NDN Testbed

John DeHart
Computer Science & Engineering
Washington University

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

- **Green**: FIB entry exists for prefix at this node
  - From above image we see that MEMPHIS is missing ndn:/ndn/cn/edu/bupt

- **Red**: FIB entry does not exist for prefix at this node
  - From above image we can tell that MEMPHIS, UCLA and LIP6 have local hosts currently connected to them.

- **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/status.htm**
  - 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.

### Status Information

<table>
<thead>
<tr>
<th>Status Information</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Last log processed:</td>
<td>nitr/log</td>
</tr>
<tr>
<td>Last timestamp in log:</td>
<td>Mon Aug 25 14:29:10 2014 CST</td>
</tr>
</tbody>
</table>

### Status Key

<table>
<thead>
<tr>
<th>Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online</td>
<td></td>
</tr>
<tr>
<td>Offline</td>
<td></td>
</tr>
<tr>
<td>Out-of-date, no update for 40 min</td>
<td></td>
</tr>
<tr>
<td>Online, but not-in-topo (NPT)</td>
<td></td>
</tr>
</tbody>
</table>

### Advertised Prefixes

<table>
<thead>
<tr>
<th>Router</th>
<th>Timestamp</th>
<th>Prefix</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>/ndn/edu/bupt/%C1.Router/buthub</td>
<td>Mon Aug 25 2014 14:26:50 GMT-0500 (CDT)</td>
<td>/ndn/edu/bupt</td>
<td>Online</td>
</tr>
<tr>
<td>/ndn/edu/uic/%C1.Router/ndnhub</td>
<td>Mon Aug 25 2014 14:26:11 GMT-0500 (CDT)</td>
<td>/ndn/edu/uic</td>
<td>Online</td>
</tr>
<tr>
<td>/ndn/edu/uic/%C1.Router/ndhx</td>
<td>Mon Aug 25 2014 14:26:30 GMT-0500 (CDT)</td>
<td>/ndn/edu/uic</td>
<td>Online</td>
</tr>
<tr>
<td>/ndn/edu/umich/%C1.Router/ndn0</td>
<td>Mon Aug 25 2014 14:20:09 GMT-0500 (CDT)</td>
<td>/ndn/edu/umich</td>
<td>Online</td>
</tr>
<tr>
<td>/ndn/fr/orange1/%C1.Router/orange-ndn-1</td>
<td>Fri Aug 22 2014 18:20:41 GMT-0500 (CDT)</td>
<td>/ndn/fr/orange1</td>
<td>Out-of-Date</td>
</tr>
</tbody>
</table>
Bandwidth Monitoring

- [http://ndnmap.arl.wustl.edu/](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 on the Open Network Lab (ONL)

- ONL is an Internet-accessible networking lab
  - [http://onl.wustl.edu/](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/](http://named-data.net/)

- **Policies for joining:**

- **Installing an end host:**
  » [http://named-data.net/doc/NFD/0.2.0/](http://named-data.net/doc/NFD/0.2.0/)

- **ONL:**
  » [http://onl.wustl.edu/](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...