

1. Problem statement

- The problem we are addressing is wireless connectivity throughout Ames and the surrounding area. With 5G implemented, it allows for many low power user devices to be connected to the internet in a large area. 5G will provide fast, reliable internet connection for many different use cases.

2. Requirements and constraints

Requirements

- Deploy Agriculture and Rural (ARA) base station equipment.
- Deploy ARA user equipment throughout the city of Ames and ISU research and teaching farms.
- Perform measurements of network reliability and speeds.
- Experiment with 5G-and-beyond solutions

Constraints

- Resources are provided by the ARA research team such as wireless platforms and software defined radios.
- Many different wireless platforms for testing a wide spectrum of frequencies over large distances.
- Using the ARA SDR platforms to provide a network stack to the ARA research community.
 - i. Sub 7.2 GHz platforms from 470MHz to 806MHz
 - ii. mmWave platforms from 24.25-29.5 GHz with 500MHz real-time bandwidth

3. Engineering standards

- IEEE 802 5G standards will be referenced to conform code modifications to open-source software
- Use of industry-accepted hardware standards for software defined radios (SDRs) and antennas to achieve the listed network spec constraints above.
- IEEE 1914.1 standard for Fronthaul Transport Networks (FTNs) will be referenced when defining what type of user-station network is being set up.

4. Intended users and uses

Researchers

- To develop and test 5G and future network solutions in a live environment testbed.
- Enables the study of multi-modal, long distance, and high-throughput wireless backhaul communication and networking.
- Enables research of applications involving wireless networks, fiber networks, edge/cloud computing, AR/VR based ag education, and tele-operation of ag vehicles

Rural communities and farmers

- Use high speed and capacity networks for rural areas, focusing primarily on smart agriculture and industrial automation.

References

- <https://futurenetworks.ieee.org/tech-focus/june-2017/standards-for-5g-and-beyond>
- <https://arawireless.org/equipment/>
- <https://arawireless.org/deployment/>
- <https://arawireless.org/research/>