

CS 925

Lecture 17

Media Delivery

Thursday, March 28, 2024

Delivery Granularity

▶ Video

- sequence of frames vs sequence of segments
- quality (resolution / pixel resolution / frame rate)
- compression (intra-frame and inter-frame)

▶ Audio

- linear stream of data
- quality (resolution / sample rate / number of channels)
- constant vs variable rate compression

Media Formats

▶ Video

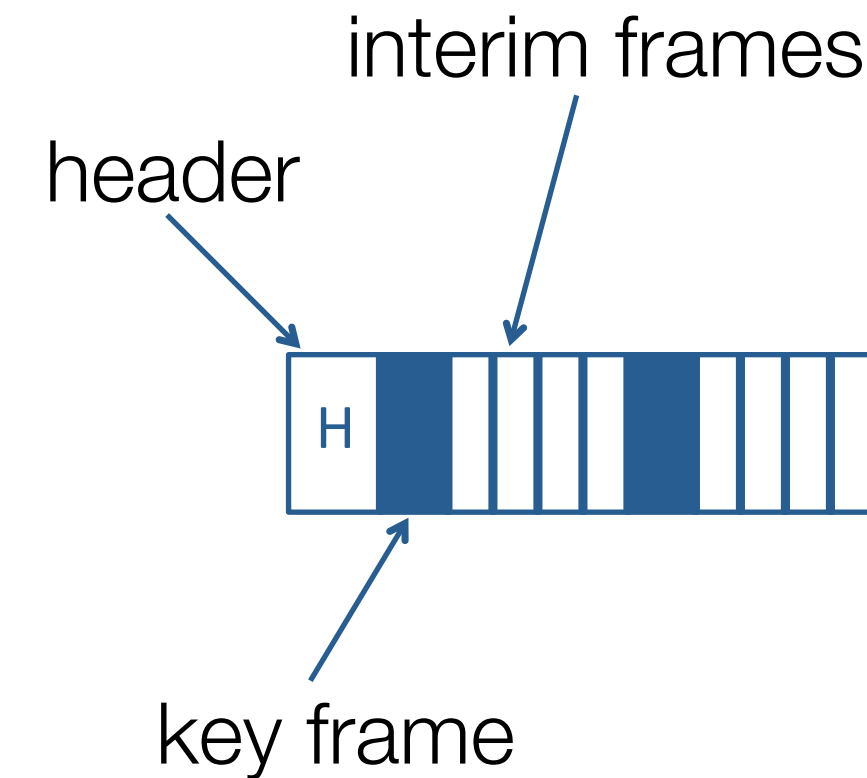
- compression within a frame
- compression between frames

▶ Audio

- compression

▶ “Containers”

- video, audio, closed caption / subtitles
- time synchronized



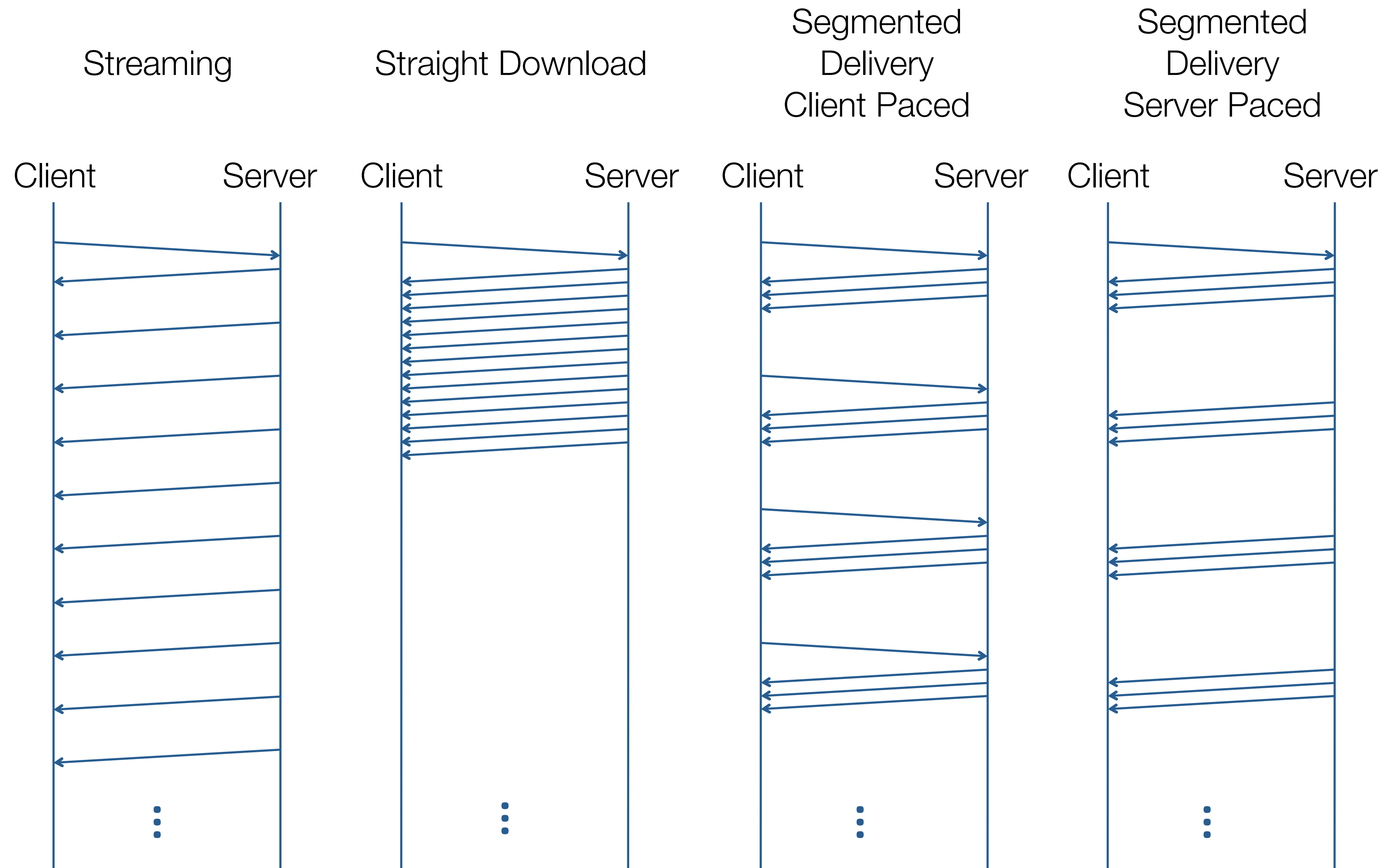
Video Quality Metrics

- ▶ **Playback Latency**: initial buffer fill time
- ▶ **Playback Artifacts**: missed deadlines
 - late/lost in-between frames
 - late/lost key frames
- ▶ **Playback Stoppages**: buffer under-runs
 - excessive unreliable transport loss/lateness
 - excessive reliable transport retransmission delay
- ▶ **Time Shift Latency**: difference from real-time

Video Delivery Pacing

- ▶ Streaming (RTSP/RTP)
 - unreliable (UDP) transport, server-side pacing
- ▶ Straight Download (HTTP)
 - reliable transport (TCP or QUIC/HTTP3), no pacing
- ▶ Segmented Delivery (HTTP Progressive Download)
 - reliable transport (TCP or QUIC/HTTP3), client-side pacing, using HTTP Range GETs or segment files
 - reliable transport (TCP or QUIC/HTTP3), server-side pacing

Video Delivery Pacing



RTP

- ▶ **Real-time Transport Protocol (RTP)**
 - data transfer protocol
- ▶ **RTP Control Protocol (RTCP)**
 - control protocol (QoS and synchronization)
 - **Messages**: Source Description (SDES), Sender/Receiver Report (SR/DR), Goodbye (BYE), Application-specific Message (APP)
 - hierarchical aggregation
- ▶ Typically run over **UDP** on unprivileged ports, one pair of flows per multimedia stream. Sessions initiated using signaling protocols (e.g., SIP, **RTSP**)

RTSP

- ▶ Real-Time Streaming Protocol
- ▶ Establishes and controls media **sessions**
 - Play, pause, fast forward,...
- ▶ Not responsible for streaming itself
- ▶ Typically runs over **TCP** (UDP is an option)
- ▶ Similar to HTTP...
- ▶ ... unlike HTTP, RTSP is a state-full protocol

RTSP/RTP/RTCP

