

# **Archipelago**

**Linking Researchers On-Campuses and in the Cloud  
through SDN-Enabled Microsegmentation**

NSF PI Meeting - 2019-09-25

Tracy Futhey, Richard Biever, Maria Gorlatova, William Brockelsby

# Agenda

- Motivation
- Archipelago Approach
- Applications and Benefits
- Phases, Testing, Timeline

# Motivation

- Explosion of network connected devices (over 100K at Duke)
- Increasing awareness of the need for enhanced cybersecurity
- Delivery of enhanced cybersecurity at network speed
- The need to transfer increasingly large research data sets
- Compliance requirements: NIST SP 800-171, PCI-DSS, etc
- Cost reduction



**We must improve the performance and security of computer networks to make it easier and less costly for scientists to move, store, and analyze their data.**

# Existing Strategies and Achievements at Duke

- Science DMZ
  - 10 Gb/s L3 connection to MCNC/NCREN for research traffic
  - 10 Gb/s L2 connectivity to RENCI Breakable Experimental Network (BEN)
  - 10 Gb/s L2 connection to MCNC/NCREN as a part of the Triangle SDN initiative
- SDN Express Paths for Research Flows
  - (OCI-1246042, \$497K, 1/1/2013-12/31/2014)
  - Strategically placed SDN/OpenFlow datapaths permit intelligent steering of research traffic
  - Plexus – internally developed controller based on Ryu that permits specific flows to bypass sources of friction such as inter-VRF firewalls and facilitates connectivity to research circuits
  - Switchboard – internally developed web application that permits authorized users to request security appliance bypass dynamically in service of research needs

# Archipelago

Archipelago seeks to improve the performance and security of computer networks to make it easier and less costly for scientists to move, store, and analyze their data that works within a Science DMZ architecture, but does not require a full overlay build of a Science DMZ.

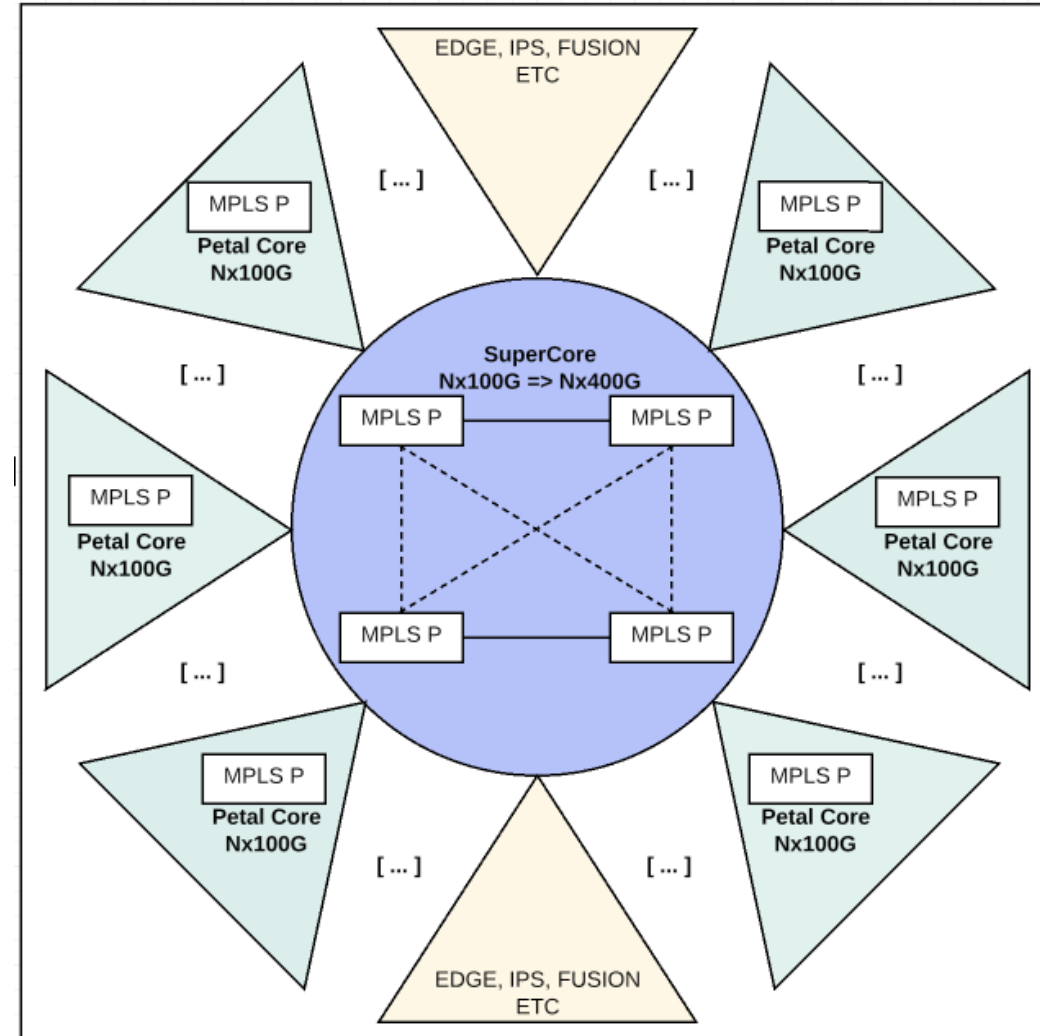
# Archipelago Approach

- Leverage software defined networking
- Use best-of-breed equipment
- Deploy a hybrid architecture
  - Augment existing infrastructure instead of replacing it – cost reduction
  - Leverage an existing high performance substrate
  - Reduce complexity
  - Minimize risk

# Archipelago Approach: Hybrid Architecture

- Augmentation of existing infrastructure yields a hybrid architecture leveraging a common substrate
- Supports wired + wireless connectivity for diverse use cases
- Virtual Science DMZ as a slice of the network - Avoids the need to deploy a parallel functional block of the network

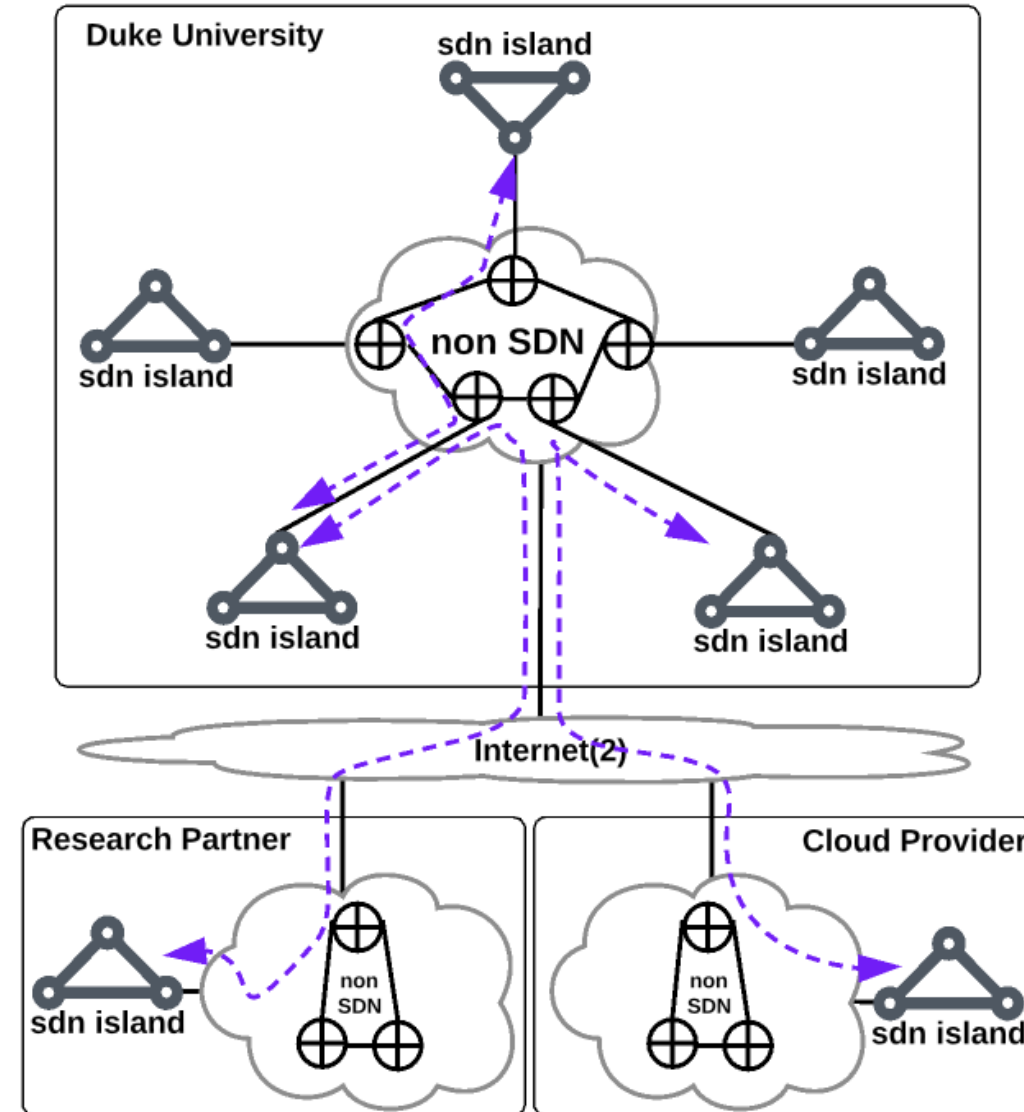
Emerging Duke Super Core / Petal Core Substrate Design



# Archipelago: High Level View

## Hybrid Architecture:

- Native augmentation with SDN forwarding elements yields islands
- Overlays can (but are not required) to connect islands of SDN yielding an Archipelago
- Hybrid use of approaches allows gradual insertion on campuses, between campuses and within the cloud





## Archipelago: Applications

Intelligent, distributed, horizontally scalable network fabric enables multiple applications including but not limited to:

- Policy enforcement
- Microsegmentation
- Friction bypass
- etc

# Archipelago

## Deliverables

- Architectural plans and guidelines
- Software in support of an advanced hybrid traditional + SDN network
- Example applications and use cases
- Documentation

## Broader Impact

Archipelago delivers a hybrid architecture that places SDN features within reach of a broader set of university and college campuses while aggressive microsegmentation and flow optimization simultaneously improve performance and cybersecurity for any institution, large or small.

# Q&A