


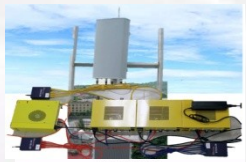
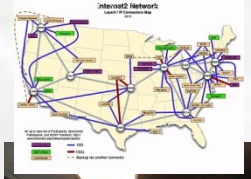


GENI: Future Planning: Key Issues

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GENI Engineering Conference (GEC 24)
Arizona State University
March 8-9, 2016

NSF: Sponsored by the National Science Foundation

GENI Concepts

- GENI Is a Research Instrument.
- Scientists Have a Long History of Creating Their Own Instruments for Their Research (e.g., Galileo & His Telescope, Antonie van Leeuwenhoek and His Microscope)
- GENI Must Be Designed/Operated/Governed *By Researchers For Researchers.*

First Principles

- Providing a Clean Slate Remains Critically Important.
- Existing Implemented Production Infrastructure (Static/Calcified) Is a Major Barrier To Innovation.
- Network Researchers Must Be Able To Design, Implement, and Operate Their Own Instruments -- Knowledge Discovery Environments .
- High Energy Physics: Synchrotrons.
- Astrophysics/Astronomy: Telescopes.
- Oceanography: Ocean Observatories

Advanced Photon Source

APS At Argonne National Laboratory, Argonne, Illinois

Case Study: Astrophysical Research Consortium

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- Astrophysical Research Consortium (ARC)
- Purpose: Design, Build, and Operate the Apache Point Observatory Located In The Sacramento Mountains in Sunspot, New Mexico (With an Initial Specific Focus On Building a 3.5 m Telescope)
- ARC Was Established In 1984 – Over 30 Years Of Successful Scientific Discovery
- Founding Members:
  - New Mexico State University, University of Washington, University of Chicago, Princeton University, and Washington State University (No Longer a Member).

Case Study: Astrophysical Research Consortium

- Astrophysical Research Consortium (ARC)
- Current Members:
  - New Mexico State University, University of Washington, University of Chicago, Princeton University, the Institute for Advanced Study, Johns Hopkins University, University of Colorado, University of Virginia, and Georgia State University.
- Expanded Mission: .5 m Telescope, 1 m Telescope, 2.5 m Telescope
- Building Construction Started 1985,
- Full Operations of Telescope November 1994 (Problems With Mirror Fabrication)

Case Study: Astrophysical Research Consortium

- Who makes scientific decisions? Scientists
- Who makes financial decisions? Scientists
- Funding:
  - 3.5 m = Consortium
  - .5 (ARCSAT) = Consortium
  - 2.5 (SDSS) = Consortium and Others
  - 1 m = New Mexico State University
- Provides a “Platform” For Multiple Science Projects, e.g., SDSS, Not Only Physical Resources, But Also, A Framework for Processes, Policies, and Procedures

Case Study: Astrophysical Research Consortium

- Decision Making
  - Board of Directors (Faculty)
  - Administrative Board (Faculty)
- Costs
  - Instrument $8.8 Million
  - Faculty and Students $1.2 Million
- Funding Sources:
  - ARC Non-Federal Funds: $3.2 million
  - Consortium Funds: $1.2 Million
  - NSF: $5.6 Million
- ARC Today Is Still Is Advancing Science

Desirable Characteristics of Possible Future GENI Consortium

- The Mission of A Research Consortium Must Be Solely To Advance The Mission Of The Consortium – and Not Be Diluted By Other Missions
- Strategies To Best Simultaneously Address Both Sustainability and Ongoing R&D
  - Sustainability Dimensions
    - Ideas/Concepts/Innovations
    - Optimal Technology Refresh
    - Community
    - Financials

An Environment for New Knowledge Discovery

- A Open, Deeping Programmable Highly Extendible Highly Distributed Environment --- A Platform Optimized For New Knowledge Discovery.
- Platform – Stable, Reliable, But Able To Quickly Expand & Evolve
- Instruments Are Created Within a Fundamentally Different Value System Than IT Production Environments
- Open Architecture, Open Source, Open Interfaces, Open Inter-Operability, Open Services
- No Preconceptions About The Future Should Be Inherent Within The Design.

Exstensibility-Extendibility

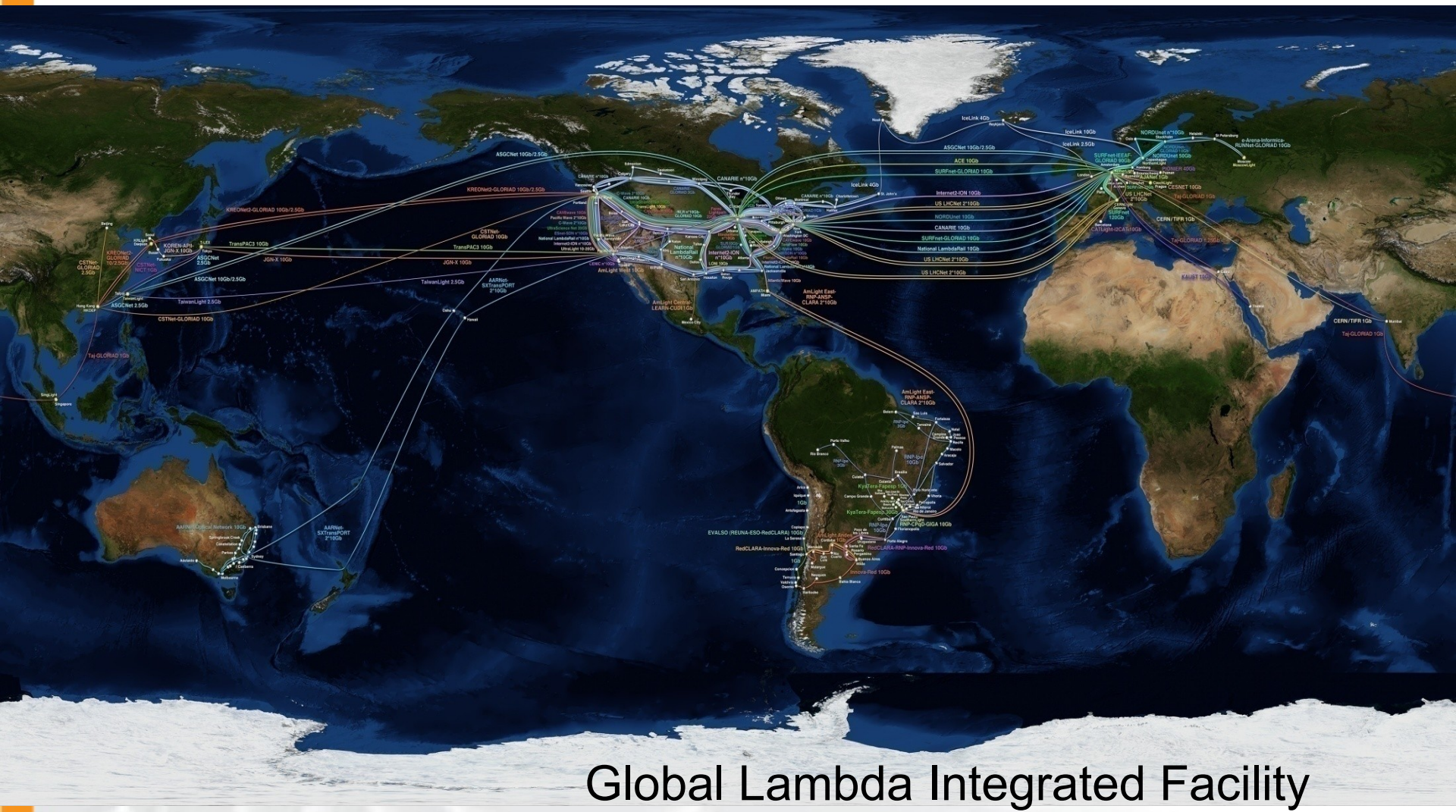
- Expansion To/Integration With Other Environments, Nationally and Internationally
  - Software Defined Network Exchanges (SDXs)
  - Software Defined Infrastructure (SDI)
  - NSFCloud Testbeds (Chameleon, CloudLab)
  - Optical/Photonics
  - Distributed Science Research Environments
  - Smart Cities
  - US Ignite
  - Digital Manufacturing and Design Innovation
  - Instrumentation, Including Science Instrumentation
  - Sensor Based Environments
  - FIRE/SAVI/Next Generation Internet Testbeds, Future Internet Testbeds, Open Science Data Cloud, Etc.
  - Cyberphysical Systems

Community Opportunity: An Environment for New Learning

- GENI Is Also An Important Educational Tool
  - Basic & Advanced Fundamental Concepts.
  - Methods Of Designing, Conducting, Analyzing and Describing Replicable Research Experiments.
  - Techniques For Innovation
  - Theories of Network Science – An Examination of Fundamental Concepts
  - Explorations of Basic Network Design Concepts (e.g., vs Applied Engineering)

Community Opportunity: The International GENI

- GENI Must Be International (G=Global!)



Community Opportunity: Industry

- Benefits/Challenges Of Drawing Membership Academic v. Industry Institutions
  - Benefits
    - All Dimensions: Ideas/Technology Refresh/ Community/Financial
  - Challenges
    - High Risk vs Minimal-No Risk
    - Long Term vs Short Term Perspective
  - All Variables Depend On The Type of Corporate Research Center That Is Involved (& Partners Should Be Corporate Research Centers)

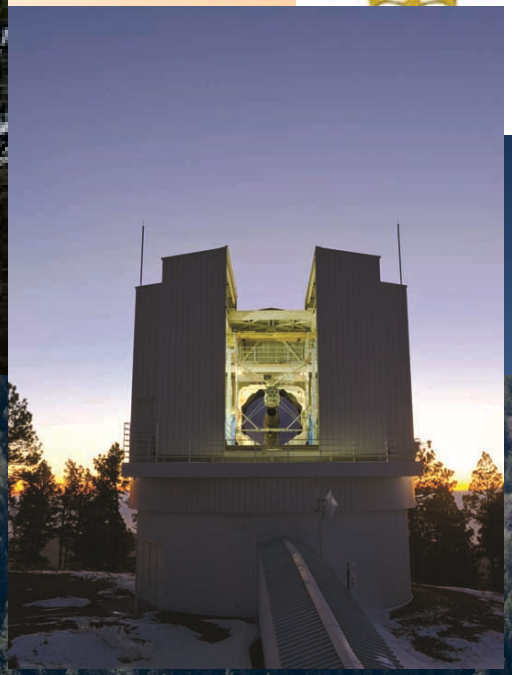
Community Opportunity: Close Integration of Research Science Workflows and Foundation Network Capabilities

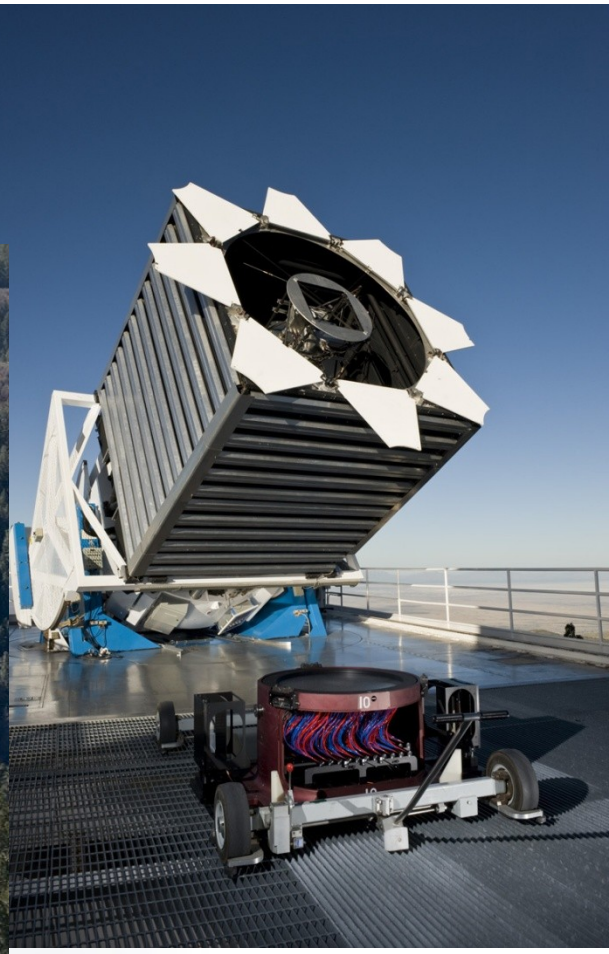
- Opportunity: Using GENI To Develop Innovative Techniques for Extremely Close Integration of Research WorkFlows and Dynamic Programmable Network Resources
- Precision Workflows Enabled By Precision Networking
- Especially For Big Data Science

Financials And Sustainability

- Budget Should Be As Minimal As Possible: Covering Only Essential Components
- Such Minimization Allows For Wide Participation By Contributors (i.e., N/D With Small N and Very Large D
- This Also Assists To Achieve Real Financial Sustainability Over Time
- NB: The Entity That Pays Should Be Carefully Selected (Old Adage: “The Person Who Pays The Piper Names The Tune”)

Thanks!





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