



# SwitchOn Workshop – São Paulo/Brazil October 15<sup>th</sup> 2015

## SDN Testbeds @ AmLight: One Year Later

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# Describing AmLight

## *AmLight is a Distributed Academic Exchange Point*

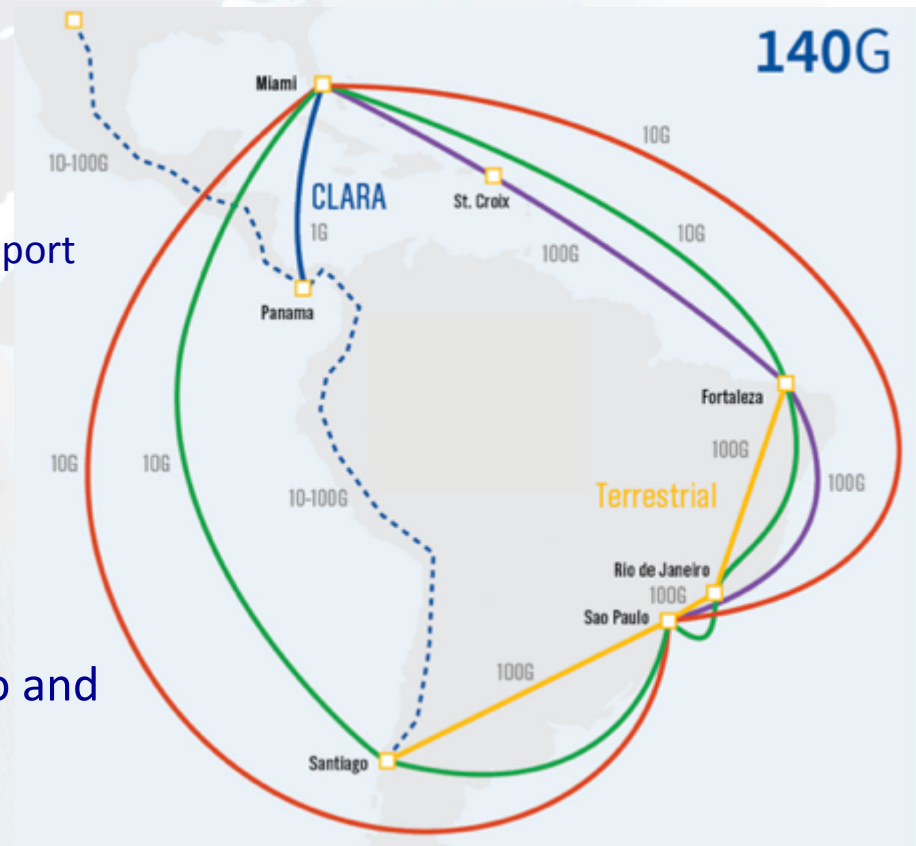
4 x 10G links and two topologies:

- **SDN ring:** Miami-Sao Paulo-Chile-Miami
  - 20 Gbps of total capacity
  - Full Openflow and network virtualization support
- **MPLS ring:** Miami-Brazil-Miami
  - 20 Gbps of total capacity
  - Layer 2 support

Soon to be added to the SDN ring:

- A new **10Gbps** ring (capacity)
- A **100 Gbps** alien wave between Sao Paulo and Miami:
  - Focused on experimentation

Total of **120Gbps** to Internet2 through AMPATH IXP



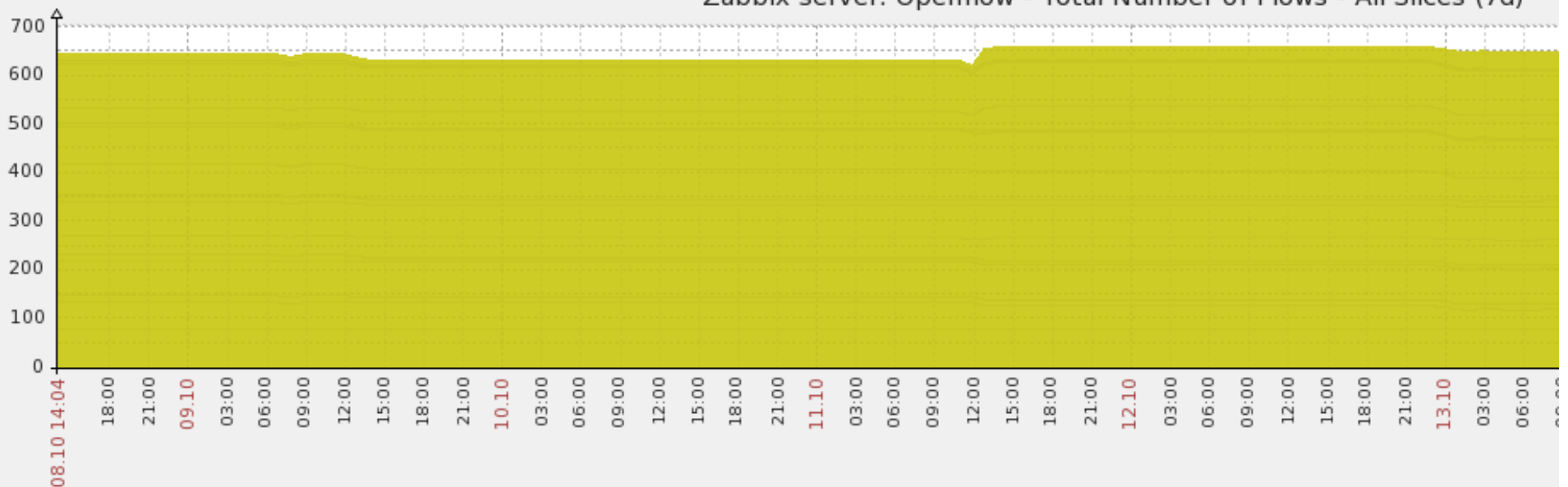
# Describing AmLight SDN



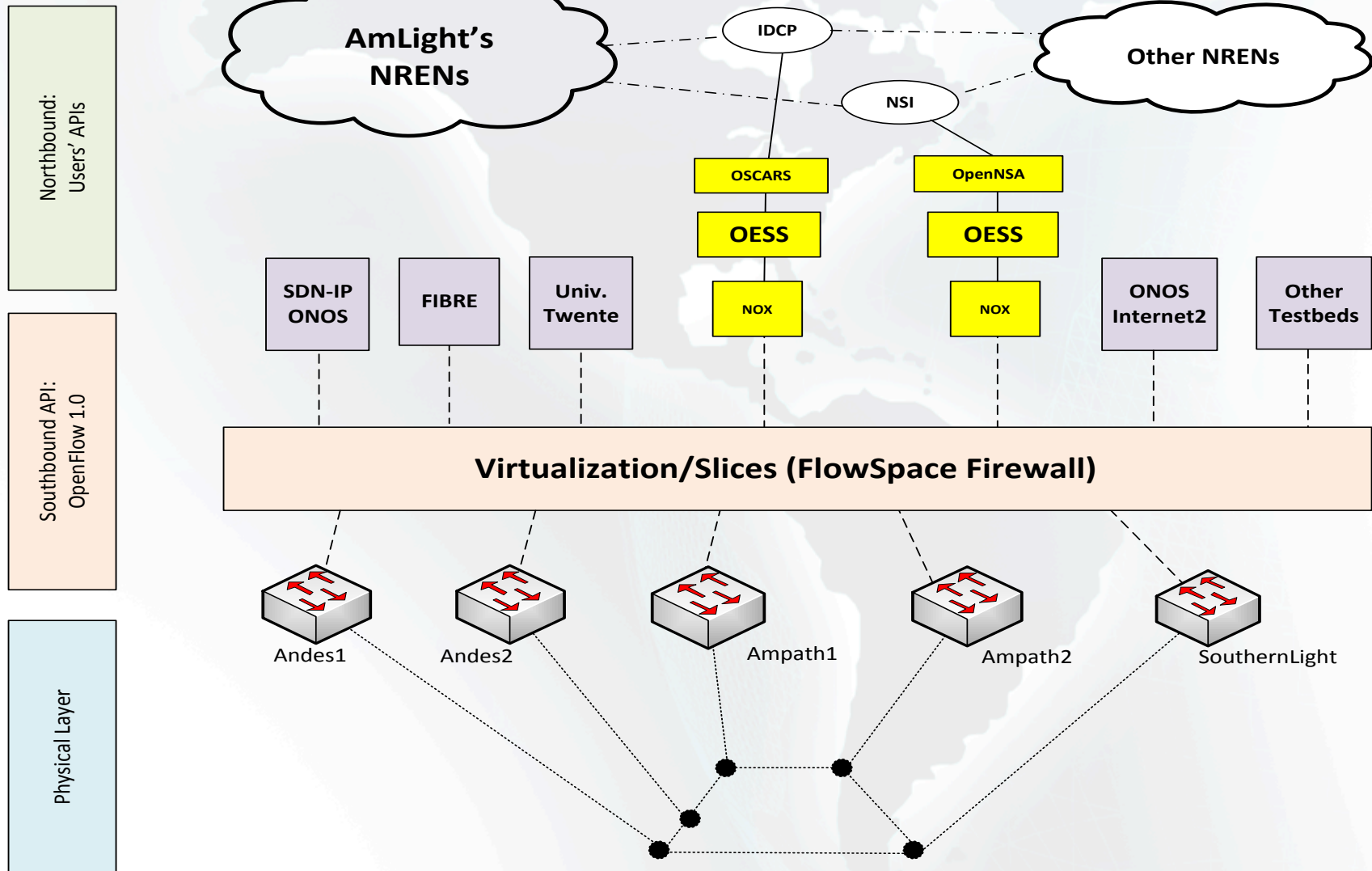
- Production SDN Infrastructure (since Aug 2014)
- Connects AMPATH and SouthernLight GLIF GOLES
- Carries **Academic** and **Non-Academic** traffic
  - L2VPN, IPv4, IPv6, Multicast
- Supports Network Virtualization/Slicing

OpenFlow 1.0

Zabbix server: Openflow - Total Number of Flows - All Slices (7d)



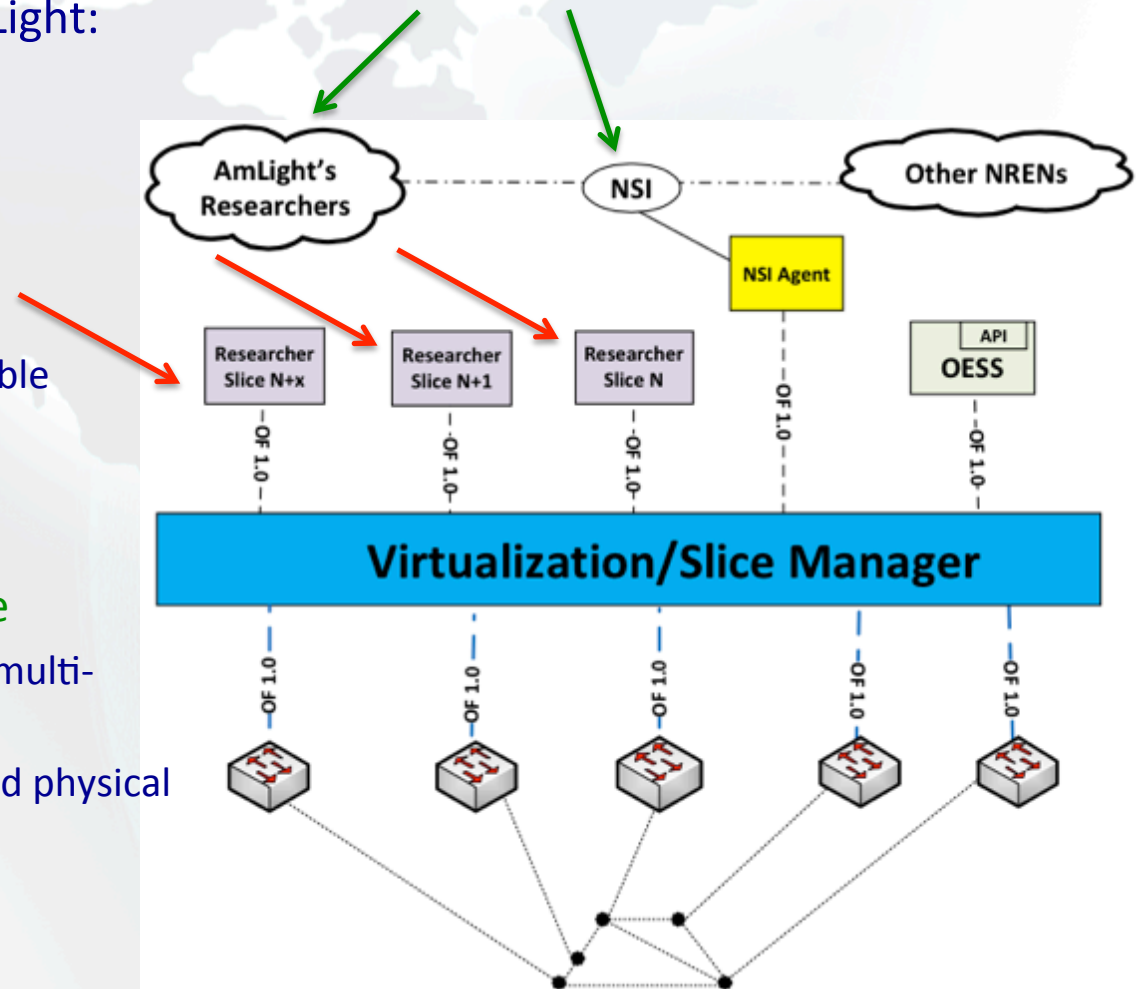
# SDN Stack



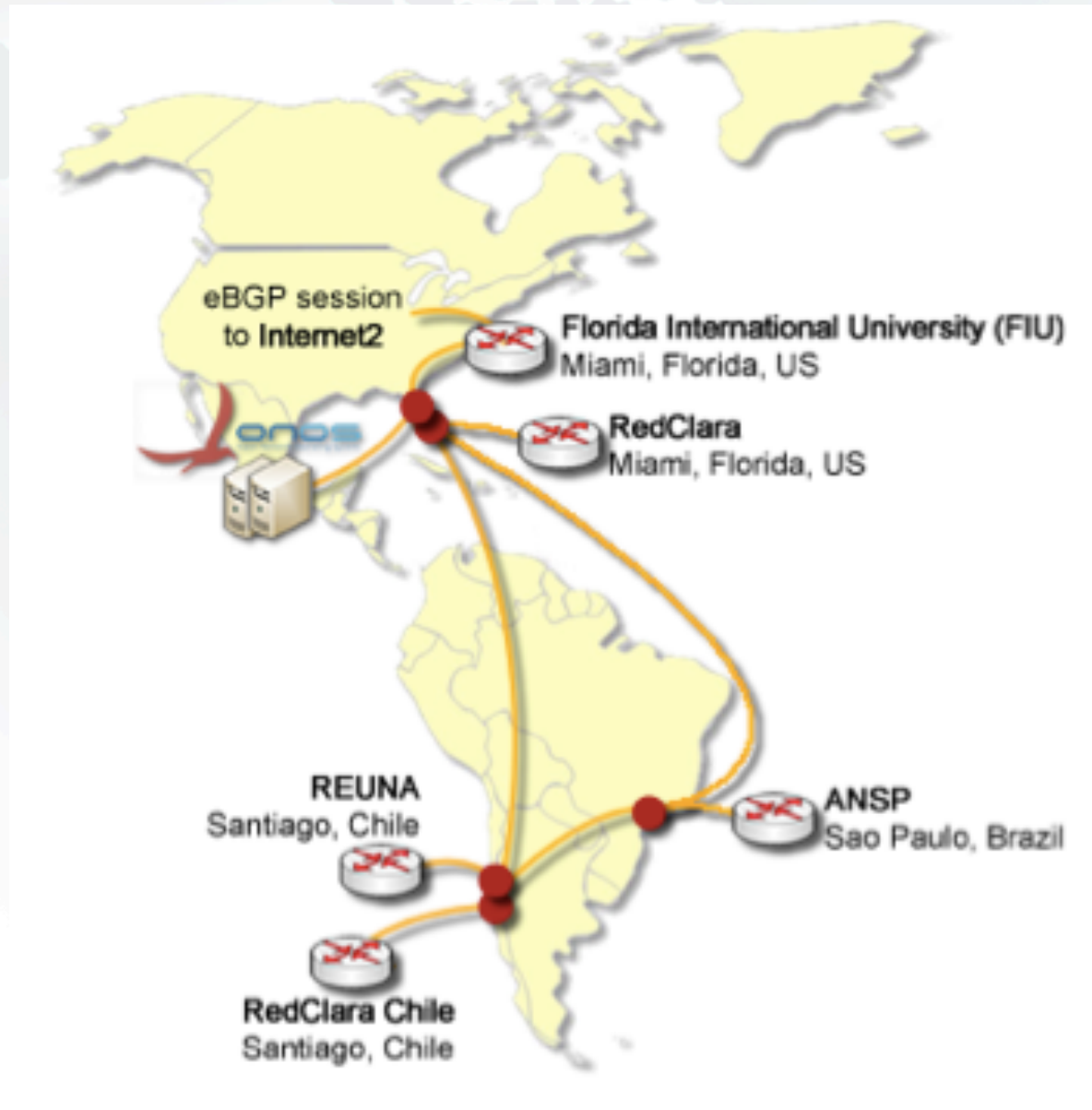
# Programmability @ AmLight

Two possible interfaces to use AmLight:

- **Openflow** (1.0, 1.3 in the future)
  - Through dedicated slices
  - Real devices (Brocade MLXe)
  - Own VLAN range
  - Different virtual topologies available
  - Layer 2 and Layer 3 matches
  - Low level configuration
- **NSI v2 – Network Service Interface**
  - High level abstraction for layer 2 multi-domain provisioning
  - No need to know the topology and physical devices/configurations



# Examples – ONOS SDN-IP @ ONS



# Examples(2) – ONOS SDN-IP @ ONS



# Examples (3) – And more...



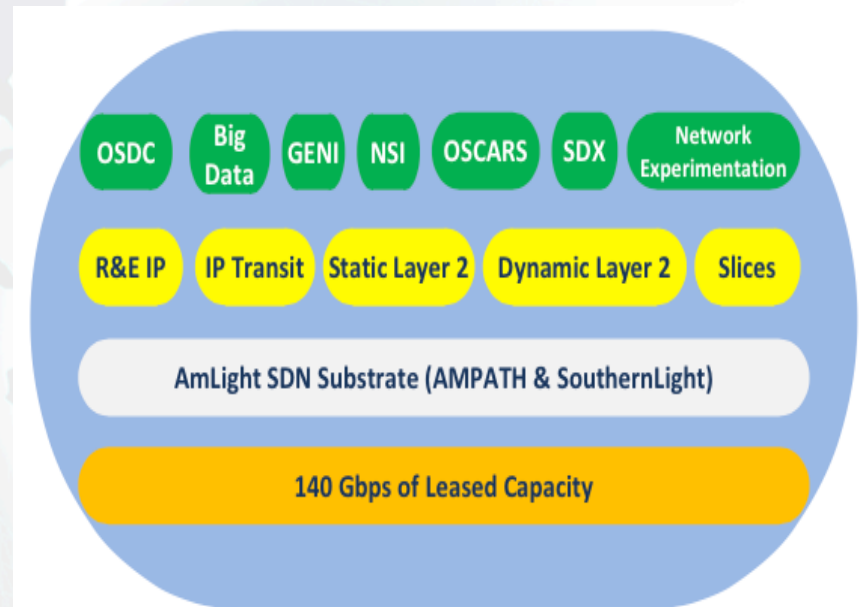
- In partnership with RNP:
  - FIBRE (*Future Internet testbeds / experimentation between BRazil and Europe*): how to use an OpenFlow native backbone to interconnect FIBRE islands (or racks)?
  - FIBRE island installed at AMPATH/Miami and using AmLight
- In partnership with Internet2:
  - Internet2 Technology Exchange 2014 – Multi Domain controller managing slices from different SDN domains (Internet2, AmLight, Univ. of Utah and MAX)
  - Internet2 Global Summit – ONOS SDN-IP demonstration
- In partnership with University of Twente:
  - *“Assessing the Quality of Flow Measurements from OpenFlow Devices”*
  - Authors: Luuk Hendriks, Ricardo de O. Schmidt, Ramin Sadre, Jeronimo A. Bezerra, and Aiko Pras
- All of them running on the same production infrastructure



# Open Points

## Challenges for the near future at AmLight:

- Troubleshooting
  - Flow consistence among layers
  - **OpenFlow sniffer**
- Quality of Service
  - Bandwidth Guarantee in an Openflow/SDN
  - Dynamic application load-balance
- Security
  - Secure access with network virtualization
  - Isolation between applications
  - **Testbed Sanitizer**
- Networking
  - Scalability
  - IP/IPv6/Multicast Routing
  - **Inter-SDN domain forwarding (SDX)**



# What next?

- Do you want to have your own testbed?
  1. Send an e-mail to [sdn@amlight.net](mailto:sdn@amlight.net) explaining your project
  2. Your application will be tested in our Mininet environment
    - Tested for security, not functionality
  3. Then, your application will be tested in our physical environment
    - Also for security
    - ... to understand how devices handle your application
  4. Once it is ok, your application will added to our production environment
    - Joint operation
    - Any new code change will restart the process



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Do you want to know more?  
[www.sdn.amlight.net](http://www.sdn.amlight.net)

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