H.264

KAMERA/TECHNIK

H.264 ist ein weit verbreiteter Videokompressionsstandard (auch als AVC oder MPEG-4 Part 10 bekannt) mit ausgezeichneter Kompressionseffizienz. Er bleibt der dominante Codec für Videoverteilung in Rundfunk-, Streaming- und Archivierungsanwendungen.

H.264 Video Codec (AVC/MPEG-4 Part 10) H.264, formally known as Advanced Video Coding (AVC) or MPEG-4 Part 10, is the dominant video compression standard globally. It provides significant compression efficiency while maintaining acceptable quality, making it ubiquitous in broadcast, streaming, and consumer applications. Technical Foundation H.264 represents a major advancement in video compression technology: Standardization : ITU-T and ISO/IEC joint standard (2003) Compression Type : Lossy compression algorithm Efficiency : ~50% smaller files than MPEG-2 at similar quality Ubiquity : Most widely supported codec globally Compression Architecture H.264 uses sophisticated compression techniques: Prediction Methods : Intra-frame prediction (within frame) Inter-frame prediction (between frames) Directional prediction patterns Adaptive block sizing (4x4 to 16x16) Entropy Coding : Context-Adaptive Variable-Length Coding (CAVLC) Context-Adaptive Binary Arithmetic Coding (CABAC) More efficient bitstream encoding Transform and Quantization : Integer transform (avoiding floating-point errors) Scalable quantization Adaptive quantization matrixes Profiles and Levels H.264 defines multiple profiles for different applications: Common Profiles : Baseline : Simple, low-power devices (phones, streaming) Main : Standard for broadcast and consumer electronics High : Enhanced coding efficiency (broadcast, streaming) High 10 : 10-bit color depth support Levels (1.0 through 5.2): Specify maximum resolution, frame rate, and bitrate Level 4.2: 2160p@60fps (4K high framerate) Level 5.2: 8192x4320@60fps (8K capable) Bitrate Performance H.264 efficiency varies by content: Typical Bitrates : 1080p/24fps : 5-8 Mbps for near-lossless quality 1080p/60fps : 8-15 Mbps 4K/24fps : 15-25 Mbps 4K/60fps : 25-50 Mbps Variable Bitrate (VBR) : Adaptive bitrate allocation Higher bits for complex scenes Lower bits for simple content Improved perceived quality Industrial Applications Broadcast : HD television transmission Cable and satellite delivery Terrestrial digital TV IPTV services Streaming : YouTube (standard delivery) Netflix (original preferred codec) Amazon Prime Most online video platforms Archival : Professional broadcast preservation Institutional archive masters Standards-based long-term format Mobile and Consumer : Smartphone video recording Video conferencing Gaming platforms Portable media H.264 in Production While not a primary acquisition codec, H.264 appears throughout production: Proxy Workflows : Low-bitrate H.264 proxies for editing Fast playback on standard computers Significant file size reduction Simultaneous online review distribution Wireless Transmission : Monitoring systems use H.264 Wireless video transmission Back-to-monitor video feeds On-set review systems Dailies and Deliverables : Review version distribution Client approval screeners Festival submission formats Streaming platform delivery Hardware Acceleration H.264 benefits from dedicated hardware: Encoding : NVIDIA NVENC (GPU acceleration) Intel Quick Sync (CPU-integrated) Apple ProRes (GPU acceleration) AMD VCE (GPU acceleration) Decoding : Most modern chips include H.264 decoders Battery-efficient playback Real-time performance on modest hardware Consumer device universal support H.264 Limitations Despite ubiquity, H.264 has drawbacks: Compression Artifacts :

Block-based compression creates visible edges Ringing around fine details Motion artifacts in high-motion content Quality degradation in low-bitrate scenarios Modern Standards : H.265/HEVC provides 50% better compression VP9 and AV1 offer improved quality/bitrate Better suited for 4K and HDR content Patent Licensing : Encumbered by MPEG LA patent pool Licensing fees can be significant Legal complexity in some scenarios H.264 vs. H.265 Feature H.264 H.265 Efficiency Baseline 50% better 4K Support Possible but heavy Optimized HDR Limited support Full support Patent Status More established Ongoing litigation Adoption Near universal Growing Bitrate for HD 5-8 Mbps 2.5-4 Mbps Future Status H.264 remains relevant because: Legacy Support : Decades of infrastructure Device Ubiquity : Every device plays H.264 Standards Stability : Mature, well-understood Cost : No ongoing licensing for playback Reliable Archive : Proven long-term stability However, newer standards increasingly handle: Ultra HD and 8K content HDR delivery Higher framerate content Superior compression efficiency