

Streaming Pipeline Cheat Sheet

Five jobs, the protocols across each hop, and the latency budgets

The pipeline, stage by stage

1. Capture	Camera or screen — raw pixels + audio	5-20 ms
2. Encode	Codec compresses (H.264 / H.265 / AV1)	50-500 ms
3. Package	Cut into segments + manifest (CMAF / fMP4)	200 ms - 4 s
4. CDN	Origin to shield to edge, cached close to viewer	5-80 ms
5. Player	Buffer, decode, draw (hls.js / Shaka / native)	0.5 - 30 s

Protocol families on each hop

Contribution (ingest)	RTMP, SRT, RIST, WHIP, Zixi — stages 1-3
Distribution (delivery)	HLS, LL-HLS, DASH, CMAF, WebRTC, WHEP, HESP, MoQ — stages 3-5
Adaptive bitrate (ABR)	Player picks rungs from a ladder — keeps quality stable

Typical glass-to-glass latency by stack

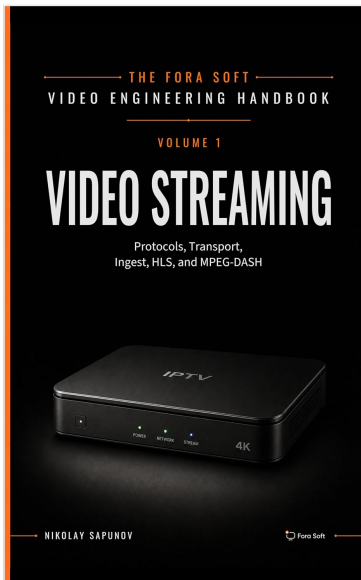
Traditional HLS / DASH	20-30 s
Low-Latency HLS (LL-HLS)	2-5 s
Low-Latency DASH (CMAF chunked)	2-5 s
HESP	0.4-1 s
WebRTC delivery	0.2-0.5 s
Media over QUIC (MoQ)	0.3-1 s

Where each stage usually fails first

- **Capture** — unplugged cable, dropped HDMI, mic gain too low
- **Encode** — encoder CPU saturates, bitrate target too high for content
- **Package** — segment duration mismatch, manifest cache TTL too long
- **CDN** — cache misses, hot-segment thundering herd, edge fill spikes
- **Player** — buffer underrun on bad Wi-Fi, ABR oscillation, codec unsupported

Rule of thumb: the player buffer dominates total latency.

Shrinking it is the biggest lever for low latency, and the fastest way to introduce stalls if you misjudge the network.



GO DEEPER · VOLUME 2 OF 7

Video Streaming: A Complete Guide to Video Delivery

From Network Protocols and Transport to Ingest, HLS, and MPEG-DASH

By Nikolay Sapunov, CEO at Fora Soft · 1,124 pages · Kindle & paperback on Amazon

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This sheet fits the five pipeline stages, the protocol families and typical latency per stack on one page. Volume 2 takes the first half of that pipeline apart: live, VOD and near-live trade-offs, the glass-to-glass budget, contribution over RTMP, SRT and RIST, and packaging into HLS, DASH and CMAF.

WHAT YOU WILL FIND INSIDE

- Live vs VOD vs near-live and what each costs in latency
- Contribution protocols: RTMP, SRT, RIST, WHIP
- Segmenting and manifests in HLS, DASH and CMAF
- Where the glass-to-glass budget goes, stage by stage

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Designing a streaming pipeline from camera to player?

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