Structure- and Cost-Aware Partitioning for Large Graphs over Geo-Distributed Datacenters

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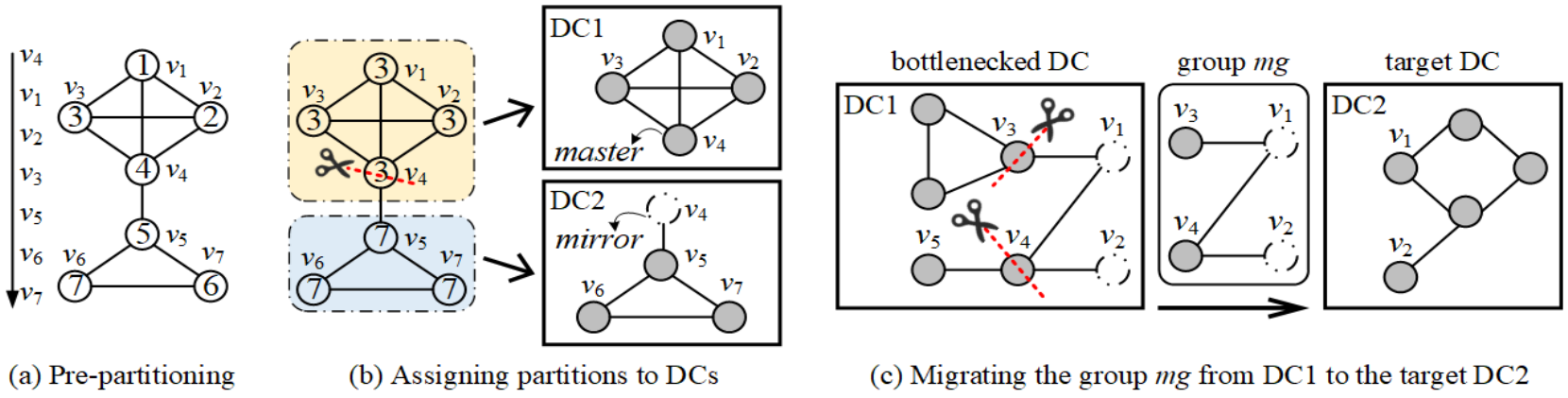
Problems & Ideas

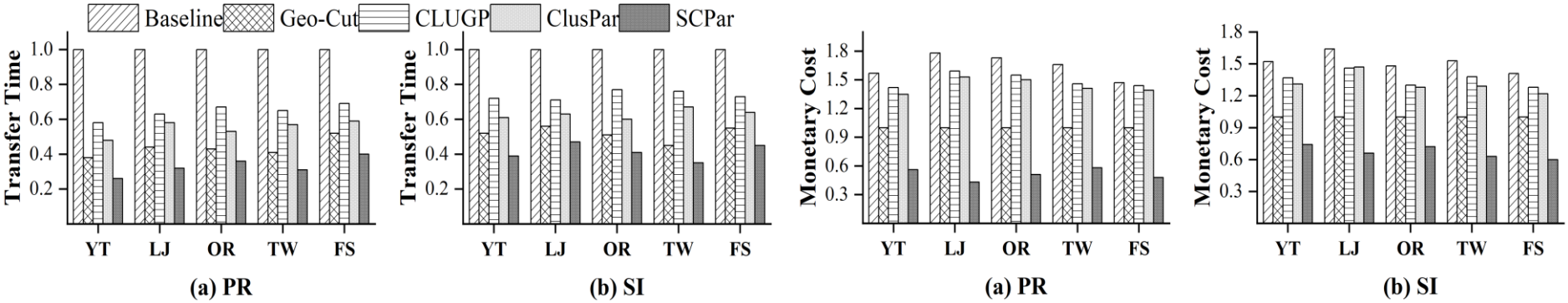
- Problems of graph partitioning over geo-distributed DCs:
  - Due to the heterogeneity of real-world node traffic and network-related costs (e.g., bandwidth, monetary), minimizing inter-DC communication in geo-distributed graph processing is non-trivial.
  - Existing methods fail to preserve structural information during optimization in geo-distributed environments.
- Ideas: We propose a structure- and cost-aware graph partitioning method that accounts for graph structures, traffic patterns, and various heterogeneities in geo-distributed DCs.



Overview of structure-aware pre-partitioning and cost-aware partition refinement. (a): Node labels are updated in a specific order to ensure stable structural information; (b): Partitions are split and assigned to the DCs with low RTT; (c): Identify the bottlenecked DC and migrate a group to refine the partitions.

Main Contributions

- Contributions:
  - A structure- and cost-aware graph partitioning method that consists of two optimized stages for geo-distributed DCs;
  - An improved label propagation method that better preserves the structural information and reasonably assigns the partitions to the DCs;
  - Development of a group migration algorithm that can identify performance bottlenecks and address cost-aware issues for the runtime of graph processing.



Performance comparison of partition methods using two graph algorithms. Left (a)-(b): Normalized inter-DC data transfer time; Right (a)-(b): Normalized monetary cost of inter-DC data transfer.