Institute for the Wireless Internet of Things at Northeastern University

Platforms for Advanced Wireless Research

OAI 5G NR STANDALONE MODE DEMO OVER COLOSSEUM

Presenter:
Shweta Shrivastava
s.shrivastava@northeastern.edu

Team:
Abhimanyu Gosain
agosain@coe.neu.edu
Mario Joa-Ng
m.joa-ng@northeastern.edu

OpenAirX-Labs, Northeastern University

OpenAirX-Labs

- A lab ecosystem incubated within the Institute for Wireless Internet of Things @ Northeastern University
  - Part of the Platforms for Advanced Wireless Research (PAWR) program
  - Funded by NSF and the U.S. DOD OUSD (R&E)
  - Supported by OSA board as the official North American Designate Affiliate Development Partner
- North American home for development, testing and integration of OpenAirInterface 5G SA software stack.
- Provide a benchmark, end-to-end 5G Standalone reference architecture to promote innovation

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OAI 5G Activities @ OpenAirX-Labs

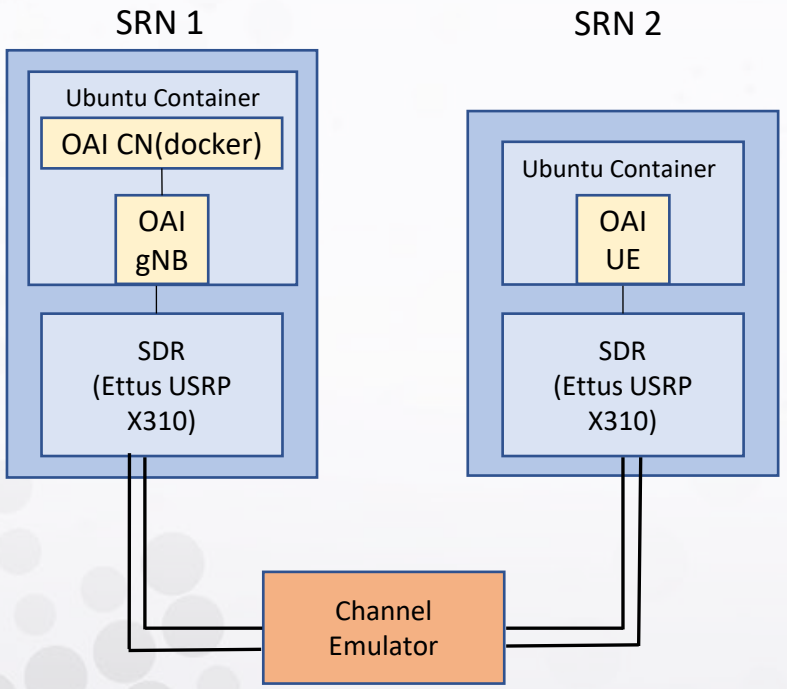
- Focus: Deliver robust and feature-rich OAI NR UE to enable E2E SA deployment over SDR-based testbeds
- Development Activities
  - Extraction and processing of UL DCI formats 0_0 and 0_1
  - Enable dynamic scheduling on UL and multiple UL allocations within a frame
  - Scheduling Request/Buffer Status Report
- Stability/Performance Improvements
  - Resolved several errors and failures at NR UE
  - Resolved issues to enable multiple UE support
  - Improved throughput from 500kbps DL/10kbps UL to 8Mbps DL/3.5 Mbps UL
- Set up a CI/CD system at NU to provide additional support to Eurecom for OAI testing

Test Platforms

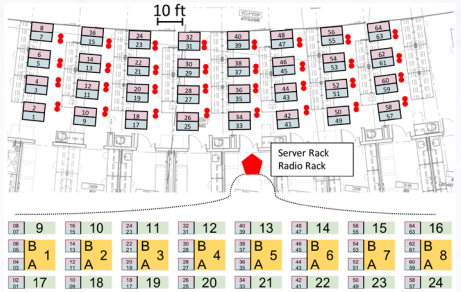
Colosseum

COLOSSEUM at Northeastern University

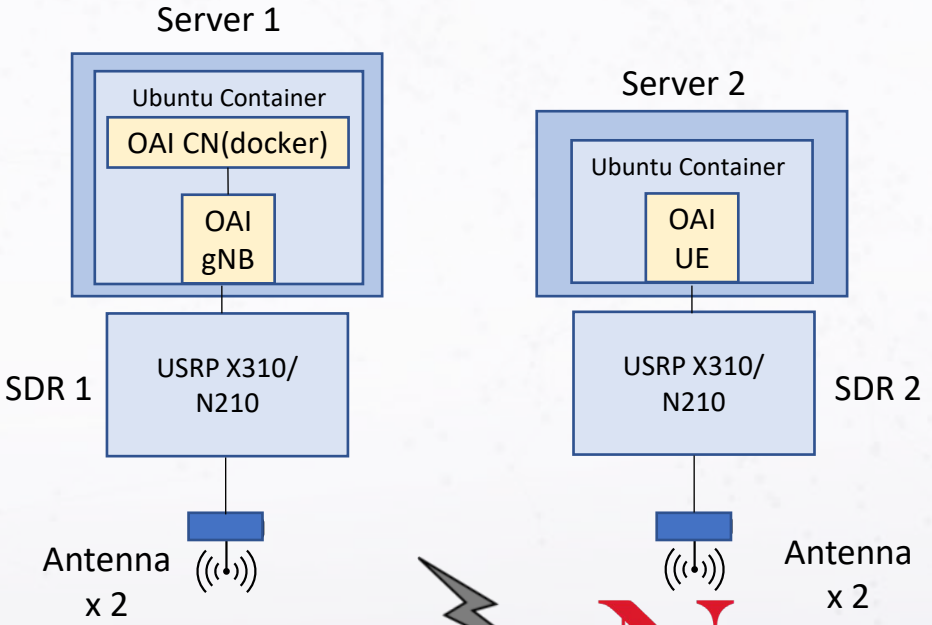
Colosseum testbed
- Large-scale wireless emulator
- 128 computational nodes
  - Intel Xeon E5-2600 CPUs
- 128 USRP X310 SDRs
- Massive channel emulator
- Octoclocks



Arena



Arena testbed
- Open access wireless testing platform
- 12 computational servers
  - Intel Xeon E2186G CPUs
- 24 SDRs (16 USRP N210 + 8 USRP X310)
- 64 antenna grid.
- 4 NI OctoClocks



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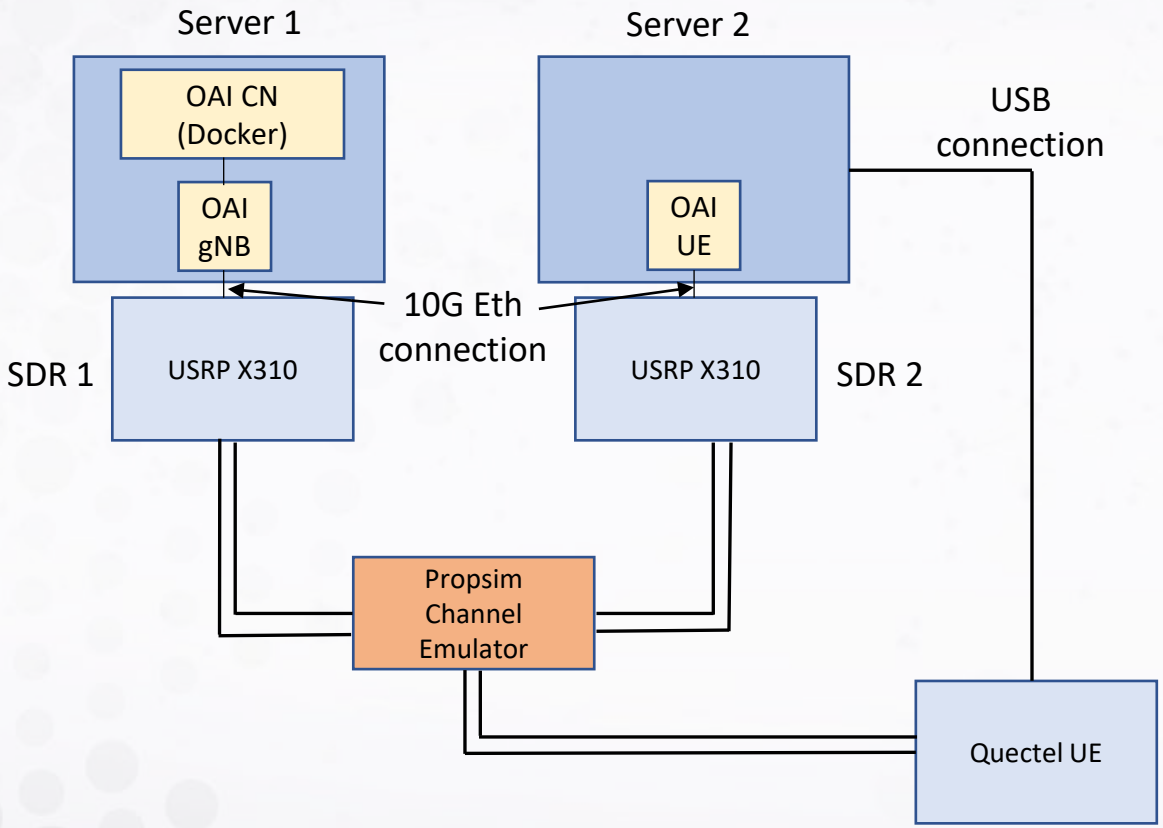
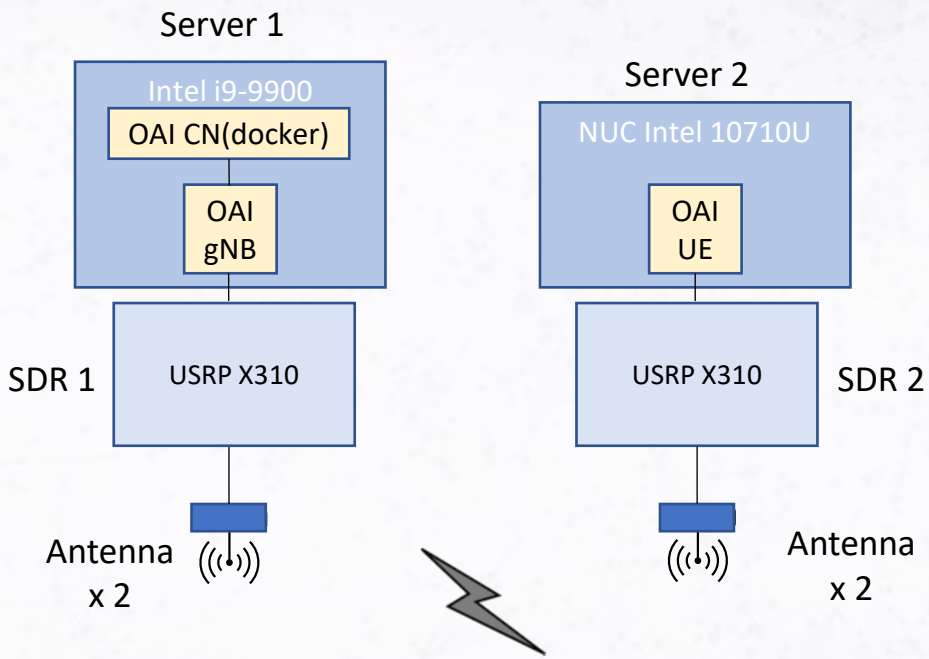
Test Platforms

AERPAW Testbench @ NCSU



AERPAW Testbench @ MSU



PAWR-AERPAW Team at NCSU:

Prof. Rudra Dutta, Prof. Ismail Guvenc, Prof. Mihail L. Sichitiu, Ozgur Ozdemir

PAWR-AERPAW Team at MSU:

Prof. Vuk Marojevic, Keith Powell

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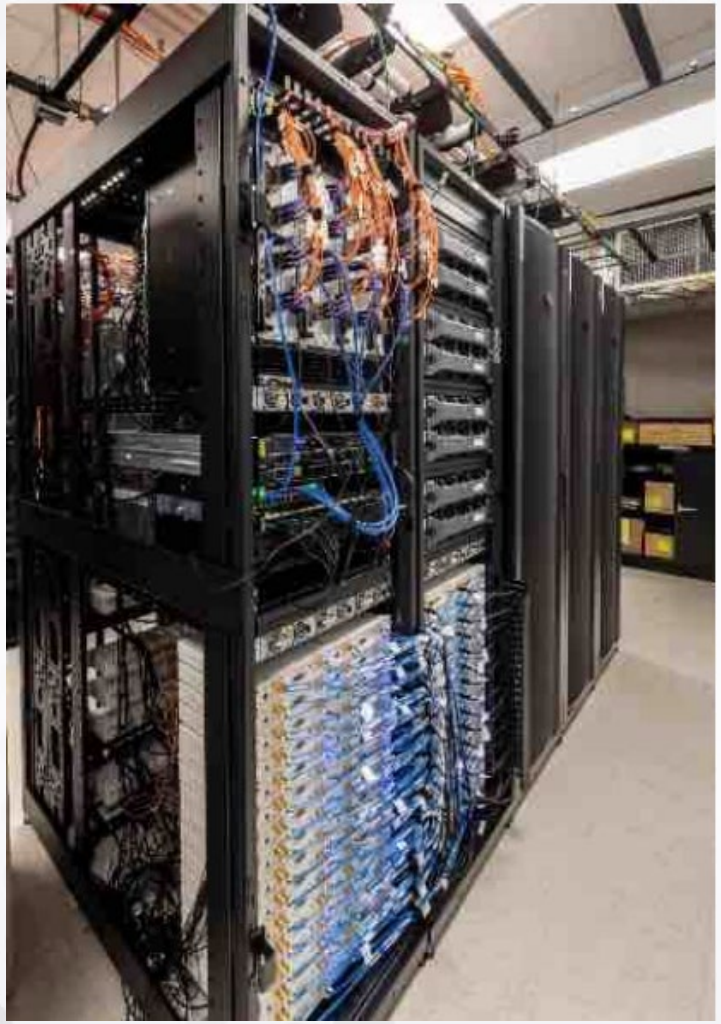
Colosseum: A Large-Scale Wireless Emulator Testbed



- A massive $20M wireless systems testbed developed by DARPA housed at Northeastern University
  - Funded by NSF
- 128 Computer servers (Intel Xeon), 128 programmable radios (USRP X310)
- Massive Channel Emulator (MCHEM)
  - 256 x 256 100 MHz RF channel emulation
  - Real-time emulation and complex RF scenarios
- Remotely accessible and used by researchers from the NSF community for experiments in
  - Spectrum Sharing
  - AI + Wireless
  - 5G (softwarization, slicing, security)
  - IoT

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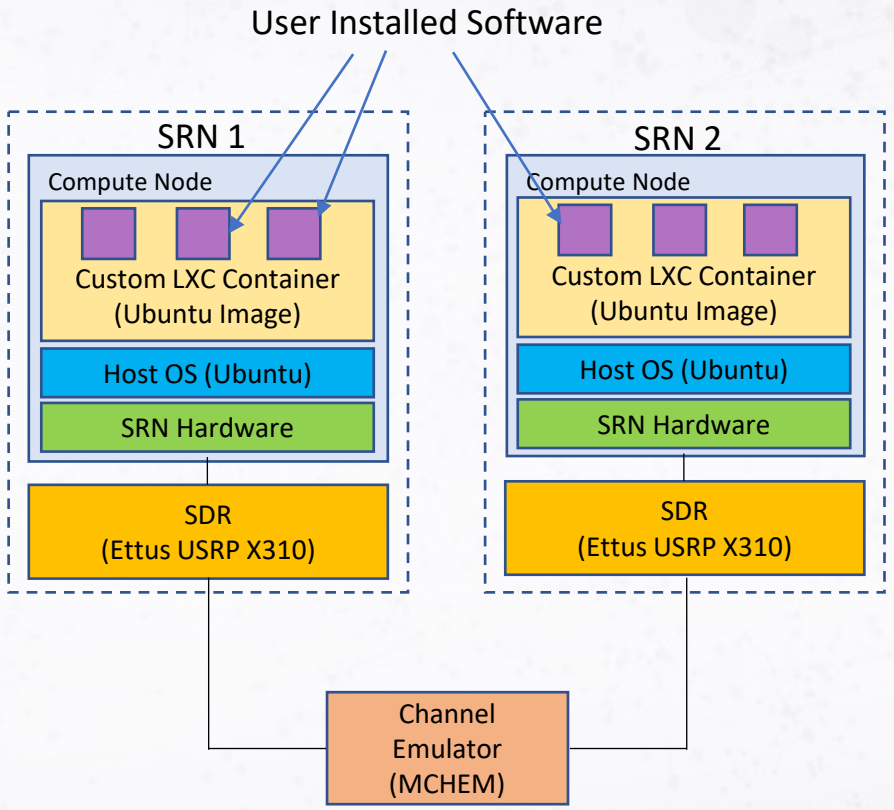
Running Experiments in Colosseum

- Every user experiment in Colosseum is run in containers
- Colosseum uses LXC containers
- Colosseum provides base container images that users can customize according to the requirements of their experiment
- Experimenters can install software/packages in the container and configuring those as needed*.
- We also provide pre-built containers for OAI 5G
  - OAI 5G CN container: oai-5gcn
  - OAI 5G RAN (gNB/NR UE) container: oai-5g-sa-ran



* For details on how to create custom Colosseum containers, please see:

- https://www.youtube.com/watch?v=HmZlTQ0xL1E&list=PLyPwVNte-Wvqovf58LWsfmvWLHQ-dGGQz&index=7
- https://colosseumneu.freshdesk.com/a/solutions/articles/61000284967

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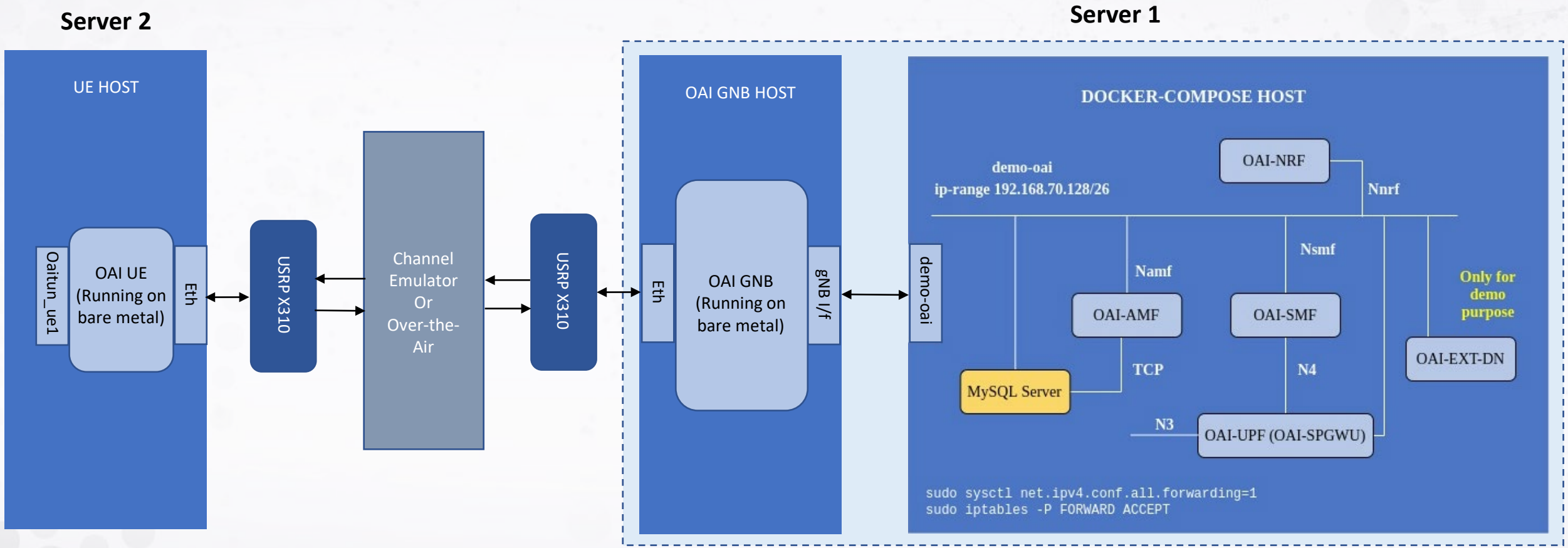
OAI Code Structure Overview

OAI 5G NR SA Demo Setup – Bare metal



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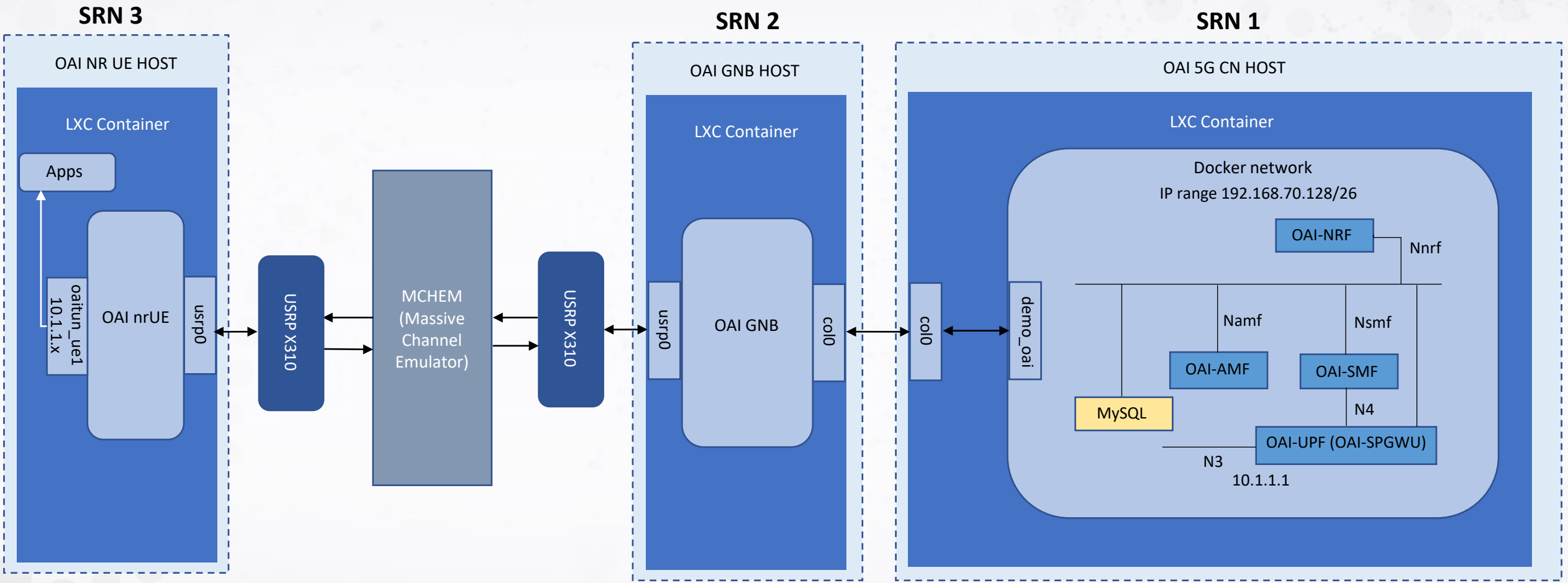
OAI 5G NR SA Demo Setup - Colosseum



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Deploying and Configuring OAI 5G Core Network

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OAI 5G Throughput Demo

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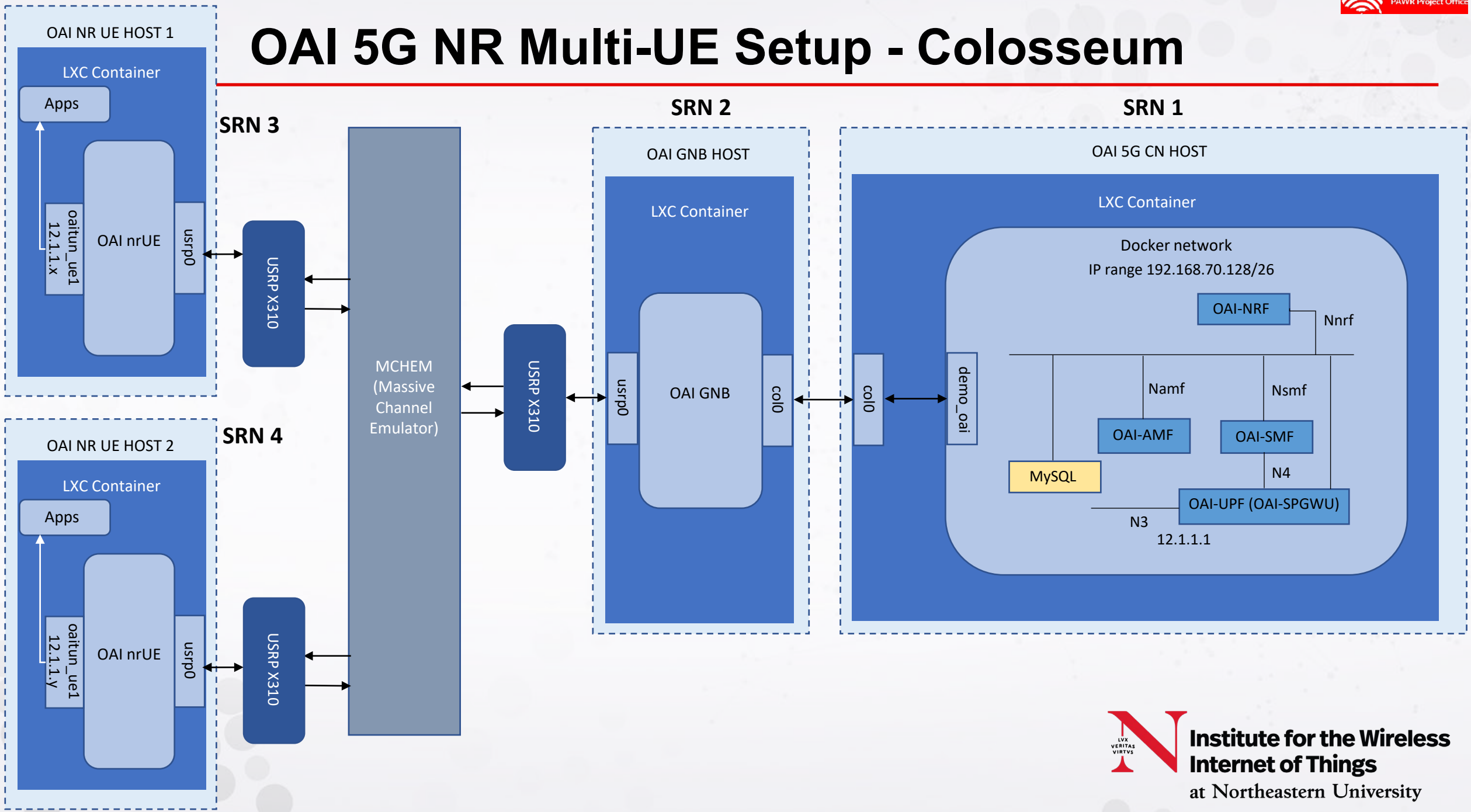
OAI 5G NR Multi-UE Setup - Colosseum



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OAI 5G Multiple UE Demo

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Helpful Links

- **Deploying OAI 5G Standalone Network:**
  https://openairx-labs.northeastern.edu/deploying-oai-in-5g-standalone-mode/
- **Deploying OAI 5G SA on Colosseum:**
  https://openairx-labs.northeastern.edu/deploying-oai-5g-sa-mode-on-colosseum/

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Thank You!

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