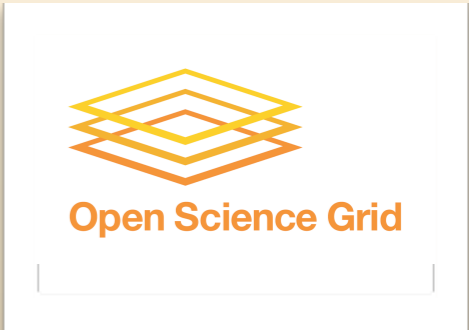
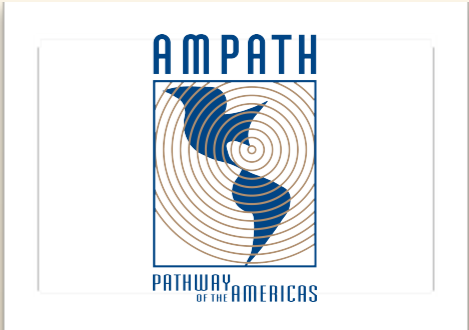


IU GlobalNOC

- Formed in 1998 to provide operations for the Abilene Network
- The leader in operating Research and Education Networks
- Staff of ~65 people (Indy and Blmt) - UITS Networks division
 - Service Desk: 24x7x365 Call Center & Monitoring Center
 - Network Engineering: Troubleshooting, planning and install
 - Systems Engineering & Tool Development: 11 engineers
 - Developing & supporting GRNOC toolset and systems
 - Operational support for research platforms like the Internet2 Observatory and NLRview
 - Measurement collection and visualization

Supported Projects



What does the GlobalNOC do?



What does the GlobalNOC do?

- ❏ Service Desk Services
 - ❏ Monitoring, problem tracking





What does the GlobalNOC do?

Service Desk Services

Monitoring, problem tracking

Engineering

Troubleshooting

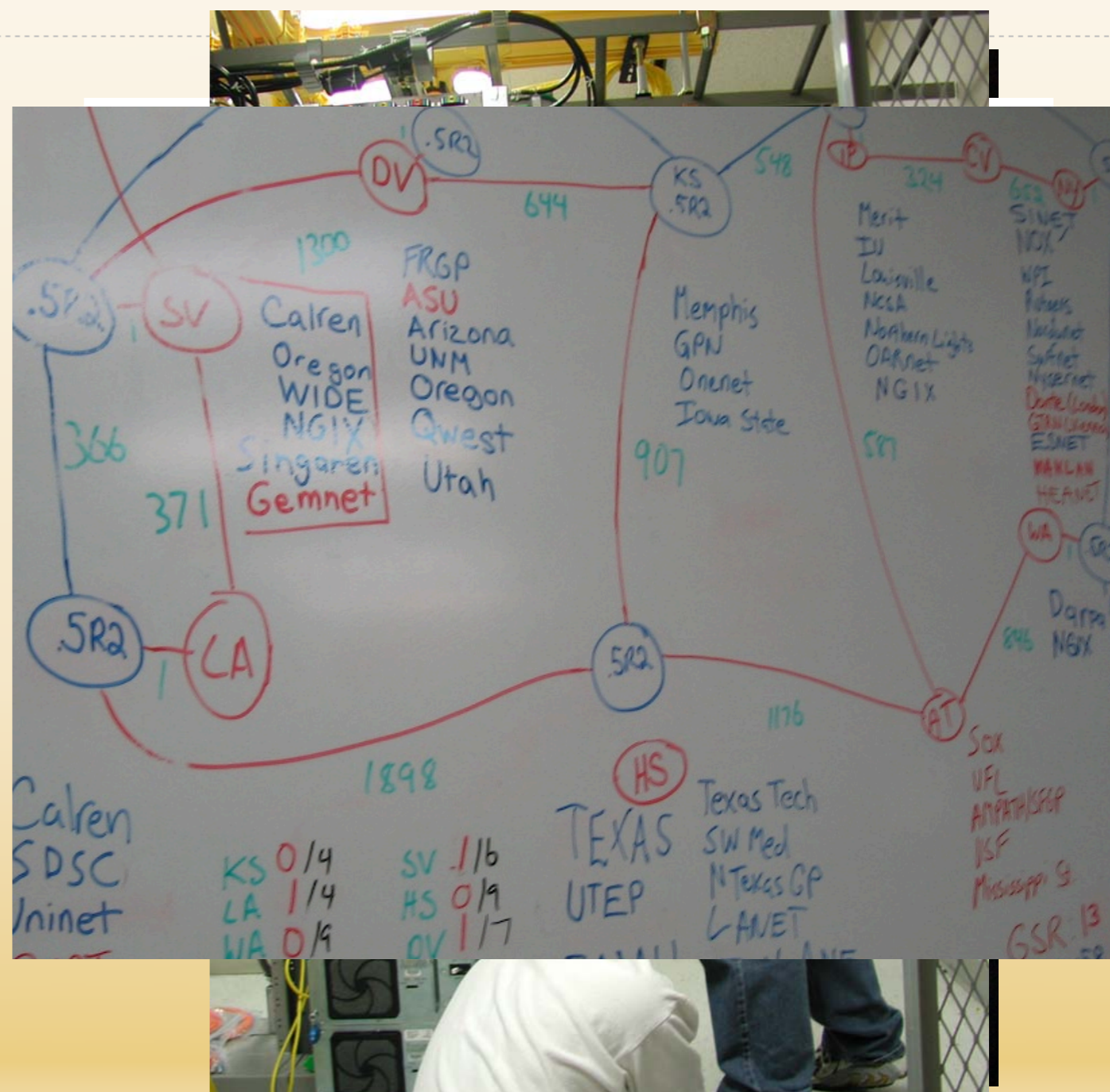
GlobalNOC AlertMon
Current Alerts
Last Updated 14:29:05

Network	Host Group	Hostname	Service	Duration	Database Device	Description	Acknowledgement	Ack History
National LambdaRail	NLR Layer 1	STARIL39A (db)	ALARMS	-7d 7h 50m 45s	SHELF-3	SHELF-COMM-FAIL: Shelf Communication Failure	binelson: turn up - 8560:52 (remove)	Host / Service
National LambdaRail	NLR Layer 1	STARIL39A (db)	ALARMS	-7d 7h 50m 45s	SHELF-4	SHELF-COMM-FAIL: Shelf Communication Failure	binelson: turn up - 8560:52 (remove)	Host / Service
I-Light	I-Light Layer 3	rtr2.ipat.ilight.net (db)	INTF - t1-1/0/0:9:27.0	0d 1h 12m 37s	t1-1/0/0:9:27.0	Link to Jefferson County CES [POP:cesjffm] [CID:DHDC226611] is Down	dvandall: Outage - 2824:83 (remove)	Host / Service
GRNOC Internal	Syseng Round Robin Servers	tick-blmt.globalnoc.iu.edu (db)	MYSQL-SLAVE	0d 2h 12m 12s		Slave IO: Yes Slave SQL: No Seconds Behind Master: (null)	nclouli: Alert - 4864:101 (remove)	Host / Service
I-Light	I-Light Layer 3	rtr.ipat.ilight.net (db)	INTF - t1-1/0/0:2:4.0	0d 3h 42m 43s	t1-1/0/0:2:4.0	Link to Martin University [POP:martin] [CID:DHZA327157NB] is Down	jokbrown: Outage - 2823:83 (remove)	Host / Service
IP Grid	IPGrid Layer 2	sw.wcc.iu.teragrid.org (db)	INTF - TenGigabitEthernet 7/8	0d 7h 28m 42s	TenGigabitEthernet 7/8	Link to BB to bF10-2 Te6/1	jokbrown: Outage - 429:75 (remove)	Host / Service
National LambdaRail	NLR Layer 1	MCLNVA39A (db)	ALARMS	0d 15h 29m 50s	CHAN-1-3-23-RX	LOS-P: Incoming Payload Signal Absent	rmrobert: SC09 - 9593:52 (remove)	Host / Service
National LambdaRail	NLR Layer 1	MCLNVA39A (db)	ALARMS	0d 15h 32m 27s	CHAN-1-3-22-RX	LOS-P: Incoming Payload Signal Absent	rmrobert: SC09 - 9593:52 (remove)	Host / Service
National LambdaRail	NLR Layer 1	MCLNVA39A (db)	ALARMS	0d 15h 34m 46s	CHAN-1-3-21-RX	LOS-P: Incoming Payload Signal Absent	rmrobert: SC09 - 9593:52 (remove)	Host / Service
National LambdaRail	NLR Layer 1	MCLNVA39A (db)	ALARMS	0d 15h 37m 49s	CHAN-1-3-20-RX	LOS-P: Incoming Payload Signal Absent	rmrobert: sc09 - 9593:52 (remove)	Host / Service
National LambdaRail	NLR Layer 1	SLKDUT35A (db)	ALARMS	0d 18h 21m 11s	FAC-6-1-1	CARLOSS: Carrier Loss On The LAN	tyabell: FRGP Maintenance - 9583:52 (remove)	Host / Service
National LambdaRail	NLR Layer 1	OGDNUT35A (db)	ALARMS	1d 0h 54m 25s	FAC-1-1-1	CARLOSS: Carrier Loss On The LAN	tyabell: FRGP Maintenance - 9583:52 (remove)	Host / Service
National LambdaRail	NLR Layer 2	atla.layer2.nlr.net (db)	INTF - GigabitEthernet9/6	2d 4h 18m 44s	GigabitEthernet9/6	Link to vini2 is Down	rcoombs: Instability - 5784:55 (remove)	Host / Service
GRNOC Internal	Internet2 Systems	ndb3-blmt.abilene.ucaid.edu (db)	DISK	3d 23h 24m 23s		DISK UNKNOWN: Host not responding	nclouli: alarm - 4830:14 (remove)	Host / Service



What does the GlobalNOC do?

- ▣ Service Desk Services
 - ▣ Monitoring, problem tracking
- ▣ Engineering
 - ▣ Troubleshooting
- ▣ Installation services
- ▣ Network Design and Consulting



What does the GlobalNOC do?

- ❏ Service Desk Services
 - ❏ Monitoring, problem tracking
- ❏ Engineering
 - ❏ Troubleshooting
- ❏ Installation services
- ❏ Network Design and Consulting
- ❏ Software and Measurement



IU GlobalNOC and Measurement

- Network data collections

- Experience with research infrastructure

- >150 I2 Observatory, NLRView, CIC, I-Light, Gigapop, IU campus, etc.. measurement points

- Co-located research equipment

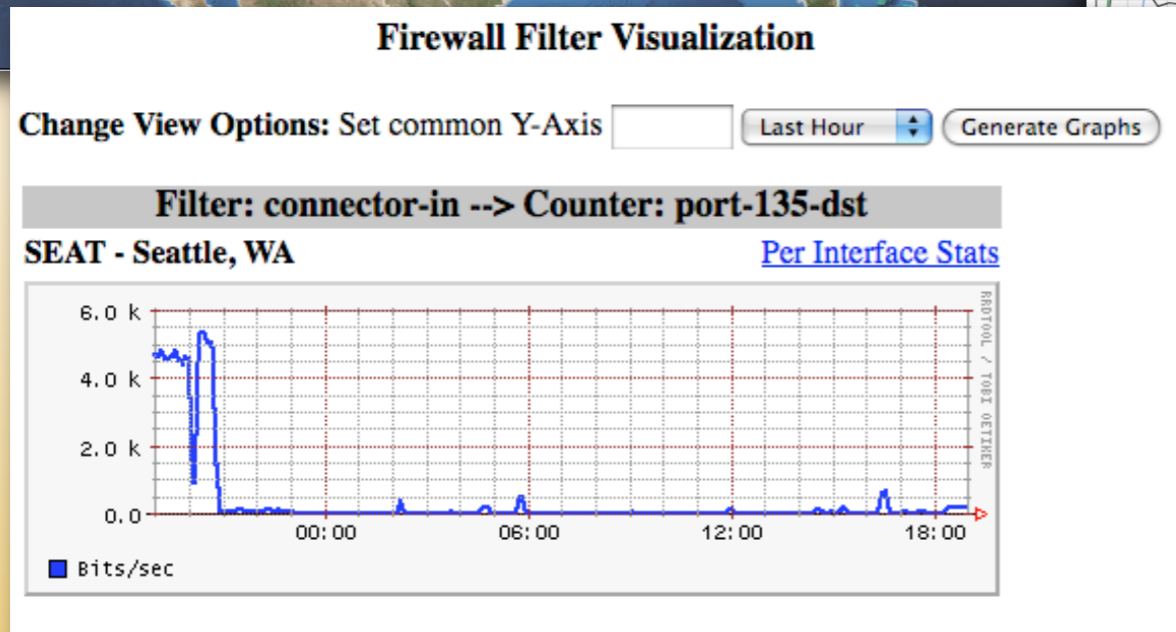
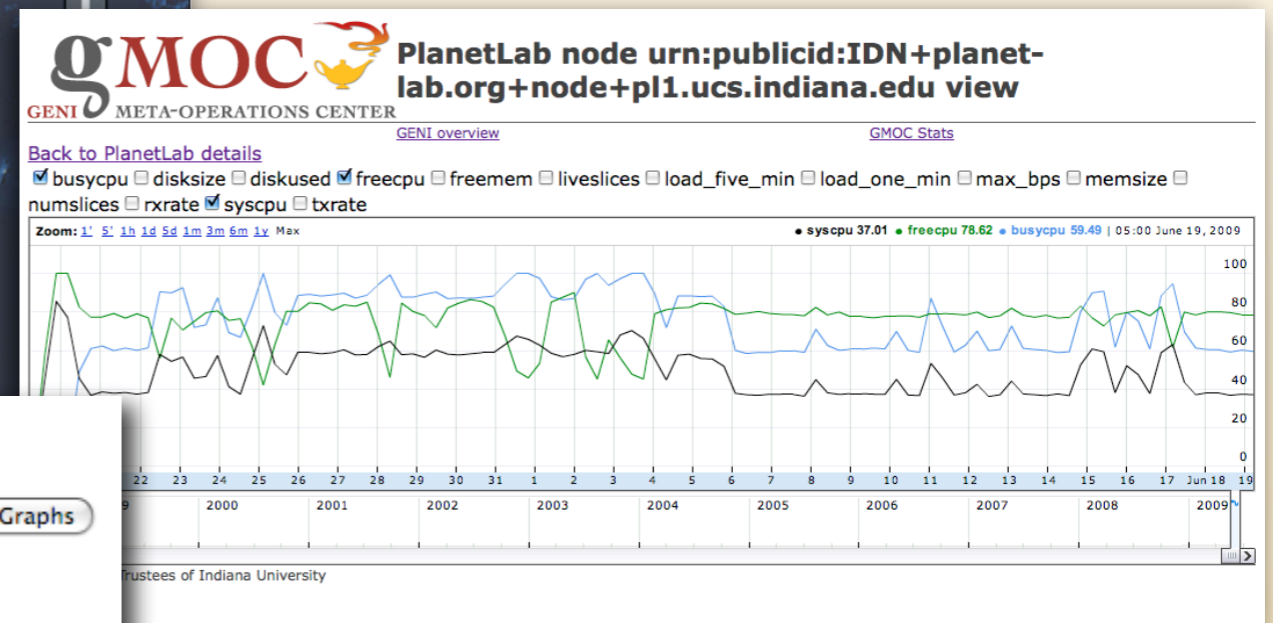
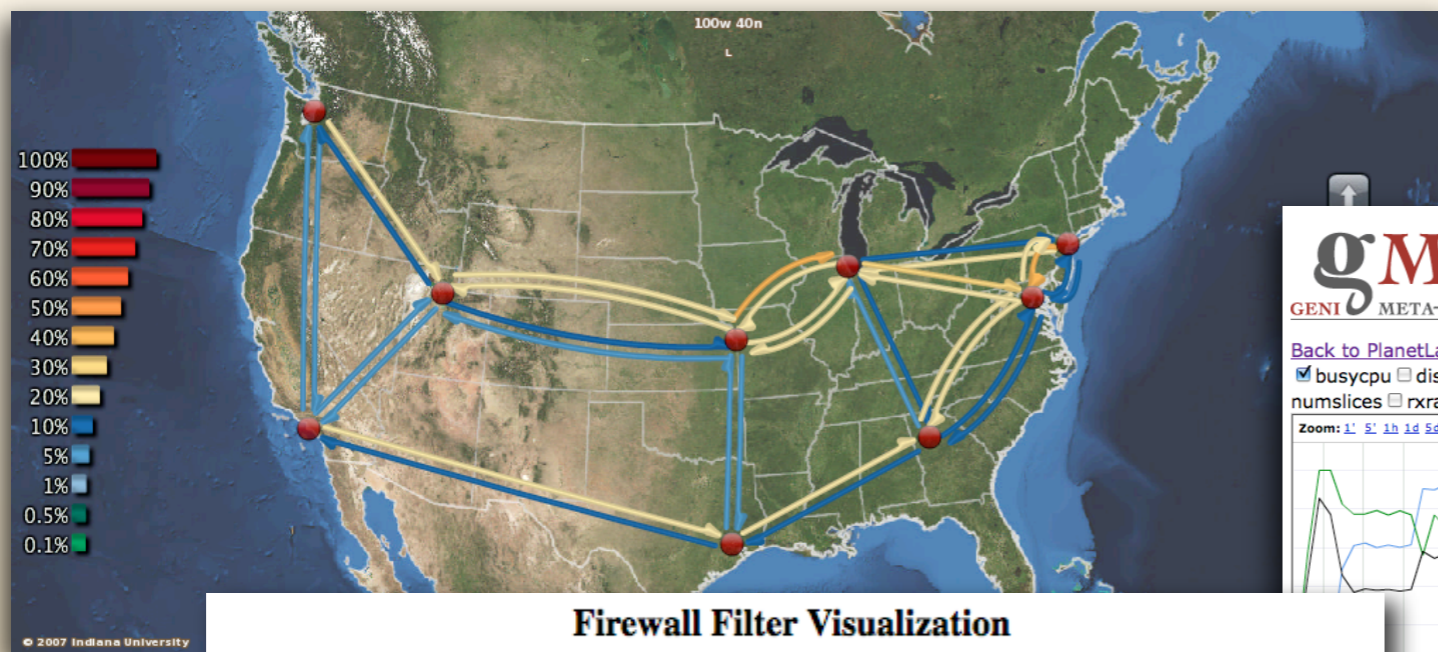
- Visualization systems

- Atlas

- WorldView



Measurement Data and Visualization



Typical Measurement Points

- ❏ 1-10 servers per pop -- 1 and 2U rackmount, central data collection
- ❏ 10 Gb/sec capable
- ❏ Time source (GPS or CDMA)
- ❏ Software
 - ❏ Netflow/sflow, routing data, packet capture?
 - ❏ Active measurements (BWCTL, OWAMP, NPAD, NDT)
- ❏ SNMP stats (Utilization, Environmental, etc..)
- ❏ “Visible Network”, Router/Switch/NE Proxy, LLAMA

Researcher Questions

- ❏ Where is the data?
 - ❏ Human readable and machine readable
- ❏ Why can't I get the data?
 - ❏ Privacy, Cost, Technology
- ❏ State of the network?
 - ❏ Researcher often doesn't know what they are looking for but see an anomaly in their data
 - ❏ Topology (Virtual and Physical), Outages, Utilization, etc..

Data Management and Network Data

- 🔸 Metadata attached to measurement data
 - 🔸 Operational Data - state of network and experiments
 - 🔸 Data transformations - curated data
 - 🔸 Dynamic Slice Provisioning as a source of data
 - 🔸 Instrumenting the experiment
 - 🔸 Experiment description language
 - 🔸 Workflow Languages (BPEL, YAWL, etc..)
- 🔸 Policy info

GENI

- ❖ National scale testbed for clean-slate research on networking technologies
- ❖ Virtualized infrastructure
- ❖ GENI Meta Operational Center
 - ❖ Operational Dataset
 - ❖ Emergency Stop
 - ❖ Concept of Operations

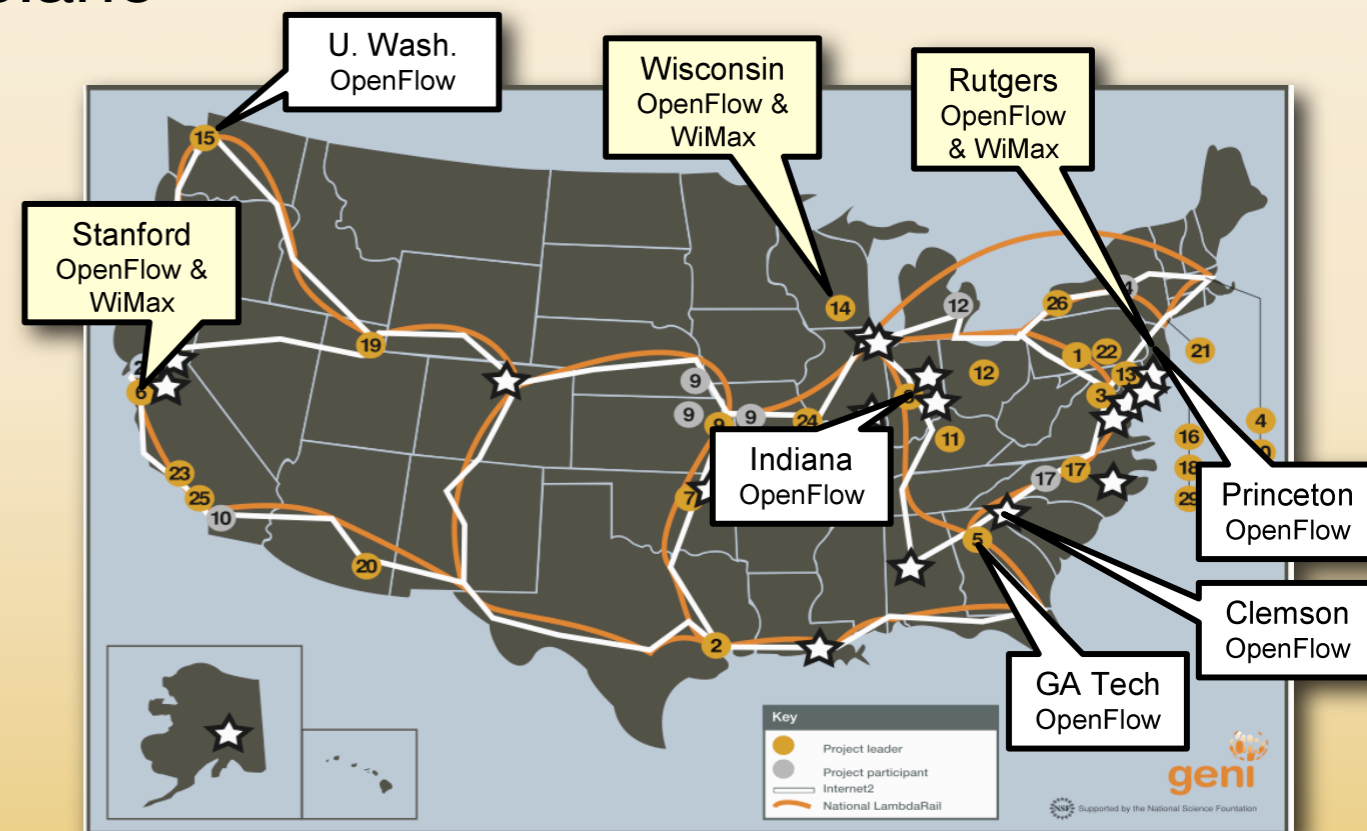


NetKarma

- ❏ Collaboration of GlobalNOC and Pervasive Technology Institute
 - ❏ PI: Beth Plale Co-PI: Chris Small
- ❏ Record provenance of experiments on GENI
 - ❏ Attach Data and Metadata related to a single experiment into an archive
- ❏ How to deal with data intensive research?
- ❏ How to I record experimental conditions of very complex experimental apparatus
- ❏ How do a create a recipe of an experiment?

Openflow

- ❖ Run experimental protocols on production networks
- ❖ Open standards - implemented by major switch vendors
- ❖ Separate control plane from data plane
- ❖ Campus Trial at Indiana University
 - ❖ Operations
 - ❖ Distributed measurement
 - ❖ Inter-campus connectivity
- ❖ <http://www.openflowswitch.org>



Making data available

- GlobalNOC site
 - <http://globalnoc.iu.edu/>
- Visualizations and raw data
- PerfSonar
- Storage and curation
- Portals - DatCat
- New methods from NetKarma work??

Security related data

- 🔥 Data traces (packet capture, Netflow) with data provenance
- 🔥 Security related counters (e.g. “firewall” filters on Internet2)
- 🔥 Agility of attacks especially attacks on Internet infrastructure
 - 🔥 Using BGP to cloak activities
- 🔥 Experience with operations
 - 🔥 Statistics on downtime
 - 🔥 Security related tickets and outages

Data Collection and Internships

- 🔸 New ways to collect data
 - 🔸 Network Operators run code developed by researchers
 - 🔸 Return data to researchers that does not contain sensitive info
- 🔸 Internships
 - 🔸 2 Undergraduate intern positions filled, 2 more open
- 🔸 Measurement suggestions
 - 🔸 Tell us what data would be useful we'll see if we can provide it