High-Performance Networking Research

VNOD: Virtual Network On Demand

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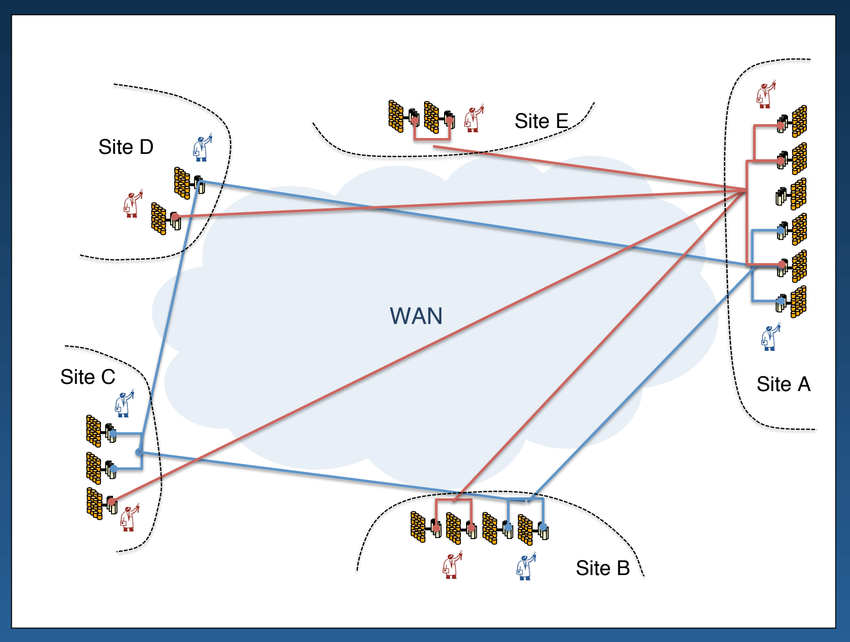
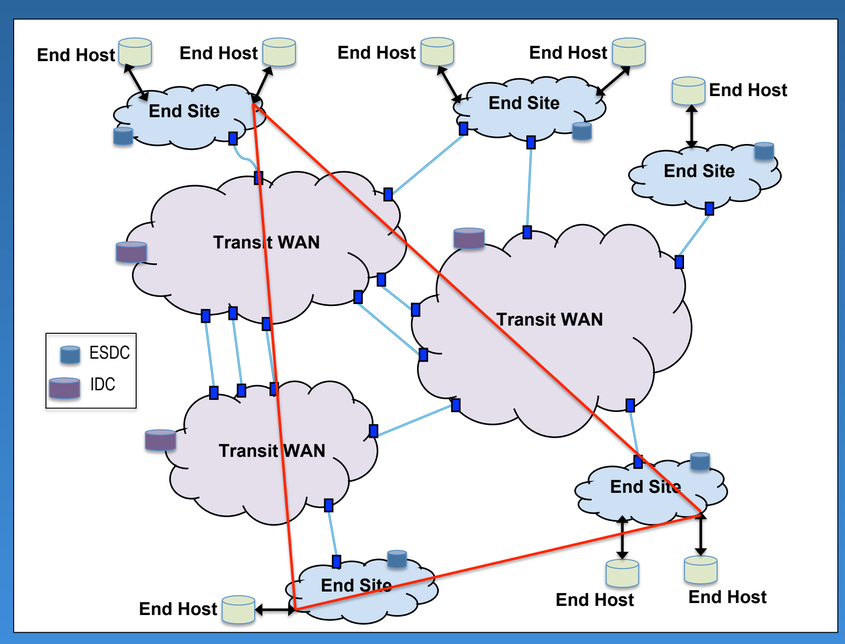
End Goal: Capability to create on-demand virtual networks with guaranteed QoS composed of end-to-end virtual paths
Each virtual network services a user community

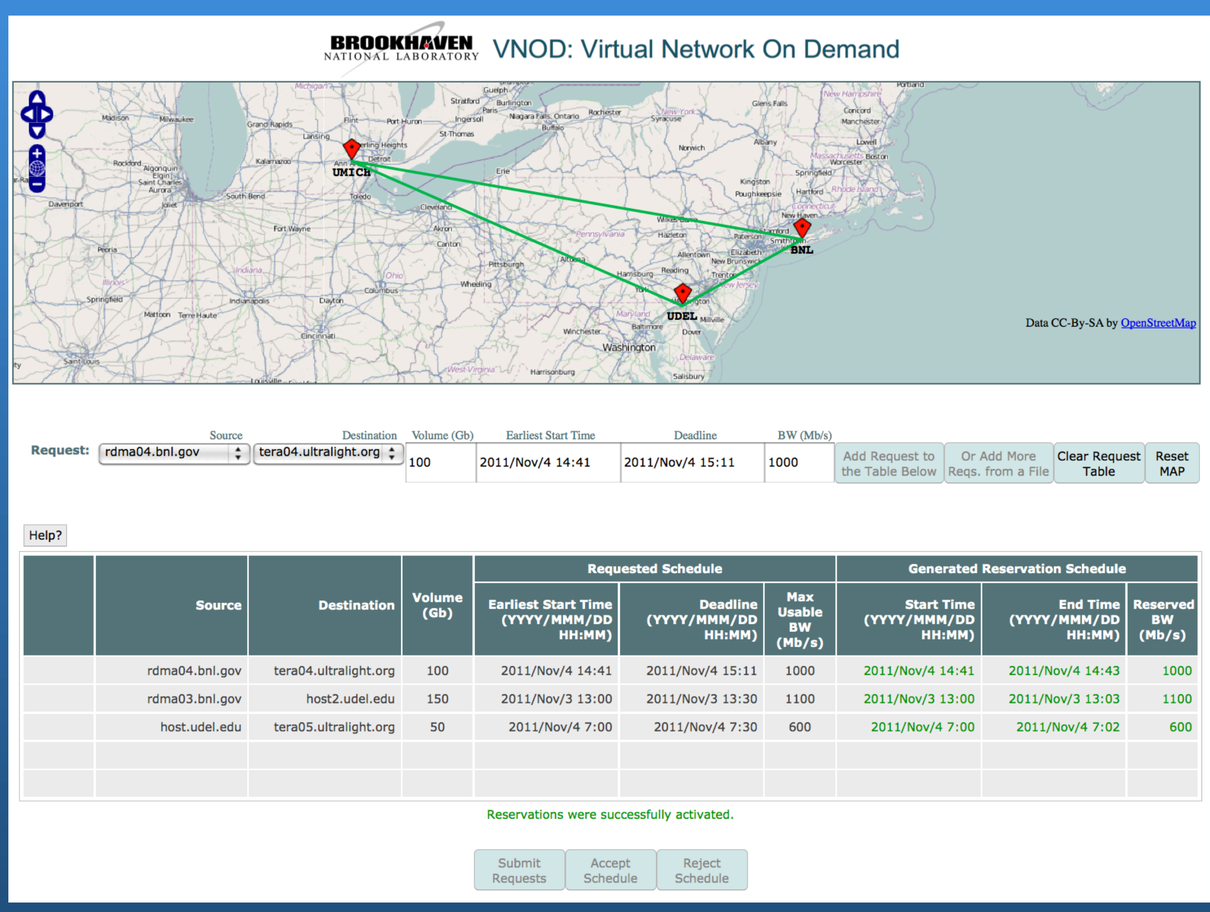
- What is the input, and how is it provided?
  - Flexible resource reservation requests between end hosts
  - Multiple requests
  - Each request can be between end hosts on different end sites
  - End sites are connected via WANs
  - A front end to submit requests
- What is the output?
  - Appropriate reservation schedule across domains to satisfy input requests
  - Results in a virtual network connecting given end hosts
  - Each link connecting two end hosts is a virtual link
  - End users should be unaware of underlying virtual links
- What to reserve (i.e., a reservation schedule)?
  - Need algorithms to calculate reservation schedules
  - RRA: Resource reservation algorithm [Sharma:SC]
    - Can accommodate multiple flexible requests on a given path
  - Others algorithms in progress
    - When path is not given.
    - When end points of separate requests are different.



Virtual Network Domains



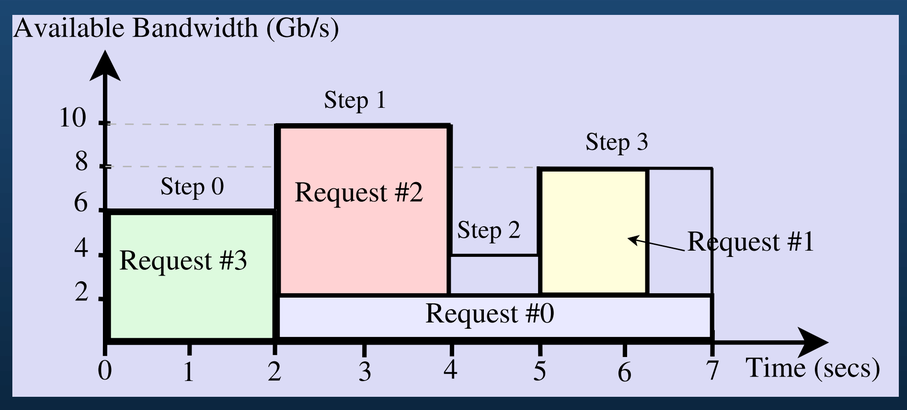
System Setup



How to reserve?

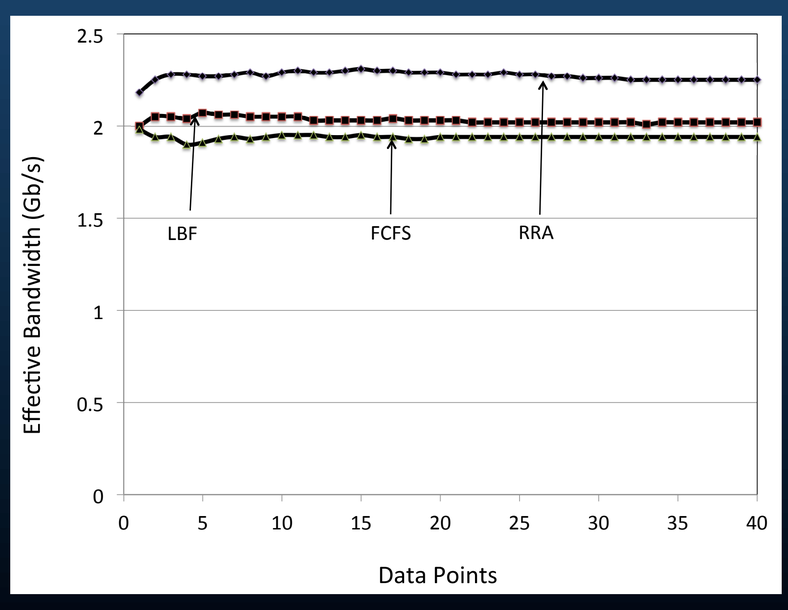
- A new framework to create an on-demand virtual network
  - Network controllers
    - End-Site Domain Controllers (ESDC)
      - TeraPaths
      - ESCPS
    - Inter-Domain Controllers (IDC)
      - OSCARS
  - Intelligent resource schedulers
  - Modular architecture
    - Capability to plugin different controllers and schedulers
- Challenges
  - Bandwidth availability changes over time
    - Maintaining such availability at end sites
    - Requesting availability from WANs
  - Each domain can have heterogeneous QoS capabilities
  - All encountered scheduling problems are NP-hard

Request Submission



An Example of Output Schedule

[Sharma:SC] S. Sharma, D. Katramatos, and D. Yu, "End-to-end network QoS via scheduling of flexible resource reservation requests," To appear ACM/IEEE Supercomputing Conference (SC), Seattle, WA, November, 12–18, 2011.



Advantage of Efficient Scheduling

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