On-Prem Storage Architecture Decision Guide

Turn a storage number into hardware that survives a disk failure. Pair with the article and your own retention rules.

Step 1 - where the disks sit: DAS, NAS, or SAN

Topology	Access level	Live recording?	Best for
DAS	Local disk (SATA / SAS)	Yes - the default	Small / mid single-recorder NVR
NAS	File (SMB / NFS)	Rarely - too slow	Back-end archive tier
SAN	Block (iSCSI / FC)	Yes - built for it	Large multi-recorder, shared pool

Step 2 - how the disks are grouped: RAID level

RAID	Usable	Survives	Write pen.	Surveillance fit
RAID 0	100%	0 failures	x1	Never - one disk lost loses all
RAID 1	50%	1 failure	x2	Small single-recorder NVR
RAID 5	(n-1)/n	1 failure	x4	Small arrays / smaller drives only
RAID 6	(n-2)/n	2 failures	x6	The default for large arrays
RAID 10	50%	1 per mirror	x2	Write-heavy, fast-rebuild priority

Size for two budgets, not one

Capacity budget (from the retention math): bitrate x cameras x days, grossed up for RAID parity + 80%-fill headroom (~1.4-1.6x). Throughput budget: total camera bitrate x RAID write penalty. Example: 40 cameras x 4 Mbps = 160 Mbps = 20 MB/s of continuous writes; on RAID 6 (x6 penalty) the disks do up to ~120 MB/s of raw work, non-stop. Plan disk COUNT from throughput, disk SIZE from capacity, take whichever needs more disks. A hardware controller with battery-backed write cache absorbs the bursts.

Surveillance drives: CMR, never SMR

Use surveillance-rated drives (WD Purple, Seagate SkyHawk): workload 180-550 TB/year vs ~55 for a desktop drive, vibration tolerance for many-bay chassis, streaming firmware that prioritizes writing the stream. They are always CMR. NEVER put an SMR (shingled) drive in a surveillance array - under sustained writes or a rebuild it stalls below ~10 MB/s and the controller ejects it. Check the model's CMR/SMR status before every purchase.

The failure that matters: a disk drops mid-incident

RAID keeps recording (degraded) - but the rebuild is the danger window: 12-24 h on large drives, days on a busy or SMR array, and the array is still degraded. On RAID 5 a second failure OR an unrecoverable read error (URE) during rebuild loses the array; reading ~44 TB across a 5x12 TB rebuild approaches the consumer URE limit. Defenses: RAID 6 (or RAID 10), a hot spare so the rebuild starts at once, and 20-30% throughput headroom so degraded mode still records every frame.

Your array - fill in the two budgets and the choices

Item	Your value	Item	Your value
Cameras x bitrate	____ x ____ Mbps	Topology (DAS/NAS/SAN)	_____
Write load (MB/s)	_____	RAID level	_____
Retention (days)	____ days	Usable TB needed	____ TB
Raw TB (x1.5)	____ TB	Drives + hot spare	____ + ____

Illustrative 2026 figures (vendor datasheets; standard RAID write penalties and URE rates). Drive specs, prices, and rebuild times vary by model and load - re-validate against live datasheets. Confirm retention limits with your retention policy and qualified counsel.