# Implementation

## Federate Learning

1. Handshake
2. Server distribute
3. Local testing:

Test batch size is 1

1. Local update
2. Local upload
3. Server aggregation
4. Training end
5. Server global iteration management
6. New client add or client failure

## Additional

1. Normalization
2. ADAM

# Experiment

1. Learning\_rate: 最简单的参数，第一个测试
2. Num\_epochs
3. Batch\_size (GD and mini-batch)
4. subsample

## Performance of global model on each client’s testset

实验环境：

iterations:100，subclient: 0 (all clients)，optimisation method: 0 (GD)

**Figure 1: Client Test Set Performance Line Chart**

* **Description**: Track the performance of the global model on each client's test set across multiple rounds.
* **Plot Details**:
  + **X-axis**: Round number
  + **Y-axis**: Loss
  + **Legend**: Each client represented as a separate line

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## GD vs mini-batch

实验环境：

iterations:100，subclient: 0 (all clients)， opt method: 0&1, batch\_size: 64

**Figure 2: Optimization Method Comparison Line Chart**

* **Description**: Compare the performance of a single client's test set using both Gradient Descent and Mini-Batch Gradient Descent.
* **Plot Details**:
  + **X-axis**: Round number
  + **Y-axis**: Loss
  + **Legend**: Two lines representing GD and Mini-Batch GD

实验环境：

iterations:100，subclient: 0 (all clients)， opt method: 1, batch\_size: 1,16,32,64

**Figure 3: Batch Size Impact Line Chart**

* **Description**: Observe the impact of different batch sizes on the performance of a single client's test set.
* **Plot Details**:
  + **X-axis**: Round number
  + **Y-axis**: Loss
  + **Legend**: Each batch size represented as a separate line

实验环境：

iterations:100，subclient: 0 (all clients)， opt method: 1, batch\_size: 16,64

* **Description**: Analyze the effect of varying learning rates on the test set performance of a single client.
* **Plot Details**:
  + **X-axis**: Round number
  + **Y-axis**: Loss
  + **Legend**: Each learning rate represented as a separate line

## Subsampling

实验环境：

iterations:100，subclient: 0-4 (all clients)， opt method: 1, batch\_size: 64

* Description: Analyse the impact of subsample
* **Plot Details**:
  + **X-axis**: Round number
  + **Y-axis**: Loss
  + **Legend**: each subclient number

### SGD vs ADAM