

## Introduction to Layer 4-7 Traffic Generation

**Goal:** Use LANforge to emulate layer 4-7 download traffic

Creating web browsing and movie watching emulation is a common task with LANforge. This cookbook will introduce HTTP download examples and describe the difference between the *Layer 4-7* and *Generic* traffic generation techniques. We will begin on a CT520a with 20 stations. There are two methods of emulating web browsing:

1. **Layer 4-7 connections:** these are workers doing downloads using `curl`
2. **Generic connections:** these are scripts called programs that can download or upload. Not just any program can be used, these programs need to be able to bind to a specified network interface.

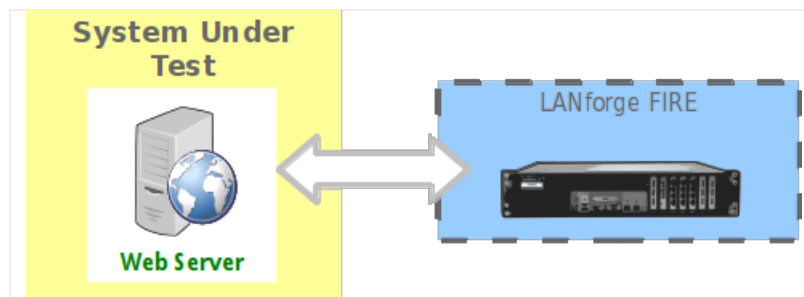
If you want to:

...**load test** a web server, you will use mostly use **Layer 4-7** connections.

...**multiple video streams**, you would use **Generic** connections that call `c-clive`

...**Upload files**, you would use **Generic** connections that call `curl`

The following examples do not assume your LANforge has a route to the Internet, but are pointing at a webserver IP address. We are going to show making a common mistake in the first example.



### Simple HTTP Get

- 1.
2. Check your *Port Mgr* tab and note we have 20 stations on resource 2, radio `wiphy0`.

LANforge Manager Version(5.3.9)

Control Reporting Tear-Off Info Plugins

Chamber View Stop All Restart Manager Refresh HELP

Test Mgr Test Group Resource Mgr Event Log Alerts Port Mgr vAP Stations DUT Profiles Traffic-Profiles Messages

Status Layer-3 L3 Endps VoIP/RTP VoIP/RTP Endps Armageddon WanLinks Attenuators RF-Generator File-IO Layer-4 Generic

Disp: 192.168.100.39:0.0 Sniff Packets ☒ Down ☐ VRF Clear Counters Reset Port Delete

Rpt Timer: medium (8 s) Apply Display Crgate Modify Batch Modify

All Ethernet Interfaces (Ports) for all Resources.

Port	Phantom	Down	Parent Dev	Channel	Alias	SSID	IP	AP	Mode	Signal	Nc
1.1.03	<input type="checkbox"/>	<input type="checkbox"/>			eth3		0.0.0.0				
1.1.04	<input type="checkbox"/>	<input checked="" type="checkbox"/>			eth4		0.0.0.0				
1.1.05	<input type="checkbox"/>	<input checked="" type="checkbox"/>			eth5		0.0.0.0				
1.2.03	<input type="checkbox"/>	<input type="checkbox"/>	wiphy0	157	sta1000	jedway1-vap1000	10.136.0.70	04:F0:21:A8:92:AB	802.11an-AC	-30 dBm	-103 d
1.2.05	<input type="checkbox"/>	<input type="checkbox"/>	wiphy0	157	sta1001	jedway1-vap1000	10.136.0.89	04:F0:21:A8:92:AB	802.11an-AC	-20 dBm	-103 d
1.2.06	<input type="checkbox"/>	<input type="checkbox"/>	wiphy0	157	sta1002	jedway1-vap1000	10.136.0.72	04:F0:21:A8:92:AB	802.11an-AC	-20 dBm	-103 d
1.2.07	<input type="checkbox"/>	<input type="checkbox"/>	wiphy0	157	sta1003	jedway1-vap1000	10.136.0.71	04:F0:21:A8:92:AB	802.11an-AC	-20 dBm	-103 d
1.2.08	<input type="checkbox"/>	<input type="checkbox"/>	wiphy0	157	sta1004	jedway1-vap1000	10.136.0.73	04:F0:21:A8:92:AB	802.11an-AC	-20 dBm	-103 d
1.2.09	<input type="checkbox"/>	<input type="checkbox"/>	wiphy0	157	sta1005	jedway1-vap1000	10.136.0.75	04:F0:21:A8:92:AB	802.11an-AC	-20 dBm	-103 d
1.2.10	<input type="checkbox"/>	<input type="checkbox"/>	wiphy0	157	sta1006	jedway1-vap1000	10.136.0.76	04:F0:21:A8:92:AB	802.11an-AC	-20 dBm	-103 d
1.2.11	<input type="checkbox"/>	<input type="checkbox"/>	wiphy0	157	sta1007	jedway1-vap1000	10.136.0.80	04:F0:21:A8:92:AB	802.11an-AC	-20 dBm	-103 d
1.2.12	<input type="checkbox"/>	<input type="checkbox"/>	wiphy0	157	sta1008	jedway1-vap1000	10.136.0.78	04:F0:21:A8:92:AB	802.11an-AC	-20 dBm	-103 d
1.2.13	<input type="checkbox"/>	<input type="checkbox"/>	wiphy0	157	sta1009	jedway1-vap1000	10.136.0.74	04:F0:21:A8:92:AB	802.11an-AC	-20 dBm	-103 d
1.2.14	<input type="checkbox"/>	<input type="checkbox"/>	wiphy0	157	sta1010	jedway1-vap1000	10.136.0.77	04:F0:21:A8:92:AB	802.11an-AC	-20 dBm	-103 d
1.2.15	<input type="checkbox"/>	<input type="checkbox"/>	wiphy0	157	sta1011	jedway1-vap1000	10.136.0.88	04:F0:21:A8:92:AB	802.11an-AC	-20 dBm	-103 d
1.2.16	<input type="checkbox"/>	<input type="checkbox"/>	wiphy0	157	sta1012	jedway1-vap1000	10.136.0.81	04:F0:21:A8:92:AB	802.11an-AC	-20 dBm	-103 d
1.2.17	<input type="checkbox"/>	<input type="checkbox"/>	wiphy0	157	sta1013	jedway1-vap1000	10.136.0.79	04:F0:21:A8:92:AB	802.11an-AC	-20 dBm	-103 d
1.2.18	<input type="checkbox"/>	<input type="checkbox"/>	wiphy0	157	sta1014	jedway1-vap1000	10.136.0.85	04:F0:21:A8:92:AB	802.11an-AC	-20 dBm	-103 d
1.2.19	<input type="checkbox"/>	<input type="checkbox"/>	wiphy0	157	sta1015	jedway1-vap1000	10.136.0.84	04:F0:21:A8:92:AB	802.11an-AC	-20 dBm	-103 d
1.2.20	<input type="checkbox"/>	<input type="checkbox"/>	wiphy0	157	sta1016	jedway1-vap1000	10.136.0.87	04:F0:21:A8:92:AB	802.11an-AC	-20 dBm	-103 d
1.2.21	<input type="checkbox"/>	<input type="checkbox"/>	wiphy0	157	sta1017	jedway1-vap1000	10.136.0.82	04:F0:21:A8:92:AB	802.11an-AC	-20 dBm	-103 d
1.2.22	<input type="checkbox"/>	<input type="checkbox"/>	wiphy0	157	sta1018	jedway1-vap1000	10.136.0.86	04:F0:21:A8:92:AB	802.11an-AC	-20 dBm	-103 d
1.2.23	<input type="checkbox"/>	<input type="checkbox"/>	wiphy0	157	sta1019	jedway1-vap1000	10.136.0.83	04:F0:21:A8:92:AB	802.11an-AC	-20 dBm	-103 d
1.2.24	<input type="checkbox"/>	<input type="checkbox"/>	wiphy1	64	sta2100	jedway1-vap1100	10.136.0.92	04:F0:21:38:03:B7	802.11an-AC	-21 dBm	-103 d
1.2.26	<input type="checkbox"/>	<input type="checkbox"/>	wiphy1	64	sta2101	jedway1-vap1100	10.136.0.90	04:F0:21:38:03:B7	802.11an-AC	-21 dBm	-103 d

Logged in to: jedway1:4002 as: Admin

3. Move to the *Layer 4-7* tab

LANforge Manager Version(5.3.9)

Control Reporting Tear-Off Info Plugins

Chamber View Stop All Restart Manager Refresh HELP

Generic Test Mgr Test Group Resource Mgr Event Log Alerts Port Mgr vAP Stations DUT Profiles Traffic-Profiles Messages

Status Layer-3 L3 Endps VoIP/RTP VoIP/RTP Endps Armageddon WanLinks Attenuators RF-Generator File-IO Layer-4

Rpt Timer: fast (1 s) Go Test Manager all Select All Start + Stop - Quiesce Clear

View 0 - 500 Go Display Crgate Modify Batch Modify Delete

Layer-4 Endpoints for Selected Test Manager

Name	EID	Type	Status	Total-URLs	URLs/s	Bytes-RD	Bytes-WR	Tx Rate	Tx Rate (1 min)	Rx Rate	Rx Rate (1 min)
------	-----	------	--------	------------	--------	----------	----------	---------	-----------------	---------	-----------------

Logged in to: jedway1:4002 as: Admin

4. Create a new connection, this example is named **www1**. on resource 2, WiFi station **sta1000** Next, consider the **URLs per 10 minute** field.

**Create/Modify L4Endpoint**

Name:  Rpt Timer:  Test Manager:

Shelf:  Resource:  Port:  IP Addr:

Endp Name:  URLs per 10m:  Max Speed:

Quiesce:  URL Timeout:

TFTP Block Size:

Proxy Port:  Proxy Server:

Proxy Auth:

Proxy Auth Types: ☐ Basic ☐ Digest ☐ NTLM

HTTP Compression: ☐ Gzip ☐ Deflate

HTTP Auth Types: ☐ Basic ☐ Digest ☐ GSS-Negotiate ☐ NTLM

How many URLs should try to process per 10 minutes:

- 600: 1/s
- 1200: 2/s
- 1800: 3/s
- 2400: 4/s
- 3000: 5/s

A. Hover your mouse over the *URLs per 10 min* field to see the tool tip. If you wanted to create *five connections per second*, that would be **3000** connections in 10 minutes. This differs from the *Max Speed* field, which sets the maximum bit per second for the connection.

5. Continue with other settings. We are purposely going to make an error and diagnose it.

**Create/Modify L4Endpoint**

Name:  Rpt Timer:  Test Manager:

Shelf:  Resource:  Port:  IP Addr:

Endp Name:  URLs per 10m:  Max Speed:

Quiesce:  URL Timeout:  DNS Cache Timeout:

TFTP Block Size:

Proxy Port:  Proxy Server:

Proxy Auth:

Proxy Auth Types: ☐ Basic ☐ Digest ☐ NTLM

HTTP Compression: ☒ Gzip ☐ Deflate

HTTP Auth Types: ☐ Basic ☐ Digest ☐ GSS-Negotiate ☐ NTLM

SSL Cert:

SMTP-From:

Agent/RCPT-TO:

UL/DL:  ☒ IPv4 ☐ IPv6

URL:

Source/Dest File:

☐ Get-URLs-From-File ☐ Authenticate Server ☐ Use-Proxy ☐ Allow-Reuse ☐ Allow-Cache ☒ Enable 4XX ☐ Show Headers

☒ Bind DNS ☒ FTP PASV ☒ FTP EPSV

A. Set the request rate, choose the number of *URLs per 10 min* to **3000**

B. DNS Cache Timeout: 600

C. Select **Gzip**

D. Set *URL* to http://10.136.0.1/

E. Set *Destination file or directory* to /dev/nu11 if you are on Linux. (If you are on Windows, you need to use NUL)

F. Select **Enable 4XX** to show errors in logs

G. Select **Bind DNS** so that hostnames are resolved over **sta1000** (*not over our management port*)

H. Click **Apply**. Do not close this window.

6. Back in the *Layer 4-7* tab, select the connection

LANforge Manager Version(5.3.9)

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Status Layer-3 L3 Endps VoIP/RTP VoIP/RTP Endps Armageddon WanLinks Attenuators RF-Generator File-IO Layer-4

Rpt Timer: fast (1 s) Go Test Manager all Select All Start + Stop - Quiesce Clear

View 0 - 500 Display Create Modify Batch Modify Delete

Layer-4 Endpoints for Selected Test Manager

Name	EID	Type	Status	Total-URLs	URLs/s	Bytes-RD	Bytes-WR	Tx Rate	Tx Rate (1 min)	Rx Rate	Rx Rate (1 min)
www1	1.2.3.161	L4/Gen	Stopped	0	0	0	0	0	0	0	0

Logged in to: jedway1:4002 as: Admin

7. **Start** the connection

LANforge Manager Version(5.3.9)

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Rpt Timer: fast (1 s) Go Test Manager all Select All Start + Stop - Quiesce Clear

View 0 - 500 Display Create Modify Batch Modify Delete

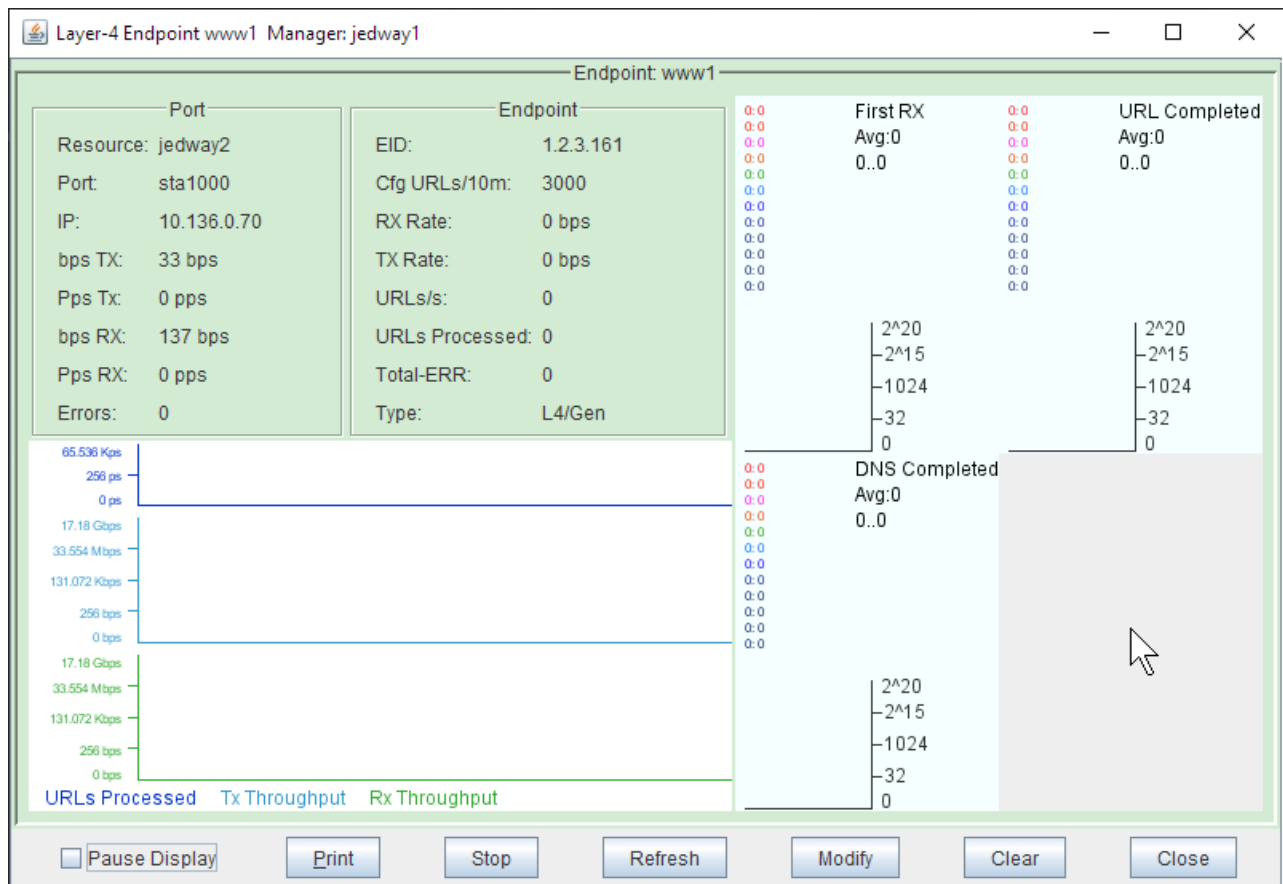
Layer-4 Endpoints for Selected Test Manager

Name	EID	Type	Status	Total-URLs	URLs/s	Bytes-RD	Bytes-WR	Tx Rate	Tx Rate (1 min)	Rx Rate	Rx Rate (1 min)
www1	1.2.3.161	L4/Gen	Run	0	0	0	0	0	0	0	0

Logged in to: jedway1:4002 as: Admin

A. ... then click **Display**

8. Watch the **www1** endpoint window...



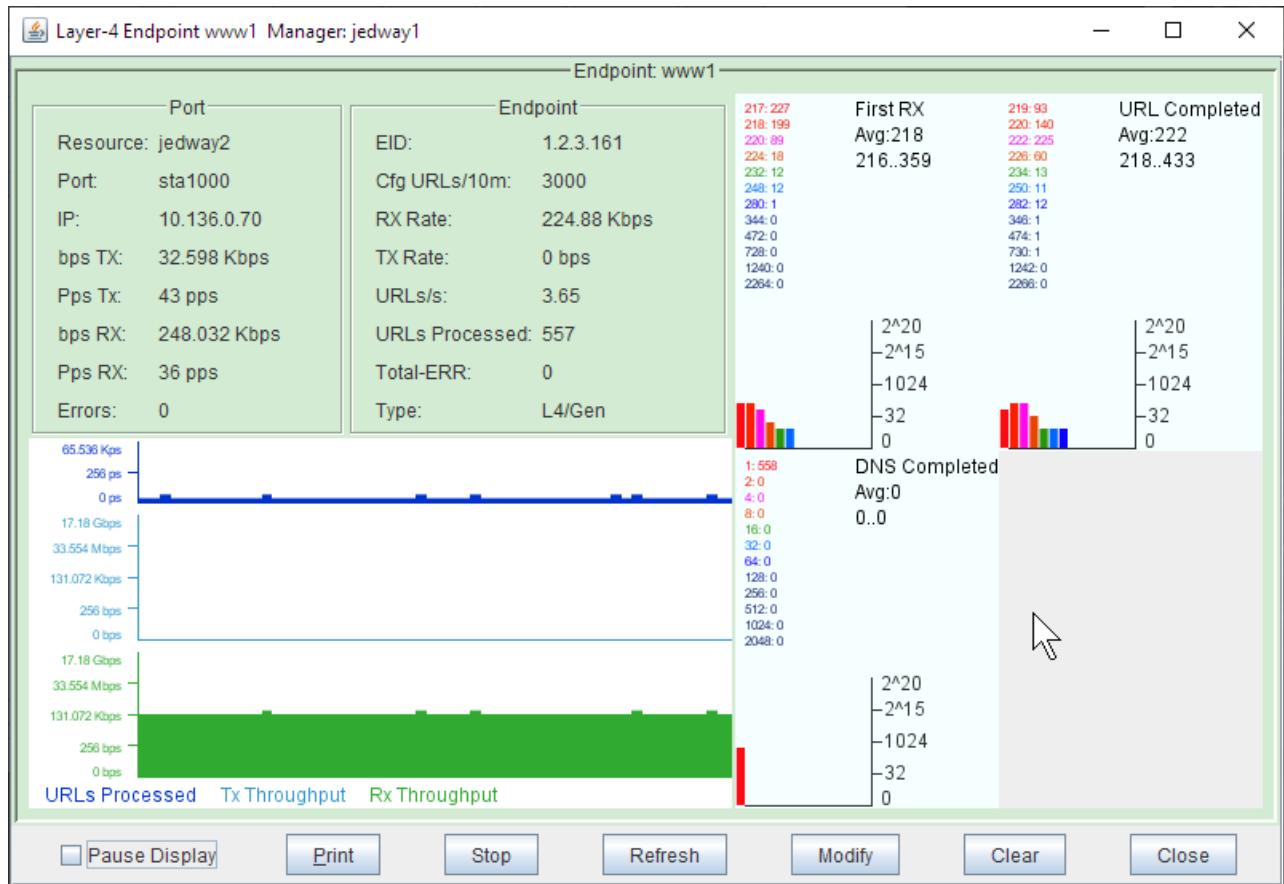
A. Notice how there is no traffic to `ctweb`; because the hostname will not resolve over our test network. This is a common mistake. Let's use the IP of our other LANforge hosting our test network instead.

9. Change the URL to use an IP address: `http://10.136.0.1/`

The screenshot shows the 'Create/Modify L4Endpoint' dialog box. The 'Name' field is set to 'www1'. The 'Rpt Timer' is set to 'fast (1 s)'. The 'Test Manager' is set to 'default\_tm'. The 'Shelf' is set to '1'. The 'Resource' is set to '2 (jedway2)'. The 'Port' is set to '3 (sta1000)'. The 'IP Addr' is set to 'AUTO'. The 'Endp Name' is set to '161'. The 'URLs per 10m' is set to '3000'. The 'Max Speed' is set to 'Infinite'. The 'Quiesce' is set to '3 (3 sec)'. The 'URL Timeout' is set to '1000'. The 'DNS Cache Timeout' is set to '600 (10 min)'. The 'TFTP Block Size' is set to 'Default (512 B)'. The 'Proxy Port' is set to '0'. The 'Proxy Server' is empty. The 'Proxy Auth' is empty. The 'Proxy Auth Types' are 'Basic', 'Digest', and 'NTLM'. The 'HTTP Compression' is 'Gzip'. The 'HTTP Auth Types' are 'Basic', 'Digest', 'GSS-Negotiate', and 'NTLM'. The 'SSL Cert' is 'ca-bundle.crt'. The 'SMTP-From' is empty. The 'Agent/RCPT-TO' is empty. The 'UL/DL' is 'Download'. The 'IPv4' checkbox is checked. The 'IPv6' checkbox is unchecked. The 'URL' field is highlighted with a red circle and contains the text 'http://10.136.0.1/'. The 'Source/Dest File' is 'dev/null'. The 'Get-URLs-From-File' checkbox is unchecked. The 'Authenticate Server' checkbox is unchecked. The 'Use-Proxy' checkbox is unchecked. The 'Allow-Reuse' checkbox is unchecked. The 'Allow-Cache' checkbox is unchecked. The 'Enable 4XX' checkbox is checked. The 'Show Headers' checkbox is unchecked. The 'Bind DNS' checkbox is checked. The 'FTP PASV' checkbox is checked. The 'FTP EPSV' checkbox is checked. The 'Apply', 'OK', 'Batch-Create', and 'Cancel' buttons are at the bottom.

- A. Click **Apply**
- B. Do not close the window.

10. The endpoint display now shows traffic.



- A. **Not having DNS resolution is a common problem in test networks.**
- B. It can cause problems when connecting to a https website and getting certificate errors.
- C. Click **Close**

11. It is pretty simple to create a connection per WiFi station on our LANforge. Return to our **Create/Modify L4Endpoint** window for **www1**

**Create/Modify L4Endpoint**

Name:  Rpt Timer:  Test Manager:

Shelf:  Resource:  Port:  IP Addr:

Endp Name:  URLs per 10m:  Max Speed:

Quiesce:  URL Timeout:  DNS Cache Timeout:

TFTP Block Size:

Proxy Port:  Proxy Server:

Proxy Auth:

Proxy Auth Types: ☐ Basic ☐ Digest ☐ NTLM

HTTP Compression: ☒ Gzip ☐ Deflate

HTTP Auth Types: ☐ Basic ☐ Digest ☐ GSS-Negotiate ☐ NTLM

SSL Cert:

SMTP-From:

Agent/RCPT-TO:

UL/DL:  ☒ IPv4 ☐ IPv6

URL:

Source/Dest File:

☐ Get-URLs-From-File ☐ Authenticate Server ☐ Use-Proxy ☐ Allow-Reuse ☐ Allow-Cache ☒ Enable 4XX ☐ Show Headers

☒ Bind DNS ☒ FTP PASV ☒ FTP EPSV

A. Click **Batch-Create**

12. In the **Batch Create** window, create 19 more connections

**Layer-4 Batch Creator: www1**

www002, www003 ... www020

Resources: 2, 2 ... 2

Ports: sta1001, sta1002 ... sta1019

IPs: AUTO, AUTO ... AUTO

Quantity:  Number of Digits:  ☒ Zero Pad

Starting Name Suffix:  Name Increment:

Resource Increment A:

Port Increment A:

IP Addr Increment A:

File Increment:  ☐ Get-URLs-From-File

A. Quantity: **19**

B. Number of Digits **\*\*3\*\***

C. File Increment: **\*\*0\*\*** (because we don't have multiple `/dev/nu11` files)

D. Click **Apply**

13. Back in the *Layer 4-7* tab, observe all our connections

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View 0 - 500 Display Crgate Modify Batch Modify Delete

Layer-4 Endpoints for Selected Test Manager

Name	EID	Type	Status	Total-URLs	URLs/s	Bytes-RD	Bytes-WR	Tx Rate	Tx Rate (1 min)	Rx Rate	Rx Rate (1 min)
www002	1.2.5.162	L4/Gen	Stopped	0	0	0	0	0	0	0	0
www003	1.2.6.163	L4/Gen	Stopped	0	0	0	0	0	0	0	0
www004	1.2.7.164	L4/Gen	Stopped	0	0	0	0	0	0	0	0
www005	1.2.8.165	L4/Gen	Stopped	0	0	0	0	0	0	0	0
www006	1.2.9.166	L4/Gen	Stopped	0	0	0	0	0	0	0	0
www007	1.2.10.167	L4/Gen	Stopped	0	0	0	0	0	0	0	0
www008	1.2.11.168	L4/Gen	Stopped	0	0	0	0	0	0	0	0
www009	1.2.12.169	L4/Gen	Stopped	0	0	0	0	0	0	0	0
www010	1.2.13.170	L4/Gen	Stopped	0	0	0	0	0	0	0	0
www011	1.2.14.171	L4/Gen	Stopped	0	0	0	0	0	0	0	0
www012	1.2.15.172	L4/Gen	Stopped	0	0	0	0	0	0	0	0
www013	1.2.16.173	L4/Gen	Stopped	0	0	0	0	0	0	0	0
www014	1.2.17.174	L4/Gen	Stopped	0	0	0	0	0	0	0	0
www015	1.2.18.175	L4/Gen	Stopped	0	0	0	0	0	0	0	0
www016	1.2.19.176	L4/Gen	Stopped	0	0	0	0	0	0	0	0
www017	1.2.20.177	L4/Gen	Stopped	0	0	0	0	0	0	0	0
www018	1.2.21.178	L4/Gen	Stopped	0	0	0	0	0	0	0	0
www019	1.2.22.179	L4/Gen	Stopped	0	0	0	0	0	0	0	0
www020	1.2.23.180	L4/Gen	Stopped	0	0	0	0	0	0	0	0
www1	1.2.3.161	L4/Gen	Run	1,329	3.517	10,023,200	0	0	0	219,071	212,452

Logged in to: jedway1:4002 as: Admin

14. Highlight them, and click **Start**

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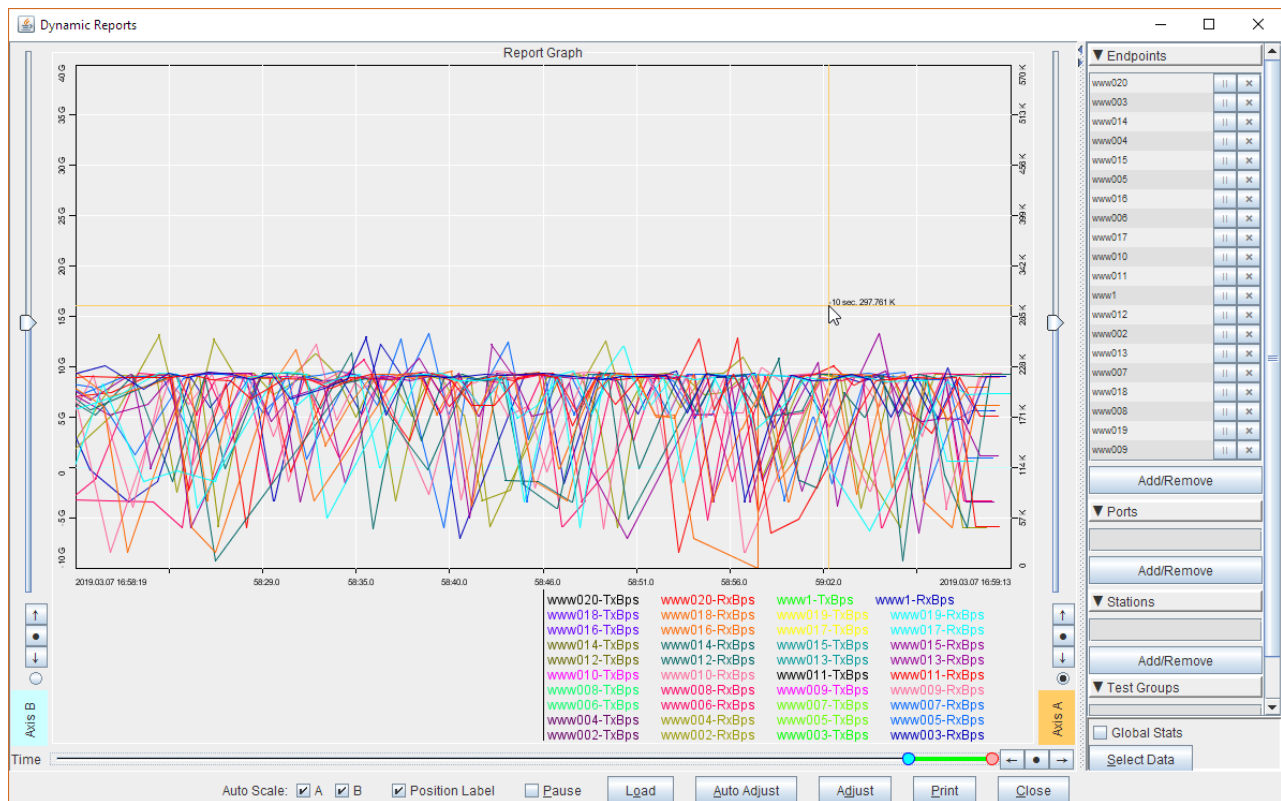
Name	EID	Type	Status	Total-URLs	URLs/s	Bytes-RD	Bytes-WR	Tx Rate	Tx Rate (1 min)	Rx Rate	Rx Rate (1 min)
www002	1.2.5.162	L4/Gen	Run	36	2.934	272,687	0	0	0	177,820	178,018
www003	1.2.6.163	L4/Gen	Run	33	2.73	250,064	0	0	0	165,495	166,179
www004	1.2.7.164	L4/Gen	Run	34	2.806	257,605	0	0	0	170,064	170,698
www005	1.2.8.165	L4/Gen	Run	33	2.801	248,853	0	0	0	168,985	169,138
www006	1.2.9.166	L4/Gen	Run	17	1.587	129,408	0	0	0	96,645	96,843
www007	1.2.10.167	L4/Gen	Run	28	2.306	212,359	0	0	0	139,928	140,381
www008	1.2.11.168	L4/Gen	Run	31	2.63	234,982	0	0	0	159,472	159,594
www009	1.2.12.169	L4/Gen	Run	25	2.246	189,736	0	0	0	136,365	136,828
www010	1.2.13.170	L4/Gen	Run	31	2.524	233,771	0	0	0	152,269	152,423
www011	1.2.14.171	L4/Gen	Run	25	2.248	191,184	0	0	0	137,530	138,019
www012	1.2.15.172	L4/Gen	Run	26	2.117	197,277	0	0	0	128,487	128,603
www013	1.2.16.173	L4/Gen	Run	29	2.596	219,900	0	0	0	157,465	157,891
www014	1.2.17.174	L4/Gen	Run	33	2.705	250,064	0	0	0	164,003	164,375
www015	1.2.18.175	L4/Gen	Run	35	2.841	265,146	0	0	0	172,172	172,212
www016	1.2.19.176	L4/Gen	Run	28	2.527	212,359	0	0	0	153,313	153,965
www017	1.2.20.177	L4/Gen	Run	33	2.854	250,064	0	0	0	173,039	173,833
www018	1.2.21.178	L4/Gen	Run	31	2.786	234,982	0	0	0	168,915	169,493
www019	1.2.22.179	L4/Gen	Run	29	2.36	219,900	0	0	0	143,187	143,299
www020	1.2.23.180	L4/Gen	Run	60	3.18	453,671	0	0	0	192,376	192,754
www1	1.2.3.161	L4/Gen	Run	1,439	3.317	10,852,710	0	0	0	217,047	200,419

Logged in to: jedway1:4002 as: Admin

15. Note that if we were to *Right Click*→Display to show dynamic report

16. *Right Click* → *Dynamic Report*to show dynamic report





A. This shows throughput for all the connections.

B. Notice how crowded this graph is. There is a simpler way to display overall throughput.

17. Next, select the *Port Mgr* tab.

A. Select resource 2, radio **wiphy0**

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Disp: 192.168.100.136:0.0 Sniff Packets ☒ Down ☐ Clear Counters Reset Port Delete

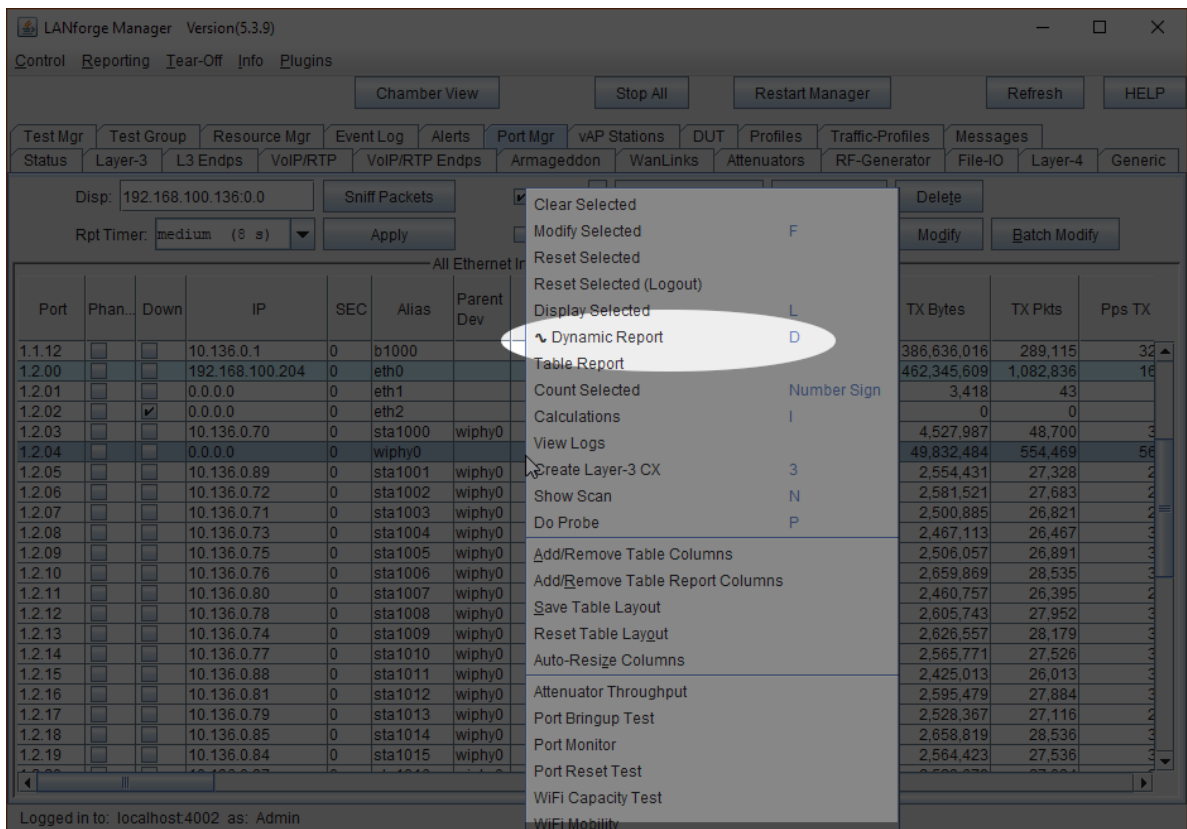
Rpt Timer: medium (8 s) Apply ☐ VRF Display Create Modify Batch Modify

All Ethernet Interfaces (Ports) for all Resources.

Port	Phan...	Down	IP	SEC	Alias	Parent Dev	RX Bytes	RX Pkts	Pps RX	bps RX	TX Bytes	TX Pkts	Pps TX
1.1.12			10.136.0.1	0	b1000		29,472,718	498,801	714	338,384	350,517,462	262,003	37
1.2.00			192.168.100.204	0	eth0		50,417,464	366,437	64	67,642	1,443,767,448	1,067,982	17
1.2.01			0.0.0.0	0	eth1		83,496	461	0	0	3,418	43	
1.2.02		<input checked="" type="checkbox"/>	0.0.0.0	0	eth2		0	0	0	0	0	0	
1.2.03			10.136.0.70	0	sta1000	wiphy0	32,227,757	39,232	34	231,821	4,249,441	45,735	4
1.2.04			0.0.0.0	0	wiphy0		481,580,802	868,496	756	4,935,819	45,479,244	507,221	71
1.2.05			10.136.0.89	0	sta1001	wiphy0	17,212,070	21,510	32	217,238	2,310,505	24,739	3
1.2.06			10.136.0.72	0	sta1002	wiphy0	17,558,579	21,939	31	215,423	2,348,721	25,209	3

Logged in to: localhost:4002 as: Admin

B. Right Click → Dynamic Report to show dynamic report



C. See the overall throughput through the radio

