

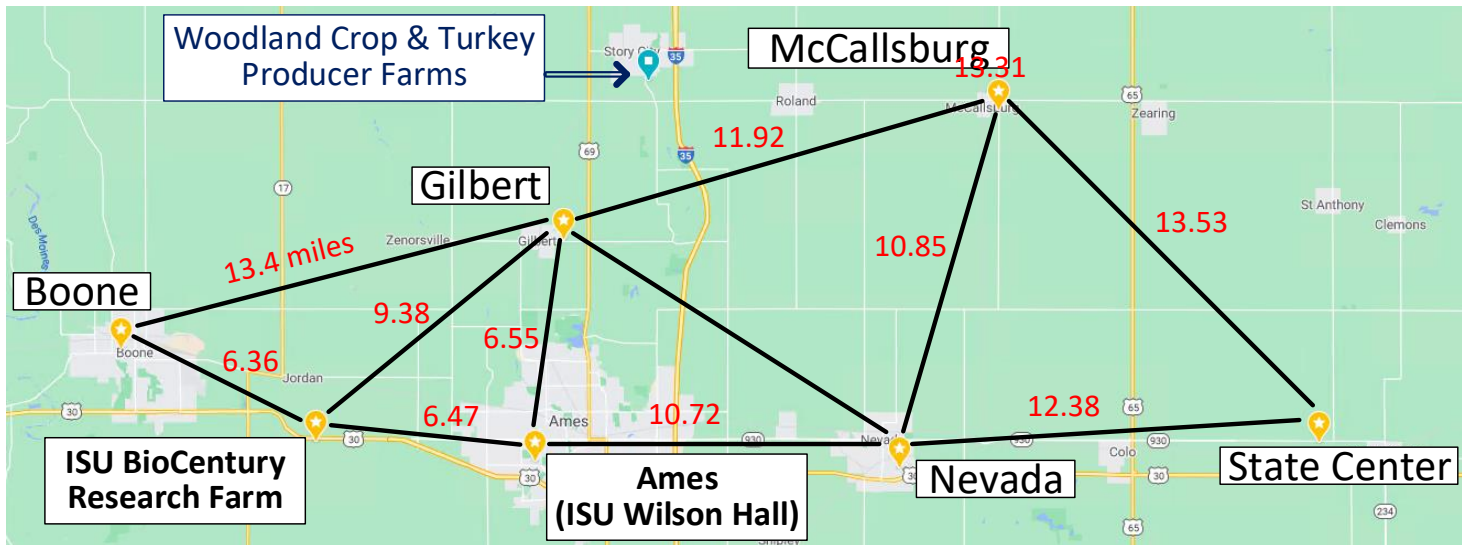


End-to-End Containerized OAI 5G-NR on ARA Wireless Living Lab

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ARA Deployment in Rural Settings



AraHaul sites each with 1+ AraRANs



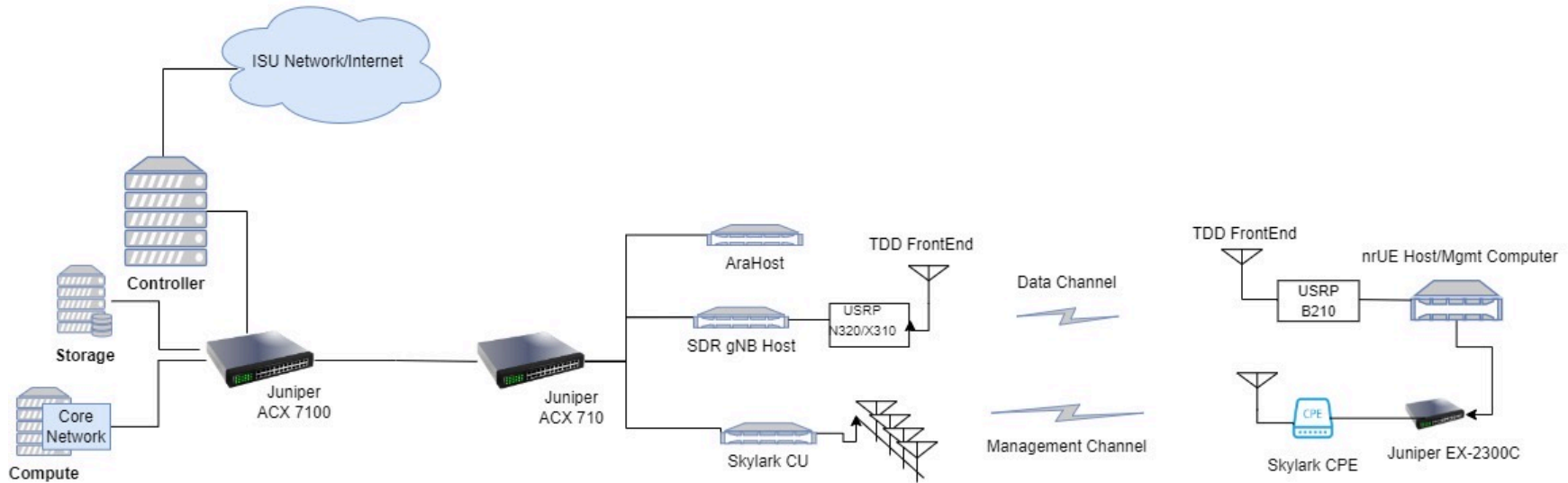
AraRANs around Ames

Long-Distance, High-Throughput Communications

AraHaul: multi-modal, long-distance, high-throughput systems		
Terrestrial Communications		
Optical (AraOptical)	160Gbps	15km+
mmWave (Aviat WTM 4800)	20Gbps	15km+
Microwave (Aviat WTM 4200)	2.5Gbps	20km+
Multi-band (Aviat WTM 4811)	2.5-20Gbps	15km+
Satellite Communications		
LEO Satellite Communications	100Mbps	Across planet
<ul style="list-style-type: none"> • Capabilities Enabled <ul style="list-style-type: none"> * Spatial, temporal, and spectral channel diversity for robust high-capacity * RaptorQ rateless coding for real-time bandwidth aggregation 		

AraRAN		
High-throughput COTS and SDR systems		
Low-UHF mMIMO (Skylark)	100Mbps+	10km+
mmWave (NI, InterDigital, Ericsson)	100Mbps+	150km+
sub-7GHz (NI, Ericsson)	50Mbps+	1km+
Edge computing systems		
<ul style="list-style-type: none"> • Capabilities Enabled <ul style="list-style-type: none"> * Bandwidth aggregation, channel aggregation & bonding * mMIMO * Waveforms beyond OFDM * Dynamic spectrum sharing 		

AraRAN Deployment Diagram



Data Center
Durham Center, ISU



Base Station
Wilson Hall, ISU

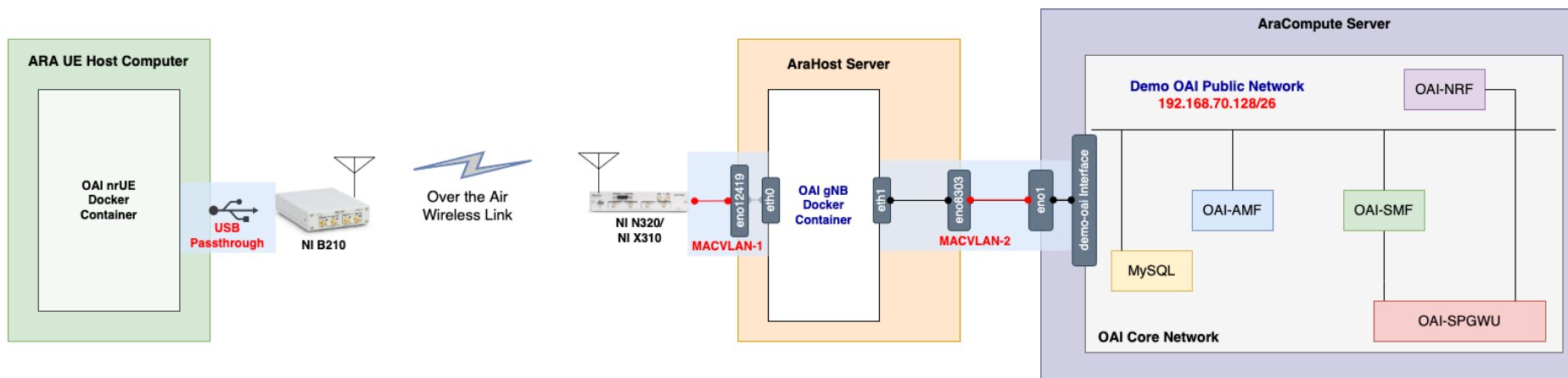


Portable UE
Southwest Recreational Park

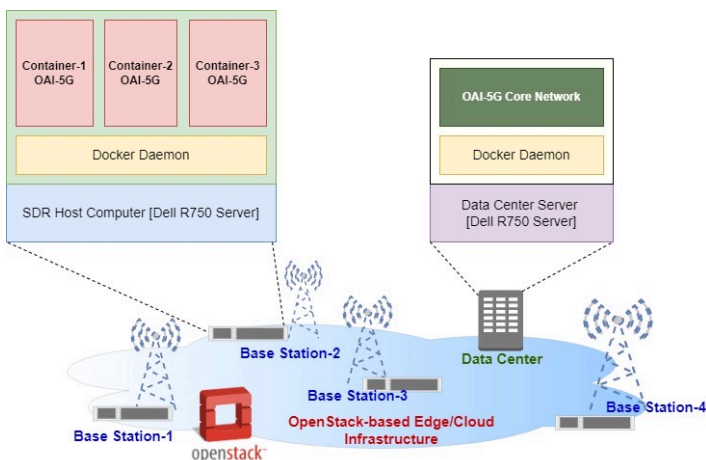
• AraRAN Phase-1 UEs

- Up to 20 NI B210 UEs (13 fixed + 7 mobile) near fixed base stations.
- Mobile UEs on CyRide buses, Ag vehicles, buses, and fire and safety vehicles.
- COTS 5G UEs used as both management and experimenter UEs.

Over the Air OAI 5G SA Setup on ARA Testbed



Hardware and Software Specification



Component	Hardware	Software
Controller	AraCompute Server: Dell EMC R750	OS: Ubuntu 20.04 LTS, Cloud OS: OpenStack Xena
Core Network	Host: Dell EMC R750	OS: Ubuntu 18.04 LTS oai-cn5g-fed v1.4.0
gNB	AraHost Server: Dell EMC R750 SDR: NI N320 / X310 Tower Mounted Booster: Max. Output Power 40dBm	OS: Ubuntu 18.04 LTS Docker v20.10.20 UHD Driver v4.0.0.0 OAI Branch: 2022.w26
nr-UE	Host: Supermicro E300-12D-8CN6P Superserver SDR: NI B210 UE Booster: 30 dBm	OS: Ubuntu 18.04 LTS Docker v20.10.20 UHD Driver v4.0.0.0 OAI Branch: 2022.w26