

Americas Lightpaths (AmLight) supporting NSF Large Facilities and CI in the Americas

White Paper for NSF Large Facilities Cyberinfrastructure Workshop

Florida International University (FIU) is the awardee of the NSF International Research Network Connections (IRNC) program, under cooperative agreements, to build and operate the network infrastructure that links the U.S. research networks with peer networks in South America and the Caribbean. This network infrastructure, referred to as AmLight, consists of multiple 10/100 Gbps links, presently totaling 240Gbps of aggregate bandwidth capacity between the U.S. and South America; an international exchange point facility in Miami, Florida, called AMPATH, which terminates the many network connections that depart from the U.S. to, and that arrive from, the research and education networks of the nations of South America, and the Caribbean. FIU has been performing this role on behalf of the NSF since 2005.

Science data flows between NSF Large Facilities or CI, operating in South America or the Caribbean, benefit from the use of the AmLight network links and the network infrastructure that connect these large facilities or CI back to the U.S. AmLight network links are built and operated by network operators whose purpose it is to support research and education communities. The commitment to collaborate and coordinate among the network operators is underpinned by agreements (MOUs) FIU established with the network operators participating in AmLight. For example, in the U.S., network operators are primarily FIU, Florida LambdaRail (regional network in Florida), Internet2 (U.S. national research and education network), ESnet (U.S. national research and education network), and a few others. In South America, network operators are primarily RedCLARA (regional network of Latin America), RNP (national research and education network of Brazil), ANSP (Academic Network of Sao Paulo), REUNA (national research and education network of Chile), and others.

Remote users of NSF Large Facilities in South America or the Caribbean depend on reliable network services to access CI for their research. For example, this could be a low latency network service to remotely control a telescope in Chile, or a higher throughput network service to transfer a large LHC data set from a data center in Sao Paulo to Fermi Lab. Impacts to network services, caused by fiber cuts, power outages, retransmits, etc., will significantly impact applications using CI at NSF Large Facilities. The impact could render the science application inoperative when the NSF Large Facility and the CI are continents apart. For example, a fiber cut will impact a science data flow from an observatory in Chile to the NCSA data center in Champaign, Illinois. Fortunately, networks participating in AmLight have instrumented their networks with monitoring and measurement instruments to detect network impacting events. Data collected from these instruments enable network operators to represent the conditions on the networks that constitute the end-to-end path of the data flow. To inform users of CI at NSF Large Facilities, a web-based interface is available that shows network conditions for many of the interconnection points along the networks between the U.S., South America and the

Caribbean. With the web-based interface and other deployed tools, AmLight is achieving its goal to improve detection of network impacting events and to minimize their impacts on science data flows.

Flows of science data between endpoints is a very important unit of measure for AmLight. Flows should experience little to no friction along the end-to-end path. The end-to-end path should be instrumented to monitor and measure network conditions that could impact science data flows. Mechanisms, such as a Science DMZ or Data Transfer Nodes (DTN), should be considered as best practices to reduce friction on science data flows. AmLight can facilitate the implementation and use of these mechanisms for NSF Large Facilities and CI.