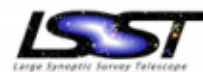




Responding to the demands of big data scientific instruments through the development of an international software defined exchange point (SDX)

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The Phenomenon

- New scientific instruments are being developed in the southern hemisphere that will increase the need for large, real-time data transfers among scientists throughout the world:
 - The Large Synoptic Survey Telescope (LSST) being built in Chile
 - Will produce 6.4 GB images that must be transferred to the U.S. in 5 seconds
 - The Square Kilometer Array (SKA) in South Africa
 - Will transmit approximately 160Gbps of data from each radio dish to a central processor

LSST network requirements

- LSST operation will consist of <n> Channels:
 - Control Channel
 - Requires low latency, high priority, and low bandwidth
 - Bandwidth around a few Mbps
 - Data Channel
 - Require high bandwidth availability, low latency and high priority
 - 5.6GB images to be sent in < 5 sec: up to 90 Gbps
- End-to-end path must provide high resilience, low delay, multiple paths, high bandwidth and an efficient control plane to act in all status changes

Limitations of traditional networks

- Traditional networks are based on destination MAC or IP addresses
 - Sub-optimal resource utilization
 - Forwarding based on other fields implies complex operation
- Some R&E networks can accommodate big data requirements:
 - Multiple paths with multiple 100G links
 - Dynamic provisioning, Bandwidth reservation, Network programmability, etc.
- But R&E networks are interconnected through Academic Exchange Points:
 - Almost no support for programmability
 - Manual provisioning of circuits and services (QoS profiles, for instance)
 - Data-intensive end-to-end applications may require all networks in the path support QoS and Programmability
 - Including the Academic Exchange Points
- Software Defined Exchanges offer a potential solution

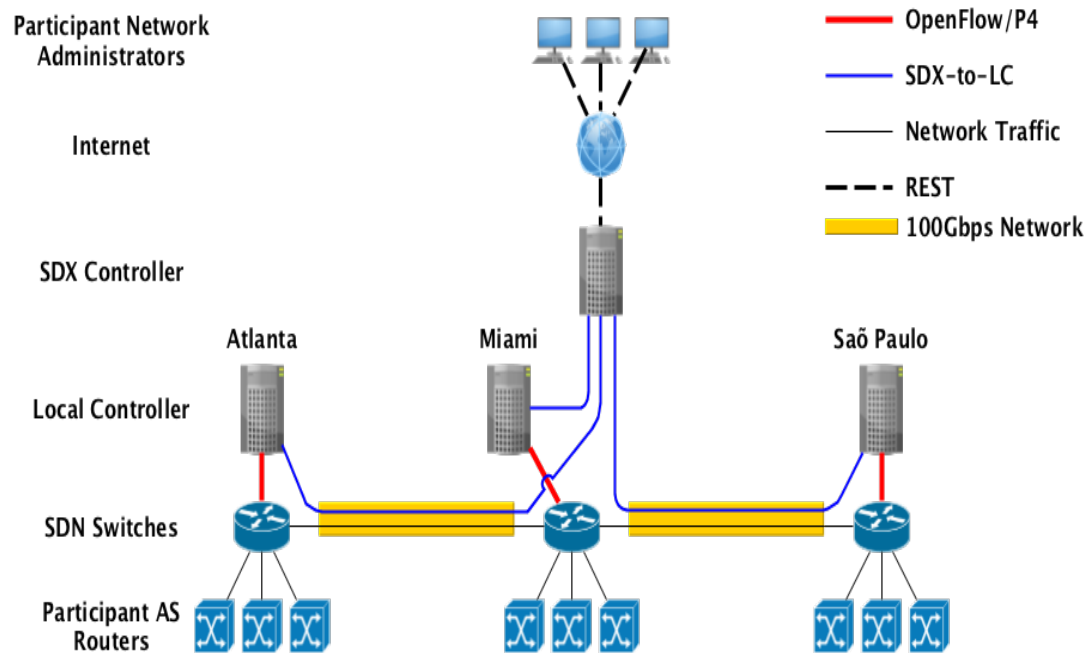
SDX

- A Software Defined eXchange (SDX) seeks to introduce Software Defined Networking (SDN) technologies into Academic Exchange Points to optimize resource sharing and allocation
 - Inter-domain R&E network programmability
 - End-to-End QoS coordination and enforcement
- Policies based on packet header field:
 - Match TCP or UDP source and destination ports,
 - Match source and destination IP address or
 - Match source and destination MAC addresses
- Policies based on external data:
 - Collect information from other systems, such as
 - network monitoring systems, user databases, DNS or NTP server
 - Match parameters, such as network latency, bandwidth, user name, domain name, date and time

SDX Applications

- To augment BGP policies in an Academic Exchange Point:
 - Application-specific peering
 - Inbound traffic engineering
 - Wide-area load balancing
 - Redirection through middle boxes
- Data Domain:
 - Data-on-demand
 - Data preprocessing
 - High-quality media transmission over long-distance networks.

AtlanticWave-SDX Project



- NSF project to build a distributed international SDX controller
- Initially, three locations to cover (São Paulo, Miami, and Atlanta)
- Thousands of KM of fiber between each location
- Split controller design
 - Central controller for interacting with users
 - Local controllers at each location

APIs for Different Audiences

- Administrators

```
{"l2tunnel":  
  {  
    "starttime": "2016-10-12T23:20:50",  
    "endtime": "2016-10-13T23:20:50",  
    "srcswitch": "atl-switch",  
    "dstswitch": "mia-switch",  
    "srcport": 5,  
    "dstport": 7,  
    "srcvlan": 1492,  
    "dstvlan": 1789,  
    "bandwidth": 1  
  }  
}
```

- Domain scientists

```
{"dtntunnel":  
  {  
    "quantity": "7TB",  
    "deadline": "2016-10-30T23:59:59",  
    "srcdtn": "gt-dtn",  
    "dstdtn": "fiu-dtn"  
  }  
}
```


Web Interface



Topology

Requests

About Us

sdonovan

Request a Pipe

Users can request for a pipe based on their requirements and role

Network Engineers Scientists

Enter the start date:

Enter the start time:

Enter the end date:

Enter the end time:

Preview

Submit

Enter the desired bandwidth:

Enter the physical port number at source:

Enter the physical port number at destination:

Enter the source VLAN:

Enter the destination VLAN:

Select source:

Miami

Select destination:

Atlanta

Meet the Team

Conclusion

- SDX could be used to address users' requirements for compute, storage and networking resource sharing
- SDX has to evolved to inter-domain SDN capabilities in an Academic Exchange Point
- SDX has potential to provide end-to-end inter-domain programmability and QoS
- With SDX, SKA and LSST can achieve their goals of
 - high bandwidth availability
 - low latency and high priority over existing R&E interconnected networks