



Institute for the Wireless Internet of Things at Northeastern University

Colosseum Evolution

Colosseum Team:

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Platforms for Advanced
Wireless Research



MITRE



MASSACHUSETTS
TECHNOLOGY
COLLABORATIVE



N COLOSSEUM
at Northeastern University

Colosseum Roadmap

Updating
Infrastructure

Digital Twin

Toward AI-RAN

New Use Cases

New Channel
Emulation
Capabilities

Updating Colosseum Infrastructure

Modernize Colosseum infrastructure in phases:

- New compute for **AI and next-gen wireless use cases**
- Storage to support **digital twin** use cases and AI/ML training
- Programmable backbone to quickly enable **new applications** (e.g., OTIC)
- Upgraded connectivity to support **integration** with other testbeds

Updating Colosseum Infrastructure



New servers in Q4
Dell PowerEdge R750 with **A100 GPUs**



New servers in Q2-Q3 to be deployed soon
Dell PowerEdge R760 with **A30 GPUs**



Upgraded storage
New Dell NAS with 100 GbE uplinks



SONiC network backbone - 100 GbE fabric for the data center



Upgraded firewall
VPN access with 10 Gbps link

Colosseum O-RAN Blueprints

New feature on Colosseum website: **Blueprints** for O-RAN experiments

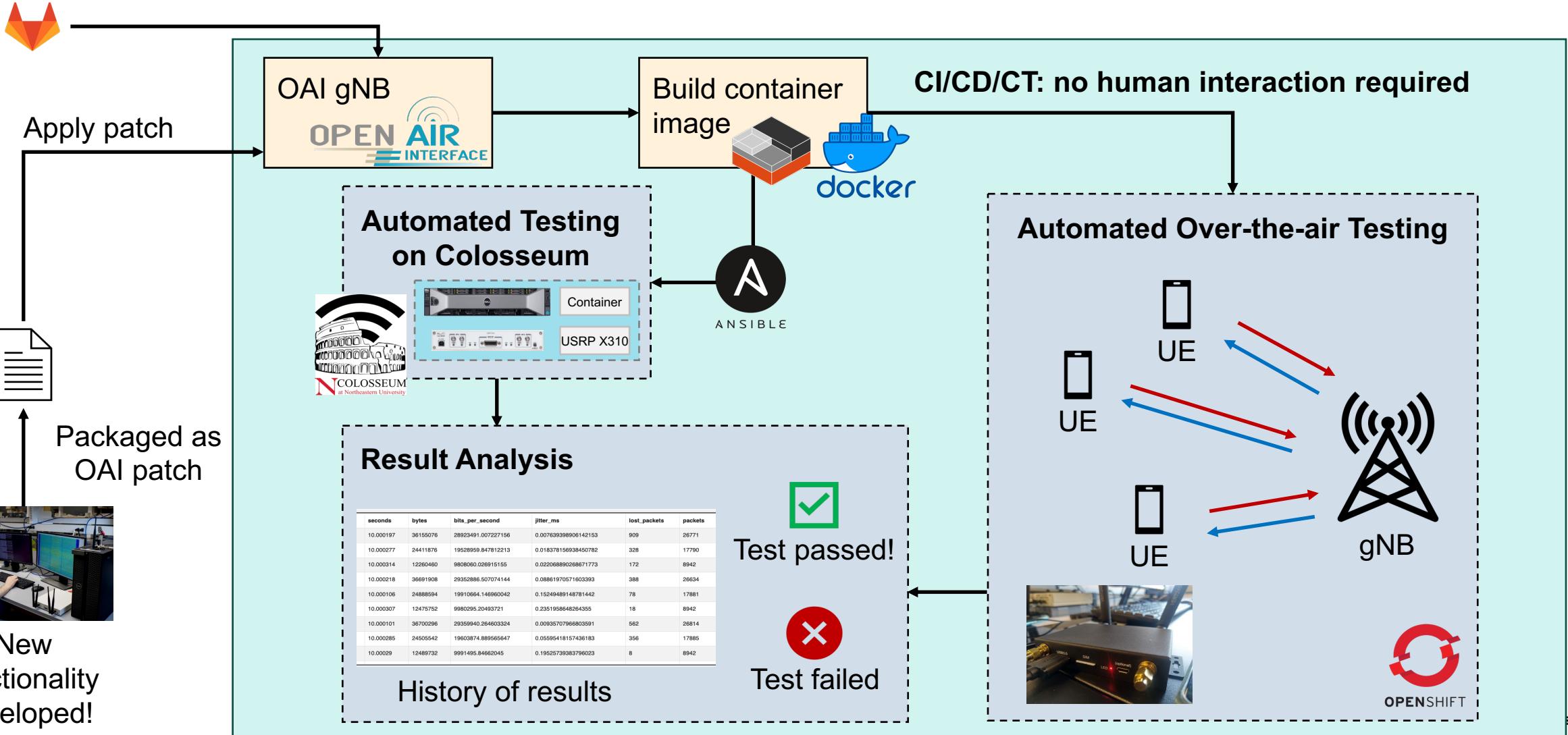
Before: manual selection

Blueprint: pre-define list of images for specific experiments (e.g., RAN, O-RAN, IAB, etc)

Name	Image	Description	Quantity
RIC	oai-core	Radio Intelligent Controller (RIC) of the RAN to manage radio resources for network orchestration.	1
Core	oai-core	OAI Core Network to handle data routing and user session management.	1

the Wireless
things
n

Colosseum CI/CD for End-to-End Protocol Stacks



CI/CD – OAI Use Case

- Colosseum builds and tests triggered by Eurecom Jenkins instance
- Results are sent back and stored as “artifacts”
- Functional end-to-end tests with full stack 5G system

The screenshot shows the Jenkins dashboard for the 'RAN-Trigger-NEU-CI' project. The top navigation bar includes links for 'Dashboard', 'RAN-Trigger-NEU-CI', and other Jenkins instances. Below the header, there are sections for 'Status' (green checkmark), 'Changes' (empty), and 'Open Blue Ocean'. A red arrow points from the 'Build History' section to the 'Last Successful Artifacts' section. The 'Build History' table lists recent builds: #55 (Mar 12, 2024, 8:48 PM), #54 (Mar 12, 2024, 7:41 PM), #53 (Mar 12, 2024, 6:39 PM), #52 (Mar 12, 2024, 5:45 PM), #51 (Mar 12, 2024, 4:07 PM), #50 (Mar 1, 2024, 5:02 PM), and #49 (Mar 1, 2024, 3:59 PM). The 'Last Successful Artifacts' section displays two files: 'test_summary.html' (259.43 KiB) and 'results.tar.xz' (913.51 KiB), each with a 'view' link. The 'Permalinks' section provides links to all builds listed in the history table.

Build	Date
#55	Mar 12, 2024, 8:48 PM
#54	Mar 12, 2024, 7:41 PM
#53	Mar 12, 2024, 6:39 PM
#52	Mar 12, 2024, 5:45 PM
#51	Mar 12, 2024, 4:07 PM
#50	Mar 1, 2024, 5:02 PM
#49	Mar 1, 2024, 3:59 PM

RAN-Trigger-NEU-CI

Trigger the NEU CI - build and run of test stages

Last Successful Artifacts

- [test_summary.html](#) 259.43 KiB [view](#)
- [results.tar.xz](#) 913.51 KiB [view](#)

Permalinks

- [Last build \(#55\), 56 min ago](#)
- [Last stable build \(#55\), 56 min ago](#)
- [Last successful build \(#55\), 56 min ago](#)
- [Last failed build \(#53\), 3 hr 4 min ago](#)
- [Last unsuccessful build \(#53\), 3 hr 4 min ago](#)
- [Last completed build \(#55\), 56 min ago](#)

CI/CD – OAI Use Case

Example of test result

https://jenkins-oai.eurecom.fr/job/RAN-Trigger-NEU-CI/lastSuccessfulBuild/artifact/results/test_summary.html

Test Summary

Protocol	Transmit Rate	Stream	Metric	Mean	Max	Figure
iPerf3 Downlink 2024-05-01 19:03:17						
TCP	Transmit rate unlimited	0	Data Transferred [Mbit]	67.830916	78.405184	

We maintain a historic average of prior test results for

- DL data transferred
- DL throughput
- UL data transferred
- UL throughput
- TCP congestion window
- RTT

and check if the current test is within 95% of the historic average

Git Commit Info	Version: Branch: develop Abrev. Hash: d977ac8fc Date: Tue Apr 30 15:38:45 2024 +0000
Test Outcome UE 1 (Colosseum SRN-031)	PASS ✓

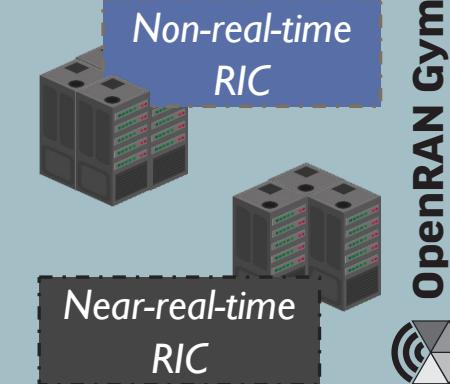
Final Status	PASS ✓
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Colosseum Connection with Arena, X5G

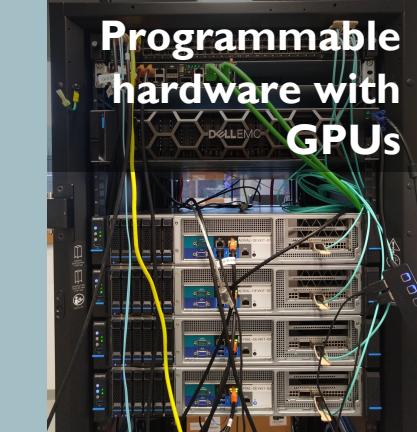
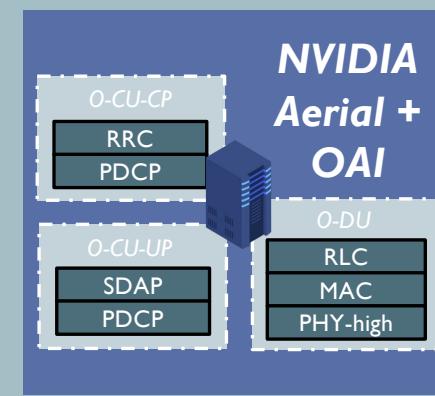
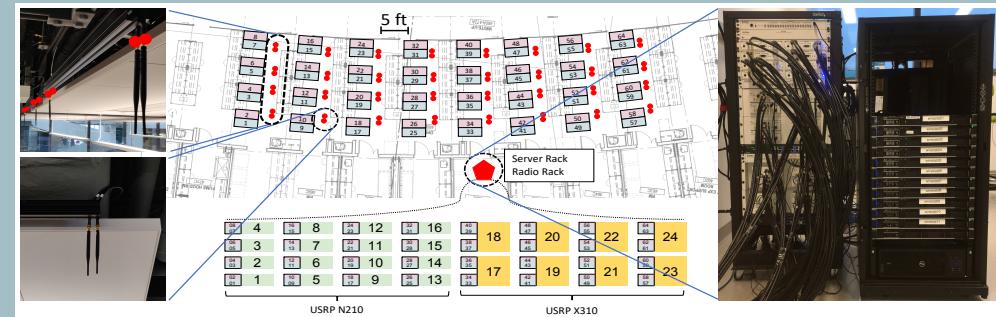
Colosseum Digital Twin



Same network domain



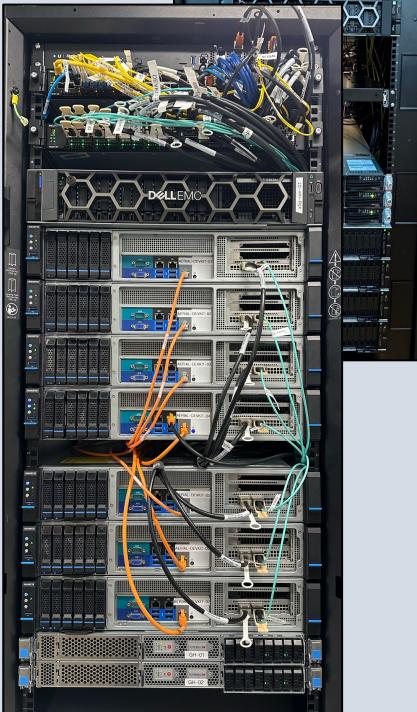
Arena – Over-the-Air SDRs



X5G Hardware Deployment

X5G

Boston



Dell S5248F-ON + ER FW
OpenShift Cluster Network

Dell R760

OpenShift Control Nodes

Dell R750

OAI/SRS DU

Networking Infrastructure

Bonded Dell Switches

8x Gigabyte E251-U70

6x SMC GH200

RuSIM

UeSIM

CoreSIM

Qulsar QG2

Synchronization Infrastructure

NVIDIA ARC DUs

RuSIM

UeSIM

CoreSIM

Campus Network

Burlington

Cisco FirePower FW

Colosseum Fabric

Fibrolan Falcon RX

Dell S5248F-ON

Gigabyte E251-U70

SMC GH200



RuSIM

CoreSIM

DuSIM

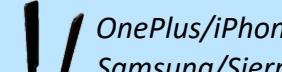
Foxconn/Amplitech/
Solid/Airspan



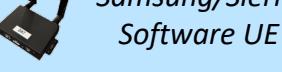
RUs



OTA



OTA



UEs



OnePlus/iPhone
Samsung/Sierra
Software UE

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at Northeastern

Open6G OTIC – Co-located With Colosseum

*The Colosseum data center now also hosts an O-RAN ALLIANCE
Open Testing and Integration Center (OTIC)*



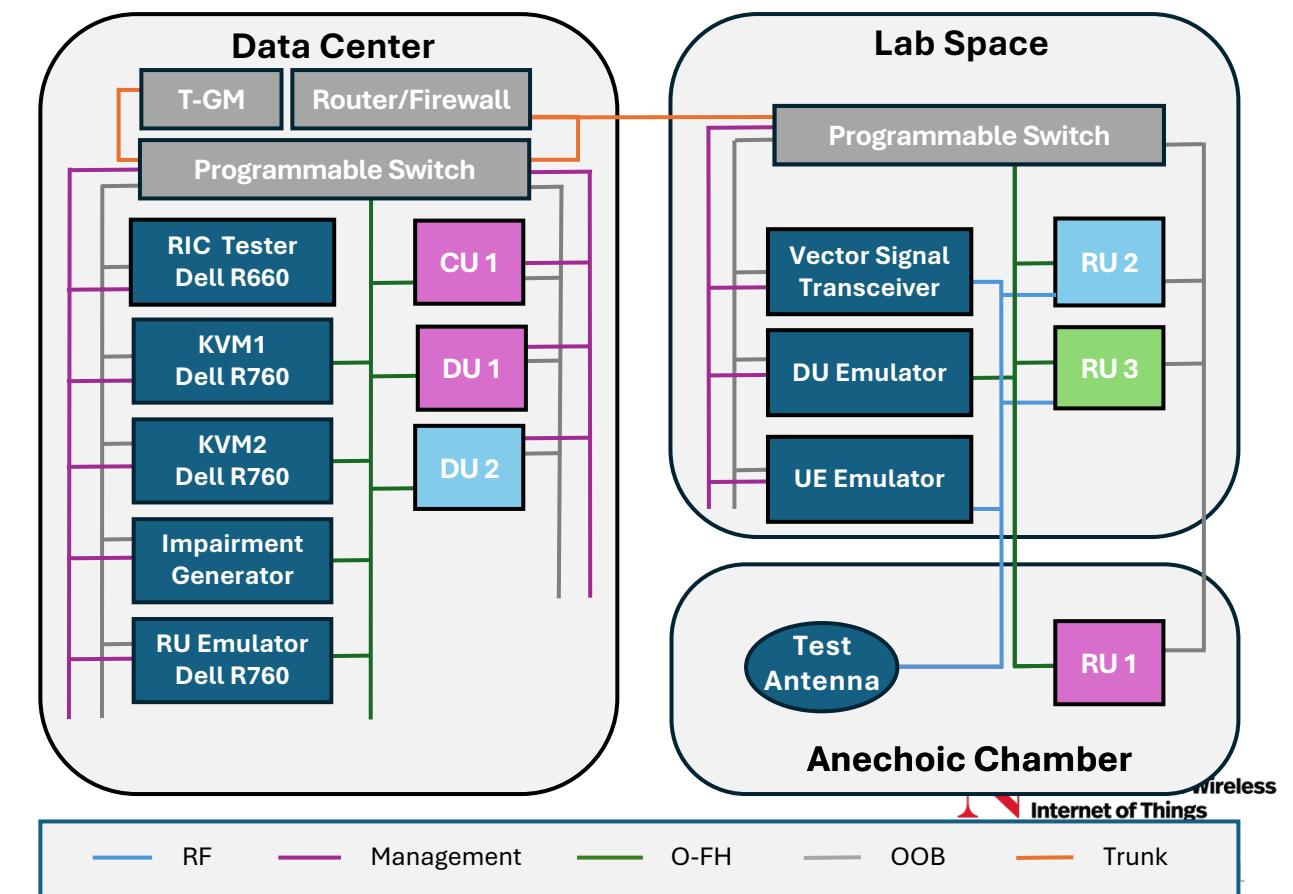
Research & Development
(R&D)



Testing & Integration (T&I)



System Integration (SI)



OTIC Goals



Testing of next-generation Open RAN system with focus on end-to-end control, RICs, AI/ML



Different Radio Access Network (RAN) implementations for xApp/rApp testing

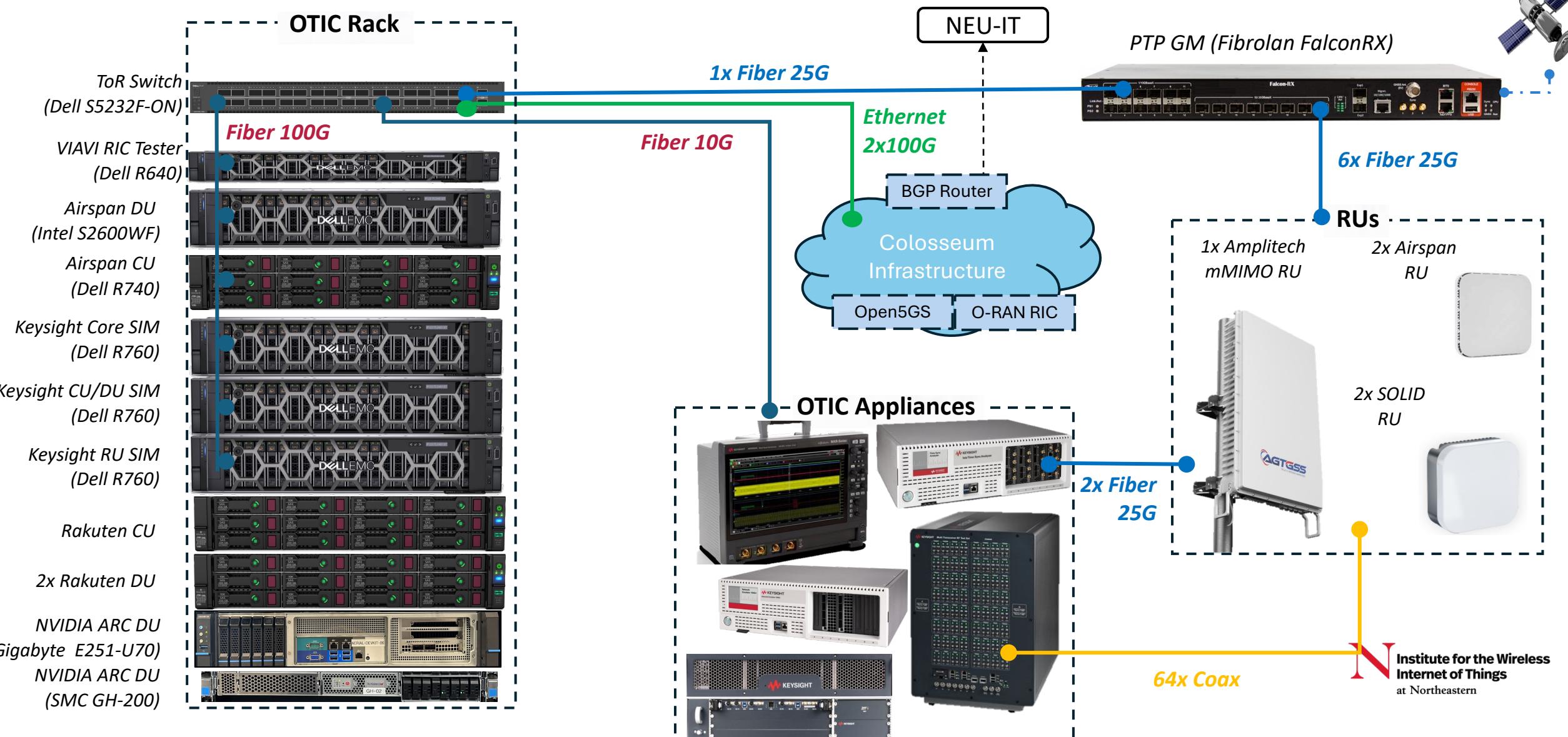


Leverage testbeds available at Northeastern (including Colosseum)



New testing equipment for RIC testing and beyond

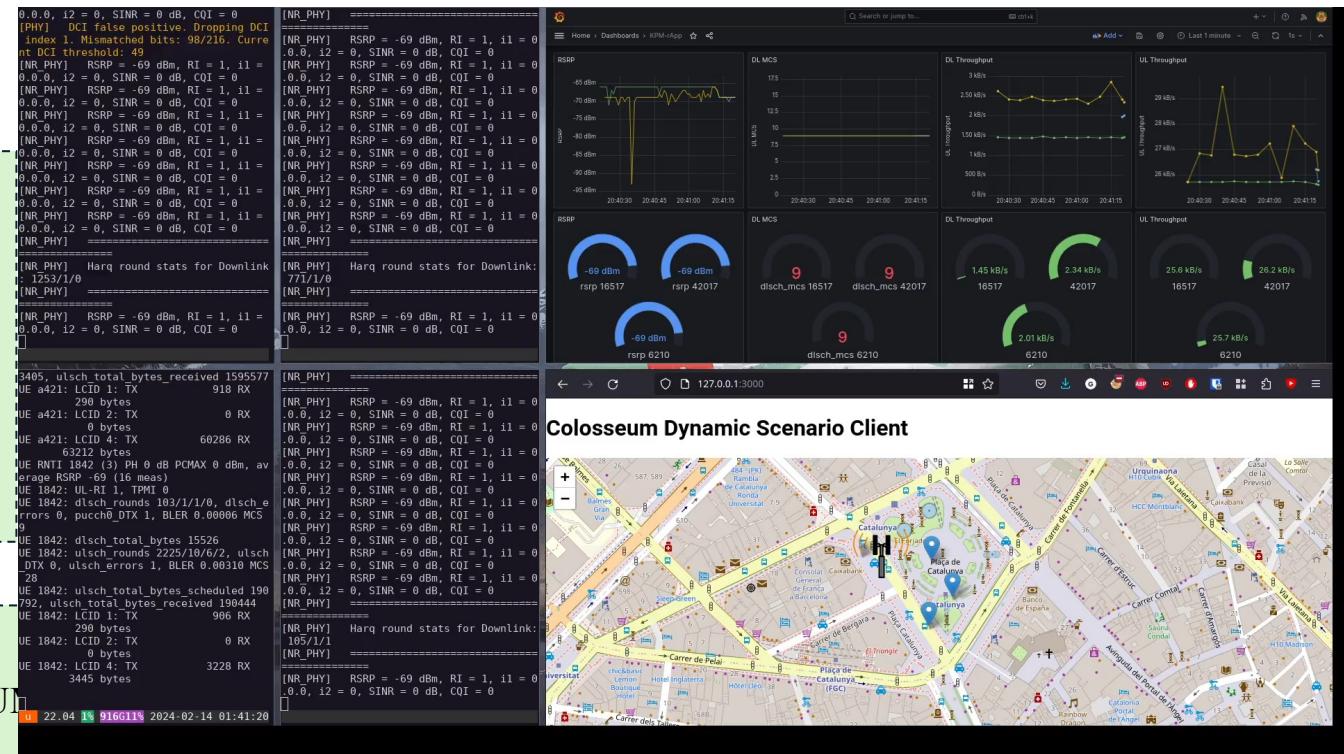
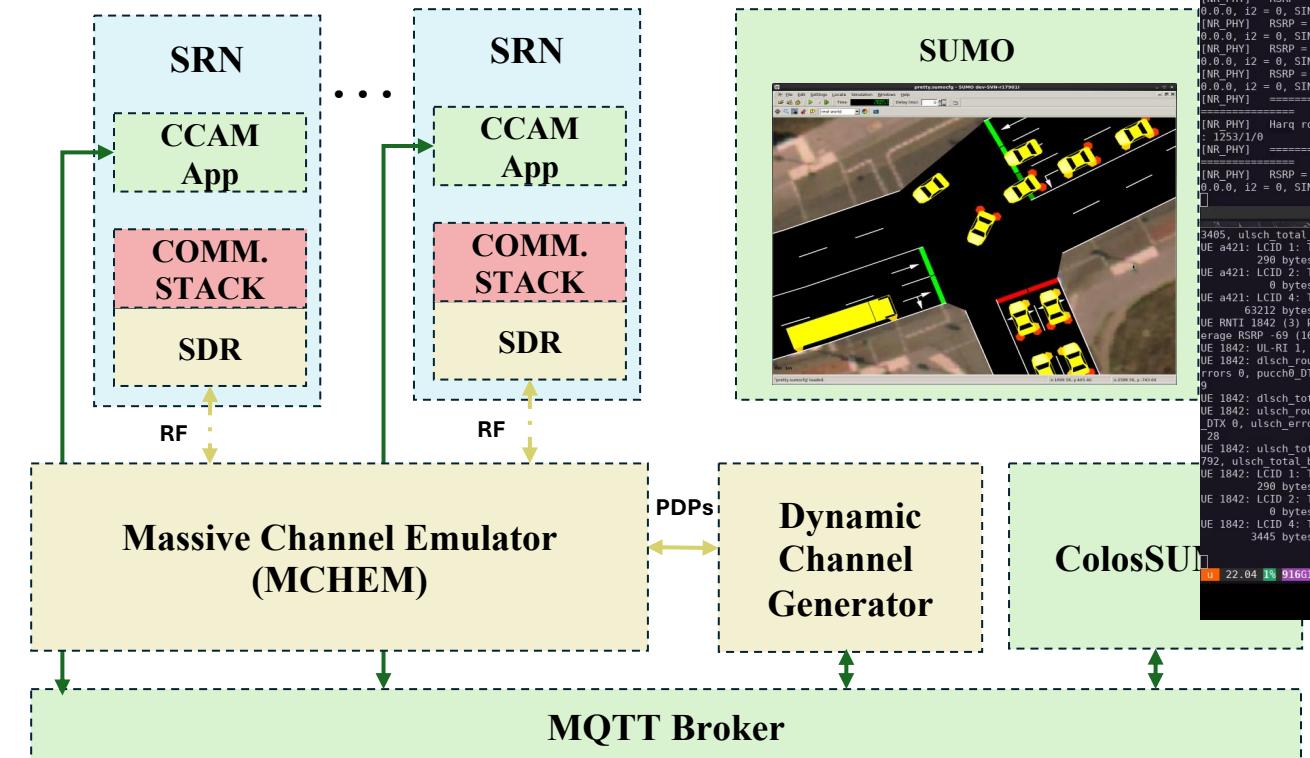
Current OTIC Infrastructure - Burlington



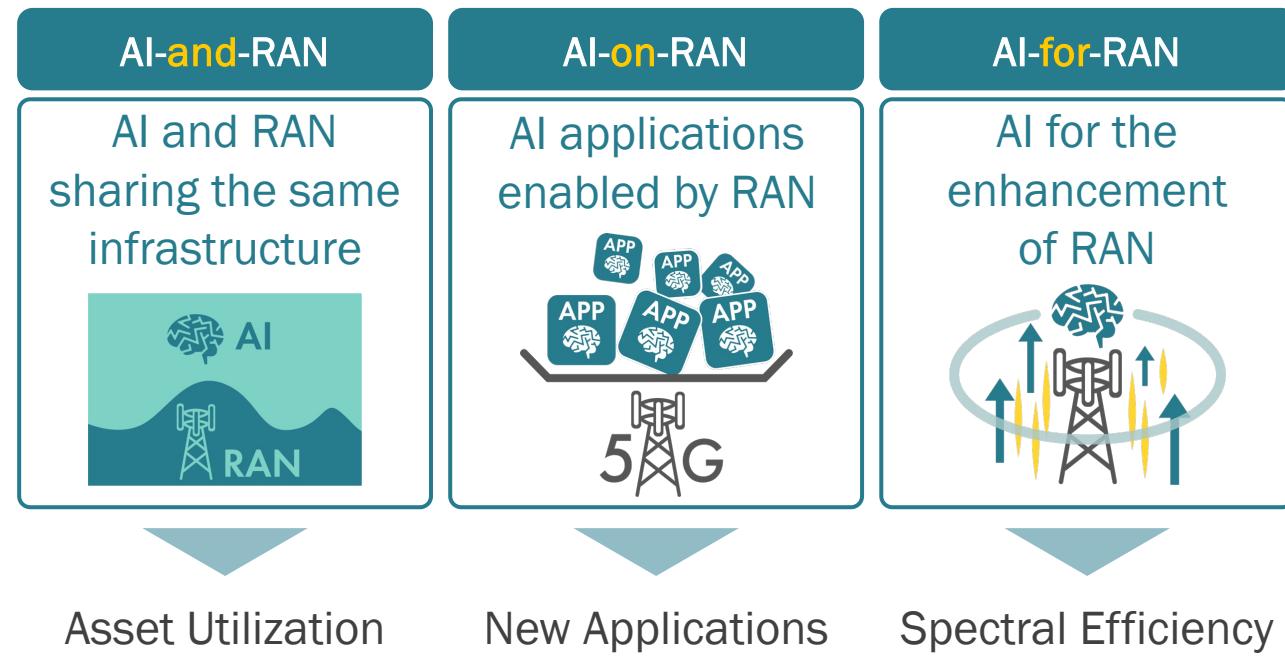
Dynamic MCHEM Prototype

Work in progress:

- Develop a dynamic version of the channel emulator
- Enable dynamic mobility applications

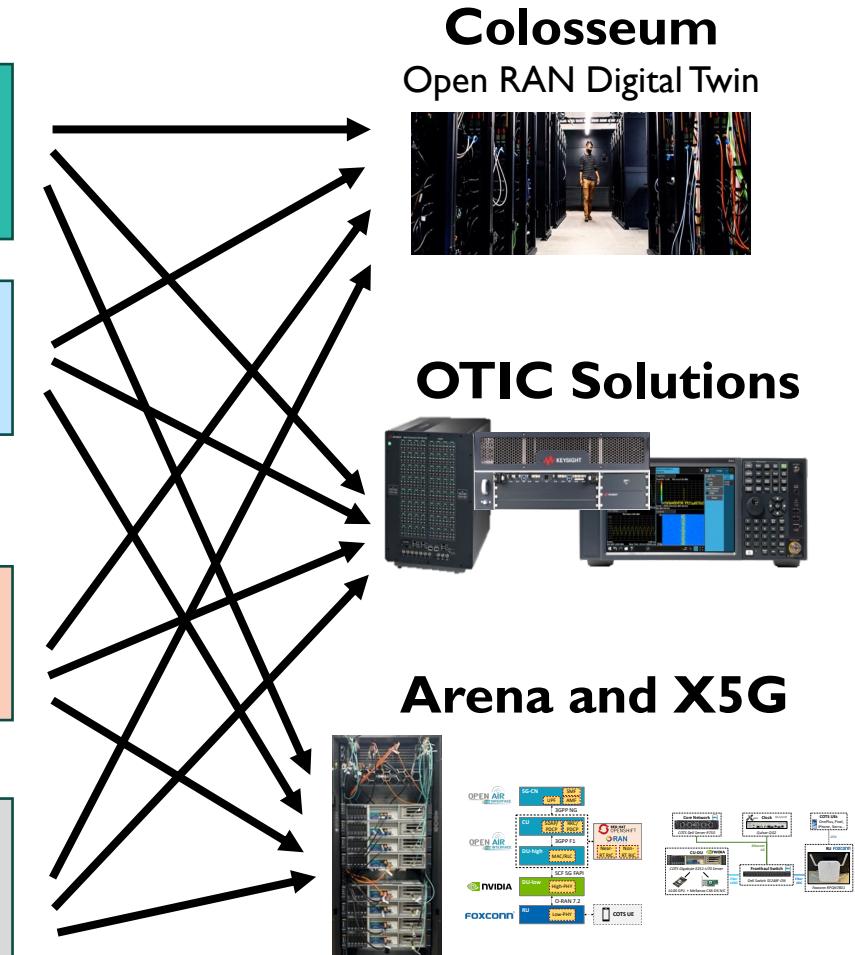
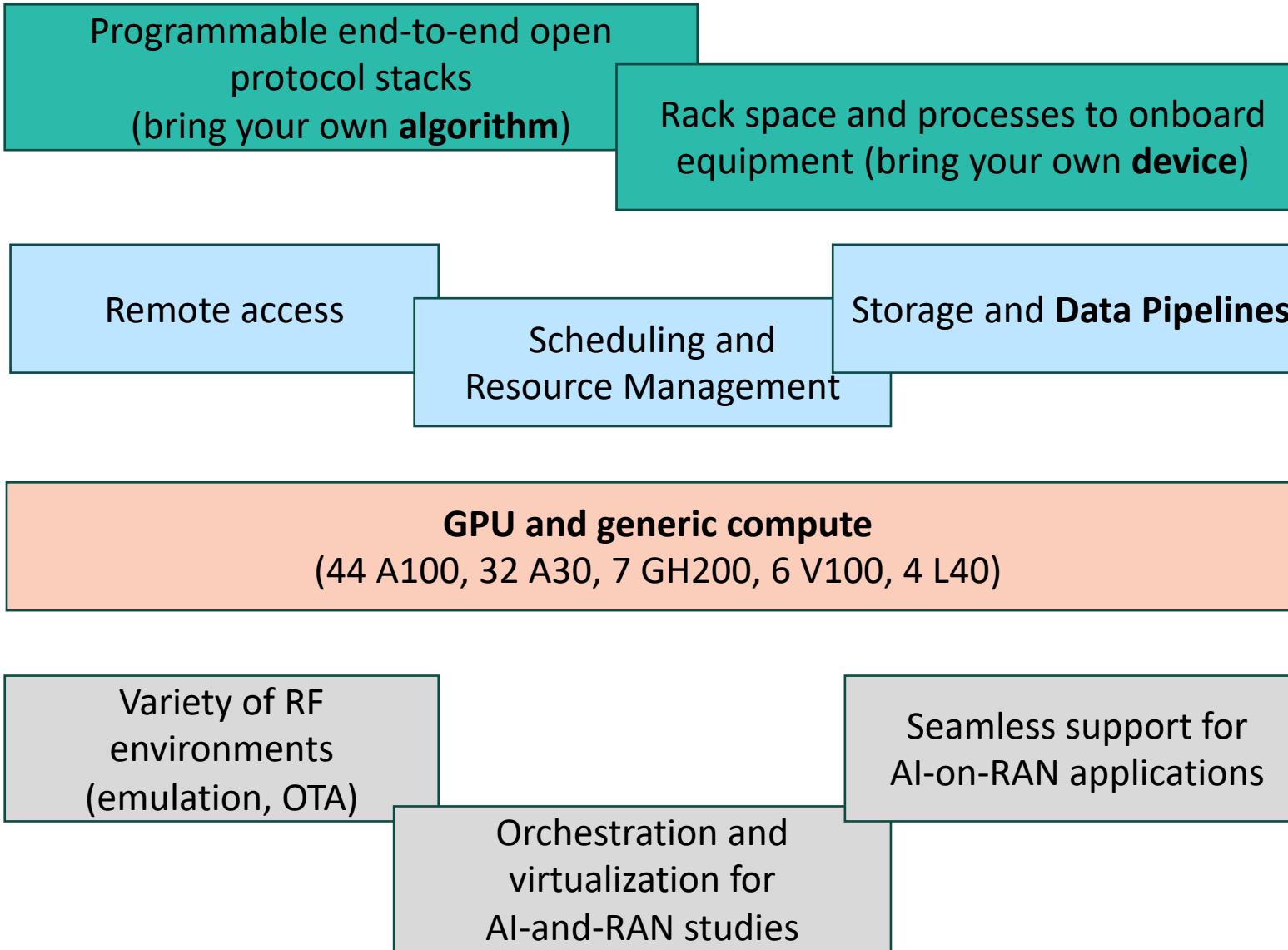


Toward AI-RAN



- Colosseum and its future extensions as a platform for developing AI-RAN use cases
- Data collection
- AI/ML validation
- AI/ML training

Colosseum and X5G for AI-RAN





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