


A Cooperation Mechanism for Pure P2P File-Sharing Networks to Improve Application-Level QoS

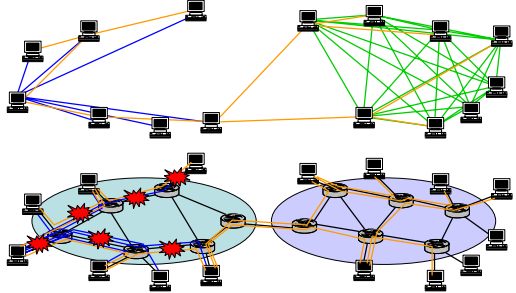
Naoki Wakamiya

Osaka University, Japan
wakamiya@ist.osaka-u.ac.jp




Competing Overlay Networks

- Overlay networks competing underlying physical network resources disrupt each other

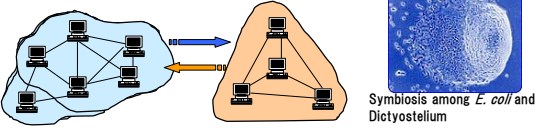


2




Overlay Network Symbiosis

- Collective performance of overlay networks can be improved by cooperation of them
- Overlay network = organism
 - Emerges as a new node joins
 - Shrinks as a node leaves
 - Direct and/or indirect interactions
 - Changes in internal structure



Symbiosis among *E. coli* and Dictyostelium


3



Cooperation of P2P File-sharing Networks

- Independent (Selfish)
 - Performance and topology dynamically change as a result of dynamic behavior (search, response, retrieval, topology change) of others
- Cooperation through sharing control information
 - Share control information such as measurement and topology and organize less-influential networks
- Cooperation through relaying messages
 - Relaying search/response messages leads to higher hit rate and higher robustness
- Aggregation and re-organization of P2P networks
 - Reduces the load on physical networks and attains higher performance by avoiding competition

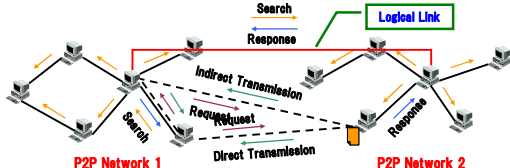
4




Cooperation Mechanism

- P2P networks find each other
- Decide whether to cooperate or not
- Establish a logical link between peers
- Exchange query/response message
- Actively cooperating P2P networks are finally merged

How should two overlay networks be connected?



5

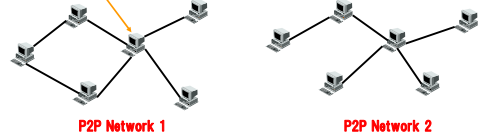


Cooperation Mechanism: candidate peer

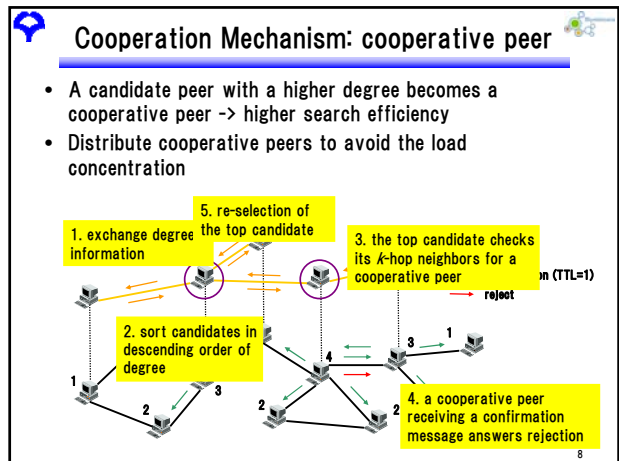
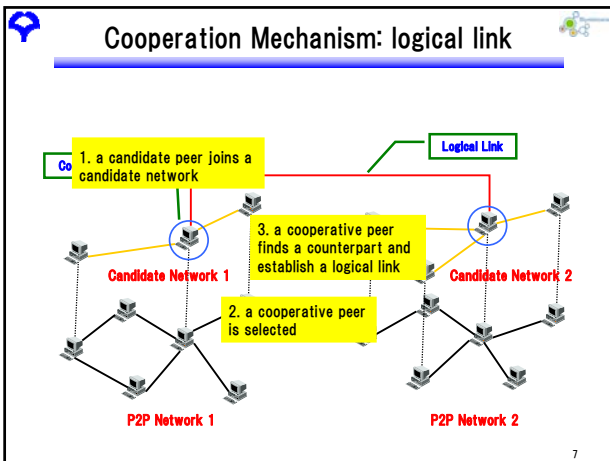
- A peer introduces a cooperation program on its own decision and becomes a candidate peer
 - cannot find a desired file
 - cannot find the enough number of file holders
 - cannot obtain a file fast enough

Cooperation program

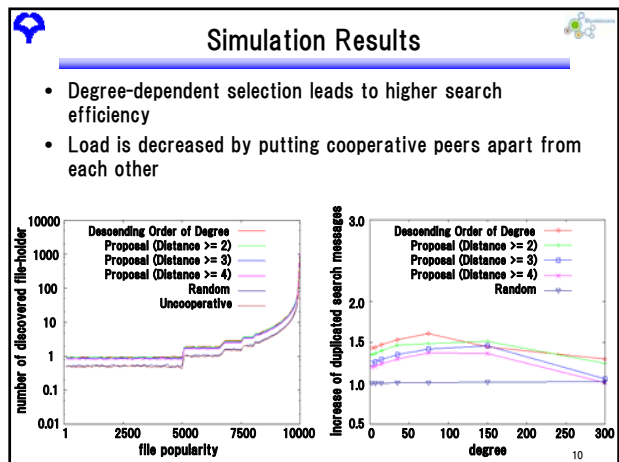
- protocol conversion
- meta-information cache
- decision of cooperation



6



- ### Simulation Experiments
- Measures
 - The number of discovered file-holders
 - Search latency
 - Rate of load increase (duplicated search messages, number of messages)
 - Two scale-free networks of 10,000 peers
 - 10 cooperative peers in a network
 - 93,668 files of 10,000 kinds
 - File-popularity follows Zipf distribution
 - Averaged over 20,000 search messages (TTL=7)
 - File to find is determined following Zipf distribution



- ### Conclusion and Future Works
- We propose a mechanism for P2P file-sharing networks to effectively and efficiently cooperate with each other to enhance their application-level QoS
 - We need to investigate cooperation among dynamic P2P networks
 - We plan to implement our mechanism in an actual P2P file-sharing system