Best Practices and Lessons Learned from Open RAN Commercial Deployment by Vodafone

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1. Executive Summary

Vodafone has undertaken a strategic transformation toward Open RAN to increase flexibility, strengthen supply-chain resilience, and accelerate innovation. Commercial deployment relies on a converged multi-technology architecture, a mature multi-vendor ecosystem, and a standardized operating model enabling scalable Open RAN Industrialization.

2. Open RAN Key Benefits

At the foundation of Vodafone's Open RAN strategy lies a set of core principles that explain why this architectural shift delivers meaningful value. Beyond the technological evolution itself, these principles provide the framework through which Open RAN enables tangible benefits and supports scalable industrialization across the network.

Within this context, the primary benefits of Open RAN can be articulated as follows:

- **Open Interfaces:** Standardized O-RAN Alliance and 3GPP interfaces that enable true multi-vendor interoperability.
- **Cloudification:** Virtualized DU/CU workloads deployed on general purpose IT hardware, enhancing agility and scalability.
- **Intelligent Platforms:** Service Management & Orchestration (SMO) and RAN Intelligent Controller (RIC) introduce unified orchestration, advanced automation, and Artificial Intelligence / Machine Learning (AI/ML) driven optimization capabilities.

3. Vodafone Open RAN Architecture Overview

Vodafone's Open RAN architecture has been designed to provide a coherent, scalable, and future ready technical foundation that enables true multi-vendor operation under a unified framework. This architectural approach forms a central pillar of Vodafone's Open RAN Industrialization strategy, ensuring that diverse network functions and components can interoperate consistently while supporting automated, cloud native operations.

The architecture can be summarized in three key pillars:

- **Converged Architecture:** Vodafone has adopted a unified RAN architecture that integrates 2G, 4G, and 5G under a single management, orchestration, and optimization framework, reducing operational complexity and ensuring consistent deployment practices.
- **Managed Multi-Vendor Model:** The deployment follows an integration framework that enables different network functions and components to coexist under standardized O-RAN and 3GPP interfaces, supported by clear separation of responsibilities, pre-validated components, and consistent lifecycle processes.
- **Distributed Architectural Approach:** Vodafone applies a distributed architecture, positioning latency sensitive functions at the edge to avoid premature centralization and ensure efficient handling of performance, availability, and transport constraints. Architectural choices are guided by technological maturity and operational needs.

Industry experience shows that Open RAN architecture evolves progressively as interfaces maturity, automation capabilities, and operational frameworks advance. This reinforces the need for architectural decisions guided by technological readiness rather than being fixed at early stages.

4. Evolution Toward Autonomous Network Operations

Vodafone's Open RAN program is closely aligned with a broader transformation toward autonomous network operations. This evolution is driven by the need to manage increasing complexity across disaggregated architectures while ensuring operational efficiency, agility, and long-term scalability. Open RAN provides the foundation for this shift, enabling higher degrees of automation and intelligence through standardized interfaces and cloud native design.

Across the industry, autonomous operation proves most effective when supported by standardized interfaces and a mature control framework that ensures consistent behaviour across disaggregated components.

The evolution toward autonomous networks is defined by the following principles:

- **Automation as a Core Capability:** Open RAN introduces a management framework that supports zero touch provisioning, automated configuration, and real-time performance optimization. Automation is no longer an addon but an inherent component of network operations.
- **AI/ML Driven Decision Making:** The integration of intelligence within the management and orchestration layers enables predictive optimization, initiative-taking fault handling, and dynamic resource allocation. These capabilities strengthen network resilience and improve operational outcomes.
- **Closed Loop Control:** Autonomous functions leverage continuous monitoring and feedback mechanisms to adjust network behaviour without manual intervention. This supports consistent performance even under changing traffic patterns and service conditions.
- **Unified Operating Model:** As networks become more software driven, operational models shift toward centralized orchestration, policy driven workflows, and standardized processes that allow multi-vendor systems to behave as a coordinated whole.

  Future Ready Architecture: The transition toward autonomous networks lays the groundwork for next generation capabilities, ensuring that the network can evolve toward emerging paradigms such as AI native design and advanced automation without architectural disruption.

5. Operational Model & Organizational Implications of Open RAN

Open RAN industrialization introduces a material shift in the operational model compared to traditional Single RAN (SRAN) deployments. While SRAN relies on vertically integrated vendors with clearly bounded responsibilities, Open RAN requires a federated operating model spanning RAN, Cloud, IT, and automation domains.

Operational phases evolve accordingly. In addition to deployment and operations, Open RAN introduces structured pre-integration, package validation, and lifecycle governance stages that are critical to achieving scale. These phases require tighter coordination between product integration, deployment, and operations teams, supported by standardized acceptance gates and automation-driven workflows.

Organizationally, new roles emerge to manage this complexity. Beyond traditional RAN engineering and operations functions, Open RAN introduces roles such as Package Managers, Release Managers, and Integration Engineers, responsible for end-to-end coherence of multi-vendor packages. Clear ownership boundaries must be established between RAN, Cloud, and IT teams, particularly around infrastructure lifecycle, cloud platform management, and SMO-driven automation.

A key differentiator versus SRAN is the introduction of a Third-Party System Integrator (3PSI). Acting under operator governance, the 3PSI coordinates multi-vendor integration, interoperability validation, and issue resolution across domains, enabling the operator to retain architectural control without assuming full integration execution internally.

Successful Open RAN industrialization depends on a unified operating model where responsibilities are explicitly defined, interfaces between teams are formalized, and automation is embedded from design to operations. Operators must proactively adapt organizational structures and governance models to avoid fragmentation and ensure predictable, scalable operations.

6. Deployment Best Practices

Open RAN deployment at scale requires a repeatable, consistent, and automation driven approach. Vodafone's Industrialization program has demonstrated that deployment efficiency depends not only on technical readiness but also on standardized processes and tightly coordinated integration across all domains. The following practices have proven essential to achieving predictable, high-quality rollout at scale.

- **Standardized Deployment Blueprints:** The use of unified deployment templates ensures consistency across markets, reduces variability, and accelerates field execution. Standardization also minimizes integration errors and provides a clear baseline for troubleshooting and optimization.
- **Pre-Configuration and Preparation:** Whenever possible, network functions and configuration elements are prepared in advance, aligning with centrally defined design principles. This reduces onsite workload and enables faster, more reliable installation. Consistent with industry experience, defining unified feature and configuration profiles helps reduce interpretation gaps and minimizes integration rework in multi-vendor environments.
- **Vendor Ecosystem and Package Lifecycle Management:** Open RAN shifts vendor management from single end-to-end solutions to a multi-vendor, package-centric model. Industrialization requires clear governance at package level, with defined ownership, responsibilities, and lifecycle expectations across RAN, cloud, and platform components. Structured onboarding, mandatory pre-integration, and explicit accountability for interoperability and performance are essential to reduce integration risk and enable sustainable scale-out.
- **Automation Enabled Rollout:** Deployment activities increasingly rely on automation provided through the management framework, enabling zero touch provisioning, consistent configuration, and streamlined activation workflows. Automation is a key enabler for scaling Open RAN efficiently. Neutral pre-integration environments have shown significant value in identifying interoperability issues early, reducing rework before components enter operator validation labs.
- **Process Simplification and Alignment:** Open RAN deployment benefits from simplified operational processes that align infrastructure, Cloud, and RAN layers under a consistent model. Clear governance and standardized workflows ensure that multi-vendor components behave cohesively throughout deployment.
- **Feedback Driven Continuous Improvement:** Insights from early deployments feed directly into design refinements, tooling enhancements, and updated best practices. This continuous improvement loop strengthens reliability as deployment volume increases.

7. Lessons Learned

Open RAN has demonstrated that disaggregated architectures can be deployed and operated at scale when supported by strong integration governance, standardized processes, and automation-driven operating models. Vodafone's experience shows that the transition from pilot implementations to industrialized deployments provides a set of meaningful lessons that continue to shape future evolution across the ecosystem.

The most relevant lessons learned are the following:

- **Standardization is essential for scale:** Unified design frameworks, configuration templates, and consistent deployment blueprints reduce variability and ensure predictable performance across diverse environments.
- **Pre-integration and validation reduce complexity:** Early alignment and structured verification of components, supported by centrally defined configuration profiles, help minimize interpretation gaps and accelerate readiness for commercial deployment.
- **Automation must be embedded early:** Zero-touch provisioning, automated configuration, and AI-assisted optimization simplify operations and lay the foundation for more advanced autonomous network capabilities.
- **Integration maturity depends on clear governance:** Successful multi-vendor operation requires the operator to lead coordination, define expectations, and establish frameworks that reduce ambiguity and ensure coherent behaviour across all components.
- **Cross-operator collaboration accelerates progress:** Sharing insights, aligning expectations, and promoting common frameworks across operators strengthen ecosystem maturity and support industry-wide consistency.
- **Architecture must evolve with technological readiness:** Open RAN benefits most when architectural decisions, such as function distribution or automation depth, are guided by interface maturity, operational experience, and real performance needs rather than early assumptions.

8. Key Success Factors and Challenges

Vodafone's Open RAN Industrialization highlights a set of factors that have consistently enabled successful large-scale deployments, as well as challenges that continue to shape the evolution of open, disaggregated networks. These insights complement the best practices and lessons learned, providing a holistic view of the operational realities behind Open RAN adoption.

Key Success Factors

- **Architectural Consistency:** Maintaining a unified design framework across network generations supports coherent evolution, simplifies integration, and accelerates deployment. This consistency has proven fundamental for scaling Open RAN effectively.
- **Integration Governance Led by the Operator:** Clear coordination, structured validation phases, and transparent decision frameworks enable reliable multivendor operation. Industry experience reinforces that operator led governance plays a central role in ensuring alignment across components.
- **Performance and SLA Management in Multi-Vendor Open RAN:** In Open RAN environments, end-to-end performance and SLA compliance are no longer implicitly guaranteed by a single vendor. Clear definition of KPIs, explicit ownership across domains, and

integrated performance validation are essential to ensure predictable behaviour and sustain performance at scale.

- **Automation First Operational Model:** Embedding automation in provisioning, configuration, and optimization activities allows for predictable operations and forms the basis for more advanced autonomous capabilities over time.
- **Standardization at All Levels:** Consistent blueprints, configuration profiles, and lifecycle processes help reduce variability and ensure repeatability at scale, enabling Open RAN to behave predictably in diverse environments.

Key Challenges

- **Interpretation Variability across Specifications:** Differences in feature interpretation and optional behaviours can introduce integration mismatches. Unified profiles and structured pre-verification have proven effective in mitigating these challenges.
- **Multi-layer Coordination across Disaggregated Domains:** Cloud, transport, and RAN layers evolve at different speeds, requiring close alignment to maintain operational coherence and avoid bottlenecks during deployment and optimization.
- **Evolving Interface Maturity:** Open RAN relies on interfaces whose standardization and ecosystem readiness progress over time. Deployments must adapt to varying levels of maturity while avoiding premature architectural commitments.
- **Operational Scaling Requirements:** As Open RAN deployments expand, maintaining consistent quality requires strong observability, continuous improvement loops, and tools capable of supporting dynamic and distributed environments.

9. Conclusion

Open RAN has progressed from an exploratory concept to a fully industrialized model capable of supporting largescale commercial networks. Vodafone's experience shows that openness, cloud native design, and automation can be combined to deliver a flexible, resilient, and future ready RAN architecture. Through consistent standardization, strong integration governance, and an automation driven operating model, Open RAN has proven capable of evolving into a robust foundation for multi-vendor operations at scale.

As the ecosystem continues to mature, collaboration among operators, alignment around shared frameworks, and the ongoing evolution of open interfaces will play an increasingly key role. These elements are essential for unlocking advanced capabilities, including AI enabled optimization and more autonomous network behaviours. Vodafone's contributions and lessons learned aim to support this collective progress and help shape the next generation of open, interoperable, and intelligent mobile networks.