NGI Testbeds

(Goal 2.1 Testbeds only)

PITAC NGI Program Review
October 6, 1999

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What is NGI Goal 2.1?

- A “leading edge but stable” infrastructure for providing end-to-end high performance and advanced services (referred to as NGI/I2 class) for the purpose of Goal 3 applications development
- Wide area backbone networks (referred to as “JETnets”) involved in this infrastructure:

ESnet

(DREN)

Joint Engineering Team

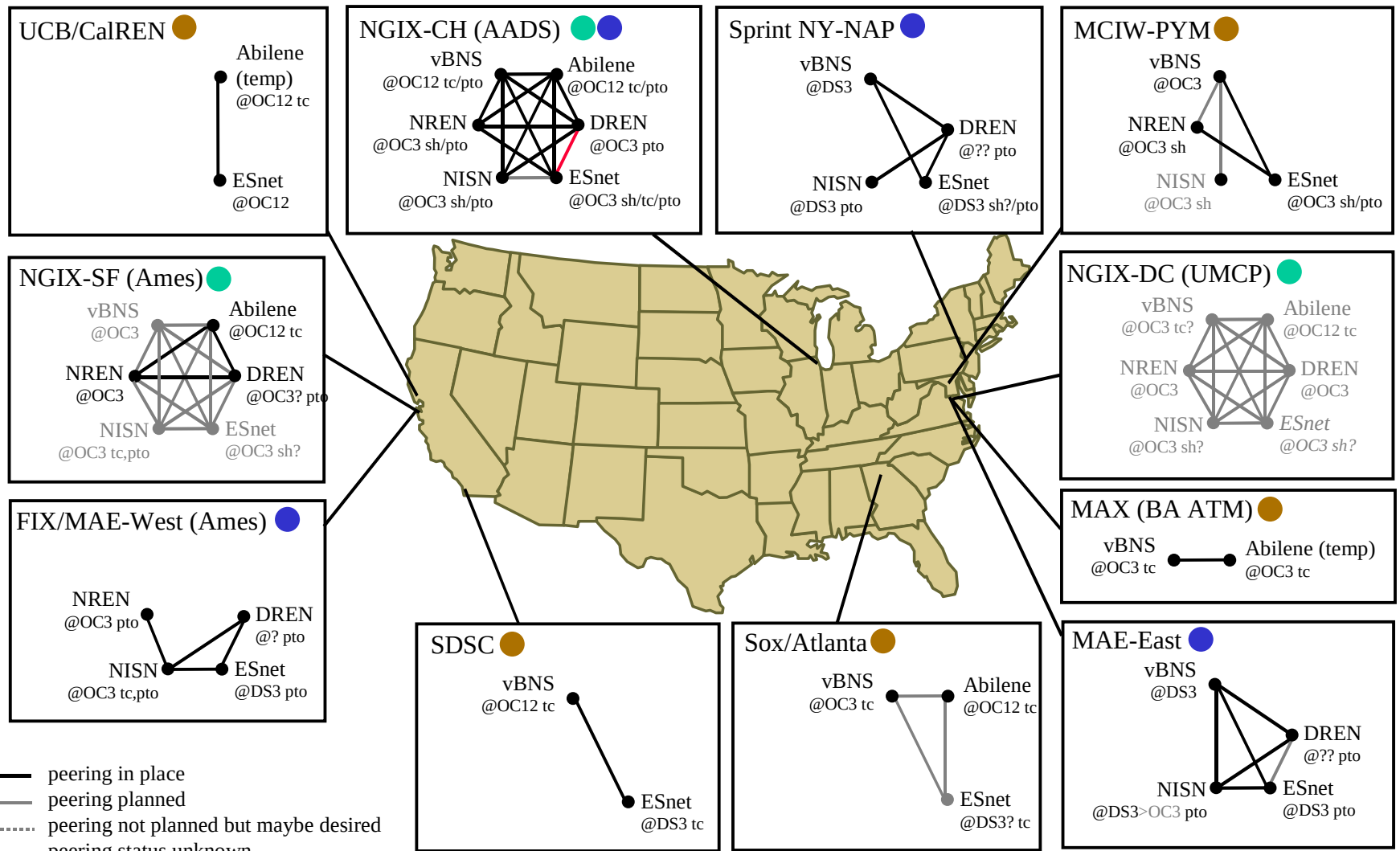
- A forum of NGI, Internet2 and other federal networks/agencies mainly for technical exchange and coordination
- Reports to LSN
- Focused on interconnection and peering of JETnets in support of end-to-end services
- Facilitates joint (inter-agency, states, I2) efforts for special connections like Alaska and Hawaii
- Joint meetings with Gigapop operators
- Very limited campus nets participation

JETnets NGI Funding and Service Types

Network	*NGI Program Funding*	*NGI/I2 Class Service*	*Commodity Internet Service*
Abilene	Yes	Yes	No
DREN	No	Yes	Yes
ESnet	Yes	Yes	Yes
NISN	No	Limited	Yes
NREN	Yes	Yes	No
vBNS	Yes	Yes	No

NSF funds vBNS (directly and indirectly) and Abilene (indirectly)

JETnets Interconnections and Peering



peering in place
peering planned
peering not planned but maybe desired
peering status unknown

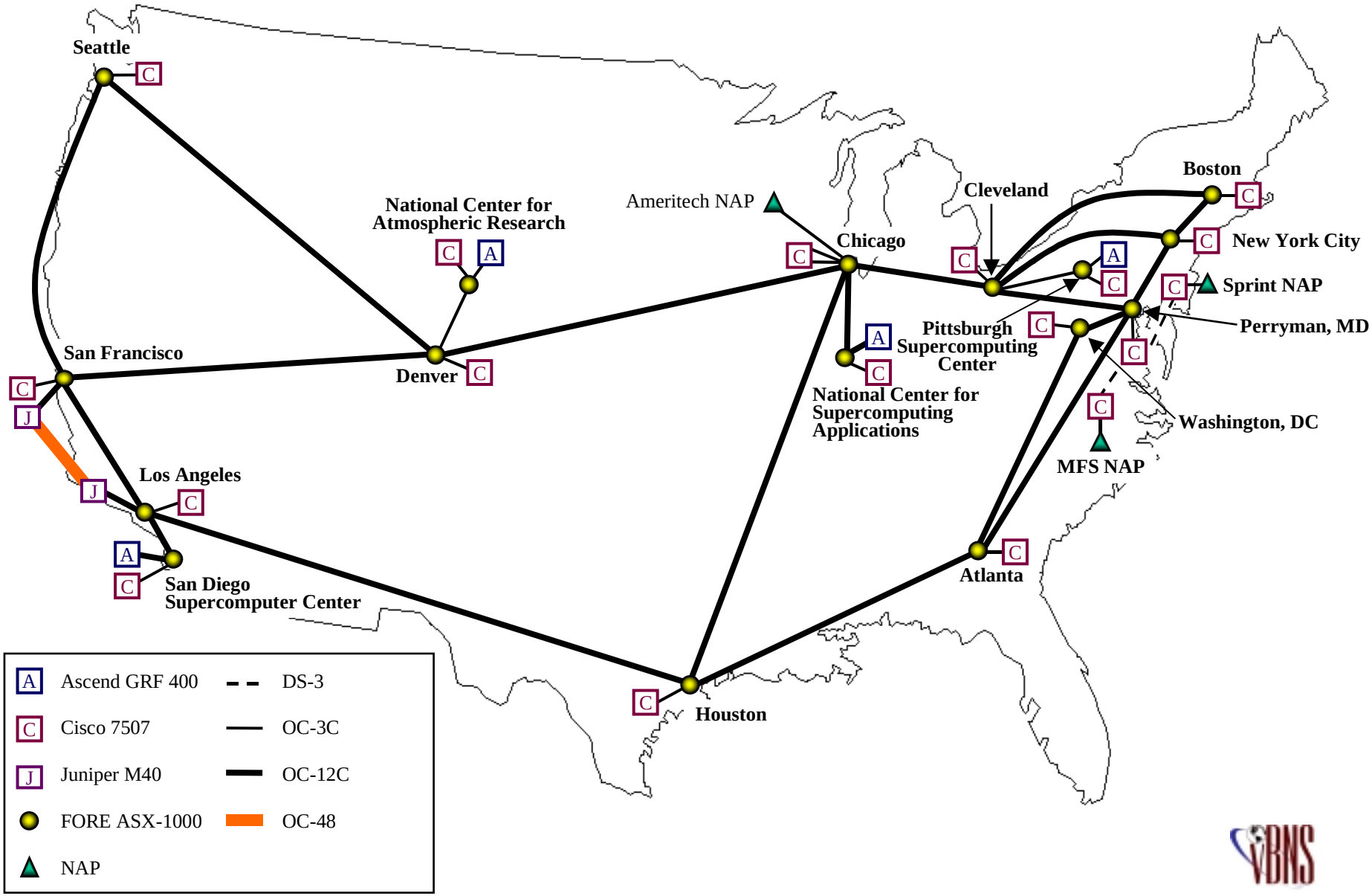
JETnet: connected to the exchange point
JETnet: plan to connect to the exchange point
JETnet: no current plan to connect but maybe desired

sh: SHared circuit to the exchange point
tc: circuit also serving as Tail Circuit for some customers
pto: Peering Traffic with Others (non-JETnets) goes on the same circuit
temp: Temporary peering until a nearby NGIX is established

NGIX
Public Exchange Point
Private Exchange Point

JB 5Oct99

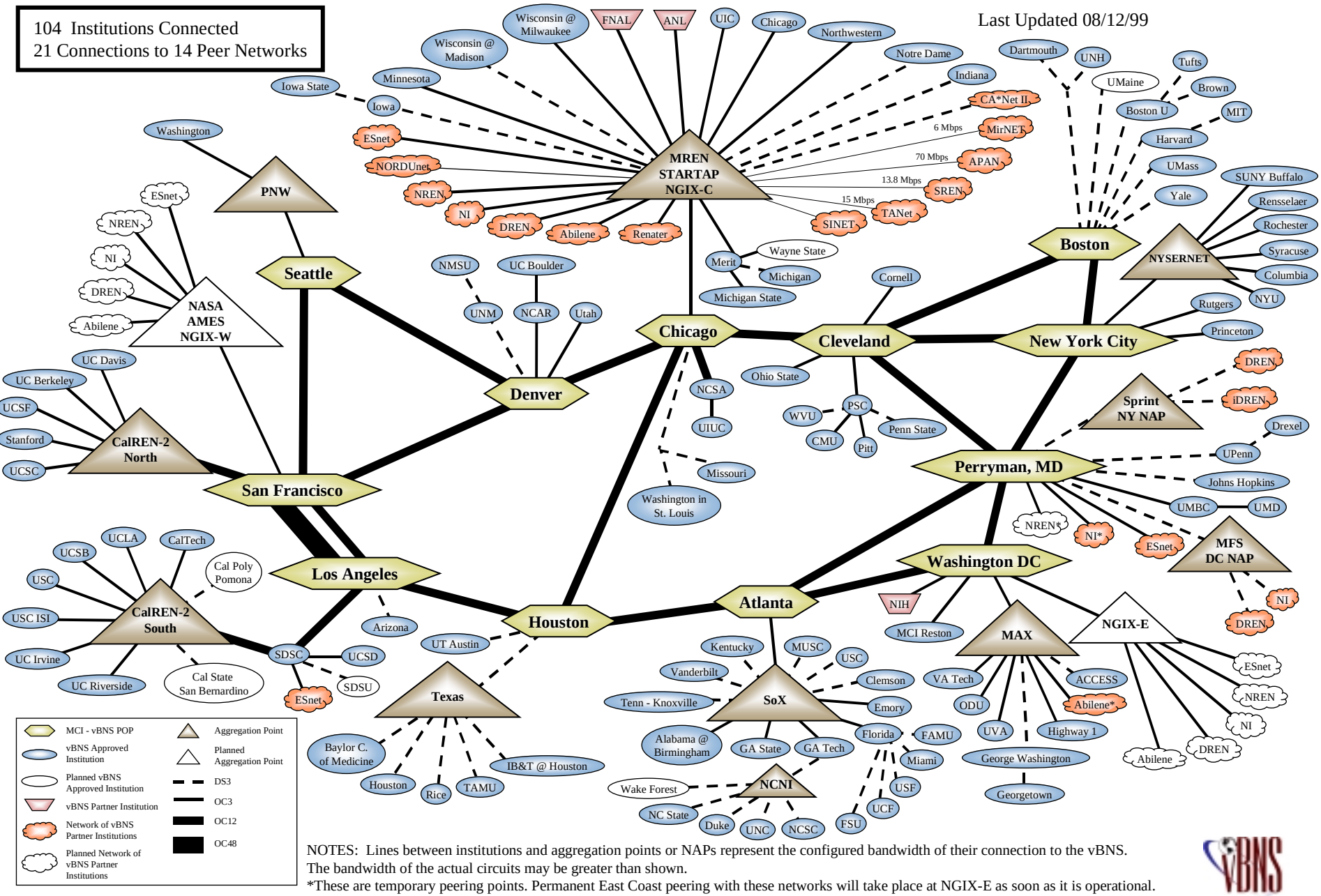
vBNS Network



vBNS Connected Sites

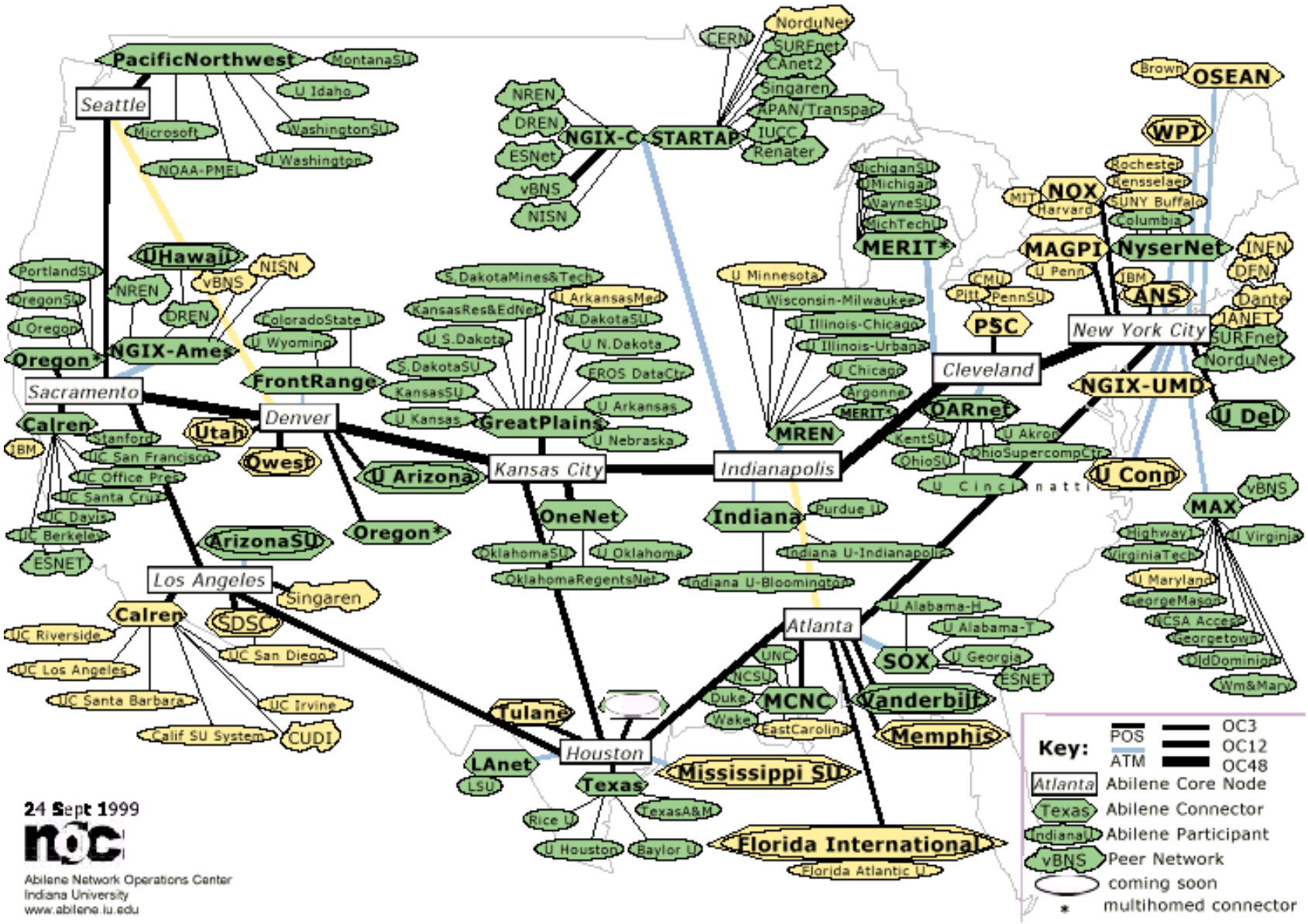
104 Institutions Connected
21 Connections to 14 Peer Networks

Last Updated 08/12/99



NOTES: Lines between institutions and aggregation points or NAPs represent the configured bandwidth of their connection to the vBNS.
The bandwidth of the actual circuits may be greater than shown.
*These are temporary peering points. Permanent East Coast peering with these networks will take place at NGIX-E as soon as it is operational.

Abilene Network and Connected Sites



Advanced Services

- IP multicast: all JETnets (except NISN) have native multicast running in production mode using the PIM-SM, MBGP and MSDP protocols -- 1999 is the year native multicast became real in the backbones (still not on many campuses)
- IP QoS: Abilene, ESnet, NREN and vBNS are active members of the QBone project (inter-domain diffserv); vBNS has offered “reserved b/w” service using RSVP/ATM
- IPv6: all JETnets are part of the 6Bone project and vBNS is testing a native IPv6 service (separate routers)

Measurement Activities

- Passive measurements: Coral/OCXmon -- totally noninvasive, detailed characteristics of individual flows
- Active measurements: AMP, Surveyor -- including throughput, topology, RTT, one-way delay, delay variation, packet loss
- BGP/SNMP data analysis
- Analysis and visualization tools development
- *Key experts: Hans-Werner Braun (SDSC/NLANR), Kim Claffy (SDSC/CAIDA), Matt Mathis (PSC/NLANR), Kevin Thompson (MCIW/vBNS) and Matt Zekauskas (Advanced/I2 Measurements WG Chair)*

Performance Expectation and Issues

- For OC3 or higher connected sites with 100Mbps switched campus nets and fine tuned end systems (and no firewall in the path) you can expect 80 Mbps end-to-end (memory to memory)
- This is not the TYPICAL case
- Most performance bottlenecks are in the end systems: lack of path MTU discovery, TCP implementation, multiple memory copying and buffer management; there are also problems in local networks (under-power routers)
- NGI program first phase mostly focused on wide area nets, now we are focusing on local nets and end systems

Plans for Performance Improvement

- Had two NLANR workshops and special meeting of JET with I2 measurements WG
- Identifying those end systems/applications that have sink/source of large volume traffic; contacting the owners to understand their application and systems and help them with better tuning
- Providing fined tuned laptops for measuring end-to-end performance from particular subnet to help local net operators to find network problems
- Building patches for Linux (possibly getting them into Red Hat release) as a way to encourage other OS vendors to do the same thing
- Labeling sites and end-systems within each site which are capable of 100x performance; eventually making it typical

vBNS 5 minute samples of high bandwidth flows

Source addr	Source name	Dest addr	Dest name	proto	S-port	D-port	Mbps	site	date
128.183.245.17	gila-f.gsfc.nasa.gov	144.92.108.135	origin.ssec.wisc.edu	TCP	41475	5500	49.928	dng	9/20/99
132.206.1.24	telemann.mcrcim.mcgill.edu	204.168.186.132	AESDEMO.ACF.NYU.EDU	UDP	1135	10019	42.789	dng	9/20/99
140.221.9.163	dyfed.mcs.anl.gov	224.2.177.155	n/a	UDP	1447	55524	33.392	wae	9/20/99
131.193.181.182	ncdm182.lac.uic.edu	130.14.35.64	julessun.nlm.nih.gov	TCP	4745	38346	31.764	wae	9/20/99
128.223.215.225	d215-225.uoregon.edu	233.13.254.18	n/a	UDP	1075	60414	31.545	wae	9/20/99
192.67.81.48	t90-h.sdsc.edu	129.116.218.161	archive.hpc.utexas.edu	TCP	1879	ftp-data	30.860	rto	9/20/99
141.142.7.4	modi4.ncsa.uiuc.edu	128.109.178.168	cyclops.ncsc.org	UDP	29578	13051	28.702	dng	9/20/99
128.125.253.189	ferret.usc.edu	140.221.123.111	ico16-123.mcs.anl.gov	TCP	18267	2854	26.618	rto	9/20/99
128.138.162.170	umc162-170.Colorado.EDU	152.7.40.34	Lee-05-34.rh.ncsu.edu	UDP	7777	1873	26.271	dnj	9/20/99
140.221.8.53	jade.mcs.anl.gov	224.2.177.155	n/a	UDP	1050	55524	15.320	rto	9/20/99
130.14.25.1	ncbi.nlm.nih.gov	128.182.73.251	tourney.psc.edu	TCP	ftp-data	3273	15.201	wae	9/20/99
128.223.215.225	d215-225.uoregon.edu	224.2.253.181	n/a	UDP	1053	57708	13.583	wae	9/20/99
128.105.165.30	blackbird.cs.wisc.edu	131.215.145.148	hpss.cacr.caltech.edu	TCP	33682	ftp-data	12.952	rto	9/20/99
128.183.245.17	gila-f.gsfc.nasa.gov	128.111.101.54	zebra.icess.ucsb.edu	TCP	41551	5500	12.175	rto	9/20/99
130.14.25.1	ncbi.nlm.nih.gov	130.126.50.68	keck1.life.uiuc.edu	TCP	ftp-data	30413	11.673	wae	9/20/99
128.135.152.130	flash.uchicago.edu	128.182.73.54	golem.psc.edu	TCP	4119	ftp-data	11.435	dng	9/20/99
140.221.8.39	geode.mcs.anl.gov	224.2.177.155	n/a	UDP	1083	55524	10.822	dng	9/20/99
128.47.221.4	n/a	164.67.77.32	n/a	ICMP	0	0	10.247	rto	9/20/99
128.117.3.216	dataproc.ucar.edu	128.138.191.51	omicron.Colorado.EDU	TCP	ssh	1020	10.197	ncar	9/20/99
132.249.40.55	golden.sdsc.edu	128.218.68.33	mjolnir.compchem.ucsf.edu	TCP	2595	ftp-data	10.109	rto	9/20/99

Related web sites

- Abilene -- http://www.ucaid.edu/abilene/
- ESnet -- http://www.es.net/
- DREN -- http://www.hpcmo.hpc.mil/Htdocs/DREN/
- NISN -- http://www.nisn.nasa.gov/
- NREN -- http://www.nren.nasa.gov/
- vBNS -- http://www.vbns.net/
- NLANR -- http://www.nlanr.net/
- CAIDA -- http://www.caida.org/
- JET -- http://www.ccic.gov/jet
- Qbone -- http://www.internet2.edu/qbone
- NSF ANI -- http://www.interact.nsf.gov/cise/descriptions.nsf/pd/ani?openDocument