BitTorrent Optimization Techniques

(from various online sources)

Announcement

- No recitation next week!
- Final review session
  - Next Sunday (5/2) 5-7pm, GHC 4215
  - Let us know what you want at http://www.doodle.com/6qvsnubhmam2zkxp
  - More specifics will be announced on the course webpage.

Announcement (2)

- TA Evaluations!
  - Your comments / feedbacks are welcomed
    - Any reasonable criticism
    - Anything you liked or didn't like
    - Anything you would like to do / see
  - Helps us improve the recitations and our teaching style!

Evaluation links

- 441 A Kaushik Lakshminarayanan
  http://www.surveymonkey.com/s/3WJKHTM

- 441 B Rui Meireles
  http://www.surveymonkey.com/s/3WQSLXV

- 441 C Daegun Won
  http://www.surveymonkey.com/s/3WSD2VW

Before we start

- Everything we discuss here is about BitTorrent
- Not everything might be useful for the project
  - We'd like to make it your work to figure it out
  - It wouldn't be hard ☺

Two Important Aspects

- Peer selection
  - How to choose other peers to exchange data with
- Chunk selection
  - How to choose / prioritize chunks to download

Peer selection

- Employs a ‘Tit-for-Tat’ strategy
  1. Unless provoked, the agent will always cooperate
  2. If provoked, the agent will retaliate
  3. The agent is quick to forgive
  4. The agent must have a good chance of competing against the opponent more than once.
- Called choking algorithm

Good choking algorithm

- Caps the number of simultaneous uploads
- Avoids choking/ unchoking too quickly
- Reciprocate to peers who
  - let the peer download
  - try to use unused peers once in a while (get out of local maxima)

More specificially...

- Peer A chokes Peer B if it decides not to upload to B
  - Choking = temporary refusal to upload
- Each peer (A) unchokes at most 4 peers that have chunks that A doesn't have
  - 3 peers with fastest upload rate (to A)
  - 1 randomly chosen peers
    - Called 'Optimistic Unchoking'

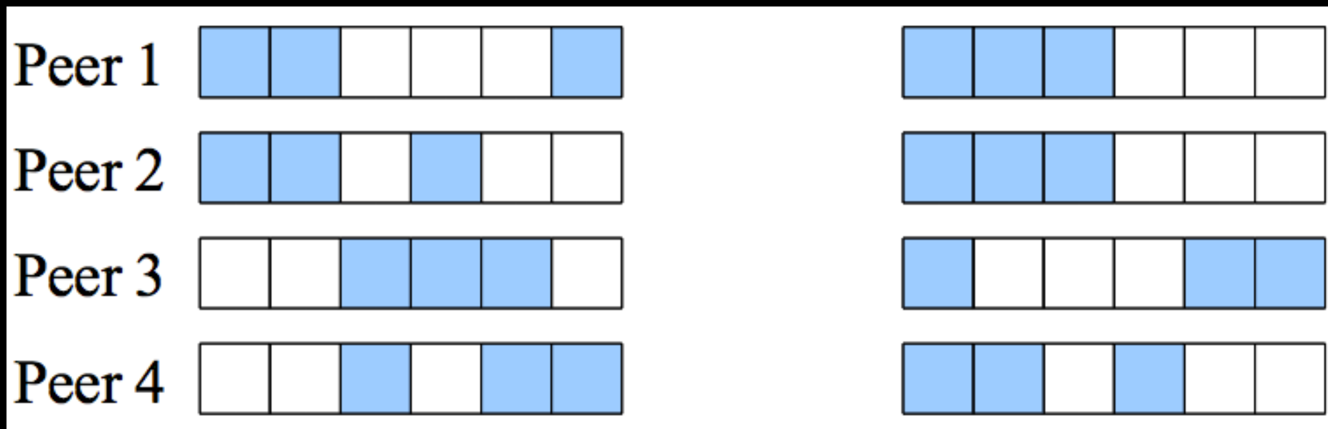
Optimistic Unchoking

- Finds potentially faster peers
- Allow new peers to receive their first piece
- Helps out ‘snubbed’ users
  - Snubbed users = Choked by all its peers

Chunk Selection Strategies

- Random First Piece
- Rarest First
- Endgame Mode

Chunk Overlaps



- Small overlap
  - Every pair can exchange something
  - Better utilization of bandwidth
- Big overlap
  - Only a few peers are very 'valuable'
  - Less utilization of bandwidth

What do we want?

- Ultimately, we want to maximize the total transfer rate of all simultaneous transfers
- It would be nice if every pair has something to exchange
  - So that we can utilize most of the possible end-to-end connections

What does it have to do with chunk selection?

- If something is …
  - Too popular
    - So much supply but not many looking for it
  - Too rare
    - So much demand but not many having it

- Then it is much less likely to utilize all end-to-end connections

Maximizing Bandwidth Utilization

- Keep all chunks as evenly popular as possible
  - So that we can maximize the number of simultaneous transfers

Prioritizing algorithm should
aim towards
uniform distribution!

Chunk Selection Strategies

- Random First Piece
- **Rarest First**
- Endgame Mode

Random First Piece

- Initially, the peer has nothing
  - Important to have some pieces to reciprocate for the choke algorithm.
- Need something ASAP
  - Randomly chosen chunks are likely to be more replicated
    - Can download them faster
  - Then the peer can upload something
- First four piece, then switch to Rarest First

Rarest First

- Look at all chunks at all peers
- Request the ‘rarest’ piece
  - Owned by fewest peers

- Yes, aim towards UNIFORM DISTRIBUTION!

- What if the original seeder leaves before no one downloads the whole file?
  - Oh no!

Rarest First

- What if the original seeder leaves before no one downloads the whole file?
  – This policy increases the likelihood that everything is still available!

Endgame Mode

- Happens near the end
  - Request the missing blocks to everyone.
  - Cancel pending requests when the chunk is downloaded
- A bit wasteful, but…
  - Speeds up the completion
  - Not too much waste in practice
  - Prevents slow completion due to a single peer with slow transfer rate

Anything else you can do?

There are more things you can improve…

Other things you can do

- You can easily improve your congestion-avoidance algorithm
  - Check out other algorithms such as TCP new-Reno(highly recommended)
- The network topology might be not totally random
  - May have a number of clusters and so on…
- And of course, look up for more on the web!

Sources

- http://www.rasterbar.com/products/libtorrent/bittorrent.pdf
- http://www.ict.kth.se/courses/ID2210/lectures/Lecture08-BitTorrent.pdf
  - If the above doesn't work, try http://docs.google.com/viewer?a=v&q=cache:tW513GkEkXkJ:www.ict.kth.se/courses/ID2210/lectures/Lecture08-BitTorrent.pdf+bittorrent+lecture+pdf&hl=en&gl=us&pid=bl&srcid=ADGEESgjwWMdTDIEQMWa6wRklCax3kOIhy4GKlRk-rIhFlhViP6x5dGyDsIkSlsQDkv6lquNlMycLDED-VlsocwV1i9k1AGftgzXIOgYbp7IozD2xTcR3WtLlN7Ha9j3o67o7Y5TL_RF&sig=AHIEtbSh2BXqAKN8ck4kEj-p6yg-J_DcTA
- http://www.cs.cornell.edu/Courses/cs514/2008sp/bittorrent.pdf
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