Early experience improving the provisioning process to enhance scientific collaborations

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Abstract:
Supporting scientific collaborations involving the provisioning of resources across multiple institutional boundaries are challenging and fraught with a lot of effort in communication and coordination. Campuses are increasingly deploying Science DMZ and Identity and Access Management CI to enhance scientific collaborations across institutional boundaries. What CI capabilities for Science DMZ, and IAM at the campus, regional, national, and international levels are being implemented to improve the provisioning process for researchers? We describe an approach for significantly improving the provisioning process based on Software Defined Networking (SDN). This SDN solution introduces network programmability as a new capability for network-oriented applications.

Introduction:
“A key goal of CI is to support scientific collaboration through a variety of computational, network, data and software elements distributed across campuses, regional, national and international organizations, and spanning scientific communities.” Provisioning of resources across multi-institutional domains to support science collaborations is challenging. The provisioning process often involves a lot of effort in communication and coordination between the organizations that own the resources. For example, consider a layer 2 circuit between two universities, one in Brazil, and one in the U.S. Between these two universities, it is quite common for network traffic to transit five, six, or even seven separate Research and Education (R&E) networks operating different technologies. So, deploying this new layer 2 circuit requires a high degree of coordination between all networks involved; e.g., VLAN ID selection, and bandwidth and Quality of Service requirements. A provisioning activity like this could take weeks. Moreover, troubleshooting these circuits is also a very complex activity.

Campuses are increasingly deploying Science DMZ and Identity and Access Management (IAM) CI to enhance multi-institutional distributed scientific collaborations. Moreover, campuses and service providers have adopted approaches based on Software Defined Networking (SDN) to support Science DMZ and IAM CI. What CI capabilities for Science DMZ, and IAM at the campus, regional, national, and international levels are being implemented to simplify the provisioning process for researchers?
Improving the provisioning process using Software Defined Networking:
Florida International University (FIU) and its collaborators in the Americas Lightpaths (AmLight⁴) project are exploring how to enhance multi-institutional distributed scientific collaborations by facilitating the provisioning process, across all collaborating institutions. AmLight is a project of the U.S. National Science Foundation International Research Network Connections (IRNC⁵) program to facilitate science research and education between the U.S. and the nations of Latin America.

AmLight has implemented an SDN solution between the U.S. and Brazil and improved the provisioning process for establishing network circuits (VLANs) that once took weeks, and now takes minutes. This capability is available in the U.S., up to the AMPATH⁶ international exchange point in Miami, the regional level (Florida LambdaRail⁷), and to the national level (Internet2⁸); in Brazil, it’s available to the SouthernLight⁹ international exchange point, the Academic Network of São Paulo (ANSP¹⁰), and Rede Nacional de Ensino e Pesquisa (RNP¹¹). This capability must next be extended into the campuses, and integrate with the Science DMZ and IAM CI resources, and to ultimately be provided as a service to the researchers. Using a web interface, a researcher should be able to provision the resources he/she needs to orchestrate an experiment, and not have to contact NOCs and submit complicated time consuming requests.

This SDN solution on AmLight also added network programmability as a capability. Researchers can now deploy their network-oriented applications and use AmLight as a real platform for at-scale experimentation. Being network-aware means that these applications will be able to provision their circuits, including capacity on demand, and to react to network conditions, such as increasing delay and packet loss.

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³ Software-Defined Networking, https://www.opennetworking.org/sdn-resources/sdn-definition
⁴ AmLight - America's Lightpaths, http://www.amlight.net/
⁶ AMPATH - America's Pathways, http://www.ampath.net
⁷ Florida LambdaRail, http://www.flrnet.org
⁸ Internet2, http://www.internet2.edu
¹¹ RNP - Rede Nacional de Ensino e Pesquisa, http://www.rnp.br/