CoSeC-RAN Pilot Project Documentation

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Site Map (w/ Status)

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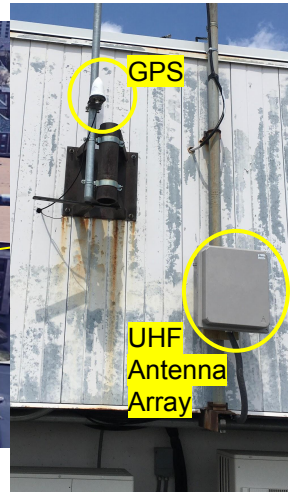
Site Investigation	100	100	100	100	100	0	100	100
Deployment Solution	100	100	100	90	100	0	100	100
Enclosure Design	100	100	100	80	100	0	–	–
Major Equipments	100	100	100	100	100	0	100	30
Materials & Supplies	100	100	100	90	100	0	100	20
Cable Conduit	100	100	100	0	100		–	–
Fiber and power Installation	100	100	100	0	100		90	–
Fiber Backbone Routing	80	100	60	80	60		50	20
Transceiver Installation	100	100	100	0	100		–	–
Antenna Installation	100	100	100	0	100		–	–
Connectivity Test	100	100	0	0	0		20	–
Site Test	80	0	0	0	0		10	–
Cyber Security	0	0	0	0	0		20	100
MISC	20	0	0	0	0		0	0

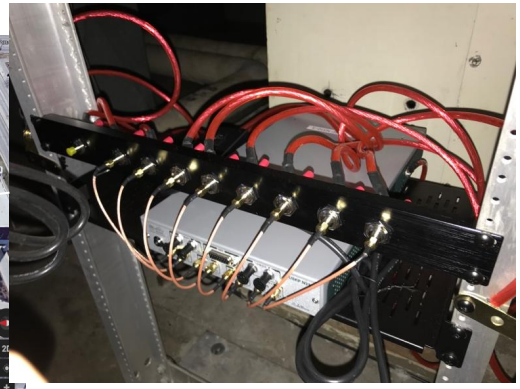
Site Map (w/ Issues)

- **Schorr as Data Center (Preparation)**
  - Switch arrived?
- **WSEC as Fronthaul Fiber Hub (Deploying)**
  - Switch, 4U server, FPGA board Deployed (Garhan)
  - Garhan setup temp connection, (permanent one on Friday?)
- Old Father Hall (Deployed)
  - Radio (2x10G SFP+), GPS & UHF Antennas Deployed, Working
  - UHF Antenna Array Replaced, GPS Antenna Installed
  - Fiber Backbone Re-route to WSEC Fiber Hub (sfp0, sfp1)
- Scott Engineering Center (SEC) (Deploying)
  - Materials Ready
  - Radio Antenna Head/Cable Conduit/RF Cable, done,
  - Fiber/Ethernet (media converter) installed
  - Need to fix connectivity to mgmt port, sfp0, sfp1
- Andersen Hall (Preparation)
  - Materials Ready
  - Fiber (9/28/2018), cabinet for radio (9/16/2018)
  - Antenna Head Installation
- Traffic Light (Preparation)
  - On site meeting (Aug. 16, 2pm)
  - Separated radio and antenna enclosures hanging on pole
  - Enclosures, Deployment Solution: Jerry, Warren, David Y.
- Food Innovation Center-NIC (Installation)
  - Site Investigation (Blake, Jerry, Zhongyuan)
  - Installation, Fiber & 6U Cabinet (Blake, Zhongyuan, Jerry)



OFH

1. Currently working with 1GbE fiber
2. Need replace antenna array
3. Need install GPS antenna
4. Need grounding USRP N310
5. Need upgrade to 10G SFP+
6. Fiber backbone re-route to WSEC
   - Sfp1 connected
   - Sfp0 not yet

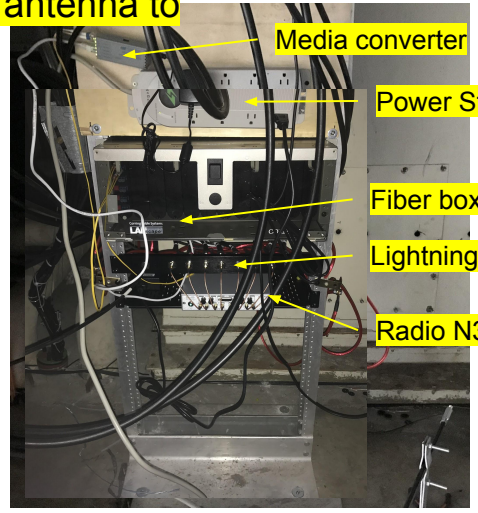


SEC

1. 25ft RF Cable (25ft) ready
2. New Cable Conduit (Blake)
3. USRP connected but mgmt port need route to mgmt switch
4. Antenna installation
5. Fiber backbone routing

Metal Material Around Antennas

mounted lower than this antenna to reduce interference



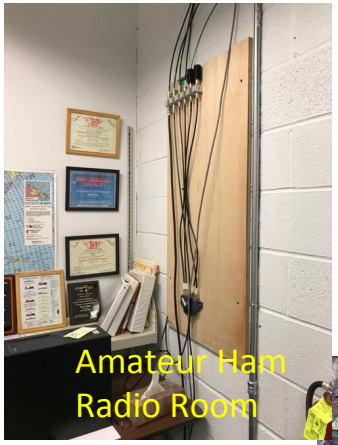
Media converter

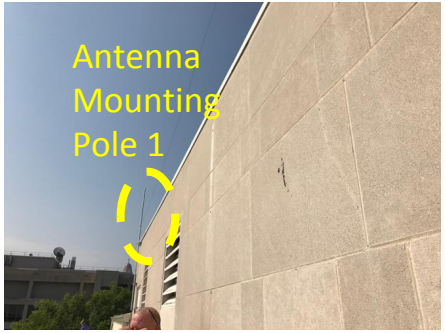
Power Strip

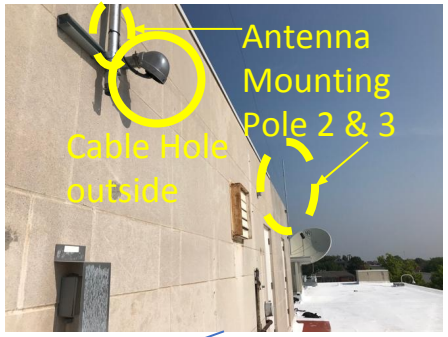
Fiber box

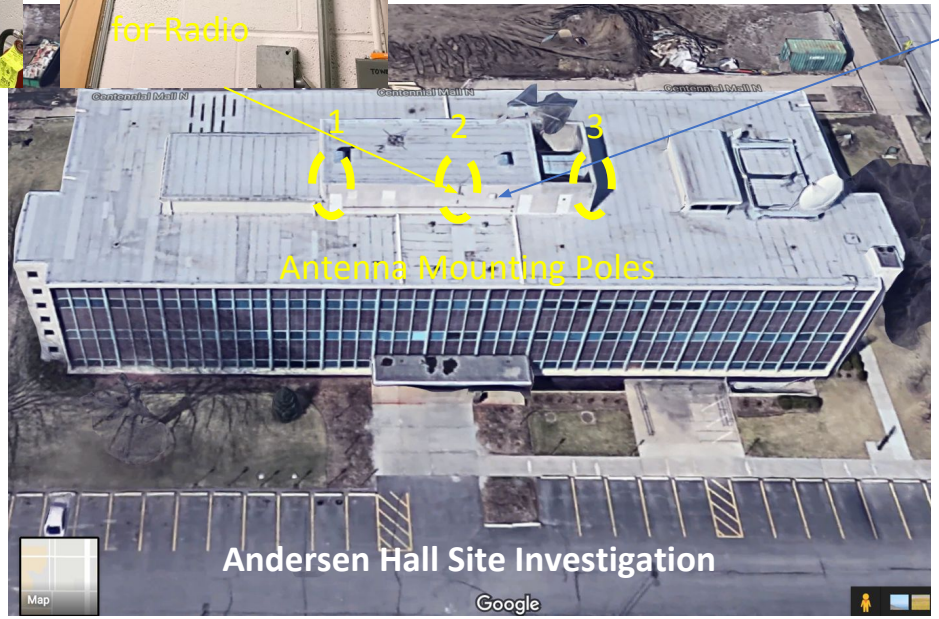
Lightning Arrestors

Radio N310 Transceiver







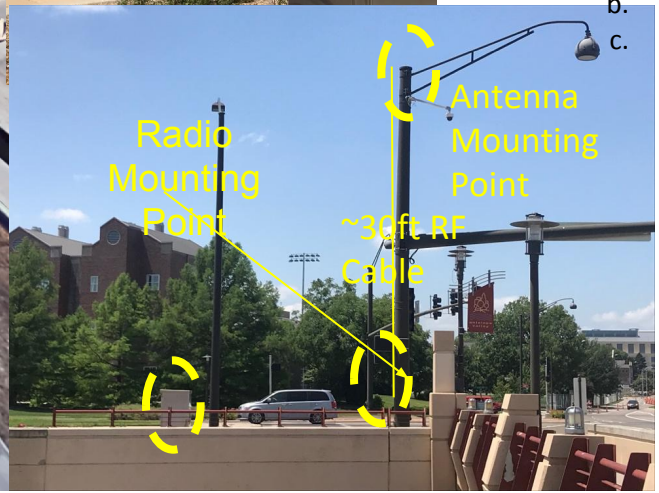


An 6U cabinet (ready) will be mounted outside this room, right above the door, Blake issued construction order

1. 2-inch cable conduit ordered (Blake)
2. Mounting of 6U cabinet ordered (Blake)
3. Transceiver Installation
4. Antenna Installation

Wireless Channel

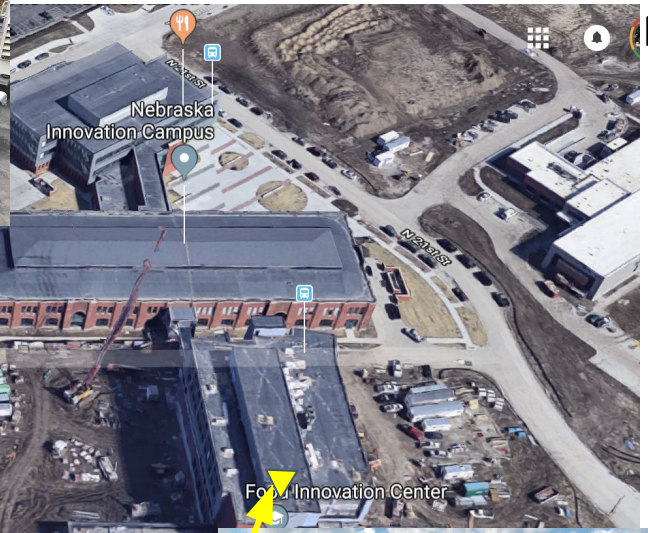
1. Line of Sight to Old Father Hall Site
2. Street Canyon channel to SEC site (17th street)



Traffic Light

Antelope Valley Pkwy & Vine St.

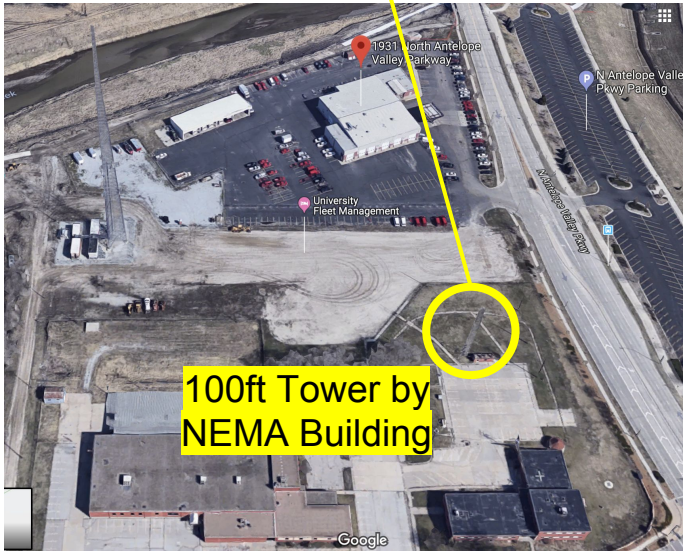
1. Radio NEMA enclosures
   a. Radio (Warren, Jerry)
   b. Switch (David)
2. Antennas Mounting
   a. UHF Antenna Array enclosure (Warren, Jerry)
   b. GPS Antenna (Ready)
3. Radio Enclosure Interface:
   a. 110V power,
   b. fiber, 3 pairs
   c. grounding



NIC-Food Innovation Center

- Site investigation
  - Indoor spot for radio 6U cabinet
  - Roof spot to install Antenna
- Material Preparation
  - Fiber, Copper (Blake)
  - Antennas, Cables, etc. (Zhongyuan)
- Installation
  - Ant Sled, Cabinet (Blake, Jerry)
  - Radio & Antennas (Zhongyuan)
  - Fiber Routing, Mgmt Port (ITS)

mmWave
Test Platform



NEMA Tower to FIC mmWave Link

- Option Offered by (Michael Ruhrdanz)
- Equipments
  - Moonblink Communications, Inc.
  - Fastbacks Network
- Fiber & Power?
- Next?

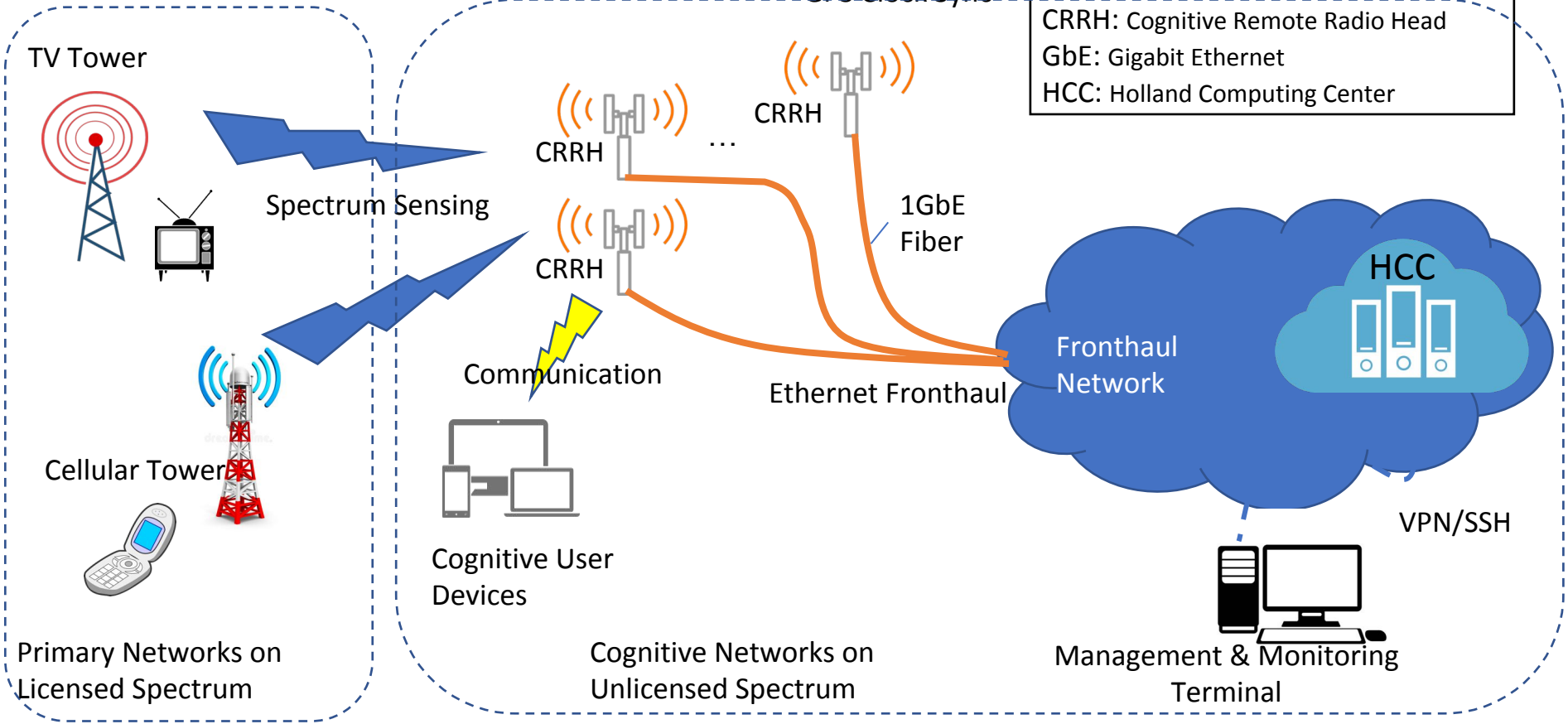
ToDo List

- ❑ Deploy sites on WSEC and Andersen Hall
- ❑ Weatherproof Enclosure for Radio, Antennas & Edge Switch
  - Updated Design & Requirements (Zhongyuan)
  - Separated radio and antenna enclosures, (David, Jerry, Warren)
  - Select edge switch with 10G/1G SFP, RJ45, POE (David Young)
- ❑ Traffic Light Site: Assemble Lower Enclosure (Warren, Jerry, David)
- ❑ Food Innovation Center site investigation (Blake)
  - RM 404

Design & Technical Solution

CoSeC-RAN Concept

C-RAN: Cloud Radio Access Network
CoSeC-RAN: Cognitive Secure C-RAN
CRRH: Cognitive Remote Radio Head
GbE: Gigabit Ethernet
HCC: Holland Computing Center



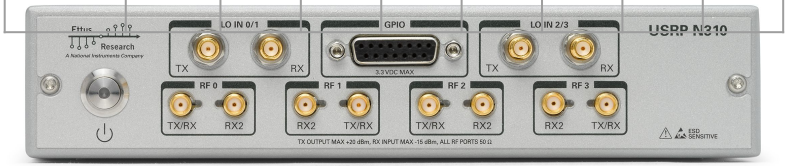
Cognitive Remote Radio Head

50Ω Low Loss RF Cable x 9

Active GPS Antenna, 26dB Gain, w/ Filter

Labeling

Antenna Array	1	2	3	4	5	6	7	8
USRP	RF0 RX2	RF1 RX2	RF2 RX2	RF3 RX2	RF0 TX/ RX	RF1 TX/ RX	RF2 TX/ RX	RF3 TX/ RX



Radio IQ Data Stream
2x SFP+ 10GbE (Dark fiber)
High Throughput, Low Latency

4 Tx, 4 Rx Ports

Front Panel

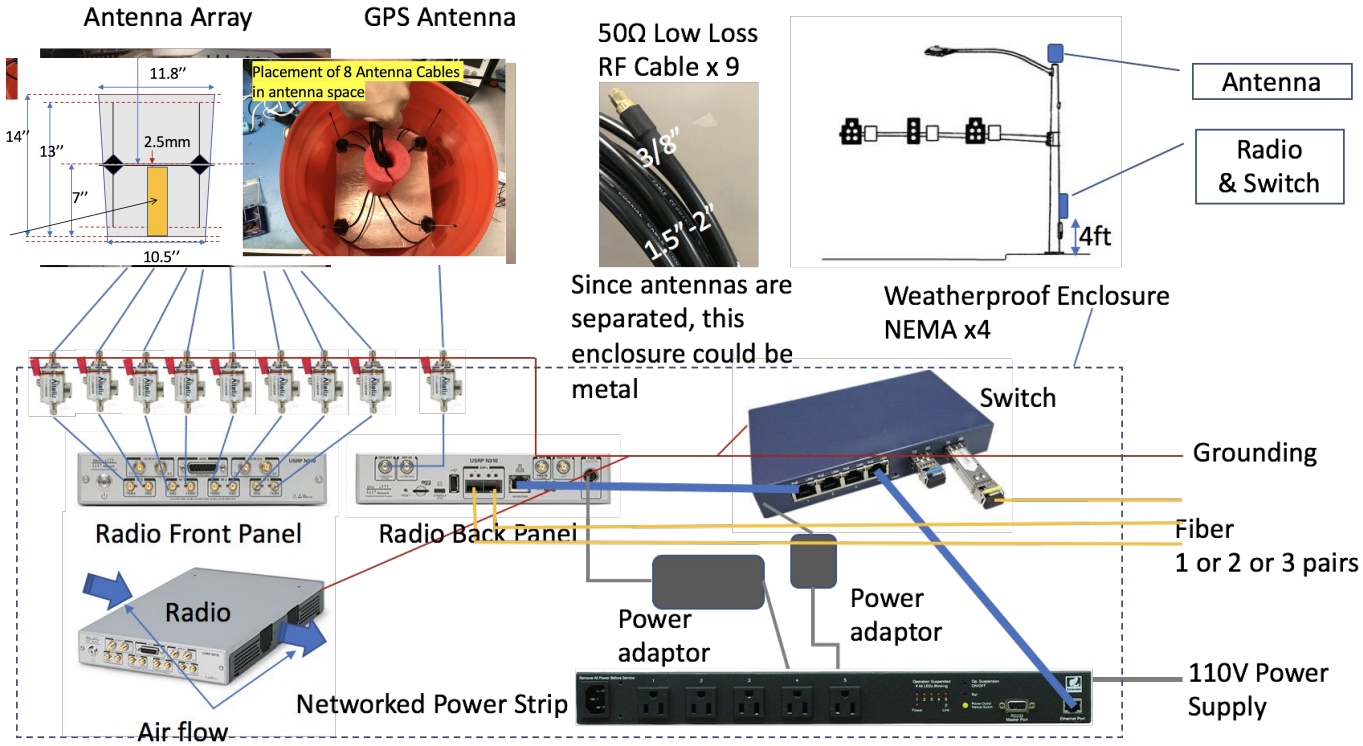
3.3V GPS Port

Power Supply

Back Panel

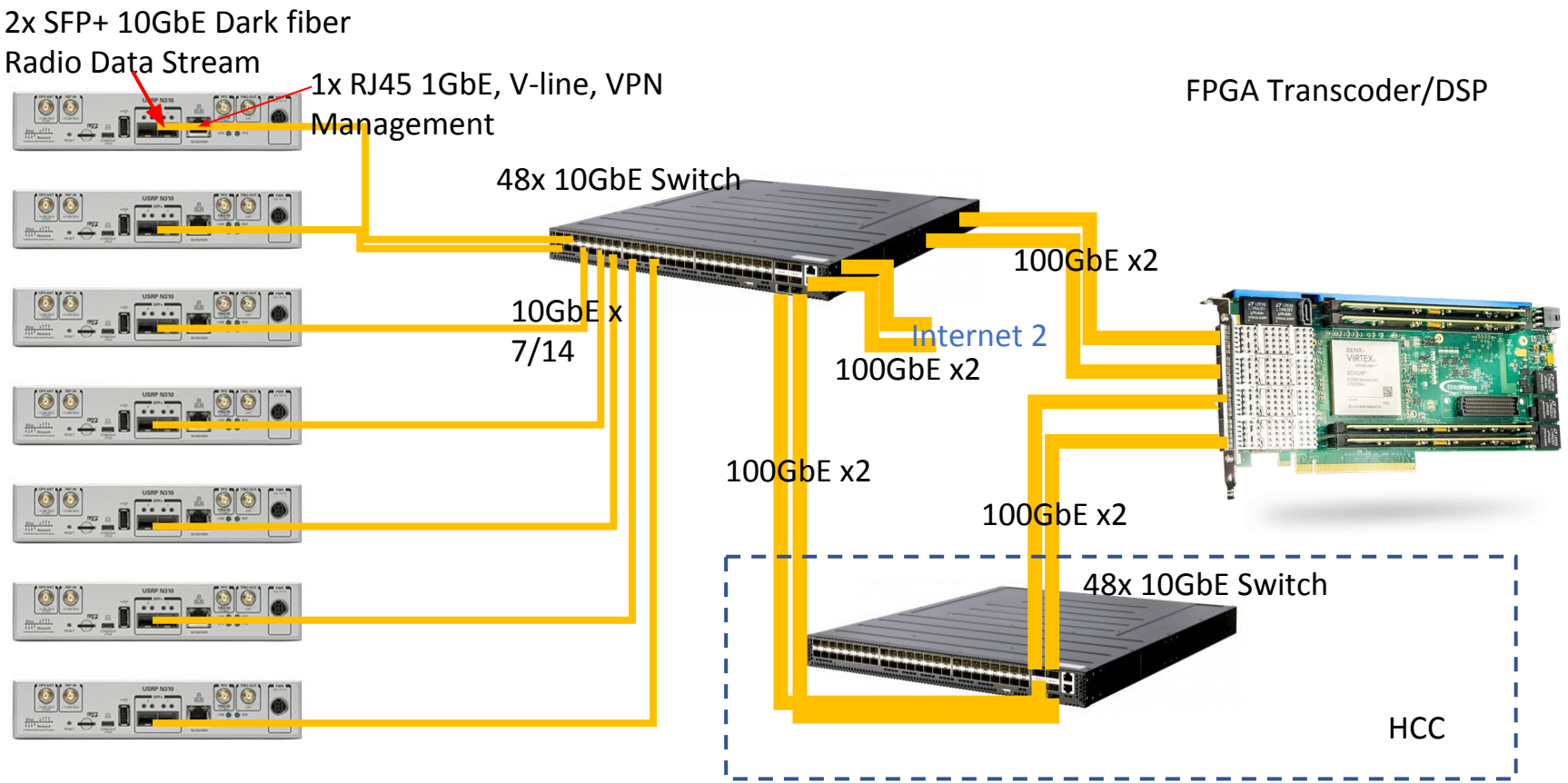
Device Management
1x RJ45 1GbE (V-line, VPN)
Low speed, High Security

Cognitive Remote Radio Head, Traffic Light



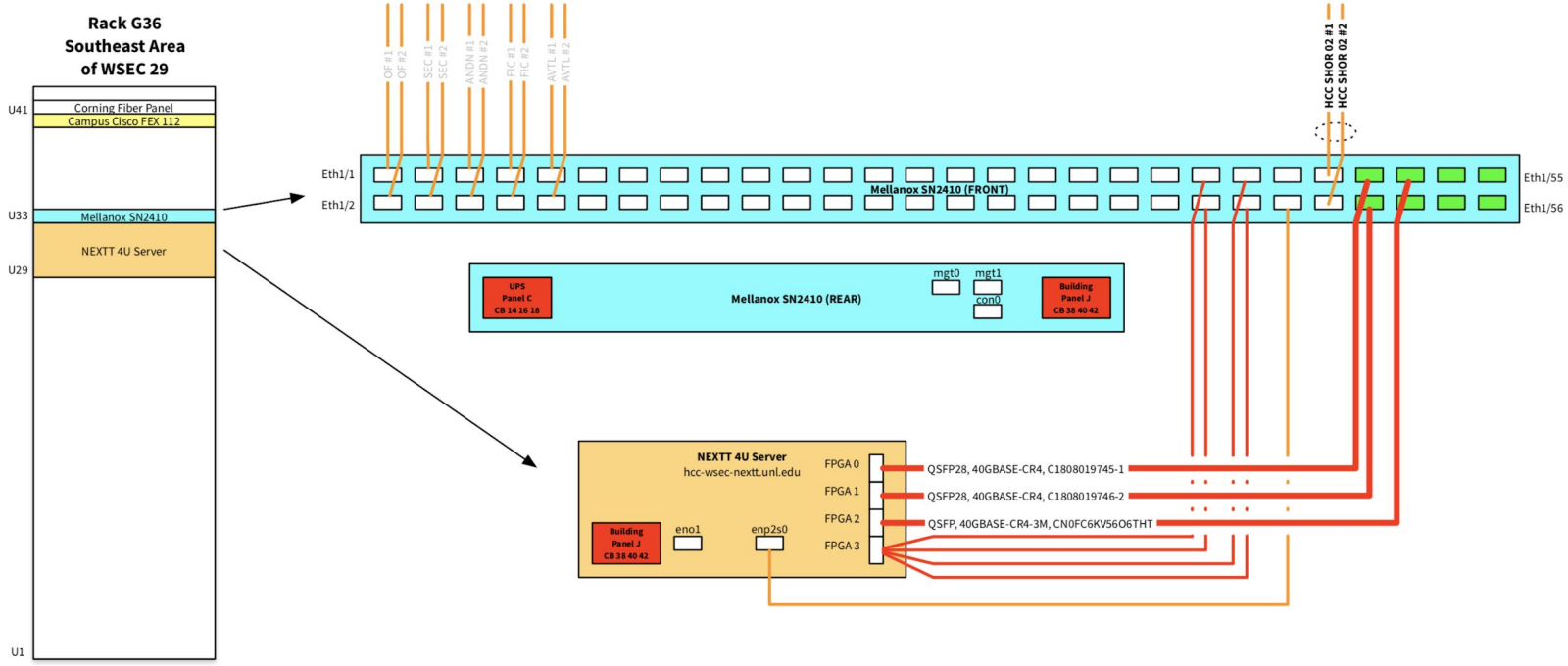
- David Young strongly suggests this solution for practical consideration
- Antennas mounted on top of the pole
  1. existing solution
  2. No drilling on the pole
  3. Antenna not blocked by metal
  4. 30ft RF cable
- Enclosure of Radio and switch mounted 4ft above the ground
  1. Easy for maintenance: e.g. access the radio when necessary, replace lightning arrestors, add or remove IoT devices.
  2. Larger enclosure and easy layout for easy/safe maintenance
  3. David has the switch and can provide an enclosure

Full Fronthaul Network Solution

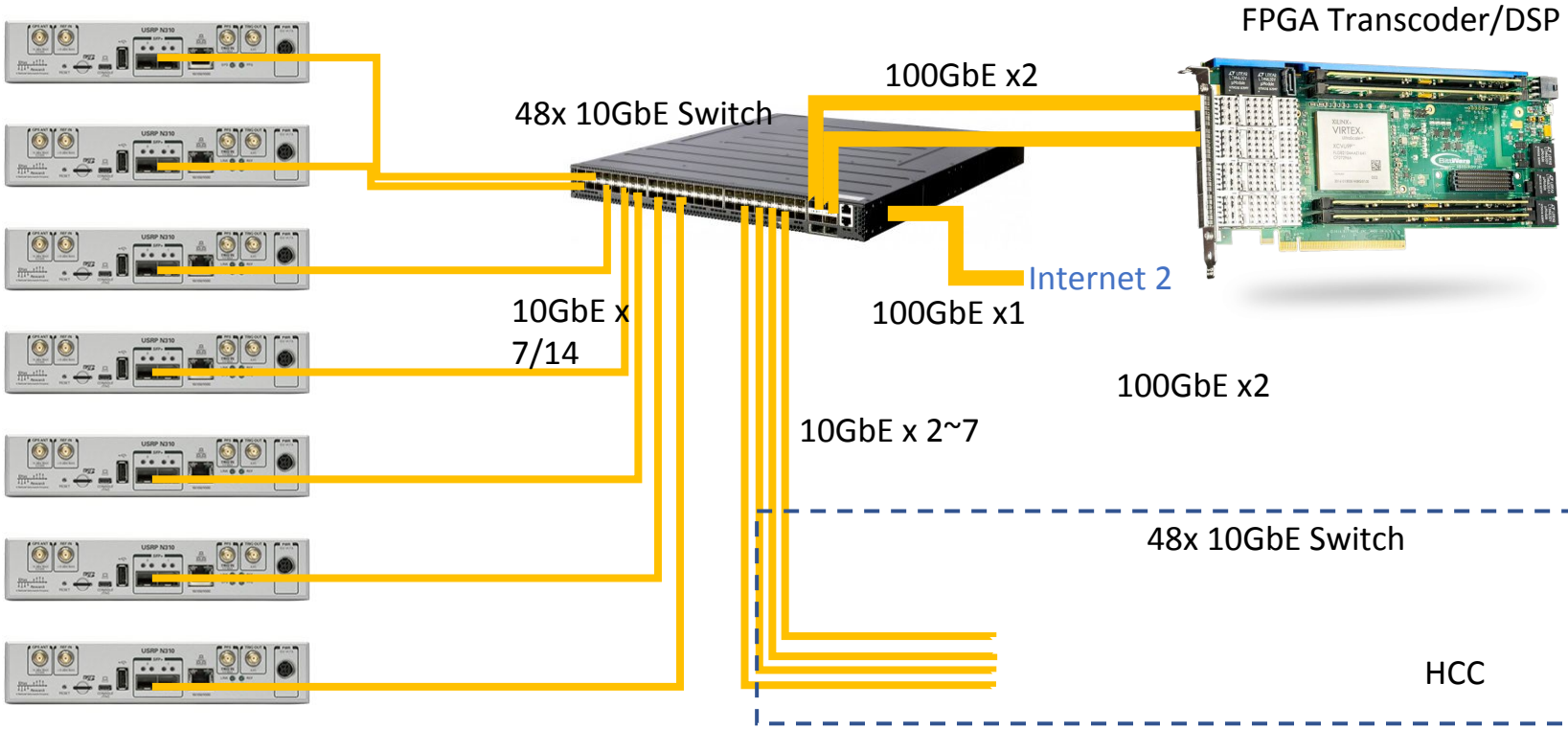


FPGA & Aggregation Switch Connection

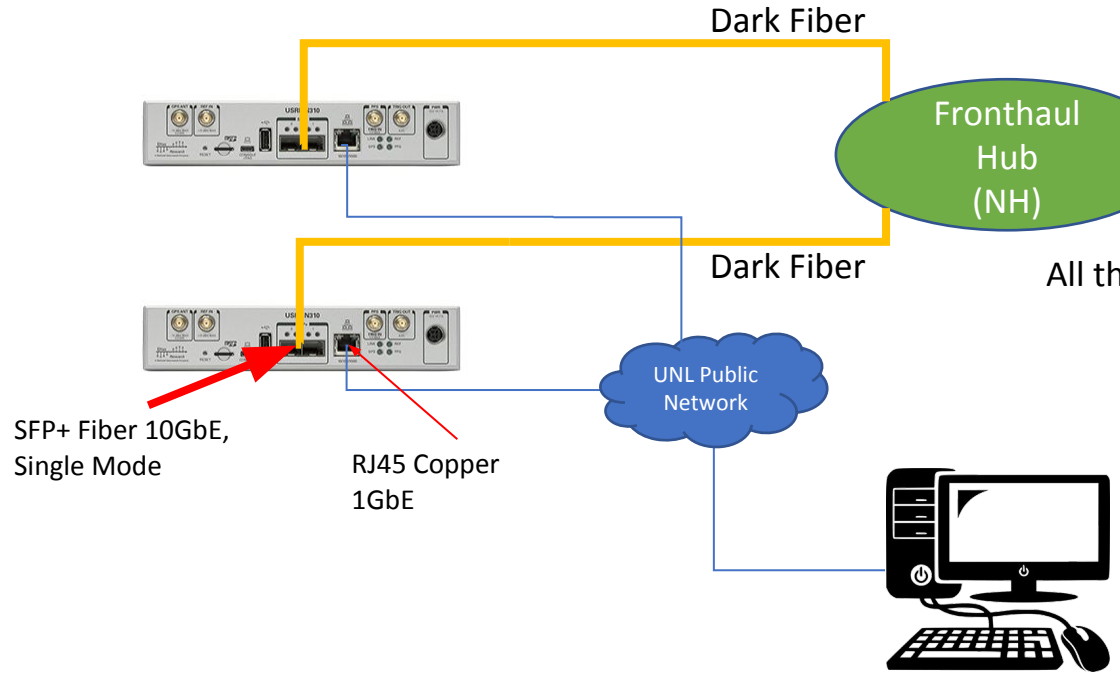
WSEC 29 Rack G36
NEXTT Project
Thu Sep 13 2018



Fast Track Fronthaul Network Solution



Radio Fronthaul v.s. Management Network



Each N310 will have 3 IP addresses:

1. 1x Management Port:
   - RJ45 Copper 1Gbps Ethernet (1GbE)
   - UNL Public Network IP
   - Requirement: Low Speed, High Security
   - Usage: Update Firmware, Set Device IP Address, Reboot
2. 2x Data Ports:
   - SFP+ 10GbE, Single Mode Fiber
   - Private IP Addresses Assigned by HCC
   - Requirement: High Throughput, Low Latency
   - Usage: Radio Operations

Questions & Discussion

- How many available fibers between Nebraska Hall and HCC @ Schorr? (>3 pairs)
- Length of fiber between Nebraska Hall and HCC? < 2km (6560 ft) (Yes, below 2km)
- Are there rack space & Server to host FPGA board at Nebraska Hall? (No, we purchased it)
- What needs to be done for connecting Internet 2
- Existing available fiber ports (10GbE) at Nebraska Hall? (No, we purchased the switch)
- Consider Move Nebraska Union Site to Andersen Hall Site (Decided move to Andersen Hall)
- Solutions for Traffic Light Site (Radio in Cabinet v.s. on Traffic Light Pole?) (Separated on Pole)
- Weatherproof Cabinet for SDR Radio to ease RF Cable routing (N310 is designed for indoor usage)

Reference Links

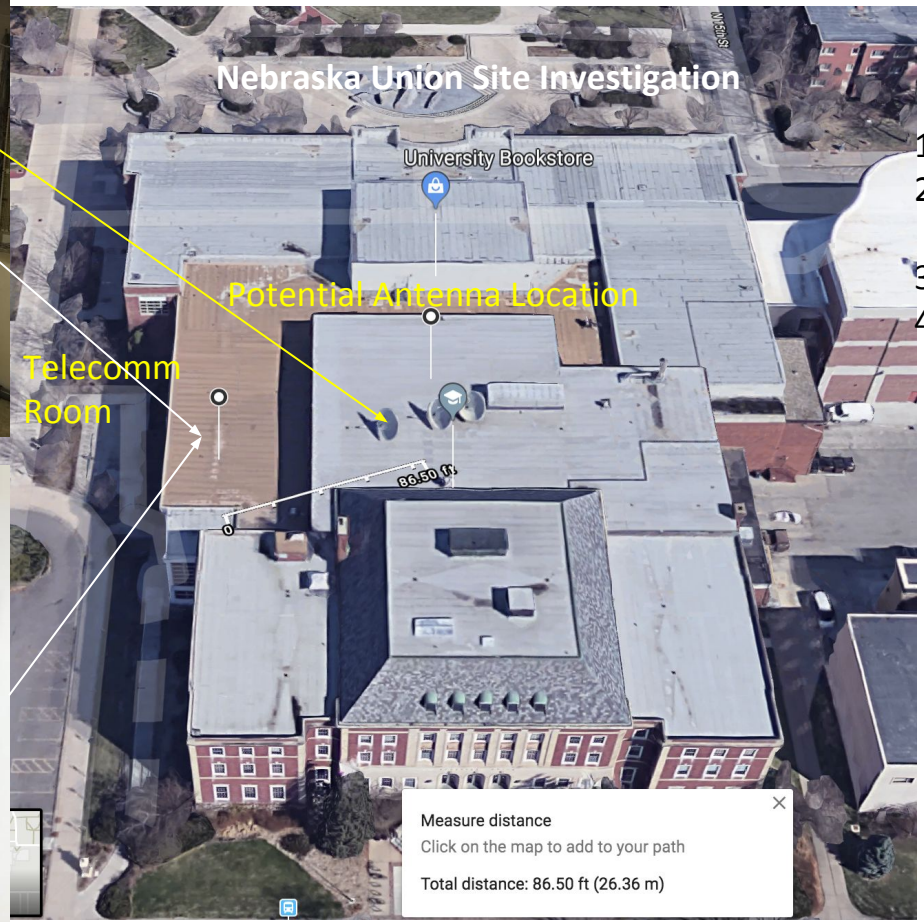
https://www.advancedwireless.org/salt-lake-city/

https://www.advancedwireless.org/platforms/

Recycled Slides (Completed Issue)

Link Budget

2 sites can talk to each other in TV band (400-700MHz) if maximum LOS distance < 1km and no other interference



Difficult to Route the RF Cable

1. need open the ceiling,
2. from 2nd floor to roof (4th floor),
3. Need Long RF Cable > 100ft,
4. high RF signal loss