Encoding Ladder Design Worksheet

Size your ladder before you ask an encoder for a quote: set the top rung from content and audience, choose how many rungs and how they're spaced, map them to your devices, pick codec and rate control, then run the one cost sanity check. Engineering guidance — confirm vendor numbers live, they change.

1 · PICK YOUR TOP RUNG (what your content and audience justify)

- ☐ **Match the top rung to the screen, not your ego.** 4K/2160p only if you serve big TVs, premium content, and fast networks. 1080p is the sensible top for most services; a news or talking-head channel rarely needs more.
- ☐ **Let content complexity set the ceiling.** A grainy action film needs a high top rung; a flat cartoon or slide deck looks identical at half the bitrate. The top rung is the most expensive to deliver — scrutinise it first.
- ☐ **Write your top rung:** resolution _____ , bitrate _____ kbps, codec _____ .

2 · CHOOSE RUNG COUNT & SPACING (5–9 rungs for most catalogs)

- ☐ **Count the rungs.** Too few = jarring quality jumps; too many = paying to store renditions nobody can tell apart. Five to nine covers most catalogs. Rungs: _____
- ☐ **Space them evenly.** Each rung should roughly double or halve its neighbour's bitrate, so ABR gets clean, well-separated choices and quality steps feel smooth.
- ☐ **Keep a real floor.** A 145–730 kbps bottom rung keeps viewers on weak mobile networks watching instead of buffering. Do not forget the bottom of the ladder.

3 · MAP RUNGS TO YOUR DEVICES (don't ship renditions nobody plays)

- ☐ **Phones** live on the low and middle rungs (234p–720p). A 4K rung sent to a phone is wasted twice — the screen can't show it and the device won't request it.
- ☐ **Tablets and laptops** use the middle and upper rungs (360p–1080p).
- ☐ **TVs and streaming sticks** use the upper rungs (540p–4K). Build the high rungs for the living room; thin the very lowest.
- ☐ **Audience test:** mobile-first market with modest data → invest in low/middle rungs, maybe skip 4K. Premium living-room → carry the high rungs.

4 · SET CODEC & RATE CONTROL (reach vs efficiency)

- ☐ **Codec.** H.264 for universal reach; HEVC or AV1 to cut 30–50% of bitrate at equal quality on devices that support them. Newer codec = fewer bytes, narrower reach.
- ☐ **Rate control.** Constrained VBR (peak ≤ ~200% of average, per Apple's HLS authoring spec) balances quality and deliverability; CBR is steadier but larger.
- ☐ **Profile / level cap.** Stay at or below H.264 High Profile, Level 4.2 for broad device playback.
- ☐ **Per-title?** If your catalog mixes easy and hard content, per-title encoding can cut storage and CDN delivery by up to ~50%. Decide whether the extra analysis compute is worth it.

THE ONE SANITY CHECK BEFORE YOU LOCK THE LADDER

Add every rung's bitrate to get the stored bitrate; multiply your average delivered rung by watch-time to get the bill. Storage = sum of all rungs × hours (cheap). Delivery = average delivered bitrate × watch-hours × audience (the dominant cost). Worked: a 7-rung ladder summing 17,475 kbps stores a 2-hour film in ~15.7 GB; at a 3 Mbps average delivered rung, one 2-hour view sends ~2.7 GB — about 11–22 cents on a CDN. If a better-tuned ladder drops the average delivered rung from 3 to 2.4 Mbps for the same picture, you cut a fifth off every viewer's delivery cost — every month, forever. Tune the ladder to your content, not to someone else's default.



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- Bitrate ladders and ABR rung selection (Vol. 3)
- HLS, MPEG-DASH and CMAF packaging (Vol. 2)
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