Location Awareness in Unstructured Peer-to-Peer Systems

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Outline

- Introduction
- Related Work
- Location-Aware Topology Matching
- Three Main Operations
- Simulation & Performance Evaluation
- Conclusion

1. Introduction

- LTM

  (Location-aware Topology matching)
  - Unstructured P2P
  - Solve Mismatching problem
  - Distributed , Doesn't require global view
- Main idea
  - Build an efficient overlay by disconnecting slow connection
  - Choosing closer peer as neighbor

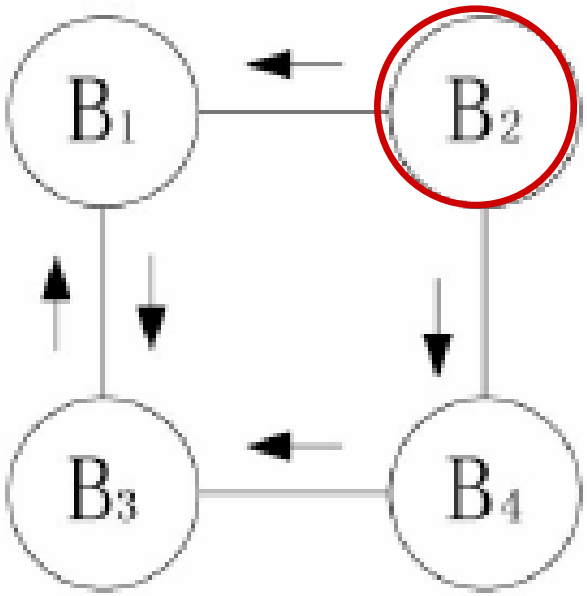
2.Related Work

- Other ways to reduce traffic cost in unstructure-P2P system
  - Forwarding-based
    - Only forward to subset of neighbors
  - Cache-based
    - Remember index of files/peers used before
  - Overlay topology optimization
    - Logical topology / physical topology
    - LTM

3.Location-Aware Topology Matching

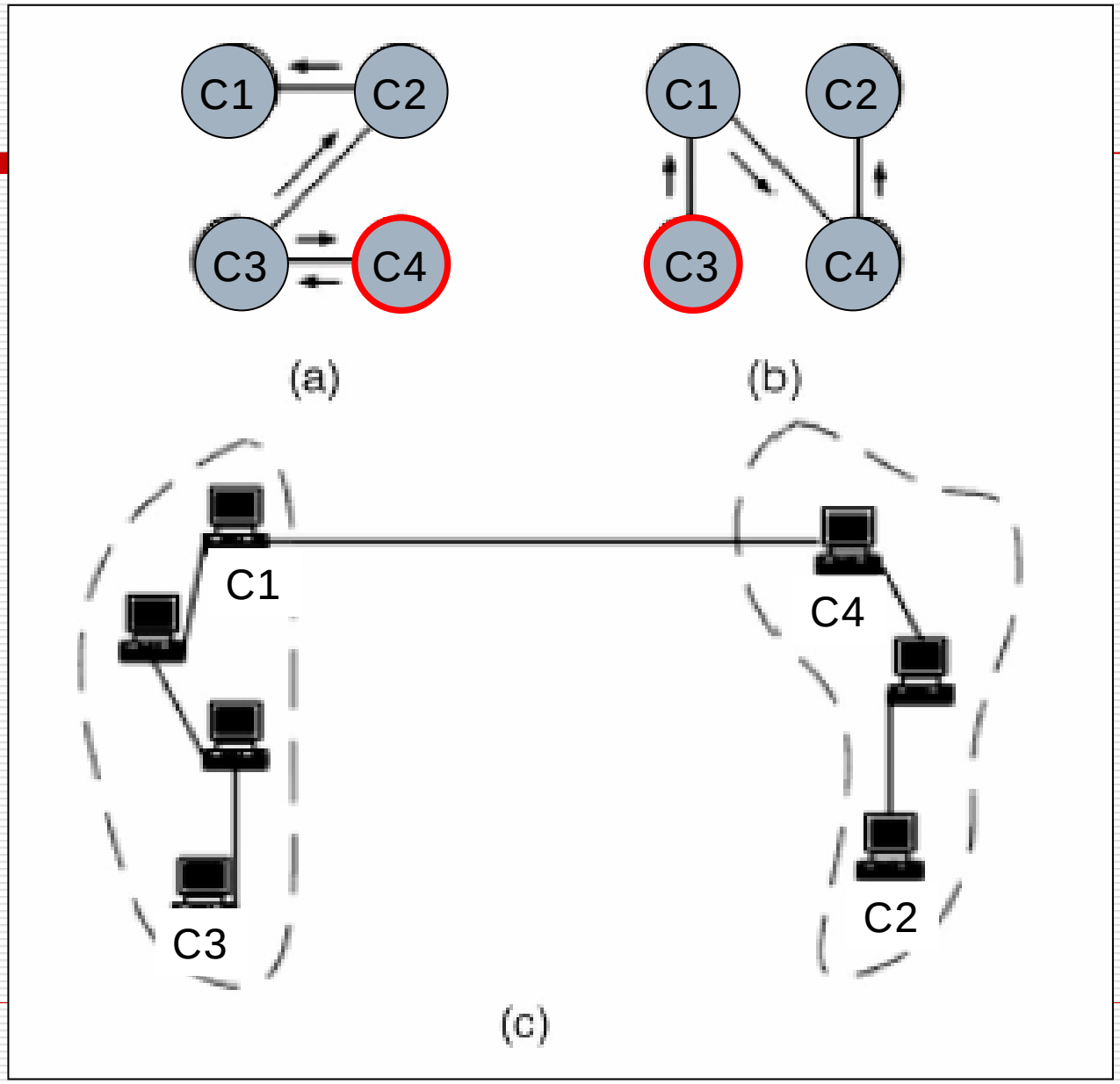
- Problems at unstructured P2P system
  - Unnecessary Message Duplications in Overlay Connections
  - Topology Mismatch (logical/physical)

Unnecessary Message Duplications in Overlay Connections



Unnecessary traffic on logical link B_1B_3.

Topology Mismatch

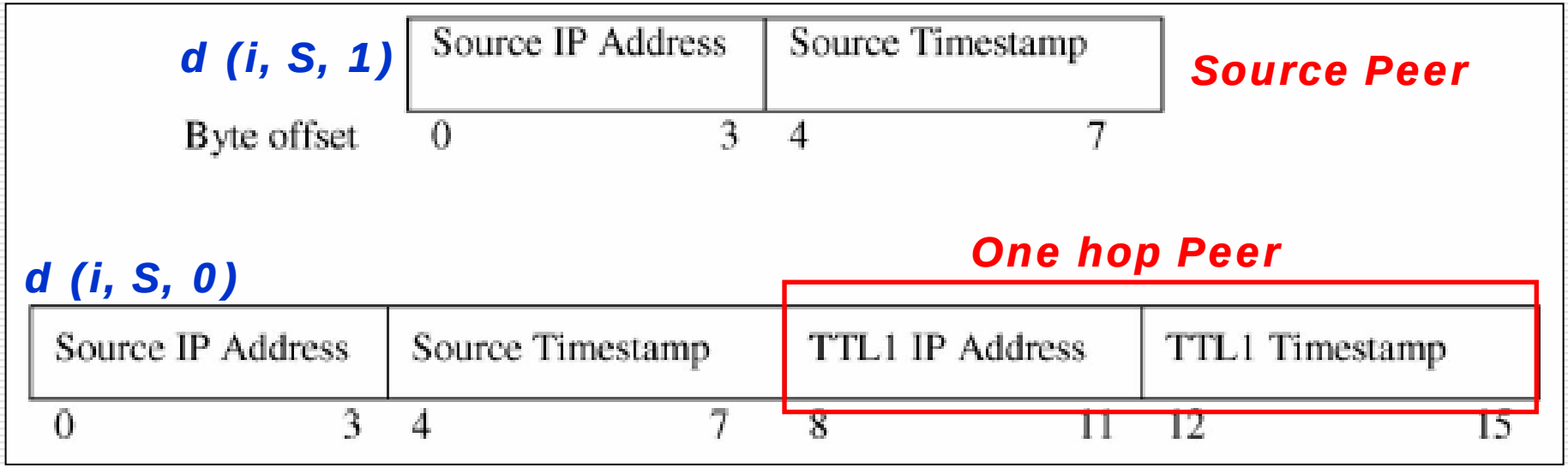


4.Three Main Operations

- TTL2-Detector Flooding
  - Flooding 2 hops
- Slow Connection Cutting
- Source Peer Probing

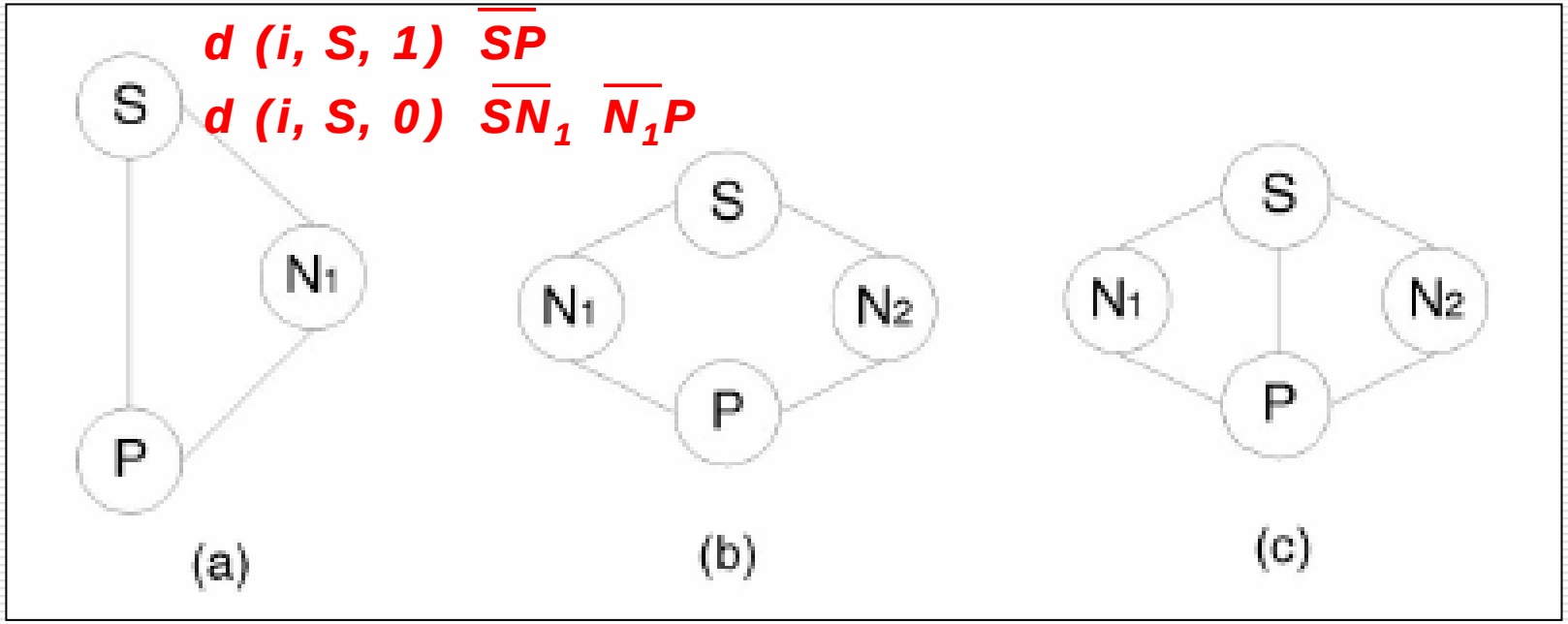
TTL2-Detector Flooding

- Each peer floods a TTL2-Detector periodically
- d (i, S, v)
  - i : Message ID
  - S: Initial Source
  - v: TTL value



Slow Connection Cutting

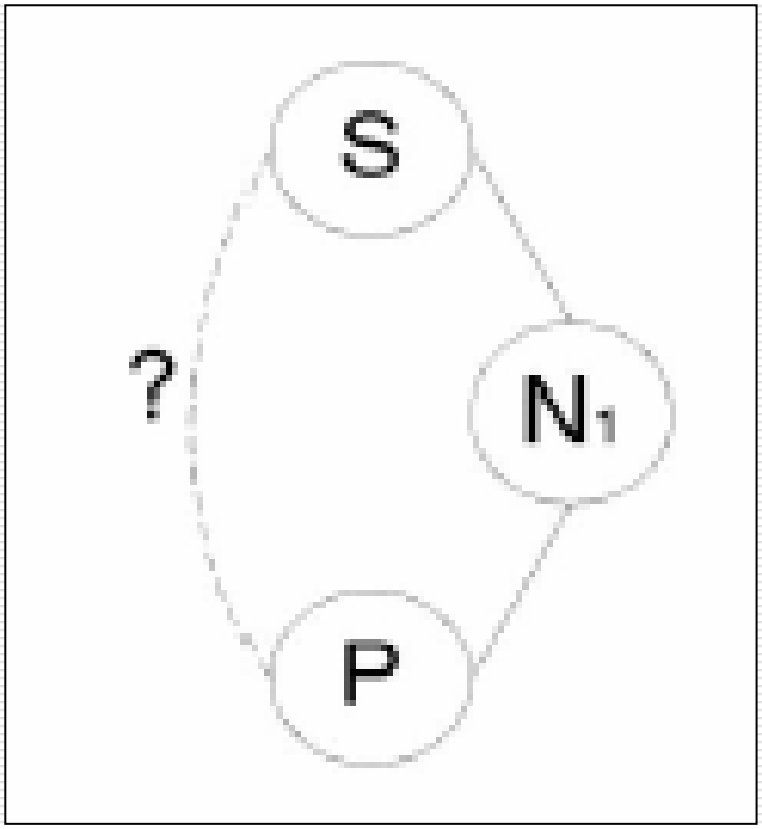
- 3 kinds of cases
- Will-Cut List / Cut List



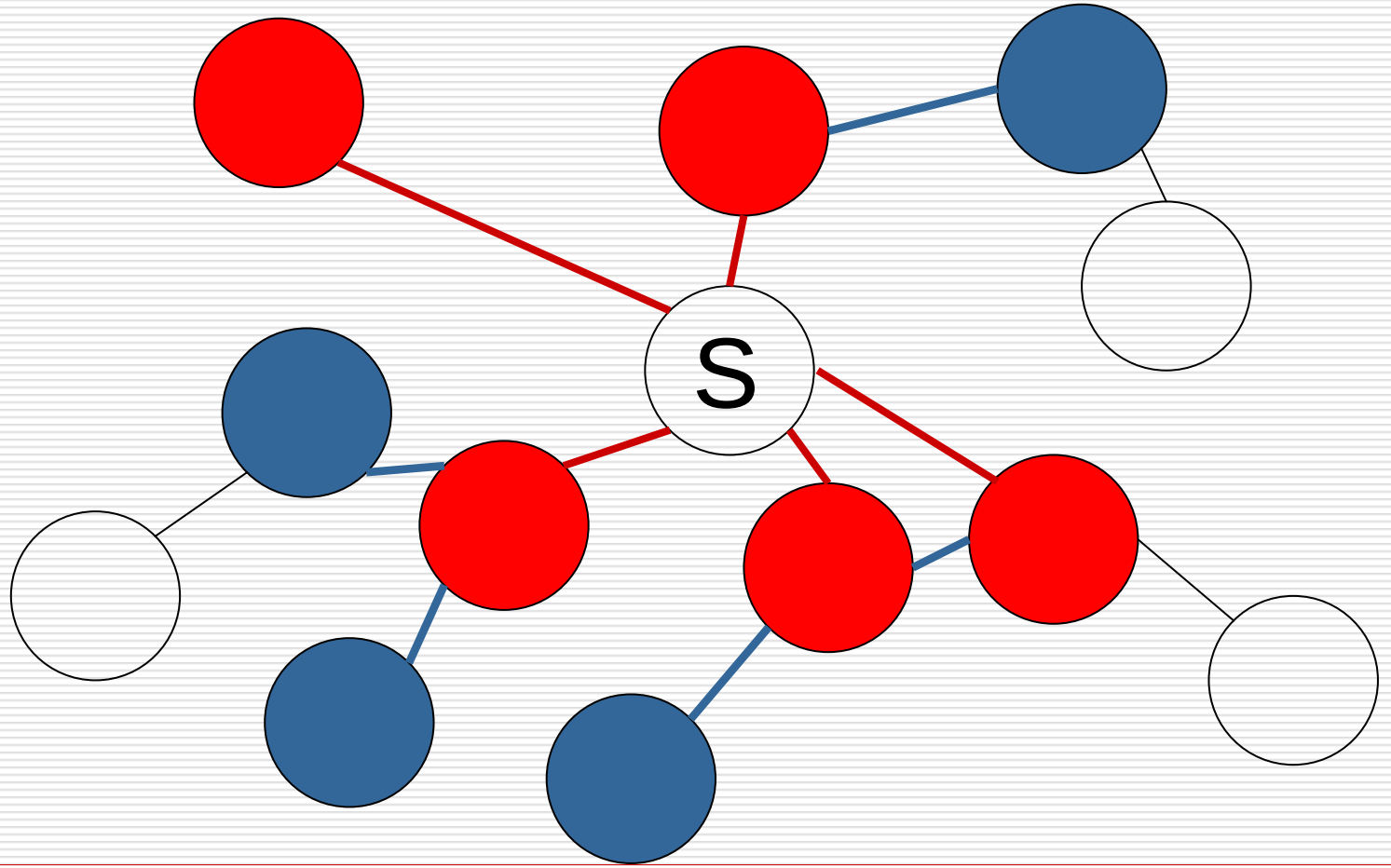
Source Peer Probing

- Peer P receives only one *d(i,s,0)* during a certain time

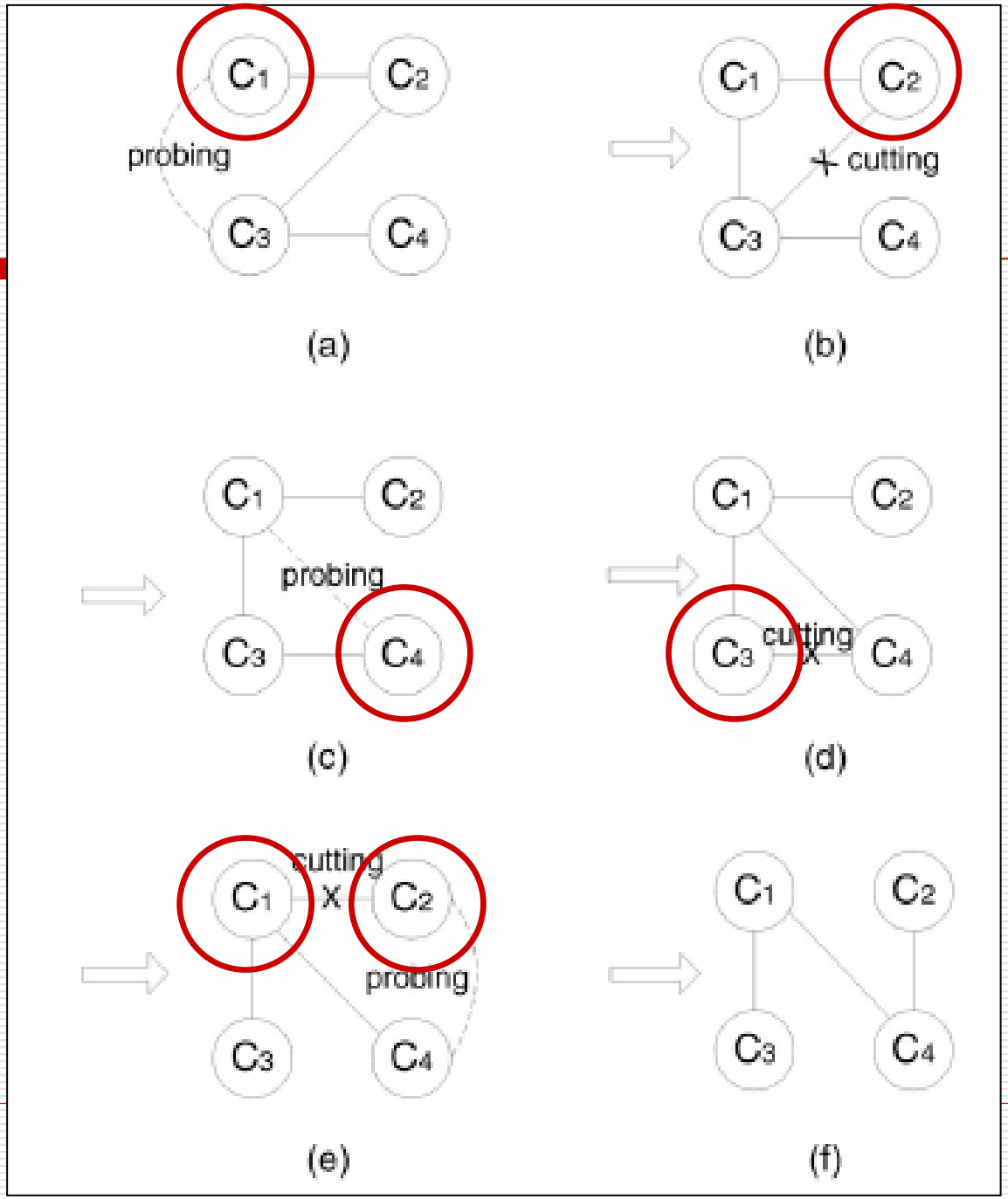
- $P \in (N^2(S)-N(S))$



Definition : N(S) $N^2(S)$



Operation Example



5.Simulation & Performance Evaluation

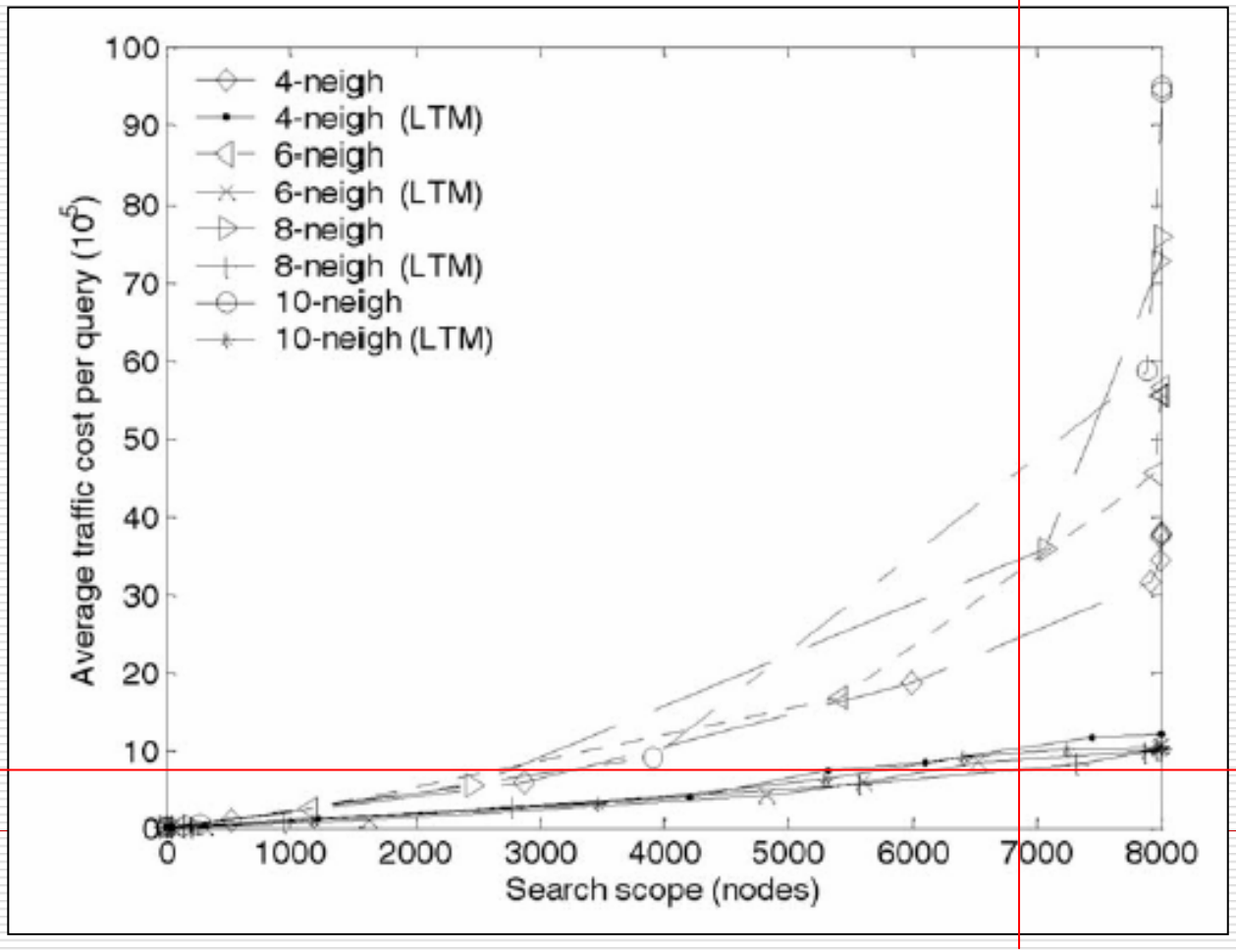
- Performance Metrics
  - Average traffic cost vs. search scope
    - Tc = Message * number of Links
    - Search scope = number of peers reached
  - Average neighbor distance
  - Query response time

Simulation Environment

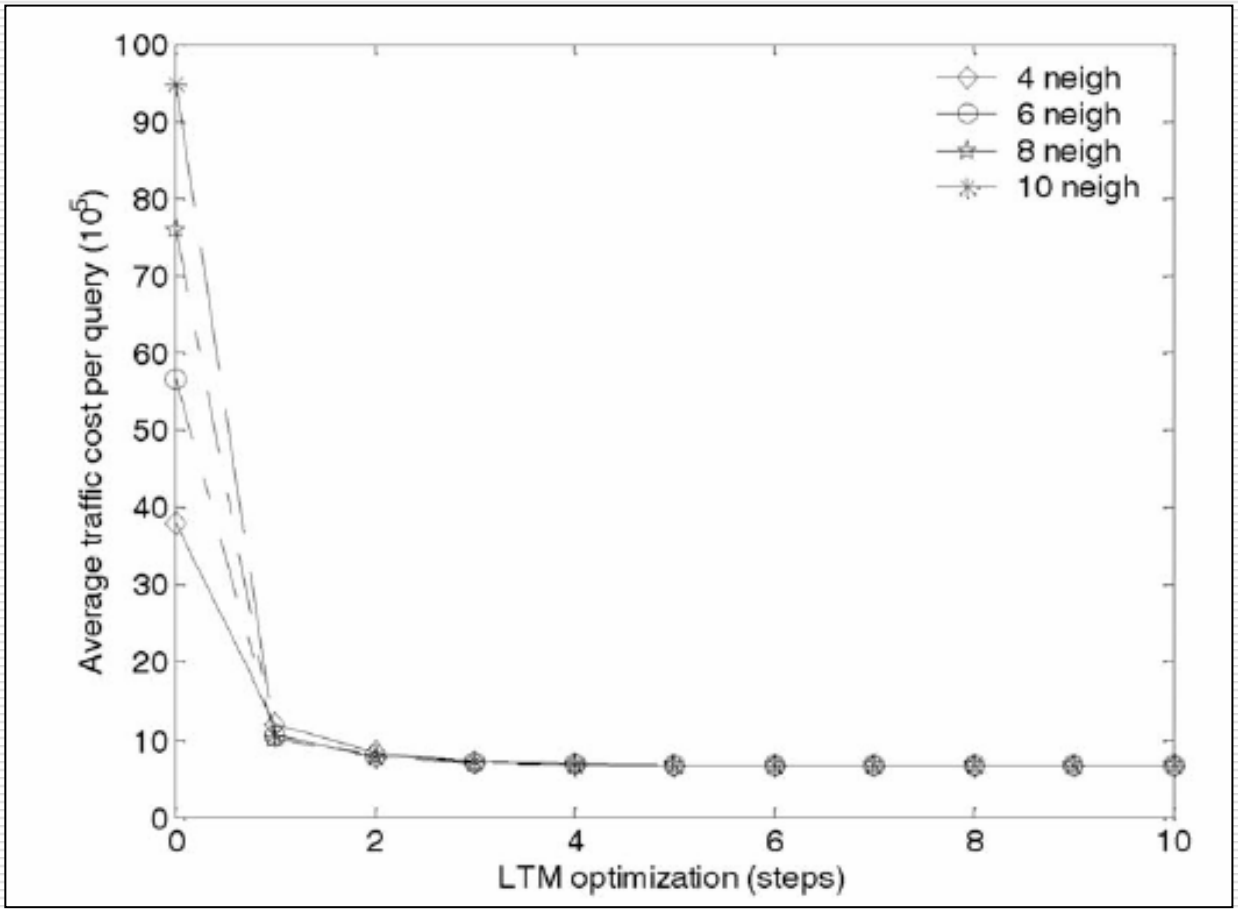
- Overlay (logical) :
  2000,3000,5000,8000 nodes
- Physical :
  22000 Internet-like nodes
- Neighbors :
  4,6,8,10 neighbors

LTM in Static Environment

- Traffic cost vs. Search scope (Only 1 step LTM)

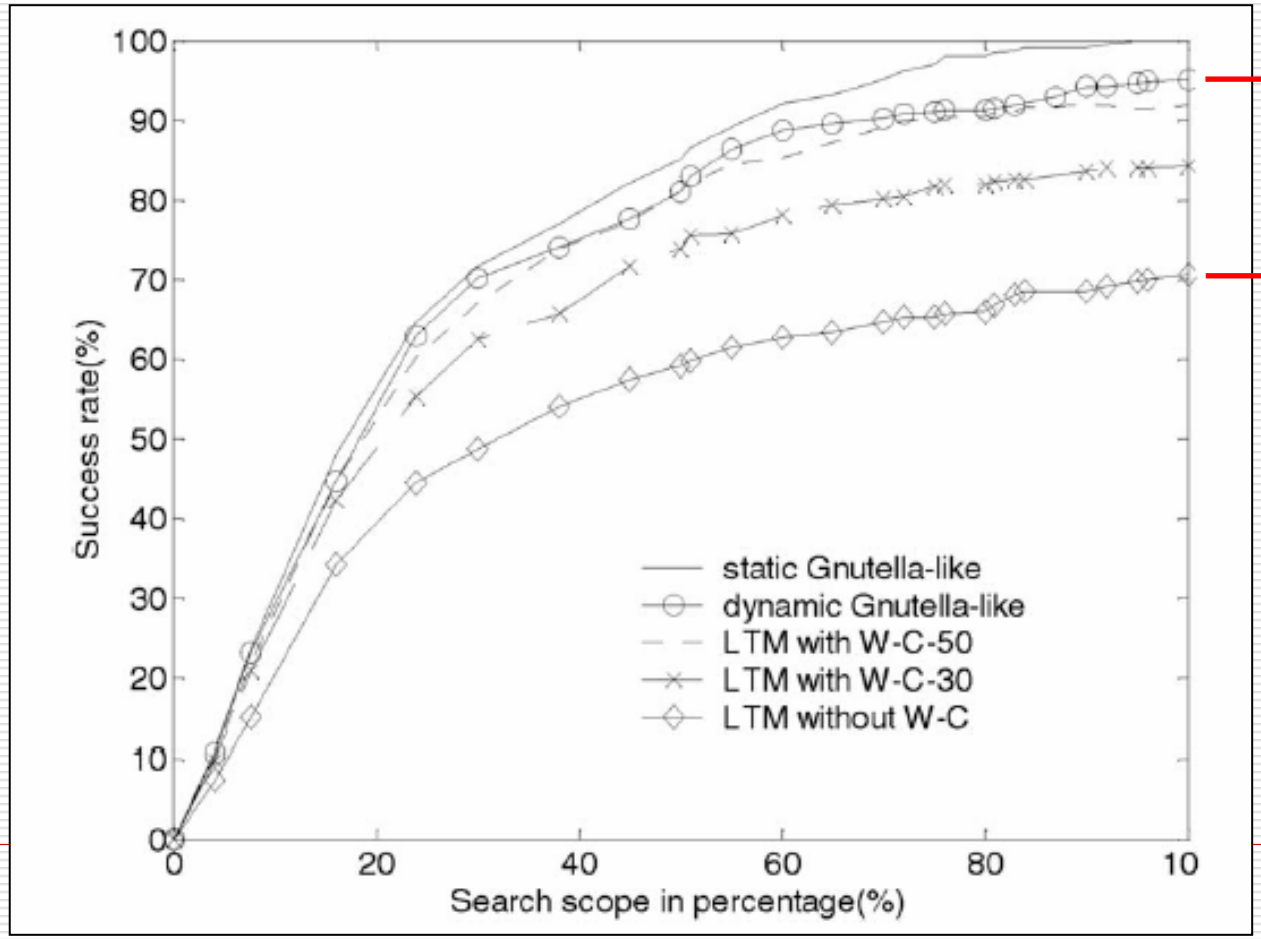


Traffic cost vs. optimization step



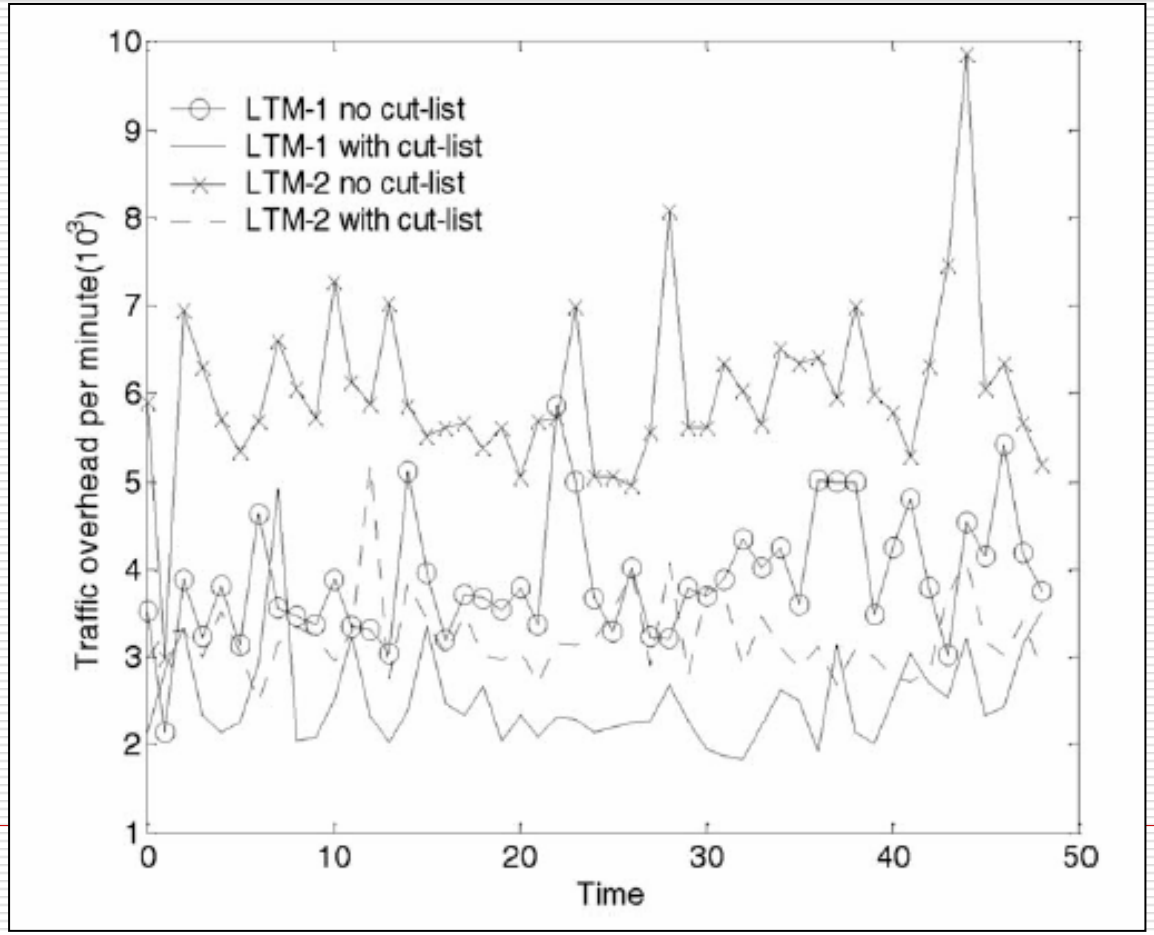
LTM in Dynamic Environment

- Effectiveness of Will-Cut List (W-c-50➔ 50 sec)

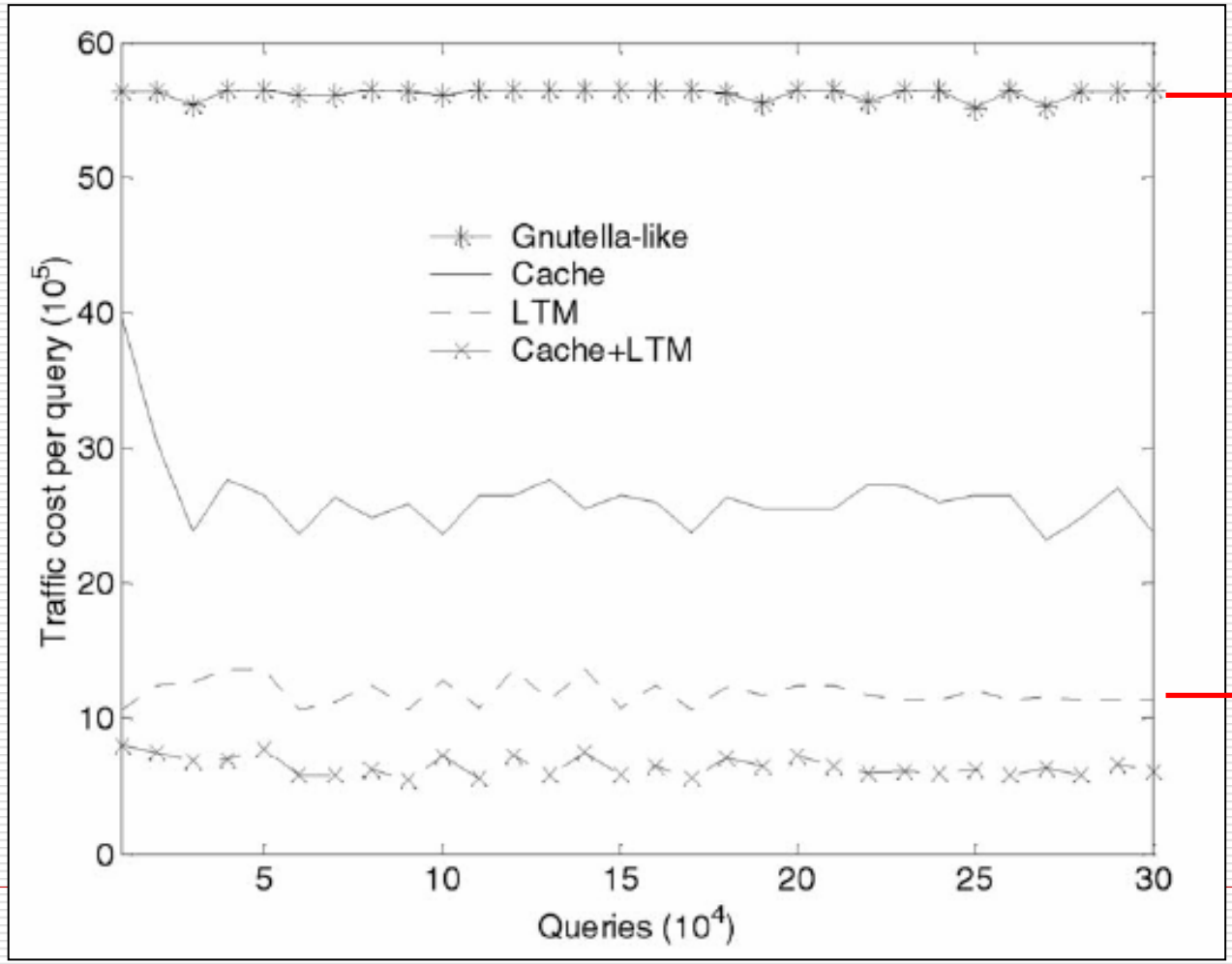


Effective ness of cut list

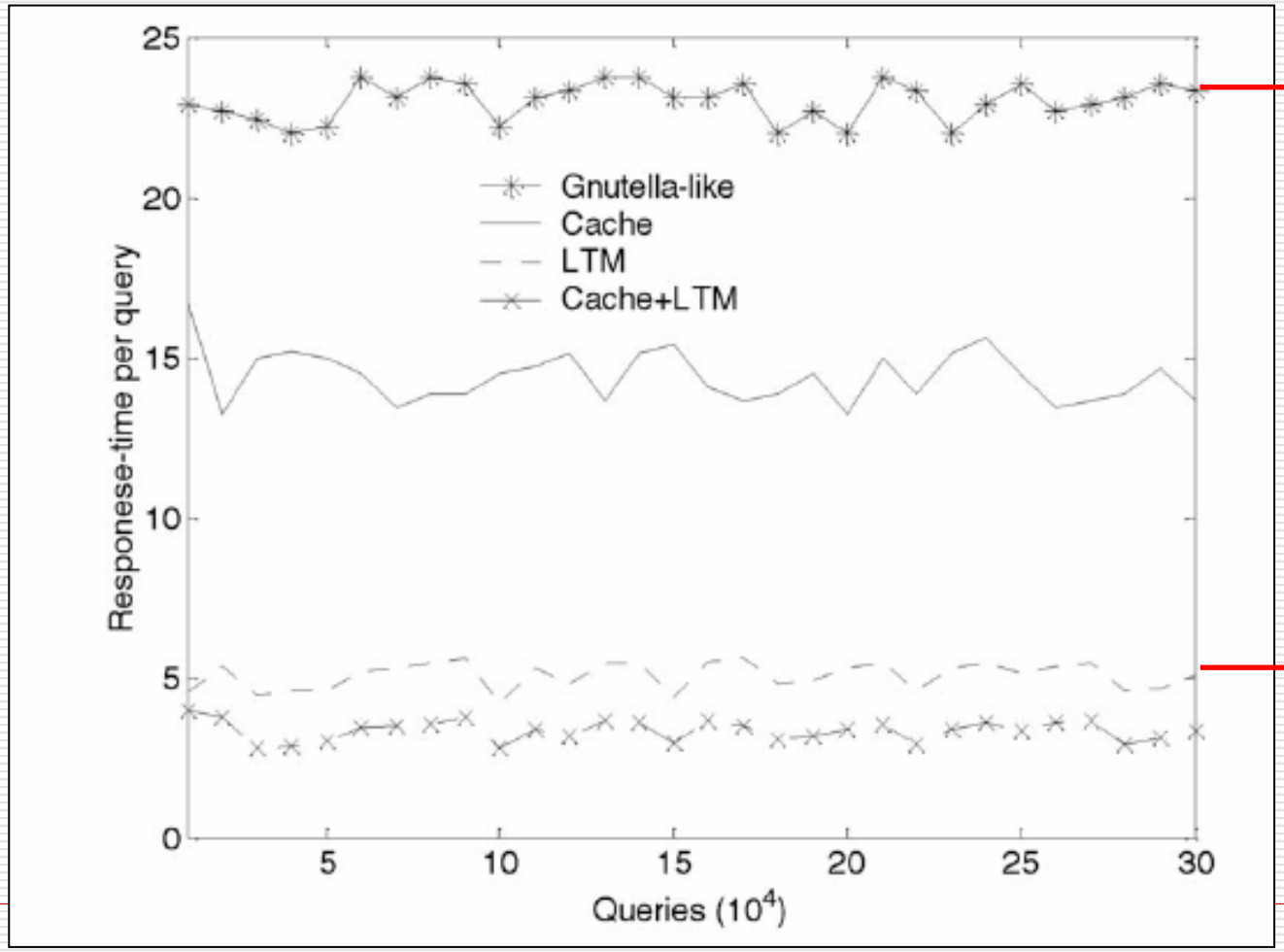
- LTM-k means k-times LTM / per minute



Traffic cost of 4 schemes



Average response time of 4 schemes



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6.Conclusion

- Using LTM in unstructured P2P system can reduce 75% traffic cost and 65% query response time
- Will-cut List and cut List can improve the performance of LTM
- LTM is completely distributed and scalable

Reference

- IEEE TRANSACTIONS ON PARALLEL AND DISTRIBUTED SYSTEMS, VOL. 16, NO. 2, FEBRUARY 2005
- *Yunhao Liu, Member, IEEE, Li Xiao, Member, IEEE, Xiaomei Liu,*

  Lionel M. Ni, Fellow, IEEE, and Xiaodong Zhang, Senior Member, IEEE