

Client Availability in Federated Learning: It Matters!



Georgia Institute of Technology

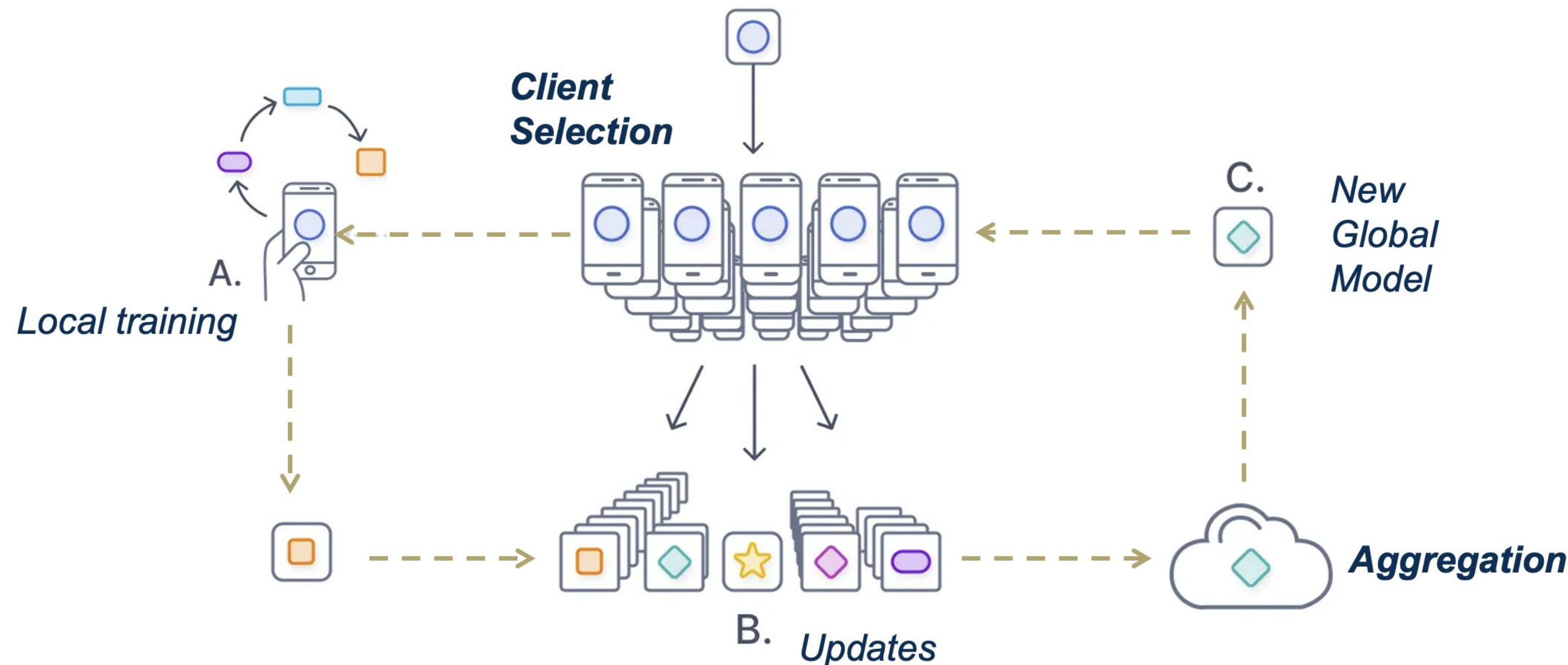


Dhruv Garg*, Debopam Sanyal*, Myungjin Lee[◇], Alexey Tumanov, Ada Gavrilovska
Georgia Institute of Technology, [◇]Cisco Research

Federated Learning (FL)

Multiple use-cases

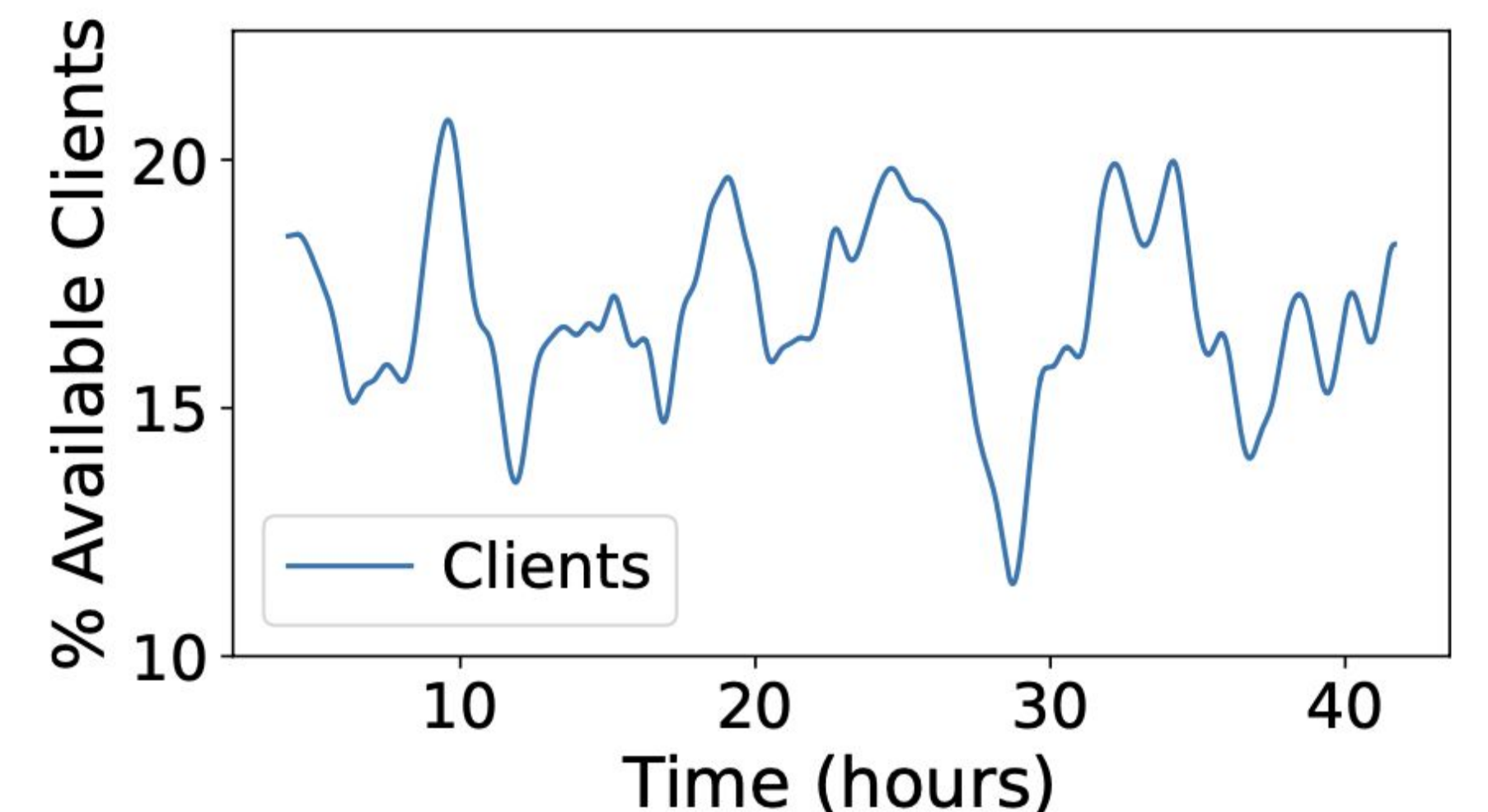
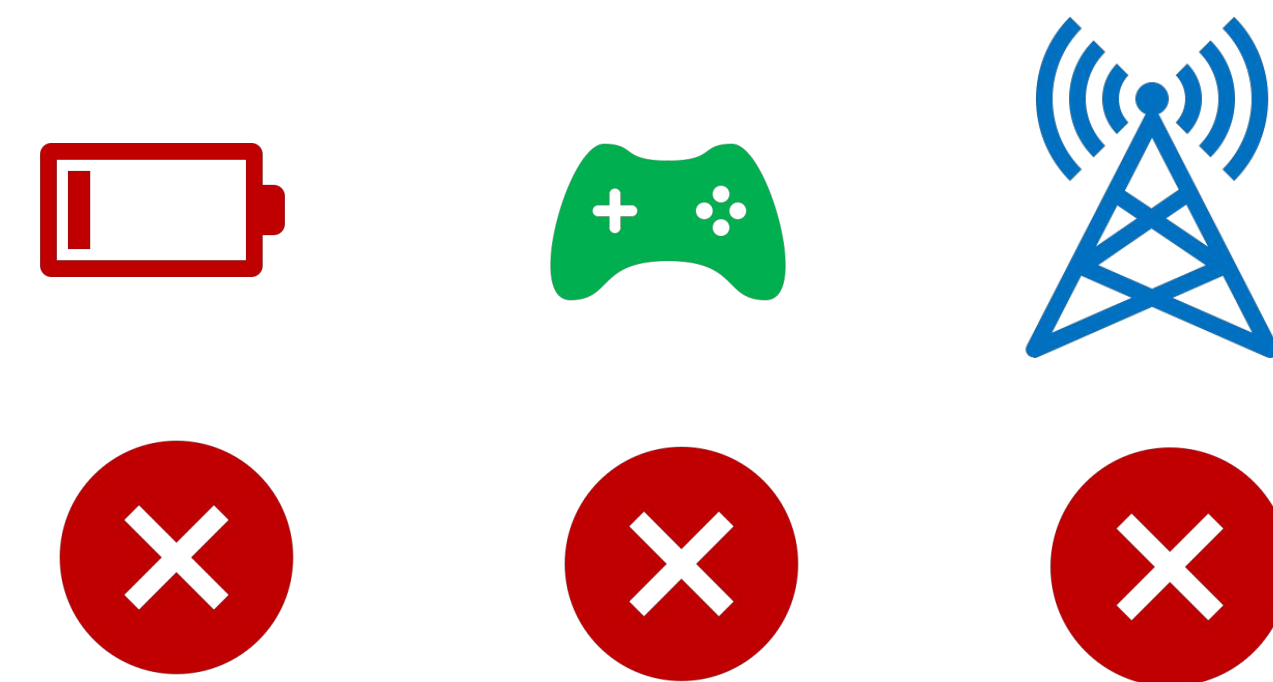
- Keyboard personalization, virtual assistants



Client Dynamics in FL Training

FL job runs for several **days**

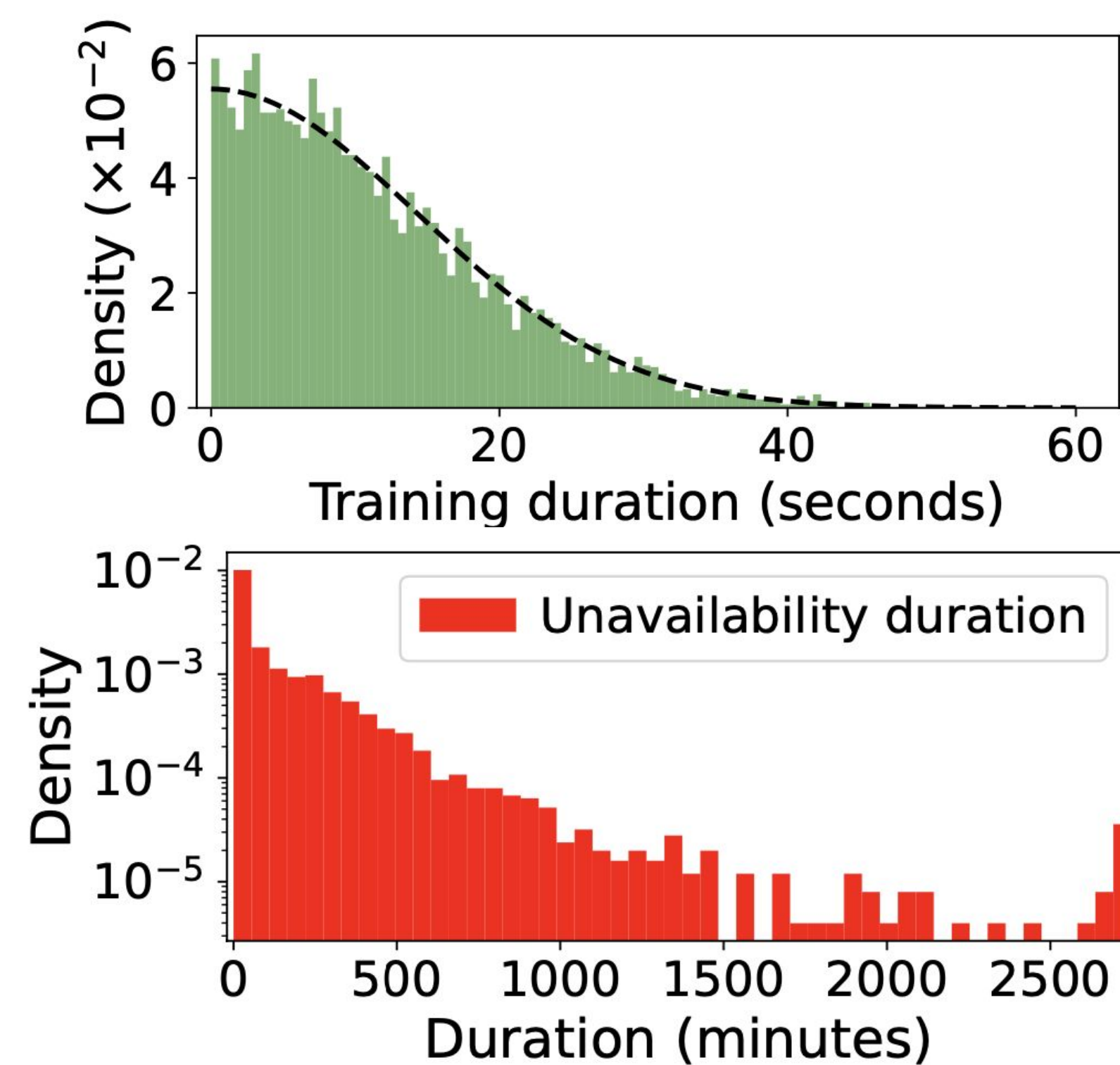
Clients can become unavailable



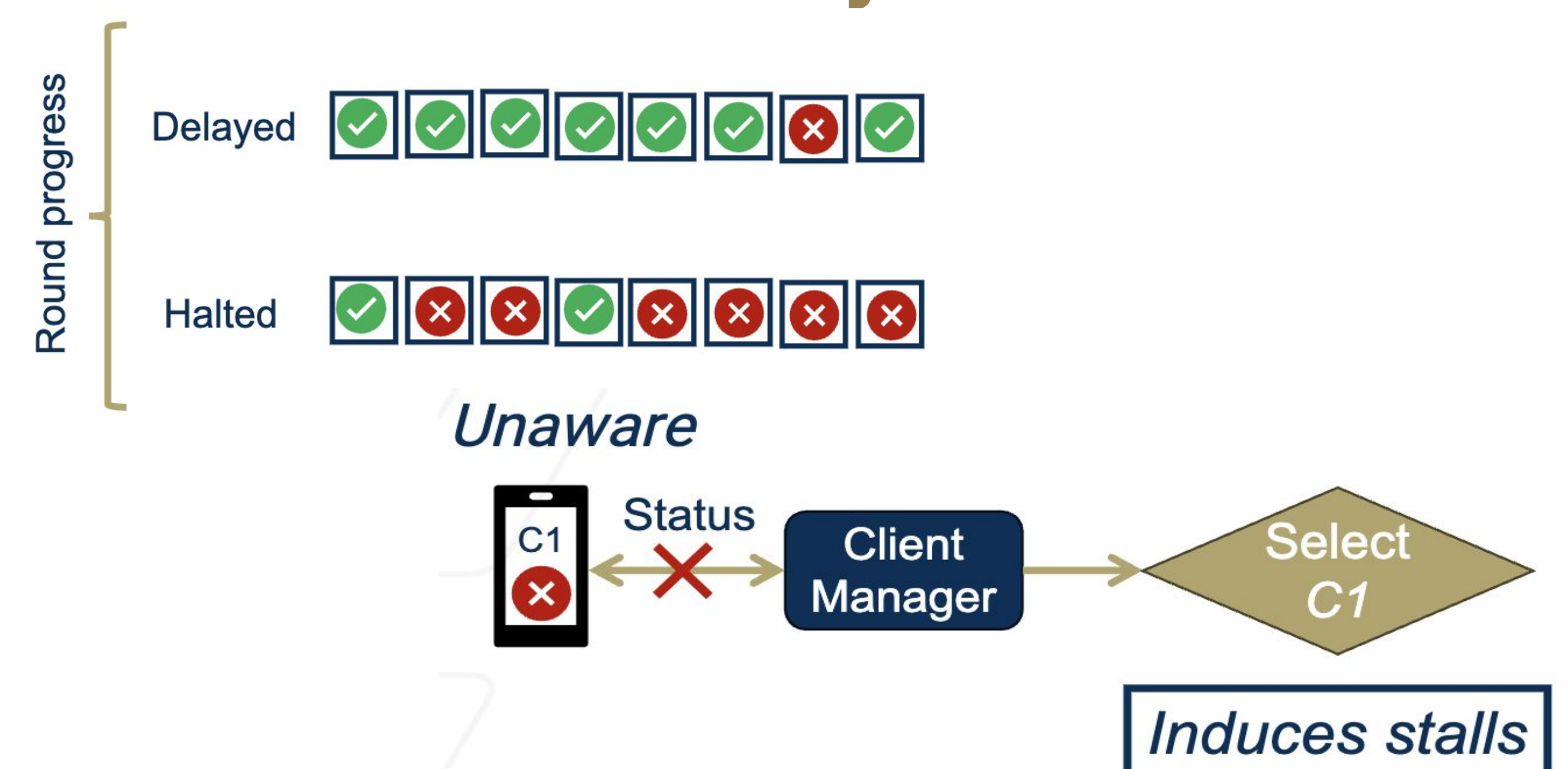
Trace	FedScale	LinkedIn	Google
Client Availability	10-20%	20-80%	10-60%

Unavailability != Stragglers

- Straggler** clients
 - Return updates with a delay
- AsyncFL mitigates stragglers
- Unavailable** clients
 - Cannot participate at all



SOTA is Availability Unaware



Experiment Setup

Success Metric: Time-to-accuracy

- Better ML convergence
- Resource efficiency

Task: Image classification CIFAR-10

- 300 clients

Client Availability Traces

- Synthetic: Availability ~80%
- Real-world: Availability 10-22%

Execution Strategies

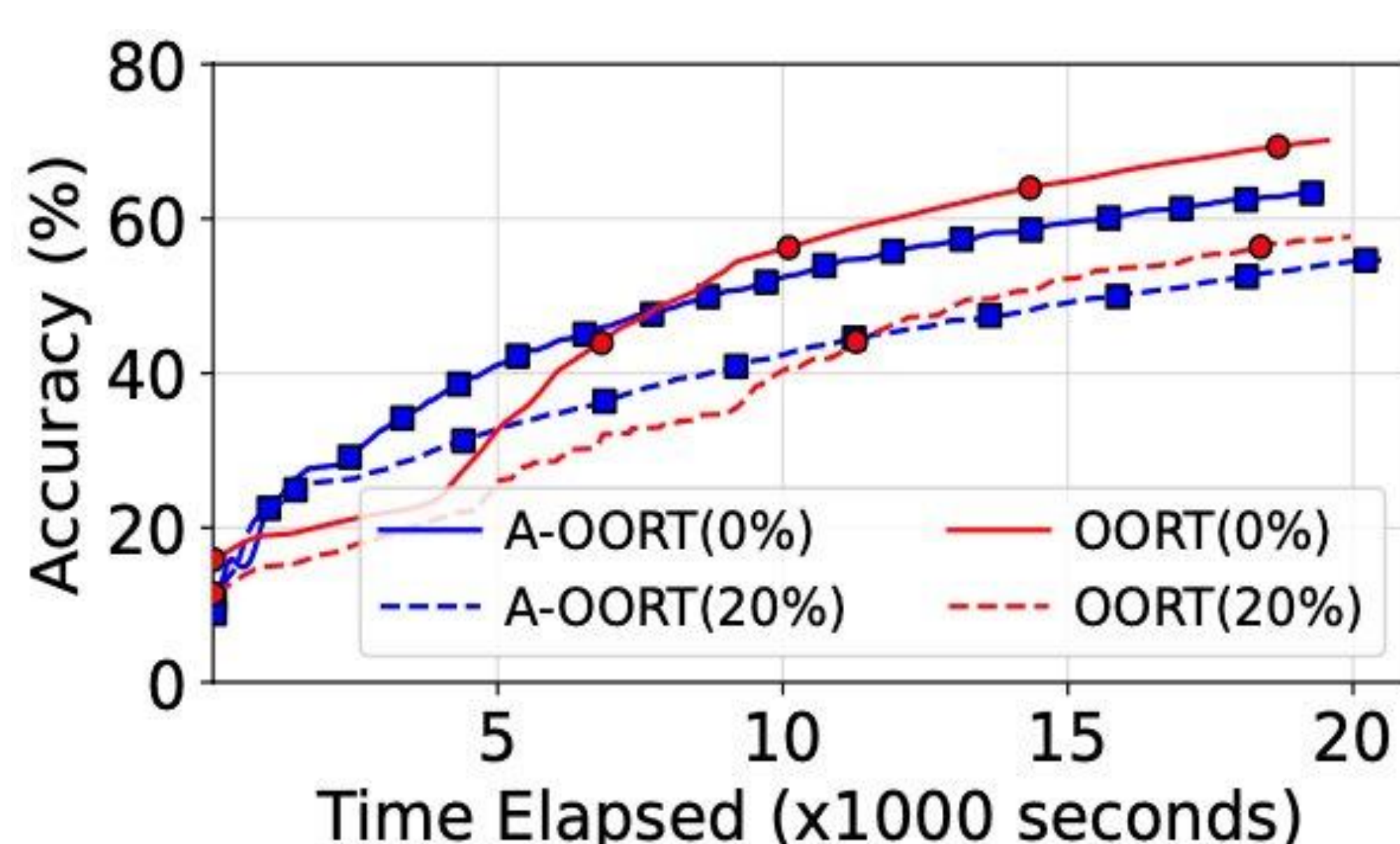
Paradigm	Strategy	Availability Awareness (Oracular)
Sync FL	OORT	✗
	OORT*	✓
Async FL	A-OORT	✗
	A-OORT*	✓

Unavailability Impacts Training

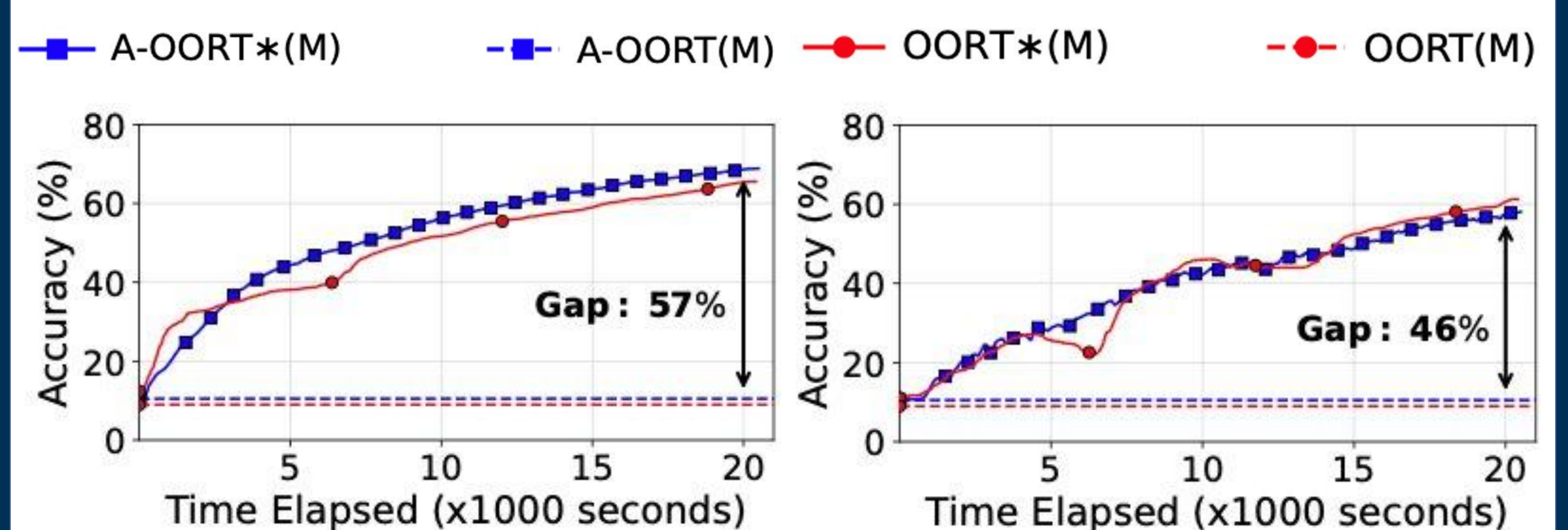
~10% drop in accuracy in unaware strategies

OORT(20%) loses 11% accuracy

A-OORT(20%) loses 9.5%



Performance On Real-world Traces



Opportunities in FL

Client selection with real-time awareness

- Selectors should utilize:
 - Real-time client availability
 - History and changes in clients' capabilities

Efficient aggregation by managing staleness

- Not all stale updates are equal:
 - Mitigate impact of high unavailability with received updates
 - Moderately stale updates could contribute to training