K-GENI and ETRI Virtualized Programmable Platform

Myung-Ki SHIN
mkshin@etri.re.kr
ETRI

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Why Virtualized Programmable Platform ?

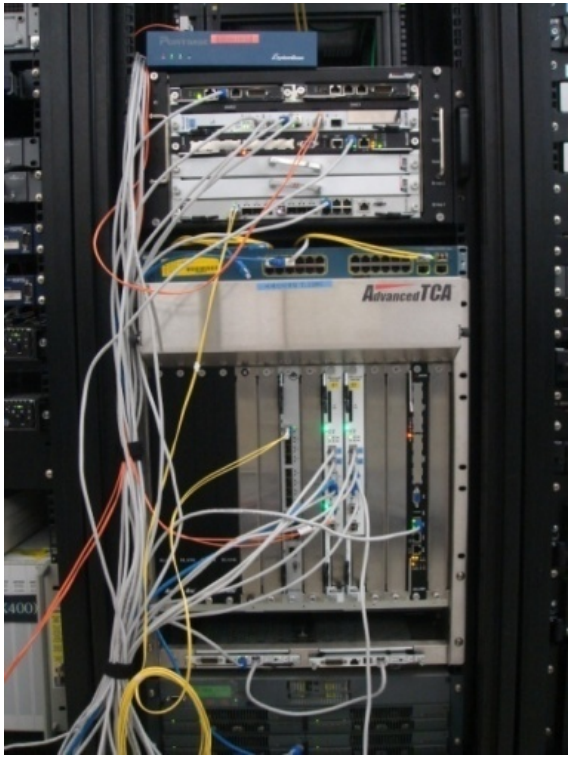
- The current Internet architecture is under serious reconsideration and people started thinking about alternatives.
  - Redefining Internet architecture requires many challenged works
- It's necessary to support a variety of the new different architectures to accommodate the heterogeneity of Future Internet (FI).
  - A common platform should be provided to accommodate the new heterogeneous architecture research and experiments in a shared infrastructure and testbed.

Two Objectives

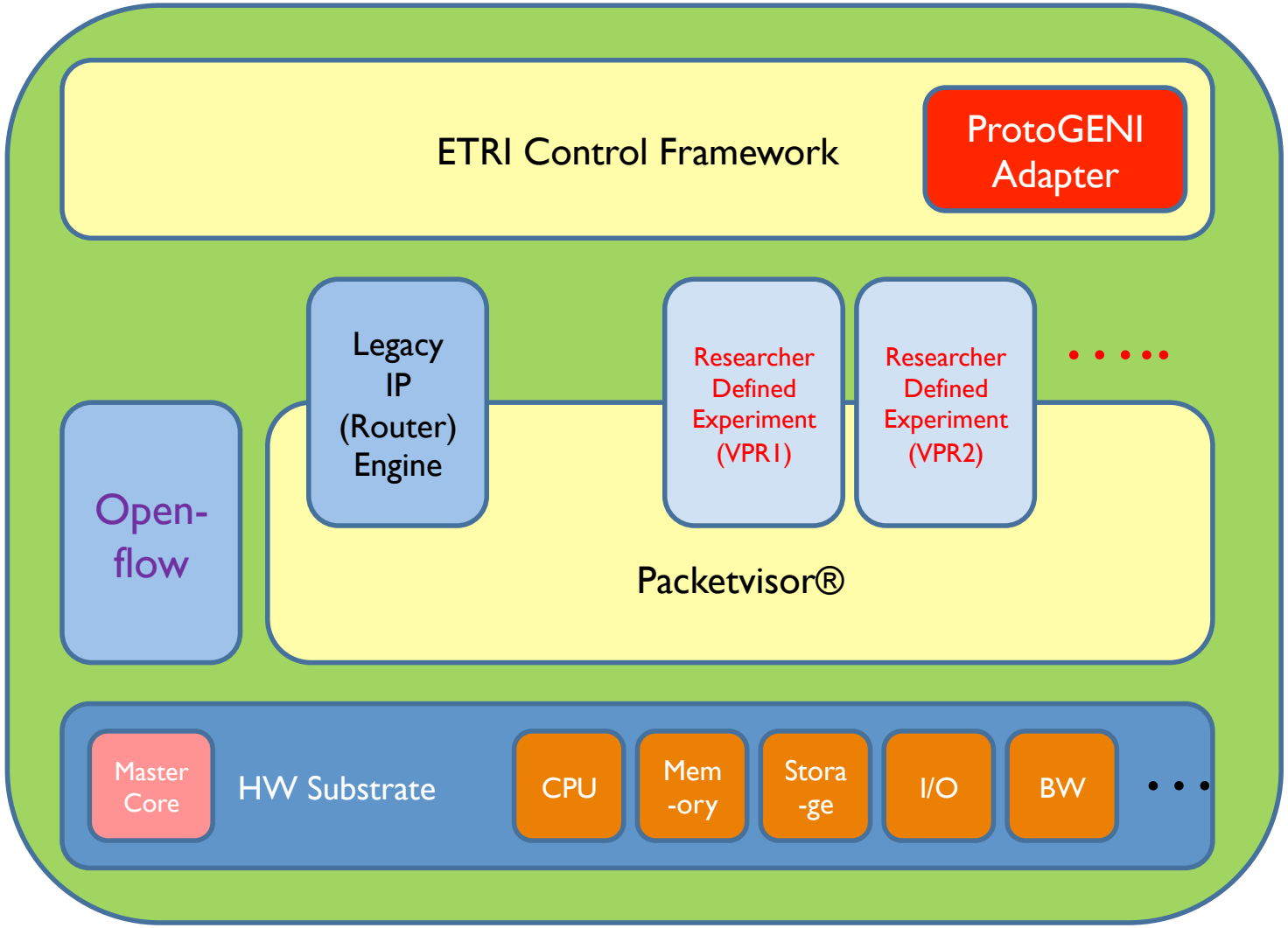
- Future Internet Testbed as a short-term solution for architecture experiments
  - Running multiple experiments simultaneously in a shared experimental testbed
  - E.g., GENI
- Future Internet Architecture as a long-term solution for the future Internet
  - Virtualization, programmability, and federation would be an integral part of Future Internet Architecture
  - E,g, CABO and FP7 "the network of the future" projects (e.g., 4WARD, Trilogy, …)

ETRI Platform Prototype

- NP-based hardware platform
  - Virtualized programmable substrate that operate at high speed (ATCA hardware)
- Virtualized programmable routers
  - Researcher-defined "Silver-based Virtual Routers"
- Common Platform APIs
  - Programming APIs for Researchers
  - Open substrate interfaces
- Capabilities and functions
  - Dynamic End-to-end Slice Operations
    - Control Framework APIs (protoGENI-compatible)
  - Openflow enabled

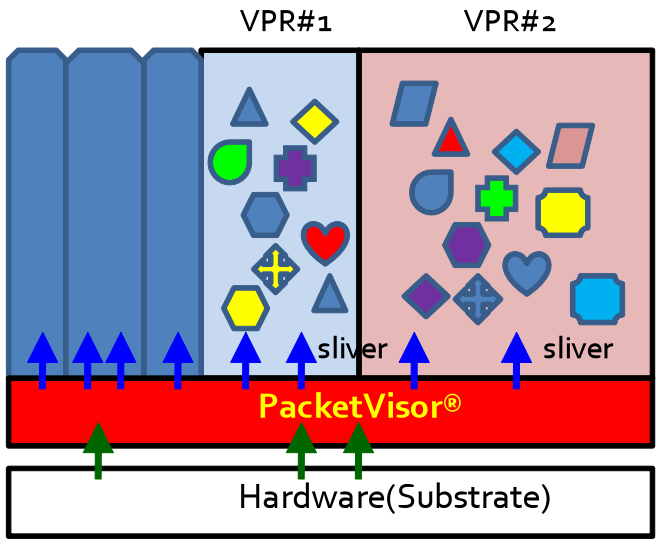


Platform Architecture

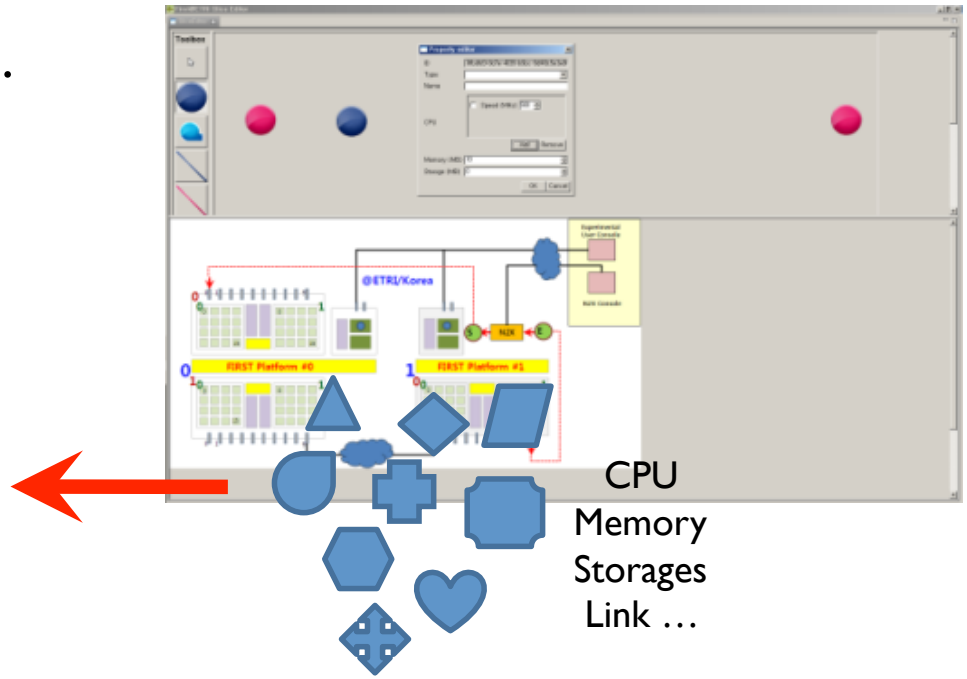


Researcher-defined "Virtualized Programmable Routers (VPR)"

- Dynamic resource allocation to sliver/link
  - Computing resources
    - CPU, memory, storage…
  - Network resources
    - Bandwidth/Link …



VPR - Virtualized Programmable Router

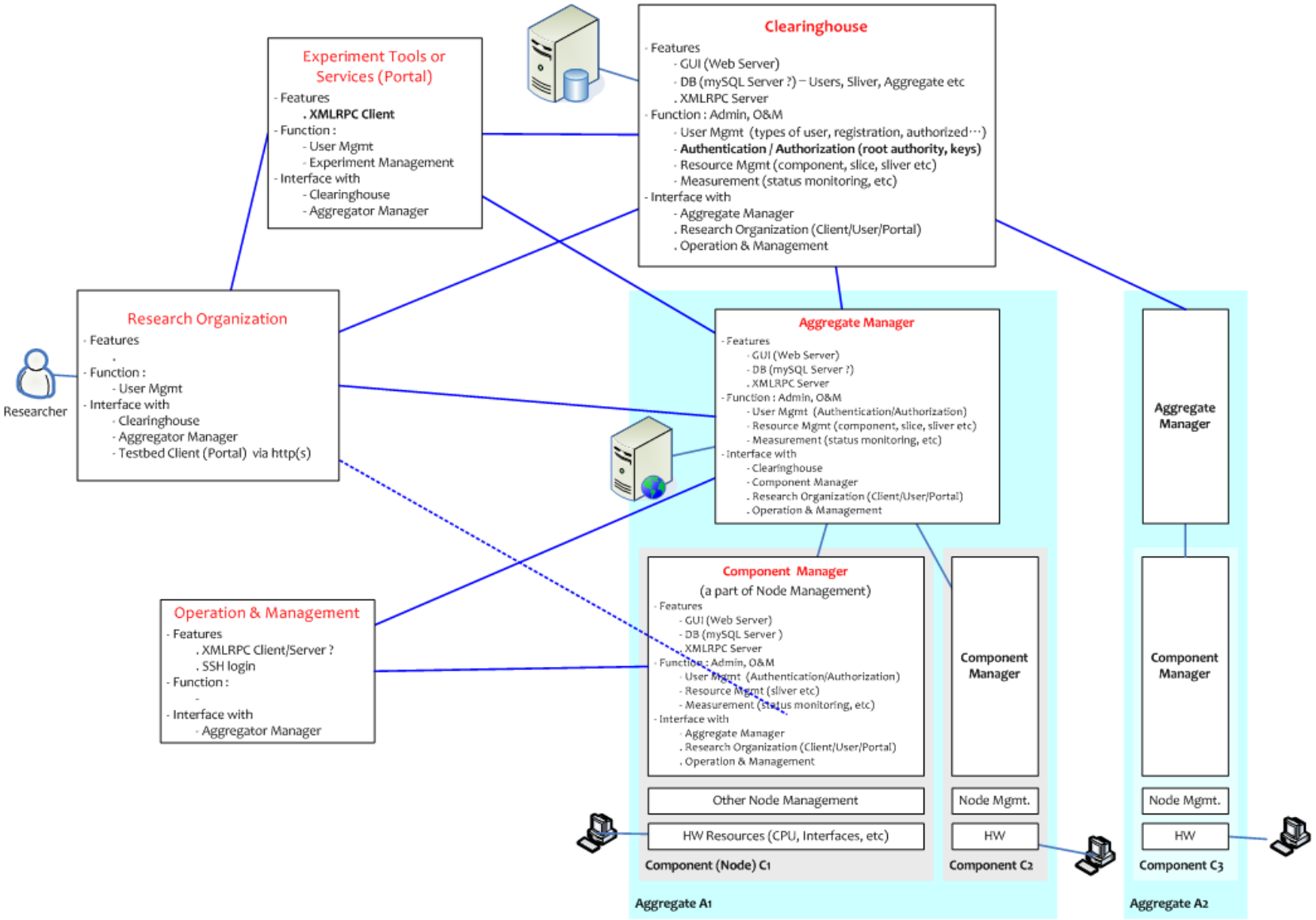


Resources

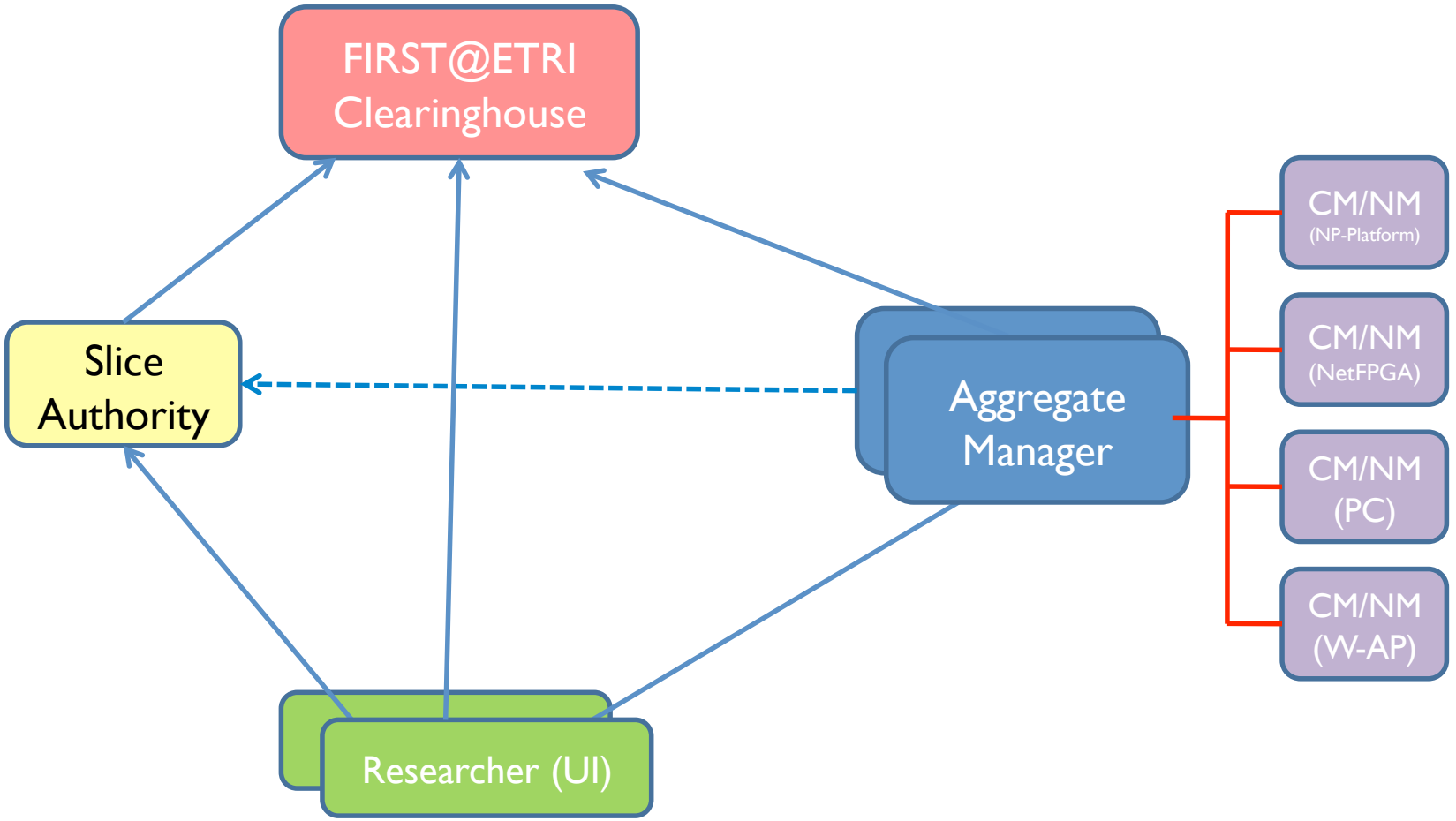
Ongoing works for ETRI Platform

- Control Framework and UI
  - ProtoGENI Control Integration
- Open Substrate Interfaces
- Programming APIs for Researchers
- Packetvisor®

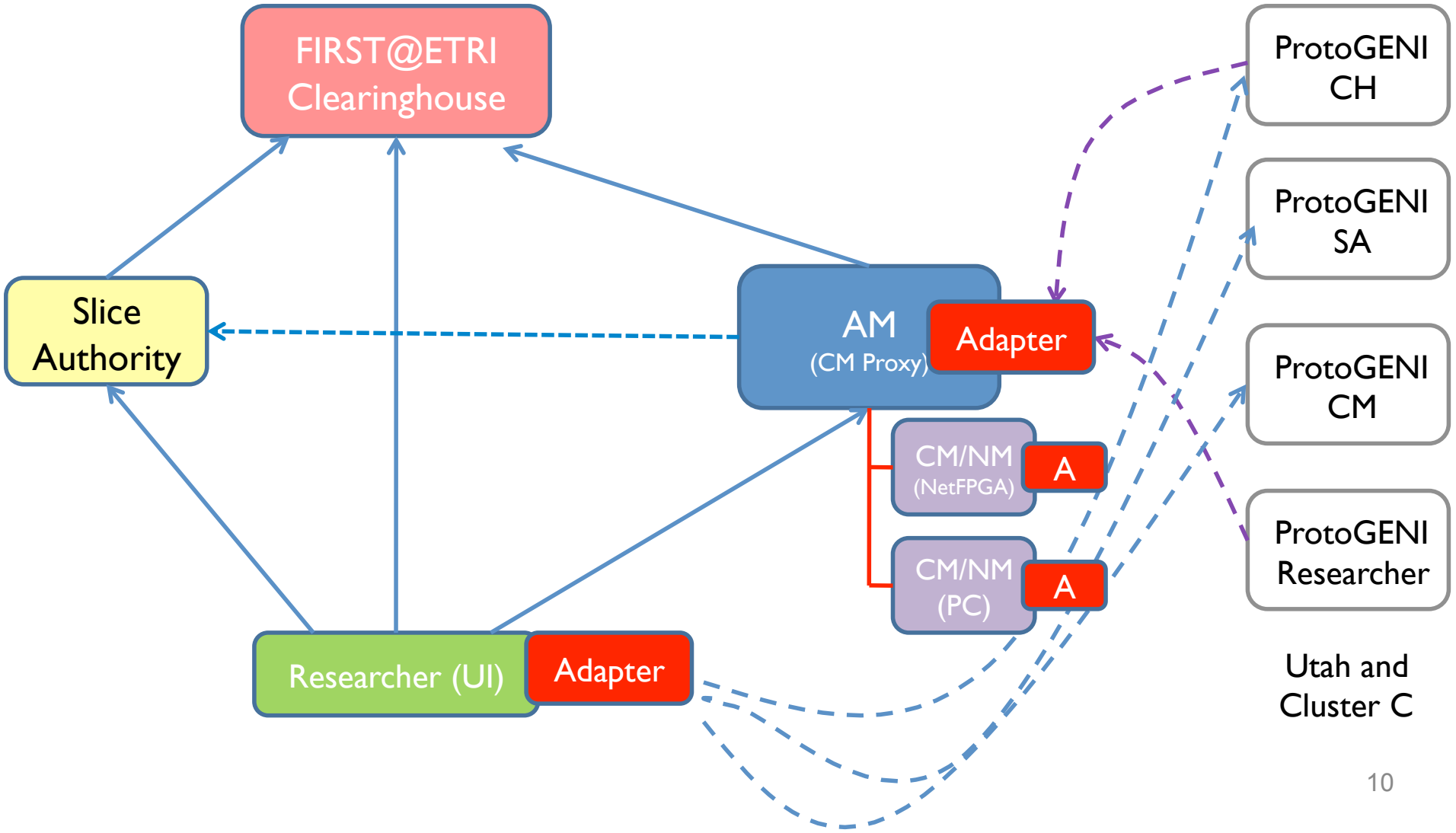
ETRI Control Framework Overview



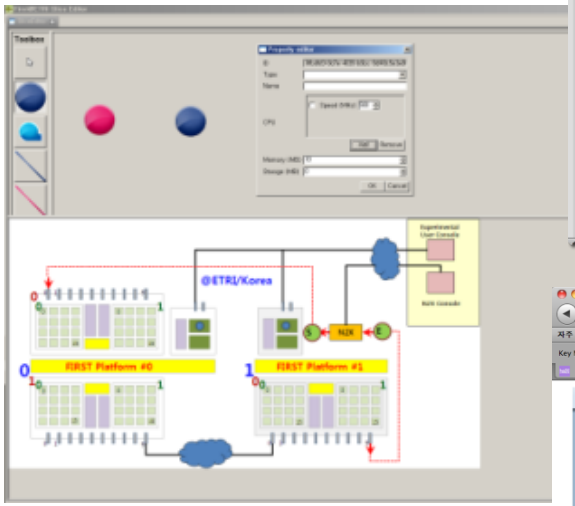
ETRI Control Framework Entities



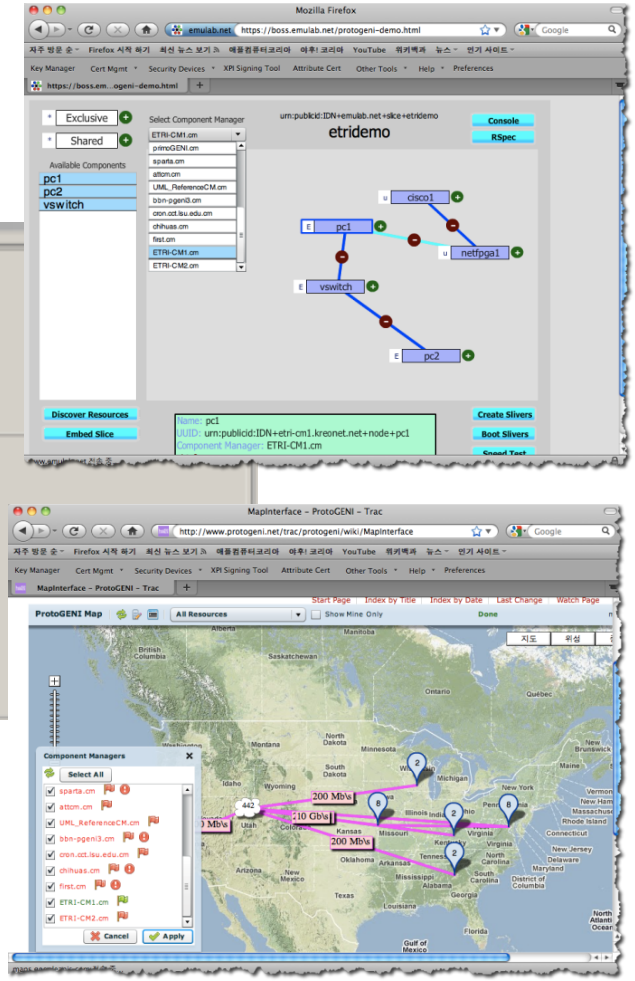
ProtoGENI Adapter Integration



Graphical Interfaces for Researcher



ETRI Java Interface



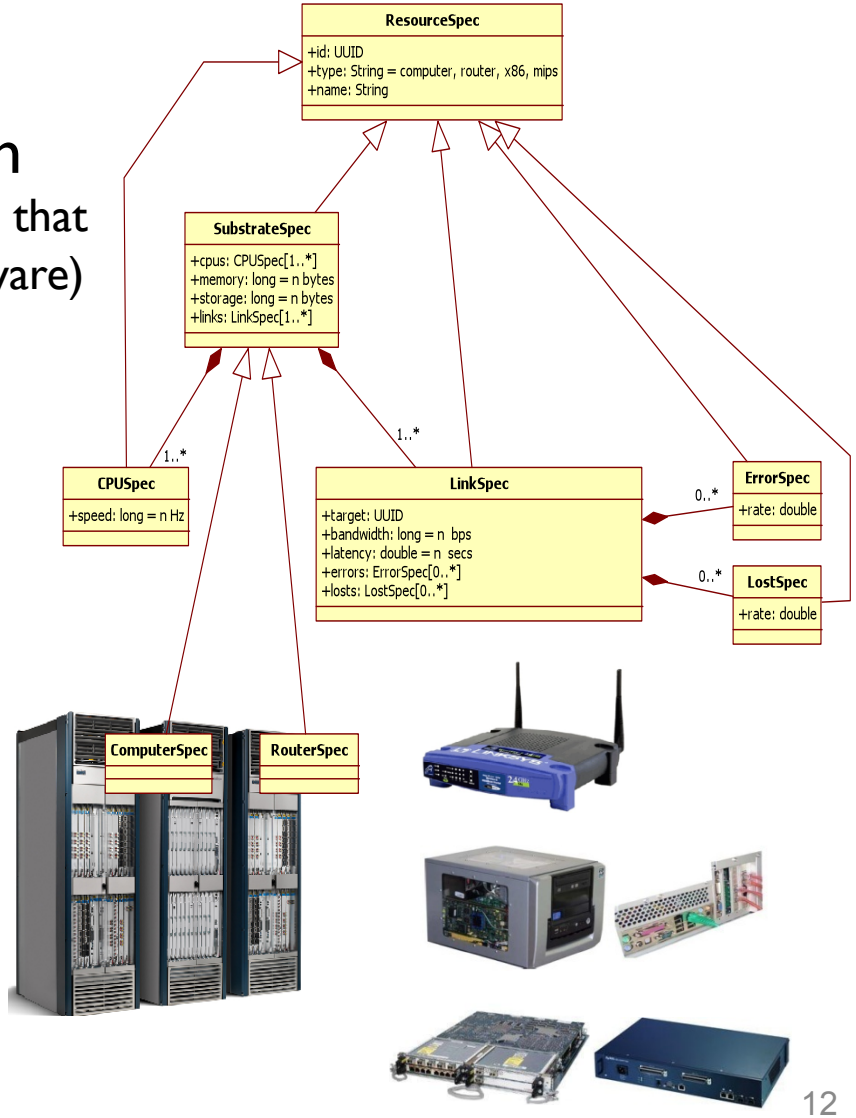
ProtoGENI Interface

iPhone /Android Interface

Open Substrate Interfaces

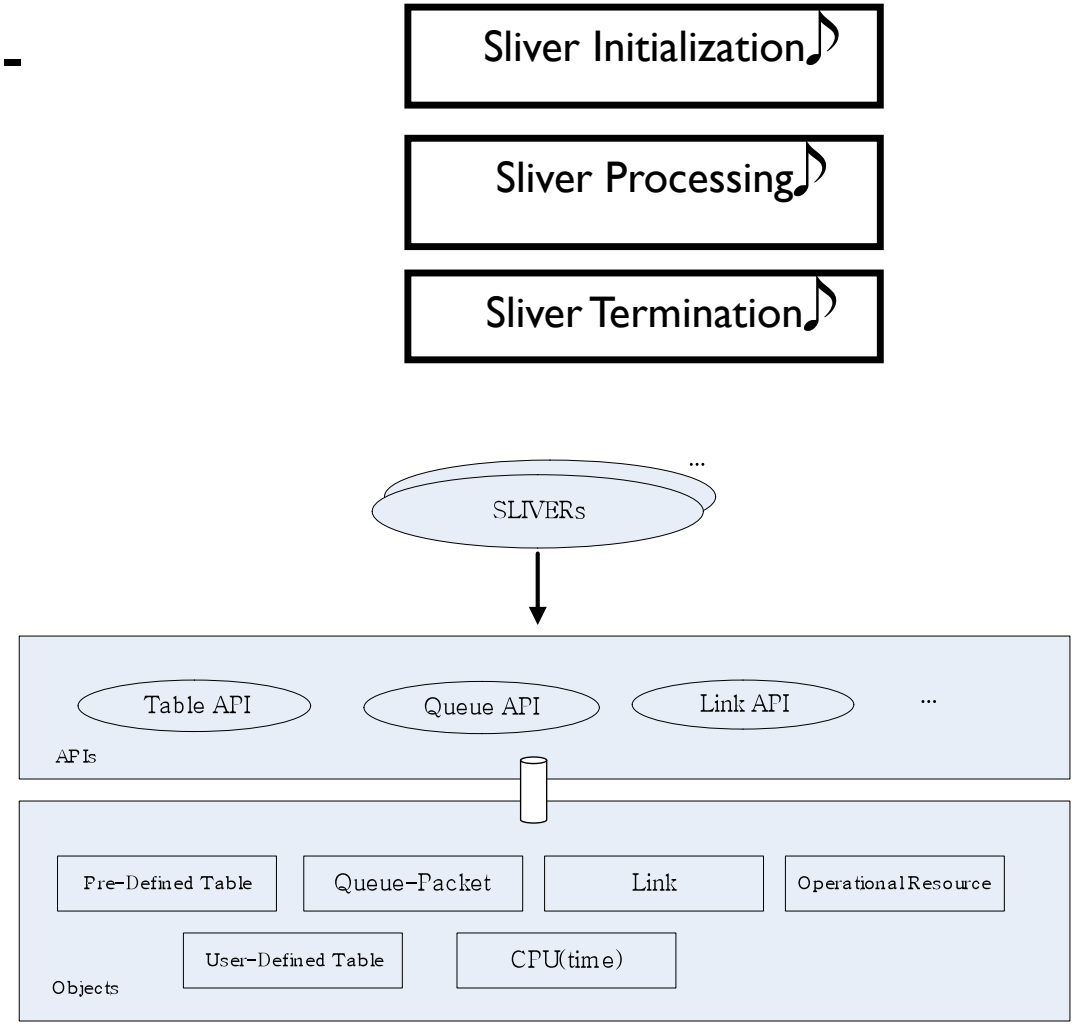
- Multiple Substrate Support
  - NP-based hardware Platform
    - •Virtualized programmable substrate that operate at high speed (ATCA hardware)
  - NetFPGA/PC, Wireless AP, etc.

- allocateSliver/deallocateSliver …
- allocatePort/dealloctePort …
- allocateLink/deallocateLink …
- uploadProgram/upgradeProgram …
- getSliverStatus …
- getPortStatus …
- getProgramStatus



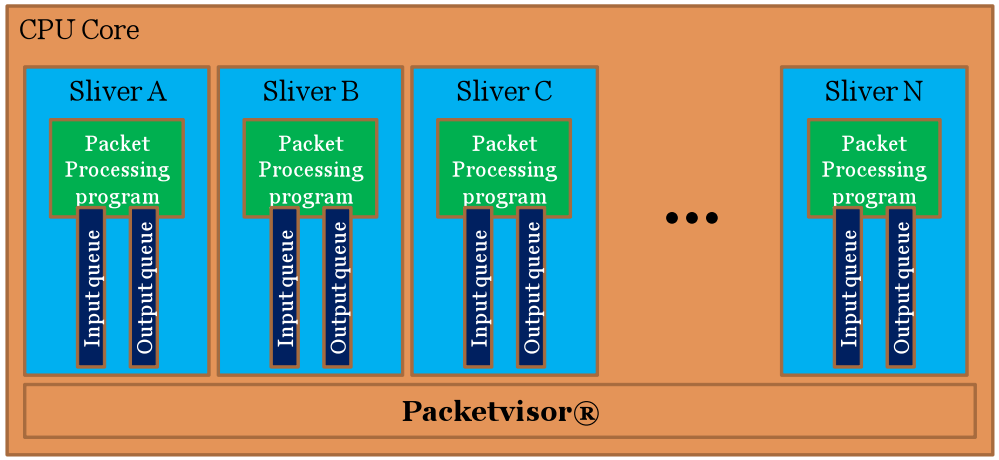
Programming APIs for Researchers

– E.g., To support hardware-based packet processing
  - work_request_sync()
    /* get_work */
  - send_packet_prepare()
    /* packet building */
  - send_packet_finish()
    /* packet sending */
  - …



Packetvisor®

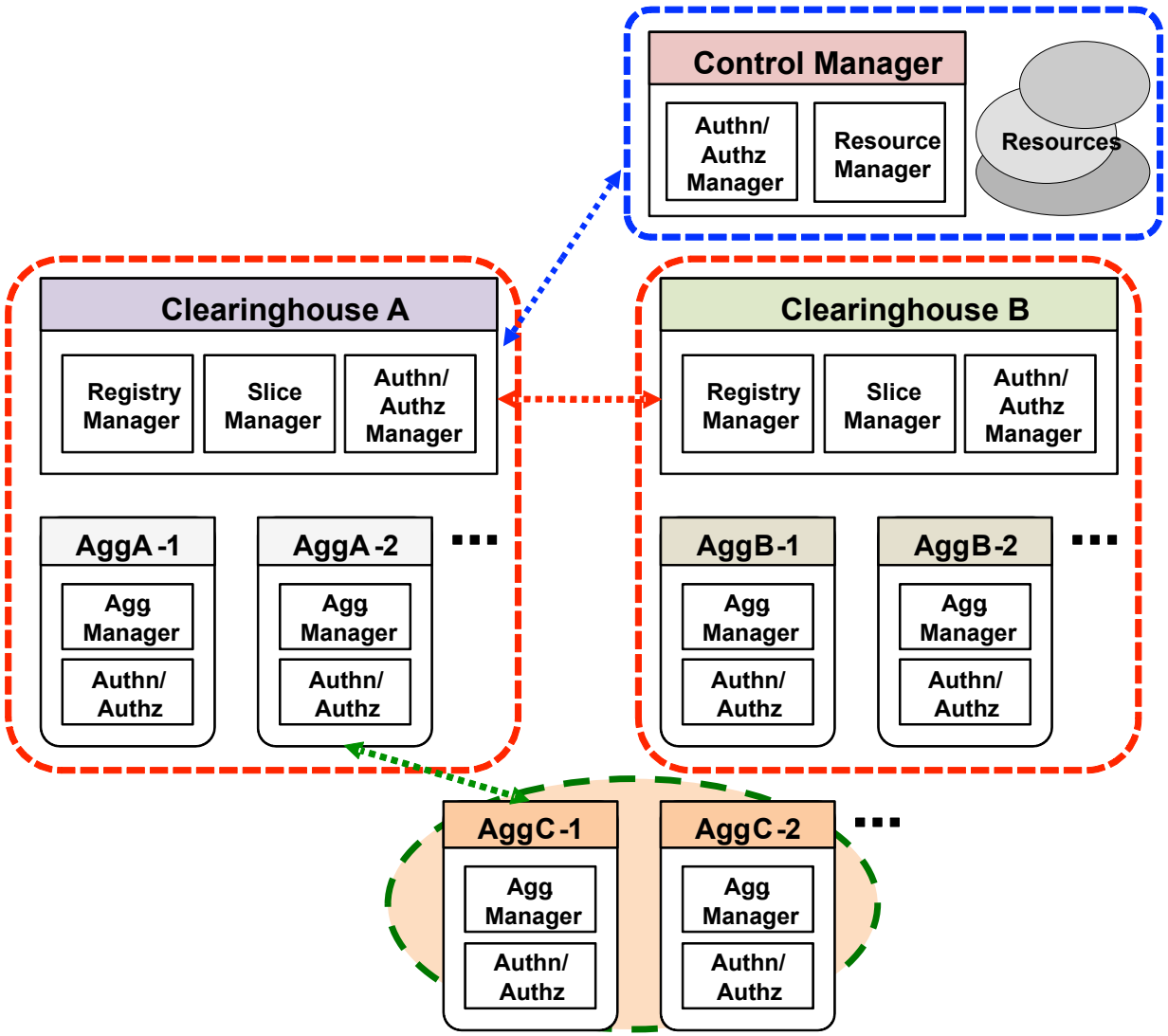
- (Simple) Packetvisor
  - Load multiple images (experiments) on 1 CPU Core
    - Multiple slivers scheduling
  - Dynamic CPU resource allocation on slivers
  - I/O queues virtualization
  - Memory, storage …
  - Bandwidth/Link



Spiral-2 : K-GENI

- Title
  - K-GENI : Establishment of operational linkage between GENI and ETRI/KISTI-Korea for international federation
- Principal Investigator Information:
  - PI: James G. Williams, Indiana University
  - Co-PIs: Myung Ki Shin-ETRI, Dongkyun Kim-KISTI
- Scope of the work
  - Provision a dedicated international connection between Korea and Indiana University in the US to facilitate an investigation into international federation strategies for operations between the GENI Meta-Operations Center, at Indiana University, and ETRII/KISTI-Korea.
  - Support tests for methods of interoperability between GMOC and the dvNOC system.
  - Develop an external networking report to help guide other GENI projects with future external connectivity.

Federation Scenarios



Federation among independent Infrastructures (with different CF) e.g., GENI, FIRE, Japan, and Korea

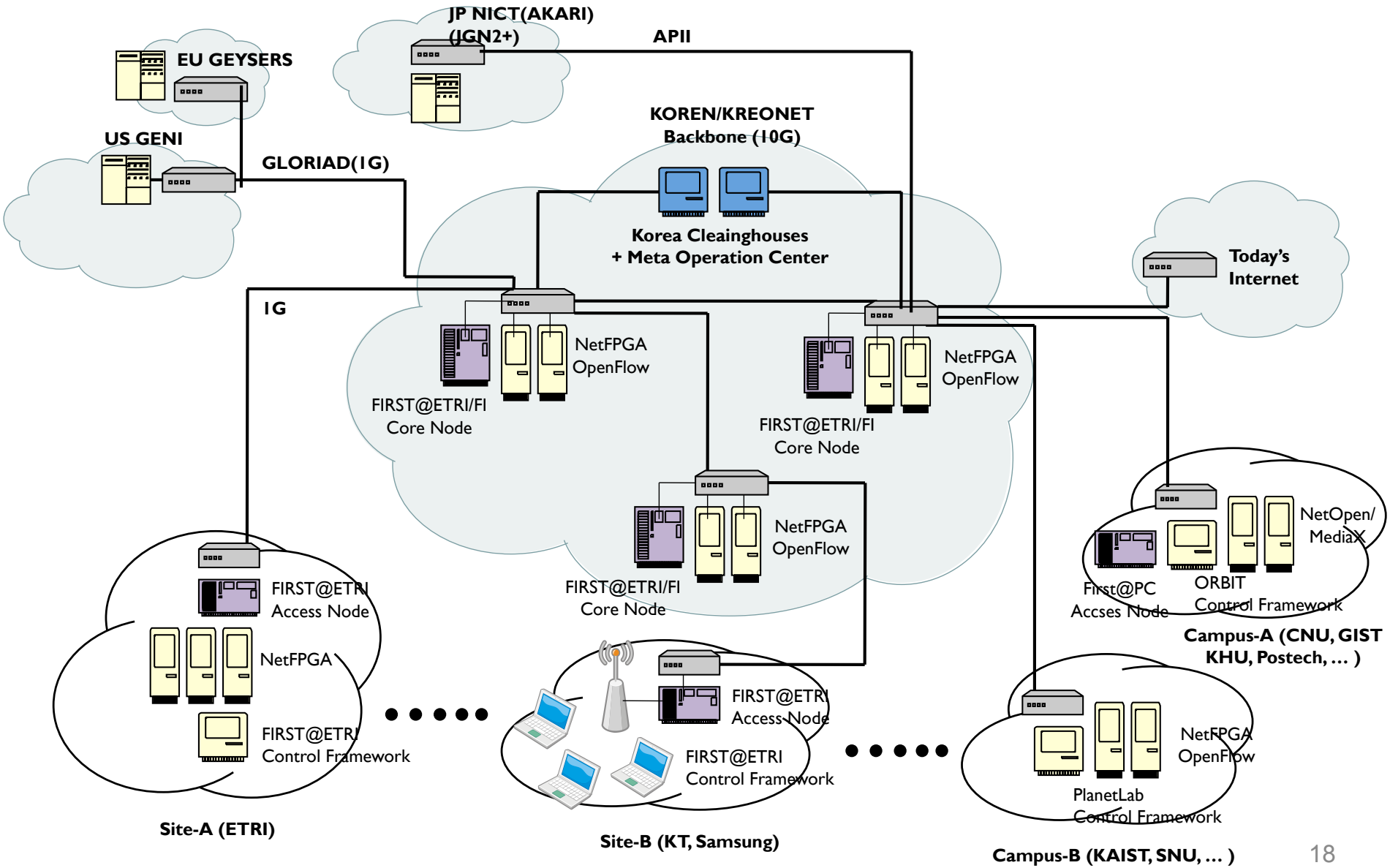
Federation among independent Infrastructures (with same CF) e.g., KOREN and KREONET

Federation with resources (Aggregate) e.g., GIST, SNU

General Solution for Federation

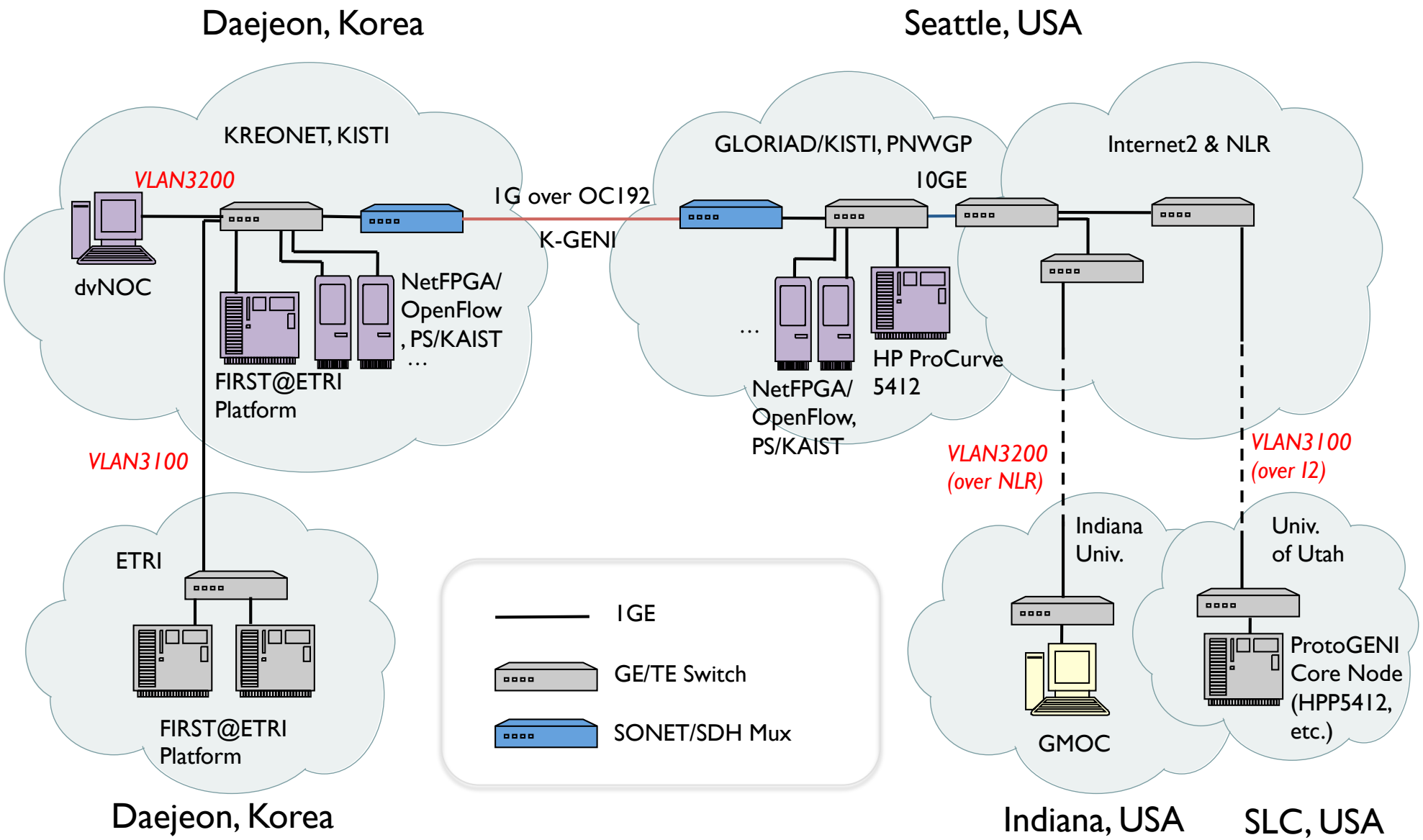
- Share researcher credentials and resource description (rspec)
- Agree on slice operation/management API and allocation policy
  - Sometimes, Adapter (broker) would be required
- Allow experiments (services) to run across (national) boundaries

Korea Testbed and Deployment



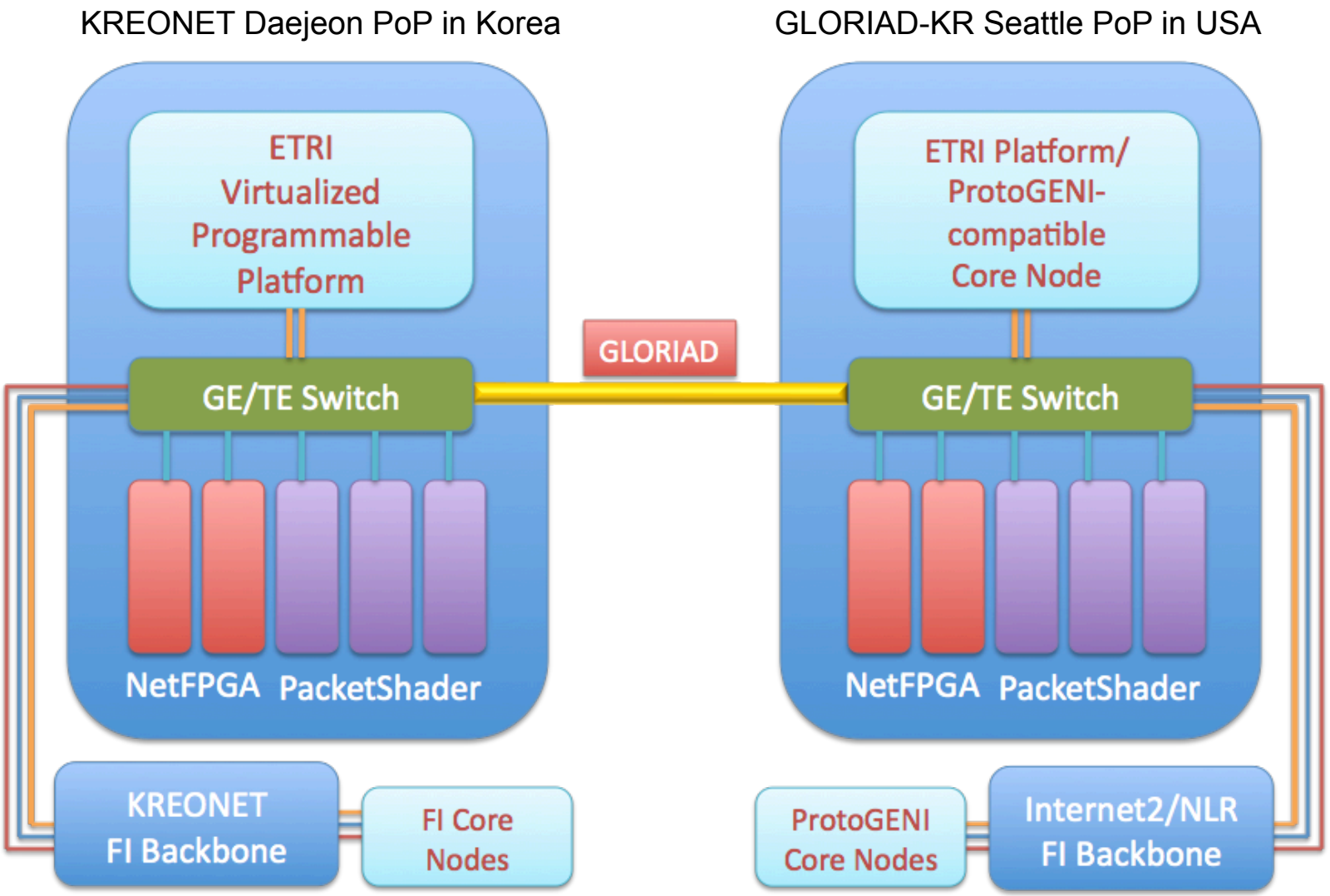
Core Node Deployment on KREONET

Korea – GENI Interconnection



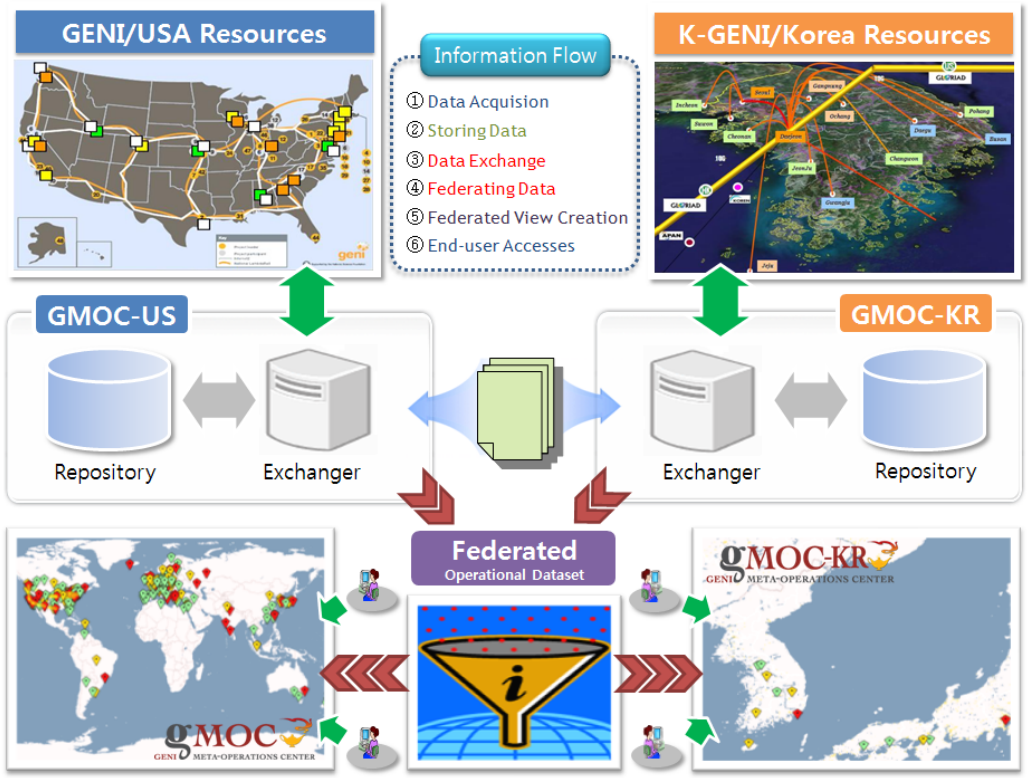
Dongkyun Kim@KISTI, mirr@kisti.re.kr, April 2010

Core Node Interconnection



Federated Meta Operations (GENI – Korea)

- Data acquisition from KISTI/ETRI and GENI (IU, Utah, etc.)
- Storing data into each resource repository
- Data exchanges using APIs provided by GMOC
- Federating data: topology, identifiers, schemas, etc.
- Creating federated user-oriented views/interfaces



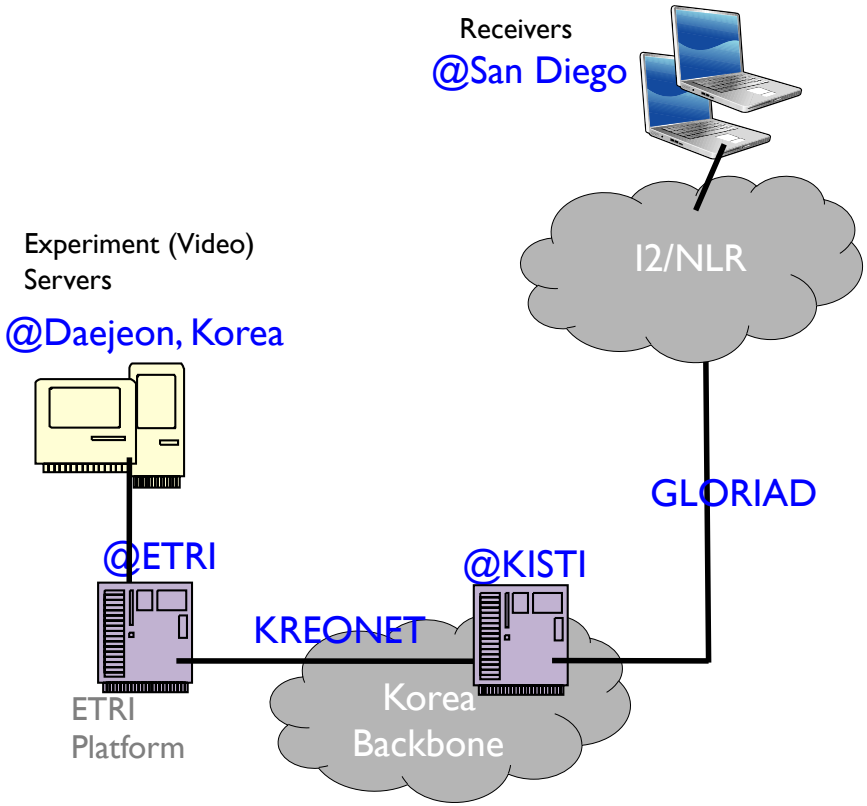
Demo@GEC8

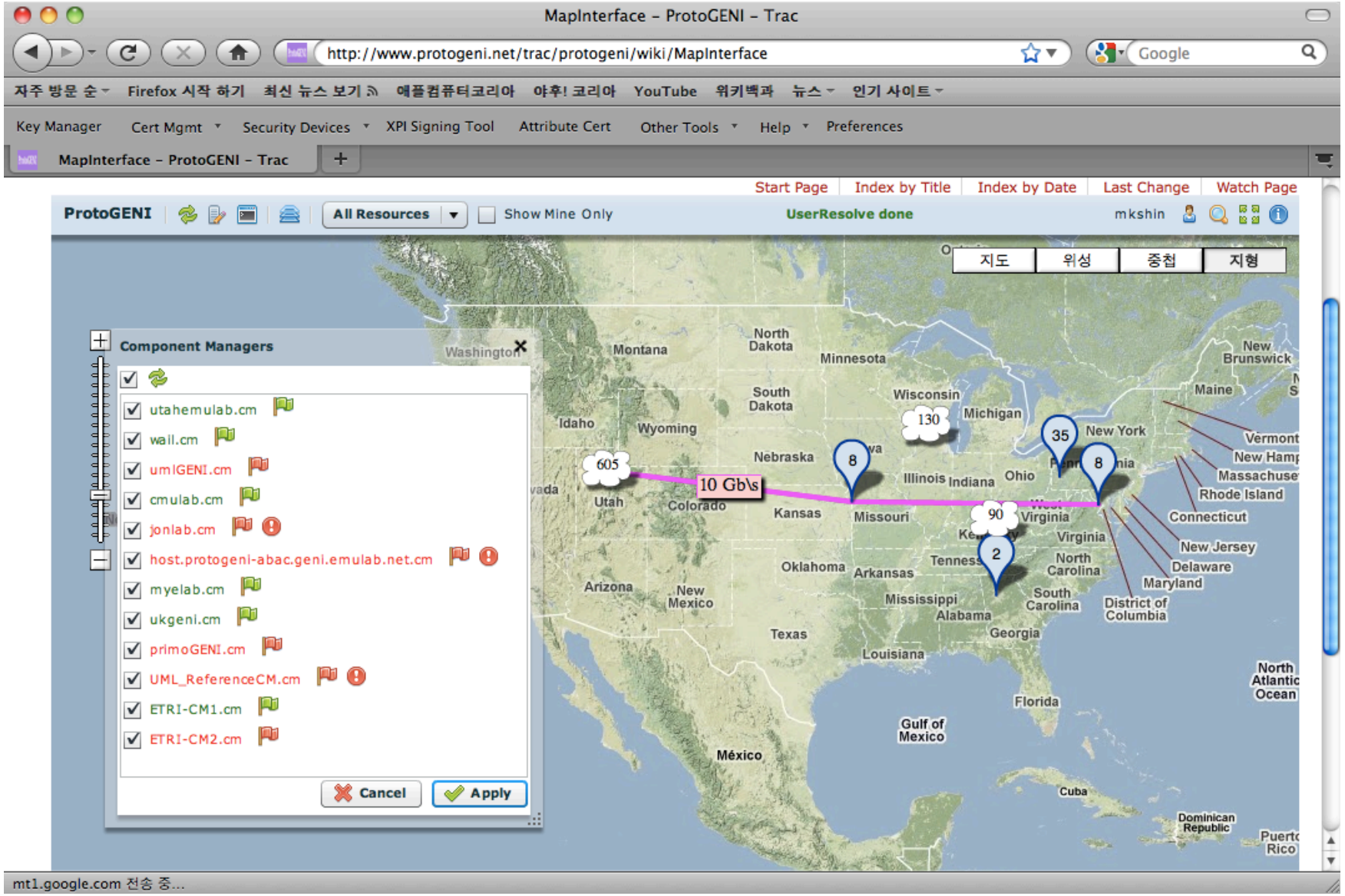
- Packetvisor
  - Dynamic CPU resource allocation on slivers
- ProtoGENI Integration
  - ProtoGENI UI and Reference CM Integration

Packetvisor® Demo

Dynamic CPU Resource Allocation

1.5MHz Router → 3MHz Router




MapInterface - ProtoGENI - Trac
http://www.protogeni.net/trac/protogeni/wiki/MapInterface
Google
Key Manager
Cert Mgmt
Security Devices
XPI Signing Tool
Attribute Cert
Other Tools
Help
Preferences
Start Page
Index by Title
Index by Date
Last Change
Watch Page
ProtoGENI
All Resources
Show Mine Only
UserResolve done
mkshin
지도
위성
중첩
지형
Component Managers
utahemulab.cm
wail.cm
umlGENI.cm
cmulab.cm
jonlab.cm
host.protogeni-abac.geni.emulab.net.cm
myelab.cm
ukgeni.cm
primoGENI.cm
UML_ReferenceCM.cm
ETRI-CM1.cm
ETRI-CM2.cm
Cancel
Apply
10 Gb\s
605
130
35
8
90
2
Montana
North Dakota
Minnesota
South Dakota
Wisconsin
Michigan
Idaho
Wyoming
Nebraska
Illinois
Indiana
Ohio
Utah
Colorado
Kansas
Missouri
Virginia
Arizona
New Mexico
Oklahoma
Arkansas
Tennessee
North Carolina
South Carolina
Mississippi
Alabama
Georgia
Texas
Louisiana
Florida
Gulf of Mexico
México
Cuba
New York
Maine
New Brunswick
Vermont
Massachusetts
Rhode Island
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