The Internet2 Research and Development Agenda for 2010: The Year of End to End Deployment

Randall Frank
Chief Technology Officer, Internet2
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Being Honest With Ourselves

- Lots of great advanced technology out there deployed in pockets
- Great at custom demos that show off incredible bandwidth, high quality video, seemless authentication, …
- Not so great at making this all available to normal end users at their desks
- Users often need to become network experts to make all of this work

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Example Technologies

- High performance networking (reserved bandwidth, predictable QoS)
- Performance monitoring
- Authentication

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What's missing?

- Predictable deployment in a large scale end to end environment
- Technologies that work across the incredible diversity of networking infrastructures that are present within the R&E community
- Troubleshooting tools that enable end user to know what to do when things don't work

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2010: Concerted Effort to Move from Demos to Production

- Previous model: we did our work in the network core, now if only campuses and regionals would do their part…
- New model: joint effort to make technology work end to end
- Work with campuses and regionals to develop plans for funding and deployment

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High Performance Networking

- Goal: allow research users access to predictable high performance/high bandwidth flows
- Allow network be better handle needs of research users by capacity reservation

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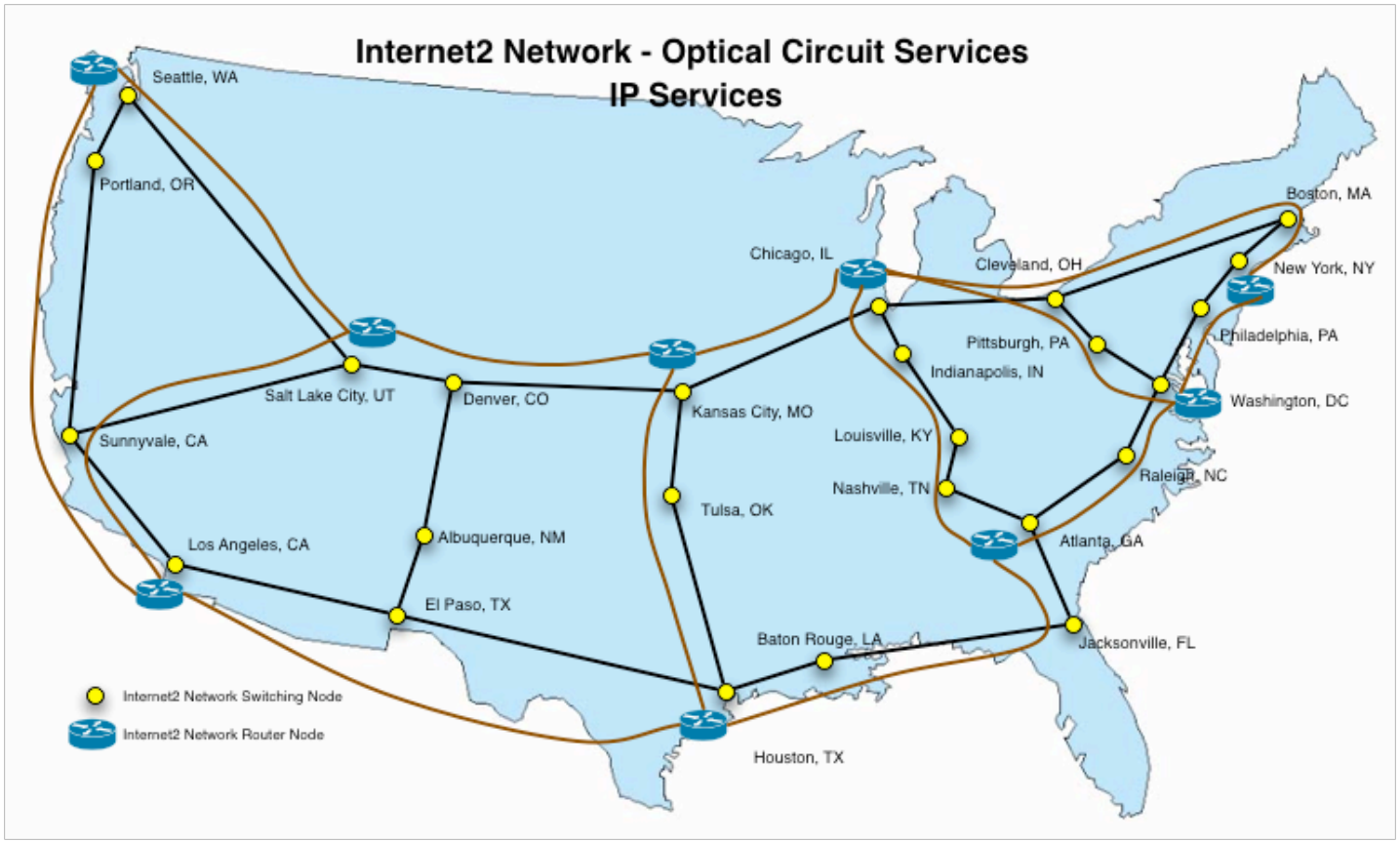
Internet2 Network - Optical Circuit Services
IP Services
Seattle, WA
Portland, OR
Salt Lake City, UT
Denver, CO
Sunnyvale, CA
Los Angeles, CA
Albuquerque, NM
El Paso, TX
Chicago, IL
Kansas City, MO
Tulsa, OK
Houston, TX
Baton Rouge, LA
Indianapolis, IN
Louisville, KY
Nashville, TN
Atlanta, GA
Jacksonville, FL
Cleveland, OH
Pittsburgh, PA
Raleigh, NC
Washington, DC
Philadelphia, PA
New York, NY
Boston, MA
Internet2 Network Switching Node
Internet2 Network Router Node

Some Experiments didn't have right scaling/deployment characteristics

- Implemented separate circuit based network for reserved capacity
  - Required separate interface(s) for downstream networks
  - Didn't integrate into financial or operational model, not financially viable given current funding models
  - Didn't deal with campus/regional issues
  - Physical vs. virtualized services
  - Required users to become network experts

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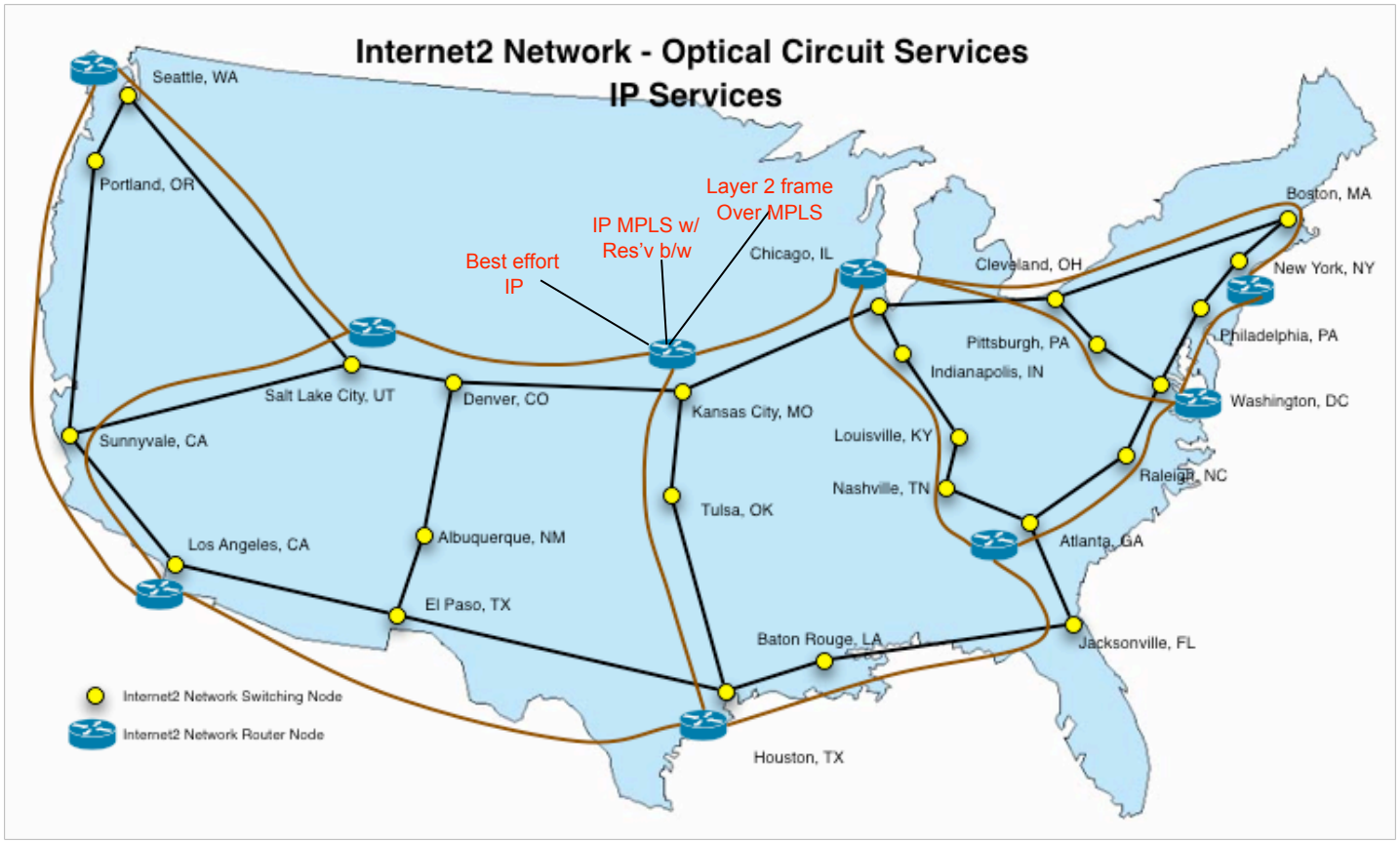
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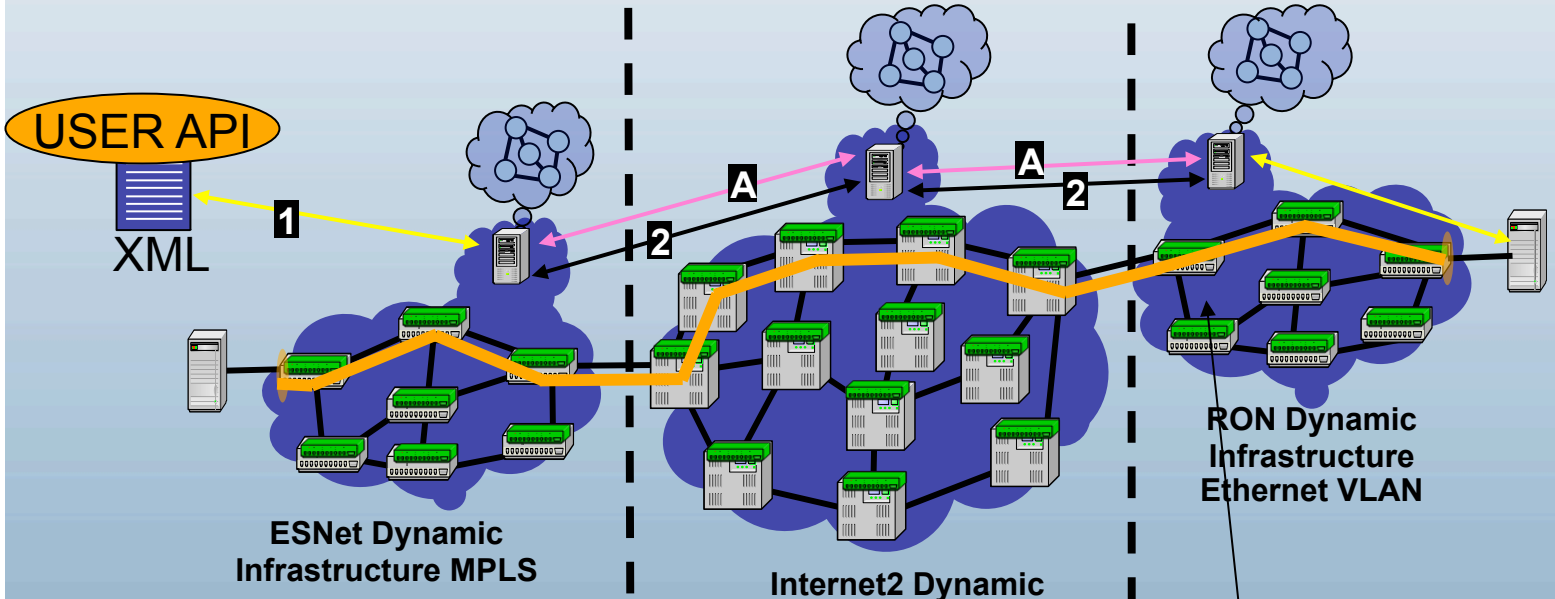
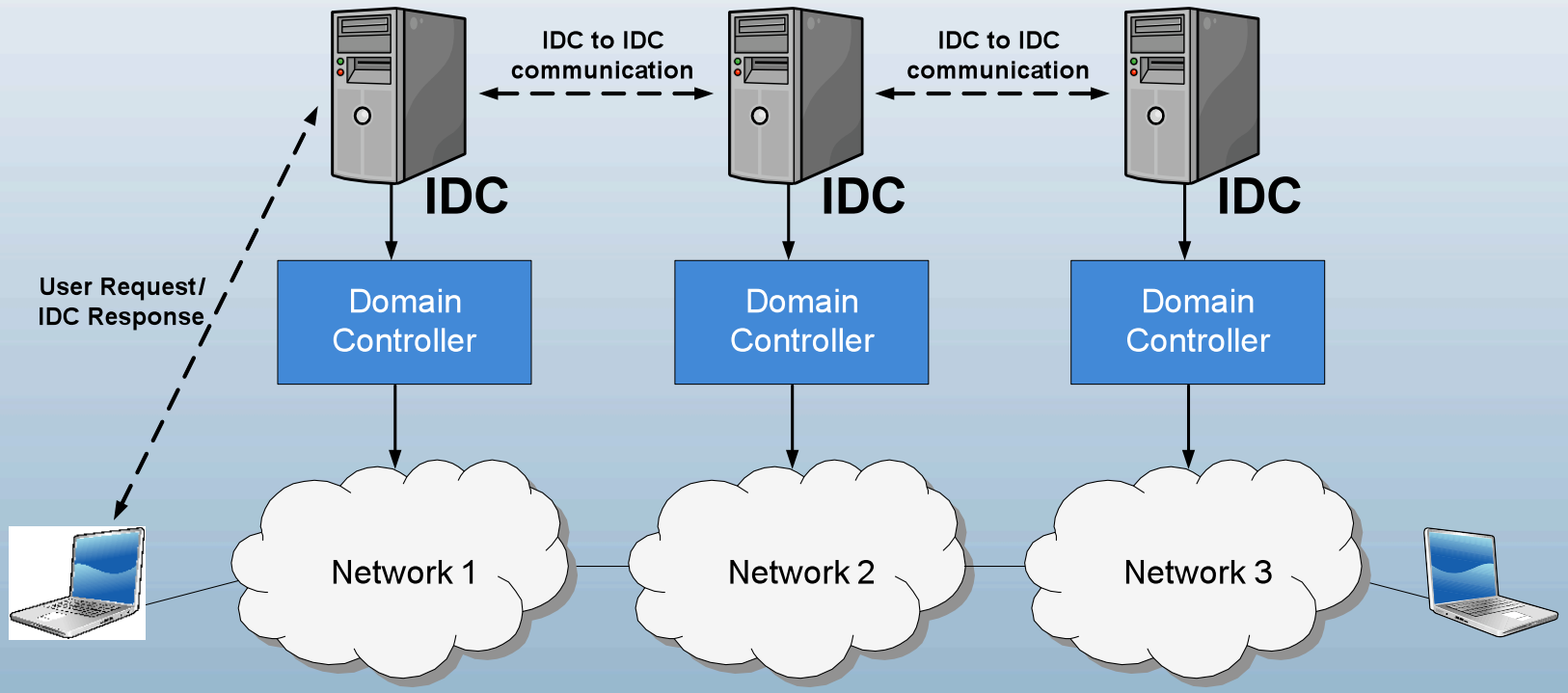
Cleveland, OH
Pittsburgh, PA
Indianapolis, IN
Raleigh, NC
Washington, DC
Philadelphia, PA
New York, NY
Boston, MA
Best effort IP
IP MPLS w/ Res'v b/w
Layer 2 frame Over MPLS
Internet2 Network Switching Node
Internet2 Network Router Node

ION Services InterDomain

- No difference from a client (user) perspective for InterDomain vs IntraDomain



DCN Control Plane



InterDomain Controller (IDC) Protocol (IDCP)

- Developed via collaboration with multiple organizations
  - Internet2, ESnet, GEANT2, Nortel, University of Amsterdam, others
- The following organizations have implemented/deployed systems which are compatible with this IDCP
  - Internet2 Dynamic Circuit Network (DCN)
  - ESNet Science Data Network (SDN)
  - GÉANT2 AutoBahn System
  - Nortel (via a wrapper on top of their commercial DRAC System)
  - Surfnet (via use of above Nortel solution)
  - LHCNet (use of I2 DCN Software Suite)
  - Nysernet (use of I2 DCN Software Suite)
  - University of Amsterdam (use of I2 DCN Software Suite)
  - DRAGON Network

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Performance Measurement

- Perfsonar
  - Widely adopted framework for exchange of network measurement data
  - Joint development of ESNET, Internet2, GEANT2, RNP and others
  - Goal: allows users world-wide to obtain data on end-end performance of a network path

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Successes

- Gaining widespread acceptance across diverse networks and communities
- Extensive deployment within some networks (e.g., ESNET)

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Limitations

- Not ubiquitous – users can't rely on available of data collection points
- Implementation somewhat complex
  - Lack of standard, low cost deployment devices
  - Authorization environment still lags
- End user friendly analysis tools

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2010 Goals

- Low cost deployment kits
- Work with (virtual) communities to spur deployment
- Partner with other orgs that have specialized expertise (Gloriad?)
- Work with vendors to build Perfsonar collection into network devices

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Authentication

- Shiboleth: international R&E standard for federated authentication
  - Each campus continues to use local authentication environment
  - SAML based
  - Allow inter-campus trust (within federation) of other campus authentication assertions
  - InCommon: US Federation, 300+ campuses

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Inter-Federation Authentication

- EduGain – allows for trust relationship between federations
- EduRoam – service that allows for shared access to campus wireless services (Europe deploying, under investigation in other locations)

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Goals for 2010

- “productize” InCommon Federation in US
- Gain acceptance outside of R&E for R&E authentication
  - US Federal government acceptance of InCommon for US Gov’t authentication of academic users
- Eduroam expansion
- Expansion of services using Shib
  - Today primarily web based authentication
  - Deployment within other API services (e.g., Perfsonar)

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Lots of possibilities for US/China Cooperation

- Extension of IDC services between US and Chinese R&E networks
- Perfsonar deployment
- EduGain/EduRoam possible deployments
- Others …

Thank You