Towards Low-Redundancy Push-Pull P2P Live Streaming

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ABSTRACT

P2P live streaming systems are constructed in two major approaches: tree-push versus mesh-pull. The hybrid push-pull streaming, as an emerging and promising approach, shows advantages against tree-push and mesh-pull approaches. In our study, we find that the total traffic overhead (including signaling overhead and video redundancy overhead) is a significant problem in current push-pull systems. Video redundancy is a large contributor of the total traffic overhead. To reduce traffic overhead and further improve system performance, we propose a new hybrid design with two simple but effective mechanisms and implement them in a push-pull streaming system called Low-redundancy Streaming (LStreaming). We have shown that LStreaming dramatically reduces the total traffic overhead, i.e., up to 33% and 37% reduction compared with mesh-pull and GridMedia respectively, and achieves streaming rates closer to the optimal value. In this demo, we show that LStreaming can achieve short startup delay, low overhead (especially low video redundancy), almost optimal streaming rate and short playback lag among all peers in a prototype network.

Categories and Subject Descriptors:
H.4.3[Communications Applications]

General Terms: Design, Performance

Keywords: P2P, push-pull, tree-push, mesh-pull

1. OVERVIEW

Peer-to-peer (P2P) streaming architectures have advanced in two major approaches: tree-push versus mesh-pull. The major advantages of mesh-pull systems include the simple design principle and inherent robustness. However, these mesh-pull systems often suffer from high overhead, long startup delay. Unlike mesh-pull systems, tree-push systems achieve high throughput and low overhead only when the tree structure does not break down due to peer churn and peers at the higher level of the tree have sufficient upload capacities to support the streaming for their children peers.

Recently, researchers are exploring a new type of hybrid push-pull streaming architecture, which appears to be promising to offer a good tradeoff among throughput, scheduling overhead and delay performance. In [1], we study this push-pull streaming architecture in detail and find that high video redundancy is a significant problem in the current hybrid design. For example, the total traffic overhead of GridMedia [2] may reach as high as 10% of the effective video traffic. Due to the large video traffic volume, we believe that 10% overhead is quite significant and there is room for reducing this overhead. The total traffic overhead consists of the signaling overhead and redundant video traffic. Among the total traffic overhead, we find that the redundant video traffic constitutes the major portion.

In order to reduce the total overhead, especially the video redundancy, and to achieve an optimal throughput at the same time, we design a new hybrid push-pull live streaming system with two simple but effective mechanisms (i.e. sub-stream scheduling and re-scheduling) and implement them in a prototype called Low-redundancy Streaming (LStreaming). The optimal throughput refers to the effective download rate, which excludes redundant video and signaling overhead, equal to the playback rate. Our goals in this demo can be summarized as follows:

- LStreaming can almost achieve the optimal throughput, which leads to a smooth video playback. LStreaming can maintain a low traffic overhead (i.e. 4.5% total overhead out of the effective video traffic) and an attractive short startup delay (i.e. 7s).
- The server collects system statistics, including startup delay, throughput, overhead and playback lags, from all peers in the system and display them visually.
- The upload rate from one peer to another can be controlled at the application level. Triggered by the rate-limit operations, we demonstrate how the migration occurs between mesh-pull and tree-push in this hybrid system. We show how the proposed mechanisms conduct sub-stream scheduling during the tree-push mode.

2. ACKNOWLEDGEMENT

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3. REFERENCES

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