A Network in a Laptop: Rapid Prototyping for Software-Defined Networks

Bob Lantz, Brandon Heller, Nick McKeown

ACM HotNets-IX, No. 19, 2010

 Presented by 101064535 鄭如意
Software-Defined Network

Controller

Switch 1

Switch 3

Switch 2

Switch 3

Host 1

Host 2

Host n
Motivation

I have a new idea about SDN

Paper deadline approaching

No hardware
Motivation

Same code can’t be deployed in real network
Motivation

VMs are too heavy weights

VM switch

VM host

VM
Idea of Mininet

- Environment: Linux
- Hosts: A host in Mininet is simply a shell process (e.g. bash) moved into its own network namespace with the unshare(CLONE NEWNET) system call.
Idea of Mininet

Lightweight => scalability
Idea of Mininet

Deployment
Mininet workflow

Step 3: Control the behavior between hosts

Command line
mininet> Host 1 ping Host 2
mininet> Host 2 ping Host 1

API-- MiniEdit

Python API for define some script

Interactive

Host 1

Host 2
Monitor Interface
## Performance

<table>
<thead>
<tr>
<th>$S$ (Switches)</th>
<th>User (Mbps)</th>
<th>Kernel (Mbps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>445</td>
<td>2120</td>
</tr>
<tr>
<td>10</td>
<td>49.9</td>
<td>940</td>
</tr>
<tr>
<td>20</td>
<td>25.7</td>
<td>573</td>
</tr>
<tr>
<td>40</td>
<td>12.6</td>
<td>315</td>
</tr>
<tr>
<td>60</td>
<td>6.2</td>
<td>267</td>
</tr>
<tr>
<td>80</td>
<td>4.15</td>
<td>217</td>
</tr>
<tr>
<td>100</td>
<td>2.96</td>
<td>167</td>
</tr>
</tbody>
</table>
## Performance

<table>
<thead>
<tr>
<th>Topology</th>
<th>Host</th>
<th>switch</th>
<th>Setup(s)</th>
<th>Stop(s)</th>
<th>Mem(MB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimal</td>
<td>2</td>
<td>1</td>
<td>1.0</td>
<td>0.5</td>
<td>6</td>
</tr>
<tr>
<td>Linear(100)</td>
<td>100</td>
<td>100</td>
<td>70.7</td>
<td>70.0</td>
<td>112</td>
</tr>
<tr>
<td>VL2(4, 4)</td>
<td>80</td>
<td>10</td>
<td>31.7</td>
<td>14.9</td>
<td>73</td>
</tr>
<tr>
<td>FatTree(4)</td>
<td>16</td>
<td>20</td>
<td>17.2</td>
<td>22.3</td>
<td>66</td>
</tr>
<tr>
<td>FatTree(6)</td>
<td>54</td>
<td>45</td>
<td>54.3</td>
<td>56.3</td>
<td>102</td>
</tr>
<tr>
<td>Mesh(10, 10)</td>
<td>40</td>
<td>100</td>
<td>82.3</td>
<td>92.9</td>
<td>152</td>
</tr>
<tr>
<td>Tree(4^4)</td>
<td>256</td>
<td>85</td>
<td>168.4</td>
<td>83.9</td>
<td>233</td>
</tr>
<tr>
<td>Tree(16^2)</td>
<td>256</td>
<td>17</td>
<td>139.8</td>
<td>39.3</td>
<td>212</td>
</tr>
<tr>
<td>Tree(32^2)</td>
<td>1024</td>
<td>33</td>
<td>817.8</td>
<td>163.6</td>
<td>492</td>
</tr>
</tbody>
</table>
Attribute of Mininet

• Advantage:
  – Interactive
  – Sharing
  – Deployment

• Disadvantage:
  – $O(n)$ linear lookup for software tables
  – Host cannot be migrated live like VMs.
Concussion

• Mininet is a system for rapidly prototyping large network on the constrained resources of a single laptop.

• http://mininet.org/