

Video Surveillance System Anatomy

The seven-stage pipeline — the typical technology and the typical failure mode at every hop.

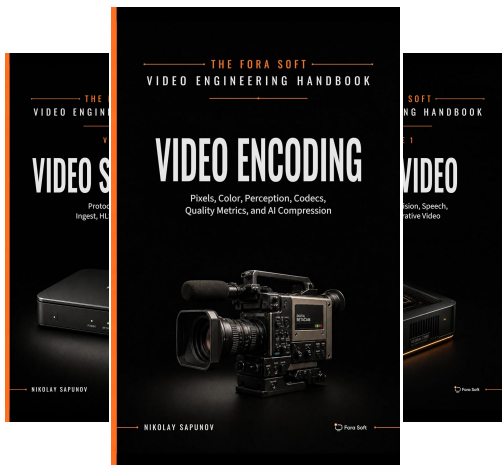
Stage	Typical technology	Typical failure mode
1 • Camera capture + compress	IP camera; H.264 / H.265 encoder; sensor + lens chosen by task (DORI)	Wrong camera for the task; bitrate set needlessly high
2 • Network carry stream + power	PoE switch (IEEE 802.3af/at/bt); structured cabling; dedicated VLAN	PoE budget or uplink under-provisioned; cameras brown out
3 • Ingest find + pull stream	ONVIF discovery; RTSP control (RFC 7826); RTP transport (RFC 3550)	'ONVIF just works' — only the baseline streams; rest needs SDK
4 • Storage retain footage	Recording server; surveillance-grade drives; RAID; recording mode	Sized for the demo, not the retention policy; fills early
5 • Analytics video into events	Edge / edge-server / cloud computer vision; ONVIF Profile M metadata	Tiers blurred into 'AI'; false-alarm flood; unbudgeted cloud bill
6 • Client view + respond	VMS desktop / browser / mobile; role-based access control (RBAC)	Too many feeds per operator; flat access fails a privacy audit
7 • Integration events into action	APIs and SDKs; access control; alarms; notifications	Alert fatigue; island deployment reviewed only after the fact

Wrapping layer — Privacy & retention

GDPR / EDPB Guidelines 3/2019 / Illinois BIPA; encryption in transit and at rest; retention limits. Biometrics (face, license plate) are a legal gate before they are a feature.

Storage math: $\text{storage} = \text{bitrate} \times \text{cameras} \times \text{hours} \times \text{days}$. Worked example: 40 cameras $\times$ 4 Mbps $\times$ 24 h $\times$ 30 days $\approx$ 51.6 TB in H.264; $\approx$ 26 TB in H.265; less again on motion or event recording.

Engineering guidance, not legal advice. Confirm specifics with qualified counsel.



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This reference walks the seven stages from camera to integration with the usual technology and failure mode at each hop. Our seven-volume handbook covers the same stack in depth: Volume 1 for H.264 and H.265 encoding, Volume 2 for RTSP, RTP and network transport, Volume 6 for the computer vision behind analytics.

WHAT YOU WILL FIND INSIDE

- H.264 and H.265 encoder settings for cameras
- Detection and tracking models for video analytics
- RTSP, RTP and transport over constrained networks
- Storage maths driven by bitrate and retention

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Designing a VMS or replacing one that keeps failing at the same hop?

We will review your pipeline stage by stage, find where it breaks and build the VMS, analytics or integration layer around it. 250+ video products shipped since 2005.

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