PRAGMA 28

PRAGMA Experimental Network Testbed (ENT)

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ENT Goals

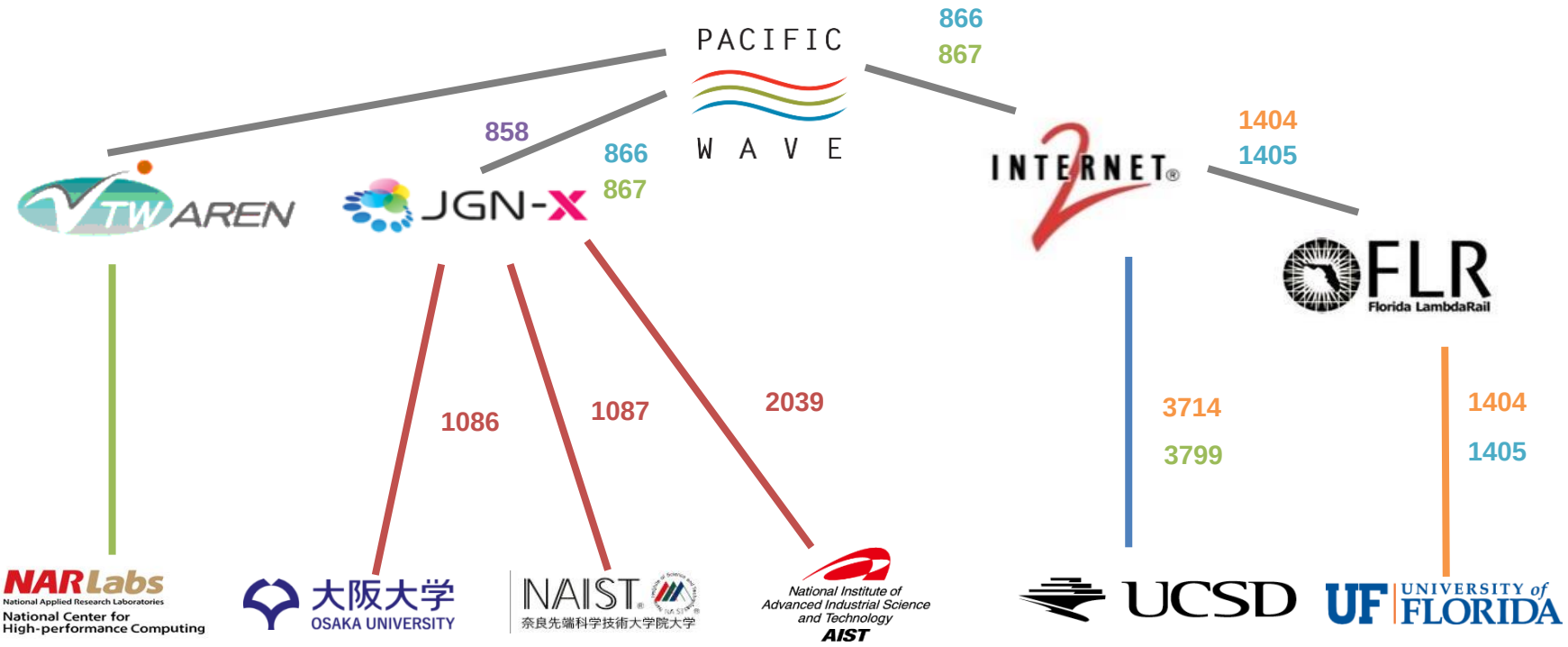
- Build a breakable international SDN testbed for use by PRAGMA researchers
  - By no means a production system
  - Complete freedom to access and configure network resources
- Provide access to SDN hardware/software to PRAGMA researchers
- Offer networking support for PRAGMA multi-cloud and user-defined trust envelopes

ENT Progress

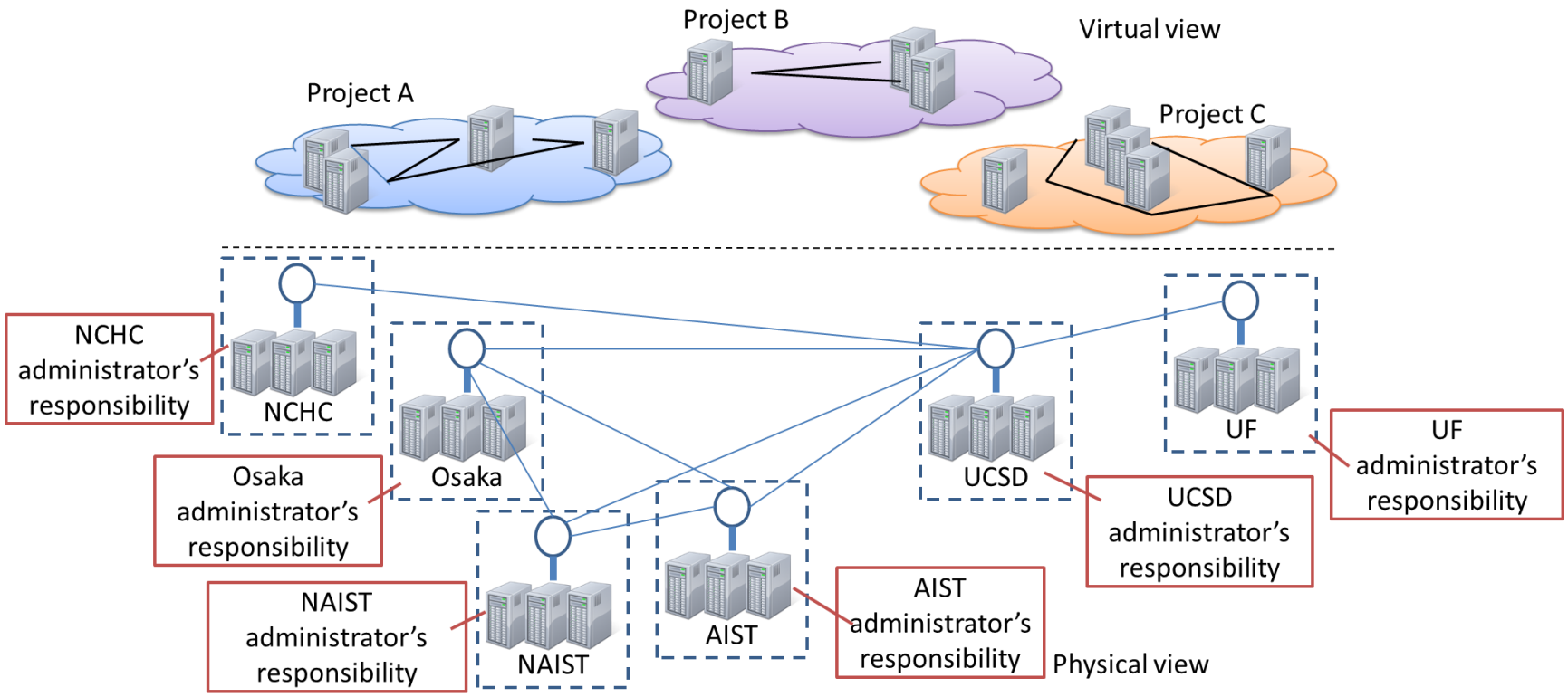
- PRAGMA 25 – Start of the project
- PRAGMA 26
  - Preliminary international links configuration
  - Preliminary tests using GRE tunnels
- PRAGMA 27
  - International links connecting Japan (NAIST, AIST, Osaka U) and US (UF and UCSD) established
  - Experiments with multi-path controllers
- PRAGMA 28
  - Connection to Taiwan (NCHC) established
  - Network slicing with AutoVFlow

ENT Activities

- ENT Backbone
  - TWAREN connected through Pacific Wave
- OpenFlow Network Slicing
  - AutoVFlow deployed and tested (demo)



ENT Activities – Control Plane



- Distributed implementation via AutoVFlow
- Support for multiple experiments

ENT Accomplishments

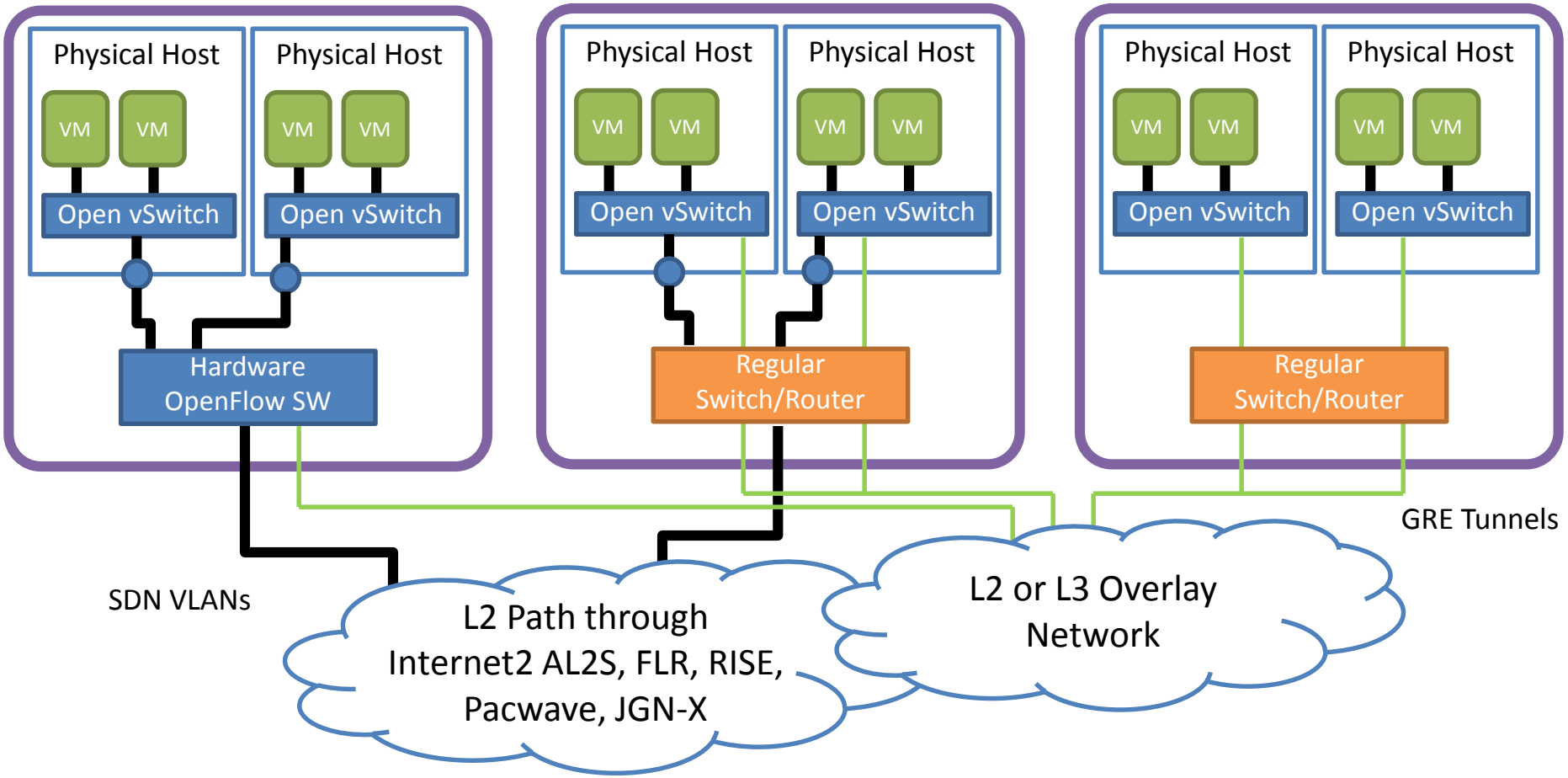
- ENT backbone live
  - Connection with TWREN established
  - Static L2 links: NAIST, Osaka U, AIST, UF, UCSD, NARLabs
- OpenFlow slicing tested
  - AutoVFlow deployed at NAIST, UF, UCSD
- ENT presented at Internet2 Focused Technical Workshop: International SDN/Openflow testbeds

ENT Expansion

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

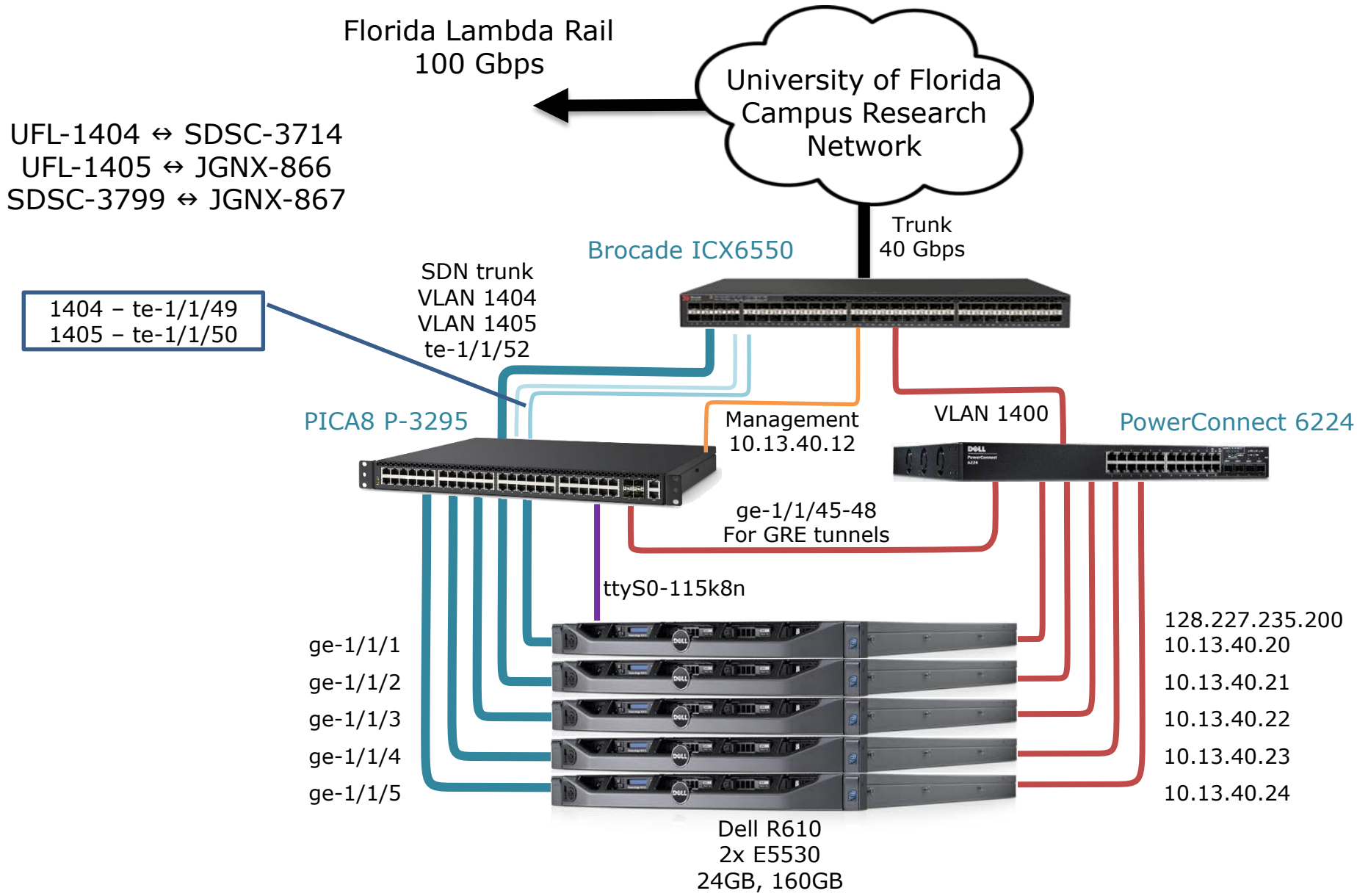
Site without hardware support:
- NO Link to L2/VLAN
- NO OpenFlow-enabled switch



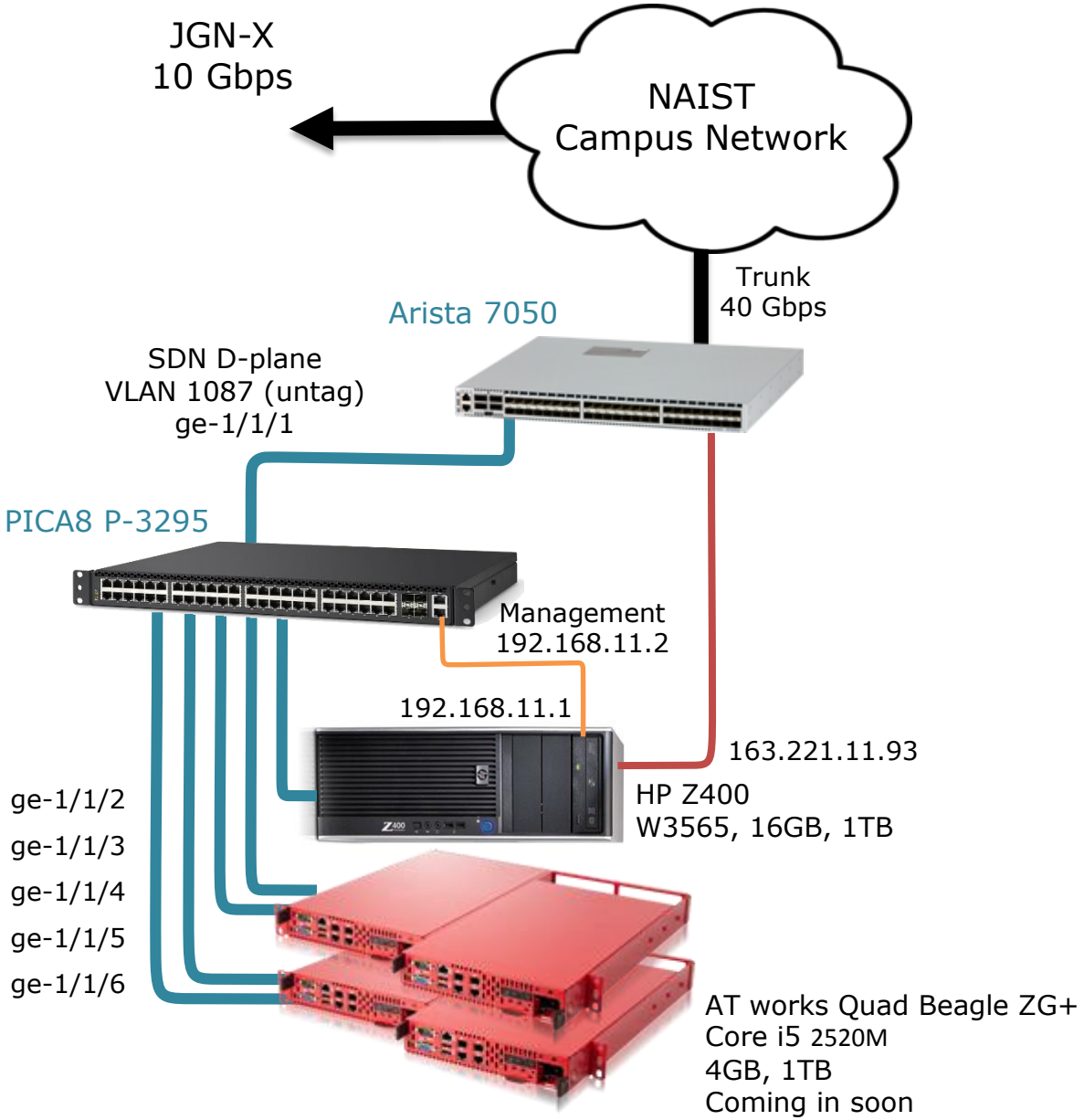
Resources

- L2 paths established through Internet2, FLR, JGN-X and Pacific Wave
  - VLAN-1404 (UF) to VLAN-3714 (UCSD)
  - VLAN-866 (JGN-X) to VLAN-1405 (UF)
  - VLAN-867 (JGN-X) to VLAN-3799 (UCSD)
- L2 paths established through JGN-X and Pacific Wave
  - VLAN-866, 867 (JGN-X) to the RISE OpenFlow switch in Tokyo
  - VLAN-2039 (AIST) to the RISE OpenFlow switch in Tokyo
  - VLAN-1086 (OsakaU) to the RISE OpenFlow switch in Osaka
  - VLAN-1087 (NAIST) to the RISE OpenFlow switch in Osaka
  - TWAREN
- OpenFlow-enabled Switches
  - PICA8 switch at UF, UCSD, NAIST, AIST
  - HP switch at Osaka-U
- Servers
  - 19 nodes dedicated to PRAGMA-ENT at UF
  - 8 nodes dedicated to PRAGMA-ENT at UCSD
  - 4 nodes dedicated to PRAGMA-ENT at NAIST
  - 4 nodes dedicated to PRAGMA-ENT at AIST
  - 5 nodes dedicated to PRAGMA-ENT at Osaka-U

UF Deployment



NAIST Deployment



Future Plans

- Network expansion (more sites)
- DOCK simulations
  - Use SDN monitoring capabilities to profile communication pattern while running DOCK
- LifeMapper
  - Address data licensing and security with SDN
- End user support
  - ENT operations center