How Airtel's "Aura" powers a more open telco cloud

Table of contents

Company introduction and project abstract

Headquartered in India, Airtel is a global telecommunications company with operations in 18 countries across South Asia and Africa. The company ranks amongst the top three mobile operators globally and its mobile network covers a population of over two billion people. Airtel is India's largest integrated telecom provider and the second largest mobile operator in Africa. At the end of March 2021, Airtel had over 471 mn customers across its operations.

Airtel's portfolio includes high speed 4G/4.5G mobile broadband, Airtel Xstream Fiber that promises speeds upto 1Gbps, converged digital TV solutions through the Airtel Xstream 4K Hybrid Box, digital payments through Airtel Payments Bank as well as an integrated suite of services across connectivity, collaboration, cloud and security that serves over one million businesses.

Airtel's OTT services include Airtel Thanks app for self-care, Airtel Xstream app for video, Wynk Music for entertainment and Airtel BlueJeans for video conferencing. In addition, Airtel has forged strategic partnerships with hundreds of companies across the world to enable the Airtel platform to deliver an array of consumer and enterprise services.

The largest hyperscaler cloud providers are now behaving like, and competing with, communication service providers, completely altering the telecommunications landscape. These hyperscalers are threatening to reduce the status of telecommunication companies to only the providers of "fat network pipe". At the same time, exponential data growth has put a severe strain on the profitability and even survivability of telecommunications companies across the world, and more so in a hypercompetitive and price-sensitive market like India.

To meet these challenges in the turbulent market scenario, Airtel wanted to refresh its network architecture with the following business drivers through its Open Telco Cloud Innovation project named "Aura":

- Lower the network total cost of ownership (TCO)—specifically capital and operating expenses—which, like other telecommunications companies, is its biggest expense item.
- Improve the customer experience through a more responsive and performant network.
- Realize faster time to market; rapidly enhance and expand its core network to meet the increased demand of mobile data.
- Launch new digital services in B2B, IoT and 5G by onboarding of third-party services, including gaming, remote media production and enterprise services.

"Aura" Architecture principles

Airtel and IBM set the architecture principles early on to align all downstream design, development and implementation activities in this transformation journey:

- Achieve stability and performance at scale, at par with "vertically integrated" network designs.
- Support multiple evolving hardware—network functions virtualization infrastructure (NFVI) architectures—underneath standardized virtual infrastructure managers (VIM) to exploit performance optimizations.
- Use extreme automation to achieve a public cloud kind of experience—both in the build phase and the run phase.
- Ensure lifecycle management across NFVI (VIM/CIM) and VNF upgrades.
- Develop a flexible architecture that can support a variety of core, edge and far-edge network workloads.
- Use fully decoupled architecture which is VNF and container agnostic, SDN agnostic and hardware agnostic and enabled for close-loop orchestration.
- Provide support for both virtual machines (VMs) and container-based network functions, with clean migration to the Red Hat® OpenShift® platform as workloads become containerized.

This solution is based on IBM Network Cloudification Reference Architecture, which is developed around the European Telecommunications Standards Institute (ETSI) NFV Architecture Framework. It's built upon the foundations of the best-of-breed Red Hat technologies, including Red Hat OpenStack, OpenShift, Ceph storage and so on, and IBM and Airtel services.

“Aura” Automation vision

Automation is the foundation on which this open, programmable hybrid multi-service network cloud platform is being set up. It entails standardization and automation right from the “planning” to “build” to “run” stage to give a public cloud like, near-zero-touch experience.

It means to implement an end-to-end process through automation—to respond to service demands, say by a network planner, to quickly plan a new site, or respond to an engineering team’s demands to scale out the network to a new site.

In the current scenario, these processes are highly manual—involving lots of Excel sheet ingenuity, human design inputs and tribal knowledge of build and operations—which has the potential for errors, leading to inconsistent cloud deployments and delayed onboarding of network services.

Airtel will have a catalog-driven user experience of a hyperscale public cloud in all its process touchpoints when planning, building and operating its hybrid multi-service network clouds—powered by automations from IBM and Airtel solutions and services.

Key design goals of automation

Automation has been designed to achieve the following goals:

- Reduce human errors and delays in cloud deployment.
- Build a consistent cloud every time, at scale.
- Preserve tribal knowledge from humans and encode it in automation playbooks and processes.
- Reduce costs of deploying a cloud site.
- Reduce the time for deployment from months to weeks to days.
- Deploy and manage vEPC, vRAN and other network sites at scale.

End-to-end operating model

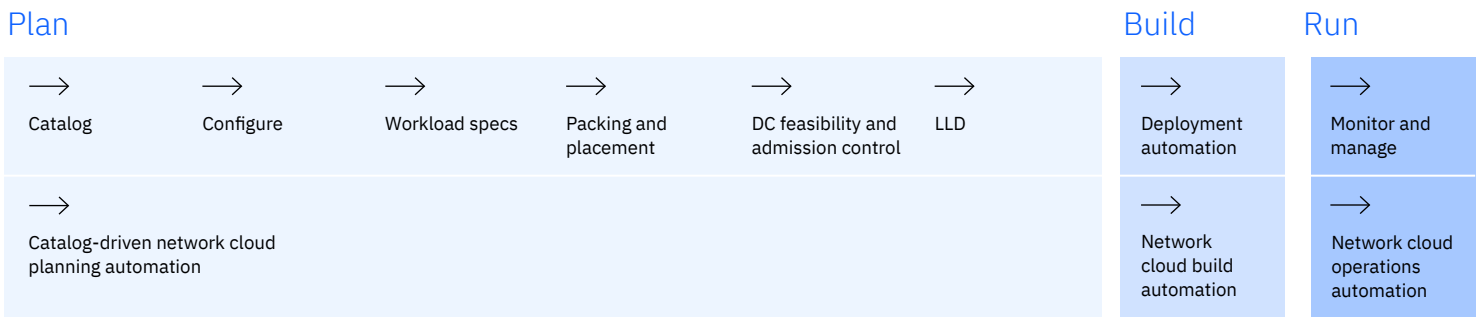
Roles	Mobility and enterprise business teams	Planning team	SI partner	NEP or SI	NEP or SI	SI partner	SI partner	SI partner	Operations or NOC
Process	→ Catalog-based planning and build	→ Feasi-bility, VNF planning, IP planning, and infra-structure capacity	→ Cloud build	→ VNF and CNF on-boarding	→ Site and PNF integration and config-uration	→ NOC integration	→ Testing	→ MBSS/ security hardening	→ O&M hand-over and lifecycle manage-ment
Implementation	→ Planning automation and build catalog		→ Config-urator and LLD automator	→ End-to-end LLD build		→ Deploy cloud	→ Deploy service		⇄ Maintain service

Automation architecture

This comprehensive automation includes three key phases, which seamlessly segue from one phase to the other as shown in the following diagrams:

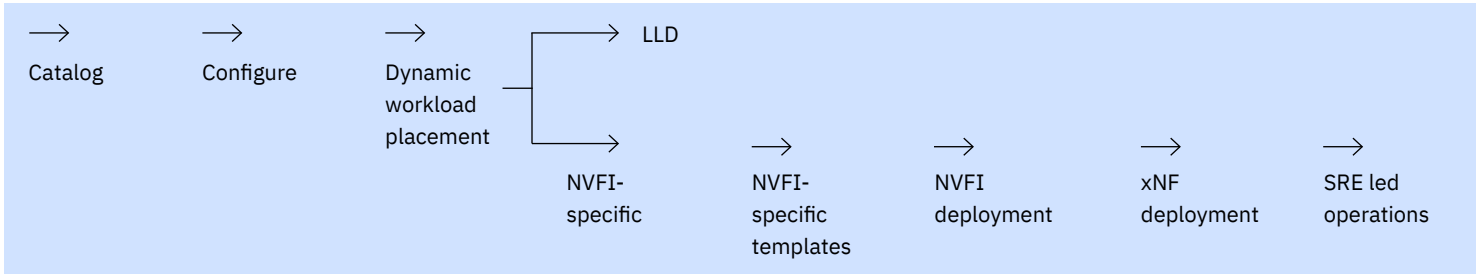
- Planning. Plan to order
- Build. Order to build
- Run. Build to manage

Stages of automation



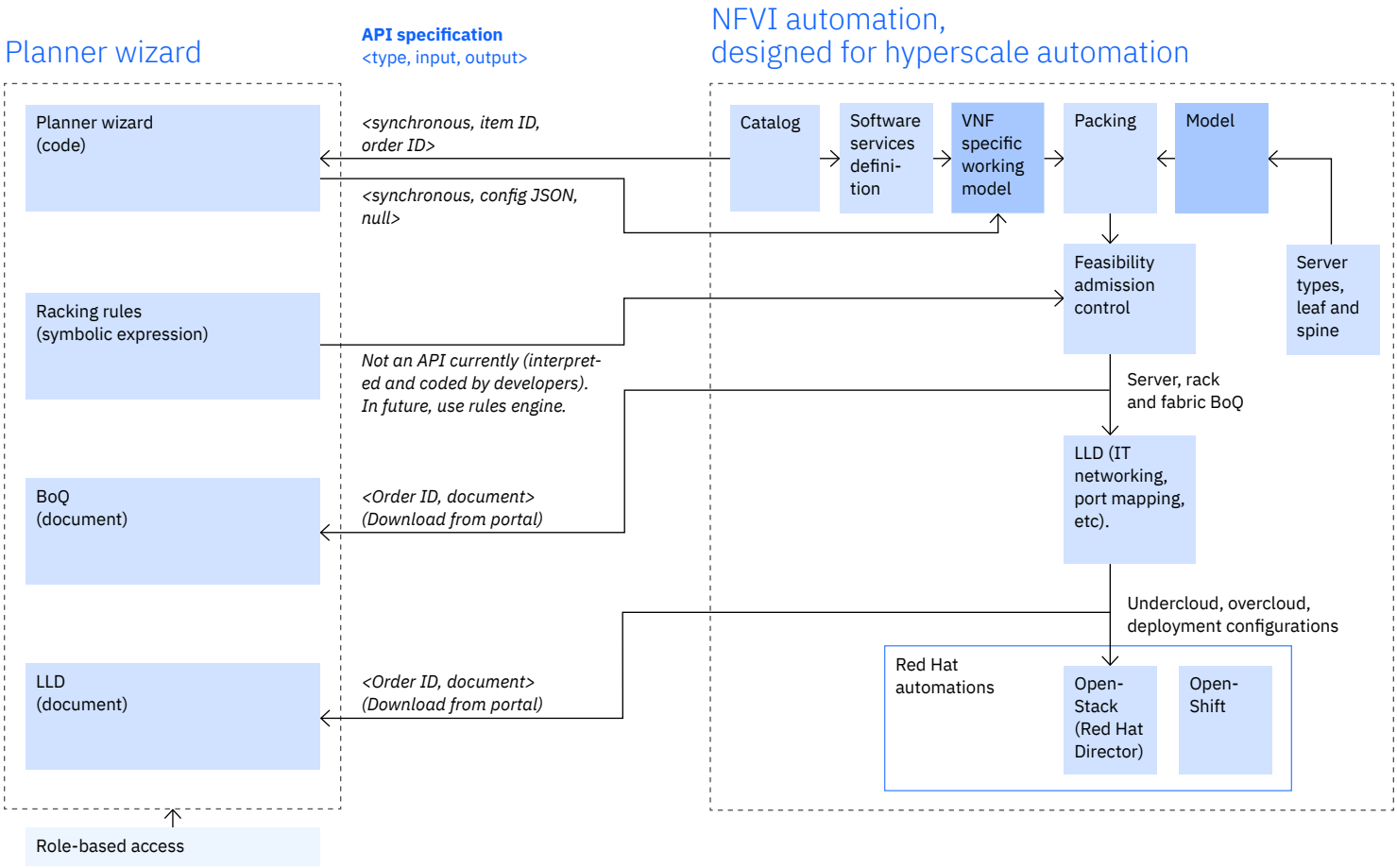
This open cloud architecture built on the foundation of zero-touch provides benefits across the entire telecommunications value chain.

Telco value chain automation



High level automation architecture that has been implemented is shown below:

Automation architecture



How the “Aura” project is unique in telecommunications cloud innovation

This project entails a tectonic shift in the way telecommunications and network equipment providers (NEPs) have approached SDN and NFV in more than a decade. So far, the vertical cloud stack and single neck-to-choke approach has been adopted by telecommunications companies, working closely with their NEPs, to bridge the immediate tactical needs of traffic growth. It has led to some benefits, but this model hasn’t been able to break silos and the bulk of the potential CapEx and OpEx saving opportunities are still trapped in these vertical network cloud silos.

Secondly, to squeeze better performance, NEPs have forked the cloud stack they adopted from the upstream OpenStack communities for their vertical network clouds. This process limits the openness of the cloud and thus limits the benefits that can be realized from a truly disaggregated horizontal cloud.

This project sets up the foundation for an open multi-service hybrid network cloud platform, which is innovation led and provides an opportunity to move up the value chain.

This horizontal, disaggregated architecture can:

- Onboard core network, edge and enterprise workloads.
- Onboard virtualized, as well containerized workloads.
- Provide a well-defined migration path from virtualized to containerized workloads.
- Seamlessly scale both horizontally and vertically

This disaggregated architecture is VNF and CNF agnostic, fabric and SDN agnostic, and hardware agnostic which enables Airtel to unlock the full value from the innovations in each layer.

This open cloud architecture is built on the foundation of “extreme automation” in all stages— planning, build, test and run—with the objective of a zero-touch, public cloud experience at all stages of the lifecycle.

It uses the software-defined nature of the next-generation networks to put in place a strategic zero-touch automation vision that spans the existing infrastructure, the new virtualized infrastructure and the end-to-end operational processes that link this telecommunications value chain from core to the edge.

NEPs have “tested the waters” with automation, but the scope of automation has been limited. NEPs have traditionally taken a restrictive view of automation to fulfill a tactical need, and in most cases, it’s also restricted to their own workloads. Additionally, we haven’t come across any NEP attempting automation from ordering to operations. Only hyperscalers are attempting it so far—on the “edge”.

What has been achieved so far

Catalog-driven planning automation

Airtel and IBM have worked closely over the last several months to convert this vision into reality. It has been a joint effort between Airtel strategy, planning and operations subject matter experts working with IBM’s functional experts, Red Hat OpenStack experts, and full stack and UI developers to build a planner wizard that completely automates the network cloud procurement process, resulting in software-driven outputs and artifacts, namely:

- A service catalogue of workloads for core, edge, far edge and enterprise workloads
- Automated bill of quantity (BoQ) for the above workloads
- Automated build of the low-level design (LLDs) for the cloud sites
- Automated generation of parameters from the LLD for the templates required by the cloud build automation—specifically for use with the TripleO, the upstream project used in Red Hat to build the overcloud computes from the undercloud nodes
- Telecommunications-specific racking and stacking rules, and their server type standardizations into the code

Build automation

Build automation has been fully automated to streamline the “build” process, making it faster and “error-free”.

- Automated server preparation, basic input/output system (BIOS), firmware, RAID and so on
- Single-click cloud deployment
- Automated, cloud-validation post deployment and user accepted testing (UAT)

Run automation

Operations activities have been automated with the objective to reduce the time and effort required to trouble-shoot, diagnose and resolve issues and achieve lower MTTR (Mean Time To Repair).

- Automated health check and diagnosis of the system
- On-demand, one-click debug of system for troubleshooting
- Automation of controller replacement, compute replacement and storage node replacement
- Automated scale out and scale in
- Logging and monitoring, including integration with fault management (FM) and performance management (PM)
- Automated backup and restore

Future vision

Data center information model: Another important aspect of this automation is the concept of the planned site. It’s the manifestation of the BoQ and the LLD for the network cloud site planned in a data center information model (DCIM). This model is a crucial aspect of the automation design, which has far-reaching implications in the end-to-end processes.

- It provides a model-driven view of the BoQ and the LLD—that is the planned state of the network cloud site.
- It provides the scaffolding for site expansion planning.
- It provides a comparative point to network operations when the planned site goes into deployed state using our cloud build automation.
- When a network topology discovery tool discovers the newly deployed cloud, the DCIM provides a clear view of what was originally planned, helping improve cloud planning, design and automated deployment.
- It’s also useful to reconcile the changes between planning and operations.
- It’s very handy in troubleshooting and assurance processes.

How Airtel had benefitted from this project

Cloud implementation of the virtual vEPC and virtual vRAN sites had been carried out using the automation developed as a part of this program resulting into significant benefits for Airtel:

- Automated provisioning has eliminated the deployment errors and inconsistencies that come with traditional manual provisioning; it has also reduced cloud implementaiton time from 4 weeks to 1 week.
- Automation of day-2 operations has simplified network operations e.g. health check process has been completely automated resulting into saving of upwards of 50% effort.
- The major impact will be in operations. Today a client like Airtel plans its capacity at the start of the year and builds its networks accordingly. The next phase of automation at Airtel is to automate complete site expansion, making the planning process more agile and reducing the TCO for network deployment, but using just-in-time (JIT) principles.

Acronyms

API: Application Programming Interface

B2B: Business 2 Business

BIOS: Basic Input Output System

BoQ: Bill of Quantity

CapEx: Capital Expenditure

CNF: Container Network Function

DC: Data Centre

DCIM: Data Centre Information Model

ETSI: European Telecommunication Standards Institute

FM: Fault Management

IoT: Internet of Things

IP: Internet Protocol

JIT: Just in Time

LLD: Low Level Design

MBSS: Minimum Baseline Security Standard

MTTR: Mean Time To Repair

NEP: Network Equipment Provider

NFVI: Network Function Virtualization Infrastructure

NIC: Network Interface Card

NOC: Network Operations Centre

OpEx: Operational Expenditure

PM: Performance Management

PNF: Physical Network Function

RAID: Redundant Array of Independent Disks

SDN: Software Defined Network

SRE: Site Reliability Engineering

TCO: Total Cost of Ownership

TOSCA: Topology and Orchestration Specification for Cloud Applications

vEPC: Virtual Evolved Packet Core

VIM: Virtual Infrastructure Manager

VM: Virtual Machine

VNF: Virtual Network Function

vRAN: Virtualized Radio Access Network

xNF: x (any) Network Function

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Produced in the United States of America
June 2021

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