NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

School of Computer Science and Engineering
College of Engineering

BlockFL: Blockchain-enabled

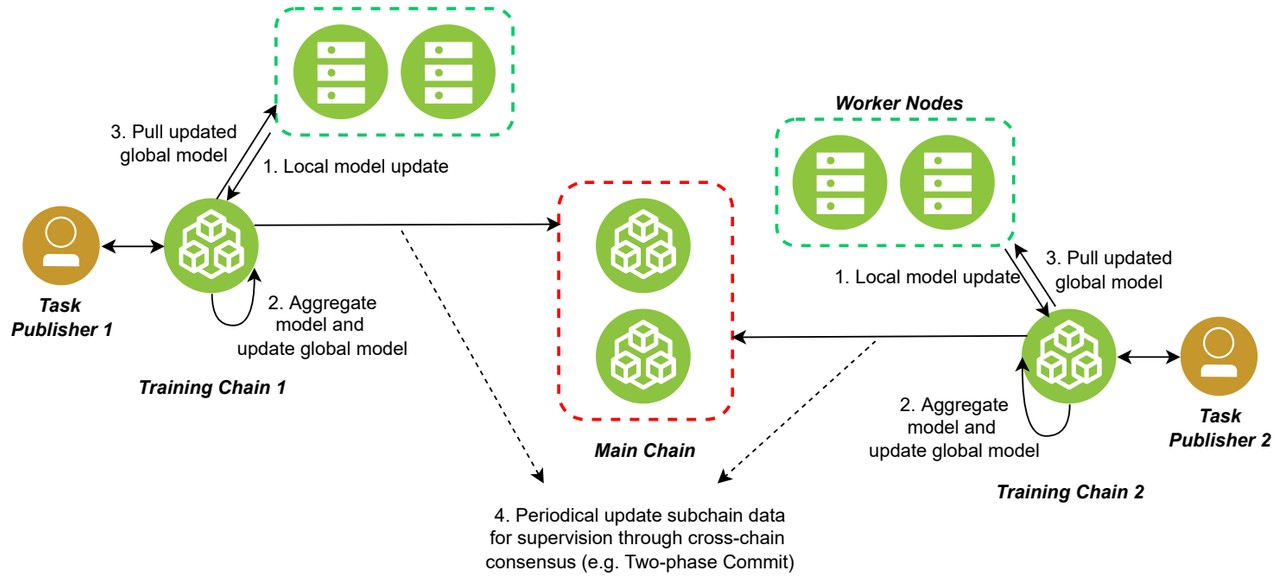
decentralized Federated Learning and model trading

Student: Pham Tan Anh Khoa Supervisor: Prof Dusit Niyato

Project Objectives:

This project aims to achieve secure and scalable Federated Learning (FL) by leveraging a sharding technique to improve scalability of the Blockchain-based Federated Edge Learning (BFEL) framework with a main chain and multiple subchains. Specifically, to release the cross-chain transaction processing workload of the main chain, the number of working consensus nodes for the main chain can be divided into multiple clusters to process multiple cross-chain transactions in parallel. This method helps reduce the execution time for FL task training and improve transaction throughput on the main chain.

System Architecture:



The BFEL model adopts a multi-blockchain framework. In BlockFL, the consensus nodes of the main chain are partitioned into n clusters to process FL training information from n subchains. The main feature of this design is to improve cross-chain transaction processing parallelism and throughput. It maintains security and consistency in the main chain by ensuring that every cluster can tolerate malfunctioning nodes.

Results:

The execution time with sharding is shorter than without sharding. As the number of working consensus nodes grows, the time difference becomes more apparent. Despite the limitation of spinning up more blockchain nodes, given this trend, it can be foreseen that sharding would save much more training time for FL in reality with thousands of working nodes.