TECHNISCHE UNIVERSITÄT BERLIN
Fakultät IV – Elektrotechnik und Informatik
Fachgebiet Internet Network Architectures

WirelessLab WS 2016/17
Homework 9: Transport over Wireless

There has been significant amount of work on wireless transport, ranging from improving TCP operation to new transport protocol proposals. In this homework, we will have a first look at TCP performance in different scenarios. You will conduct the experiments on real hardware.

Question 1: (25 Points) *Setup*

(a) You set up your own experiment using your assigned wireless nodes - two Alix boards running OpenWRT, located in our server room and reachable via SSH. For this, you should provide your ssh key to us. See the ISIS news forum for the assignment of your nodes. 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**. Install ssh and make sure it works! Our stepping stone is called `wirelesslab.inet.tu-berlin.de`.

(b) Install the necessary tools

(c) Setup your two nodes so that they can communicate with each other over their wireless interfaces, and reach the student host over the wired interface. Provide the network and wireless configuration files of one node. How do you check that the nodes can exchange traffic with each other?

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

Question 2: (75 Points) *TCP performance over a "reliable" wireless link*

(a) Setup your two nodes so that they can communicate with each other over their wireless interfaces, and reach the student host over the wired interface. Furthermore, setup an additional monitor interface on the node that should act as the receiver.

Set these parameters on the two communicating wireless interfaces to the following: (Note: have a look at the tool `iw` and the `/sys/kernel/debug/ieee80211/` kernel options)

- Transmission power: 1 dBm
- Transmission rate: three different values - 6 Mbps, 24 Mbps, and 54 Mbps.
- Make use of the 802.11g card.
- Disable ANI.
- Set Noise Immunity level to 0 (noise-low).
- Enable OFDM Weak Signal Detection.
- RX and TX antenna = 2
- Disable diversity as follows:
  `echo 'fixed-b' > /sys/kernel/debug/ieee80211/phy0/ath5k/antenna`

(b) For each transmission rate, set up the following experiments using *iperf*. Make sure to spread your runs across different times of the day to account for any time of day effects (note down the times in your report).

- Send UDP traffic from the sender to the receiver. Do this 20 times for a 60-seconds long run. Make sure that you slightly exceed the transmission rate in order to saturate the medium.
- Send TCP traffic from the sender to the receiver. Do this 20 times for a 60-seconds long run.

Collect the output of the iperf sessions and a tcpdump trace for each run. For the tcpdump trace, make sure you do the measurements with a monitor mode interface.

(c) Please plot the following:

- The median along with confidence intervals of the measured throughput of TCP and UDP. Show the results for different transmission rates together in a single graph. Explain the results.
- For one of the TCP (and UDP) experiments per transmission rate, show the sequence numbers (in Bytes) versus time. Show the results for TCP and UDP together in a single graph. Explain the results.

Reading
H. Balakrishnan, et al. A comparison of mechanisms for improving TCP performance over wireless links, ACM Sigcomm 1996.

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

- For all questions: write a report with the plots and their discusson (i.e. the answers to the discussion questions). You can prepare your document using latex. Preferred format is a PDF document.
- For all questions: all the commands and scripts. 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 (scripts, traces etc.) and having your group number in its file name. Delete all files that you don't want to have graded before you finalize your submission. Please also upload a README file, if you think you need some extra documentation (if we don't understand what you submit, we cannot grade it).

Due Date: Wednesday, January 18th, 23:55.