reliable paths to other nodes in several different directions, but single channel nodes still have a place in the scheme of things!

Sysops conferences have come up with recommendations for how best to set up a network node - there are several people around who can advise you on these and help to get you up and running...

Please, lets get away from the:

G9XYZ>BEACON,CALL1*,CALL2*,CALL3* <UI C>:*** G9XYZ-9 LEVEL-2 DIGI ***
24 HOURS *** ANYTOWN, ANYCOUNTY *** SYSOP MIKE *** IO99ZZ ***

messages and digi-ing which aren't needed and waist valuable air time and continue building a "network"!!!

Mike G8TIC @ Sysop: WORCS network node

Date: 06 Oct 89 13:24
From: G8TIC@G8TIC
To: ALL@GBR
Subject: Making better use of FRACK/RESPTIME

TNCs have many parameters that alter their effectiveness, a number of the defaults supplied "at manufacture" are far from ideal bearing in mind the crowding on UK packet channels. Two of these parameters are:

FRACK   - FRame AC knowledgement timer - or how long your TNC will wait for acknowledgement of its last transmission, and

RESPTIME   - RESPonse TIME - how long your TNC will wait in case the other person's is going to transmit again, before starting to send something back.

The TAPR defaults are FRACK=3 seconds and RESPTIME=0.5 second. In the UK this means that often your TNC sends a frame (packet) to the other end when it REALLY WASN'T NECESSARY, i.e. the far end heard it perfectly but hadn't got round to replying purely because of the others on the channel!

If you gave your TNC a longer waiting time more data would get through the first time and fewer collisions would occur, this in turn would lower the total number of "transmissions" on the channel and would therefore benefit everyone.

On the busy channels, i.e. 144.650, 144.675 and 432.675 it would be a good idea to change FRACK to 5 seconds, and RESPTIME to 1 second - most people won't really notice the difference, but the increase in reliability and reduction in un-necessary transmissions should make it worth it!

Mike G8TIC @ GB7???, Sysop: WORCS network node.

Date: 06 Oct 89 13:03
From: G8TIC@G8TIC
To: ALL@GBR
Subject: PERSIST, DWAIT and your TNC

How many people are still using DWAIT rather than PERSIST/SLOTTIME on their TNCs?
I guess most are!

A packet radio controller uses CSMA (Carrier Sensed Multiple Access) techniques to gain
access to the channel in order to transmit data. When the channel is busy, the TNC waits
for it to become clear before transmitting. Once the channel goes free a "collision
avoidance" algorithm is used to reduce, as much as possible, your transmitted packets
from bumping into someone else's - this reduces the number of retries and improves
channel throughput.

There are two collision avoidance methods, "default wait" and "p-persistent CSMA", found
in packet controllers. The former is the old DWAIT mechanism, while the latter is the new
PERSIST/SLOTTIME mechanism.

Basically in the old DWAIT scheme the TNC waits for a fixed time (set by DWAIT) and
then adds a random bit - the new scheme uses probability theory and implements a
"binary exponential back-off", basically it waits for a fixed *short* period of time (set by
SLOTTIME) and then throws a dice, the resultant number is less than the probability value
it transmits otherwise it waits for the SLOTTIME again... chances are you'll most likely
transmit in the first slot, then the second, then the third etc.

Okay - so what's the point of all this?

Currently, we are using a mixture of DWAIT and SLOTTIME/PERSIST and the two don't
go together well at all! The result is extra (avoidable) collisions and retries - its like playing
cards - it helps if we all play by the same rules!

Some new TNC's support PERSIST/SLOTTIME, some support both, some older TNC
software supports DWAIT only - but by the large these can be upgraded cheaply - any you
usually get a PMS etc. thrown in as well!

What we need to do is to get everyone possible using the "new rules" so that we get more
out of our crammed channels! So, if your TNC has a p-persistent CSMA mode please
enable it... you will probably have to set PPERSIST ON to tell it to use p-persistent instead
of DWAIT, set SLOTTIME to 100mS and PERSIST value to:

        32 on 144.650/144.675/432.675
        64 on all other channels

The persistence value is the likelihood of transmitting in any given slot 32 means 32/256
which is 1/8th chance - contrary to popular belief making PERSIST higher doesn't mean
you will get more packets through as you will cause exponentially more collisions! The
busier the channel the LOWER the value persistence value should be for optimum
throughput.

All network nodes (TheNet, NET/ROM, BPQ etc.) use p -persistent CSMA already but sysops should check that their values are "compatible".

Please try it out! (if anyone is interested I can provide mathematical proofs of why p-persistent works best).
Mike G8TIC @ , Sysop: WORCS network node
*** DISCONNECTED [11-Oct-89 20:40:13]