Parallelism Tuning — Cheat Sheet

Slices, tiles, WPP, subpictures — one page for x264, x265, libaom, SVT-AV1. Companion to article 4.6 of Block 4. Print on A4 or US Letter.

Mechanism map — what each tool buys you

Mechanism	Where	Bitrate cost	Typical speedup	Best for
Slice (raster)	H.264/HEVC/VVC	1-3% per 32 slices	2-4x	Packet-loss resilience
FMO slice	H.264 only	2-5%	Limited	ROI (poor decoder support)
Tile	HEVC/VVC/AV1	0.5-2.0%	5-10x	Multi-core parallelism
WPP wavefront	HEVC, VVC	~1%	3-5x	Single-stream speedup
Subpicture	VVC only	0.5-1.5%	5-10x	Composite / ROI / VR

Encoder flag map (production defaults, 2026)

Encoder	Slice flag	Tile flag	WPP flag	Thread flag
x264	`--slices N`	`n/a`	`n/a`	`--threads N`
x265	`--slices N`	`--ctu-info none (no tiles)`	`--wpp/--no-wpp`	`--frame-threads N / --pools`
libaom (AV1)	`n/a`	`--tile-columns L --tile-rows L`	`n/a`	`--threads N --row-mt 1`
SVT-AV1	`n/a`	`--tile-columns L --tile-rows L`	`n/a`	`--lp N --pin 0`
VVenC (VVC)	`--slices N`	`--tile-columns/--tile-rows`	`--wpp 1`	`--threads N`
Hardware (NVENC/VPU)	`preset-coupled`	`via SDK / preset`	`preset`	`preset`

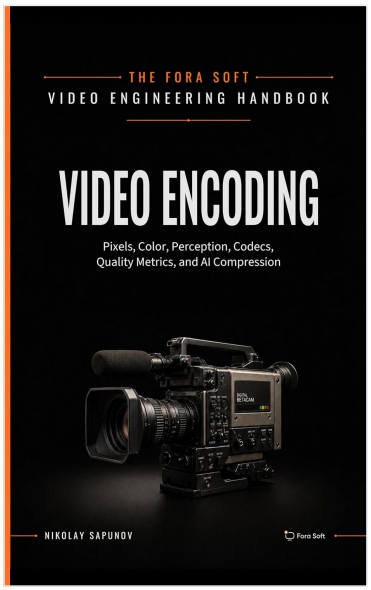
Workload recipes — VOD, live, WebRTC, surveillance

Workload	Tile grid	Slices	WPP	Cores/stream	Notes
Premium VOD 4K	4x4 (AV1) / 4x2 (HEVC)	1	on	16-32	encode-once, max quality
Standard VOD 1080p	2x2	1	on	4-8	balanced bitrate / cost
Live OTT 1080p60	2x2	1	on	4-6	real-time, hardware preferred
Live OTT 4K60	4x2 (HEVC) / 4x2 (AV1)	1	on	8-12	VPU / ASIC for safety margin
WebRTC 1080p30	1x1	1	off	1-2	minimise header / latency cost
Surveillance grid	per-camera subpicture	1/sub	off	1/cam	VVC subpicture or HEVC MCTS

Pre-flight audit

- [ ] Tile count <= cores allocated per stream - never per cluster.
- [ ] AV1 tiles use only power-of-two counts; max 32 columns x 32 rows, total <= 64.
- [ ] x265: WPP on for single-file speed; off for batch jobs on >= 32-core nodes.
- [ ] x264 / WebRTC: single slice; avoid '--slices N' unless you genuinely lose packets.
- [ ] Live HEVC: slice header overhead is ~50 bits per slice - cap slice count to one per frame.
- [ ] VVC subpictures only if the player extracts regions at runtime; otherwise plain tiles.
- [ ] Re-benchmark with VMAF after every change - speedup at quality loss is not a win.

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This cheat sheet maps slices, tiles, WPP and subpictures to encoder flags and workload recipes. Volume 1 explains why those switches cost bitrate and what they buy: how H.264, HEVC, AV1 and VVC split a frame, encoder rate control, presets and quality metrics like VMAF.

WHAT YOU WILL FIND INSIDE

- Slices, tiles and WPP in H.264, HEVC, AV1
- Rate control and its effect on quality
- Encoder presets and threading trade-offs
- Measuring quality loss with VMAF

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