Embracing Openness and Disaggregation: Our Journey with OpenRAN@Brasil

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Agenda

- Who are we?
- What is Open RAN?
- The OpenRAN@Brasil Program
- Next Steps
- Final Remarks

Who are we?

- Rede Nacional de Ensino e Pesquisa (RNP)
  - Brazilian Network for Education and Research
  - Helped to bring the Internet to Brazil in 1992
  - Today, our network reaches all states of the country
  - Interconnected to other NRENs in Latin America, North America, Africa and Europe

800
connected organizations

+4 million
users

50
community connections

+100 Gbps
connections

What is Open RAN?

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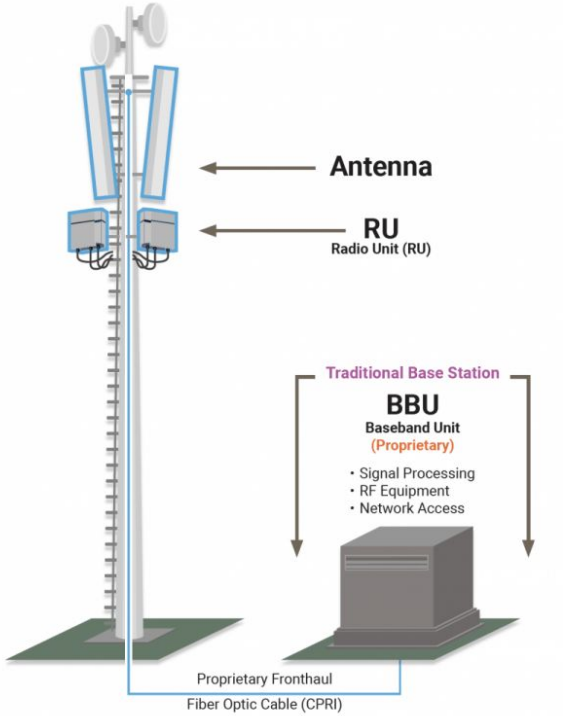
What is Open RAN?

- RAN (Radio Access Network)
  - Users' entry point to the network
  - In general, composed of three elements
    - Antenna
    - Radio Unit (RU)
    - Baseband Unit (BBU)



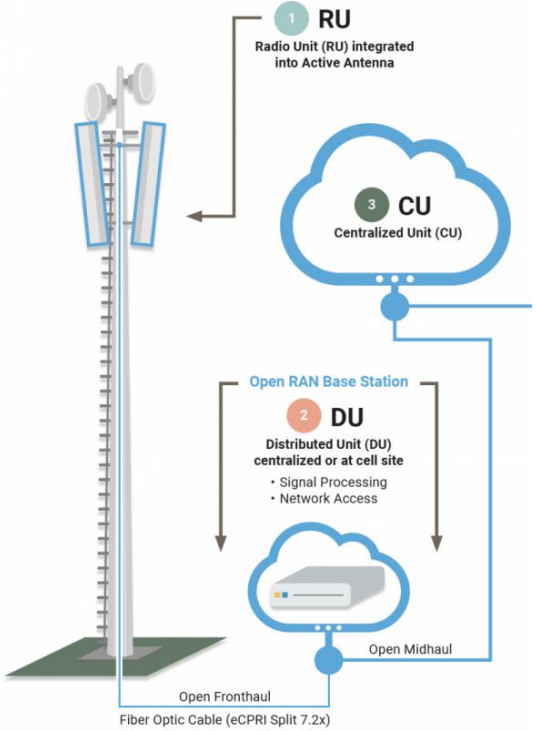
Source: https://www.mavenir.com/wp-content/uploads/2020/11/Open-RAN-Infographic-FINAL.pdf

What is Open RAN?

- Traditional Operator Networks
  - Proprietary hardware and software
  - Closed and proprietary interfaces
  - Single vendor
    - Makes the network operator a "hostage" of the vendor
    - Performance reduction when deploying cells from different vendors
    - Barrier for innovation

What is Open RAN?

- Three main elements
  - Radio Unit (RU)
  - Distributed Unit (DU)
  - Centralized Unit (CU)
- Programmable and software-defined operation
  - DU and CU run as virtualized SW functions on off-the-shelf HW
- Open and standardized interfaces
  - Makes network deployment more modular
  - Multivendor
- "Disaggregated RAN"
  - Network agility and flexibility
  - Increased innovation
  - Cost savings



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Open RAN Initiatives

- O-RAN Alliance
  - Founded by AT&T, China Mobile, Deutsche Telekom, NTT DOCOMO and Orange
  - Architecture for open, intelligent, virtualized and fully interoperable RAN
- Telecom Infra Project (TIP)
  - A Meta initiative
  - Non profit organization focused on advance global connectivity
- Open Network Foundation (ONF)
  - Proposed the Software-Defined RAN (SD-RAN)
    - 3GPP compliant
    - Consistent with the O-RAN architecture
- Open Air Interface (OAI)
  - Flexible platform towards an open cellular ecosystem
  - Includes different projects (5G RAN, 5G Core Network, Mosaic5G)

The OpenRAN@Brasil Program

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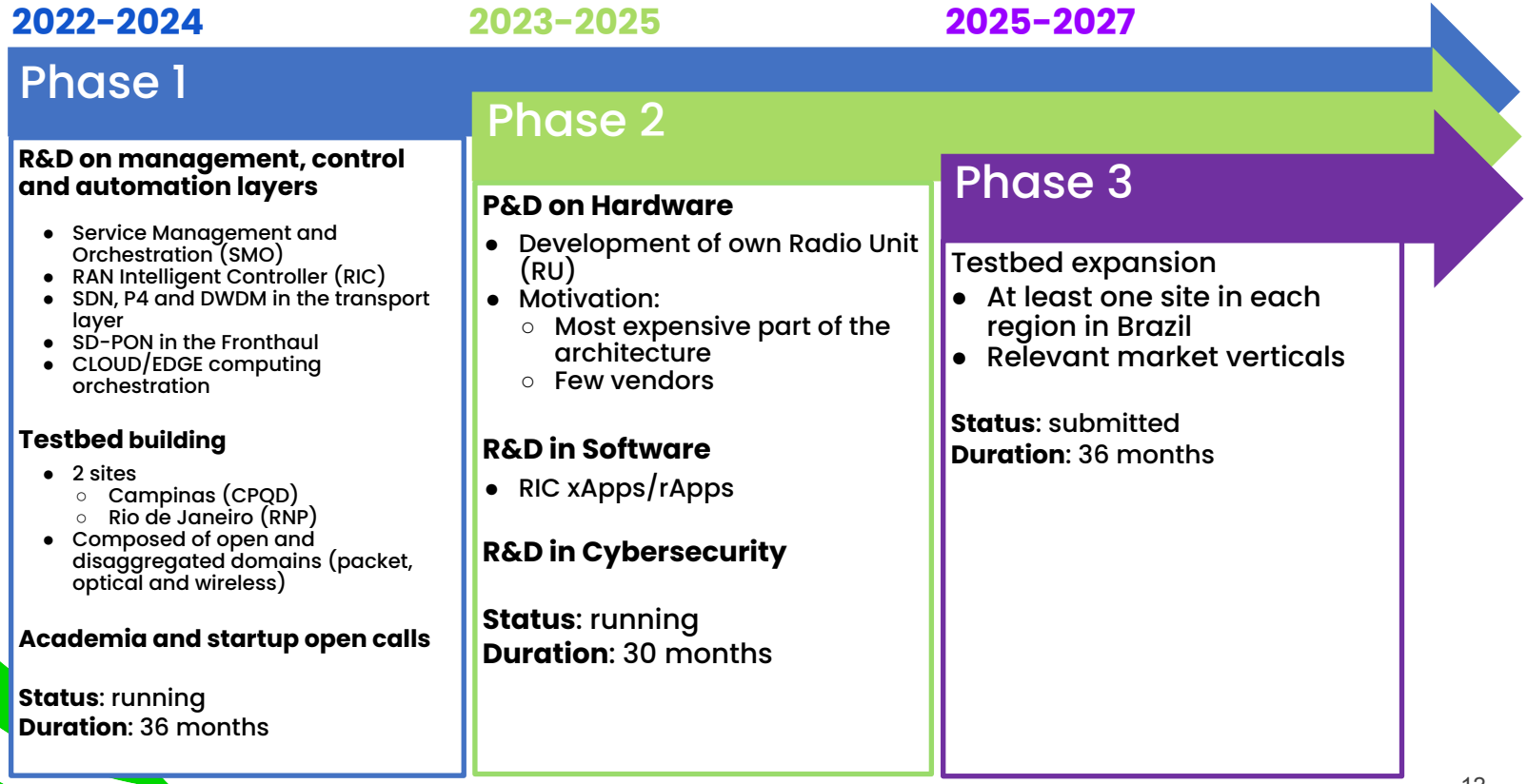
The OpenRAN@Brasil Program

- **Aspiration:** to accelerate the development of an open network ecosystem from research, development, innovation and workforce training in technologies and applications related to 5G and beyond
  - Stimulating interaction between actors from industry, academia and government
  - Promoting different application scenarios
  - Promoting collaborative development models (mainly open source)
  - Promoting the innovation ecosystem through the experimentation and demonstration space
  - Promoting workforce training

The OpenRAN@Brasil Program

- Cornerstones
  - **Research, develop, deploy and validate** innovative solutions for intelligent management and control of open and disaggregated networks in different technological domains
  - **Build and make available** experimentation infrastructures in different technological domains that adopt openness and disaggregation
  - **Train** professionals and **engage** academia/industry

OpenRAN@Brasil - Phases



OpenRAN@Brasil - Partners

Execution	
Phase 1	**Phase 2**
RNP ORGANIZAÇÃO SOCIAL DO MCTI; CPQD; UNICAMP; Universidade Federal do Pará; Universidade Federal do Rio Grande do Norte; Universidade Federal de Ouro Preto; Universidade Federal Fluminense	RNP ORGANIZAÇÃO SOCIAL DO MCTI; CPQD; ELDORADO; Inatel; Universidade Federal do Pará; UFG; UNISINOS; UFCG
Coordination	
RNP ORGANIZAÇÃO SOCIAL DO MCTI	

The OpenRAN@Brasil Phase 1

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Phase 1

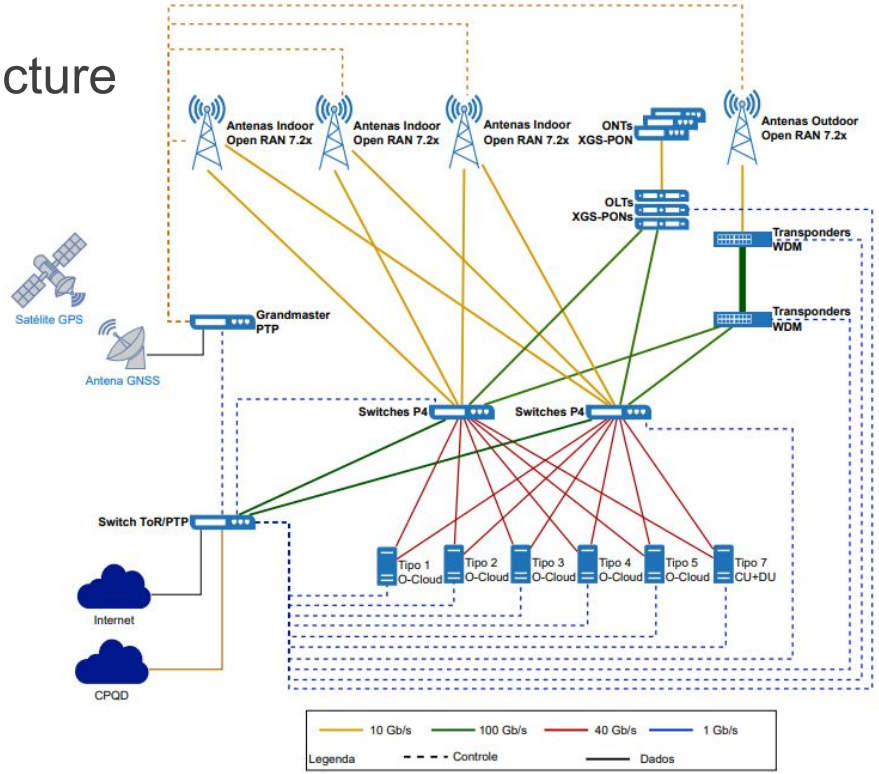
- Objective:
  - R&D to build an open and programmable infrastructure (testbed)
    - Disaggregated equipments
    - Offered to different communities (academia, industry and service providers)
  - Foster RD&I in open RAN
    - Working groups & Startups
  - Train specialized workforce in different open RAN technologies

Phase 1 - Testbed

- Testbed characteristics
  - Open hardware
  - Open software
    - Developed by international communities/initiatives
  - Paradigms
    - Softwarization, Virtualization and Disaggregation
- Testbed resources
  - multiple technological domains
    - Edge/central cloud, packet (P4), optical (PON and DWDM networks) and wireless (Open RAN 5G)
  - multiple RICs
    - SD-RAN (ONF) and O-SC (O-RAN Alliance)

Phase 1 - Testbed

- O-RAN Alliance Split 7.2X architecture
  - O-RU disaggregated from O-DU
- Computing
  - 6 to 7 servers
- O-RAN antennas
  - 3 indoor 5G O-RAN antennas
- Packet domain
  - Leaf-spine topology
  - P4 switches
- Optical domain
  - PON (XGS-PON and GPON)
  - DWDM



Phase 1 - Testbed

- Sites
  - Two sites deployed in Phase 1
    - CPQD - Campinas, SP
    - RNP - Rio de Janeiro, RJ
  - Both located in the southeast
    - Geographical distance: 397 km (~246.7 miles)
    - Road distance: 493.1 km (~306.4 miles)
  - Connected by a 10 Gbps link

Phase 1 - Open Calls

WGs & Startups	Topic
ORAN-QOS	QoS for open RAN
Plateou	Slicing orchestration
OIRAN	High availability, low power orchestration
FAIR-5G	5G security
AGIR	Intent-based management for open RAN
IQoS	Smart Management for QoS
Acta Robotic	Robotics
Anlix	Monitoring
Quickium	Computer vision
Ring-0 Networks	Security

The OpenRAN@Brasil Phase 2

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Phase 2

- Objectives:
  - R&D of a 5G O-RAN Alliance compliant Radio Unit (O-RU)
  - R&D of smart SDN applications for the Open RAN domain (xApps/rApps)
  - Open RAN cybersecurity risk analysis

- Hardware
  - 8T8R (40W each)
  - N78 Band
- O-RU management software
  - NETCONF protocol/YANG models

xApps and rApps

- What are they?
  - Automation and optimization tools
  - Control and management features
- Differences
  - xApp: near-real time
    - Optimize radio spectrum efficiency
  - rApp: non-real time
    - ML for establishing policies
- Four xApps in development
  - RIC distribution
  - Energy consumption
  - Network slicing
  - Self-organizing RAN
- Different RICs being explored
  - Open Network Foundation: SD-RAN
  - O-RAN Alliance: SC

The OpenRAN@Brasil Phase 3

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Phase 3

- Objectives:
  - Expand the testbed infrastructure to every region in Brazil
    - North, Northeast, Central-west, South
  - R&D on applications
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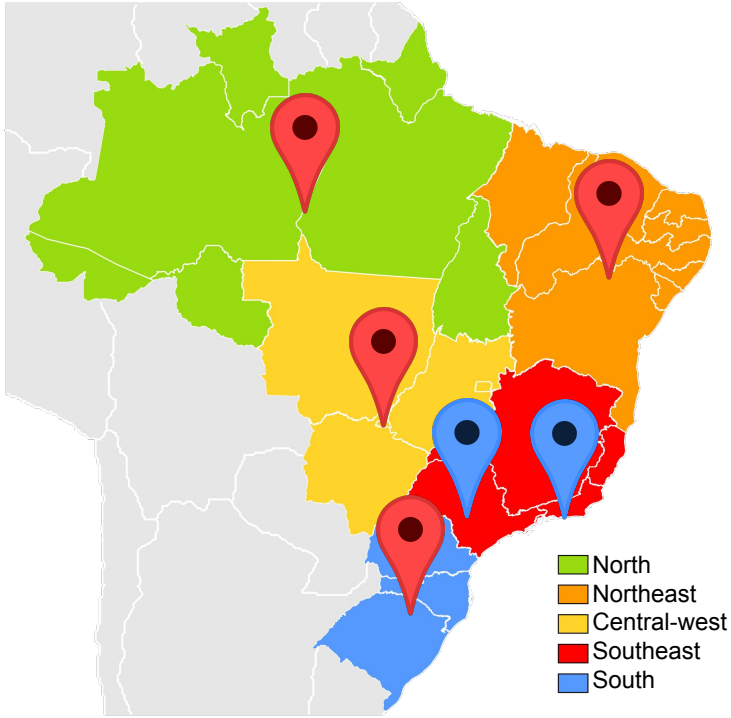

Phase 3 - Open Calls

- Testbed expansion
  - Selecting proposals from Institutes of Science and Technology
- R&D on applications
  - Focus on application/use cases in:
    - Industry
    - Agriculture
    - Health
    - Education
    - Cities
    - Gaming

Next steps

- Testbed release
  - October 2023
  - Incremental release
    - v1.0: 5G open RAN network capabilities
    - v2.0: Smart orchestration capabilities
    - v3.0: New capabilities (under investigation)
      - use of GPUs for ML/AI
      - Improved Wi-Fi capabilities

Next steps

- Incorporate additional partners
  - New ICTs want to be part of the program
  - Build a community of open RAN research in Brazil
  - Put together different infrastructures
    - commercial and open source Open RAN stacks
  - Test interoperability
  - Knowledge exchange

Final Remarks

- Open RAN stimulates competition in the communication industry
  - Open the market for new hardware/software vendors
  - Cost reduction for operators
    - Single vendor dependency reduction
  - Interoperability between different components allows the adoption of more suitable solutions for specific scenarios

Final Remarks

- Open RAN can boost advances in innovative applications
  - Flexibility and interoperability facilitate the appearance of new services and business models
    - New apps/services for advanced scenarios (smart cities, industrial automation, digital health, …)
  - Driving digital transformation in different sectors
    - Health, agriculture, education, among others…

Final Remarks

- The OpenRAN@Brasil Program has the potential of
  - Fostering innovation
  - Reducing costs
  - Strengthening national industry
  - Expanding connectivity
  - Promoting global collaboration

Thanks!

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