

Towards a Modular Federated Learning Framework on Edge Devices

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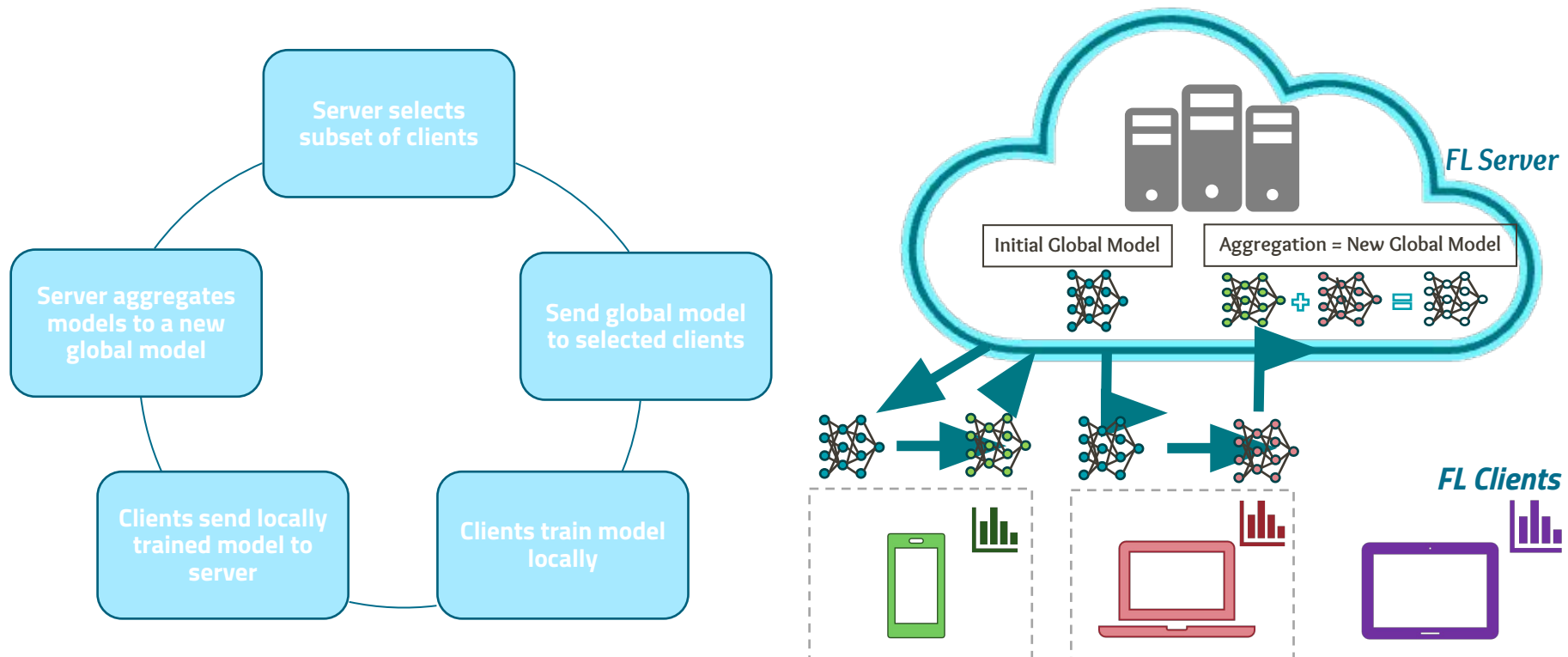
Computational and Data Sciences





Federated Learning

- lot and edge devices are a **rich data source**
- Data cannot be moved to a central location – **huge network costs, privacy concerns**
- Solution? **Federated Learning!**





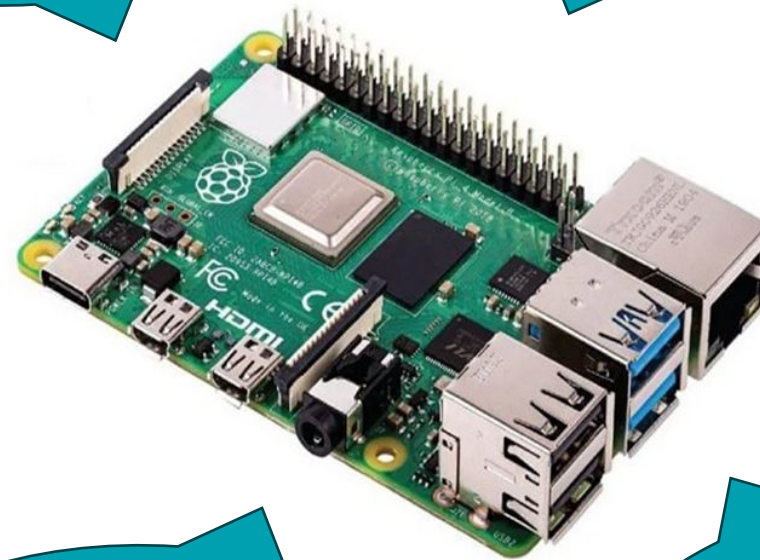
Challenges with training on the Edge

Prone to failure!

Limited Memory!

Likely to be periodically available

May have non-IID data



Unreliable network!

Variable performance!



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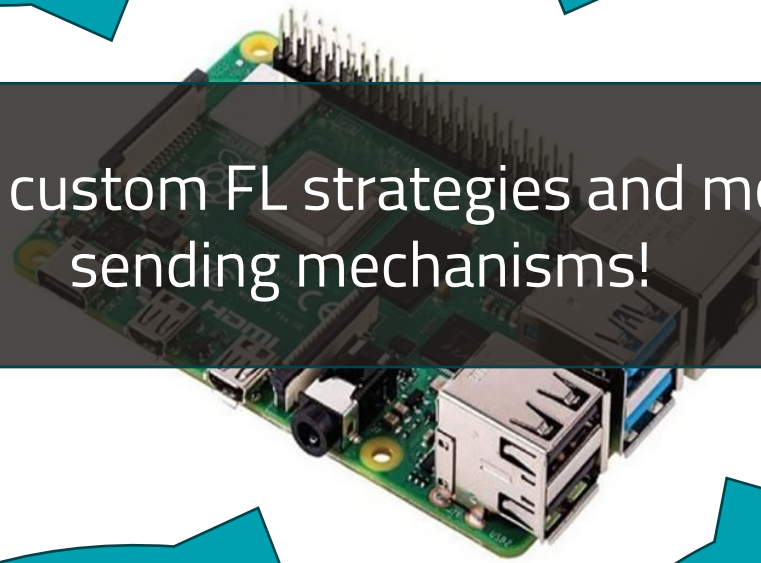
Likely to be periodically available

Need custom FL strategies and model sending mechanisms!

May have non-IID data

Unreliable network!

Variable performance!



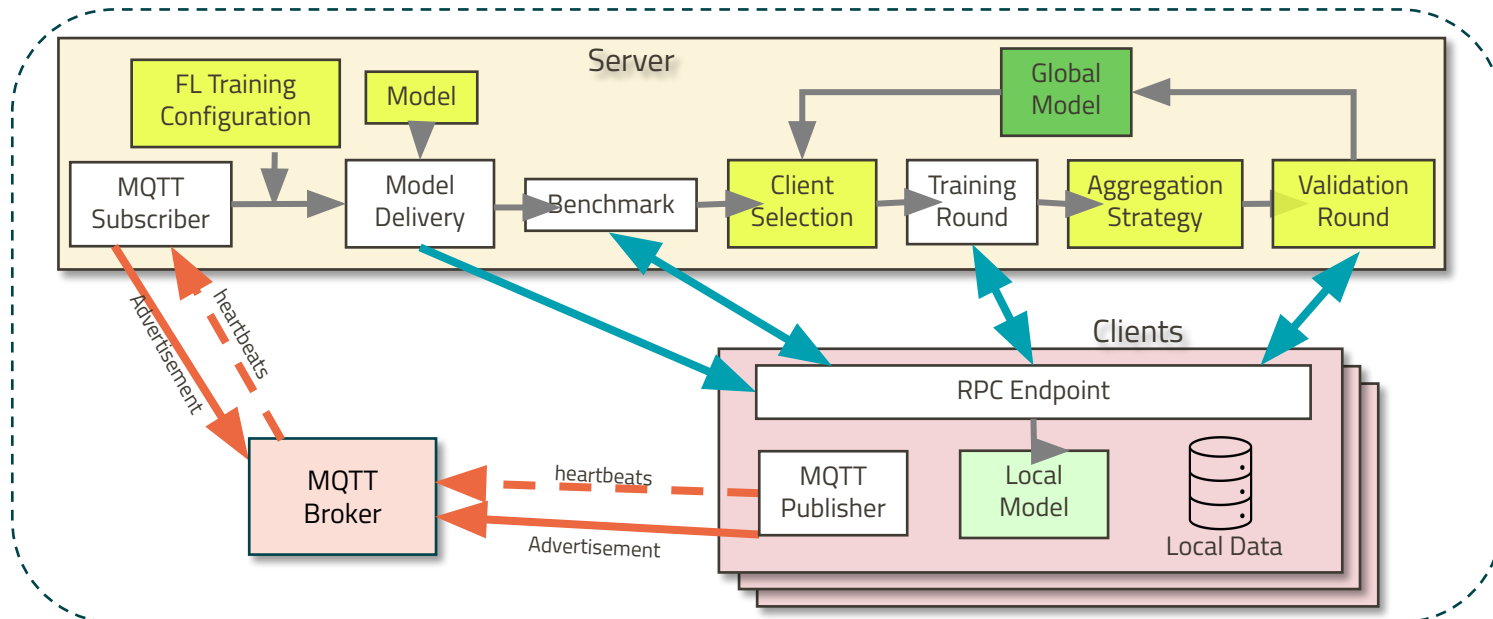
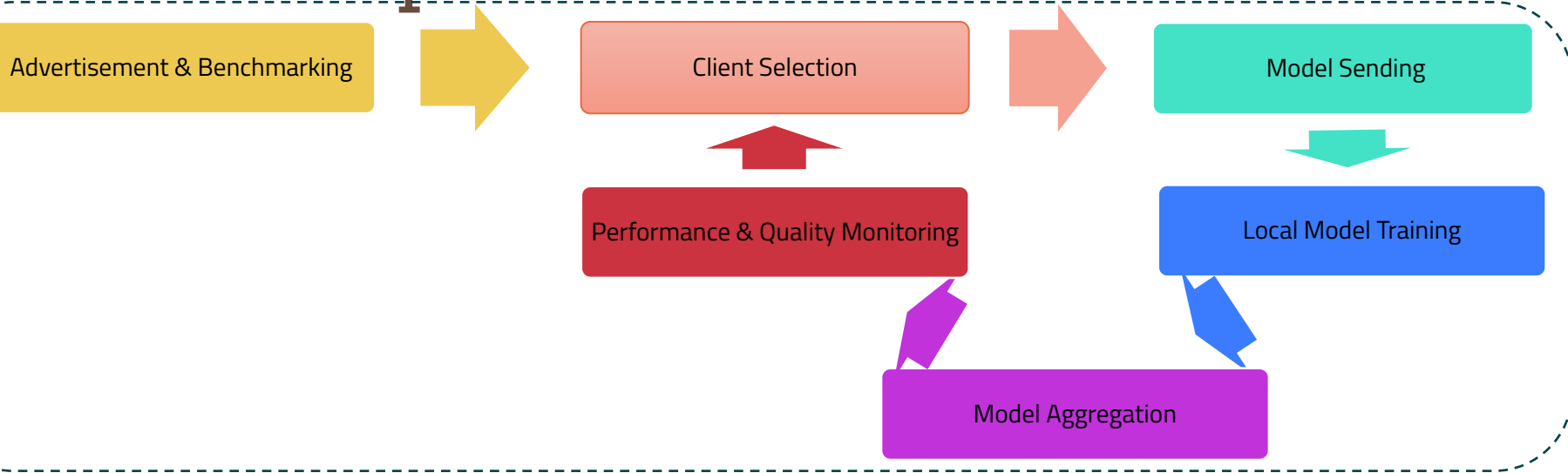


Comparison with popular FL frameworks

	TensorFlow Federated (Google)	PySyft (OpenMind)	FedScale (UMich)	LEAF (CMU)	FLOWER (UCambridge)	Flotilla (IISc)
Single-node simulation	✓	✓	✓	✓	✓	✓
Multi-node execution (on the edge)		✓	✓		✓	✓
Client Availability			✓			✓
Online Model Delivery						✓
Custom sync. strategy	✓	✓	✓	✓	✓	✓
Custom async. strategy			✓			✓



Flotilla Pipeline





Experiments

Server:

Workstation with AMD Ryzen 9 3900X CPU and GeForce RTX 3080 GPU.

Clients:

- Raspberry Pi 4B's with 2GB RAM – 18
- Raspberry Pi 4B's with 8GB RAM – 12

Network:

1 Gigabit Ethernet LAN

Dataset:

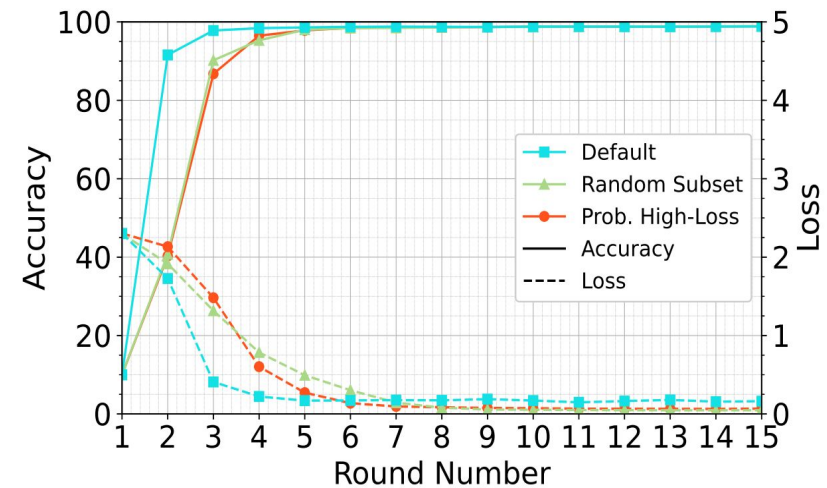
- EMNIST I.I.D partition among 30 clients

Model:

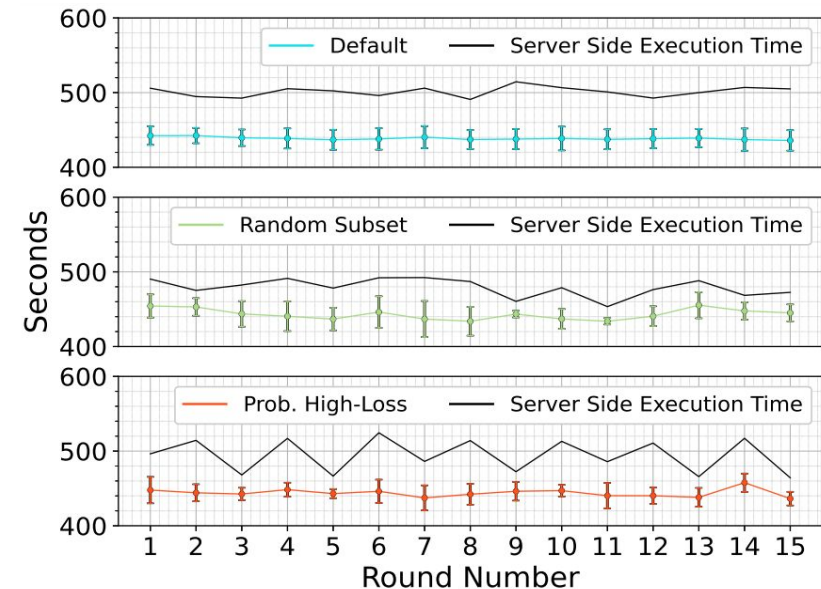
- AlexNet

Client selection:

- Default – 100% clients selected every round
- Random subset – 20% of clients selected randomly every round
- Prob High-Loss – 20% of clients selected randomly based on client validation loss



Loss and Accuracy for AlexNet on EMNIST dataset



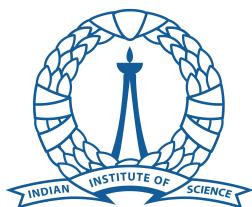
AlexNet roundwise training time for client selection policies

Poster
144!



Thank you! Questions?

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