TECHNISCHE UNIVERSITÄT BERLIN

Fakultät IV – Elektrotechnik und Informatik
Fachgebiet Internet Network Architectures

WirelessLab WS 2016/17
Homework 4: Active and Passive Measurement

The goal of this assignment is to introduce you to the testbed devices, to let you set up and run your own experiment, and to collect and analyze your own measurements. You will also be able to apply what you've learned in the previous homeworks.

Question 1: (10 Points) *Setup*

You set up your own experiment using your assigned wireless nodes - two Alix boards running LEDE (OpenWRT), located in a rack on our floor and reachable via SSH. For this, you should provide your ssh key to us. The APs in our testbed can be accessed through a stepping stone. In order to get access to our stepping stone, you need to use **ssh**. Our stepping stone is called `wirelesslab.inet.tu-berlin.de`.

(a) See the ISIS news forum for the assignment of your nodes, how to reboot them and how to access the serial terminal.

(b) Install the necessary tools (tcpdump, iperf, etc.).

(c) Setup your two nodes so that they can communicate with each other over their wireless interfaces, and still be able to reach the student host over the wired interface.

(d) Setup an additional monitor interface on one of the nodes.

(e) Provide the network and wireless configuration files of one node. How do you check that the nodes can exchange traffic with each other?

Hint: Each of your nodes has an Atheros 802.11a/b/g card (ath5k) and **one** has an additional 802.11n card (ath9k). Use the ath5k cards for communication and the ath9k card as the monitor.

Question 2: (30 Points) *Passive Measurements and Difference of Management frames*

(a) Use the monitor interface for a passive measurement on three different channels. How many other networks can you find and what are they called?

(b) Beacons and Probe Response frames are almost equal. However, there are a few differences. Name and describe the differences. Hand in the parts of your traces that show the important packets and point to them.

(c) When is the Tag **Extended supported rates** used by management frames? Is the Extended supported rates Information Element actively used?

— Turn the page —

Question 3: (60 Points) *Active Measurement*

(a) You will now setup your own experiment for active measurement, measuring the throughput and RSS depending on different transmission rates and power levels.

- Transmission power: Will be set to two different values - 0 dBm and 11 dBm
- Transmission rate: Will be set to two different values - 6 Mbit/s and 54 Mbit/s.

Hence, there are four scenarios. The choice of a channel is up to you.

Important: The node with the monitor interface has to be the receiver!

Using `iperf`, generate UDP traffic with a packet size of 1024 bytes. Make sure that you slightly exceed the transmission rate in order to saturate the medium. For instance, if you set the physical rate 6 Mbit/s, set the `iperf` bandwidth to 7 Mbit/s.

For each scenario, perform 12 times a 30-seconds long run. Collect the output of the iperf sessions and a `tcpdump` trace for each run.

Hint: For the `tcpdump` trace, make sure you do the measurements with your monitor mode interface.

(b) For the four scenarios and the 12 runs per scenario plot an ECDF and the median along with confidence intervals for:

- The throughput using the `iperf` trace
- The received signal strength (RSS) from the `tcpdump` trace

What do you conclude? Why?

Submission

`https://isis.tu-berlin.de/course/view.php?id=8501`

Please submit a PDF document containing *a cover page* with your names and group ID, and *having your group number in its file name*.

The PDF should contain for all questions:

- A description of your approach. Which tools did you use? Where can we find the scripts?

- The plots produced by your scripts. Please number them and reference them in the text, so we know which plot belongs to which question - If we don't understand what you submit, we cannot grade it.

- A description of what you observed from the plots. Are there outliers? Is there any notable phenomenon?

- If applicable: What were your expectations about the performance? Does the plot match with your expectations? If not, what could be the explanation?

Please also include your scripts in a format in which we could run them ourselves.

All code must be properly documented using inline comments in English.

Make an archive (.tar.gz, .zip) containing *a directory* with all of your files and *having your group number in its file name*. All files that belong to a specific question must have the question/subquestion in their filenames. Please try not to clutter your submission with temporary files.

Due Date: Wednesday, November 23th, 23:55.