Towards an Emulator for Software-Defined Wireless Networks

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1. Introduction
2. Mininet-WiFi
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4. Related Work
5. Limitations and Future Work
6. Conclusions

Towards an Emulator for Software-Defined Wireless Networks
1. Introduction
Popularity of WiFi Networks
Importance of emulating / simulating wireless networks to evaluate performance, test and debug protocols as well.

Software-Defined Wireless Networking
Centralized control of wireless networks, separating the data plane and control plane, programmatic network control via OpenFlow.
Mininet-WiFi

**Goal:** providing high fidelity emulation for realistic network evaluation in a controlled environment to support research in wireless networking and SDWN.

**Approach:** Leverage code (Mininet) and lessons on fast prototyping and experimental evaluation (emulation) in wired SDN.
Wireless channel Emulation

- Propagation
- Broadcast
- Modulation
- Mobility

Realistic experiments

- Reproducing real networks behavior
2. Mininet-WiFi
Emulator in support of Software-Defined Wireless Networking

Fork of Mininet (based on lightweight virtualization / Linux containers)

mac80211_hwsim/softmac
Towards an Emulator for Software-Defined Wireless Networks
Towards an Emulator for Software-Defined Wireless Networks
Command Line Interface

```
alpha@alpha- Inspiron-5547:~$ sudo mn --wifi
*** Enabling Wireless Module
*** Creating network
*** Adding controller
*** Adding Station(s): sta1 sta2
*** Adding Access Point(s): ap1
*** Associating Station(s): (sta1, ap1) (sta2, ap1)
*** Starting controller(s)
c0
*** Starting 1 Access Point(s)
ap1 ...
*** Starting CLI:
mininet-wifi> 
```
### Working within Mininet-WiFi

```
mininet-wifi>
```

<table>
<thead>
<tr>
<th><strong>Network</strong></th>
<th><strong>Iperf</strong></th>
<th><strong>iw</strong></th>
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<tbody>
<tr>
<td>Ping</td>
<td>sta1 iperf -c 10.0.0.1</td>
<td>sta1 iw dev sta1-wlan0 scan</td>
</tr>
<tr>
<td>sta1 ping sta2</td>
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<th><strong>Queries</strong></th>
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<tr>
<td>Noise</td>
<td>Position</td>
<td>Distance</td>
</tr>
<tr>
<td>noise sta1</td>
<td>position sta1</td>
<td>distance sta1 sta2</td>
</tr>
</tbody>
</table>

### Python Code

_Towards an Emulator for Software-Defined Wireless Networks_
3. Demonstration
Demonstration

Reproducing related research
Using all the wireless networks around us

Demonstration

Using all the wireless networks around us within Mininet-WiFi
4. Related Work
log(cost), where cost = f(complexity, resources, environment conditions)

Increasing Realism

Increasing Complexity

Mininet-WiFi
EMANE
EstiNet
CORE

Assert
BOWL
iMinds
Nitos
Orbit
R2Lab

NS-3
OpenNet
OMNeT++

Test and Evaluation Options

Simulators

Emulators

TestBeds

Live Networks

Towards an Emulator for Software-Defined Wireless Networks
5. 
Limitations & Future Work
Limitations and Future Work

Good enough Abstraction of Wireless Channel
➔ Broadcast
➔ Propagation
➔ More Mobility Models
➔ Reproducing Real Network

Further reading:
6. Conclusions
Conclusions

Popularity of WiFi Networks & SDWN

Evaluation in Controlled Environment (HiFi Wireless Emulator)

Collaborate on Future Research around Wireless Networking and SDWN

Towards an Emulator for Software-Defined Wireless Networks
Thank you!

Questions?

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WebSite: http://www.intrig.dca.fee.unicamp.br/
Source: https://github.com/intrig-unicamp/mininet-wifi
Docker: https://hub.docker.com/r/ramonfontes/mininet-wifi/
Videos: https://goo.gl/4P02YB