

GENI Optical Workshop

9-25-07

Outline

Why GENI?

What is GENI?

Status

GENI and 'Optical'

Next Steps...

**GENI - 'Global Environment for
Networking Innovations'**

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The Internet is *great* at what it does, but..

- **Security** is weak
- **Availability/Reliability** is an issue
- **Instrumentation** is weak
- **Predictability** is weak
- **Manageability** is an issue

Our Critical Infrastructures Cannot Rely on it!

- **Mobility** is not well supported
- **Sensing** is not well supported
- **Scalability** is an issue

Persistent problems not solvable by incremental improvements to the current Internet

- **New Paradigms** may prove more powerful, providing the basis for a superior Future Internet



Future Internet?

Distributed Systems and Services?

Network and Protocol Architectures?

New Paradigms?

Applications
And User
Requirements

Disruptive
Technologies

Network
Capabilities

Internet
Architecture
Limitations

Clean Slate Optical?
This is not Ma Bell's telephone system anymore...



Broad Scope of 'GENI' Research

- Security
- Privacy and Accountability
- Mobility
- Availability & Reliability
- Manageability
- Economics
- Crisis Management
- Developing World
- Theoretical Foundations
- Applications & Human Interaction
- The iGeneration
- Data Plane Performance Scaling
- Control Plane
- Real-Time Systems
- Optical Networking
- Wireless Networking
- Self Organized Networks
- Sensor Networks

Experimental Facility to Validate Research

• **GENI**



What is GENI?

A Nationwide Programmable Facility for Research
into Future Internet Technologies

Using a 'Clean-Slate' Approach
– 'Out of the Box' Thinking

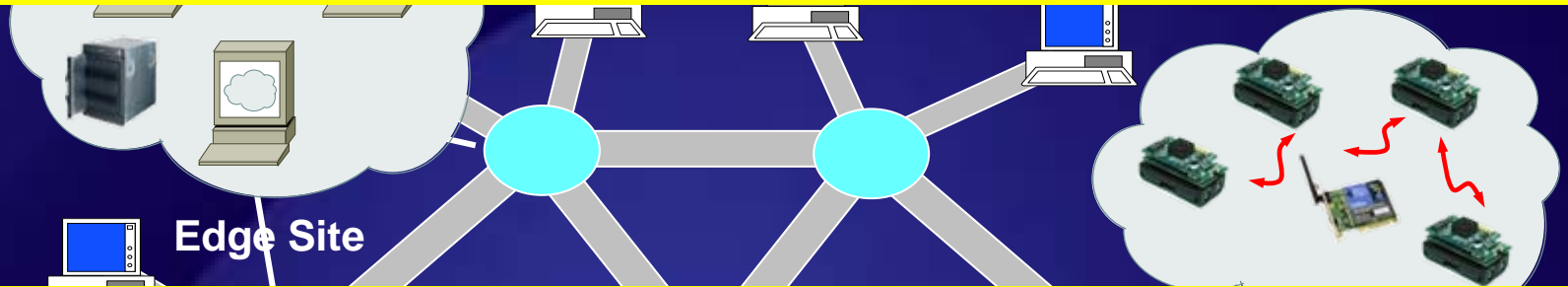
What does 'Out of the Box' Mean for Optical?

- Adaptive Bit Rate (Path Dependent) Transmission?
- Point to Multipoint?
- Open Spectrum?
- Will new technology revolutionize the way we build networks?

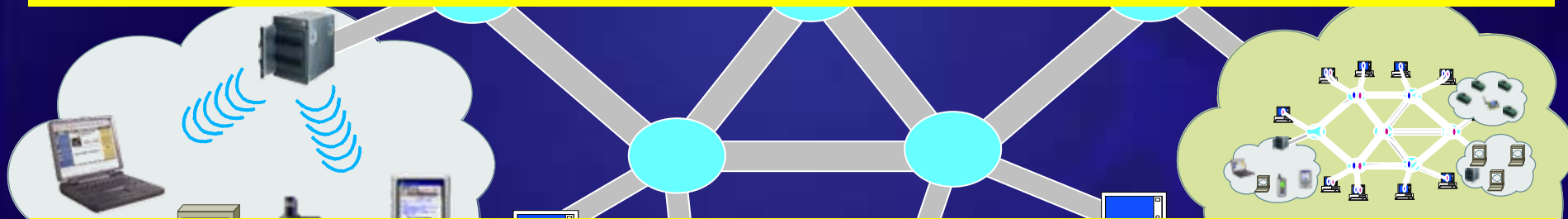


Schematic GENI Network

What about other Network Topologies?



What about Optical Access Systems?



Will Photonic Integration Change how this looks?

Mobile Wireless Network

Federated
International Facility

Edge Nodes

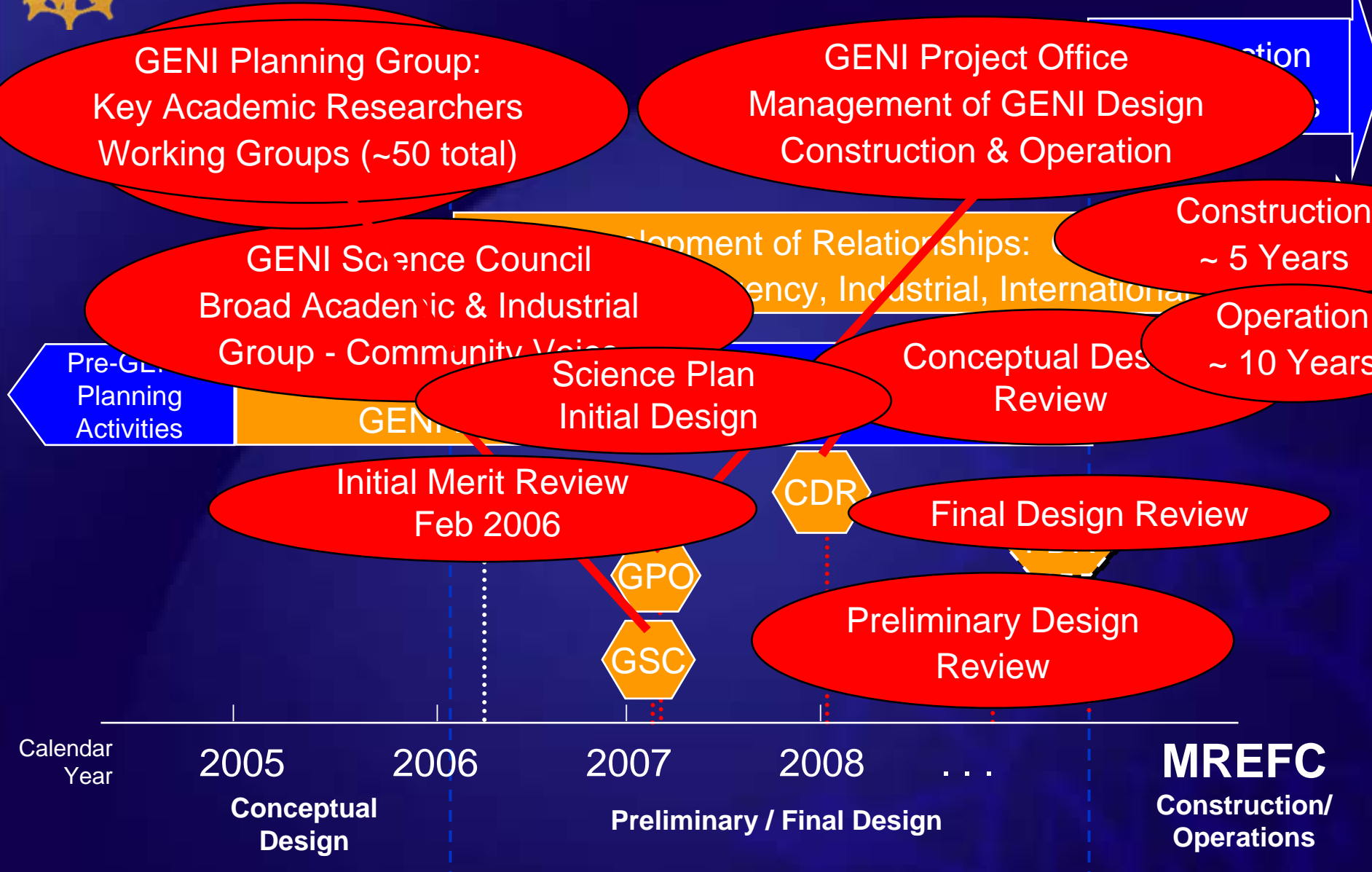


GENI Guiding Principles

- **Clean Slate Research** into future Internet Technologies
- **Microcosm of the future Internet:** smaller, but sufficiently sized for experimental validity, including ALL aspects of the future Internet
- **Real People, Real Applications:** to validate real experiments
- **Out of the Box Thinking:** forward looking research (crazy ideas?)
- **Programmable:** in all layers
- **GENI Native:** end-to-end
- **Slicing + Virtualization:** support simultaneous, independent expts.
- **Federation:** active cooperation, extensibility
- **Strong substrate coupling:** wireless, optical, sensor, process/storage
- **Fully instrumented:** understand and facilitate operation & experiments
- **Flexible and future-proof:** GENI design and build planned for continual introduction of new technologies, edge networks and subnets
- **Partnerships:** add technologies, end users, and global scale
- **Inclusiveness:** combine ALL research fields with a role in the future Internet; full participation, globally, from academe, industry, government



Snapshot of GENI Activities





GENI Status

- Still in the Formative Stages
- ‘GENI Science Plan’ under revision
- GENI Facility ‘Conceptual Design’ in process
- Next stage looking to broaden participation
 - Look for ideas from interested parties
 - ‘OUT OF THE BOX’ thinking at the Physical Layer
 - Stronger coupling with ‘Physical Layer’ Communities
 - Optical Networking
 - Wireless Networking
 - Stronger coupling with Internet Applications
 - Social and Behavioral Issues
 - Economic issues



GENI and Optics

- Clearly differentiate three areas:
 - The GENI Facility
 - Optical Networking Research for the Future Internet
 - Optical Technologies that will impact the Future Internet
 - Developed externally, included into GENI when mature
 - GENI can provide strong justification for funding these areas

The GENI Facility will allow research into Optical Networking and allow the inclusion of new Optical Technologies as they mature during the GENI lifecycle



Next Steps for Optics in GENI?

- Start from the Base provided by the Optical Planning Group
- Expand through Summer Optical Study Groups
- Get Involved:
 - Provide Input, Join a Working Group
 - Propose Development & Prototyping effort
- Build cross-field relationships
- Help Educate ‘non optics’ folks
 - What is optics, what does it do? What can it do for them?
 - Reciprocate! - Learn about networking, protocols, computing...
- Think out of the Box
 - New, Novel Ideas - Technologies, Systems, Architectures
- Help define GENI Research Agenda & Facility
 - Propose novel optical networking ideas to FIND

Help define the ‘Future Internet’