Circuit Monitoring for DYNES

April 20th 2011, Internet2 Spring Member Meeting
Aaron Brown – Internet2
Dynamic Circuits

- Scientific disciplines require greater network capacity and predictably to cope with growing data sets sizes and time constrained operations
- Cross-domain dynamic circuits, like those provided by the Internet2 ION Service, can be used to improve the connectivity
  - Provides guaranteed bandwidth
  - Ensures that the high bandwidth traffic doesn’t interfere with other production traffic
- DYNES
  - A NSF-funded project to deploy dynamic circuit networking technology in support of the High Energy Physics community
    - Will use the OSCARS circuit provisioning software
  - Will bring 33 new sites into the dynamic circuit network “cloud” with hundreds of users
Current View Of Circuits

• If a failure occurs, what can a user do?
Fixing This Circuit View

• Goal: to enable users to get measurements in their circuits while allowing domains to provide as much or as little information to the user as the domain wants

• Develop a solution in collaboration with other groups and organizations including DANTE, ESnet, the Network Markup Language Working Group and the Network Measurement Control Working Group
  – Broad agreement ensures that users can monitor their circuits, no matter what domains they traverse

• Multi-faceted approach
  – Enable domains to export monitoring data about circuits
  – Enable users to discover the domains that make up their circuit, and the monitoring data those domains contain about the circuit

• Leverage the standard perfSONAR infrastructure when available
Circuit Monitoring Architecture
Circuit Monitoring Architecture

perfSONAR Topology Service

perfSONAR Topology Service

perfSONAR Topology Service
Circuit Monitoring Architecture

perfSONAR Measurement Archive  perfSONAR Topology Service

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Implementation

- Two broad components
  - Domain Software Agent
    - Creates Domain’s circuit descriptions
    - Registers these descriptions with a perfSONAR Topology Service
  - A Web UI client that displays statistics about a Domain’s current and historical circuits
Circuit Monitoring Agent

- This agent is the “glue” that connects together a Domain’s provisioning software (OSCARS) and monitoring infrastructure with the perfSONAR services so that users can find information about circuit statistics.
- When new circuits are brought up, the agent looks at the intra-domain path for the circuit, and builds a description of that path.
  - This description is then registered into a perfSONAR Topology Service.
- Needs to know how the domain monitors its devices to ensure an appropriate description of the circuit.
  - If configured, the agent can use a user-defined script to start circuit monitoring.
Everyone has their own method of monitoring their hardware

Define the needed functionality instead of requiring a specific solution
  – Offer a specific solution to users who want to use it

Requirements:
  – Software that can measure the operational status and utilization of the elements making up the circuit
  – These measurements are made available using standard perfSONAR protocols

As long as the monitoring meets the above requirements, it can be made to work in the Circuit Monitoring infrastructure
Router/Switch Monitoring Component

- **Specific Solution: ESxSNMP**
  - Developed by Jon Dugan at ESnet
  - Uses SNMP to monitor operational status and utilization statistics for all equipment elements, including physical interfaces, VLAN interfaces and LSPs
  - These interface statistics are then made available using the perfSONAR-PS SNMP MA
  - This software will be packaged for easy installation
Web UI Client

- The distributed nature of the data doesn’t mesh well with the near-instantaneous results expected by web users.
- The Web UI includes collector daemons that lookup and retrieve topology and measurements about the end-to-end circuit from each domain, and store them in a local cache.
- The Web UI then uses the cached information to display end-to-end circuit statistics to the end user.
Architecture – Web UI Client

- Router
  - ESxSNMP Or Similar
  - Measurement Archive
  - Measurement Collector
  - Topology/Measurement Cache
  - Web GUI
- Router
  - Topology Service
  - Topology Collector
- Router
  - OSCARS
Web UI Client – Inter-Domain Path

Circuit Monitoring

Active Circuits

Historical Circuits

testdomain-2.net-101
testdomain-2.net-100
testdomain-3.net-205
testdomain-3.net-187
testdomain-2.net-89
testdomain-2.net-88
testdomain-3.net-161
testdomain-2.net-87
testdomain-2.net-86
testdomain-2.net-85
testdomain-2.net-84
testdomain-3.net-145
testdomain-2.net-83
testdomain-2.net-82
testdomain-2.net-78
testdomain-2.net-77
testdomain-2.net-76
testdomain-2.net-75
testdomain-2.net-68

Circuit

Name: testdomain-3.net-187
Bandwidth: 100
Status: FINISHED
Start Time: Fri Apr 08 2011 16:02:10 GMT-0400 (EDT)
End Time: Fri Apr 08 2011 16:04:10 GMT-0400 (EDT)

Inter-Domain Path

-> testdomain-2.net  
-> testdomain-3.net  
->

<-> testdomain-3.net  
<-> testdomain-2.net  
<->
Web UI Client – Inter-Domain Path

Circuit Monitoring

Active Circuits
Historical Circuits

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testdomain-2.net-77
testdomain-2.net-76
testdomain-2.net-75
testdomain-2.net-68
testdomain-3.net-77
testdomain-2.net-66

Circuit

<table>
<thead>
<tr>
<th>Name</th>
<th>testdomain-3.net-187</th>
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</tr>
</tbody>
</table>

Inter-Domain Path

Intra-Domain Path for testdomain-2.net

- node-3.testdomain-2.net
  - port-6.1673
Web UI Client – Inter-Domain Path

Circuit Monitoring

Active Circuits

Historical Circuits
- testdomain-2.net-101
- testdomain-2.net-100
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- testdomain-3.net-187
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- testdomain-2.net-65
- testdomain-2.net-64
- testdomain-2.net-63
- testdomain-2.net-62
- testdomain-3.net-67
- testdomain-1.net-53
- testdomain-2.net-56
- testdomain-2.net-55
- testdomain-2.net-54
- testdomain-2.net-53
- testdomain-2.net-52
- testdomain-2.net-47

Circuit

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Inter-Domain Path

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- testdomain-3.net
- testdomain-2.net
- testdomain-3.net
- testdomain-2.net

Intra-Domain Path for testdomain-2.net

- node-3.testdomain-2.net
- port-6.1673

Utilization at port port-6.1673 on host node-3.testdomain-2.net

Graph showing utilization at 8 Gbps, 7 Gbps, 6 Gbps, 5 Gbps, 4 Gbps, 3 Gbps, 2 Gbps, 1 Gbps, and 0 Mbps over time.
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For more information, visit http://www.internet2.edu/performance