Towards an Emulator for Software-Defined Wireless Networks

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1. Introduction
2. Mininet-WiFi
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6. Conclusions
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-Inspriron-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>

Network

<table>
<thead>
<tr>
<th>Ping</th>
<th>Iperf</th>
<th>iw</th>
</tr>
</thead>
<tbody>
<tr>
<td>sta1 ping sta2</td>
<td>sta1 iperf -c 10.0.0.1</td>
<td>sta1 iw dev sta1-wlan0 scan</td>
</tr>
</tbody>
</table>

Queries

<table>
<thead>
<tr>
<th>Noise</th>
<th>Position</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<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
Related Work

\[
\log(\text{cost}), \text{ where } \text{cost} = f(\text{complexity, resources, environment conditions})
\]

Test and Evaluation Options

- **Simulators**
  - NS-3
  - OpenNet
  - OMNeT++

- **Emulators**
  - Mininet-WiFi
  - EMANE
  - EstiNet
  - CORE

- **TestBeds**
  - Assert BOWL
  - iMinds
  - Nitos
  - Orbit
  - R2Lab

Log(Realism)

Increasing Complexity

- Loss of real experimental conditions
- Loss of experimental conditions reproducibility, repeatability, etc.

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
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