

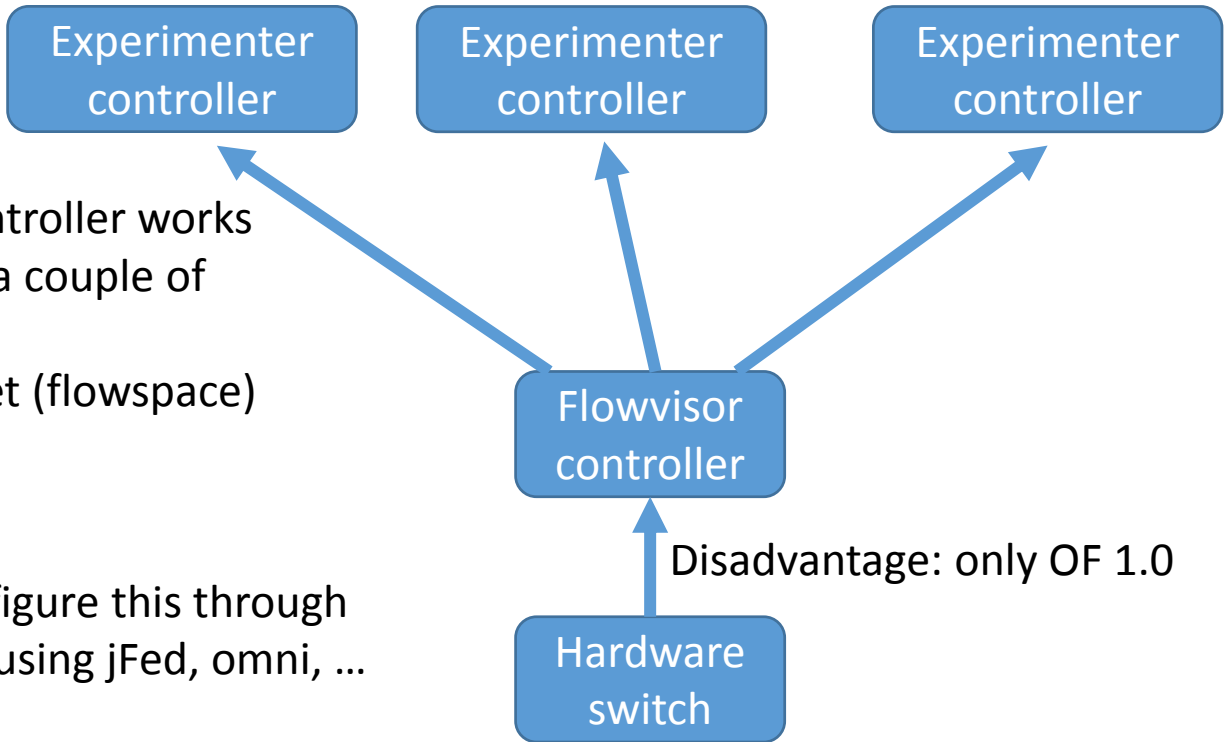
Openflow with hardware switches

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Disadvantages of OpenVSwitch in software

- Limited number of ports
 - Limited bandwidth/processing power
 - Depending on the experiment, there might be some influence of the underlying system, e.g. mac learning
 - bare metal nodes and L2 switch for vlans
 - XEN bridges
- > using hardware openflow switches solves this

Sharing a hardware switch



Each controller works only on a couple of ports
Or subset (flowspace)



We can configure this through the AM API using jFed, omni, ...

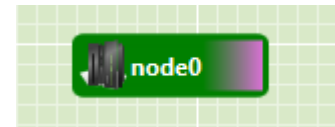
Disadvantage: only OF 1.0

Setup

3 nodes which are connected
to hardware switch
(documentation to know which nodes)



Controller (can be different experiment)



Configuration of flowspace for HW switch
and reference to controller

The screenshot shows the 'jFed Experimenter Toolkit' interface. The 'RSpec Editor' tab is active, displaying XML configuration code for an OpenFlow datapath. The code includes various namespaces and attributes for defining the datapath and its connection to a controller.

```
1 <?xml version='1.0'?>
2 <rspec xmlns="http://www.geni.net/resources/rspec/3" type="request" generated_by="jFed RSpec Editor"
3 13T05:36:43.775+02:00" xmlns:emulab="http://www.protogeni.net/resources/rspec/ext/emulab/1"
4 xmlns:jfedBonfire="http://jfed.iminds.be/rspec/ext/jfed-bonfire/1"
5 xmlns:delay="http://www.protogeni.net/resources/rspec/ext/delay/1" xmlns:jfed-
6 command="http://jfed.iminds.be/rspec/ext/jfed-command/1"
7 xmlns:client="http://www.protogeni.net/resources/rspec/ext/client/1" xmlns:jfed-ssh-
8 keys="http://jfed.iminds.be/rspec/ext/jfed-ssh-keys/1" xmlns:jfed="http://jfed.iminds.be/rspec/ext/j:
9 xmlns:xs="http://www.w3.org/2001/XMLSchema-instance" xmlns:openflow="http://www.geni.net/resources/r:
10 xmlns:sharedvlan="http://www.protogeni.net/resources/rspec/ext/shared-vlan/1"
11 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.geni.net/resourc:
12 http://www.geni.net/resources/rspec/3/request.xsd http://www.geni.net/resources/
13 http://www.geni.net/resources/rspec/ext/openflow/3/of-resv.xsd">
14 <openflow:sliver description="bvermeul's experiment." email="brecht.vermeulen@ugent.be" ref="http://
15 <openflow:controller url="tcp:10.2.0.127:6633" type="primary"/>
16 <openflow:group name="johngrp">
17 <openflow:datapath
18 component_id="urn:publicid:IDN+openflow:foam:foam.atlantis.ugent.be+datapath+5e:3e:08:9e:01:61:64:cc"
19 component_manager_id="urn:publicid:IDN+openflow:foam:foam.atlantis.ugent.be+authority+am">
20 <openflow:port num="1"/>
21 <openflow:port num="2"/>
22 <openflow:port num="3"/>
23 </openflow:datapath>
```

RSpec for openflow switch

```
<openflow:sliver description="bvermeul's experiment." email="brecht.vermeulen@ugent.be" ref="http://jfed.iminds.be">
  <openflow:controller url="tcp:10.2.0.127:6633" type="primary"/>
  <openflow:group name="johngrp">
    <openflow:datapath
      component_id="urn:publicid:IDN+openflow:foam:foam.atlantis.ugent.be+datapath+5e:3e:08:9e:01:61:64:cc"
      component_manager_id="urn:publicid:IDN+openflow:foam:foam.atlantis.ugent.be+authority+am">
      <openflow:port num="1"/>
      <openflow:port num="2"/>
      <openflow:port num="3"/>
    </openflow:datapath>
  </openflow:group>

  <openflow:match>
    <openflow:use-group name="johngrp"/>
    <openflow:packet>
      <openflow:dir type value="0x800,0x806"/>
      <openflow:ip src value="192.168.3.0/24" />
      <openflow:nw list value="192.168.3.0/24" />
    </openflow:packet>
  </openflow:match>
</openflow:sliver>
</rspec>
```

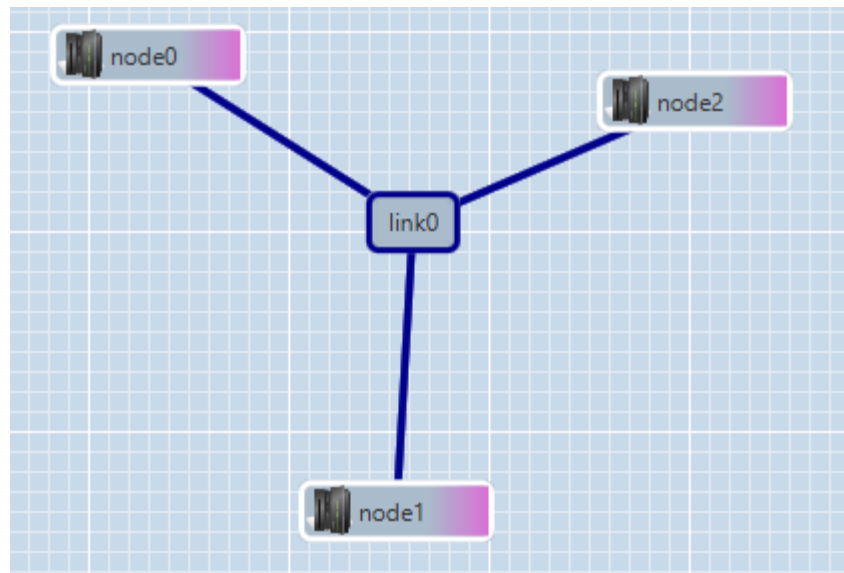
See <http://doc.ilabt.iminds.be/ilabt-documentation/openflow.html>

Workflow

- Reserve nodes connected to switch
- Reserve a node for the controller -> get IP address
- Create RSpec for openflow
 - Port numbers
 - Controller IP
- Start up controller and the rest is similar to experimenting with OVS

Alternative in GENI

- Based on HP procurve switches where you can set an openflow controller per VLAN
 - Instageni only
 - Less performing then previous example with dedicated switches



You enable link0 to be an openflow controlled switch

RSpec link section contains controller URL

```
<link client_id="link-2">  
  <interface_ref client_id="host1:if0"/>  
  <interface_ref client_id="host2:if0"/>  
  <interface_ref client_id="host3:if0"/>  
  <link_type name="lan"/>  
  <vtop:link_attribute key="nomac_learning" value="yep"/>  
  <emulab:openflow_controller url="tcp:CONTROLLER_IP:6633"/>  
</link>
```

See <http://groups.geni.net/geni/wiki/GENIExperimenter/Tutorials/OpenFlowHW/DesignSetup>