

CSCI 251: Concepts of Parallel and Distributed Systems

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Peer to Peer Architectures

File distribution: client-server versus P2P. For the following models, μ_s is the server upload rate, N is the number of clients, F is the file size, d_{min} is the minimum client download rate, and μ_i is the upload rate of the i 'th client.

Client-Server Architecture

- Server transmission: the server must sequentially send (upload) N file copies. Time to send one copy: $\frac{F}{\mu_s}$. Time to send N copies: $\frac{NF}{\mu_s}$
- Client: each client must download the file copy. If the minimum client download rate is d_{min} , then the minimum client download time is $\frac{F}{d_{min}}$.

The total time to distribute is lower bounded by the maximum of $\frac{NF}{\mu_s}$ and $\frac{F}{d_{min}}$.

Peer to peer architecture

- Server transmission: the server must upload at least one copy. This requires $\frac{F}{\mu_s}$ time.
- Client: each client must download a file copy, taking a minimum of $\frac{F}{d_{min}}$. As an aggregate, they must download NF bits with the max upload rate being $\mu_s + \sum \mu_i$.

The total time to distribute is lower bounded by the maximum of $\frac{F}{\mu_s}$, $\frac{F}{d_{min}}$, and $\frac{NF}{\mu_s + \sum \mu_i}$. Compared to the client-server model, whose total time increases linearly with the number of clients, the total distribution time for peer to peer architectures increases logarithmically.

BitTorrent

In BitTorrent's file distribution system, the file is divided into 256 kilobyte chunks. Peers in torrents send and receive file chunks. A **tracker** tracks peers participating in the **torrent**, the group of peers exchanging chunks of a file. A peer joining the torrent starts with no chunks, but will accumulate them over time from other peers. It first registers with the tracker to get a list of peers and connects to a subset of peers. While downloading, the peer uploads chunks to other peers. The peer may change peers with whom it exchanges chunks, and once it has the entire file, it may leave or remain in the torrent to help propagate chunks.

Reminders

Project 2 is due Friday, December 8th.

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