INTERNET 2

Open Health Tools

San Diego Meeting, Sept 8-9, 2011

Michael Sullivan, M.D.

Internet2: Community, Initiatives, and OHT
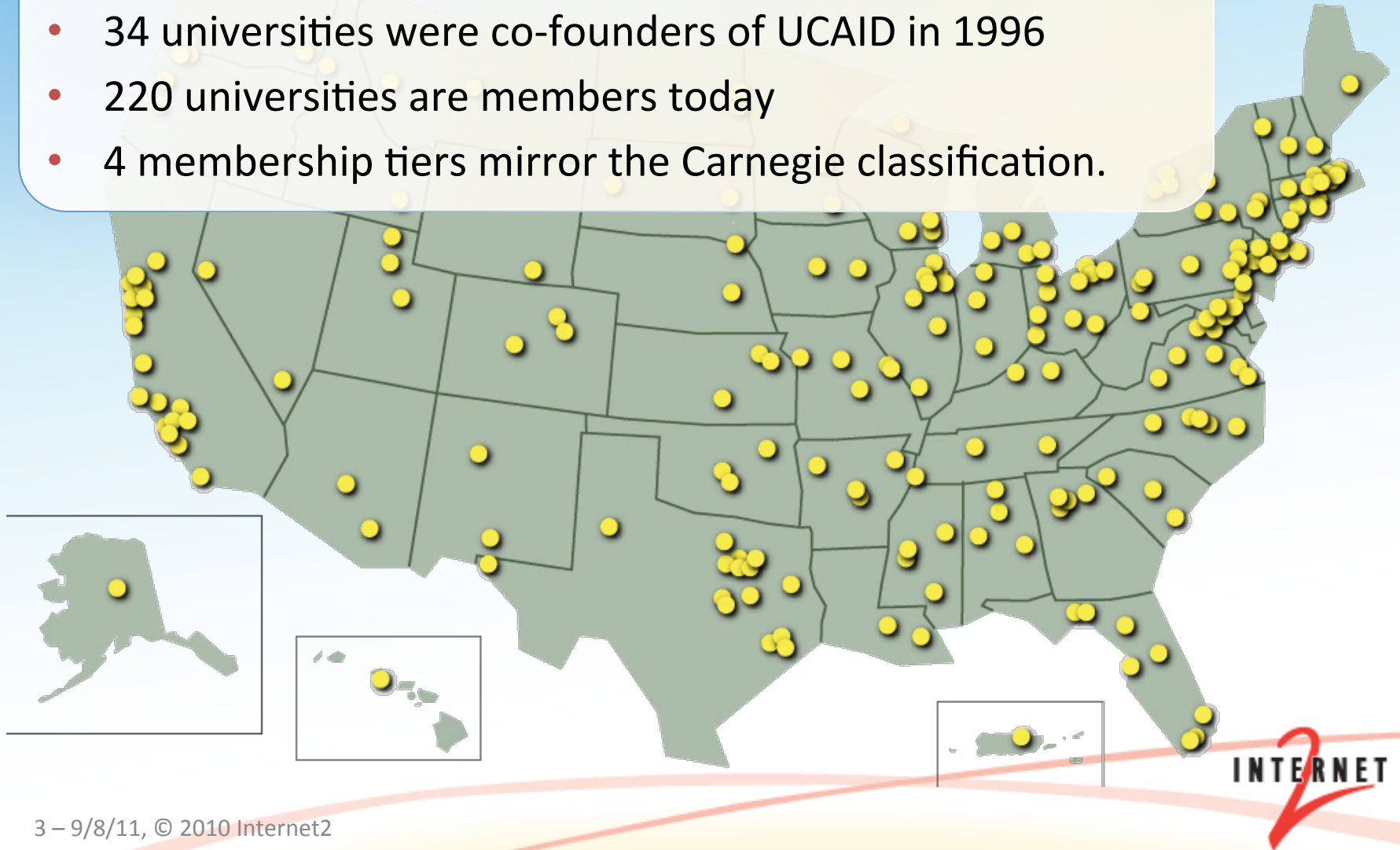
Internet2 Community

350 Member Institutions

100 International Partners

65,000 Community Anchor Institutions

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Higher Education Members

- Universities form the core group of Internet2 members.
- 34 universities were co-founders of UCAID in 1996
- 220 universities are members today
- 4 membership tiers mirror the Carnegie classification.

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Industry Members

- 40 members from industry
- Partners with R&E community
- Advanced network development
- Tech transfer
- Membership level based on annual revenues

Affiliate Members

- 60 Affiliate members
  - Government agencies
  - Non-profits oriented to research and education

- Membership levels based on annual operating budgets

US Dept of Veterans Affairs (VA)
Howard Hughes Medical Institute
Library of Congress
National Geographic
National Institutes of Health (NIH)
Nat'l Oceanic & Atmospheric Admin (NOAA)
National Science Foundation (NSF)
The World Bank
United Nations System of Organizations (UN)
US Antarctic Program (USAP)
US Dept of Energy ESnet
ESnet Laboratories
Federal Highway Admin, Turner-Fairbank Center
Jet Propulsion Lab
Los Almos National Lab
NASA Goddard Space Flight Center
Nat'l Institute of Standards & Technology (NIST)
The Children's Hospital of Philadelphia
US Department of Commerce, Boulder Labs
Coalition For Networked Information (CNI)
Desert Research Institute
EDUCAUSE
Healthcare Info & Mgmt Sys Society (HIMSS)
Indian Health Service
Indiana Higher Education Telecom System
Internet Educational Equal Access Foundation
Laboratory for Telecom Sciences (LTS)

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Connector & Regional Network Members

- ## 22 Connectors
  - Nodes on the Internet2 backbone

- ## 35 Regional Networks
  - Sub-state, state or multi-state

Pacific Northwest
IP (10 GigE)
8 Participants

Oregon Gigapop
IP (2x5 GigE)
3 Participants

MREN
IP (2.5 Gbps)
8 Participants

Merit Network
IP (2x10 Gbps)
16 Participants
ION Enabled

NOX
IP (2x10 Gbps)
20 Participants
ION Enabled

NYSERNet
IP (1 GigE)
14 Participants
ION Enabled

CIC OmniPoP
IP (2x10 Gbps)
12 Participants
ION Enabled

Indiana GigaPOP
IP (10 GigE)
7 Participants

MAGPI
IP (2x5 Gbps)
11 Participants
ION Enabled

University of Utah/UEN
IP (2x10 GigE)
6 Participants
ION Enabled

GPN
IP (2x10 Gbps)
21 Participants
ION Enabled

KyRON
IP (10 GigE)
2 Participants
ION Enabled

Drexel University
IP (1 GigE)
1 Participant

MCNC / SCGPoP
IP (2x10 GigE)
7 Participants

CENIC
IP (2x10 Gbps)
37 Participants
ION Enabled

University of Memphis
IP (10 GigE)
1 Participant

FLR/SOX
IP (2x10 Gbps)
24 Participants

MAX
IP (2x5 Gbps)
29 Participants
ION Enabled

3ROX
IP (1 GigE)
5 Participants

- Connector Site
- Router Site

LEARN
IP (10 GigE)
15 Participants
ION Enabled

LONI
IP (10 GigE)
6 Participants
ION Enabled

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International Partnerships

- Agreements with over 100 international networks
- Enabling collaboration between U.S. researchers and overseas counterparts

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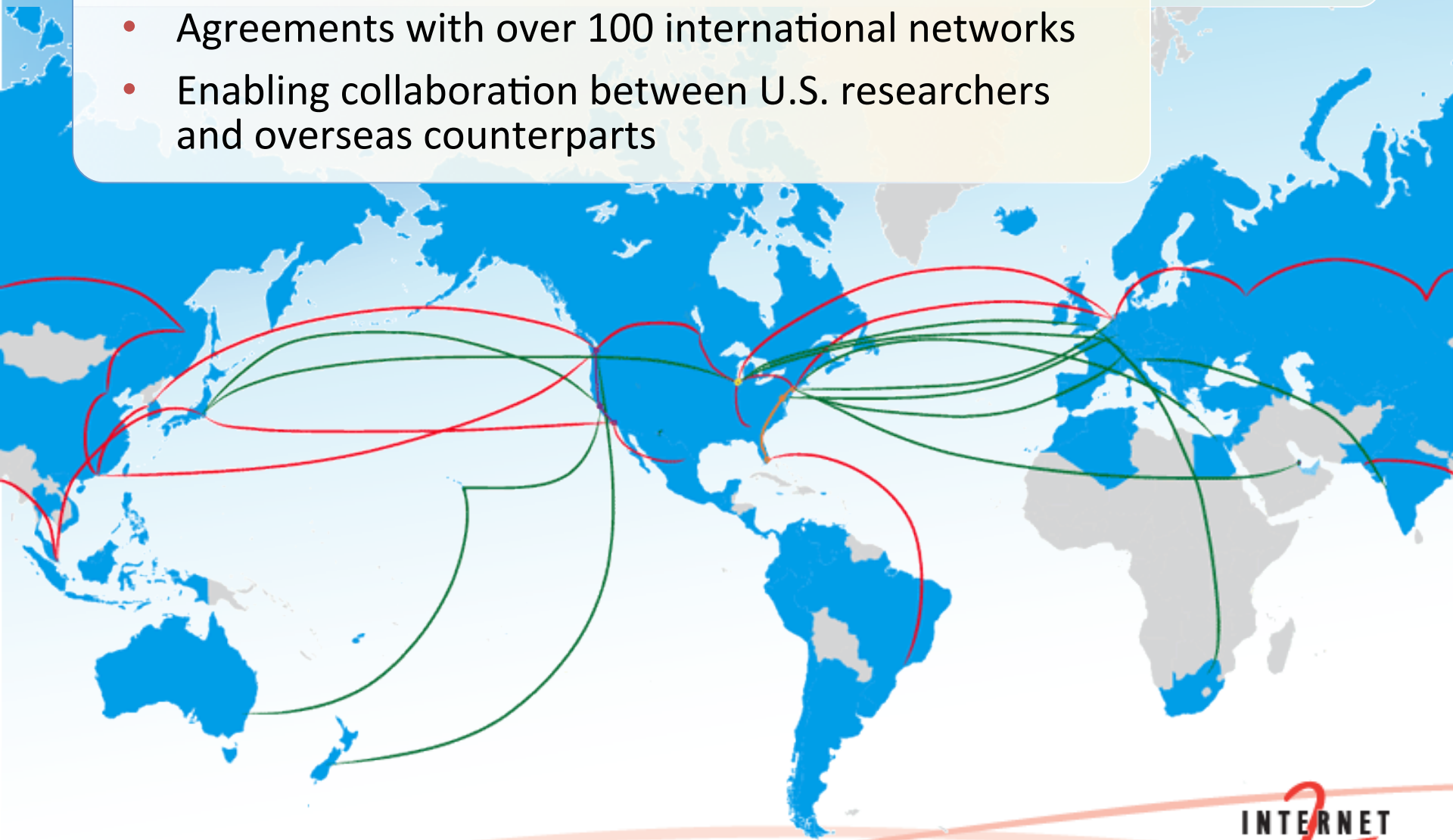
Connected Global R&E Networks

AFRICA
Algeria (ARN)
Kenya (KENET)
Malawi (MAREN)
Morocco (MARWAN)
South Africa (TENET)
Tanzania (TERNET)
Tunisia (CCK)
Uganda (RENU)

AMERICAS
Argentina (INNOVA|RED)
Brazil (RNP2/ANSP)
Canada (CAnet 4)
Chile (REUNA)
Colombia (RENATA)
Costa Rica (RedCONARE)
Ecuador (CEDIA)
El Salvador (RAICES)
Guatemala (RAGIE)
Mexico (CUDI)
Panama (RedCyT)
Peru (RAAP)
Trinidad (Univ. of the West Indies)
Uruguay (RAU2)
Venezuela (Reacciun2)

ASIA and PACIFIC
Australia (AARNET)
China (CERNET, CSTNET, NSFCNET)
Fiji (USP-SUVA)
Hong Kong (HARNET)
India (ERNET)
Indonesia (ITB)
Japan (SINET, WIDE, JGN2)
Korea (KOREN, KREONET2)
Malaysia (MYREN)
New Zealand (KAREN)
Pakistan (PERN)
Philippines (PREGINET)
Singapore (SingAREN)
Taiwan (TANet2, ASnet)
Thailand (UniNet, ThaiSARN)
Vietnam (VinaREN)

CENTRAL & SOUTHWEST ASIA
Armenia (ASNET-AM)
Azerbaijan (AzRENA)
Georgia (GRENA)
Kazakhstan (KazRENA)
Kyrgyz Republic (KRENA)
Tajikistan (TARENA)
Turkey (ULAKBIM)
Turkmenistan (TuRENA)
Uzbekistan (UzSciNet)

EUROPE
Albania (ASA/INIMA)
Andorra (Univ. of Andorra)
Austria (ACOnet)
Belarus (BASNET, UNIBEL)
Belgium (BELNET)
Bosnia-Herzegovina (BIHARNET)
Bulgaria (ISTF)
Croatia (CARNet)
Cyprus (CyNET)
Czech Republic (CESnet)
Denmark (Forskningsnettet)
Estonia (EENet)
Finland (Funet)
France (RENATER)
Germany (X-WiN)
Greece (GRNET)
Hungary (NIIF/HUNGARNET)
Iceland (RHnet)
Ireland (HEAnet)
Italy (GARR)
Latvia (LATNET)
Lithuania (LITNET)
Luxembourg (RESTENA)
Macedonia (MARNet)
Malta (UofM/RicerkaNet)
Moldova (RENAM)
Montenegro (MREN)
Netherlands (SURFnet)

EUROPE cont'd
Norway (UNINETT)
Poland (PIONIER)
Portugal (FCCN)
Romania (RoEduNet)
Russian federation (RBnet, RUNNET)
Serbia (AMRES)
Slovakia (SANET)
Slovenia (ARNES)
Spain (redIRIS)
Sweden (SUNET)
Switzerland (SWITCH)
Ukraine (URAN)
United Kingdom (JANET)

MIDDLE EAST
Egypt (EUN/ENSTINET)
Israel (IUCC)
Jordan (JUNet)
Palestinian Territories (Birzeit
        Univ./Al-Quds Open Univ.)
Qatar (Qatar FN)
Syria (HIAST)
United Arab Emirates (ANKABUT)

MULTINATIONAL NETWORKS
APAN
GEANT2
NORDUnet
redCLARA
UbuntuNet

INTERNET2

Open governance process and structure

- Board of Trustees
  - elected by members
  - provides strategic direction, leadership and oversight

- Four Advisory Councils
  - offer strategic guidance
  - set priorities
  - nominated by Level 1–3 members

Advisory Councils include:

Applications, Middleware and Services Advisory Council (AMSAC)

Architecture and Operations Advisory Council (AOAC)

External Relations Advisory Council (ERAC)

Research Advisory Council (RAC)

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Initiatives

- Network Research
- Middleware
- Arts and Humanities
- Security
- Science and Engineering
- K20
- Health Sciences

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Network Research Initiative

- **GENI** - Global Environment for Network Innovations
  - NFS funded
  - Virtual lab for network research at scale

- **Phoebus** – High-Performance Data Transfer
  - Supports Dynamic Circuit Networks like ION

- **perfSONAR** –Performance Measurement
  - Open performance monitoring framework
  - Department of Energy, Internet2, GEANT, RNP

- **NDDI** – Network Development and Deployment Initiative
  - Stanford University, Indiana University, Internet2
  - Software Defined Networking (SDN)
  - OpenFlow protocol
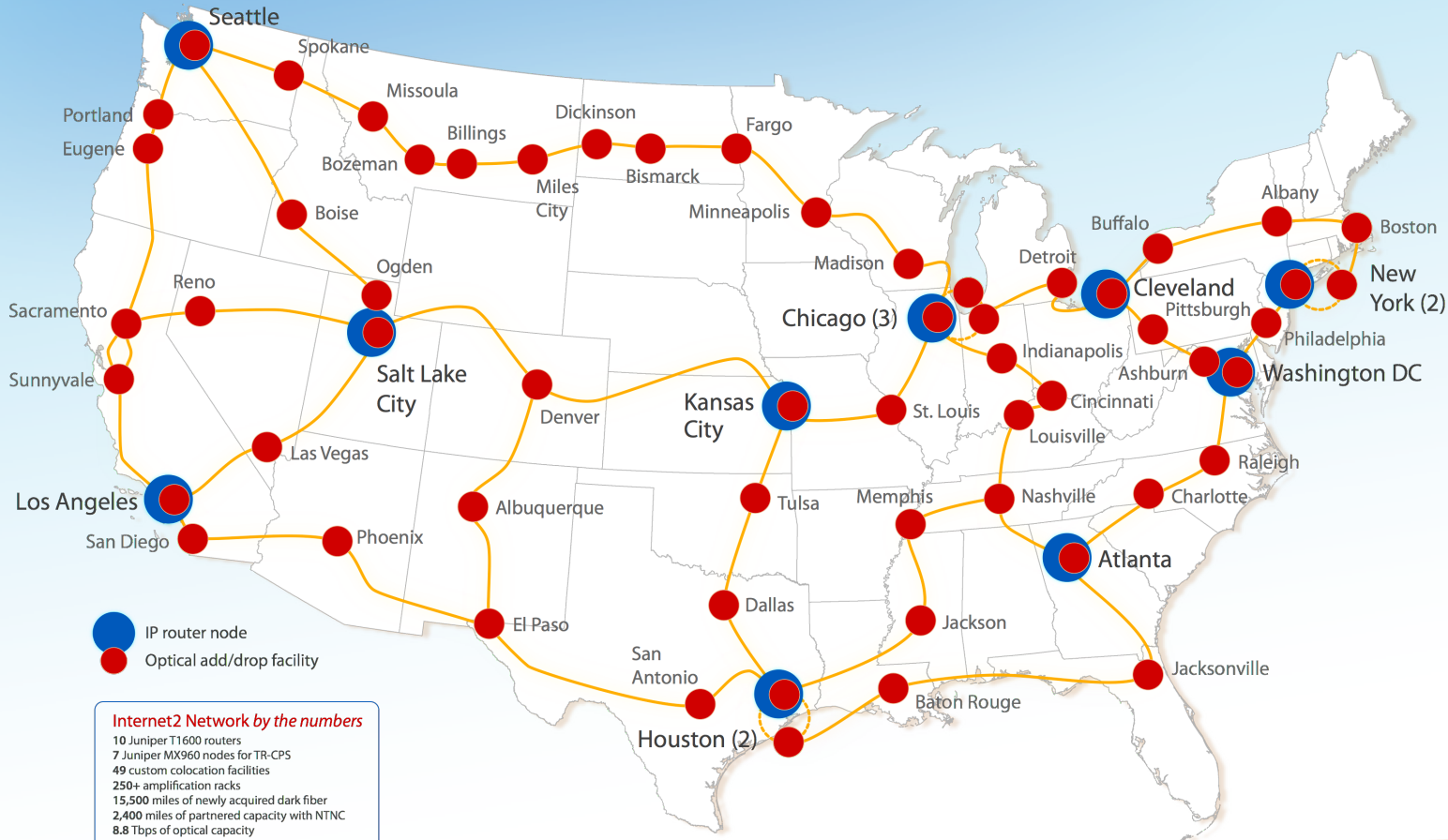 - Open Science, Scholarship and Services Exchange

version: 3.1

performance

pS

toolkit

INTERNET 2

Advanced Production and Research Network

Internet2 Planned 100 Gigabit Infrastructure Topology (DRAFT)
Draft – Last updated 04/10/11

Internet2 Network *by the numbers*
10 Juniper T1600 routers
7 Juniper MX960 nodes for TR-CPS
49 custom colocation facilities
250+ amplification racks
15,500 miles of newly acquired dark fiber
2,400 miles of partnered capacity with NTNC
8.8 Tbps of optical capacity
100 Gbps of IP capacity
300+ Ciena ActiveFlex 6500 network elements

- IP router node
- Optical add/drop facility

Middleware Initiative

- Goal:
  - Simplify secure access to online resources
- Projects:
  - Shibboleth® Federated Single Sign-On software
  - Grouper™ Groups Management Toolkit
  - COmanage collaborative organization management platform
- Working groups

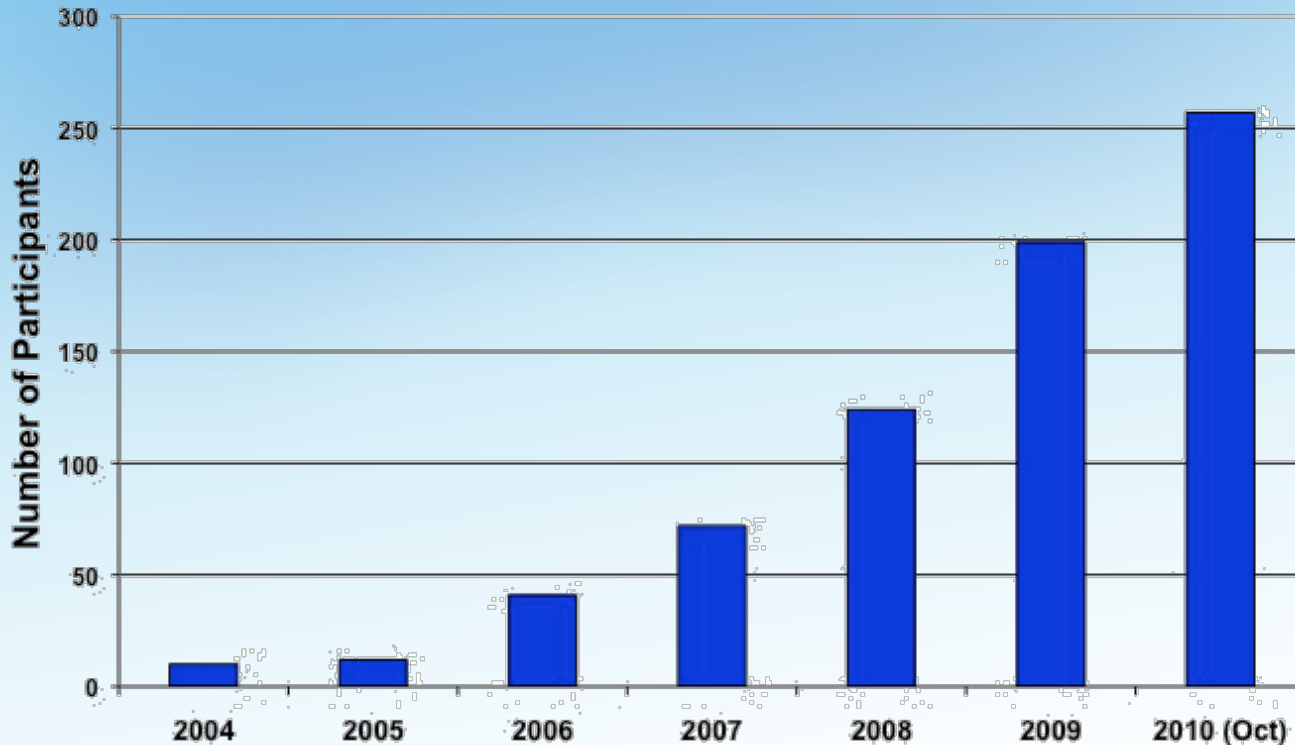

Shibboleth®

Grouper™

COmanage™

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InCommon Federation

- U.S. identity and access management federation for higher education

- Addresses
  - Legal / Policy Agreements
  - Level of Assurance (LOA)
  - Shared attributes
  - Business proposition

- Participants
  - Universities
  - Service/Resource providers
  - Government agencies
  - Laboratories

InCommon Federation Growth

Adoption history:
2004: **10** (pilot)
2005: **12**
2006: **41**
2007: **72**
2008: **124**
2009: **200**
2010: **257**

InCommon categories:
HE: 186
(5 million end users)
Partners: 74
(NIH, NSF, Labs, TeraGrid,
K12 School Pilot,
Marketplace of applications)

Security Initiative

- Advanced applications challenge security

- EDUCAUSE/Internet2 Higher Education Information Security Council

- Affiliations
  - Salsa
  - Middleware Initiative

Working Groups and SIGs

Disaster Planning and Recovery (Salsa-DR)

Computer Security Incident (Salsa-CSI2)

DNSSec SIG

NetGurus

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Science & Engineering Initiative

- Researchers collaborate in global labs today.

- Outreach partnerships:
  - Large Hadron Collider (LHC)
  - Electronic Very Long Baseline Interferometry (eVLBI)
  - Laser Interferometer Gravitational-Wave Observatory (LIGO)
  - Open Science Grid (OSG)

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K20 Initiative

- Community Anchor Institutions (CAIs) include:
  - primary and secondary schools
  - community & vocational colleges
  - public libraries
  - healthcare institutions
  - museums, zoos and aquariums

- >65,000 CAIs connect to Internet2 through state and regional networks.

Broadband Technology Opportunity Program (BTOP)

- National Telecommunications and Information Agency (NTIA) awarded $4 Billion to 233 projects as part of its BTOP program.

- BTOP focused on funding middle mile networks to serve CAIs.

- BTOP extends broadband access to:
    - 3,000 healthcare organizations
    - 5,000 public safety entities
    - 7,000 K-12 schools
    - 600 community colleges
    - 2,000 libraries
    - 5,000 government facilities
    - 700 other institutions

- $62 million awarded to Internet2 and partners to:
    - upgrade Internet2 backbone to 100 Gbps
    - create the U.S. Unified Community Anchor Network (U.S.UCAN).

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U.S.UCAN

United States Unified Community Anchor Network

- Project of Internet2 to support CAI advanced networking.
- Leverages the Internet2 network backbone
  - IP Network with 100 gigabit capacity
  - Optical Network 8.8 terabit capacity
- Connects CAIs, BTOP networks, and regional networks
- Aims to connect 130,000 more CAIs to Internet2.
- Enables applications that require advanced networking.

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Health Sciences Initiative

Communities and organizations engaged with the Internet2
Health Sciences Initiative

- Research
  - NIH (NLM, NCI, Cancer Centers)
  - Centers for Disease Control (CDC)
  - Global Virus Network (GVN)

- Education
  - Academic Health Centers
  - Medical Schools

- Health Care
  - FCC Rural Health Care Pilot Program (RHCPP) participants
  - BTOP Networks and U.S. UCAN
  - Indian Health Service (IHS)
  - Veterans Affairs (VA)

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Seven Strategic Focus Areas

Advanced network and network services leadership

Net+ services "above the network"

U.S. UCAN

National/Regional collaboration

Global reach and leadership

Research community development and engagement

Industry partnership development and engagement

Two Communities – Two Strategies

	Biomedical Researchers	Rural Health Care Providers
Global Reach	NRENs, Global Research VOs	
Research Community	NCI, CDC, WHO, GVN	
Industry Partnerships	Cisco, OHT, OHSL	Box.net, SaaS EHR vendors
Net+ Services		Cloud services
U.S. UCAN		BTOP and RHCPP networks
Advanced Network		
Regional Collaboration		

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Strategy for Biomedical Researchers

Cyberinfrastructure for global health research.

- Proposed Working Group
  - Cancer Centers
  - National Cancer Institute (NCI)
  - Centers for Disease Control (CDC)
  - World Health Organization (WHO)
  - Global Virus Network (GVN)

- Prioritized Services
  - Collaboration Tools – I2 Cloud Video Services
  - Bulk data transport – Science DMZ
  - Middleware – Federated IdM, COmanage, perfSONAR

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Strategy for Rural Health Care Providers

Cloud services for rural health care providers.

- Proposed Working Group
  - 6 FCC RHCPP networks (7 more expected this year)
  - Health care CAIs
  - BTOP networks
  - VA and IHS facilities

- Prioritized Services
  - Backup storage service – Box.net functionality
  - EHRs – SaaS EHR vendors, e.g. Healthland for CAHs
  - Bulk transport for images, genomes?
  - HIE / HISP services?
  - Telemedicine services?

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Thank you.

- General Information
  - Internet2:   http://www.internet2.edu
  - U.S. UCAN: http://www.usucan.org
  - Info Kit: http://www.internet2.edu/info

- Internet2 Health Sciences

  - Contact: Michael Sullivan, MD
                          msullivan@internet2.edu

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