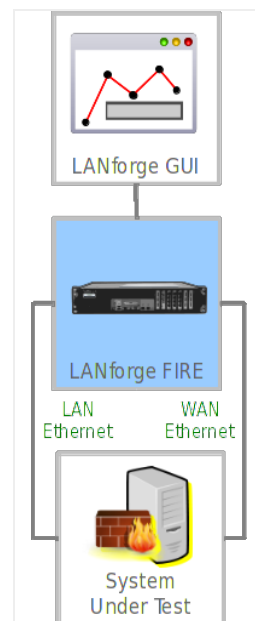
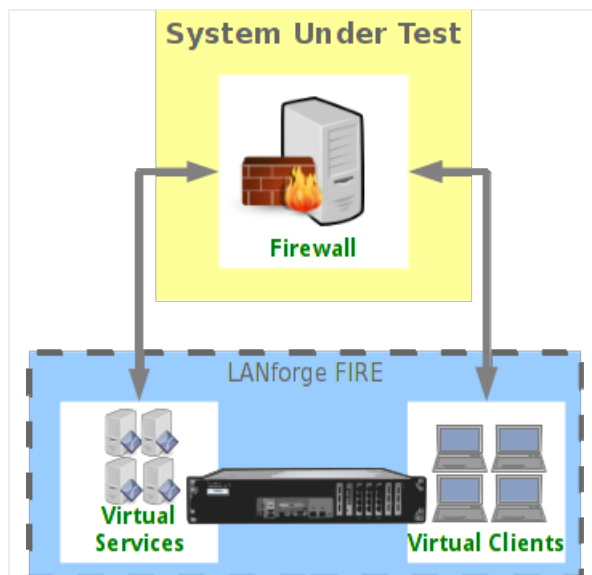


Multiple Thousands of TCP Connections

Goal: Set up and run traffic on multiple thousands of stateful TCP connections. As of LANforge release version 5.1.4, LANforge-FIRE has the capability to create multiple thousands of TCP connections using only two ports on one Layer-3 connection that can all run simultaneously and in a stateful manner. This feature can be used to test connection state aware devices such as firewalls, stateful packet inspection systems and intrusion detection/prevention systems.

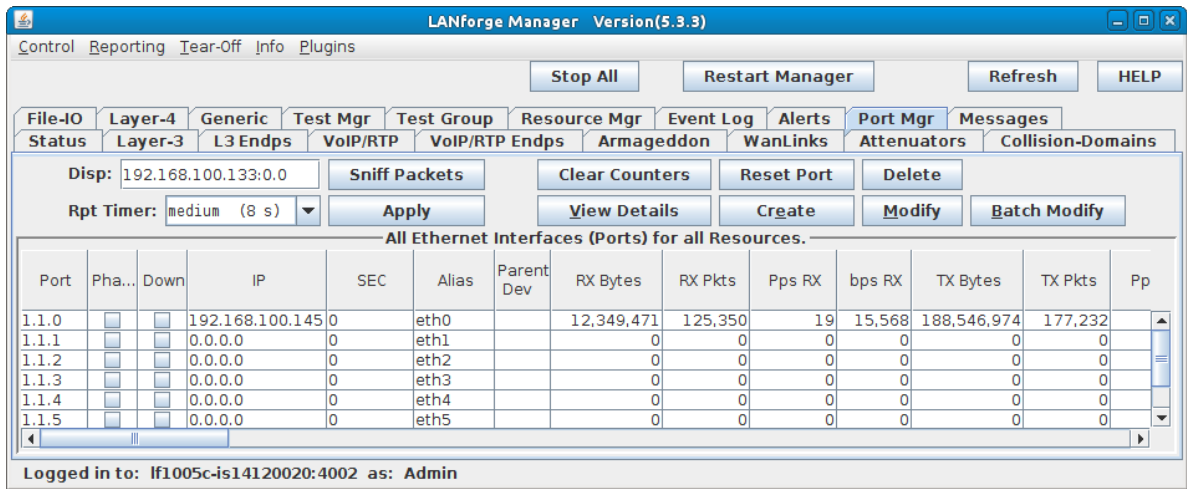
The upper limit of the total number of concurrent connections is determined by the processor speed and total memory available on the system running the LANforge software. In addition, the packet rate and payload size of each connection will also affect performance.

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

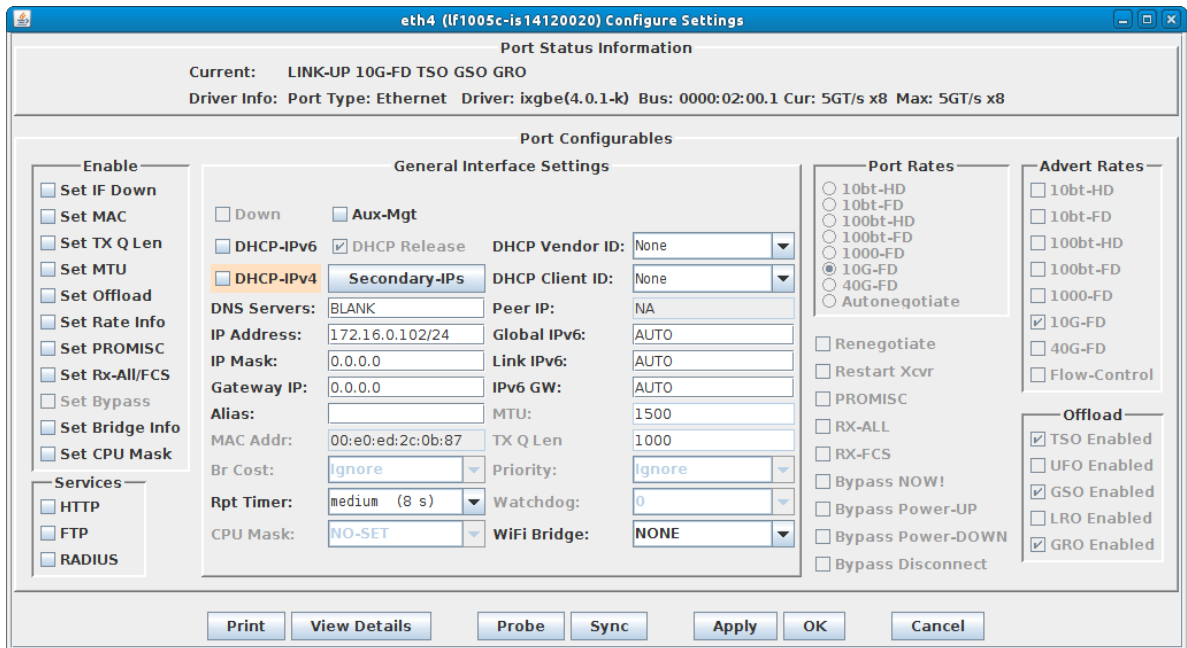


1. For this example, two physical ports on a single LANforge system are connected together.
2. Set up the LANforge ports so that they have valid IP addresses and IP masks.

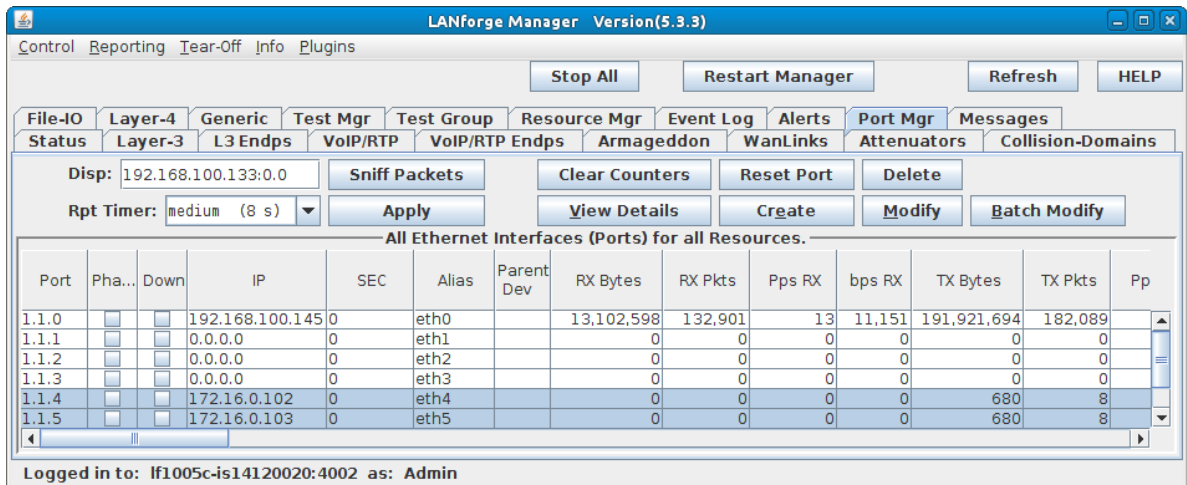
- A. Using the LANforge GUI, go to the Port Manager tab.



- B. Assign IP addresses and masks to the two ports.



- C. Verify the port configuration.



For more information see [LANforge User's Guide: Ports \(Interfaces\)](#)

3. Set up a Layer-3 Multi-Conn TCP connection.

A. Go to the **Layer-3** tab, and select the **Create** button.

LANforge Manager Version 5.3.3

Control Reporting Tear-Off Info Plugins

Stop All Restart Manager Refresh HELP

File-IO Layer-4 Generic Test Mgr Test Group Resource Mgr Event Log Alerts Port Mgr Messages

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

Rpt Timer: default (5 s) 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 Rx A	Pkt Rx B	Bps Rx A	Bps Rx B	Rx Drop % A	Rx Drop % B	Drop Pkts A	Drop Pkts B

Logged in to: lf1005c-is14120020:4002 as: Admin

B. For Endpoint A, type in a name in the **CX Name** field, choose a **CX Type** of 'LANforge/TCP', choose the correct ports and set the **Report Timer** to 'fast (1 s)'.

multi-001 - Create/Modify Cross Connect

+ - All Display Sync Batch-Create Apply OK Cancel

Cross-Connect

CX Name: multi-001

CX Type: LANforge / TCP

Resource: 1 (lf1005c-is14120020)

Port: 4 (eth4)

Min Tx Rate: New Modem (56 Kbps)

Max Tx Rate: Same

Min PDU Size: AUTO

Max PDU Size: Same

IP ToS: Best Effort (0)

Pkts To Send: Infinite

Endpoint A (Client)

Endpoint B (Server)

1 (lf1005c-is14120020)

5 (eth5)

New Modem (56 Kbps)

Same

AUTO

Same

Best Effort (0)

Infinite

Report Timer: fast (1 s)

Pld Pattern: increasing

Min IP Port: AUTO

Max IP Port: Same

Min Duration: Forever

Max Duration: Same

Min Reconn: 0 (0 ms)

Max Reconn: Same

Multi-Conn: Normal (0)

Script

Thresholds

C. Set the **Min Tx Rate** on both Endpoints A and B to '9.6Kbps'. Leave the Max Tx Rate on both set to 'Same'.

multi-001 - Create/Modify Cross Connect

+ - All Display Sync Batch-Create Apply OK Cancel

Cross-Connect

CX Name: multi-001

CX Type: LANforge / TCP

Resource: 1 (lf1005c-is14120020)

Port: 4 (eth4)

Min Tx Rate: Old Modem (9.6 Kbps)

Max Tx Rate: Same

Min PDU Size: AUTO

Max PDU Size: Same

IP ToS: Best Effort (0)

Pkts To Send: Infinite

Endpoint A (Client)

Endpoint B (Server)

1 (lf1005c-is14120020)

5 (eth5)

Old Modem (9.6 Kbps)

Same

AUTO

Same

Best Effort (0)

Infinite

Report Timer: fast (1 s)

Pld Pattern: increasing

Min IP Port: AUTO

Max IP Port: Same

Min Duration: Forever

Max Duration: Same

Min Reconn: 0 (0 ms)

Max Reconn: Same

Multi-Conn: Normal (0)

Script

Thresholds

A. **NOTE:** Higher speeds and/or bursty transmit rates will require more memory to process per connection.

- D. Set the **Min PDU Size** on both Endpoints A and B to '1024B'. Leave the Max PDU Size on both set to 'Same'.

multi-001 - Create/Modify Cross Connect

Display Sync Batch-Create Apply OK Cancel

1 Cross-Connect
CX Name: multi-001
CX Type: LANforge / TCP

Resource: 1 (If1005c-is14120020) 1 (If1005c-is14120020)
Port: 4 (eth4) 5 (eth5)
Min Tx Rate: Old Modem (9.6 Kbps) Old Modem (9.6 Kbps)
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 Report Timer: fast (1 s)

Endpoint A (Client) Endpoint B (Server)

Pld Pattern: increasing increasing
Min IP Port: AUTO AUTO
Max IP Port: Same Same
Min Duration: Forever 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 Script Thresholds

A. **NOTE:** Larger packet sizes will use more memory, smaller packet sizes will require more CPU processing time.

- E. Set **Min IP Port** to **0 (zero)** on Endpoint A. Leave the Min IP Port on Endpoint B set to AUTO.

multi-001 - Create/Modify Cross Connect

Display Sync Batch-Create Apply OK Cancel

1 Cross-Connect
CX Name: multi-001
CX Type: LANforge / TCP

Resource: 1 (If1005c-is14120020) 1 (If1005c-is14120020)
Port: 4 (eth4) 5 (eth5)
Min Tx Rate: Old Modem (9.6 Kbps) Old Modem (9.6 Kbps)
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 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: Forever Forever
Max Duration: Same Same
Min Reconn: 0 (0 ms) 0 (0 ms)
Max Reconn: Same Same
Multi-Conn: 5000 One (1)

Script Thresholds Script Thresholds

A. Leaving Min IP Port on AUTO would make connections very slow to reconnect due to IP port re-use issues. Multi-conn may not work at all with a fixed IP port.

- F. Leave the **Min Duration** set to Forever and **Max Duration** set to Same for both endpoints, unless you want each of the multiple TCP connections to teardown and restart after a specified duration.

multi-001 - Create/Modify Cross Connect

Display Sync Batch-Create Apply OK Cancel

1 Cross-Connect
CX Name: multi-001
CX Type: LANforge / TCP

Resource: 1 (If1005c-is14120020) 1 (If1005c-is14120020)
Port: 4 (eth4) 5 (eth5)
Min Tx Rate: Old Modem (9.6 Kbps) Old Modem (9.6 Kbps)
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 Report Timer: fast (1 s)

Endpoint A (Client) Endpoint B (Server)

Pld Pattern: increasing increasing
Min IP Port: AUTO AUTO
Max IP Port: Same Same
Min Duration: Forever 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 Script Thresholds

G. For Endpoint A, set the **Multi-Conn** to the desired number of multiple TCP connections.

multi-001 - Create/Modify Cross Connect

CX Name: multi-001
CX Type: LANforge / TCP

Endpoint A (Client) Endpoint B (Server)

Resource: 1 (lf1005c-is14120020) 1 (lf1005c-is14120020)

Port: 4 (eth4) 5 (eth5)

Min Tx Rate: Old Modem (9.6 Kbps) Old Modem (9.6 Kbps)

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

Report Timer: fast (1 s)

Multi-Conn: 5000

A. You can type in any value that your license allows here or choose one from the drop down box. The recommended approach is to create a new Multi-Conn connection for every 5000 connections.

H. For Endpoint B, set the **Multi-Conn** to one, then select **OK** to create the connection.

multi-001 - Create/Modify Cross Connect

CX Name: multi-001
CX Type: LANforge / TCP

Endpoint A (Client) Endpoint B (Server)

Resource: 1 (lf1005c-is14120020) 1 (lf1005c-is14120020)

Port: 4 (eth4) 5 (eth5)

Min Tx Rate: Old Modem (9.6 Kbps) Old Modem (9.6 Kbps)

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

Report Timer: fast (1 s)

Multi-Conn: 5000 One (1)

A. Endpoint B is the 'server' side of the TCP connection, therefore it is only necessary to have one Multi-Conn set up on Endpoint B to reply to all of the Endpoint A TCP SYN packets when the 5000 connections are being established.

For more information see [LANforge User's Guide: Creating & Modifying Cross Connects](#)

4. Create 5 more Layer-3 Multi-Conn TCP connections.

A. On the **Layer-3** tab, highlight the first connection created in the previous step and select **Modify**.

LANforge Manager Version 5.3.3

Control Reporting Tear-Off Info Plugins

Stop All Restart Manager Refresh HELP

File-IO Layer-4 Generic Test Mgr Test Group Resource Mgr Event Log Alerts Port Mgr Messages

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

Rpt Timer: default (5 s) Go Test Manager all Select All Start Stop Quiesce Clear

View 0 - 200 Go Display Create Modify Delete

Name	Type	State	Pkt Rx A	Pkt Rx B	Bps Rx A	Bps Rx B	Rx Drop % A	Rx Drop % B	Drop Pkts A	Drop Pkts B
multi-001	LF/TCP	Stopped	0	0	0	0	0	0	0	0

Logged in to: lf1005c-is14120020:4002 as: Admin

B. Select the **Batch-Create** button.

The dialog box is titled "multi-001 - Create/Modify Cross Connect". It has a toolbar with buttons: "+", "-", "All", "Display", "Sync", "Batch-Create" (highlighted), "Apply", "OK", and "Cancel".

1 Cross-Connect

CX Name: multi-001
CX Type: LANforge / TCP

Endpoint A (Client)	Endpoint B (Server)
Resource: 1 (lf1005c-is14120020)	1 (lf1005c-is14120020)
Port: 4 (eth4)	5 (eth5)
Min Tx Rate: Old Modem (9.6 Kbps)	Old Modem (9.6 Kbps)
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 Report Timer: fast (1 s)

Endpoint A (Client)	Endpoint B (Server)
Pld Pattern: increasing	increasing
Min IP Port: AUTO	AUTO
Max IP Port: Same	Same
Min Duration: Forever	Forever
Max Duration: Same	Same
Min Reconn: 0 (0 ms)	0 (0 ms)
Max Reconn: Same	Same
Multi-Conn: 5000 (5,000)	One (1)

Buttons: Script, Thresholds (for both endpoints)

C. Set the **Quantity** to 5, and set **Port Increment A** and **Port Increment B** to 0 (zero)

The dialog box is titled "Layer-3 Batch Creator: multi-001".

multi-002, multi-003 ... multi-006
Endp-A Resources: 1, 1 ... 1
Endp-B Resources: 1, 1 ... 1
Endp-A Ports: eth4, eth4 ... eth4
Endp-B Ports: eth5, eth5 ... eth5
Endp-A IPs: AUTO, AUTO ... AUTO
Endp-B IPs: AUTO, AUTO ... AUTO

Quantity:	5	Number of Digits:	3	<input checked="" type="checkbox"/> Zero Pad
Starting Name Suffix:	001	Name Increment:	1	
Resource Increment A:	0	Resource Increment B:	0	
Port Increment A:	0	Port Increment B:	0	
IP Addr Increment A:	0	IP Addr Increment B:	0	
IP-Port Increment A:	1	IP-Port Increment B:	1	

Buttons: Apply, Close

D. Select the **Apply** button.

E. Verify that six Multi-Conn TCP connections were created.

The screenshot shows the LANforge Manager Version 5.3.3 interface. The 'Test Manager' tab is active, displaying a table of cross connects for selected test managers. The table has columns for Name, Type, State, Pkt Rx A, Pkt Rx B, Bps Rx A, Bps Rx B, Rx Drop % A, Rx Drop % B, Drop Pkts A, and Drop Pkts. Six entries are listed, all with a state of 'Stopped' and zero values for the other metrics.

Name	Type	State	Pkt Rx A	Pkt Rx B	Bps Rx A	Bps Rx B	Rx Drop % A	Rx Drop % B	Drop Pkts A	Drop Pkts B
multi-001	LF/TCP	Stopped	0	0	0	0	0	0	0	0
multi-002	LF/TCP	Stopped	0	0	0	0	0	0	0	0
multi-003	LF/TCP	Stopped	0	0	0	0	0	0	0	0
multi-004	LF/TCP	Stopped	0	0	0	0	0	0	0	0
multi-005	LF/TCP	Stopped	0	0	0	0	0	0	0	0
multi-006	LF/TCP	Stopped	0	0	0	0	0	0	0	0

Logged in to: lf1005c-is14120020:4002 as: Admin

For more information see [LANforge User's Guide: Layer-3 Endpoints \(FIRE\)](#)

5. Run traffic and verify results.
- A. Highlight all six connections.

LANforge Manager Version(5.3.3)

Control Reporting Tear-Off Info Plugins

Stop All Restart Manager Refresh HELP

File-IO Layer-4 Generic Test Mgr Test Group Resource Mgr Event Log Alerts Port Mgr Messages

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

Rpt Timer: default (5 s) 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 Rx A	Pkt Rx B	Bps Rx A	Bps Rx B	Rx Drop % A	Rx Drop % B	Drop Pkts A	Drop Pkts B
multi-001	LF/TCP	Stopped	0	0	0	0	0	0	0	0
multi-002	LF/TCP	Stopped	0	0	0	0	0	0	0	0
multi-003	LF/TCP	Stopped	0	0	0	0	0	0	0	0
multi-004	LF/TCP	Stopped	0	0	0	0	0	0	0	0
multi-005	LF/TCP	Stopped	0	0	0	0	0	0	0	0
multi-006	LF/TCP	Stopped	0	0	0	0	0	0	0	0

Logged in to: lf1005c-is14120020:4002 as: Admin

- B. Select the **Start** button

LANforge Manager Version(5.3.3)

Control Reporting Tear-Off Info Plugins

Stop All Restart Manager Refresh HELP

File-IO Layer-4 Generic Test Mgr Test Group Resource Mgr Event Log Alerts Port Mgr Messages

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

Rpt Timer: default (5 s) 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 Rx A	Pkt Rx B	Bps Rx A	Bps Rx B	Rx Drop % A	Rx Drop % B	Drop Pkts A	Drop Pkts B
multi-001	LF/TCP	Run	966,616	972,843	46,927,611	47,012,605	0	0	0	0
multi-002	LF/TCP	Run	975,233	976,506	47,150,075	47,350,229	0	0	0	0
multi-003	LF/TCP	Run	971,641	976,080	47,087,849	47,256,566	0	0	0	0
multi-004	LF/TCP	Run	972,768	973,387	47,058,671	47,088,616	0	0	0	0
multi-005	LF/TCP	Run	967,832	975,218	47,047,707	47,177,471	0	0	0	0
multi-006	LF/TCP	Run	963,246	967,196	46,653,686	46,872,712	0	0	0	0

Logged in to: lf1005c-is14120020:4002 as: Admin

- C. Go to the **L3 Endps** tab to verify that all 30,000 connections are running.

LANforge Manager Version(5.3.3)

Control Reporting Tear-Off Info Plugins

Stop All Restart Manager Refresh HELP

File-IO Layer-4 Generic Test Mgr Test Group Resource Mgr Event Log Alerts Port Mgr Messages

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

Min PDU Size AUTO Go Max PDU Size Same Go

MIN Tx Rate New Modem (56 Kbps) Go MAX Tx Rate Same Go

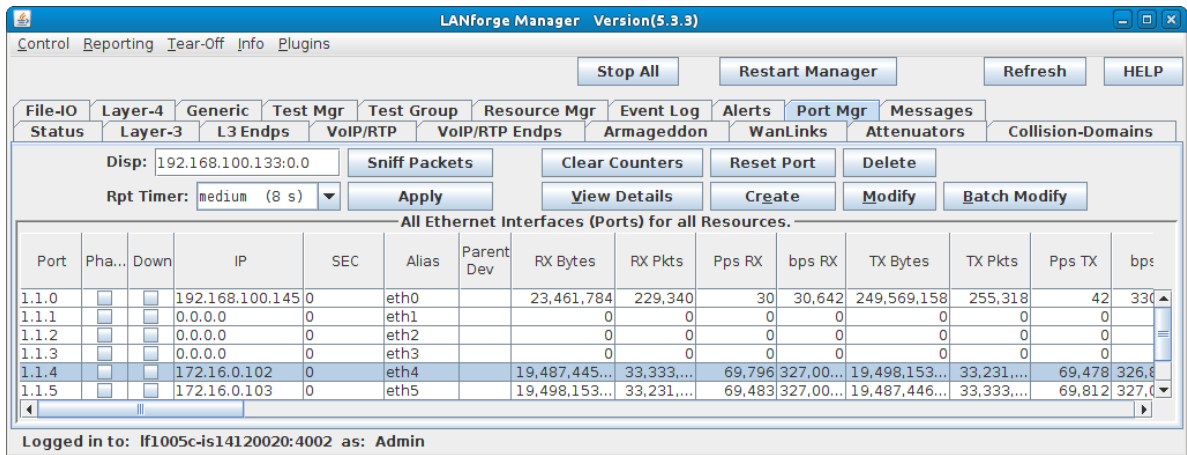
View 0 - 400 Display Create Modify Batch Modify Delete

All Endpoints

Tx Bytes	Rx Bytes	Replays	TCP Rtx	Dup Pkts	Rx Dup %	OOO Pkts	Rx OOO %	RX Wrong Dev	CRC Fail	RX BER	CX Active	CX Estab	CX Estab/s
2,168,671,232	2,165,875,712	0	0	0	0	0	0	0	0	0	5,000	5,000	0
2,168,355,840	2,169,897,984	0	0	0	0	0	0	0	0	0	5,000	5,000	0
2,173,019,136	2,170,444,800	0	0	0	0	0	0	0	0	0	5,000	5,000	0
2,173,028,352	2,173,854,720	0	0	0	0	0	0	0	0	0	5,000	5,000	0
2,172,618,752	2,169,956,352	0	0	0	0	0	0	0	0	0	5,000	5,000	0
2,173,020,160	2,177,105,920	0	0	0	0	0	0	0	0	0	5,000	5,000	0
2,170,354,688	2,168,975,360	0	0	0	0	0	0	0	0	0	5,000	5,000	0
2,170,106,880	2,170,354,688	0	0	0	0	0	0	0	0	0	5,000	5,000	0
2,172,047,360	2,167,830,528	0	0	0	0	0	0	0	0	0	5,000	5,000	0
2,168,659,968	2,171,337,728	0	0	0	0	0	0	0	0	0	5,000	5,000	0
2,167,525,376	2,160,612,352	0	0	0	0	0	0	0	0	0	5,000	5,000	0
2,164,663,296	2,168,122,368	0	0	0	0	0	0	0	0	0	5,000	5,000	0

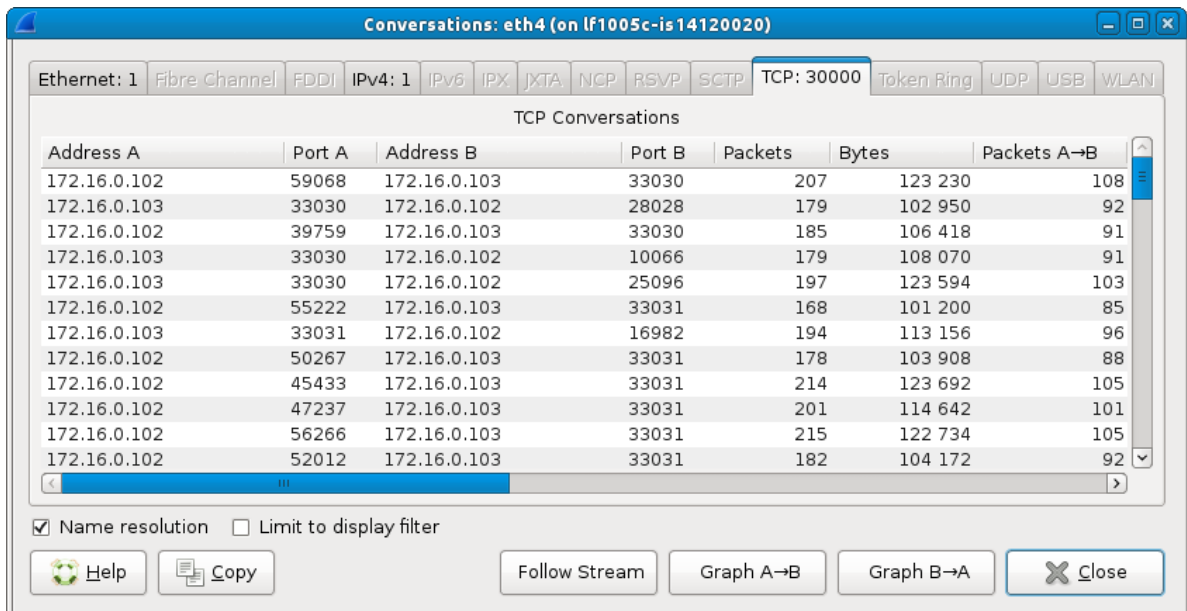
Logged in to: lf1005c-is14120020:4002 as: Admin

- D. Or, go to the **Port Mgr** tab, and sniff one of the ports while the **Multi-Conn TCP** connections are running.



- A. **NOTE:** You will need a lot of memory to run a Wireshark capture on 30,000 connections. It is probably best to stop all connections, set up the Wireshark capture, start all connections and let them run for 30 seconds to 1 minute before stopping them all, then stop the Wireshark capture and wait for it to process all those packets!

- E. After the Wireshark capture is complete, go to **Statistics - Conversations** to allow Wireshark to analyze the conversations and show that all 30,000 connections were captured. This will take some time to complete depending on the size of the capture.



For more information see [LANforge User's Guide: Layer-3 Endpoints \(FIRE\)](#)

Candela Technologies, Inc., 2417 Main Street, Suite 201, Ferndale, WA 98248, USA
www.candela-tech.com | sales@candela-tech.com | +1.360.380.1618