

GENI Enabled Software Defined Exchange (SDX) and ScienceDMZ (SD-SDMZ)

What next for SDX research?

GENI NICE Workshop

CoNEXT 2016

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Irving, California

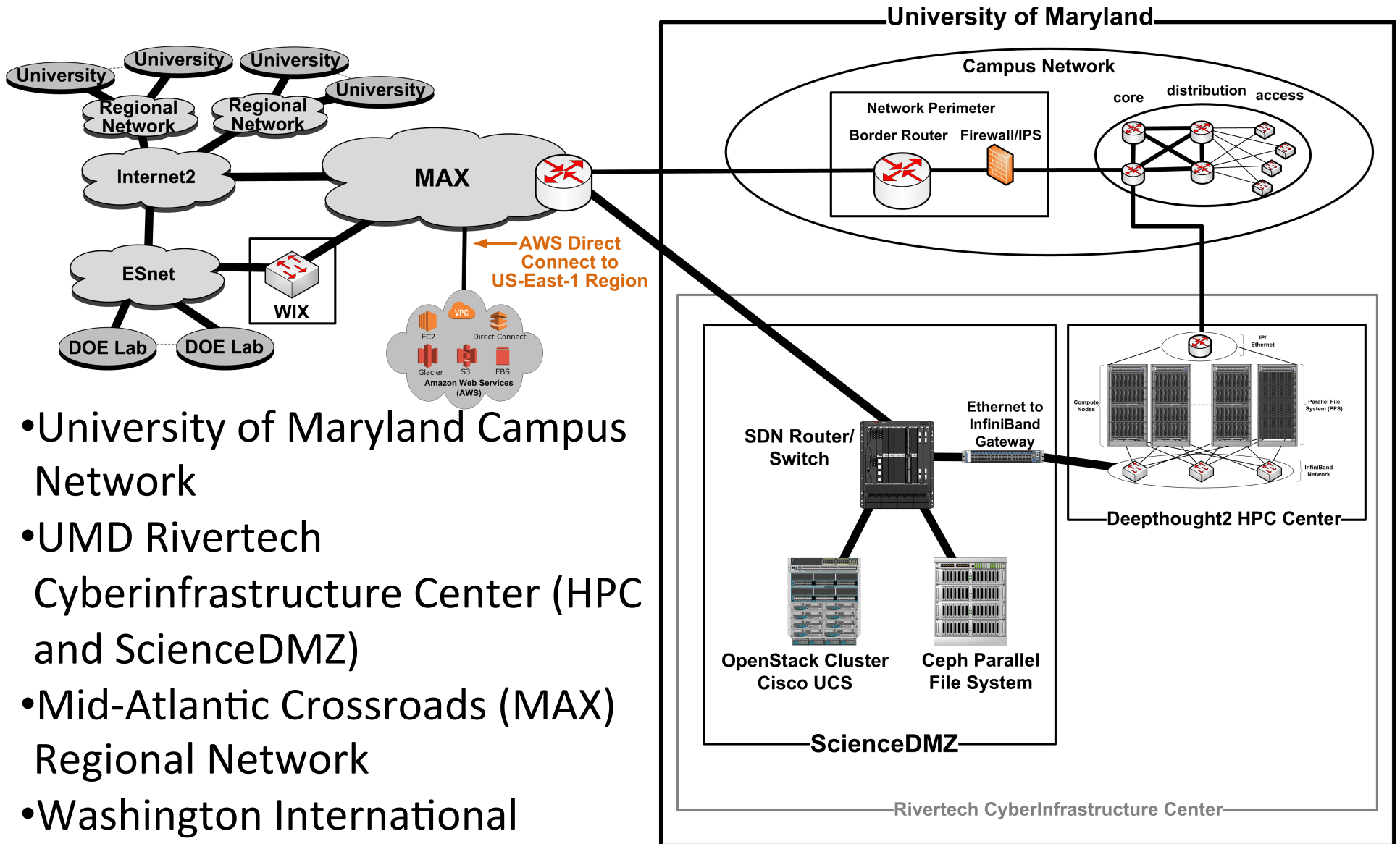
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UNIVERSITY OF
MARYLAND

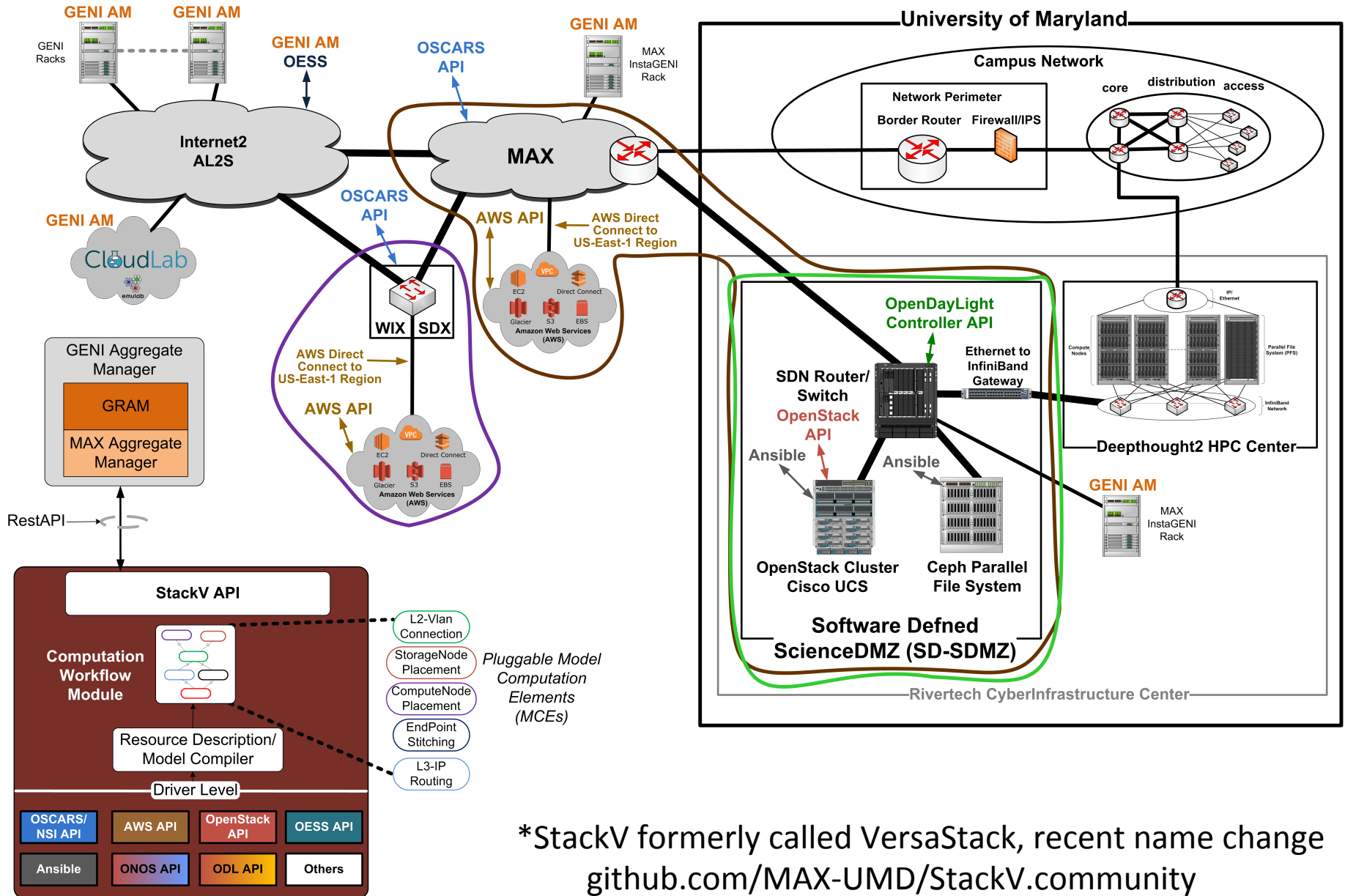


Software Defined in Context of R&E Cyberinfrastructure



- University of Maryland Campus Network
- UMD Rivertech Cyberinfrastructure Center (HPC and ScienceDMZ)
- Mid-Atlantic Crossroads (MAX) Regional Network
- Washington International Exchange (WIX)

Software Defined in Context of R&E Cyberinfrastructure

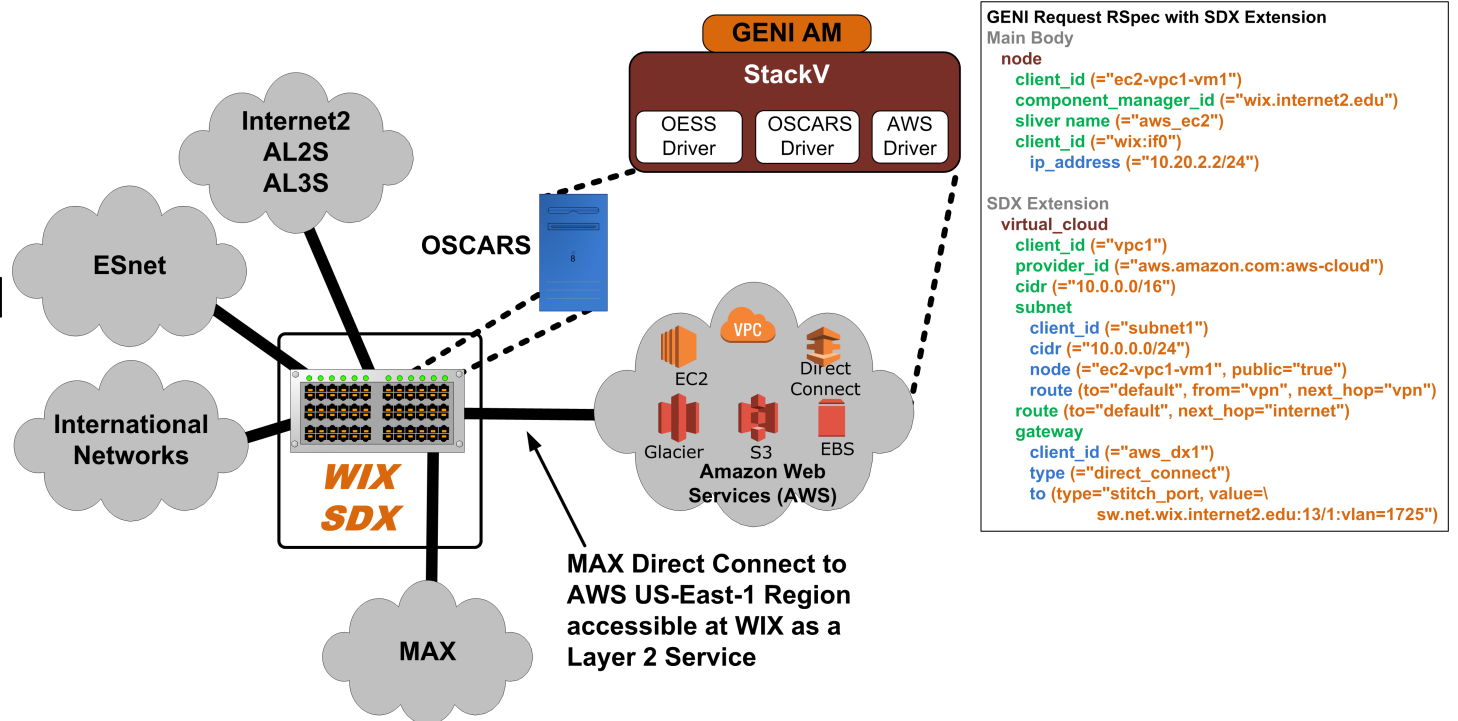


*StackV formerly called VersaStack, recent name change
github.com/MAX-UMD/StackV.community

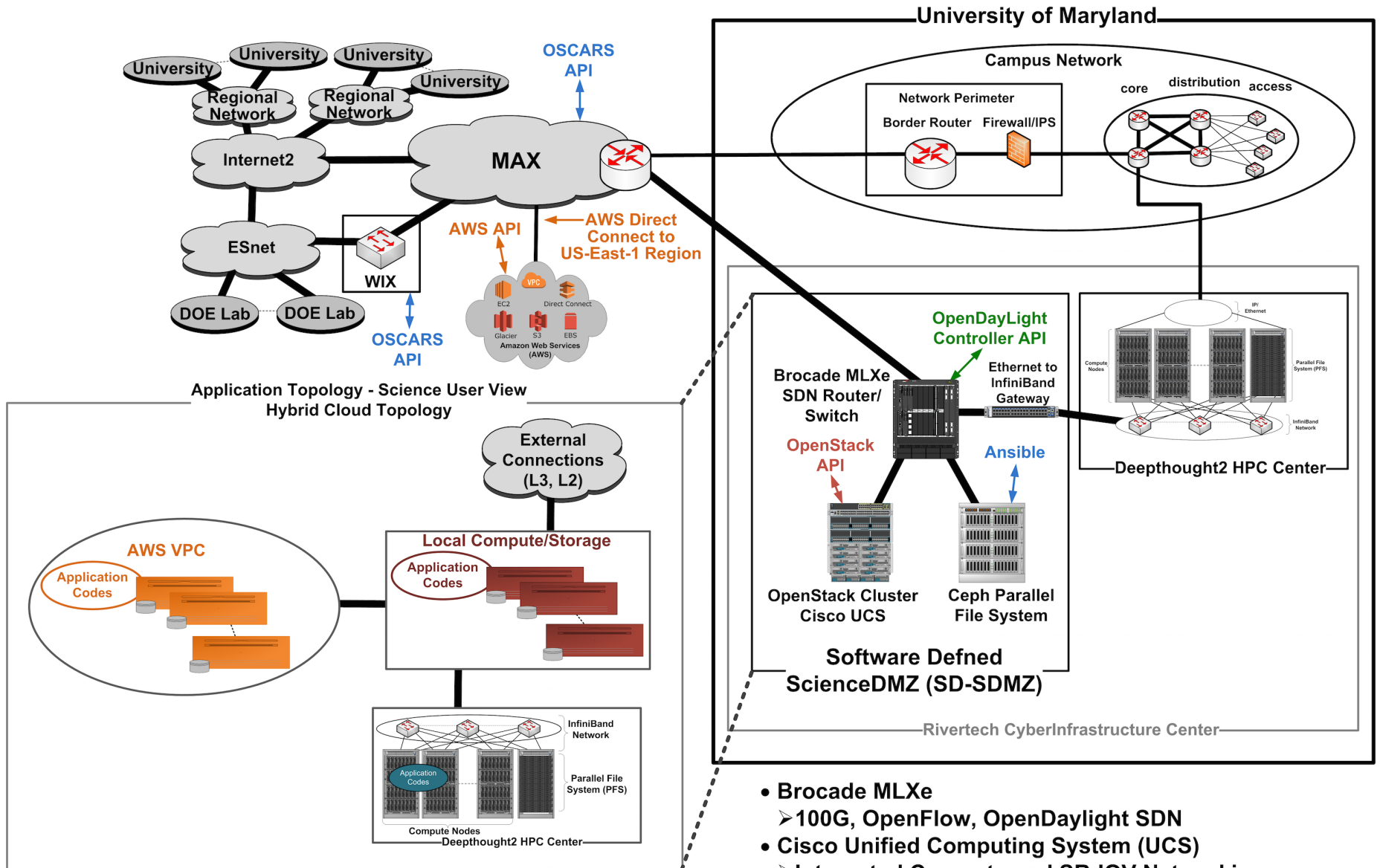
Software Defined Exchange (SDX)

- WIX is a production Exchange Point in McLean, Virginia (jointly operated by Internet2 and MAX)
- Includes OSCARS service enabling Dynamic Cross Connects
- MAX has made its AWS Direct Connect Service available at the WIX via Layer2 VLAN service
- MAX runs a GENI AM/StackV instance with OSCARS and AWS drivers

- GENI
Stitching to
WIX for GENI
Slice with
with AWS
attachment



SD-SDMZ Advanced Hybrid Cloud Service



- Brocade MLXe
 - 100G, OpenFlow, OpenDaylight SDN
- Cisco Unified Computing System (UCS)
 - Integrated Compute and SR-IOV Networking
- Ceph High Performance Storage System

GRAM based GENI AM Policy Control for SDX and SD-SDMZ

- GRAM with ABAC like policy features for resource access control:
 - Federation(Clearinghouse), Virtual Organization (Project), Slice, User
 - VLANs (total), Bandwidth, VMs, Ceph Storage, SR-IOVs
- Future Features Desired:
 - Realtime policy adjustments
 - More policy granularity (specific VLANs, resources)
 - SDXs with compute and storage embedded

What are the next research challenges for SDX?

- Depends on vision for the desired functions
- For us - How do we leverage SDI to create a next generation cyberinfrastructure which will facilitate domain science research and enable new innovations
- Cyberinfrastructure needs to become easier to use and require less knowledge/expertise from the domain science community.
- Applying Software Define Infrastructure (SDI) at specific points in this infrastructure is the key:
 - Software Defined Exchange (SDX)
 - Software Defined ScienceDMZ (SD-SDMZ)

What are the next research challenges for SDX?

- Why build SDI “services” based cyberinfrastructure?
 - we will not be able to figure out exactly what services the domain scientist needs the first time thru
 - however, we need an infrastructure that will allow us to start with something, test with the domain scientists, and rapidly adapt and iterate until we find what works
- The only way for cyberinfrastructure to become simpler to use is to make it more complex/
sophisticated
 - hardware and user facing services – get simpler
 - software defined part – gets more complicated

What are the next research challenges for SDX?

- Longer term, imagining a distributed ecosystem of SDXs and SD-SDMZs which can be orchestrated to enable control/tailoring of end-to-end flows
- This may be thought of as “democratizing the middlebox functions and infrastructure”.



Thanks



Extras

UMD SD-SDMZ Services

Advanced Hybrid Cloud (AHC) Service

On Demand, Application Specific, Hybrid Topologies which include one of more of the following:

- ✓ Local OpenStack Virtual Machines (with SRIOV interfaces to network and storage)
- ✓ Dedicated Local Ceph Storage Resources and Connections
- ✓ Integrated AWS Resources (Virtual Private Cloud (VPC) or Public)
 - User controlled AWS resources, or
 - SD-SDMZ facility provided AWS resources (EC2, Storage, S3 endpoints)
- ✓ Network Connections
 - AWS Direct Connect integration for access to AWS Public or VPC resources
 - Layer2/Layer3 External Connections across Internet2, ESnet, others
 - Customized topology templates for individual user requirements
- ✓ Future:
 - Service connections/integration with other public cloud infrastructures
 - Service connections/integration with other R&E cloud, HPC, data repositories, etc.
 - Schedulable Services

Team and Research Projects

- **UMD/MAX Team**

- Tom Lehman
- Xi Yang
- Alberto Jimenez
- Multiple Students

- **Results from several research projects including:**

- High Performance Computing with Data and Networking Acceleration (HPCDNA)



- Resource Aware Intelligent Network Services (RAINS)



U.S. DEPARTMENT OF
ENERGY

Office of Science

- GENI Enabled Software Defined Exchange (SDX)

