#### **DREAM**:Lab

# Towards a Modular Federated Learning Framework on Edge Devices

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### Motivation

- Federated Learning: Learning when data cannot be shared outside client
- Collaboratively training a model on local data – privacy preserved
- Most FL frameworks are not built to be problem agnostic
- Usually built for single-node simulation
- Most FL frameworks are not built for/tested on real edge hardware
- Do not provide mechanisms for client availability and online model delivery

	TensorFlow Federated	PySyft <i>OpenMind</i>	FedScale <i>UMich</i>	LEAF <i>CMU</i>	FLOWER UCambridge	Flotilla (IISc)
Single-node simulation	~	~	~	~	~	~
Multi-node Exec.		<ul> <li></li> </ul>	$\checkmark$		$\checkmark$	~
Client Avail.			$\checkmark$			
Online Model Delivery						>
Custom sync. Strategy	~	~	>	$\checkmark$	~	>
Custom async. strategy						~

## Flotilla Design

#### **Flotilla Server**

- MQTT heartbeats to monitor clients liveliness, gRPC to orchestrate training sessions.
- Executes the client selection and aggregation strategy (custom or default) while training
- Send relevant model, custom trainer and custom data-loader to client if required.

#### **Flotilla Client**

- Are stateless and may be ephemeral
- Hosts gRPC server that allows benchmarking, starting training, returning model and validation.

Results						
	100	5				
Model: AlexNet	80	4				
Dataset: EMNIST IID	00 III	→ Default → Random Subset 3 00 → Prob. High-Loss				
Devices: 30	JJ 40	— Accuracy 2				





- Raspberry Pis, 1 GPU workstation
- Client Selection
  - **Default**: 30 of 30 clients
  - **Random**: Random 6 of 30 clients
  - **Prob. High Loss:** 6 of 30 clients w/ hi-loss

![](_page_0_Figure_31.jpeg)

## Future Work

- Implement popular asynchronous and semi-synchronous algorithms to show modularity
- Incorporate resilience to server failure in the

https://gmau.dream-lab/flotilla [Soon public]

![](_page_0_Picture_36.jpeg)

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