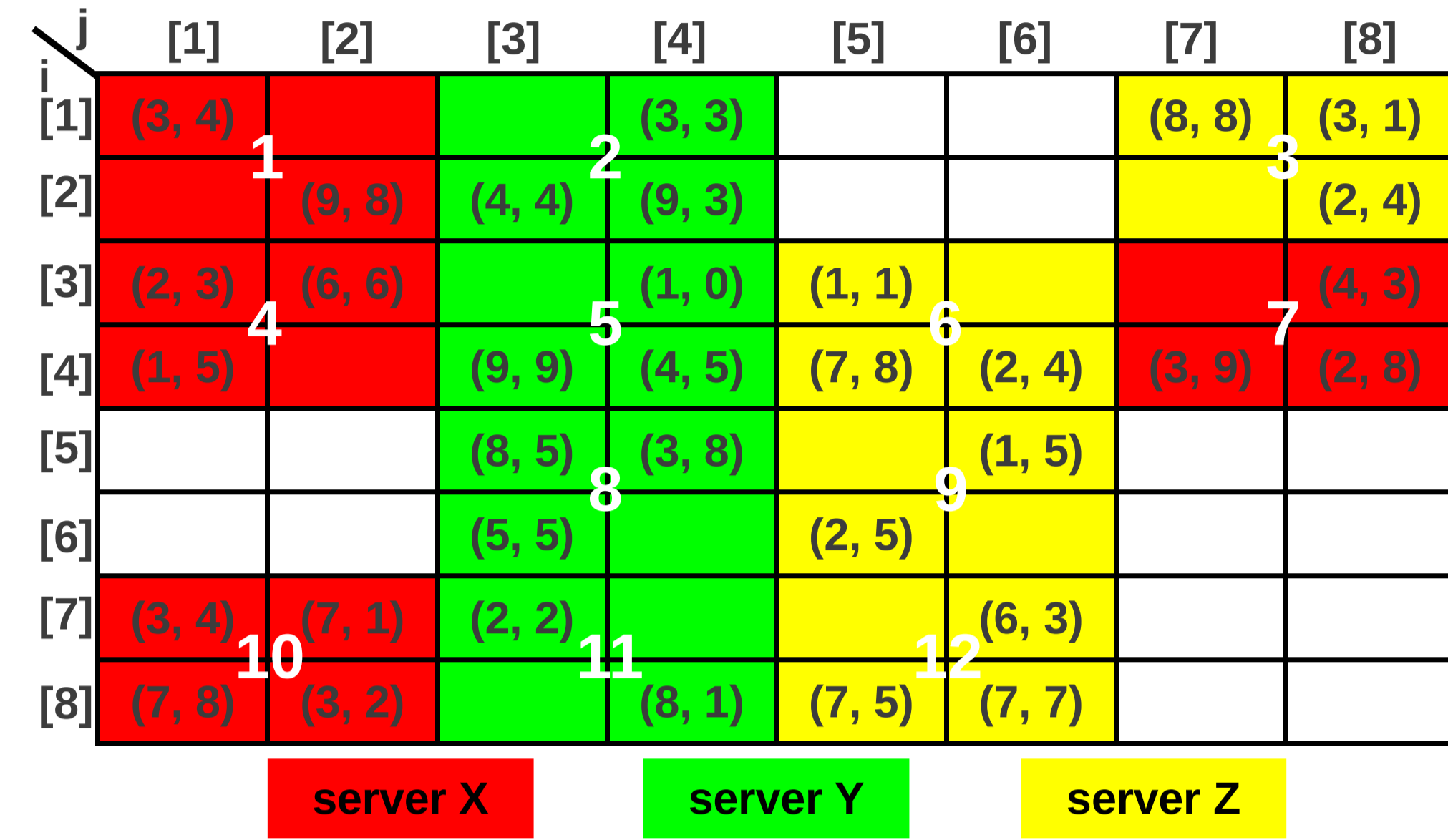
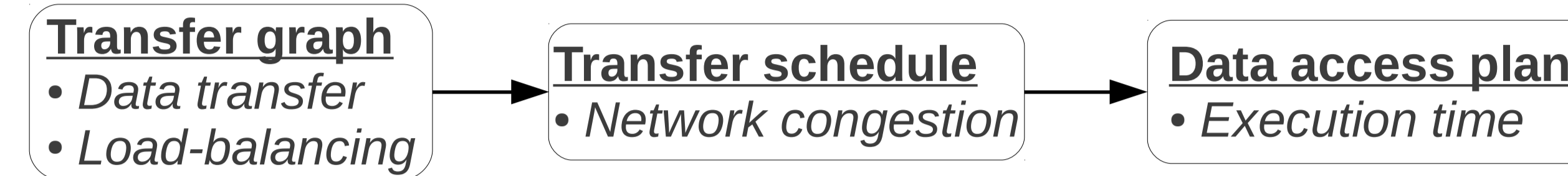




## Shared-Nothing Architecture



## Query Optimization



Network transfer time:

$$\min \left\{ \max_{ijk} \{ y_{ijk} \cdot t \cdot T_{ntwk} \} \right\}$$

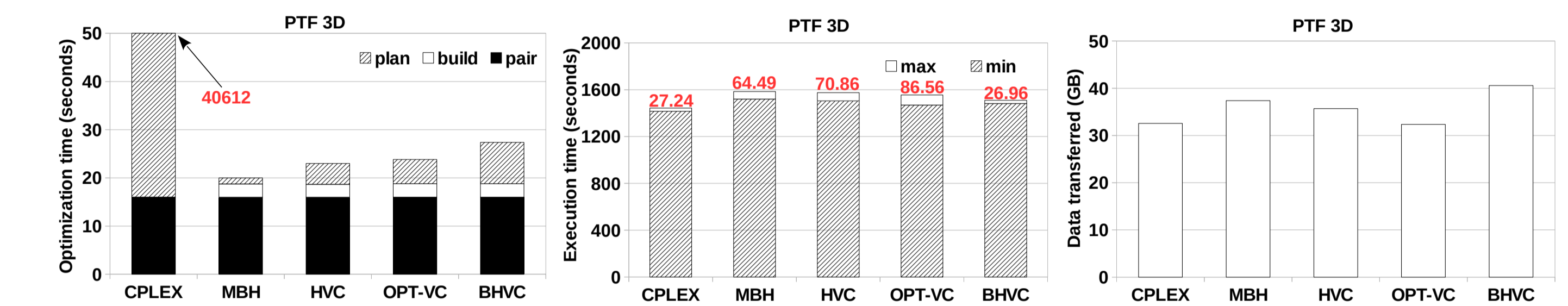
Disk access time:

$$\min \left\{ \max_k \left\{ \sum_{tj} y_{ijk(t-1)} \sum_{i' \in \Psi_i} (1 - z_{i'j}(t-1)) \cdot T_{disk} \right\} \right\}$$

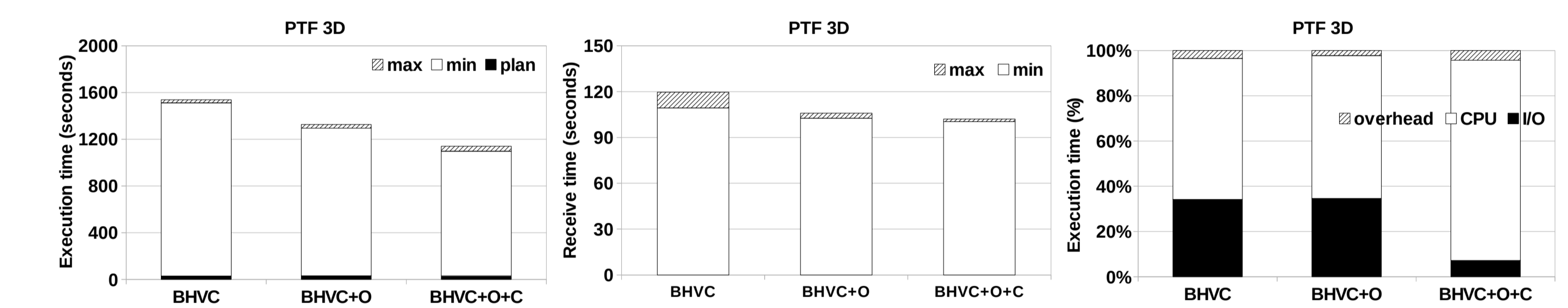
## Experiments

PTF catalog: PTF[time=1, 153064; ra=1, 100000; dec=1, 50000]  
1 billion objects, 12 GB  
LinkedGeoData: GEO[long=1, 100000; lat=1, 50000] 30 million objects, 1 GB

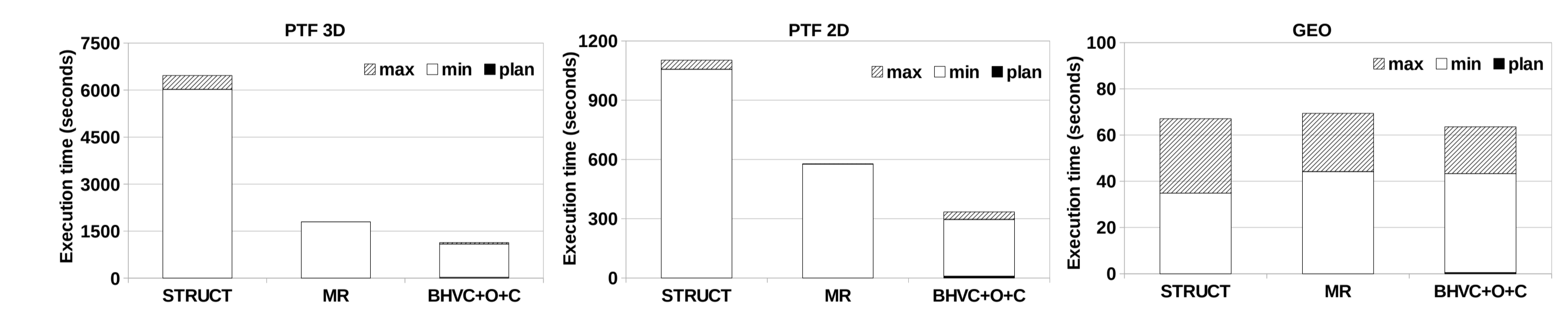
Transfer graph evaluation on PTF 3D query:  
optimization time, execution time, and transferred data



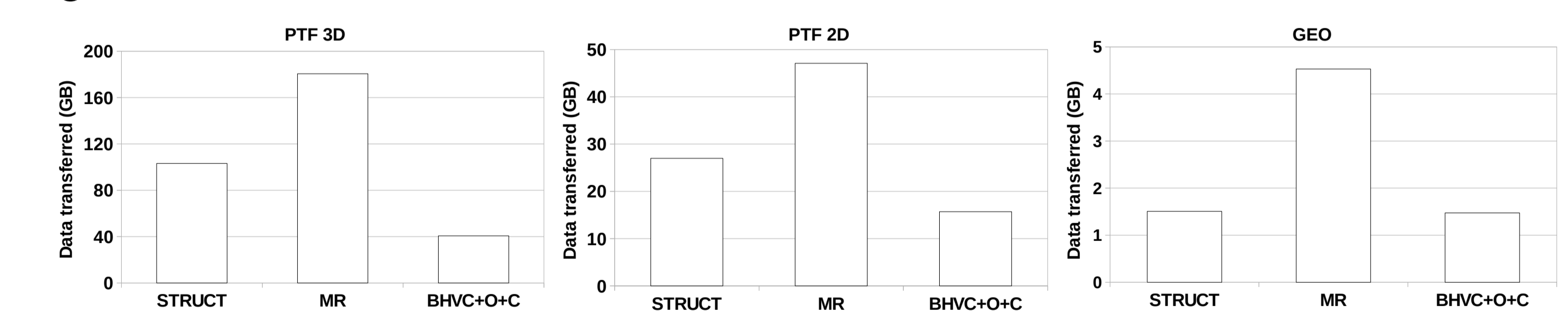
Query optimization evaluation on PTF 3D query:  
execution time, receiving time, and thread time distribution



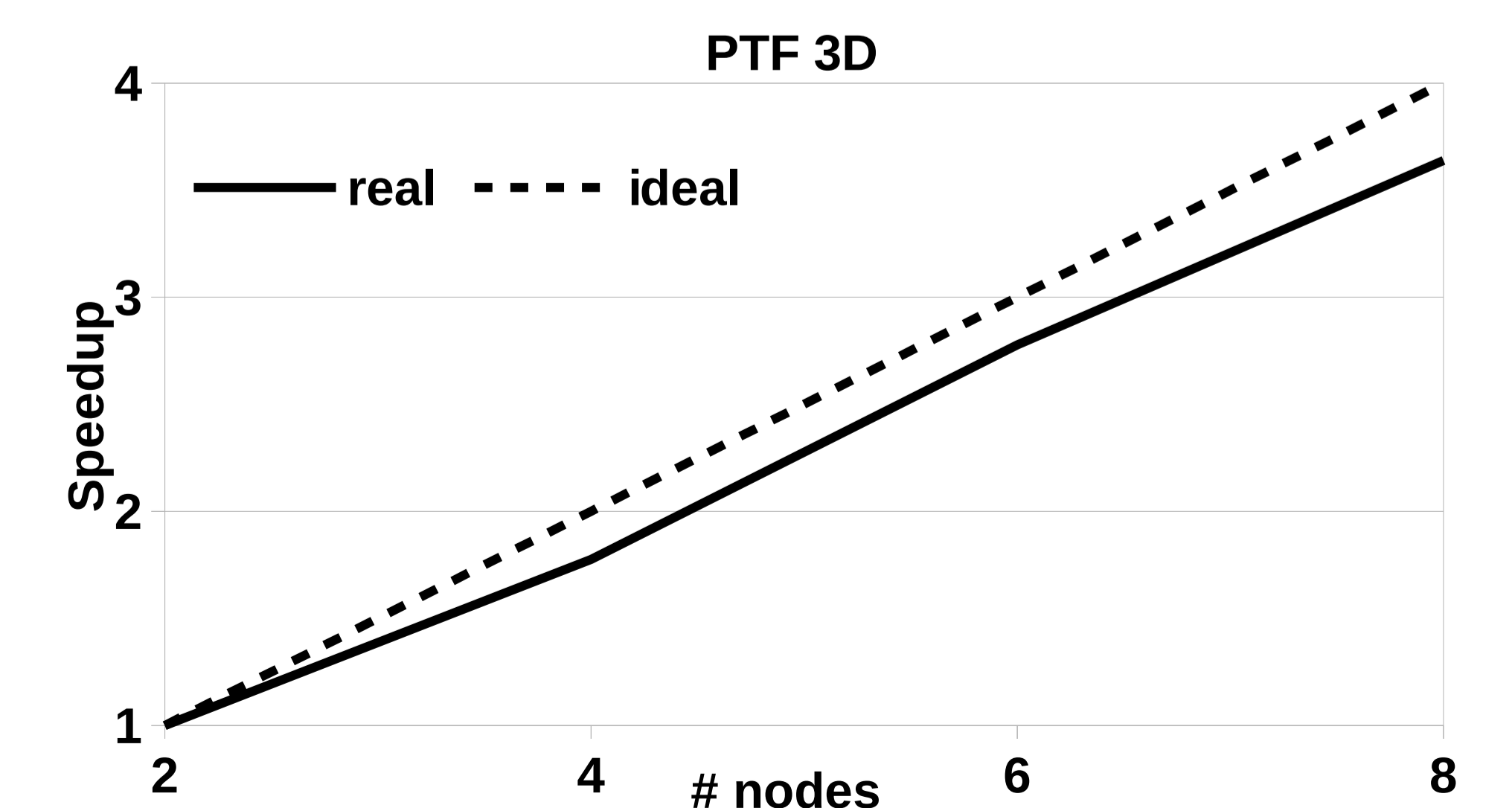
Algorithm execution time:



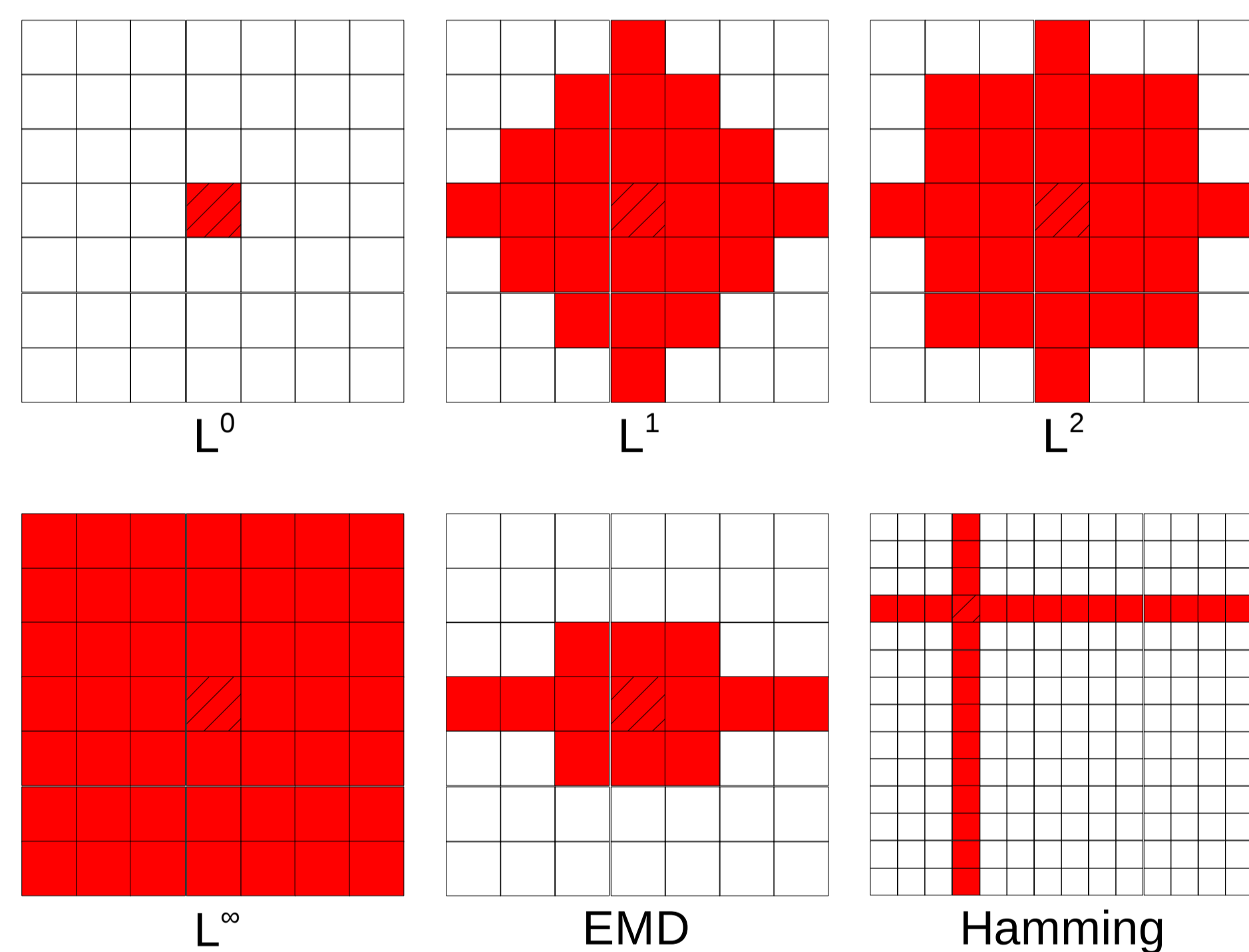
Algorithm data transferred time:



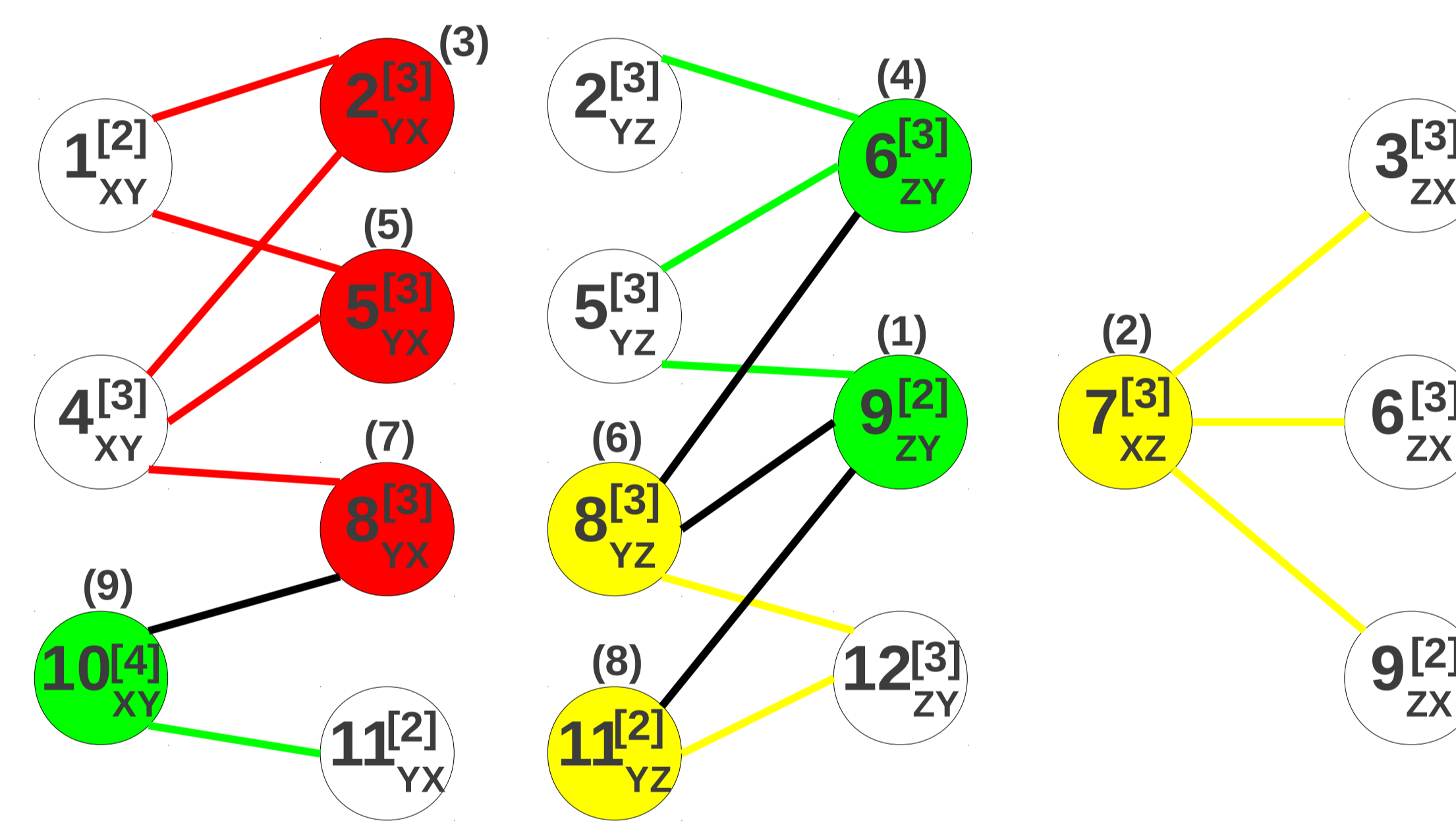
Scalability:



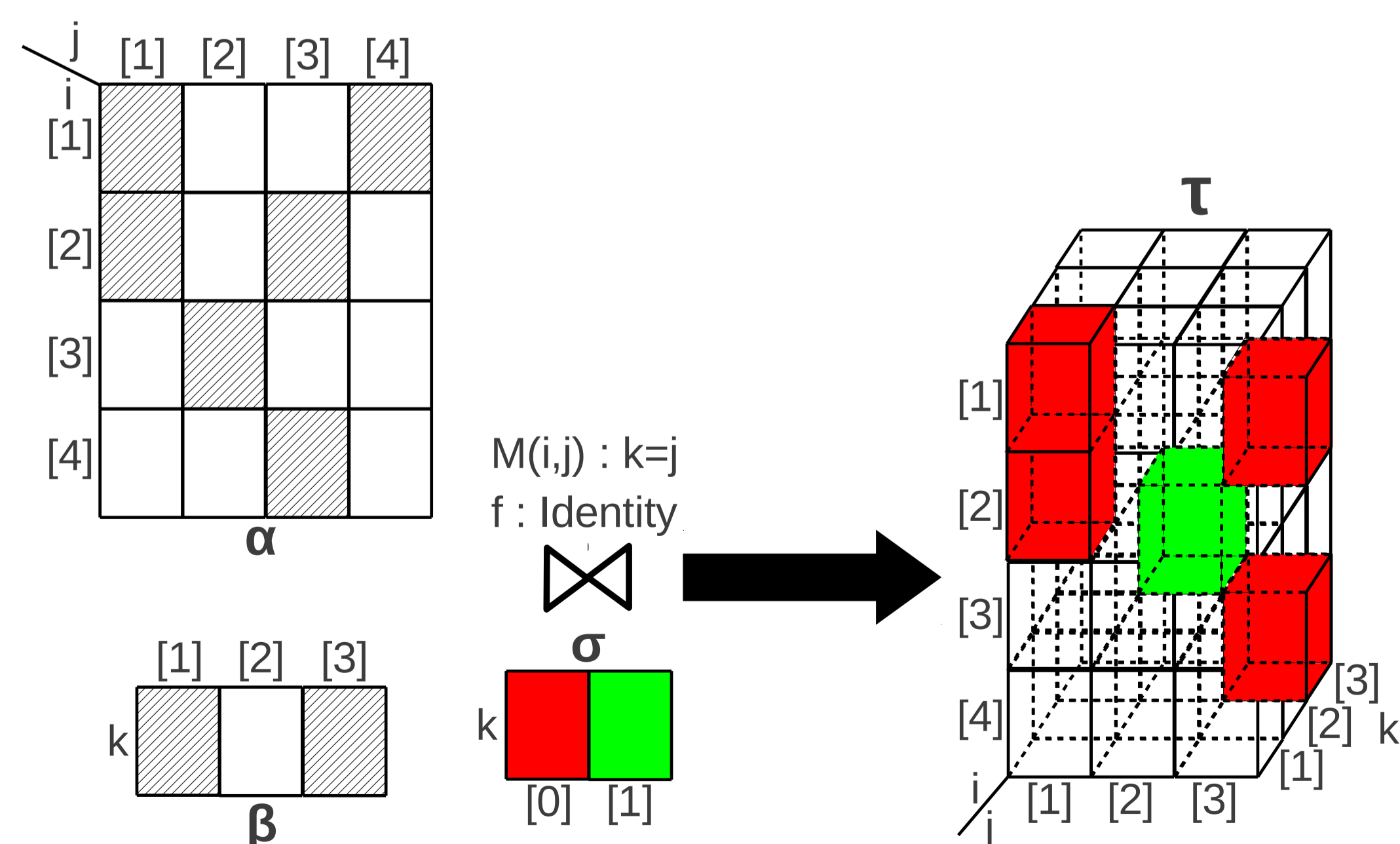
## Similarity Shape Array



## Transfer Graph Optimization



## Array Similarity Join



SELECT \* INTO  $\tau$  FROM  $\alpha$  SIMILARITY JOIN  $\beta$   
ON ( $k=j$ ) WITH SHAPE  $\sigma$

## Transfer Schedule Network

