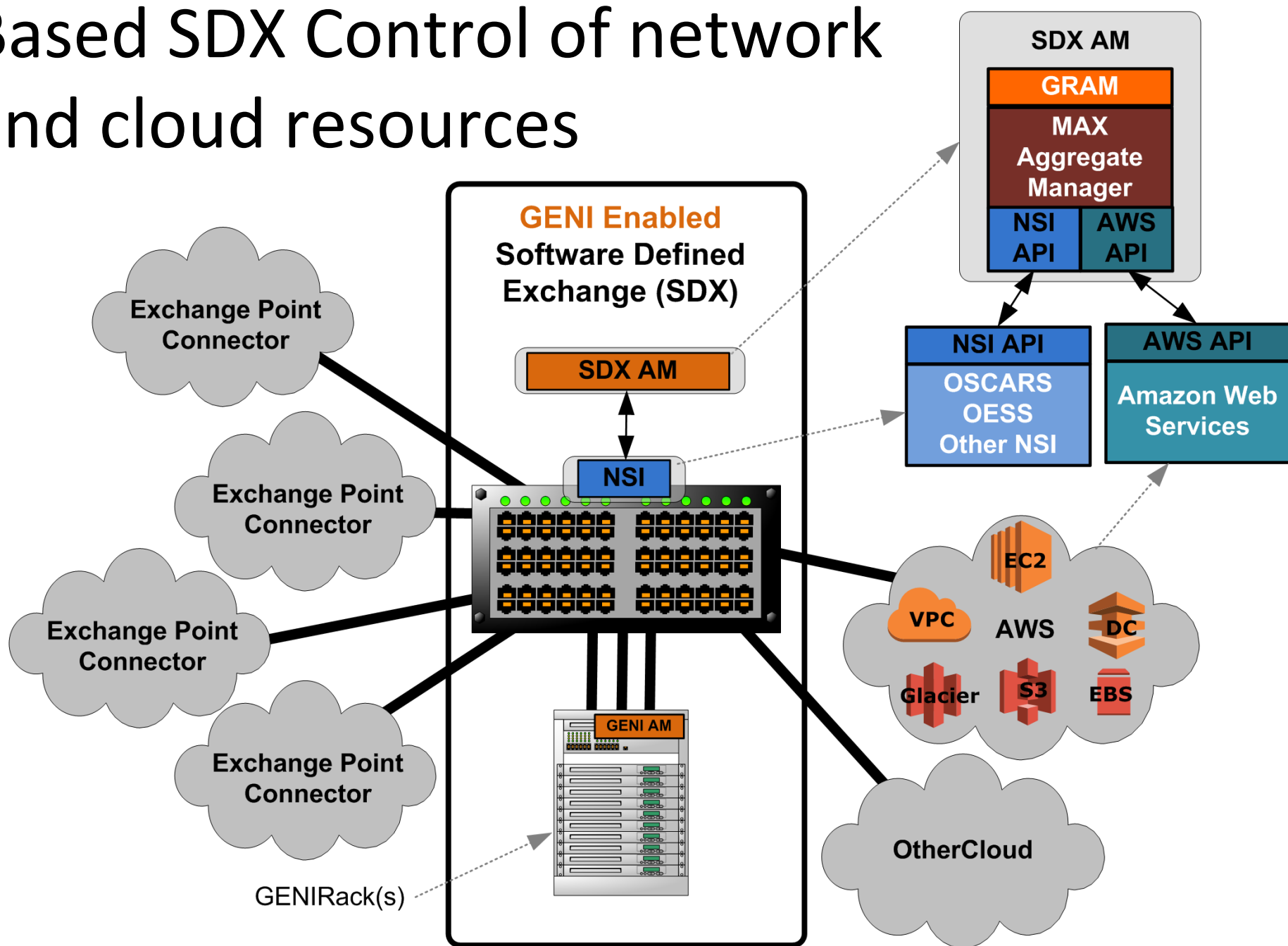


GENI Enabled Software Defined Exchange (SDX)

GRAM/MAX Aggregate Manager Based SDX Control of network and cloud resources



Request RSpec with SDX Extension

Main Body

node

```
client_id ("ec2-vpc1-vm1")
component_manager_id ("wix.internet2.edu")
sliver name ("aws_ec2")
client_id ("wix:if0")
ip_address ("10.20.2.2/24")
```

SDX Extension

virtual_cloud

```
client_id ("vpc1")
provider_id ("aws.amazon.com:aws-cloud")
cidr ("10.0.0.0/16")
```

subnet

```
client_id ("subnet1")
cidr ("10.0.0.0/24")
node ("ec2-vpc1-vm1", public="true")
route (to="default", from="vpn", next_hop="vpn")
route (to="default", next_hop="internet")
```

gateway

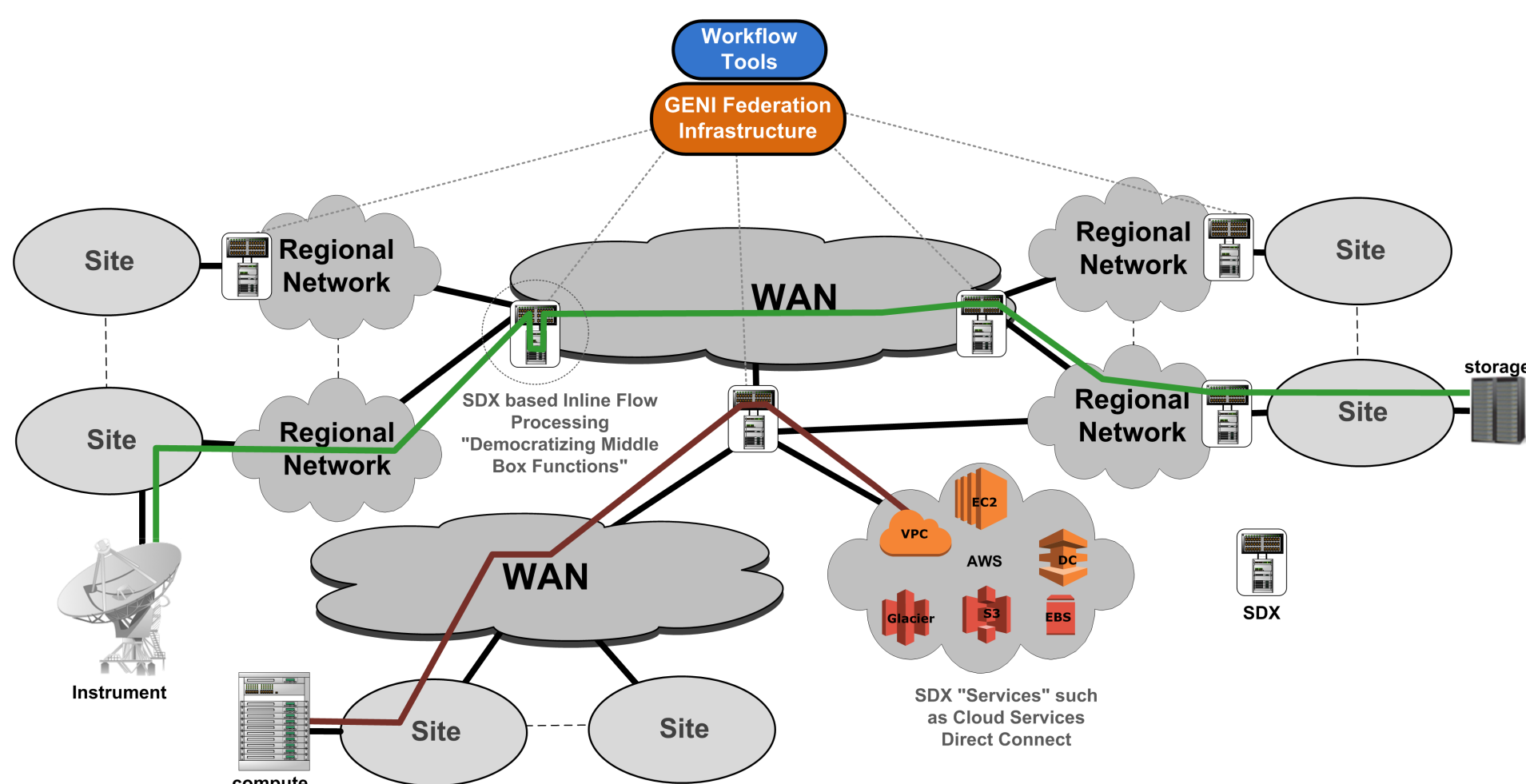
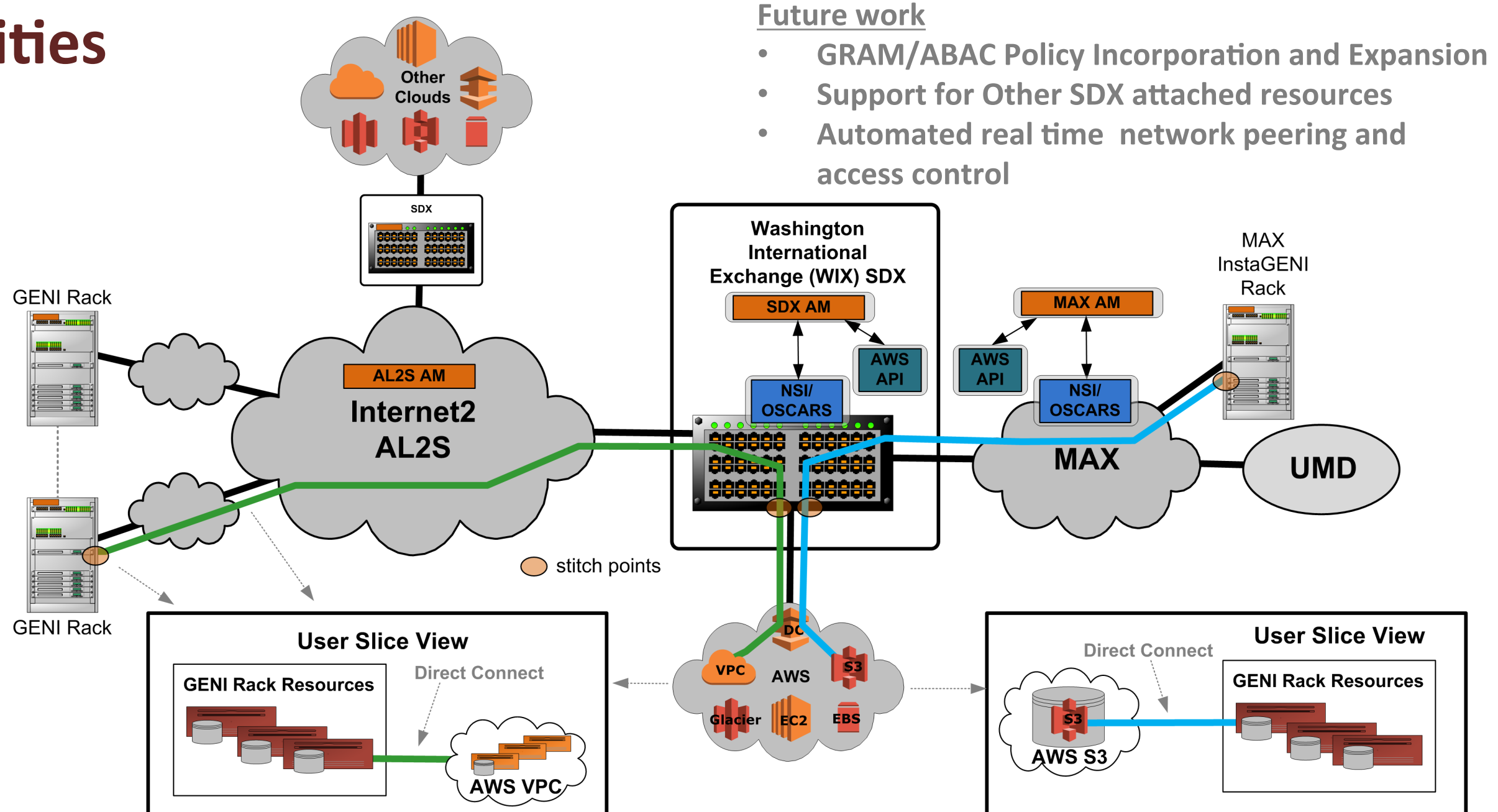
```
client_id ("aws_dx1")
type ("direct_connect")
to (type="stitch_port, value=\
"sw.net.wix.internet2.edu:13/1:vlan=1725")
```

GRAM with ABAC like policy features for multiple control levels for SDX utilization and connected resources:

- Federation(Clearinghouse), Virtual Organization (Project), Slice, User
- Realtime authorizations and access policy adjustments needed

Current Prototype Capabilities and Demonstration

- MAX AM extended to understand "SDX Connected Resources"
- RSpec SDX Extension defined
- Enables integrated slice instantiation and stitching to include SDX connected resources such as AWS over Direct Connect as shown in this demonstration



- ✓ SDX will be critical components of the future Internet infrastructure
- ✓ Imagining ecosystem of federated distributed SDXs and ScienceDMZs
- ✓ GENI Software Suite, with a few modifications, can be used to enable federated policy driven SDX