Mininet-WiFi: Emulating Software-Defined Wireless Networks

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Agenda

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

1 Introduction

Motivation

Popularity of WiFi Networks

It is important to emulate wireless networks for performance evaluating, testing, and protocol/system debugging.

Software-Defined Wireless Networking

It allows centralized control of wireless networks, separating the data plane and control plane, also allowing the control of the network through the OpenFlow protocol.

Main Goal

Mininet-WiFi

Aims at providing high fidelity emulation of wireless networks enabling real network analysis in fully controlled environments in support of research on Wireless and SDWN.

Challenges

Wireless channel emulation

- Propagation
- Broadcast
- Modulation
- Mobility

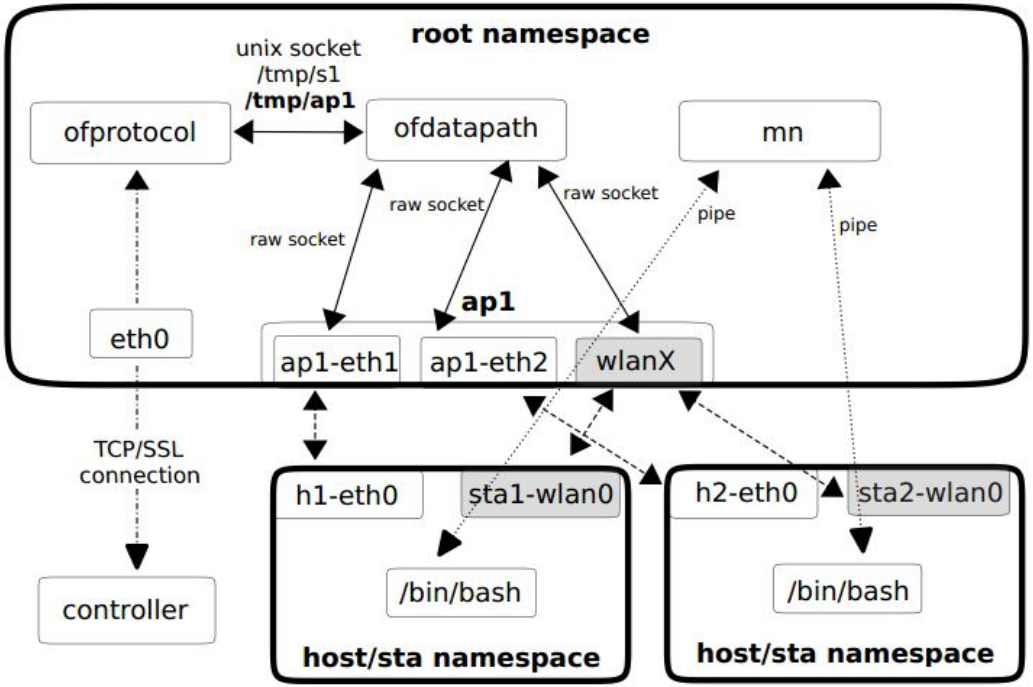
Realistic experiments

- Reproducing real networks behavior

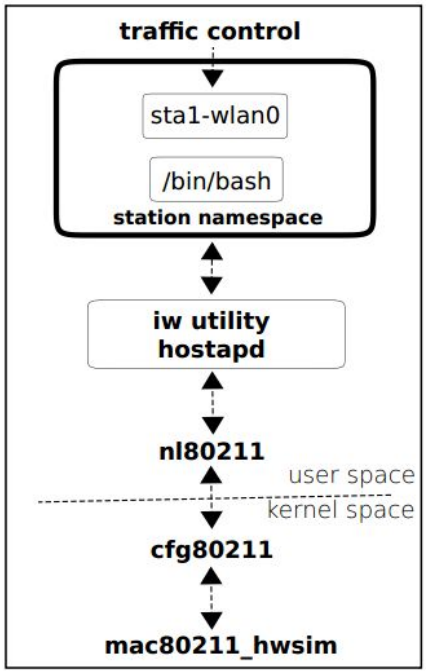
2 Mininet-WiFi

- Solution for Emulating Software-Defined Wireless Networks
- Fork of Mininet
  (based on lightweight virtualization / Linux containers)
- mac80211_hwsim/softmac

Architecture



Working Process



CLI

```
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 with Mininet-WiFi

mininet-wifi>

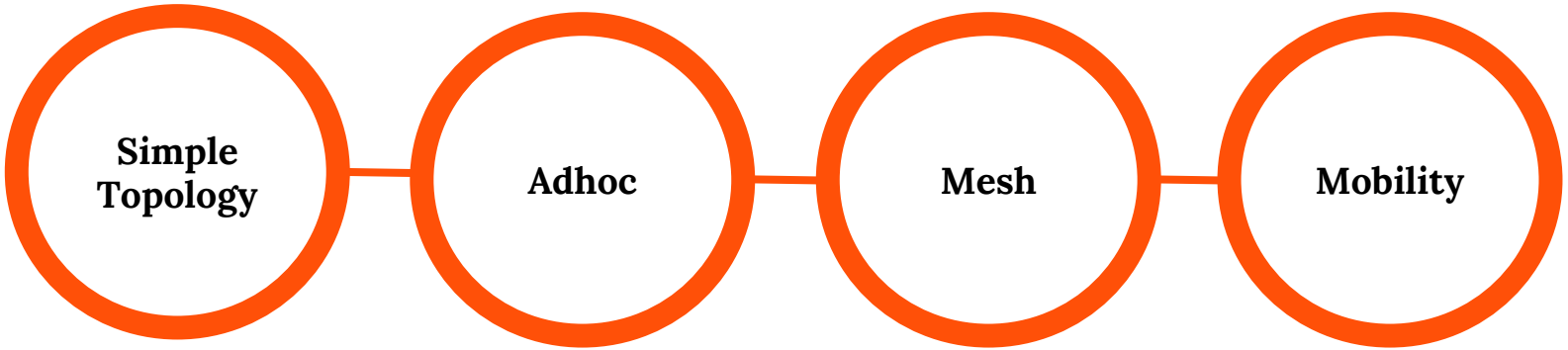
Network

Ping	Iperf	iw
sta1 ping sta2	sta1 iperf -c 10.0.0.1	sta1 iw dev sta1-wlan0 scan

Queries

Position	Distance
position sta1	distance sta1 sta2

Python Codes



and others...

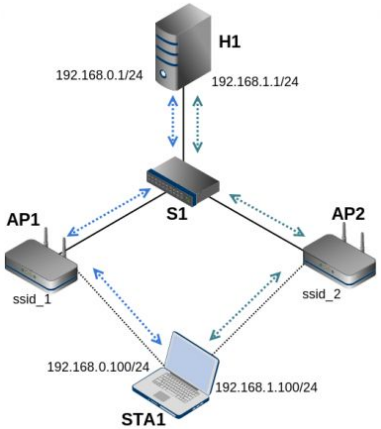
Performance Evaluation

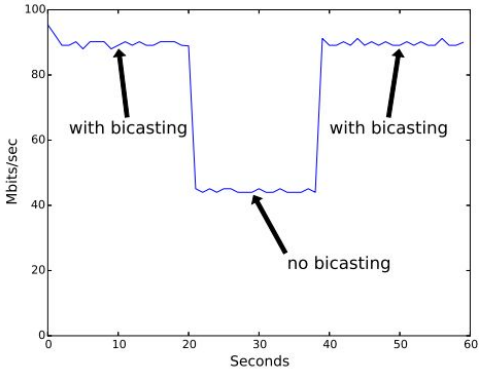
Operation	Time (ms)
Start an AP	17
Start a Station	63
Associate two nodes	10
Start mac80211_hwsim	5
Stop AP and Stations	350

3 Case Studies

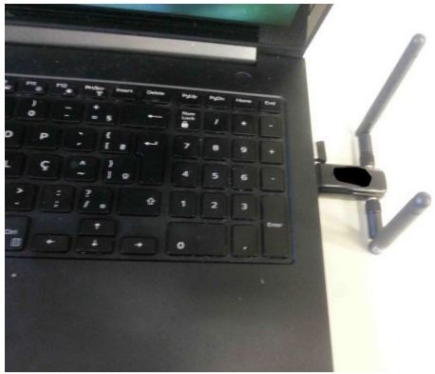
#1 Wireless Bicasting

https://goo.gl/NP0QyZ





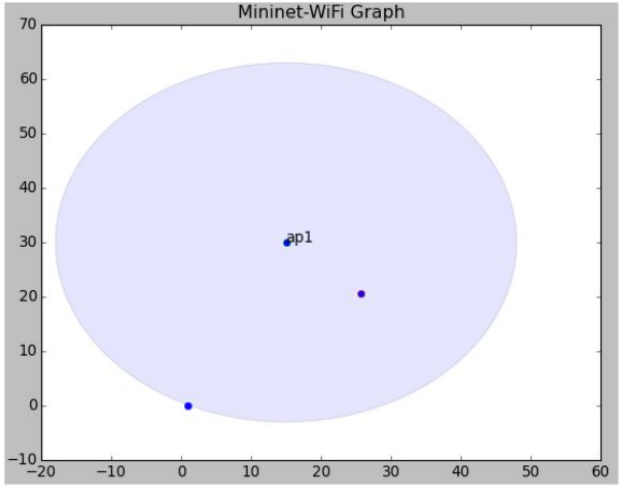
#2 Integration with Physical Wireless Interface



https://goo.gl/UcCtZB

Case Studies

#3 Mobility

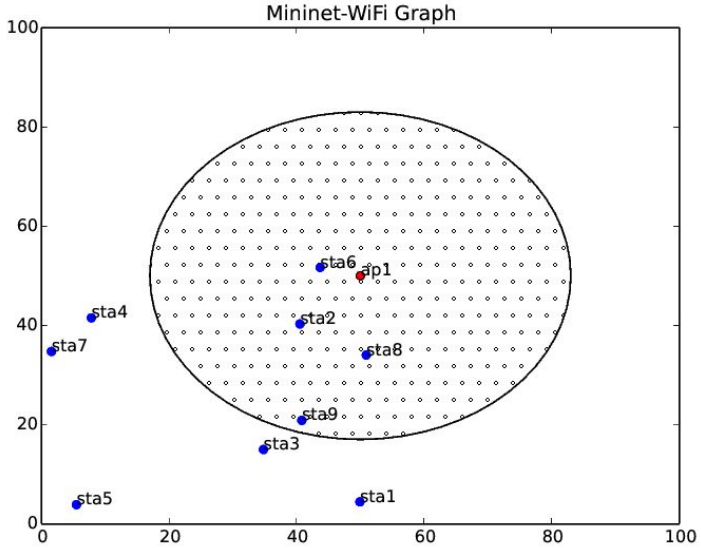



```
mininet-wifi> sta1 ping sta2
PING 10.0.0.3 (10.0.0.3) 56(84) bytes of data.
64 bytes from 10.0.0.3: icmp_seq=1 ttl=64 time=38.0 ms
64 bytes from 10.0.0.3: icmp_seq=2 ttl=64 time=18.1 ms
64 bytes from 10.0.0.3: icmp_seq=3 ttl=64 time=22.9 ms
64 bytes from 10.0.0.3: icmp_seq=4 ttl=64 time=25.8 ms
64 bytes from 10.0.0.3: icmp_seq=5 ttl=64 time=29.0 ms
From 10.0.0.2 icmp_seq=37 Destination Host Unreachable
```

Mobility

Mobility Models

- RandomWalk
- TruncatedLevyWalk
- RandomDirection
- RandomWaypoint
- GaussMarkov



Video: https://goo.gl/sbDDpH

Case Studies

#4 Reproducing Related Research

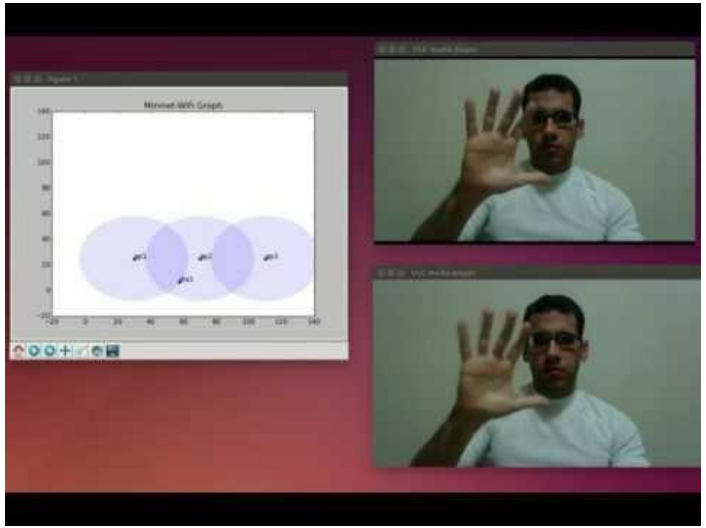
Using all the wireless networks around us

http://goo.gl/siZ2hH

Case Studies

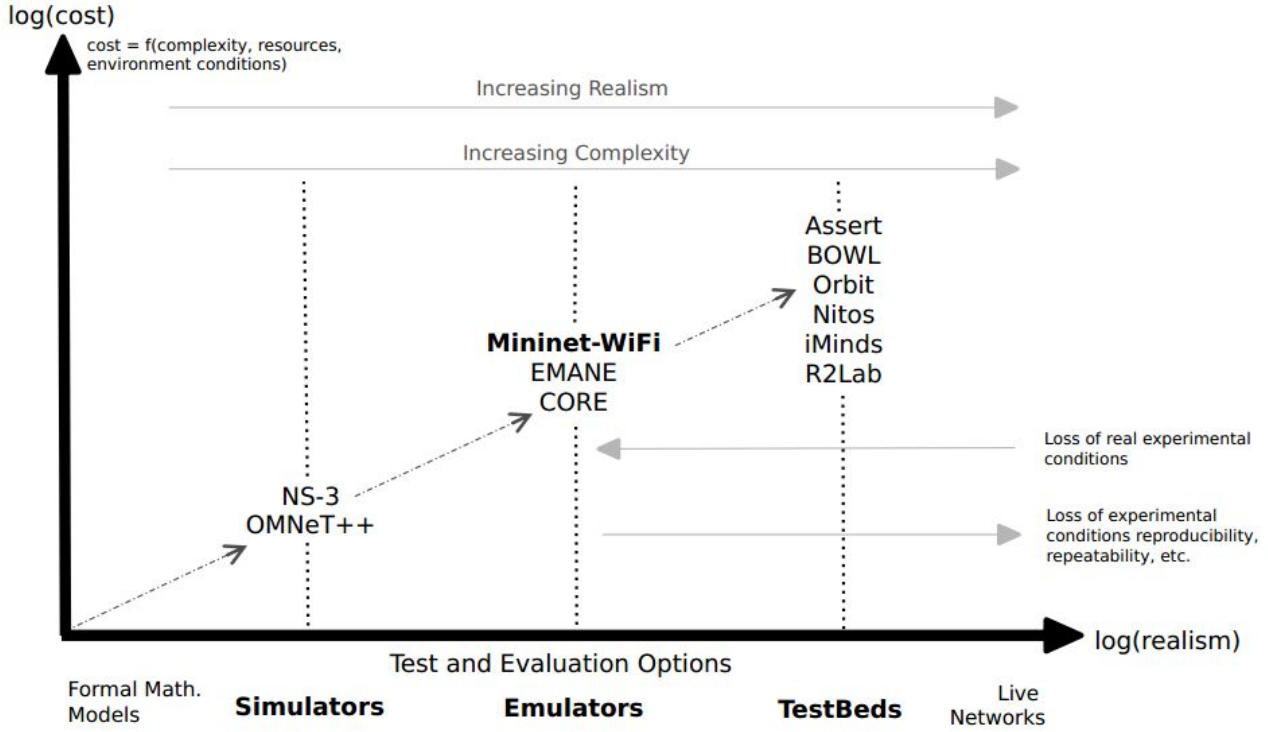
Using all the wireless networks around us

within Mininet-WiFi



https://goo.gl/NrIRme

4 Related Work



5

Limitations & Future Work

Limitations & Future Work

- **Broadcast** - 1s/2016
- **Propagation** - 2s/2016
- **Mobility** - 1s/2017
- **Reproducing Real Network** - 2s/2017

6 Conclusions

- **Popularity of WiFi Networks**
- Evaluation in Controlled Environment (HiFi Wireless Emulator)
- Community-based collaborative research around Wireless Networking and SDWN

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

Thanks!

Any *questions* ?

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