



PEERIALISM

Streaming of Live and VoD

Mikael Höggqvist, Senior Research Engineer

Distribution of Live and VoD content

- Distribution of the stream happens using a **Content Delivery Network** (CDN)
- **HTTP-based** streaming protocols are used for transport
 - De-facto standard for all devices: PCs, tablets and phones
 - Stateless
 - Pull-based
 - Multiple qualities (bitrates)
 - Different embodiments
 - Apple HTTP Streaming (HLS)
 - Adobe HTTP Dynamic Streaming (HDS)
 - Microsoft's Smooth streaming (SS)

Level(3)
COMMUNICATIONS

HIGHWINDS™

Akamai

Limelight
NETWORKS

Jstream



Microsoft
Silverlight™



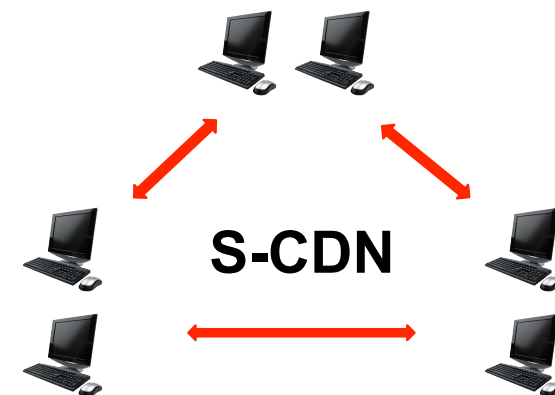
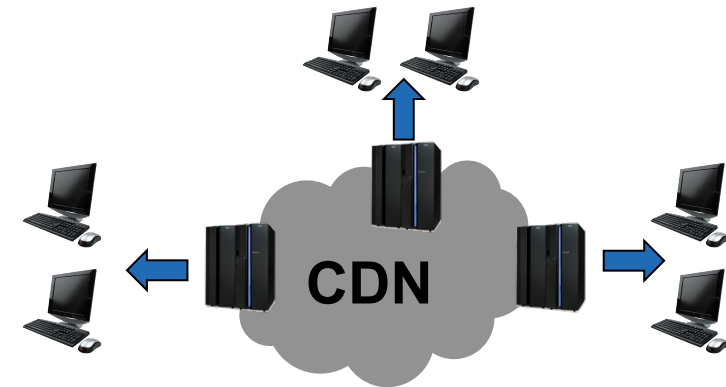
Hive Streaming

Hive streaming is a **software CDN**

- Much **more cost-effective** than a hardware CDN

Requirements:

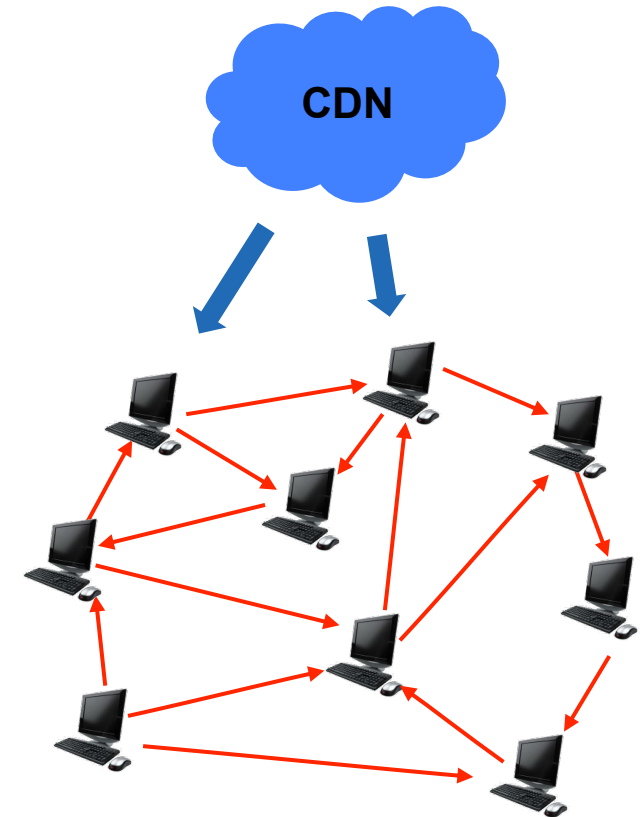
- **Vendor integration** with support for:
 - All streaming protocols: SmoothStreaming, HLS and HDS
 - All streaming servers implementations
 - All players
- Same **quality of user experience** (QoE) as a hardware CDN
 - Metrics: delay and delivered bitrate
- **Locality Awareness**
 - Traffic kept local to a network region



General Approach

Hive streaming acts as a **distributed cache**

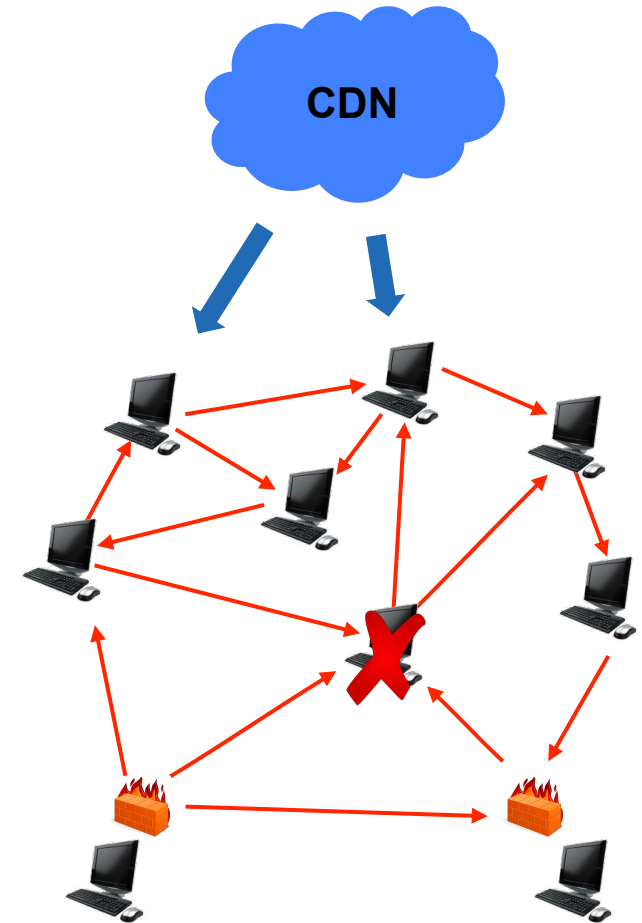
- HTTP Streaming:
 - Each Video/Audio chunk is packaged as a HTTP file
 - A chunk exists in multiple qualities (bitrates)
 - Choice of bitrate depends on available bandwidth, rendering capabilities and load on host
- **Hive agent**
 - Local HTTP proxy on each user machine
 - General HTTP streaming **cache node**
 - Cache hit: retrieve from other viewers
 - Cache miss: retrieve from source
 - **Efficiency** determined by:
 - Structure of the overlay network, i.e. set of node interconnections
 - How the data is exchanged between nodes



Hive Streaming

The **challenges** in building a distributed cache

- Coping with
 - Network Congestion
 - Limited bandwidth capacity
 - Churn
 - Connectivity constraints, e.g. Firewalls and NATs
- Quality of user Experience
 - Real-time nature of the service
 - Hard deadlines on the delivery of content
 - Quickly react to bitrate switches
 - Locality of content, depending on the type of deployment

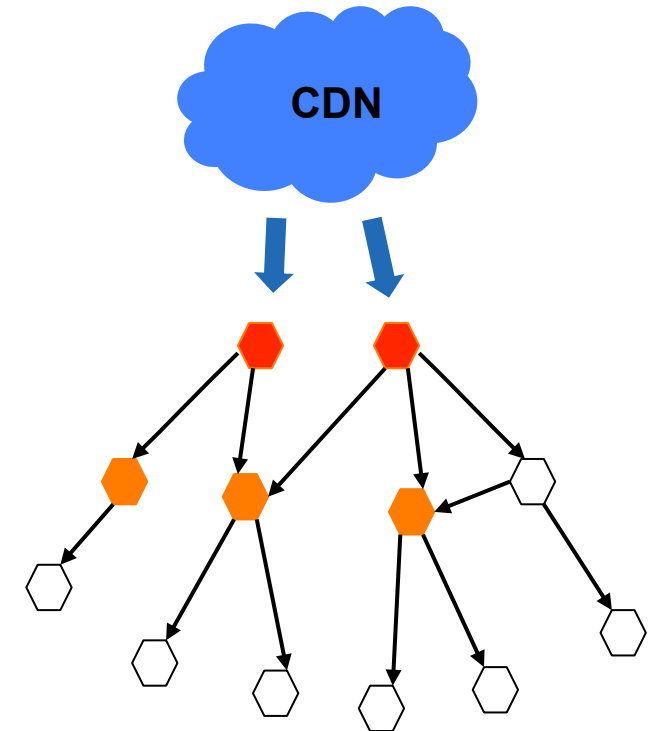


Wide Area Network Deployment (Internet)

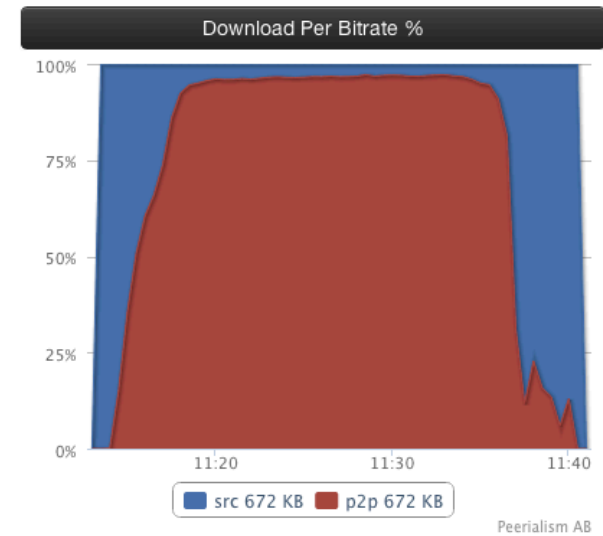
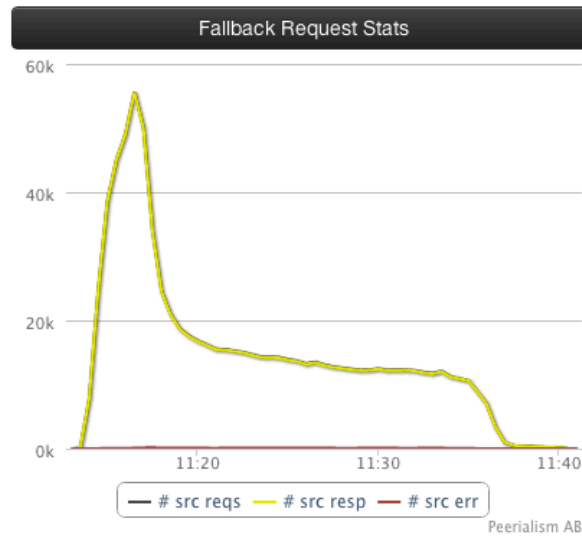
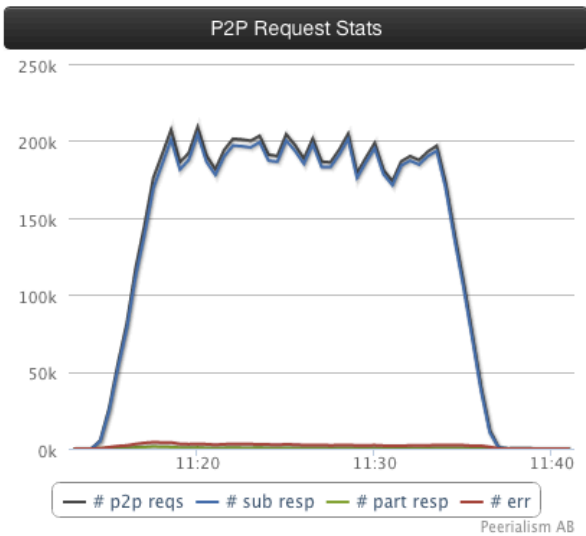
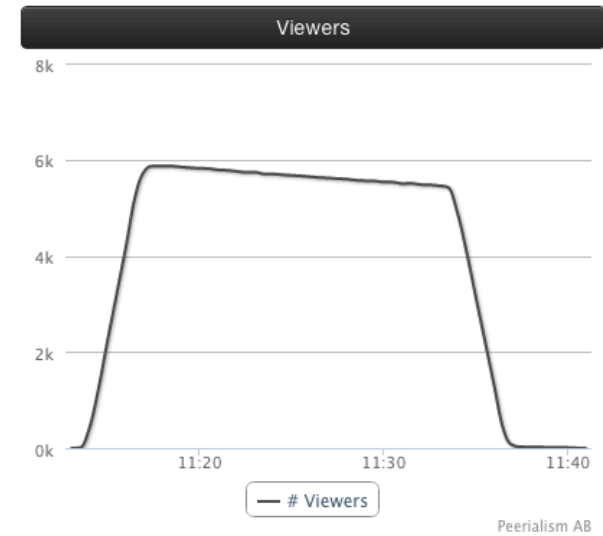
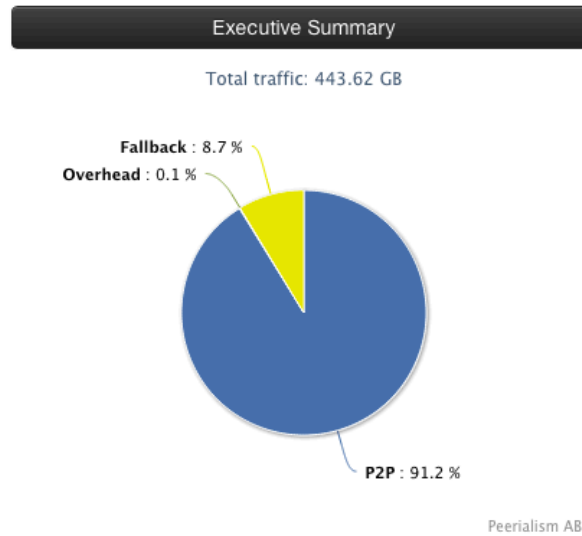
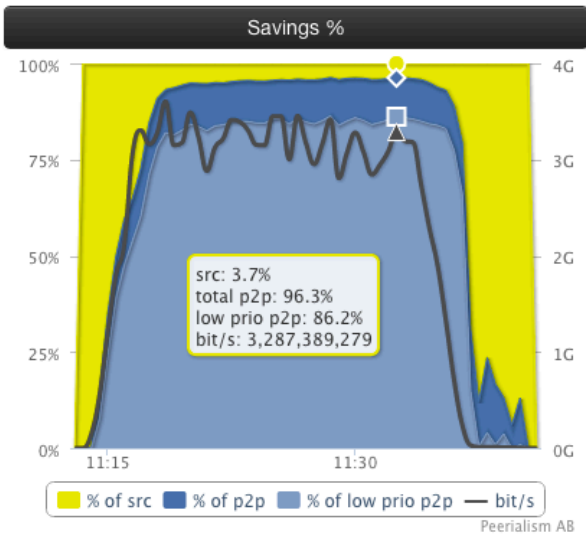
Hive strives to **minimize load on source** of the stream

We construct a mesh overlay network

- Completely **self-organizing** system
 - Each node runs the same algorithm with local knowledge
- **Emergent** behaviours
 - Nodes with higher capacity position themselves closer to the source of the stream
 - Nodes of the same Autonomous system (AS) cluster together



Results WAN



Test. Stream of 700Kbit/s, 6000 concurrent test

By the way...publications

Peer2View: a Peer-To-Peer HTTP-live streaming platform, Roverso et Al., P2P 2012, Sept, Tarragona (SP)

SmoothCache: HTTP-Live Streaming Goes Peer-To-Peer, Roverso et Al., IFIP Networking 2012, May, Prague (CZ)

DTL: Dynamic Transport Library for Peer-To-Peer Applications, Reale et Al., ICDCN 2012, January, Hong Kong (China)

NATCRACKER: NAT Combinations Matter, Roverso et Al., ICCCN 2009, July, San Francisco (CA)

Mesmerizer: an effective tool for a complete peer-to-peer software development life-cycle, Roverso et Al., Simutools 2011, Feb, Barcelona (SP)
