

PRAGMA 26

# PRAGMA Experimental Network Testbed (ENT)

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# PRAGMA-ENT Goals

- Build a breakable international SDN testbed for use by PRAGMA researchers
- Provide access to SDN hardware/software to PRAGMA researchers
- Integrate with overlay networks (e.g., ViNe)

# PRAGMA-ENT Progress

- Established in PRAGMA-25 (Oct-2013)
- Collaboration through [pragma-ent@googlegroups.com](mailto:pragma-ent@googlegroups.com)
  - If interested, please send join requests to [tsugawa@acis.ufl.edu](mailto:tsugawa@acis.ufl.edu)
  - 20 members
  - 10 Institutions
  - Support from Internet2, KDDI, NICT, FLR
- First group meeting: SC'13 (Nov-2013)
  - Monthly conference calls ever since
- Presence at Internet2 2014 Global Summit (Denver, Apr 06-11)
  - Jim Williams (IU/Internet2)
  - Chris Griffin (UF/FLR)
  - Jin Tanaka (KDDI)

# Members

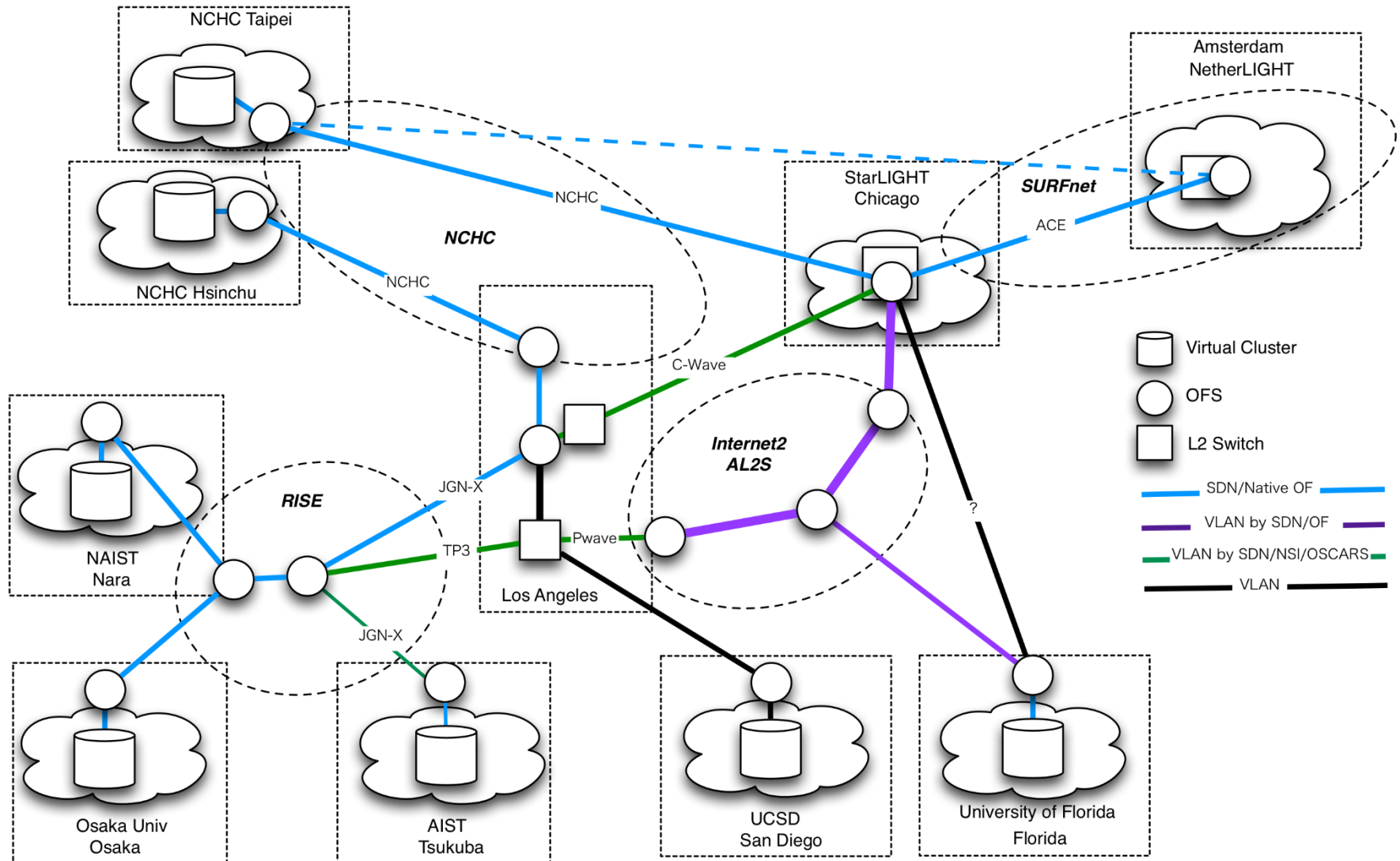
- University of Florida
  - Maurício Tsugawa
- Osaka University
  - Shinji Shimojo
  - Susumu Date
  - Yasuhiro Watashiba
- Nara Institute of Science and Tech
  - Kohei Ichikawa
  - Pongsakorn U-chupala
- University of California, San Diego
  - Phil Papadopoulos
  - Luca Clementi
- Advanced Industrial Science and Tech
  - Atsuko Takefusa
  - Yoshio Tanaka
- KDDI
  - Jin Tanaka
- Indiana University
  - Jim Williams
  - Jennifer Schopf
- Jilin University
  - Xiaohui Wei
- Computer Network Information Center – Chinese Academy of Sciences
  - Ren Young Mao
- National Center for High-performance Computing
  - Fang-Pang Lin
  - Te-Lung Liu
- Kasetsart University
  - Putchong Uthayopas

# L2 Network - First Draft (by Jin Tanaka)

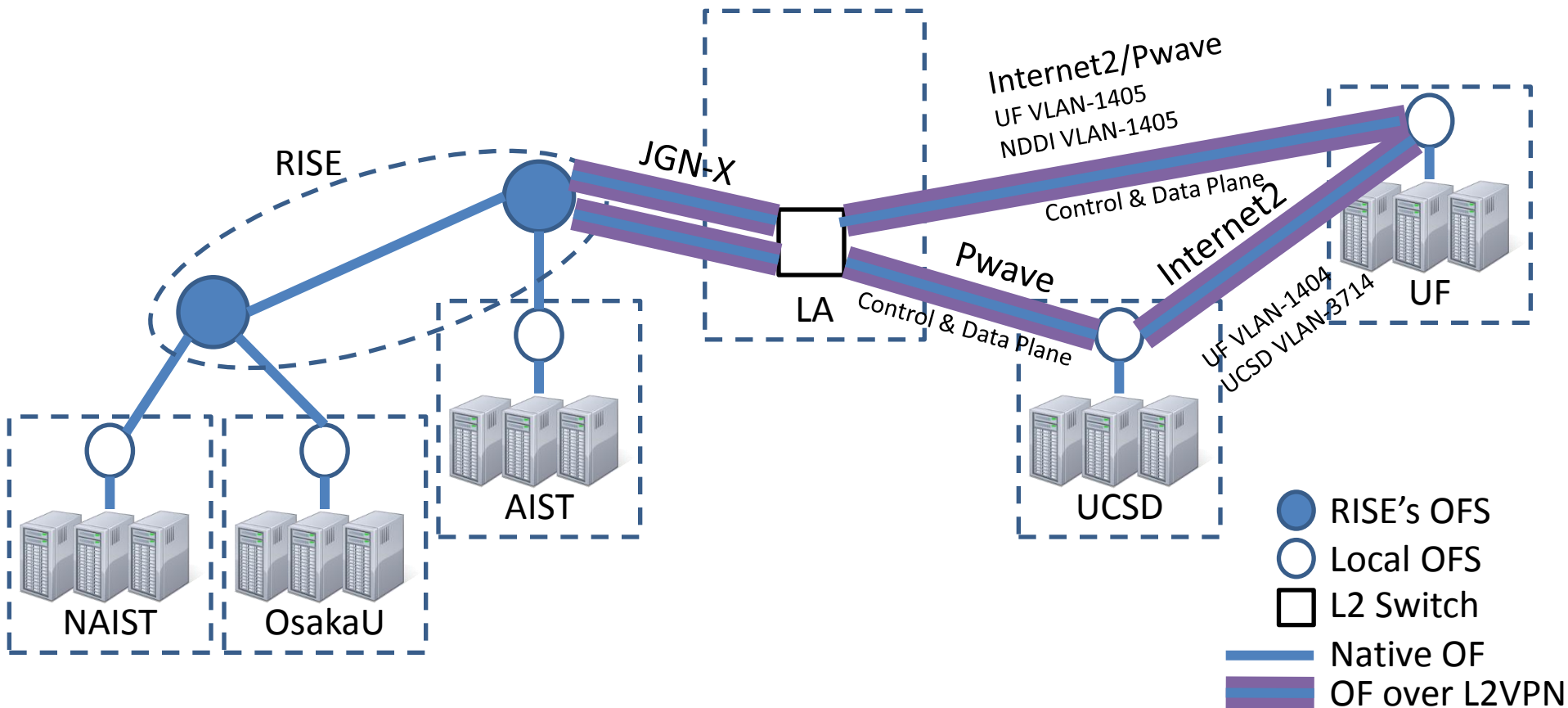
Draft diagram of Global SDN for PRAGMA Experimental

Rev 0 · 3 03/24/2014

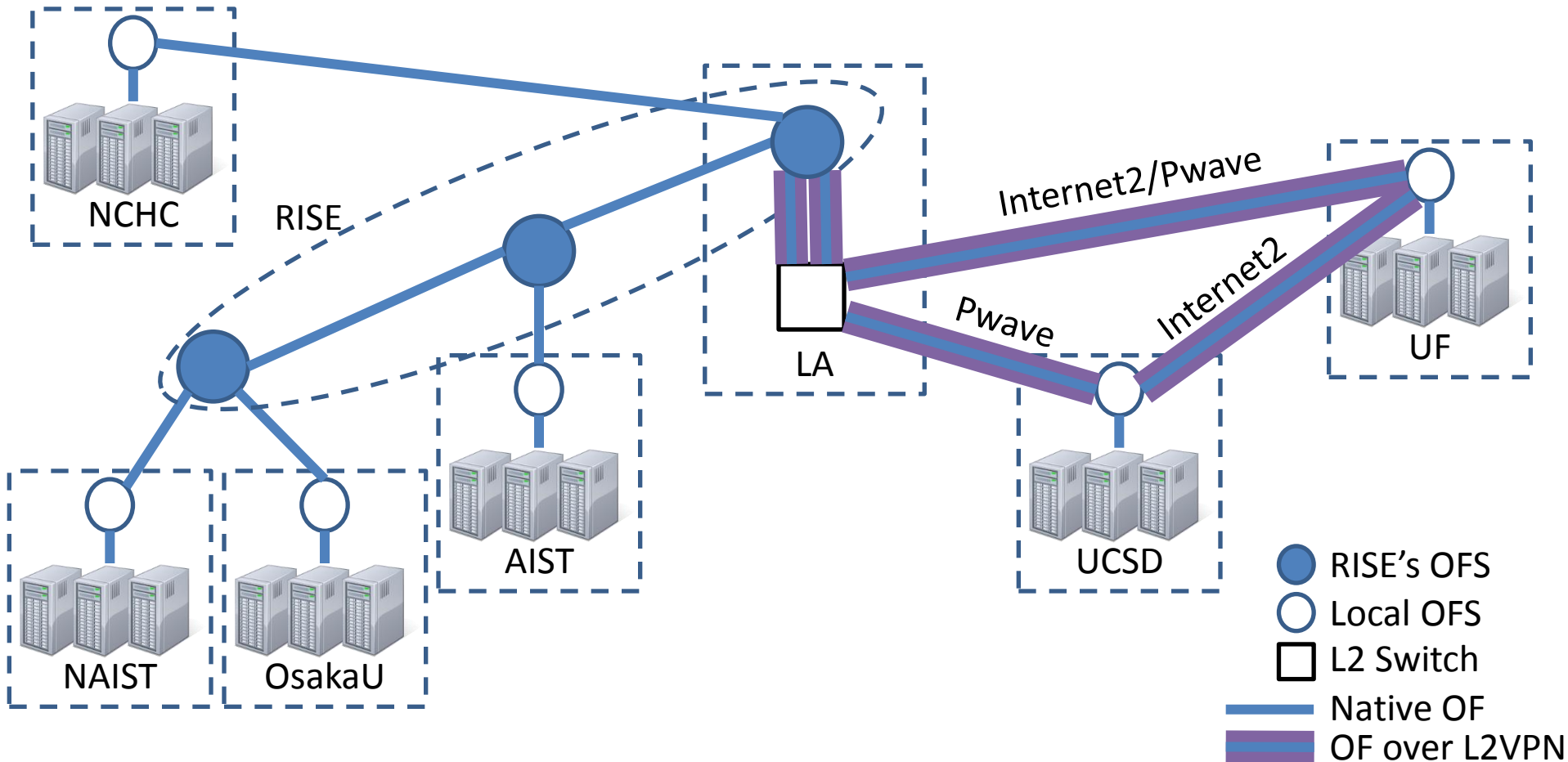
tanaka@ote.kddi.com



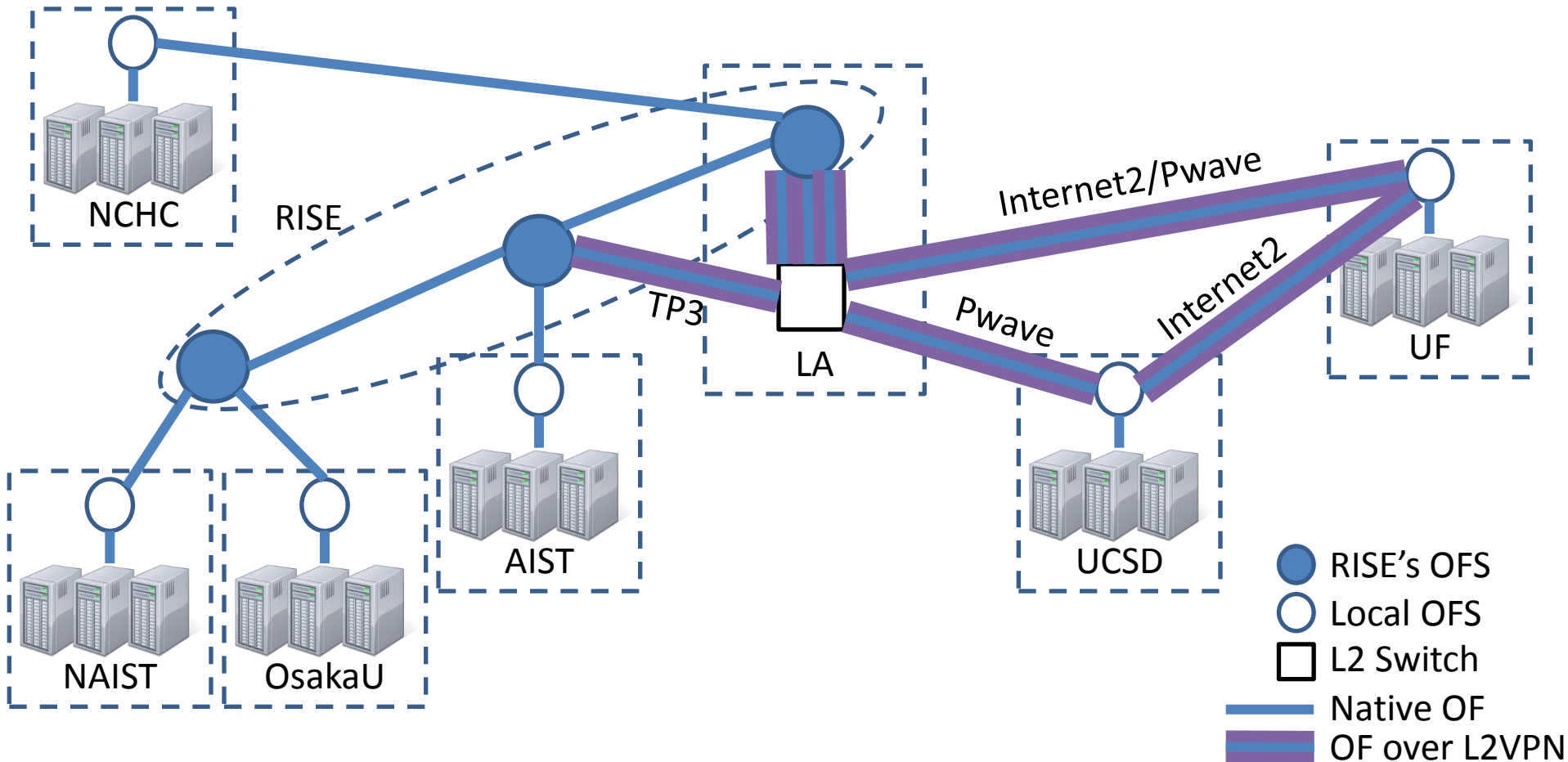
# Connecting US's switches into RISE in Japan over L2VPN



# Connecting US and NCHC into the RISE Switch in LA



# Connecting US and NCHC into the RISE Switch in LA + Multipath between JP and US





# SDN Data Plane

Site with full hardware support:

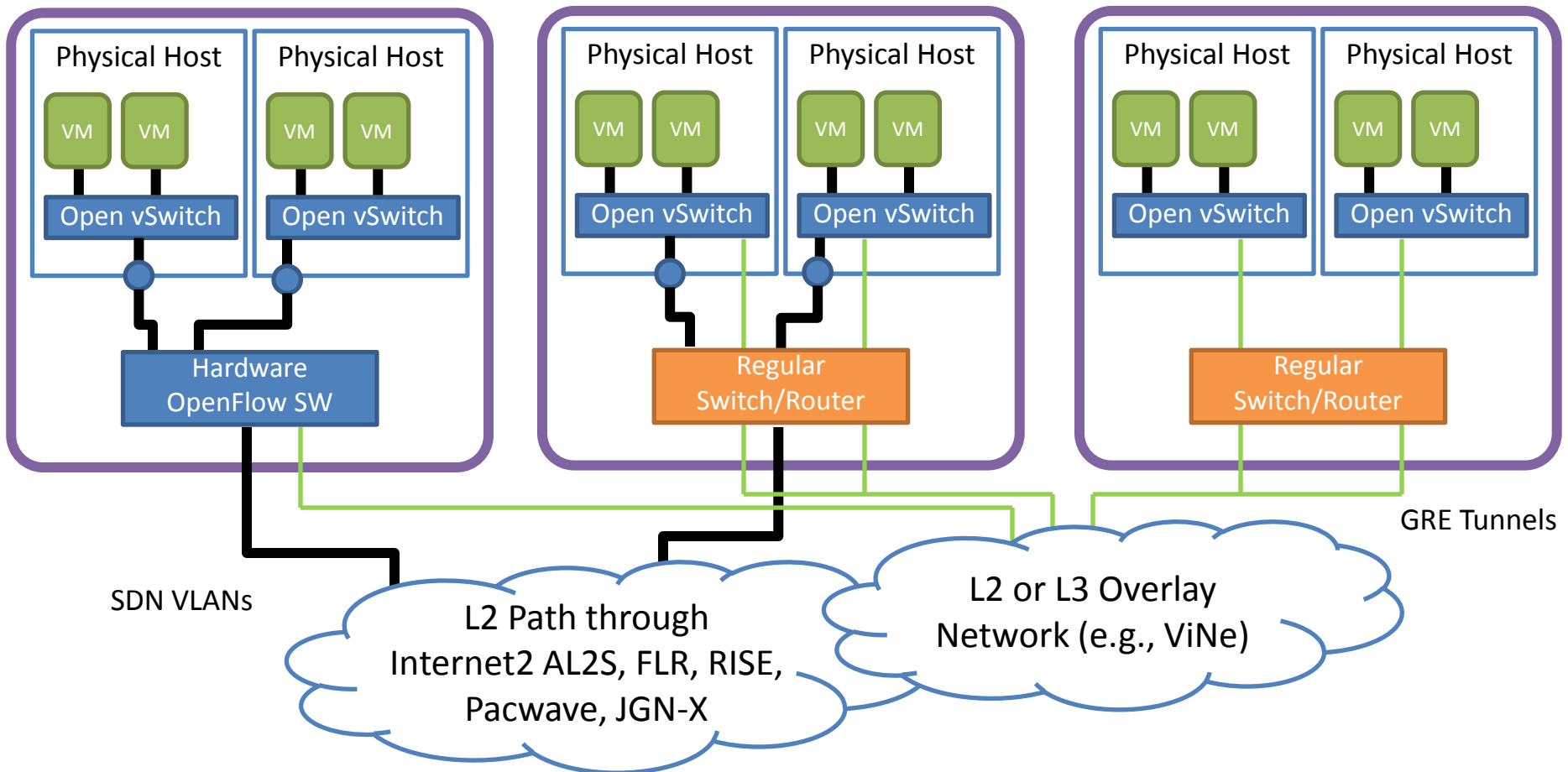
- Link to L2/VLAN
- OpenFlow-enabled switch
- UF, UCSD, NAIST, Osaka-U, AIST

Site with partial hardware support:

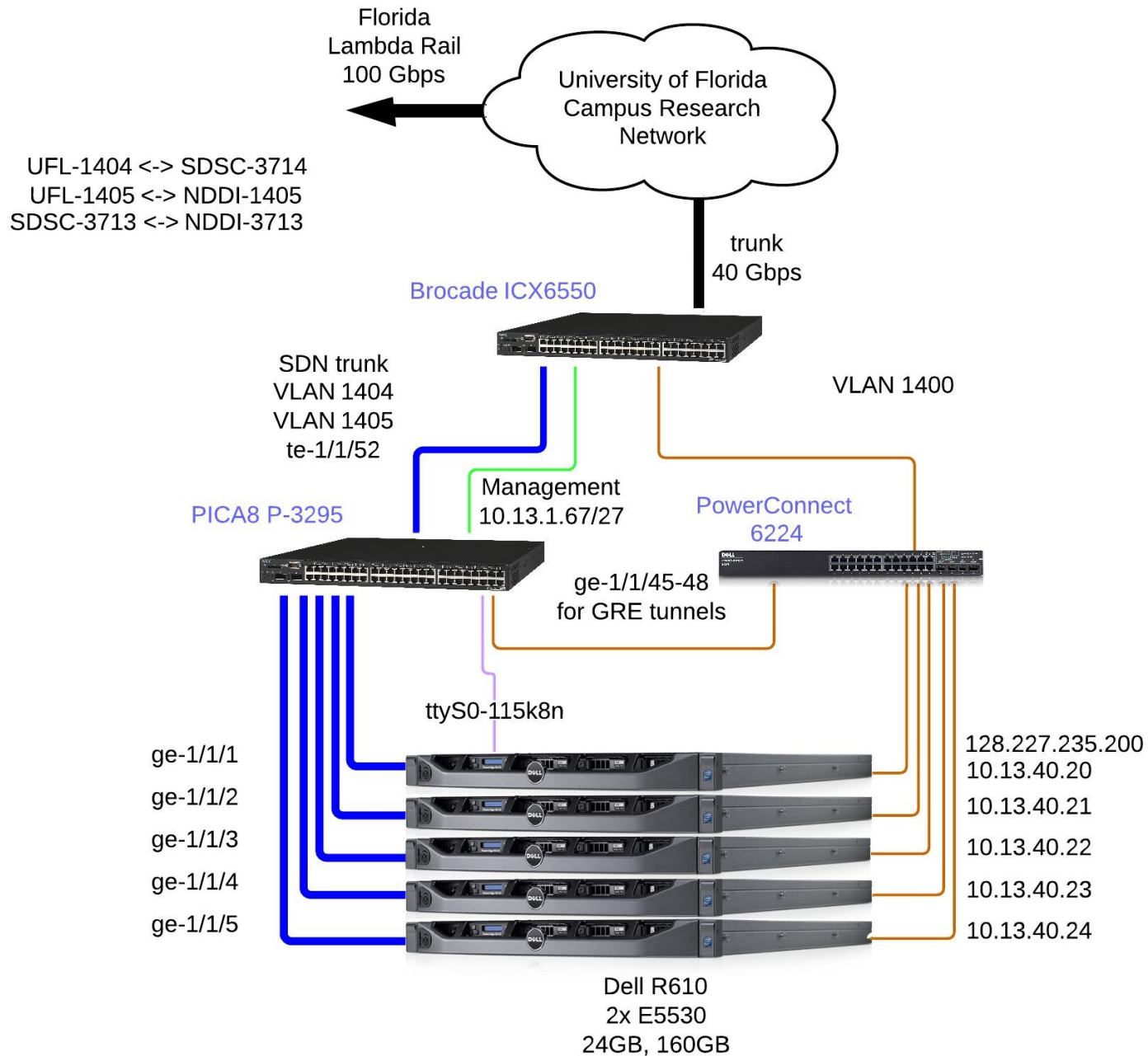
- Link to L2/VLAN
- NO OpenFlow-enabled switch

Site without hardware support:

- NO Link to L2/VLAN
- NO OpenFlow-enabled switch



# UF Deployment



# Resources

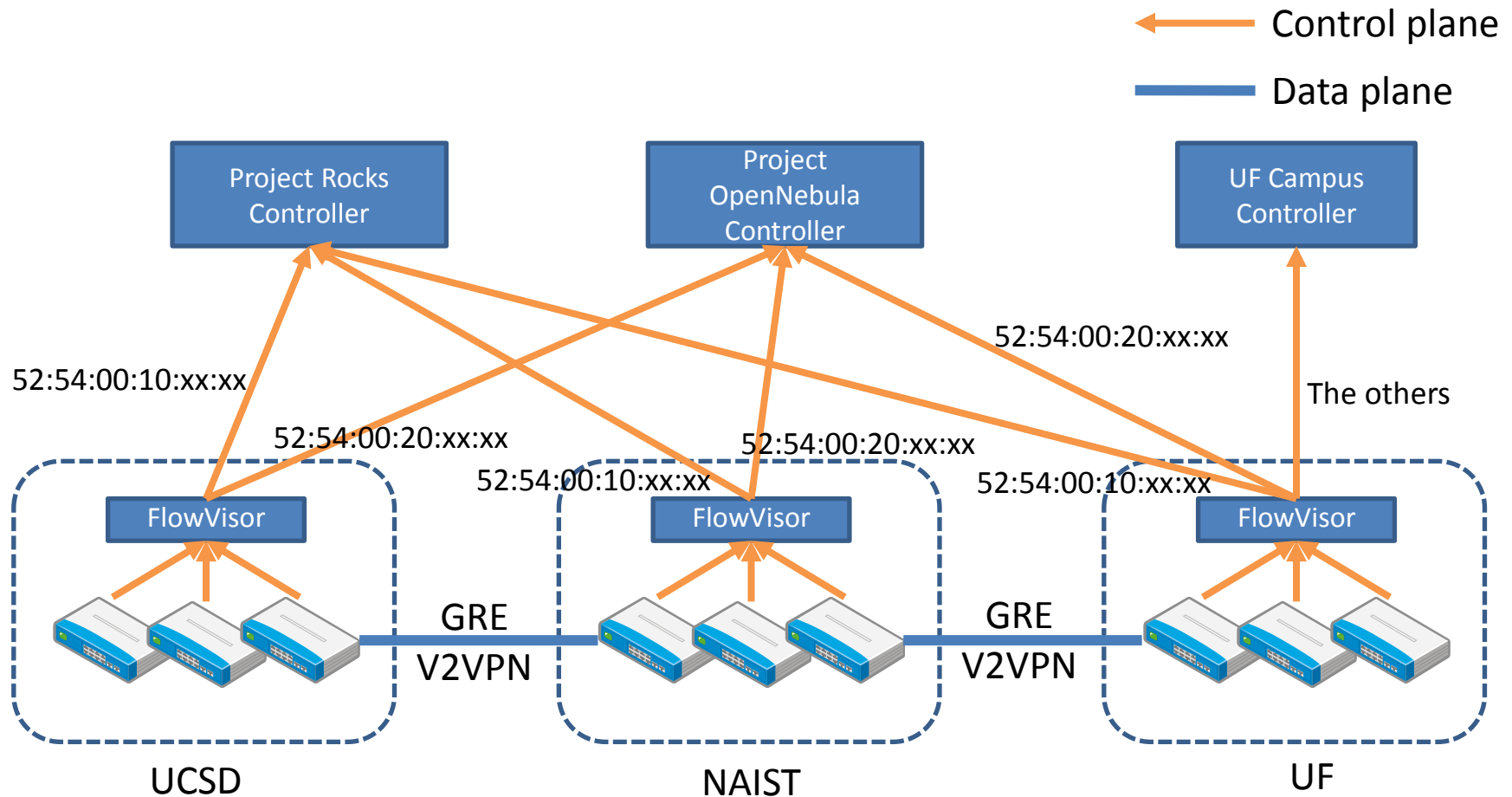
- L2 paths established through Internet2 and Florida Lambda Rail
  - VLAN-1404 (UF) to VLAN-3714 (UCSD)
  - VLAN-3713 (NDDI) to VLAN-3713 (UCSD)
  - VLAN-1405 (UF) to VLAN-1405 (NDDI)
- L2 paths established through NDDI and JGN-X
  - VLAN-1405 (NDDI) to ?
  - VLAN-3713 (NDDI) to ?
- OpenFlow-enabled Switches
  - PICA8 switch at UF, UCSD, NAIST, AIST
  - HP switch at Osaka-U
- Servers
  - 5 nodes dedicated to PRAGMA-ENT at UF
  - 8 nodes dedicated to PRAGMA-ENT at UCSD
  - 3 nodes dedicated to PRAGMA-ENT at NAIST
  - 4 nodes dedicated to PRAGMA-ENT at AIST
  - 3 nodes dedicated to PRAGMA-ENT at Osaka-U

# MAC address assignment

- Without coordination between sites, MAC address conflict among VMs may occur
- KVM(QEMU) uses MAC addresses of the form 52:54:00:xx:xx:xx
- Idea: reserve slices for each institution and/or project
  - 52:54:00:0x:xx:xx Management use
  - 52:54:00:10:xx:xx Institution A
  - 52:54:00:11:xx:xx Institution B
  - 52:54:00:12:xx:xx Institution C
  - 52:54:00:13:xx:xx Project 1

# Multi-tenant/project network

- Slicing a network into multiple tenants using FlowVisor/FlowSpace Firewall



# Future Directions

- Expand the PRAGMA-ENT L2 connectivity
- Deploy overlay networks to manage GRE tunnels
  - Sites without L2 network reach will be able to join
  - Sites without OF switches will be able to join
- Documentation on PRAGMA website
- Monitoring tool
- Applications/use cases