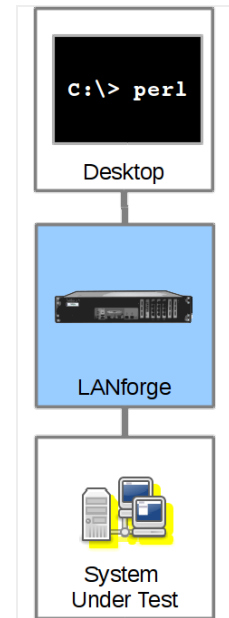


Emulate video streaming traffic with the 13_video_em.pl Script

Goal: Emulate video stream traffic patterns using Layer-3 connections.

Using the `13_video_em.pl` and the `13_vid_group.pl`, we assemble two test groups of connections, a group of Generic connections, and a group of Layer3 connections, that emulate the bursty buffer filling pattern of traffic that video streaming tends to resemble. Requires LANforge 5.4.2.



1.

Begin with stations

- A. Using a CT523c, we can create 16 stations, and for this script setup you probably do not want to create more than that. These scripts poll LANforge every 200ms and that loads the server quickly. If you are using a CT521a or CT522b, then consider starting with five or six stations.

There needs to be a continuously named series of stations.

LANforge Manager Version(5.4.2) +c11-sock

Control Reporting Tear Off Info Plugins

Chamber View Stop All Restart Manager Refresh HELP

Status Port Mgr VoIP/RTP VoIP/RTP Endps DUT Profiles Alerts Messages Warnings +

Disp: 192.168.92.14:0.0 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	Down	Parent Dev	Channel	Alias	SSID	AP	IP	MAC
1.1.00	<input type="checkbox"/>			eth0			192.168.92.14	0c:c4:7a:e2:01:e6
1.1.01	<input type="checkbox"/>			eth1			10.40.0.74	0c:c4:7a:e2:01:e7
1.1.02	<input type="checkbox"/>	wiphy0	153	sta000	jedway-wpa2-x2048-5-1	00:0E:8E:7B:DF:9B	10.40.10.155	00:0e:8e:25:a1:47
1.1.04	<input type="checkbox"/>	wiphy0	153	sta001	jedway-wpa2-x2048-5-1	00:0E:8E:7B:DF:9B	10.40.10.153	00:0e:8e:c5:54:47
1.1.05	<input type="checkbox"/>	wiphy0	153	sta002	jedway-wpa2-x2048-5-1	00:0E:8E:7B:DF:9B	10.40.10.150	00:0e:8e:de:10:47
1.1.06	<input type="checkbox"/>	wiphy0	153	sta003	jedway-wpa2-x2048-5-1	00:0E:8E:7B:DF:9B	10.40.10.151	00:0e:8e:79:22:47
1.1.07	<input type="checkbox"/>	wiphy1	153	sta004	jedway-wpa2-x2048-5-1	00:0E:8E:7B:DF:9B	10.40.10.157	00:0e:8e:13:4d:e3
1.1.09	<input type="checkbox"/>	wiphy1	153	sta005	jedway-wpa2-x2048-5-1	00:0E:8E:7B:DF:9B	10.40.10.152	00:0e:8e:ce:a1:e3
1.1.10	<input type="checkbox"/>	wiphy1	153	sta006	jedway-wpa2-x2048-5-1	00:0E:8E:7B:DF:9B	10.40.10.161	00:0e:8e:d6:e9:e3
1.1.11	<input type="checkbox"/>	wiphy1	153	sta007	jedway-wpa2-x2048-5-1	00:0E:8E:7B:DF:9B	10.40.10.159	00:0e:8e:e2:b5:e3
1.1.12	<input type="checkbox"/>	wiphy2	153	sta008	jedway-wpa2-x2048-5-1	00:0E:8E:7B:DF:9B	10.40.10.164	04:f0:21:94:eb:03
1.1.14	<input type="checkbox"/>	wiphy2	153	sta009	jedway-wpa2-x2048-5-1	00:0E:8E:7B:DF:9B	10.40.10.162	04:f0:21:57:12:03
1.1.15	<input type="checkbox"/>	wiphy2	153	sta010	jedway-wpa2-x2048-5-1	00:0E:8E:7B:DF:9B	10.40.10.160	04:f0:21:82:0c:03
1.1.16	<input type="checkbox"/>	wiphy2	153	sta011	jedway-wpa2-x2048-5-1	00:0E:8E:7B:DF:9B	10.40.10.163	04:f0:21:ee:8c:03
1.1.17	<input type="checkbox"/>	wiphy3	153	sta012	jedway-wpa2-x2048-5-1	00:0E:8E:7B:DF:9B	10.40.10.158	00:19:70:02:14:2d
1.1.19	<input type="checkbox"/>	wiphy3	153	sta013	jedway-wpa2-x2048-5-1	00:0E:8E:7B:DF:9B	10.40.10.154	00:19:70:34:8e:2d
1.1.20	<input type="checkbox"/>	wiphy3	153	sta014	jedway-wpa2-x2048-5-1	00:0E:8E:7B:DF:9B	10.40.10.156	00:19:70:7f:e1:2d
1.1.21	<input type="checkbox"/>	wiphy3	153	sta015	jedway-wpa2-x2048-5-1	00:0E:8E:7B:DF:9B	10.40.10.165	00:19:70:d5:c8:2d
1.1.03	<input type="checkbox"/>	0	0	wiphy0			0.0.0.0	00:0e:8e:4e:59:47
1.1.08	<input type="checkbox"/>	0	0	wiphy1			0.0.0.0	00:0e:8e:5a:70:e3
1.1.13	<input type="checkbox"/>	0	0	wiphy2			0.0.0.0	04:f0:21:20:37:03
1.1.18	<input type="checkbox"/>	0	0	wiphy3			0.0.0.0	00:19:70:be:62:2d
1.1.22	<input checked="" type="checkbox"/>	wiphy0	153	wlan0	jedway-wpa2-x2048-5-1	Not-Associated	0.0.0.0	5a:12:5e:ea:af:d7
1.1.23	<input checked="" type="checkbox"/>	wiphy1	153	wlan1		Not-Associated	0.0.0.0	06:78:0b:9c:c9:79

Logged in to: localhost:4402 as: Admin

For more information see [Creating Stations](#)

- B. In this example we will use `eth1` as our **upstream port**. We will be referring to that using the EID format: `1.1.2` For more information see [LANforge Entity IDs](#)

2.

Create Connections Using `13_vid_group.pl`

A. The script `l3_vid_group.pl` has help examples. You can do four tasks with the script.

```

Terminal - lanforge@ct524-genia:~/scripts
jreynolds@cholla5:~/git/lanforge-scripts x lanforge@ct524-genia:~/scripts
[lanforge@ct524-genia scripts]$ ./l3_vid_group.pl
Usage: ./l3_vid_group.pl # create a large group of Layer 3 creations that emulate video traffic
--action -a { create | destroy | start | stop }
--buffer_size -b {bytes K|M} # size of emulated RX buffer, default 3MB
--clear_group -z # empty test group first
--cx_name -c {connection prefix}
--endp_type -t {tcp|udp|lf_tcp|lf_udp}
--first_sta -i {name}
--log_cli {[]filename} # log cli commands
--mgr -m {lanforge server} # default localhost
--mgr_port -p {lanforge port} # default 4002
--num_cx -n {number} # default 1
--resource -r {station resource}
--speed -s {bps K|M|G} # maximum speed of tx side, default 1Gbps
--stream --vid_mode -e {stream resolution name|list} # default yt-sdr-1080p30
# list of streams maintained in l3_video_em.pl
--test_grp -g {test group name} # all connections placed in this group
# default is {cx_name}_tg for the Generic connections
# we manage Layer 3 connections in _L3_{cx_name}_tg
--upstream -u {port short-EID} # video transmitter port;
# use 1.1.eth1 or 1.2.br0 for example
# upstream port does not need to be on same resource

Examples:
# create 30 stations emulating 720p HDR 60fps transmitted from resource 2:
./l3_vid_group.pl --action create --buffer_size 8M --clear_group --cx_name yt1080p60.1 \
--endp_type udp --first_sta sta0000 --num_cx 30 \
--resource 2 --speed 200M --stream yt-hdr-720p60 --test_group yt60fps \
--upstream 1.2.br0

# start test group:
./l3_vid_group.pl -a start -g yt60fps

# stop test group:
./l3_vid_group.pl -a stop -g yt60fps

# add 30 more stations on resource 3 to group
./l3_vid_group.pl -a create -b 8M -c yt1080p60.3 -t udp -i sta0100 -n 30 -r 3 \
-s 200M -e yt-hdr-720p60 -g yt60fps -u 1.2.br0

# destroy test group
./l3_vid_group.pl -a destroy -g yt60fps
[lanforge@ct524-genia scripts]$

```

- A. Create groups of video emulators
- B. Start groups
- C. Stop groups
- D. Destroy groups

B. We will create a group of 16 connections on our stations. Use the command:

```

./l3_vid_group.pl --action create --endp_type tcp --first_sta sta000
--num_cx 16 --test_grp sixteen --upstream 1.1.eth1

```

```

Terminal - lanforge@ct524-genia:~/scripts
jreynolds@cholla5:~/git/lanforge-scripts x lanforge@ct524-genia:~/scripts
[lanforge@ct524-genia scripts]$ ./l3_vid_group.pl --action create --endp_type tcp --first_sta sta000 --num_cx 16 --test_grp sixteen --upstream 1.1.eth1
No cross connects found for test group _L3_sixteen.
No cross connects found for test group sixteen.
Creating test group [sixteen]...Creating test group [_L3_sixteen]...adding L3 CX to _L3_sixteen .....done
Creating Generic connections for video emulation .....done
Adding generic connections to sixteen .....done
[lanforge@ct524-genia scripts]$

```

C. You will see two test group created. The group named `_L3_sixteen` contains the Layer-3 tcp connections. The group named `sixteen` contains Generic connections that control the Layer-3 connections.

The screenshot shows the LANforge Manager interface. At the top, there are buttons for 'Chamber View', 'Stop All', 'Restart Manager', 'Refresh', and 'HELP'. Below that, there are tabs for 'Status', 'Port Mgr', 'Layer-3', 'L3 Endps', 'Generic', 'Test Group', 'Alerts', and 'Warnings'. The 'Test Group' tab is selected, showing a 'Rpt Timer' set to 'fast (1 s)' and several control buttons: 'Select All', 'Start +', 'Stop -', 'Quiesce', 'Clear', 'Display', 'Create', 'Modify', and 'Delete'. The main area displays a table of LANforge Test Groups:

Name	Run	Script	Cross Connects							
_L3_sixteen	<input type="checkbox"/>	None	sixteen-0000	sixteen-0001	sixteen-0002	sixteen-0003	sixteen-0004	sixteen-0005	sixteen-0006	...
sixteen	<input type="checkbox"/>	None	CX_sixteen-0000	CX_sixteen-0001	CX_sixteen-0002	CX_sixteen-0003	CX_sixteen-0004	CX_sixteen-0005	CX_sixteen-0006	C...

At the bottom, it says 'Logged in to: localhost:4402 as: Admin'.

D. The Generic tab will have 16 connections.

The screenshot shows the LANforge Manager interface with the 'Generic' tab selected. The window title is 'LANforge Manager Version(5.4.2) +cli-sock'. The interface includes a menu bar (Control, Reporting, Tear Off, Info, Plugins), a toolbar (Chamber View, Stop All, Restart Manager, Refresh, HELP), and a sub-menu bar (Status, Port Mgr, Layer-3, L3 Endps, Generic, Test Group, Alerts, Warnings, +). Below the sub-menu bar, there are controls for 'Rpt Timer' (fast (1 s) with a Go button) and 'Test Manager' (all with a dropdown arrow). Action buttons include 'Select All', 'Start +', 'Stop -', 'Clear', 'Create', 'Modify', and 'Delete'. The main table is titled 'Generic Endpoints for Selected Test Manager' and contains 16 rows of connection data. At the bottom, it says 'Logged in to: localhost:4402 as: Admin'.

Name	EID	Status	Rpt#	Last Results	Tx Bytes	Rx Bytes	Tx Pkts	PDU/s TX	Rx Pkts	PDU/s RX	Dropped	bps TX	bps RX
sixteen-0000	1.1.2.161	Stopped	0		0 B	0 B	0	0	0	0	0	0 bps	0 bps
sixteen-0001	1.1.4.163	Stopped	0		0 B	0 B	0	0	0	0	0	0 bps	0 bps
sixteen-0002	1.1.5.165	Stopped	0		0 B	0 B	0	0	0	0	0	0 bps	0 bps
sixteen-0003	1.1.6.167	Stopped	0		0 B	0 B	0	0	0	0	0	0 bps	0 bps
sixteen-0004	1.1.7.169	Stopped	0		0 B	0 B	0	0	0	0	0	0 bps	0 bps
sixteen-0005	1.1.9.171	Stopped	0		0 B	0 B	0	0	0	0	0	0 bps	0 bps
sixteen-0006	1.1.10.173	Stopped	0		0 B	0 B	0	0	0	0	0	0 bps	0 bps
sixteen-0007	1.1.11.175	Stopped	0		0 B	0 B	0	0	0	0	0	0 bps	0 bps
sixteen-0008	1.1.12.177	Stopped	0		0 B	0 B	0	0	0	0	0	0 bps	0 bps
sixteen-0009	1.1.14.179	Stopped	0		0 B	0 B	0	0	0	0	0	0 bps	0 bps
sixteen-0010	1.1.15.181	Stopped	0		0 B	0 B	0	0	0	0	0	0 bps	0 bps
sixteen-0011	1.1.16.183	Stopped	0		0 B	0 B	0	0	0	0	0	0 bps	0 bps
sixteen-0012	1.1.17.185	Stopped	0		0 B	0 B	0	0	0	0	0	0 bps	0 bps

E. The Layer-3 tab will have 16 connections.

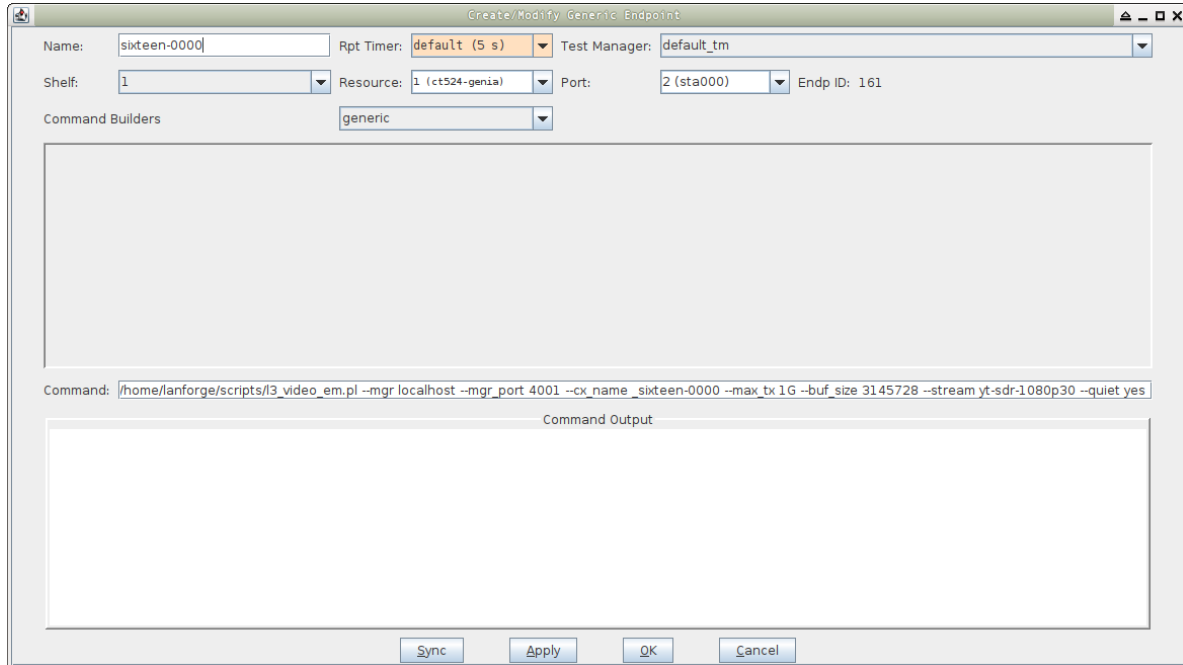
The screenshot shows the LANforge Manager interface with the 'Layer-3' tab selected. The window title is 'LANforge Manager Version(5.4.2) +cli-sock'. The interface includes a menu bar (Control, Reporting, Tear Off, Info, Plugins), a toolbar (Chamber View, Stop All, Restart Manager, Refresh, HELP), and a sub-menu bar (Status, Port Mgr, Layer-3, L3 Endps, Generic, Test Group, Alerts, Warnings, +). Below the sub-menu bar, there are controls for 'Rpt Timer' (fast (1 s) with a Go button) and 'Test Manager' (all with a dropdown arrow). Action buttons include 'Select All', 'Start +', 'Stop -', 'Quiesce', 'Clear', 'Display', 'Create', 'Modify', and 'Delete'. The main table is titled 'Cross Connects for Selected Test Manager' and contains 16 rows of connection data. At the bottom, it says 'Logged in to: localhost:4402 as: Admin' and 'Reset layout for table: cx-mgr'.

Name	Type	State	Endpoints (A ↔ B)	Pkt Rx A	Pkt Rx B	Bps Rx A	Bps Rx B	Rx Drop % A	Rx Drop % B
sixteen-0000	LF/TCP	Stopped	sixteen-0000-A ↔ sixteen-0000-B	0	0	0	0	0	0
sixteen-0001	LF/TCP	Stopped	sixteen-0001-A ↔ sixteen-0001-B	0	0	0	0	0	0
sixteen-0002	LF/TCP	Stopped	sixteen-0002-A ↔ sixteen-0002-B	0	0	0	0	0	0
sixteen-0003	LF/TCP	Stopped	sixteen-0003-A ↔ sixteen-0003-B	0	0	0	0	0	0
sixteen-0004	LF/TCP	Stopped	sixteen-0004-A ↔ sixteen-0004-B	0	0	0	0	0	0
sixteen-0005	LF/TCP	Stopped	sixteen-0005-A ↔ sixteen-0005-B	0	0	0	0	0	0
sixteen-0006	LF/TCP	Stopped	sixteen-0006-A ↔ sixteen-0006-B	0	0	0	0	0	0
sixteen-0007	LF/TCP	Stopped	sixteen-0007-A ↔ sixteen-0007-B	0	0	0	0	0	0
sixteen-0008	LF/TCP	Stopped	sixteen-0008-A ↔ sixteen-0008-B	0	0	0	0	0	0
sixteen-0009	LF/TCP	Stopped	sixteen-0009-A ↔ sixteen-0009-B	0	0	0	0	0	0

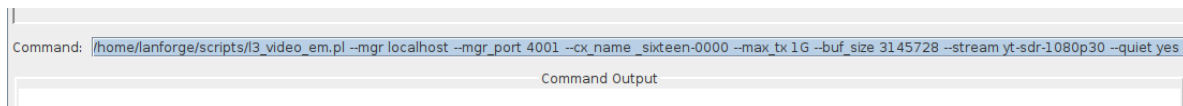
F. When we inspect one of the Generic connections, we can see the command it uses.

```
/home/lanforge/scripts/l3_video_em.pl --mgr localhost --mgr_port 4001  
--cx_name _sixteen-0000 --max_tg 1G --buf_size 3145728 --stream yt-sdr-1080p30 --quiet yes
```

You can paste this command into a shell prompt on your LANforge and use it. We discuss the options in the following section.



G. You can highlight the command in the window and copy it with **Ctrl-C**

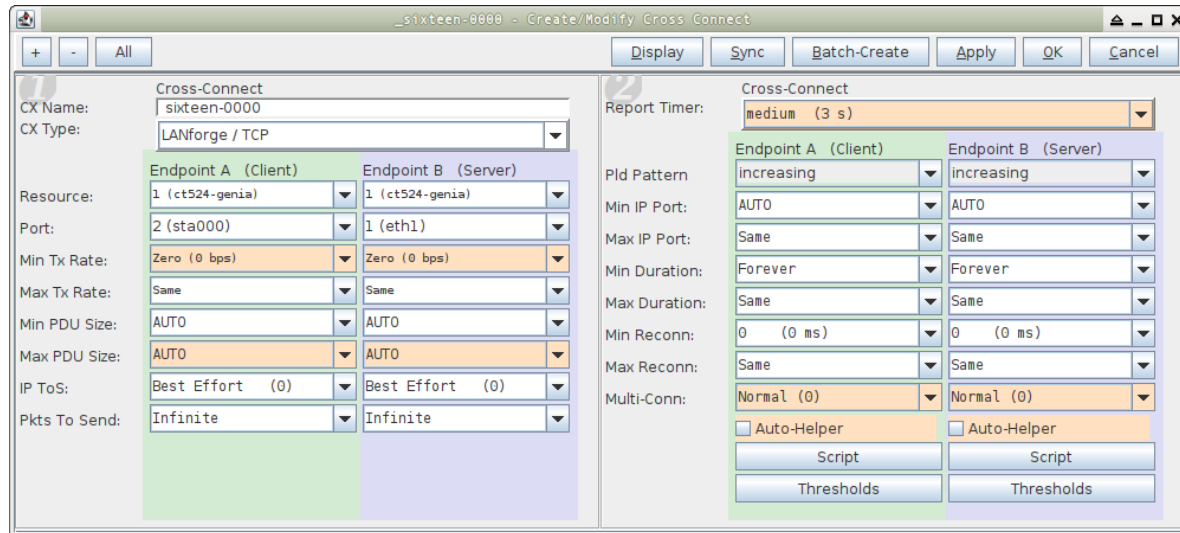


H. You can paste the command into the shell with **Ctrl-Shift-V**



I. When we inspect the Layer-3 connection, we see these aspects:

- It is a **TCP** connection. This is optional, you can create UDP connections; the Android YouTube app uses TLS over UDP (QUIC protocol) connections.
- Both endpoints are set at **0 bps** transmit. The Generic script will control the throttle on the B-side of the connection.
- The PDU size is auto. This doesn't have much bearing on TCP, but might have bearing on UDP connections.
- The **Report Timer** is set to three seconds. This value is too long to graph with much detail in the Dynamic Report, but you can shorten it to 500ms if you desire to see more resolution in the Dynamic Report graph. This Report Timer value directly impacts processor load, so use it judiciously.
- Auto-Helper is a new feature intended to reduce CPU load, it has little impact at the moment.
- Multi-con is not desired for this style of connection.

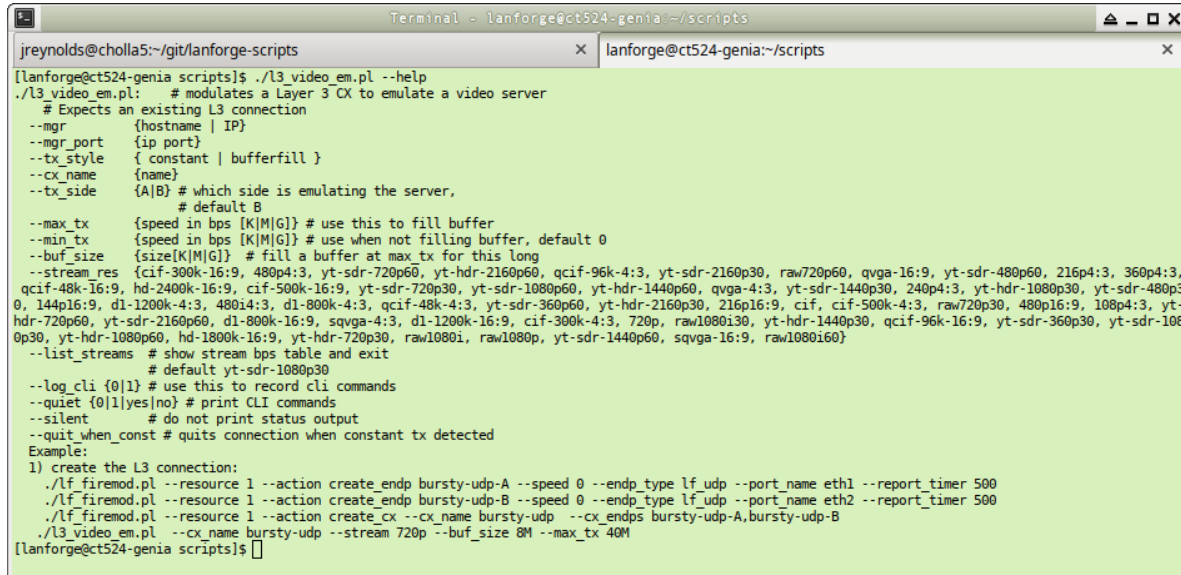


3.

Exploring 13_video_em.pl

A. The options for `l3_video_em.pl` are available with `--help`. The most important options for tuning video streaming emulation are:

- **tx_style**: bufferfill is default and models present video playback
- **max_tx**: this is the starting TX rate. The `l3_vid_group` script defaults this to 1Gbps, which is unrealistic for common WiFi connections. The script will regularly poll the station side for a TX-RATE value of the station to determine a more realistic upper bound for maximum rate. The more stations that share the same channel, the less realistic this rate becomes. We want to know this to some degree so that we can determine a realistic pause between buffer fills at a given bit rate.
- **buf_size**: observation of packet captures indicate that a video plugin on a browser buffers three to four megabytes of video. Between this number and our `max_tx` rate, we can calculate when to transmit to fill the video buffer before it empties.
- **stream_res**: This is a list with broadly agreed upon estimates of video bitrates. When people mention frame-rate, that is just part of the bitrate calculation; audio quality, color depth, and resolution are all part of the bitrate value.



```
Terminal - lanforge@ct524-genia:~/scripts
jreynolds@cholla5:~/git/lanforge-scripts x lanforge@ct524-genia:~/scripts
[lanforge@ct524-genia scripts]$ ./l3_video_em.pl --help
./l3_video_em.pl: # modulates a Layer 3 CX to emulate a video server
# Expects an existing L3 connection
--mgr {hostname | IP}
--mgr_port {ip port}
--tx_style { constant | bufferfill }
--cx_name {name}
--tx_side {A|B} # which side is emulating the server,
# default B
--max_tx {speed in bps [K|M|G]} # use this to fill buffer
--min_tx {speed in bps [K|M|G]} # use when not filling buffer, default 0
--buf_size {size[K|M|G]} # fill a buffer at max tx for this long
--stream_res {cif-300k-16:9, 480p4:3, yt-sdr-720p60, yt-hdr-2160p60, qcif-96k-4:3, yt-sdr-2160p30, raw720p60, qvga-16:9, yt-sdr-480p60, 216p4:3, 360p4:3,
qcif-48k-16:9, hd-2400k-16:9, cif-500k-16:9, yt-sdr-720p30, yt-sdr-1080p60, yt-hdr-1440p60, qvga-4:3, yt-sdr-1440p30, 240p4:3, yt-hdr-1080p30, yt-sdr-480p3
0, 144p16:9, d1-1200k-4:3, 480i4:3, d1-800k-4:3, qcif-48k-4:3, yt-sdr-360p60, yt-hdr-2160p30, 216p16:9, cif, cif-500k-4:3, raw720p30, 480p16:9, 108p4:3, yt-
hdr-720p60, yt-sdr-2160p60, d1-800k-16:9, sqvga-4:3, d1-1200k-16:9, cif-300k-4:3, 720p, raw1080i30, yt-hdr-1440p30, qcif-96k-16:9, yt-sdr-360p30, yt-sdr-108
0p30, yt-hdr-1080p60, hd-1800k-16:9, yt-hdr-720p30, raw1080i, raw1080p, yt-sdr-1440p60, sqvga-16:9, raw1080i60}
--list_streams # show stream bps table and exit
# default yt-sdr-1080p30
--log_cli {0|1} # use this to record cli commands
--quiet {0|1}yes|no # print CLI commands
--silent # do not print status output
--quit_when_const # quits connection when constant tx detected
Example:
1) create the L3 connection:
./lf_firemod.pl --resource 1 --action create_endp bursty-udp-A --speed 0 --endp_type lf_udp --port_name eth1 --report_timer 500
./lf_firemod.pl --resource 1 --action create_endp bursty-udp-B --speed 0 --endp_type lf_udp --port_name eth2 --report_timer 500
./lf_firemod.pl --resource 1 --action create_cx --cx_name bursty-udp --cx_endps bursty-udp-A,bursty-udp-B
./l3_video_em.pl --cx_name bursty-udp --stream 720p --buf_size 8M --max_tx 40M
[lanforge@ct524-genia scripts]$
```

B. A table of **stream resolutions** are available when you use the `--list` option. By default, the `l3_vid_group.pl` script uses the `yt-sdr-1080p30` stream size. That name can be decoded like so:

yt: YouTube (but any popular stream, really)

sdr: Standard Dynamic Range color, **hdr**: High Dynamic Range color

1080: frame height

p: progressive, **i**: interlaced

30: 30 frames per second; smaller bitrates might be 29.9, 25, or 24

```

Terminal - lanforge@ct524-genia:~/scripts
jreynolds@cholla5:~/git/lanforge-scripts x lanforge@ct524-genia:~/scripts x
[lanforge@ct524-genia scripts]$ ./l3_video_em.pl --list
Predefined Video Streams
=====
Stream      W      H      Audio+Video
[ 108p4:3 ] 144 x 108 using 48 kbps
[ qcif-48k-4:3 ] 144 x 108 using 48 kbps
[ sqvga-16:9 ] 160 x 90 using 48 kbps
[ sqvga-4:3 ] 160 x 120 using 48 kbps
[ qcif-48k-16:9 ] 192 x 108 using 48 kbps
[ qvga-16:9 ] 320 x 180 using 48 kbps
[ qvga-4:3 ] 320 x 240 using 48 kbps
[ 144p16:9 ] 192 x 144 using 96 kbps
[ qcif-96k-4:3 ] 192 x 144 using 96 kbps
[ qcif-96k-16:9 ] 256 x 144 using 96 kbps
[ 216p4:3 ] 288 x 216 using 300 kbps
[ cif-300k-4:3 ] 288 x 216 using 300 kbps
[ cif ] 352 x 288 using 300 kbps
[ 216p16:9 ] 384 x 216 using 300 kbps
[ cif-300k-16:9 ] 384 x 216 using 300 kbps
[ 240p4:3 ] 320 x 240 using 500 kbps
[ cif-500k-4:3 ] 320 x 240 using 500 kbps
[ cif-500k-16:9 ] 384 x 216 using 500 kbps
[ 360p4:3 ] 480 x 360 using 800 kbps
[ 480i4:3 ] 640 x 480 using 800 kbps
[ 480p4:3 ] 640 x 480 using 800 kbps
[ d1-800k-4:3 ] 640 x 480 using 800 kbps
[ d1-800k-16:9 ] 852 x 480 using 800 kbps
[ yt-sdr-360p30 ] 640 x 360 using 1128 kbps
[ d1-1200k-4:3 ] 640 x 480 using 1200 kbps
[ 480p16:9 ] 852 x 480 using 1200 kbps
[ d1-1200k-16:9 ] 852 x 480 using 1200 kbps
[ yt-sdr-360p60 ] 640 x 360 using 1628 kbps
[ 720p ] 1280 x 720 using 1800 kbps
[ hd-1800k-16:9 ] 1280 x 720 using 1800 kbps
[ hd-2400k-16:9 ] 1280 x 720 using 2336 kbps
[ yt-sdr-480p30 ] 852 x 480 using 2628 kbps
[ yt-sdr-480p60 ] 852 x 480 using 4128 kbps
[ yt-sdr-720p30 ] 1280 x 720 using 5384 kbps
[ yt-hdr-720p30 ] 1280 x 720 using 6884 kbps
[ yt-sdr-720p60 ] 1280 x 720 using 7884 kbps
[ yt-sdr-1080p30 ] 1920 x 1080 using 8384 kbps
[ yt-hdr-720p60 ] 1280 x 720 using 9884 kbps
[ yt-hdr-1080p30 ] 1920 x 1080 using 10384 kbps
[ yt-sdr-1080p60 ] 1920 x 1080 using 12384 kbps
[ yt-hdr-1080p60 ] 1920 x 1080 using 15384 kbps
[ yt-sdr-1440p30 ] 2560 x 1440 using 16512 kbps
[ yt-hdr-1440p30 ] 2560 x 1440 using 20512 kbps
[ yt-sdr-1440p60 ] 2560 x 1440 using 24512 kbps
[ yt-hdr-1440p60 ] 2560 x 1440 using 30512 kbps
[ yt-sdr-2160p30 ] 3840 x 2160 using 40512 kbps
[ yt-hdr-2160p30 ] 3840 x 2160 using 50512 kbps
[ yt-sdr-2160p60 ] 3840 x 2160 using 61512 kbps
[ yt-hdr-2160p60 ] 3840 x 2160 using 76012 kbps
[ raw720p30 ] 1280 x 720 using 221184 kbps
[ raw720p60 ] 1280 x 720 using 442368 kbps
[ raw1080i ] 1920 x 540 using 1486512 kbps
[ raw1080i30 ] 1920 x 540 using 1488000 kbps
[ raw1080i60 ] 1920 x 540 using 1488000 kbps
[ raw1080p ] 1920 x 1080 using 2976000 kbps
[lanforge@ct524-genia scripts]$

```

C. Running the command

- D. When we run the `l3_video_em.pl` command that we copied and pasted into our terminal above, we'll see regular output ever several seconds. Lets discuss whats going on:

```
Terminal - lanforge@ct524-genia:~/scripts
jreynolds@cholla5:~/git/lanforge-scripts x lanforge@ct524-genia:~/scripts x
[lanforge@ct524-genia scripts]$ /home/lanforge/scripts/l3_video_em.pl --mgr localhost --mgr_port 400
1 --cx_name_sixteen-0000 --max_tx 1G --buf_size 3145728 --stream yt-sdr-1080p30 --quiet yes
Filling yt-sdr-1080p30 3072 KB buffer est 0.050331648sec, empties in 3.00164885496183 sec
Random start delay: 3.30490141553221...
Stopping and configuring _sixteen-0000
Starting _sixteen-0000
Likely overfill detected, txsec: 0.0007
## drain_wait_seconds: 1.8043; est fill: 0.1398; actual fill 1.1973; dev: -1.0575
deltas: Sent 1900544 B/ 2879862464.36994 bps;
Setting max_tx to 360000000
## drain_wait_seconds: 2.2942; est fill: 0.1678; actual fill 0.7074; dev: -0.5397
deltas: Sent 20971520 B/ 26679081050.06976 bps;, Sent 19333120 B/ 44991395.84851 bps;
Setting max_tx to 300000000
## drain_wait_seconds: 2.3269; est fill: 0.1398; actual fill 0.6747; dev: -0.5349
deltas: Sent 51576832 B/ 58945207837.85504 bps;, Sent 16515072 B/ 37426482.13639 bps;
Setting max_tx to 360000000
## drain_wait_seconds: 2.2706; est fill: 0.1678; actual fill 0.7311; dev: -0.5633
deltas: Sent 76742656 B/ 1870580609.91320 bps;, Sent 22151168 B/ 44755255.38064 bps;
Setting max_tx to 300000000
## drain_wait_seconds: 2.3010; est fill: 0.1553; actual fill 0.7006; dev: -0.5453
deltas: Sent 108199936 B/ 108181984353.88416 bps;, Sent 15728640 B/ 36379923.07554 bps;
Setting max_tx to 324000000
## drain_wait_seconds: 2.2852; est fill: 0.1553; actual fill 0.7164; dev: -0.5611
deltas: Sent 134021120 B/ 166901817013.20667 bps;, Sent 17367040 B/ 40456583.69786 bps;
Setting max_tx to 324000000
## drain_wait_seconds: 2.3233; est fill: 0.1398; actual fill 0.6784; dev: -0.5386
deltas: Sent 162791424 B/ 195196318138.62094 bps;, Sent 17498112 B/ 40336066.73510 bps;
Setting max_tx to 360000000
^C
Stopping _sixteen-0000: INT
[lanforge@ct524-genia scripts]$
```

- A. **Filling yt-sdr-1080p30 3072KB buffer:** tells us our video bitrate, and our buffer size (3MB)
- B. **est 0.0503 sec:** estimate of how long at 1Gbps filling the buffer will take
- C. **empties in 3.0016 sec:** playback rate before buffer is fully played.
- D. **Random start delay: 3.304sec...**: the script is waiting this long before starting. This is so that we avoid a load spike, false detections of constant transmit, and more realistic transmit pattern.
- E. **Likely overfill detected** This warning appears when you transmit longer than your buffer fill takes. Estimates are inaccurate at the start.
- F. **drain_wait_seconds** is the computed time between stopping and restarting the next transmission. This is our empty time minus our transmit time.
- G. **Actual fill:** describes how long transmitting a full buffer took.
- H. **dev:** the difference between estimated fill time and actual fill time.
- I. **Setting max_tx to 360000000:** indicates we have detected our RX-Rate for our station was detected, and estimates could be better in range. Estimates are only for an isolated station.

4. Starting and Stopping Connections

- A. You can use the LANforge GUI *Test Groups* tab or the `l3_vid_group.pl` script to start and stop connections.
- B. First, make sure you stations are associated. The scripts will not admin-up your stations.

C. Using the LANforge GUI

- A. Highlight the Test Group holding the Generic connections. In our example that is the group named **sixteen**
- B. Press the **Start** button.
- C. The Generic scripts will control the Layer-3 scripts in the `_l3_sixteen` group.
- D. Stopping the test group will also stop the Layer-3 connections.

D. Using the `l3_vid_group.pl` script

- A. Starting the groups uses the `--action start` argument:

```
./l3_vid_group.pl --test_grp sixteen --action start
```
- B. Stopping the groups uses the `--action stop` argument:

```
./l3_vid_group.pl --test_grp sixteen --action stop
```

5. Observing Performance

LANforge Manager Version(5.4.2) +cli-sock

Control Reporting Tear Off Info Plugins

Chamber View Stop All Restart Manager Refresh HELP

Status Port Mgr Layer-3 L3 Endps Generic Test Group Alerts Warnings +

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

View 0 - 500 Display Create Modify Delete

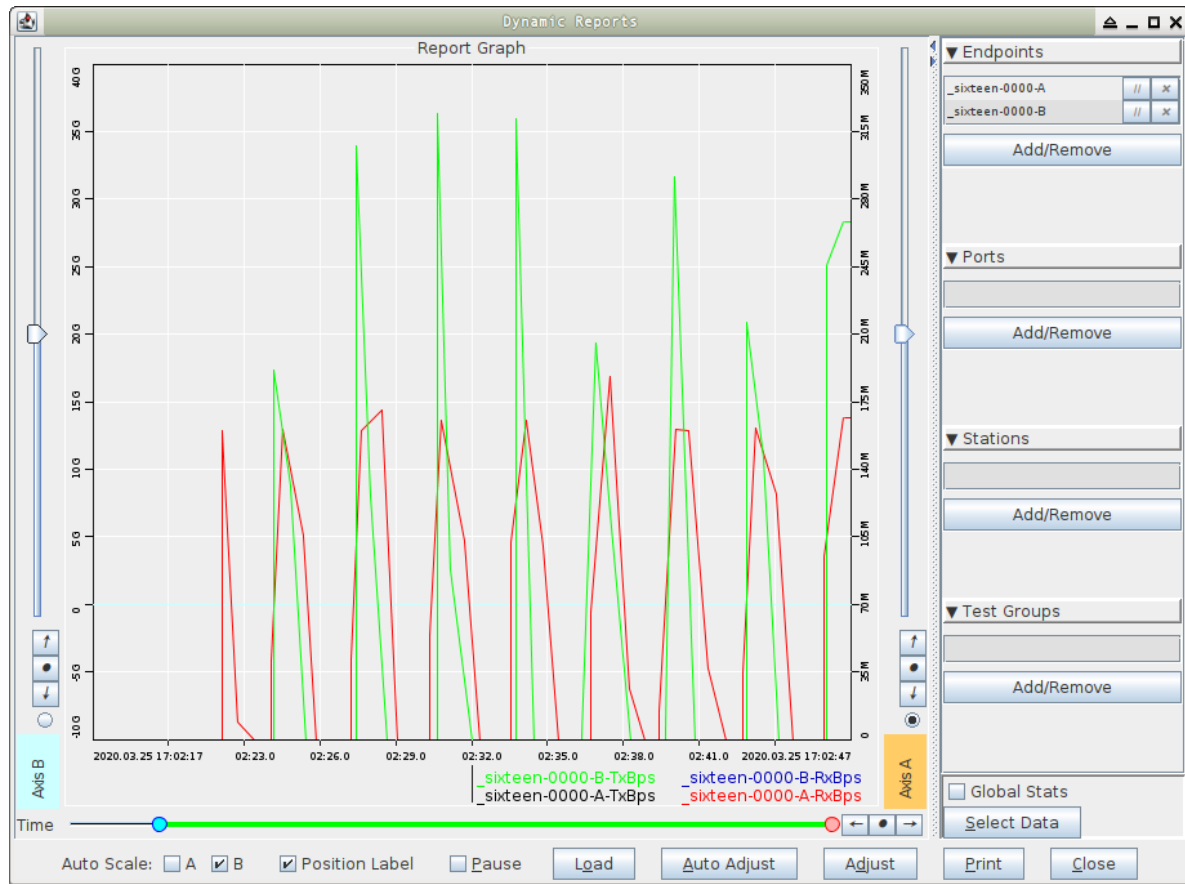
Cross Connects for Selected Test Manager

Name	Type	State	Endpoints (A ↔ B)	Pkt Rx A	Pkt Rx B	Bps Rx A	Bps Rx B	Rx Drop % A	Rx Drop % B
sixteen-0000	LF/TCP	Stopped	sixteen-0000-A ↔ sixteen-0000-B	3,347	0	81,395,677	0	0.624	0
sixteen-0001	LF/TCP	Stopped	sixteen-0001-A ↔ s		Start Selected	Plus	0	0	0
sixteen-0002	LF/TCP	Stopped	sixteen-0002-A ↔ s		Stop Selected	Minus	0	0	0
sixteen-0003	LF/TCP	Stopped	sixteen-0003-A ↔ s		Clear Selected		0	0	0
sixteen-0004	LF/TCP	Stopped	sixteen-0004-A ↔ s		Modify Selected	F	0	0	0
sixteen-0005	LF/TCP	Stopped	sixteen-0005-A ↔ s		Display Selected	X	0	0	0
sixteen-0006	LF/TCP	Stopped	sixteen-0006-A ↔ s		Dynamic Report	D	0	0	0
sixteen-0007	LF/TCP	Stopped	sixteen-0007-A ↔ s		Table Report	T	0	0	0
sixteen-0008	LF/TCP	Stopped	sixteen-0008-A ↔ s		Count Selected	E	0	0	0
sixteen-0009	LF/TCP	Stopped	sixteen-0009-A ↔ s		Calculations	C	0	0	0
sixteen-0010	LF/TCP	Stopped	sixteen-0010-A ↔ s		Add/Remove Table Columns		0	0	0
sixteen-0011	LF/TCP	Stopped	sixteen-0011-A ↔ s		Add/Remove Table Report Columns		0	0	0
sixteen-0012	LF/TCP	Stopped	sixteen-0012-A ↔ s		Save Table Layout		0	0	0
sixteen-0013	LF/TCP	Stopped	sixteen-0013-A ↔ s		Reset Table Layout		0	0	0
sixteen-0014	LF/TCP	Stopped	sixteen-0014-A ↔ s		Auto-Resize Columns		0	0	0
sixteen-0015	LF/TCP	Stopped	sixteen-0015-A ↔ s		Enforce Fairness		0	0	0

Logged in to: localhost:4402 as: Admin

- You can observe the performance of the Layer-3 connections using the Dynamic Reports window.
- First, use the **Rpt Timer** combo box to apply a 500ms report timer to the connection. Press **Go** to apply
- Next, right click the connection and select **Dynamic Report** (or press **D**)

D. Observe the bursts of transmission.



- Use the **Adjust** button to adjust your time window:
- Select **30** for max-time-ago
- Select **0** for min-time-ago
- Click **Apply**