

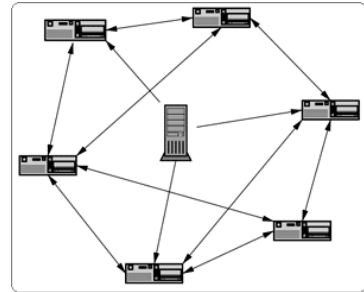
## SA/MA: BitTorrent for Really Selfish Peers

### Motivation and Informal Description

As pure peer-to-peer (p2p) systems are completely decentralized and resources are shared directly between participating peers, all p2p systems potentially suffer from free riders, i.e. peers that eagerly consume resources without reciprocating in any way. Not only do free riders diminish the quality of service for other peers, but they also threaten the existence of the entire system. For that reason, it is crucial for any system without centralized control to incorporate a rigorous incentive mechanism that renders freeloading evidently unattractive to selfish peers.

Unfortunately, many solutions so far either could easily be fooled or were unrealistically complex. Bram Cohen's BitTorrent protocol heralded a paradigm shift as it demonstrated that cooperation can be fostered among peers interested in the same file, and that concentrating on one file is often enough in practice. The fair sharing mechanism of BitTorrent is widely believed to strongly discourage freeloading behavior (cf [2]).

Contrary to such belief, Locher et al. showed in [3] that BitTorrent in fact does not provide sufficient incentives to rule out free riding. The large degree of cooperation observed in BitTorrent swarms is mainly due to the widespread use of obedient clients which willingly serve all requests from other peers. We, the DCG group, have developed our own BitTorrent client BitThief [1] that never serves any content to other peers, but still achieves download rates as high as the official BitTorrent client.



Analyzing the incentives in p2p networks and designing cheating proof protocols is still subject to much research work. A main difficulty of such a protocol is to overcome the *bootstrap problem*: If a new peer enters a swarm, it needs to get at least some data in order to trade with other peers. The BitTorrent protocol solves the bootstrap problem with an optimistic unchoking mechanism, i.e., peers give free data to random peers from time to time. However, this can be exploited!

### Offered thesis

As part of our long-term goal of designing an efficient and cheating-proof p2p-system, your thesis should explore the possibilities to overcome the bootstrap problem. One solution might be a tit-for-tat trading mechanism beyond the borders of one file. Another might be the introduction of virtual money.

Ideally, you would study the existing systems, come up with some improvements and finally implement them in the existing BitThief client.

You should have some basic programming skills, interest in peer-to-peer computing and Game Theory.

Good results are likely to become part of a publication (paper).

### Contact us for more details!

- Raphael Eidenbenz: [eidenbenz@tik.ee.ethz.ch](mailto:eidenbenz@tik.ee.ethz.ch), ETZ G61.1, phone 044 632 70 28
- Roger Wattenhofer: [wattenhofer@tik.ee.ethz.ch](mailto:wattenhofer@tik.ee.ethz.ch), ETZ G63, phone 044 632 63 12

## References

- [1] <http://dcg.ethz.ch/projects/bitthief/>.
- [2] B. Cohen. Incentives Build Robustness in BitTorrent, 2003. <http://www.bittorrent.org/bittorrentecon.pdf>.
- [3] T. Locher, P. Moor, S. Schmid, and R. Wattenhofer. Free Riding in BitTorrent is Cheap. In *5th Workshop on Hot Topics in Networks (HotNets)*, Irvine, California, USA, November 2006.