Across

ACROSS is a HORIZON-JU-SNS-2022 funded research project that designs and implements an end-to-end service deployment and management platform for next generation networks and services, aiming at unprecedented levels of automation, performance, scalability, and energy efficiency.

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TC3: Intelligence-driven zero-touch orchestration

Summary of the TC3 Approach

TC3 demonstrates how networks can become proactive, rather than reactive, by using AI to anticipate and address issues before they impact performance. Instead of waiting for a failure or slowdown, the system constantly analyses real-time telemetry and predicts congestion, outages, or security threats. Based on this insight, it automatically reconfigures the network—rerouting traffic, adjusting resources, and even mitigating potential attacks. This approach makes networks more reliable, efficient, and sustainable while reducing the burden on operators. TC3 brings us closer to fully autonomous, self-healing networks that optimize themselves in real time.

Key Innovations & Business Value

- TC3 introduces predictive orchestration—an AI-driven system that proactively avoids service disruptions and optimizes performance, significantly enhancing reliability, energy efficiency, and SLA compliance while lowering operational costs.
- TC3 enables telecom operators and enterprises to deliver more consistent, high-quality services with fewer manual interventions and greater confidence in network stability.

Architecture & Core Technologies

TC3 combines a Network Digital Twin (NDT) and an AI-driven anomaly detection system, both hosted on Kubernetes within Telefónica's Mouseworld. The NDT uses Kubernetes Network Emulation (KNE) to simulate realistic topologies for model training and testing, which facilitates efficient configuration, monitoring, and management of the virtual network, allowing for rapid iteration and experimentation. The AI system ingests telemetry to detect congestion, service degradation, or security risks. This architecture allows continuous improvement through feedback loops, enabling predictive, self-healing networks.

Key Innovations

- Integration of a Network Digital Twin (NDT) for safe, large-scale experimentation and model training.
- Ability to emulate network behaviour under various conditions, which allows for continuous optimization and adaptive improvements.
- AI-driven anomaly detection engine that leverages real-time telemetry for predictive orchestration.
- Synthetic traffic generation for realistic testing of AI models under dynamic conditions.
- Scalable data pipeline using Kafka and Grafana for real-time analysis and visualization.

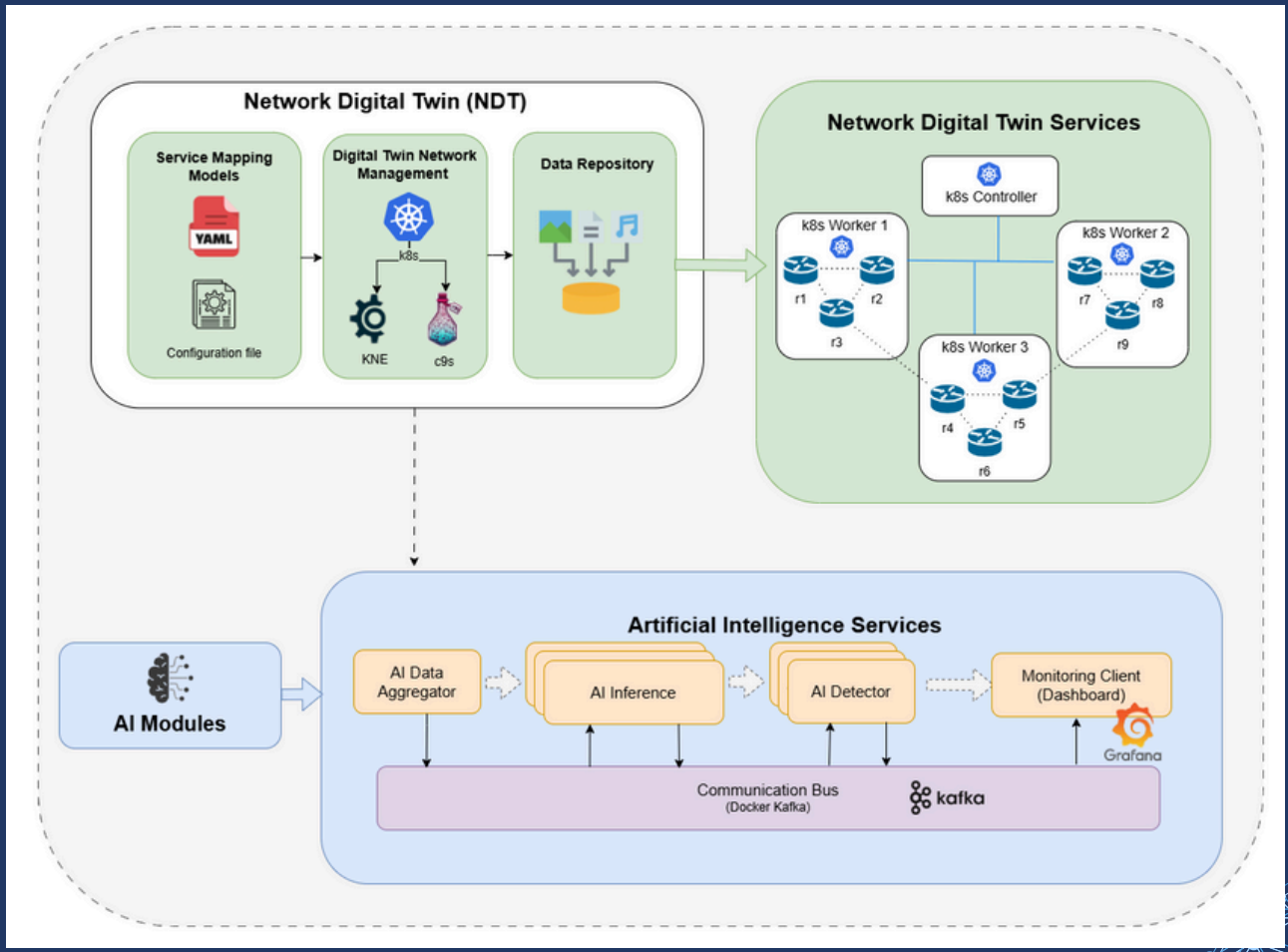
Implementation & Validation

TC3 integrates an NDT (via KNE) with an AI system for anomaly prediction. Tools such as Kafka are used for scalable data streaming and event ingestion, while Grafana provides real-time monitoring and visualization. The system is validated through different controlled stress scenarios, using synthetic traffic generated in the NDT to ensure model reliability under diverse and dynamic conditions.

Important KPIs for TC3 include:

- Reaction time: 0.0635 seconds, significantly outperforming the target of <1 second.
- ML classification model accuracy reached values up to 0.999 and 0.997, clearly exceeding the target of >0.9 in most TC3 cases.
- Precision values of ML classification model reached up to 0.995, exceeding the target of >0.9 in multiple TC3 evaluations.
- Recall of ML classification model achieved values up to 0.991, exceeding the target of >0.9 in most TC3 evaluations.
- F1-score of ML classification model ranged from 0.655 to 0.992 against a target of >0.9.

Overview of the ACROSS Test Case 3



Expected Impact & Market Potential

The ability to foresee and prevent service degradation or security incidents before they occur gives TC3 enormous market relevance. This approach is highly valuable in sectors requiring uninterrupted, high-performance connectivity—such as healthcare, finance, logistics, and manufacturing.
TC3 supports telecom providers in meeting stringent SLA expectations while lowering costs and boosting service trust. TC3 positions the ACROSS platform as a frontrunner in enabling intent-based, AI-native infrastructure capable of adapting to user demands, business goals, and emerging cyber risks in real time.

Technical Benefits

TC3 applies advanced AI and machine learning to automate decision-making based on real-time telemetry data. It supports dynamic traffic engineering, SLA enforcement, and automated DDoS mitigation. The system intelligently adjusts routing paths, resources, and energy use to ensure performance and sustainability, resulting in faster incident response, reduced energy consumption, and minimal human intervention.

Business & Industry Value

TC3 reduces service outages, improves efficiency, and supports regulatory compliance.
For telecom providers, this unlocks more competitive SLA offerings and improves customer satisfaction. For vertical industries, TC3 ensures reliable connectivity for critical operations while lowering infrastructure and energy costs. Its standards-aligned, open design supports cross-industry adoption, making it a strategic investment for any organization looking to build autonomous, AI-driven infrastructure that’s both robust and sustainable.