

## Peer-to-peer networks – (due till May 13, 2009)

### Exercise 9.1: Bit torrent

a) Bit torrent distinguishes between three download strategies.

- Rarest first
- Random choice
- End game mode

What are the advantages of these strategies as compared to downloading data-chunks consecutively? What are the disadvantages?

Solution:

Downloading data-chunks consecutively means that every participant starts with the low numbers. In particular, if downloads are interrupted, then the first chunks are requested more often as compared to the last ones which can create bottlenecks. In addition, every peer will also offer the chunks obtained so far. Downloading sequentially would mean that the first chunks are offered a long time, the last ones would appear only shortly in the network.

This is mitigated by asking for random chunks. Even if many peers interrupt their transmission, the load is still more balanced. However, rare chunks can still emerge coincidentally. Then, downloading (and offering) those rare chunks spreads the demand more evenly. But care has to be taken not to start going for the rare pieces, too early. This could result in a run on the few rare parts which might overload the peers that offer them.

The advantage of the end-game mode, as compared to traditional consecutive downloading is, that a missing piece can not be delayed by a slow sender. Keep in mind that while requesting for chunks, a client will almost always „collect“ a few peers which deliver slowly. So the last missing parts should be delivered by several peers at a time. The chance that none of them delivers is low.

## Peer-to-peer networks – (due till May 14, 2008)

### Exercise 9.1: Bit torrent

b) Finishing a download can sometimes be delayed by the completion of the last chunk. Suggest a better algorithm than bit torrent's „end game mode“.

Solution:

- Peers could generate a data fountain. A client would only have to obtain the seed of the random number source alongside with a packet. The advantage of the fountain would be that all packets are pairwise different with a high probability. As a consequence, there are no problems with rare packets. An additional packet will almost always contribute, no matter which source generates it.
- All chunks could be XORed. The resulting chunk can be used to fill any gap of a single chunk.
- The Reed-Solomon code could be used as described in the tutorial.