

Pushing the Performance of Biased Neighbor Selection through Biased Unchoking

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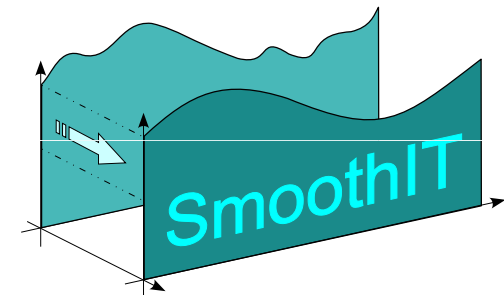
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*Simple Economic Management Approaches of
Overlay Traffic in Heterogeneous Internet
Topologies*

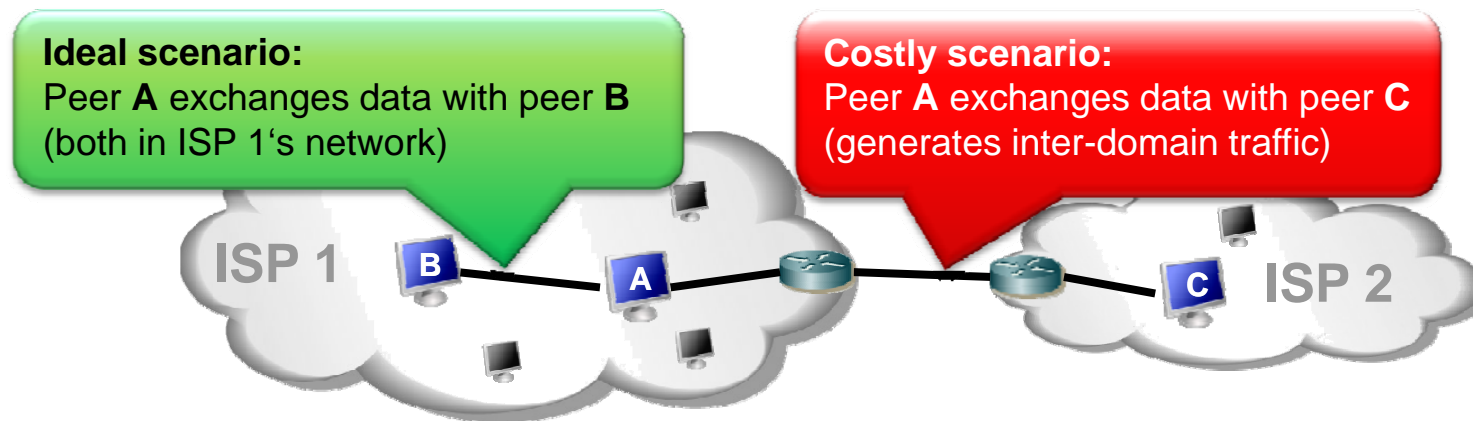
European Seventh Framework STREP FP7-2007-ICT-216259



Agenda

- ▶ Introduction
 - Topology-awareness in P2P-based CDNs
 - BitTorrent
- ▶ Topology-aware peer behaviors
 - Biased neighbor selection
 - Biased unchoking
- ▶ Performance study
- ▶ Conclusion

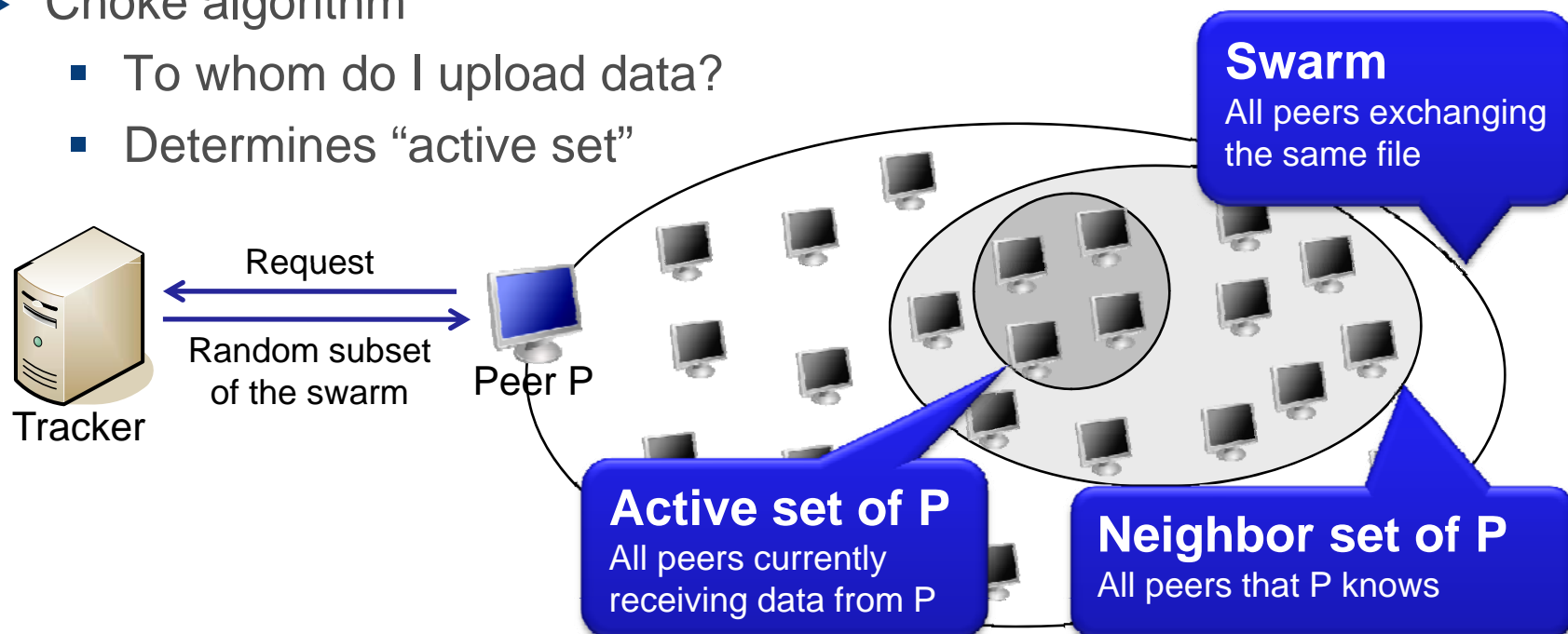
Topology-Awareness in P2P-Based CDNs



- ▶ P2P-based content distribution networks (CDNs), e.g., BitTorrent
 - Large fraction of today's Internet traffic
 - Mostly topology-unaware
- ▶ Topology-awareness
 - Information exchange between overlay and underlay
 - Goals: efficient network usage, reduced costs for ISPs
- ▶ Focus of this study: topology-aware peer behaviors
 - Assumption: topology information given
 - Investigation of **inter-domain traffic** and **download times**

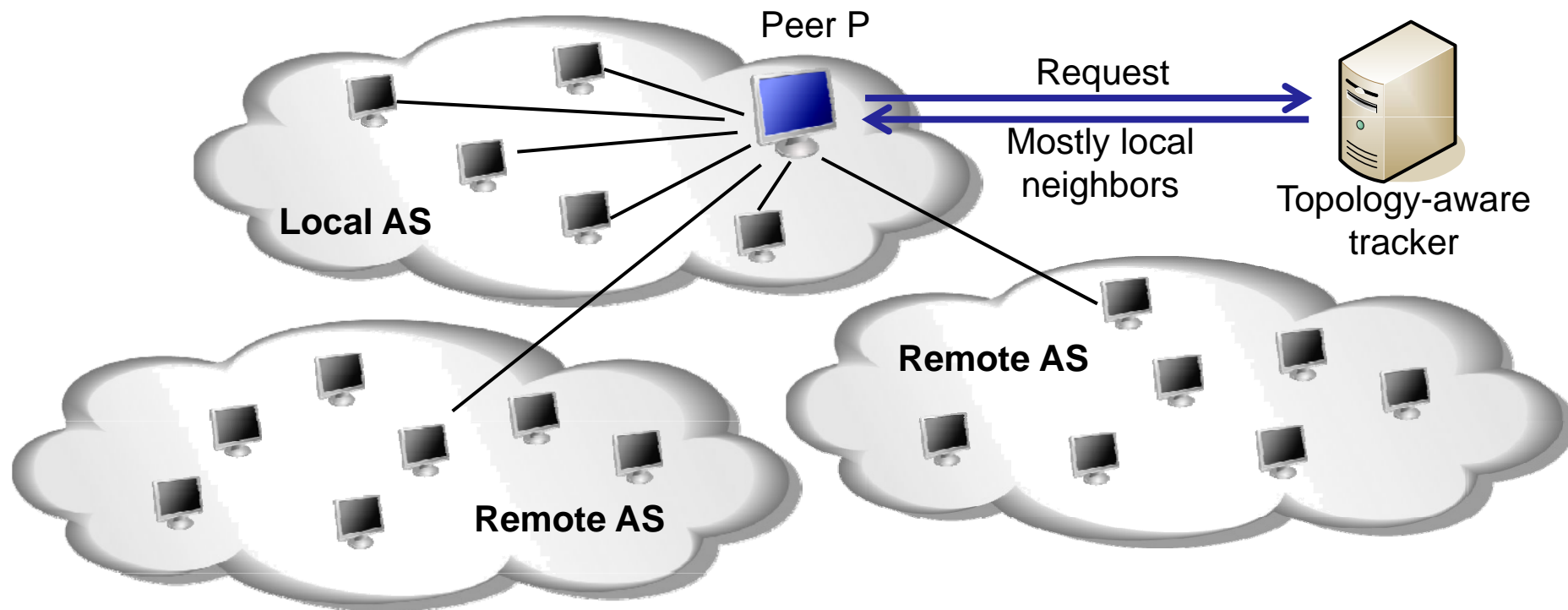
BitTorrent

- ▶ One of the most popular file-sharing application
- ▶ Peers exchange parts of the file (so-called chunks)
- ▶ Neighbor selection
 - Which other peers of the swarm do I know?
 - Done by the “tracker”
- ▶ Choke algorithm
 - To whom do I upload data?
 - Determines “active set”



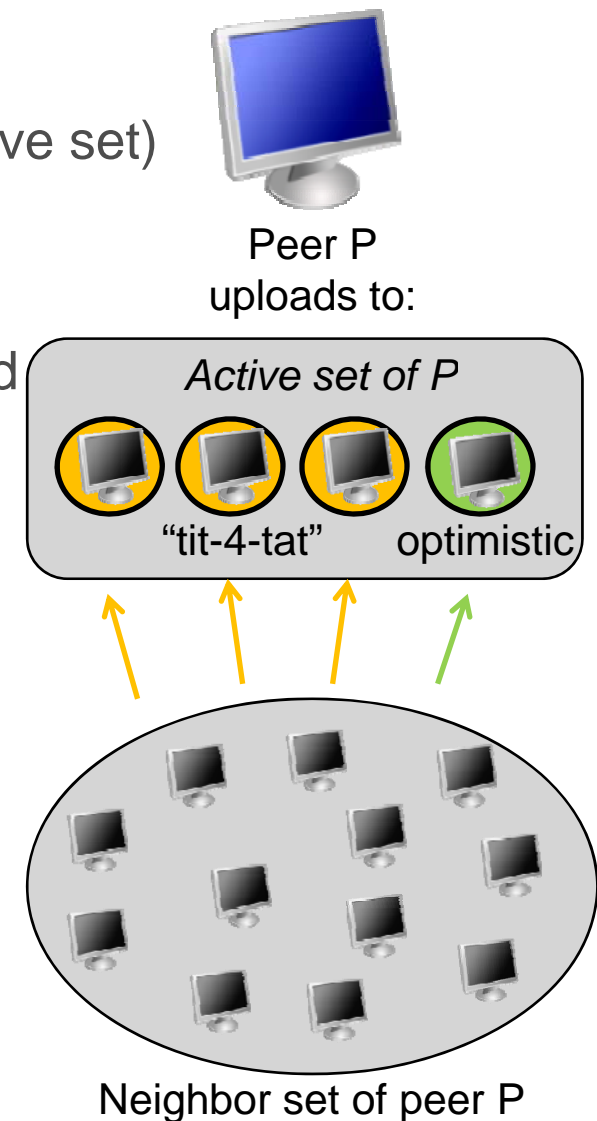
Biased Neighbor Selection (BNS)

- ▶ Adaptation of neighbor selection, used for comparison in this study
- ▶ Different forms proposed in literature (by Bindal et al., Xie et al., ...)
- ▶ One option: topology-aware tracker
 - Knows autonomous system (AS) of every peer
 - Preferentially returns local neighbors



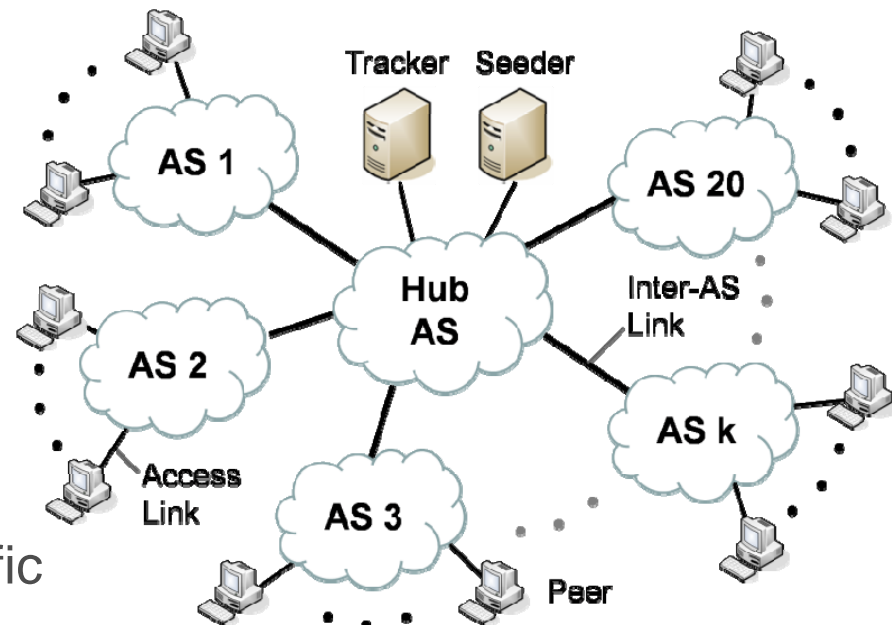
Biased Unchoking (BU)

- ▶ Choke algorithm
 - Determines who receives data from P (active set)
 - “Choked” neighbors don’t receive data
 - “Unchoked” neighbors receive data
 - At most 4 neighbors concurrently unchoked
- ▶ Behavior of regular BitTorrent (regBT)
 - 3 neighbors with fastest upload to P unchoked every 10 s (“tit-4-tat”)
 - 1 **randomly selected** neighbor unchoked every 30 s (“optimistic unchoking”)
- ▶ **Biased** unchoking
 - **Local neighbors** selected for optimistic unchoking when possible
 - Tit-4-tat unchanged



Evaluation Methodology

- ▶ Simulation study based on ProtoPeer framework
- ▶ Simulated scenario
 - Single swarm, shared file of size 154 MB
 - Access bandwidth of peers: 1 Mbit/s up-, 16 Mbit/s downstream
- ▶ Steady-state analysis
 - Arrival- and departure process of peers
 - Warm-up phase discarded (1.5 h of 6.5 h simulation time)
- ▶ Swarm size: around 120 to 200 peers concurrently online, approx. 2300 peers/simulation
- ▶ Measurements
 - Sum of inter-/intra-domain traffic
 - Download times of the peers



Network topology with 20 autonomous systems (ASes)

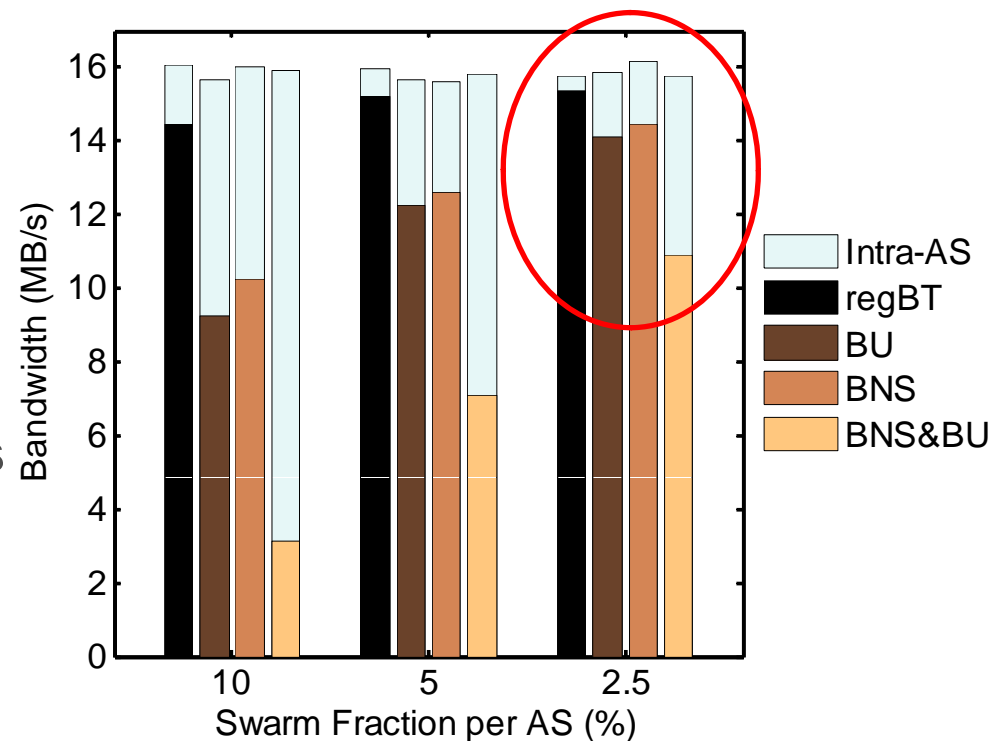
Impact of Swarm Distribution

- ▶ Experiment: varying number of ASes: 10, 20, 40
⇒ fraction of the swarm per AS: 10%, 5%, and 2.5%

- ▶ Observations

- Fewest inter-AS traffic with BNS&BU
- Inter-AS traffic increases with number of ASes
- BNS&BU still effective when only **very few peers** are in one AS

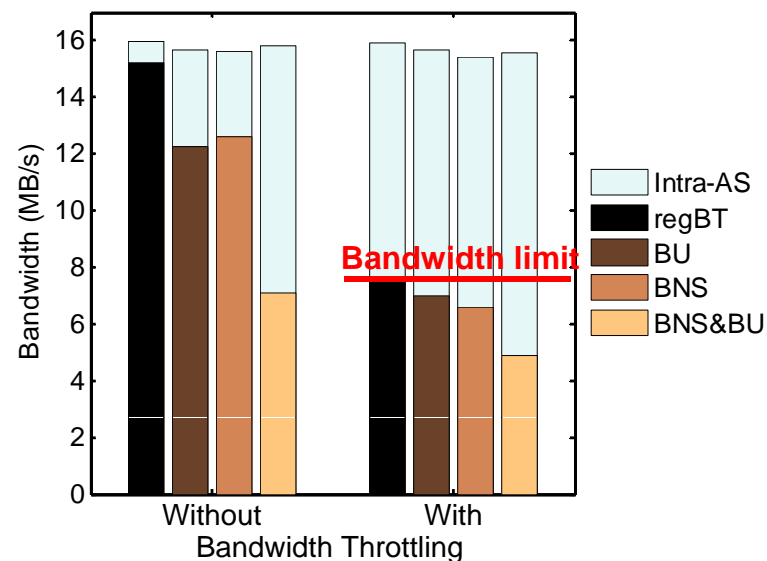
- ▶ No impact on download times (unlimited bandwidth of inter-AS links)



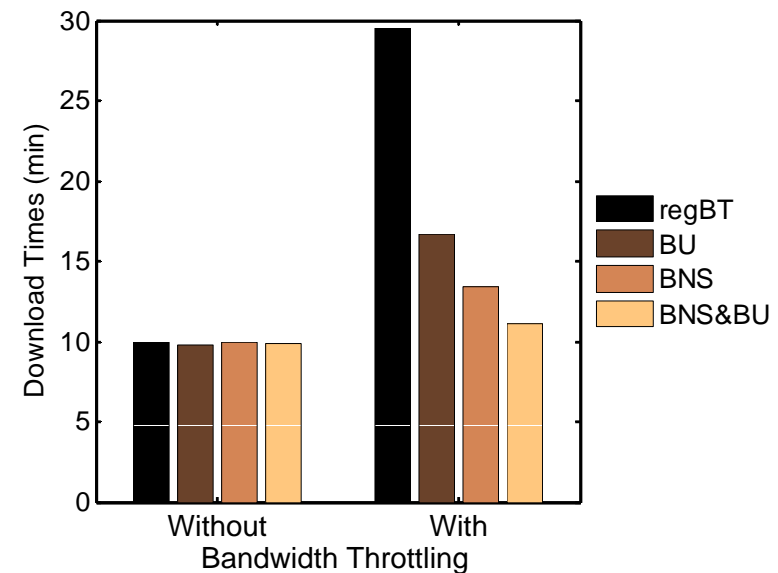
Inter-AS traffic for different number of ASes

Impact of Bandwidth Throttling

- ▶ Experiment: unlimited vs. limited bandwidth of all inter-AS links
- ▶ Observations
 - Bandwidth throttling reduces inter-AS traffic
 - Bandwidth throttling increases download times
 - BNS and BU can reduce the download times (fewer connections use inter-AS links)



Inter-AS traffic with and w/o bandwidth throttling



Download times with and w/o bandwidth throttling

Summary

- ▶ Topology-aware algorithms for BitTorrent
 - Biased neighbor selection (from literature)
 - Biased unchoking (our proposal)
- ▶ Biased unchoking especially effective for swarms
 - Spanning many autonomous systems
 - With a low number of seeders and flash-crowds (not shown)
- ▶ Biased unchoking and biased neighbor selection
 - Can reduce inter-AS traffic and download times
 - **Complement each other**, should be used in combination
- ▶ Further work
 - Heterogeneous scenarios
 - More sophisticated distinctions than local/remote peers