Consortium GARR
8° BORSISTI DAY
"ORIO CARLINI"
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TOWARDS REMOTE ACCESS TO VIRTUALIZED TELECOM RESEARCH INFRASTRACTURS

By

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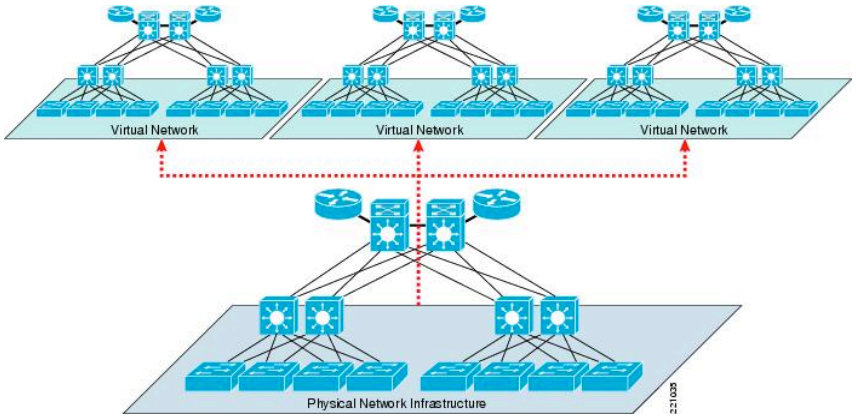
MOTIVATION

- SDN-NFV reinvents telecom network& service infrastructure
- To develop & test SDN-NFV based technology
  - Access and test real infrastructure with real users
- GARR is concerned with providing an open infrastructure for researchers

OBJECTIVE

- Definition, implementation and demonstration of a proper management and virtualization architecture
- allocate capacity and virtual topologies based on the users' requests ===>Setup an appropriate slice of the resources of the testbed (VMs, bandwidth, switches) for the experiments



Taken from: http://slideplayer.com/slide/6393603/

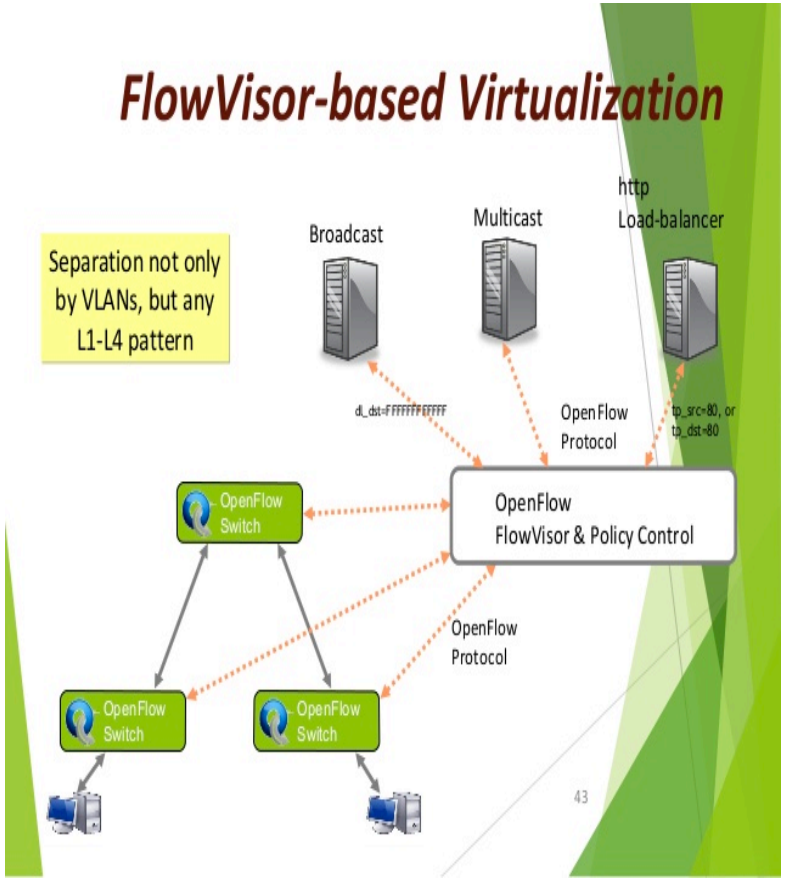
ACTIVITIES

- Study an appropriate and secure solution for
  - enabling testbed users to deploy their own SDN controllers
  - enable communication with the testbed infrastructure
- able to control and configure a slice of the testbed resources;

ACTIVITIES

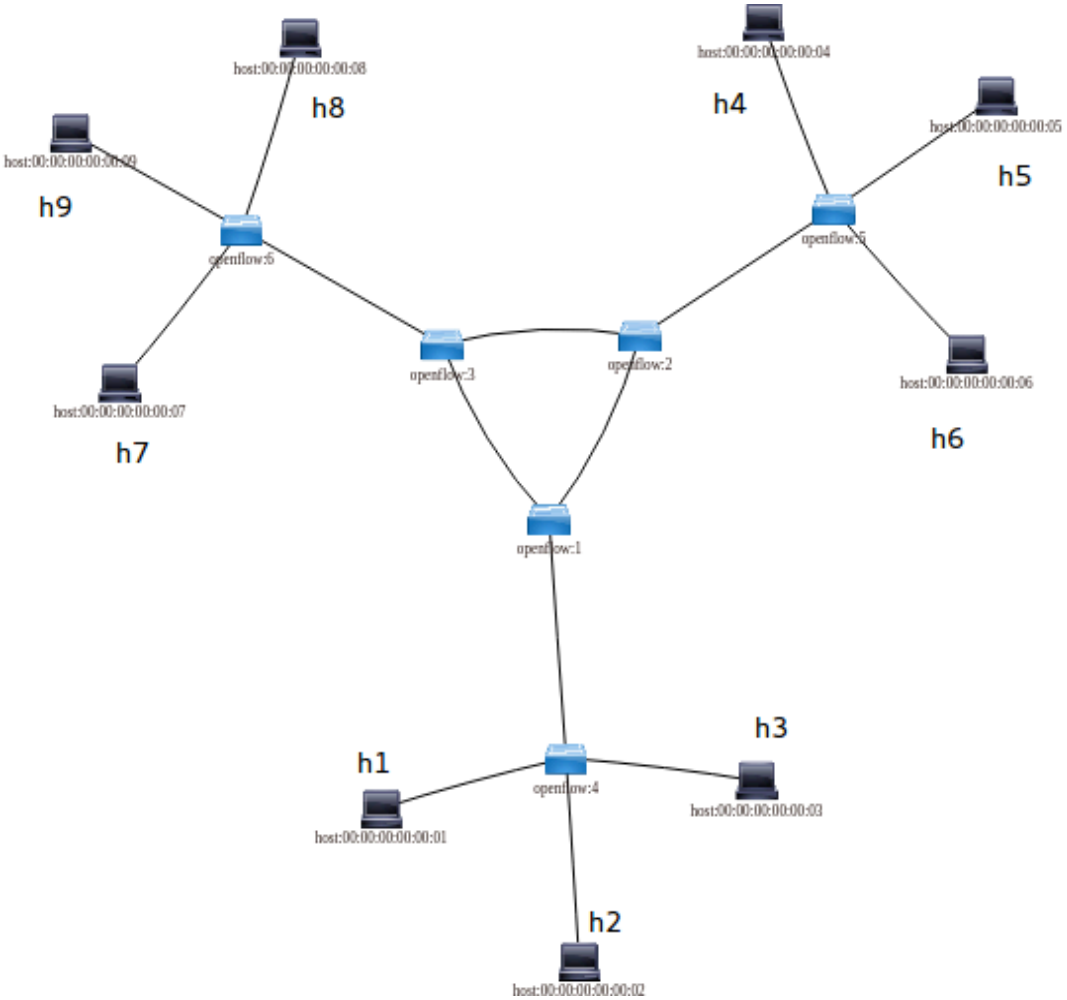
Taken from:
http://www.slideshare.net/idrajeev/software-defined-network-and-virtualization

- Flowvisor:
  - Separates openflow networks into different independent network slices
  - allows experiments to run on the sliced network without interfering to one another
  - will be placed between the OpenFlow switch and the OpenFlow controller and act as a transparent proxy



ACTIVITIES

- Mininet topology: 6-switches connected with 100Mbps links and 9-Hosts

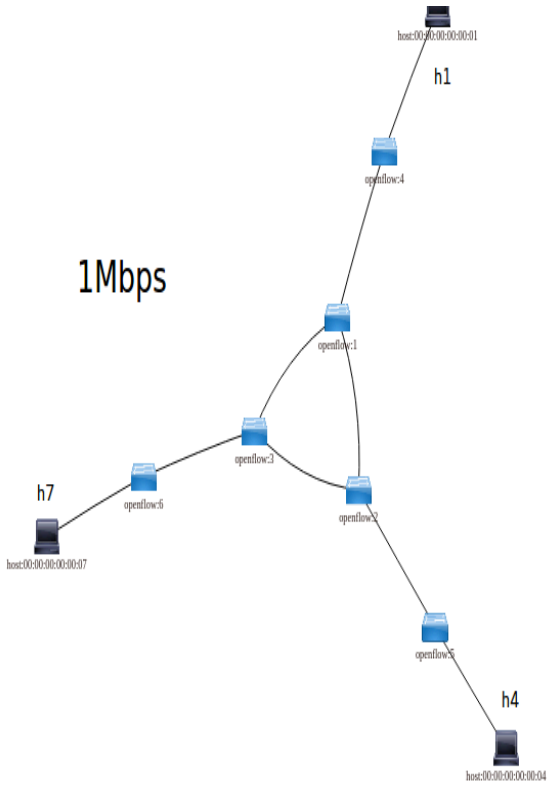


Host name	IP address
h1	10.0.0.1
h2	10.0.0.2
h3	10.0.0.3
h4	10.0.0.4
h5	10.0.0.5
h6	10.0.0.6
h7	10.0.0.7
h8	10.0.0.8
h9	10.0.0.9

ACTIVITIES

- Three slices:

Slice Name			Hosts included	Assigned Controller
research1	10.0.0.1	10.0.0.4	10.0.0.7	192.168.51.111
research2	10.0.0.2	10.0.0.5	10.0.0.8	192.168.51.112
research3	10.0.0.3	10.0.0.6	10.0.0.9	192.168.51.116



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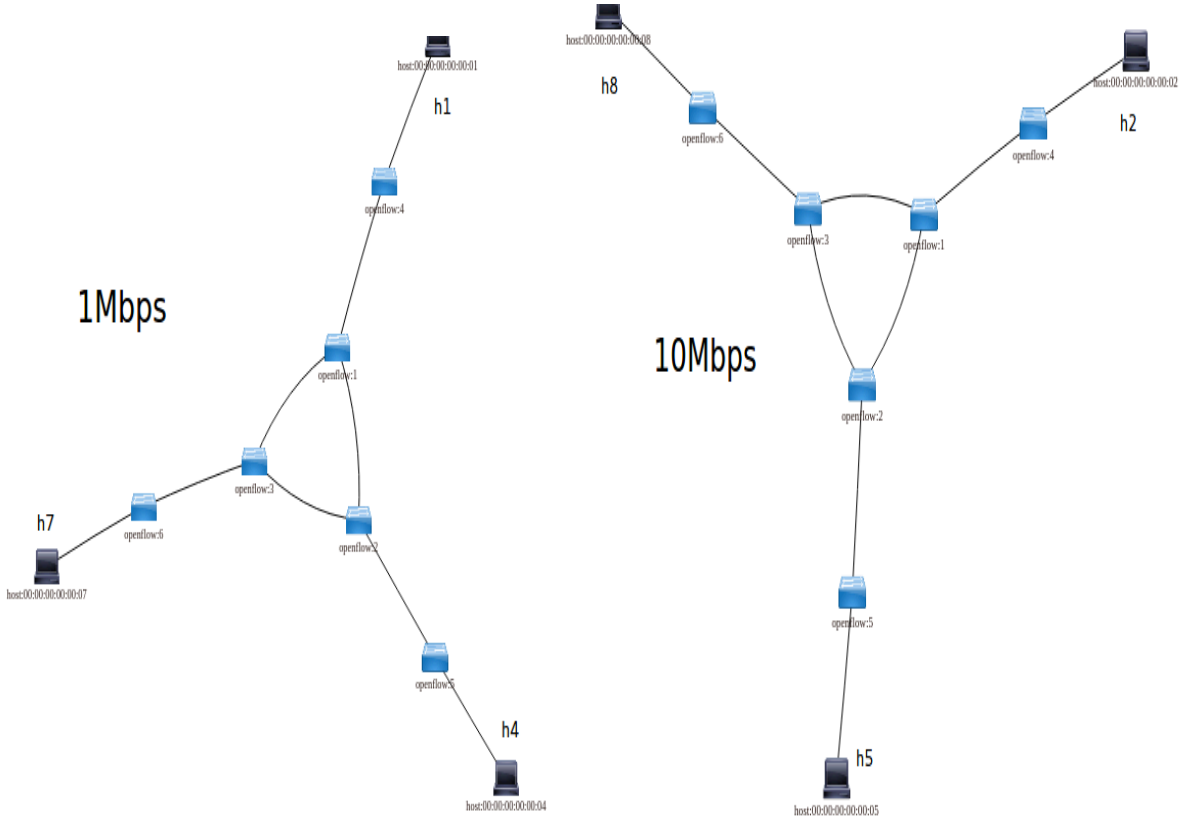

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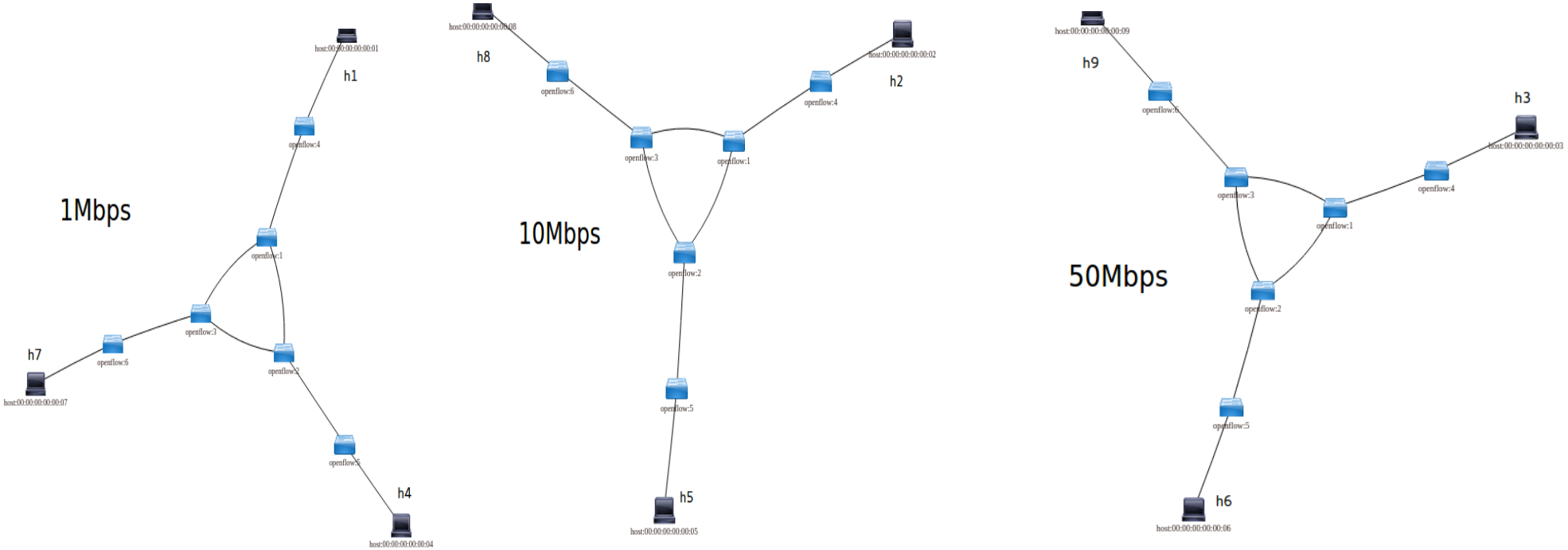
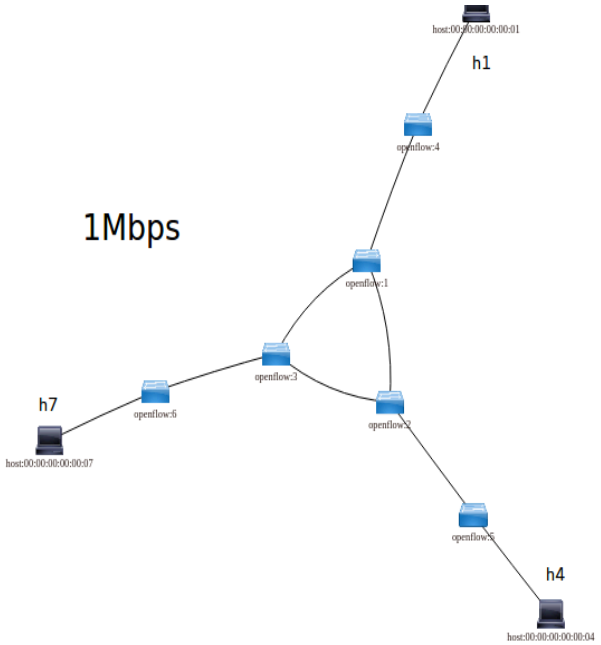
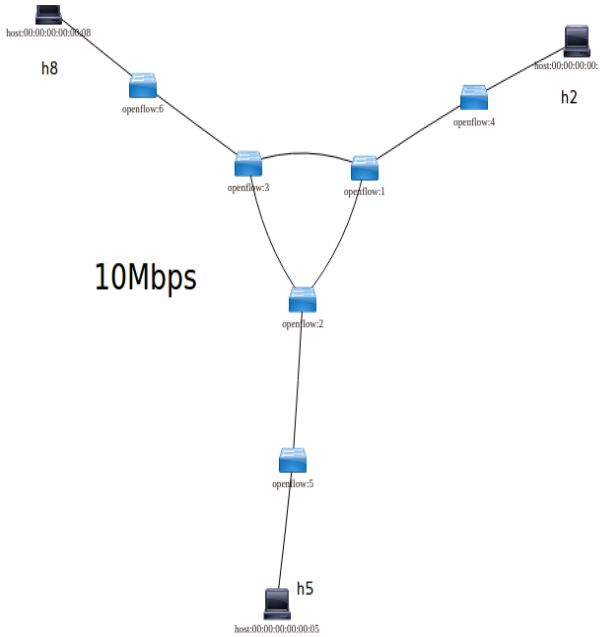
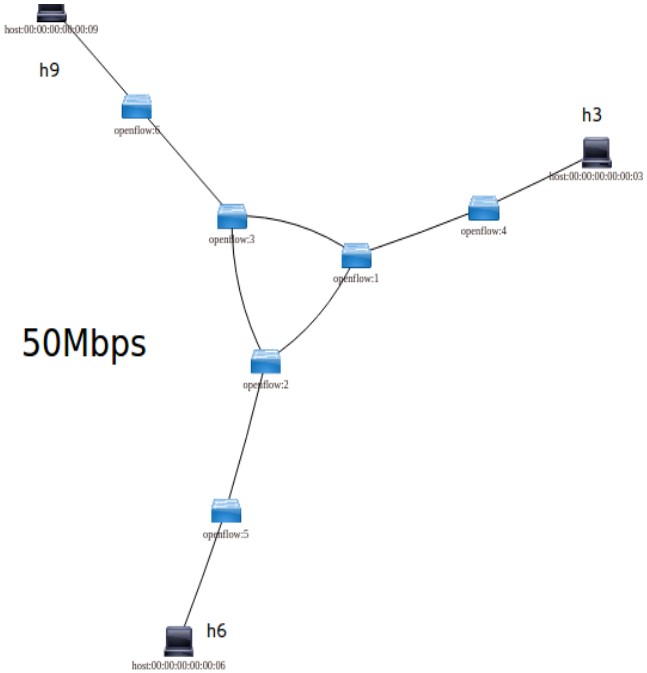


ACTIVITIES





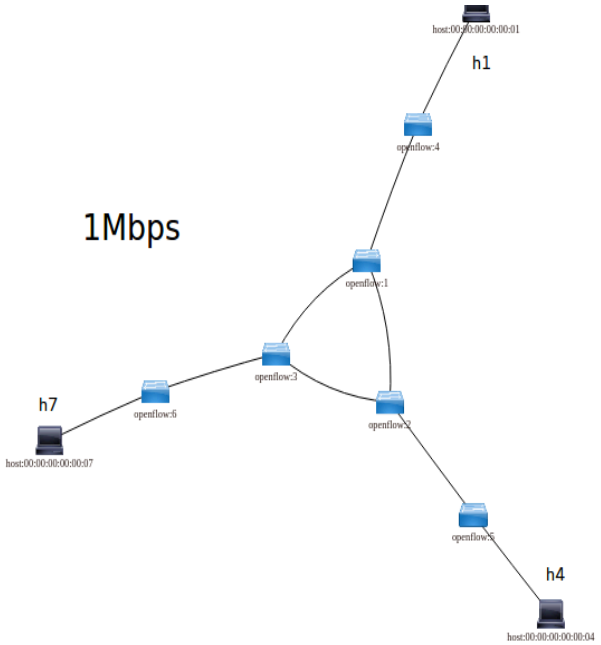


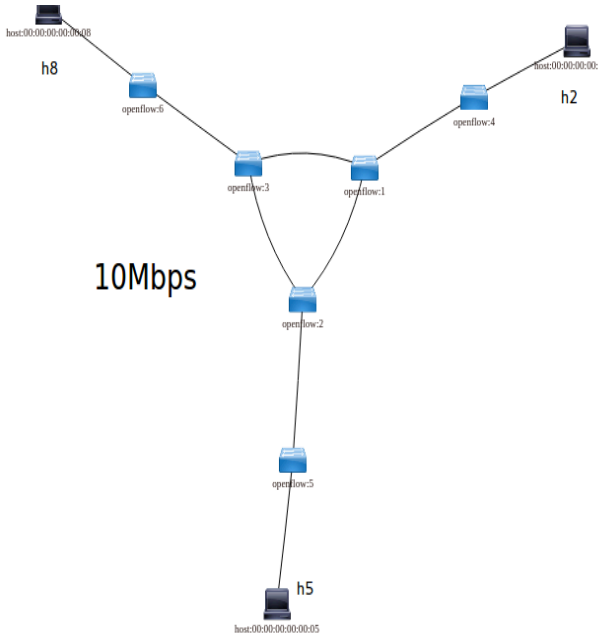
- *Reachability* test

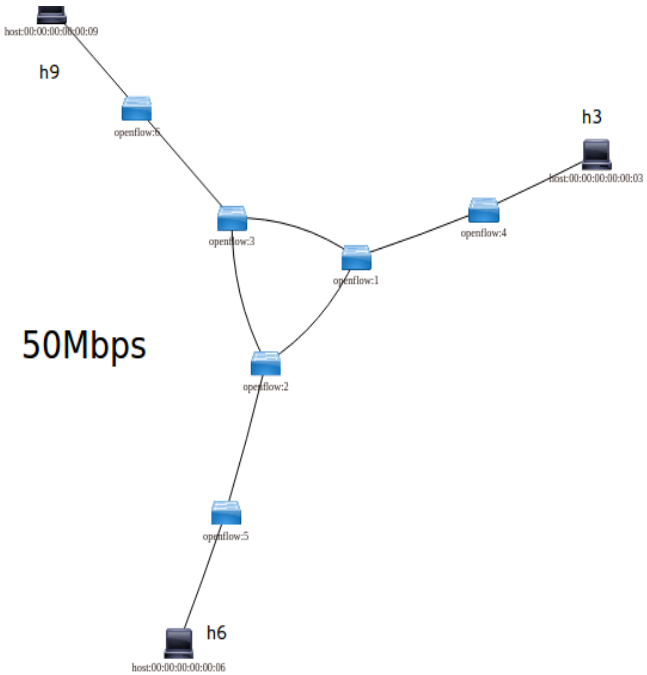
**** Ping: testing ping reachability*
h1 -> X X h4 X X h7 X X
h2 -> X X X h5 X X h8 X
h3 -> X X X X h6 X X h9
h4 -> h1 X X X X h7 X X
h5 -> X h2 X X X X h8 X
h6 -> X X h3 X X X X h9
h7 -> h1 X X h4 X X X X
h8 -> X h2 X X h5 X X X
h9 -> X X h3 X X h6 X X
**** Results: 75% dropped (18/72 received)*

→ *Interference free*

ACTIVITIES





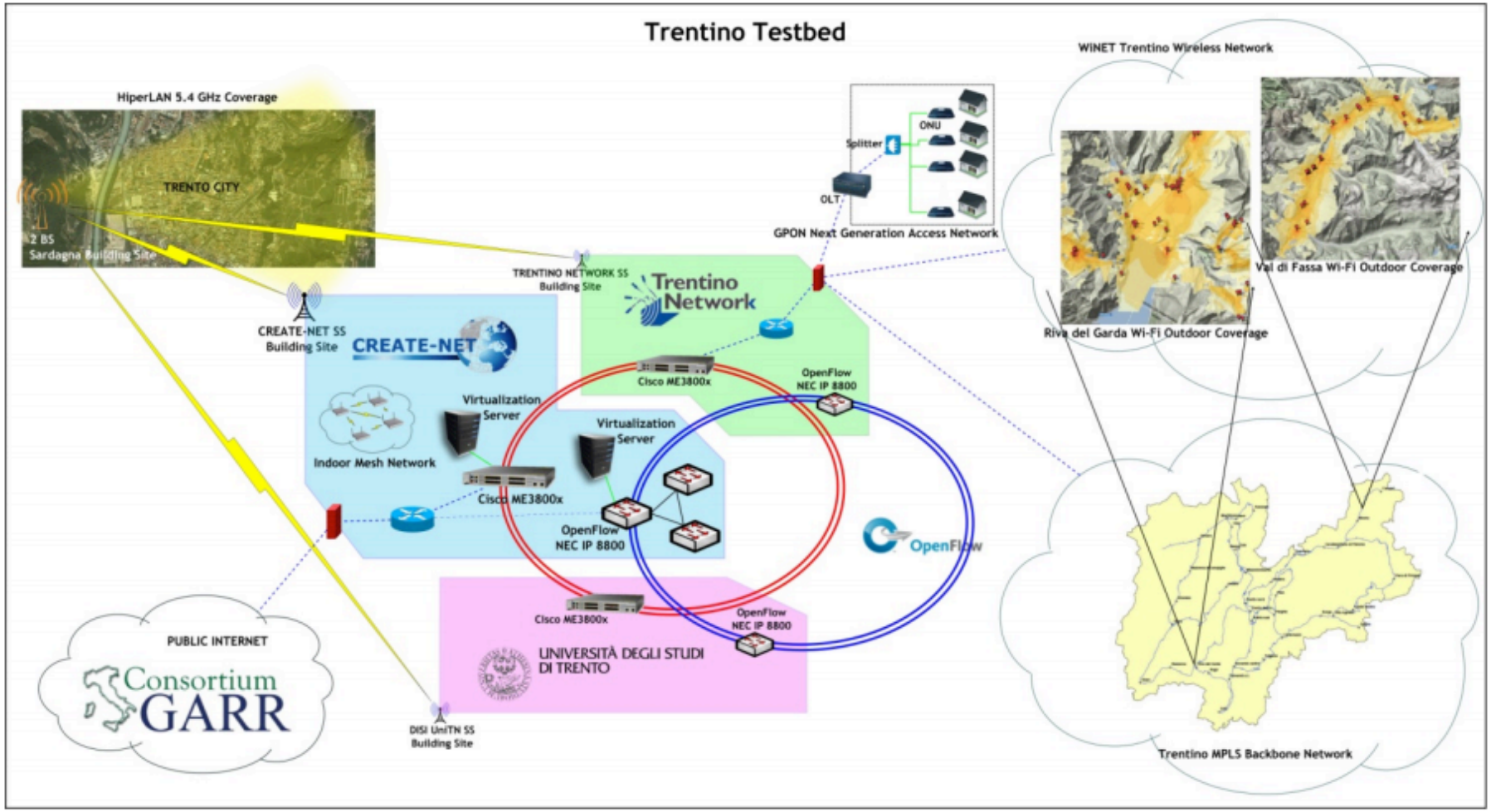


- *E2E bandwidth*

Slice Name	Hosts for Bandwidth measure		End-to-End Bandwidth Before (QoS)	End-to-End Bandwidth After (QoS)
research1	10.0.0.1	10.0.0.4	*105 Mbits/sec*	*957 Kbits/sec [1Mbps]*
research2	10.0.0.2	10.0.0.8	*100 Mbits/sec*	*9.54 Mbits/sec [10Mbps]*
research3	10.0.0.3	10.0.0.9	*98.6 Mbits/sec'*	*48.4 Mbits/sec [50Mbps]*

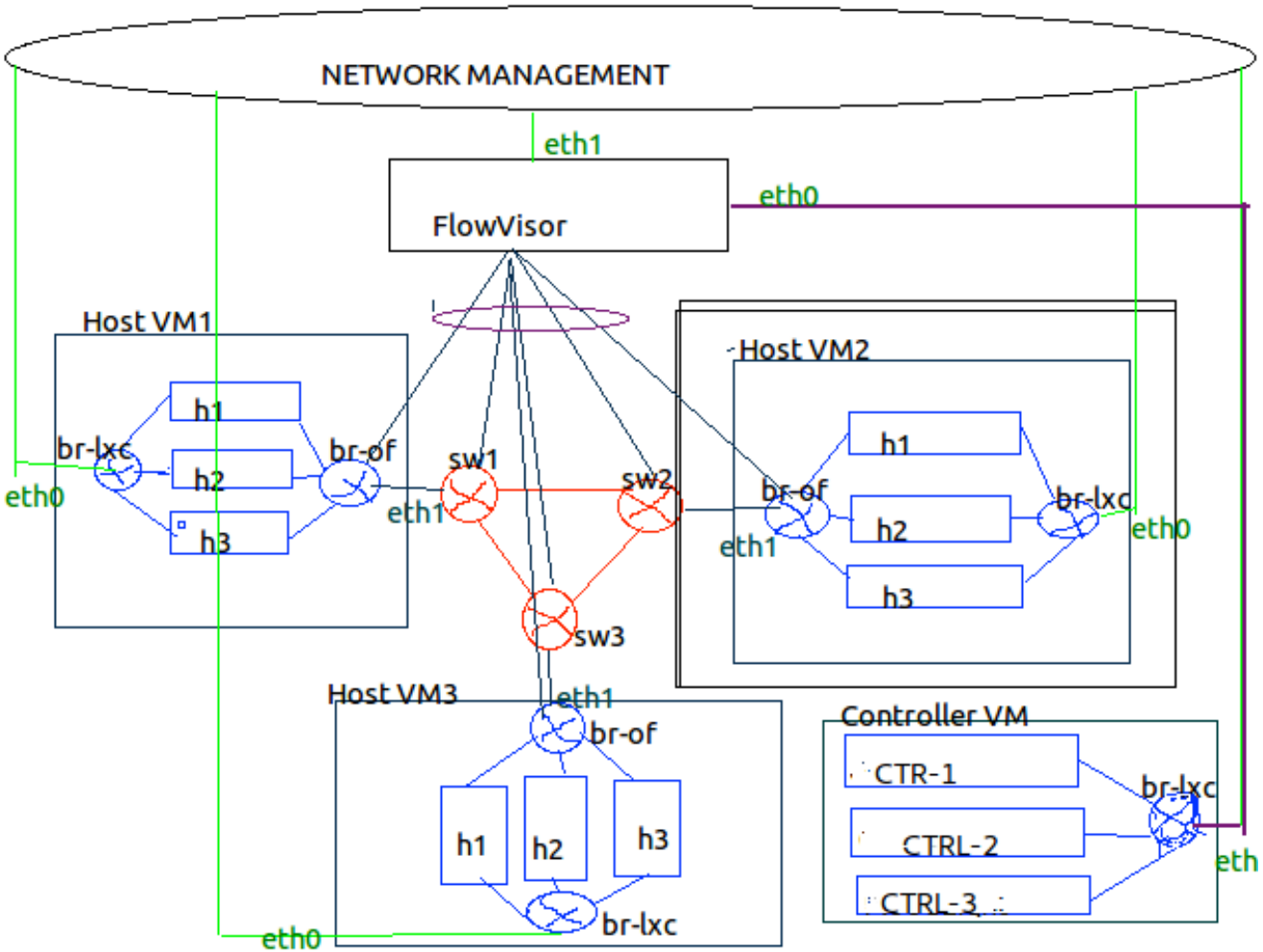
ACTIVITIES

The Testbed Topology

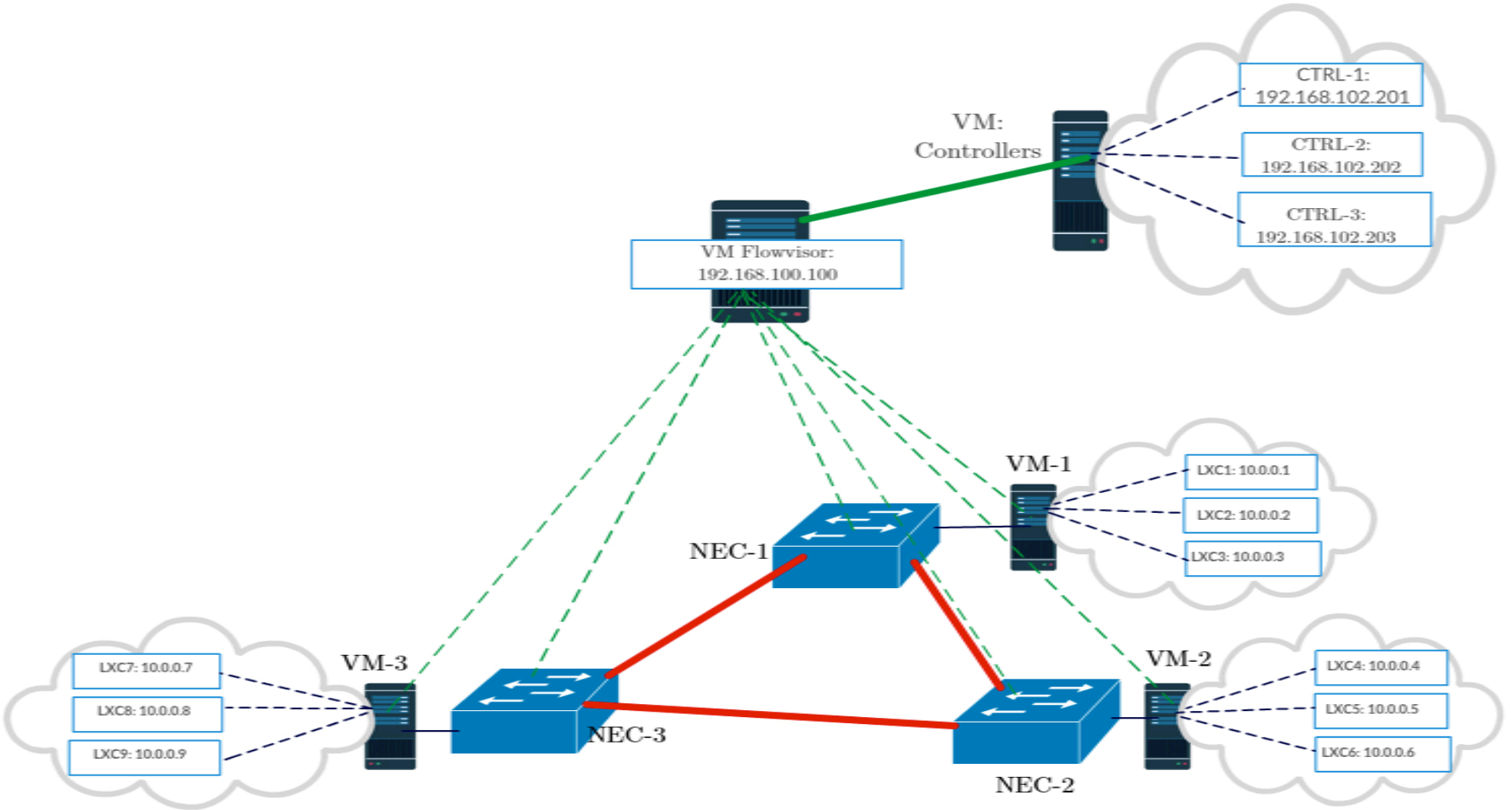


ACTIVITIES

The Lab setup



ACTIVITIES: **The Lab setup**



RESULT

Slice Name		Hosts included		Assigned Controller
research1	10.0.0.1	10.0.0.4	10.0.0.7	192.168.102.203
research2	10.0.0.2	10.0.0.5	10.0.0.8	192.168.102.202
research3	10.0.0.3	10.0.0.6	10.0.0.9	192.168.102.201

- Three slices:
- *Reachability* test

PING 10.0.0.2 (10.0.0.2) 56(84) bytes of data.
From 10.0.0.1 icmp_seq=9 Destination Host Unreachable

PING 10.0.0.6 (10.0.0.6) 56(84) bytes of data.
From 10.0.0.1 icmp_seq=10 Destination Host Unreachable

PING 10.0.0.4 (10.0.0.4) 56(84) bytes of data. [From 10.0.0.1]
64 bytes from 10.0.0.4: icmp_req=1 ttl=64 time=21.1 ms
64 bytes from 10.0.0.4: icmp_req=2 ttl=64 time=0.806 ms

→ *Interference free*

- *E2E bandwidth* test

Slice Name	Hosts for Bandwidth measure		End-to-End Bandwidth Before (QoS)	End-to-End Bandwidth After (QoS)
research1	10.0.0.1	10.0.0.4	*104.5 Mbits/sec*	*937 Kbits/sec [1 Mbps]*
research2	10.0.0.2	10.0.0.5	*380.7 Mbits/sec*	*9.36 Mbits/sec [10 Mbps]*
research3	10.0.0.3	10.0.0.6	*105.8 Mbits/sec'*	*47.3 Mbits/sec [50 Mbps]*

RESULT

- **Video streaming use-case:** 30Mbits video is used for the test

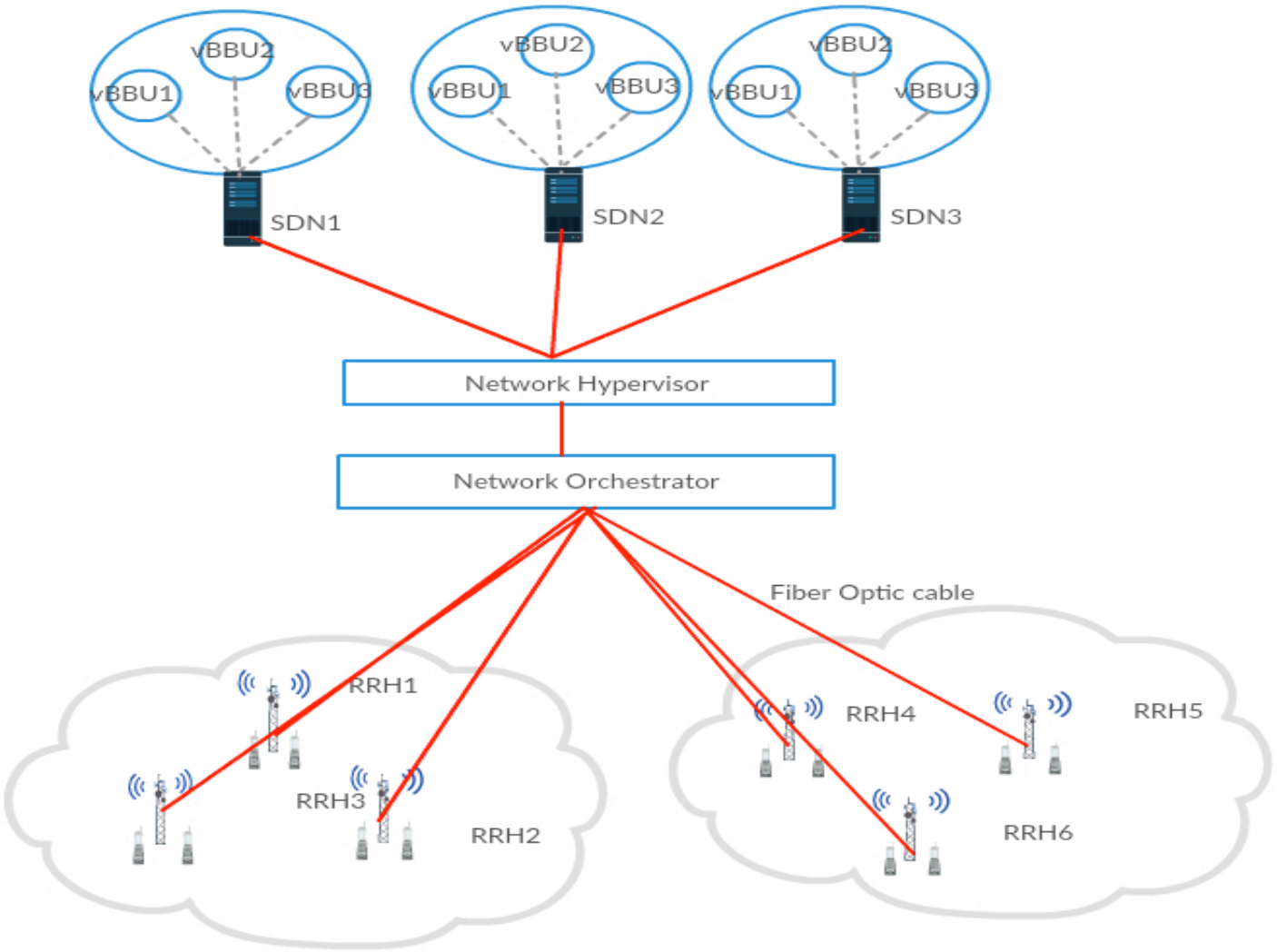
Video stored at	Video streamed to	Bandwidth used	Slice category
10.0.0.1	10.0.0.7	1Mbps	research1
10.0.0.5	10.0.0.2	10Mbps	research2
10.0.0.9	10.0.0.6	50Mbps	research3

RESULT

CONCLUSION AND FUTURE WORKS

- Three slices has been created and tested
  - 1Mbps, 10Mbps and 50Mbps virtual networks
  - No interference
- GARR infrastructure with Flowvisor solutions infrastructure for researchers
- Single-domain SDN/Openflow networks
- (i) Multi-domain SDN/Openflow (ii) Multi-tenant 5G C-RAN (extension)

CONCLUSION AND FUTURE WORKS



CONCLUSION AND FUTURE WORKS

- **Task 1. Definition of the end-to-end architecture for multi-domain SDN and dynamic resource allocation of the C-RAN**
  - Duration: 2 Months (M1 - M2)
- **Task 2. Implementation of the system.**
- Duration: 8 Months (M3 - M10).
- **Task 3.Testing and validation.**
- Duration: 4 Months (M9 - M12)

- Thank you