

Agilent N2X  
**Stateful TCP and Data  
Application Traffic  
and Measurement**  
*Integrated L2-7 Solution*



N5575A and N5576A  
Technical Data Sheet

**The Agilent N2X Integrated L2-7 Solution is the first to provide integrated L2-7 application traffic generation and quality-of-service measurements, with the capability to load routers and broad-band network gateways with realistic, dynamic and repeatable TCP sessions at scale.**



**Agilent Technologies**

## Key Features

- **Characterize L4 forwarding performance with “Connection Blasting”**
- **Load a GbE pipe with stateful TCP traffic at line rate**
- **Emulate a fully-featured TCP stack: fast re-transmit, slow start, congestion avoidance**
- **Higher-layer application traffic over active TCP connections**
- **Real-time goodput measurements on TCP traffic**
- **Integrated on same physical interface and software application as stateless N2X traffic**

## Product Overview

Agilent N2X is the industry’s most comprehensive test solution for testing the development and deployment of services in a converged infrastructure. Next-generation networks are responsible for delivering services in a multiplay environment where services such as voice and video must be prioritized over bandwidth hogs such as peer-to-peer applications running over stateful TCP connections. Prioritization of revenue-generating services over lower-priority traffic is mission critical for any service providers’ business to ensure that subscribers receive the quality of service and quality of experience they expect.

Consequently, the bar has been raised for testing of network elements to go beyond stateless traffic generation and measurement to a paradigm of stateful “connection blasting” to determine device performance in the context of dynamic TCP flows. While network elements such as routers and BNGs may not participate directly in the TCP protocol exchange, various queuing mechanisms such as RED or WRED can dramatically affect the performance of a TCP exchange. Furthermore, more advanced architectures are actively inspecting individual flows then prioritizing those flows by application according to service provider policy, for example, prioritizing VoIP traffic over peer-to-peer traffic which consumes excessive bandwidth but brings in relatively little revenue and profit.

The Agilent N2X Integrated L2-7 Solution is the first to load routers and other forwarding devices with realistic, dynamic and repeatable TCP sessions at scale, and provide integrated L2-7 application traffic generation and quality-of-service measurements.

N2X provides a unique FPGA-based solution that can “blast” the device under test with tens of thousands of TCP connections, and measure key TCP-centric statistics for throughput and connection establishment. The unique programmable hardware implementation provides the world’s first solution that rapidly scales to tens of thousands of flows with an emulated fully-featured TCP stack, including congestion control mechanisms such as fast re-transmit, slow start, and congestion avoidance. These features are implemented in hardware to ensure tests are deterministic and can be repeated with consistent results. N2X overcomes the reliability issues associated with CPU-based solutions that are subject to sporadic activity such as caching, which can result in different test measurements for identical test runs and compromise the integrity of the test process. Further realism is provided by simulating transactions of the most common applications, over stateful TCP connections. Thirteen application types are supported (please see below for a complete list) covering P2P, mail, web, file transfer, and instant messaging.

## Product Features

The Agilent N2X Integrated L2-7 Solution includes the N5575A Stateful TCP Traffic and Measurement Software, and the complementary N5576A Data Application Simulation Software that enables higher-layer application traffic to be transmitted over active TCP connections. The combined solution provides the following functionality:

### Flexible Connection Blasting

N2X's stateful TCP traffic model provides unprecedented flexibility and ease of use to quickly find the non-drop rate of forwarding devices in the presence of stateful traffic. N2X is the only solution that offers a dynamic traffic load 'slider bar' that allows users to immediately adjust traffic load on the fly. By comparison, other solutions require the user to completely stop a test session, set a new bandwidth level, and then re-start traffic – a tedious and time-consuming procedure.

### Line-rate at GbE

The unique FPGA implementation of N2X's stateful TCP traffic model allows you to fill a gigabit Ethernet interface with stateful traffic, even for very short (less than 1 kilobyte) packet lengths. This differs from CPU-based solutions which typically max out quickly at a few hundred megabits per second. Consequently, achieving line-rate with a CPU-based solution requires multiple test ports, making the overall solution prohibitively expensive.

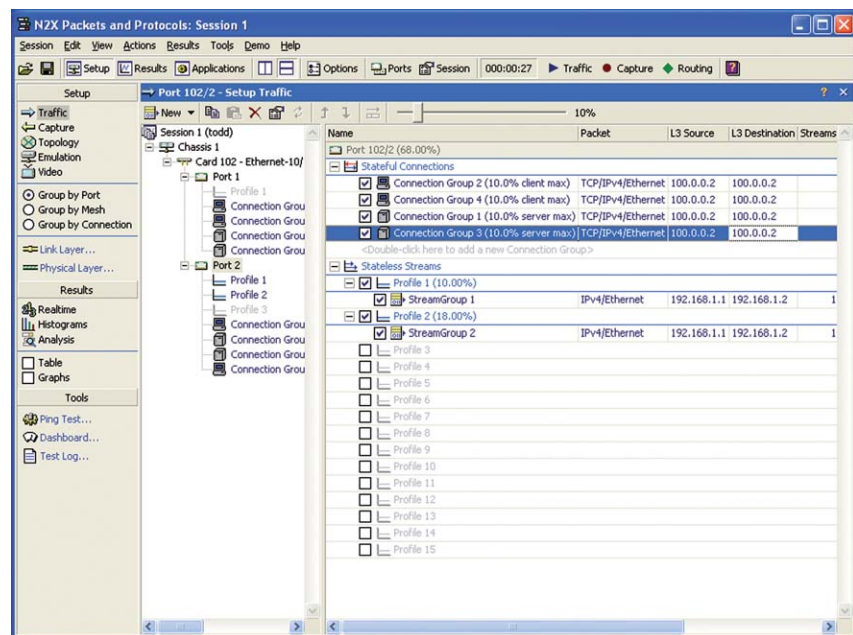


Figure 1: Integrated Stateful and Stateless Traffic Generation and Measurement

### Fully-Featured TCP Stack

Not all TCP implementations are the same – some vendors actually implement two solutions: a fully-featured implementation that can only achieve limited bandwidth, and a cut-down version which scales well, but strips away the essential elements of TCP, rendering the results of such tests meaningless. N2X is the only solution that can scale while maintaining a fully-featured TCP implementation, specifically providing retransmission (fast re-transmit) even at line rate.

### Goodput Measurements

The N2X stateful TCP implementation provides real-time measurement with nano-second accurate statistics including throughput for L2, L3 and L4 (=goodput). Statistics are also provided for *connections to count attempted, successful and failed connections*, as well as the *number of active connections*. TCP-specific statistics are provided to count fast retransmit occurrences, current round-trip time, misdirected packets and checksum errors.

### Integrated Solution

The Agilent N2X brings unique integration to the market in two key ways. First, only the N2X integrates both L2-3 and L4-7 testing on the same software application running simultaneously on the same physical port. Unlike solutions which are on two separate hardware platforms, or perhaps a common hardware platform but mutually exclusive software applications, the Agilent N2X brings L2-3 testing and L4-7 testing conveniently together on the same test system, simultaneously on the same physical port, and in the same integrated software application.

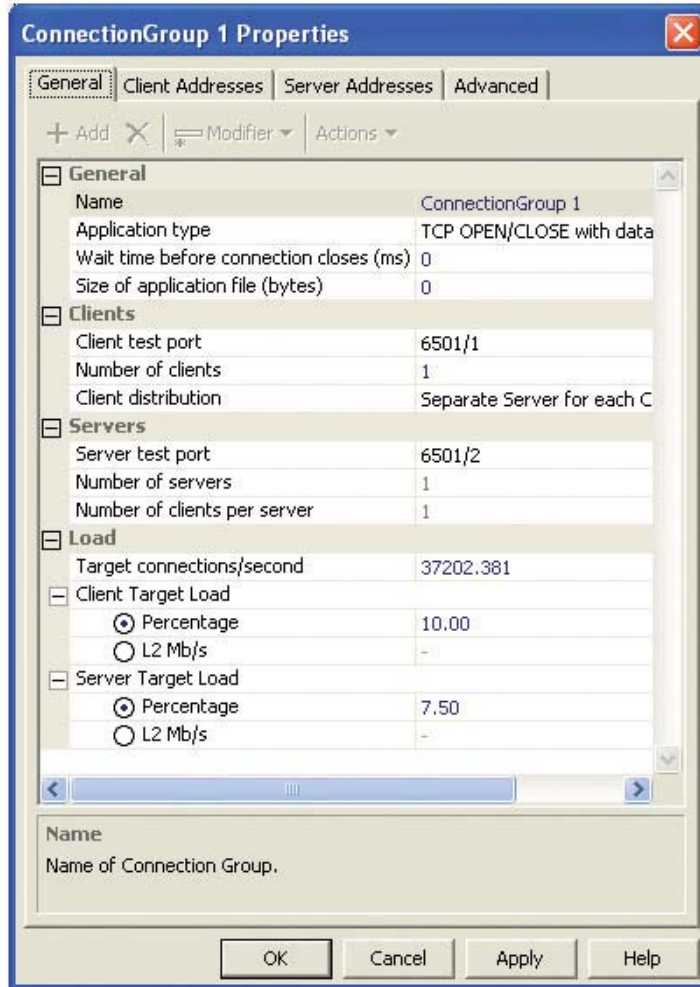


Figure 2: Defining stateful TCP traffic on the Agilent N2X

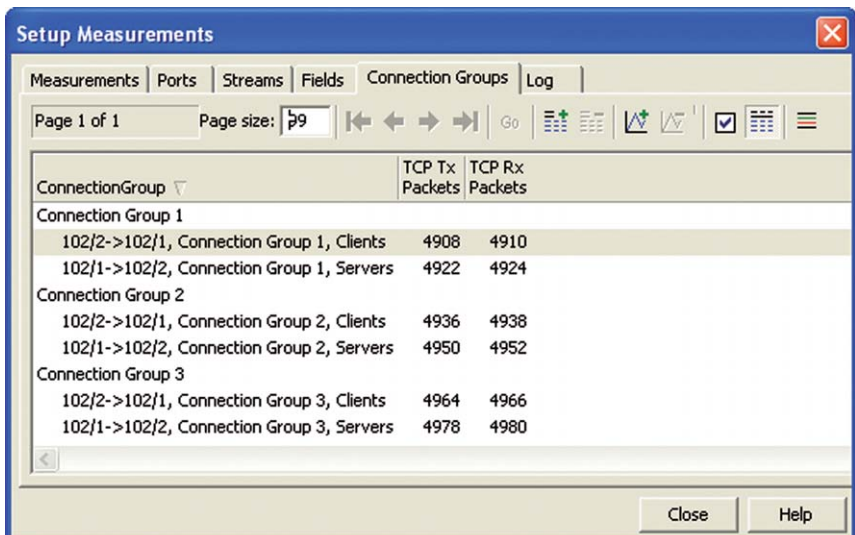


Figure 3: Real-time Stateful TCP Measurements

Second, only the N2X provides tightly integrated stateful and stateless traffic generation and measurement in the same test solution. With 32K streams and flexible PDU definitions, the N2X has provided powerful and flexible traffic generation and analysis for several years. With the addition of a highly-scalable stateful traffic and measurement solution to the Packets and Protocols application, N2X users now have access to two traffic and analysis models uniquely integrated into the same software application and running simultaneously on the same physical interface.

### **Higher-Layer Application Traffic (N5576A only)**

Once stateful TCP connections have been established, N2X simulates the 13 common TCP-based applications over those connections. Those applications are:

- Web-surfing: HTTP 1.0, HTTP 1.1)
- File transfer: FTP
- Peer-to-peer: BitTorrent, eDonkey, Gnutella, Kazaa
- E-mail: IMAP, POP3, SMTP
- Instant Messaging: WindowsMessenger, YahooIM
- Video: YouTube
- Voice: SIP

Application transactions are simulated by a sequence of messages exchanged between clients and servers (or client to client in the case of peer to peer) that are simulated on N2X test ports. Furthermore, again due to the FPGA implementation, the Agilent N2X delivers unprecedented performance for simulated applications – see technical specifications for details.

### **Deterministic Repeatability**

With CPU-based solutions, a CPU is responsible for various tasks such as caching, etcetera, that can randomly interrupt the TCP emulation function, resulting in different measurement results for seemingly identical test runs. The same test performed five times can produce five different results. With a hardware-based solution, results are repeatable and deterministic, allowing the developer to get consistent results, and determine the effects of modified design.

### **Hardware Requirements**

The N5575A Stateful TCP Traffic and Measurement Software and N5576A Data Application Software are supported on the N5551A/B N2X 4 Port 10/100/1000 XR-2 test cards.

### **Powerful Scripting Environment**

As with other Agilent N2X features, all functionality is accessible via the Tcl API interface, allowing the user to automate testing into a scripted environment.

### **Remote Access**

The Agilent N2X Integrated L2-7 solution can be controlled via the local system controller, or can be controlled remotely from any PC attached to a corporate LAN.

## Technical Specifications

This section describes the features of the Stateful TCP Traffic and Measurement Solution that are accessible using the GUI and Tcl/Tk scripting environment.

### N5575A

#### TCP Features

<b>Fast Re-transmit</b>	• Enable/Disable
<b>Re-transmission timeout</b>	• Configurable
<b>Maximum Window Size</b>	• Configurable
<b>Maximum Segment Size</b>	• Configurable
<b>Slow Start</b>	• Enable/Disable
<b>Teardown</b>	• 3-way/4-way/reset selectable

#### Supported Applications

<b>TCP</b>	• TCP open/close • TCP bulk data transfer
------------	--

#### Scalability

<b>Scalability Bandwidth</b>	• Line rate on GbE interface with packet size > 1 kilobyte
<b>Simultaneous TCP Connections</b>	• 32,000 connections/port-pair
<b>Ports</b>	• Maximum 64 ports/system

#### Performance

<b>TCP Connections set up rate</b>	• Up to 372,023 connections/second/port-pair
<b>Ports</b>	• Maximum 64 ports/system

#### Measurements

<b>Port and group level</b>	<ul style="list-style-type: none"> <li>• TCP active connections</li> <li>• TCP established connections</li> <li>• TCP attempted connections</li> <li>• TCP failed establishment attempts</li> <li>• TCP failed connections after establishment</li> <li>• TCP timeouts</li> <li>• TCP fast retransmit occurrences</li> <li>• TCP packets Tx'd</li> <li>• TCP packets Rx'd</li> <li>• TCP L2 octets Tx'd</li> <li>• TCP L2 octets Rx'd</li> <li>• TCP goodput octets</li> <li>• TCP goodput packets</li> <li>• TCP packets not received</li> <li>• TCP L2 Tx throughput</li> <li>• TCP L2 Rx throughput</li> </ul>
<b>Group Level only</b>	<ul style="list-style-type: none"> <li>• Current Round Trip Time (RTT)</li> <li>• TCP Packets not received</li> </ul>
<b>Port Level only</b>	<ul style="list-style-type: none"> <li>• Mis-directed TCP packets</li> </ul>

### N5576A

#### Supported Applications

<b>HTTP</b>	<ul style="list-style-type: none"> <li>• HTTP 1.0 &amp; 1.1 get (html)</li> <li>• HTTP 1.0 &amp; 1.1 put (jpeg)</li> </ul>
<b>FTP</b>	<ul style="list-style-type: none"> <li>• FTP get</li> <li>• FTP put</li> </ul>
<b>BitTorrent</b>	<ul style="list-style-type: none"> <li>• Data transfer</li> </ul>
<b>eDonkey</b>	<ul style="list-style-type: none"> <li>• Connect, data transfer, search</li> </ul>
<b>Gnutella</b>	<ul style="list-style-type: none"> <li>• Connect, data transfer, search</li> </ul>
<b>IMAP</b>	<ul style="list-style-type: none"> <li>• Login and retrieve mail</li> </ul>
<b>Kazaa</b>	<ul style="list-style-type: none"> <li>• Data transfer</li> </ul>
<b>POP3</b>	<ul style="list-style-type: none"> <li>• Login and retrieve mail</li> </ul>
<b>SIP</b>	<ul style="list-style-type: none"> <li>• Connection</li> </ul>
<b>SMTP</b>	<ul style="list-style-type: none"> <li>• Data transfer</li> </ul>
<b>WindowsMessenger</b>	<ul style="list-style-type: none"> <li>• Login and data transfer</li> </ul>
<b>Yahoo!IM</b>	<ul style="list-style-type: none"> <li>• Login and message exchange</li> </ul>
<b>YouTube</b>	<ul style="list-style-type: none"> <li>• Data transfer</li> </ul>

#### Performance

<b>BitTorrent data transfer</b>	• Up to 164,042 connections/second/port-pair
<b>FTP PUT or GET data transfer</b>	• Up to 372,024 connections/second/port-pair
<b>HTTP 1.0 GET</b>	• Up to 216,637 connections/second/port-pair
<b>HTTP 1.1 GET</b>	• Up to 216,637 connections/second/port-pair
<b>eDonkey data transfer</b>	• Up to 98,970 connections/second/port-pair
<b>Gnutella data transfer</b>	• Up to 153,563 connections/second/port-pair
<b>IMAP login and retrieve email</b>	• Up to 15,288 connections/second/port-pair
<b>Kazaa data transfer</b>	• Up to 72,590 connections/second/port-pair
<b>POP3 login and retrieve email</b>	• Up to 54,162 connections/second/port-pair
<b>SIP</b>	• Up to 55,978 connections/second/port-pair
<b>SMTP data transfer</b>	• Up to 97,504 connections/second/port-pair
<b>WindowsMessenger login and message exchange</b>	• Up to 70,902 connections/second/port-pair
<b>Yahoo!IM login and message exchange</b>	• Up to 37,247 connections/second/port-pair
<b>YouTube data transfer</b>	• Up to 13,283 connections/second/port-pair

This page intentionally left blank.

## Agilent N2X

Agilent's N2X multi-service tester combines leading-edge services with carrier grade infrastructure testing and emulation. The N2X solution set allows network equipment manufacturers and service providers to more comprehensively test new services end-to-end, resulting in higher quality of service and lower network operating costs.

## Software and Support Agreement

To protect your investment in the Agilent N2X, every new system includes an initial 12-month comprehensive system-based warranty and Software and Support Agreement (SSA).

Renewing Agilent support services ensures uninterrupted technical support and software upgrades, giving you confidence in N2X throughout the life of your system.

The N2X technical support portion of your SSA includes assistance with product operation and measurements, and verification that the N2X equipment is in correct working order.

## Warranty and Support

### Hardware Warranty

All N2X hardware is warranted against defects in materials and workmanship for a period of 1 year from the date of shipment.

### Software Warranty

All N2X software is warranted for a period of 90 days.

The applications are warranted to execute and install properly from the media provided.

This warranty only covers physical defects in the media, whereby the media is replaced at no charge during the warranty period.

## Ordering Information

To order and configure the test system, consult your local Agilent field engineer.

## Sales, Service and Support

N2X must be serviced by an approved Agilent Technologies service centre, please contact us for more information.

### United States:

Agilent Technologies  
Test and Measurement Call Center  
P.O. Box 4026  
Englewood, CO 80155-4026  
1-800-452-4844

### Canada:

Agilent Technologies Canada Inc.  
2660 Matheson Blvd. E  
Mississauga, Ontario  
L4W 5M2  
1-877-894-4414

### Europe:

Agilent Technologies  
European Marketing Organisation  
P.O. Box 999  
1180 AZ Amstelveen  
The Netherlands  
(31 20) 547-2323

### United Kingdom

07004 666666

### Japan:

Agilent Technologies Japan Ltd.  
Measurement Assistance Center  
9-1, Takakura-Cho, Hachioji-Shi,  
Tokyo 192-8510, Japan  
Tel: (81) 426-56-7832  
Fax: (81) 426-56-7840

### Latin America:

Agilent Technologies  
Latin American Region Headquarters  
5200 Blue Lagoon Drive, Suite #950  
Miami, Florida 33126  
U.S.A.  
Tel: (305) 269-7500  
Fax: (305) 267-4286

### Asia Pacific:

Agilent Technologies  
19/F, Cityplaza One, 1111 King's Road,  
Taikoo Shing, Hong Kong, SAR  
Tel: (852) 3197-7777  
Fax: (852) 2506-9233

### Australia/New Zealand:

Agilent Technologies Australia Pty Ltd  
347 Burwood Highway  
Forest Hill, Victoria 3131  
Tel: 1-800-629-485 (Australia)  
Fax: (61-3) 9272-0749  
Tel: 0-800-738-378 (New Zealand)  
Fax: (64-4) 802-6881

This information is subject to change without notice.

Printed on recycled paper

© Agilent Technologies, Inc. 2008

Printed in USA. September 22, 2008

5989-6439EN

