Open-Source Software As A Catalyst for Innovation In the O-RAN Ecosystem

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O-RAN SOFTWARE COMMUNITY

AETHER

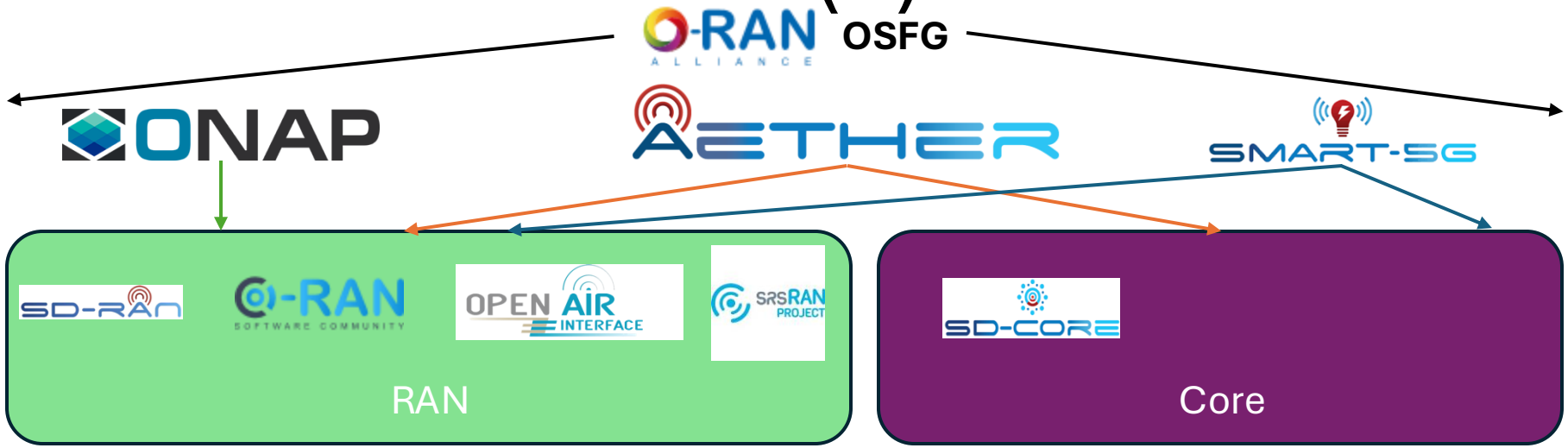
Agenda

- Introduction to Open RAN
- The Role of Open-Source Software in Telecommunications
- Open RAN: Innovation Through Open-Source
- Case Studies, Examples, Ongoing efforts
- Benefits and Challenges
- Conclusion

Introduction to Open RAN

- **What is Open RAN?**
  - Open RAN refers to disaggregating the RAN (Radio Access Network)
  - Open and interoperable interfaces between the components (**RU** – Radio Units, **DU** – Distributed Units and **CU** – Centralized Units).
- **Why Open RAN?**
  - Flexibility
  - Cost-efficiency
  - Innovation
  - Decoupling Hardware and Software
- **Industry trends promoting Open RAN adoption**
  - 5G and Beyond
  - Ecosystem growth
  - Government and Regulatory support
  - Security and Sovereignty

The Role of Open-Source Software in Telecommunications (1)



* List not exhaustive, more projects are out there!

Kubernetes (Container orchestration)

OpenStack (Infrastructure)

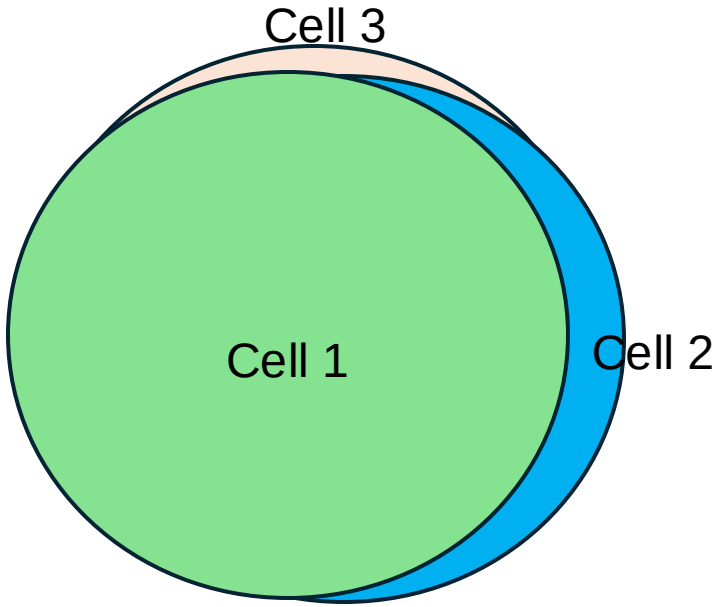
Bare metal servers (Linux)

The Role of Open-Source Software in Telecommunications (2)

- The impact of open-source software on innovation:
  - **Accelerated Development Cycles**
  - **Community-Driven Innovation**
  - **Vendor Independence**
  - **Security and Quality**
  - **Slow adoption at first, but then it grows exponentially**

Case Study: Energy Savings and Traffic Steering

- 3 one cell base stations with significant overlapping coverage



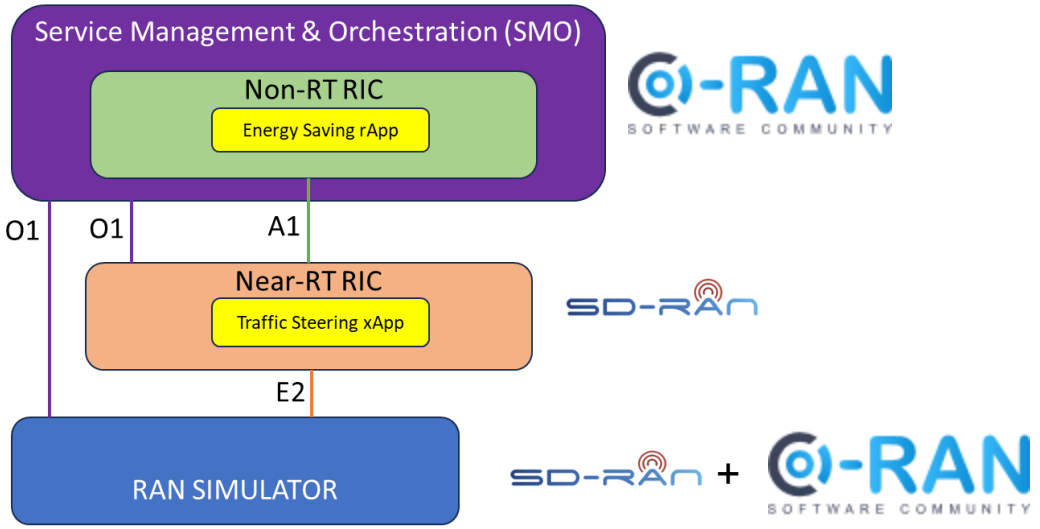
- Normal operation, load is balanced among 3 cells
  - 120 UEs
    - 30 served by Cell 1
    - 30 served by Cell 2
    - 30 served by Cell 3
    - 30 moving between the cells

- Cell 1 is the candidate cell for on/off (capacity cell)
- Cell 2 and 3 are alive all the time (coverage cells)
- The cell load is changed in a time-varying manner

1. ES rApp monitors load of the cells
2. ES rApp predicts the load
3. ES rApp selects cell for shutting down
4. ES rApp informs TS xApp
5. TS xApp drains selected cell
6. ES rApp shuts down cell
7. ES rApp keeps monitoring…

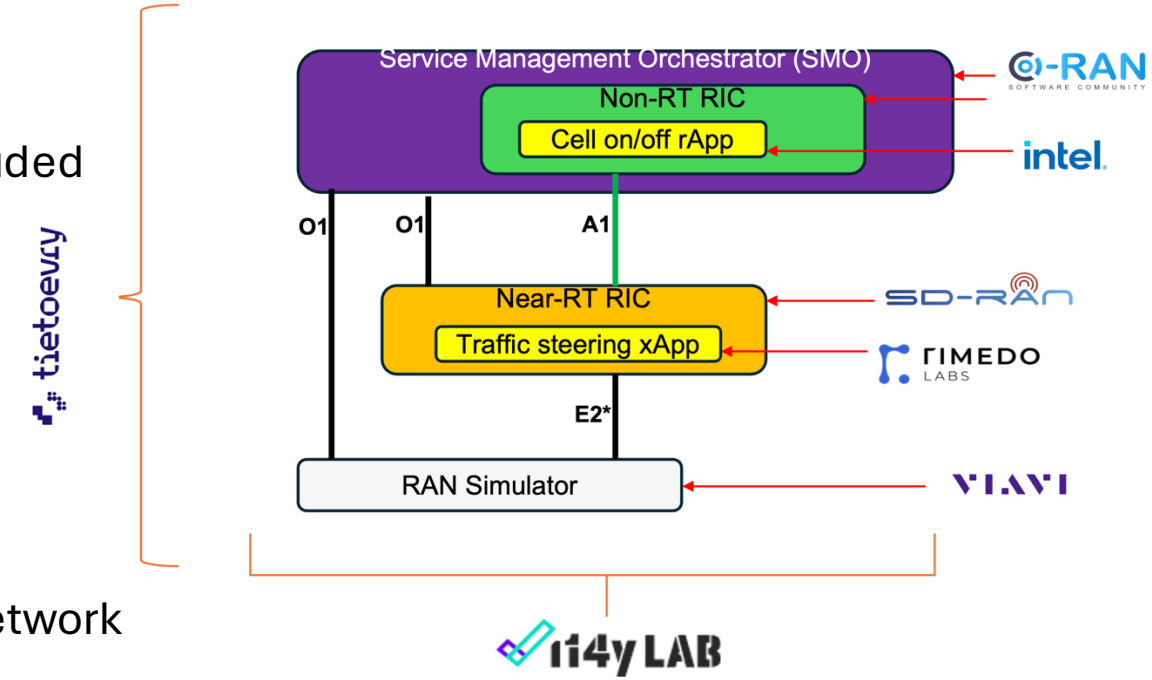
Example demos (1)

- FYUZ, Madrid, October 2023
- Intelligent **cell on/off RAN energy savings application** (rApp) that works hand-in-hand with a **traffic steering application** (xApp)
- Ensuring quality of service while optimizing RAN energy consumption
- Rimedo Labs has developed the rApp and xApp
- Tietoevry has provided system integration and test services



Example demos (2)

- RIC Forum, Dallas, March 2024
- **RAN energy saving and traffic steering coordinated under one demo**
  - Cell on-off rApp
  - Traffic steering xApp
- All key O-RAN compliant elements are interfaces included
  - Near-RT RIC, Non-RT RIC, SMO
  - **A1, O1, and E2* interfaces**
- rApp and xApp are from **different vendors**
  - Demonstrating **interoperability**
- **Open-source** Near-RT RIC, Non-RT RIC and SMO
- Commercial RAN Simulator
  - A realistic representation of O-RAN compliant RAN
- Energy saving AI/ML models for rApp trained on real network data (TIM)



Example demos (3)

- Demo in i14y Lab (ongoing effort)
- Uses O-RAN SC SMO and Non-RT RIC frameworks
- Idea to demonstrate **TS rApp** and ES rApp
  - Research needed for TS over O1
- Goal is to advance to a field trial

Example demos (4)

- Demo in POWDER Lab, University of Utah (ongoing effort)
- Uses O-RAN SC SMO and Non-RT RIC framework
- Idea to demonstrate **commercial rApps**, ported onto the **open-source stack**, on top of a **commercial simulator**
- Goal is to replace the RAN simulator with real hardware in the POWDER outdoor testbed

Ongoing efforts (1)

- NTIA R&D Grant: 5G Energy Efficiency - Metrics, Models, and System Tests
- Research, develop, and validate accurate and effective test methods:
  - To measure the energy efficiency of 5G network components
  - Effectiveness of end-to-end Open RAN energy optimization strategies
- In collaboration with WINLAB, Rutgers University
- Uses **open-source components** for the experiments: O-RAN SC, OAI, srsRAN

Ongoing efforts (2)

- RIC Evaluation – joint effort between Aether and O–RAN SC
- Led by Aether and O-RAN SC projects
- Conducted by Rimedo Labs
- Purpose is to assess the state of open-source Near-RT RIC frameworks, analyze gaps
  - O-RAN SC Near-RT RIC
  - SD-RAN
  - FlexRIC
- Steps towards harmonization in the different communities

Ongoing efforts (3)

- NSF funded INDIGO Project (Intelligent 5G “All-G” Networks Designed and Integrated for Globalized Operations)

- O-RAN SC **SMO framework** is used to depict a Single Operator SMO
- O-RAN SC **Simulator project** is used to simulate RAN with its relevant interfaces (focus on O1 and OFH-MP)

Benefits of Open-Source Software in Open RAN

- Interoperability and Standardization
- Flexibility and Customization
- Rapid Innovation and Iteration
- Cost Reduction Through Shared Development
- Diversification of the Supply Chain
- Support for SMEs, Startups and Academia
- Workforce Development and Skill Building
- Enhanced Security and Transparency
- Strategic Autonomy

Challenges in Leveraging Open-Source for Open RAN

- Integration Complexities
- Maintaining Quality and Performance
- Security Concerns
- Managing Diverse Contributions
- Support and Maintenance
- Sustaining Open-Source Projects
- Investment in R&D
- Sustainability of Business Models

Conclusion

- **Changing the Telecom Landscape**
  - Disruption of Traditional Models
  - Future-Ready Networks
  - Ecosystem Growth
  - Sustainability and Long-Term Vision
- All stakeholders - telecom operators, vendors, regulators, and developers - need to continue tight collaboration

Q&A

Thank you!