

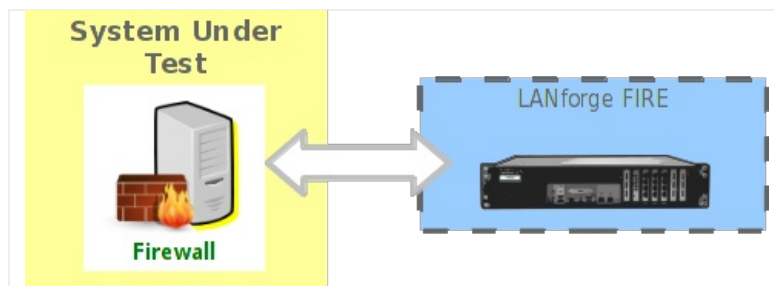
## Generating Traffic to a Firewall

**Goal:** Set up and run traffic to test a firewall.

In this test scenario, LANforge-FIRE is used to generate traffic to a firewall DUT in order to measure the following benchmarks:

- **UDP Throughput** - Maximum payload bits per second with a UDP traffic flow.
- **TCP Throughput** - Maximum payload bits per second with a TCP traffic flow.
- **TCP Concurrent Connections** - Maximum number of simultaneous TCP connections.
- **TCP Connections per Second** - Maximum number of established TCP connections per second.

**NOTE:** If you are attempting to run this test scenario, you will need a LANforge license key that enables the correct number of ports and multi-connections. Please contact us at [support@candelatech.com](mailto:support@candelatech.com) for assistance.



1. The **UDP Throughput** test will use a scripted Layer-3 connection to vary the rate and payload size to determine the bi-directional UDP throughput of the DUT across the scripted parameters.

A. On the Port Manager tab, set up the LANforge ports with valid IP addresses.

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File-IO Layer-4 Generic Test Mgr Resource Mgr Serial Spans PPP-Links Port Mgr Messages

Status Layer-3 L3 Endps VoIP/RTP VoIP/RTP Endps Armageddon WanLinks Collision-Domains

Disp: 192.168.100.169:0.0 Sniff Packets Clear Counters Reset Port Delete

Rpt Timer: 30000 Apply View Details Create Modify Batch Modify

All Ethernet Interfaces (Ports) for all Resources.

| Port   | Phan...                  | IP              | Alias | RX Bytes | RX Pkts | Pps RX | bps RX | TX Bytes | TX Pkts | Pps TX | bps TX | Collisions |
|--------|--------------------------|-----------------|-------|----------|---------|--------|--------|----------|---------|--------|--------|------------|
| 1.1.00 | <input type="checkbox"/> | 192.168.100.173 | eth0  | 132,975  | 1,219   | 7      | 6,644  | 846,756  | 1,034   | 6      | 39,572 | 0          |
| 1.1.01 | <input type="checkbox"/> | 0.0.0.0         | eth2  | 0        | 0       | 0      | 0      | 0        | 0       | 0      | 0      | 0          |
| 1.1.02 | <input type="checkbox"/> | 0.0.0.0         | eth3  | 0        | 0       | 0      | 0      | 0        | 0       | 0      | 0      | 0          |
| 1.1.03 | <input type="checkbox"/> | 0.0.0.0         | eth4  | 0        | 0       | 0      | 0      | 0        | 0       | 0      | 0      | 0          |
| 1.1.04 | <input type="checkbox"/> | 0.0.0.0         | eth5  | 0        | 0       | 0      | 0      | 0        | 0       | 0      | 0      | 0          |
| 1.1.05 | <input type="checkbox"/> | 0.0.0.0         | eth1  | 0        | 0       | 0      | 0      | 0        | 0       | 0      | 0      | 0          |
| 1.1.06 | <input type="checkbox"/> | 192.168.0.2     | eth6  | 0        | 0       | 0      | 0      | 468      | 6       | 0      | 36     | 0          |
| 1.1.07 | <input type="checkbox"/> | 172.16.0.1      | eth7  | 0        | 0       | 0      | 0      | 468      | 6       | 0      | 36     | 0          |
| 1.1.08 | <input type="checkbox"/> | 0.0.0.0         | eth8  | 0        | 0       | 0      | 0      | 0        | 0       | 0      | 0      | 0          |
| 1.1.09 | <input type="checkbox"/> | 0.0.0.0         | eth9  | 0        | 0       | 0      | 0      | 0        | 0       | 0      | 0      | 0          |
| 1.1.10 | <input type="checkbox"/> | 0.0.0.0         | eth10 | 0        | 0       | 0      | 0      | 0        | 0       | 0      | 0      | 0          |
| 1.1.11 | <input type="checkbox"/> | 0.0.0.0         | eth11 | 0        | 0       | 0      | 0      | 0        | 0       | 0      | 0      | 0          |
| 1.1.12 | <input type="checkbox"/> | 0.0.0.0         | eth12 | 0        | 0       | 0      | 0      | 0        | 0       | 0      | 0      | 0          |
| 1.1.13 | <input type="checkbox"/> | 0.0.0.0         | eth13 | 0        | 0       | 0      | 0      | 0        | 0       | 0      | 0      | 0          |

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B. On the Layer-3 tab, create a UDP connection.

- A. Set Endpoint A to use the DUT WAN port.
- B. Set Endpoint B to use the DUT LAN port.
- C. Make sure CX Type is LANforge / UDP then select **Apply**.

C. Select the **Script** button to set up the scripting parameters.

- A. Set up the script to iterate over the rates.
- B. Specify the payload sizes to be tested.

For more information see [LANforge FIRE Cookbook example: Scripted Layer-3 Test](#)

D. Highlight the connection and select the **Start** button.

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Status Layer-3 L3 Endps VoIP/RTP VoIP/RTP Endps Armageddon WanLinks Collision-Domains

Rpt Timer (ms): 3000 Go Test Manager all Select All Start Stop Quiesce Clear

View 0 - 200 Go Display Create Modify Delete

Cross Connects for Selected Test Manager

| Name     | Type   | State | Pkt Tx A->B | Pkt Tx A<-B | Rate A->B | Rate A<-B | Rx Drop A | Rx Drop B | Rpt Timer | EID | Endpoints (A <-> B) |
|----------|--------|-------|-------------|-------------|-----------|-----------|-----------|-----------|-----------|-----|---------------------|
| udp-test | LF/UDP | Run   | 123,666     | 124,196     | 1,184,398 | 1,184,746 | 0         | 0.254     | 1000      | 1.8 | udp-test-A <=> udp- |

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E. The final test report shows the results of the test run. Here we can see that the DUT has the best bi-directional throughput with 1460Byte payloads at 24.9Mbps.

Script Report for Endpoint: udp-test-A

Started test at: Thu Sep 23 07:28:03 2010  
 Iteration Duration: 60000ms Pause Duration: 5000ms  
 Number of running endpoints at end of first iteration: 2  
 System Load at end of first iteration: 0.05

Endpoint Information:  
 Endpoint ID: udp-test-A Type: LANFORGE\_UDP Peer Endpoint ID: udp-test-B

Summary data for each iteration:

| ## | pld-size<br>- (bytes) | cfg-rate<br>(bps) | tx-bps<br>- | rx-bps<br>peer | rx-bps-LL<br>peer | tx-pps<br>- | rx-pps<br>peer | tx-pkts<br>- | rx-pkts<br>peer | cx-drops<br>peer | drop%<br>peer | rx-lat(ms)<br>peer |
|----|-----------------------|-------------------|-------------|----------------|-------------------|-------------|----------------|--------------|-----------------|------------------|---------------|--------------------|
| 0  | 60                    | 10000000          | 1313968     | 1313832        | 0                 | 2737        | 2737           | 164246       | 164229          | 17               | 0.010         | 319                |
| 1  | 128                   | 10000000          | 2787447     | 2787447        | 0                 | 2722        | 2722           | 163327       | 163327          | 0                | 0.000         | 263                |
| 2  | 256                   | 10000000          | 5516322     | 5516322        | 0                 | 2694        | 2694           | 161611       | 161611          | 0                | 0.000         | 205                |
| 3  | 512                   | 10000000          | 9993967     | 9993967        | 0                 | 2440        | 2440           | 146396       | 146396          | 0                | 0.000         | 0                  |
| 4  | 1024                  | 10000000          | 9993967     | 9993967        | 0                 | 1220        | 1220           | 73198        | 73198           | 0                | 0.000         | 0                  |
| 5  | 1280                  | 10000000          | 9994581     | 9994581        | 0                 | 976         | 976            | 58562        | 58562           | 0                | 0.000         | 0                  |
| 6  | 1460                  | 10000000          | 9993019     | 9993019        | 0                 | 856         | 856            | 51334        | 51334           | 0                | 0.000         | 0                  |
| 7  | 1472                  | 10000000          | 9994487     | 9994487        | 0                 | 849         | 849            | 50923        | 50923           | 0                | 0.000         | 0                  |
| 8  | 60                    | 15000000          | 1317586     | 1317586        | 0                 | 2745        | 2745           | 164701       | 164701          | 0                | 0.000         | 443                |
| 9  | 128                   | 15000000          | 2792550     | 2792550        | 0                 | 2727        | 2727           | 163626       | 163626          | 0                | 0.000         | 370                |
| 10 | 256                   | 15000000          | 5523149     | 5523149        | 0                 | 2697        | 2697           | 161811       | 161811          | 0                | 0.000         | 288                |
| 11 | 512                   | 15000000          | 10815556    | 10815556       | 0                 | 2641        | 2641           | 158431       | 158431          | 0                | 0.000         | 204                |
| 12 | 1024                  | 15000000          | 14991497    | 14991497       | 0                 | 1830        | 1830           | 109801       | 109801          | 0                | 0.000         | 0                  |
| 13 | 1280                  | 15000000          | 14991019    | 14991019       | 0                 | 1464        | 1464           | 87838        | 87838           | 0                | 0.000         | 0                  |
| 14 | 1460                  | 15000000          | 14990696    | 14990696       | 0                 | 1283        | 1283           | 77007        | 77007           | 0                | 0.000         | 0                  |
| 15 | 1472                  | 15000000          | 14989082    | 14989082       | 0                 | 1273        | 1273           | 76371        | 76371           | 0                | 0.000         | 0                  |
| 16 | 60                    | 20000000          | 19984952    | 1319512        | 0                 | 41635       | 2749           | 2498119      | 164939          | 2333180          | 93.397        | 471                |
| 17 | 128                   | 20000000          | 19985510    | 2825114        | 0                 | 19517       | 2759           | 1171026      | 165534          | 1005492          | 85.864        | 449                |
| 18 | 256                   | 20000000          | 5532058     | 5532058        | 0                 | 2701        | 2701           | 162072       | 162072          | 0                | 0.000         | 371                |
| 19 | 512                   | 20000000          | 10823885    | 10823885       | 0                 | 2643        | 2643           | 158553       | 158553          | 0                | 0.000         | 263                |
| 20 | 1024                  | 20000000          | 19985203    | 19985203       | 0                 | 2440        | 2440           | 146376       | 146376          | 0                | 0.000         | 1                  |
| 21 | 1280                  | 20000000          | 19986261    | 19986261       | 0                 | 1952        | 1952           | 117107       | 117107          | 0                | 0.000         | 0                  |
| 22 | 1460                  | 20000000          | 19987400    | 19987400       | 0                 | 1711        | 1711           | 102675       | 102675          | 0                | 0.000         | 0                  |
| 23 | 1472                  | 20000000          | 19986620    | 19986620       | 0                 | 1697        | 1697           | 101834       | 101834          | 0                | 0.000         | 0                  |
| 24 | 60                    | 25000000          | 24979984    | 1343464        | 0                 | 52042       | 2799           | 3122498      | 167933          | 2954565          | 94.622        | 469                |
| 25 | 128                   | 25000000          | 24983006    | 2851755        | 0                 | 24397       | 2785           | 1463848      | 167095          | 1296753          | 88.585        | 451                |
| 26 | 256                   | 25000000          | 19315678    | 5539908        | 0                 | 9431        | 2705           | 965889       | 162302          | 403587           | 71.319        | 449                |
| 27 | 512                   | 25000000          | 10834057    | 10834057       | 0                 | 2645        | 2645           | 158702       | 158702          | 0                | 0.000         | 321                |
| 28 | 1024                  | 25000000          | 20846592    | 16534323       | 0                 | 2545        | 2018           | 152685       | 121101          | 31584            | 20.686        | 207                |
| 29 | 1280                  | 25000000          | 24984576    | 24984576       | 0                 | 2440        | 2440           | 146394       | 146394          | 0                | 0.000         | 1                  |
| 30 | 1460                  | 25000000          | 24985856    | 24985856       | 0                 | 2139        | 2139           | 128352       | 128352          | 0                | 0.000         | 1                  |
| 31 | 1472                  | 25000000          | 24982588    | 24982588       | 0                 | 2121        | 2121           | 127289       | 127289          | 0                | 0.000         | 1                  |
| 32 | 60                    | 30000000          | 29977504    | 1320720        | 0                 | 62453       | 2752           | 3747188      | 165090          | 3582098          | 95.594        | 471                |
| 33 | 128                   | 30000000          | 29979699    | 2772036        | 0                 | 29277       | 2707           | 1756623      | 162424          | 1594199          | 90.754        | 457                |
| 34 | 256                   | 30000000          | 29977498    | 5595648        | 0                 | 14637       | 2732           | 878247       | 163935          | 714312           | 81.334        | 447                |
| 35 | 512                   | 30000000          | 10844706    | 10844706       | 0                 | 2648        | 2648           | 158858       | 158858          | 0                | 0.000         | 379                |
| 36 | 1024                  | 30000000          | 20856757    | 16537188       | 0                 | 2546        | 2019           | 152762       | 121124          | 31638            | 20.711        | 247                |
| 37 | 1280                  | 30000000          | 25577301    | 18959360       | 0                 | 2498        | 1852           | 149867       | 111090          | 38777            | 25.874        | 210                |
| 38 | 1460                  | 30000000          | 28829939    | 19782611       | 0                 | 2468        | 1694           | 148099       | 101623          | 46476            | 31.382        | 183                |
| 39 | 1472                  | 30000000          | 28997811    | 19803503       | 0                 | 2462        | 1682           | 147747       | 100901          | 46846            | 31.707        | 182                |

Close Save File

For more information see [Full script report for the UDP test.](#)

2. The **TCP Concurrent Connections** test will measure the maximum number of simultaneous TCP connections that the DUT can maintain at once.

A. On the Port Manager tab, create 5 MAC-VLANs on the LANforge port connected to the DUT LAN port.

The screenshot shows the 'Create VLANs on Port: 1.1.2' configuration window. The window is titled 'Create VLANs on Port: 1.1.2' and has a blue header bar. The main content area is divided into several sections, each marked with a circled number (1, 2, 3, 4) in the left margin.

- Section 1:** Radio buttons for selecting the VLAN type:  MAC-VLAN,  802.1Q-VLAN,  Redirect,  Bridge,  GRE Tunnel,  WiFi STA,  WiFi VAP,  WiFi Monitor, and  WiFi Virtual Radio.
- Section 2:** Configuration fields: Shelf: 1, Resource: 1 (ct503-60), Port: 6 (eth6).
- Section 3:** VLAN configuration fields: VLAN ID: (empty), Parent MAC: 00:90:0b:38:82:75, MAC Addr: xx:xx:xx:\*:\*:xx, Quantity: 5, DHCP-IPv4: , DHCP Client ID: None, IP Address: 192.168.0.201/24, IP Mask or Bits: (empty), Gateway IP: 192.168.0.1, Global IPv6: AUTO, Link IPv6: AUTO, IPv6 GW: AUTO.
- Section 4:** Security and other options: #1 Redir Name: (empty), #2 Redir Name: (empty), STA ID: (empty), WiFi AP: (empty), Key/Phrase: (empty),  WPA,  WPA2,  WEP,  Down.

At the bottom of the window, there are two buttons: 'Apply' and 'Cancel'.

B. Verify that the MAC-VLANs have correct IP addresses.

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File-IO Layer-4 Generic Test Mgr Resource Mgr Serial Spans PPP-Links Port Mgr Messages

Status Layer-3 L3 Endps VoIP/RTP VoIP/RTP Endps Armageddon WanLinks Collision-Domains

Disp: 192.168.100.169:0.0 Sniff Packets Clear Counters Reset Port Delete

Rpt Timer: 30000 Apply View Details Create Modify Batch Modify

All Ethernet Interfaces (Ports) for all Resources.

| Port   | Phan...                  | IP              | Alias  | RX Bytes   | RX Pkts | Pps RX | bps RX | TX Bytes   | TX Pkts | Pps TX | bps TX | Collisions | R |
|--------|--------------------------|-----------------|--------|------------|---------|--------|--------|------------|---------|--------|--------|------------|---|
| 1.1.00 | <input type="checkbox"/> | 192.168.100.173 | eth0   | 17,610,... | 188,904 | 9      | 8,141  | 91,531,... | 122,400 | 8      | 47,809 | 0          |   |
| 1.1.01 | <input type="checkbox"/> | 0.0.0.0         | eth2   | 0          | 0       | 0      | 0      | 0          | 0       | 0      | 0      | 0          |   |
| 1.1.02 | <input type="checkbox"/> | 0.0.0.0         | eth3   | 0          | 0       | 0      | 0      | 0          | 0       | 0      | 0      | 0          |   |
| 1.1.03 | <input type="checkbox"/> | 0.0.0.0         | eth4   | 0          | 0       | 0      | 0      | 0          | 0       | 0      | 0      | 0          |   |
| 1.1.04 | <input type="checkbox"/> | 0.0.0.0         | eth5   | 0          | 0       | 0      | 0      | 0          | 0       | 0      | 0      | 0          |   |
| 1.1.05 | <input type="checkbox"/> | 0.0.0.0         | eth1   | 0          | 0       | 0      | 0      | 0          | 0       | 0      | 0      | 0          |   |
| 1.1.06 | <input type="checkbox"/> | 192.168.0.2     | eth6   | 884        | 11      | 0      | 38     | 4,290      | 52      | 0      | 303    | 0          |   |
| 1.1.07 | <input type="checkbox"/> | 172.16.0.1      | eth7   | 0          | 0       | 0      | 0      | 0          | 0       | 0      | 0      | 0          |   |
| 1.1.08 | <input type="checkbox"/> | 0.0.0.0         | eth8   | 0          | 0       | 0      | 0      | 0          | 0       | 0      | 0      | 0          |   |
| 1.1.09 | <input type="checkbox"/> | 0.0.0.0         | eth9   | 0          | 0       | 0      | 0      | 0          | 0       | 0      | 0      | 0          |   |
| 1.1.10 | <input type="checkbox"/> | 0.0.0.0         | eth10  | 0          | 0       | 0      | 0      | 0          | 0       | 0      | 0      | 0          |   |
| 1.1.11 | <input type="checkbox"/> | 0.0.0.0         | eth11  | 0          | 0       | 0      | 0      | 0          | 0       | 0      | 0      | 0          |   |
| 1.1.12 | <input type="checkbox"/> | 0.0.0.0         | eth12  | 0          | 0       | 0      | 0      | 0          | 0       | 0      | 0      | 0          |   |
| 1.1.13 | <input type="checkbox"/> | 0.0.0.0         | eth13  | 0          | 0       | 0      | 0      | 0          | 0       | 0      | 0      | 0          |   |
| 1.1.14 | <input type="checkbox"/> | 192.168.0.201   | eth6#0 | 0          | 0       | 0      | 0      | 726        | 9       | 0      | 228    | 0          |   |
| 1.1.15 | <input type="checkbox"/> | 192.168.0.202   | eth6#1 | 0          | 0       | 0      | 0      | 636        | 8       | 0      | 195    | 0          |   |
| 1.1.16 | <input type="checkbox"/> | 192.168.0.203   | eth6#2 | 0          | 0       | 0      | 0      | 558        | 7       | 0      | 167    | 0          |   |
| 1.1.17 | <input type="checkbox"/> | 192.168.0.204   | eth6#3 | 0          | 0       | 0      | 0      | 726        | 9       | 0      | 227    | 0          |   |
| 1.1.18 | <input type="checkbox"/> | 192.168.0.205   | eth6#4 | 0          | 0       | 0      | 0      | 636        | 8       | 0      | 195    | 0          |   |

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- C. Create a Layer-3 connection that has a low-speed rate with **Multi-Conn** set to 10000 and **Min IP Port** to **0 (zero)** on Endpoint-A. **Multi-Conn** should be set to 1 on Endpoint-B.

- A. Endpoint-A will be one of the MAC-VLANs and Endpoint-B will be the port connected to the DUT WAN port. This setup will initiate the TCP sessions from the LAN side of the DUT.
- B. Low-speed depends on the DUT, we could also set the rate to zero which would allow the TCP connections to be set up without payload data to be transmitted, but this would not give an accurate picture of the firewall performance. Here we are using 1Kbps connections with 1KB size payload.
- C. This is an iterative test, the number of TCP connections to use will depend on the DUT capabilities. Modify the number of connections as necessary to find the most accurate measurement.
- D. The DUT should be power-cycled to reset it before each test run.



- D. Select the Batch-Create button to create 4 more copies of this connection each with a new MAC-VLAN port.

Layer-3 Batch Creator: tcp-max-1

tcp-max-2, tcp-max-3 ... tcp-max-5  
Endp-A Resources: 1, 1 ... 1  
Endp-B Resources: 1, 1 ... 1  
Endp-A Ports: eth6#1, eth6#2 ... eth6#4  
Endp-B Ports: eth7, eth7 ... eth7  
Endp-A IPs: AUTO, AUTO ... AUTO  
Endp-B IPs: AUTO, AUTO ... AUTO

|                       |                                |                       |                                |  |
|-----------------------|--------------------------------|-----------------------|--------------------------------|--|
| Quantity:             | <input type="text" value="4"/> | Number of Digits:     | <input type="text" value="1"/> | <input checked="" type="checkbox"/> Zero Pad |
| Starting Name Suffix: | <input type="text" value="1"/> | Name Increment:       | <input type="text" value="1"/> |  |
| Resource Increment A: | <input type="text" value="0"/> | Resource Increment B: | <input type="text" value="0"/> |  |
| Port Increment A:     | <input type="text" value="1"/> | Port Increment B:     | <input type="text" value="0"/> |  |
| IP Addr Increment A:  | <input type="text" value="0"/> | IP Addr Increment B:  | <input type="text" value="0"/> |  |
| IP-Port Increment A:  | <input type="text" value="1"/> | IP-Port Increment B:  | <input type="text" value="1"/> |  |

E. Highlight and start each set of 10000 connections until the target max simultaneous connections are running.

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Status Layer-3 L3 Endps VoIP/RTP VoIP/RTP Endps Armageddon WanLinks Collision-Domains

Rpt Timer (ms): 3000 Go Test Manager all Select All Start Stop Quiesce Clear

View 0 - 200 Display Create Modify Delete

Cross Connects for Selected Test Manager

| Name      | Type   | State   | Pkt Tx A->B | Pkt Tx A<-B | Rate A->B | Rate A<-B | Rx Drop A | Rx Drop B | Rpt Timer | EID  | Endpoints (A <-> B)      |
|-----------|--------|---------|-------------|-------------|-----------|-----------|-----------|-----------|-----------|------|--------------------------|
| tcp-max-1 | LF/TCP | Run     | 2,556       | 669         | 554,125   | 145,035   | 24,215    | 66,549    | 1000      | 2.11 | tcp-max-1-A <=> tc...    |
| tcp-max-2 | LF/TCP | Run     | 660         | 135         | 141,953   | 29,190    | 2,963     | 54,697    | 1000      | 2.12 | tcp-max-2-A <=> tc...    |
| tcp-max-3 | LF/TCP | Run     | 956         | 95          | 210,837   | 20,508    | 10,526    | 84,937    | 1000      | 2.13 | tcp-max-3-A <=> tc...    |
| tcp-max-4 | LF/TCP | Run     | 448         | 32          | 96,356    | 6,882     | 15,625    | 88,393    | 1000      | 2.14 | tcp-max-4-A <=> tc...    |
| tcp-max-5 | LF/TCP | Run     | 7,964       | 4,697       | 1,746,889 | 1,035,909 | 48,009    | 65,281    | 1000      | 2.15 | tcp-max-5-A <=> tc...    |
| tcp-test  | LF/TCP | Stopped | 0           | 0           | 0         | 0         | 0         | 0         | 1000      | 2.9  | tcp-test-A <=> tcp-te... |
| udp-test  | LF/UDP | Stopped | 0           | 0           | 0         | 0         | 0         | 0         | 1000      | 1.8  | udp-test-A <=> udp-...   |

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F. On the Layer-3 Endpoints tab, highlight the Running A-Side Endpoints, then right-click and select Calculations.

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File-IO Layer-4 Generic Test Mgr Resource Mgr Serial Spans PPP-Links Port Mgr Messages  
 Status Layer-3 L3 Endps VoIP/RTP VoIP/RTP Endps Armageddon WanLinks Collision-Domains

MIN Pkt Size 1k (1,024 B) Go MAX Pkt Size 1k (1,024 B) Go Start Stop Quiesce Clear  
 MIN Tx Rate <Custom> Go MAX Tx Rate <Custom> Go Display Create Modify Batch Modify Delete  
 View 0 - 400 Go

All Endpoints

| Name        | EID       | Run                                 | Mng                                 | Script  | Tx Rate    | Tx Rate(1) | Rx Rate    | Rx Rate(1) | Rx Drop % | Tx Pkts | Rx Pkts | Delay | Dropped |
|-------------|-----------|-------------------------------------|-------------------------------------|---------|------------|------------|------------|------------|-----------|---------|---------|-------|---------|
| mc-rx       | 1.1.8.14  | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | None    | 0          | 0          | 0          | 0          | 0         | 0       | 0       | 0     | 0       |
| mc-tx       | 1.1.1.13  | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | None    | 0          | 0          | 0          | 0          | 0         | 0       | 0       | 0     | 0       |
| tcp-max-1-A | 1.1.14... | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | None    | 392,701    | 4          | 56,844     | 53.507     | 3,559     | 411     | 2,188   | 0     | 0       |
| tcp-max-1-B | 1.1.7.22  | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | None    | 98,226     | 1          | 120,272    | 77.207     | 884       | 803     | 9,223   | 0     | 0       |
| tcp-max-2-A | 1.1.15... | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | None    | 806,990    | 5          | 115,638    | 59.602     | 7,277     | 833     | 4,786   | 0     | 0       |
| tcp-max-2-B | 1.1.7.24  | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | None    | 228,667    | 2          | 276,996    | 74.42      | 2,062     | 1,840   | 13,955  | 0     | 0       |
| tcp-max-3-A | 1.1.16... | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | None    | 409,904    | 5          | 53,063     | 59.24      | 3,700     | 386     | 1,926   | 0     | 0       |
| tcp-max-3-B | 1.1.7.26  | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | None    | 105,170    | 1          | 118,054    | 78.88      | 947       | 781     | 12,943  | 0     | 0       |
| tcp-max-4-A | 1.1.17... | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | None    | 346,614    | 4          | 49,457     | 53.886     | 3,112     | 356     | 2,712   | 0     | 0       |
| tcp-max-4-B | 1.1.7.28  | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | None    | 91,955     | 1          | 93,350     | 80.431     | 828       | 609     | 13,647  | 0     | 0       |
| tcp-max-5-A | 1.1.18... | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | None    | 1,951,8... | 2          | 401,829    | 67.826     | 17,506    | 3,977   | 6,954   | 0     | 0       |
| tcp-max-5-B | 1.1.7.30  | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | None    | 1,378,1... | 1          | 1,529,4... | 487.927    | 443,920   | 76.389  | 12,361  | 4,121 | 15,600  |
| tcp-test-A  | 1.1.7.17  | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | Enabled | 0          | 0          | 0          | 0          | 0         | 0       | 0       | 0     | 0       |
| tcp-test-B  | 1.1.6.18  | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | Enabled | 0          | 0          | 0          | 0          | 0         | 0       | 0       | 0     | 0       |
| udp-test-A  | 1.1.7.15  | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | Enabled | 0          | 0          | 0          | 0          | 0         | 0       | 0       | 0     | 0       |
| udp-test-B  | 1.1.6.16  | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | Enabled | 0          | 0          | 0          | 0          | 0         | 0       | 0       | 0     | 0       |

Start Selected  
 Stop Selected  
 Clear Selected  
 Modify Selected  
 Display Selected  
 Count Selected  
 Calculations

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G. The top line, Sum, is what we are interested in for Maximum Concurrent TCP Connections.

| LANforge Table Calculations |            |            |           |            |           |           |          |        |         |    |
|-----------------------------|------------|------------|-----------|------------|-----------|-----------|----------|--------|---------|----|
| -Totals-                    |            |            |           |            |           |           |          |        |         |    |
| Calculation                 | Tx Rate    | Tx Rate(1) | Rx Rate   | Rx Rate(1) | Rx Drop % | Tx Pkts   | Rx Pkts  | Delay  | Dropped | T: |
| Sum                         | 3,542,088  | 3,066,110  | 509,843   | 730,812    | 363.1     | 543,657   | 75,611   | 44,980 | 0       | 55 |
| Mean (Average)              | 708,417... | 613,222    | 101,968.6 | 146,162.4  | 72.62     | 108,731.4 | 15,122.2 | 8,996  | 0       | 11 |
| Median                      | 744,526    | 535,911    | 101,837   | 141,546    | 72.25     | 114,265   | 15,136   | 9,555  | 0       | 11 |

| LANforge Table Calculations |            |            |          |            |           |           |         |         |         |     |
|-----------------------------|------------|------------|----------|------------|-----------|-----------|---------|---------|---------|-----|
| -Deviations-                |            |            |          |            |           |           |         |         |         |     |
| Name                        | Tx Rate    | Tx Rate(1) | Rx Rate  | Rx Rate(1) | Rx Drop % | Tx Pkts   | Rx Pkts | Delay   | Dropped | T:  |
| tcp-max-1-A                 | 32,891.4   | -92,633    | -3,867.6 | -16,719.4  | 1.04      | 5,011.6   | -585.2  | 1,096   | 0       | 5,1 |
| tcp-max-2-A                 | 74,053.4   | -77,311    | -131.6   | -13,883.4  | 1.96      | 11,392.6  | 13.8    | 559     | 0       | 11, |
| tcp-max-3-A                 | 36,108.4   | 118,473    | 1,124.4  | -4,616.4   | -0.36     | 5,533.6   | 147.8   | -978    | 0       | 5,6 |
| tcp-max-4-A                 | 54,659.4   | 166,077    | 3,882.4  | 31,067.6   | -0.68     | 8,409.6   | 529.8   | -1,269  | 0       | 8,  |
| tcp-max-5-A                 | -197,71... | -114,606   | -1,007.6 | 4,151.6    | -1.95     | -30,347.4 | -106.2  | 592     | 0       | -3  |
| Standard Deviation          | 111,744... | 131,633.8  | 2,842.9  | 19,209.57  | 1.52      | 17,155.28 | 405.11  | 1,052.5 | 0       | 17, |

H. Scroll right to the CX Active and CX Established columns and select the **Refresh** button. This DUT can maintain a maximum of 41,864 simultaneous TCP connections.

| LANforge Table Calculations |            |            |         |          |          |              |          |        |           |          |
|-----------------------------|------------|------------|---------|----------|----------|--------------|----------|--------|-----------|----------|
| -Totals-                    |            |            |         |          |          |              |          |        |           |          |
| Speed                       | Tx Bytes   | Rx Bytes   | TCP Rtx | Dup Pkts | OOO Pkts | RX Wrong ... | CRC Fail | RX BER | CX Active | CX Estab |
| 0                           | 556,704... | 80,131,568 | 16      | 1        | 0        | 0            | 0        | 0      | 41,864    | 47,633   |
| 0                           | 111,340... | 16,026,313 | 3.2     | 0.2      | 0        | 0            | 0        | 0      | 8,372.8   | 9,526.6  |
| 0                           | 117,007... | 16,009,164 | 3       | 0        | 0        | 0            | 0        | 0      | 9,088     | 10,128   |

| LANforge Table Calculations |             |             |         |          |          |              |          |        |           |          |
|-----------------------------|-------------|-------------|---------|----------|----------|--------------|----------|--------|-----------|----------|
| -Deviations-                |             |             |         |          |          |              |          |        |           |          |
| Speed                       | Tx Bytes    | Rx Bytes    | TCP Rtx | Dup Pkts | OOO Pkts | RX Wrong ... | CRC Fail | RX BER | CX Active | CX Estab |
| 0                           | 5,131,87... | -612,796... | -0.2    | -0.2     | 0        | 0            | 0        | 0      | 715.2     | 560.4    |
| 0                           | 11,666,022  | -17,148.8   | 1.8     | 0.8      | 0        | 0            | 0        | 0      | 1,251.2   | 1,205.4  |
| 0                           | 5,666,40... | 175,487.2   | -1.2    | -0.2     | 0        | 0            | 0        | 0      | 691.2     | 601.4    |
| 0                           | 8,611,430   | 613,051.19  | 0.8     | -0.2     | 0        | 0            | 0        | 0      | 840.2     | 946.4    |
| 0                           | -31,075...  | -158,592.8  | -1.2    | -0.2     | 0        | 0            | 0        | 0      | -3,497.8  | -3,313.6 |
| 0                           | 17,567,004  | 449,330.94  | 1.3     | 0.45     | 0        | 0            | 0        | 0      | 1,968.2   | 1,871.12 |

- A. **CX Active** is the metric we are attempting to measure for Maximum Simultaneous TCP Connections. It will fluctuate with the DUT's ability to maintain the number of active TCP connections.
- B. **CX Established** is the number of TCP connections LANforge has established since the start of the test. It will continue to increase as the DUT closes the TCP connections it cannot maintain.

3. The **TCP Connections per Second** test will measure the rate of TCP connections that can be set up through the DUT.

A. Create a Layer-3 TCP connection with the Duration and IP Port set to zero.

**tcp-cxps - Create/Modify Cross Connect**

**1 Cross-Connect**

CX Name: tcp-cxps  
CX Type: LANforge / TCP

| Endpoint A (Client)        | Endpoint B (Server) |
|----------------------------|---------------------|
| Resource: 1 (ct503-60)     | 1 (ct503-60)        |
| Port: 6 (eth6)             | 7 (eth7)            |
| Min Tx Rate: Zero (0 bps)  | Zero (0 bps)        |
| Max Tx Rate: Same          | Same                |
| Min PDU Size: 1k (1,024 B) | 1k (1,024 B)        |
| Max PDU Size: Same         | Same                |
| IP ToS: Best Effort (0)    | Best Effort (0)     |
| Pkts To Send: Infinite     | Infinite            |

**2 Cross-Connect**

Report Timer: fast (1 s)

| Endpoint A (Client)     | Endpoint B (Server) |
|-------------------------|---------------------|
| Pld Pattern: increasing | increasing          |
| Min IP Port: Any (0)    | AUTO                |
| Max IP Port: Same       | Same                |
| Min Duration: 0 (0 ms)  | Forever             |
| Max Duration: Same      | Same                |
| Min Reconn: 0 (0 ms)    | 0 (0 ms)            |
| Max Reconn: Same        | Same                |
| Multi-Conn: Normal (0)  | Normal (0)          |

Script Thresholds

**3 Test Manager**

Cross-Connect: default\_tm  
Quiesce: 3 (3 sec)

| Endpoint A (Client)                  | Endpoint B (Server)                  |
|--------------------------------------|--------------------------------------|
| IP Addr: AUTO                        | AUTO                                 |
| <input type="checkbox"/> Replay File | <input type="checkbox"/> Replay File |
| <input type="checkbox"/> Loop        | <input type="checkbox"/> Loop        |
| <input type="checkbox"/> Dest Mac    | <input type="checkbox"/> Dest Mac    |

Filename:   
Dest MAC:   
  
**4 Cross-Connect**

| Endpoint A (Client)                | Endpoint B (Server)                |
|------------------------------------|------------------------------------|
| Snd Buff Size: OS Default          | OS Default                         |
| Rcv Buff Size: OS Default          | OS Default                         |
| Send Bad FCS: zero (0%)            | zero (0%)                          |
| Src MAC: 00:00:00:00:00:00         | 00:00:00:00:00:00                  |
| <input type="checkbox"/> Use-Proxy | <input type="checkbox"/> Use-Proxy |
| Proxy Addr: 0.0.0.0                | 0.0.0.0                            |
| Proxy Port: 0                      | 0                                  |
| Socket Priority: 0                 | 0                                  |

Payload Payload

B. Highlight and Start the connection.

LANforge Manager Version(5.1.6)

Control Reporting Tear-Off Help

Stop All Restart Manager Refresh HELP

File-IO Layer-4 Generic Test Mgr Resource Mgr Serial Spans PPP-Links Port Mgr Messages

Status Layer-3 L3 Endps VoIP/RTP VoIP/RTP Endps Armageddon WanLinks Collision-Domains

Rpt Timer (ms): 3000 Go Test Manager all Select All Start Stop Quiesce Clear

View 0 - 200 Go Display Create Modify Delete

Cross Connects for Selected Test Manager

| Name      | Type   | State   | Pkt Tx A->B | Pkt Tx A<-B | Rate A->B | Rate A<-B | Rx Drop A | Rx Drop B | Rpt Timer | EID  | Endpoints (A <-> B)      |
|-----------|--------|---------|-------------|-------------|-----------|-----------|-----------|-----------|-----------|------|--------------------------|
| tcp-cxps  | LF/TCP | Run     | 0           | 0           | 0         | 0         | 0         | 0         | 1000      | 2.16 | tcp-cxps-A <=> tcp-...   |
| tcp-max-1 | LF/TCP | Stopped | 0           | 0           | 0         | 0         | 0         | 0         | 1000      | 2.11 | tcp-max-1-A <=> tc...    |
| tcp-max-2 | LF/TCP | Stopped | 0           | 0           | 0         | 0         | 0         | 0         | 1000      | 2.12 | tcp-max-2-A <=> tc...    |
| tcp-max-3 | LF/TCP | Stopped | 0           | 0           | 0         | 0         | 0         | 0         | 1000      | 2.13 | tcp-max-3-A <=> tc...    |
| tcp-max-4 | LF/TCP | Stopped | 0           | 0           | 0         | 0         | 0         | 0         | 1000      | 2.14 | tcp-max-4-A <=> tc...    |
| tcp-max-5 | LF/TCP | Stopped | 0           | 0           | 0         | 0         | 0         | 0         | 1000      | 2.15 | tcp-max-5-A <=> tc...    |
| tcp-test  | LF/TCP | Stopped | 0           | 0           | 0         | 0         | 0         | 0         | 1000      | 2.9  | tcp-test-A <=> tcp-te... |
| udp-test  | LF/UDP | Stopped | 0           | 0           | 0         | 0         | 0         | 0         | 1000      | 1.8  | udp-test-A <=> udp-...   |

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- C. View the **CX-Estab/s** rate on the Layer-3 Endpoints tab. This DUT can set up about 120 connections per second.

The screenshot shows the LANforge Manager interface. The 'L3 Endps' tab is selected, displaying a table of endpoint statistics. The table includes columns for various metrics such as 'OOO Pkts', 'RX Wrong', 'CRC Fail', 'RX BER', 'CX Active', 'CX Estab', 'CX-Estab/s', 'Pattern', 'Min Pkt', 'Max Pkt', 'Min Rate', and 'Max Rate'. The 'CX-Estab/s' column shows values of 7,157 and 7,077 for two specific endpoints. The interface also features control buttons like 'Start', 'Stop', 'Quiesce', 'Clear', 'Display', 'Create', 'Modify', 'Batch Modify', and 'Delete'.

| OOO Pkts | RX Wrong ... | CRC Fail | RX BER | CX Active | CX Estab | CX-Estab/s | Pattern        | Min Pkt | Max Pkt | Min Rate | Max Rate | Se |
|----------|--------------|----------|--------|-----------|----------|------------|----------------|---------|---------|----------|----------|----|
| 0        | 0            | 0        | 0      | 0         | 0        | 0          | 0 INCREASING   | 1,024   | 1,024   | 0        | 0        |    |
| 0        | 0            | 0        | 0      | 0         | 0        | 0          | 0 INCREASING   | 1,024   | 1,024   | 56,000   | 56,000   |    |
| 0        | 0            | 0        | 0      | 1         | 7,157    | 119        | 119 INCREASING | 1,024   | 1,024   | 0        | 0        | C  |
| 0        | 0            | 0        | 0      | 1         | 7,077    | 119        | 119 INCREASING | 1,024   | 1,024   | 0        | 0        | C  |
| 0        | 0            | 0        | 0      | 0         | 0        | 0          | 0 INCREASING   | 1,024   | 1,024   | 1,000    | 1,000    | C  |
| 0        | 0            | 0        | 0      | 0         | 0        | 0          | 0 INCREASING   | 1,024   | 1,024   | 1,000    | 1,000    | C  |
| 0        | 0            | 0        | 0      | 0         | 0        | 0          | 0 INCREASING   | 1,024   | 1,024   | 1,000    | 1,000    | C  |
| 0        | 0            | 0        | 0      | 0         | 0        | 0          | 0 INCREASING   | 1,024   | 1,024   | 1,000    | 1,000    | C  |
| 0        | 0            | 0        | 0      | 0         | 0        | 0          | 0 INCREASING   | 1,024   | 1,024   | 1,000    | 1,000    | C  |
| 0        | 0            | 0        | 0      | 0         | 0        | 0          | 0 INCREASING   | 1,024   | 1,024   | 1,000    | 1,000    | C  |
| 0        | 0            | 0        | 0      | 0         | 0        | 0          | 0 INCREASING   | 1,024   | 1,024   | 1,000    | 1,000    | C  |
| 0        | 0            | 0        | 0      | 0         | 0        | 0          | 0 INCREASING   | 1,024   | 1,024   | 1,000    | 1,000    | C  |
| 0        | 0            | 0        | 0      | 0         | 0        | 0          | 0 INCREASING   | 1,024   | 1,024   | 1,000    | 1,000    | C  |
| 0        | 0            | 0        | 0      | 0         | 0        | 0          | 0 INCREASING   | 1,024   | 1,024   | 1,000    | 1,000    | C  |
| 0        | 0            | 0        | 0      | 0         | 0        | 0          | 0 INCREASING   | 1,024   | 1,024   | 56,000   | 56,000   | 0/ |
| 0        | 0            | 0        | 0      | 0         | 0        | 0          | 0 INCREASING   | 1,024   | 1,024   | 56,000   | 56,000   | 0/ |
| 0        | 0            | 0        | 0      | 0         | 0        | 0          | 0 INCREASING   | 1,024   | 1,024   | 56,000   | 56,000   | C  |
| 0        | 0            | 0        | 0      | 0         | 0        | 0          | 0 INCREASING   | 1,024   | 1,024   | 56,000   | 56,000   | C  |

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For more information see [LANforge GUI User's Guide](#)

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