TUNIE

Virtualized Network Experiment Testbed in China

Tsinghua University, Beijing 100084, China

Email: yong-li07@mails.tsinghua.edu.cn

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Tsinghua University
Network Innovation Environment

State Key Lab on Microwave & Digital Communication

DEE, Tsinghua Univ.

Outline

- **Virtualized Testbed Design**

- **System Prototype**
  - Devices and network sites
  - Experiment System and Interface

- **Consideration of Federation with GENI**
  - KanseiGENI deployment
  - OpenFlow network deployment
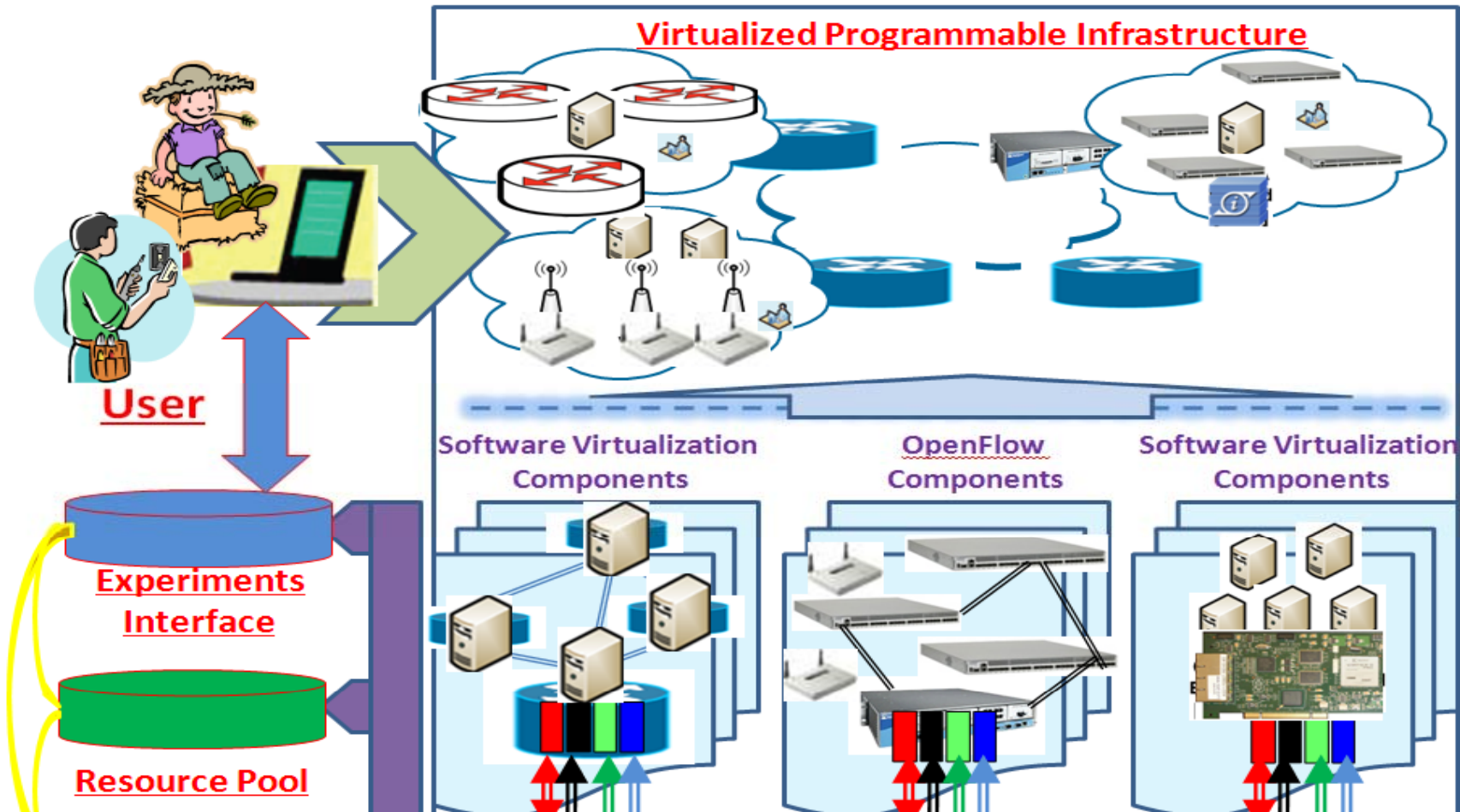 - ORCA control framework

Virtualized Nodes Design

- Combining software and hardware virtualization
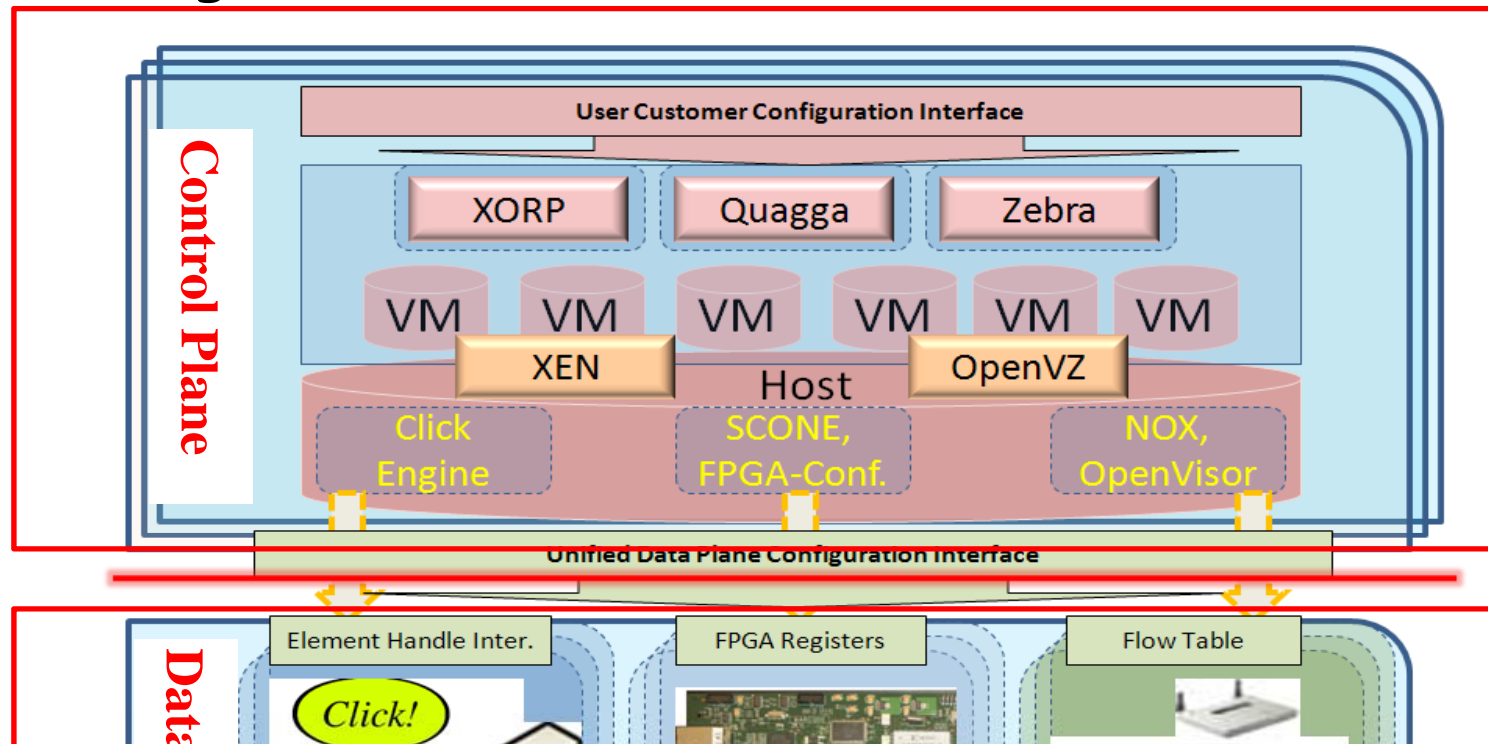
Providing E2E Virtualized Programmable Network Environment from Wire to Wireless in both the Control Plane and Data Plane !
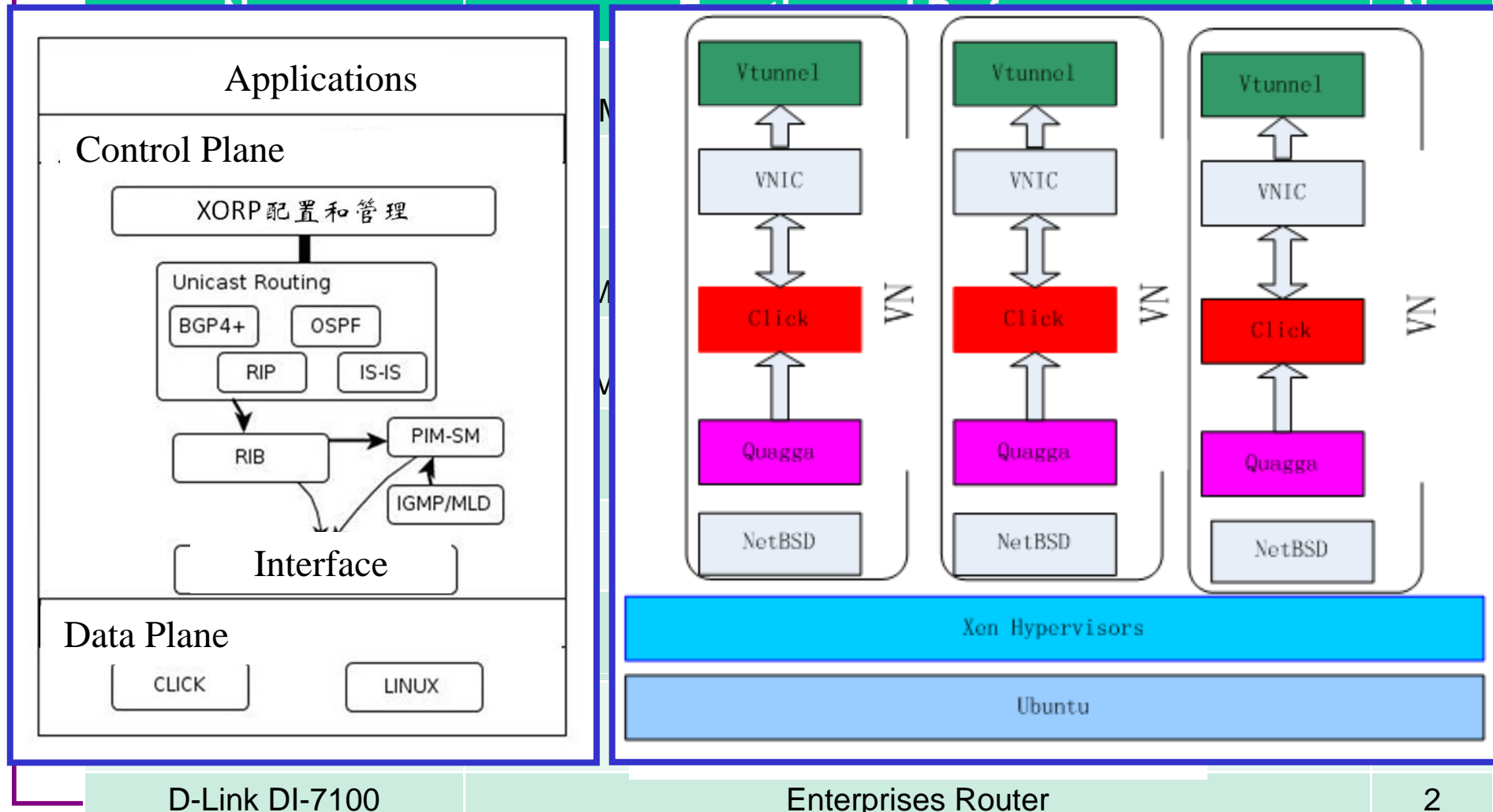
TUNIE Design

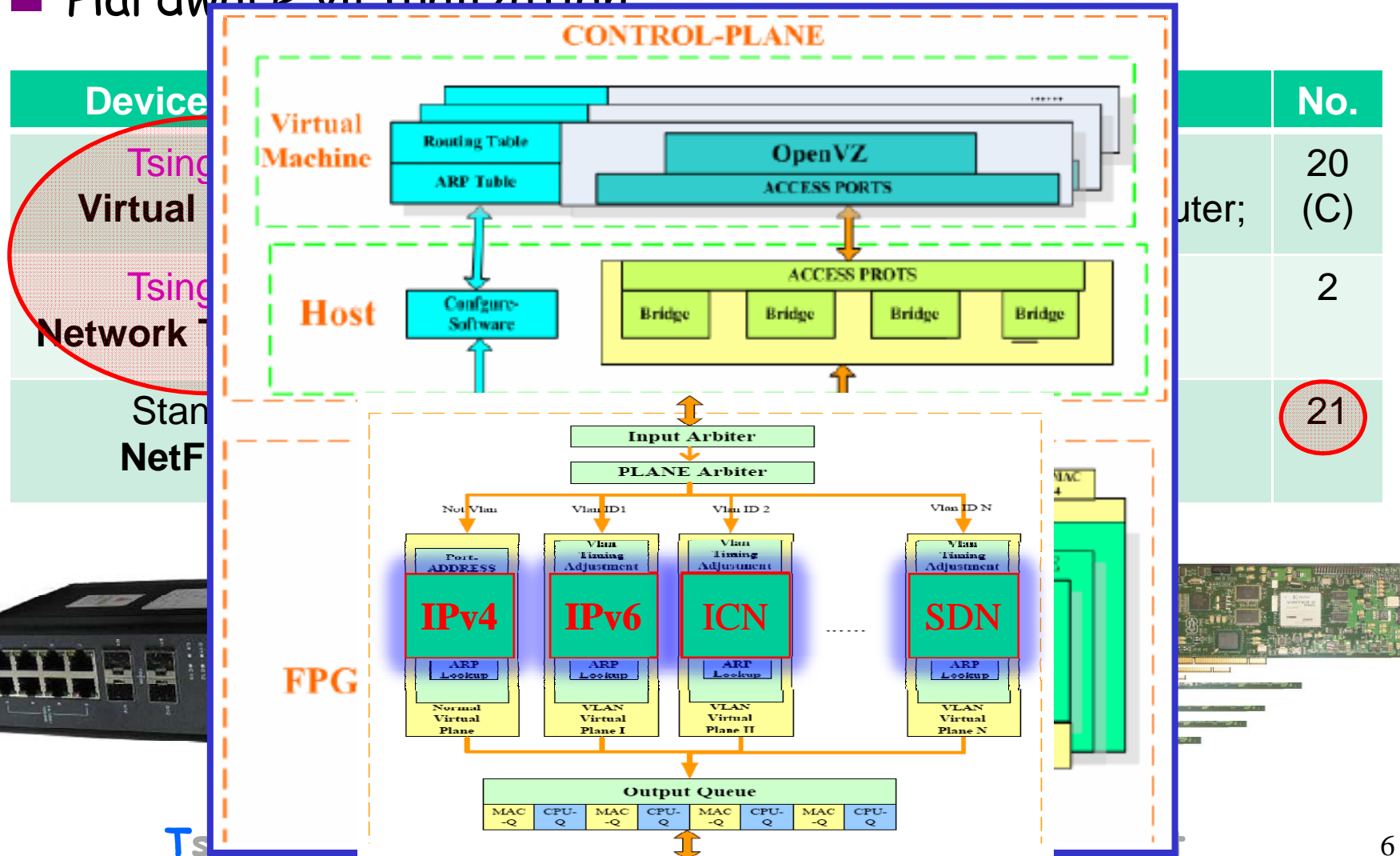**Provide friendly Experiment Interface with security management and basic measurement.**

TUNIE: System Prototype

- Software Virtualization

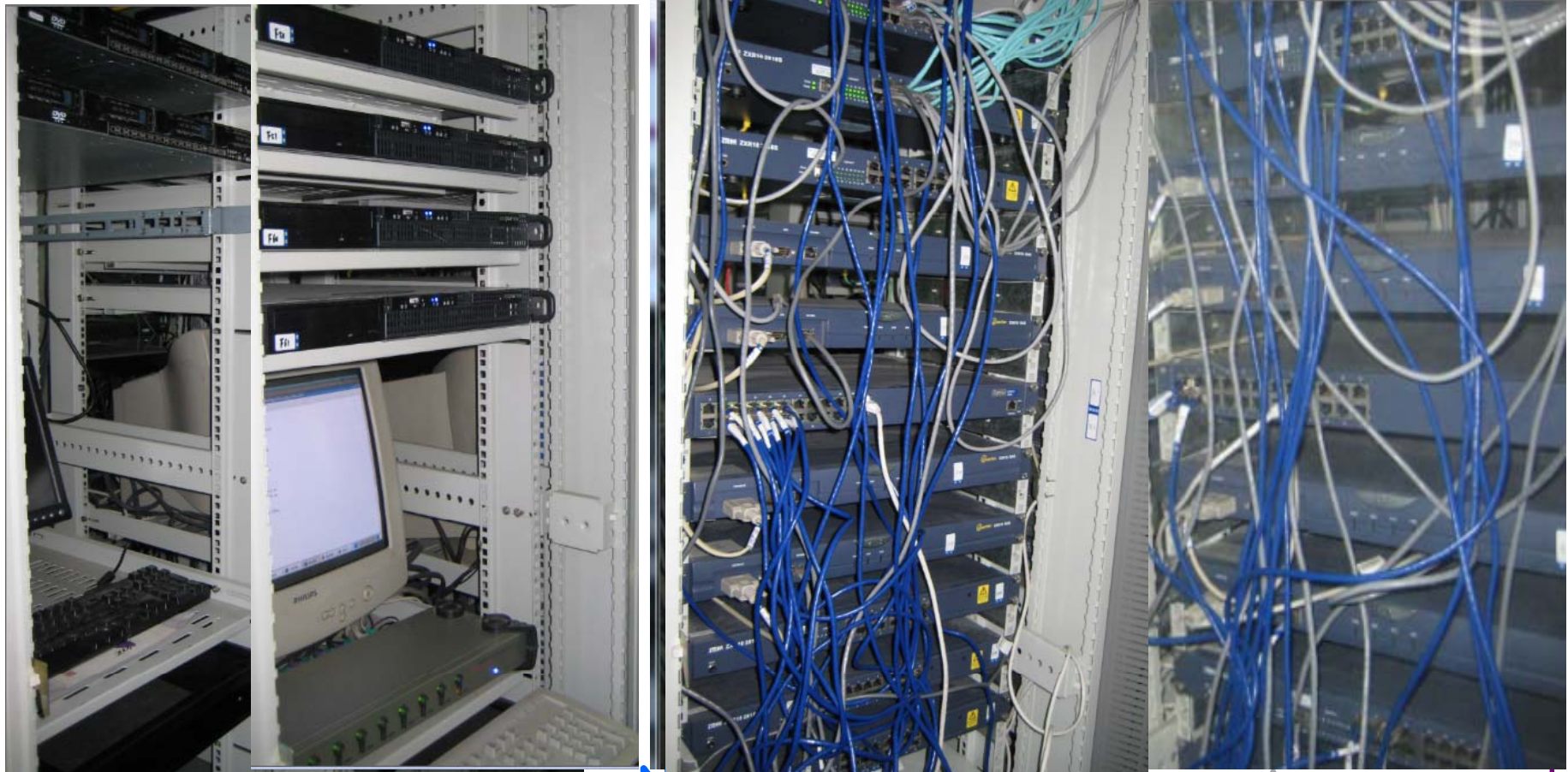# TUNIE: System Prototype

■ Hardware virtualization

Hardware - Sites 1

- **15 cores** Servers + **8** PC: **15 nodes**
  - ➢ **Supply About 200 virtual nodes (dynamic)**

Hardware - Sites2

- Server cluster: 20 nodes
  - Also support virtual nodes

Network of all 4 Sites

Cluster 3
China Unicom
4 Nodes

4 Nodes
Cluster 4
Bupt University

VPN

VPN: CERNET2

Cluster 1
Tsinghua Main Building
12 Nodes

VPN: Tsinghua Campus Net

16 Nodes
Cluster 2
Tsinghua Rohm Building
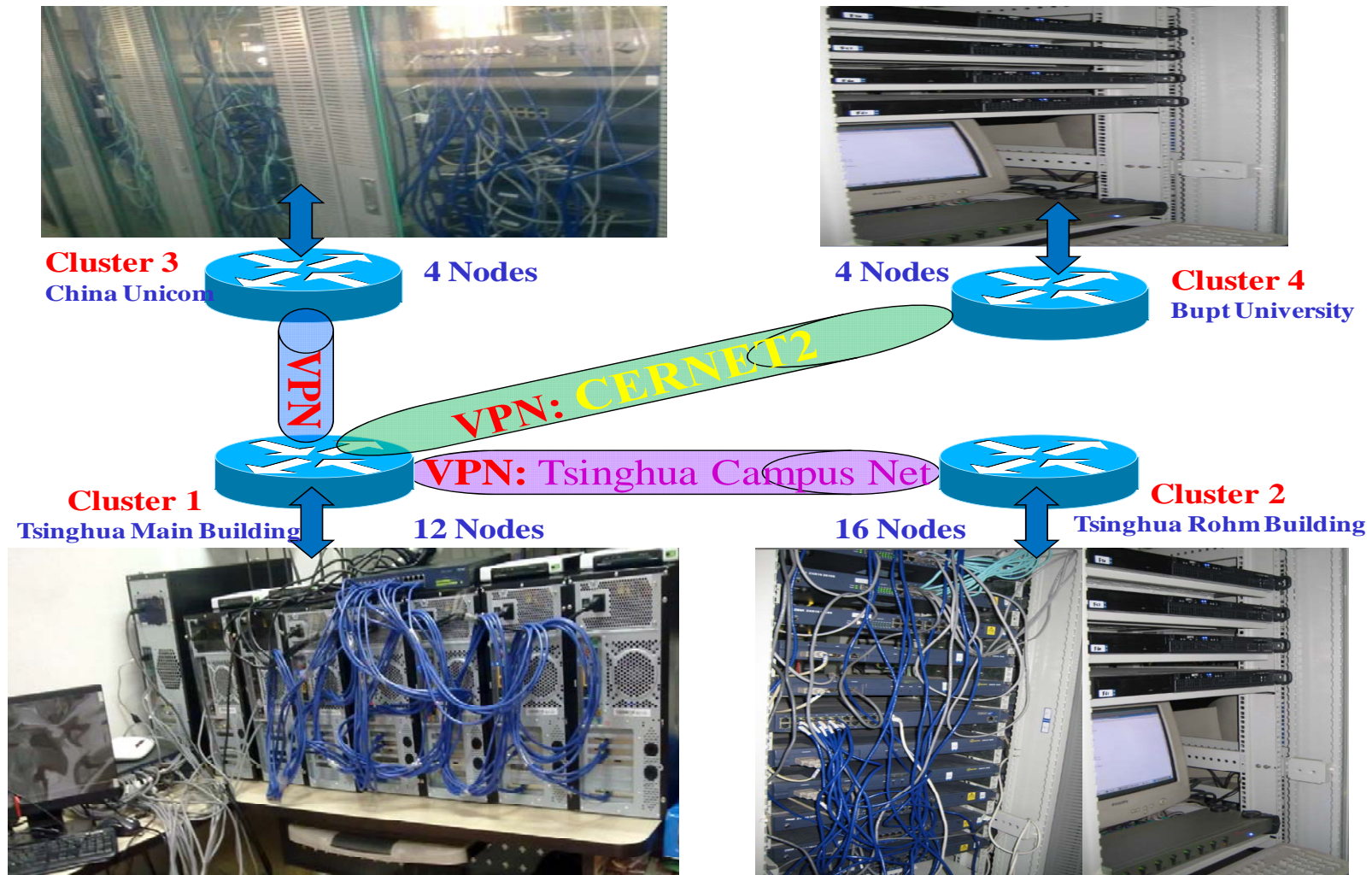
TUNIE: Experiment Interface

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┌─────────────────────────────────────────┐
│          System Resources Query          │
└─────────────────────────────────────────┘
                      ▼
┌─────────────────────────────────────────┐
│             Experiment Design            │
└─────────────────────────────────────────┘
                      ▼
┌─────────────────────────────────────────┐
│          Experiment Deployment           │
└─────────────────────────────────────────┘
                      ▼
┌─────────────────────────────────────────┐
│             Result Collection            │
└─────────────────────────────────────────┘
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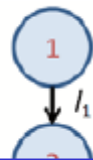
Demo 1: Uni-Multi Virtualed Networks
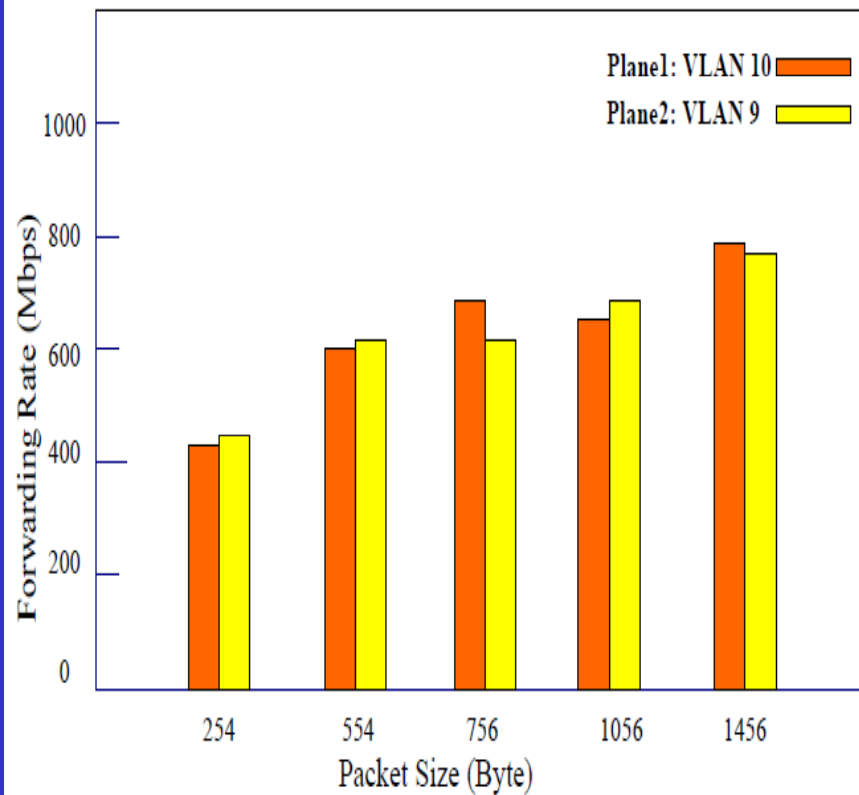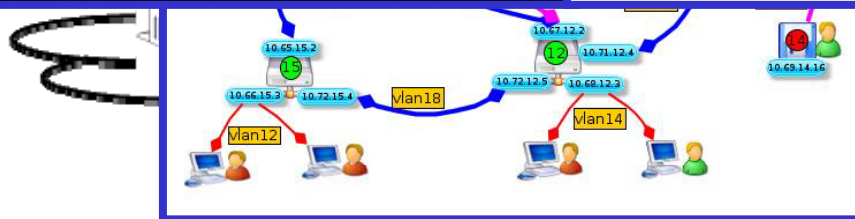
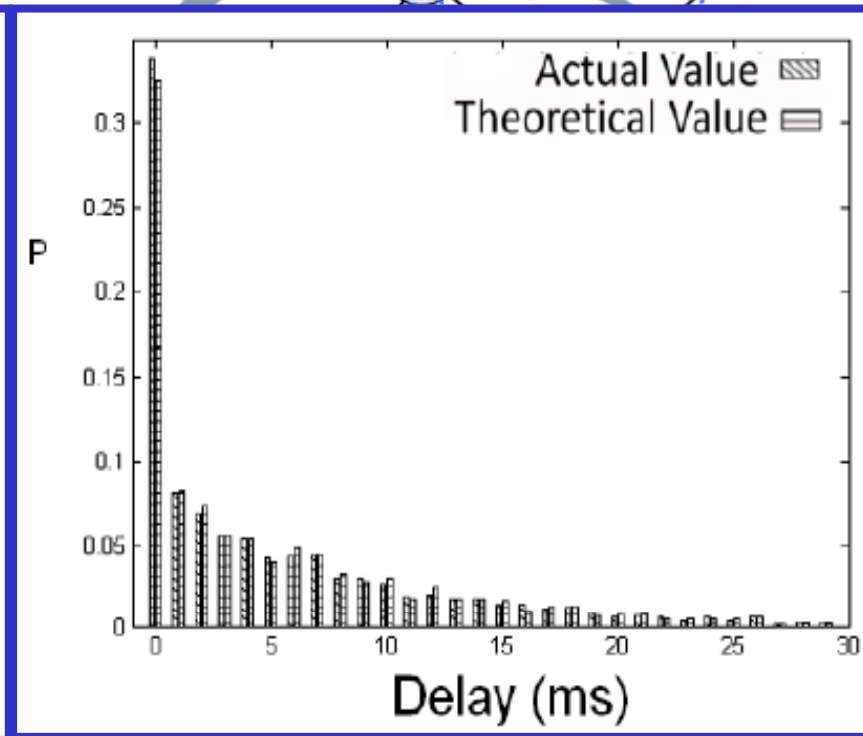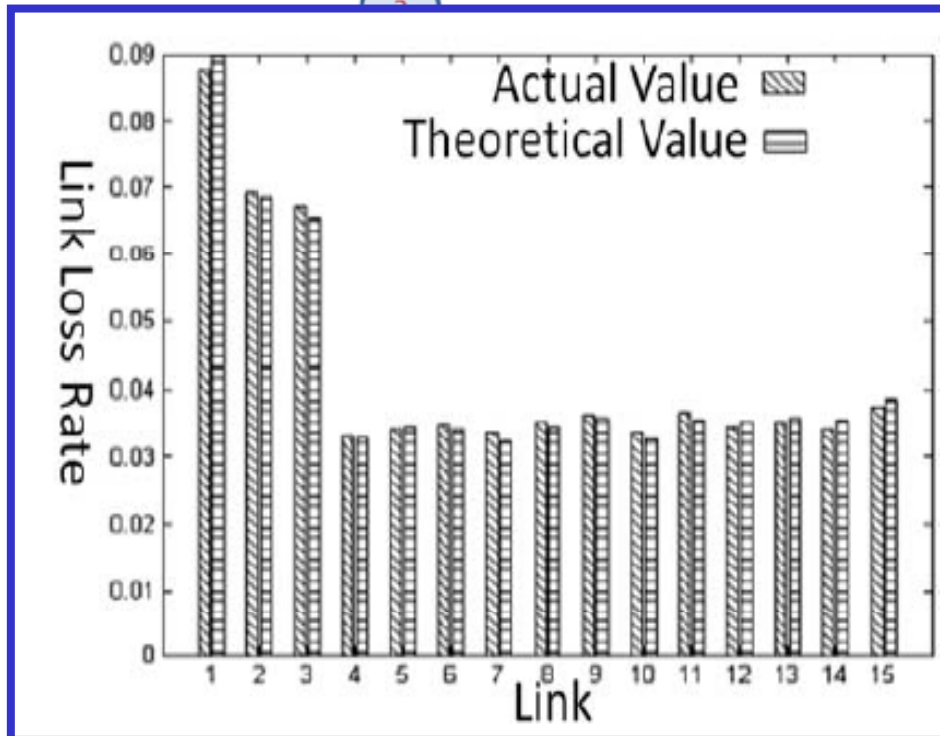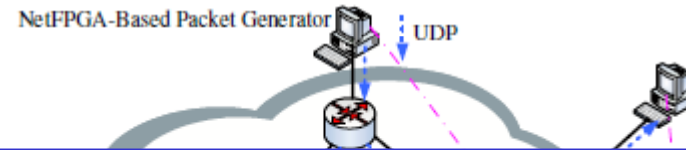**IEEE INFOCOM 11 Demo**

Demo 2: Network Tomography

IEEE GLOBECOM 2011

Other Demos List

- **New Network Architecture Prototype Experiment**
  - Network virtualization based Uni-Multi integration test
  - Control-Data Plane Separation Network
  - Software-define network prototype
  - Information-centric Networks
- **Network Algorithms and Protocols Experiment**
  - Network tomography based link loss rate inference
  - Network tomography based link delay inference
  - Transportation layer load balance

TUNIE: Conclusion

- **Efficient Virtualization**
  - TUNIE uses both hardware- and software-based virtualization technologies, and provides a uniformed management system to control network resource to achieve efficient allocation and usage.

- **Deep Programmability**
  - TUNIE affords enough customization to enable the implementation of new algorithms and the deployment of new protocols in both Data plane and Control Plane

- **High Flexibility**
  - TUNIE implements the system with both hardware and software solutions. At the same time, it achieves high flexibility in component choice and requirements satisfying by providing selection choices to users.

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  - ORCA Control framework

KanseiGENI deployment

- **Tsinghua ROHM EE Building Sensor deploy**
  - TelosB nodes
  - Tsinghua-FLOWS nodes
  - Other Commotional Sensor nodes
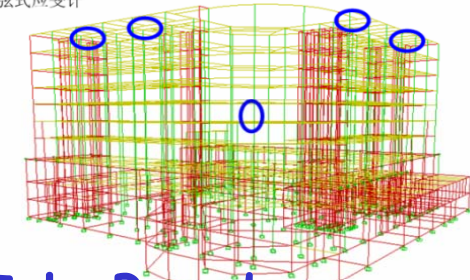- **KanseiGENI Deployment**
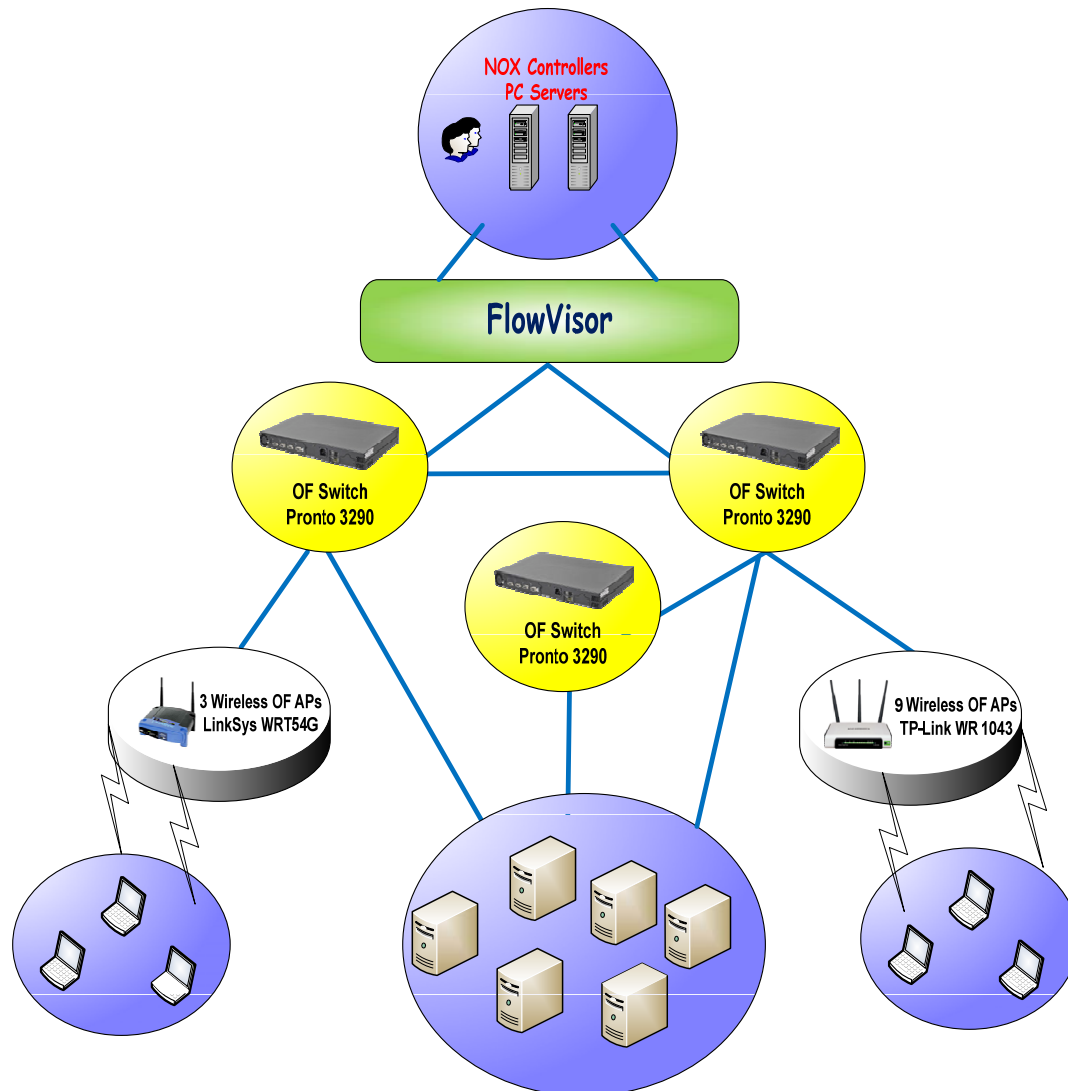 - Have set up the KanseiGENI system with TelosB nodes
  - http://fi.ee.tsinghua.edu.cn:82/KanseiGenie/
- **Plan**
  - Deploy FLOWS sensor to KanseiGENI

OpenFlow Network deployment

NOX Controllers
PC Servers

FlowVisor

OF Switch
Pronto 3290

OF Switch
Pronto 3290

OF Switch
Pronto 3290

3 Wireless OF APs
LinkSys WRT54G

9 Wireless OF APs
TP-Link WR 1043

Name

Active Flow Number

Flow Injection Rate

Flow Setup Delay

Packet Loss Rate

RTT

Wget Delay

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TUNIE: Federation with GENI

- **Choose:**
  - ➤ **Using GENI Stitching Architecture**
  - ➤ **Using GENI Control framework OCRA**
- **Control framework update**
  - ➤ **Considering OCRA**
- **Using the deployed OpenFlow as link 2 layer connectivity to connect different sites**
- **Under ORCA, integrate sensor testbed with the wired TUNIE.**

- **Comments and Suggestions are welcome☺**

Thanks

TU-NIE
C&Q&A

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Tsinghua University, Beijing 100084, China

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