Network Research Exhibition: the Future of Networking and Computing with Big Data Streams

Tom Lehman
Energy Sciences Network
Lawrence Berkeley National Laboratory

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Enable Science Workflow and Network Interaction with Deterministic "Quality of Experience"

- No realtime per flow data available for planning or monitoring
- No "deterministic" network services available
- Start data flow, and hope for the best

Excellent Information available about aggregated (over time and data flows) use of the network infrastructure
Elevate Network to First Class Resource
API driven Automation and Orchestration

Workflow and Network can interact for planning, resource discovery, negotiation, and full life cycle monitoring/troubleshooting

Workflow: Would like to move 1TB anytime in the next 24 hours
Network: You can start in 2 hours, and will have at least 50Gbs end-to-end

- Allows workflows to identify data flows which are higher priority
- Allows the network to traffic engineer to fully utilize all network paths
Workflows can "coordinate" with End-to-End Networked Cyberinfrastructure

- Intent Based APIs
- Resource Discovery
- Service Life Cycle
- Monitoring/Troubleshooting
- Deterministic Networking

Types of Interactions
- What is possible?
- What is recommended?
- Requests with negotiation
- Scheduling
Key Themes

• Today, science workflows view the network as an opaque infrastructure - inject data and hope for an acceptable Quality of Experience.

• We should allow workflow agents to interact with the network - ask questions, see what is possible, get flow specific data and resources

• Science workflow planning should be able to include the networks as a first-class resource (along side compute, storage, instruments)

• This requires collaborative cross-discipline teams for workflow co-design

• The same mechanisms that allow the above can also be used for individual networks to distribute traffic more efficiently across entire infrastructure
Extras
SENSE - Multi-Resource / Domain Orchestration

- Science Workflow
- Specific Topology and Services

SENSE operates between the automation layer controlling the individual networks/end-site resources, and science workflow agents/middleware.

Diagram:
- Application Workflow Agents
- SENSE
- SDN Layer
- SDMZ
- End Site
  - Instruments
  - Storage
  - Compute
  - DTNs
- Regional
  - WAN
  - SDX
  - Regional

Diagram includes network services and other resources.
SENSE and Rucio/FTS/XRootD Interoperation

- Rucio identifies groups of data flows (IPv6 subnets) which are "high priority"
- SENSE takes flows from the site edge and "Traffic Engineers" paths across the WAN and End Sites
- Enables use of "multiple paths between sites" and provision of "deterministic" network resources to workflows

Scientific Data Management and Movement Suite
Primary system for LHC and others

SENSE Network RM
SENSE Site RM
SENSE Site RM
End Site

SENSE and Rucio/FTS/XRootD Interoperation

Rucio
FTS
SENSE Orchestrator
SENSE Site RM
SENSE Site RM
WAN

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