

Scripted All-in-One Cable Modem Testing

Goal: Use LANforge to test CMTS and cable-modem network (DUT).

LANforge will serve DHCP and TFTP to the DUT, generate TCP traffic to measure upload and download speeds on each modem, and generate reports. In this example, eth0 is the management port, eth1 is the upstream network port (connects to CMTS), and ports eth2-eth9 are connected to cable modems. Eth2-9 are configured for DHCP, and eth1 is configured with static IP. Eth1 is also configured to serve DHCP requests to the cable modems and other LANforge ports.

- 1. Set up the network interfaces.
- 2. Configure eth1 to serve DHCP and TFTP.
 - A. Go to Status panel in LANforge GUI. Click 'Netsmith' button on the resource.
 - B. Right-click in empty space and select **New Router**. Use default values and click **OK**.
 - C. Drag eth1 into the virtual router. Then double-click the virtual eth1 icon to configure DHCP. DHCP files for CMTS setups must be hand-written by the user. Configure LANforge to use this custom-dhcp config file.

_	Create/Mo	dify Connection	×					
	Sector Sciences	Interface-Cost:	1					
Port 1-A:	1 (eth1)	RIP-Metric:	1					
Port 1-B: 🗹 Skip	<auto create="" new="" port=""></auto>	VRRP IP:	0.0.0.0					
WanLink: 🗹 Skip	<auto create="" new="" wanlink=""></auto>	VRRP ID:						
Port 2-B: 🗹 Skip	<auto create="" new="" port=""></auto>	VRRP Priority:						
Port 2-A: Skip	<auto create="" new="" port=""></auto>	VRRP Interval:	1					
DHCP Lease Time:	43200	Subnets (a.b.c.d/xx):	- - 1 0.0.0.0 0.0.0.0/24 1 1 100 1 1					
DHCP DNS:		0.0.0/0						
DHCP Range Min:								
DHCP Range Max:								
DHCP Domain:								
DHCPv6 DNS:		Next-Hop-IPv6:						
DHCPv6 Range Min:		IPv6 Subnets (aaa::0/xx)						
DHCPv6 Range Max:								
DHCPd Config File:	/home/lanforge/docis-dhcp.conf							
NAT 🗹 DHCP	DHCPv6 🗹 Custom DHC	VRRP Cand-RP						
	OK	Cancel						

- D. When Netsmith setup is complete, click Apply on the main Netsmith window to start up the DHCP service, etc. This screenshot was taken after the Layer-3 connections were set up.
- 3. Configure eth2-9 to use DHCP.
 - A. Go to Port-Mgr tab, double-click each port, and make sure the DHCP option is selected. Apply changes.
- 4. Set up Layer-3 connections to generate the throughput tests.

A. Go to the Layer-3 tab, and click Create. Many cable modems are configured to do NAT and/or some firewalling, so normally you will need the connections to be TCP and to originate out from the client-side port. So, choose the LANforge/TCP connection type, and make the 'B' side eth1. Everything else can stay at the default values because we will use a script to automate the settings.

LANforge Manager Version(5.2.7) _ D													o x	
<u>C</u> ontrol <u>R</u> eporting <u>T</u> ear-Off Info														
Stop All Restart Manager Refresh HELP										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												omains		
Rpt Timer: fast (1 s) 🔻 Go Test Manager all 💌 Select All Start Stop Quiesce Clear														
View 0-200 To Go Display Create Modify Delete												e		
tcp-1 - Create/Modify Cross Connect												<		
Name	Туре	State	Pkt											Rpt Tim
tcp-1	LF/TCP	Stopped		+	-	All	Display	Sync		Batch-Create	Apply	OK	Cance	10
tcp-2	LF/TCP	Stopped										1		10
tcp-3	LF/TCP	Stopped					Cross-Conne	ct						10
tcp-4	LF/TCP	Stopped		CX I	Name	:	tcp-1							10
tcp-5	LF/TCP	Stopped							_		_			10
tcp-6	LF/TCP	Stopped		CXT	Туре:		LANforge / T	CP			•			10
tcp-7	LF/TCP	Stopped							_					10
tcp-8	LF/TCP	Stopped					TX Endpoint			RX Endpoint				10
udp-1	LF/UDP	Stopped		_			1 (lf cable)			1 (If askla)				10
udp-1-dl	LF/UDP	Stopped		Res	ource	e:	I (II-cable)			I (II-cable)				10
udp-1-ul	LF/UDP	Stopped		Por	t:		2 (eth2)		-	1 (eth1)	-			10
udp-2	LF/UDP	Stopped							-					10
udp-3	LF/UDP	Stopped		Min	Tx Ra	ate:	New Modem (5	6 Kbps) 🔫		New Modem (56 Kbp	s) 🔻			10
udp-4	LF/UDP	Stopped		Max		ate	New Modem (5	6 Khns) 🚽		New Modem (56 Kho	s) 🗸			10
udp-5	LF/UDP	Stopped		Max	IX R	are:	new nodelli (S	- 10p3 / •		new nodelii (50 kbp	· / ·			10
udp-6	LF/UDP	Stopped		Min	PDU	Size:	lk (1,0	24 B) 🔽	•	1k (1,024 B)	-			10
udp-7	LF/UDP	Stopped					Como			Como				10
udp-8	LF/UDP	Stopped		Max	CPDU	Size:	Same	T		Same				10
udp-8-dl	LF/UDP	Stopped		IP T	oS:		Best Effort (0) 🗸	-	Best Effort (0)	-			10
udp-8-ul	LF/UDP	Stopped						-	-					10
				Pkts	s To S	Send:	Infinite	•		Infinite	-			
4			_											•
Logged i	n to: 17/	128 215 8	B. 400	2 26	· Adr	nin			-					

- B. Create 7 similar connections, always with B side port of eth1, and use A side ports eth2-eth9. In the Create/Modify window you can just change the name, change the port, and press apply. This will make copies of the connections.
 - A. You can also use **Batch-Create** (located in the Create/Modify window) to create these connections.

_	Layer-3 Batch Creator: tcp-1		_ • ×							
top-2 top-3 top-8										
Endn-A Resources: 1	1 1									
Endp-R Resources: 1, 1 1										
Endp & Derter oth2 oth4 oth0										
Enap-A Ports: etn3, etn4 etn9										
Endp & Dec										
Endp R IPs. AU										
епар-в ірз: Ас	10, A010 A010									
A 4 6 6 8 7 8 7 8 9										
Quantity:	7 Number of Digits:	4	Zero Pad							
Starting Name Suffix:	1 Name Increment:	1								
Resource Increment A:	0 Resource Increment B:	0								
Port Increment A:	1 Port Increment B:	0								
IP Addr Increment A:	0 IP Addr Increment B:	0								
IP-Port Increment A:	1 IP-Port Increment B:	1								
Apply Close										

B. Set Quantity to 7, Port Increment B to 0, and deselect Zero Pad.

- C. Click Apply.
- 5. Create Test-Group to control the 8 Layer-3 TCP connections.

A. Go to the Test Group tab, and click Create. Give your test group a name. Select the 8 Layer-3 TCP connections you just created in the previous step and add those to the Test Group. Click Apply and make sure the new group shows up in the Test Group table.

LANforge Manager Version(5.2.7) _ D											
<u>C</u> ontrol <u>R</u> eporting <u>T</u> ear-Off Info											
Stop All Restart Manager Refresh HEL											
File-IO Layer-4 Generic Test Mgr Test Group Resource Mgr Event Log Alerts Port Mgr Messages											
Status Layer-s Listings voie/Are trigs Annagedoin Waitchiks Attendators Conston-Domain											
Rpt Timer: fast (1 s) Go Select All Start Stop Quiesce Clear Display Create Modify Delete											
LANforge Test Groups											
Name Run Script											
docsis-1 En 2/2 udp-1 udp-2 udp-3 udp-4 udp Create/Modify Test Group											
docsis-1 🔲 Enabled udp-1 udp-2 udp-3 udp-4 udp											
docsis-2-3.2 Enabled udp-1 udp-2 udp-3 udp-4 udd											
adocsis-2-6.4 Enabled up-1 up-2 up-3 up-4 up-4 up-											
docsis-5x4											
docsis 2.0 C En 0/2 udp-1 udp-2 udp-3 udp-4 udp											
tcp-doc_2.0 🔽 Running tcp-1 tcp-2 tcp-3 tcp-4 tcp-5 Registered CXs Free CXs											
tcp-1 udp-1											
tcp-2 udp-1-ul											
top-4 << Add Cx udp-2											
tcp-5 udp-3											
tcp-6 udp-4											
tcp-7 Free Cx>> udp-5											
tcp-8 udp-6											
udp-7 🚽											
udp-8											
Apply OK Cancel											
Logged in to: 174,128,215,88:4002 as: Admin											

B. We need to add a script to automate the test. Click the Script button in the Test Group create/modify window. Choose RFC 2544 script type. In this scenario, we want to test each modem one at a time, so we select the Sequential option for Group Action. The rates sections determine the speeds for each iteration. In this case, the first iteration will send from B to A at 35Mbps. This is the download test. The next iteration will upload from A to B at 17Mbps. When the two iterations are complete, the script will repeat on the next Layer-3 connection.

Add/Modify Script													
Group Name:	tcp-d	oc_2.0	▼ S	Script Type: RFC-2544							•		
Script Name:	my-sc	ript	G	Group Action:					Sequential				
🗹 Enable Script 🕑 Show Reports 🕑 Symmetric 📃 Loop 🔲 Hide Iteration Details 🛄 Hide Legend 🗌												sv	
Script Iterations:	2		E: Script	stim Coni	ated Durat figuration	tion:	1.167	'm				1	
Show Dups	Show OO	0 Show A	ttenuation	H	Hide Laten	cy Distrib	utions	Hid	le Constr	aints			
Run Duration:		30 s (30 s)	•	Pause Dur	ation:		5 s	(5 s)			-	
Max Drop Perce	nt:	20% (20%)		-	Max-Tx-Un	derrun:		20% (2	20%)		_	-	
Max Jitter:		high (100 ms)		Max RT Latency: 500ms (500 ms)								-	
Max Failed OK:		0		-									
Rates A bps 0 (0 bps) 17000000 (17 M	bps)	Rates B) Payl 1472 (1	oad .438	Sizes A KB)	Paylo 1472 (1.	ad Size	es B	Attenu	ations	(dd	Bm) -	
	Show Previ	ous Report	Sync		Ар	ply	ок		Cancel				

A. To start the test, select the Test Group in the table and click the Start button. You should see a script-report window pop up, and the state should go to running. To see a live report of throughput and other values, right-click on the Test Group table and select the Dynamic Report option.



B. View the individual connections from the Layer-3 tab.

LANforge Manager Version(5.2.7)												
Control Reporting Tear-Off Info												
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 VolP/RTP VolP/RTP Endps Armageddon WanLinks Attenuators Collision-Domains												
Rpt Timer: fast (1 s) V Go Test Manager all V Select All Start Stop Quiesce Clear												ear
View	0 - 200)		Go			Displa	ay <u>C</u> rea	ate <u>M</u>	odify	Delete	
Cross Connects for Selected Test Manager												
Name	Type	State		PLt TV AC-B	Rate A->B	Rate A<-B	By Dron	By Dron		ron Pkt		Bot -
tcn-1	Турс	Stopped	42 749	81 865	6 711 626	12 851 243	0	0	0	0	0	npc 🔺
tcp-2	LE/TCP	Stopped	42,861	88,984	6,728,081	13,969,911	0	0	0	0	0	
tcp-3	LF/TCP	Stopped	30,145	51,342	4,731,463	8.059.586	0	0	0	0	0	
cp-4	LF/TCP	Stopped	6.610	50.126	1.036.267	7.868.768	0	0	0	0	0	_
tcp-5	LF/TCP	Stopped	43,250	79,407	6,788,978	12,465,882	0	0	0	0	0	
tcp-6	LF/TCP	Stopped	43,323	86,980	6,800,439	13,654,896	0	0	0	0	0	
tcp-7	LF/TCP	Run	33	42,989	13,064	25,175,099	0	0	0	0	90	
cp-8	LF/TCP	Stopped	0	0	0	0	0	0	0	0	0	
udp-1	LF/UDP	Stopped	0	0	0	0	0	0	0	0	0	
udp-1-dl	LF/UDP	Stopped	0	0	0	0	0	0	0	0	0	
udp-1-ul	LF/UDP	Stopped	0	0	0	0	0	0	0	0	0	-
4						· · · ·	!				-	•
Loggedi	nto: 174	.128.215.88	:4002 as: A	dmin								

7. Gather reports.

A. When the script completes, a summary of each iteration will be shown in the Script Report window. The text may be converted to HTML, but for this particular script, the graphs are not useful because we are using Sequential mode, so just saving the text to a file or printing it is probably the best option. Note that some of these tests failed the constraints configured in the script. In this case, it is because those modems were not capable of the requested speeds.

	Script Report for: tcp-doc_2.0													
Summ	ary data	for each iter	ation:									<u>^</u>		
##	old-size	cfq-rate	tx-bps	rx-bps	rx-bps-LL	tx-pps	rx-pps	tx-pkts	rx-pkts	cx-drops	drop%	rx-lat(ms)		
-	(bytes)	(bps)		peer	peer		peer	-	peer	peer	peer	peer		
0*	1472	. 0	0	. 0	. 0	0	. 0	O	. 0	. 0	0.000	0		
1*	1472	17000000	16780407	16780407	Θ	1425	1425	42749	42749	0	0.000	213		
0*	1472	0	0	0	Θ	0	Θ	O	0	Θ	0.000	6		
1*	1472	17000000	16811418	16811418	0	1428	1428	42828	42828	0	0.000	99		
0	1472	O	Θ	0	0	0	O	0	0	0	0.000	5		
	Failed	peer transmit-	percent constr	aint, report	ted: 57.5443%	min: 80								
1	1472	17000000	11819964	11819964	Θ	1004	1004	30112	30112	0	0.000	233		
	Failed	transmit-perce	nt constraint,	reported: 6	59.5292% min:	80								
0	1472	0	0	0	0	0	0	0	0	0	0.000	6		
	Failed	peer transmit-	percent constr	aint, report	ted: 56.1805%	min: 80				226-22				
1	1472	17000000	2581692	2581692	0	219	219	6577	6577	0	0.000	532		
	Failed	transmit-perce	nt constraint,	reported: 1	15.1864% min:	80								
0*	Failed	tatency constr	aints: 532000	max-tat: 500	0000	0	0	0	0	0	0 000			
1*	1472	17000000	16062549	16062549	0	1441	1441	42217	42217	0	0.000	52		
0*	1472	17000000	10303348	10903048	0	1441	1441	43217	43217	0	0.000	7		
1*	1472	17000000	16992768	16002768	0	1//3	1//3	13200	13200	0	0.000	20		
0*	1472	17000000	10332/00	10352700	0	1440	1445	43230	43230	0	0.000	34		
1*	1472	1 7000000	16941566	16941566	0	1439	1439	43161	43161	0	0.000	147		
ō	1472	0	10041000	10041000	õ	1400	0	40101	40101	0	0 000			
	Failed	peer transmit-	percent constr	aint. report	ted: 30.5155%	min: 80	0	0	0	0	01000	Ŭ		
1	1472	17000000	43964	37950	0	4	3	112	96	16	14,286	2756		
	Failed	transmit-perce	nt constraint.	reported: (0.25861% min:	80	-							
	Failed	latency constr	aints: 2756000) max-lat: 50	00000									
				ALC: 100										
Peer	Endpoin	it Summary data	for each iter	ation:				201 201220		1000				
##	old-size	ctg-rate	tx-bps	rx-bps	rx-bps-LL	tx-pps	rx-pps	tx-pkts	rx-pkts	cx-drops	drop%	rx-lat(ms)		
1	(bytes)	(bps)	-	peer	peer	-	peer		peer	peer	peer	peer		
0	14/2	35000000	32121395	32121668	0	2/28	2/28	81831	81832	-1	-0.001	18		
	14/2	0	0	0	0	0	0	0	0	0	0.000	0		
	14/2	35000000	34916233	34916233	0	2965	2965	88951	88921	0	0.000	40		
1	14/2	25000000	20140402	20140402	0	1710	1710	0 E1200	E1 200	0	0.000	105		
1	1472	35000000	20140493	20140493	0	1/10	1/10	51309	21308	0	0.000	125		
1	1472	35000000	19663173	19663172	0	1670	1670	50002	50002	0	0.000	52		
1	1472	33000000	190031/2	T3003T/5	0	10/0	10/0	30093	30093	0	0.000	52		
	1472	35000000	21156041	21156041	0	2646	2646	70274	79374	0	0.000	65		
1	1472	0000000	01100941	01130941	0	2040	2040	/93/4	/93/4	0	0.000	0		
0	1472	35000000	34129596	341 29596	0	2898	2898	86947	86947	0	0.000	57		
lĭ	1472	0000000	0	0	0	2000	2000	00047	00047	0	0.000	0		
ō	1472	35000000	34071935	34071935	0	2893	2893	86803	86803	0	0.000	52		
ĩ	1472	0	0	0	0	0	0	0	0	0	0.000	0		
ō	1472	35000000	10680439	10680439	õ	907	907	27209	27209	O	0.000	45		
1	1472	0	0	0	0	0	0	0	0	0	0.000	0		
												-		
				Close	Sa	ave File		Graphical Di	splay					

- B. When the script completes, you could also pause the dynamic report and print it. For an electronic copy, use a PDF printer to create PDF files instead of printing to paper.
- C. The Layer-3 tab will color-code the 8 connections, with red meaning fail, and green meaning pass. You can print the connections you are interested in by selecting them in the table and using right-click → Table Report. This report can be printed or otherwise saved.

endp-mgr: Table Report													_ =	×
Table Report														
Name	EID	Run	Mng	Script	Tx Rate	Tx Rate(Rx Rate	Rx Rate(1)	Rx Drop %	Tx Pkts	Rx Pkts	Delay	Dropped	J
tcp-1-A	1.1.2.29			Group 2/2	6,711,6	0	12,851,	0	0	42,749	81,865	0	0	
tcp-1-B	1.1.1.30			Group 2/2	12,851,	0	6,711,6	0	0	81,865	42,749	0	0	
tcp-2-A	1.1.3.27			Group 2/2	6,728,0	0	13,969,	0	0	42,861	88,984	0	0	
tcp-2-B	1.1.1.28		V	Group 2/2	13,969,	0	6,728,0	0	0	88,984	42,861	0	0	
tcp-3-A	1.1.4.31		~	Group 0/2	4,731,4	0	8,059,5	0	0	30,145	51,342	0	0	
tcp-3-B	1.1.1.32			Group 0/2	8,059,5	0	4,731,4	0	0	51,342	30,145	0	0	
tcp-4-A	1.1.5.33		~	Group 0/2	1,036,2	0	7,868,7	0	0	6,610	50,126	0	0	
tcp-4-B	1.1.1.34		~	Group 0/2	7,868,7	0	1,036,2	0	0	50,126	6,610	0	0	
tcp-5-A	1.1.6.35		~	Group 2/2	6,788,9	0	12,465,	0	0	43,250	79,407	0	0	
tcp-5-B	1.1.1.36		~	Group 2/2	12,465,	0	6,788,9	0	0	79,407	43,250	0	0	
tcp-6-A	1.1.7.37			Group 2/2	6,800,4	0	13,654,	0	0	43,323	86,980	0	0	
tcp-6-B	1.1.1.38			Group 2/2	13,654,	0	6,800,4	0	0	86,980	43,323	0	0	
tcp-7-A	1.1.8.39		~	Group 2/2	6,780,1	0	13,632,	0	0	43,194	86,836	0	0	
tcp-7-B	1.1.1.40		~	Group 2/2	13,632,	0	6,780,1	0	0	86,836	43,194	0	0	
tcp-8-A	1.1.9.41			Group 0/2	21,189	0	4,275,6	0	0	145	27,242	0	0	
tcp-8-B	1.1.1.42			Group 0/2	4,275,6	0	18,783	0	11.034	27,242	129	0	0	
														Þ
						Print	R	efresh	Close					

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