Applications and network measurements for Software Defined Radio on CHI@Edge

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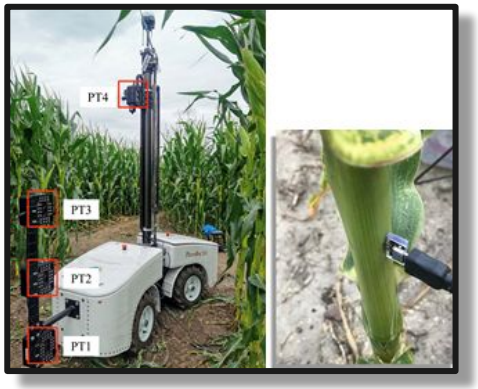
Agenda

- Example Applications at ARA
- Software defined Radio with CHI@Edge
- Experiment Workflow - Demo
- Why CHI@Edge

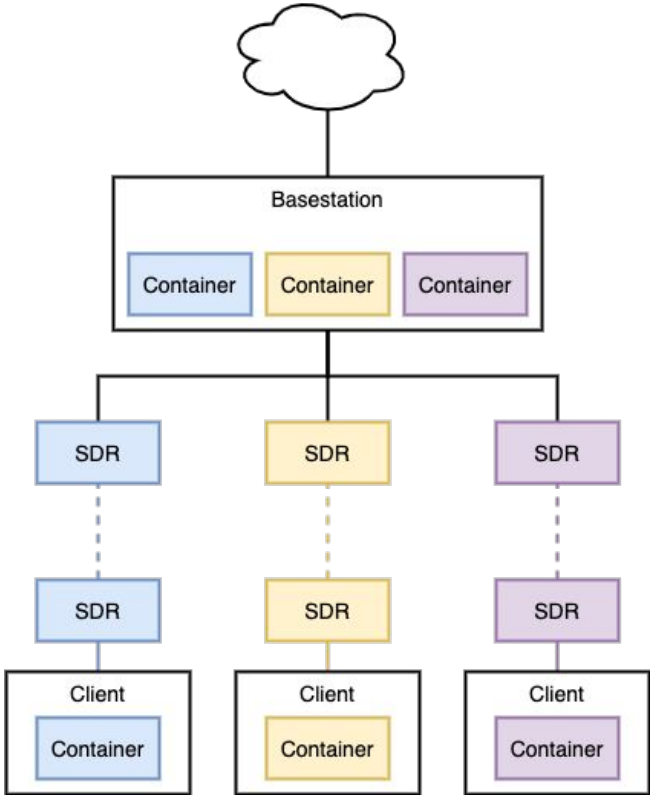
Example Applications

- Agriculture Robot with sensors
  - Real-time, high throughput phenotyping
  - high resolution imaging sensors
  - E.g. Phenonet
- Transportation
  - Automated vehicle control e.g. Golf cart, etc,
  - Control information over wireless link
  - Real time control
- Precision LiveStock Farming
  - Individual animal behaviour patterns - Animal welfare
- Rural Education
  - AR and VR applications
  - Connecting classrooms to the fields
  - Rural STEM education



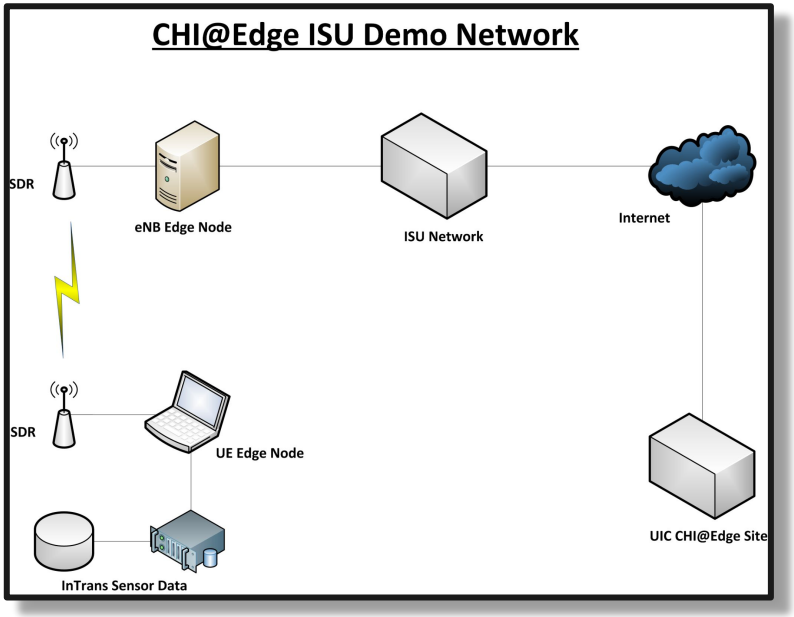
Example Applications (Cont.)

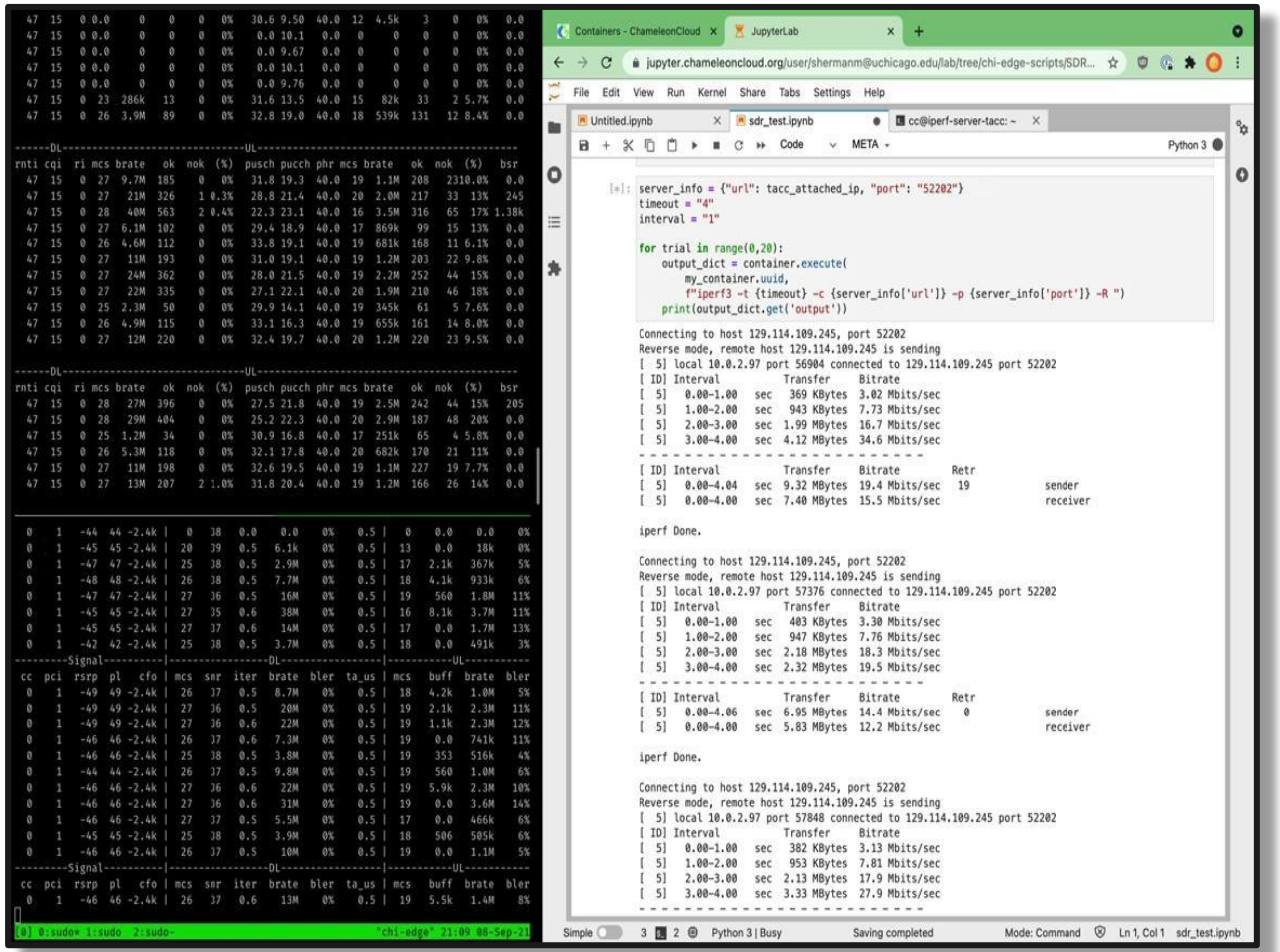
- Wireless Experiments
  - Channel sounding
  - Massive MIMO
  - mmWave
  - System studies
  - Spectrum Innovation
  - Other Wireless networks studies
- Orchestration and resource virtualization



Experiment Workflow (demo)

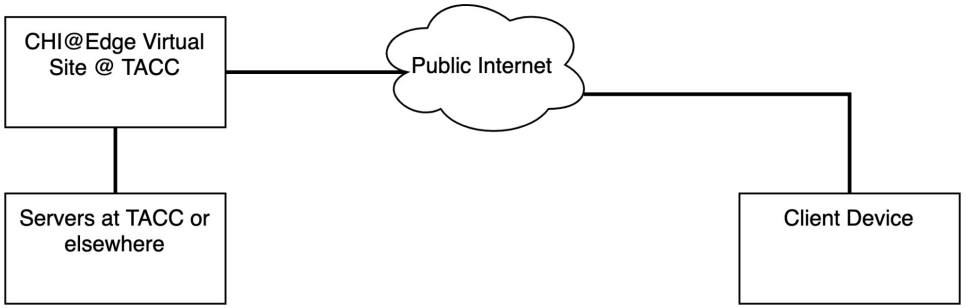
- User reserve eNB & UE Nodes
- User Launch containers
- Run protocol stack
- Results



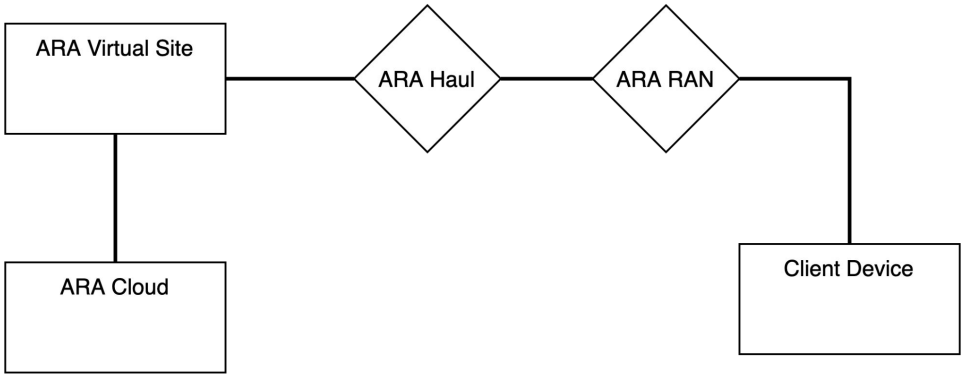

Containers - ChameleonCloud
JupyterLab
jupyter.chameleoncloud.org/user/shermanm@uchicago.edu/lab/tree/chi-edge-scripts/SDR...
File Edit View Run Kernel Share Tabs Settings Help
Untitled.ipynb
sdr_test.ipynb
cc@iperf-server-tacc: ~
Code
META
Python 3
server_info = {"url": tacc_attached_ip, "port": "52202"}
timeout = "4"
interval = "1"
for trial in range(0,20):
output_dict = container.execute(
my_container.uuid,
f"iperf3 -t {timeout} -c {server_info['url']} -p {server_info['port']} -R ")
print(output_dict.get('output'))
Connecting to host 129.114.109.245, port 52202
Reverse mode, remote host 129.114.109.245 is sending
[5] local 10.0.2.97 port 56904 connected to 129.114.109.245 port 52202
[ID] Interval Transfer Bitrate
[5] 0.00-1.00 sec 369 KBytes 3.02 Mbits/sec
[5] 1.00-2.00 sec 943 KBytes 7.73 Mbits/sec
[5] 2.00-3.00 sec 1.99 MBytes 16.7 Mbits/sec
[5] 3.00-4.00 sec 4.12 MBytes 34.6 Mbits/sec
[ID] Interval Transfer Bitrate Retr
[5] 0.00-4.04 sec 9.32 MBytes 19.4 Mbits/sec 19 sender
[5] 0.00-4.00 sec 7.40 MBytes 15.5 Mbits/sec receiver
iperf Done.
Connecting to host 129.114.109.245, port 52202
Reverse mode, remote host 129.114.109.245 is sending
[5] local 10.0.2.97 port 57376 connected to 129.114.109.245 port 52202
[ID] Interval Transfer Bitrate
[5] 0.00-1.00 sec 403 KBytes 3.30 Mbits/sec
[5] 1.00-2.00 sec 947 KBytes 7.76 Mbits/sec
[5] 2.00-3.00 sec 2.18 MBytes 18.3 Mbits/sec
[5] 3.00-4.00 sec 2.32 MBytes 19.5 Mbits/sec
[ID] Interval Transfer Bitrate Retr
[5] 0.00-4.06 sec 6.95 MBytes 14.4 Mbits/sec 0 sender
[5] 0.00-4.00 sec 5.83 MBytes 12.2 Mbits/sec receiver
iperf Done.
Connecting to host 129.114.109.245, port 52202
Reverse mode, remote host 129.114.109.245 is sending
[5] local 10.0.2.97 port 57848 connected to 129.114.109.245 port 52202
[ID] Interval Transfer Bitrate
[5] 0.00-1.00 sec 382 KBytes 3.13 Mbits/sec
[5] 1.00-2.00 sec 953 KBytes 7.81 Mbits/sec
[5] 2.00-3.00 sec 2.13 MBytes 17.9 Mbits/sec
[5] 3.00-4.00 sec 3.33 MBytes 27.9 Mbits/sec
Simple
Python 3 | Busy
Saving completed
Mode: Command
Ln 1, Col 1
sdr_test.ipynb
[0] 0:sudo* 1:sudo 2:sudo-
"chi-edge" 21:09 08-Sep-21

Network Measurements vs. Network Control

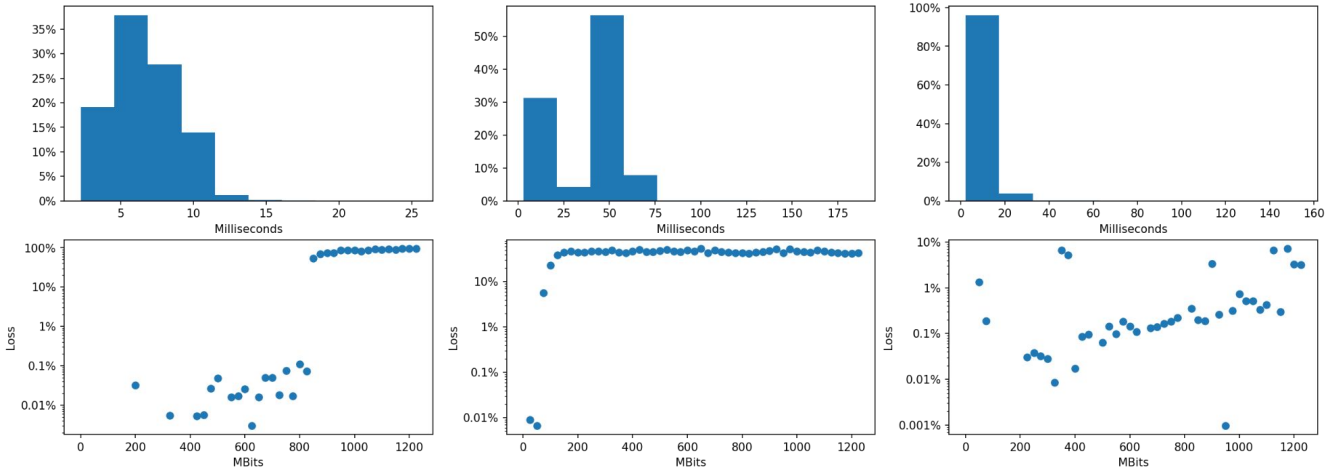
- Edge device to cloud
- Last mile problem
- Measure the connection properties

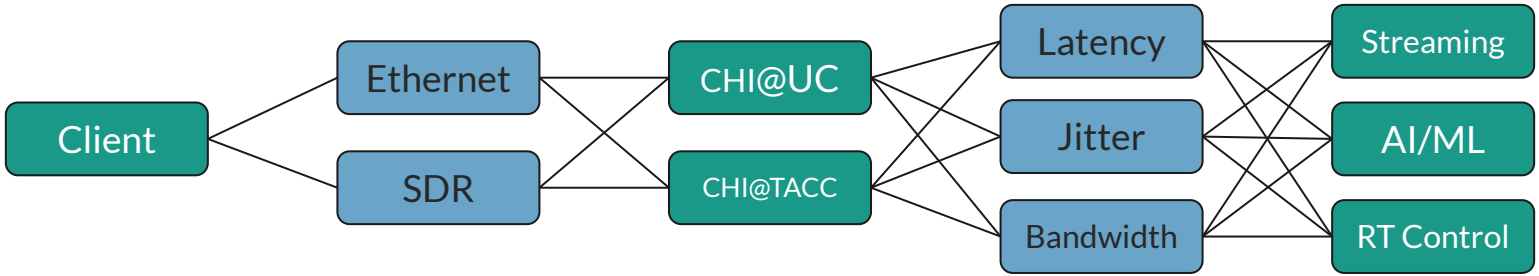


- Deployment at ARA will control the full path



Results From Current Deployment





Why CHI@Edge

- Infrastructure Virtualization
  - Parallel experiments
  - Parallel Computing Resource usage
- Minimize Latency - Real time applications
  - Edge (eNB computing resources)
  - Edge - cloud (near)
  - Edge - cloud (far)
- Parametrize Experiments
  - Frequency, Resource Blocks, Tx Power etc.

- Share premade images for srsRAN, OpenAirInterface, GNURadio
  - Base case should “just work”, default configuration
  - Reuse same container with different configuration files
  - Allow experimenters to get started quickly