GoalBit Contributions to PPSP:

Improvements to the Peer Protocol.

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Outline

1 Introduction

GoalBit Project

Project goals

- Open Source P2P live video streaming solution (the first one, released under the GNU General Public License).
- Open protocol reference implementation.

Project achievements

- More than 75.000 downloads.
- SourceForge project rank: $150 \sim 300$.
- 20 research papers published.
- 22 developers and researchers involved (PhDs, Master thesis, degree thesis...).
- Investigation partially supported by INRIA, ANTEL and UdelaR.

GoalBit Protocol

Goalbit Transport Protocol (GBTP)

- GBTP uses a BitTorrent-like approach.
- Peers↔Tracker communication over HTTP/HTTPS.
- Peer↔Peer communication over TCP.
- When using Kademlia (trackerless mode) peers communicate each other over UDP.
- GBTP applies UPnP to establish the port forwarding (NAT traversal issues).
- It presents a low overhead in the content transmition (between 0.30% and 1.10 %).

Full GBTP Specification:

http://sourceforge.net/apps/mediawiki/goalbit/index.php?title=
Goalbit_architecture

2. Our comments about the Peer Protocol (v00)

Outline

Pieces Related Definitions

Should not be included in the protocol more details about the pieces, and how peers store them?

- This is a fundamental concept in the protocol.
- For example, these questions should have a answer:
    - How do we identify a piece?
    - How do we map the pieces to the buffer map?
    - Do the pieces have a fixed size? or could they have a variable one?

In GoalBit Transport Protocol:

- The pieces have fixed size, and its numbering is cyclic in the [0, MAX_PIECE_ID] interval.
- Each peer has a sliding window (over previous interval of possible ID values) associated with it.
- The sliding window has a minimum value (called the base) and a length (which defines the maximum window value).
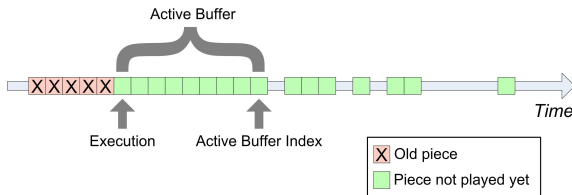
Startup Process

When a new peer enters the network, how does he know where (at what ChunkID) he should start asking for pieces?

- This should be defined in the Peer and/or Tracker protocol.

In GoalBit Transport Protocol:

- 2 important concepts defined in the protocol are:
    - **Active buffer**: defined as the consecutive sequence of pieces that a peer has, starting at the execution index.
    - **Active Buffer Index (ABI)**: defined as the largest piece ID inside the active buffer.

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Startup Process (2)

In GoalBit Transport Protocol:

- The peers report periodically theirs ABIs to the tracker.
- When a new peer enters to the network, he contacts the tracker who:
  1. Registers the peer in the swarm.
  2. Returns a peerlist.
  3. Returns a ABI (based on the maximum ABI on the swarm), where the peer should start asking for new pieces.
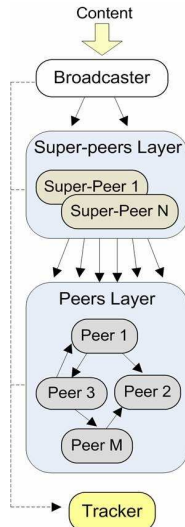
Different Peer Types in the Network

Should not be considered by the protocol the existence of different kinds of peers in the network?

- It is not the same the peer who is generating the live content than a peer who only consumes it.

In GoalBit Transport Protocol:

- The **broadcaster** gets the content and put it into the platform.
- The **super-peers** are peers with a good capacity (bandwidth), and their role is to help in the initial distribution of the content.
- The **peers** are the final users.
- (also the **broadcaster-super-peer** could be used, in order to avoid the need of super-peers in the network).

Content

Broadcaster

Super-peers Layer

Super-Peer 1
Super-Peer N

Peers Layer

Peer 1

Peer 3   Peer 2

Peer M

Tracker

Strategies Applied in the Protocol

Should not be recommended some guide about the different strategies applied in the protocol?

- Peer selection strategy: which peer will be allowed to make downloads.
- Piece selection strategy: which piece will be requested.
- It is known that these strategies have a direct effect on the Quality of Experience (in particular, in the initial buffering time and in the playback continuity).

In GoalBit Transport Protocol:

- The piece selection follows a hybrid method approach between methods *rarest-first* (BitTorrent) and *greedy*.
- The peer selection used is *tit-for-tat* with *optimistic-unchoking* (also used in BitTorrent).

Content Packaging

What about how the content should be encapsulated into the pieces? should this be part of the Peer Protocol? should it be a separated specification?

- This is not as simple as putting bytes inside the pieces (how a player syncs the streaming?, what happens when a chunk is lost?, can all muxers be treated in this way?).

- This is clearly a problem related to the P2P streaming distribution.

- Is there any relationship between how the content is packaged and its transportation?

  - Imagine inside the pieces there is its digest, and they are singed by the broadcaster. When a peer download a piece, checking its content, he can determine if the piece is corrupted or if it is a fake piece (discarding and requesting it again).

  - Is it possible (or better) to do this without knowing what is inside the content?

Content Packaging (2)

In GoalBit Transport Protocol:

- We define the *GoalBit Packetized Streaming (GBPS)*.
- GBPS supports multiple media formats (i.e. it does not impose any restriction about the codecs and muxers to be encapsulated).
- In our implementation (GoalBit Player) GBTP uses GBPS.
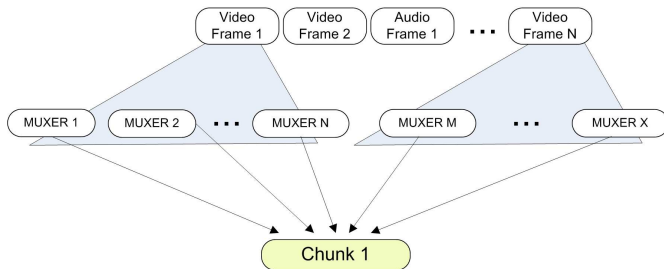
Quality of Experience

Should not be supported by the protocol a way to measure and report the QoE? (perhaps as an optional feature)

- It is always important to have a vision of the video quality being perceived by final users.
- This could be part of the Peer Protocol and/or the Tracker Protocol, letting open the technology used to measure it (not specifying how to measure the QoE).

In GoalBit Transport Protocol:

- Each peer is capable of measuring its own QoE and reporting it to the Tracker.
- In order to measure the QoE, it is used the PSQA technology.

Content Transport Protocol

Why not to use the same Peer Protocol in order to transfer the content between peers?

- If not, NAT Traversal issues should be also resolved for the Content Transport Protocol (and depending on which protocol is used, it could be necessary to execute this process more than once).

In GoalBit Transport Protocol:

- There is an specific message included in the Peer Protocol, used to send the content between peers (the same as in BitTorrent).

Thanks for your attention.