

The logo for Internet2, featuring the word "INTERNET" in a black, sans-serif font, with a large, stylized red "2" superimposed over it. The background of the slide has a yellow-to-white gradient at the top, with several thin, curved red lines sweeping across it.

INTERNET2



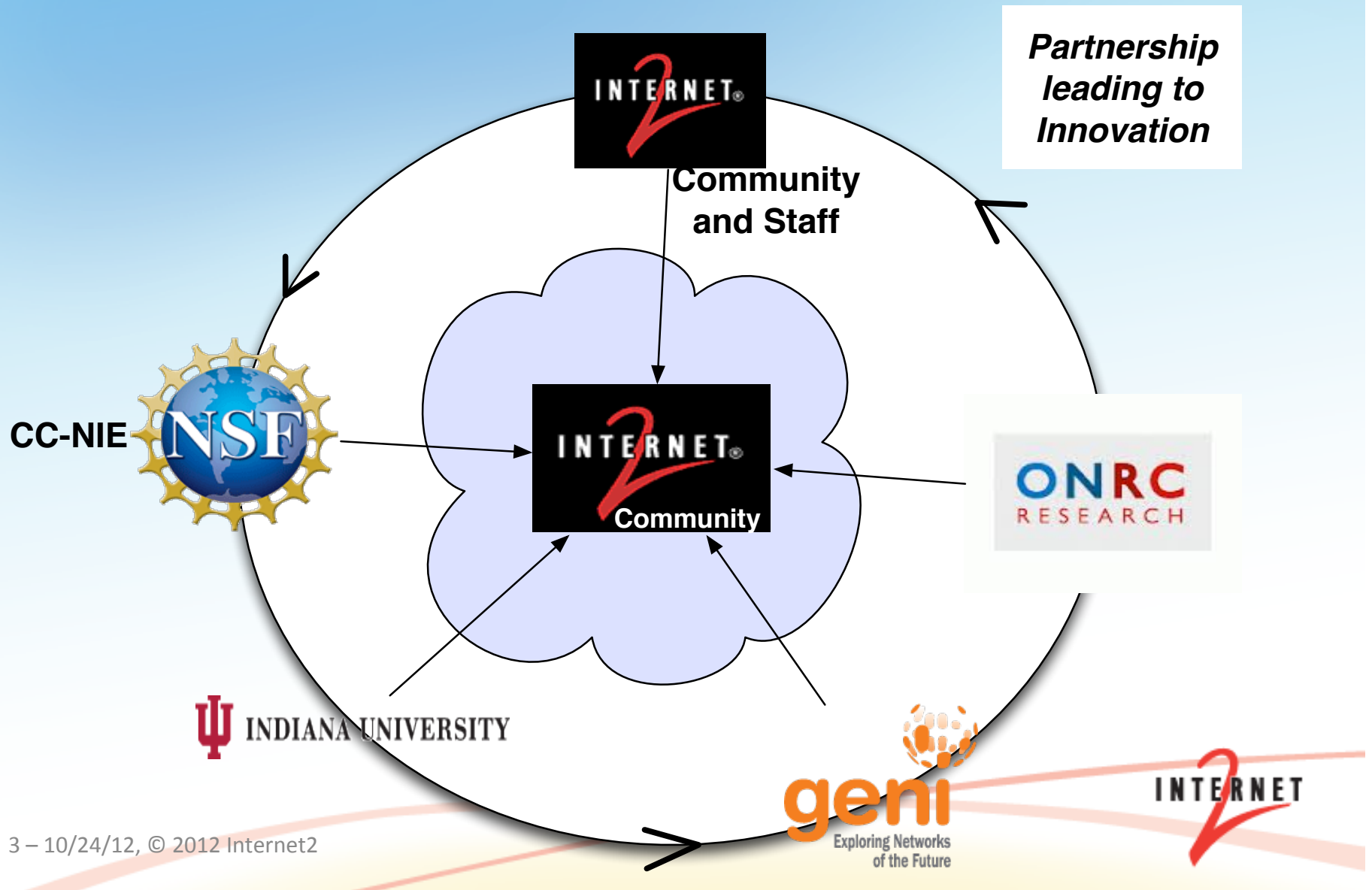
GENI and Internet2

**Supporting the Network Research Community
across the Internet2 Network
Eric Boyd, Internet2**

Overview

- Internet2 Innovation Program
- Internet2 Advanced Layer 2 Service
- Recent Improvements to Internet2 support of GENI
- Internet2 and GENI – Moving Forward Together

Innovation through Partnership

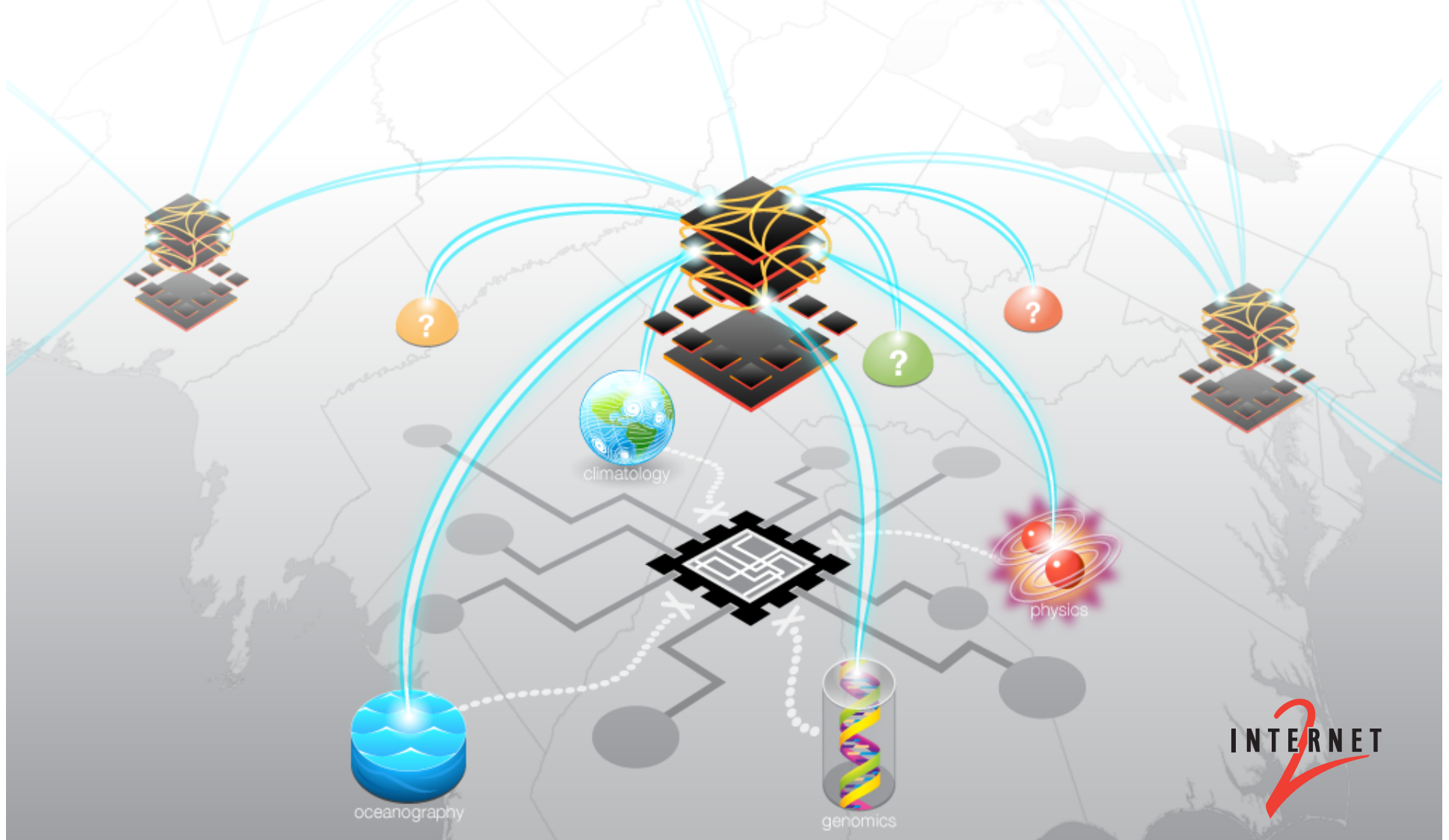


Components of Internet2 Innovation Program

- 3 components of the Internet2 Innovation Program:
 - Ubiquitous bandwidth and limited aggregation (100G)
 - Open up the network stack (support Software-Defined Networking)
 - Enable data intensive science (support for Science DMZs)
- Matches NSF/Research community call for investment
 - CC-NIE
 - Big Data
- Matches NSF, GPO, OSTP in the application space:
 - GENI RACKS
 - US Ignite



This is what we ~~want to be~~ **ARE** able to say: The **100G** testbed of innovation for tomorrow's Internet is available nationwide, right now. **The playground is open.**

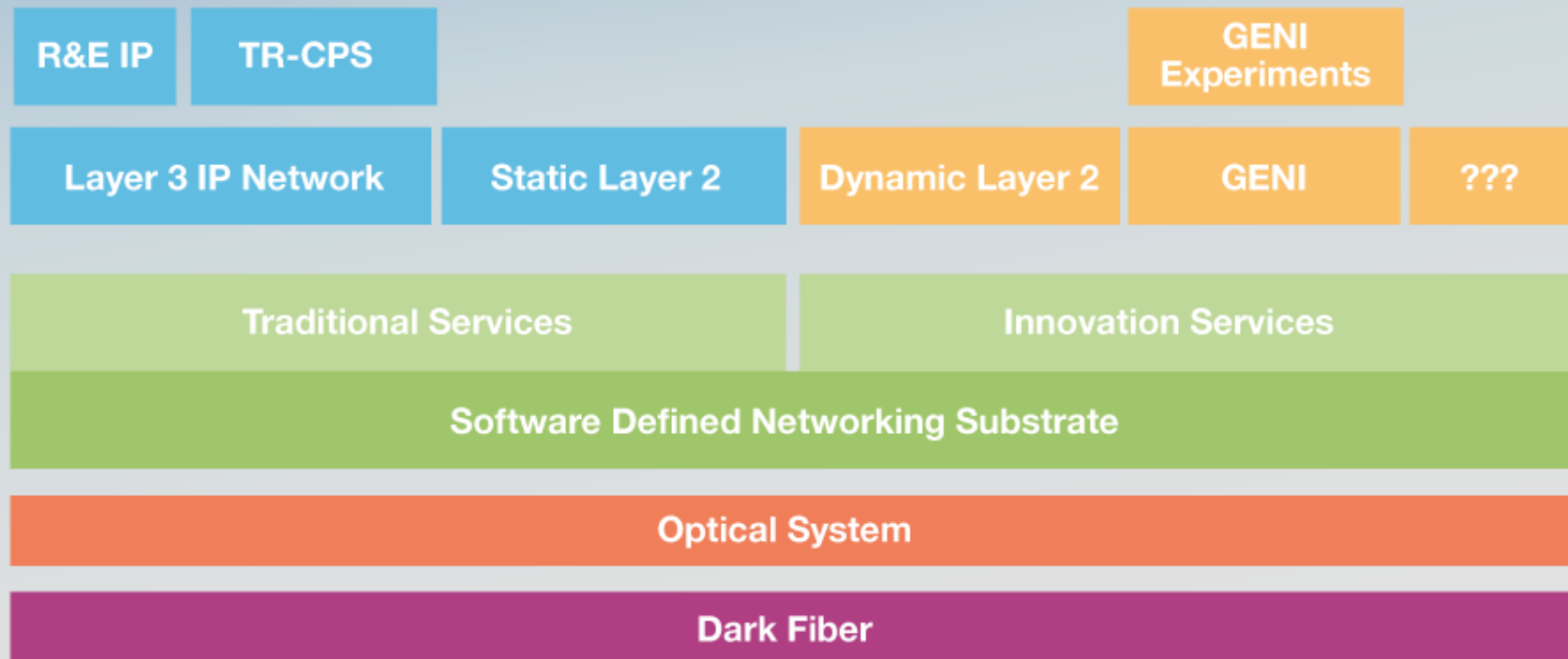


Internet2 Service Layers

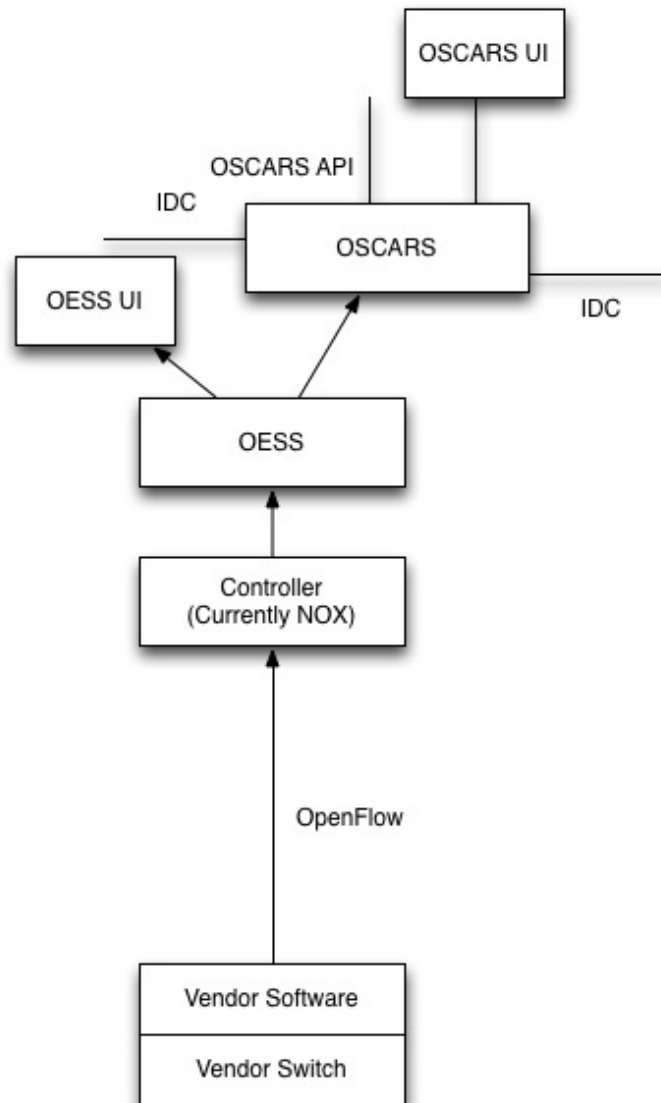
- Advanced Layer3 Service Network
 - 10 Juniper routers
 - Interconnected via bundles of 10G
- Advanced Layer2 Service Network
 - 14 nodes deployed (growing to ~35)
 - Heterogeneous (Brocade, Juniper, Cisco, ...)
 - Interconnected via 100G
 - 5 node advanced test network (NEC)
- Advanced Layer1 Service Network
 - Only 10/40/100G capable Layer 1 Service in the US
 - 88 channels of 100G capability
 - 56 Add/drop and flexibility to add more
- TR-CPS Network
 - 5 Juniper MX-960 routers
- Interconnects
 - 4x 100GigE and 6x 10GigE between L2 and L3
 - Expect 100G interconnects between L2 and Exchange Points

Long-term Architectural Aspiration

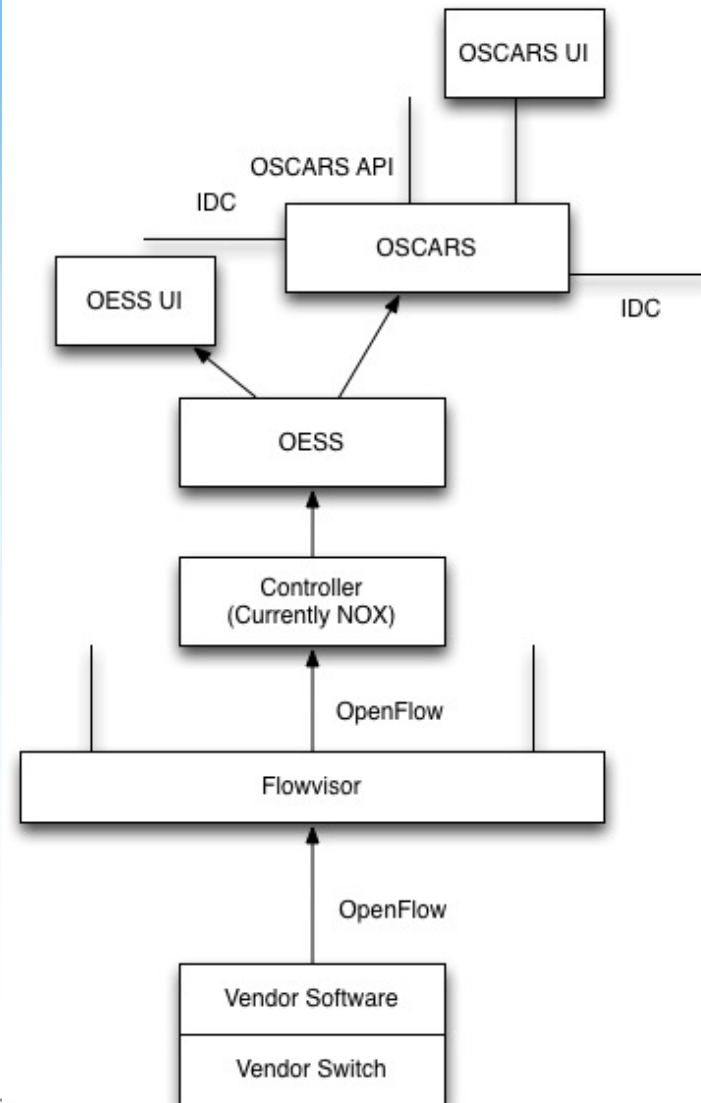
Software Defined Networking



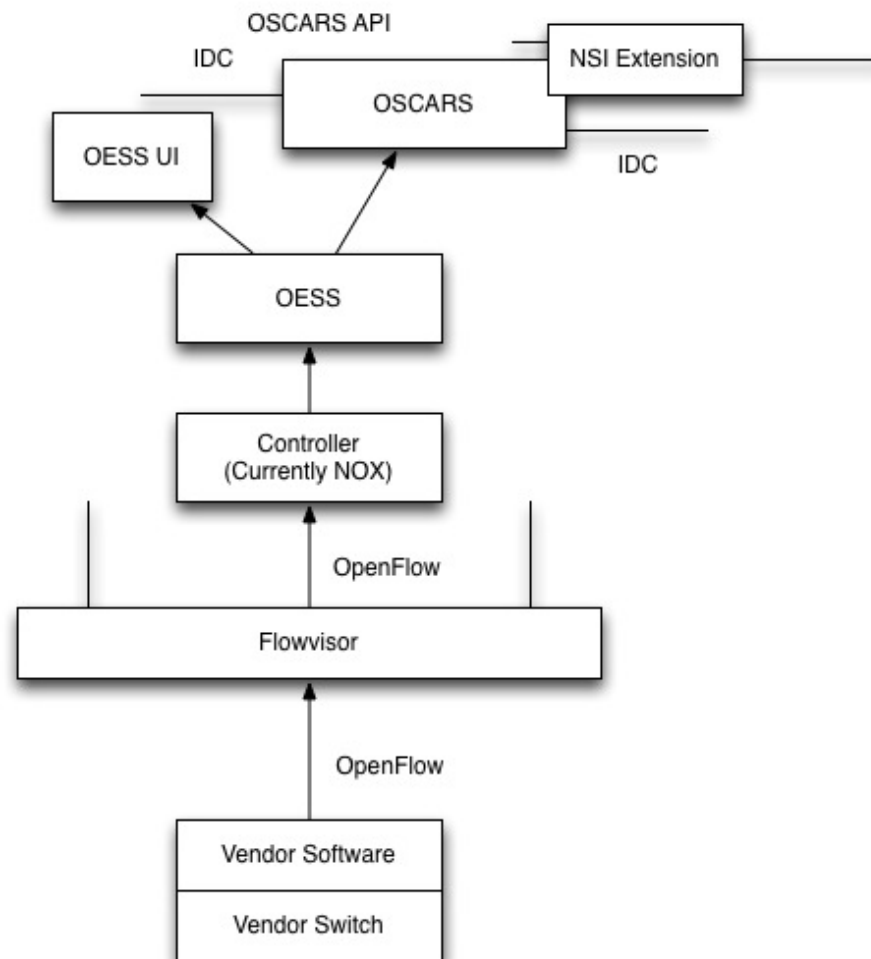
Software Stack --- Today



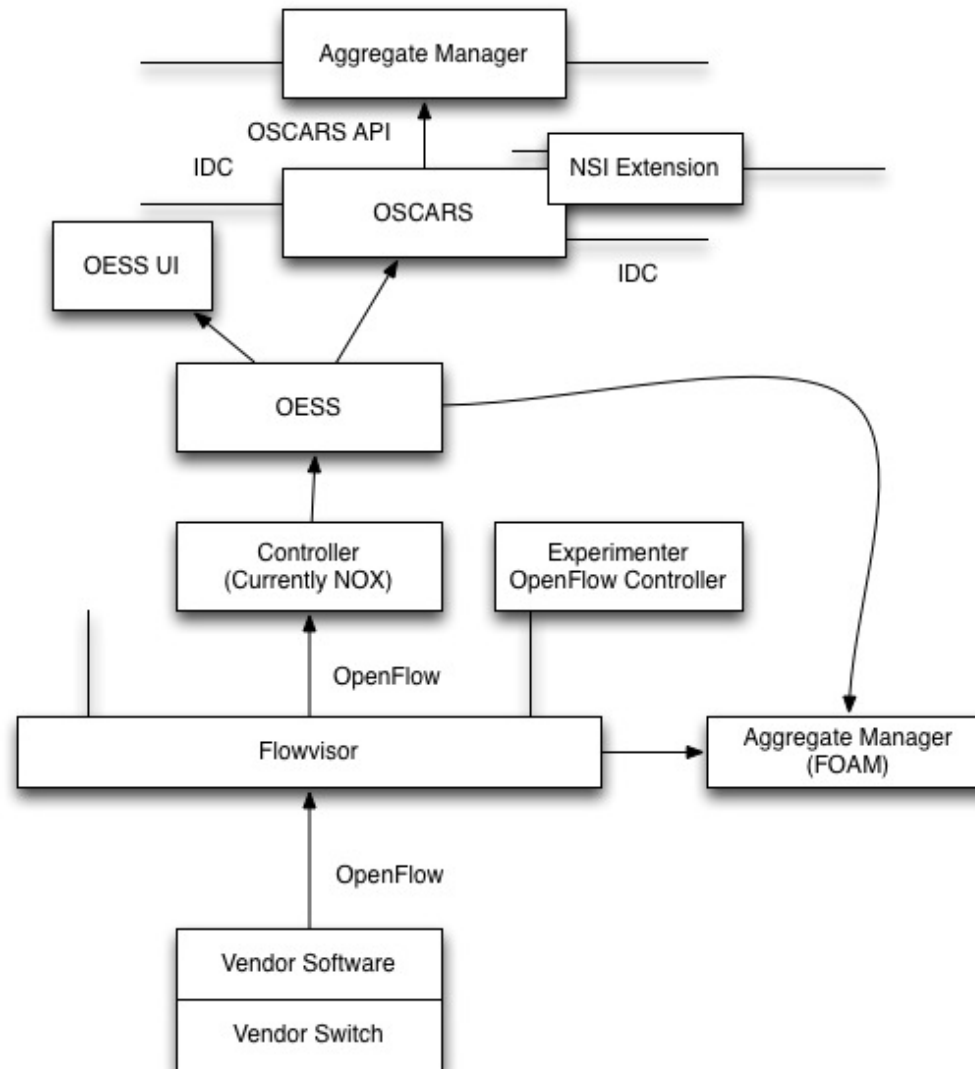
Software Stack --- Q1 2013



Software Stack --- Future



Software Stack --- Not fully baked



Advanced Layer 2 Service Policies

- Internet2 is committed to extending a policy-free approach within the Internet2 Advanced Layer 2 Service
- Each individual node should function like an “exchange point” in terms of policy, cost, capabilities
- Internet2 would like to position this service on the forefront of pushing “open” approaches in distributed networks.

Advanced Layer 2 Service Features (Now)

CORE

- 10G & 100G dedicated ports
- Heterogenous
 - Brocade, Juniper (underway)
- 7x24x365 production-quality support
- Robust evolution and regressive lab testing plan

VLAN PROVISIONING

- User (& backup) VLAN provisioning through GUI
- Ability to reach Internet2 Layer 3 Services
- Ability to reach International Exchange Points at 100G
- Interdomain provisioning to IDC Domains

APPLICATION INTERFACE

- IDC API
- OESS API
- Sherpa API



Advanced Layer 2 Service Features (Planned)

CORE

- Heterogenous
 - Juniper (Q1 2013)
 - Cisco (TBD)
 - Dell (DYNES sites, TBD)
- Virtualization via Flowvisor (Q1 2013)
- OpenFlow 1.3 Support (TBD)

VLAN PROVISIONING

- Multipoint VLANs (Q4 2012)
- Interdomain provisioning to NSI Domains (TBD)

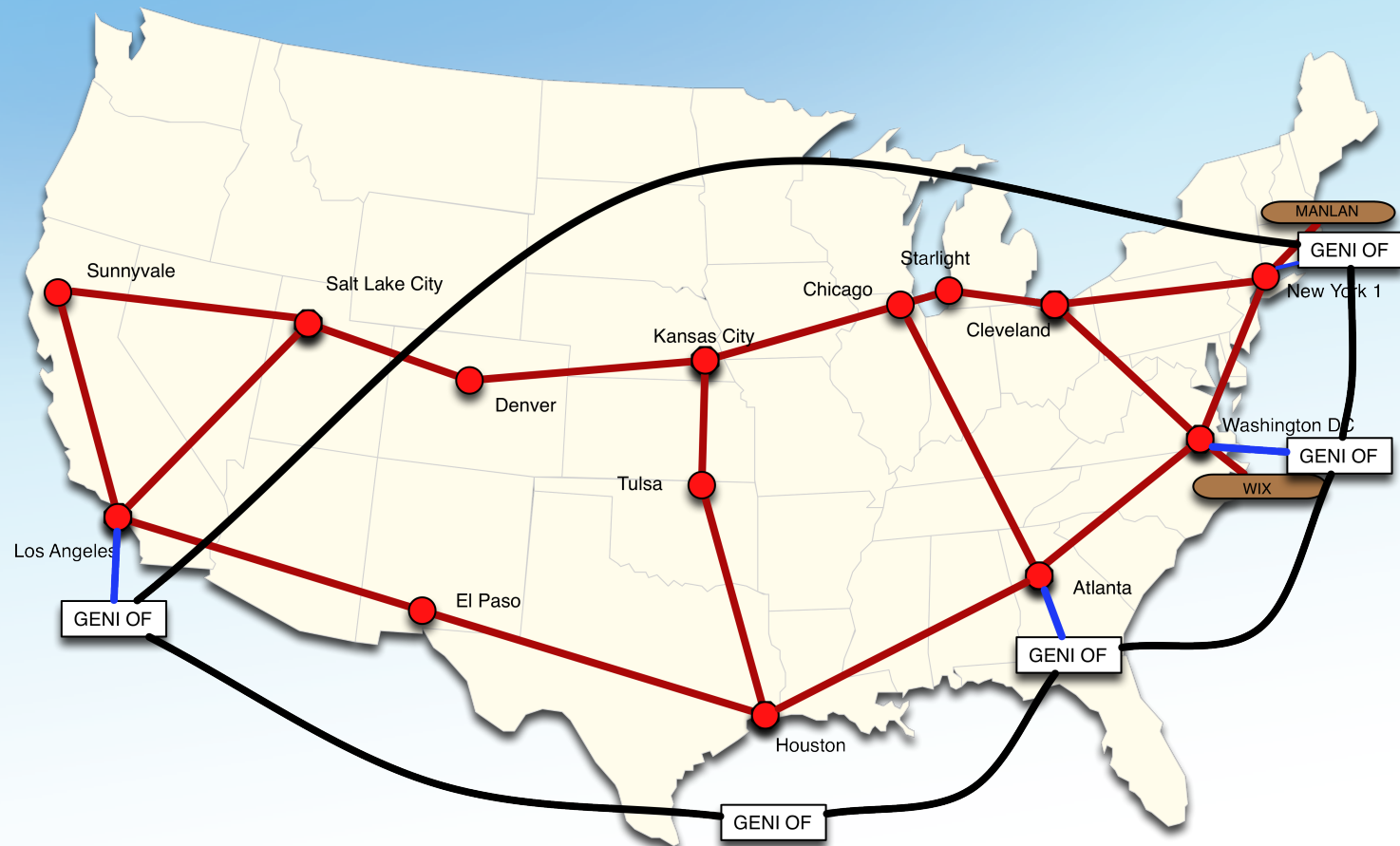
APPLICATION INTERFACE

- NSI API (Planned)
- GENI API (Q2 2013)
- User OpenFlow Slice Support (Q2 2013)

INNOVATION TESTING ENVIRONMENT

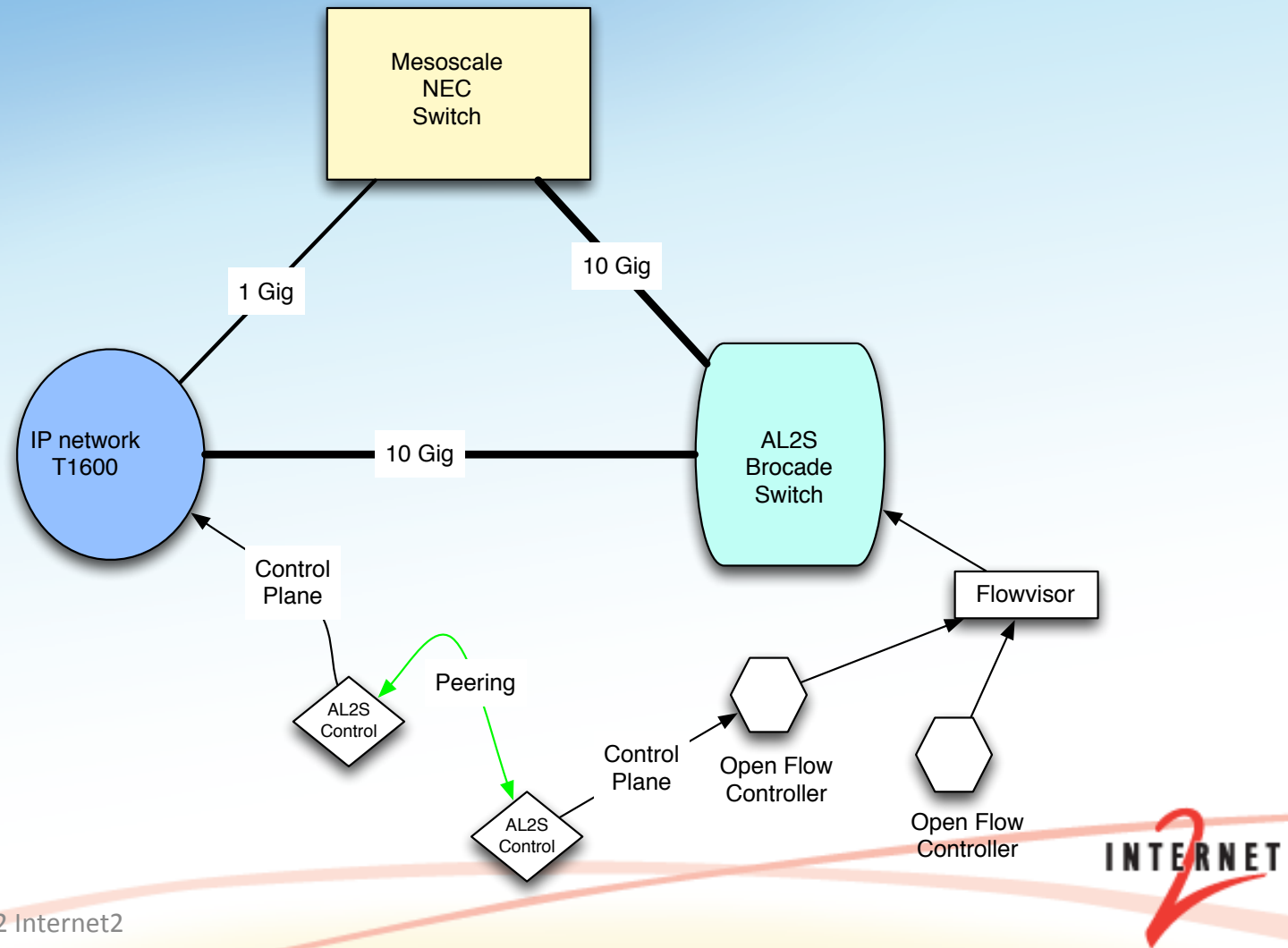
- InCentre Participant (Q4 2012)
- ONS Participant (TBD)
- SDN Production Test Platform
 - NEC (Q4 2012)

Current GENI Mesoscale Infrastructure

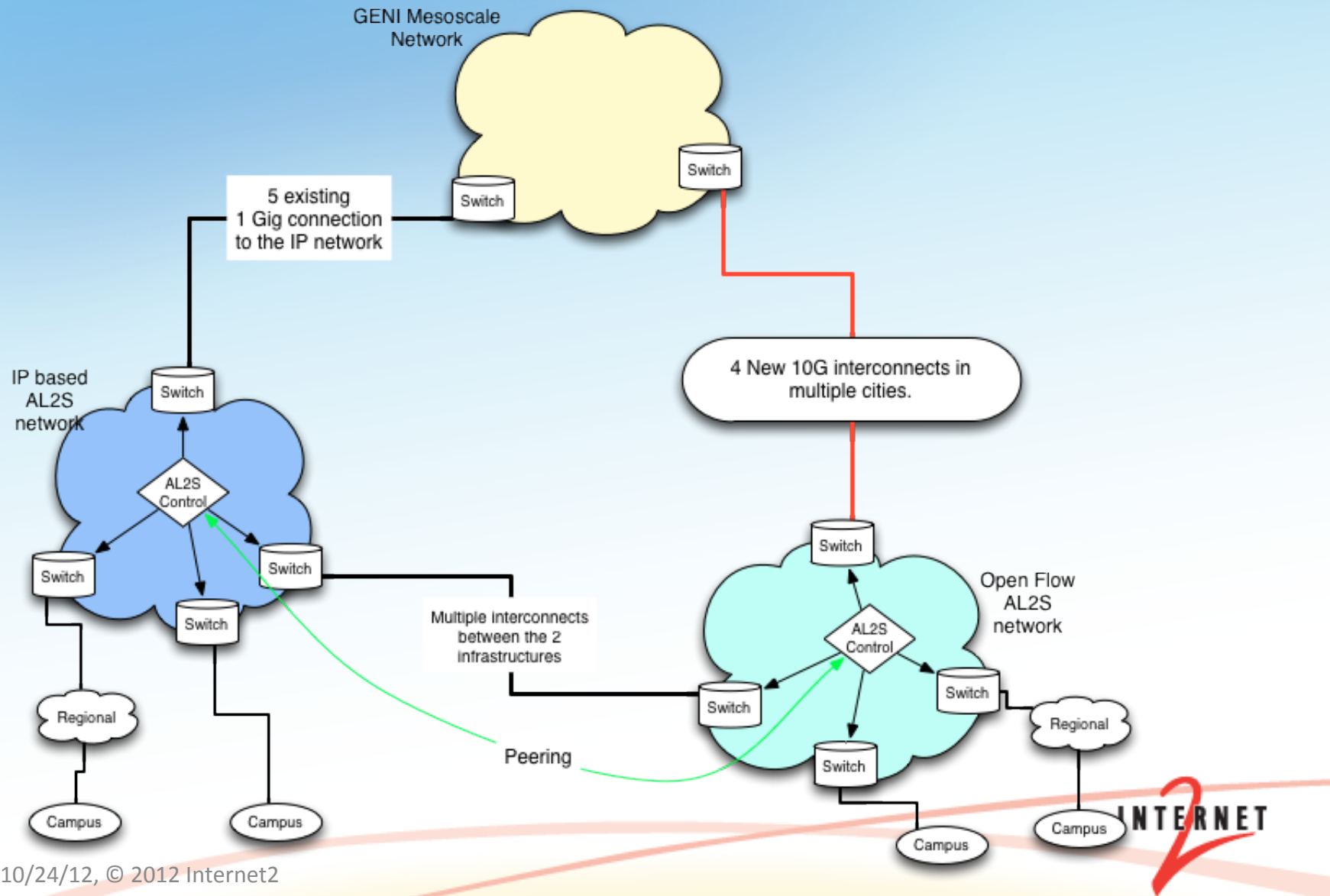


Current GENI Mesoscale Infrastructure

GENI interconnectivity
in a representative
city, e.g. DC

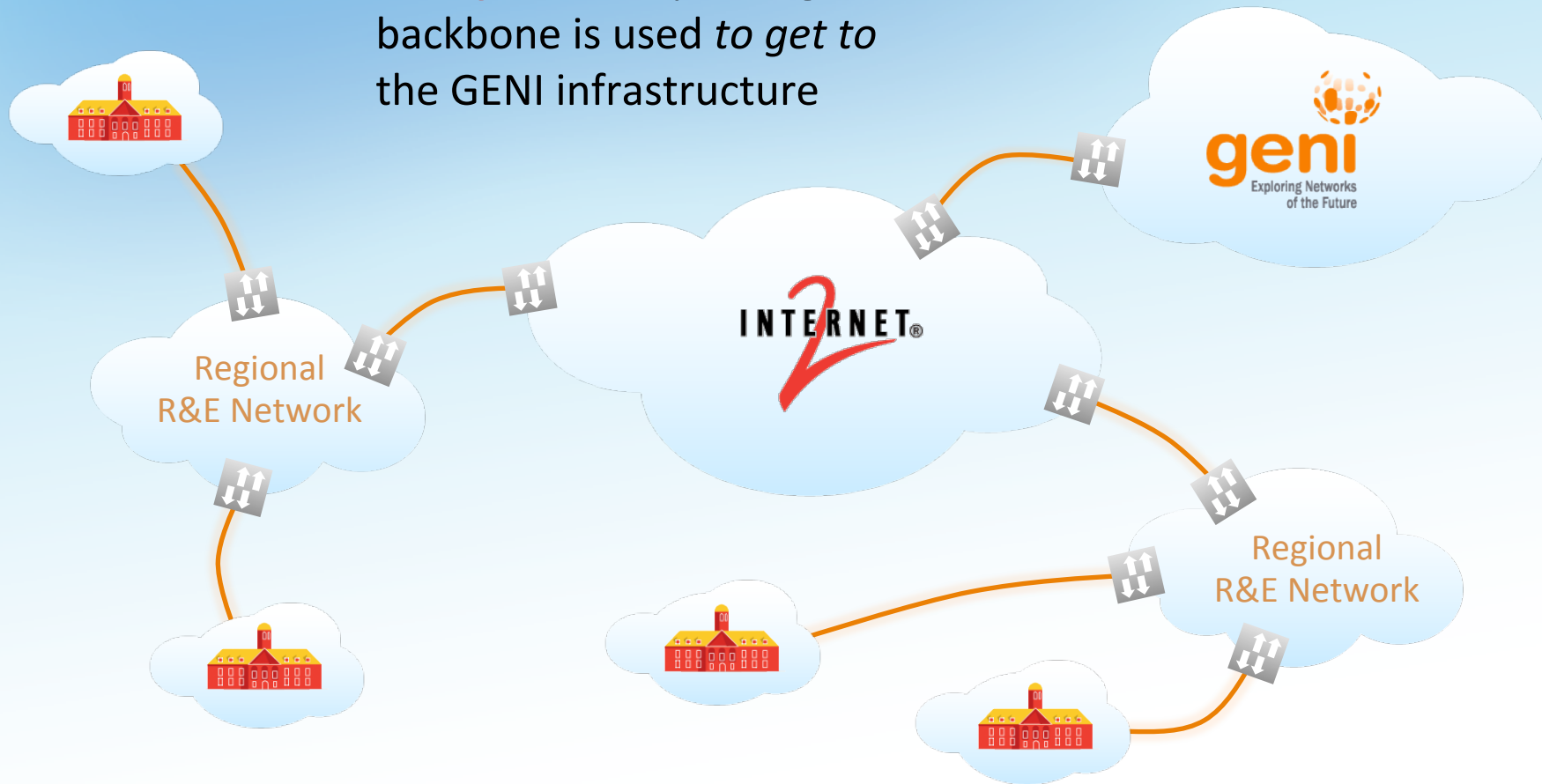


Current GENI Mesoscale Infrastructure



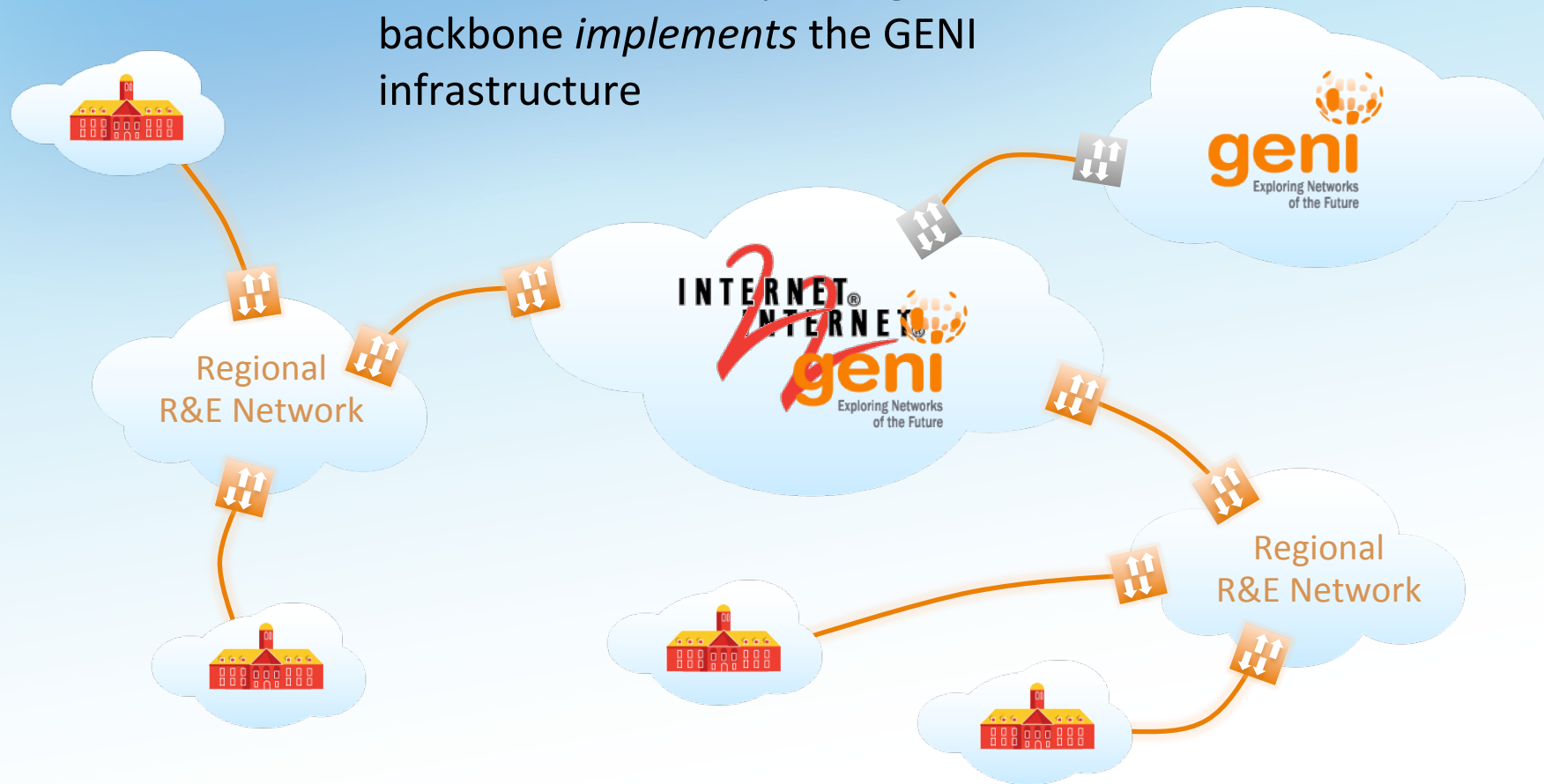
Internet2 and GENI Today

Today, the campus/regional/national backbone is used *to get to* the GENI infrastructure



Internet2 and GENI Tomorrow

Tomorrow, the campus/regional/national backbone *implements* the GENI infrastructure



Internet2 and GENI

- GENI environment implemented on the Internet2 backbone
 - **Today:** The campus/regional/national backbone is used *to get to* the GENI infrastructure
 - **Tomorrow:** The campus/regional/national backbone *implements* the GENI infrastructure
- Software and operational environment of GENI is supported in a production environment
 - **Tomorrow:** Aggregate manager API, dynamic stitching, instrumentation and measurement API
 - **Next Day:** GENI environment continues to evolve to meet needs of network research community



**GENI AND INTERNET2
SUPPORTING THE NETWORK RESEARCH COMMUNITY ACROSS
THE INTERNET2 NETWORK**

October 23, 2012, GEC15

Eric Boyd, Internet2