HyPR: A High-Performance Policy Registry for Scalable User Equipment Policy Management in 5G Core

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(Pt9)Abstract—**The advent of 5G Core networks has introduced network slicing and open APIs that enable diverse business to-business (B2B) service opportunities. At the center of these capabilities lies the management of User Equipment Route Se lection Policies (URSP), which allow fine-grained traffic control at the device level to guarantee Quality of Service (QoS). However, the current 3GPP-mandated approach of storing binary-encoded URSPs per UE in the Unified Data Repository (UDR) leads to severe scalability and redundancy issues. As the number of connected devices scales into very large deployments, redundant storage and cascading updates amplify operational bottlenecks and increase the risk of service-level agreement (SLA) violations. In this paper, we propose HyPR: a Hybrid Policy Registry that combines an object store for semantic policy definitions with a binary cache for frequently used, pre-encoded policies. Our evaluation demonstrates up to 60% storage reduction with neg ligible latency overhead (less than 0.1 milliseconds), even under large-scale device populations. By decoupling policy definitions from UE assignments, HyPR provides a scalable and dynamic solution that reduces UDR load and enables third-party-driven policy modification through network APIs.**

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