Axiata
Autonomous
AI Network

WHITE PAPER

A Comprehensive Approach to the Autonomous Networks and AI

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1.0 EXECUTIVE SUMMARY

Axiata Group, a leading telecommunications conglomerate in Asia, has launched an ambitious initiative to transform its network infrastructure and operations through the implementation of Autonomous Networks (AN) and Artificial Intelligence (AI). This white paper details Axiata's A3 (Axiata AN AI) strategy, which aims to overcome the limitations of legacy architecture and propel the network to the highest AN level as defined by the TM Forum. The A3 strategy represents a paradigm shift in both technology and network-building approaches, positioning Axiata at the forefront of the telecom industry's digital transformation. This document serves existing and future technology partners in addressing Axiata's needs.

2.0 INTRODUCTION

Axiata has evolved from a holding entity with a portfolio of pure-play mobile assets into a Triple Core Strategy driven business focusing on Digital Telco, Digital Businesses and Infrastructure. The A3 strategy is a crucial component of this transformation, designed to address the challenges posed by legacy architecture in rapidly advancing network capabilities.

3.0 A3 NETWORK ARCHITECTURE

The A3 Network Architecture is designed to deliver several critical capabilities essential for the 5G era and beyond:

3.1 KEY FEATURES

- Openness.
- Programmability.
- Cost efficiency.
- AI native.
- TMF/ODA conformity.
- Scalability.

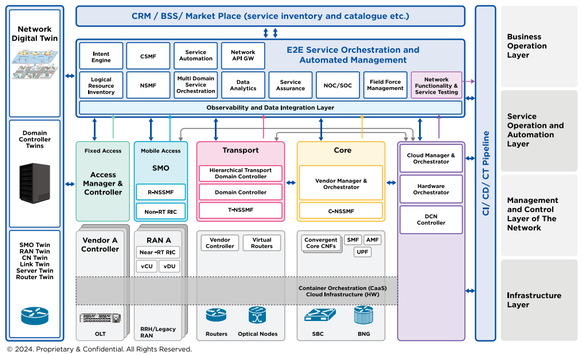
3.2 CORE COMPONENTS

- Cloud Native Infrastructure (CNI): A horizontal and disaggregated platform hosting all software applications and Cloud Native Functions (CNF) across network domains.
- Service operation and automation layer: Interacts with all domains via open interfaces for service operations.
- Business operation layer: Communicates with the service operation layer through open interfaces, like TMF.
- CI/CD/CT pipeline: Automates the lifecycle management of all applications.
- Network Digital Twin (NDT): Provides necessary digital simulation of the network.

3.3 10 KEY PRINCIPLES

1. Decoupling of hardware and software.
2. Separation of user plane and control plane.
3. Cloudification ultimately extending to cell sites.
4. Decomposition of network elements.
5. Cloud-native and microservices-based application implementation.
6. Open APIs and network programmability through Software Defined Networks.
7. CI/CD/CT-based software lifecycle management.
8. Service orchestration.
9. Digital twin technology.
10. Adoption of Open Source.

HIGH LEVEL A3 NETWORK ARCHITECTURE



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Fig. High-level A3 Network Architecture

4.0 DOMAIN-SPECIFIC IMPLEMENTATIONS

4.1 DOMAIN-SPECIFIC IMPLEMENTATIONS

- Primarily utilises Passive Optical Network (PON) technology.
- Implements Optical Line Terminal (OLT) for customer proximity.
- Employs vendor-specific management and control layer.
- Utilises southbound standards and protocols (e.g., Netconf, SSH, SNMP, BGP/PCEP).
- Implements northbound APIs for interaction with service orchestration and automation layer.

4.2 RADIO ACCESS NETWORK (RAN)

- Support for open interfaces and standards including A1, O1 and O2 as defined by OpenRAN alliance.
- Supports native AI/ML and data analytics capabilities that enable seamless development and deployment of vendor independent 3rd party applications and use cases including RAN planning, SON and ZTP.
- A unified management and control platform based on a standardised data architecture and standardised interfaces that enables multi-vendor, multi system support and portability of use cases and AI/ML models seamlessly across Axiata operating companies. (e.g. Service Management and Orchestration framework)
- Integrates Non-Real-Time and Near-Real-Time RAN Intelligent Controllers (RIC).
- Supports both legacy (OSSii) and Open RAN components.

4.3 TRANSPORT NETWORK (TN)

- Implements SDN-based programmable architecture.
- Utilises hierarchical controllers for efficient management.
- Supports front-haul, mid-haul, back-haul and core site connectivity.
- Implements Ethernet with 802.1 Time-Sensitive Networking (TSN) and Passive WDM for front-haul.
- Gradual transition from IP/MPLS to SRv6 networks.

4.4 CORE NETWORK (CN)

- Adopts cloud-native Service-Based Architecture (SBA) as outlined by 3GPP.
- Implements convergent core strategy for 4G/5G integration.
- Deploys key 5G Standalone (SA) functions (e.g., UPF, SMF, AMF, NRF).
- Achieves Fixed Mobile Convergence (FMC) through integration of non-3GPP access.
- Implements Control and User Plane Separation (CUPS) principles.

5.0 MANAGEMENT AND CONTROL LAYER

Each network domain incorporates a management and control layer with the following key components:

- Domain orchestration: Orchestrates cloud infrastructure for deploying domain network functions.
- Controller: Interacts with network elements, optimises resource utilisation and enhances network efficiency.
- Network observability and assurance: Handles continuous collection and storage of logs, metrics and alerts.
- AI/ML and data analytics: Enables integration of various algorithms and facilitates access to external data.
- Automation functionality: Supports the integration of third-party and in-house applications for closed-loop automation.
- Intent engine: Translates network intent into resource intent for respective network elements.

6.0 E2E SERVICE ORCHESTRATION AND AUTOMATED MANAGEMENT LAYER

E2E Service Orchestration and Automated Management coordinates and automates service delivery across different network domains (RAN, Core, Transport and Edge), managing the complete service lifecycle from creation to termination. It leverages AI/ML-driven automation for zero-touch operations, enabling closed-loop control for self-healing and optimisation, while ensuring seamless integration of network resources, policies and SLAs to deliver reliable end-to-end services with reduced operational costs and improved customer experience.

1. Intent Engine (IE) - translates business requirements into network intents. It receives insights from Data Analytics, provides intents to MDSO, guides service automation policies.
2. Logical Resource Repository (LRR) - maintains inventory of all network resources with the capacity of updating MDSO with resource status, receiving requests from NSMF, tracking resource allocation.
3. Communication Service Management Function (CSMF): manages customer-facing service lifecycle. It receives orchestration from MDSO, sends requirements to NSMF, interfaces with service assurance.
4. Network Slice Management Function (NSMF) - manages network slice lifecycle with the capability of receiving service requirements from CSMF, requesting resources from LRR, coordinating with MDSO.
5. Service Automation (SA) - automates service processes and workflows triggered by MDSO, follows intent engine policies.
6. Multi Domain Service Orchestration (MDSO) - coordinates cross-domain service delivery, receiving intents from IE, Orchestrating CSMF and NSMF and triggering service automation.
7. Network API Gateway (NAG) - provides unified API interface to network exposing network monetisation capabilities.
8. Data Analytics (DA) - provides network and service insights, receives data from ODI layer, feeds insights into Intent Engine and supports service assurance and NOC/SOC.
9. Service Assurance (SvcA) - monitors service quality and performance, receives analytics from DA, reports KPIs to NOC, monitors service health.
10. Network/Service Operations Centre (NOC/SOC): centralises network and service operations management, receives service KPIs and SLAs from Service Assurance, manages Field Force and Network Testing, consumes operational data from ODI.
11. Field Force Management (FFM) - manages field operations and maintenance, receives tasks from NOC, updates ODI with field data, coordinates with Network Testing.
12. Network Testing (NT) - Performs network testing and validation, receives requests from NOC, reports results to ODI and supports service assurance.
13. Observability & Data Integration Layer (ODI) - centralises data collection and integration and constitutes the Single Source of Truth for data. It collects data from NAG, feeds Data Analytics and provides operational data to NOC.

7.0 IMPLEMENTATION CONSIDERATIONS

7.1 CLOUD NATIVE DESIGN

- All components should follow cloud-native design principles.
- Deployment should be possible on any third-party cloud platforms.

7.2 API INTEGRATION

- Standardised northbound and southbound APIs for each domain.
- Integration with end-to-end service orchestration and automation layer.

7.3 NETWORK SLICING

- Implementation of network slicing capabilities across all domains.
- Unified management of slices through the E2E service orchestration layer.

7.4 CI/CD/CT PIPELINE

- Vendor independent automation of end-to-end lifecycle management for Cloud Native Functions (CNFs).
- Support for GitOps model for implementing CI/CD/CT pipelines.
- Compatibility with multiple Kubernetes versions for cluster rolling upgrades.

8.0 INTENDED OUTCOMES

The implementation of the A3 strategy is expected to yield several significant benefits:

1. Substantial reduction in operational expenditure through extreme automation.
2. Minimised capital expenditure via stable orchestration and automation layer and utmost openness of the ecosystem.
3. Vendor inclusive and open innovation capabilities.
4. Significantly shortened time-to-market for services, especially complex 5G offerings.
5. Addressing critical challenges such as:
   - Erosion of traditional revenue streams.
   - Lack of disruptive competition.
   - Insufficient agility.
   - High network costs.
   - Flat or declining Average Revenue Per User (ARPU).

9.0 CONCLUSION

Axiata's A3 strategy represents a comprehensive and forward- thinking approach to network transformation. By leveraging cutting-edge technologies such as AI, ML and cloud-native architectures, Axiata aims to achieve full autonomy in their networks, with advanced capabilities including self-optimisation, self-healing and self-defence. Ultimately this will also secure a competitive cost advantage of network production costs.

This initiative not only positions Axiata at the forefront of the telecom industry's digital transformation but also ensures the company's continued profitability and growth in the increasingly complex and competitive 5G era and beyond. The success of the A3 strategy will likely serve as a blueprint for other telecom operators in the region, potentially reshaping the entire industry's approach to network management and service delivery.

As Axiata moves forward with the implementation of the A3 strategy, ongoing collaboration with vendors, continuous refinement of the architecture and a commitment to innovation will be crucial in realising the full potential of autonomous networks and AI in telecommunications.