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LiveShift
Current Progress and Challenges

Fabio Victora Hecht

Department of Informatics IFI, Communication Systems Group CSG, University of Zürich

Motivation and Objectives

Progress Report

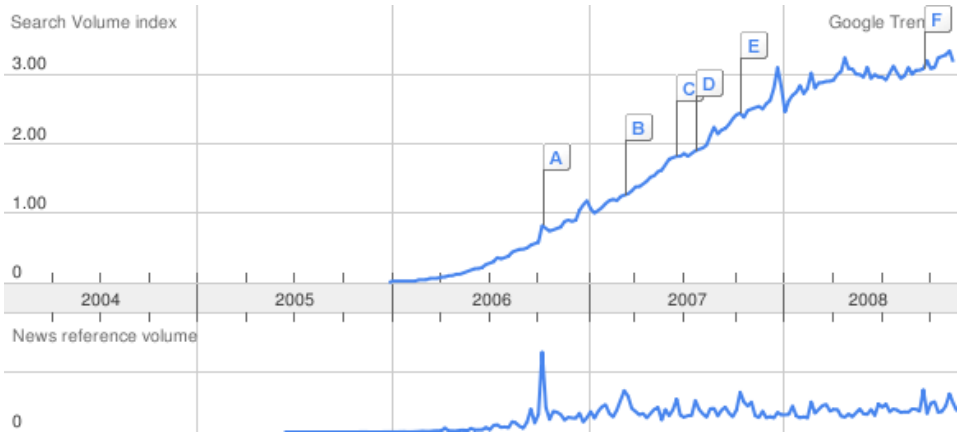
Current and Future Work

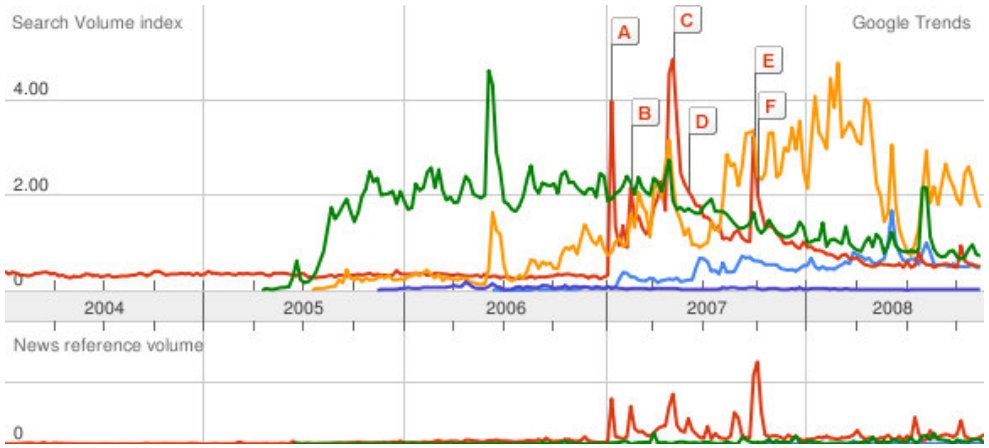
Motivation

- Increasing **IP** connectivity
- Success of video sharing websites and applications
- High **traffic** demands, flash crowd effect
  - Infrastructure + network administration
- Drawbacks of current solutions
  - Market highly concentrated
  - Proprietary solutions
  - Censorship
  - On-demand/live segmentation
  - Low quality
  - High delay on live (SopCast can be more than 1 minute)

Motivation

Google Search Volume





YouTube

joost

SopCast

Zattoo

PPLive

Source: Google Trends

Proposed Solution

- **Peer-to-peer** streaming
  - **Scalable**, copes with flash crowds
  - Able to circumvent **censorship**
  - Low **cost** to distribute (cost is shared among peers)
- **Open** source, based on open standards
  - Community-based
  - No central control
  - **Robust**
- Goals
  - Maximize Quality of **Experience** for user
    - Delay, video quality, scalability
  - Minimize **Cost** for ISP, content provider
    - Overhead introduced by P2P

LiveShift

- Peer-to-peer video streaming application
- Combines **Live** streaming and **Video-on-Demand**
- Demo presented in P2P'08 in Aachen
  - Idea and base functionality implemented and presented
  - **Feedback** from participants taken into consideration
  - Work continued
- Recent changes
  - **Mesh-pull** distribution (was multiple-tree-pull)
  - Notion of larger segments composed of small blocks

LiveShift – Mesh

- LiveShift distributes video blocks via a mesh-pull approach
  - Video is divided in small blocks
  - Peers exchange blocks with no defined structure (e.g. tree)
    - Normally with a limited number of peers (neighbors)
  - Peers pull (request) each block

LiveShift – Mesh

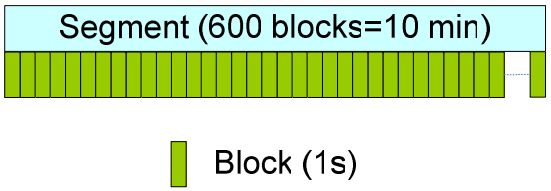
- When compared to tree approaches
- Advantages
  - Flexible fanin and fanout
  - Easy to use all available **bandwidth**
  - Copes better with **churn**
    - Impact of peer leaving is lower
    - No structure maintenance to perform
- Disadvantages
  - Overhead: more control messages involved
    - One request per block
    - Normally involves exchanging of **bitmaps**

LiveShift – Block Size

- Tradeoff
- **Smaller** block
  - Less delay
  - More requests
    - To DHT/tracker to find peers that have a block
  - Larger address space
    - More lookups
    - Larger identifier length

LiveShift – Blocks & Segments

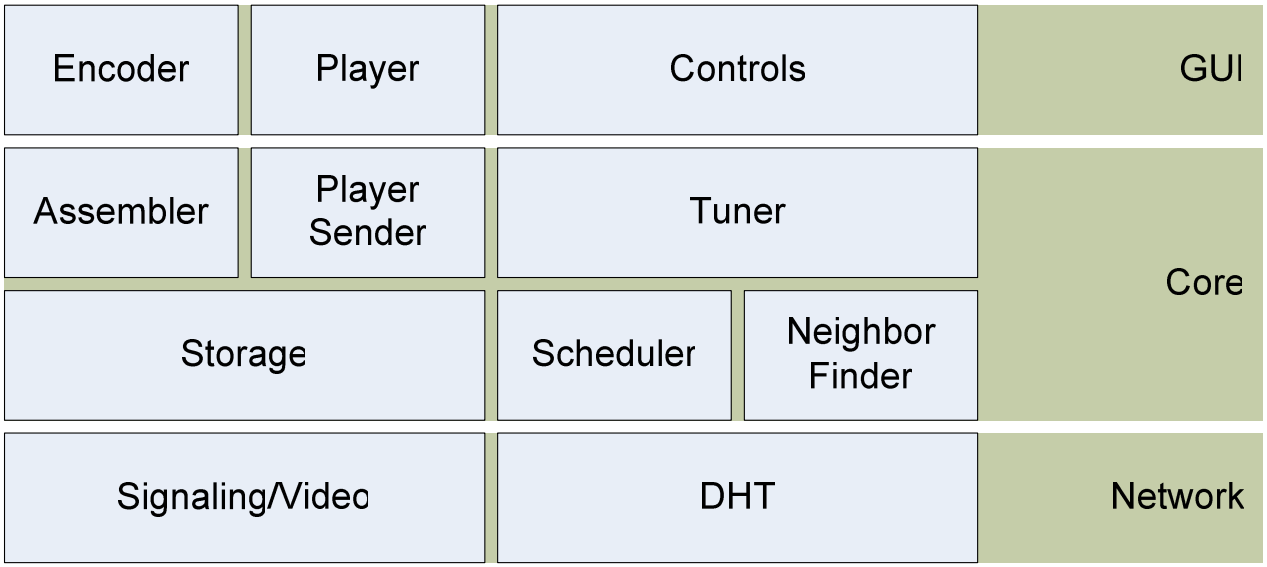
- The compromise
  - Larger **segments** composed of smaller **blocks**
  - Segments
    - Identified by **channel + start time**
    - **DHT** associates segments with peers that have at least a block
    - Peers exchange **bitmaps** of which blocks they have in a segment (neighborhood)
  - Blocks
    - Identified by **segment + block#**
    - Requested **directly** between peers
    - Reply may contain the **video** data
    - In LiveShift, **time-addressed**
      - Size in bytes may vary



LiveShift – Neighbor Finding

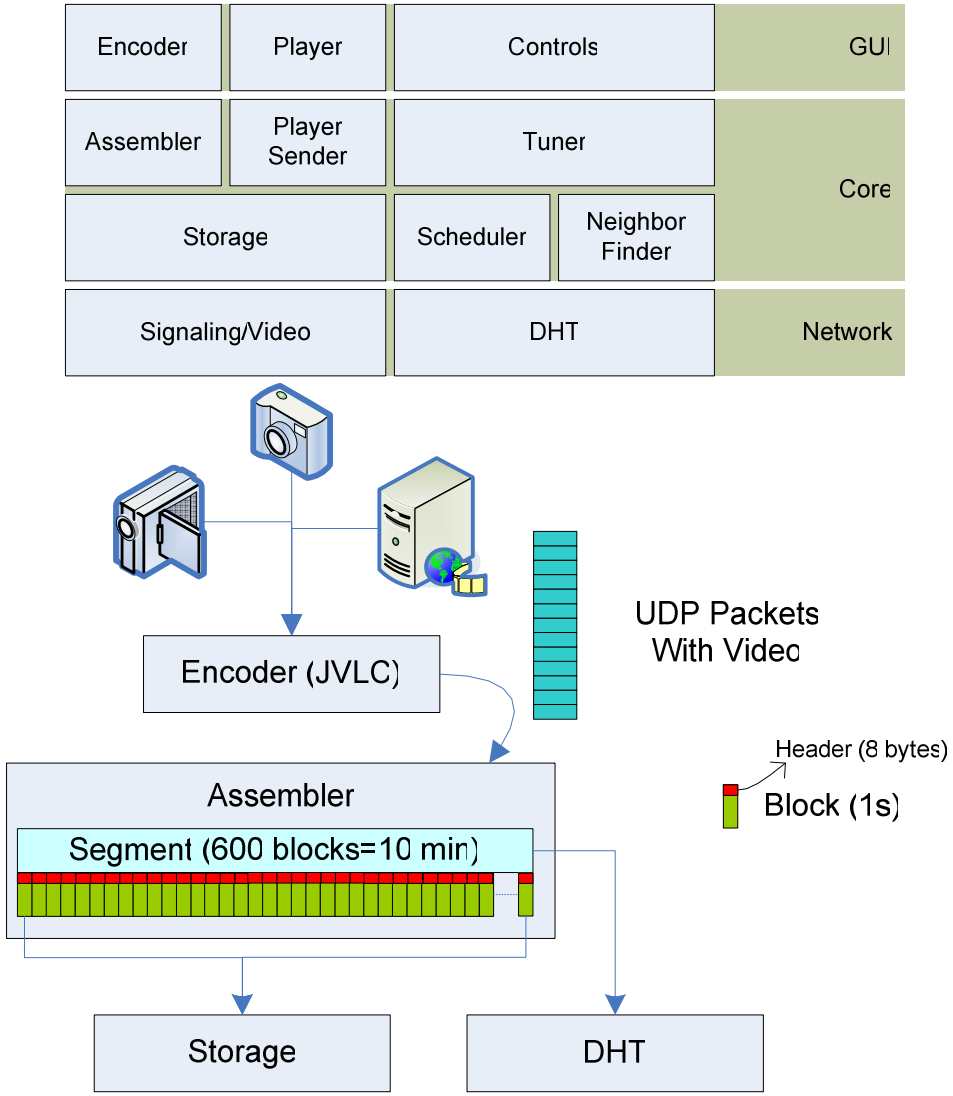
- **Current** mesh-pull implementations
  - Step 1: **find** possible neighbors (normally central tracker)
  - Step 2: start **exchanging** bitmaps (done periodically)
  - Step 3: request/receive blocks
- Result
  - High delay for live streaming
  - High startup time for VoD
  - Low **QoE**
- LiveShift approach
  - Step 1: find neighbors (DHT)
  - Step 2: request/receive blocks (bitmaps go **piggybacked**)
- Lower delay/startup time is foreseen

LiveShift Architecture



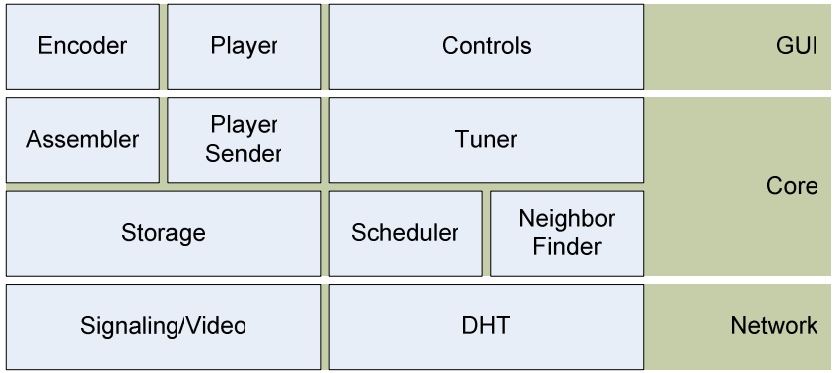
LiveShift – Publishing

- Encoder (JVLC)
  - Encodes video from any source using any codec
  - Outputs MPEG-TS in RTP
- Assembler
  - Receives video packets from Encoder
  - Distributes them into **blocks**
  - Distributes blocks into **segments**
  - Segments are announced on DHT
- Storage
  - Stores blocks and segments



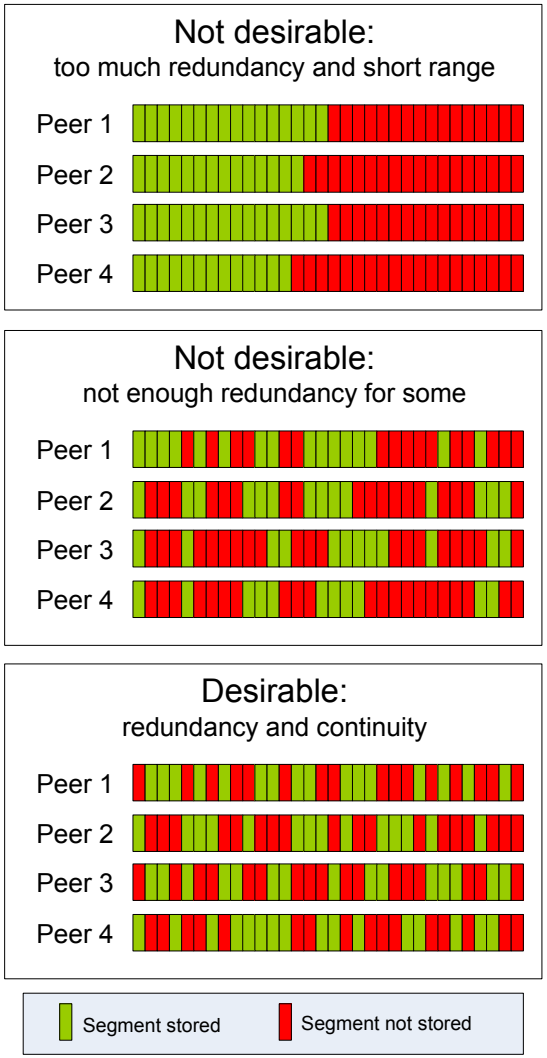
LiveShift – Watching

- Tuner
  - Coordinates other components
- Neighbor Finder
  - Periodically checks **DHT** for other peers
  - Decides which and how many **neighbors** to keep
- Scheduler
  - Decides which **blocks** to request
  - Decides which **neighbors** to request
  - Reply may come with video block
- Player Sender
  - Verifies which blocks have arrived
  - Sends video to Player
  - Decides what to do if blocks are **missing**



LiveShift – Distributed Storage

- Peers participate in a **P2P storage** of video segments
- Storage in each peer is **limited**
- Challenge
  - **Ideal distribution** of stored segments
  - Very low or no communication **overhead**
  - Related work not found yet on this specific situation



LiveShift – Distributed Storage

- Current strategy
  - First, **fill** up the allowed storage space with every segment received
  - When full, selectively **deletes** segments with a two-factor system: redundancy and time
  - **Redundancy**: probability P of keeping a segment

    P=(redundancy/swarmsize)
  - **Time**: If not keeping it by the above probability, gives priority to newer segments
- A global challenge in P2P long-time storage
  - In order to have availability of blocks, it needs availability of **peers**
  - Situation improves with good **reputation** mechanisms or deployment of **superpeers** (e.g. owned by ISP, content provider)

LiveShift Reputation

- PSH
  - By Bocek et al.
  - Expected to help spread blocks faster
    - Higher success ratio
  - Question: does it help to give a benefit to share what is not being watched?
    - Consistent ID needed to keep long-term reputation score
      - Outdated information?
      - Space requirements?
    - Interest match enough to produce encounters?

Near Future Work

- Optimization
  - **Policies** for
    - Selecting **neighbors**
      - Localization of traffic
    - Scheduling **blocks**
      - Requesting several blocks with one request
      - Push vs. pull approach
    - Storing **segments**
  - Improve scalability

Near Future Work

- Evaluation
  - Run on EMANICSLab
  - Study policies with two high-level objectives
    - Presented in introduction
  - ISP-assisted localization
- Paper showing LiveShift
  - Architecture
  - Parameter study
  - Evaluation
    - Compare to other implementations? How? Which?

Future Work

- Further improvements
  - PSH reputation mechanism

- Publish code as **open source** project
  - Only **2** projects found yesterday on Source Forge
    - One seems inactive – no releases or files – only one developer
    - One released last file in 2006 – also only one developer
  - Question on whether it is **too early**
  - Question on whether it will be **too late**
    - Pioneering is generally good
    - Easier to attract attention early

Preliminary Conclusions

- P2P Streaming is feasible
- Major challenges
- Vast opportunity for improvements
- Work is in early stage
- Software developed so far permits evaluation of different algorithms in a realistic environment

The End

Thank you!

hecht@ifi.uzh.ch

