

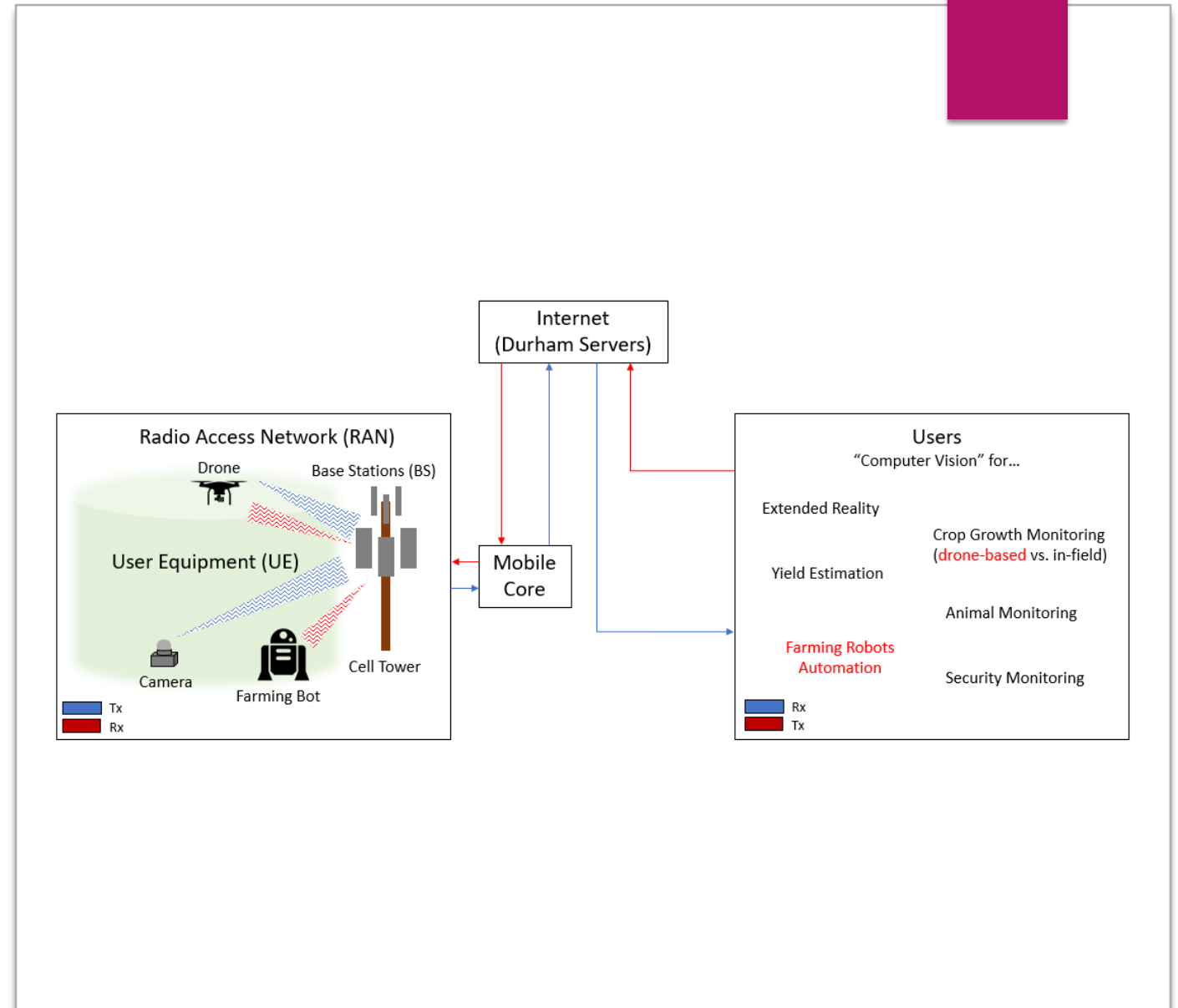
# Application Exploration of 5G-and-Beyond Wireless Systems and Rural Broadband TESTING TALK

# Introduction/Problem Statement

- 5G allows us to not only transfer large data efficiently, but at faster speeds. We are looking to make commercial farming more efficient through the capabilities enabled in 5G.
- Currently working w/ Dr. Hongwei and his ARA project
  - Wireless living lab, real-world wireless experimental infrastructure for smart and connected rural communities

# Unit Testing

- ▶ TX and RX
  - ▶ Throughput
  - ▶ Latency
  - ▶ Jitter
- ▶ UE to BS, BS to UE
- ▶ UE to UI
  - ▶ Process of accessing image remotely
- ▶ UI to UE
  - ▶ Process of executing automation commands
    - ▶ Drone, Farming Bot, Camera Angle



TX = Transmit  
RX = Receive  
UE = User Equipment  
BS = Base Station  
UI = User Interface

# Interface Testing

- ▶ Application for users to interface with video feed
  - ▶ Test usability with intended users
- ▶ Some potential applications w/ interface testing specifics:
  - ▶ Extended Reality or Security Monitoring
    - ▶ Latency between real-time events and user interface/video feed
  - ▶ Animal (Livestock, Poultry, Fish) Monitoring
    - ▶ Ensure accuracy of ML image recognition to actual # of animals present
  - ▶ Farming Robots Automation
    - ▶ Latency of called commands vs when it is executed
  - ▶ Yield Estimation
    - ▶ Compare to actual yield

# Integration Testing

- ▶ Four systems
  - ▶ User
  - ▶ UI
  - ▶ ARA wireless network
  - ▶ Analysis
    - ▶ Sensors + cameras

# System Testing

- ▶ Camera → UE → Network → Computer → Processing → Output
- ▶ We want to break this into chunks that would more easily help us identify where errors are occurring within our design.
- ▶ Want to be testing for video quality, latency, and correct analysis of video feed.
- ▶ Start by the overall process into two smaller groups
  - ▶ Camera → UE → Network → Computer
  - ▶ Computer → Processing → Output
- ▶ Once these two smaller groups are working correctly, we'd test the whole system together and iron out any kinks from there.

# Regression Testing

- ▶ Approval from clients and advisors
  - ▶ Avoid interference with current ARA projects
  - ▶ Operate lab equipment safely
- ▶ Documentation
  - ▶ Software- GitHub's tracked changes
  - ▶ Hardware- Create equipment protocols and risk assessment
- ▶ Team Communication
  - ▶ Check with team managers before running new tests and additions

# Acceptance Testing

- ▶ Functional
  - ▶ Video feed and live data analysis
  - ▶ Performance characterization
    - ▶ Throughput
    - ▶ Delay
    - ▶ Delay Jitter
    - ▶ Reliability
    - ▶ Quality of Experience
- ▶ Non-Functional
  - ▶ User testing and surveys
  - ▶ Ease of use