

**SDMAY24-20 - Mohamed Selim**

# PAWR Program

**Utilizing PAWR Program to Develop Advanced Hands-on  
Labs for Networking & Cybersecurity Courses**

**Midterm Peer Review**

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# Introduction

## The Challenge:

On August 1, 2023, GENI (Global Environment for Network Innovation), a virtual lab environment used for simulation of networking and systems for research and education, **shut down** its servers and began transitioning to FABRIC.

No current good replacement.

Iowa State has used GENI for networking classes in the past, such as CprE 431.

## The Solution:

The goal of this project is to research and analyze a variety of platforms that educators can use to replace GENI within their curriculum.

Our efforts are to be a **resource** for educators and students to look at and determine the best alternative or solution to finding a network infrastructure to create and simulate networking and cybersecurity courses.

Future or current professors from around the country would read our paper and sample our test lab experiments, and determine if it would make a good fit for their class.

# Overview

## **PAWR (Platform for Advanced Wireless Research)**

Is pivotal in facilitating experimental exploration within wireless technologies, encompassing novel wireless devices, communication methodologies, network infrastructures, system architectures, and service topologies.

The PAWR Project Office administers this ambitious public-private partnership that boasts \$100 million in investments. PAWR is financially supported and backed by the National Science Foundation (NSF), with 30+ wireless companies and associations actively participating in advancing the mission to expedite the progression of wireless technologies.

## **ARA (Agricultural and Rural Communities)**

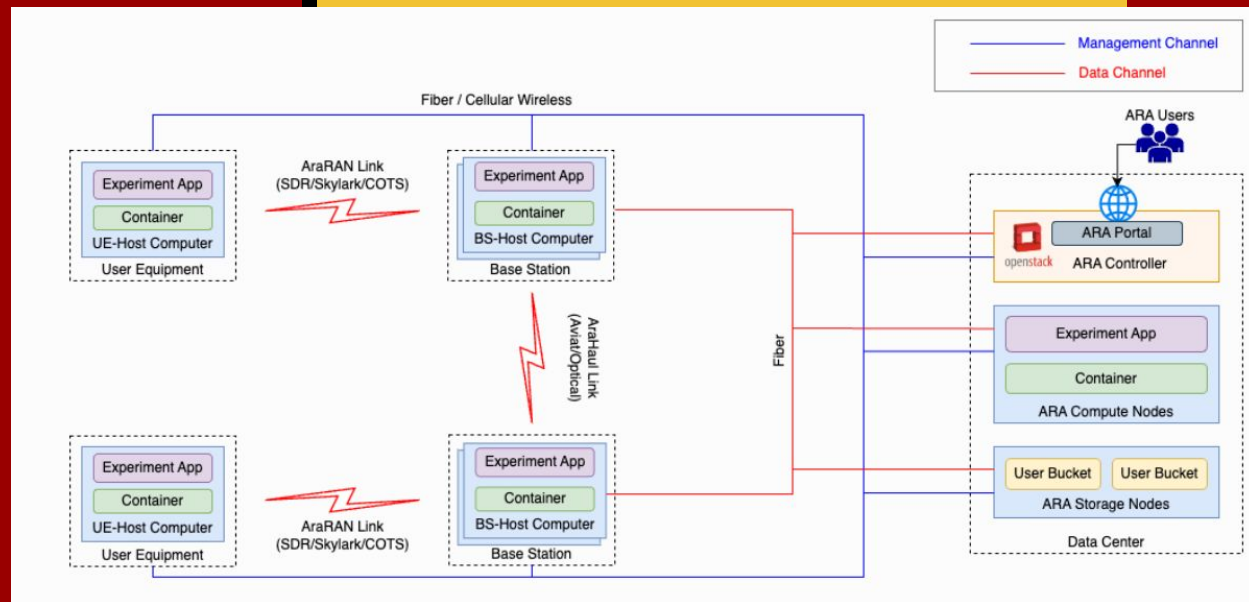
ARA is the next generation of a wireless living lab set to target farming and rural communities to aid in their mission of developing wireless technologies that are affordable, smart, and able to connect to agricultural and rural devices seamlessly.

Their wireless infrastructure spans the rural environment for exploiting the scope of applications within precision agriculture: robots, autonomous vehicles, cameras, sensors, and phenotyping.

# Detailed Design

## Design Details

- Docker container
- Ubuntu
- USRP b210
- 802.15 (4G)



# Demonstration

## Lab 00: Introductory Walkthrough: [Link](#)

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### ClassName ### Lab 00 - Lab Walkthrough

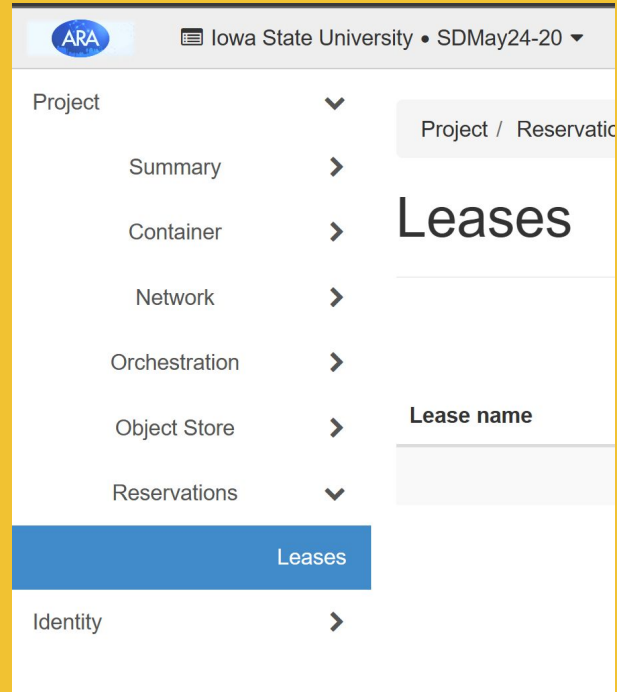
#### Getting started with Ara

##### What is ARA?

ARA is an at-scale platform for advanced wireless research deployed across the Iowa State University campus, the City of Ames, and surrounding farms and rural communities. The purpose is to serve as a wireless living lab for smart and connected Agricultural and ruRAL communities (ARA), enabling the development and research of rural-focused wireless technologies that are affordable and efficient.

ARA consists of a wide variety of wireless technologies and infrastructures that include low-UHF mMIMO, mmWave, sub-7GHz, microwave, satellite, and free space optical communication, offering bandwidth ranging from a few megabits per second to hundreds of gigabits per second.

##### Technical Requirements for ARA User Setup:



# Work Progress

## Spring, 2024 Milestones Achieved

### Complete Lab 00 & 01

- We have successfully completed Lab 00 and Lab 01 that we can begin pushing out to other classes and courses in efforts to gain traction and feedback.

### Website Updates

- Our personal website continues to be updated to be accurate and inline with our progress and efforts in achieving the goal.

### Future Lab Exploration

- We've met several times with several professors on gauging interest and specifics when designing future labs and experiments to be tested on the ARA Platform. We've contacted professors in and out of the university to spread our mark and research.



## Spring, 2024 Milestones to come

### Complete ~4 various functional Lab Experiments

- We are about 25% complete with this major milestone. The additional labs have been brainstormed and have begun production with supplemental resources close behind.

### Research Paper Production

- We are about 70% complete with this major task. The rough draft of the paper is completed, we just now continue to revise and make adjustments when necessary.

### Have Actual Lab Implementation

- We've contacted a few professors in relation to our introductory lab sets, and await implementation from them. While this is a restraint, we have also outsourced from various universities in efforts to achieve this. We are about 60% complete and confident in getting this completed by the end of the semester.

# Challenges / Solutions

## Challenges

One of our major challenges stemmed from how new ARA is and how little documentation there is. We've been fortunate enough to be in great contact and good communication with the ARA team in order to find limitations and restrictions

Another challenge we face is the willingness and participation from professors in implementing our labs to gain participation and feedback. Professors have a specific curriculum and we want to be as universal and tangible as possible while meeting our own guidelines.

## Solutions

To attempt to overcome these obstacles, we continue to strive for communication and collaboration with the ARA Team. We want to find our limits and restrictions with the platform and tools.

To increase feedback and participation, we outsourced from other Universities and branched out our audience to gain traction and recognition.

Our challenges and solutions aren't hardware specific or focused, but rather a limitation on time, a scope of curriculum, and the newly developed ARA.

# Conclusion

## As we head into Spring Break,

We are confident and comfortable with the work we've achieved thus far. We were able to get running on two (2) ARA Lab Experiments related to Wireless Networks and have made contact with various professors on efforts to get them implemented in their classrooms for a testing phase.

Our work continues as we continue to develop more labs with specific focuses and continue to outsource from other Universities in efforts to bring ARA across the country.

As we develop these labs, we are given insight on our Research Paper with implementing PAWR and ARA platforms into an educational setting.

## As we return from Spring Break,

We will continue to develop and create intricate, motive focused, and specialized experiments regarding Cybersecurity and Wireless Networks to empower the next generation of students and educators.

We have the blueprints for completing 2-3 more related labs and experiments, and will just need to develop the material and Lab Documents.

We need to continue to revisit and improve on our Research Paper and submit that for review rather sooner than later. This will require time, efforts, and a strong understanding of the various PAWR platforms and how their contribution to education is instrumental.

We have a roadmap created for success and now just need time and effort to complete it before the end of the semester.



# PAWR Program

**Thank you!**

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