Scalable and Secure Framework for Federated Learning in IoV applying Committee-based Chained Hotstuff

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***Abstract*— Applying Federated Learning (FL) in the Internet of Vehicles (IoV) presents a critical trade-off between privacy, security, and performance, which conventional blockchains fail to address due to prohibitive latency and overhead. To overcome these limitations, we propose a novel framework featuring a stack-based verification engine for deterministic validation, an on-chain management system for conditional privacy, and a Committee-based Chained HotStuff (C-CHS) consensus algorithm. The C-CHS protocol fundamentally resolves the leader bottleneck by enabling parallel block preparation. Our evaluation demonstrates substantial performance gains: C-CHS increases throughput by up to 92% (vs. CHS) and 873% (vs. PBFT), while reducing latency by up to 52% and 90%, respectively. These results validate our framework as a secure, scalable, and practical solution for deploying FL in large-scale IoV environments.**

***Keyword*— Blockchain, IoV, Conditional Privacy, Hotstuff, Federated Learning**

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