NDN Managed Gateways and The NDN Testbed

John DeHart
Computer Science & Engineering
Washington University

www.arl.wustl.edu
NDN Nodes

- Types of NDN Nodes
  - Gateway Routers
  - End User
  - Application Nodes

- Gateway Router Nodes
  - Managed
    - Managed by Washington U. team so you don’t have to...
    - ONLY used for:
      - Gateway routing function (ndnd, OSPFN)
      - Running a repository (ndnr)
      - Operator management of site keys and certificates
    - Each member site will provide at least one managed gateway node
      - More may be provided if desired.
    - Non-member sites may provide managed node(s) also
  - Unmanaged . . .
NDN Nodes

- **Gateway Router Nodes (continued)**
  - **Unmanaged**
    - Member sites may run additional unmanaged router nodes
      - Behind the site’s managed gateway router
    - Non-member sites with a managed gateway router
      - May have additional unmanaged router nodes behind the site’s managed gateway router
    - Non-member sites without a managed gateway router
      - May have unmanaged node(s) connected through a member site
        - That member site takes on some responsibility for non-member site

- Before any unmanaged node is added to the Testbed WU team needs to be notified

- **To contact WU Testbed Management Team:**
  - Send email to: ndntestbed@arl.wustl.edu
Managed Gateway Router Nodes

Installation (Done by local Site personnel)

- OS: Ubuntu 12.04 LTS Server (Not Desktop)
  - http://www.ubuntu.com/download/server
  - Add ssh server during installation
  - Two accounts:
    - operator: For local site operator
    - ndnops: For WU team (provide us with the password so we can use sudo)
      - We will provide a public key for ssh access
    - NO OTHER USER ACCOUNTS.

- Firewall Issues
  - GRE tunnel access to/from other gateway nodes
  - ndnx access to/from clients of a gateway node
    - Port 6363
    - Broadcast/Multicast group on UDP 224.0.23.170 port 56363
  - ssh access for WU team
  - Probably some others that we’ll learn about as we bring it all up...

- Certificates and keys
  - UCLA team is working on a new set of tools.
  - Local operator will be responsible for signing keys for local users
Managed Gateway Router Nodes

- **Configuration and Maintenance (Done by WU team)**
  - **git vs. apt-get**
    - Tagged versions of packages from git repos and build on each node
    - In the future we may build Ubuntu pkgs for installation from a PPA
      - `> sudo apt-get install ndn`
  - **What NDN related packages?**
    - `ndnx`: (ndnd, ndnr, ...)
    - OSPFN3.0
    - `ndnxmli` client: generates data for ndnmap
    - NDN packages to support certificates and keys
    - Perhaps a few others...
  - **Configuration of a Node**
    - GRE Tunnels
    - OSPFN Configuration
    - Configuration files installed from git repo
      - Separate set of files for each Testbed node
        - WU team will define and maintain configuration files
      - May use a private git repo to protect configuration files
      - In the future configuration files may be installed as part of ‘apt-get’
Managed Gateway Router Nodes

- **Plan for releases**
  - 3 month cycle (11/2013, 2/2014, ...)
  - Testing of new releases
    - Unit testing of each individual package is done by owner of package
    - Integration testing to be done by WU
      - WU’s Open Network Lab (ONL) Testbed ([http://onl.wustl.edu/](http://onl.wustl.edu/))
  - More about this later...

- **Research Testbed vs. Reliable Managed Testbed**
  - What are we allowed to experiment with?
    - Strategy layer experimentation?
    - Caching and forwarding strategy experimentation?
    - Routing protocol experimentation?
  - ndnd development responsibilities
    - Strategy layer
    - Caching and Forwarding
    - Bug Fixes
    - Testing and Release
NDN Testbed Operations

- **Responsible Parties**
  - Washington U. Team will manage
    - Remote restarts
    - Remote updates
    - Remote configuration
  - Operator(s) at each site will be responsible for:
    - Physical Installation
    - Initial OS Installation
    - Manual interventions (power cycle, crash recovery, etc.)
    - Local user key signing
  - Testbed Root key management
NDN Testbed Operations (continued)

- **Status Monitoring**
  - We plan to consolidate and augment current status monitoring tools
    - Memphis: [http://netlab.cs.memphis.edu/script/htm/status.htm](http://netlab.cs.memphis.edu/script/htm/status.htm)
    - Arizona: [http://www.cs.arizona.edu/people/yifengl/tbs.html](http://www.cs.arizona.edu/people/yifengl/tbs.html)
  - Node status
  - Link status
  - ndnd status
    - Memory size?
    - etc...
  - Routing/Prefix/FIB status
  - etc...

- **Usage Monitoring**
  - Bandwidth
  - Investigate what ndnd internals can be monitored effectively
    - PIT entries?
    - Content store?
  - Application specific monitoring?
  - etc...
Current NDN Testbed
NDN Testbed Changes

- **Removal of WU SPP Nodes**
  - Special purpose ATCA chassis that were part of the GENI project
  - Located at Internet2 Sites
  - No longer feasible time-wise to maintain
  - Will not conform to new NDN-NP Testbed policy constraints

- **Change in participating sites**

- **Re-organization of inter-node links**
  - Three general regions:
    - California (UCLA, UCLA Remap, UCSD)
    - Continental Divide (Arizona, CSU)
    - Midwest (Michigan, Memphis, UIUC, WashU)

- **We already have requests from non-members to join**
  - Beijing and other sites in China
  - Paris and other sites in Europe
  - Others?
Proposed NDN-NP Testbed: Geographic View
All IPs have the form 10.0.x.y. Last two bytes shown in above diagram.
Each Site is assigned a /24 subnet
Each link is in a /30 subnet
  » Link 10.0.x.y/10.0.x.y+1 is in a subnet of 10.0.x.y-1 – 10.0.x.y+2
NDN Testbed Changes (continued)

- **Testbed size?**
  - Are there research goals that require a larger testbed?
  - Are there any research goals that should influence link choices?
    - Rich vs. sparse interconnection

- **Alternatives for adding more nodes**
  - Extra nodes at member sites
  - Non-member sites
  - EC2 Instances
NDN Testbed Integration Testing using the Open Network Lab (ONL)

- ONL is an Internet-accessible networking lab (onl.wustl.edu)
  - built around set of extensible gigabit routers
  - intuitive Remote Lab Interface makes it easy to get started
  - extensive facilities for performance monitoring

- Current Resources:
  - 14 highly configurable five port Network Processor based Routers
  - over 100 rack-mount computers that serve as end systems
    - including multicore servers with 8 cores and 48 cores
  - Support for ccnx

- In the works:
  - Support for ndnx
  - Support for VMs
  - 84 new machines (24 12 core, 60 2 core)
  - 12 5-port software routers
  - 8 2-port 10Gb/port (or 16-port 1Gb/port) software routers
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
NDN Testbed Topology in ONL for Testing