

# KREONET SOFTWAREIZATION

- KRE○NET-S\*/VDN Deployment thru Distributed Control  
Based on ONOS -

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**September 15**  
**ONOS Day 2015**

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- Background and Motivation
- KRE○NET-S\* as the Next KREONET
- Deployment Status of KRE○NET-S\*
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- Conclusions

# Background and Motivation

« Nationwide 17 GigaPoPs 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



Global Ring Network for Advanced Applications Development



# KREONET (Top 10) Advanced Applications



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

Weather & Climate



High Energy Physics



Education & Collaboration



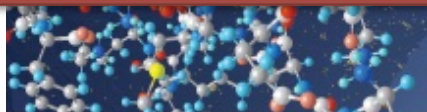
Astronomy

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

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

Medical Science

Future Internet



New Medicine/Bio



Culture & Art



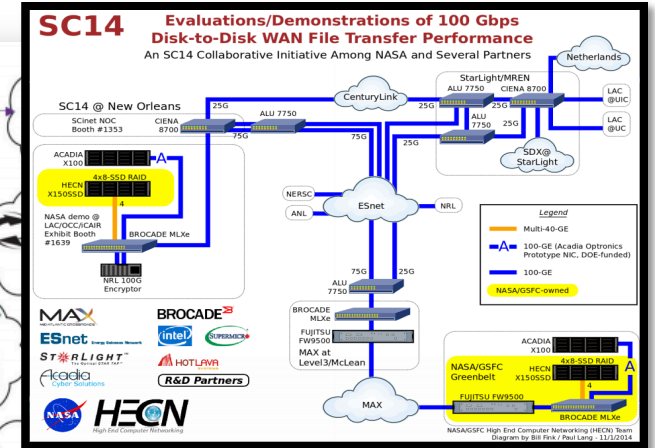
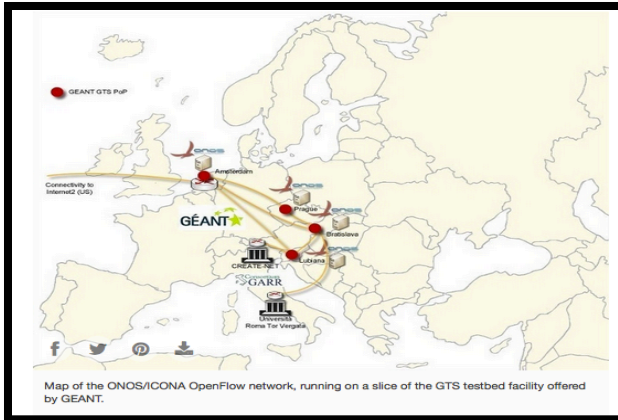
Constructions



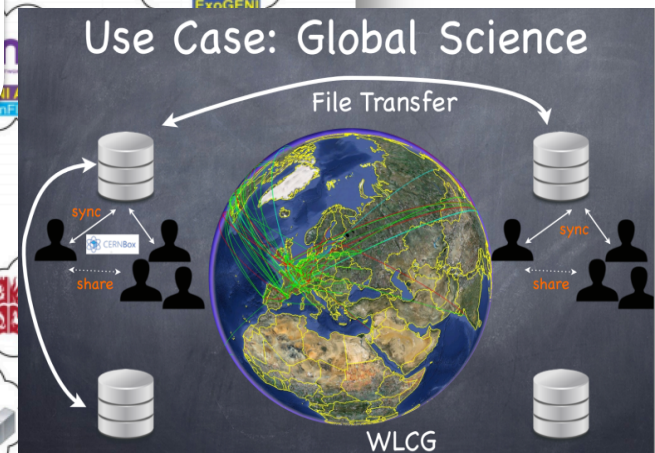
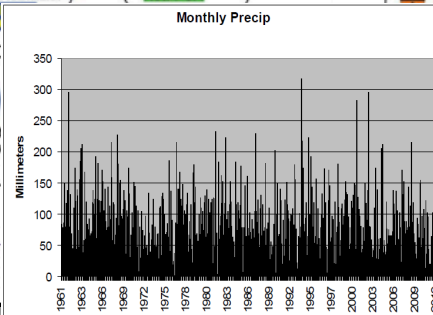
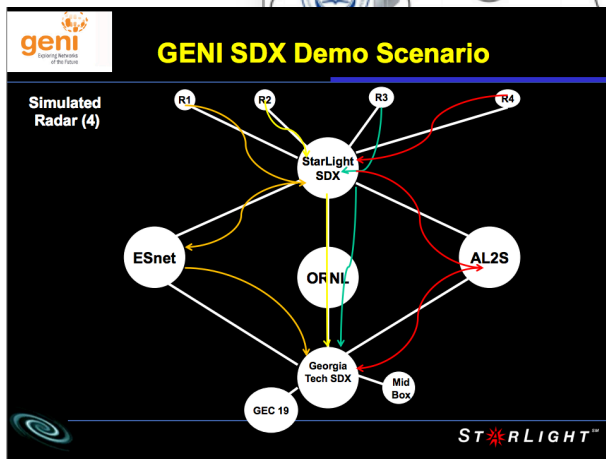
Supercomputing



# Global Collaborations



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



# The Next: KREONET-S\*

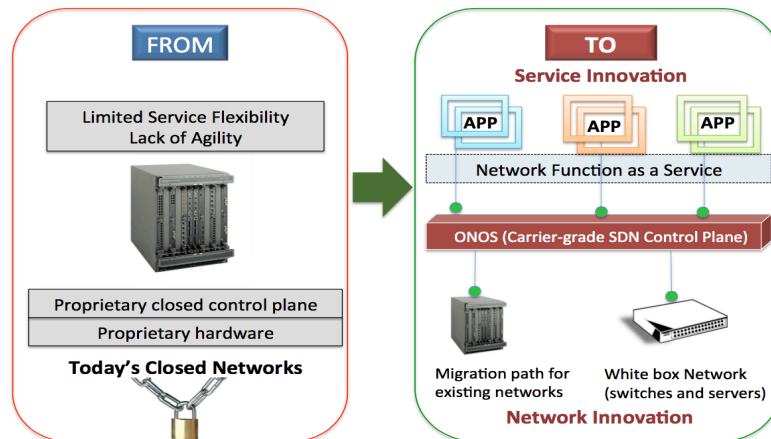
- **KREONET-S\* Main Goals**
  - **Carrier-grade Reliable “Public SD-WAN” Operations**
    - Distributed Controls and 24 x 7 Network Operations
  - **New User Interfaces, Services, and Experiences**
  - **Multi-vendor and Multi-layer Network Infrastructure**
- **Principal Building Blocks**
  - Northbound (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**, etc.

# The Next: KREONET-S\*

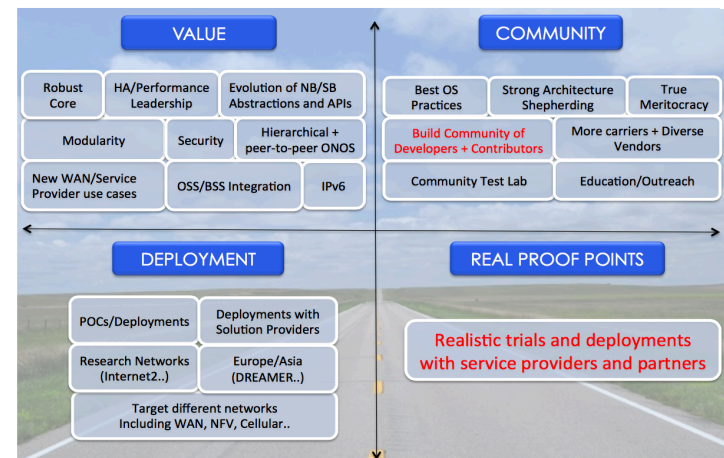
- Embracing Open Technologies
  - OpenFlow, OVS, OPNFV, OpenStack, Many others..
  - **ONOS Affiliate**
    - Technical collaborations for ONOS deployment
    - Setting up discussion channel for operational experiences
    - Applying various SDN applications on KREONET-S\*

## ONOS Vision for Service Provider Networks

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



## ONOS in 2015

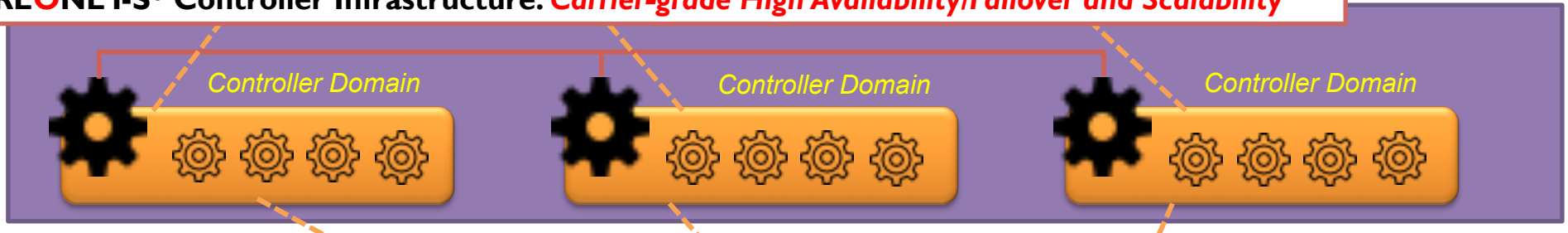


# The Next: KREONET-S\*

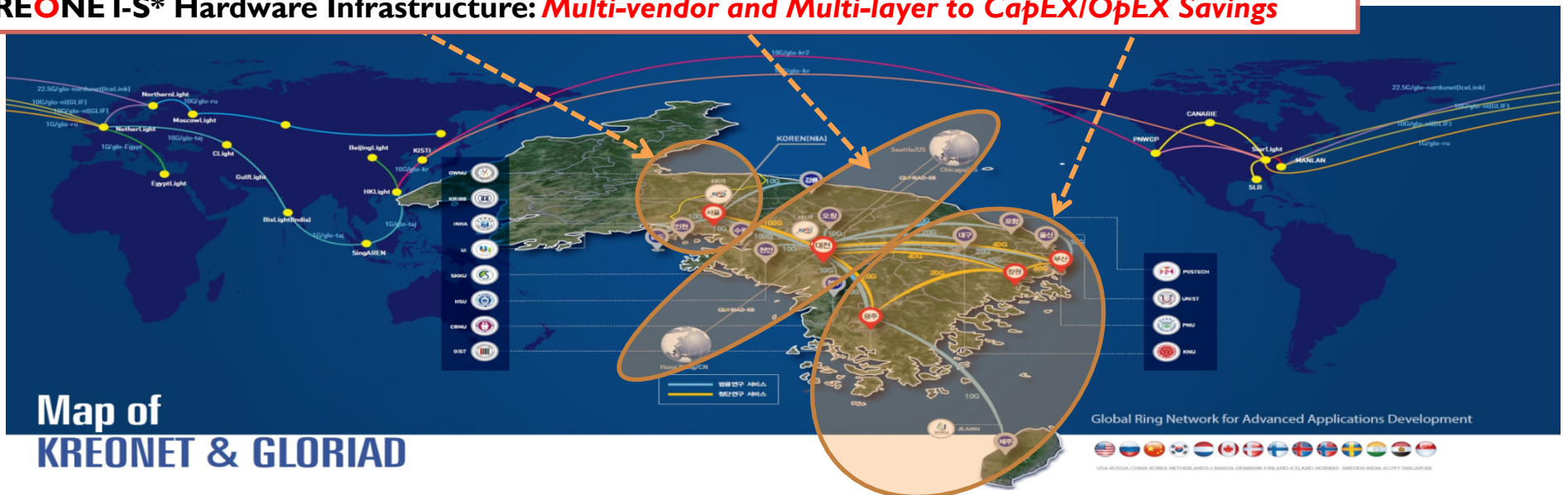
**KREONET-S\* Applications & Services: *High Performance, Advanced Security, New User Services & Experiences***



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

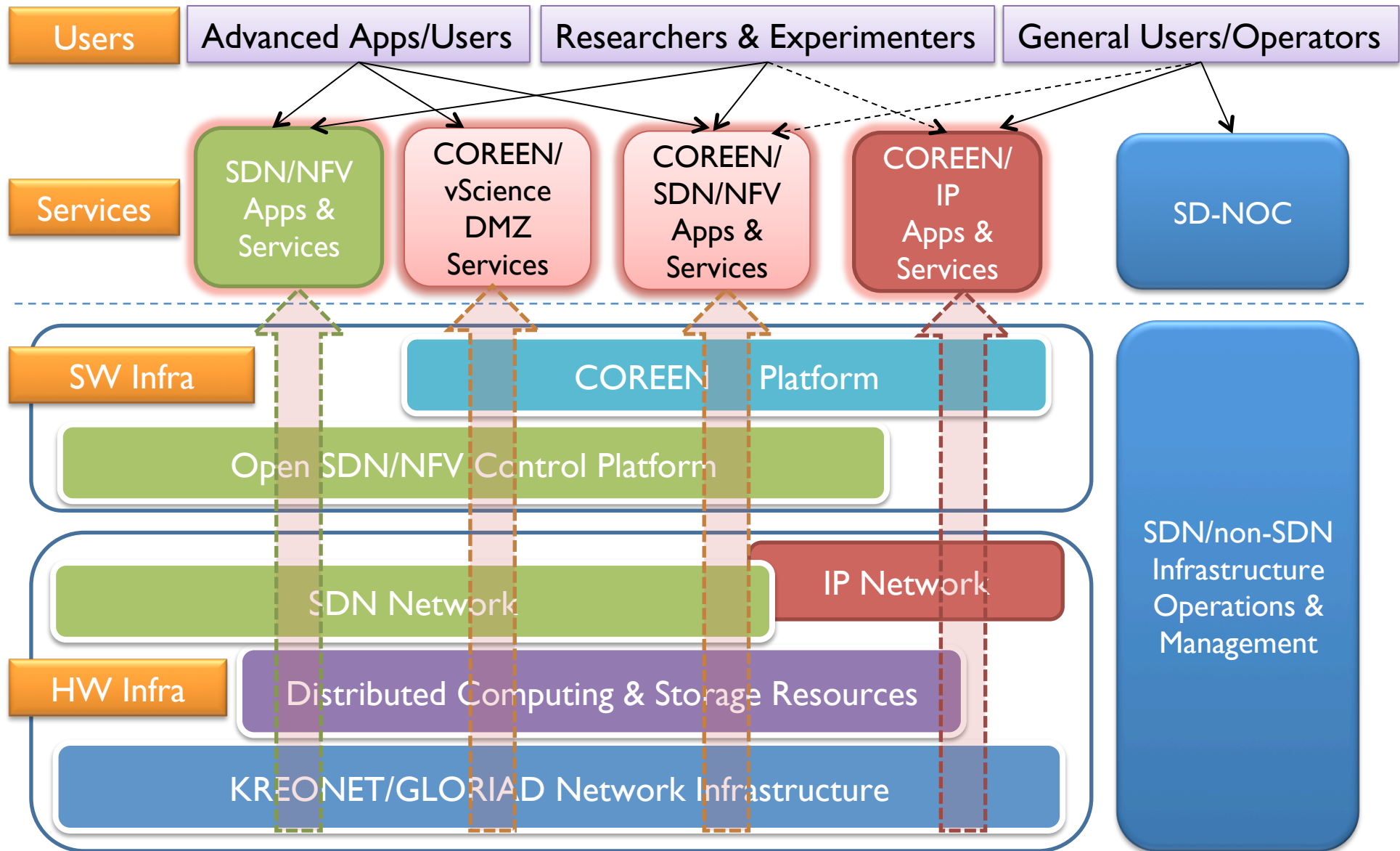


## KREONET-S\* Hardware Infrastructure: *Multi-vendor and Multi-layer to CapEX/OpEX Savings*



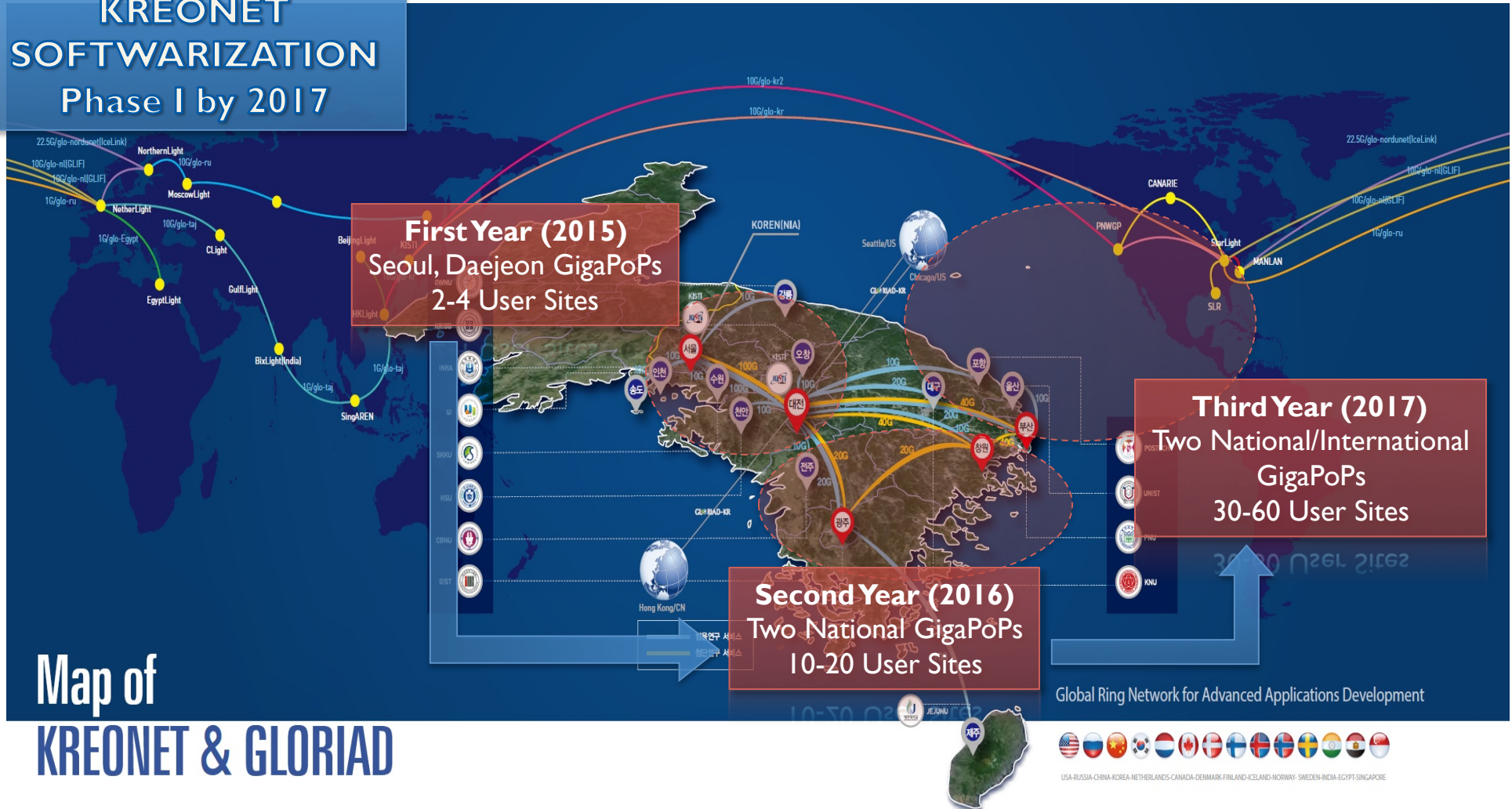


# The Next: KREONET-S\* (Plan)

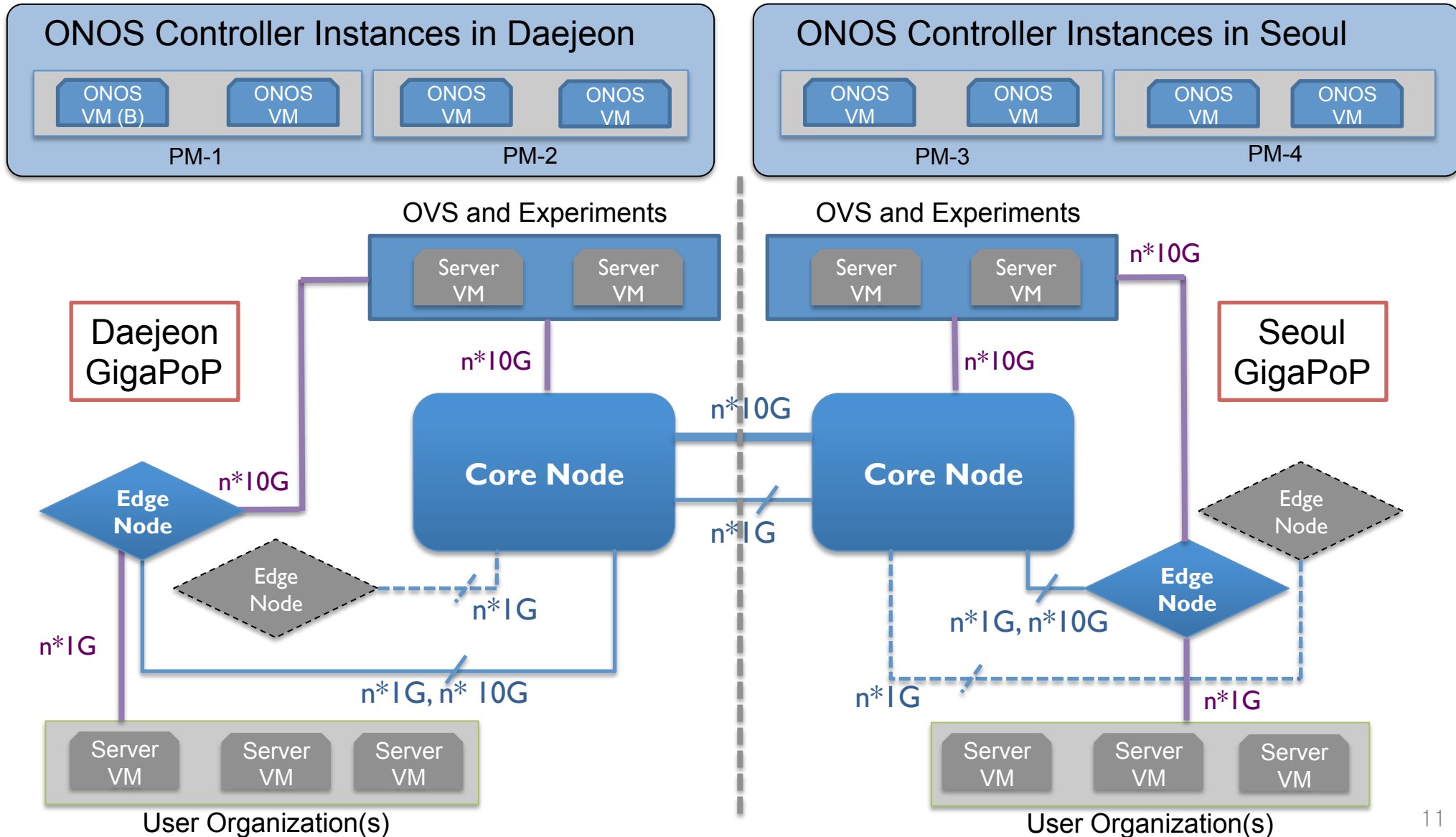


# KREONET-S\* Roadmap

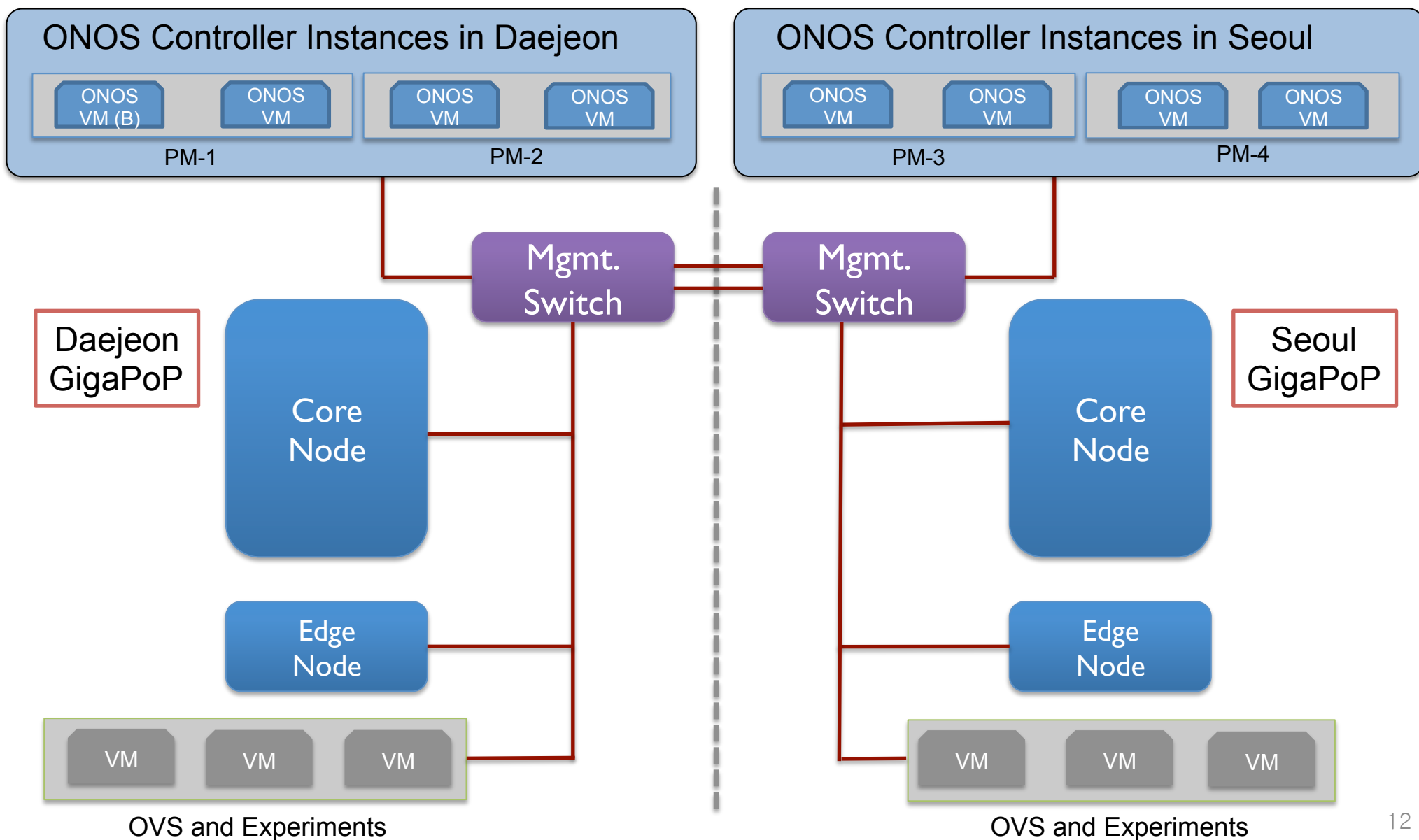
**KREONET  
SOFTWAREIZATION  
Phase I by 2017**



# Deployment 2015 - Overall Design



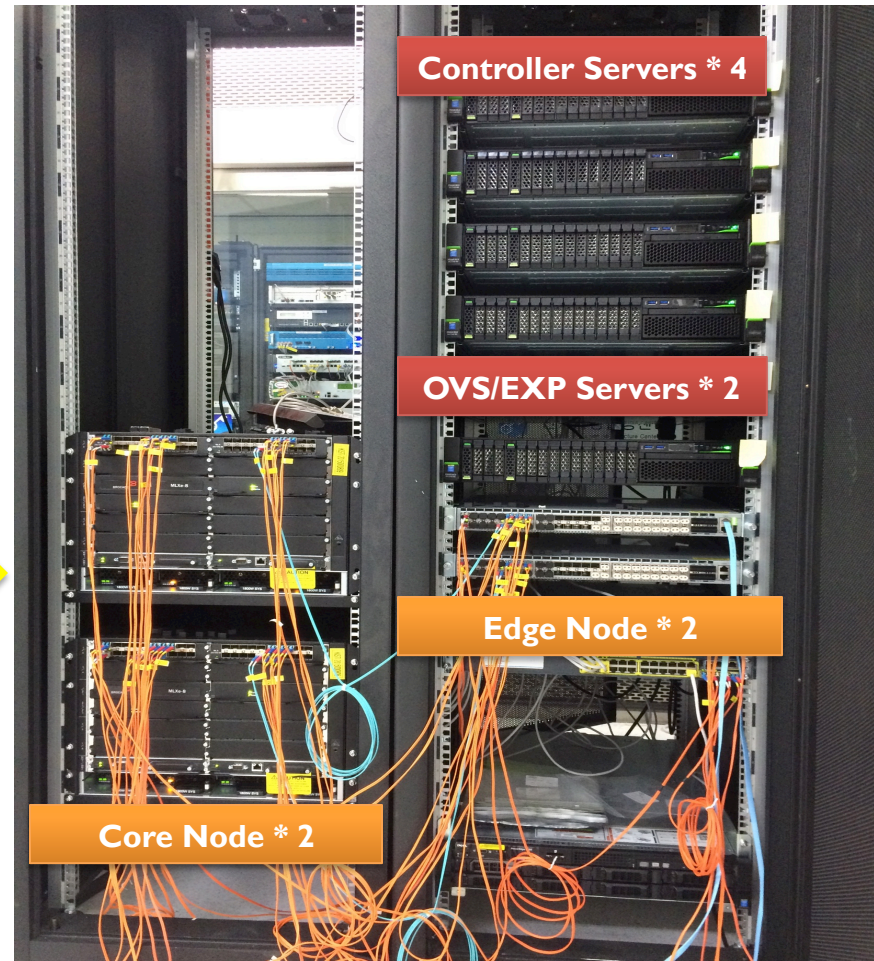
# Deployment 2015 - Mgmt./Controls





# KREONET-S\* Deployment

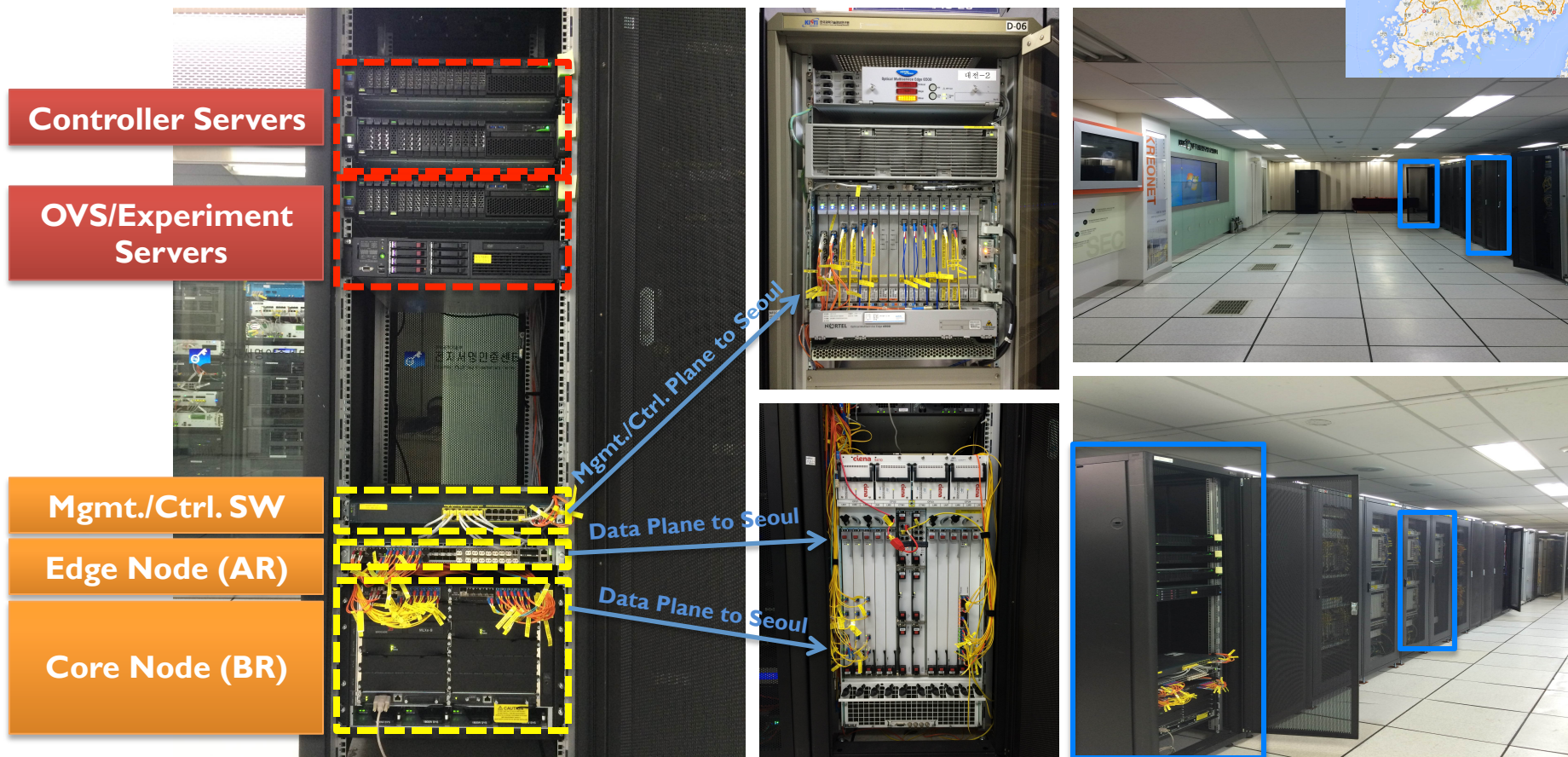
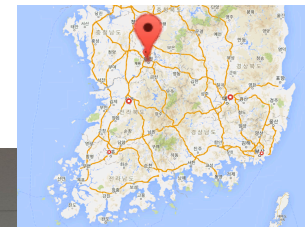
- Local (In-Lab) Testbed (before Deployment)





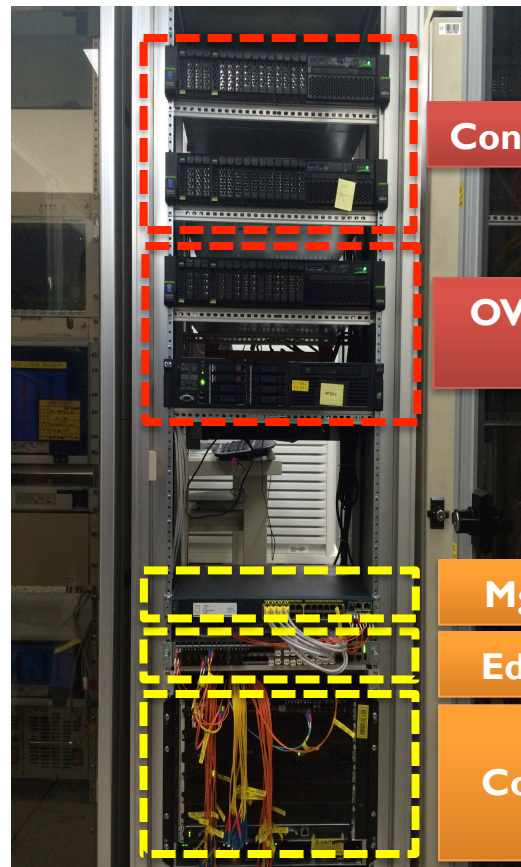
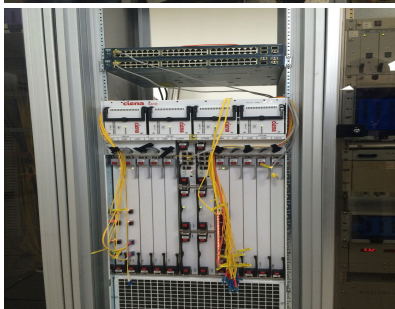
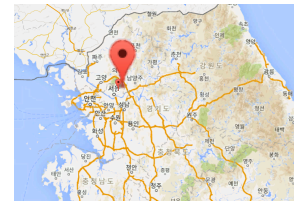
# KREONET-S\* Deployment

- Daejeon GigaPoP (After Deployment)



# KREONET-S\* Deployment

- Seoul GigaPoP (After Deployment)



Controller Servers

OVS/Experiment  
Servers

Mgmt./Ctrl. SW

Edge Node (AR)

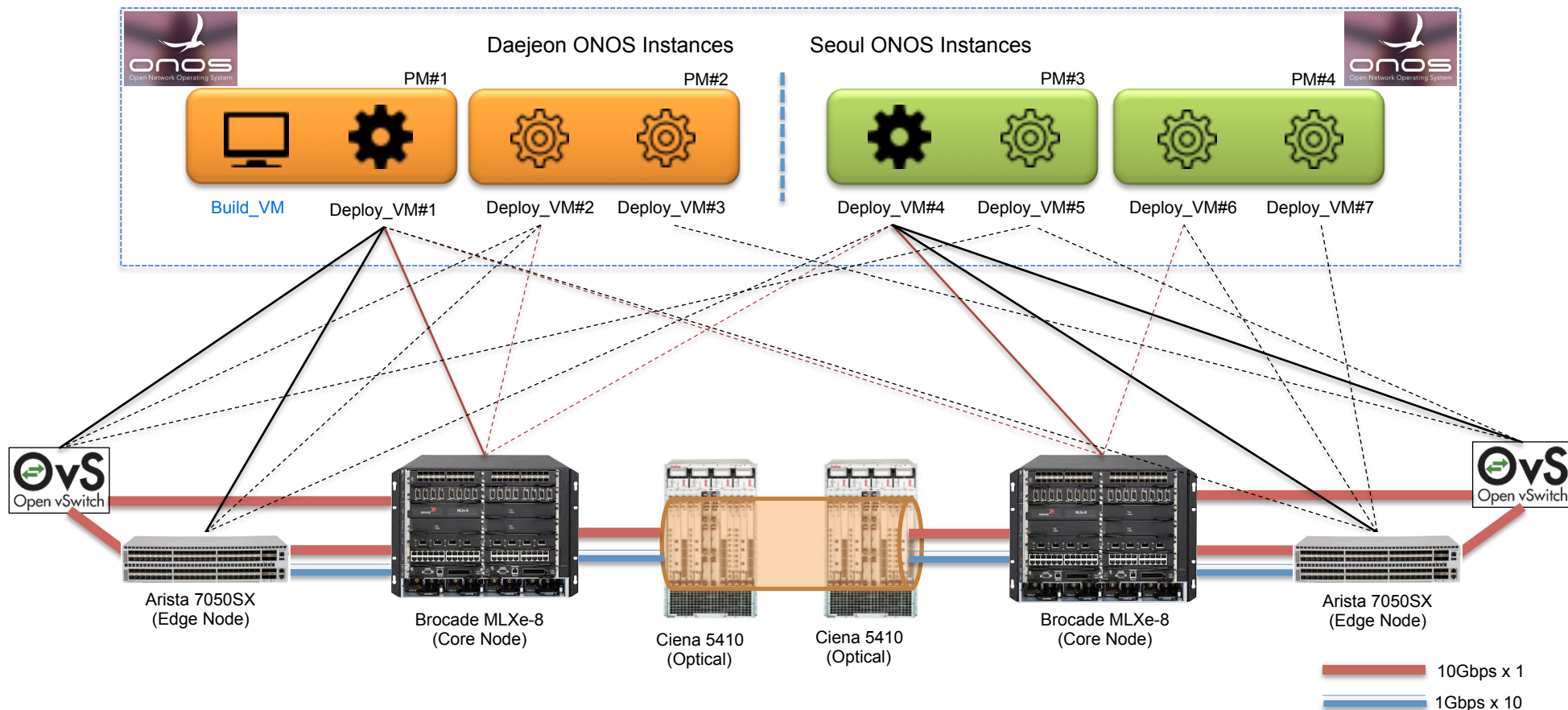
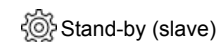
Core Node (BR)



# KREONET-S\* Deployment

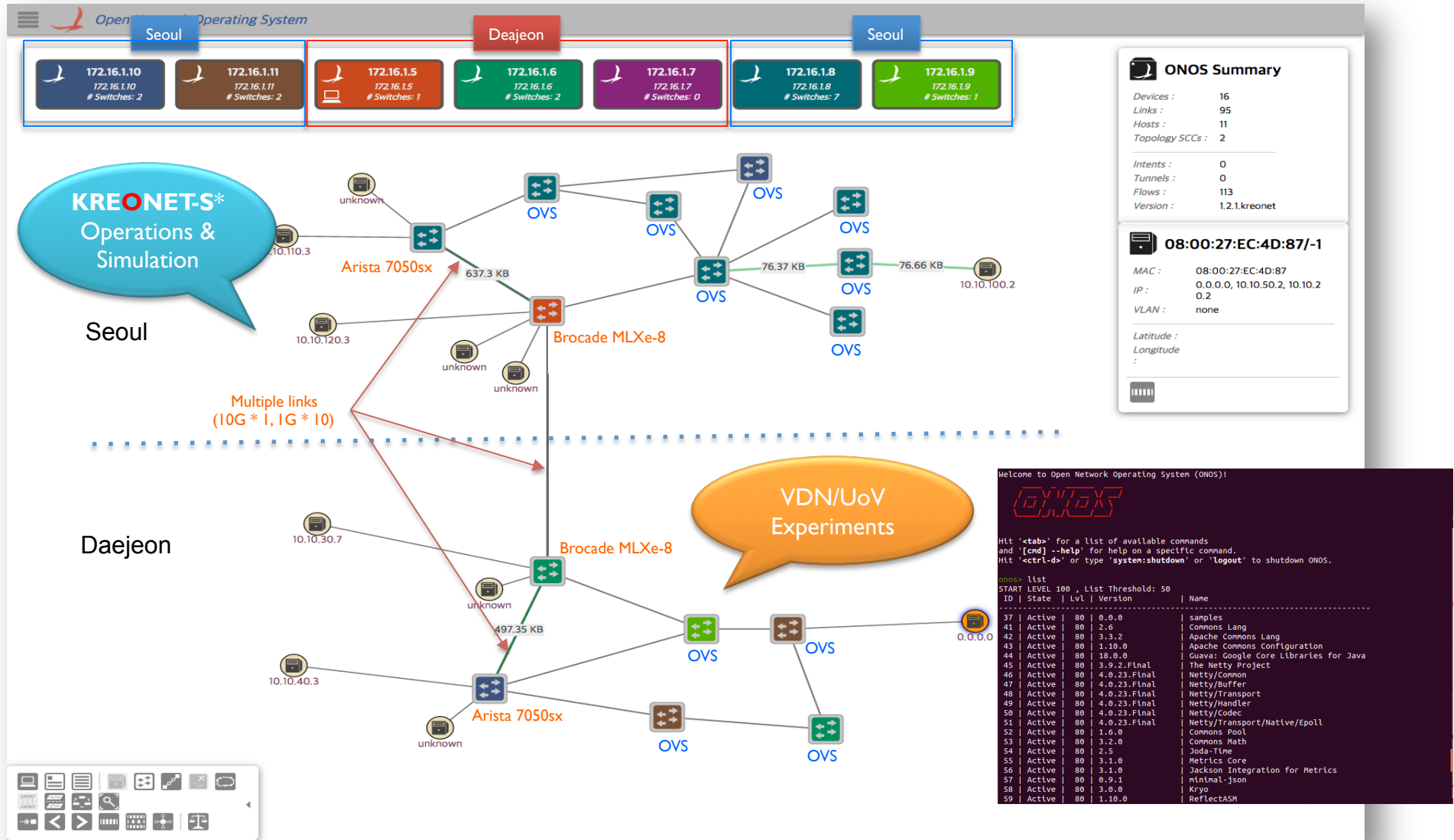
- Deployment Status as of Today

KREONET-S\* 7-Node ONOS Cluster: Distributed Controls



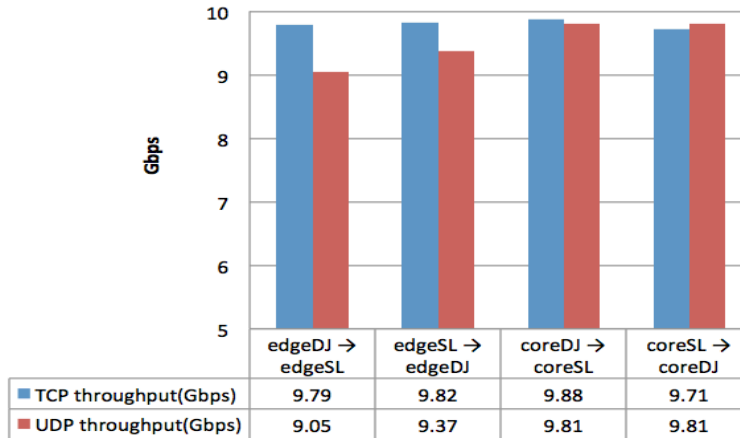


# KREONET-S\* Deployment

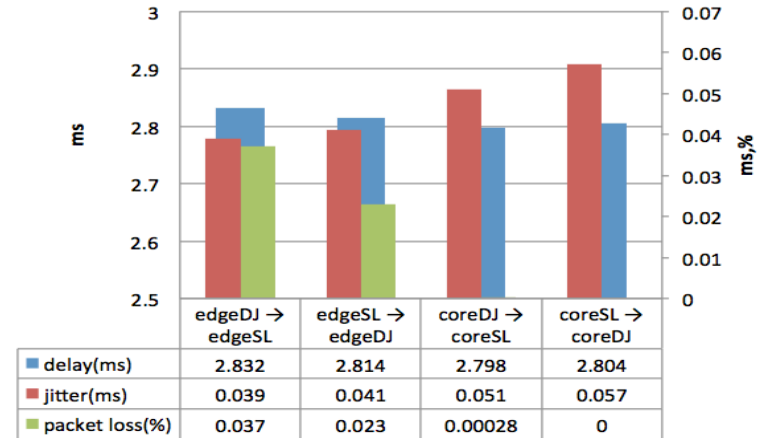


# KREONET-S\* Deployment

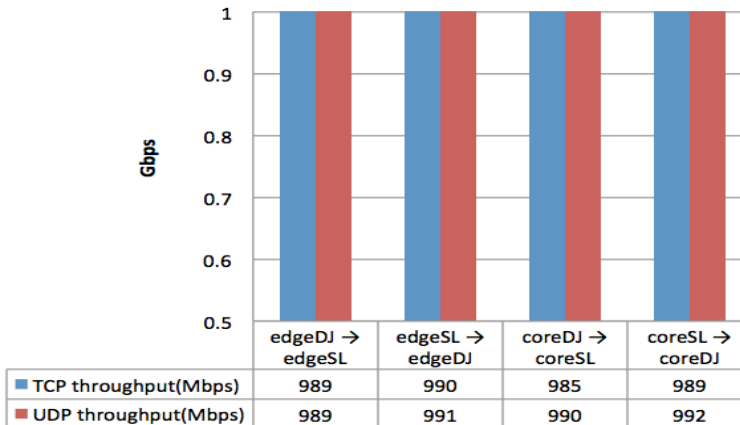
## 10Gbps TCP/UDP Throughput



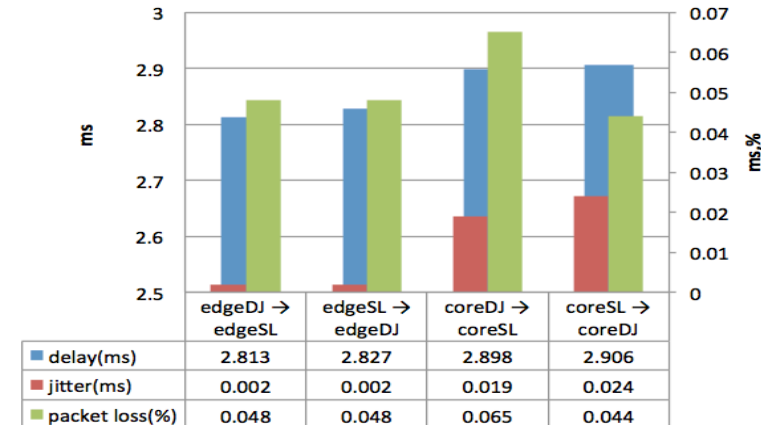
## 10Gbps Delay, Jitter, Packet-loss



## 1Gbps TCP/UDP Throughput



## 1Gbps Delay, Jitter, Packet-loss

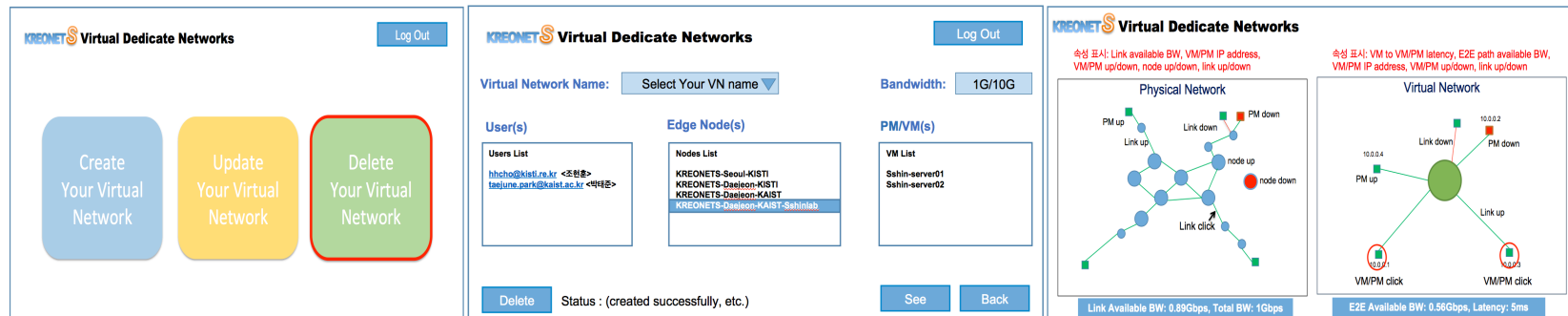


# KREONET-S\* Applications

- **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)

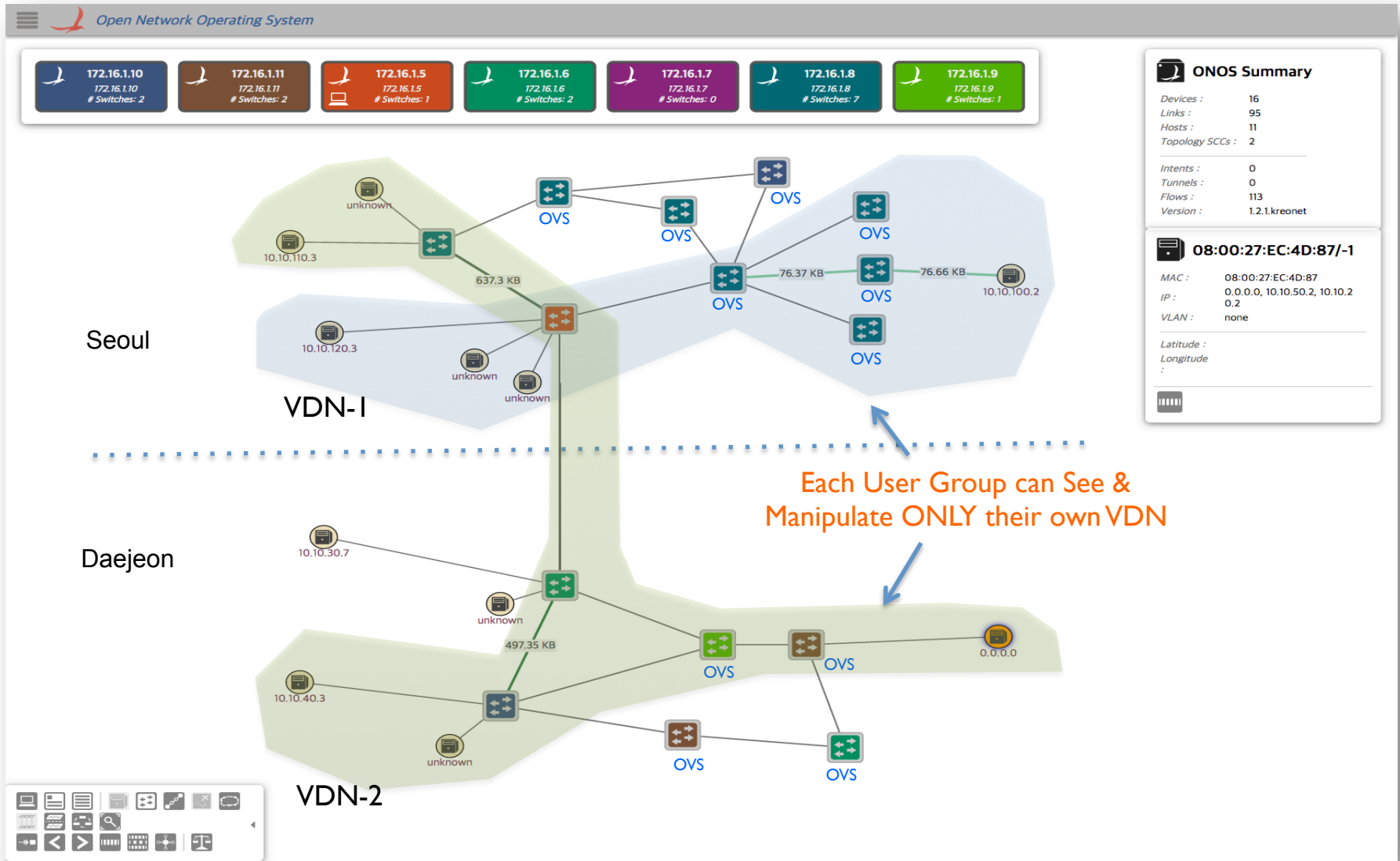
# Virtual Dedicate Network

- **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 Attributes



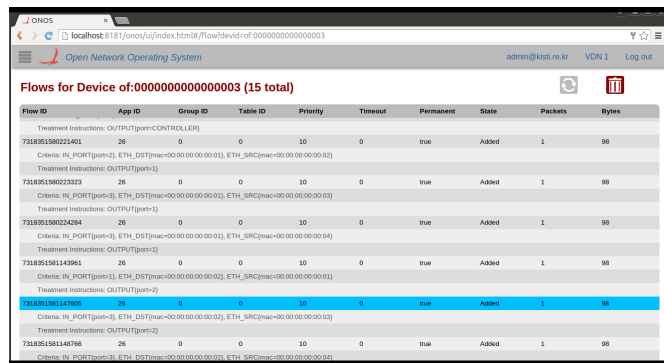


# Virtual Dedicate Network



# Virtual Dedicate Network

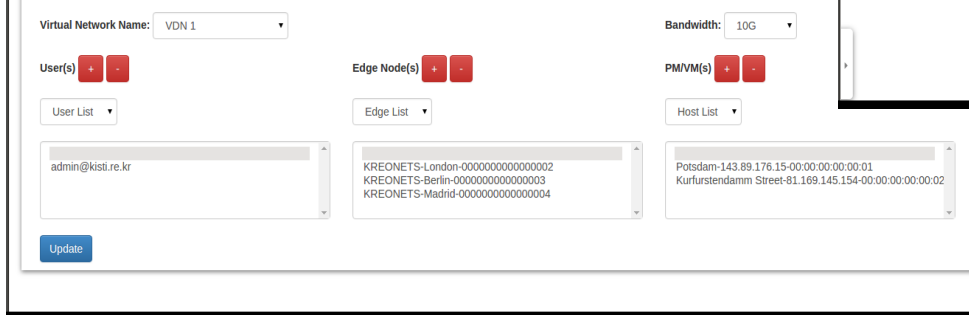
- KISTI-KAIST Joint Development
  - VDN Prototype I Design and Implementation (2015)
  - VDN management modules, dedicate & isolated network allocation: being applied to KREONET-S\*



ONOS Open Network Operating System admin@kisti.re.kr VDN 1 Log out

Flows for Device of:0000000000000003 (15 total)

Flow ID	App ID	Group ID	Table ID	Priority	Timeout	Permanent	State	Packets	Bytes
Treatment Instructions: OUTPUT(port=CONTROLLER)									
731835158021401	25	0	0	10	0	true	Added	1	98
Criteria: IN_PORT(port=2), ETH_DST(mac=00:00:00:00:00:01), ETH_SRC(mac=00:00:00:00:00:02)									
Treatment Instructions: OUTPUT(port=2)									
731835158023323	25	0	0	10	0	true	Added	1	98
Criteria: IN_PORT(port=3), ETH_DST(mac=00:00:00:00:00:01), ETH_SRC(mac=00:00:00:00:00:03)									
Treatment Instructions: OUTPUT(port=1)									
731835158024284	25	0	0	10	0	true	Added	1	98
Criteria: IN_PORT(port=3), ETH_DST(mac=00:00:00:00:00:01), ETH_SRC(mac=00:00:00:00:00:04)									
Treatment Instructions: OUTPUT(port=1)									
731835158147961	25	0	0	10	0	true	Added	1	98
Criteria: IN_PORT(port=1), ETH_DST(mac=00:00:00:00:00:01), ETH_SRC(mac=00:00:00:00:00:01)									
Treatment Instructions: OUTPUT(port=2)									
731835158147965	25	0	0	10	0	true	Added	1	98
Criteria: IN_PORT(port=3), ETH_DST(mac=00:00:00:00:00:02), ETH_SRC(mac=00:00:00:00:00:03)									
Treatment Instructions: OUTPUT(port=2)									
731835158148166	25	0	0	10	0	true	Added	1	98
Criteria: IN_PORT(port=3), ETH_DST(mac=00:00:00:00:00:02), ETH_SRC(mac=00:00:00:00:00:04)									



Virtual Network Name: VDN 1

Bandwidth: 10G

User(s) + - Edge Node(s) + - PM/VM(s) + -

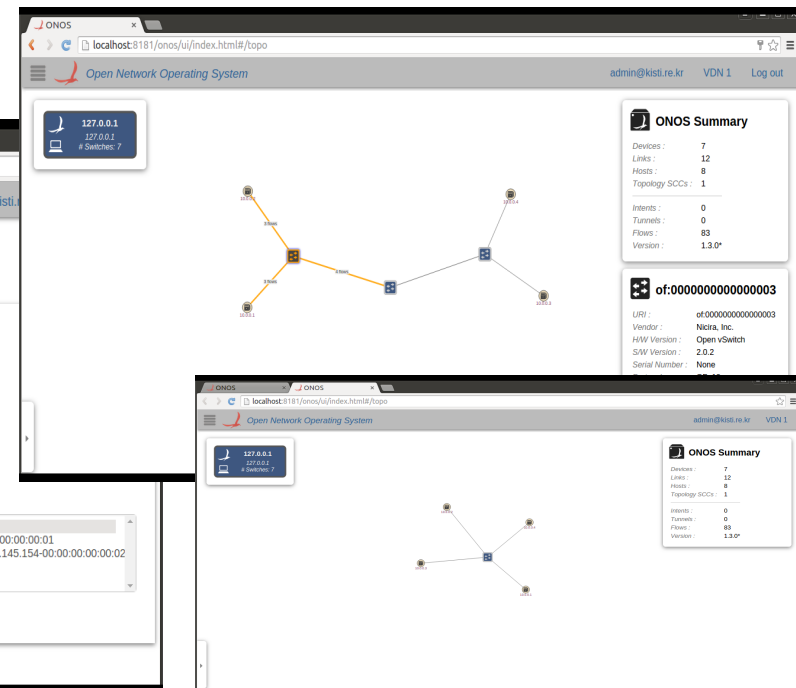
User List ▼ Edge List ▼ Host List ▼

admin@kisti.re.kr

KREONETS-London-0000000000000002  
KREONETS-Berlin-0000000000000003  
KREONETS-Madrid-0000000000000004

Potsdam-143.89.176.15-00:00:00:00:00:01  
Kurfurstendamm Street-81.169.145.154-00:00:00:00:00:02

Update



# Conclusions

- **KRE○NET-S\* Making HAPPEN**
  - New SDN Infrastructure with Multi-vendor & Multi-layer
  - Distributed Controls and Resilient SDN Operations
  - VDN & UoV for New User Services and Experiences
- **Further Work 2015**
  - Keep Testing and Experimenting
    - Failover & Operational Issues, Performance, etc.
  - *VDN Development and Deployment with KAIST*
  - *SDN-IP Experiment and Deployment with ON.Lab*
  - (Experimental) User Site Connections & Operations
    - 2-4 Sites: e-KVN, Supercomputing, HEP, etc.

# Thank You!

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