# Two-phase Commit for Group Photo

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## 1 Project Goals

In this project, we aim to develop a collaborative image compilation system that generates and publishes group collages created from multiple images contributed by various individuals. The system will comprise several UserNodes, representing individual users' devices such as smartphones or laptops, and a centralized Server responsible for coordinating the assembly and publication of the collages. This architecture enables seamless collaboration among users and efficient management of the collage creation process. In order to achieve this goal, we need a protocol - 2PC and a failure recovery mechanism.

## 2 Communication Protocol - 2PC

The communication protocol employed in this project between the Server and UserNodes is based on the Two-Phase Commit (2PC) protocol. The protocol consists of two main phases: Prepare and Commit, which are implemented through the following steps: 1. When a user initiates a commit, the server logs the list of UserNodes involved along with transaction details and requests participants to vote. 2. The server awaits responses from the participants, who will vote either 'yes' or 'no'. 3. If all participants agree, the server sends a 'commit' decision. If at least one participant disagrees or times out, the server sends an 'abort' decision. 4. The server logs its decision and flushes it to disk while sending the decision to the participants and waiting for their acknowledgments (ACKs). 5. The participants accept the decision and, in the case of a 'commit', delete the relevant files.

## 3 Lost Messages

After observing Autolab and consulting with a TA, it has been determined that lost cases can occur in three types: Lost Vote, Lost Decision, and Lost ACK. To handle these scenarios, the following approaches are adopted: 1. Lost Vote: If a vote is lost, a timeout is triggered, causing the transaction to abort. 2. Lost Decision and Lost ACK: For these cases, the system employs a strategy of repeatedly sending the decision or acknowledgment until it is successfully received by the intended recipient.

## 4 Failure Recovery

The failure recovery in this system primarily relies on log files, which are designed with three phases according to the 2PC protocol: PREPARE, DECISION, and DONE. Initially, both the server and UserNodes must check and recover from log files if necessary, with a timer set to ensure the recovery process is complete. On the server side, if the DECISION phase is missing in the log, the current transaction is aborted, and all participants are informed. However, if the DONE phase is absent but the other two phases remain, the server must repeat the COMMIT stage. On the UserNode side, if the DONE phase is missing, the node will repeat the process, redoing file unlocking and removing files when a commit occurs. This approach ensures the system can effectively recover from failures and maintain consistency during the collage creation process.

## 5 Other Design Decisions

Helper classes (AdvancedMessage) have been implemented to facilitate the serialization and deserialization of information, enhancing the system's overall performance. Additionally, the incorporation of a callback option allows for more efficient and flexible communication between components during the collage creation process.