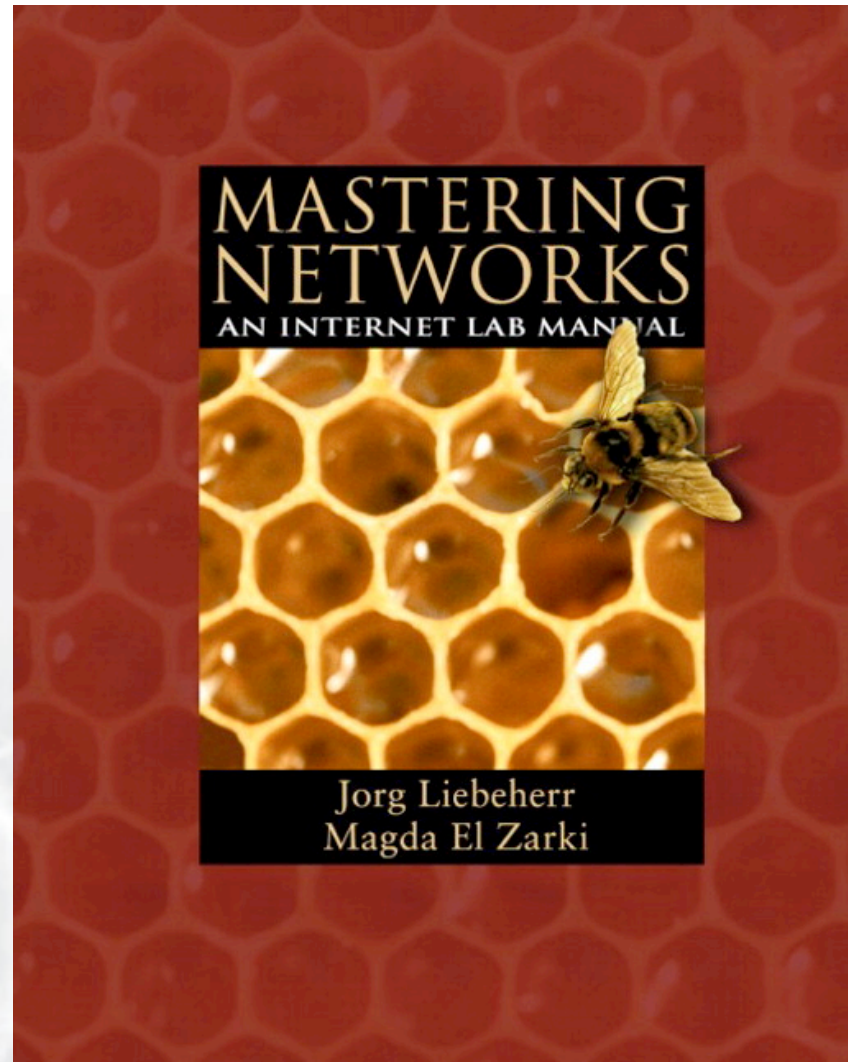


A Virtual Computer Networking Lab

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GEC 19,
March 17th 2014

Computer Networking Labs



- Each institution requires a set of hardware (switches, routers, cables, computers)
- Hardware outdates fairly quickly
- Certain aspects are vendor specific
- Equipment is unused for periods of time

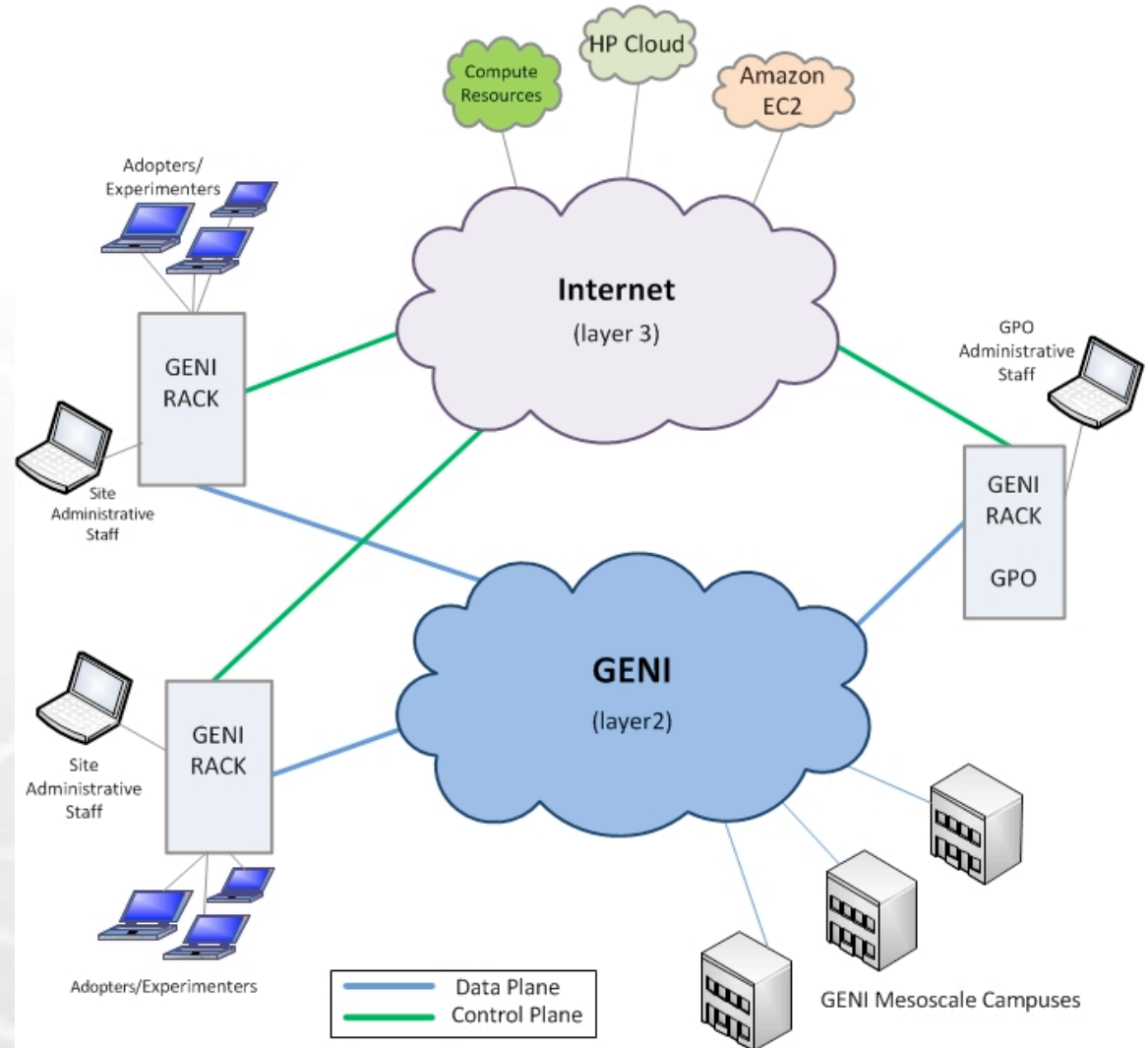


- Use GENI infrastructure to teach lab
- Individual institutions don't need hardware
- “Guide” students as much as needed
- Teach new technologies (e.g., OpenFlow)

Downside:

- Students **do not** touch hardware

- GENI Portal
- GENI APIs
- GENI Racks
- GIMI Tools




localhost:4000/labwiki
6444

LabWiki
user1 Log out

Plan

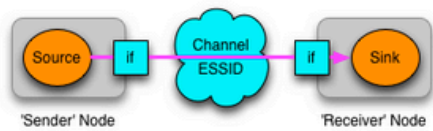
Prepare

Execute



Tutorial: First Experiment

As mentioned before, we want to configure an experiment as shown below:




The first step is to describe the experiment in OEDL, the OMF Experiment Description Language. To see how this looks for this experiment, open the '1_hello.rb' file in the **Prepare** column.

Ignoring some of the details we can see the definition of two resource groups, **Sender** in line 6 and **Receiver** in line 21.

```
6: defGroup('Sender', ...
...
21: defGroup('Receiver', ...
```

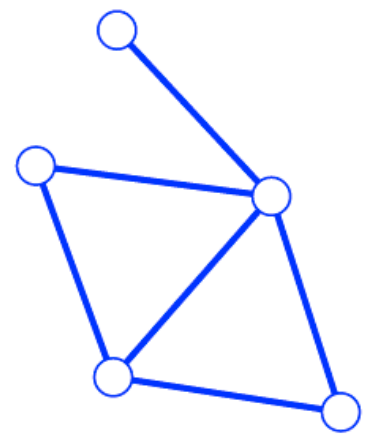
There will be more on groups later, but in this

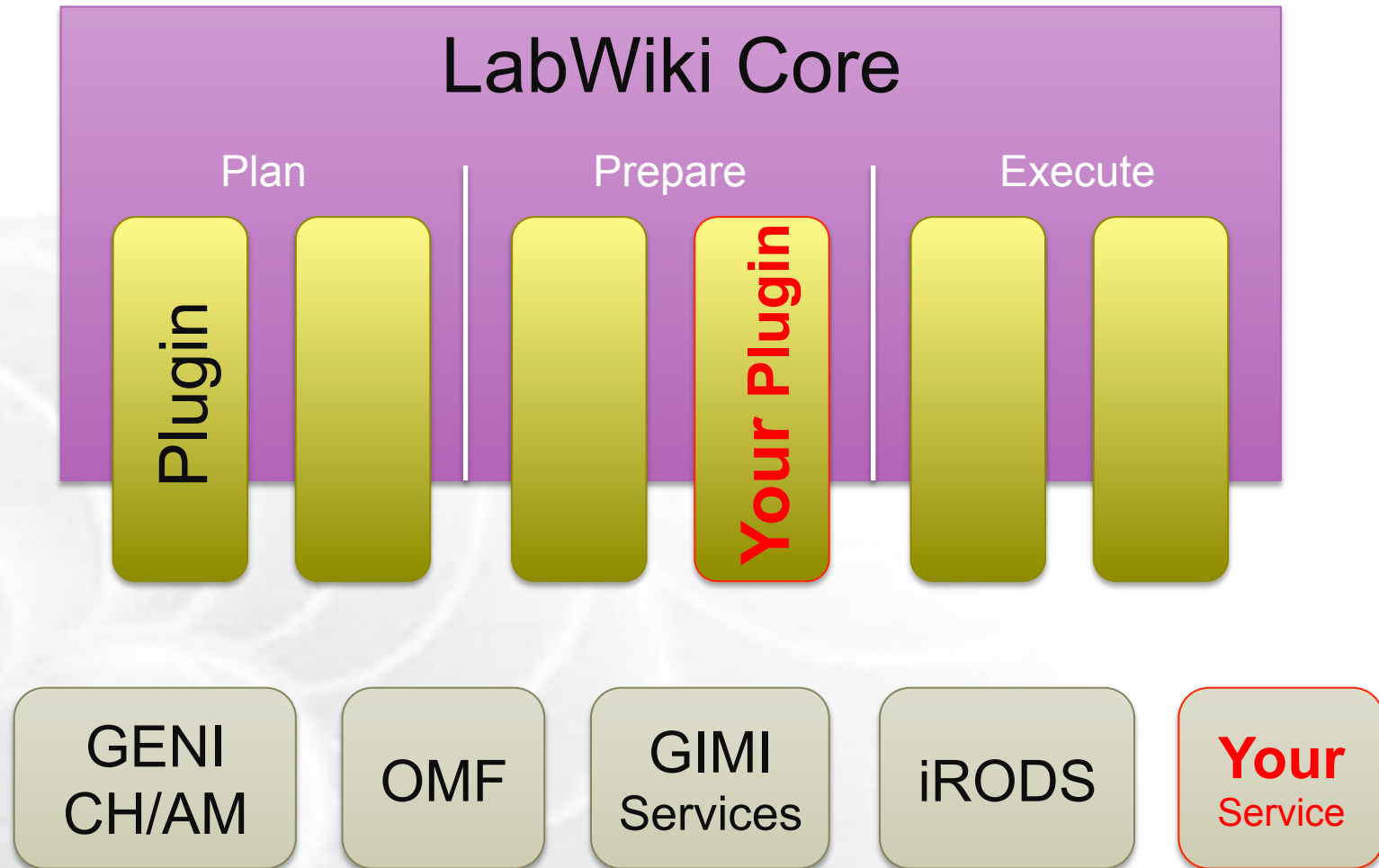


```

1 defProperty('res1', 'omf.nicta.node1', "
2 defProperty('res2', 'omf.nicta.node2', "
3 essid = (0...8).map{65.+(rand(25)).chr}.
4 channel = rand(11)+1
5
6 defGroup('Sender', property.res1) do |no
7   node.addApplication("test:app:otg2") d
8   app.setProperty('udp:local_host', '1
9   app.setProperty('udp:dst_host', '192
10  app.setProperty('udp:dst_port', 3000
11  #app.measure('udp_out', :interval =>
12  app.measure('udp_out', :samples => 1
13  end
14  node.net.w0.mode = "adhoc"
15  node.net.w0.type = 'g'
16  node.net.w0.channel = channel
17  node.net.w0.essid = essid
18  node.net.w0.ip = "192.168.0.2"
19  end
20
21 defGroup('Receiver', property.res2) do |
22  node.addApplication("test:app:otr2") d
23  app.setProperty('udp:local_host', '1
24  app.setProperty('udp:local_port', 30
25  #app.measure('udp_in', :interval =>

```





Experimenter



1. Instrument

0. Reserve

6. Obtain

LabWiki



2. Run

3. Collect

iRODS

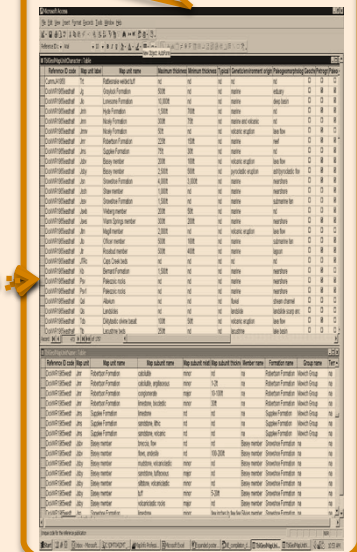


Automated
Archiving

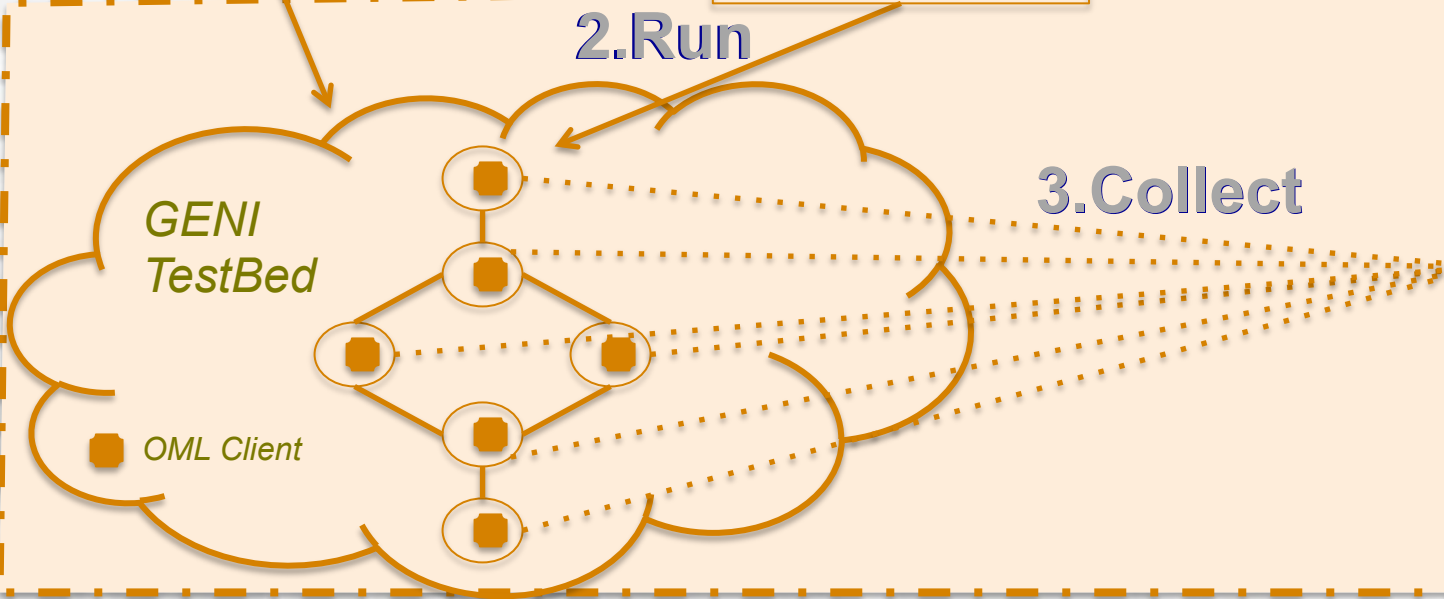
5. Save

4. Plot

OML
Server



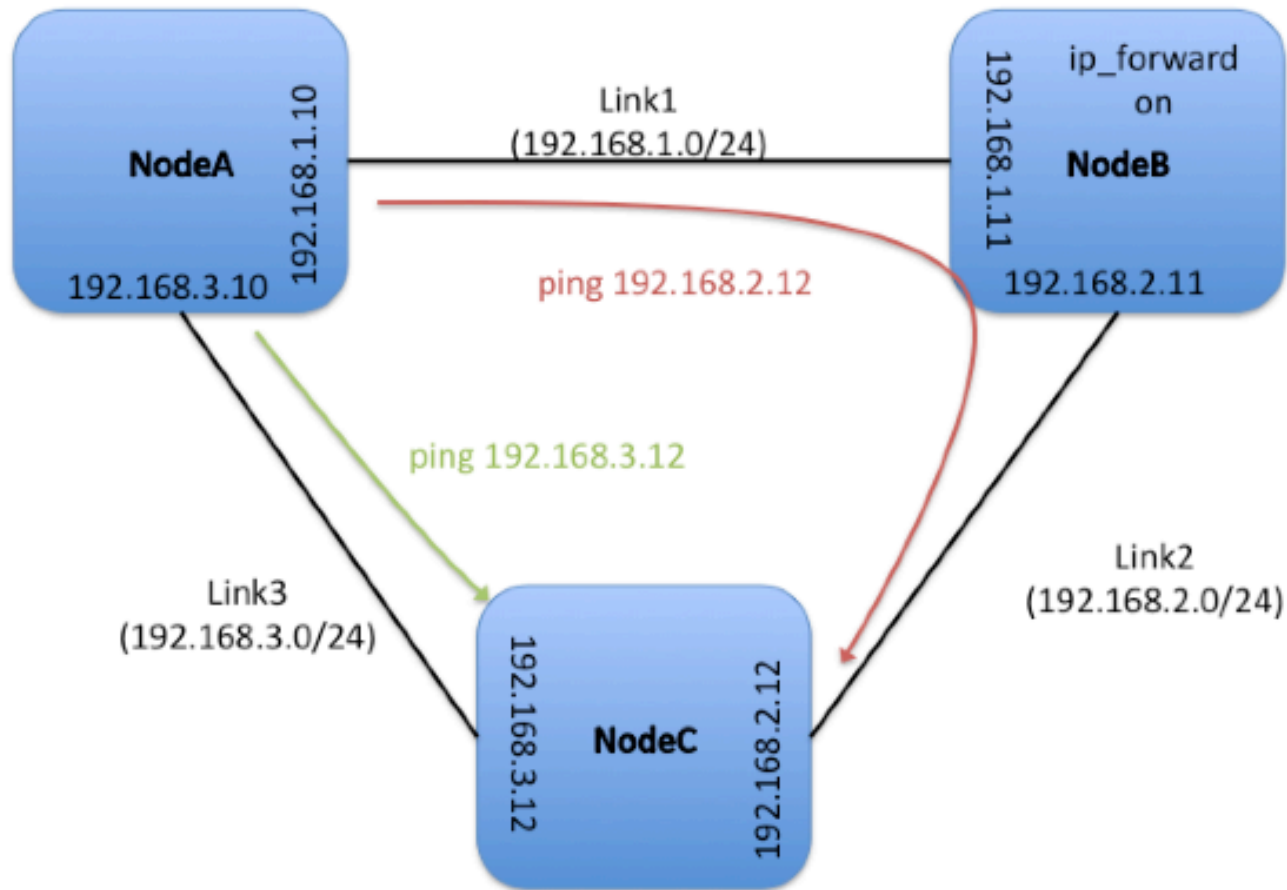
Time	Value	Unit	...
10:30:00	100	Hz	...
10:30:01	105	Hz	...
10:30:02	110	Hz	...
10:30:03	115	Hz	...
10:30:04	120	Hz	...
10:30:05	125	Hz	...
10:30:06	130	Hz	...
10:30:07	135	Hz	...
10:30:08	140	Hz	...
10:30:09	145	Hz	...
10:30:10	150	Hz	...

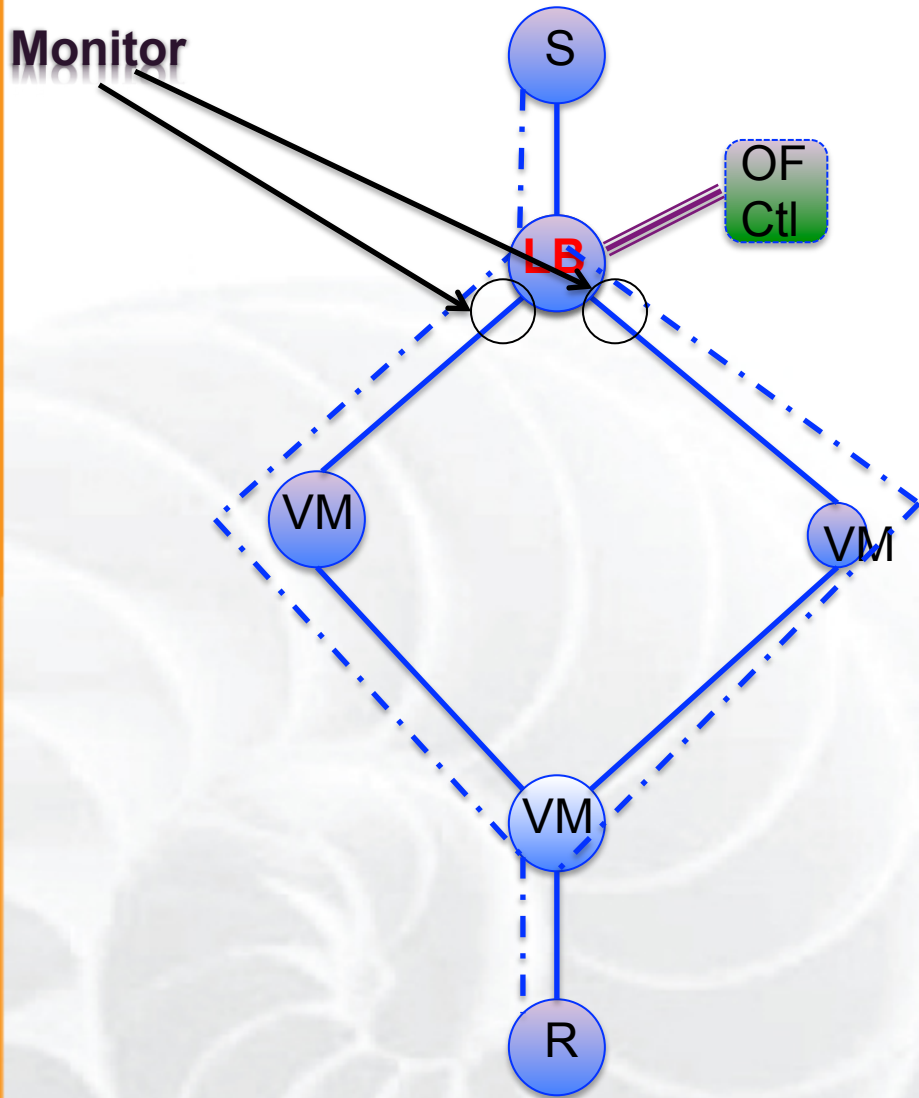


Lab	Title
1	Beginners Lab
2	Introductory Lab
3	TCP & UDP
4	Static & Dynamic IP Routing
5	OpenFlow Lab
6	OpenFlow-based routing
7	Data Center
8	Wireshark

* OF learning switch to teach how Ethernet switch works

- Create an interface to course management system(s) (e.g., moodle)
- Be able to “observe” student performance
- Allow for easy new module development
- Video clips





Total Traffic

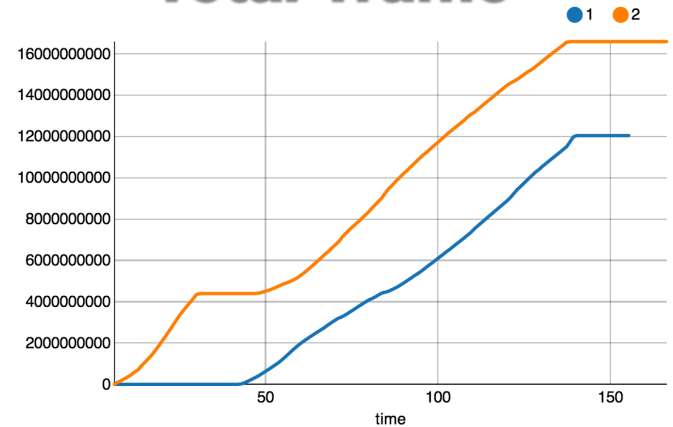


Figure: Cumulated Number of Bytes on each Path

Throughput

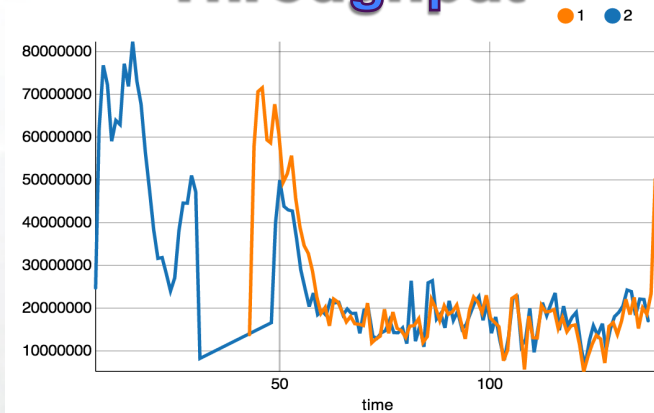


Figure: TCP Throughput (Bytes-per-Second) on each Path

Modified slide from : <http://www.deutsche-telekom-laboratories.de/~robert/GENI-Experimenters-Workshop.ppt>

- General
 - Methods
 - Curriculum
- Modules/Lab
 - TCP, UDP
 - OpenFlow
- LabWiki

- Modules
 - Joint development will make them better
 - Community should be able to contribute
- LabWiki
 - Create an interface to course management system(s) (e.g., moodle)
 - Be able to “observe” student performance
 - Allow for easy new module development
 - Video clips

