Agilent
End to End testing with the N2X

Technical Overview

This guide shows how to configure the end to end testing on the 10/100/1000 tri-rate XR-2 cards. Similar procedures can be used for other cards.

Example configuration as shown in Figure 1: (alternatively you can use laptop controllers with extra NIC cards or 2 slot chassis)

- 2x N5544C/N5545C Rackmount controller
- 2x N5540A N2X chassis
- 2x N5551A N2X 4-port 10/100/1000 XR-2 test card
- 2x E7881B N2X packets and protocols software
- 2x E7882A Routing emulation license for IPv4 protocols

Figure 1. Typical set up
Configuring the N2X

NOTE: It is VERY important that you put the cards in the remote systems in the same slot of the chassis.

In this example we are using cards in Chassis 1, Slot 01 and ports 1 and 2 are selected.

► Step 1.

Start the local N2X software as normal and once at the Port Selection window select 2 ports, 102/1 and 102/2 and then click on “OK” (Figure 2)

Then you will come to the GUI for the N2X

► Step 2.

Click on the “Link Layer” button (Figure 3), and select the “Ethernet” tab to configure the Ethernet interface, its IP address and enable ARP. (Figure 4)

You can miss out this step if you only want to transmit traffic or are using the new GPF protocol emulations. (See N2X online help for more detail on configuring the Link Layer for the new GPF emulations)
Configure the Traffic

► Step 4.
Click on the “Traffic” setup box. (Figure 5)

► Step 5.
Click on the first profile in the area below it. (Figure 5)

► Step 6.
Then for Port 1 right click on the first profile. Select “Properties”. (Figure 6)
► Step 7.

Edit the “Profile 1” properties for the traffic you wish to send in the normal manner. (Figure 7)

► Step 8.

Now create a Steam Group and edit the properties in the normal manner (consult with N2X online help for information on configuring traffic. Set the source and destination addresses (any value that you need for your test scenario). For this example we can call the source address 1.1.1.1 and the destination address 2.2.2.2 (Figure 8)
► Step 9.

Also make sure you select where you expect the traffic to be received on the General tab. So for Port 101/1 select the traffic to be expected on Port 101/2. (Figure 9)

► Step 10.

Now we need to create a similar profile on Port 2. Once again set the parameters that you require (you can cut and paste the stream group from Port 101/1 to port 101/2 as a quick way to do this) . Now edit the stream and click on the address fields. Now the source address and the destination address need to be swapped. So the source address would be 2.2.2.2 and the destination address would be 1.1.1.1 (basically sending the traffic the other way).

Prior to setting up the remote N2X, we must first determine the measurements that need to be recorded.

Typical End to End Measurements

Packet loss and sequence type measurements

N2X inserts a sequence number in transmitted PDUs to facilitate these types of measurements, and these measurements can equally be done by a local or remote N2X on the receiving side. It is also possible to do this in both directions end-to-end simultaneously, even to the point of start/stop of the transmitter and receiver measurements independently at each end by having separate test sessions for Tx and Rx. This allows direct comparison of Tx and Rx packet counts, as well as sequence number-based measurements.

To set up these types of measurements follow the advice in the N2X Online help. Figure 10 shows an example of stream based statistics set up for packet loss for our configured profile.

► Step 11.

Select Setup button from the Results side of the GUI. (Figure 10)
Step 12.
Select "Stream" tab and select streams of interest (in this example we only have one stream – see N2X help for how to use field modifiers to increment more) (Figure 11)

Step 13.
Select "Measurements" tab and select measurements of interest ie. packet loss, sequence errors etc. (Figure 12)
Delay measurements

These are based on timestamps inserted in transmitted PDUs, and appended to received ones by N2X. With no mechanism to synchronise absolute timestamps between remote N2X systems, clearly we do not have the ability to measure absolute delay end-to-end. But if you are able to arrange for your system to return the transmitted PDUs to the point of origin (ie, by swapping source and destination IP address at a remote loopback point within a router – this may be a maintenance mode), then the N2X will measure round-trip latency. Clearly, if the round trip latency is less than the end-to-end latency spec then all is well. If it exceeds the end-to-end spec then it is almost always reasonable to apportion half the round-trip latency to each direction.

► Step 14.
Configuring for round trip latency – select latency measurement as required from measurement table (Figure 12)

Delay variation (latency variation or packet Jitter).

From its release 6.9 (August 2007), N2X has been able to compute both latency and latency variation in real-time, and display the results directly from the GUI in real-time. In end-to-end mode, clearly the computed absolute delay values will be arbitrary, since timestamps at each end are not synchronised. But provided the configurations of the N2X systems at both ends are the same, and that the traffic generated is constant traffic, not burst traffic, with a consistent (unchanging) frame/packet length. The latency variation results will be valid since they are based on differences between successive receive timestamps. The overall accuracy of such end-to-end latency variation measurements will be a little less than for round-trip because the clocks in the two N2X systems may drift very slightly relative to each other.

Our accuracy for this end to end jitter measurement is as follows:

1. Base measurement error for latency variation is ±30 ns.
2. At frame rates slower than 1000 frames per second, additive measurement error may occur, to a maximum of +/-3us at 1 frame per second (our lowest supported frame rate) though the extent of such error is on a system by system basis, and will typically be much lower, and not be observable until frames rates much lower than 1000 frames per second.

► Step 15.
To set up latency variation use the N2X histogram capability (Figure 13) – see N2X online help for information on how to set this up. Setting it up for end to end tests is exactly the same as if setting it up for single end testing. Make sure both ports are selected and available for real time measurements.

Figure 13. N2X real time jitter histograms
The Remote N2X

► Step 16.

Save the configuration (see again N2X Online help for details)

► Step 17.

Connect to the remote controller and load up the saved configuration file on to the equivalent ports 101/1 and 101/2.

The N2X rackmount controllers allow you to use a second NIC card to connect to a WAN so you can use this to open up a remote desktop session (or whatever remote control you wish to use) on the remote controller and control both controllers from the same screen. We advise using remote desktop to connect to the remote controller – more details on this can be found in the N2X installation guide. If you wish to use a laptop controller then you will need to supply your own second NIC card and some method (Terminal Services, VNC etc) to communicate with the second controller.

► Step 17.

Now if you save that configuration – copy it across to your remote controller (easiest way is by sharing a drive), you should be able to load it on the second N2X system, and it will then have the same traffic configuration. (Figure 14)

Now once traffic is being transmitted, we can see the transmit and receive statistics for each port and each stream. You can then go ahead and make the measurements described above.

Note – if you are also using protocol emulations (eg., BGP, OSPF etc) to connect to the device or network then these will work independently from the traffic so will have to be configured independently on each session.