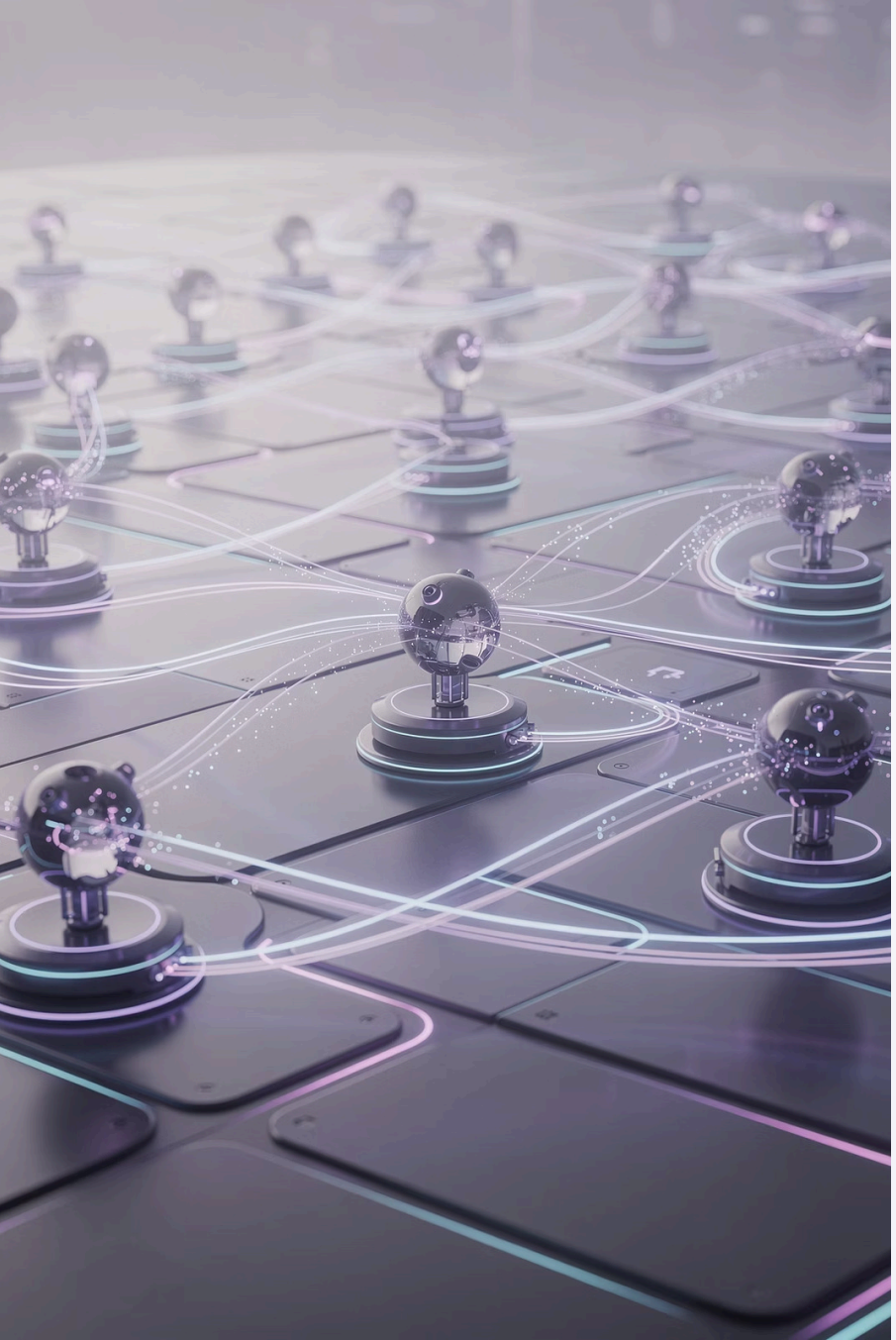


The Intelligent, Autonomous Telecom Network of the Future

AI Solutions and Architecture for the Networks of Tomorrow

From Automation to Autonomy: The Telecom Evolution

Current State

Self-organising networks, cloud-native 5G design — automation for efficiency

AI Enhancement

NWDAF and RAN intelligence as add-ons for prediction, planning, and optimisation

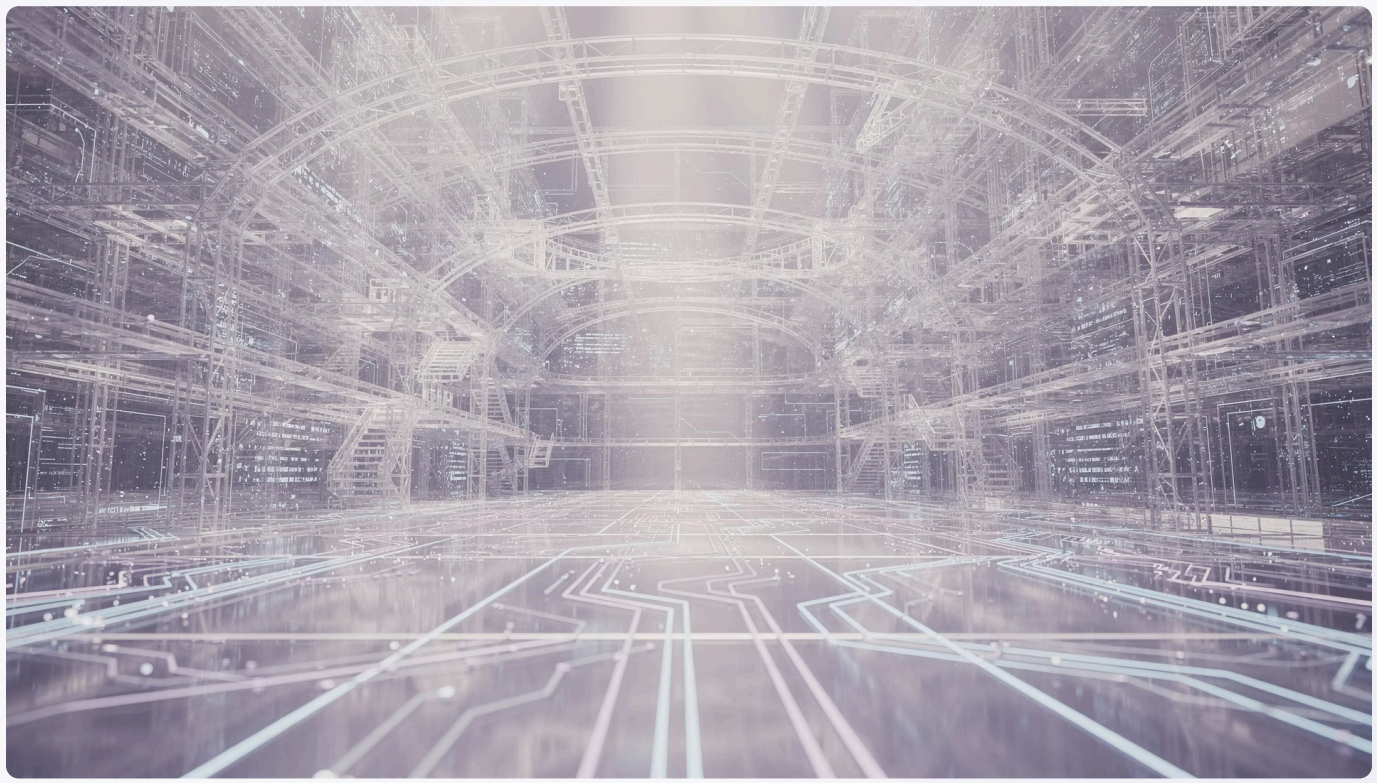
AI-Native Future

Intelligence embedded across all layers — radio, transport, core, edge, and operations

The vision: networks that don't merely carry traffic, but **sense, reason, decide, and act** autonomously.

ARCHITECTURE

AI-Native Architecture: A Fundamental Redesign



Embedded Intelligence

AI is integral to network design — not bolted on as an afterthought

Distributed Systems

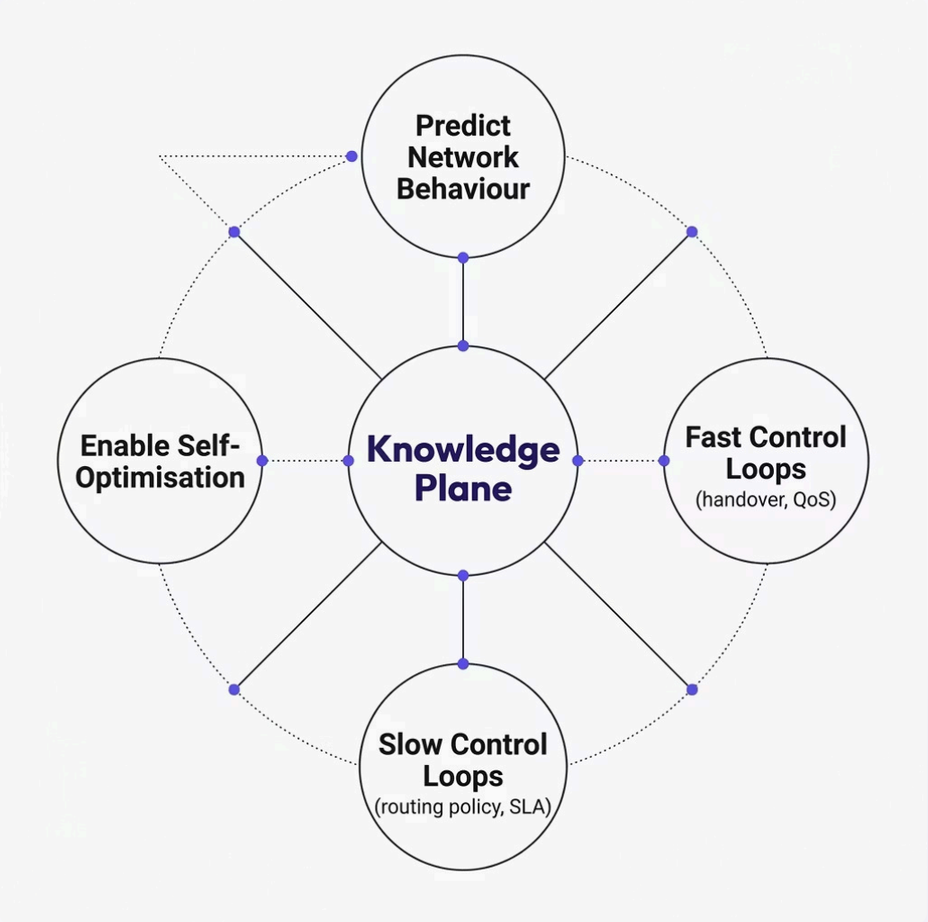
A distributed intelligent system, far beyond simply faster 5G

Key Enablers

Reconfigurable infrastructure, adaptive middleware, and intelligent network functions

Source: Saad Sheikh, Medium (March 2026)

The Knowledge Plane: The Network's Central Intelligence



The **Knowledge Plane (KP)** is a conceptual intelligence layer using AI/ML for real-time decision-making and cognitive automation across the network.

Source: TelecomTrainer.com

⚡ Fast Loops

Real-time handover decisions and QoS enforcement

🔄 Slow Loops

Policy-driven routing adjustments and SLA management

Agentic AI: The Power of Autonomous Agents

Reason & Plan

AI agents act as "knowledge robots" — observing KPIs and making intelligent, data-driven decisions autonomously

NVIDIA Blueprint

NIM microservices and LLMs power network configuration planning and autonomous parameter adjustment

Cross-Layer Orchestration

Coordinates load balancing, interference coordination, and power saving across vendors and layers

Source: NVIDIA NIM

INNOVATION

AgentRAN: Natural Language Intents for Autonomous Control

A hierarchy of AI agents interprets **Natural Language intents** to orchestrate network control — decomposing complex goals across time, space, and protocol layers through structured agent conversations.

Source: arXiv:2508.17778

AI-RAN Factory

Continuously generates improved agents from live operational data, enabling true self-evolution

Bootstrapped Intelligence

No initial training data required — transparent and auditable decision-making from day one

The AI-Native Shadow 5G Core: Resilient Intelligence

Traditional Core

Signalling and legacy control plane functions

AI-NRF Broker

Capability management and intelligent orchestration

AI-NFs Inference

Autonomous intelligence for real-time decisions

Traditional architectures struggle with latency, scalability, and governance for distributed AI. **HCLTech's AI-Native Shadow 5G Core** embeds AI as a third operational pillar alongside user-plane and control-plane functions.

Source: HCLTech Whitepaper

AI-NRF

Acts as a capability broker, registering and discovering AI functions across the network

AI-NFs

Mirrored inference engines isolated from critical signalling for agility without risk

Edge Agentic AI for O-RAN: Safety and Optimisation

1

Persona-Based Multi-Tools

Specialised AI personas collaborate within the RAN Intelligent Controller (RIC) for targeted optimisation tasks

2

Proactive Anomaly Detection

Multimodal data fusion enables detection and mitigation of issues before they impact service quality

3

Safety-Aligned Rewards

Zero network outages under high-stress conditions — near real-time responsiveness with consistent QoS

Source: arXiv:2507.21696

Best Practices for Autonomous Network Architecture

Embrace AI-Native Design

Intelligence must be foundational — architected in from the ground up, not added as an afterthought

Leverage Agentic AI

Deploy reasoning, planning agents that act autonomously across network layers and vendor boundaries

Implement a Knowledge Plane

Centralise intelligence to enable real-time control loops and scalable, reliable decision-making

Prioritise Safety & Governance

Critical network functions and edge deployments demand rigorous safety alignment and auditability

Adopt Open Architectures

O-RAN and open frameworks enable modularity, vendor diversity, and seamless AI integration

Focus on Self-Evolution

Build systems designed to learn, adapt, and improve continuously from operational data

The Future is Autonomous

Self-configuring, self-healing, self-optimising networks delivering **zero-wait, zero-touch, zero-fault** services — moving from L2/L3 autonomy towards L4 and beyond.

Better User Experience

Consistent, adaptive service quality at every touchpoint

Resource Efficiency

AI-driven utilisation reduces waste and operational cost

New Service Innovation

Intelligent networks unlock entirely new categories of services and business models

Call to Action: Architects, strategists, and leaders must drive this evolution through strategic investment and bold adoption of AI-native principles — the transformation starts now.