

Test Video Streaming using DASH Server and InterOp APK

Goal: Host DASH server on LANforge and test Video Streaming using InterOp apk.

This cookbook requires LANforge GUI version 5.4.6 and above.

Background

DASH is used for embedding videos in a web page without using third party services such as youtube or vimeo. It is mostly used in OTT platforms.

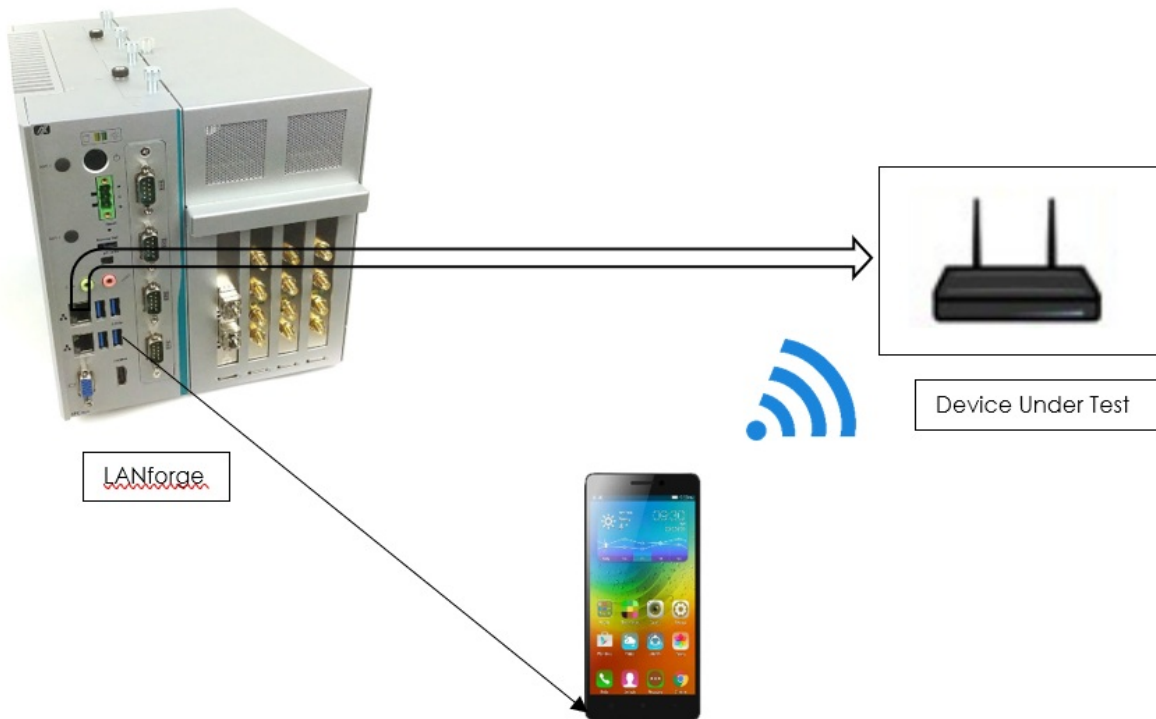
Dynamic Adaptive Streaming over HTTPS (DASH) is a variant of Dynamic Adaptive Streaming (DAS) that uses the HTTPS protocol for delivering video content over the internet. HTTPS is the secure version of HTTP, and it provides encryption and authentication to protect the privacy and integrity of the data being transmitted.

With DASH, the video content is encoded at multiple bitrates and is divided into small segments that can be downloaded and played back in a continuous stream. These segments are delivered over the internet using HTTPS, which provides secure and reliable delivery of the video content.

Android App has inbuilt Video Media Player (Exoplayer) which can run various types of Media Types which includes:

- Progressive
- DASH (Dynamic Adaptive Streaming over HTTPS)
- HTTP Live Streaming
- Real Time Streaming Protocol

Diagram of Setup



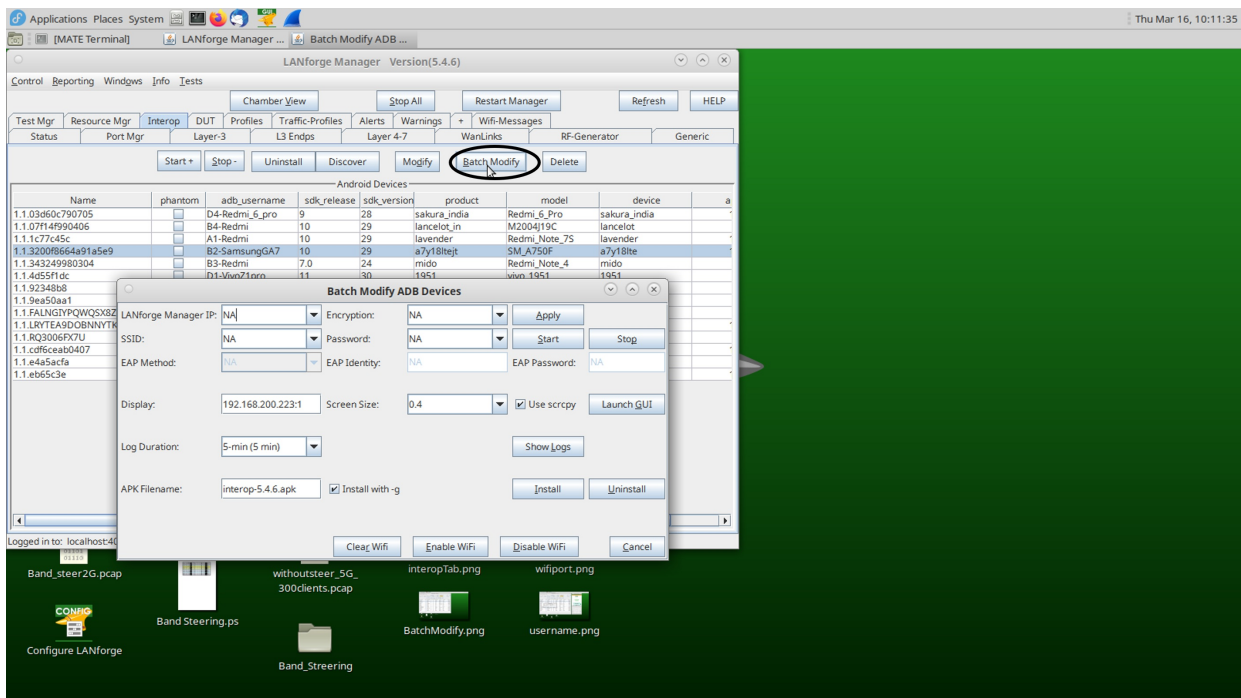
1. Connect Android Phone to LANforge via USB such that the device will appear in Interop Tab.

- Note: Make sure to enable developer settings in android phones.

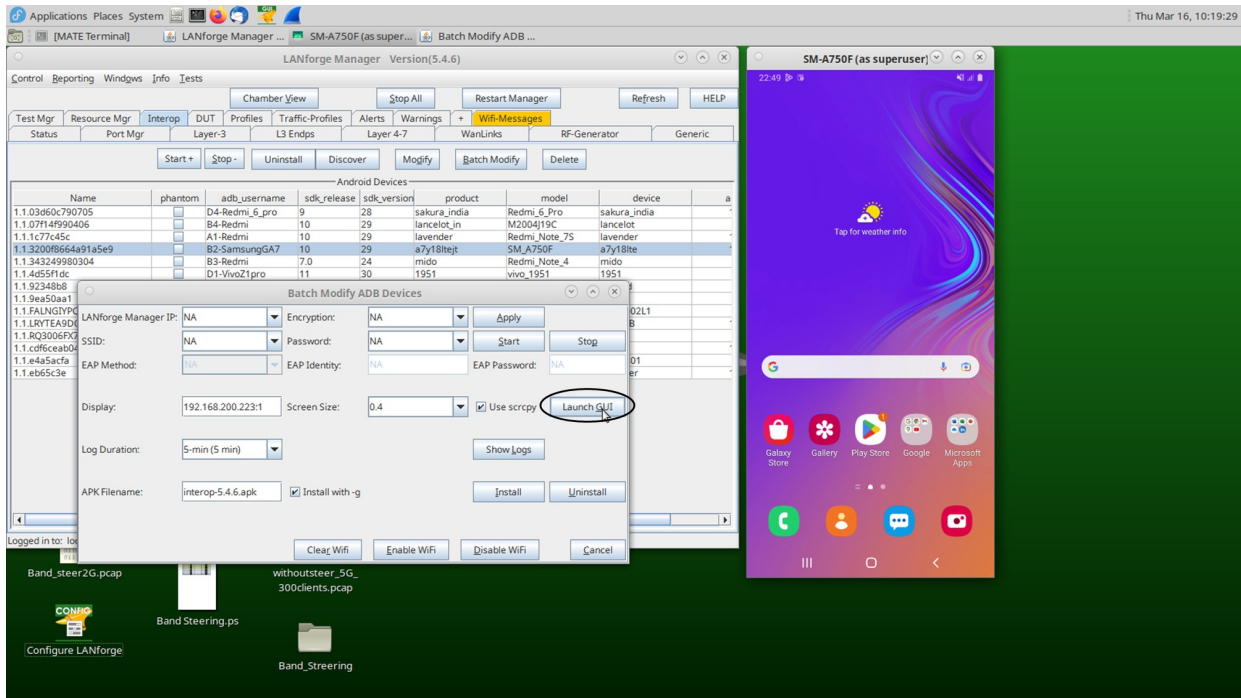
The screenshot shows the LANforge Manager software interface. The "Interop" tab is selected, displaying a table of connected Android devices. The table has columns for Name, phantom, adb_username, sdk_release, sdk_version, product, model, device, and app_id. The "Batch Modify" button is highlighted in the top right of the table area.

Name	phantom	adb_username	sdk_release	sdk_version	product	model	device	app_id
1.1.03660c790705	<input type="checkbox"/>	D4-Redmi_6_pro	9	28	sakura_india	Redmi_6_Pro	sakura_india	1033401959
1.1.07148990406	<input type="checkbox"/>	B4-Redmi	10	29	lancelot_in	M2004J9C	lancelot	583273323
1.1.1c77c45c	<input type="checkbox"/>	A1-Redmi	10	29	lavender	Redmi_Note_7S	lavender	1639924111
1.1.3200f664491a5e9	<input type="checkbox"/>	B2-SamsungGA7	10	29	a7y18tejt	SM_A750F	a7y18te	1592459474
1.1.343249980304	<input type="checkbox"/>	B3-Redmi	7.0	24	mido	Redmi_Note_4	mido	3293885
1.1.47602309	<input checked="" type="checkbox"/>	F2-M1A2	10	29	jasmine	M1_A2	jasmine_sprout	1480481586
1.1.48b5e3311020	<input checked="" type="checkbox"/>	F5-PocoM	10	29	citrus_in	M2010J19CI	citrus	2066903497
1.1.4d5f1dc	<input type="checkbox"/>	D1-VivoZ1pro	11	30	1951	vivo_1951	1951	281426062
1.1.65a790ac	<input checked="" type="checkbox"/>	F1-Minote5Pro	9	28	whyred	Redmi_Note_5_Pro	whyred	888686251
1.1.9234868	<input type="checkbox"/>	D3-M5pro	9	28	whyred	Redmi_Note_5_Pro	whyred	281270792
1.1.95fca44	<input checked="" type="checkbox"/>	C5-V15Pro	11	30	1818	vivo_1818	1818	160739707
1.1.967dd9c1	<input checked="" type="checkbox"/>	A3-Oppo	10	29	CPH1931	CPH1931	OP4B79L1	811650130
1.1.9ea50aa1	<input type="checkbox"/>	9ea50aa1	0	4	4	4	4	0
1.1.CB512F28L9	<input checked="" type="checkbox"/>	E2-SonyXp	8.0.0	26	F5122	F5122	F5122	1112346364
1.1.FALNGYIPQWQX8ZT	<input type="checkbox"/>	A4-Realme	11	30	RMX2002	RMX2002	RMX2002L1	260783416
1.1.K7HIB8B8QONZBE	<input checked="" type="checkbox"/>	G2-Lenovo	6.0	23	PB2-650M	Lenovo_PB2_650M	PB2	213355921
1.1.LRYTEA9DOBNNYTK7	<input type="checkbox"/>	A2-OppoA12	9	28	CPH2083	CPH2083	OP4BFB	1290928190
1.1.R9PTA0P9JY	<input checked="" type="checkbox"/>	C2-SamsungTab	12	31	gta8	SM_X205	gta8	1000646220
1.1.RQ3006F7U	<input checked="" type="checkbox"/>	G6-SonyX1	8.0.0	26	G3416	G3416	G3416	9917160
1.1.c252e63d	<input checked="" type="checkbox"/>	E9-Vivo	10	29	1904	vivo_1904	1904	1740287573
1.1.cdf6ceb0407	<input type="checkbox"/>	C3-PocoM2	10	29	shiva	M2004J19P1	shiva	1226019428
1.1.e4a5acfa	<input type="checkbox"/>	B1-Realme2pro	10	29	RMX1801	RMX1801	RMX1801	997407002
1.1.eb653e	<input type="checkbox"/>	C4-Redmi	10	29	lavender	Redmi_Note_7S	lavender	1905624741
1.21.*	<input checked="" type="checkbox"/>			0				

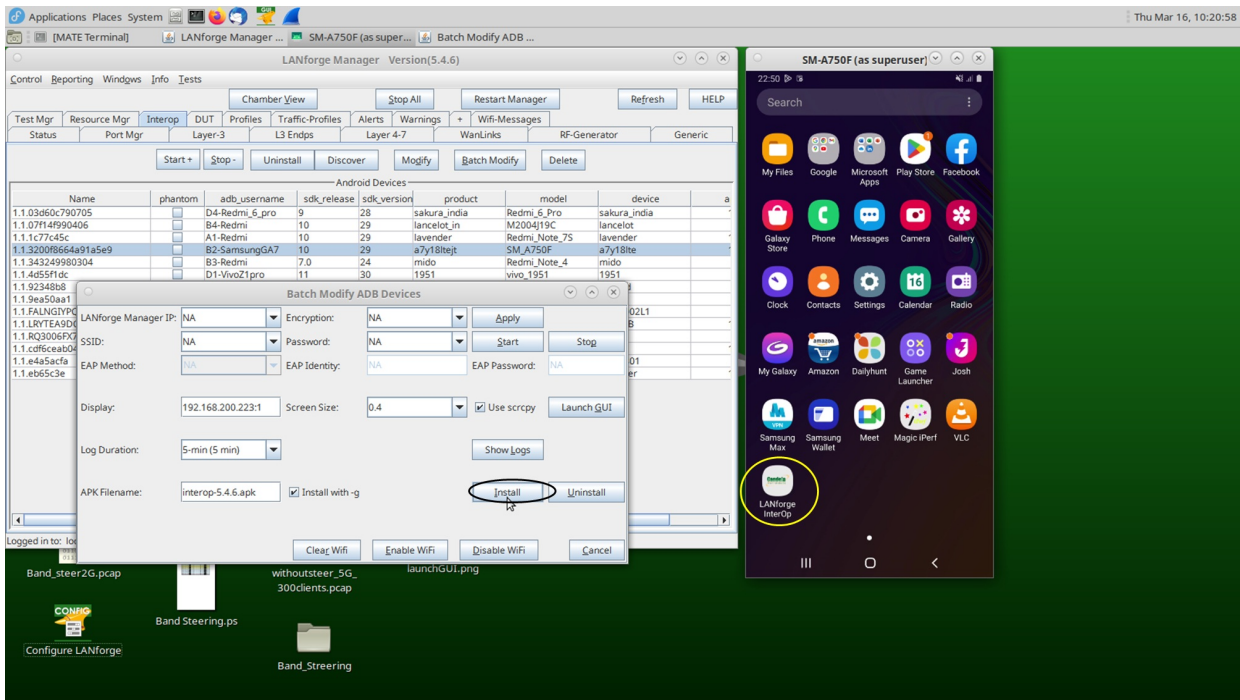
2. Select the device in Interop Tab and click on Batch Modify tab.



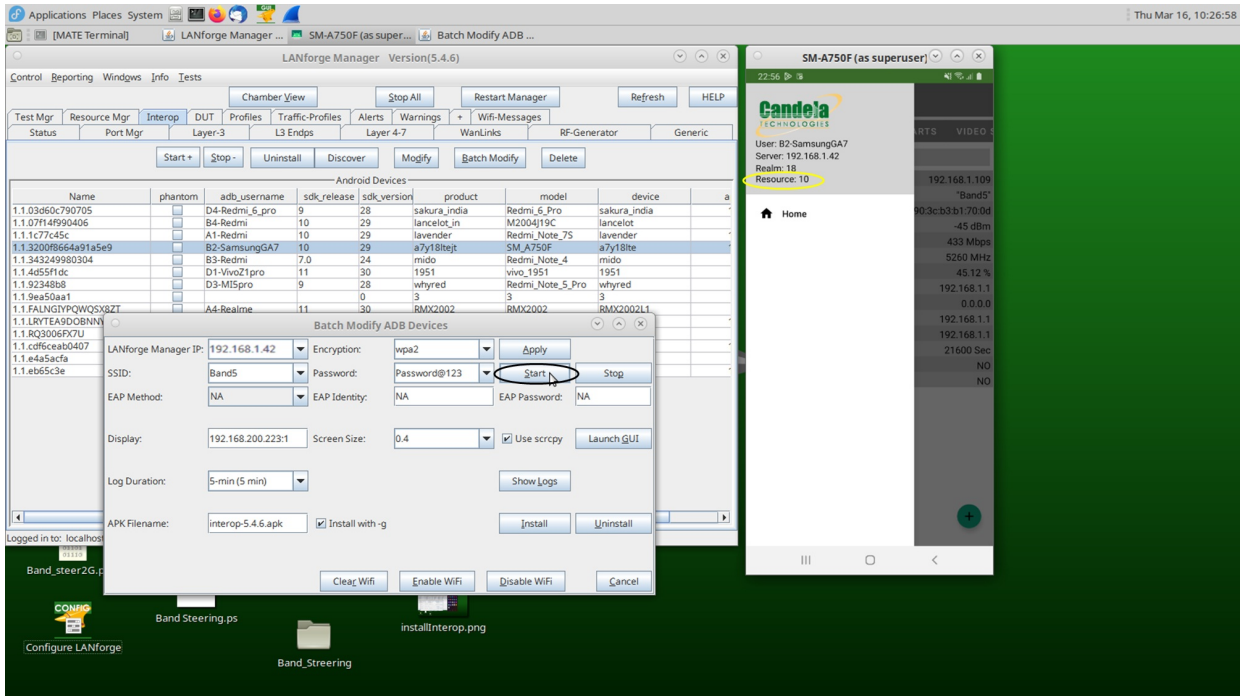
3. Select Launch GUI option to view the mobile screen.



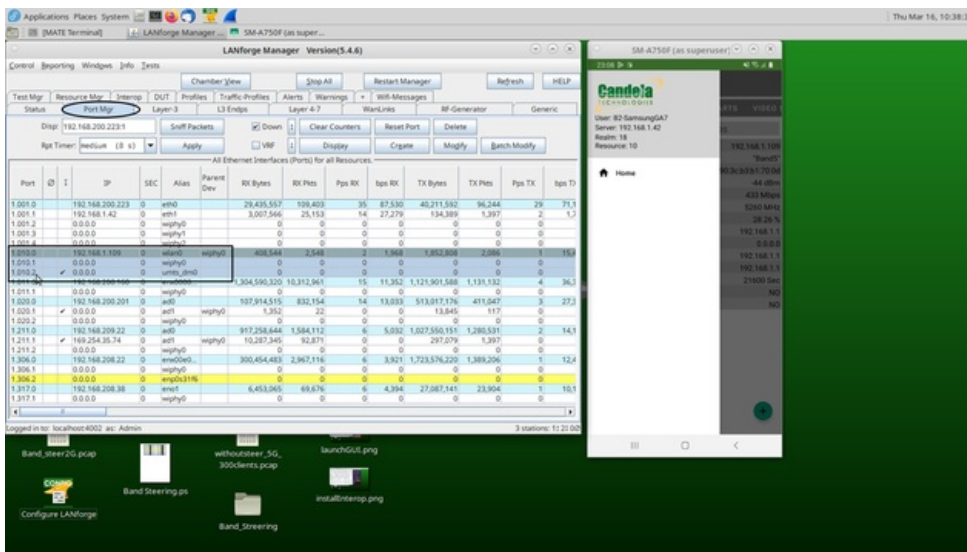
4. Click Install to install Interop apk onto the mobile phone.



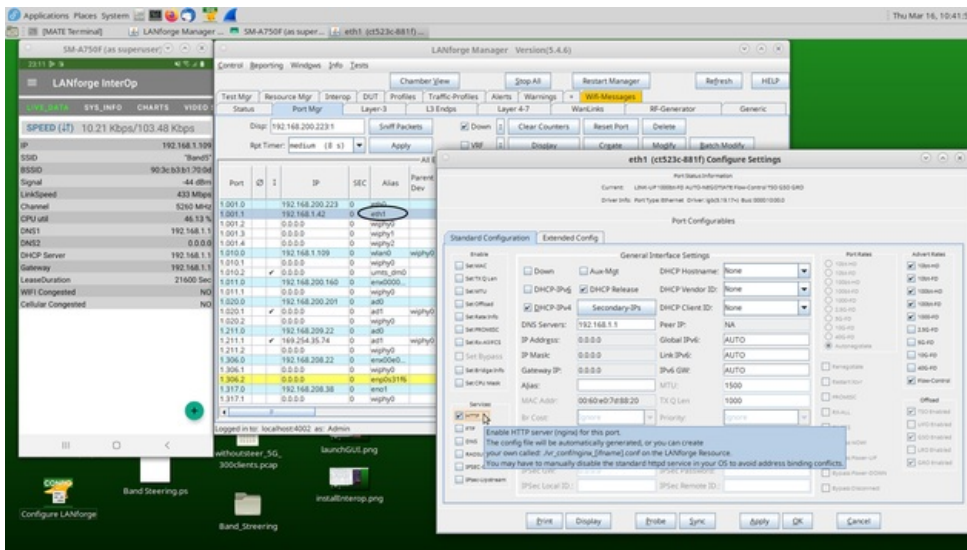
5. Enter LANforge Manager IP, SSID, Encryption and Password. Then, click Apply and start options such that device will be connected to Wi-Fi and enter testroom. Here, mobile got clustered to the LANforge with Resource-Id 10.



6. After entering the Test room, device must appear in Port Manager Tab. That is the Wi-Fi port of Mobile.



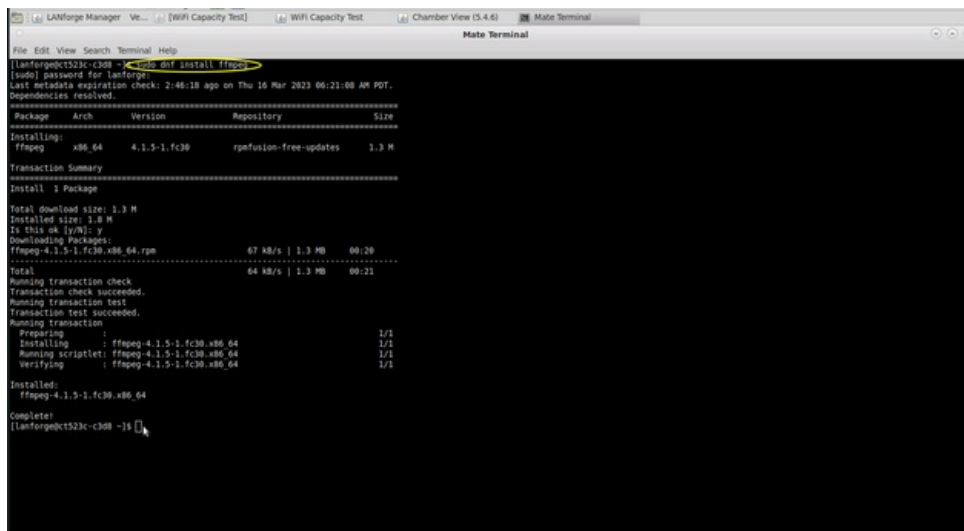
7. To run nginx on eth1 port enable http on eth1 interface by double-clicking on the port and apply the settings.



8. To host DASH server on LANforge use the following commands.

1. `sudo dnf install ffmpeg`

Ffmpeg is a popular multimedia framework that can be used to record, convert, and stream audio and video files.



2. `sudo dnf install https://download1.rpmfusion.org/free/fedora/rpmfusion-free-release-$(rpm -E %fedora).noarch.rpm https://download1.rpmfusion.org/nonfree/fedora/rpmfusion-nonfree-release-$(rpm -E %fedora).noarch.rpm`

This command installs the RPM Fusion repositories on a Fedora system. RPM Fusion is a repository of software packages that are not included in the default Fedora repositories, such as multimedia codecs and drivers.

```

lanforge@1523c-c3d8 ~$ sudo dnf install https://download1.rpmfusion.org/free/fedora/rpmfusion-free-release-$(rpm -E %fedora).noarch.rpm https://download1.rpmfusion.org/nonfree/fedora/rpmfusion-nonfree-release-$(rpm -E %fedora).noarch.rpm
Last metadata expiration check: 2:48:39 ago on Thu 16 Mar 2023 06:21:02 AM PDT.
rpmfusion-free-release-30.noarch.rpm                14 kB/s | 13 kB  00:00
rpmfusion-nonfree-release-30.noarch.rpm            15 kB/s | 14 kB  00:00
Dependencies resolved.
Package Architecture Version Repository Size
-----
Installing:
rpmfusion-nonfree-release                          noarch          30-1          @commandLine 14 k
Downgrading:
rpmfusion-free-release                             noarch          30-1          @commandLine 13 k
Transaction Summary
-----
Install 1 Package
Downgrade 1 Package
Total size: 28 k
Is this ok [y/N]: y
Downloading Packages:
Running transaction check
Transaction check succeeded.
Running transaction test
Transaction test succeeded.
Running transaction:
Preparing : rpmfusion-nonfree-release-30-1.noarch 1/1
Installing : rpmfusion-nonfree-release-30-1.noarch 1/3
Downgrading : rpmfusion-free-release-30-1.noarch 2/3
Cleaning : rpmfusion-free-release-30-2.noarch 3/3
Verifying : rpmfusion-free-release-30-1.noarch 1/3
Verifying : rpmfusion-free-release-30-2.noarch 2/3
Verifying : rpmfusion-nonfree-release-30-1.noarch 3/3
Downgraded:
rpmfusion-free-release-30-1.noarch
Installed:
rpmfusion-nonfree-release-30-1.noarch
Complete!
lanforge@1523c-c3d8 ~$

```

3. `sudo dnf install gpac`

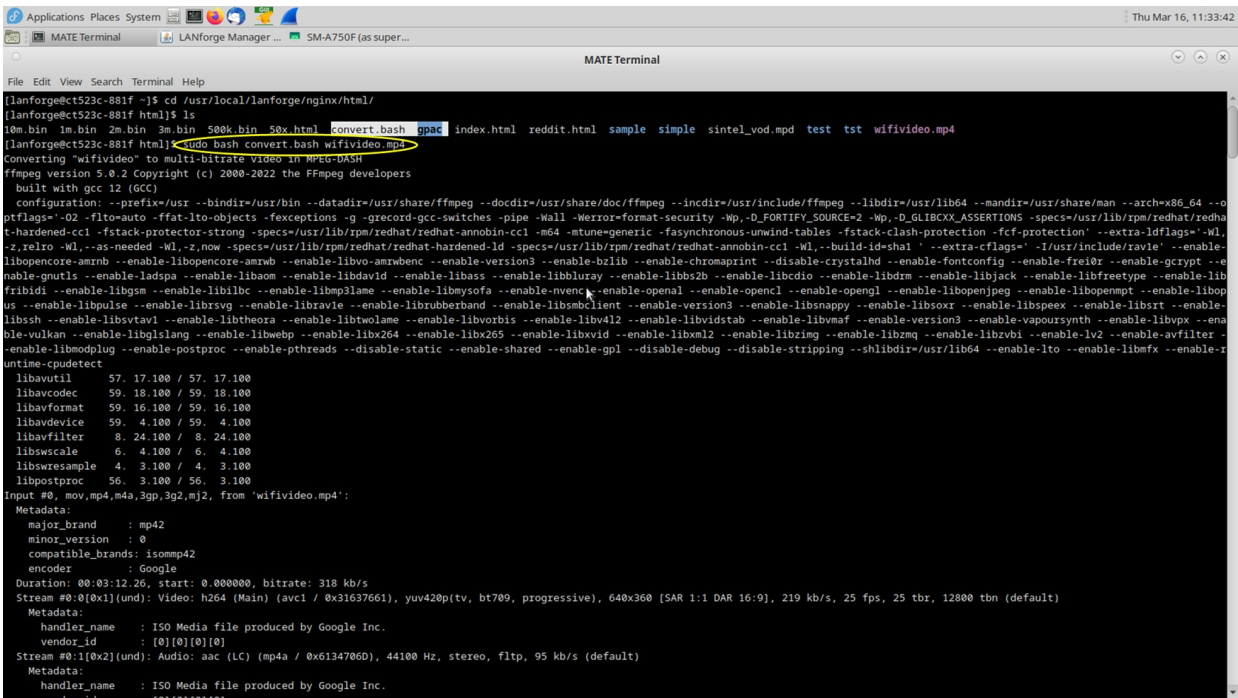
GPAC is an open-source multimedia framework that can be used to create, package, and stream multimedia content. This command, when run, downloads and installs the GPAC package and its dependencies on your system. After the installation is complete, use the GPAC tools to create and manipulate multimedia content.

```

lanforge@1523c-c3d8 ~$ sudo dnf install gpac
RPM Fusion For Fedora 38 - Nonfree - Updates                25 kB/s | 80 kB  00:03
RPM Fusion For Fedora 38 - Nonfree                          33 kB/s | 227 kB 00:06
Last metadata expiration check: 0:00:03 ago on Thu 16 Mar 2023 09:10:56 AM PDT.
Dependencies resolved.
Package Architecture Version Repository Size
-----
Installing:
gpac x86_64 0.7.1-10.fc38 rpmfusion-free 450 k
Installing dependencies:
gpac-libs x86_64 0.7.1-10.fc38 rpmfusion-free 1.9 M
openjpeg-libs x86_64 1.5.1-23.fc38 fedora 82 k
Transaction Summary
-----
Install 3 Packages
Total download size: 2.4 M
Installed size: 7.5 M
Is this ok [y/N]: y
Downloading Packages:
(1/3): openjpeg-libs-1.5.1-23.fc38.x86_64.rpm 75 kB/s | 82 kB  00:01
(2/3): gpac-0.7.1-10.fc38.x86_64.rpm 189 kB/s | 450 kB  00:02
(3/3): gpac-libs-0.7.1-10.fc38.x86_64.rpm 704 kB/s | 1.9 MB  00:02
Total 591 kB/s | 2.4 MB  00:04
Running transaction check
Transaction check succeeded.
Running transaction test
Transaction test succeeded.
Running transaction:
Preparing : openjpeg-libs-1.5.1-23.fc38.x86_64 1/1
Installing : gpac-libs-0.7.1-10.fc38.x86_64 1/3
Installing : gpac-0.7.1-10.fc38.x86_64 2/3
Running scriptlet: gpac-0.7.1-10.fc38.x86_64 3/3
Verifying : openjpeg-libs-1.5.1-23.fc38.x86_64 1/3
Verifying : gpac-0.7.1-10.fc38.x86_64 2/3
Verifying : gpac-libs-0.7.1-10.fc38.x86_64 3/3
Installed:
gpac-0.7.1-10.fc38.x86_64 gpac-libs-0.7.1-10.fc38.x86_64 openjpeg-libs-1.5.1-23.fc38.x86_64
Complete!
lanforge@1523c-c3d8 ~$

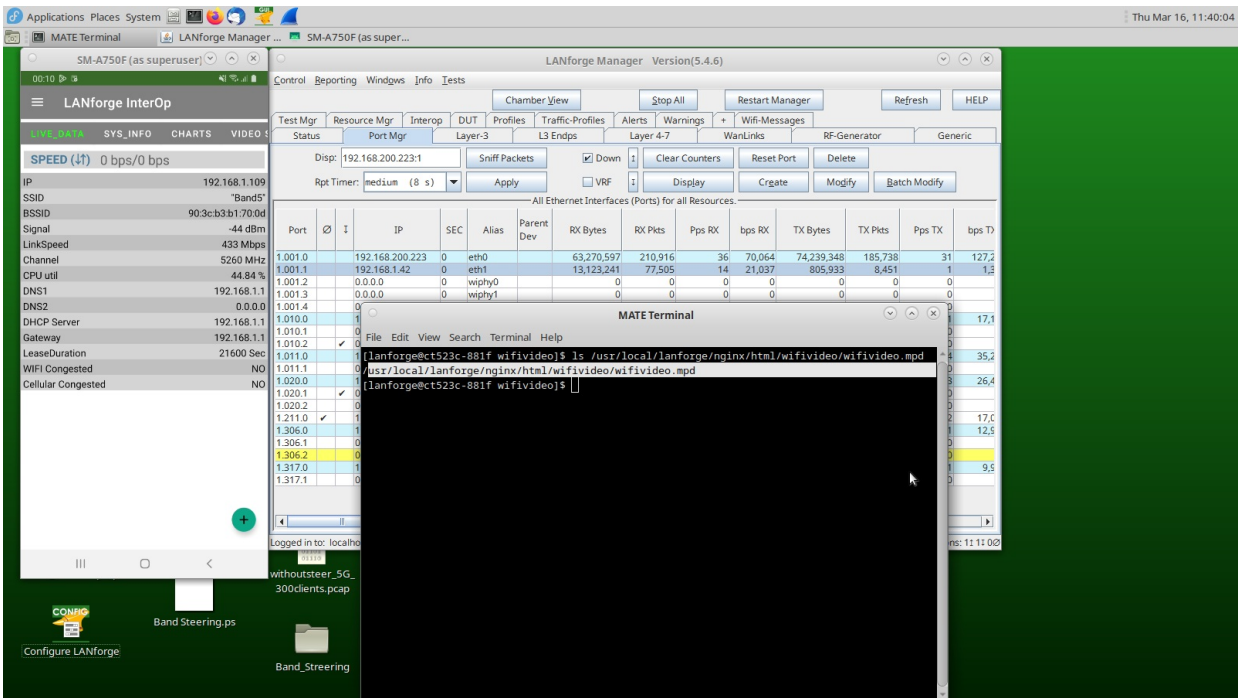
```

9. Place below mentioned wifivideo.mp4 and convert.bash file in the html directory:
`/usr/local/lanforge/nginx/html/`
 1. `convert.bash`
 2. `wifivideo.mp4`
10. Run the `convert.bash` to convert `.mp4` to `.mpd` file using the command:
`sudo bash convert.bash wifivideo.mp4`



```
lanforge@ct523c-881f ~]# cd /usr/local/lanforge/nginx/html/
lanforge@ct523c-881f html]# ls
10m_bin 1n_bin 2m_bin 3m_bin 500k_bin 50x_html convert-bash ppac index.html reddit.html sample simple sintel_vod.mpd test tst wifivideo.mp4
lanforge@ct523c-881f html]# sudo bash convert-bash wifivideo.mp4
Converting 'wifivideo' to multi-bitrate video in MP4-DASH
ffmpeg version 5.0.2 Copyright (c) 2000-2022 the FFmpeg developers
  built with gcc 12 (GCC)
  configuration: --prefix=/usr --bindir=/usr/bin --datadir=/usr/share/ffmpeg --docdir=/usr/share/doc/ffmpeg --incdir=/usr/include/ffmpeg --libdir=/usr/lib64 --mandir=/usr/share/man --arch=x86_64 --os=linux --enable-gpl --enable-gnutls --enable-ladspa --enable-libaom --enable-libass --enable-libbluray --enable-libb2sum --enable-libbrotli --enable-libdav1d --enable-libdc1394 --enable-libdirac --enable-libfdk_aac --enable-libfreetype --enable-libfribidi --enable-libgsm --enable-liblame --enable-liblirc2 --enable-libmp3lame --enable-libmysofa --enable-libnvenc --enable-libopenal --enable-libopenh264 --enable-libopus --enable-libpango --enable-libparaview --enable-librav1e --enable-librtmp --enable-librubberband --enable-libshaderc --enable-libshine --enable-libsnappy --enable-libsoxr --enable-libspeex --enable-libsrt --enable-libssh --enable-libsvtav1 --enable-libtheora --enable-libtwolame --enable-libvorbis --enable-libvpx --enable-libx264 --enable-libx265 --enable-libxvid --enable-libzimg --enable-libzmq --enable-libzstd --enable-libzvt --enable-openssl --enable-postproc --enable-pthreads --disable-static --enable-shared --enable-gpl --disable-debug --disable-stripping --shlibdir=/usr/lib64 --enable-lto --enable-libmfx --enable-lto
Input #0: mov,mp4,m4a,3gp,3g2,mj2, from 'wifivideo.mp4':
  Metadata:
    major_brand      : mp42
    minor_version    : 0
    compatible_brands: isommp42
    encoder          : Google
  Duration: 00:03:12.26, start: 0.000000, bitrate: 318 kb/s
  Stream #0:0[0x1](und): Video: h264 (Main) (avc1 / 0x31637661), yuv420p(tv, bt709, progressive), 640x360 [SAR 1:1 DAR 16:9], 219 kb/s, 25 fps, 25 tbr, 12800 tbn (default)
  Metadata:
    handler_name     : ISO Media file produced by Google Inc.
    vendor_id       : [0][0][0]
  Stream #0:1[0x2](und): Audio: aac (LC) (mp4a / 0x6134766D), 44100 Hz, stereo, fltp, 95 kb/s (default)
  Metadata:
    handler_name     : ISO Media file produced by Google Inc.
```

11. A new directory will be created automatically to store the .mpd file. In the below picture, wifivideo.mpd is stored in wifivideo directory.



LANforge Manager Version(5.4.6)

Control Reporting Windows Info Tests

LANforge InterOp

SPEED (↓) 0 bps/0 bps

IP: 192.168.1.109

SSID: "Bands"

BSSID: 90:3c:b3:17:0d

Signal: -44 dBm

LinkSpeed: 433 Mbps

Channel: 5260 MHz

CPU util: 44.84%

DNS1: 192.168.1.1

DNS2: 0.0.0.0

DHCP Server: 192.168.1.1

Gateway: 192.168.1.1

LeaseDuration: 21600 Sec

WiFi Congested: NO

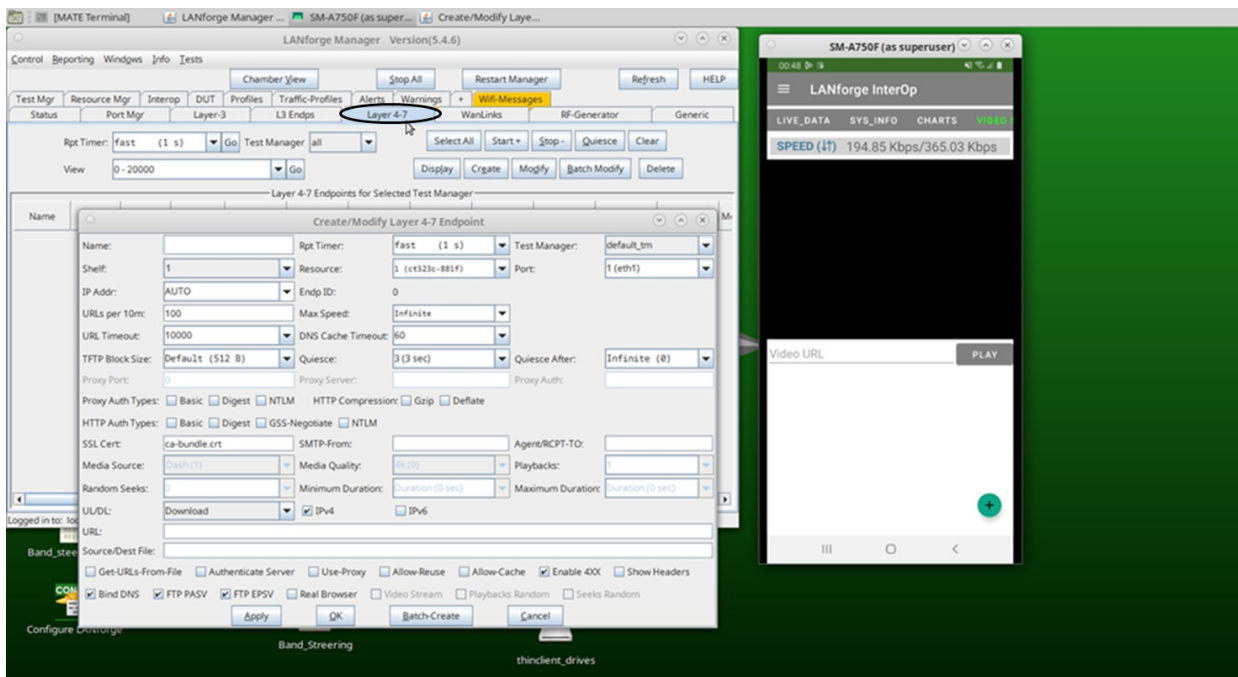
Cellular Congested: NO

Port	IP	SEC	Alias	Parent Dev	RX Bytes	RX Pkts	Pps RX	bps RX	TX Bytes	TX Pkts	Pps TX	bps TX
1.001.0	192.168.200.223	0	eth0		63,270,597	210,916	36	70,064	74,239,348	185,738	31	127.2
1.001.1	192.168.1.42	0	eth1		13,123,241	77,505	14	21,037	805,933	8,451	1	1.3
1.001.2	0.0.0.0	0	wiphy0		0	0	0	0	0	0	0	0
1.001.3	0.0.0.0	0	wiphy1		0	0	0	0	0	0	0	0
1.010.0	0.0.0.0	0			0	0	0	0	0	0	0	0
1.010.1	0.0.0.0	0			0	0	0	0	0	0	0	0
1.011.0	0.0.0.0	0			0	0	0	0	0	0	0	0
1.011.1	0.0.0.0	0			0	0	0	0	0	0	0	0
1.020.0	0.0.0.0	0			0	0	0	0	0	0	0	0
1.020.1	0.0.0.0	0			0	0	0	0	0	0	0	0
1.020.2	0.0.0.0	0			0	0	0	0	0	0	0	0
1.211.0	0.0.0.0	0			0	0	0	0	0	0	0	0
1.306.0	0.0.0.0	0			0	0	0	0	0	0	0	0
1.306.1	0.0.0.0	0			0	0	0	0	0	0	0	0
1.306.2	0.0.0.0	0			0	0	0	0	0	0	0	0
1.317.0	0.0.0.0	0			0	0	0	0	0	0	0	0
1.317.1	0.0.0.0	0			0	0	0	0	0	0	0	0

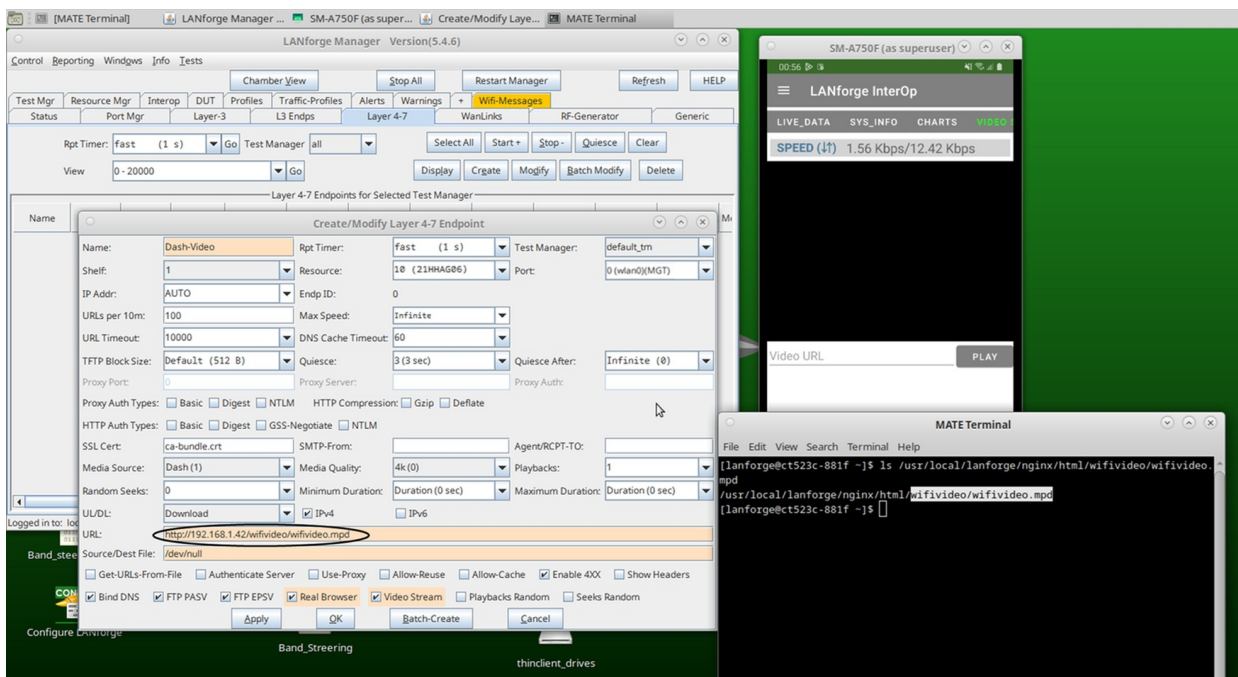
MATE Terminal

```
lanforge@ct523c-881f wifivideo]# ls /usr/local/lanforge/nginx/html/wifivideo/wifivideo.mpd
/usr/local/lanforge/nginx/html/wifivideo/wifivideo.mpd
lanforge@ct523c-881f wifivideo]#
```

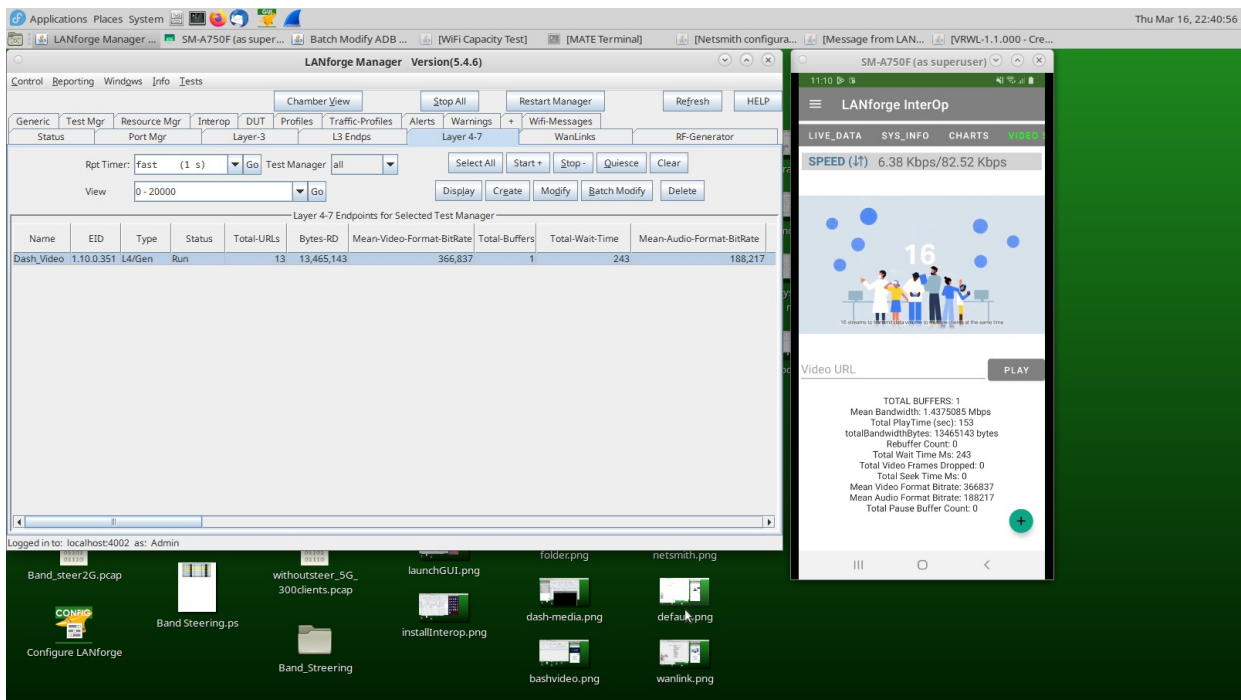
12. Create a L4 Endpoint by clicking on Layer 4-7 tab and opening the Video Streaming tab on app.



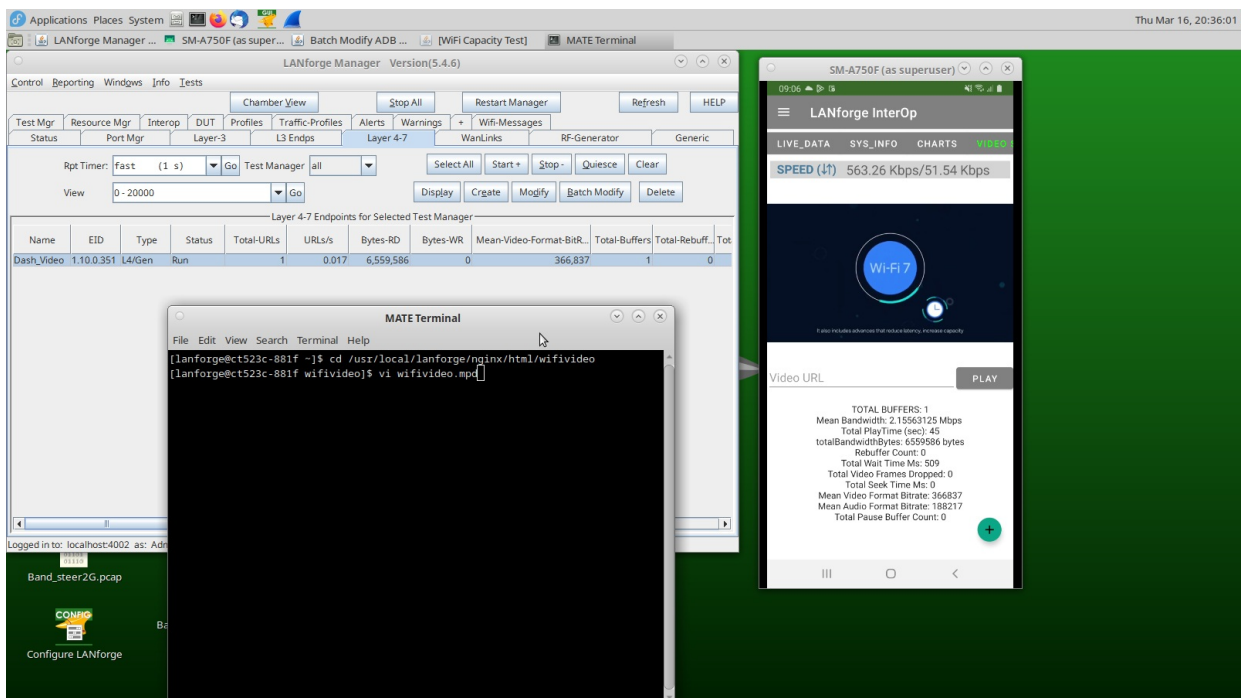
13. Add the URL and Source/Dest File. Select Resource port number of your mobile, enable Real Browser, and Video Stream options. Add the eth1 IP address on which nginx server is enabled and enter the URL.



14. Start the endpoint. The video will be play on the phone and the stats will be reported in the Layer-4 tab in the GUI as well as on LANforge Interop app.



The stats can also be viewed in the MPD file by using the command: `vi wifivideo.mpd` in the terminal.



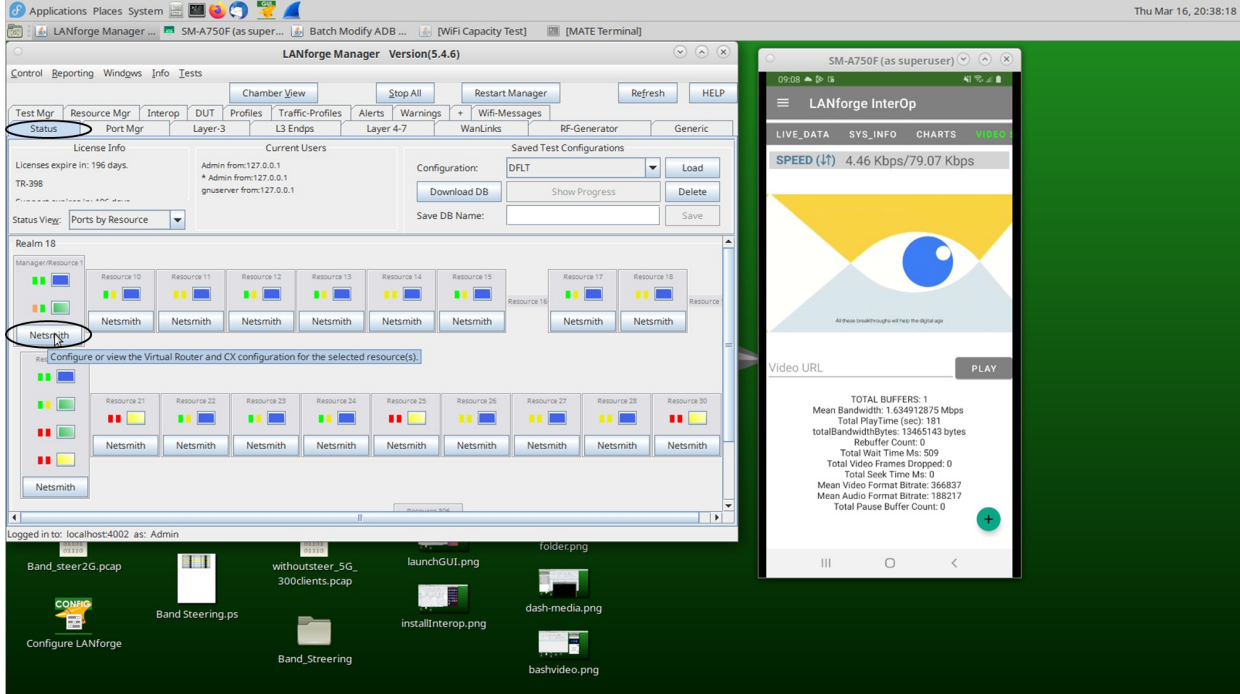
Mpd file maps with bandwidth that is mentioned in LANforge InterOp app. From the Mpd we can observe bandwidth as 366837 which is same as mentioned above in InterOp.


```
Applications Places System Thu Mar 16, 20:35:15
LANforge Manager ... SM-A750F (as super... Batch Modify ADB ... [WiFi Capacity Test] MATE Terminal MATE Terminal

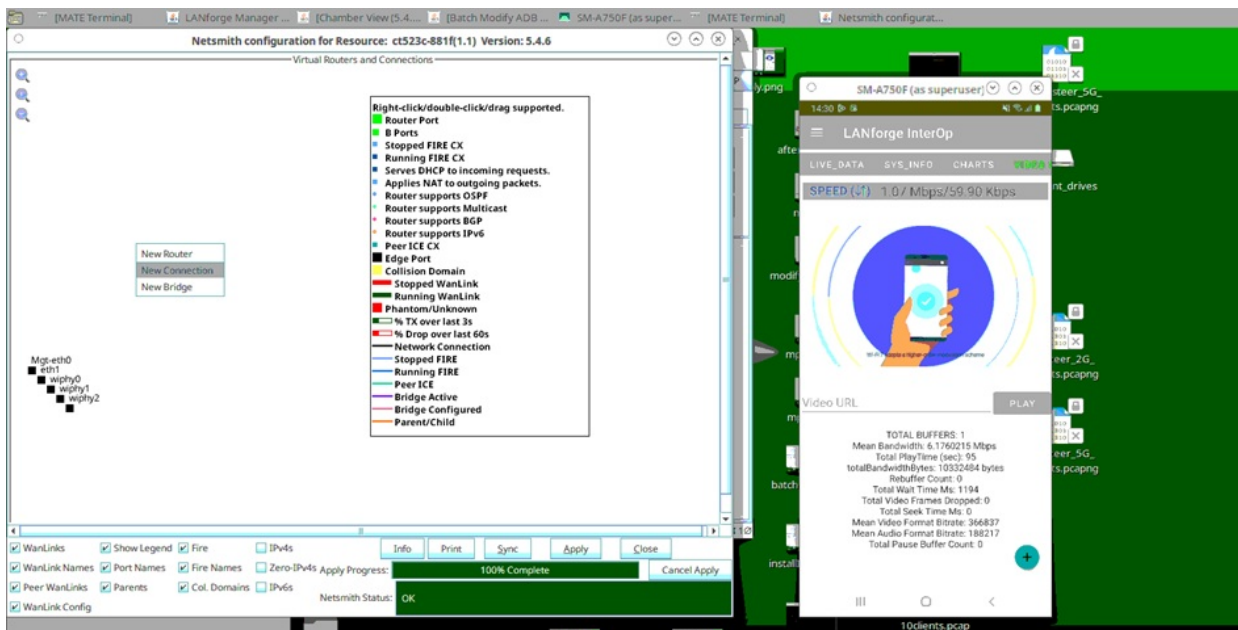
File Edit View Search Terminal Help
15 </Representation>
16 <Representation id="3" mimeType="video/mp4" codecs="avc1.64001E" width="640" height="360" frameRate="25" sar="1:1" bandwidth="257430">
17 <SegmentTemplate media="wifivideo_1500_dashNumber5.m4s" initialization="wifivideo_1500_dashinit.mp4" timescale="12800" startNumber="1" duration="25600"/>
18 </Representation>
19 <Representation id="4" mimeType="video/mp4" codecs="avc1.64001F" width="1280" height="720" frameRate="25" sar="1:1" bandwidth="612000">
20 <SegmentTemplate media="wifivideo_400_dashNumber5.m4s" initialization="wifivideo_400_dashinit.mp4" timescale="12800" startNumber="1" duration="25600"/>
21 </Representation>
22 <Representation id="5" mimeType="video/mp4" codecs="avc1.64001F" width="960" height="540" frameRate="25" sar="1:1" bandwidth="366930">
23 <SegmentTemplate media="wifivideo_400_dashNumber1.m4s" initialization="wifivideo_400_dashinit1.mp4" timescale="12800" startNumber="1" duration="25600"/>
24 </Representation>
25 </AdaptationSet>
26 <AdaptationSet segmentAlignment="true" lang="und" startWithSAP="1">
27 <SegmentTemplate media="wifivideo_audio_dashNumber5.m4s" initialization="wifivideo_audio_dashinit.mp4" timescale="44100" startNumber="1" duration="88200"/>
28 <Representation id="6" mimeType="audio/mp4" codecs="mp4a.40.2" audioSamplingRate="44100" bandwidth="188217">
29 <AudioChannelConfiguration schemeIdUri="urn:mpeg:dash:23003:3:audio_channel_configuration:2011" value="2"/>
30 </Representation>
31 </AdaptationSet>
32 </Period>
33 </MPD>
```

If the network has issues, the bitrate goes down and the same can be reported in LANforge InterOp app. This can be tested using WANlinks in lanforge.

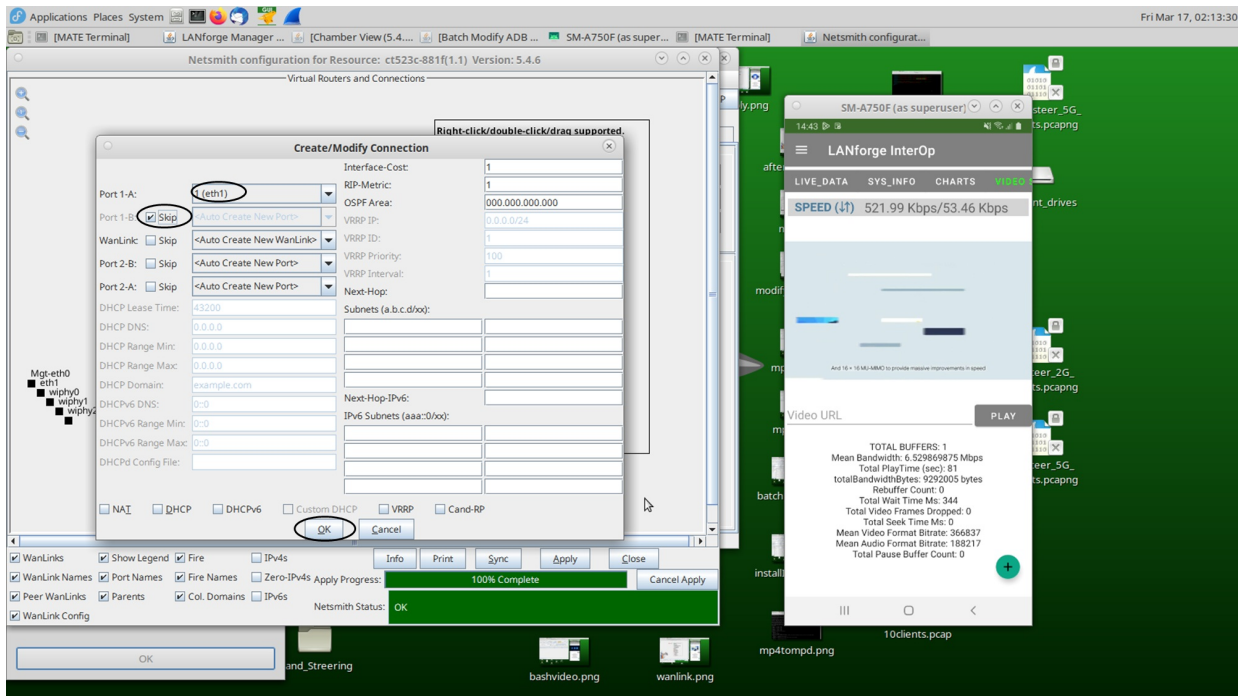
15. To create a WANlink go to the Status tab and select Netsmith.



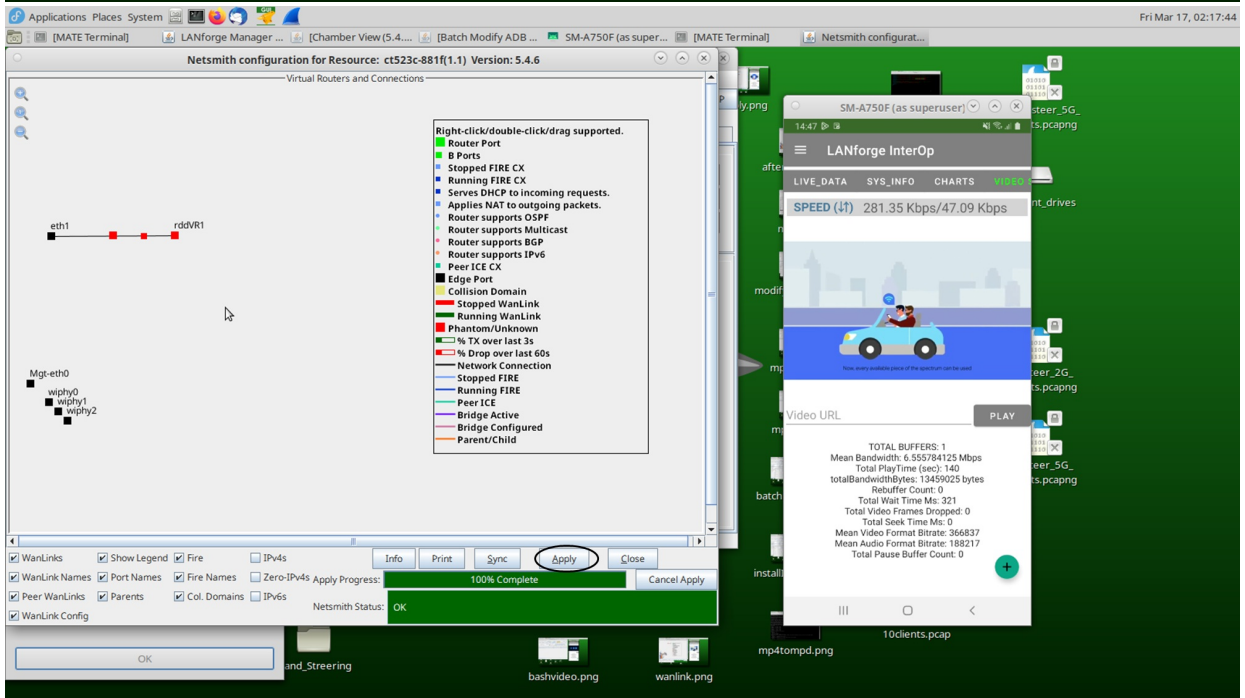
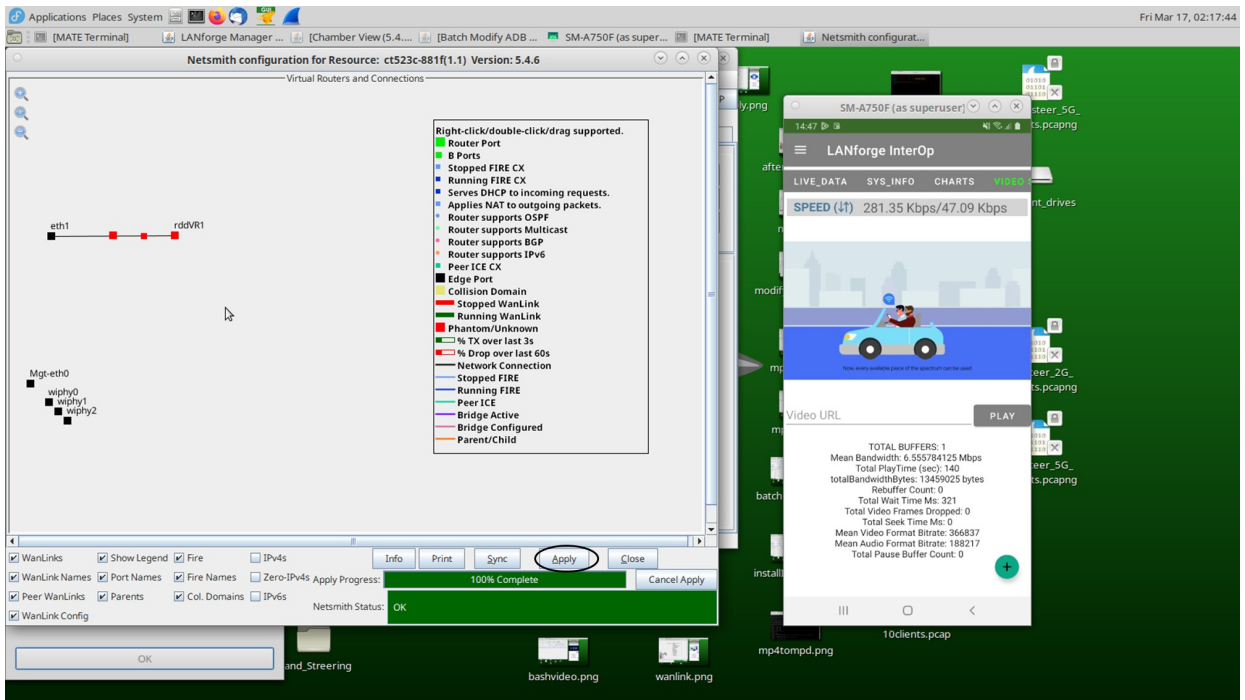
16. Right-click in the Netsmith window and select New Connection.



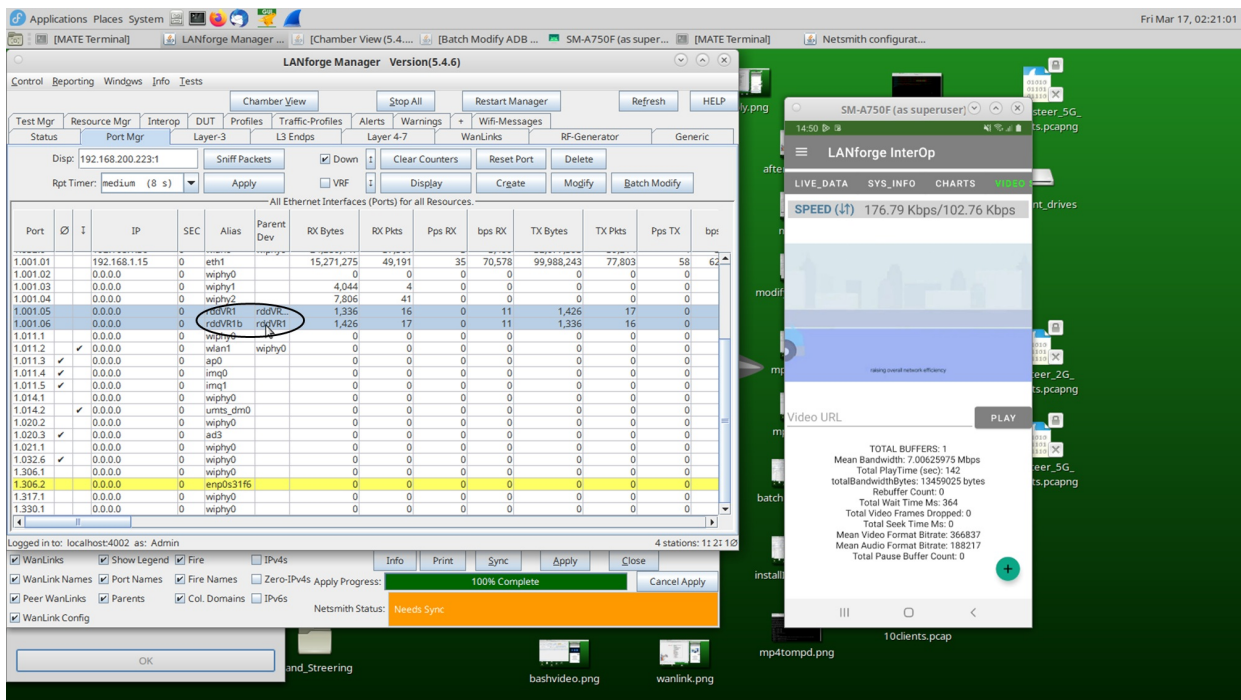
17. Select Port 1-A as the port where the server is running (eth1 in this case) and skip Port 1-B. Click OK.



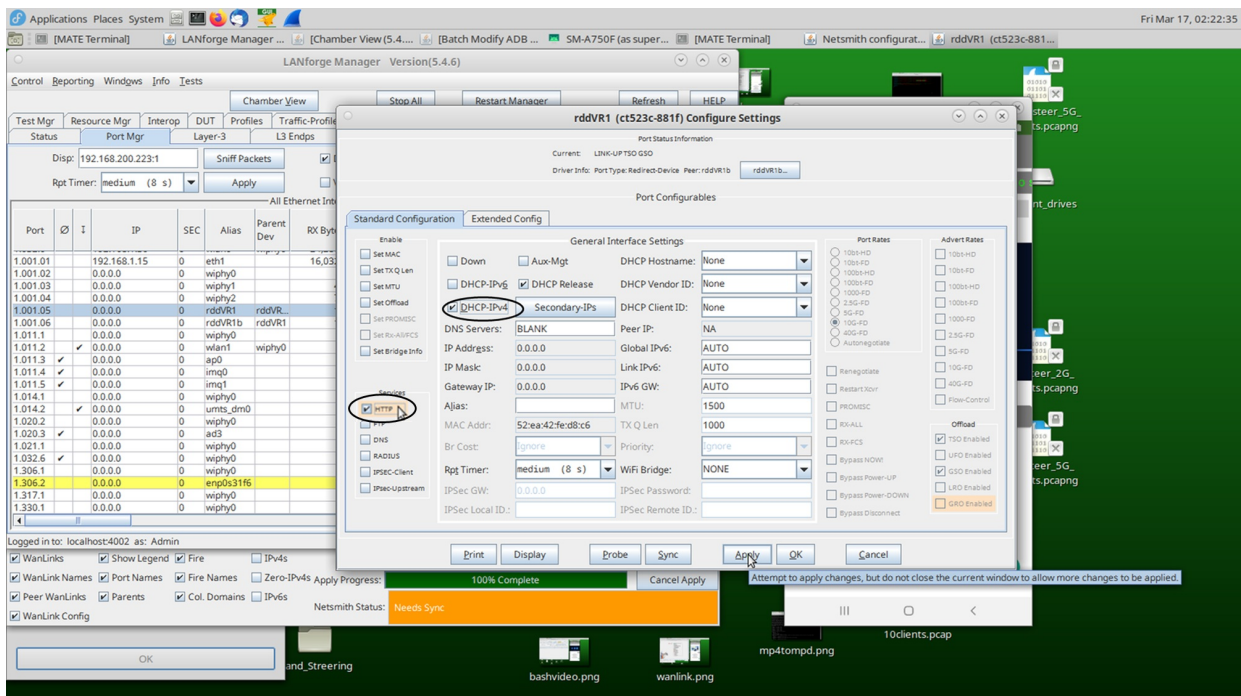
Then click on Apply in the Netsmith window, the WANlink will be created between eth1 and rddvR1.



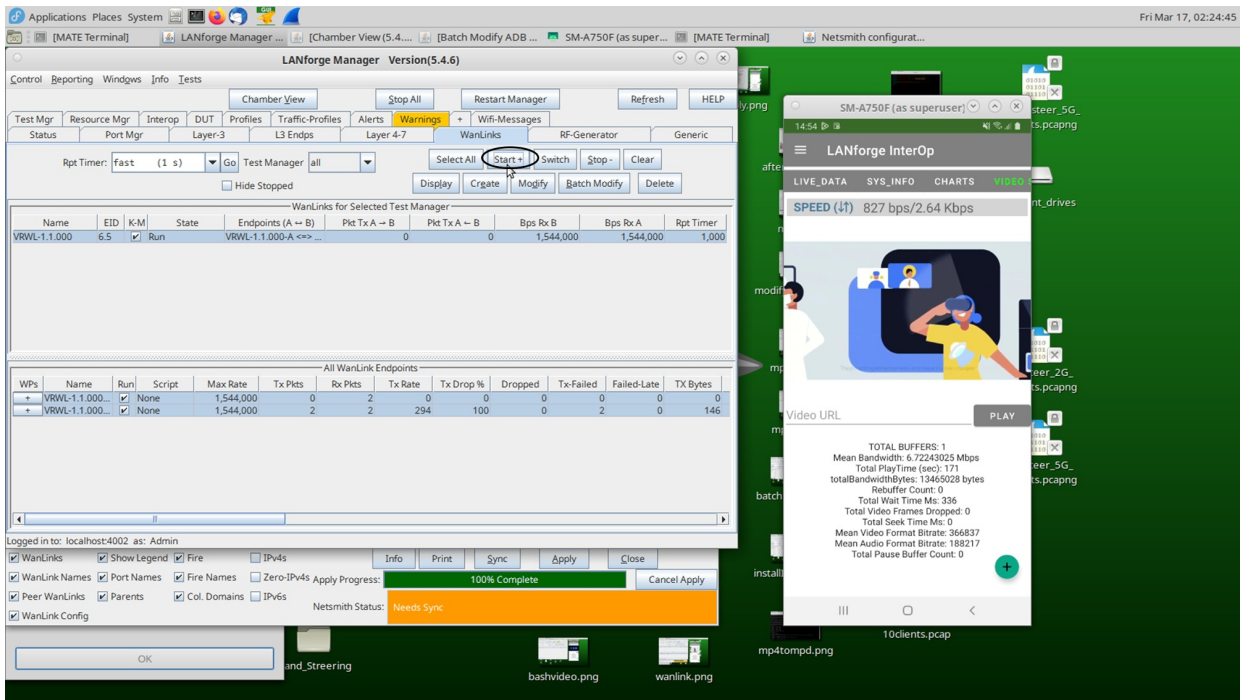
In Port manager this endpoint will also be reflected.



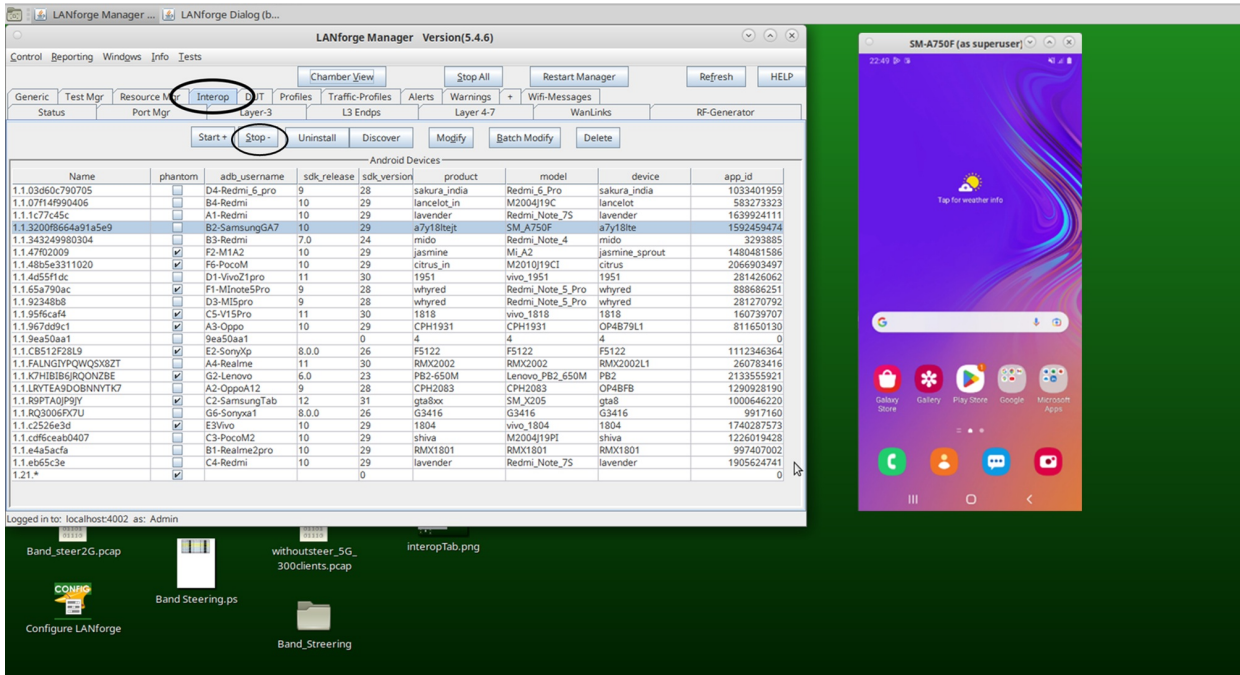
18. Click on the first of the two ports of the RDD pair, which will open a Configuration Window. Click the DHCP-IPv4 and HTTP checkbox.



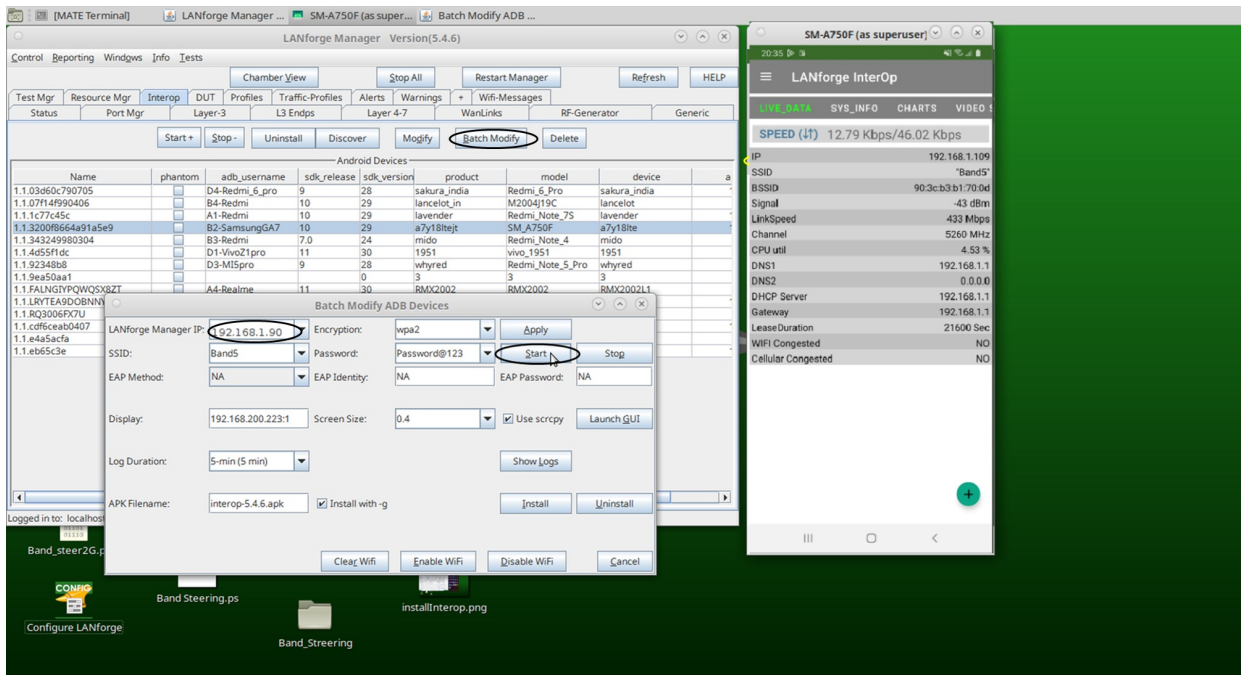
19. Now go to Wanlinks tab and click on start option to run the connection. In the Port Manager the IP address will be allocated to the first (non-b) port of the RDD pair.



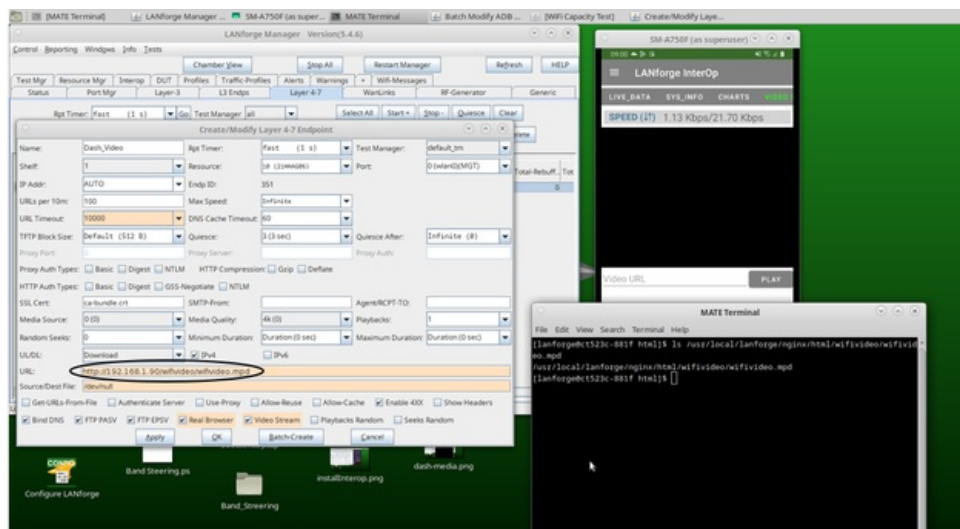
20. Then, Click on Stop to bring the device out of test room.



21. Click on the Batch Modify and enter all the details in the screenshot below. LANforge Manager IP must be WAN link IP. Here rddVR1 is allocated with "192.168.1.90" IP address.



22. Click Layer 4-7 tab, create one cross-connect with the following details, Apply the changes, and play the video. Nginx will run on rddVR1.

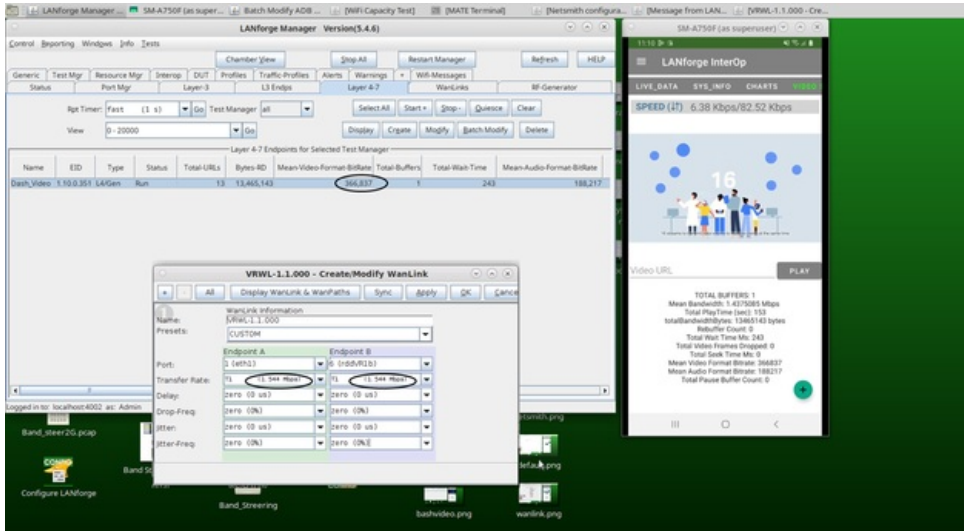


23. Click on WANlinks tab, select the WANlink to modify, and click on Modify button to modify the wanlink.

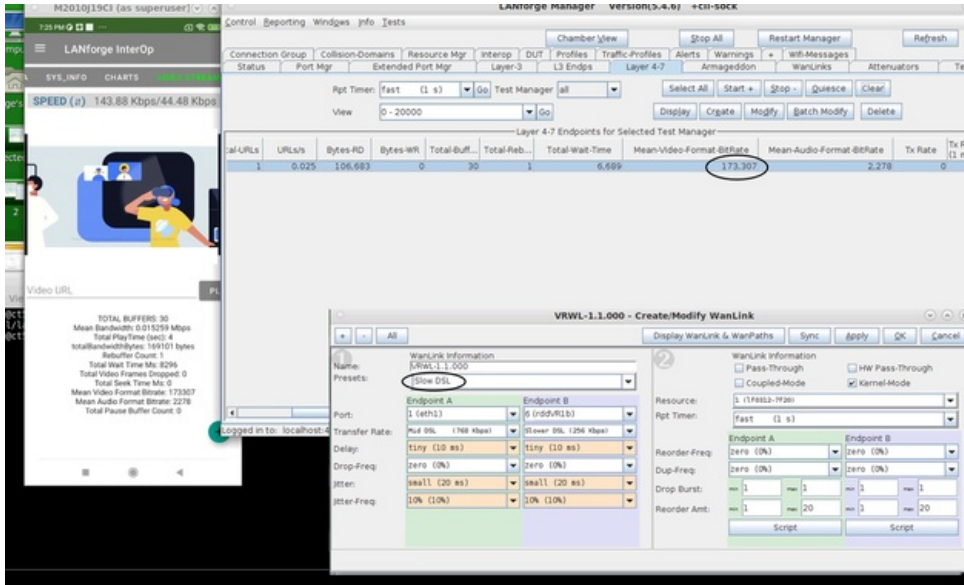


Here the Wanlink transfer rate is 1.54Mbps and the video bitrate reported is 366837. This can be observed in

Layer 4-7 and in InterOp.



24. Modify the WanLink to slow DSL and click on Apply. Video Bit rate is reduced to 173307.



It clearly indicates that the Video Player has adapted the lower quality when network is slow.

We can observe the same in the .mpd file.