NDN Testbed

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NDN Testbed: September 2014
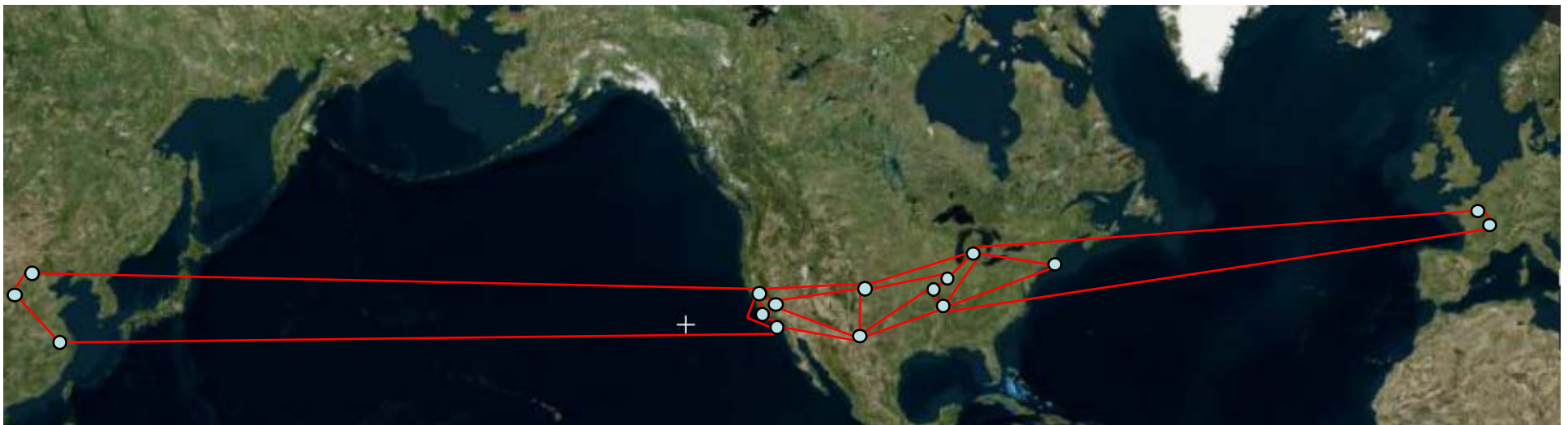
- **Consists of 16 Gateway Router Nodes**
  - » **9 at sites of the NDN PIs**
  - » **7 at sites of collaborators.**

- **Presence on 3 Continents**
  - » **North America: 11 in USA**
  - » **Asia: 3 in China**
  - » **Europe: 2 in France**
    - • **Interest from two possible new European sites yesterday…**

How to Participate?

- **Sites: Gateway Router Nodes**
  - » **All current router nodes are managed by Washington U. Team**
  - » **Why?**
    - • **So site personnel can focus on R&D.**
    - • **Faster response to issues.**
    - • **Our policies also allow for self managed nodes: But …**
  - » **How to join the Testbed? First read the policies:**
    - • **http://named-data.net/ndn-testbed/policies-connecting-nodes-ndn-testbed/**
  - » **Then contact the WU Testbed Management Team:**
    - • **Send email to: ndntestbed@arl.wustl.edu**
- **End Hosts**
  - » **Learn about NFD, install and connect:**
    - • **http://named-data.net/doc/NFD/0.2.0/**
- **Users**
  - » **From Testbed sites**
    - • **Submit certificate request with email address in your site's domain**
  - » **From non-Testbed sites**
    - • **/ndn/guest namespace homed at UCLA node**
  - » **More details coming from Alex on certificates and users**

What is in a Node?

- **OS: Ubuntu 12.04 LTS Server**
 - » **All nodes run the same OS yielding smooth management and updates.**
- **NDN Daemons:**
  - » **nfd: NDN Forwarder**
  - » **nrd: RIB and FIB management Daemon**
  - » **nfd-autoreg: Auto-registration server**
    - • **Registers default prefixes for new on-demand faces**
  - » **nlsr: NDN Link State Routing protocol daemon**
  - » **nfd-status-http-server: http access to nfd-status for remote monitoring**
  - » **ndnxmlstat_c: status data collection for remote bandwidth monitoring**
  - » **ndn-autoconfig-server: NDN hub discovery**
    - • **Responds to hosts looking for a hub**
  - » **ndnpingserver: ndnping server**
  - » **ndn-repo-ng: NDN Repository daemon**
- **Links to other Nodes**
  - » **Defined by NLSR configuration**
  - » **Each Link has a cost which roughly translates to node-to-node delay**
  - » **Cumulative costs associated with FIB entries for prefixes**

Current NDN Testbed Topology
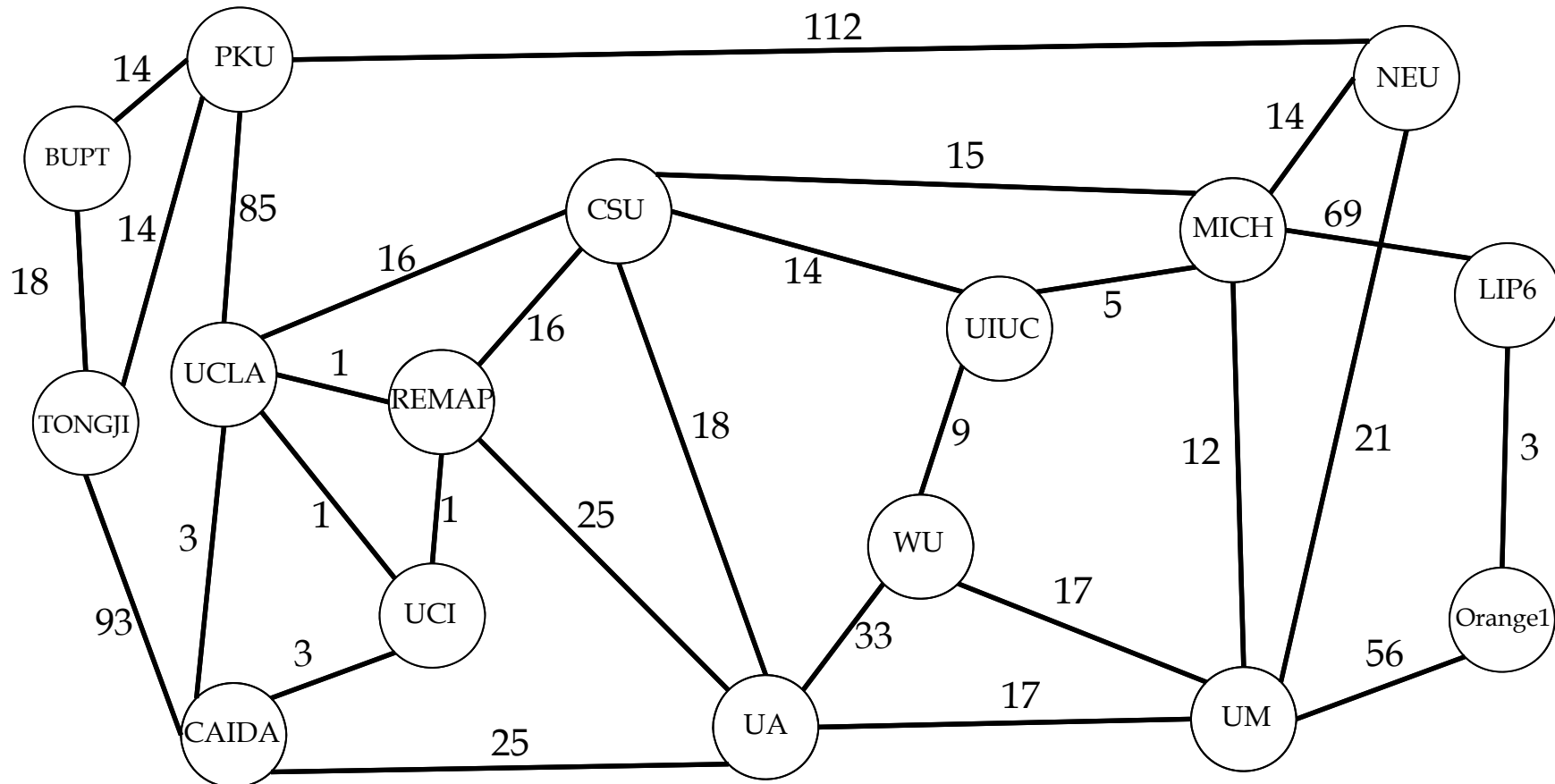
- **16 Nodes**
- **29 Links (with NLSR routing costs)**

Monitoring the NDN Testbed

- **Following slides will show monitoring of**
  - » **Status**
  - » **Routers**
  - » **Bandwidth**
- **More monitoring coming soon:**
  - » **Node-to-Node delays measured by ndnping**
  - » **Historical traffic records like:**
    - **http://www.cacti.net/**
- **Looking at Ansible**
  - » **Remote configuration management**

Status Monitoring

- **http://www.arl.wustl.edu/~jdd/ndnstatus/ndn_prefix/tbs_ndnx.html**

	BUPT	PKU	TONGJI	ARIZONA	CSU	MEMPHIS	NEU	UCI	UCLA	REMAP	UIUC	MICHIGAN	WU	LIP6	ORANGE1	CAIDA
Version	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Start Time (UTC)	2014/08/20 19:26:34	2014/08/24 11:48:28	2014/08/20 19:27:11	2014/08/22 21:37:24	2014/08/20 19:26:06	2014/08/24 11:51:11	2014/08/20 19:26:17	2014/08/20 19:25:58	2014/08/20 14:55:12	2014/08/22 21:46:25	2014/08/20 19:26:19	2014/08/22 20:31:58	2014/08/20 19:26:20	2014/08/20 19:26:15	2014/08/25 14:42:18	2014/08/25 18:11:15
Current Time (UTC)	2014/08/25 19:18:01	2014/08/25 19:18:01	2014/08/25 19:17:58	2014/08/25 19:17:57	2014/08/25 19:17:57	2014/08/25 19:17:59	2014/08/25 19:17:58	2014/08/25 19:18:00	2014/08/25 19:17:59	2014/08/25 19:18:00	2014/08/25 19:17:56	2014/08/25 19:17:57	2014/08/25 19:17:58	2014/08/25 19:17:58	2014/08/25 19:17:58	2014/08/25 19:18:01
Clock Skew																
ndn:/ndn/cn/edu/bupt	yellow					red										
ndn:/ndn/cn/edu/pku		yellow														
ndn:/ndn/cn/edu/tongji			yellow													
ndn:/ndn/edu/arizona				yellow												
ndn:/ndn/edu/colostate					yellow											
ndn:/ndn/edu/memphis																
ndn:/ndn/edu/neu							yellow									
ndn:/ndn/edu/uci								yellow								
ndn:/ndn/edu/ucla																
ndn:/ndn/edu/ucla/remap										yellow						
ndn:/ndn/edu/uiuc											yellow					
ndn:/ndn/edu/umich												yellow				
ndn:/ndn/edu/wustl													yellow			
ndn:/ndn/fr/lip6																
ndn:/ndn/fr/orange1															yellow	
ndn:/ndn/org/caida																yellow

- **Green: FIB entry exists for prefix at this node**
- **Red: FIB entry does not exist for prefix at this node**
  - » From above image we see that MEMPHIS is missing ndn:/ndn/cn/edu/bupt
- **Yellow: FIB entry does not exist for prefix at this node**
  - » Prefix is within node's domain so should only be present if local hosts have connected to the node.
  - » From above image we can tell that MEMPHIS, UCLA and LIP6 have local hosts currently connected to them.

Router Monitoring

- **http://netlab.cs.memphis.edu/script/test/ndn-**

Status information

Page last updated:	Mon Aug 25 14:29:11 2014 CST
Last log processed:	nlsr.log
Last timestamp in log:	Mon Aug 25 14:29:10 2014 CST

Status key

	Online
	Offline
	Out-of-date, no update for 40 min
	Online, but not-in-topo (NPT)

Advertised Prefixes | Link Status

Router	Timestamp	Prefix	Status
/ndn/cn/edu/bupt/%C1.Router/bupthub	Mon Aug 25 2014 14:26:50 GMT-0500 (CDT)	/ndn/cn/edu/bupt	Online
/ndn/cn/edu/pku/%C1.Router/pkuhub	Mon Aug 25 2014 14:19:15 GMT-0500 (CDT)	/ndn/cn/edu/pku	Online
/ndn/cn/edu/tongji/%C1.Router/cnlab	Mon Aug 25 2014 14:26:59 GMT-0500 (CDT)	/ndn/cn/edu/tongji	Online
/ndn/edu/arizona/%C1.Router/hobo	Mon Aug 25 2014 14:13:37 GMT-0500 (CDT)	/ndn/edu/arizona	Online
/ndn/edu/colostate/%C1.Router/mccoy	Mon Aug 25 2014 14:26:20 GMT-0500 (CDT)	/ndn/edu/colostate	Online
/ndn/edu/memphis/%C1.Router/titan	Mon Aug 25 2014 14:21:31 GMT-0500 (CDT)	/ndn/edu/memphis	Online
/ndn/edu/neu/%C1.Router/ndnrtr	Mon Aug 25 2014 14:26:28 GMT-0500 (CDT)	/ndn/edu/neu	Online
/ndn/edu/uci/%C1.Router/ndnhub	Mon Aug 25 2014 14:26:11 GMT-0500 (CDT)	/ndn/edu/uci	Online
/ndn/edu/ucla/%C1.Router/cs/aleph	Mon Aug 25 2014 14:23:33 GMT-0500 (CDT)	/ndn/edu/ucla/remap	Online
/ndn/edu/ucla/%C1.Router/cs/spurs	Mon Aug 25 2014 14:18:32 GMT-0500 (CDT)	/ndn/edu/ucla	Online
	Mon Aug 25 2014 14:18:32 GMT-0500 (CDT)	/ndn/guest	Online
/ndn/edu/uiuc/%C1.Router/ndnx	Mon Aug 25 2014 14:26:30 GMT-0500 (CDT)	/ndn/edu/uiuc	Online
/ndn/edu/umich/%C1.Router/ndn0	Mon Aug 25 2014 14:20:09 GMT-0500 (CDT)	/ndn/edu/umich	Online
/ndn/edu/wustl/%C1.Router/wundngw	Mon Aug 25 2014 14:26:33 GMT-0500 (CDT)	/ndn/edu/wustl	Online
/ndn/fr/lip6/%C1.Router/ndnhub	Mon Aug 25 2014 14:26:28 GMT-0500 (CDT)	/ndn/fr/lip6	Online
/ndn/fr/orange1/%C1.Router/orange-ndn-1	Fri Aug 22 2014 18:20:41 GMT-0500 (CDT)	/ndn/fr/orange1	Out-of-Date
/ndn/org/caida/%C1.Router/click	Mon Aug 25 2014 14:23:23 GMT-0500 (CDT)	/ndn/org/caida	Online

- **Shows status of NLSR routers and their advertised prefixes.**

- **Information extracted from NLSR log file on Memphis node.**

- **Table reflects LSA updates received at Memphis.**
  - » **From the image we can see that Memphis had not received an LSA from Orange1 for a while.**

Bandwidth Monitoring

- **http://ndnmap.arl.wustl.edu/**
- **Link width and color reflects total bandwidth on link**
- **Numbers reflect bandwidth in each direction**
 - » **Some links currently have these swapped. This will be fixed soon...**

NDN Testbed
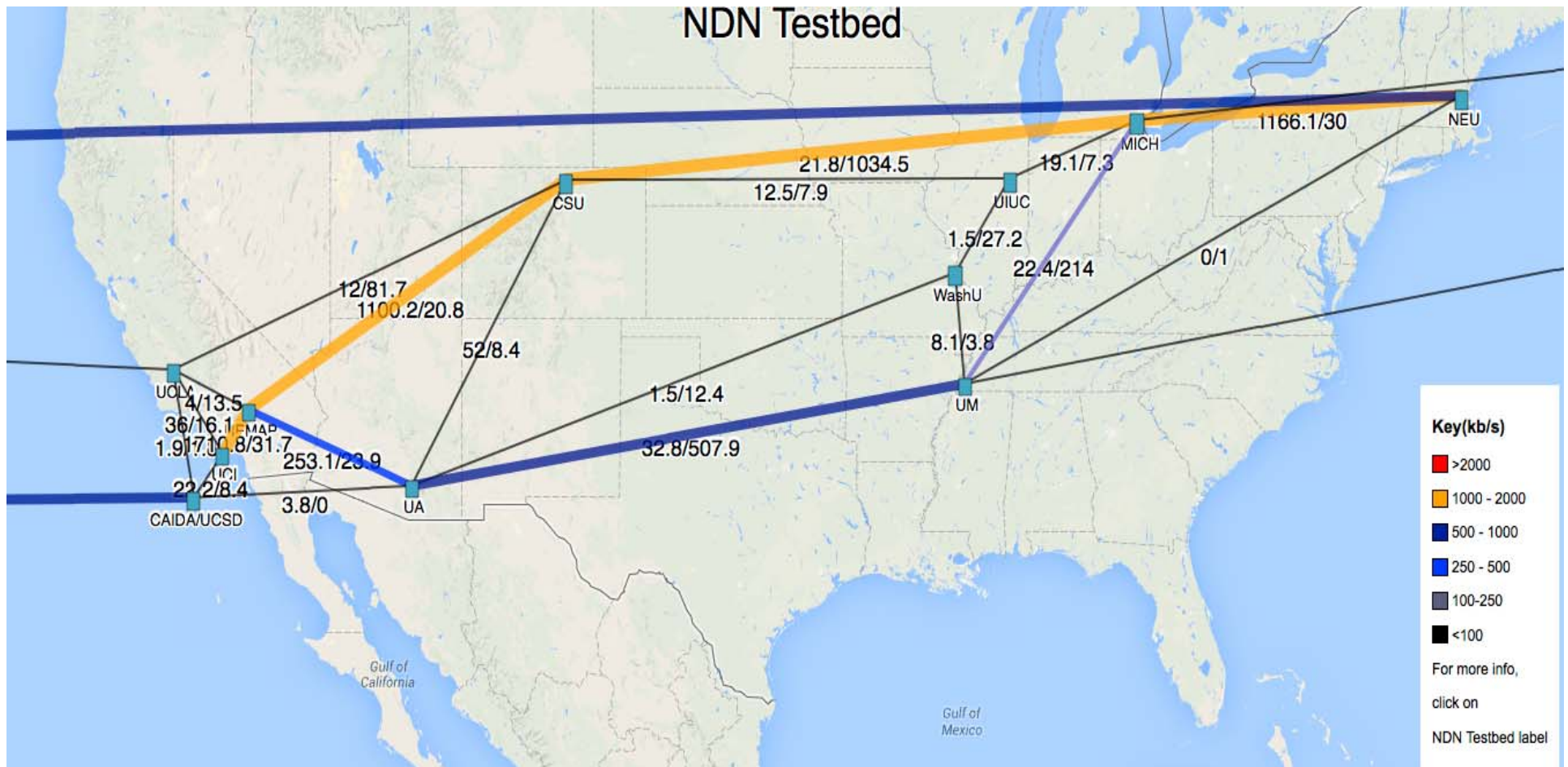
NDN on the Open Network Lab (ONL)

- ONL is an Internet-accessible networking lab
  - » **http://onl.wustl.edu/**
  - » built around a set of extensible gigabit routers
  - » intuitive Remote Lab Interface makes it easy to get started
  - » extensive facilities for performance monitoring
- Current Resources:
  - » 16 highly configurable five port Network Processor based Routers
  - » 150 rack-mount computers that serve as end systems
    - including multicore servers with 12 cores and 48 cores
  - » Support for **nfd** and **ccnd**
- In the works:
  - » Support for VMs
  - » 20 software routers: Variety of configurations:
    - 2 10Gb/port, fixed 5 1Gb/port, variable # or ports up to 16 1Gb/port
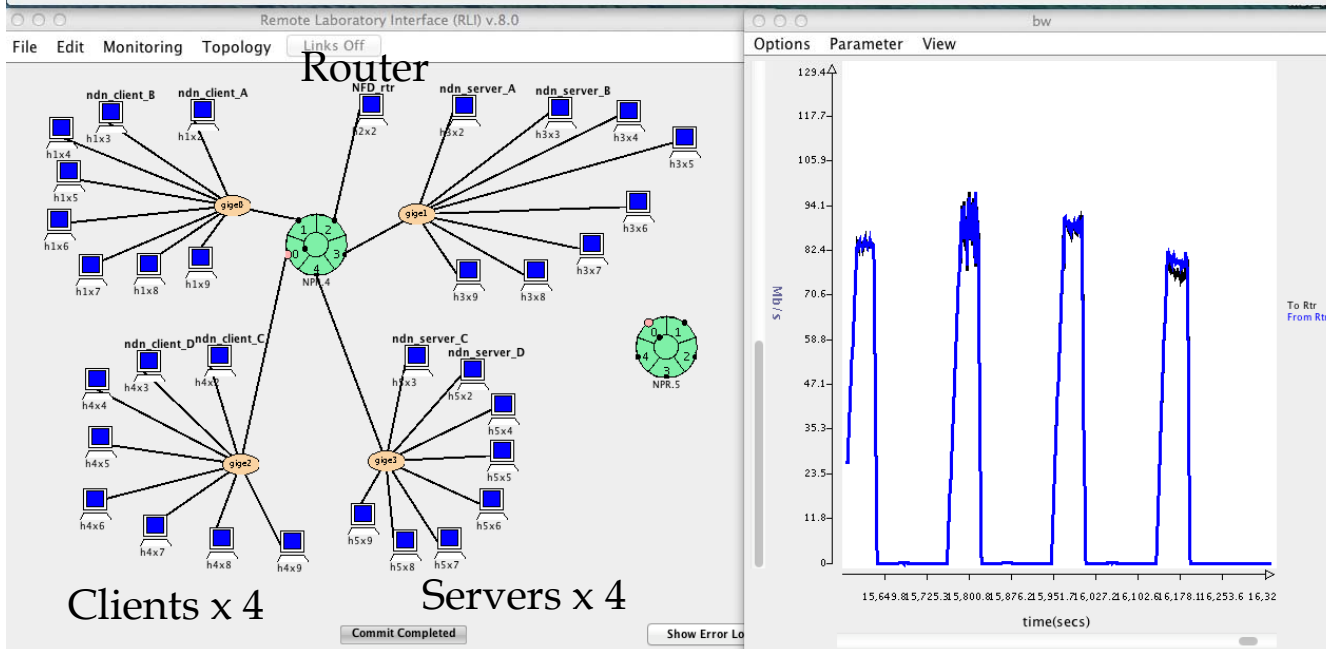
Overview of ONL
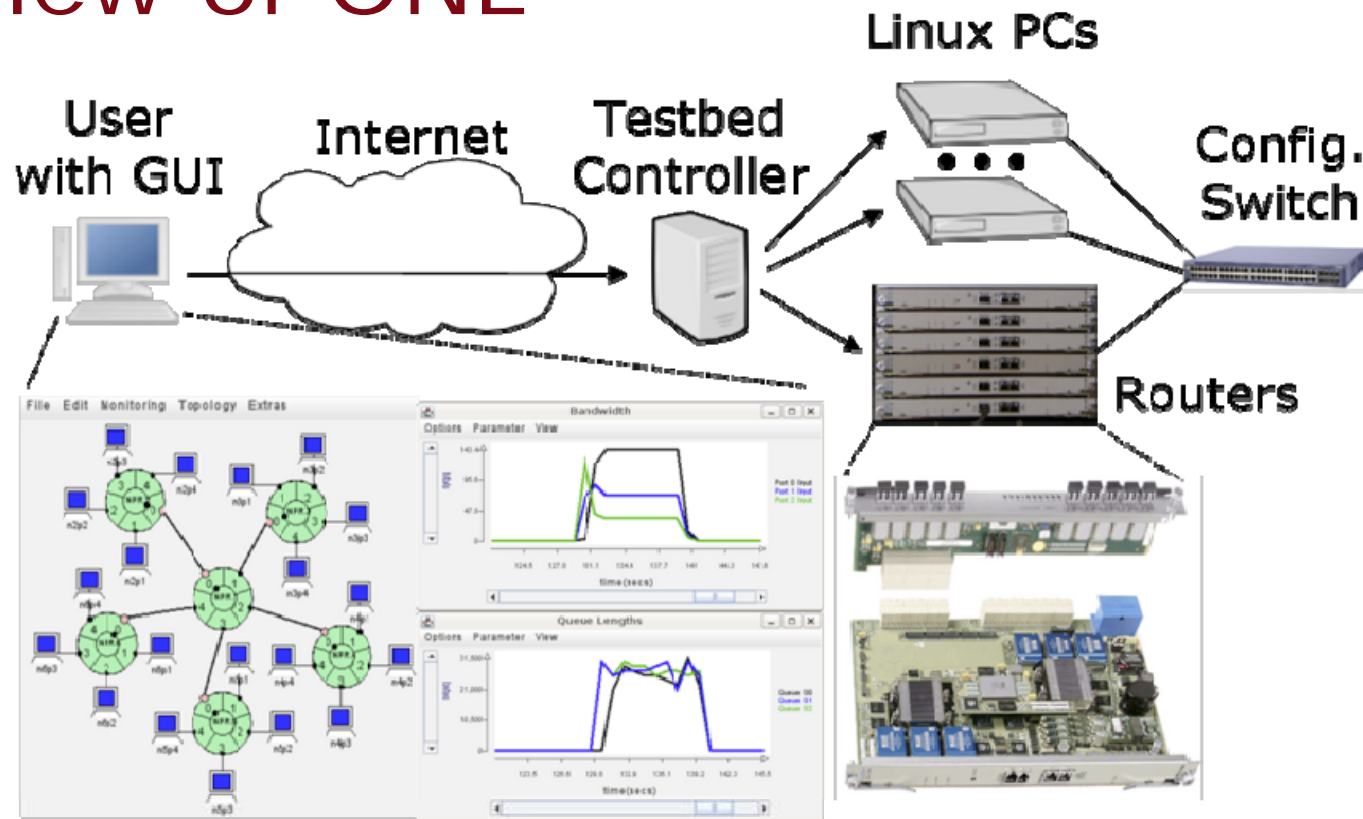
- Remote access through the Internet using a graphical user interface (called the RLI)
- Provides access to variety of hardware resources
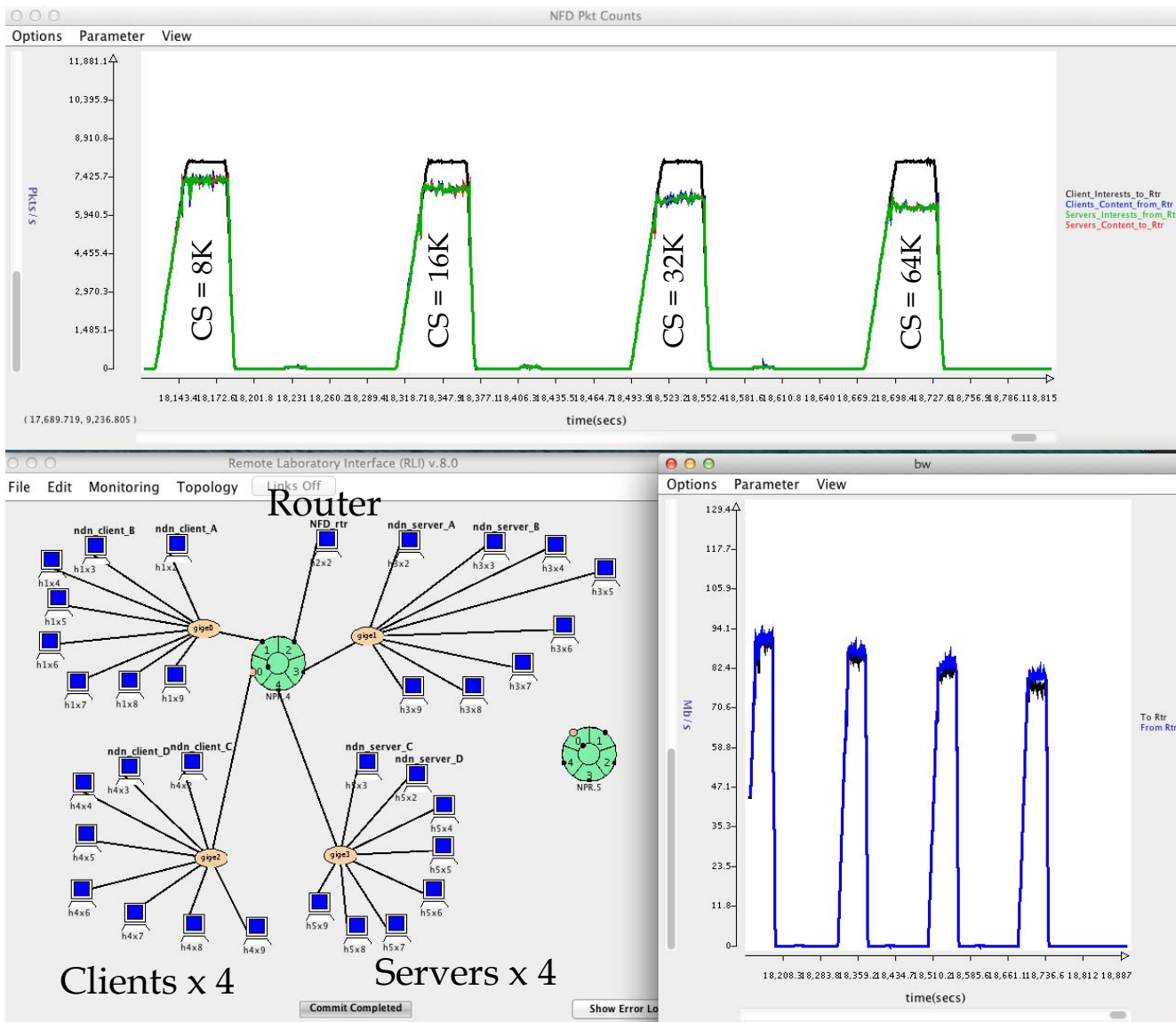- Experimental networks built with configuration switches

ONL and NDN Performance
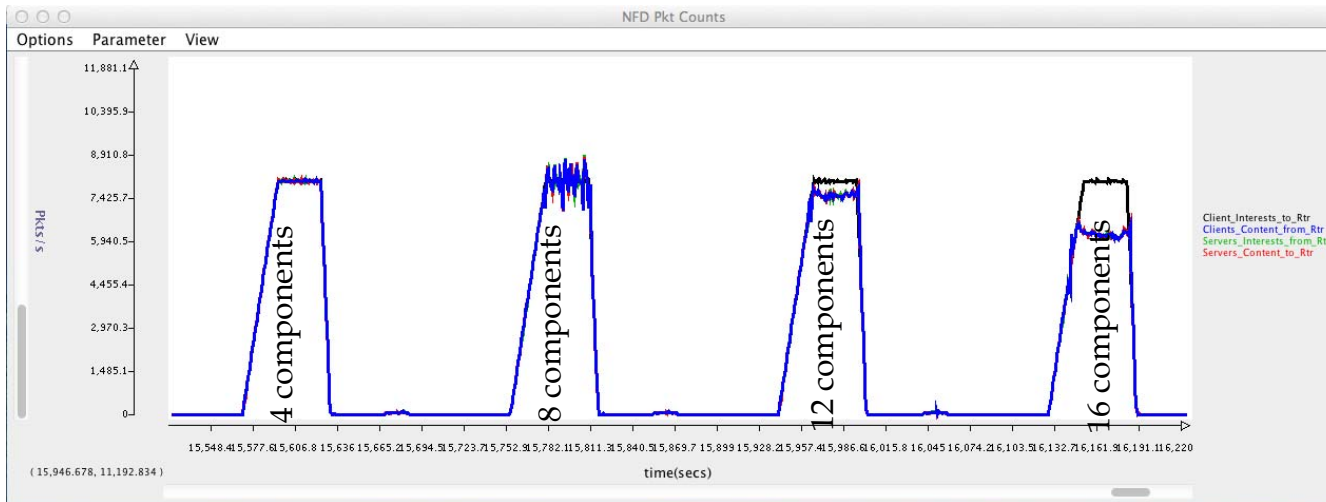
- **64 client/server**
  - » ndn-traffic
  - » ndn-traffic-server
- **Varying number of name components**
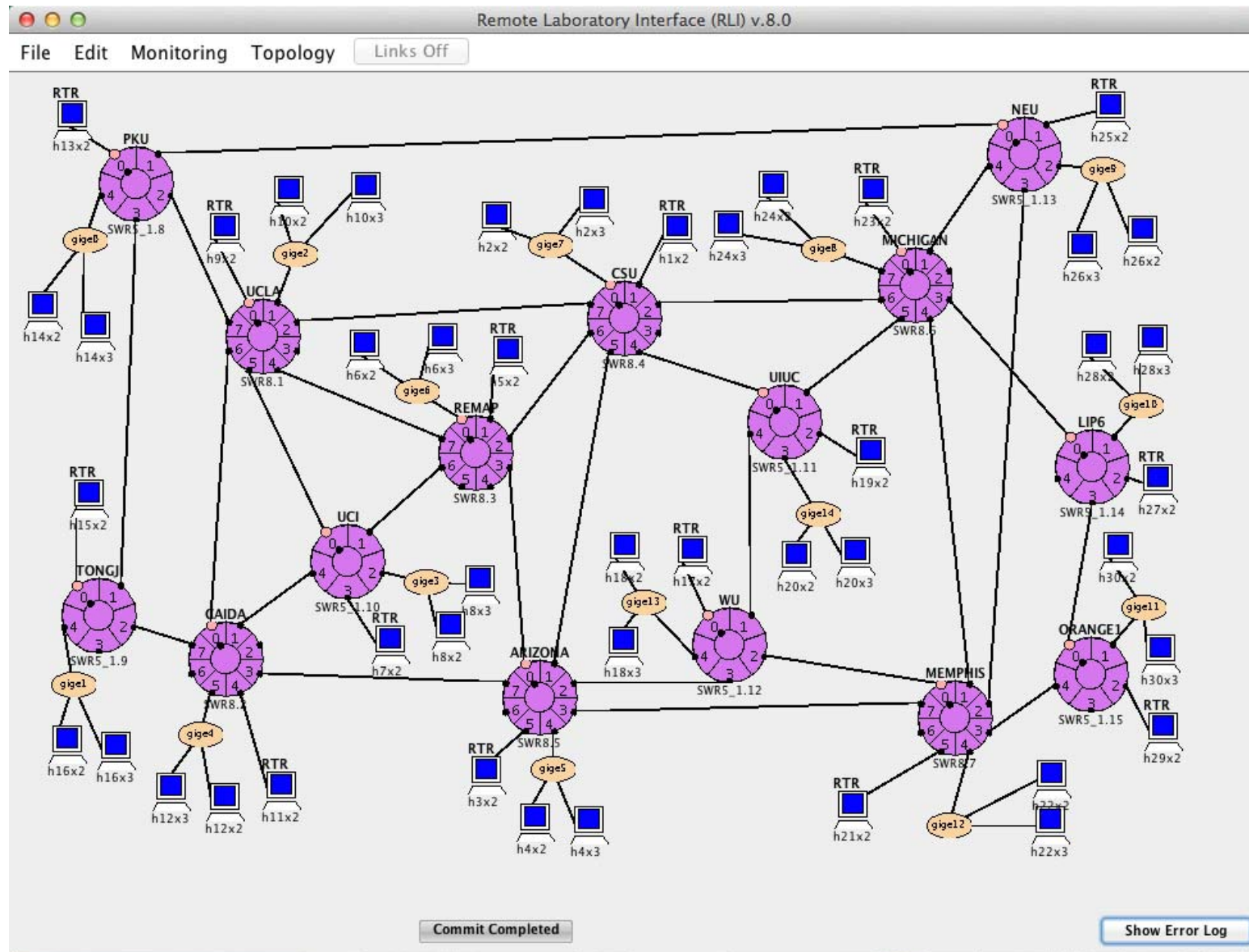- **8 characters per component**
- **CS=64K**

ONL and NDN Performance

- 64 client/server
  - » ndn-traffic
  - » ndn-traffic-server
- Varying size of Content Store
- 16 name components
- 8 characters per component

ONL and NDN Testbed Emulation

More Information: Links

■ **NDN Home Site:**

  » **http://named-data.net/**

■ **Policies for joining:**

  » **http://named-data.net/ndn-testbed/policies-connecting-nodes-ndn-testbed/**

■ **Installing an end host:**

  » **http://named-data.net/doc/NFD/0.2.0/**

■ **ONL:**

  » **http://onl.wustl.edu/**

Request

- **Doing a demo today?**
  - » **Will it be using the NDN Testbed?**
    - See me during a break today...

    - I want to monitor things and know what to look at

    - One demo wants to simulate a link breakage and I just want to make sure we aren't surprising anyone else...