



Track 2: Cloud and Wired networking

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CLOUD

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WIRED NETWORKING

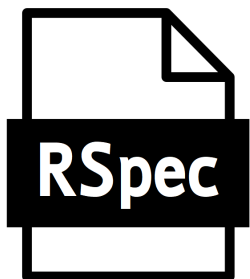
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The Experiment Specification

What is an Experiment Specification?

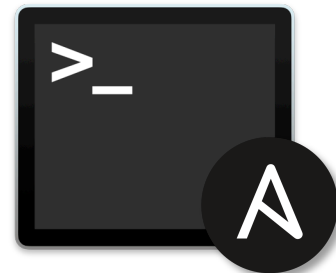
Espec bundles:



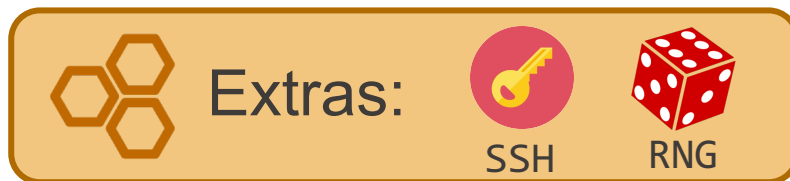
Resource
Specification

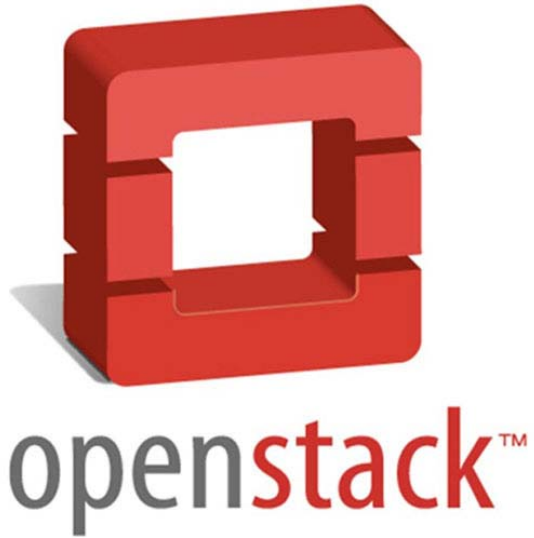


Files to be
uploaded



ANSIBLE
Commands
to be executed





Deploying OpenStack with EnOS

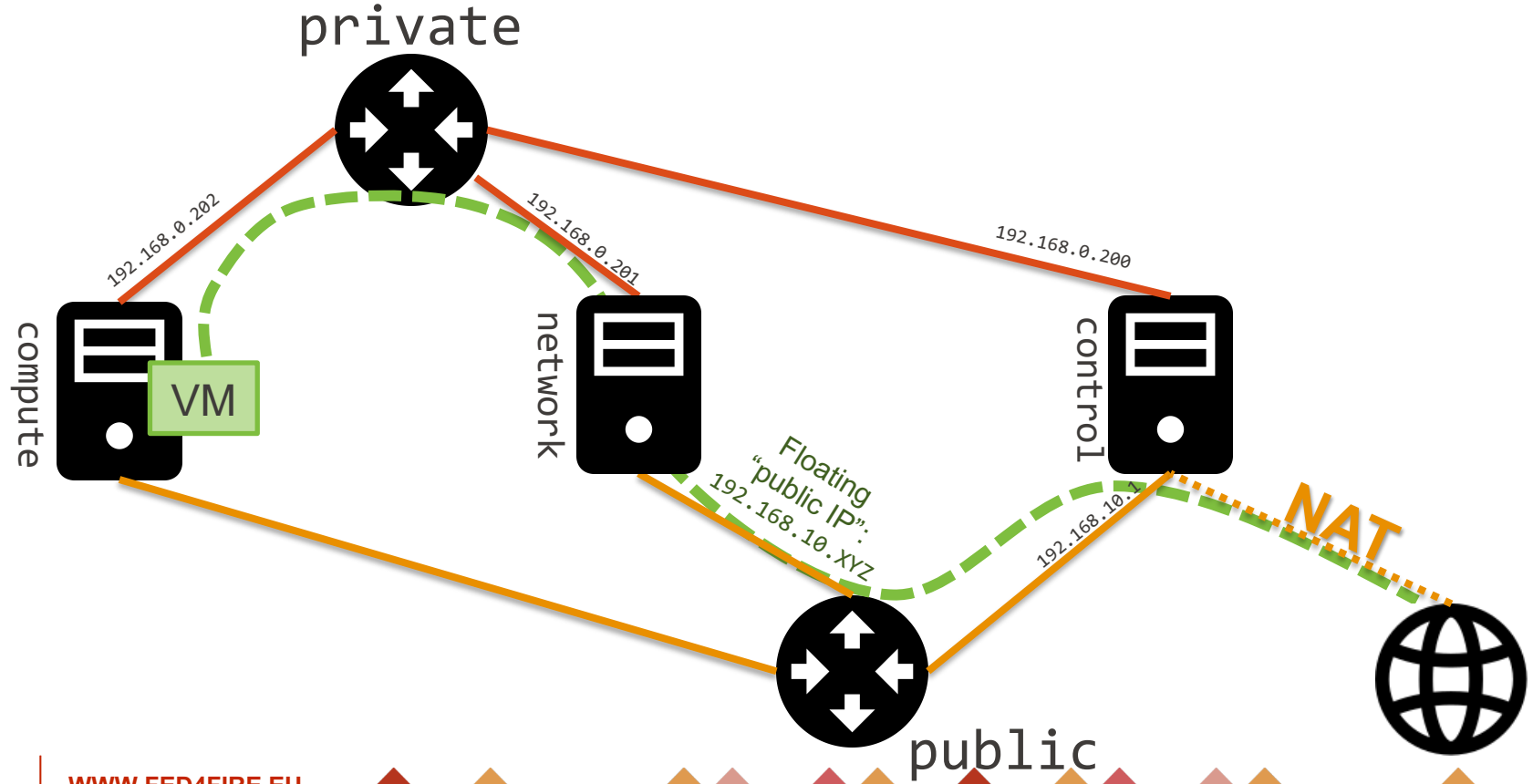
Deploying OpenStack with EnOS



EnOS allows you to **Deploy**, **Customize** and **Benchmark** OpenStack

- Developed by Inria
- Wrapper around **Kolla-Ansible**
- Deploys all OS-services as Docker containers
- ESPEC generates the EnOS config file for bootstrapping the deployment

OpenStack experiment architecture



Resources on EnOS

Tutorial

<https://doc.ilabt.imec.be/ilabt/virtualwall/tutorials/openstack.html>

EnOS documentation

<https://enos.readthedocs.io/>

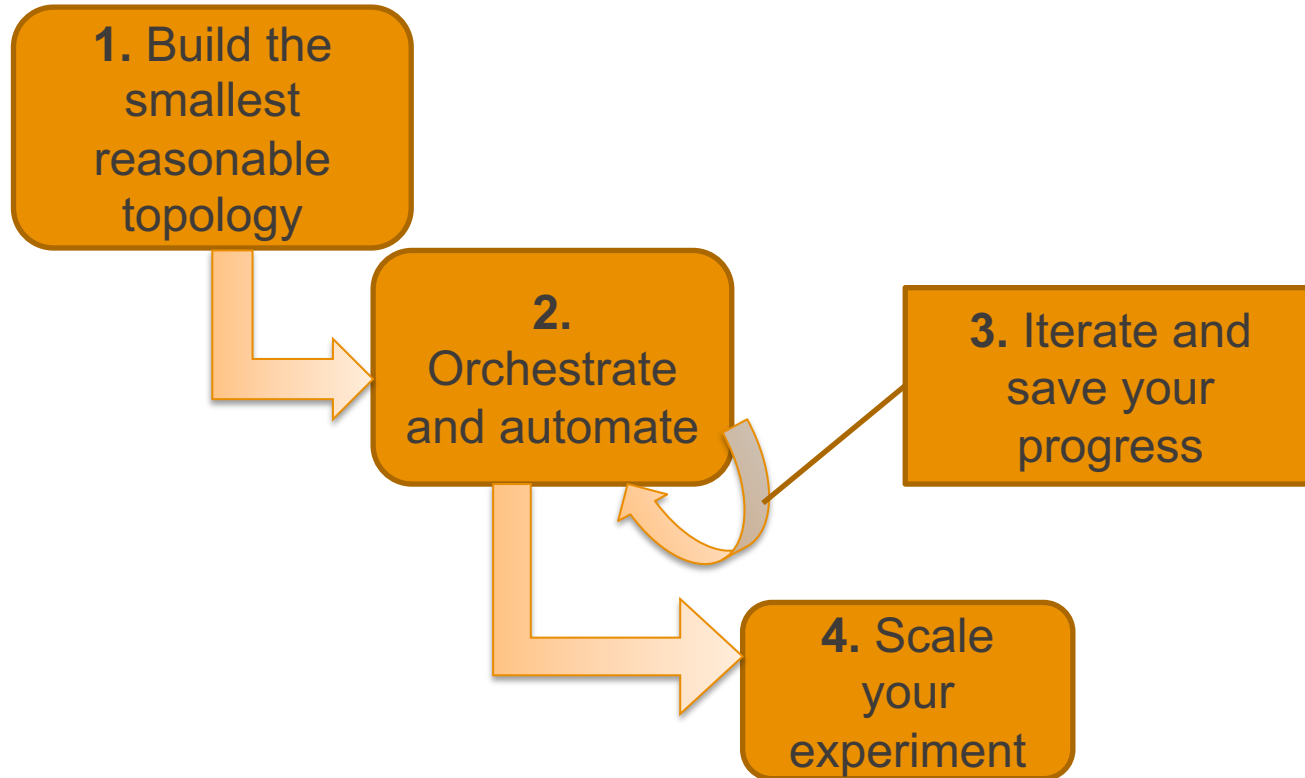
EnOS ESPEC repository

<https://gitlab.ilabt.imec.be/ilabt/enos-espec/>

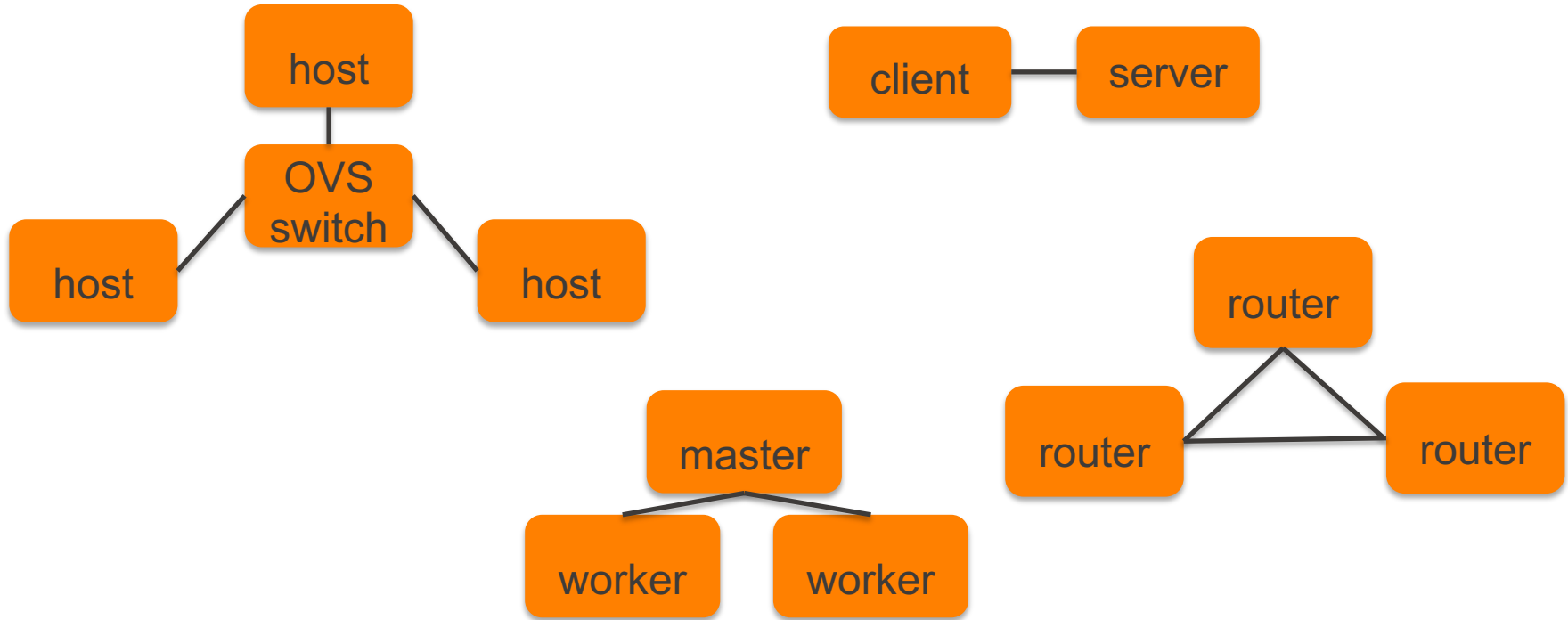


Workflow for creating and scaling up experiments

Recommended workflow



1. Build the smallest reasonable topology



2. Automate as you go

Use Configuration Management Systems to automate installation and configuration of software

Many tools available for this job: Ansible, Chef, Puppet, ...



3. Save your progress

Log all of your experimental artifacts for every experiment that works

- RSpec
- image
- install script
- custom software
- measurements
- etc.



Use version control to store your artifacts

Always know the **last configuration that worked**

4. Scale your experiment

Only scale up when your smallest reasonable experiment is working



Adapt your request RSpec to add more nodes

- Roll your own scaling script: mostly copy/pasting with minimal editing required
- Use geni-lib

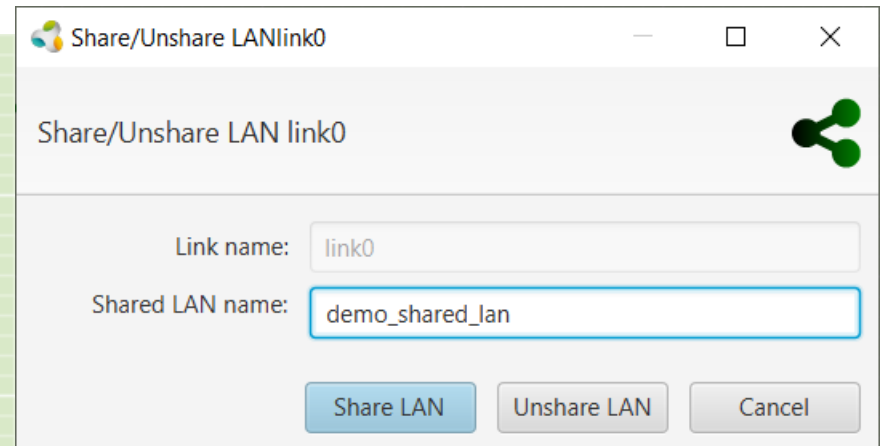
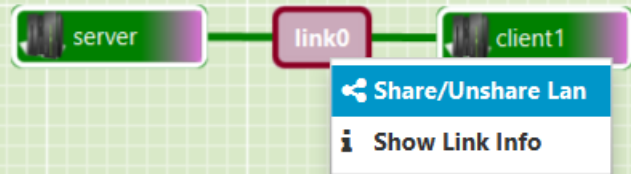


Scaling up experiments with shared LAN's

Shared LAN

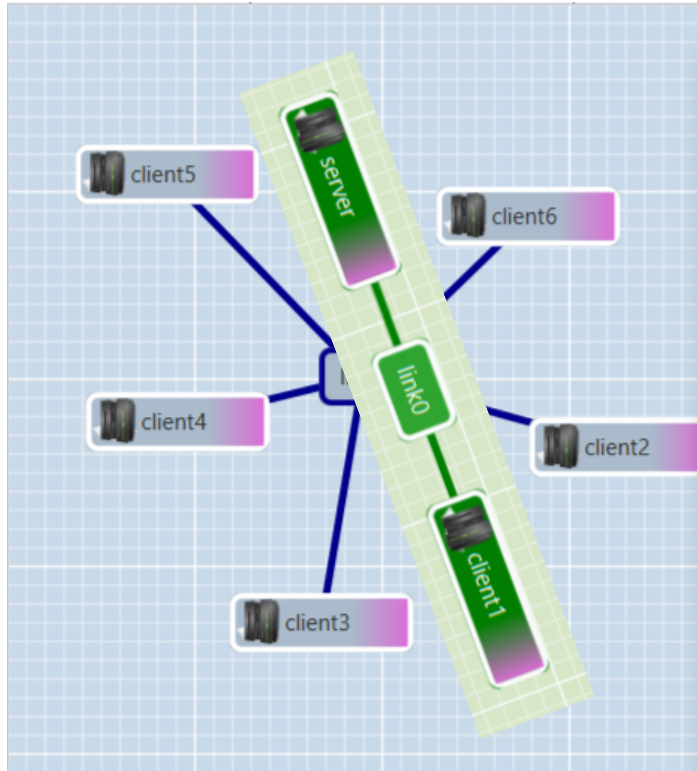
Shared LAN's allow you to add extra servers to an existing network in an experiment

Step 1: Right click on network and choose “Share/Unshare Lan”



Shared LAN

Step 2: Design a new experiment with extra servers



Shared LAN



Step 3: Fix duplicate IP-addresses

The network diagram shows a central node labeled "link0" connected to six client nodes: client2, client3, client4, client5, and client6. Each client node is represented by a laptop icon and a text label.

Properties of link0

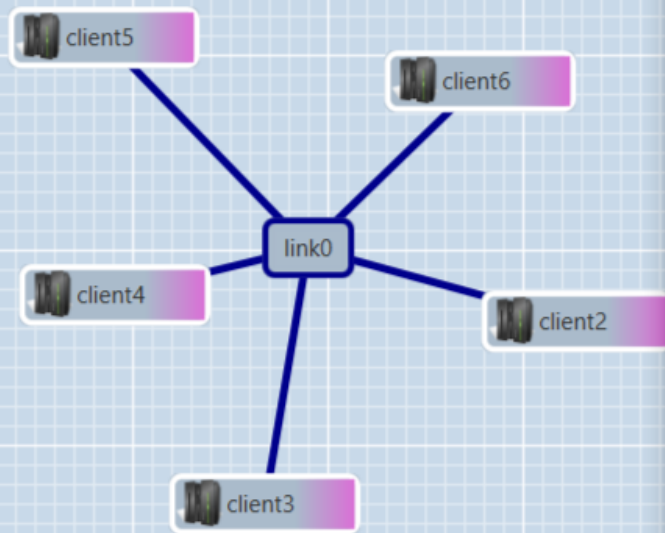
General Impairment Link Type

Link name: link0

Configuration type: Automatic IPv4 IPv6

Interface ID	IP Address	Netmask
client2:if0	192.168.0.3	255.255.255.0
client3:if0	192.168.0.4	255.255.255.0
client4:if0	192.168.0.5	255.255.255.0
client5:if0	192.168.0.6	255.255.255.0
client6:if0	192.168.0.7	255.255.255.0

IP addresses:



Properties of link0

General Impairment Link Type

Link name:

Configuration type: Automatic IPv4 IPv6

Interface ID	IP Address	Netmask
client2:if0	192.168.0.3	255.255.255.0
client3:if0	192.168.0.4	255.255.255.0
client4:if0	192.168.0.5	255.255.255.0
client5:if0	192.168.0.6	255.255.255.0
client6:if0	192.168.0.7	255.255.255.0

IP addresses:

Save Cancel

Shared LAN



Step 5: Configure link in new experiment to connect to existing Shared LAN

The screenshot shows the 'Properties of link0' dialog box with the 'Link Type' tab selected. The 'Link type' dropdown is set to 'lan'. Two informational notes are highlighted in yellow: 'NOTE: Known supported link types for this link are: gre-tunnel, egre-tunnel, lan' and 'NOTE: (e)gre-tunnel only works when all nodes have a public IPv4 address'. The 'Connect to existing Shared LAN:' section is highlighted with an orange border, showing a checked checkbox and a text field containing 'demo_shared_lan'. The 'Make into a new Shared LAN:' section is partially visible, showing an unchecked checkbox and a text field, followed by three unchecked checkboxes: 'Use real VLAN' and 'No MAC learning'.

Properties of link0

General Impairment Link Type

Link type:

lan

NOTE: Known supported link types for this link are: gre-tunnel, egre-tunnel, lan

NOTE: (e)gre-tunnel only works when all nodes have a public IPv4 address

Connect to existing Shared LAN:

demo_shared_lan

Make into a new Shared LAN:

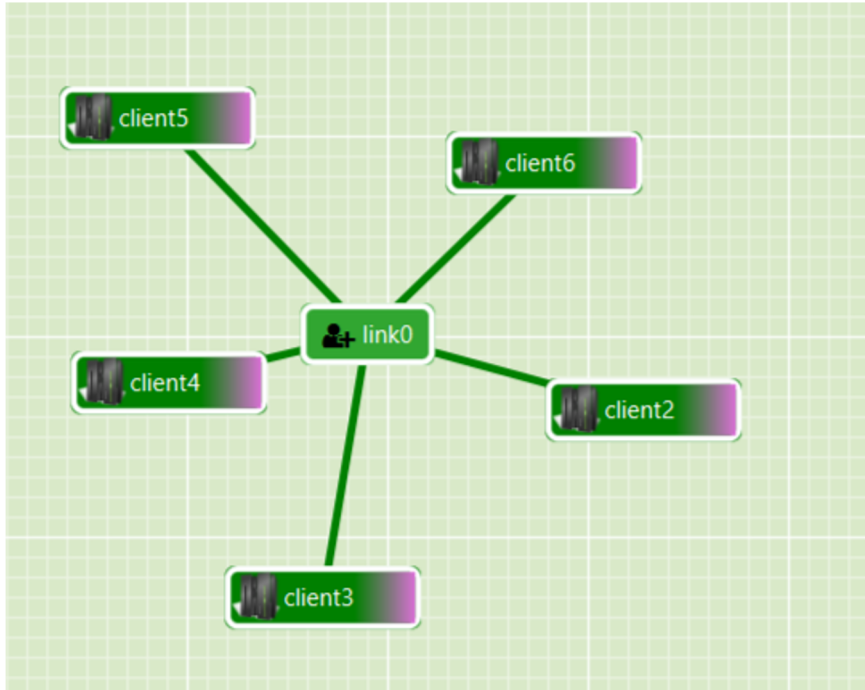
[text field]

Use real VLAN

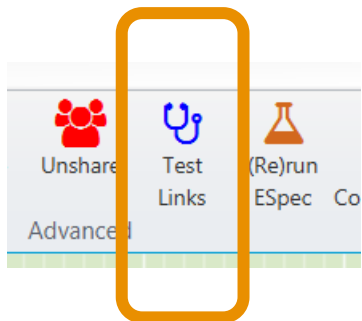
No MAC learning

Shared LAN

Step 6: Start the new experiment



Test your links!



Link Test Results

Link Test Results:

Node	Linked Node	Iface	Ping	Speed (Mbps)		
				Expected	Configured	Measured
client1	server	eth5	🔴	1000	🟢 1000	🔴 -1.0
server	client1	eth5	🔴	1000	🟢 1000	🔴 -1.0
client5	client2	vlan111	🟢	1000	🟢 1000	🟢 1074.85509780
client5	client3	vlan111	🟢	1000	🟢 1000	🟢 489.746646712
client5	client4	vlan111	🟢	1000	🟢 1000	🟢 492.140587152
client5	client6	vlan111	🟢	1000	🟢 1000	🟢 488.040384463
client4	client2	vlan111	🟢	1000	🟢 1000	🟢 522.419180941
client4	client3	vlan111	🟢	1000	🟢 1000	🟢 557.23429412
client4	client5	vlan111	🟢	1000	🟢 1000	🟢 477.703914703
client4	client6	vlan111	🟢	1000	🟢 1000	🟢 481.068355329
client2	client3	vlan111	🟢	1000	🟢 1000	🟢 507.138970557

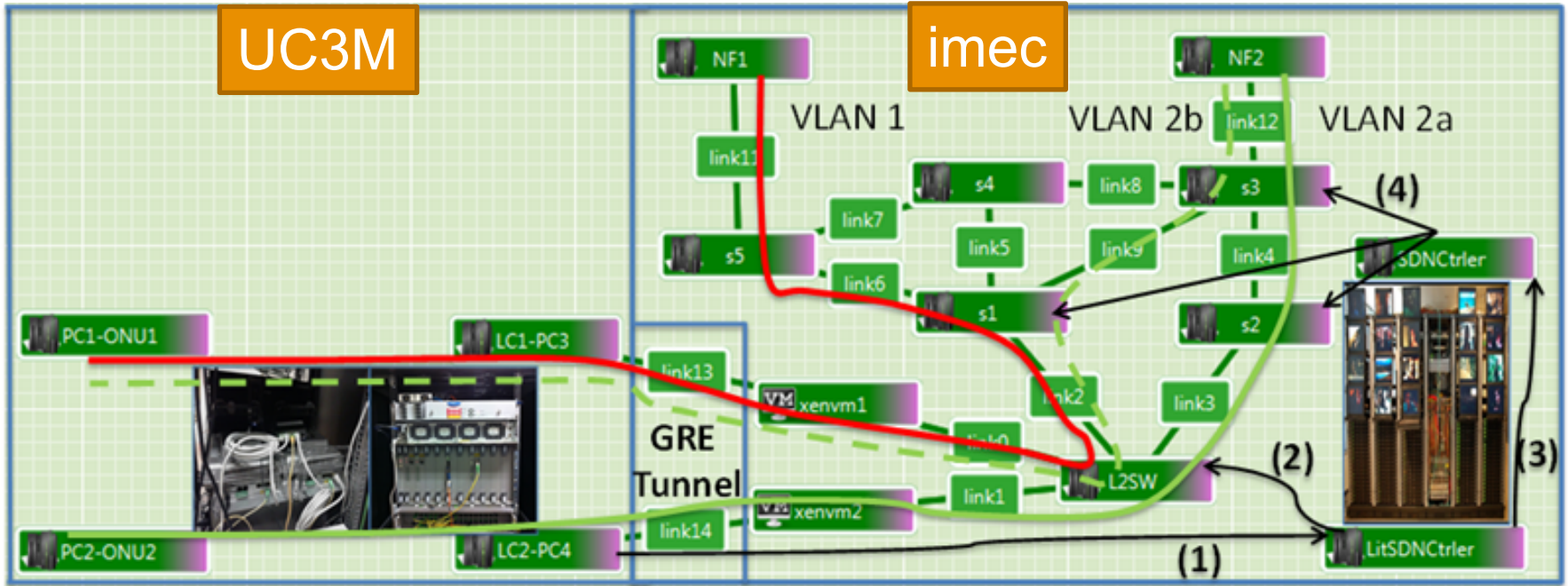
Close



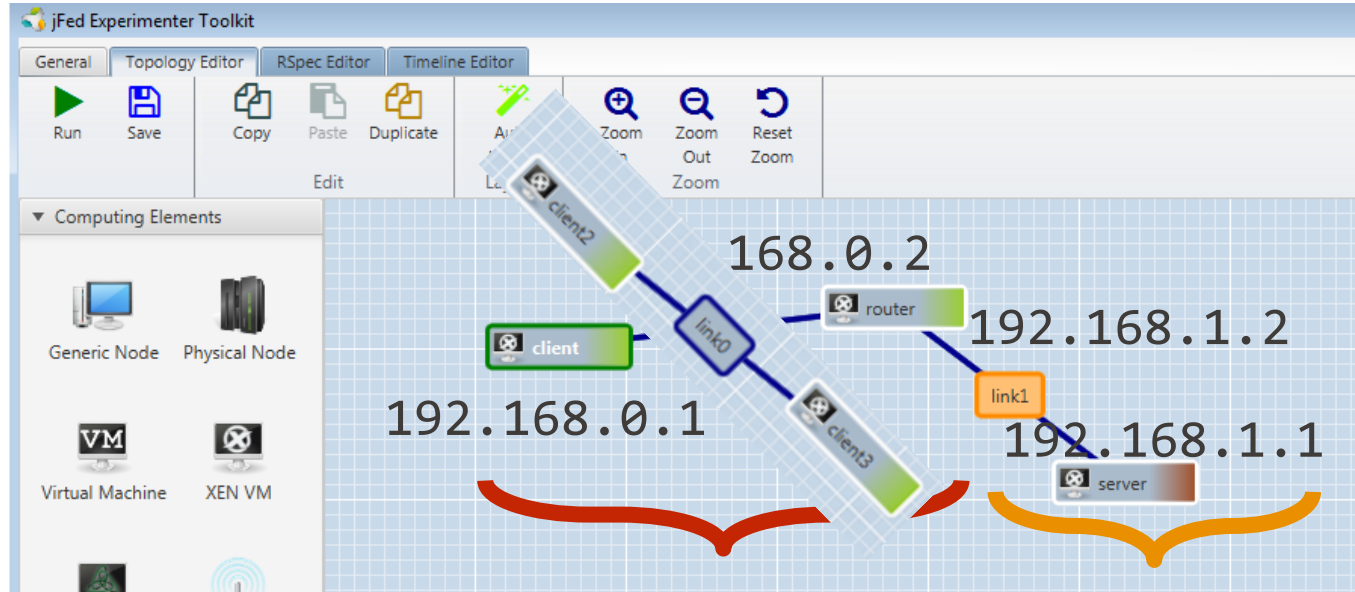
Examples of advanced networking experiments

Creating multi-testbed experiments

1. Start with creating a backbone
2. Scale up with shared LAN's on each site after that



Topology

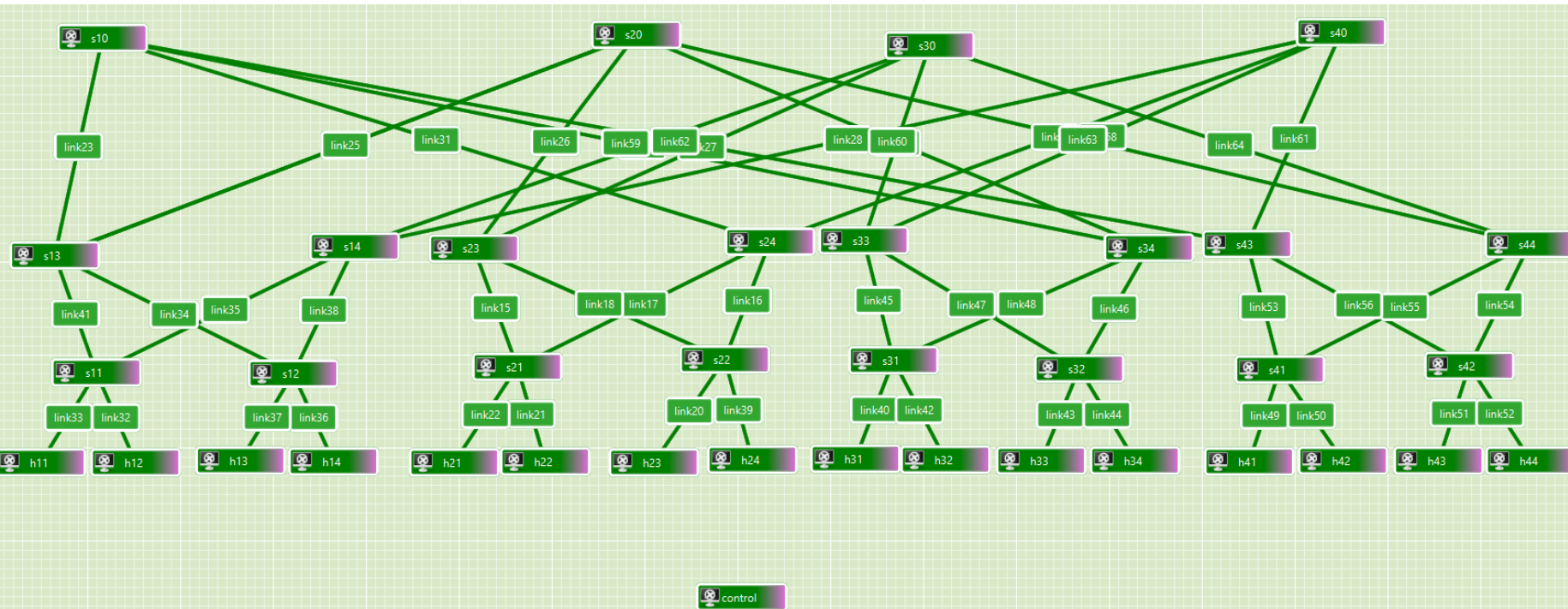


RACK 1

RACK 2

```
route add -net 192.168.1.0/24 gw 192.168.0.2
```

Advanced SDN experiment



Documentation



FED4FIRE+

Testbeds Overview

<https://www.fed4fire.eu/testbeds/>

Technical Documentation

<https://doc.fed4fire.eu/>



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WWW.FED4FIRE.EU