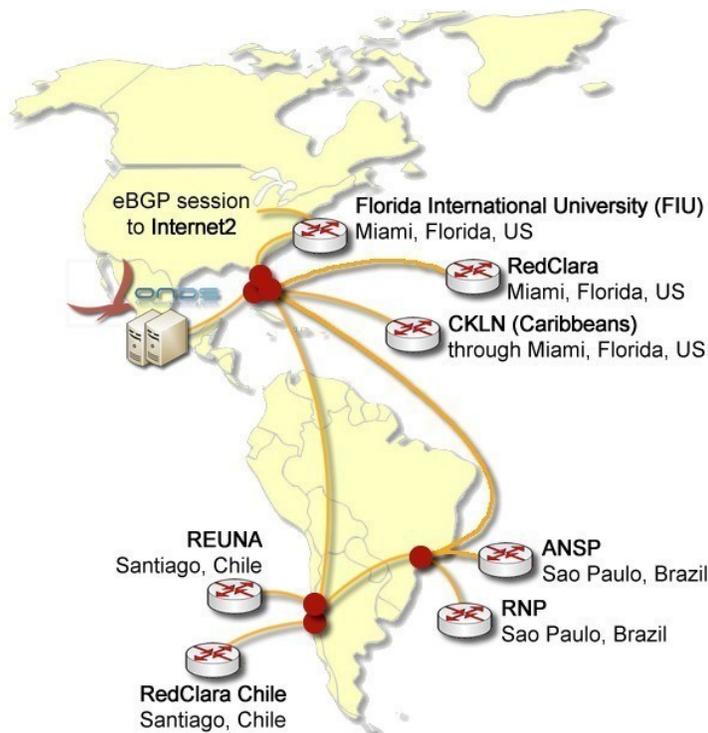


FIU/AmLight Deploys ONOS and SDN-IP Software Live on Next-Generation Research and Education Networks Connecting Brazil, Chile and the Caribbean to the US

Collaboration among FIU/AmLight, ANSP, RNP, RedClara, REUNA, and CKLN delivers a pure OpenFlow-based Software-Defined Network to accelerate research and education

Miami, Florida, Aug 20, 2015 -Florida International University ([FIU](#)) and the Open source SDN Network Operating System ([ONOS](#)) community today announced they have actively deployed ONOS and its SDN-IP Peering application on Americas Lightpaths (AmLight), creating a software-defined networking (SDN) facility entirely based on OpenFlow. Five Latin American research and education networks (RENs) – Academic Network at Sao Paulo ([ANSP](#)), Brazilian National Research and Education Network ([RNP](#)), Latin American Advanced Networks Cooperation ([RedClara](#)), National University Network of Chile ([REUNA](#)) and the Caribbean Knowledge and Learning Network ([CKLN](#)) – interconnect Brazil, Chile and the Caribbean with the U.S. via a virtual slice of the AmLight network.

Successfully deployed on both production and testbed networks via AmLight, ONOS delivers all the benefits of SDN along with carrier grade functionalities such as high performance, high availability and scale-out. Using ONOS' SDN-IP Peering application, AmLight seamlessly exchanges Layer 3 (L3) routes between software-defined networks and external legacy networks via BGP without the need for any router in the core. The application is transparent to end users and network operators can instantly benefit from reduced capex and improved system manageability, flexibility and service agility to meet the dynamic network needs of the research and education community.



Map of the ONOS / SDN-IP deployment on the FIU/AmLight network

"The deployment of ONOS represents groundbreaking work in the field of SDN and networking," said Dr.

Julio Ibarra, Assistant Vice President for Technology Augmented Research at FIU. "We're not just connecting one organization to another, but are connecting a dynamic global software-defined REN to create an open instrument for collaboration. This accelerates research discovery, advances education, and improves the delivery of public services while offering the benefits of ONOS' next-generation networking technology for improved learning, collaboration and innovation."

"The production deployment provides invaluable real-world insight from end users and network engineers, and the testbed aspect of the deployment enables experimentation to further improve and harden ONOS," said Guru Parulkar, Executive Director and Board Member at ON.Lab. "The ONOS project values collaboration with R&E network operators and their users, and the ONOS platform enables R&E network operators to rapidly innovate and better serve their communities."

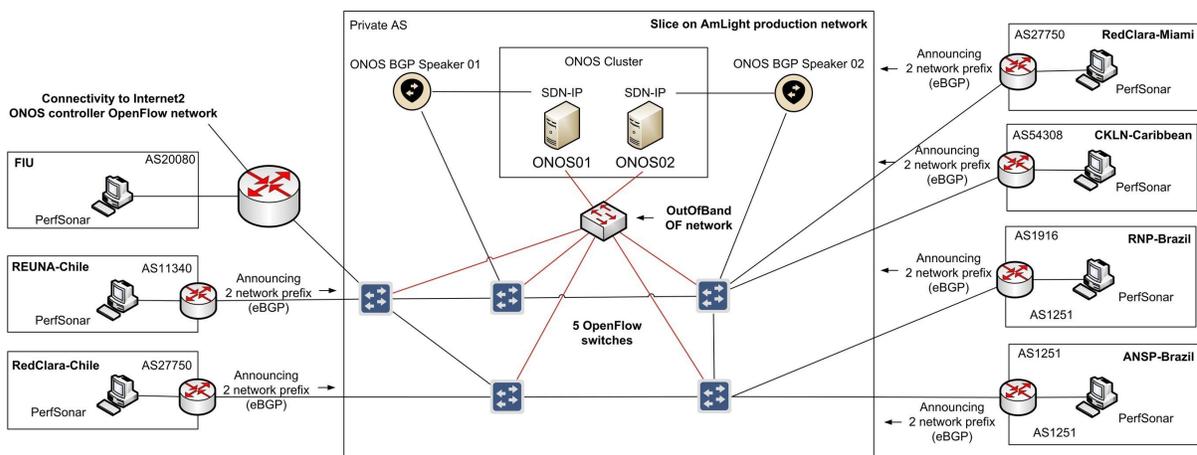
In August 2014, AmLight became the first Software-Defined network to interconnect the Americas for research and education using OpenFlow. The main focus of the AmLight SDN Project is to create an SDN substrate on top of the international links between Brazil, Chile, the Caribbean and the U.S. to provide a better infrastructure for research and experimentation to the Americas. Utilizing SDN, provisioning broadband connections takes mere seconds instead of the days required using the legacy approach. Researchers can develop network-aware applications with access to AmLight's network devices and provision the network according to their needs, dynamically spinning up services immediately. With SDN, Voice over IP, big data, and video streaming applications are able to provision their circuits on top of AmLight following specific requirements such as low latency, fewer hops, and less packet errors.

This implementation takes advantage of AmLight's ability to create virtual network slices using Internet2's FlowSpace Firewall. Symmetrically to a previously announced OpenFlow-based [Internet2 ONOS deployment](#), the AmLight network can communicate with the Internet2 ONOS slice through a shared (legacy) BGP router deployed at FIU in Miami. Through Internet2, AmLight is linked to other ONOS network facilities such as GEANT in Europe.

Industry Takeaways

The deployment allows the ONOS project to show the platform and the applications' ability to work with heterogeneous hardware devices at scale in a real network scenario, and has generated useful feedback that delivers valuable input to serve as part of the requirements for the next ONOS releases.

The solution deployed is able to: provision L3 connectivity without using legacy routers in the network core; transform ASs running OpenFlow into IP (BGP) transit networks; allow an SDN network to seamlessly connect to the rest of the Internet using BGP thus providing a powerful migration strategy; and aggregate different SDN administrative domains into BGP confederations, making the control plane more scalable.



Architectural diagram of the ONOS / SDN-IP deployment on FIU/AmLight network

Technical Details

The bigger square in the network diagram represents the AmLight network, combining five OpenFlow switches, controlled by an ONOS cluster that is composed of two controller instances and running SDN-IP. Two special purpose routers (the BGP speakers) peer with the external routers exposed by the RENs and, at the same time, connect to the SDN-IP instances.

The BGP advertisements received from the external routers are notified to SDN-IP, which converts them into intent requests and they are then converted by ONOS into flows on the OpenFlow switches thus allowing communication between the external networks. The bigger router in the upper left corner of the diagram that represents the FIU router is used both to connect to the AmLight testbed as well as to the Internet2 deployment, thereby bridging communication between the two networks.

The SDN-IP Peering application developed by the ONOS project team runs over ONOS, enabling seamless peering among the ONOS SDN-based network, traditional IP-based networks and other SDN-based networks. It delivers a migration solution, whereby new SDN capabilities can be deployed alongside existing IP-based networks so that industry adopters can allow the two to coexist while accelerating SDN adoption in real networks.

About the ONOS project

ONOS is the open source SDN networking operating system for Service Provider networks architected for high performance, scale and availability. ONOS' ecosystem comprises of ON.Lab and organizations that are funding and contributing to the ONOS initiative. These include AT&T, NTT Communications, SK Telecom, China Unicom, Ciena, Cisco, Ericsson, Fujitsu, Huawei, Intel and NEC; members who are collaborating and contributing to ONOS include ONF, Infoblox, SRI, Internet2, Happiest Minds, KISTI, KAIST, Kreonet, NAIM, CNIT, Black Duck, Create-Net, Criterion Networks and the broader ONOS community. Learn how you can get involved with ONOS at onosproject.org.

About Florida International University

Florida International University is an urban, multi-campus, public research university serving its students and the diverse population of South Florida. We are committed to high-quality teaching, state-of-the-art research and creative activity, and collaborative engagement with our local and global communities. FIU is Miami's first and only public research university, offering bachelor's, master's, and doctoral degrees. FIU is number one in the nation in awarding bachelor's and master's degrees to Hispanic students. Designated as a top-tier research institution, FIU emphasizes research as a major component in the university's mission (<http://www.fiu.edu>).

About AmLight

Americas Lightpaths ([AmLight](#)) operates high-performance network links connecting Latin America to the U.S., funded by the National Science Foundation (NSF), awards #ACI-0963053, ACI-1341895, and ACI-1140833; the Brazilian Education and Research Network – RNP (under a network management contract to the Brazilian Ministry of Science, Technology and Innovation – MCTI); and the Academic Network of Sao Paulo - ANSP (FAPESP award #2003/13708-0). AmLight aims to enhance science research and education in the Americas by interconnecting key points of aggregation, providing operation of production infrastructure, engaging U.S. and western hemisphere science and engineering research and education communities, creating an open instrument for collaboration, and maximizing benefits of all investors. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

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