

# **KREONET SOFTWAREIZATION**

- KREONET SD-WAN Deployment based on ONOS-

Dongkyun Kim, KISTI  
(on behalf of Dr. HAHN, Sunhwa)

[mirr@kisti.re.kr](mailto:mirr@kisti.re.kr)

**November 19<sup>th</sup>**  
**Open Networking Korea 2015**

# Contents

- Introduction & Background
- KRE○NET-S\* as the Next KREONET
- Deployment Status of KRE○NET-S\*
- Applications Development: VDN & UoV
- Conclusions

# KISTI, R&D Partner for the Better Society

## Provide Research Infrastructures

For the advancement of national scientific, technical, and industrial development



## Do the Research

For leading the new research paradigm  
And providing better services

As a national institute focused on S&T information, supercomputing, and research networking, KISTI plays a key role in facilitating the national R&D competitiveness

# Background of KREONET-S\*

« Nationwide 17 Regional Centers in Korea (~100Gbps), 3 International Connections to the US and China (~20Gbps), Global Research Network Collaborations (GLIF & GLORIAD), ~200 member institutions, Supercomputing/Advanced Application Services »

\*\*\* 24 x 7 Network Operations Center \*\*\*

**Toward Software and User driven Virtualized, Dynamic, and Flexible Environment**

**from Hardware-based Fixed, Closed Network Infra & Services**

Map of  
KREONET & GLORIAD

Hang Kong/CN  
— 병행연구 서비스  
— 첨단연구 서비스

Global Ring Network for Advanced Applications Development

USA-RUSSIA-CHINA-KOREA-NETHERLANDS-CANADA-DENMARK-FINLAND-ICELAND-NORWAY-SWEDEN-INDIA-EGYPT-SINGAPORE



# KREONET (Top 10) Advanced Applications



**Deterministic Network  
Performance and QoS**  
for ~100G Data Transfer

Weather & Climate

**User-oriented Dynamic &  
Flexible Networks**  
for **Time-to-Research &  
Time-to-Collaboration**

**Very Reliable and Security-  
guaranteed Networks**  
for Collaborative Research



High Energy Physics



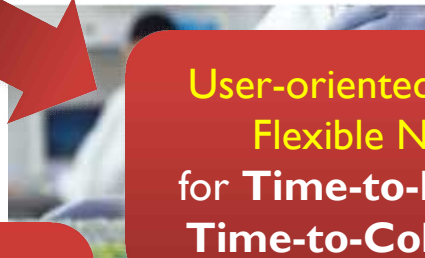
Education & Collaboration



Astronomy



New Medicine/Bio



Medical Science



Culture & Art



Future Internet

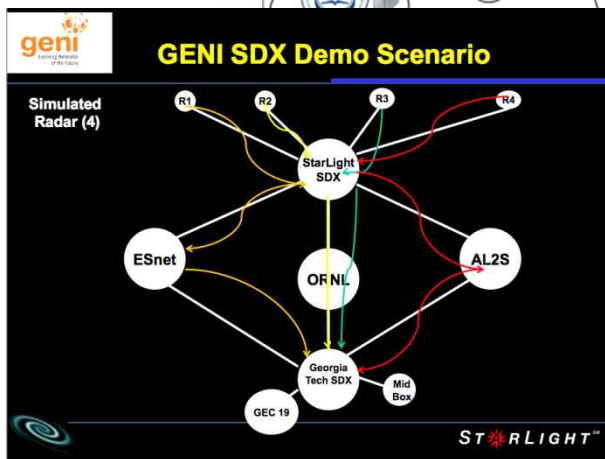
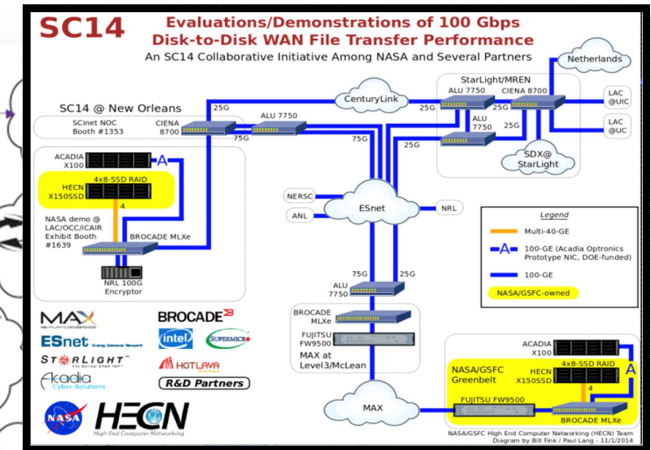
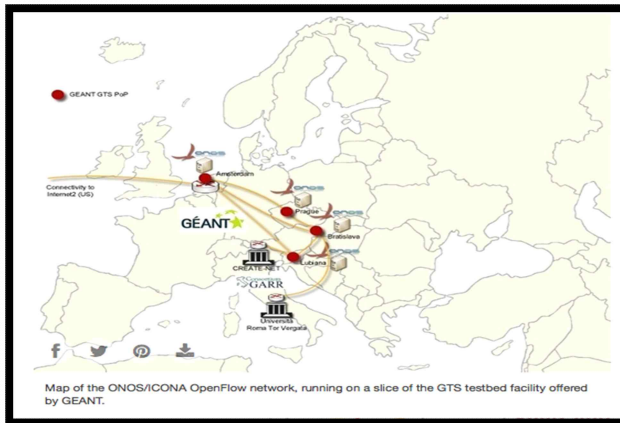


Constructions

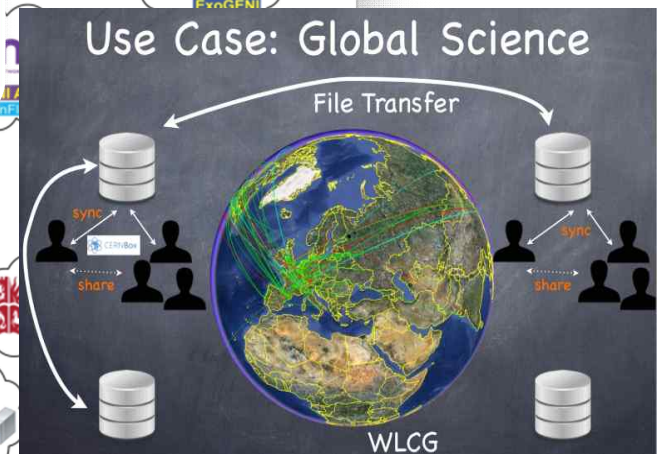
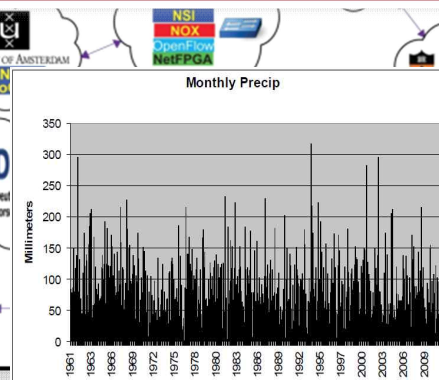


Supercomputing

# Global Collaborations



**New Network Environment**  
for Global and Domestic  
Experimenters & Researchers



Source: ONOS ICONA Project, SC14 Demos, StarLight's SDX Project

# The Next: KREONET-S\*

- **KREONET-S\* Main Goals**
  - **Carrier-grade Reliable “Public SD-WAN” Operations**
    - Distributed Controls and 24 x 7 Network Operations
  - **New User Interfaces, Services, and Experiences**
  - **Multi-vendor and Multi-layer Network Infrastructure**
- **Principal Building Blocks**
  - Northbound (Apps & Services): **VDN, UoV, vSciZ**, etc.
  - Southbound: **OpenFlow**, TLI, NETCONF, etc.
  - East-Westbound: **Distributed Controls**
    - **KISTI/KREONET - ONOS Affiliate** (in a joint effort with KAIST)
    - Service Composition: KREONET COREEN Platform, vSciZ, etc.

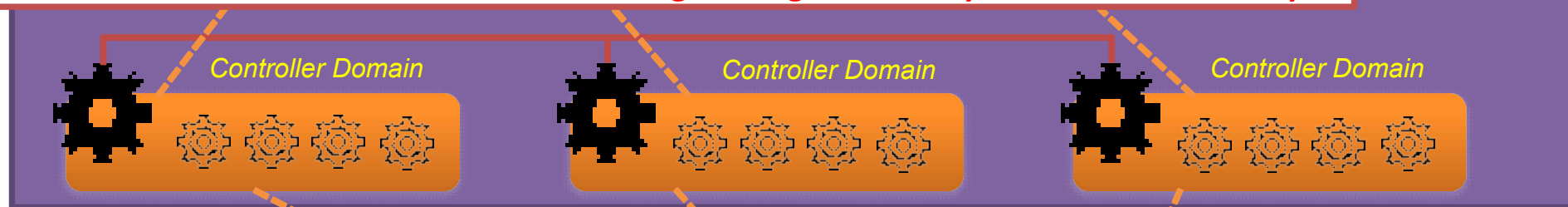


# The Next: KREONET-S\*

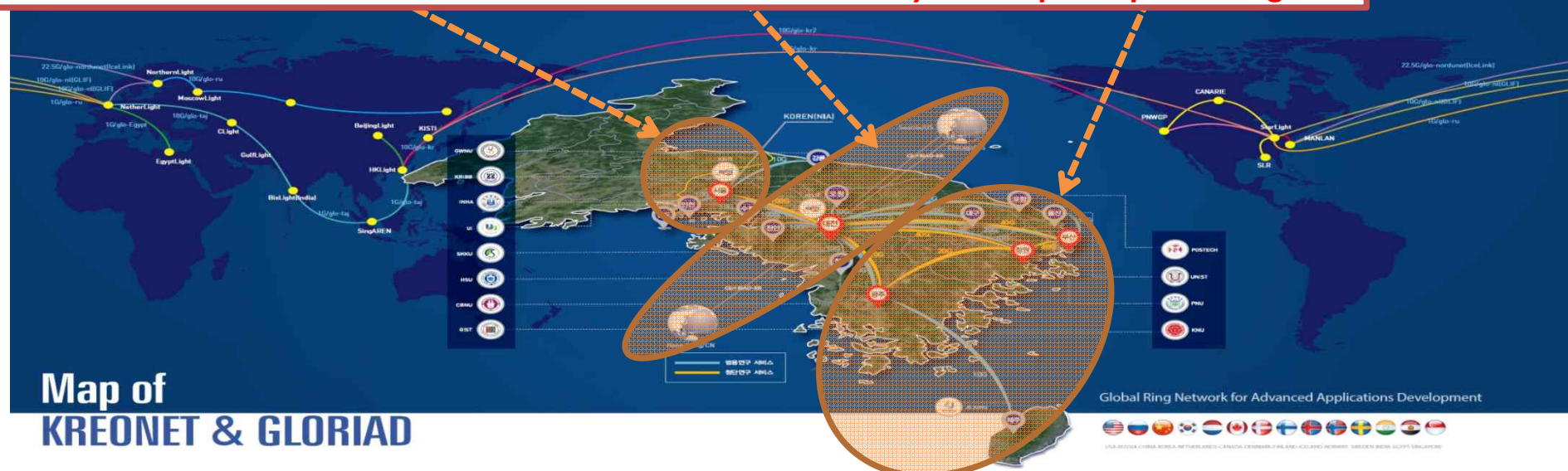
**KREONET-S\* Applications & Services:** *High Performance, Advanced Security, New User Services & Experiences*



**KREONET-S\* Controller Infrastructure:** *Carrier-grade High Availability/Failover and Scalability*



**KREONET-S\* Hardware Infrastructure:** *Multi-vendor and Multi-layer to CapEX/OpEX Savings*



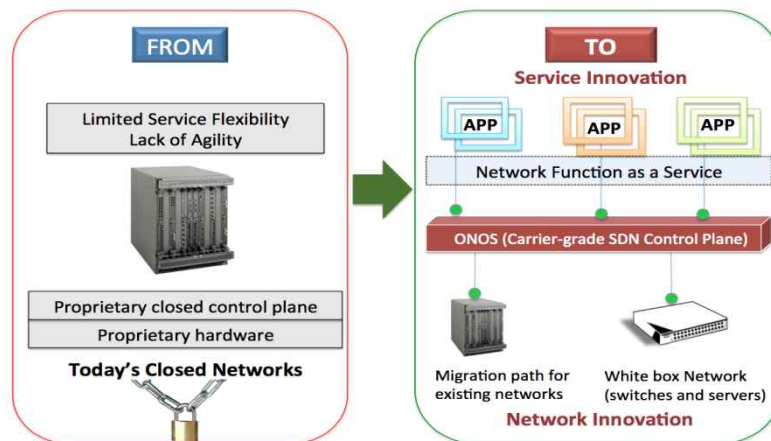


# The Next: KREONET-S\*

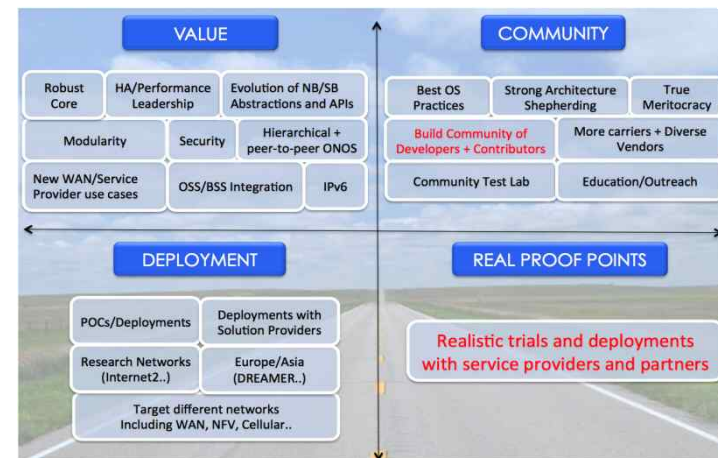
- Embracing Open Technologies
  - OpenFlow, OVS, OPNFV, OpenStack, Many others..
  - **ONOS Affiliate**
    - Technical collaborations for ONOS deployment
    - Setting up discussion channel for operational experiences
    - Applying various SDN applications on KREONET-S\*

## ONOS Vision for Service Provider Networks

Enabling Service Provider SDN adoption for carrier-grade service and network innovation



## ONOS in 2015

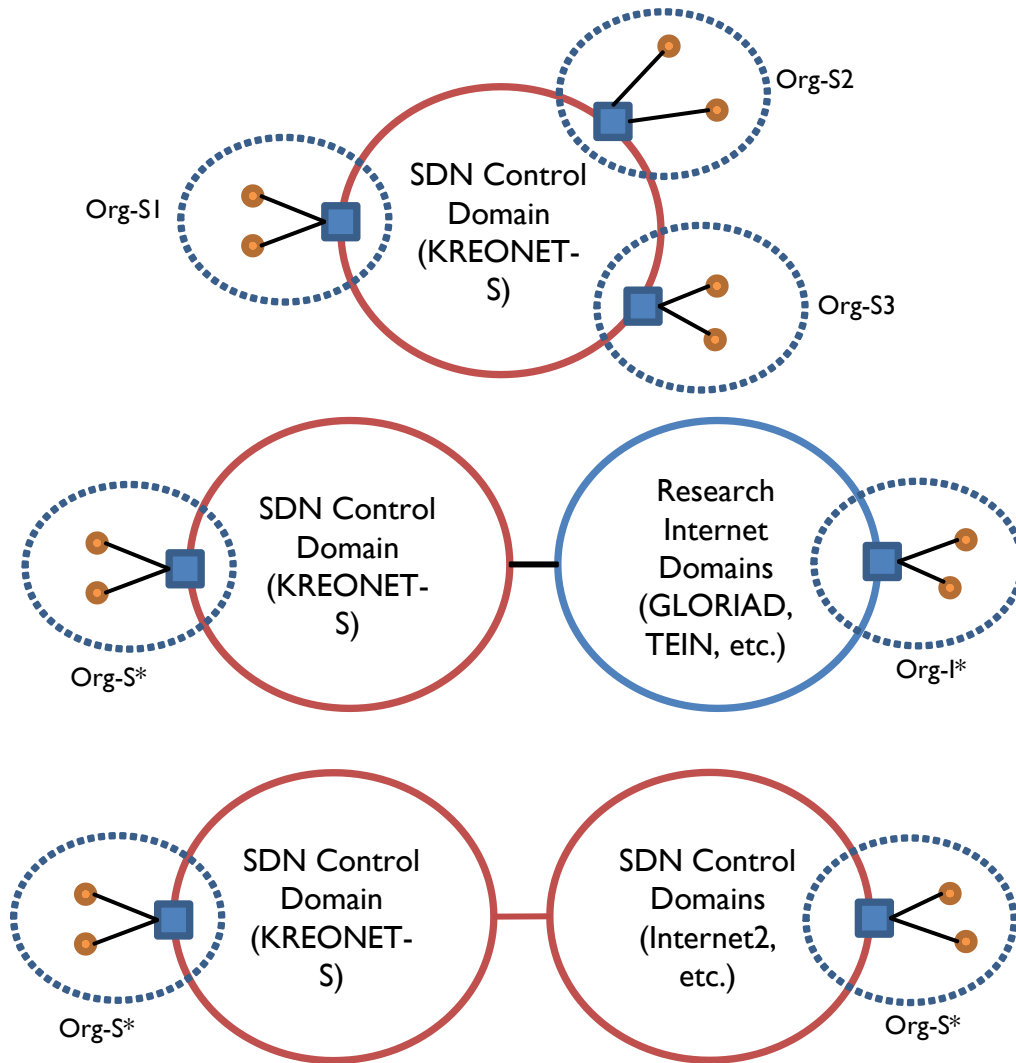


# KREONET-S\* Roadmap

## KREONET SOFTWAREIZATION Phase I by 2017



# KREONET-S\* Service Types



## Pure SDN Services

- Deterministic QoS & Performance
- Virtually Isolated User Group Networks
- Enhanced Security & New User Experiences
- User-centric Open Networking Environment

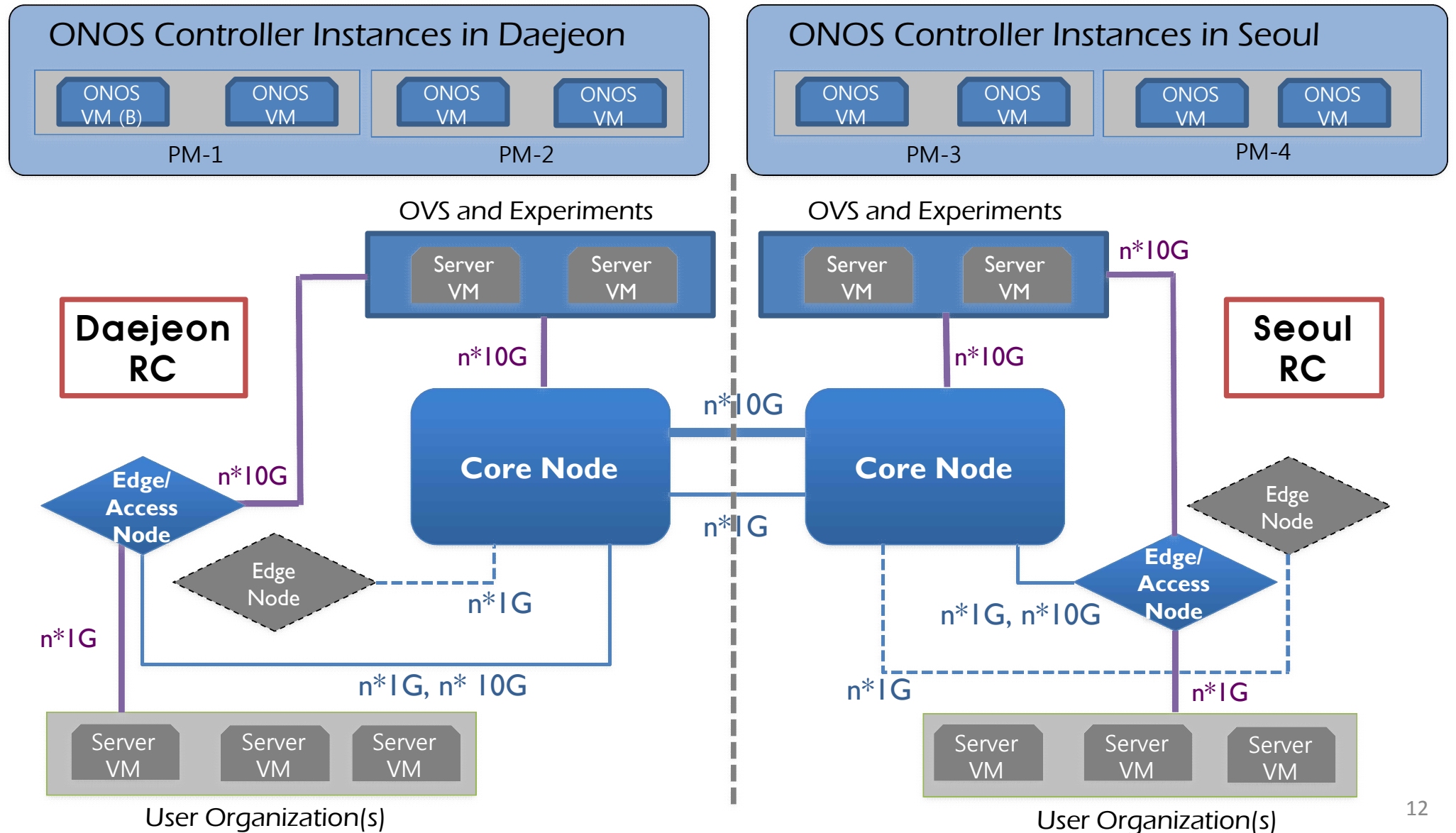
## SDN-IP Services

- SDN-to-Internet Extended Connectivity
- Traffic-engineered AS Transit (DC to DC)
- Partial Guarantee of QoS & Performance
- Partial Security, but still New User Experiences

## Federated SDN Services

- Inter-SDN Connectivity & Federated Resources
- Virtually Isolated Networks on Inter-Cluster SDN
- Deterministic Guarantee of QoS & Performance
- Enhanced Security & New User Experiences
- Extended Connectivity with SDN-IP

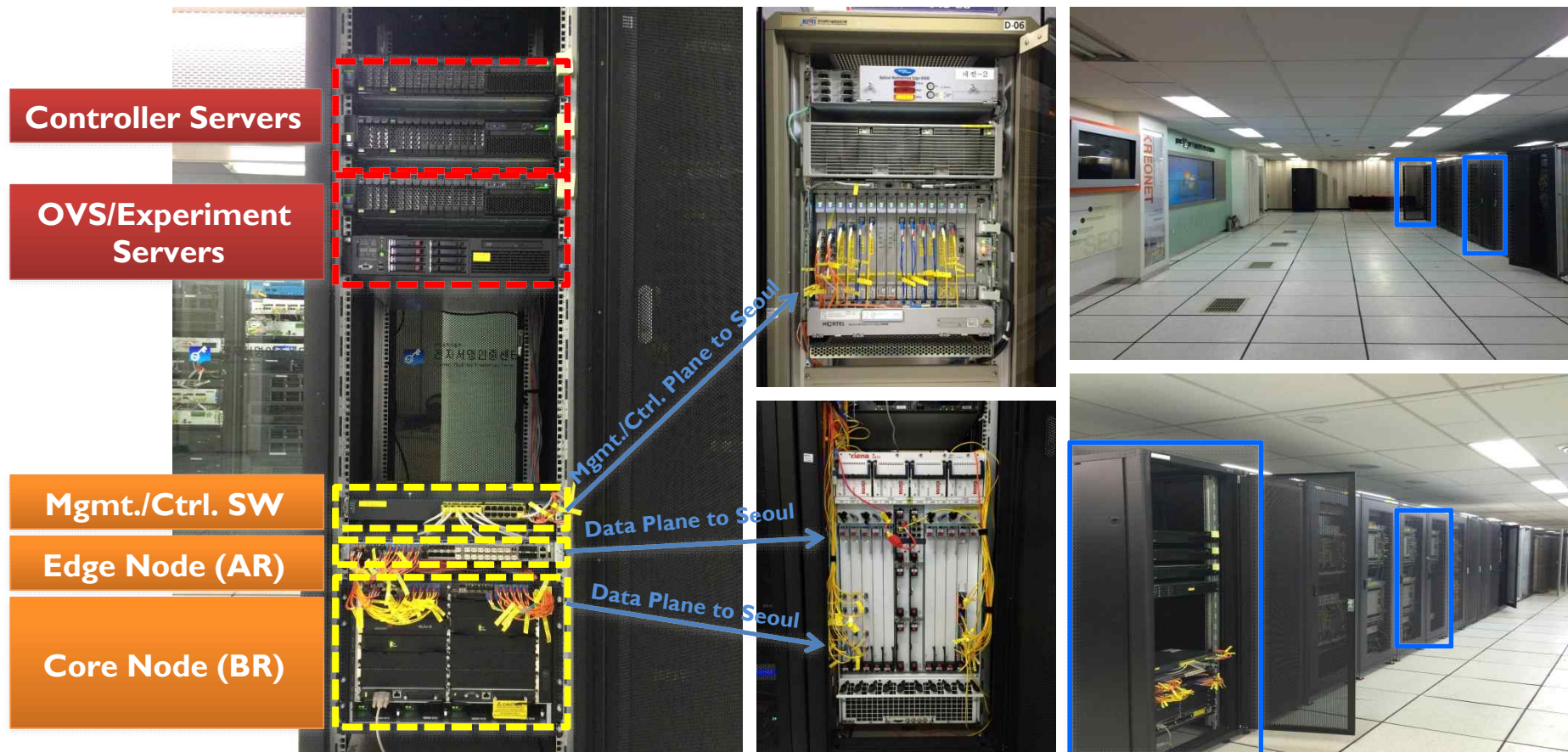
# Deployment 2015 - Overall Design





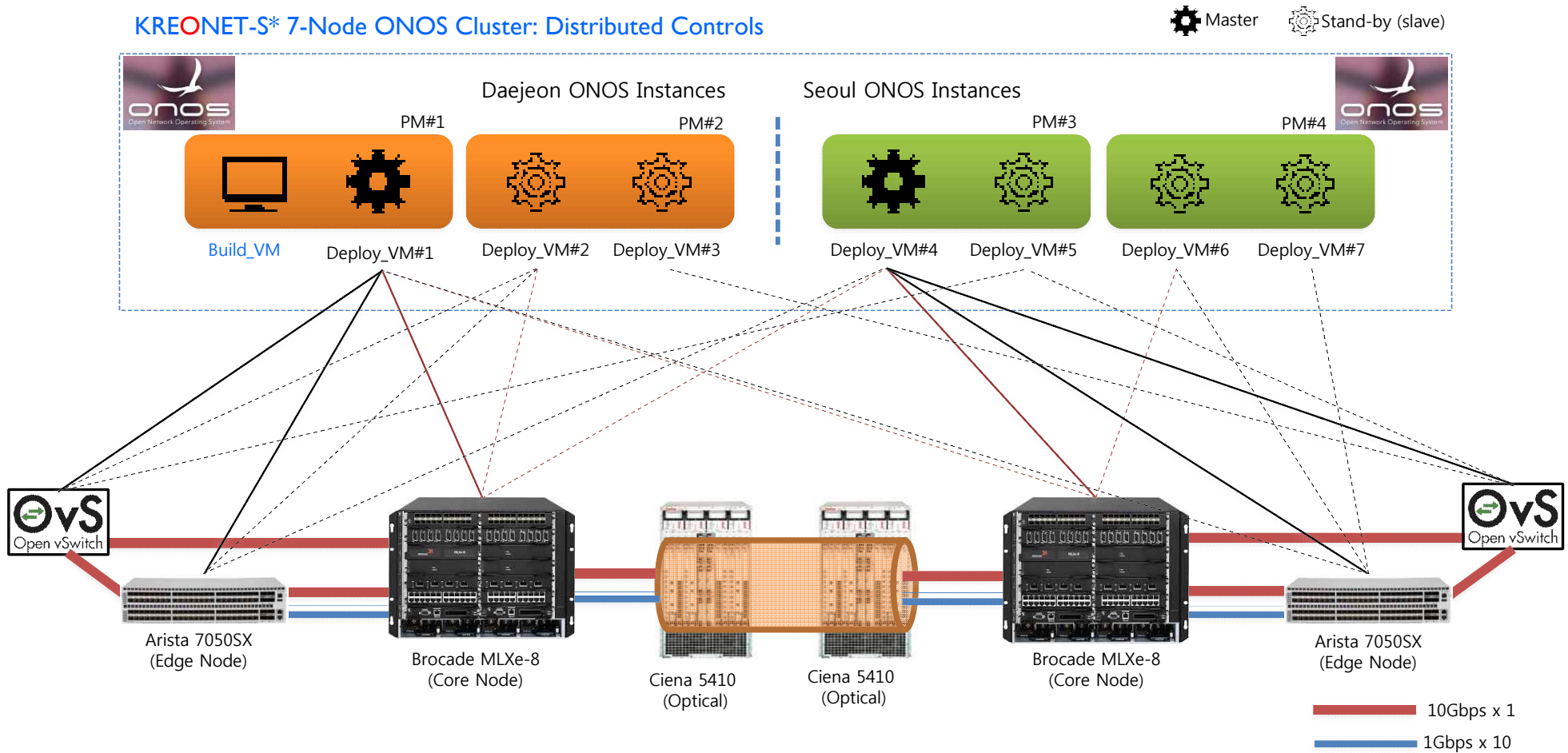
# Deployment 2015

- Softwarization of KREONET: Daejeon and Seoul Centers



# Deployment 2015

- Deployment Status as of Today



# Deployment 2015 – ONOS GUI

The screenshot displays the ONOS GUI interface. At the top, there are three tabs labeled 'Seoul', 'Daejeon', and 'Seoul'. Below these tabs are six colored boxes representing different network components with their IP addresses and switch counts:

- 172.16.1.10, 172.16.1.11 (# Switches: 2)
- 172.16.1.5, 172.16.1.6, 172.16.1.7 (# Switches: 0)
- 172.16.1.8, 172.16.1.9 (# Switches: 1)

The main area shows a network topology diagram. A blue speech bubble labeled 'KREONET-S \* Operations & Simulation' points to the 'Seoul' site. An orange speech bubble labeled 'VDN/UoV Experiments' points to the 'Daejeon' site. The diagram includes various network devices like 'Arista 7050sx', 'Brocade MLXe-8', and 'OVS' connected by links. A red arrow points to a link labeled 'Multiple links (10G \* 1, 1G \* 10)'. The bottom left shows a toolbar with various icons.

On the right side, there is an 'ONOS Summary' panel with the following information:

- Devices: 16
- Links: 95
- Hosts: 11
- Topology SCCs: 2
- Intents: 0
- Tunnels: 0
- Flows: 113
- Version: 1.2.1.kreonet

Below the summary is a panel showing the MAC address '08:00:27:EC:4D:87' and IP address '0.0.0.0, 10.10.50.2, 10.10.2.0.2'. The VLAN is 'none'. The Latitude and Longitude are also displayed.

At the bottom right, there is a terminal window showing the ONOS command prompt and a list of installed packages:

```

Welcome to Open Network Operating System (ONOS)!

Hit '<tab>' for a list of available commands.
Hit '<ctrl-d>' or type 'system:shutdown' or 'logout' to shutdown ONOS.

onoss> list
START LEVEL 100, List Threshold: 50
ID | State | Lvl | Version | Name
-----
37 | Active | 80 | 0.0.0 | samples
41 | Active | 80 | 2.0 | Commons Lang
42 | Active | 80 | 3.3.2 | Apache Commons Lang
43 | Active | 80 | 1.10.0 | Apache Commons Configuration
44 | Active | 80 | 18.0.0 | Guava: Google Core Libraries for Java
45 | Active | 80 | 3.9.2.Final | The Netty Project
46 | Active | 80 | 4.0.23.Final | Netty/Common
47 | Active | 80 | 4.0.23.Final | Netty/Buffer
48 | Active | 80 | 4.0.23.Final | Netty/Transport
49 | Active | 80 | 4.0.23.Final | Netty/Handler
50 | Active | 80 | 4.0.23.Final | Netty/Codec
51 | Active | 80 | 4.0.23.Final | Netty/Transport/Native/Epoll
52 | Active | 80 | 1.0.0 | Commons Pool
53 | Active | 80 | 3.2.0 | Commons Math
54 | Active | 80 | 2.5 | Joda-Time
55 | Active | 80 | 3.1.0 | Metrics Core
56 | Active | 80 | 3.1.0 | Jackson Integration for Metrics
57 | Active | 80 | 0.9.1 | minimal-json
58 | Active | 80 | 3.0.0 | Kryo
59 | Active | 80 | 1.10.0 | ReflectASM
    
```

# KREONET-S\* Applications

- **Virtual Dedicate Network (VDN) & User-oriented Visibility (UoV)**
  - **VDN**: OpenFlow/ONOS-based Dedicate Bandwidth Provisioning Network for User Groups on Demand
  - **UoV**: Virtual Network Visualization & Monitoring
- **Virtual ScienceDMZ**
  - Very High Performance Distributed Science Cloud & Advanced Experimental Environment (being designed)
- **ONOS SDN Apps & Use Cases**
  - **SDN-IP** (being experimented & deployed)
  - Packet-Optical, Segment routing (planning)



# Virtual Dedicate Network

- Design Principles

- User-Group based Authentication/Authorization

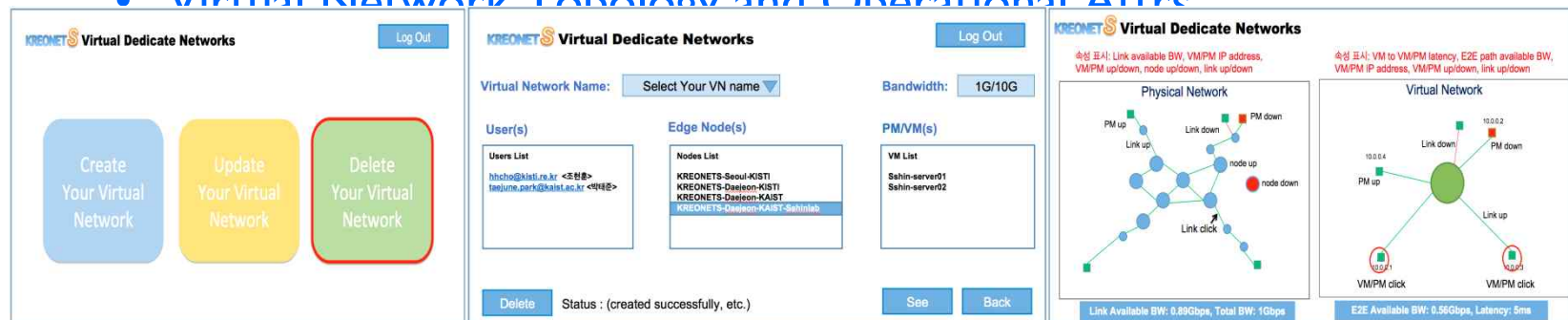
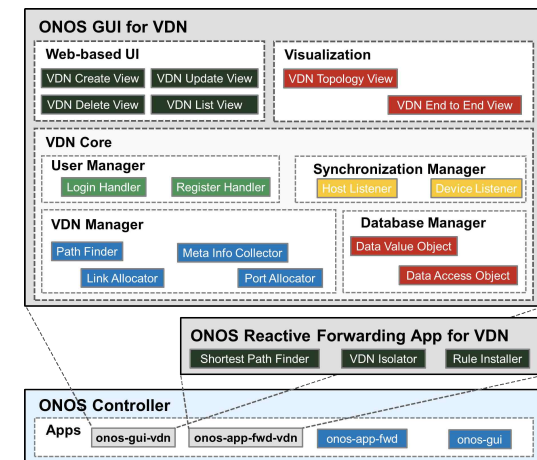
- Root user \*controls\*, General users \*use\*

- Easy-to-Use User Interface

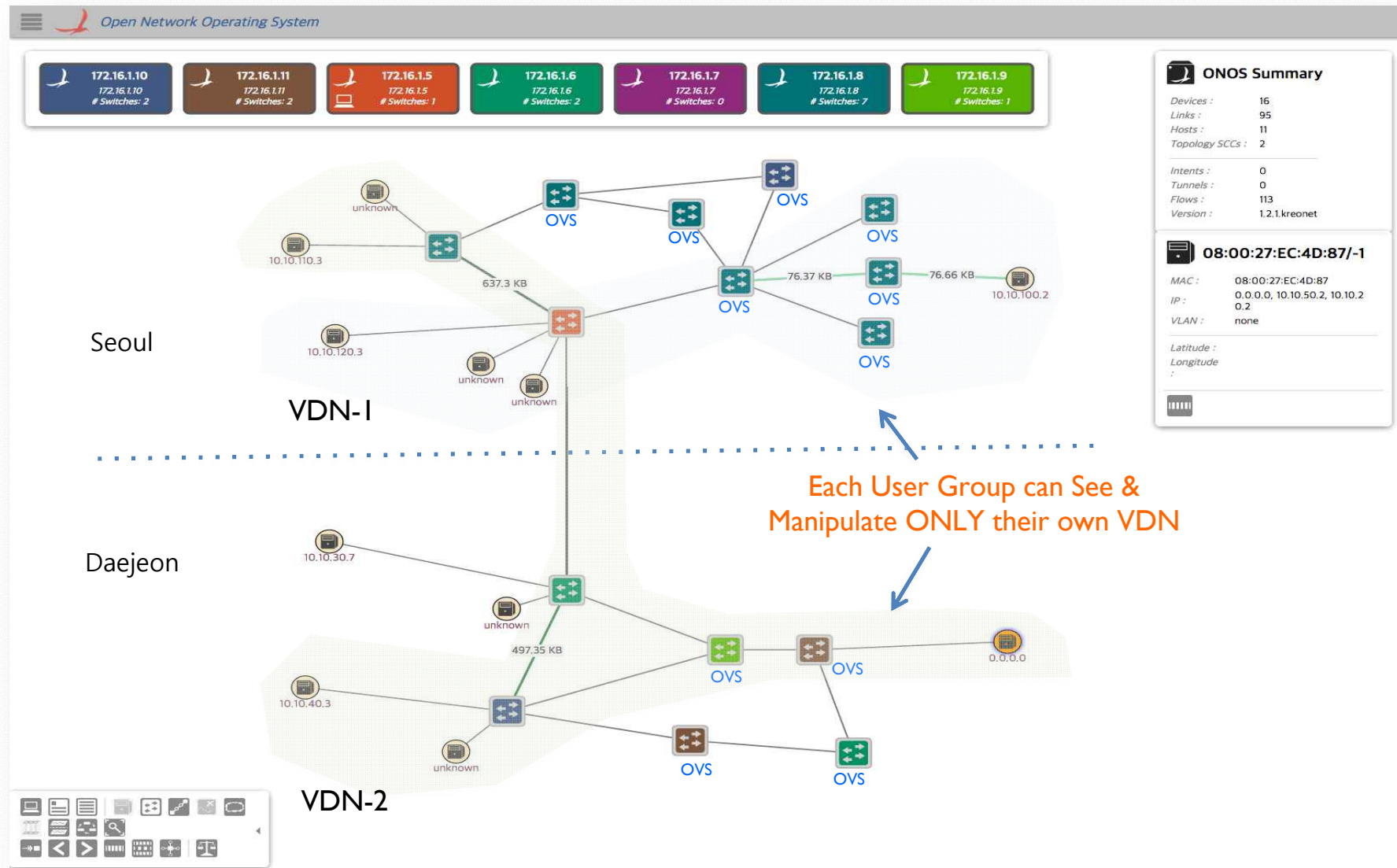
- Simple and Rapid: several-click Easy, ms Fast

- User-oriented Network Visualization and Monitoring

- Virtual Network Topology and Operational Attrs

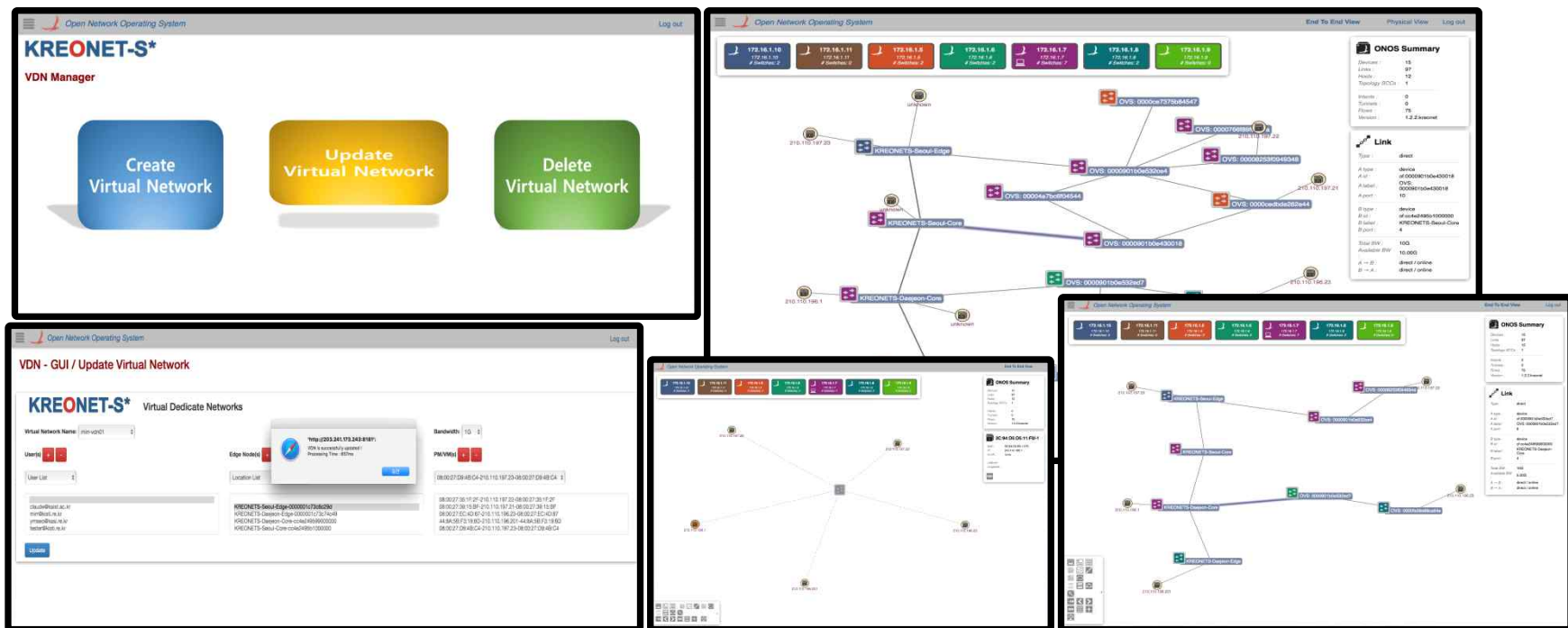


# Virtual Dedicate Network



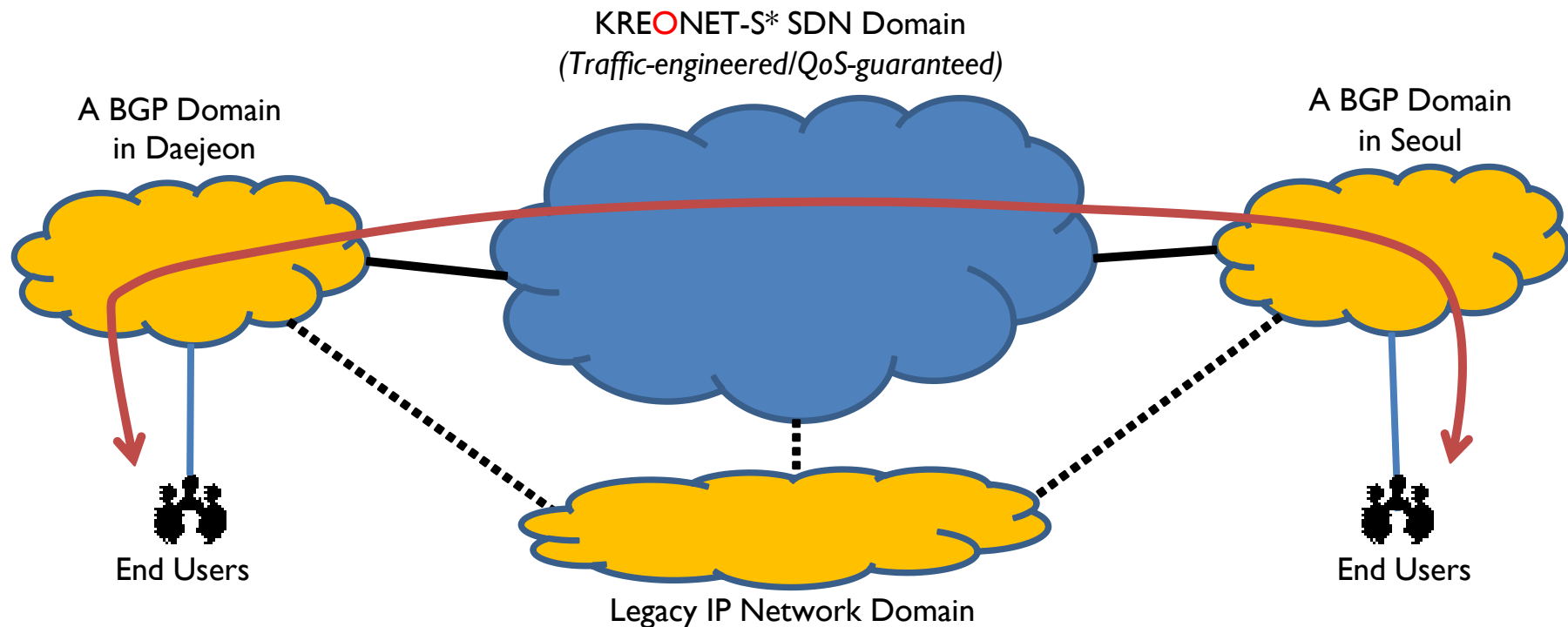
# Virtual Dedicate Network

- KISTI-KAIST Joint Development
  - VDN Prototype I Design and Implementation (2015)
  - VDN management modules, dedicate & isolated network allocation: being applied to KREONET-S\*



# SDN-IP

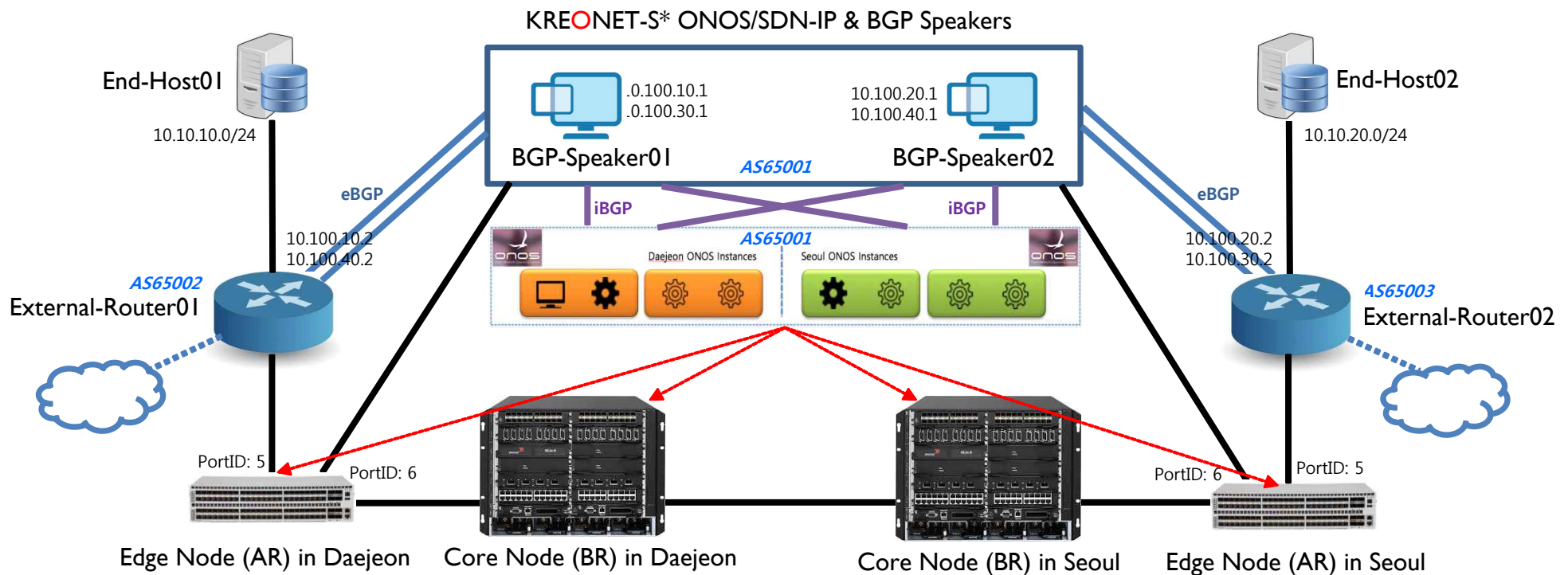
- KISTI-ON.Lab Joint Deployment & Experiment
  - Daejeon-Seoul Experimental Testbed (2015)
  - End-to-End Communications via KREONET-S SDN and BGP Network Domains



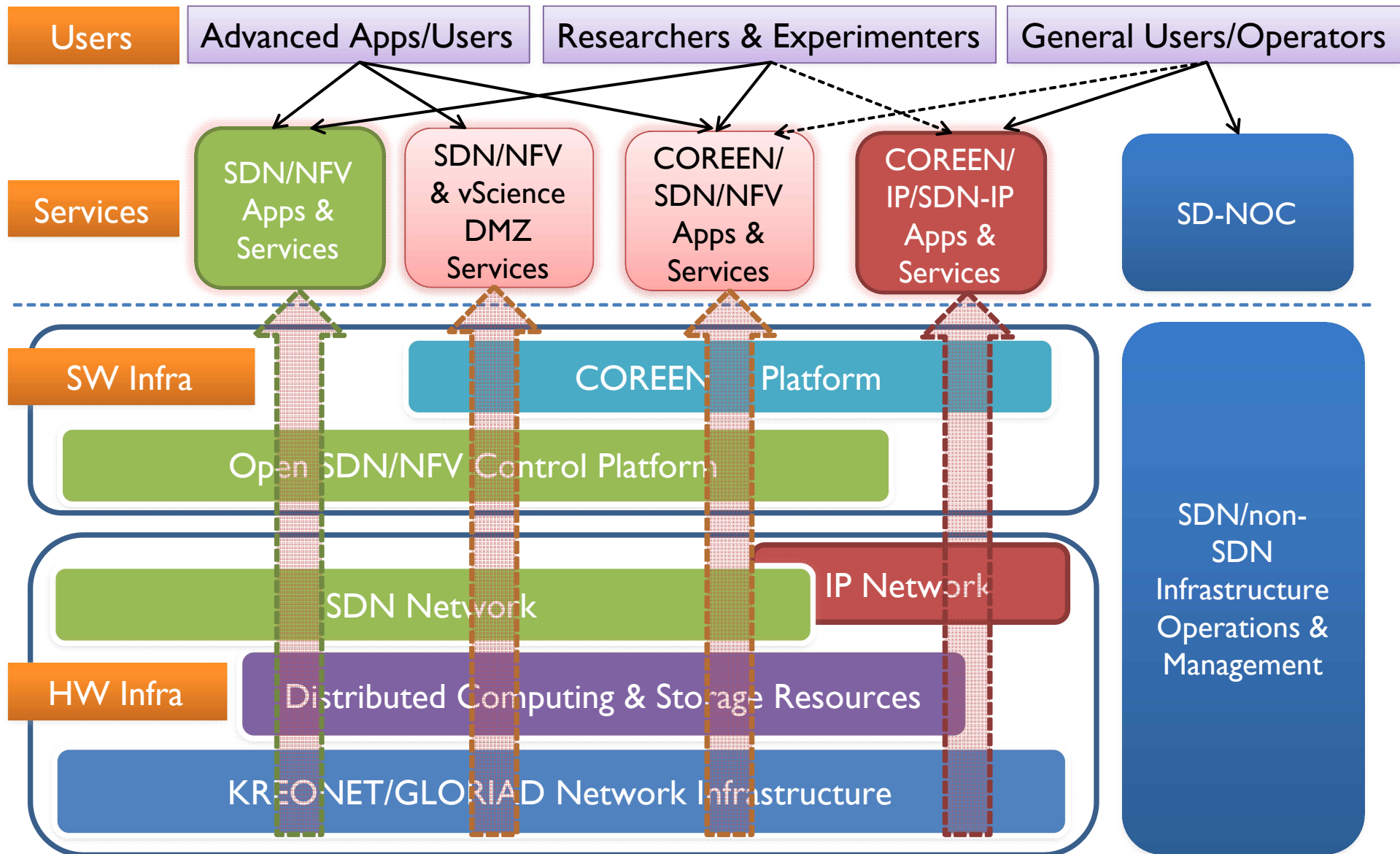


# SDN-IP Testbed

- Testbed Configurations in Detail
  - eBGP and iBGP peerings between BGP speakers, external routers & ONOS SDN-IP applications



# KREONET-S\* (Plan)



# Conclusions

- **KRE○NET-S\* Making HAPPEN**
  - New SDN Service Provider Network Deployment
  - Distributed Controls and Resilient SDN Operations
  - VDN & UoV for New User Services and Experiences
- **Further Work**
  - Keep Testing and Experimenting on Distributed Controls
    - Failover & Operational Issues, Performance, etc.
  - VDN & UoV Enhancement: UI, Performance, Stability
  - New Technology Deployment & Experiments with ON.Lab
  - Global Project & Testbed Participations with KAIST, PRP, etc.

# Thank You!

Questions and/or Comments to  
[mirr@kisti.re.kr](mailto:mirr@kisti.re.kr)