

Should we engineer for Elephant flows ?

Yatish Kumar ESnet







We searched our High Touch Database

	caida_org_name_src	caida_org_name_dst	ip_src	ip_dst	Gbps	hostname_src	hostname_dst	
Θ	U-CHICAGO-AS	ARGONNE-AS	192.170.224.134	140.221.68.2	30.037561	<pre>scidmz-ps4.scidmz.uchicago.net.</pre>	typhoon.pub.alcf.anl.gov.	
1	ARGONNE-AS	U-CHICAGO-AS	140.221.68.2	192.170.224.134	27.532194	typhoon.pub.alcf.anl.gov.	<pre>scidmz-ps4.scidmz.uchicago.net.</pre>	select (*)
2	ESNET	ESNET	2001:400:f010:200::1	2001:400:f010:240::1	26.215328	eqxch2-ps-tp.lhcone.es.net.	fnalfcc-ps-tp.lhcone.es.net.	SCICCC ()
3	ESNET	ESNET	2001:400:ee00:20::1	2001:400:ee00:21::1	26.209250	lbnl59-ps-tp.es.net.	<pre>lbnl50-ps-tp.es.net.</pre>	where
4	ESNET	ESNET	2001:400:f010:640::1	2001:400:f010:641::1	26.208939	bnl515-ps-tp.lhcone.es.net.	bnl515b-ps-tp.lhcone.es.net.	WITETE
5	ESNET	ESNET	2001:400:ee00:880::1	2001:400:ee00:881::1	26.208344	ornl1064-ps-tp.es.net.	orn15600-ps-tp.es.net.	Dool Doto > 10Choo
6	ESNET	ESNET	2001:400:ee00:221::1	2001:400:ee00:220::1	26.208284	anl541b-ps-tp.es.net.	anl221-ps-tp.es.net.	Peak Kate > 10Gpps
7	ESNET	ESNET	2001:400:ee00:881::1	2001:400:ee00:880::1	26.207954	orn15600-ps-tp.es.net.	ornl1064-ps-tp.es.net.	f.,
8	ESNET	ESNET	2001:400:ee00:601::1	2001:400:ee00:600::1	26.207889	newy1118th-ps-tp.es.net.	newy32aoa-ps-tp.es.net.	IOT AT LEAST IV
9	ESNET	ESNET	2001:400:ee00:881::1	2001:400:ee00:882::1	26.207831	orn15600-ps-tp.es.net.	orau-ps-tp.es.net.	
10	ESNET	ESNET	2001:400:ee00:200::1	2001:400:ee00:201::1	26.206976	eqxch2-ps-tp.es.net.	chic-ps-tp.es.net.	seconds
11	ESNET	ESNET	2001:400:f010:200::1	2001:400:f010:221::1	26.206912	eqxch2-ps-tp.lhcone.es.net.	anl541b-ps-tp.lhcone.es.net.	
12	ESNET	ESNET	2001:400:ee00:200::1	2001:400:ee00:202::1	26.206903	eqxch2-ps-tp.es.net.	star-ps-tp.es.net.	Order by Rate
13	ESNET	ESNET	2001:400:ee00:882::1	2001:400:ee00:881::1	26.206468	orau-ps-tp.es.net.	orn15600-ps-tp.es.net.	offerer by reade
14	ESNET	ESNET	2001:400:f010:240::1	2001:400:f010:221::1	26.206126	fnalfcc-ps-tp.lhcone.es.net.	anl541b-ps-tp.lhcone.es.net.	
15	ESNET	ESNET	2001:400:ee00:200::1	2001:400:ee00:220::1	26.205755	egxch2-ps-tp.es.net.	anl221-ps-tp.es.net.	
16	ESNET	ESNET	2001:400:ee00:240::1	2001:400:ee00:221::1	26.205489	fnalfcc-ps-tp.es.net.	anl541b-ps-tp.es.net.	
17	ESNET	ESNET	2001:400:f010:221::1	2001:400:f010:220::1	26.204826	anl541b-ps-tp.lhcone.es.net.	anl221-ps-tp.lhcone.es.net.	
18	ESNET	ESNET	2001:400:f010:200::1	2001:400:f010:220::1	26.204172	eaxch2-ps-tp.lhcone.es.net.	anl221-ps-tp.lhcone.es.net.	
19	ESNET	ESNET	2001:400:ee00:220::1	2001:400:ee00:200::1	26.203990	anl221-ps-tp.es.net.	eaxch2-ps-tp.es.net.	
20	ESNET	ESNET	2001:400:f010:241::1	2001:400:f010:200::1	26.203445	fnalgcc-ps-tp.lhcone.es.net.	eaxch2-ps-tp.lhcone.es.net.	
21	ESNET	ESNET	2001:400:f010:221::1	2001:400:f010:241::1	26.203144	an1541b-ps-tp.1hcone.es.net.	fnalgcc-ps-tp.lhcone.es.net.	
22	ESNET	ESNET	2001:400:ee00:b03::1	2001:400:ee00:10::1	26.203090	slac50s-ps-tp.es.net.	eaxsv5-ps-tp.es.net.	
23	ESNET	ESNET	2001:400:ee00:b02::1	2001:400:ee00:10::1	26.203027	slac50n-ps-tp.es.net.	eaxsy5-ps-tp.es.net.	
24	ESNET	ESNET	2001:400:ee00:20::1	2001:400:ee00:b03::1	26.202994	1bn159-ps-tp.es.net	slac50s-ps-tp.es.net.	
25	ESNET	ESNET	2001 · 400 · ee00 · 221 · · 1	2001 · 400 · ee00 · 240 · · 1	26 202628	an1541b-ns-th es net	fnalfcc-ns-th es net	
26	ESNET	ESNET	2001:400:ee00:10::1	2001:400:ee00:b03::1	26.202129	eaxsy5-ps-tp.es.net.	slac50s-ps-tp.es.net	
27	ESNET	ESNET	2001:400.000.200.1	2001:400:000:240:1	26 201956	eaxch2-ns-th es net	fnalfcc-ns-th es net	
28	ESNET	ESNET	2001:400:ee00:241::1	2001:400:ee00:221::1	26.201614	fnalgcc-ps-tp.es.net.	an1541b-ps-tp.es.net.	
29	ESNET	ESNET	2001:400.000.240.1	2001:400:000:200:1	26 201460	fnalfcc-ns-tn es net	eaxch2-ns-th es net	
30	ESNET	ESNET	2001-400-000-200-1	2001-400-000-241-1	26 201034	earch2-ns-th es net	fnalgcc-ns-th es net	
31	ESNET	ESNET	2001-400-5010-240-1	2001 · 400 · f010 · 200 · · 1	26 201015	fnalfcc-ns-tn lhcone es net	earch2-ns-th lhcone es net	avg rate
32	ESNET	ESNET	2001-400-000-10-1	2001:400.000.000.007.1	26 200805	envev5-ne-th es net	slac5An_ns_tn_es_net	0
33	ESNET	ESNET	2001:400:000.10.11	2001:400:000.0021	26 200350	lbn159-ns-th es net	slac50n-ns-th es net	
34	ESNET	ESNET	2001:400.000.201	2001:400.000.0021	26 200129	an1541b-ns-th es net	fnalgcc_ns_tn_es_net	
35	ESNET	ESNET	2001-400-0000-10-1	2001:400.0000.241.1	26 2000125	envev5-ne-th es net	lini-ns-th es net	What is ne th 2
36	ESNET	ESNET	2001-400-6010-200-1	2001.400.600.0011	26.198824	envch2-ns-th lhcone es net	fnalgec-ns-th lheone es net	winat is .ps-tp :
37		ESNET	2620.0.680.2002	2001:400.1010.2411	26.190024	Timeout	an1541b-ns-th es net	Bassuss it constates our
38	ESNET	ESNET	2020.0.000.3002	2001.400.6000.2211	26.198077	fnalgcc_ns_tn lbcone es net	ani541b-ns-th lhcone es net	Decause it generates our
30	ESNET	ESNET	2001.400.1010.2411	2001.400.1010.2211	26.190072	Ibn159-nc-th es net	ant 5410-ps-tp. theone.es.net.	lannaat alambant flaura
10	ESNET	ESNET	2001:400.0000:20:1	2001.400.000.10.1	20.15/52/	concost provide and the second	eqxsvs-ps-tp.es.net.	l largest elephant flows.
40	ESNET	ESNET	2001:400.000.101	2001:400.000.0041	26.19/20/	eqxsv5-ps-tp.es.net.	1bp159-ps-tp_ss_pst	
41	ESNET	ESNET	2001:400:0000:10:1	2001.400.000.00.20.1	26.196922	eqxsv5-ps-tp.es.net.	chat-ps-tp.es.net.	
42	ESNET	ESNET	2001:400.0000:520::1	2001:400.000.021:1	20.190039	lini no to es net.	chat-ps-tp.es.het.	
43	ESNET	ESNET	2001.400.000.1151	2001.400.0000.101	20.190407	loca ps th os not	eqxsv5-ps-tp.es.net.	
44	ESNET	ESNET	2001.400.000.8211	2001.400.0000.110.11	26.192698	cosa-ps-tp.es.net.	sand-ps-tp.es.net.	
45	ESNET	ESNET	2001.400.0000:821::1	2001.400.000.820::1	20.192622	chat-ps-tp.es.net.	nash-ps-tp.es.net.	

Zooming out a bit

	Query time 52.550	99439620972	
	caida_org_name_src	caida_org_name_dst	Gbps
	0 U-CHICAGO-AS	ARGONNE-AS	30.037561
	1 ARGONNE-AS	U-CHICAGO-AS	27.532194
	2 ESNET	ESNET	26.215328
	3 NCSA-AS	ESNET	26.198818
	4 ESNET	NCSA-AS	26.189637
	5 ESNET-WEST	ESNET-WEST	26.151662
	5 ESNET-EAST	ESNET-EAST	26.150740
	7 ESNET-EAST	ESNET-WEST	26.149878
	B ESNET-WEST	ESNET-EAST	26.145060
	9 NCSA-AS	ESNET-WEST	26.136680
	10 BNL-AS	ESNET	24.860384
	11 ESNET-WEST	NCSA-AS	24.237054
	12 ESNET-WEST	ARGONNE-AS	23.859718
	13 NCSA-AS	ESNET-EAST	23.723869
	14 BNL-AS	ESNET-EAST	22.466708
	15 BNL-AS	NU-AS	22.372516
	16 BNL-AS	ESNET-WEST	21.165468
	17 ESNET-WEST	MISU-231	20.912281
	18 MISU-231	ESNET-WEST	19.870178
	19 TACCNET	ESNET-WEST	15.653456
	20 STANFORD	ESNET-EAST	12.623604
	21 TACCNET	ESNET-EAST	12.543568
	22 MERIT-AS-6	ESNET	12.453257
	23 ESNET-WEST	LBL	10.111514
	24 SLAC	LBL	9.996838
	25 ESNET		9.969307
	26 ESNEI	BNL-AS	9.965247
	27 LDL 19 IDI	ESNET WEST	9.950527
			5.534355
			3.333032
	21 CWDII_AS_1		9.900270
1	CMIC0-M3-1		
	27 OARNET_AS_7	ESNET-EAST	9.843675
	32 0ARNET-AS-2	ESNET-EAST	9.843675
	32 0ARNET-AS-2 33 0ARNET-AS-2 34 U-CHTCACO-AS	ESNET-EAST ESNET-WEST ESNET	9.847633 9.843675 9.842789 9.740794
	32 OARNET-AS-2 33 OARNET-AS-2 84 U-CHICAGO-AS 85 RNL-AS	ESNET-EAST ESNET-WEST ESNET	9.847033 9.843675 9.842789 9.740794 9.710251
	32 OARNET-AS-2 33 OARNET-AS-2 84 U-CHICAGO-AS 35 BNL-AS 86 NCAP-AS	ESNET-EAST ESNET-WEST ESNET AMNH ESNET-EAST	9.847033 9.843675 9.842789 9.740794 9.710251 9.660255
	32 OARNET-AS-2 33 OARNET-AS-2 34 U-CHICAGO-AS 35 BNL-AS 36 NCAR-AS 37 NCAR-AS	ESNET-EAST ESNET-WEST ESNET AMNH ESNET-EAST FSNET-EAST	9.847675 9.843675 9.842789 9.740794 9.710251 9.660255 9.625336
	32 OARNET-AS-2 33 OARNET-AS-2 34 U-CHICAGO-AS 35 BNL-AS 36 NCAR-AS 37 NCAR-AS 38 IRI	ESNET-EAST ESNET-WEST ESNET AMNH ESNET-EAST ESNET-WEST FSNET-FAST	9.847635 9.843675 9.842789 9.740794 9.710251 9.660255 9.625336 9.459778
	32 OARNET-AS-2 33 OARNET-AS-2 34 U-CHICAGO-AS 35 BNL-AS 36 NCAR-AS 37 NCAR-AS 38 LBL 39 ARGONNE-AS	ESNET-EAST ESNET-WEST ANNH ESNET-EAST ESNET-EAST ESNET-EAST CSM-AS-	9.847635 9.842789 9.740794 9.710251 9.660255 9.625336 9.459778 9.362607
	32 OARNET-AS-2 33 OARNET-AS-2 34 U-CHICAGO-AS 35 BNL-AS 36 NCAR-AS 37 NCAR-AS 38 LBL 39 ARGONNE-AS 39 ARGONNE-AS 39 ALGONNE-AS	ESNET-EAST ESNET-WEST ESNET ESNET-EAST ESNET-WEST ESNET-EAST CSM-AS FSNET-EAST	9.847635 9.842789 9.740794 9.710251 9.660255 9.625336 9.459778 9.362607 9.349517
	32 OARNET-AS-2 33 OARNET-AS-2 34 U-CHICAGO-AS 35 BML-AS 36 NCAR-AS 37 NCAR-AS 38 LBL 39 ARGONNE-AS 49 ARGONNE-AS 40 UCLA 41 WASH-NSEAS	ESNET-EAST ESNET-WEST ESNET AMNH ESNET-EAST ESNET-WEST CSM-AS ESNET-EAST FSNET-EAST	9.847633 9.842789 9.740794 9.710251 9.660255 9.625336 9.459778 9.362607 9.349517 9.282061
	32 OARNET-AS-2 33 OARNET-AS-2 34 U-CHICAGO-AS 35 BNL-AS 36 NCAR-AS 37 NCAR-AS 38 LBL 39 ARCONNE-AS 39 ARCONNE-AS 30 UCLA 31 WASH-NSF-AS 32 ESNET_LEAST	ESNET-EAST ESNET-WEST ESNET AMMH ESNET-EAST ESNET-WEST ESNET-EAST ESNET-EAST ESNET-EAST ESNET-EAST IANET	9.847675 9.842789 9.740794 9.710251 9.660255 9.625336 9.459778 9.362607 9.349517 9.282061 9.184101
	32 OARNET-AS-2 33 OARNET-AS-2 34 U-CHICAGO-AS 35 BNL-AS 36 NCAR-AS 37 NCAR-AS 38 LBL 39 ARGONNE-AS 40 UCLA 41 WASH-NSF-AS 42 ESNET-EAST 43 LANET	ESNET-EAST ESNET ESNET ESNET-ANNH ESNET-EAST ESNET-EAST CSM-AS ESNET-EAST ESNET-EAST ESNET-EAST ESNET-EAST ESNET-EAST	9.847675 9.842789 9.740794 9.710251 9.660255 9.625336 9.459778 9.362607 9.349517 9.282061 9.184101 9.056038
	32 OARNET-AS-2 33 OARNET-AS-2 34 U-CHICAGO-AS 35 BML-AS 36 NCAR-AS 37 NCAR-AS 38 LBL 39 ARGONNE-AS 40 UCLA 41 WASH-NSF-AS 42 ESNET-EAST 33 JANET 44 ULTRALIGENT	ESNET-EAST ESNET-WEST ESNET-MEST ESNET-EAST ESNET-EAST ESNET-EAST ESNET-EAST ESNET-EAST JANET ESNET-EAST ESNET-EAST	9.847675 9.842789 9.740794 9.710251 9.660255 9.625336 9.459778 9.362607 9.349517 9.282061 9.184101 9.056038 9.056059
	32 OARNET-AS-2 33 OARNET-AS-2 34 U-CHICAGO-AS 35 BNL-AS 36 NCAR-AS 37 NCAR-AS 38 LBL 39 ARGONNE-AS 30 UCLA 41 WASH-NSF-AS 12 ESNET-EAST 13 JANET 14 ULTARLIGHT 15 UTARLINGTON	ESNET-EAST ESNET ESNET ANNH ESNET-EAST ESNET-EAST ESNET-EAST ESNET-EAST ESNET-EAST ESNET-EAST ESNET-ESNET ESNET ESNET ESNET ESNET	9.847675 9.842789 9.740794 9.710251 9.660255 9.625336 9.459778 9.362607 9.349517 9.282061 9.184101 9.056038 9.036058 9.036058
	32 OARNET-AS-2 33 OARNET-AS-2 34 U-CHICAGO-AS 35 BML-AS 36 NCAR-AS 37 NCAR-AS 38 LB 39 ARGONNE-AS 40 UCLA 41 WASH-NSF-AS 42 ESNET-EAST 43 JANET 43 JANET 44 ULTRALIGHT 45 UTARLINGTON	ESNET-EAST ESNET ESNET AMMH ESNET-EAST ESNET-EAST ESNET-EAST ESNET-EAST ESNET-EAST ESNET ESNET ESNET ESNET ESNET ESNET	9.843675 9.842789 9.740794 9.710251 9.660255 9.625336 9.459778 9.349517 9.282061 9.349517 9.282061 9.349517 9.282061 9.366059 8.758342 8.341057
	32 OARNET-AS-2 33 OARNET-AS-2 34 U-CHICAGO-AS 35 BNL-AS 36 NCAR-AS 37 NCAR-AS 38 LBL 39 ARGONNE-AS 30 UCLA 41 WASH-NSF-AS 42 ESNET-EAST 43 JANET 44 ULTRALIGHT 45 UTARLINGTON 46 TANET	ESNET-EAST ESNET-WEST ESNET-WEST ESNET-EAST ESNET-EAST ESNET-EAST ESNET-EAST ESNET-EAST ESNET-EAST ESNET	9.843675 9.842789 9.740794 9.710251 9.660255 9.459778 9.362667 9.349517 9.82861 9.184101 9.056038 9.036059 8.758342 8.341057
	32 OARNET-AS-2 33 OARNET-AS-2 34 U-CHICAGO-AS 35 BML-AS 36 NCAR-AS 37 NCAR-AS 38 LBL 39 ARGONNE-AS 40 UCLA 41 WASH-NSF-AS 42 ESNET-EAST 43 JANET 44 ULTRALIGHT 45 UTARLINGTON 46 TENET-1 47 FNAL-AS 48 CSM-AS	ESNET-EAST ESNET ESNET ESNET-ANNH ESNET-EAST ESNET-EAST CSM-AS ESNET-EAST ESNET-EAST ESNET-EAST ESNET-EAST ESNET-EAST ESNET ESNET-EAST ESNET ESNET-EAST ESNET ESNET-EAST	3.447633 9.843675 9.842789 9.740794 9.710251 9.660255 9.625336 9.362607 9.362607 9.362607 9.362607 9.362607 9.362607 9.362608 9.036659 8.758342 8.341057 8.287741 8.128646

These are largely, if not entirely PerfSonar

- We have found the enemy, and it is us !





Everything else has a "peak" of 10Gbps and
99% have an average < 1 Gbps

Globus, FTS etc.. move data at 100Gbps, but as multiple parallel transfers at this scale.







Much less if you open a socket like most people do.

No one on the host side wants to make a superhuman effort to use 'JUST ONE CORE'. Far easier to just use 3 or 4 cores and get on with life.



Should we engineer our network for elephant flows ?

- 1. Networks can already correctly forward elephants on any 100G/400G link. So the question is moot !
- 2. But when we have 100G campus connections into a 400G WAN. How important is it to worry about 4x100G vs. 1x400G ?

- The MICE don't care. So if 4x100G is cheaper / more redundant / doesn't require a new router chassis. Pick the better option. Or at least check your netflow and ask your users to show you a mythical pachyderm.

- 3. If you have a 10G network, then you will see 5G flows, and by all means engineer for elephants.
- 4. Next talk: "6 Gauge speaker wire, and Tube amplifiers" how do we engineer for that really deep bass.

