GENI Enabled Software Defined Exchange(SDX)

Washington International Exchange (WIX)

GENI Engineering Conference 25

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WIX - GENI Enabled 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

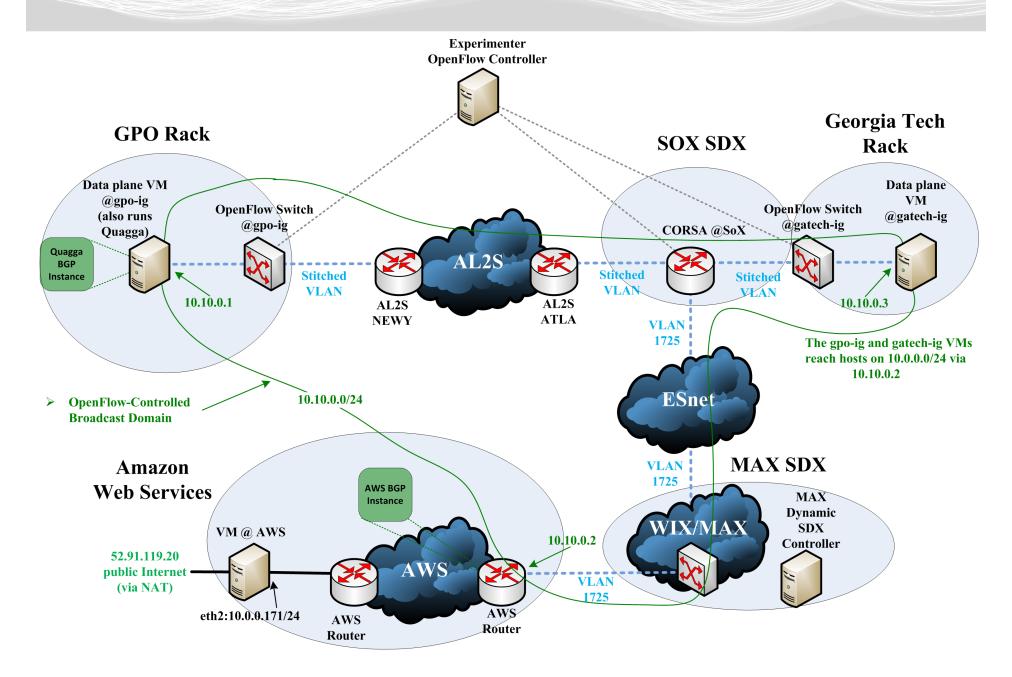
MAX runs a GENI AM/StackV instance with OSCARS and AWS

drivers **GENI Request RSpec with SDX Extension GENI AM** Main Body StackV client id (="ec2-vpc1-vm1") component_manager_id (="wix.internet2.edu") Internet2 sliver name (="aws ec2") OSCARS **OESS** AWS GENI client_id (="wix:if0") Driver Driver Driver AL2S ip address (="10.20.2.2/24") AL3S SDX Extension Stitching to virtual cloud **OSCARS** client_id (="vpc1") **ESnet** provider_id (="aws.amazon.com:aws-cloud") WIX for GENI cidr (="10.0.0.0/16") client_id (="subnet1") cidr (="10.0.0.0/24") Slice with node (="ec2-vpc1-vm1", public="true") Connect route (to="default", from="vpn", next_hop="vpn") route (to="default", next_hop="internet") International with AWS S3 client_id (="aws_dx1") **Networks** Amazon Web type (="direct connect") Services (AWS) to (type="stitch port, value=\ attachment SDX sw.net.wix.internet2.edu:13/1:vlan=1725") **MAX Direct Connect to AWS US-East-1 Region** accessible at WIX as a MAX **Layer 2 Service**

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

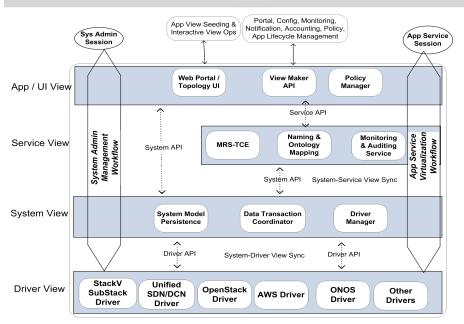
GEC 25 Demonstration - WIX



Thanks

Extras

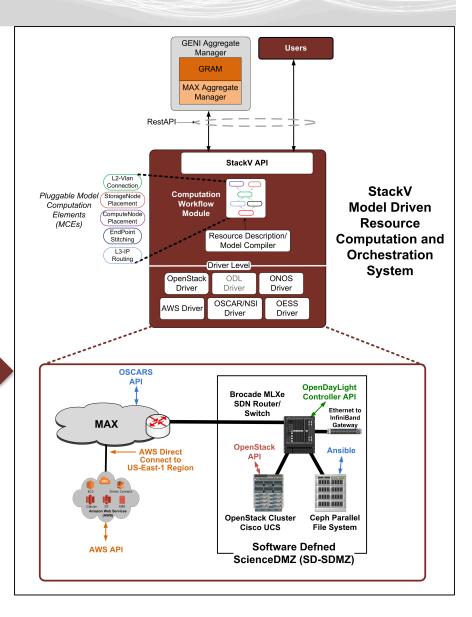
StackV Software



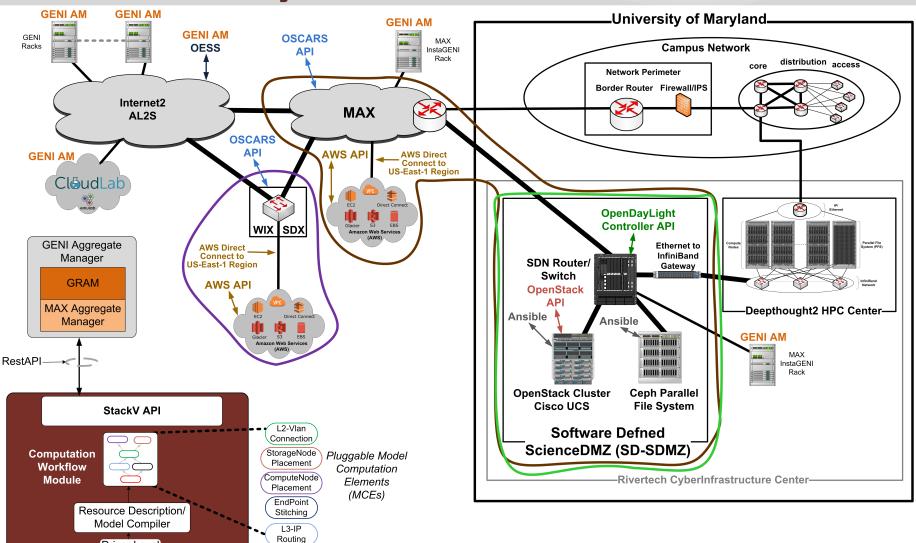
Architecture

Conceptual View

- UMD/MAX developed StackV is an open source model driven orchestration system:
 - github.com/MAX-UMD/stackV.community
 - video: tinyurl.com/umdmax-stackv
- Native StackV Application (Northbound) API
- Access via GENI Aggregate Manager API
- Multiple Drivers, Southbound APIs



Software Defined in Context of R&E Cyberinfrastructure



Driver Level

ODL API

AWS API

ONOS API

OESS API

Others

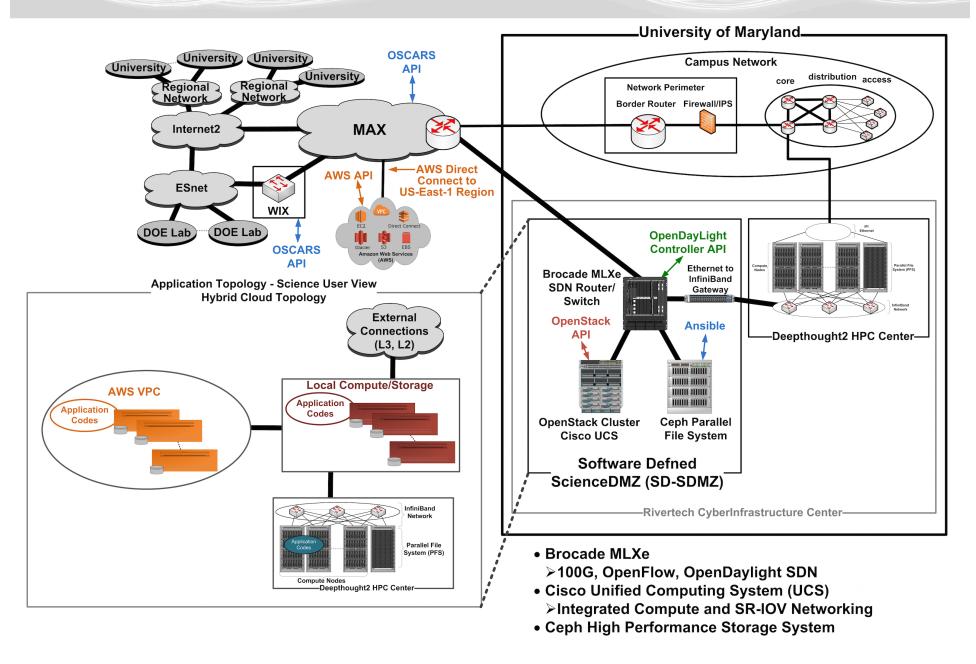
OSCARS

NSI API Ansible

WIX as a GENI Enabled SDX

- Objective is to control Exchange Point resource utilization, in an automated fashion:
 - at the Federation (Clearinghouse) level, Virtual Organization (Project)
 Level, Slice Level, and User Level
 - also need to be able to adjust authorizations and access polices in near-real time
- Current SDX Functionality
 - Leverages GRAM GENI AM based policy features
 - Establish resource quotas on a Clearinghouse, Slice, or User basis
 - Enforce allocation by total bandwidth, number of VLANs in use
- Future Capabilities Desired
 - Additional parameters available for resource access
 - Interfaces, VLAN Ranges
 - at the Federation (Clearinghouse) level, Virtual Organization (Project) Level, Slice Level, and User Level
 - Ability for real-time resource utilization adjustments based on user priority and preemption
 - SDXs with compute and storage embedded

SD-SDMZ Advanced Hybrid Cloud Service



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

Longer Term Vision for SDX and Software Defined ScienceDMZ (SD-SDMZ)

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