EE/CprE/SE 492 BIWEEKLY STATUS REPORT 3

February 10, 2020 – February 23, 2020

Group number: 37

Project title: **Open-Source Prototyping of Advanced Wireless Systems for Smart Agriculture and Connected Rural Communities**

Client &/Advisor: Hongwei Zhang, Matthias Sander-Frigau

Team Members/Role: Zequn Wang – Meeting Scribe
Dylan Sharp – Meeting Facilitator
Jiawei Deng – Chief Engineer
Zhenwei Su – Report Manager
Shaohang Hu – Test Engineer
Yulin Song – Test Engineer

- **Bi-Weekly Summary**

We have been waiting to hear back from industry contacts regarding instructions on how to build their custom operating system due to challenge we faced with using such an old kernel and OS version. In the meantime, the main focus has been on better improving our pseudo code and understanding of the 80211-kernel driver implementation / source code. Besides, we are constructing a Pseudo Code for PRK Scheduling.

- **Past week accomplishments**
  - Jiawei Deng
    - Developing Pseudo Code for PRK Scheduling. Following the chart on the PRKS Algorithm paper (Fig. 2 Architecture of PRKS), I created different boxes of Pseudo Code for different functions, including Data Packet Transmission, Link Reliability Estimation, Signal Map Maintenance, PRK Model Adaptation, Protocol Signaling, and TDMA Scheduling (https://iastate.box.com/s/2nv62t7f1e1hhmxiejn50zn8p35gy1pu). Currently, the Pseudo Code for each section has clear purpose and functionality.
    - Explained my experience about PRK Scheduling Algorithm with our new member – Yulin Song, to help him understand our project.
  - Yulin Song
    - Take notes of all equations from the paper in a logic manner.
    - Check with Jiawei's pseudo code to add missing parts for each box of the PRK S algorithm.
  - Shaohang Hu
    - OpenWrt SDK are the toolchain for helping cross compilation. I wrote up helloworld files to cross compile for a customized OpenWrt package.

        - Had a refresh on PRKS paper and the Pseudo code by Jiawei.
        - Read the source code for the Linux Wi-Fi system. Read code on ieee80211.c cfg.c rx.c, looking for parameters that can be used on PRKS algorithm.
        - Set up remote access to my Linux device for me and team members.
    - Zhenwei Su
        - Find some blogs and articles about Linux wireless system, such the working flowchart and function features. Try to understand source code and the whole progress when the system is running.
        - Read the take notes about the source code in mac80211 and ath9k. Post some docs summarized key classes in these layers.
    - Zequn Wang
        - Working with Zhenwei Su to identify files and function needed, where do we put the code and how mac80211 send packets and received packets. What are the function that send broadcast. Read some kernel documentation about mac80211(https://wireless.wiki.kernel.org/_media/en/developers/documentation/mac80211.pdf) and (https://www.kernel.org/doc/html/latest/driver-api/80211/index.html).
        - Me and Su think we need to change that .ops function in the mac80211.c from what we understand the source code, but after the group meeting and advisor meeting, we decide to focus on the rx and tx function first.
    - Dylan Sharp
        - Read and took notes on the following kernel documentation for cfg80211 and mac80211 (https://www.kernel.org/doc/html/latest/driver-api/80211/index.html).
        - I found a potential lead on how we might obtain RSSI level during a packet reception, there is an ieee_rx_status struct that contains a signal member that defined the signal strength during the reception of a frame in dBm or dB.
        - Starting to Refresh myself with PRKS in order to assist in the review of our Pseudo Code.

- **Pending issues**
  - Still have not defined which functions we will need to edit. For sure within functions along the Rx and Tx paths but those need to be defined
  - Algorithm Understanding – As a team, the team is not well rounded on the algorithm still which impacts work being done when looking into where we need to implement this algorithm in the kernel. Due to miss-understanding, wrong functions where chosen to be edited.
  - Implement pseudo code into the kernel
  - Within Pseudo Code, we still need to develop TDMA Scheduling which is related to ONAMA (http://www.ece.iastate.edu/~hongwei/group/publications/ONAMA.pdf)
  - Waiting on response from industry sponsor regarding instructions on how to build their operating system and setup the build environment

- **Individual contributions**

NAME	Individual Contributions	Hours this bi-week	HOURS cumulative
Zequn Wang	1. Learn mac80211 source code and how to use it, and other knowledge relative to receive and sent packet. 2. Post some useful link about how mac80211 work, how to receive and sent packets and what kind of function will be used.	14	27
Dylan Sharp	1. Read up on cfg80211 and mac80211 source code implementation details 2. Discovered possible way to read RSSI value during packer reception 3. Started to refresh myself with PRKS	14	34
Shaohang Hu	1. Write Hello world files (.c .h and makefile) for OpenWrt SDK. Compile for a useable package for OpenWrt. 2. Review PRKS paper and Pseudo code. 3. Read more on cfg80211 and mac80211 source codes and find the related parameters for the PRKS algorithm. 4. Set up my Ubuntu machine as server to access remotely.	15	33
Zhenwei Su	1. Learn mac80211 and the driver ath9k 2. Post summaries some the classes in these layers	16	28
Jiawei Deng	1. Refresh key points of PRK Scheduling and share experience. 2. Develop a first version of Pseudo Code for PRK Scheduling. 3. After communication with Professor Hongwei, Improving Link Reliability Estimation part of the Pseudo Code.	16	35
Yulin Song	1. Take notes of PRKS. 2. Add missing parts of pseudo code	12	24

- **Comments and extended discussion**
  - Prof. Zhang showed us more material to help with the understanding of PRKS. There is an additional power point and TinyOS implementation on his publications page (https://www.ece.iastate.edu/~hongwei/group/publications-representatives.html)

- **Plans for the upcoming bi-week**

- As a team the main goal for will be making sure everyone has a good understanding of PRKS algorithm and a beta version of our pseudo code done. Along with that will attempt to tie in where we will be getting specific parameters from data structs or functions within the kernel.
- Shaohang Hu
    - Continue reading on source codes. Help Jiawei with the implementation of the PRKS algorithm.
    - Look more into ONAMA scheduling and the implementation.
- Zequn Wang
    - Continue to understand the mac80211 source code, decide what kind of change we need to do.
    - Working with Zhenwei, to define the functions that we need to add our code.
- Jiawei Deng
    - Keep improving Pseudo Code, cooperate with Dylan to finish TDMA (ONAMA) Scheduling part.
    - Developing parameter input of the code by referencing source code from Shaohang's work last week (https://git.ece.iastate.edu/sd/sdmay20-37/issues/14#note_36590).
- Dylan Sharp
    - Help with teams' main goal by focusing on learning and teaching the team about PRKS more. Along with that, help implement pseudo code.
    - Implement ONAMA pseudo code for scheduling.
- Yulin Song:
    - Read Prof. Zhang's TinyOS implementation.
    - Figure out steps to code our pseudo code into the kernel.
- Zhenwei Su:
    - Continue to understand the working flow path in kernel space, such as how to send or receive package and signal.
    - Define the functions that we need to add our code, with their features and why
    - Probably need to learn the Pseudo code to help understand what it requires in kernel layer