ETSI ISG ENI

Experiential Networked Intelligence

A Cognitive Network Management Architecture for 5G, 6G and Future Networks

Overview

The **Experiential Networked Intelligence Industry Specification Group (ENI ISG)** defines a **Cognitive Network Management architecture** that uses Artificial Intelligence (AI) and **context-aware policies** to dynamically adjust services based on user needs, environmental conditions, and business objectives.

ENI benefits all networks—**including 5G and 6G**—by enabling:

- Automated service provisioning
- Intelligent operation & assurance
- Optimised slice management
- Enhanced resource orchestration

ENI also runs **Proofs of Concept (PoCs)** that demonstrate how AI can assist operations across current and future mobile networks.

Why AI in Networks

Future networks require adaptive, autonomous intelligence at scale. AI techniques—machine learning, reasoning, intent modelling—allow operators to solve challenges in deployment, optimisation, and lifecycle management.

ENI develops specifications for a **Cognitive Network Management System** aimed at optimising operator experience through:

- Rapid recognition of new or changed knowledge
- Faster adjustment to operational conditions
- Actionable, AI-supported decision-making in day-to-day activities

This is achieved using the **observe–orient–decide–act (OODA)** model, enabling networks to reconfigure in response to evolving requirements.

Intelligent, Flexible Networks

The introduction of **SDN, Network Virtualisation, and Network Slicing** has transformed networks into flexible, powerful, configurable platforms.

ENI enhances this evolution by making deployment and operation **more intelligent, efficient, and adaptive.**

Key Areas of Work

ENI does not standardise AI itself; it standardises **how AI is applied within ICT systems:**

- Use Cases & Requirements
- System Architecture
- AI Agents & Customisation
- Language Models & Transformers
- Data Telemetry & Knowledge Mechanisms
- Intent-Aware Policy Management

What We Deliver

Operator-Centric Intelligence

ENI improves the operator experience using **closed-loop AI mechanisms** powered by:

- Context-aware, metadata-driven policies
- Knowledge acquisition and reasoning
- Continuous adaptation to new operational conditions

These mechanisms generate recommendations for network control and management systems, enabling real-time adjustment of services and resources.

Publications & Releases

ENI has delivered:

- Initial versions of the **System Architecture** including:
  - Context-Aware Policy Management
  - Intent-Aware Network Categorisation
  - Data Mechanisms
  - Evaluation of Categorisation
  - Prominent AI-driven Control Loop Architectures
  - Functional Concepts & AI Mechanisms
- **Two Proof of Concept (PoC) Frameworks**
- **Three versions of Use Cases, Requirements & Terminology** (Release 4 complete)
- **Fourth System Architecture version** (to be published this year)

AI Agents & Agentic AI

A major focus area is **AI Agent design**, customisation, and adaptation for network operations.

Published reports include:

- **AI Agents for Network Slicing**
- **AI Agents for Core Networks**
- **Multi-AI-Agent Frameworks**

Ongoing work covers:

- **AI Agent Interface & Protocol Specification**
- **Model Training for Network AI Agents**
- **Security of Agentic AI** (in cooperation with ETSI TC SAI)

System Architecture Development

ENI continues work on:

- **High-level architecture with detailed AI decision techniques**
- **Release 4 Use Cases, Requirements & Terminology**
- Updated **AI-based network categorisation framework**
- Reports on:
  - Evaluation of Classification
  - Intent Knowledge in the Architecture
  - Data Mechanisms & Telemetry

Two-Loop Cognitive Architecture

ENI specifies an architecture based on **two AI-driven control loops:**

1. **Outer Loop:** strategic evaluation and long-term adaptation
2. **Inner Loop:** recursive, fast operational decision-making

Lifecycle:

- Data is gathered and passed through an optional API
- Normalised and processed in multiple AI analysis functions
- AI modules interact recursively for improved reasoning
- Actionable decisions are de-normalised and returned to the network through the same API

This enables autonomous, self-adapting, knowledge-driven network operation.

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