Data Transfer Node
Resource Manager

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What Problem(s) are We Solving

- End-to-end network service automation
  - Manual provisioning
  - No service consistency across domains
  - No service visibility across domains
- Application-Network interaction missing
  - Ability for science workflows to drive service provisioning
  - Programming APIs usually not intuitive and require detailed network knowledge, some not pre-known
  - Detailed network information needed, usually not easily available
- Multi-domain service visibility and troubleshooting
  - Data APIs across domains for applications, users, network administrators
  - Performance, service statistics, topology, capability etc.
  - Exchange of ‘scoped’ and authorized information
- Alignment with security policies @ the end-site
End-to-end, multi-domain provisioning automation and resource orchestration
Where we are now and what we are missing?

- Still in early project phase (1st year/3 year) and we keep up with changes.
A Data Transfer Node (DTN) is a server that constitutes the endpoint of a data transfer. Key Functionality:

- Flow Termination
- End system (auto) configuration and monitoring

DTN-RM(s):

- Resources: OS, software configuration, switching components (OVS ports, traffic limits, flow moderation) etc.
End-Site Orchestration

Science DMZ Flow Management
- Route to right flows to the right DTNs, vlan or more granular flow identification using OF;
- Support multi-science Science DMZ, with resource allocation and traffic steering;

DTN Autoconfig
- VLAN configuration on the NIC; Private or public IP address configuration of L2 or L3 VPNs
- Other configuration like TCP window size, might be a stretch
- OVS configuration and QoS configuration
- Flow steering and ACLs to connect to the internal file system over different NICs
End-Site Orchestration (cont.)

What is next:
• Normalize APIs with SENSE-RM northbound interface
• Begin to Integrate DTN-RM and SENSE-RM
• Expose topology in MRML format
• Fairshare between different orchestrators
• Continue to extend DTN-RM functionality in the SENSE context
• Implement Site Level Service to work with other controllers: ODL, Kytos, ONOS, etc…
• End-To-End monitoring, measurement and management
• RPM based installation, release as Open Source

https://goo.gl/qJJLnm
SENSE Scoped definitions

- End-to-End (network point of view)
  - DTN NIC to DTN NIC, across Science DMZ, WAN(s), Open exchange points (ideally)
- Multi-domain
  - Multiple administrative domains, independent policies and authorizations
- Provisioning automation
  - Bring-up and management of services without interrupt-driven human involvement
- Resource orchestration
  - Allocation and reservation of resources including compute, storage and network (mainly)
Flying Start: Leveraging prior work

- Modeling
  - RAINS project
- Testbed
  - Existing compute and DTN equipment@sites
  - ESnet SDN testbed across US/Europe
- SDN Software
  - ENOS and ODL concepts and some components from ESnet

ANL - Argonne National Laboratory
Caltech - California Institute of Technology
ESnet - Energy Sciences Network
FNAL - Fermilab
Internet2 - Internet2
MAX - Mid-Atlantic Crossroads
UMD - University of Maryland
WIX - Washington International Exchange
See SENSE demo at SC17!

And more demos:

- HEPCloud distributed caching demo
- Improved Monitoring and Performance in the Network Data Plane for the LHC Grid
- Multi-Purpose GP-GPU Cluster for Machine Learning Fast Prototyping
- Virtual Reality and Machine learning Quantum Networks: First light
- Data Center Interconnects (DCIs) and WaveServers
- Multi-Domain, Multi-Controller, Multi-Resource SDN application
- PRP Multi-Institution Hyper-Converged ScienceDMZ
- High Throughput Flows Between North and South Hemispheres Using Kytos
- ...