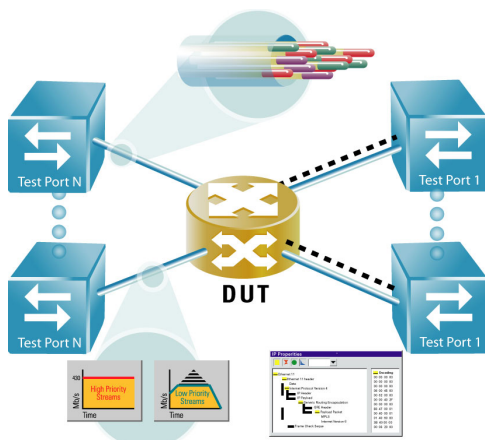




Agilent N2X Packets and Protocols Testing Quality of Service

Application Note



Testing network devices has never been easier!

- Fine-grained measurements on up to 32k customers or services
- Quick and easy stream creation
- Powerful PDU builder designed for future flexibility

Test your **quality of service** application with Agilent's multi-port Packets and Protocols Application.

In the context of networking, quality of service (QoS) refers to various technologies in which traffic flows are classified and given forwarding preference on the basis of assigned priority levels. QoS strategies create better utilization of network resources by giving delay-sensitive and mission-critical applications precedence over lower-priority streams during periods of network congestion.

QoS priority information is carried at Layer 2 in the VLAN tag's user priority field and at Layer 3 in the IP packet header's IP Precedence or Differentiated Services Code Point (DSCP) field. Since QoS agreements must be based on realistic guarantees, verifying that a device can drop lower-priority traffic when its output queues are oversubscribed is an important aspect of any test plan. This application note explains how to use Agilent N2X to measure a device's ability to forward multiple QoS traffic flows correctly as network congestion increases.



Testing with Agilent N2X

Agilent N2X is the industry's most comprehensive test solution for testing the development and deployment of network services for converging network infrastructures. Service providers, network equipment manufacturers (NEMs) and component manufacturers can verify service attributes of entire networks end-to-end, while also isolating problems down to individual networking devices and subsystems.

Agilent N2X incorporates the strength of the RouterTester 900 to deliver unparalleled test realism to verify the ultimate performance, scalability and resilience of carrier grade services and infrastructure.

The N2X Packets and Protocols application enables N2X to verify the traffic forwarding performance, protocol scalability and services delivering capabilities of switching and routing devices across the enterprise, metro/edge and core.

A powerful and flexible PDU builder makes it easy to build streams of Layer-2 Layer-7 Protocol Data Units (PDUs) containing multiple encapsulations and even proprietary formats. With the PDU builder, you can define a packet length distribution and common header type, and then edit any field, including the payload. You can also set a field modifier to vary a header field's values, creating a separate flow or measurable stream for each one. This tool reduces the time needed to generate multi-encapsulated traffic types thereby allowing you to get more out of your testing time.

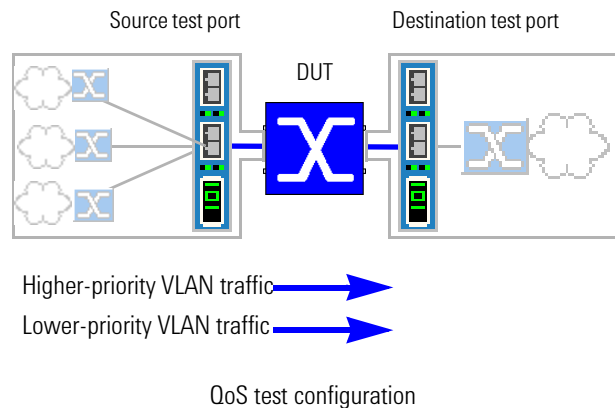
Users can also generate and analyze more streams per port than any other tester available (up to 32,768 transmit and receive streams per port), making it easy to scale your tests beyond the maximum performance parameters of your network or device. Your test can include 256 test ports per system, with 15 traffic profiles and up to 1023 - 4095 stream groups per port, depending on the port type. In total, the Traffic Generation and Analysis application can generate and measure statistics on 32,768 streams per port, using either four separate measurements over 32,768 streams or twelve measurements over 4,096 streams.

Quality of Service (QoS) test

This application note describes how to test a device's ability to apply the correct quality of service to VLAN traffic with different priority levels as network congestion increases.

Test configuration

As shown in the illustration below, a source test port sends VLAN traffic with varying priority levels to a destination test port through the system under test (DUT). The traffic load is increased in regular increments while performance statistics are taken on the destination test port. In this test the DUT is a switch or switch-enabled router.



Because N2X can generate and measure Layer-2 or Layer-3 traffic with equal facility, you can easily adapt this test to send IP traffic with varying DSCP service levels. You can also change the packet size, traffic profile, and other important test parameters.

Test summary

Step 1: Select test modules and ports. Configure two test ports on a Gigabit Ethernet interface.

Step 2: “Teach” DUT the addresses of simulated hosts. On the destination test port, use the new PDU builder to define an Ethernet stream containing a range of source MAC addresses to simulate hosts behind the port, then send the traffic from the destination test port to the source test port to teach the DUT the addresses.

Step 3: Define the traffic with different priority levels. On the source test port, define eight separate stream groups with different VLAN user priority levels and VLAN IDs, and arrange them on four profiles.

Step 4: Set the traffic profile properties. Define each traffic profile as constant or bursty, set the offered load, and specify the number of packets to send (e.g., continuous stream, n packets, or just one packet).

Step 5: Set up the statistics to view. Configure the destination test port to display a range of port- and stream-level performance measurements.

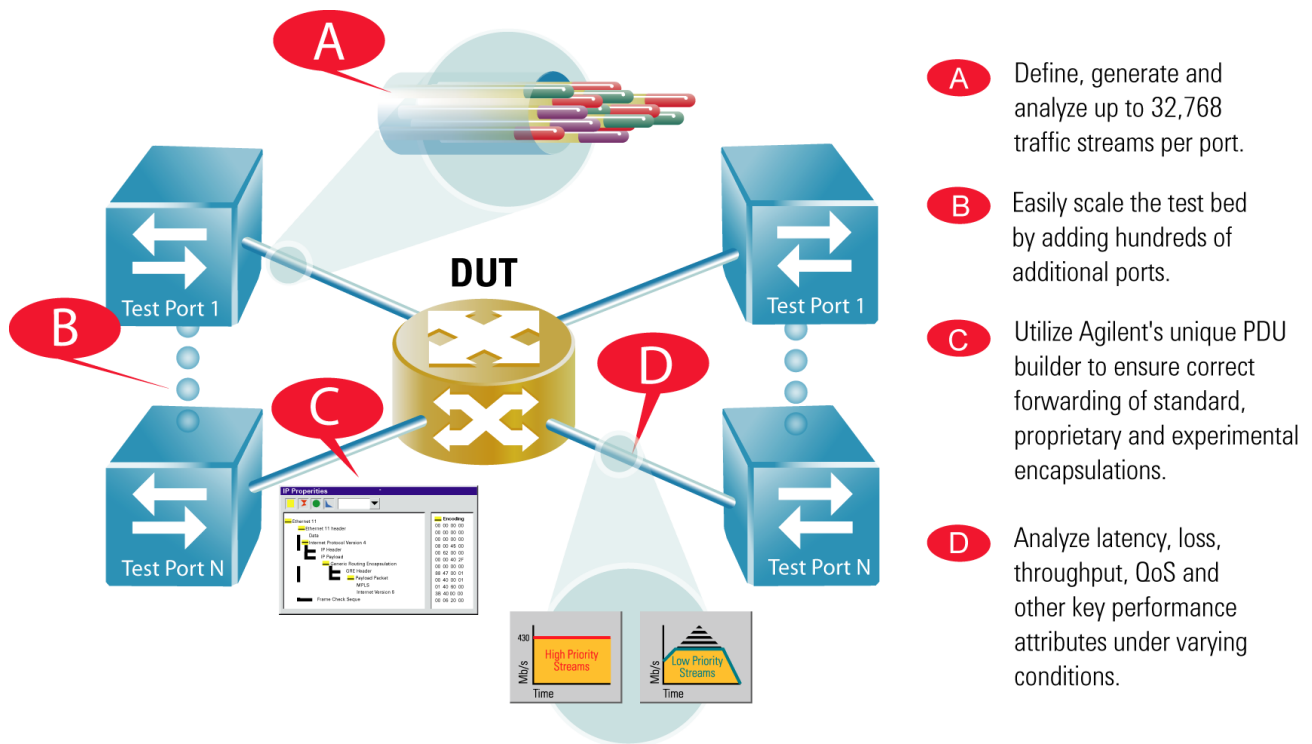
Step 6: Benchmark performance measurements. Start with an offered load that does not oversubscribe the DUT’s output port to benchmark the DUT’s performance.

Step 7: Oversubscribe the DUT’s output port. Move N2X’s dynamic slider bar to gradually increase the offered load while you view real-time statistics to verify that the DUT drops lower-priority traffic before higher-priority traffic. You can also view the effect of oversubscription on the DUT’s general performance.

Step 8: Create separate streams to analyze problems. If you notice that the DUT is incorrectly dropping traffic from high-priority flows, change the packet template for that stream group to create separate streams for each VLAN ID to help isolate the problem by obtaining finer-grained statistics.

Step 9: Stop the test. If you are sending traffic in Continuous mode, you must manually stop the test.

Step 10: Save the test configuration. You can save the entire test configuration as an XML file, including any profiles and streams you have defined.



- A** Define, generate and analyze up to 32,768 traffic streams per port.
- B** Easily scale the test bed by adding hundreds of additional ports.
- C** Utilize Agilent's unique PDU builder to ensure correct forwarding of standard, proprietary and experimental encapsulations.
- D** Analyze latency, loss, throughput, QoS and other key performance attributes under varying conditions.

The image shows two windows from the Agilent N2X software. The left window, titled "RouterTester 900: Session 1 (stannard) on BNA-STANNARD", displays a traffic profile configuration table. The right window, titled "Priority 0 StreamGroup Properties", shows the configuration for a specific stream group.

Traffic Profile Configuration Table:

Profile	Load	Stream Group	# Streams	Packet	Le
Profile 1	10.0%	→ Priority 0 StreamGroup	100	IPv4	
Profile 2	10.0%	→ Priority 1 StreamGroup	100	IPv4	
Profile 3	10.0%	→ Priority 2 StreamGroup	100	IPv4	
Profile 4	10.0%	→ Priority 3 StreamGroup	100	IPv4	
Profile 5	0.0%	→ Priority 4 StreamGroup	100	IPv4	
Profile 6	0.0%	→ Priority 5 StreamGroup	100	IPv4	
Profile 7	0.0%	→ Priority 6 StreamGroup	100	IPv4	
Profile 8	0.0%	→ Priority 7 StreamGroup	100	IPv4	
Profile 9	0.0%				

Priority 0 StreamGroup Properties:

- Destination address:** [Increment]
 - From: 00:00:C0:00:00:00
 - To: 00:00:C0:00:27:0F
 - Count: 10000
 - Step: 1
 - Left-shift (bits): 0
 - Generate stream IDs: No
- Source address:** 00:00:C0:01:01:02
- VLAN tag:**
 - VLAN tag protocol ID: 0x8100
 - VLAN user priority: 7
 - VLAN canonical format indicator: 0
- VLAN ID:** [Increment]
 - From: 700
 - To: 799
 - Count: 100
 - Step: 1
 - Left-shift (bits): 0
 - Generate stream IDs: Yes

Annotations:

- "Create a separate traffic profile for each DUT buffer queue" points to the Profile 1-4 rows in the traffic profile table.
- "Assign a unique VLAN user priority value for each stream group" points to the 'VLAN user priority' field in the stream group properties.
- "Apply a field modifier to the VLAN ID field to vary its value" points to the 'VLAN ID' field in the stream group properties.
- "Generate a separate measurable stream for each VLAN ID value" points to the 'Generate stream IDs' checkbox in the 'VLAN ID' section of the stream group properties.

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