

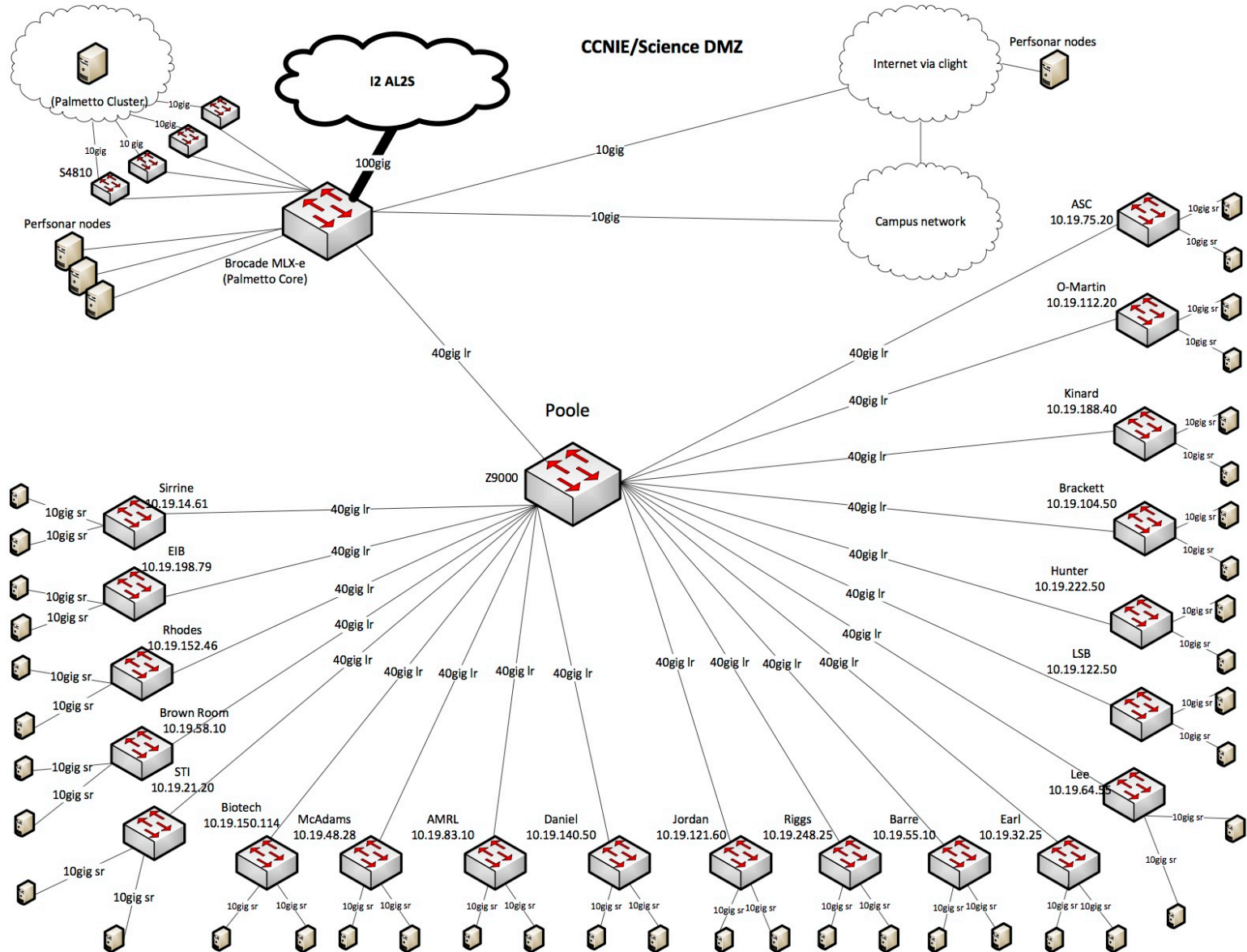
# SDN: An Operational Perspective

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# Timeline

- **2009:** KC needs VLANs mapped for access to GENI Mesoscale access. *Hmm, OpenFlow?*
- **2010-2012:** Collaboration with KC's research team: Data Analysis Network, Steroid Openflow Service, etc
- **2013-2014:** CCNIE Science DMZ implementation
- **2015:** BigSwitch BCF/BigTap in datacenter pods

# CCNIE @ Clemson



# CCNIE @ Clemson: challenges

- VLANs that mysteriously don't pass tagged frames on the Dell Z9000 in Openflow mode.
- Generally, touching anything related to Openflow required a reload or traffic disruption.
- Time-consuming, tedious firmware load process on the Pica8's and Acctons.
- Poor documentation; well-meaning but overall poor support for Openflow on all switches.
- Memory leaks when OF-guided traffic moved between certain groups of ports caused lock-ups and reloads.
- 40G highlighted L1 issues with campus fiber plant.
- Transition to long-term production: free puppies.

# SDN: a bitter aftertaste

- Network engineers felt that SDN was a solution in search of a problem.
- They thought they could do this better with traditional network devices without OpenFlow.
- Most issues were reminiscent of issues we solved back in the 90's: why must we re-live the nightmare?
- Few campus users take advantage of the network's programmability, though many believe that *SDN == fast*.

# Network Engineers $\neq$ Researchers

- Network engineers are excited about building high-performance networks that work.
- Hard to understand that a failure to move packets may be a success from a researcher's point of view.
- Frustrating for time-crunched operational engineers to spend time solving “pointless” problems.

# Solution: Research Network Engineer

- A person with a broader perspective, ideally with a science background.
- Time is split between working on production network (40%) and research projects (60%).
- Critical that this person stay engaged in network operations (keep it real).
- Even though that often results in conflict and challenges for that person.

# Now/Future

- Science DMZ continues to operate effectively.
- KC is Network CTO!
- Clemson moving to a pod-style layout in the datacenters, supporting OpenStack and VMWare.
- Utilizing BigSwitch Big Cloud Fabric (BCF) and BigTap for network layer and monitoring net, respectively.