**Goal: Minimizing the communication cost in a MapReduce job**

1. **Communication Cost**
   - The total amount of data to transfer from the map phase to the reduce phase.
   - Dominates the performance of a MapReduce algorithm.

2. **Reducer Capacity, q**
   - Reducers do not have an unbounded memory.
   - An upper bound on the sum of the sizes of the inputs that are assigned to the reducer.

3. **Mapping Schema**
   - An assignment of the set of inputs to some given reducers such that
     - A reducer is assigned inputs whose sum of the sizes is less than or equal to the reducer capacity.
     - For each output, must assign the corresponding inputs to at least one reducer in common.

4. **All-to-All Mapping Schema Problem**
   - **Inputs**: A list of inputs
   - **Outputs**: Each pair of inputs corresponds to one output
   - **Example**: Similarity-join
     Inputs \( w_1 = w_2 = w_3 = 0.20q, w_4 = w_5 = 0.19q, w_6 = w_7 = 0.18q \)

5. **X-to-Y Mapping Schema Problem**
   - **Inputs**: Two sets X and Y
   - **Outputs**: Each pair of inputs \((x_i, y_j), \forall x_i \in X, \forall y_j \in Y\)
   - **Example**: Skewjoin
     - Set \( X: w_1 = w_2 = w_3 = w_4 = 0.25q \)
     - Set \( Y: w'_1 = w'_2 = 0.25q, w'_3 = w'_4 = 0.24q, w'_5 = w'_6 = 0.23q \)

6. **Tradeoffs**
   - The reducer capacity v/s the total number of reducers
   - The reducer capacity v/s the parallelism at the reduce phase
   - The reducer capacity v/s the communication cost

7. **Reference**