

SliceNet – Cognitive Slice Management Framework for Virtual Multi-Domain 5G Networks

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CCS CONCEPTS

• **Information systems** → *Mobile information processing systems*; • **Networks** → *Network management*; • **Computing methodologies** → *Machine learning*;

Network slicing is a fundamental architectural feature of 5G network infrastructure [2], whereby independent end-to-end logical networks support a wide spectrum of vertical industries on shared resource, despite their diverging requirements. Network slice management is challenging and complicated, taking into account the various intra- and inter-domain deployment scenarios, divergent use cases with different requirements, stakeholders of different roles and business models, etc. The SliceNet project [1] aims to extend 5G infrastructure with cognitive management, control, and orchestration of cross-domain/cross-layer slices, to maximize the potential of the infrastructure, with emphasis on Quality of Experience (QoE) for vertical industries.

SliceNet management takes a “verticals in the whole loop” approach, integrating the vertical perspective into the slice management process. SliceNet investigates three use cases, Smart City, Smart Grid, and eHealth, each with its distinct QoE requirements and network usage characteristics. *Smart Grid* utilized ultra-reliable low-latency communication between Intelligent Electronic Devices to implement an automated Self-Healing power grid. *Smart City* employs reliable cost-optimized communication between massive amounts of sensors and controllers to meter utilities, monitor and manage infrastructure, get real-time traffic information, and provide public safety alerts. The *eHealth* use case provides

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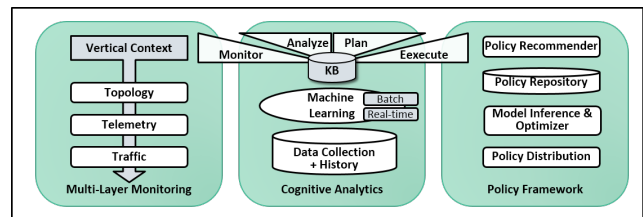


Figure 1: SliceNet Cognition Framework

secure, reliable, low-latency high-bandwidth communication between mobile emergency teams and the hospital, enabling real-time collection, processing, and streaming of patient data obtained from mobile cameras and sensors.

To substantially reduce the operational expenditure (OPEX), especially at scale, SliceNet introduces fully automated slice management and orchestration through machine learning and other artificial intelligence technologies and utilizing the autonomous computing Monitor-Analyze-Plan-Execute (MAPE) loop model, a vertically-informed multi-layer QoE monitoring sub-plane, and a slice-centric policy framework. The vertical is integrated into the cognitive management process by providing the perceived QoE and the context. The latter is used to collect context-aware cross-layer information, while the former enables supervised machine learning methods. Multi-domain SliceNet cognition extends the network management capabilities of the 5G CogNET project¹ and borrows technologies from the IBM CogNETive research project². SliceNet monitoring utilizes the SkyDive open-source project.³ An intelligent Policy Framework consumes the results of the cognition process and governs the execution and QoE optimization (see Figure 1).

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- [2] 5G PPP Architecture Working Group. 2016. View on 5G Architecture. (2016).

¹<http://www.cognet.5g-ppp.eu/>

²<http://cognetive.sl.haifa.il.ibm.com>

³<http://skydive.network>