

04830241 – Computer Network Practicum

Cross layer analysis over LTE and WLAN networks

LAB 1 – Part I

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Goal

- What will you need to do in this lab?
 - Learn to use free network protocol analyzer *Wireshark*.
 - Learn to use Chrome *Devtools* to analyze end-to-end latency.
 - Analyze the cooperation and interaction among different layers.
 - Analyze web browsing latency breakdown over Wi-Fi networks.
- What will you learn from this lab?
 - Learn to use common tools to capture and analyze network traces.
 - Learn the metrics used to analyze performance for different layers.
 - Understand the application latency caused by different layers.
 - Understand the interactions among different layers.

Lab Overview

- **Part I (3 pt) – A Closer Look into 802.11 wireless network protocol**
 - Investigate the 802.11 wireless network protocol
 - Answer the questions using a provided trace
- **Part II (3 pt) – Radio Layer and TCP Layer Analysis**
 - Look into the interactions between TCP layer and radio layer
 - Observe how TCP behaves when radio link loss happens
- **Part III (3 pt) – Cross-layer Web Access Latency Analysis**
 - Using Chrome Devtools and Wireshark
 - Analyze latency caused by each steps
 - Optional: collect your own data

Submission

- Due: **Monday Oct 21, 2019 (23:59:59 PM)**
- Submit the zipped file named “LAB1_Name_ID” to jing.wang@pku.edu.cn
 - All the source codes.
 - A report of your lab (pdf or word format).
 - A readme that describe how to run your codes and the output files
 - Optional: data logs collected by you and how you collected them and also add the results required into the report.
- Grading points:
 - Report quality is more important than length
 - You are encouraged to collect your own dataset and do runtime analysis
 - Please contact us if you have any thoughts beyond the material in this document

Part I – A Closer Look into 802.11 wireless network protocol

- Data:
 - Provided trace *Wireshark_802_11.pcap*
- Tool: Wireshark
 - A free and open source packet analyzer
 - Used for analysis pcap data
 - <https://www.wireshark.org/>
 - Install the tool on your own desktops and use it to analyze the trace
- Analysis guide
 - Learn to use Wireshark and get familiar with the tool
 - See the detailed guidance and answer the questions in LAB1–Part1.pdf
 - Beacon Frames, Data Transfer, Association/Disassociation, Other Frame types

Part II – Radio Layer and TCP Layer Analysis

- **Data: Provided trace collected by co-located devices**
 - Using Iperf (<https://iperf.fr>) to run a TCP connection
 - Above-IP network data *iperf_tcp.pcap*
 - L1/L2 network data *iperf_wlan.pcap*
- **Tool: Wireshark**
 - Tips: Wireshark can also export packet dissections as CSV/Json/xml formats
- **Analysis guide**
 - Compare the 3 way TCP handshake duration observed by different layers
 - Analyze the impact of path loss
 - Calculate retransmission rate and RTT observed from different layers
 - Plot the time series graph for both layers and analyze the interactions

Part III - Web Latency Analysis

- **Data:**

- 10 websites selected from Alexa top-50 sites (<https://www.alexa.com/topsites>)
- Above-IP network data captured by tcpdump on a cell phone
- Application information (.har files) logged by Chrome Devtools

- **Analysis guide:**

- Implement a processing program to calculate the latency of DNS Lookup, Initial TCP Connection Establishment, Request Sending, TTFB, Content Downloading Time respectively
- Draw visual waterfall graphs to show the breakdown of web access latency
- You are encouraged to collect extra dataset by yourself and do runtime analysis
 - mobility (e.g. roaming)
 - capture the 80211 header (some devices may not support)
 - other applications (e.g. videos, instant messages)