

## Building a Realistic Orchestration Validation Environment for netwoRks (ROVER)

Chris Cummings Network Automation Software Engineer Nick Buraglio Planning and Architecture

Energy Sciences Network (ESnet) Lawrence Berkeley National Laboratory TNC22

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### **The ROVER Team**

#### Team Members, from Left to Right:

Nick Buraglio, Chris Cummings, Luke Baker, Scott Richmond, George Robb, Dhivakaran (Dhiva) Muruganantham, Marc Koerner, Derek Howard, Sam Oehlert, Eric Smith, Garrett Stewart, Brendan White (Not pictured)





### **The Problem**

- Testing of orchestration software before deploying to production in a full featured environment is difficult, but required for full awareness
- Lab with physical elements is *very* constrained for resources (too many people, not enough equipment)
- Physical equipment lab (qLAB) configuration and orientation does not resemble production
- qLAB may be in a state of transition from one project to the next
- Resetting qLAB to a known state is currently not easily accomplished



### **ROVER: Origins**

- "Wow, it would be nice to do automated tests on our full orchestration stack!"
- Tested various platforms such as Eve-NG, found them not well suited for consistent but ephemeral topologies *with associated services*\*\*
- Learned about <u>containerlab</u> by talking to Roman Dodin (creator)
- Internal development and orchestration teams acknowledged need for this tooling, brought Planning and Architecture Group (PAG) into project
- PAG brought in to build an overall plan and to take ROVER from concept to initial release



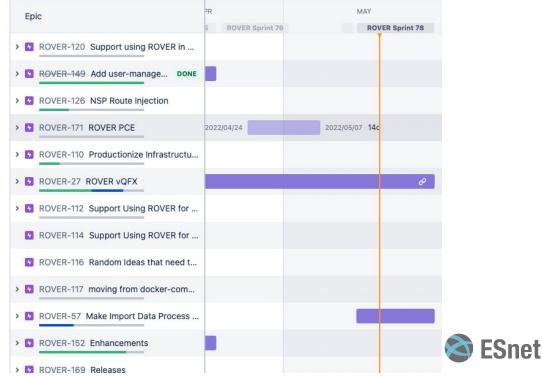
### **ROVER: Origins**

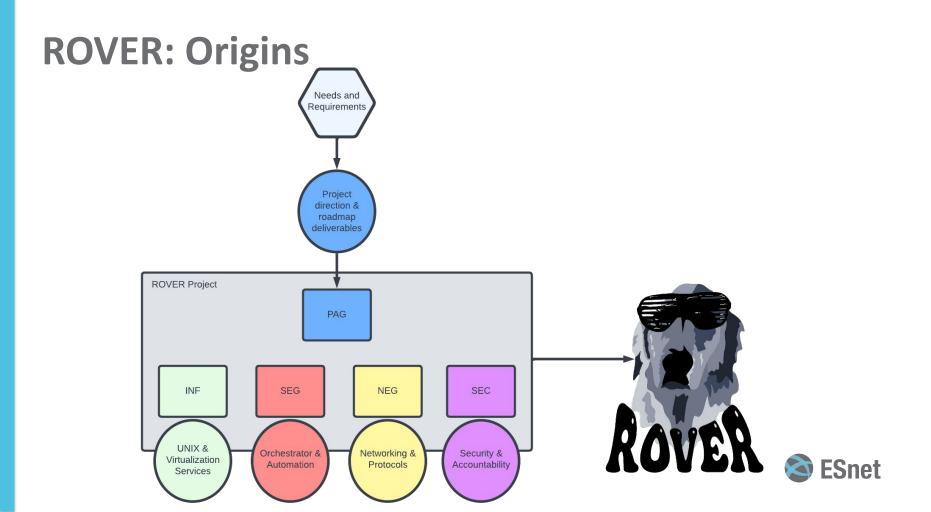
- Structured like a software project
- Clear and achievable deliverables
- Driven by needs and requirements gathered beforehand
- <u>No scope creep</u>

#### Projects / ROVER



Status category ~ Versions ~ Type ~





### **Deliverables**

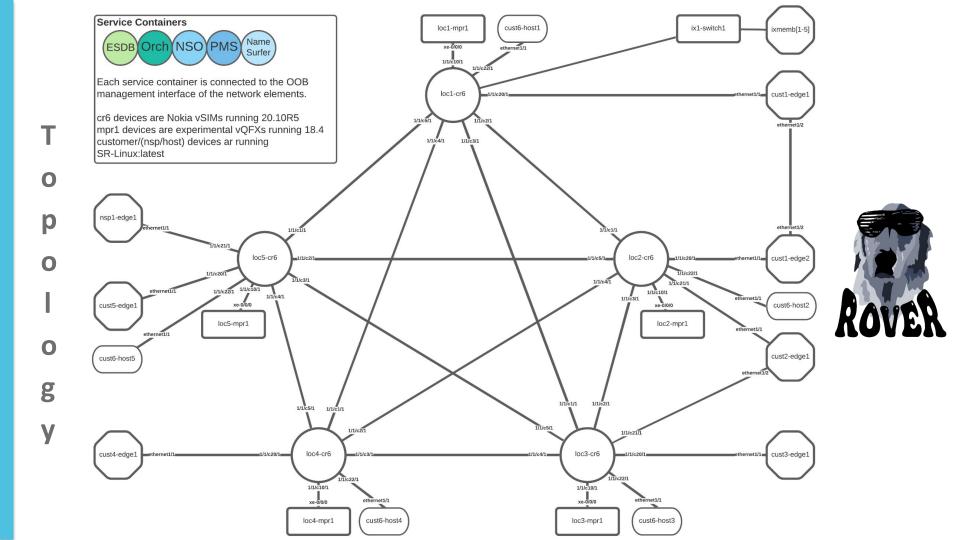
- Develop a repeatable, supportable test env for VRF migrations
- MUST—A Network topology based off production configs
- MUST—Contain OCD software to run orchestrated workflows
- MUST—Support for swapping out versions of OCD software to test latest changes
- Stretch Goals—Support dataplane capabilities
  - a. Ping across links
  - b. BGP, IS-IS, etc.



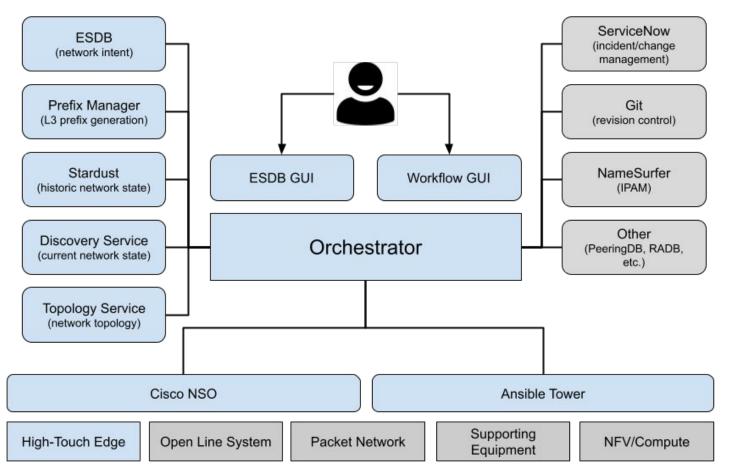
### **Categories of Users**

- A Software Developers
- A Network Engineers
- 👰 Trainers demonstrating our orchestration tooling
- 👳 Users of OCD software who need to learn the tools
- **\_\_** CI/CD Pipelines

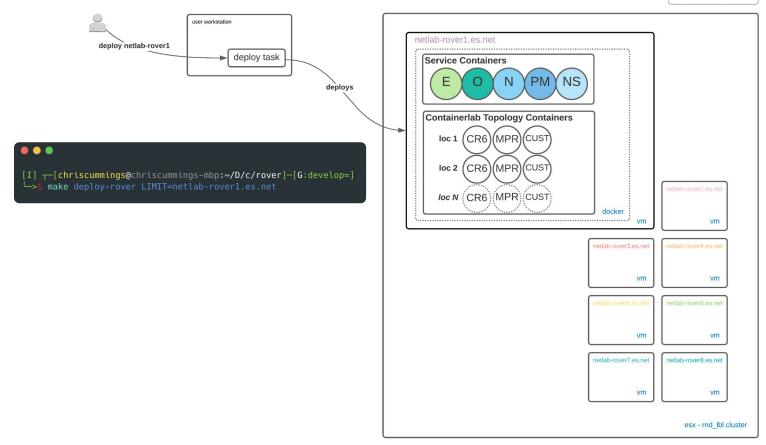




### **ESnet6 Provisioning Stack**



Legend ESDB Orchestrator NSO Prefix-Manager NameSurfer



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#### **Demonstration**

- Walkthrough of a Backbone Link Deployment Workflow
- Walkthrough of BGP Peer Deployment Workflow



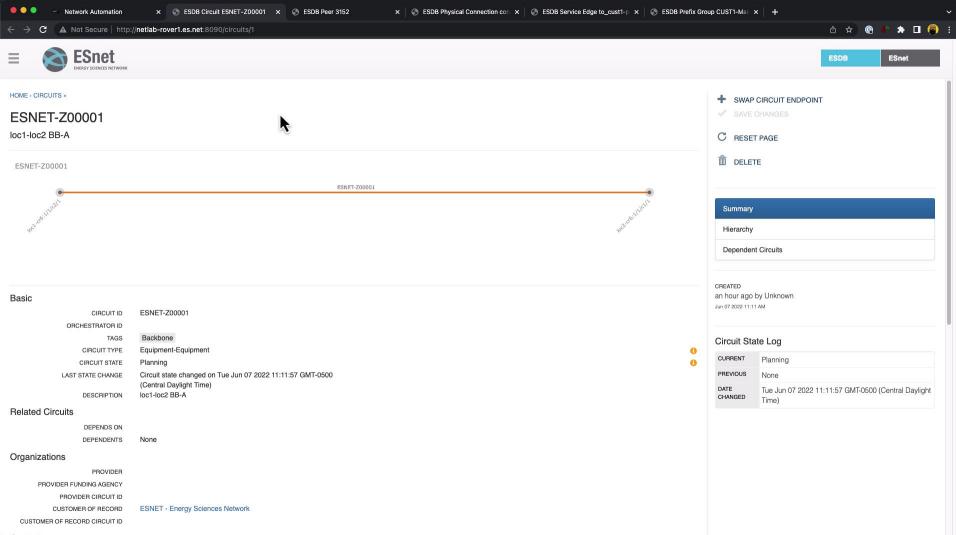
# ECMP Group (Backbone Link)



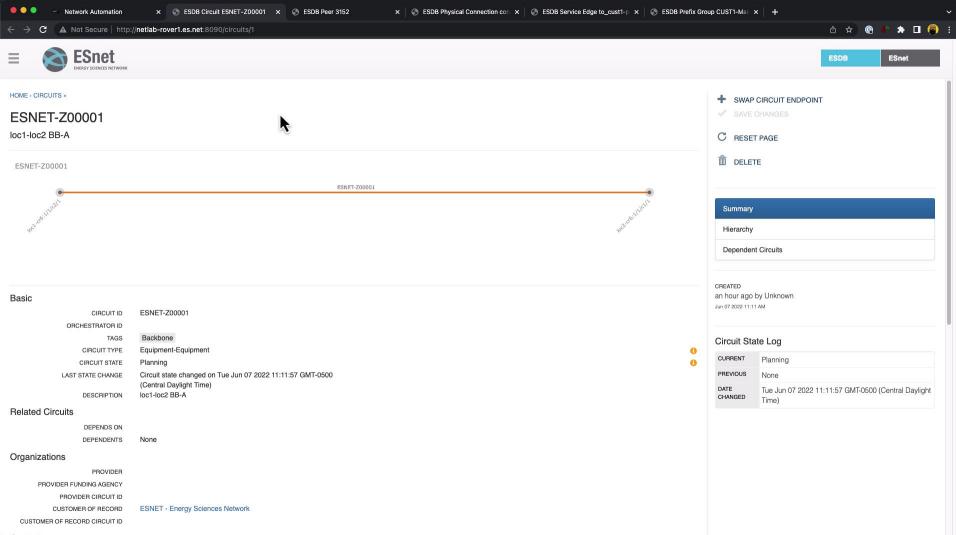
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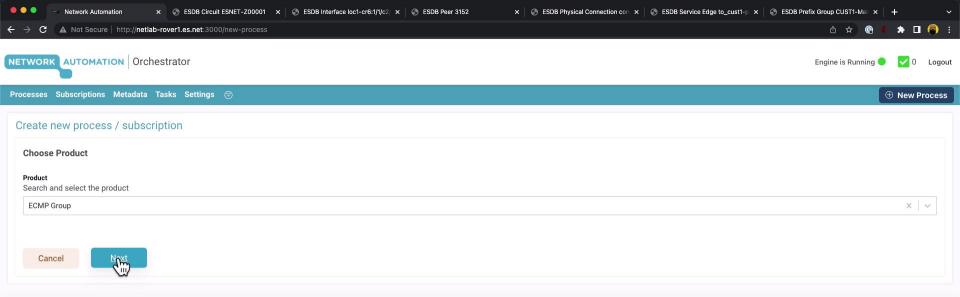
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#### Ignore Duplicate ECMP Group

If an ECMP group exists between the two chosen endpoints, click this checkbox to create another. Should only be used in cases when another circuit with a different latency/preference combination is needed

□ ignore\_duplicate\_detection

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💿 🛛 🗙 ssh clab-ipt-loc2-cr6 /Users/chriscummings (ssh -W \[netlab-rover1.es.net\]:22 lbnl-gw.es.net)

A:loc1-cr6# show system lldp neighbor Link Layer Discovery Protocol (LLDP) System Information

NB = nearest-bridge NTPMR = nearest-non-tpmr NC = nearest-customer Lcl Port Scope Remote Chassis ID Index Remote Port Remote Sys Name No Matching Entries A:loc1-cr6#

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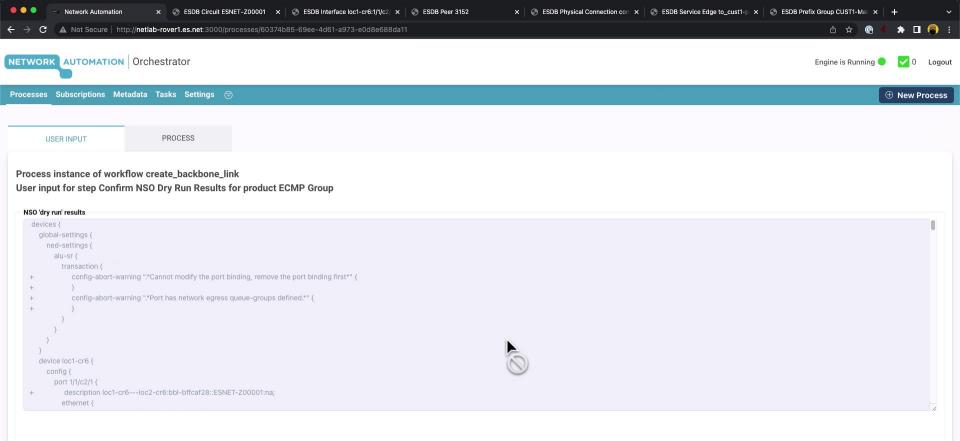
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#### Confirm NSO 'dry run' results

Confirm NSO 'dry run' results

Cancel Submit

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13 1.219834	RealtekU_c9:a8:01	EC-MAP-(or-OSI?)-Intermediate-Sys		107 P2P HELLO, System-ID: 1340.5520.002				
14 1.220190	RealtekU_3b:cd:02	SIS-all-level-2-IS's	ISIS HELLO	115 L2 HELLO, System-ID: 1340.5520.0010				
15 1.246467	RealtekU_3b:cd:02	ISIS-all-level-2-IS's	ISIS HELLO	107 L2 HELLO, System-ID: 1340.5520.0010				
16 1.246479	RealtekU_3b:cd:02	DEC-MAP-(or-OSI?)-Intermediate-Sys		107 P2P HELLO, System-ID: 1340.5520.001		2		
17 1.248206	RealtekU_c9:a8:01	DEC-MAP-(or-OSI?)-Intermediate-Sys		117 P2P HELLO, System-ID: 1340.5520.002			urce ):3b:cd:02	
19 1.252712	RealtekU_3b:cd:02	DEC-MAP-(or-OSI?)-Intermediate-Sys		117 P2P HELLO, System-ID: 1340.5520.001		52.54.00	J-3D.C0.02	
22 1.253537	RealtekU_3b:cd:02	DEC-MAP-(or-OSI?)-Intermediate-Sys		211 L2 LSP, LSP-ID: 1340.5520.0010.00-0		-ype		
23 1.253543	RealtekU_3b:cd:02	DEC-MAP-(or-OSI?)-Intermediate-Sys		83 L2 CSNP, Source-ID: 1340.5520.0010.		Virtual LAN		
25 1.257025	RealtekU_c9:a8:01	DEC-MAP-(or-OSI?)-Intermediate-Sys		117 P2P HELLO, System-ID: 1340.5520.002				
26 1.258276	RealtekU_c9:a8:01	DEC-MAP-(or-OSI?)-Intermediate-Sys		211 L2 LSP, LSP-ID: 1340.5520.0020.00-0	802.1Q Virtual LAN			
27 1.258333	RealtekU_c9:a8:01	DEC-MAP-(or-OSI?)-Intermediate-Sys		83 L2 CSNP, Source-ID: 1340.5520.0020.		1	116	31
33 1.585532	RealtekU_c9:a8:01	DEC-MAP-(or-OSI?)-Intermediate-Sys		107 P2P HELLO, System-ID: 1340.5520.002				
34 1.585548	RealtekU_c9:a8:01	DEC-MAP-(or-OSI?)-Intermediate-Sys		107 P2P HELLO, System-ID: 1340.5520.002	Priority	ID		ength
36 1.587431	RealtekU_3b:cd:02	DEC-MAP-(or-OSI?)-Intermediate-Sys		117 P2P HELLO, System-ID: 1340.5520.001	Inter	6		89
37 1.587447	RealtekU_3b:cd:02	DEC-MAP-(or-OSI?)-Intermediate-Sys		117 P2P HELLO, System-ID: 1340.5520.001				
39 1.588869	RealtekU_c9:a8:01	DEC-MAP-(or-OSI?)-Intermediate-Sy		117 P2P HELLO, System-ID: 1340.5520.002	Logical-Link Control			
40 1.589113	RealtekU_c9:a8:01	DEC-MAP-(or-OSI?)-Intermediate-Sys		117 P2P HELLO, System-ID: 1340.5520.002			5 16 1 1 1 1 1 1	
41 1.589201	RealtekU_c9:a8:01	DEC-MAP-(or-OSI?)-Intermediate-Sy		211 L2 LSP, LSP-ID: 1340.5520.0020.00-0	DSAP	SSAP	Control	
42 1.589208	RealtekU_c9:a8:01	DEC-MAP-(or-OSI?)-Intermediate-Sy		83 L2 CSNP, Source-ID: 1340.5520.0020.	ISO Network Laye		0x0003	
43 1.594985	RealtekU_3b:cd:02	DEC-MAP-(or-OSI?)-Intermediate-Sy		117 P2P HELLO, System-ID: 1340.5520.001				
44 1.594999	RealtekU_3b:cd:02	DEC-MAP-(or-OSI?)-Intermediate-Sy		211 L2 LSP, LSP-ID: 1340.5520.0010.00-0	190 10589 ISIS INTR	Domain Routeing Info	ormation Exchange E	trotocol
45 1.595002	RealtekU_3b:cd:02	DEC-MAP-(or-OSI?)-Intermediate-Sys		99 L2 CSNP, Source-ID: 1340.5520.0010.				
48 1.608417	RealtekU_3b:cd:02	DEC-MAP-(or-OSI?)-Intermediate-Sy		107 P2P HELLO, System-ID: 1340.5520.001	the second s			and the second
49 1.608429	RealtekU_3b:cd:02	DEC-MAP-(or-OSI?)-Intermediate-Sy		107 P2P HELLO, System-ID: 1340.5520.001	Intradomain Routing Pr.	Length Indicator	Version/Protocol ID Ext	
51 1.609561 52 1.609571	RealtekU_c9:a8:01 RealtekU c9:a8:01	DEC-MAP-(or-OSI?)-Intermediate-Sy DEC-MAP-(or-OSI?)-Intermediate-Sy		117 P2P HELLO, System-ID: 1340.5520.002 117 P2P HELLO, System-ID: 1340.5520.002	ISIS	27	1	0
54 1.611329	RealtekU_25:a8:01 RealtekU_3b:cd:02				Rese PDU Type	Version	Reserved	Maximum Area Address
55 1.611339	RealtekU 3b:cd:02	<pre>DEC-MAP-(or-OSI?)-Intermediate-Sy: DEC-MAP-(or-OSI?)-Intermediate-Sy:</pre>		117 P2P HELLO, System-ID: 1340.5520.001 117 P2P HELLO, System-ID: 1340.5520.001	0x0 L2 HELLC		0	3
56 1.611342	RealtekU_3b:cd:02	DEC-MAP-(or-OSI?)-Intermediate-Sys		99 L2 CSNP, Source-ID: 1340.5520.0010.				
57 1.614805	RealtekU_c9:a8:01	DEC-MAP-(or-OSI?)-Intermediate-Sys		99 LZ CSNP, Source-ID: 1340.5520.0010. 117 P2P HELLO, System-ID: 1340.5520.002	ISIS HELLO			
58 1.614805	RealtekU_c9:a8:01	DEC-MAP-(or-OSI?)-Intermediate-Sys		99 L2 CSNP, Source-ID: 1340.5520.0020.		i e e e e e e e	110	1
50 1.014010	Reallero_C9: a8:01	Dec-MAP-(01-0511)-incerniediace-sys	LI ISIS COMP	33 LZ CSNF, SUITCE-ID: 1340.5520.0020.				
	Sec contractor and a second	an a			C	SystemID	{Sender of PDU}	
		/tes captured (856 bits) on interface -, id			L	1340	0.5520.0010	
	RealtekU_3b:cd:02 (52:54:00: N, PRI: 6, DEI: 0, ID: 6	:3b:cd:02), Dst: ISIS-all-level-2-IS's (01:8	0:c2:00:00:15)				н	olding timer
> Logical-Link Cont								27
	TRA Domain Routeing Informat:	ion Exchange Protocol						
> ISIS HELLO	not bollarin houceing informat.					PDU length 86	Priorit 64	
V 1315 HELEO						80	64	
						SystemID {[	esignated IS}	
							20.0010.01	
							15	
						Area address	(es) (t=1, l=12)	
					1		v	1
						Protocols Su	pported (t=129, l=2)	
							V	

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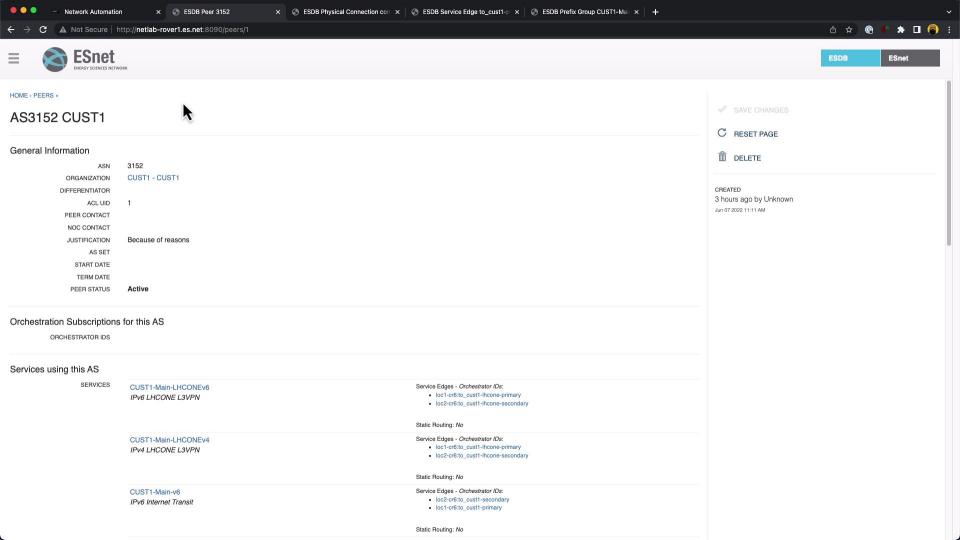
🔴 🔿 🔿 🔀 fish /Users/chriscummings/documents/Code/rover (-fish) 🕸 🗱 1	ssh clab-ipt-loc1-cr6 /Users/chriscumm	nings (ssh -W \[netlab-rover1.es.net\]:22 lbnl-gw.es.net)	#2 ssh clab-ipt-cust1-			
× ssh clab-ipt-loc1-cr6 /Users/chriscummings (ssh -W \[netlab-rover1.es.net\]:22 lbnl-gw.es.net)		× ssh clab-ipt-loc2-cr6 /Users/chriscummings (ssh -	W \[netlab-rover1.es.net\]:22 lbnl-	gw.es.net)		
status summary-address topology		No Matching Entries				
A:loc1-cr6# show router isis adjacency		A:loc2-cr6# show router int	cerface			
Rtr Base ISIS Instance 0 Adjacency		Tatasfasa Tabla (Deutau, De				
System ID Usage State Hold Interface	MT-ID	Interface Table (Router: Ba				
No Matching Entries		Interface-Name IP-Address	Adm	0pr(v4/v6)	Mode	Port/SapId PfxState
A:loc1-cr6# show system lldp neighbor Link Layer Discovery Protocol (LLDP) System Information		system 134.55.200.20/32 2001:400:0:40::200:20/12		Up/Up	Network	system n/a PREFERRED
NB = nearest-bridge	stomer	Interfaces : 1				
Lcl Port Scope Remote Chassis ID Index Remote Port Rem	mote Sys Name	A:loc2-cr6# show router isi all				
	c2-cr6					
Number of neighbors : 1						
A:loc1-cr6# show router interface		adjacency	bier-info		capabi	
		database interface	flex-algo lfa-coveraae		hostna link-a	me roup-member-status
Interface Table (Router: Base)			mapping-server		prefix	-sids
Interface-Name Adm Opr(v4/v6) Mode Po	ort/SapId	routes sr-adj-sets	sid-stats sr-lfa-coverage		spf-lo statis	
	fxState	status	summary-address		topolo	
		A:loc2-cr6# show router isi adjacency all A:loc2-cr6# show router isi				
	REFERRED					
	ystem /a REFERRED	Rtr Base ISIS Instance 0 Ad 	sage State Hold I	 Interface		 MT-ID
Interfaces : 2		No Matching Entries				
A:loc1-cr6#		A:loc2-cr6#				

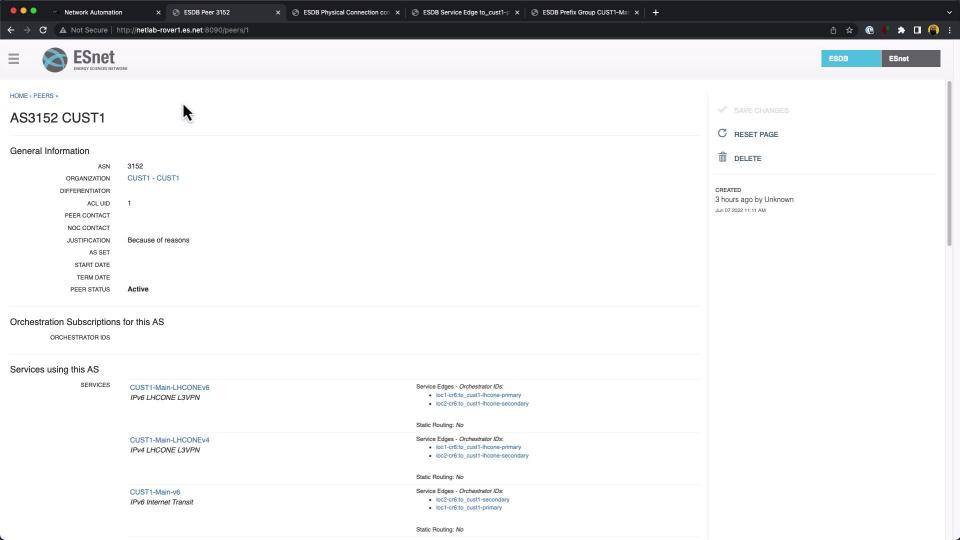
🔴 📀 🌒 🏹 fish /Users/chrisc		ঃঃ ssh clab-ipt-loc1-cr6 /Users	s/chriscummings (ssh -W \[netlab-rover1.es.net\]:22 lbnl-gw.es.net	t) #2 ssh clab-ipt-cust1-edge1		tlab-rover1.es.net\]:22 lbnl-gw.es.net)			
× ssh clab-ipt-loc1-cr6 /Users/chriscummings (ssh -W \[netlab- Link Layer Discovery Protocol (I									
NB = nearest-bridge NTPMR = ne	earest-non-tpmr NC = neare	st-customer	A:loc2-cr6# show router i						
Lcl Port Scope Remote Chase	sis ID Index Remote Port	Remote Sys Name	Interface Table (Router:	Base)					
1/1/c2/1 NB 52:54:00:A3	:CF:00 1 1/1/c1/1	loc2-cr6	Interface-Name IP-Address	Adm Opi	r(v4/v6) Mode	Port/SapId PfxState			
Number of neighbors : 1 A:loc1-cr6# show router interfac			system 134.55.200.20/32 2001:400:0:40::200:20/		/Up Network				
Interface Table (Router: Base)			Interfaces : 1						
Interface-Name IP-Address	Adm Opr(v4/v6) Mode	A:loc2-cr6# show router isis all							
loc2-bb-a 134.55.56.124/31 2001:400:0:63e::/127 fe80::5054:ff:fe3b:cd02/64 system 134.55.200.10/32 2001:400:0:40::200:10/128		ork 1/1/c2/1:6 n/a PREFERRED PREFERRED ork system n/a PREFERRED	<isis-instance> Ø adjacency database interface link-group-status</isis-instance>	bier-info flex-algo lfa-coverage mapping-server	prefix	me roup-member-status -sids			
Interfaces : 2			routes sr-adj-sets	sid-stats sr-lfa-coverage	spf-log statis				
A:loc1-cr6# show router isis ad	jacency		status A:loc2-cr6# show router i adjacency all		topolog	ду.			
Rtr Base ISIS Instance 0 Adjacer	ncy		A:loc2-cr6# show router i	sis adjacency					
System ID Usage S	State Hold Interface	MT-ID	Rtr Base ISIS Instance 0	Adjacency 🍸					
loc2-cr6 L2 l	Up 23 loc2-bb-a	0,2		Usage State Hold Inte	erface	MT-ID			
Adjacencies : 1			No Matching Entries						
A:loc1-cr6#			=====================================						

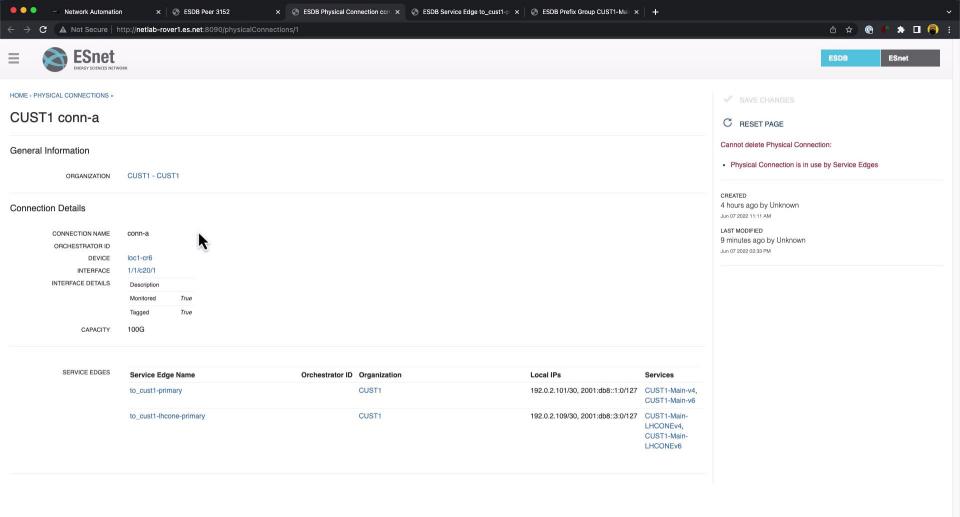
🛑 🕘 🔿 Ҡ 🕊 1 fish /Users/				នា ssh clab-ipt-loc2-cr6 /Use	ers/chriscummings (ssh -W \[netlab-rover1.es.net\]:22 lbnl-	gw.es.net) #2 ssh clab-ipt-cust1-edge1 /Users/chriscun	nmings (ssh -W \[netlab-rover1.es.net\]:22 lbnl-gw.es.net) 🌒
× ssh clab-ipt-loct-cr6 /Users/chriscummings (ssh -W\(n Link Layer Discovery Protocol			on		<ul> <li>× ssh clab-ipt-loc2-cr6 /Users/chriscum/ 134.55.200.20/32 2001:400:0:40::200</li> </ul>	nings (ssh -W [[netlab-rover1.es.net]]:22 libnl-gw.es.net) ):20/128	n/a PREFERRED
NB = nearest-bridge NTPMR =		on-tpmr NC =			Interfaces : 1		
Lcl Port Scope Remote Ch	nassis ID 1				A:loc2-cr6# show rout all	er isis	
1/1/c2/1 NB 52:54:00:	A3:CF:00 1				<isis-instance></isis-instance>		
Number of neighbors : 1 A:loc1-cr6# show router inter	'face				ø adjacency database interface	bier-info flex-algo lfa-coverage	capabilities hostname link-group-member-status
Interface Table (Router: Base					link-group-status routes	mapping-server sid-stats	prefix-sids spf-log
Interface-Name IP-Address	Adm	0pr(v4/v6)		Port/SapId PfxState	sr-adj-sets status A:loc2-cr6# show rout	sr-lfa-coverage summary-address	statistics topology
loc2-bb-a 134.55.56.124/31 2001:400:0:63e::/127 fe80::5054:ff:fe3b:cd02/64			Network	1/1/c2/1:6 n/a PREFERRED PREFERRED	adjacency all A:loc2-cr6# show rout		
system			Network	system	Rtr Base ISIS Instanc	e 0 Adjacency	
134.55.200.10/32 2001:400:0:40::200:10/128				n/a PREFERRED	System ID	Usage State Hold Interface	MT-ID
Interfaces : 2					No Matching Entries		
A:loc1-cr6# show router isis	adjacency				A:loc2-cr6# show rout	er isis adjacency	
Rtr Base ISIS Instance 0 Adja	icency				Rtr Base ISIS Instanc	e 0 Adjacency	
System ID Usag	je State Hol	d Interface		MT-ID	System ID	Usage State Hold Interface	MT-ID
loc2-cr6 L2	Up 23	loc2-bb-a		0,2	 loc1-cr6	L2 Up 24 loc1-bb-a	0,2
Adjacencies : 1					Adjacencies : 1		
A:loc1-cr6#					A:loc2-cr6#	Ĩ	

# Layer3 Service (BGP Transit)

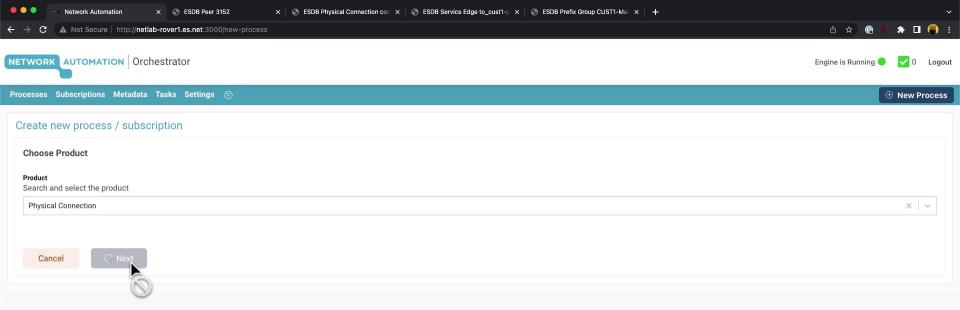




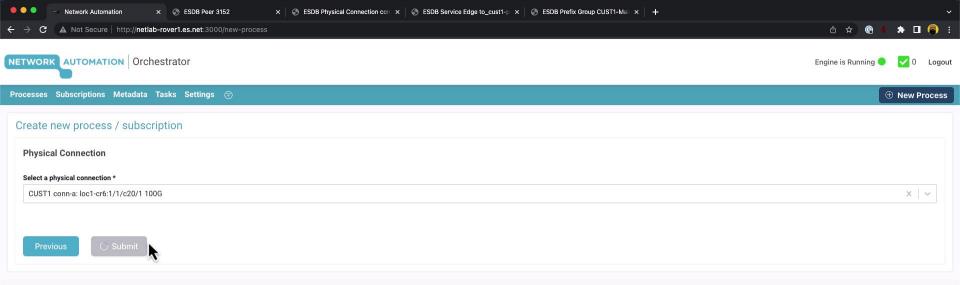




🔍 🔍 Network Automation x 📀 ESDB Peer 3152 x   📀 ESDB Physical Connection com x   📀 ESDB Service Edge to_cust1-p x   🥱 ESDB Prefix Group CUST1-Mal x   🕂	
← → C A Not Secure   http://netlab-rover1.es.net:3000/new-process	ů 🖈 🔞 4 🌲 🗖 🍘 i
NETWORK AUTOMATION Orchestrator	Engine is Running 🌒 🛃 0 Logout
Processes Subscriptions Metadata Tasks Settings ⊝	① New Process
Create new process / subscription Choose Product Product Search and select the product	
Search and select the product	~
Enroll Transponder Internal Host Connectivity L2 VPN Member Layer 3 Service	
Management Link	
Physical Connection	
Prefix List Service Edge	



🌒 🌑 👘 Network Automation x 📀 ESDB Peer 3152 x 📀 ESDB Physical Connection com x 🚱 ESDB Service Edge to_cust1-p x 🚱 ESDB Prefix Group CUST1-Mai x 🕂		
← → C ▲ Not Secure   http://netlab-rover1.es.net:3000/new-process	ů ☆ Q 4	i 🛊 🗆 🍘 i
NETWORK AUTOMATION Orchestrator	Engine is Running 🔵	) 🔽 0 Logout
Processes Subscriptions Metadata Tasks Settings 🕞		① New Process
Create new process / subscription		
Physical Connection		
Select a physical connection *		
Search and select a value		~
CUST1 conn-a: loc1-cr6:1/1/c20/1 100G		
CUST1 conn-b: loc2-cr6:1/1/c20/1 100G		
CUST2 conn-a: loc2-cr6:1/1/c21/1 100G		
CUST2 conn-b: loc3-cr6:1/1/c21/1 100G		
CUST3 conn-a: loc3-cr6:1/1/c20/1 100G		l
CUST4 conn-a: loc4-cr6:1/1/c20/1 100G		
CUST5 conn-a: loc5-cr6:1/1/c20/1 100G		
NSP1 conn-a: loc5-cr6:1/1/c21/1 100G		



• •	🔍 🔍 Network Autor	mation × (	S ESDB Peer 3152 ×	S ESDB Physical Connection con ×	S ESDB Service	Edge to_cust1-p ×   😔 ESDB Prefix Group CUST1-Mai ×	+		
← -	> C 🔺 Not Secur	e   http://netlab-rove	r1.es.net:3000/processes?activeFil	ter=isTask%2Cfalse%2Cstatus%2C	running-suspende	ed-failed-created-waiting&activePage=0%2C10&active	Sort=modified%2Cdesc&completedFilter=isTa	sk%2 🖞 🛧 🖗	🛚 4 🗰 🖬 🍘 i
	CREATED	CREATE PROCESS FO	OR PRODUCT PHYSICAL CONNECTI	ION WITH PID 4C4B79B1-8CBE-4	32-A746-CD84AI	E3F2EC8			
NET	WORK XUTOMA	TION Orchestra	tor					Engine is Runnin	g 🔘 🔽 0 Logout
15.00									
	esses Subscription	s Metadata Tasks	s Settings 🗇						The second
Proc			e commige o						
	ive Processes 🏚								8
				Target	Abbr.	Subscription(s)	Started ≎	Modified 🗸	0
	ive Processes 🏟	<b>3 -</b> ← <	> ->	Target	Abbr.	Subscription(s) description	Started 🕈	Modified 🗸	0
	ive Processes 🏟	▼ ← < Status ≑	> → Workflow ≎	Target CREATE	Abbr. ► CUST1		Started 🕈 14:43 CET	Modified - 14:44 CET	3

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# Completed Processes $\clubsuit$ - $\leftarrow$ $\leftarrow$ $\rightarrow$ $\rightarrow$

0	Workflow \$	Target	Customer	Product(s)	Tag(s)	Subscription(s)	Modified 🗸	
t	workflow name	•	• ·	product name	. F	description		
0	create_backbone_link	CREATE	789d6406-eea6-4f6a-af82-68106200d6e1	ECMP Group	BBL	loc1-cr6 to loc2-cr6	12:09 CET	Ξ
0	provision_node_enrollment	MODIFY	789d6406-eea6-4f6a-af82-68106200d6e1	Enroll Core Router	NodeEnrollment	Node loc2-cr6 Provisioned: Ready for Backbone Link	11:57 CET	Ξ
0	provision_node_enrollment	MODIFY	789d6406-eea6-4f6a-af82-68106200d6e1	Enroll Core Router	NodeEnrollment	Node loc1-cr6 Provisioned: Ready for Backbone Link	11:56 CET	≡
0	create_node_enrollment	CREATE	789d6406-eea6-4f6a-af82-68106200d6e1	Enroll Core Router	NodeEnrollment	Node loc2-cr6 Provisioned: Ready for Backbone Link	11:56 CET	Ξ
0	create_node_enrollment	CREATE	789d6406-eea6-4f6a-af82-68106200d6e1	Enroll Core Router	NodeEnrollment	Node loc1-cr6 Provisioned: Ready for Backbone Link	11:55 CET	≡

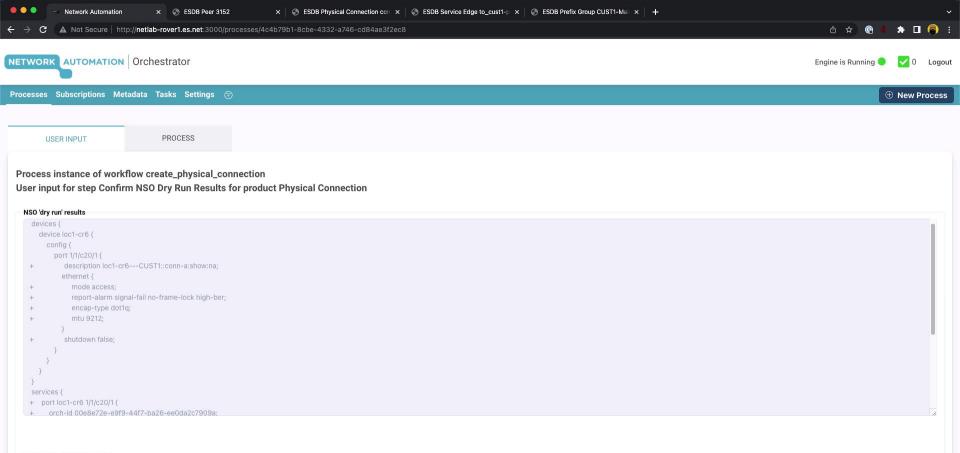
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8	0	0	<b>X</b> #1

💮 🔀 ssh clab-ipt-cust1-edge1 /Users/chriscummings (ssh -W \[netlab-rover1.es.net\]:22 lbnl-gw.es.net

A:loc1-cr6# show port description | match 1/1/c20 1/1/c20 breakout port 1/1/c20/1 100-Gig Ethernet A:loc1-cr6#

Current mode: running



### Confirm NSO 'dry run' results

Confirm NSO 'dry run' results

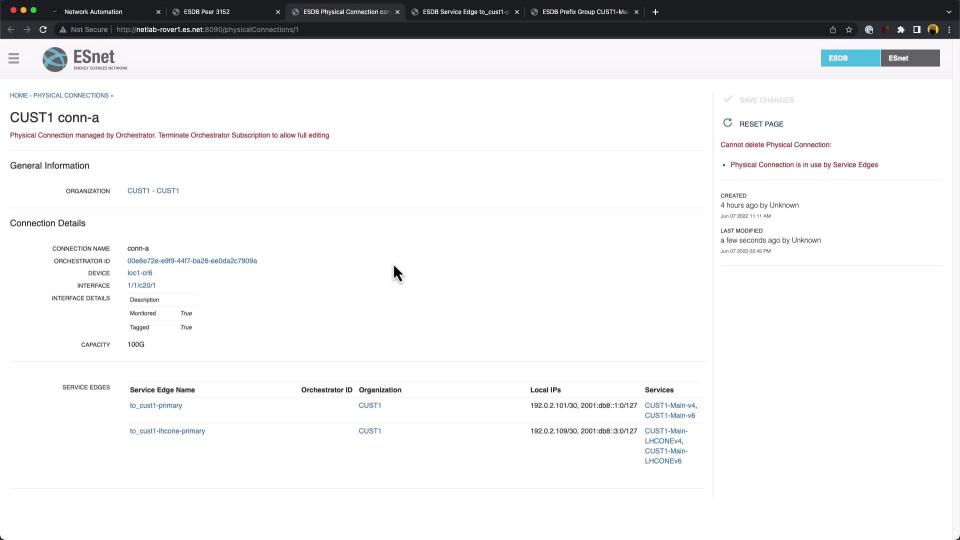


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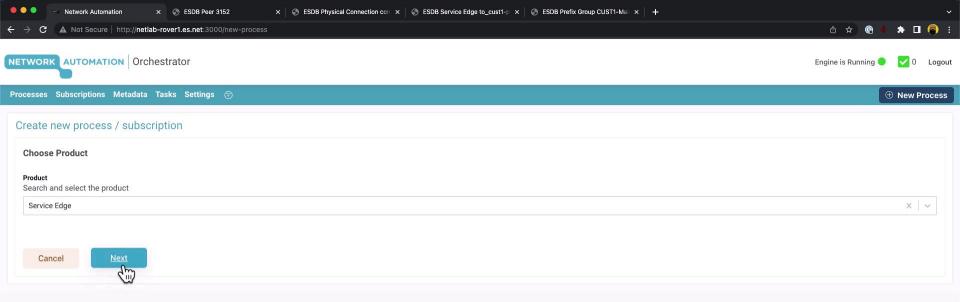
× ssh clab-ipt-loc1-cr6 /Users/chriscummings (ssh -W \[netlab-rover1.es.net\]:22 lbnl-gw.es.net)

💮 🗙 ssh clab-ipt-cust1-edge1 /Users/chriscummings (ssh -W \[netlab-rover1.es.net\]:22 lbnl-gw.es.net)

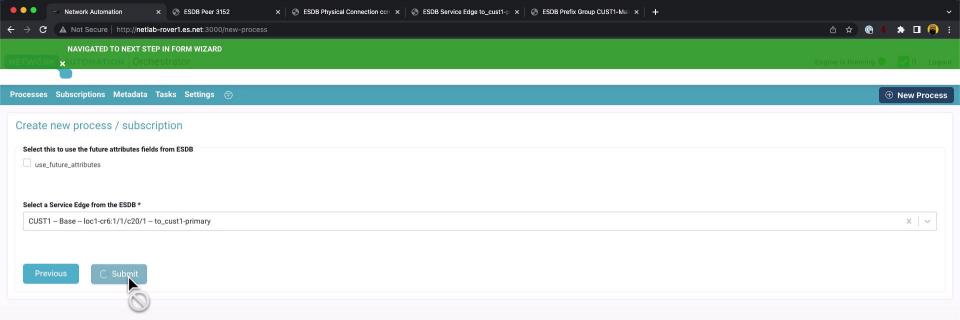
A:loc1-cr6#	show port description   match 1/1/c20	
1/1/c20	breakout port	
1/1/c20/1	100-Gig Ethernet	
A:loc1-cr6#	show_port description   match 1/1/c20	
1/1/c20	breakout port	
1/1/c20/1	loc1-cr6CUST1::conn-a:show:na	
A:loc1-cr6#		



🔍 🔍 🔍 🚥 Network Automatic	on 🛛 🗙 🕤 ESDB Peer 3152	× 🕤 🕤 ESDB Physical Connection con 🗙 🔄	ESDB Service Edge to_cust1-p × 🔇 🛇 E	SDB Prefix Group CUST1-Mai 🗙 🕇 🕂		
← → C ▲ Not Secure   I	http://netlab-rover1.es.net:8090/serviceEd	lges/1			ů ☆ (	🖻 🔹 🗯 🖬 🍘 :
	NORK				ESDB	ESnet
HOME, SERVICE EDGES, to_cust1-primary	*				SAVE CHANGES	
General Information NAME ORCHESTRATOR ID ORGANIZATION SERVICE EDGE TYPE ROUTING INSTANCE NON STANDARD CONFIG RELATED JIRA ISSUE	to_cust1-primary CUST1 - CUST1 Layer 3 Virtual Interface Base	ICE EDGE HAS A NON-STANDARD CONFIGURATION. REQU	UIRES RELATED JIRA ISSUE.		Cannot delete Service Edge: • Service Edge is in use by BGP Neighbors MIGRATE FUTURE DATA * DELETE LEGACY NAME CREATED 4 hours ago by Unknown Jun 07 2022 11:11 AM	
Orchestration Subscriptions ORCHESTRATOR IDS	s using this Service Edge				LAST MODIFIED 15 minutes ago by Unknown Jun 07 2022 02:30 FM	
Connection						
PHYSICAL CONNECTION INTERFACE SWITCH UPLINK DEVICE VLAN	CUST1 conn-a (loc1-cr6:1/1/c20/1) 1/1/c20/1 loc1-cr6 2000					
VLAN DESCRIPTION IP MTU L3 DESCRIPTION L2 DESCRIPTION	9000 - Jumbo loc1-cr6cust1(as3152):l3edge-{ORCH- loc1-cr6cust1(as3152):l3edge-{ORCH-					
LOCAL IPS	192.0.2.101/30 2001:db8::1:0/127					
BGP NEIGHBORS	192.0.2.102	AS3152 (CUST1)		Orchestrator Subscriptions:		



• • • Network Automation x 📀 ESDB Peer 3152 x 🔄 ESDB Physical Connection con x 🔄 ESDB Service Edge to_cust1-p x 🔄 ESDB Prefix Group CUST1-Mai x 🕂	
← → C ▲ Not Secure   http://netlab-rover1.es.net:3000/new-process	ů ☆ 💁 🛊 🗖 😝 :
NAVIGATED TO NEXT STEP IN FORM WIZARD	Engine is Running 🌒 🔽 0 Logout
Processes Subscriptions Metadata Tasks Settings 🗇	① New Process
Create new process / subscription	
Select this to use the future attributes fields from ESDB	
use_future_attributes	
Select a Service Edge from the ESDB *	
Search and select a value	~
CUST1 – Base loc1-cr6:1/1/c20/1 to_custprimary	1
CUST1 Base loc2-cr6:1/1/c20/1 to_cust1-secondary	
CUST1 - LHCONE loc1-cr6:1/1/c20/1 to_cust1-lhcone-primary	
CUST1 LHCONE loc2-cr6:1/1/c20/1 to_cust1-lhcone-secondary	
CUST2 Base loc2-cr6:1/1/c21/1 to_cust2-primary	
CUST2 Base loc3-cr6:1/1/c21/1 to_cust2-secondary	
CUST3 - LHCONE loc3-cr6:1/1/c20/1 to_cust3-primary-lhcone	
CUST4 - Base loc4-cr6:1/1/c20/1 to_cust4-primary	



× ssh clab-ipt-loc1-cr6 /Users/chriscummings (ssh -W \[netlab-rover1.es.net\]:22 lbnl-gw.es.net)

💮 🗙 ssh clab-ipt-cust1-edge1 /Users/chriscummings (ssh -W \[netlab-rover1.es.net\]:22 lbnl-gw.es.net)

A:loc1-cr6# show router interface

Interface-Name IP-Address	Adm	0pr(v4/v6)	Mode	Port/SapId PfxState
loc2-bb-a 134.55.56.124/31 2001:400:0:63e::/127 fe80::5054:ff:fe3b:cd02/64	Up	∪р∕∪р	Ketwork	1/1/c2/1:6 n/a PREFERRED PREFERRED
<pre>system     134.55.200.10/32     2001:400:0:40::200:10/128</pre>	Up	Up/Up	Network	system n/a PREFERRED

A:loc1-cr6#

Current mode: running

admin (5) Tue 07:36PM

🔍 Network Automation x 📀 ESDB Peer 3152 x SESDB Physical Connection com x SESDB Service Edge to_cust1-p x SESDB Prefix Group CUST1-Mail x +	
← → C ▲ Not Secure   http://netlab-rover1.es.net:3000/processes/354ede5e-a0f5-4359-b00a-fce9fe21cab4	ů ☆ @ 4 🌲 🛛 🍘 :
Processes Subscriptions Metadata Tasks Settings Θ	① New Process
USER INPUT PROCESS	

Process instance of workflow create\_service\_edge

User input for step Confirm NSO Dry Run Results for product Service Edge

+ egress {		
qos 2;		
}		
ingress {		
qos 2;		
}		
}		
address {		
ip-address 192.0.2.101/30;		
}		
3		
)		
1		
1		
,		
ſ		
rvices {		
I3-interface loc1-cr6 to_cust1-primary {		
layer3-description loc1-cr6cust1(as3152):1	sdae kookioofieene esite usheuvistereleudu	
	Juge-b32b1901.com-asite_show.intercloud,	
routing-domain esnet-293;		
route-table base;		
type external;		
admin-state up;		

### Confirm NSO 'dry run' results

Confirm NSO 'dry run' results



### 8 😑 🥝 🔍 🕬

ssh clab-ipt-loc1-cr6 /Users/chriscummings (ssh -W \[netlab-rover1.es.net\]:22 lbnl-gw.es.net)

imes ssh clab-ipt-loc1-cr6 /Users/chriscummings (ssh -W \[netlab-rover1.es.net\]:22 lbnl-gw.es.net)

## Interface Table (Router: Base)

	ana ana ana a	an ann ann an ann ann	. waa aanaa waxaa	
Interface-Name IP-Address	Adm	0pr(v4/v6)	Mode	Port/SapId PfxState
loc2-bb-a 134.55.56.124/31 2001:400:0:63e::/127 fe80::5054:ff:fe3b:cd02/64	Up	Up/Up	Network	1/1/c2/1:6 n/a PREFERRED PREFERRED
system 134.55.200.10/32 2001:400:0:40::200:10/128	Up	∪р∕∪р	Network	system n/a PREFERRED
Interfaces : 2				
A:loc1-cr6# show router interfa	ice			
Interface Table (Router: Base)				
Interface-Name IP-Address	Adm	0pr(v4/v6)	Mode	Port/SapId PfxState
loc2-bb-a 134.55.56.124/31 2001:400:0:63e::/127 fe80::5054:ff:fe3b:cd02/64	Up	Up/Up	Network	1/1/c2/1:6 n/a PREFERRED PREFERRED
system 134.55.200.10/32 2001:400:0:40::200:10/128	Up	Up/Up	Network	system n/a PREFERRED
to_cust1-primary 192.0.2.101/30 2001:db8::1:0/127 fe80::5054:ff:fe49:ea00/64	Up	Ир∕Ир	IES	1/1/c20/1:2000 n/a TENTATIVE PREFERRED

т	nta	rfac	ac	੨
-	nee	1140		-

sh netab-roverles.net "sudo ip netns exec clab-ipt-loc1-or6 topdump-U -ni eth20 -w -" | wireshark -k -l - /Users/chriscummings (ssh -W \[netlab-roverles...]
> × ssh clab-ipt-cust1-edge1 // Session ended due to idle timeout
--{ running }--[ ]-A:cust1-edge1# Session ended due to idle timeout
--{ running }--[ ]-A:cust1-edge1#
Connection to clab-ipt-cust1-edge1 closed.
[I] \_\_[chriscummings@chriscummings-mbp:~]-[14:46:05]
> \$ ssh clab-ipt-cust1-edge1
Warning: Permanently added 'clab-ipt-cust1-edge1' (ED25519) to the list of known h
ts.
admin@clab-ipt-cust1-edge1's password:
Last login: Tue Jun 7 19:29:42 2022 from 2001:400:0:40::1
Using configuration file(s): []
Welcome to the srlinux CLI.
Type 'help' (and press <ENTER>) if you need any help using this.

- --{ running }--[ ]--
- A:cust1-edge1#

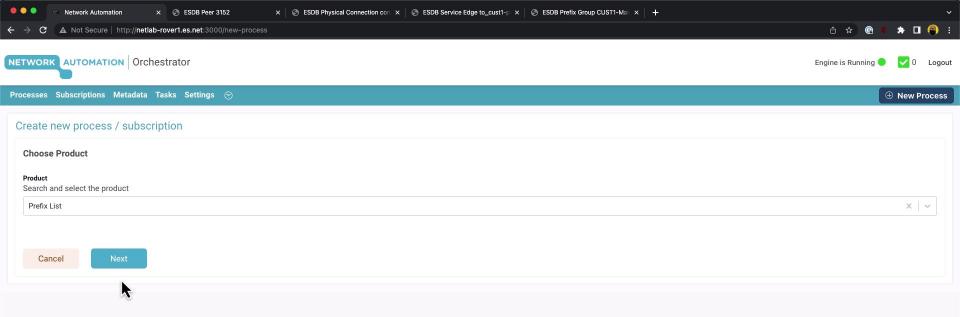
Current mode: running

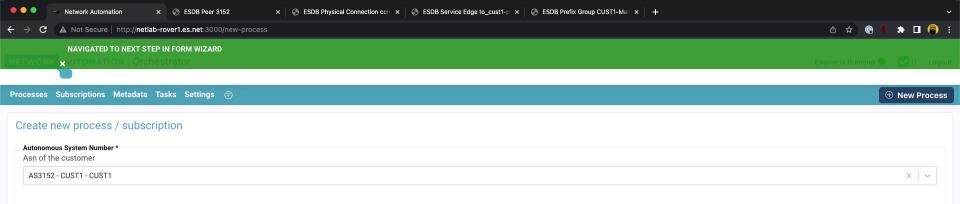
A:loc1-cr6#

Ssh clab	-ipt-loc1-cr6 /Us	ers/chriscummings (ssh -W \[r	etlab-rover1.es.n	et\]:22 ibnl-gw.es.net)	¥1
x ssh clab-ipt-loct-cr6 /Users/chriscummings (ssh -W \[netlab- 2001:db8::1:0/127 fe80::5054:ff:fe49:ea00/64	rover1.es.net\]:2	2 lbnl-gw.es.net)		TENTATIVE PREFERRED	× ssh clab Net in: Interfo Type
Interfaces : 3					Oper s Ip mtu
A:loc1-cr6# show router interfac	ce				Pref
Interface Table (Router: Base)					192. 2001 fe80
Interface-Name IP-Address	Adm	0pr(v4/v6)	Mode	Port/SapId PfxState	Net in:
loc2-bb-a 134.55.56.124/31 2001:400:0:63e::/127 fe80::5054:ff:fe3b:cd02/64	Up	Up/Up	Network	1/1/c2/1:6 n/a PREFERRED PREFERRED	Type Oper s Ip mtu Pref
system 134.55.200.10/32 2001:400:0:40::200:10/128 to_cust1-primary	Up Up	Up∕Up Up∕Up	Network IES	system n/a PREFERRED 1/1/c20/1:2000	==== 172. 2001 fe80
192.0.2.101/30 2001:db8::1:0/127 fe80::5054:ff:fe49:ea00/64	94	CFY CF		n/a PREFERRED PREFERRED	Net in Interf
Interfaces : 3					Oper s Pref
A:loc1-cr6# ping 192.0.2.102 PING 192.0.2.102 56 data bytes 64 bytes from 192.0.2.102: icmp_ 64 bytes from 192.0.2.102: icmp_ 64 bytes from 192.0.2.102: icmp_ 64 bytes from 192.0.2.102: icmp_ 64 bytes from 192.0.2.102: icmp_ 192.0.2.102 PING Statistics	_seq=2 t _seq=3 t _seq=4 t _seq=5 t	tl=64 time=8.44 tl=64 time=8.21 tl=64 time=8.94	ms. ms. ms. ך		 131. 192. 198. 198. 198. 198. 2001 2620
5 packets transmitted, 5 packets round-trip min = 5.54ms, avg = 9 A:loc1-cr6#	s receiv			3.76ms	{ rui A:custi Curren

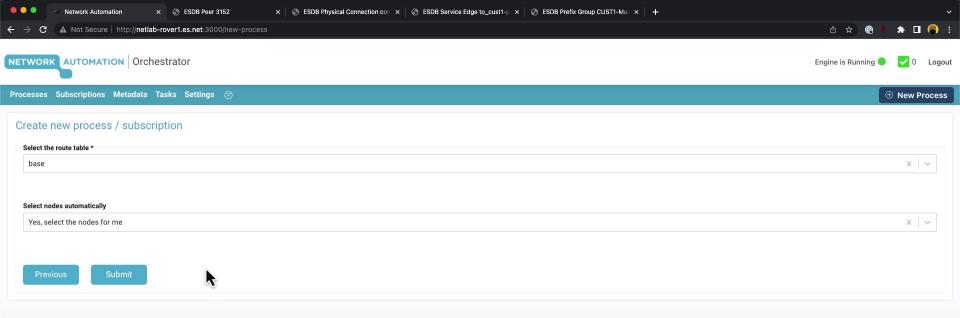
361 ssh netlab-rover1.es.net "sudo ip net	ns exec clab-ipt-loc1-cr6 tcpdump -U -nni eth20 -v	
× ssh clab-ipt-cust1-edge1 /Users/chriscummir		.net)
Net instance : defaul		
	et-1/1.2000	
Type : routed		
Oper state : up		
Ip mtu : 9000		
Prefix	Origin	Status
192.0.2.102/30	static	preferred, primary
2001:db8::1:1/127	static	preferred, primary
fe80::18b0:ff:feff:0/6	4 link-layer	preferred
Net instance : defaul		
Interface : etherr		
Type : routed		
Oper state : up		
Ip mtu : 9000		
Prefix	Origin	Status
172.16.0.0/31	static	preferred, primary
2001:db8::/127	static	preferred, primary
fe80::18b0:ff:feff:1/6	4 link-layer	preferred
Net instance : defaul		
Interface : lo1.0		
Oper state : up		
	Origin	Status
131.225.0.1/16	static	preferred, primary
192.190.216.1/22	static	preferred
198.49.208.1/24	static	preferred
198.124.68.1/22	static	preferred
198.124.212.1/23	static	preferred
198.151.133.1/24	static	preferred
2001:400:2410::1/48	static	preferred, primary
2620:6a::1/48	static	preferred
A:cust1-edge1#		
Current mode: running		admin (6) Tue 07:46

🔎 🔍 🖤 Network Automatio	n x   📀 ESDB Peer 3152 x   🔄 ESDB Physical Connection con x   🔄 ESDB Service Edge to_cust1-p x 🕤 ESDB Prefix Group CUST1-Mai x 🕇	
$\leftrightarrow$ $\rightarrow$ <b>C A</b> Not Secure   h	ttp://netlab-rover1.es.net:8090/services/2	ė ☆ 💁 🏟 🖬 🍘 i
	як	ESDB ESnet
HOME - SERVICES - CUST1-Main-v6		SAVE CHANGES
General Information	Main	DELETE
ROUTING INSTANCE ROUTING INSTANCE CUSTOMER PEER DESCRIPTION	IPv6 Internet Transit Base CUST1 - CUST1 AS3152 - CUST1	CREATED 4 hours ago by Unknown Jun 07 2022 11:12 AM
STATIC ROUTING	CHECK THIS BOX IF THE SERVICE IS STATIC ROUTED	
Orchestration Subscriptions ORCHESTRATOR IDS	for this Service	
Service Edges		
SERVICE EDGES	loc2-cr6:to_cust1-secondary v4,v6	
	loc1-cr6:to_cust1-primary v4,v6	
Prefixes	2001/00/2410-//8	
FREFILES	2001:400:2410::/48 2620:6a::/48	









San diabrige for the of years juints uninnings (san -++ ((herabrityeen teshet())))			
🗙 ssh clab-ipt-loc1-cr6 /Users/chriscummings (ssh -W \[netlab-rover1.es.net]]:22 lbnl-gw.es.net)	💮 🗙 ssh clab-ipt-cust1-edge1 /Users/chriscummings (ssh	n -W \[netlab-rover1.es.net\]:22 lbnl-gw.es.net)	
	Net instance : default		
	Interface : ethernet-	1/1.2000	
	Type : routed		
	Oper state : up		
	Ip mtu : 9000		
	Prefix	Origin	Status
	192.0.2.102/30	static	preferred, primary
	2001:db8::1:1/127	static	preferred, primary
	fe80::18b0:ff:feff:0/64	link-layer	preferred
	Net instance : default		
	Interface : ethernet- Type : routed		
	Oper state : up		
	Ip mtu : 9000		
	Prefix	Origin	Status
	172.16.0.0/31	static	preferred, primary
	2001:db8::/127	static	preferred, primary
	fe80::18b0:ff:feff:1/64	link-layer	preferred
	Net instance : default		
	Interface : lo1.0		
	Oper state : up		
		Origin	Status
	131.225.0.1/16	static	preferred, primary
	192.190.216.1/22	static	preferred
	198.49.208.1/24	static	preferred
	198.124.68.1/22	static	preferred
	198.124.212.1/23	static	preferred
	198.151.133.1/24	static	preferred
	2001:400:2410::1/48	static	preferred, primary
	2620:6a::1/48	static	preferred
	{ running }[ ]		
A:loc1-cr6# admin display-config   match l3p-base-v6-3152 context all	A:cust1-edge1#		
A:loc1-cr6#	Current mode: running		admin (6) Tue 07:46PM

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### ssh clab-ipt-loc1-cr6 /Users/chriscummings (ssh -W \[netlab-rover1.es.net\]:22 lbnl-gw.es.net)

I

A:loc1-cr6# admin display-config | match l3p-base-v6-3152 context all A:loc1-cr6# admin display-config | match l3p-base-v6-3152 context all

router Base

policy-options prefix-list "13p-base-v6-3152" prefix 2001:400:2410::/48 through 60 prefix 2620:6a::/48 through 60

#\_\_\_\_\_

policy-options

policy-statement "13p-base-in-v6-cust1-3152" entry 10 from

prefix-list "13p-base-v6-3152"

|--|--|--|--|--|--|--|

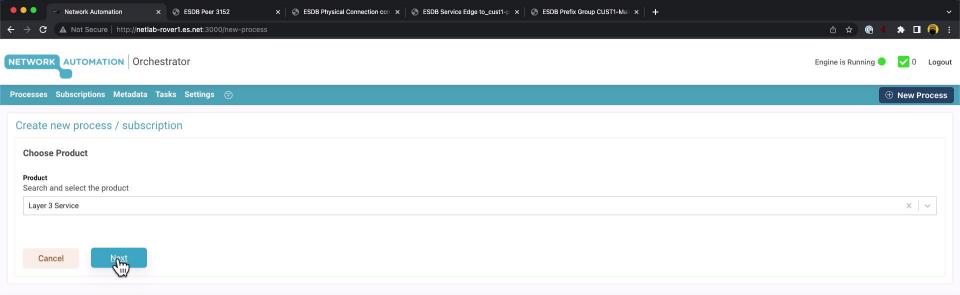
# **%**1 💮 🔀 ssh clab-ipt-cust1-edge1 /Users/chriscummings (ssh -W \[netlab-rover1.es.net\]:22 lbnl-gw.es.net Ip mtu

admin (6) Tue 07:46PM

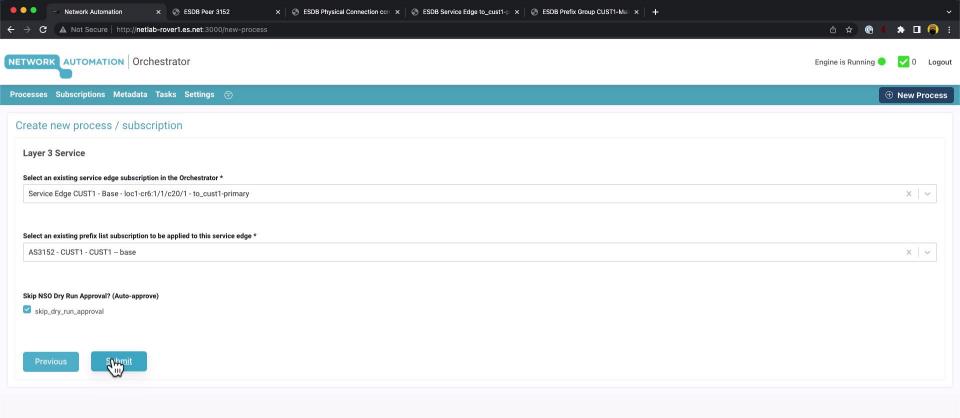
Current mode: running

A:loc1-cr6#

🔍 🔍 🔍 🦇 Network Automatio	n × 📀 ESDB Peer 3152	× S ESDB Physical Connection con ×	S ESDB Service Edge to_cust1-p ×   S ESDB Prefix Group CUST1-Mai ×   +			
$\leftrightarrow$ $\rightarrow$ <b>C</b> (A Not Secure   H	http://netlab-rover1.es.net:8090/peers/1				ů ☆ Q	4 🌸 🖬 🍘 i
	IORK				ESDB	ESnet
ASN ORGANIZATION DIFFERENTIATOR ACL UID PEER CONTACT NOC CONTACT JUSTIFICATION AS SET START DATE TERM DATE PEER STATUS	3152 CUST1 - CUST1 1 Because of reasons Active			CREATED 4 hours ago by Unknown Jun 07 2022 11:11 AM		
Orchestration Subscriptions	s for this AS					
ORCHESTRATOR IDS	16c43-5e-abf2-4dcc-9ac7-ef5fa5eb7342 Prefix		AS3152 - CUST1 - CUST1 base			
Services using this AS						
SERVICES	CUST1-Main-LHCONEv6 IPv6 LHCONE L3VPN		Service Edges - Orchestrator IDs: • loc1-cr610_cuat1-lhcone-primary • loc2-cr610_cuat1-lhcone-secondary Static Routing: No			
	CUST1-Main-LHCONEv4 IPv4 LHCONE L3VPN		Service Edges - Orchestrator IDs: • loc1-cr610_cust1-lhcone-primary • loc2-cr610_cust1-lhcone-secondary Static Routing: No			
	CUST1-Main-v6 IPv6 Internet Transit		Service Edges - Orchestrator IDs: • loc2-cr610_cust1-secondary • loc1-cr610_cust1-primary - b32b190f-3805-41d9-a278-77b841847208 Static Routing: No			
	CUST1-Main-v4 IPv4 Internet Transit		Service Edges - Orchestrator IDs: • loc2-cr610_cust1-secondary • loc1-cr61to_cust1-primary - b32b190f-3805-41d9-a278-77b841847208			
			Static Routing: No			



🔴 🔍 🐭 Network Automation x 🚳 ESDB Peer 3152 x 🗞 ESDB Physical Connection con x 🗞 ESDB Service Edge to_cust1-p x 🗞 ESDB Prefix Group CUST1-Mail x 🕇	
← → C ▲ Not Secure   http://netlab-rover1.es.net.3000/new-process	û 🖈 🕜 4 🌲 🗖 🌍 :
NAVIGATED TO NEXT STEP IN FORM WIZARD	
	Engine is Running 🔵 🔽 0 Logout
Processes Subscriptions Metadata Tasks Settings 🕞	① New Process
Create new process / subscription	
Layer 3 Service	
Select an existing service edge subscription in the Orchestrator *	
Search and select a value	~
Service Edge CUST1 - Base - loc1-cr6:1/1/c20/1 to_cust1-primary	
Select an existing prefix list subscription to be applied to this service edge *	
Search and select a value	~
Skip NSO Dry Run Approval? (Auto-approve)	
Previous	



$ \begin{array}{c} \text{AS PktRevd InQ Up/Down StatelRev/Act/Sent (Addr Family)} \\ \text{PktSent OutQ } \end{array} \\ \text{StatelRev/Act/Sent (Addr Family)} \\ \text{PktSent OutQ } \end{array} \\ \text{StatelRev/Act/Sent (Addr Family)} \\ \text{PktSent OutQ } \end{array} \\ \text{StatelRev/Act/Sent (Addr Family)} \\ StatelRev/Ac$	8 🔿 🥝 🕄 1		ssh clab	o-ipt-loo	c1-cr6 /Users/chriscu	ummings (ssh -W \[netlab-rover1.es.net\]:22 lbnl-gw.es.net)		<b>#1</b>	
Total Link State Rem Rts: 0       Total Link State Rem Act Rts: 0       A:cust1-edge1#         Total SrPlcyIpv4 Rem Rts: 0       Total SrPlcyIpv4 Rem Act Rts: 0       A:cust1-edge1#         KGP Summary	× ssh clab-ipt-loc1-cr6 /Us	ers/chriscumn	nings (ssh -W \[netlab	-rover1.	es.net\]:22 lbnl-gw.e	is.net)		🗙 ssh c	ab-ipt-cust1-edge1 /Users/chriscummings (ss
Total SrPLcyIpv& Rem Rts: 0       Total SrPLcyIpv& Rem Act Rts: 0         GP Summary         eegend : D - Dynamic Neighbor         leighbor         escription         AS PktRcvd InQ Up/Down PktSent OutQ         StatsTream         34.55.200.20         OC3-CR6         293       325         0       03h34m40s         0/0/0 (IPv4)         34.55.200.30         OC3-CR6         293       0         0       03h34m40s         Connect         34.55.200.50         OC5-CR6         293       0         0       03h34m40s         0       0         34.55.200.30         OC3-CR6       293         293       0         0       0         34.55.200.40       0         OC4-CR6       293         0       0         34.55.200.50       0         0C5-CR6       293         0       0         34.55.210.194       0         293       0         0       0         34.55.210.194       0         0       0	Total FlowIpv6	Rem Rt							unning }[ ]
Total SrPlcyIpv6 Rem Rts: 0       Total SrPlcyIpv6 Rem Act Rts: 0         KGP Summary         Leighbor         Lescription         AS PktRcvd InQ Up/Down StateIRcv/Act/Sent (Addr Family) PktSent OutQ         24.55.200.20         .0C2-CR6         293       325         0 02h39m57s       0/0/0 (IPv4) 0/0/0 (VpnIPv4) 1/0/1 (MCastIPv4) 0/0/0 (VpnIPv6)         34.55.200.30       0         .0C3-CR6       293       0         293       0       0 03h34m40s Connect         .0C3-CR6       293       0       0 03h34m40s Active         .0C3-CR6       293       0       0 03h34m40s Active         .0C5-CR6       293       0       0 03h34m40s Active         .0C5-CR6       293       0       0 03h34m40s Active         .0C5-CR6       293       0       0 03h34m40s Active	Total Link Sta	te Rem	Rts: 0		Total I	link State Rem Act Rts: 0		A:cus	t1-edge1#
AGP Summary         leighbor         leighbor         leighbor         lescription         AS PktRcvd InQ Up/Down       StatelRcv/Act/Sent (Addr Family)         PktSent OutQ         34.55.200.20         .002-CR6         293       325         0       0/0/0 (IPv4)         .0/0/0 (IPv4)         .0/0/0 (VpnIPv4)         .0/0/0 (VpnIPv4)         .0/0/0 (VpnIPv6)         .003-CR6         293       0         .0         .034.55.200.30         .003-CR6         293       0         .0         .0.4-CR6         .003         .005-CR6         .003         .005-CR6         .003         .005-CR6         .00         .0134.55.200.50         .025-CR6         .00         .0134.55.210.194         .00         .01         .01         .023         .01         .023         .01         .023         .01         .023         .023 <td>Total SrPlcyIp</td> <td>v4 Rem</td> <td>Rts: 0</td> <td></td> <td>Total S</td> <td>SrPlcyIpv4 Rem Act Rts: 0</td> <td></td> <td></td> <td></td>	Total SrPlcyIp	v4 Rem	Rts: 0		Total S	SrPlcyIpv4 Rem Act Rts: 0			
Legend : D - Dynamic Neighbor         leighbor	Total SrPlcyIp	v6 Rem	Rts: 0		Total S	SrPlcyIpv6 Rem Act Rts: 0			
Legend : D - Dynamic Neighbor         leighbor		ad that a		iak Sala					
leighbor         leighbor         lescription         AS PktRcvd InQ Up/Down PktSent OutQ         34.55.200.20         .0C2-CR6         293         333         0         0/0/0	BGP Summary								
$ \begin{array}{c} AS \ PktRevd \ InQ \ Up/Down \ PktSent \ OutQ \ Up/Down \ StatelRev/Act/Sent (Addr \ Family) \ PktSent \ OutQ \ PktSent \ $	Legend : D - D	ynamic	Neighbor						
PktSent OutQ         34.55.200.20 $0.0C2-CR6$ 293       325       0 $02h39m57s$ $0/0/0$ (IPv4)         333       0 $0/0/0$ (VpnIPv4) $1/0/1$ (MCastIPv4) $0/0/0$ (VpnIPv6)         34.55.200.30       0       0 $03h34m40s$ Connect         .0C3-CR6       293       0       0 $03h34m40s$ Connect         .0C3-CR6       293       0       0 $03h34m40s$ Connect         .0C4-CR6       293       0       0 $03h34m40s$ Connect         .0C5-CR6       293       0       0 $03h34m40s$ Connect         .0C5-CR6       293       0       0 $03h34m40s$ Active         .0C3-CR6       0       0 $03h34m40s$ Active         .0C5-CR6       293       0       0 $03h34m40s$ Active         .023       0       0 $03h34m40s$ Active $0$ .34.55.210.194       293       0 $0$ $03h34m40s$ Active	Neighbor Description			uit toitu					
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$		AS			Up/Down	StatelRcv/Act/Sent (Addr Family)			
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	134.55.200.20								
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	LUCZ-CR6	202	225	0	02h20mE7c	0/0/0 (TD:4)			
0/0/0 (VpnIPv4) 1/0/1 (MCastIPv4) 0/0/0 (VpnIPv6)         34.55.200.30         .0C3-CR6         293       0       0 03h34m40s Connect         0       0         .34.55.200.40         .0C4-CR6       293       0       0 03h34m40s Connect         .0C4-CR6       293       0       0 03h34m40s Connect         .0C5-CR6       293       0       0 03h34m40s Active         .0C5-CR6       293       0       0 03h34m40s Active         .0C3-CR6       293       0       0 03h34m40s Active         .0C5-CR6       293       0       0 03h34m40s Active         .00       0       0       0		295			021159111575				
1/0/1 (MCastIPv4) 0/0/0 (VpnIPv6)         34.55.200.30         .0C3-CR6         293       0       0 03h34m40s Connect         .0C4-CR6         293       0       0 03h34m40s Connect         .0C4-CR6       293       0       0 03h34m40s Connect         .0C4-CR6       293       0       0 03h34m40s Connect         .0C4-CR6       293       0       0 03h34m40s Connect         .0C5-CR6       293       0       0 03h34m40s Active         .0C34.55.210.194       293       0       0 03h34m40s Active         .00       0       0       0			555	U					
0/0/0 (VpnIPv6)         34.55.200.30         293       0       0 03h34m40s Connect         0       0         34.55.200.40       0         .0C4-CR6       293       0       0 03h34m40s Connect         0       0       0         34.55.200.50       0       0 03h34m40s Connect         .0C5-CR6       293       0       0 03h34m40s Active         0       0       0       0         34.55.210.194       293       0       0 03h34m40s Active         0       0       0       0									
34.55.200.30         .0C3-CR6         293       0       0 03h34m40s Connect         .0C4-CR6         293       0       0 03h34m40s Connect         .0C4-CR6       293       0       0 03h34m40s Connect         .0C5-CR6       293       0       0 03h34m40s Active         .0C5-CR6       293       0       0 03h34m40s Active         .0C5-CR6       293       0       0 03h34m40s Active         .0C5-CR6									
293       0       0       03h34m40s Connect         0       0       0         34.55.200.40       293       0       0         0.0C4-CR6       293       0       0         134.55.200.50       0       0         .0C5-CR6       293       0       0         134.55.210.194       293       0       0         293       0       0       03h34m40s Active         0       0       0       0	134.55.200.30								
0 0 34.55.200.40 .0C4-CR6 293 0 0 03h34m40s Connect 0 0 34.55.200.50 .0C5-CR6 293 0 0 03h34m40s Active 0 0 .34.55.210.194 293 0 0 03h34m40s Active 0 0	LOC3-CR6								
34.55.200.40       293       0       0 03h34m40s Connect         0       0       0         34.55.200.50       0       0         .0C5-CR6       293       0       0 03h34m40s Active         0       0       0         .34.55.210.194       293       0       0 03h34m40s Active         0       0       0       0         .34.55.210.194       293       0       0 03h34m40s Active         0       0       0       0		293	0	0	03h34m40s	Connect			
.0C4-CR6 293 0 0 03h34m40s Connect 0 0 .34.55.200.50 .0C5-CR6 293 0 0 03h34m40s Active 0 0 .34.55.210.194 293 0 0 03h34m40s Active 0 0			0	0					
293 0 0 03h34m40s Connect 0 0 34.55.200.50 .0C5-CR6 293 0 0 03h34m40s Active 0 0 .34.55.210.194 293 0 0 03h34m40s Active 0 0	134.55.200.40								
0 0 .34.55.200.50 .0C5-CR6 293 0 0 03h34m40s Active 0 0 .34.55.210.194 293 0 0 03h34m40s Active 0 0	LUC4-CR6	202	٥	0	02624-400	Connect			
134.55.200.50 .OC5-CR6 293 0 0 03h34m40s Active 0 0 134.55.210.194 293 0 0 03h34m40s Active 0 0		295			05115411140S	-connect			
293 0 0 03h34m40s Active 0 0 .34.55.210.194 293 0 0 03h34m40s Active 0 0	134.55.200.50		U	U					
0 0 .34.55.210.194 293 0 0 03h34m40s Active 0 0	LOC5-CR6								
34.55.210.194 293 0 003h34m40s Active 0 0		293	0	0	03h34m40s	Active			
293 0 0 03h34m40s Active 0 0			0	0					
	134.55.210.194								
		293			03h34m40s	Active			
Current mode: running			0	0			1		
	A:loc1-cr6#							Curre	nt mode: running

ssh -W \[netlab-rover1.es.net\]:22 lbnl-gw.es.net)

# °••• <u>⊿ ∎ ⊿</u> ⊚ ■ 🛍 🖄 🙆 ९ ⇔ ಈ 🔤 중 보 🜉 🗮 ९ ९ ९ 🕮

bgp						
No.	Time	Source	Destination	Protocol	Length   Info	
289	629.259315	2001:db8::1:1	2001:db8::1:0	BGP	145 OPEN Message	
318	659.283424	2001:db8::1:1	2001:db8::1:0	BGP	145 OPEN Message	
337	689.315440	2001:db8::1:1	2001:db8::1:0	BGP	145 OPEN Message	
356	719.335331	2001:db8::1:1	2001:db8::1:0	BGP	145 OPEN Message	
375	749.363111	2001:db8::1:1	2001:db8::1:0	BGP	145 OPEN Message	
393	779.391006	2001:db8::1:1	2001:db:::1:0	BGP	145 OPEN Message	
			54			

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8 🔿 🥝 🖓 🕅		ssh clab-ipt	-cust1-edge1 /Users/chri	iscummings (ssh -W \[netlab-rover1.es.net\]:22 lbnl-gw.es.net)	rover1.es.net]:22 [bnl-gw.es.net] 12 ssh netlab-rover1.es.net "sudo ip netns exec clab-ipt-loc1-cr6 tcpdump -U -nni eth20 -w -"   wireshark -k -i - /Users/chriscummings (ssh -W \[netlab-rover1.es #2 +									
X ssh clab-ipt-loc1-cr6 /U	Jsers/chriscummings (s	sh -W \[netlab-ro	over1.es.net\]:22 lbnl-gw.	.es.net)	⊖ 🗙 ssh clab-ipt-c	ust1-edge1 /Users/	chriscummings (ssl	n -W \[netlab-rove	r1.es.net\]:22 lbnl-	gw.es.net)				
Total FlowIpv Total Link St Total SrPlcyI	ate Rem Rts		Total	FlowIpv6 Rem Act Rts : 0 Link State Rem Act Rts: 0 SrPlcyIpv4 Rem Act Rts: 0		dge1# sho				protocols	bgp neig	nbor		
Total SrPlcyI				SrPlcyIpv6 Rem Act Rts: 0			iry for ne dynamic,			efault" LLDP, B BF	D enabled	, - disab	led, * sl	ow
BGP Summary														
Legend : D -	Dynamic Neig	ghbor			+   Net-   Inst					-+   State 		AFI/SA	+   [Rx/Ac   tive/T	
Neighbor Description					 +=======	 :+========	 +======	 +======	। रि	 =+======	 +======	 +======	x] +=====	 ⊧+
		tRcvd In( tSent Ou		State Rcv/Act/Sent (Addr Family)	Ιt	2.101	ebgp-∨   4   ebgp-∨	I	293     293	connec   t   active	I		1	1
134.55.200.20 LOC2-CR6					Ιt	b8::1:   0	<b>.</b>				i I	l I	i i	 
	293	325 333	0 02h39m57s 0	0/0/0 (IPv4) 0/0/0 (IPv6) 0/0/0 (VpnIPv4) 1/0/1 (MCastIPv4) 0/0/0 (VpnIPv6)	+ Summary: 2 configu 0 dynamic		+	+  onfigured	d session:	-+ s are esta	+  blished,0	+  disabled	+  peers	+
134.55.200.30 LOC3-CR6					{ runni A:cust1-e		]							
	293		0 03h34m40s 0	Connect										
134.55.200.40 LOC4-CR6														
	293		0 03h34m40s 0	Connect										
134.55.200.50 LOC5-CR6														
124 55 210 10	293		0 03h34m40s 0	Active										
134.55.210.19	4 293		0 03h34m40s 0	Active										
A:loc1-cr6#					Current m	ode: runn	ing				a	dmin (6)	Tue 07:4	-9PM

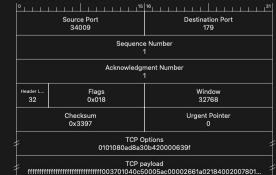
# °●●● 21 ■ 21 © ■ ■ 21 22 < ⇔ ⇔ 22 7 5 5 ■ ■ 0, 0, 0, 0

-ar						
No.	Time	Source	Destination	Protocol	Lengtr   Info	Ethernet
28	9 629.259315	2001:db8::1:1	2001:db8::1:0	BGP	145 OPEN Message	0,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
	8 659.283424	2001:db8::1:1	2001:db8::1:0	BGP	145 OPEN Message	Destination
33	7 689.315440	2001:db8::1:1	2001:db8::1:0	BGP	145 OPEN Message	52:54:00:cb:f7:14
35	6 719.335331	2001:db8::1:1	2001:db8::1:0	BGP	145 OPEN Message	02.04.00.05.7714
37	5 749.363111	2001:db8::1:1	2001:db8::1:0	BGP	145 OPEN Message	
39	3 779.391006	2001:db8::1:1	2001:db8::1:0	BGP	145 OPEN Message	
40	9 809.415415	2001:db8::1:1	2001:db8::1:0	BGP	145 OPEN Message	
43	3 836.871681	192.0.2.102	192.0.2.101	BGP	125 OPEN Message	Source
43	4 836.874204	192.0.2.101	192.0.2.102	BGP	119 OPEN Message	1a:b0:00:ff:00:00
43	6 836.876782	192.0.2.101	192.0.2.102	BGP	89 KEEPALIVE Message	Ture
43	8 836.879794	192.0.2.102	192.0.2.101	BGP	89 KEEPALIVE Message	Type 802.1Q Virtual LAN
44	0 836.881435	192.0.2.101	192.0.2.102	BGP	89 KEEPALIVE Message	
45	0 837.605478	2001:db8::1:0	2001:db8::1:1	BGP	139 OPEN Message	
45	2 837.611927	2001:db8::1:1	2001:db8::1:0	BGP	145 OPEN Message	802.1Q Virtual LAN
45	4 837.613529	2001:db8::1:0	2001:db8::1:1	BGP	109 KEEPALIVE Message	
45	6 837.621843	2001:db8::1:1	2001:db8::1:0	BGP	109 KEEPALIVE Message	Priority ID Type
45	8 837.623362	2001:db8::1:0	2001:db8::1:1	BGP	109 KEEPALIVE Message	Best 2000 IPv6

Internet Protocol Version 6



#### Transmission Control Protocol



ightarrow Frame 289: 145 bytes on wire (1160 bits), 145 bytes captured (1160 bits) on interface –, id 0

- > Ethernet II, Src: 1a:b0:00:ff:00:00 (1a:b0:00:ff:00:00), Dst: RealtekU\_cb:f7:14 (52:54:00:cb:f7:14)
- > 802.10 Virtual LAN, PRI: 0, DEI: 0, ID: 2000
- > Internet Protocol Version 6, Src: 2001:db8::1:1, Dst: 2001:db8::1:0
- > Transmission Control Protocol, Src Port: 34009, Dst Port: 179, Seq: 1, Ack: 1, Len: 55

Border Gateway Protocol - OPEN Message

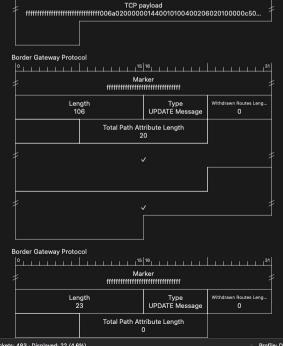
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# 0 0 0

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Time	Source	Destination	Protocol	ength   Info		Source Port	Destination Port
	2001:db8::1:1	2001:db8::1:0	BGP	145 OPEN Message		37079	179
	2001:db8::1:1	2001:db8::1:0		145 OPEN Message			
							lumber
	2001:db8::1:1	2001:db8::1:0				/5	
	2001:db8::1:1	2001:db8::1:0		145 OPEN Message		Acknowledgme	nt Number
3 779.391006	2001:db8::1:1	2001:db8::1:0	BGP	145 OPEN Message		88	
	2001:db8::1:1	2001:db8::1:0	BGP	145 OPEN Message			and the second
	192.0.2.102	192.0.2.101		125 OPEN Message	Header L	Flags	Window
4 836.874204	192.0.2.101	192.0.2.102		119 OPEN Message	32	0x018	32681
6 836.876782	192.0.2.101	192.0.2.102	BGP	89 KEEPALIVE Message			10 17 H A
8 836.879794	192.0.2.102	192.0.2.101	BGP	89 KEEPALIVE Message			Urgent Pointer
	192.0.2.101	192.0.2.102	BGP	89 KEEPALIVE Message		027699	0
	2001:db8::1:0	2001:db8::1:1		139 OPEN Message		TCP Opt	ions
	2001:db8::1:1	2001:db8::1:0		145 OPEN Message	1		
	2001:db8::1:0	2001:db8::1:1		109 KEEPALIVE Message			
	2001:db8::1:1	2001:db8::1:0	11 TO 12	109 KEEPALIVE Message	1 -	TCP payl	
			BGP	109 KEEPALIVE Message	1	ifffffffffffffffffffff006a020000001	440010100400206020100000c50
2 841.426799	192.0.2.102	192.0.2.101	BGP	199 UPDATE Message, UPDATE Message			
5 842.423607	2001:db8::1:1	2001:db8::1:0	BGP	263 UPDATE Message, UPDATE Message			
7 864.240312	192.0.2.101	192.0.2.102	BGP	162 UPDATE Message, UPDATE Message			
9 865.237053	2001:db8::1:0	2001:db8::1:1	BGP	276 UPDATE Message, UPDATE Message, UPDAT			
1 865.243128	192.0.2.102	192.0.2.101	BGP	89 KEEPALIVE Message	Border Gate	way Protocol	
	Time           629.259315           659.283424           659.31544           669.31544           679.33531           779.361311           3779.391066           880.415415           386.871681           4836.874684           836.874684           836.87482           836.87482           837.665478           837.665478           837.611927           4837.623862           841.426799           841.42679           844.426392           841.426392           842.423697           865.237653           865.237653           865.237653	9         629.259315         2001:db8::1:1           8         659.283424         2001:db8::1:1           7         699.31544         2001:db8::1:1           6         789.31544         2001:db8::1:1           5         749.35331         2001:db8::1:1           5         749.36311         2001:db8::1:1           9         779.39106         2001:db8::1:1           9         894.4154         2001:db8::1:1           9         894.4154         2001:db8::1:1           9         894.4154         2001:db8::1:1           9         894.4154         2001:db8::1:1           9         896.876782         192.0.2.101           8         836.876782         192.0.2.101           9         836.81435         192.0.2.101           0         837.605478         2001:db8::1:10           2         837.611927         2001:db8::1:10           2         837.621843         2001:db8::1:10           2         837.621843         2001:db8::1:10           2         841.426799         192.0.2.102           5         842.423607         2001:db8::1:10           2         841.426799         192.0.2.101           5 <td>9       629.259315       2001:db8::1:1       2001:db8::1:0         8       659.283424       2001:db8::1:1       2001:db8::1:0         769.31544       2001:db8::1:1       2001:db8::1:0         6       719.335331       2001:db8::1:1       2001:db8::1:0         6       719.335331       2001:db8::1:1       2001:db8::1:0         779.39106       2001:db8::1:1       2001:db8::1:0         9       89.415415       2001:db8::1:1       2001:db8::1:0         8       836.876782       192.0.2.102       192.0.2.102         8       836.876782       192.0.2.101       192.0.2.102         0       837.665478       2001:db8::1:1       2001:db8::1:1         2       837.611927       2001:db8::1:1       2001:db8::1:1         2       837.621362       2001:db8::1:1       2001:db8::1:1         6       837.623362       2001:db8::1:1       2001:db8::1:1         8       837.623</td> <td>9         629.259315         2001:db8::1:0         BGP           6         8         659.283424         2001:db8::1:1         2001:db8::1:0         BGP           769.31544         2001:db8::1:1         2001:db8::1:0         BGP           6         719.335331         2001:db8::1:1         2001:db8::1:0         BGP           6         719.335331         2001:db8::1:1         2001:db8::1:0         BGP           779.39106         2001:db8::1:1         2001:db8::1:0         BGP           9         809.415415         2001:db8::1:1         2001:db8::1:1         BGP           9         809.415415         2001:db8::1:1         2001:db8::1:1         BGP           9         809.4154415         2001:db8::1:1         BGP         837.605478         2001:db8::1:1         BGP           0         837.605478         2001:db8::1:1         2001:db8::</td> <td>9         629.259315         2001:db8::1:1         2001:db8::1:0         BGP         145         OPEN Message           8         659.283424         2001:db8::1:1         2001:db8::1:0         BGP         145         OPEN Message           6         749.31544         2001:db8::1:1         2001:db8::1:0         BGP         145         OPEN Message           6         719.335331         2001:db8::1:1         2001:db8::1:0         BGP         145         OPEN Message           5         749.36311         2001:db8::1:1         2001:db8::1:0         BGP         145         OPEN Message           9         809.415415         2001:db8::1:1         2001:db8::1:0         BGP         145         OPEN Message           9         809.415415         2001:db8::1:1         2001:db8::1:0         BGP         145         OPEN Message           9         808.676782         192.0.2.101         192.0.2.102         BGP         190         PEN Message           8         366.876782         192.0.2.101         192.0.2.102         BGP         89         KEEPALIVE Message           8         366.876782         192.0.2.101         192.0.2.102         BGP         89         KEEPALIVE Message           8         366.876782&lt;</td> <td>9       629.259315       2001:db8::1:1       2001:db8::1:0       BGP       145       OPEN Message         8       659.283424       2001:db8::1:1       2001:db8::1:0       BGP       145       OPEN Message         6       749.31544       2001:db8::1:1       2001:db8::1:0       BGP       145       OPEN Message         6       719.335331       2001:db8::1:1       2001:db8::1:0       BGP       145       OPEN Message         5       749.31544       2001:db8::1:1       2001:db8::1:0       BGP       145       OPEN Message         9       893.41541       2001:db8::1:1       2001:db8::1:0       BGP       145       OPEN Message         9       893.6871681       192.0.2.102       192.0.2.102       BGP       145       OPEN Message       32         8       368.676782       192.0.2.101       192.0.2.102       BGP       19       OPEN Message       32         8       368.676782       192.0.2.101       192.0.2.102       BGP       19       OPEN Message       32         8       368.676782       192.0.2.101       192.0.2.102       BGP       19       KEPALIVE Message       32         8       368.676782       192.0.2.101       192.0.2.102       BGP</td> <td>9       629.259315       2001: db8::1:1       2001: db8::1:0       BGP       145       OPEN Message         8       659.203424       2001: db8::1:1       2001: db8::1:0       BGP       145       OPEN Message         6       759.315340       2001: db8::1:1       2001: db8::1:0       BGP       145       OPEN Message         6       749.36311       2001: db8::1:1       2001: db8::1:0       BGP       145       OPEN Message         779.33006       2001: db8::1:1       2001: db8::1:0       BGP       145       OPEN Message         9       809.415415       2001: db8::1:1       2001: db8::1:0       BGP       145       OPEN Message         9       809.415415       2001: db8::1:1       2001: db8::1:0       BGP       125       OPEN Message         9       809.415415       2001: db8::1:1       2001: db8::1:0       BGP       130       OPEN Message         8       836.874204       192.0.2.101       192.0.2.102       BGP       139       OPEN Message       20       0.x018         8       836.874782       192.0.2.101       BGP       139       OPEN Message       20       0.x018         0       837.633279       2001: db8::1:1       2001: db8::1:1       BGP</td>	9       629.259315       2001:db8::1:1       2001:db8::1:0         8       659.283424       2001:db8::1:1       2001:db8::1:0         769.31544       2001:db8::1:1       2001:db8::1:0         6       719.335331       2001:db8::1:1       2001:db8::1:0         6       719.335331       2001:db8::1:1       2001:db8::1:0         779.39106       2001:db8::1:1       2001:db8::1:0         9       89.415415       2001:db8::1:1       2001:db8::1:0         8       836.876782       192.0.2.102       192.0.2.102         8       836.876782       192.0.2.101       192.0.2.102         0       837.665478       2001:db8::1:1       2001:db8::1:1         2       837.611927       2001:db8::1:1       2001:db8::1:1         2       837.621362       2001:db8::1:1       2001:db8::1:1         6       837.623362       2001:db8::1:1       2001:db8::1:1         8       837.623	9         629.259315         2001:db8::1:0         BGP           6         8         659.283424         2001:db8::1:1         2001:db8::1:0         BGP           769.31544         2001:db8::1:1         2001:db8::1:0         BGP           6         719.335331         2001:db8::1:1         2001:db8::1:0         BGP           6         719.335331         2001:db8::1:1         2001:db8::1:0         BGP           779.39106         2001:db8::1:1         2001:db8::1:0         BGP           9         809.415415         2001:db8::1:1         2001:db8::1:1         BGP           9         809.415415         2001:db8::1:1         2001:db8::1:1         BGP           9         809.4154415         2001:db8::1:1         BGP         837.605478         2001:db8::1:1         BGP           0         837.605478         2001:db8::1:1         2001:db8::	9         629.259315         2001:db8::1:1         2001:db8::1:0         BGP         145         OPEN Message           8         659.283424         2001:db8::1:1         2001:db8::1:0         BGP         145         OPEN Message           6         749.31544         2001:db8::1:1         2001:db8::1:0         BGP         145         OPEN Message           6         719.335331         2001:db8::1:1         2001:db8::1:0         BGP         145         OPEN Message           5         749.36311         2001:db8::1:1         2001:db8::1:0         BGP         145         OPEN Message           9         809.415415         2001:db8::1:1         2001:db8::1:0         BGP         145         OPEN Message           9         809.415415         2001:db8::1:1         2001:db8::1:0         BGP         145         OPEN Message           9         808.676782         192.0.2.101         192.0.2.102         BGP         190         PEN Message           8         366.876782         192.0.2.101         192.0.2.102         BGP         89         KEEPALIVE Message           8         366.876782         192.0.2.101         192.0.2.102         BGP         89         KEEPALIVE Message           8         366.876782<	9       629.259315       2001:db8::1:1       2001:db8::1:0       BGP       145       OPEN Message         8       659.283424       2001:db8::1:1       2001:db8::1:0       BGP       145       OPEN Message         6       749.31544       2001:db8::1:1       2001:db8::1:0       BGP       145       OPEN Message         6       719.335331       2001:db8::1:1       2001:db8::1:0       BGP       145       OPEN Message         5       749.31544       2001:db8::1:1       2001:db8::1:0       BGP       145       OPEN Message         9       893.41541       2001:db8::1:1       2001:db8::1:0       BGP       145       OPEN Message         9       893.6871681       192.0.2.102       192.0.2.102       BGP       145       OPEN Message       32         8       368.676782       192.0.2.101       192.0.2.102       BGP       19       OPEN Message       32         8       368.676782       192.0.2.101       192.0.2.102       BGP       19       OPEN Message       32         8       368.676782       192.0.2.101       192.0.2.102       BGP       19       KEPALIVE Message       32         8       368.676782       192.0.2.101       192.0.2.102       BGP	9       629.259315       2001: db8::1:1       2001: db8::1:0       BGP       145       OPEN Message         8       659.203424       2001: db8::1:1       2001: db8::1:0       BGP       145       OPEN Message         6       759.315340       2001: db8::1:1       2001: db8::1:0       BGP       145       OPEN Message         6       749.36311       2001: db8::1:1       2001: db8::1:0       BGP       145       OPEN Message         779.33006       2001: db8::1:1       2001: db8::1:0       BGP       145       OPEN Message         9       809.415415       2001: db8::1:1       2001: db8::1:0       BGP       145       OPEN Message         9       809.415415       2001: db8::1:1       2001: db8::1:0       BGP       125       OPEN Message         9       809.415415       2001: db8::1:1       2001: db8::1:0       BGP       130       OPEN Message         8       836.874204       192.0.2.101       192.0.2.102       BGP       139       OPEN Message       20       0.x018         8       836.874782       192.0.2.101       BGP       139       OPEN Message       20       0.x018         0       837.633279       2001: db8::1:1       2001: db8::1:1       BGP

Marker: fffffffffffffffffffffffffffffffff	
Length: 106	
Type: UPDATE Message (2)	
Withdrawn Routes Length: 0	
Total Path Attribute Length: 20	
v Path attributes	
> Path Attribute - ORIGIN: IGP	
> Path Attribute - AS_PATH: 3152	
$\sim$ Path Attribute – NEXT_HOP: 192.0.2.102	
> Flags: 0x40, Transitive, Well-known, Complete	
Type Code: NEXT_HOP (3)	
Length: 4	
Next hop: 192.0.2.102	
> Network Layer Reachability Information (NLRI)	
🗸 Border Gateway Protocol – UPDATE Message	
Marker: ffffffffffffffffffffffffffffffff	
Length: 23	



8 🗢 🥝 Ҡ೫1		ssh clat	p-ipt-loc1-cr6 /Users/chriscu	ummings (ssh -W \[netlab-rover1.es.net\]:22 lbnl-gw.es.net)	¥1 ssh										
× ssh clab-ipt-loc1-cr6 /Users/chriscummings (ssh -W \[netlab-rover1.es.net\]:22 lbnl-gw.es.net) Legend : D - Dynamic Neighbor						<ul> <li>⊗ × ssh clab-ipt-custi-edget/Users/chriscummings (ssh -W \(netlab-roverLes.net\):22 lbnl-gwes.net\)</li> <li>{ running }[ ]</li> <li>A:cust1-edge1# show network-instance default protocols bqp neighbor</li> </ul>									
Neighbor Description		Rcvd I Sent O		State Rcv/Act/Sent (Addr Family)	BGP neig Flags: S	nbor summa static, D	iry for ne dynamic,	twork-ins L discov	stance "d vered by		D enabled	 , - disab		 ow 	
134.55.200.20 LOC2-CR6	293	329 343	0	0/0/7 (IPv4) 0/0/3 (IPv6)		l Peer				   State   	I Uptime	I AFI/SA			
134.55.200.30				0/0/0 (VpnIPv4) 1/0/2 (MCastIPv4) 0/0/0 (VpnIPv6)	l t I defaul	192.0.   2.101   2001:d	4   ebgp-v		+======   293     293	=+========   connec   t   active		+=======     	+=======     		
LOC3-CR6 134.55.200.40	293	0 0	0 03h36m24s 0	Connect		b8::1:   0 -+									
LOC4-CR6 134.55.200.50 LOC5-CR6	293	0 0	0 03h36m24s 0	Connect	0 dynami	c peers ing }[		onfigure	d session	s are esta	blished,0	disabled	peers		
134.55.210.194	293	0 0	0 03h36m24s 0	Connect	A: CUSTI-	eage1#									
154.55.210.194	293	0 0	0 03h36m24s 0	Active											
192.0.2.102 cust1 : to_cus	t1-primary 3152	5 7	0 00h00m36s 0	14/6/4 (IPv4)											
2001:db8::1:1 cust1 : to_cus	t1-primary 3152	5 7	Ť	6/2/2 (IPv6)											
A:loc1-cr6#			<b></b>		- Current	node: runn	ing				a	dmin (6)	Tue 07:49	9PM	

Section 2 30 10 10 10 10 10 10 10 10 10 10 10 10 10	ers/chriscummings			scummings (ssh -W \[netilab-rover1.es.net\]:22 lbni-gw.es.net) es.net)	\$1 ssh netlab-rover1.es.net "sudo ip netns exec clab-ipt-loc1-cr6 tcpdump -U -nni eth20 -w -"   wireshark -k -i - /Users/chriscummings (ssh -W \[netlab-rover1.es %2										
Legend : D - D	ynamic Nei	ighbor			{ runni A:cust1-e			-instance	e default	protocols	bap neig	nbor			
Neighbor Description		ktRcvd I ktSent 0		State Rcv/Act/Sent (Addr Family)	BGP neigh	A:cust1-edge1# show network-instance default protocols bgp neighbor BGP neighbor summary for network-instance "default" Flags: S static, D dynamic, L discovered by LLDP, B BFD enabled, - disabled, * slow									
134.55.200.20 LOC2-CR6	293	329 343		0/0/7 (IPv4) 0/0/3 (IPv6)	 +   Net-   Inst 					-+   State   		AFI/SA			
				0/0/0 (VpnIPv4) 1/0/2 (MCastIPv4) 0/0/0 (VpnIPv6)	Ιt	2.101			=+=======   293 	l ished	0d:0h:   0m:43s	l nicast	4]		
134.55.200.30 LOC3-CR6	293		0 03h36m24s	Connect		2001:d   b8::1:   0	l ebgp-v l 6 l	S   	293   		0d:0h:   9m:42s   9		[2/0/6     ]   		
134.55.200.40 LOC4-CR6					+  Summary:	+	+	+	-+	-+	+	+	++		
134.55.200.50 LOC5-CR6	293		0 03h36m24s 0	Connect		peers ng }[		onfigure	d session	s are esta	blished,0	disabled	peers		
	293		0 03h36m24s 0	Connect	A.Custi-e	uyeı#									
134.55.210.194	293		0 03h36m24s 0	Active											
192.0.2.102 cust1 : to_cus	t1-primary 3152	y 5 7	0 00h00m36s 0	14/6/4 (IPv4)											
2001:db8::1:1 cust1 : to_cus	t1-primary 3152	y 5 7	, in the second s	6/2/2 (IPv6)											
A:loc1-cr6#					Current m	ode: runn	ing				a	dmin (6)	Tue 07:51P		

# **Questions?**

**ESnet**