CLIENT CAMPUS / ENGINEERING EXAMPLE / 01

Client Campus

Video security design package

Refresh video coverage at two fictional buildings, retain serviceable cameras, replace cameras that do not meet the assumed image requirements, and introduce a documented 30-day recording and migration plan.

Fictional example. Preliminary engineering assessment, equipment plan, camera schedule, storage calculations, migration approach, and implementation scope.

Camera scope	Recording design	Storage target
48 physical cameras 48 primary streams	2 recorders 24 cameras / 72 Mbps each	30 days continuous 55.9872 TB with headroom
32 retained after validation 16 planned replacements	144 Mbps assumed aggregate H.264 at 10 frames/s	60.8 TB illustrative available pool RAID and reserve shown on page 5

Recommended direction

Use two independent recording servers, each assigned 24 single-stream cameras. Retain 32 cameras subject to compatibility and image testing; replace 16 with cameras that meet the stated scene requirements. Plan 55.9872 TB of video capacity including 20% headroom. Keep product selection, software entitlements, feature interoperability, and acceptance testing as explicit release conditions.

What this package demonstrates

An engineering recommendation should connect the customer objective to camera actions, server assignments, recording settings, usable storage, licensing, procurement decisions, and an executable handover plan. This example carries those relationships through the report and editable workbook.

Example status and provenance

An original fictional example authored for the public showcase. No customer records, site files, active project scenarios, credentials, addresses, serial numbers, or commercial pricing are used.

All equipment identifiers are functional planning classes, not manufacturer part numbers. No prices or certified compatibility are asserted. The example is intentionally complete about its assumptions and open decisions.

Package contents

Pages 2-5: scope, cameras, servers, storage and network. Pages 6-8: BOM, features and licensing. Pages 9-12: migration, validation, implementation and customer handover. The companion workbook contains the 48-camera schedule and editable calculations.

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Requirements and design basis

The following inputs are invented for this example. Calculated outputs are reproducible; manufacturer-specific findings remain unresolved until evidence exists.

ID	Requirement	Example input
R-01	Coverage	48 cameras across Building A and Building B
R-02	Recording	One primary stream per physical camera, continuous recording
R-03	Retention	30 days with 20% storage planning headroom
R-04	Refresh scope	Retain 32 cameras and replace 16 after validation
R-05	Image settings	H.264, 10 frames/s, assumed 3 Mbps per stream
R-06	Analytics	Assess object alerts at the 16 replacement positions
R-07	Continuity	Migrate by camera group and preserve historical access
R-08	Exclusions	No access hardware, intercom, facial recognition, LPR, or automatic failover in this example

Evidence register

ID / source	Classification	Use and limitation
E-01 / Fictional project brief	Authored example input	Defines objectives, 30-day retention, scope, and exclusions.
E-02 / Fictional camera schedule	Authored example input	Six groups of eight cameras; all identities are generic camera classes.
E-03 / Illustrative recording settings	Planning assumption	3 Mbps, H.264, 10 frames/s, continuous recording. Replace estimates with measured rates in a live design.
E-04 / Illustrative server profile	Planning assumption	Two servers; six 8 TB data disks in RAID 6 per server; 5% filesystem reserve; separate mirrored OS disks.
E-05 / Manufacturer and entitlement evidence	Not supplied in this example	Exact camera/firmware/VMS support, server SKU/OS support, orderability, and licences require current evidence.

A live assessment would replace E-01 through E-04 with authorized project material and obtain E-05 before procurement. Nothing in this package is extracted from a customer environment.

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Camera schedule and replacement logic

Six fictional groups form the 48-camera baseline. One physical camera contributes one primary recording stream in this example; multisensor heads and secondary streams would need separate counting.

Group / location	Qty / action	Recorder	Selection basis
CG-01 / Building A / Lobbies	8 / Retain	REC-01	Assumed serviceable coverage. Confirm backlight handling, lens position, firmware, and supported recording path.
CG-02 / Building A / Circulation	8 / Retain	REC-01	Assumed usable image quality. Check corridor framing, export, timestamps, and firmware compatibility.
CG-03 / Building A / Exterior doors	8 / Replace	REC-01	Assumed poor backlight and night images. Select lens and mounting after an image objective and pilot are agreed.
CG-04 / Building B / Interior	8 / Retain	REC-02	Assumed usable indoor coverage. Confirm field of view, focus, recording stability, and day/night transitions.
CG-05 / Building B / Loading entries	8 / Retain	REC-02	Assumed serviceable cameras. Confirm low-light performance, housing condition, PoE load, and event handling.
CG-06 / Building B / Perimeter	8 / Replace	REC-02	Assumed inadequate night coverage. Validate illumination, target distance, glare, mounting, and object-alert requirements.

Replacement specification

CG-03 and CG-06 account for 16 planned replacements. Use a 4 MP outdoor fixed-camera specification with a scene-appropriate lens, WDR, IR and environmental protection. These are desired functions, not claims about a selected product. Agree target distance and usable image detail before selecting the lens or model.

Retention of existing cameras

The 32 retained positions still require model/firmware identity, image checks, stable recording and a supported integration path. Retain is an example design decision subject to those tests; it is not a manufacturer compatibility certification.

Camera configuration and analytics

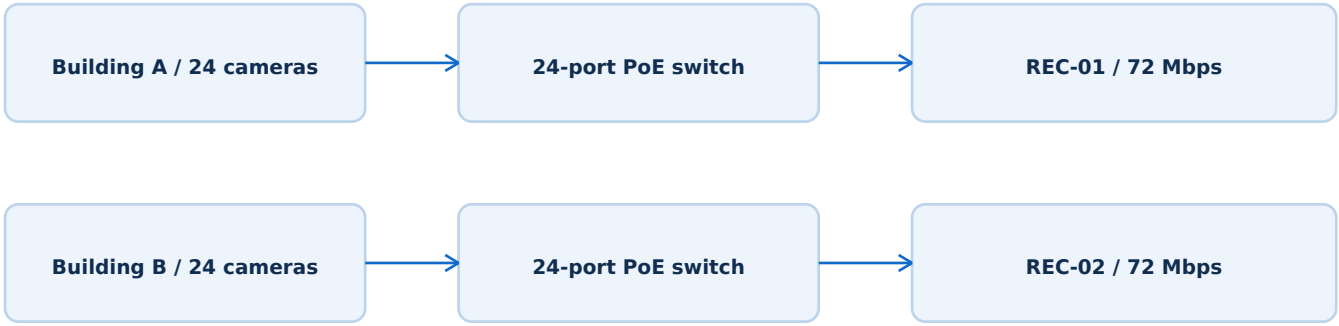
Start the example at H.264, 10 frames/s and an estimated 3 Mbps per stream. Measure representative day/night scenes and update the storage model. Object alerts are requested only at the 16 replacement positions; camera processing, platform metadata/events and licence rights must all be verified.

The workbook lists CAM-001 through CAM-048 with group/location, action, recorder assignment, stream count and bitrate. No real asset identifiers or network addresses are present.

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Recording architecture and server plan

Two recording locations split the load by building. This is a planning allocation, not automatic redundancy or failover.



Recorder	Assignment	Recording load	Video capacity target
REC-01	Building A / 24 cameras	72 Mbps assumed	27.9936 TB including headroom
REC-02	Building B / 24 cameras	72 Mbps assumed	27.9936 TB including headroom

Illustrative recorder profile

Component	Planning specification	Validation before purchase
Compute	8 physical CPU cores / 32 GB RAM per recorder	Confirm chosen VMS/OS support and measured recording, viewing and export workload.
Video disks	6 x 8 TB data disks in RAID 6 per recorder	Confirm supported disks/controller, rebuild behavior and sustained write performance.
OS disks	2 SSDs mirrored separately per recorder	Confirm boot mirror, endurance, capacity and recovery method.
Video pool	32 TB after two-disk parity; 30.4 TB after 5% reserve	Measure formatted usable capacity and any additional VMS/OS allocation.
Network / power	Dedicated managed paths, adequate uplinks, monitored UPS	Validate security policy, actual traffic, electrical load and runtime.

Availability and operational consequences

A recorder outage affects its 24 assigned cameras. RAID 6 tolerates defined disk failures but does not replace a recovery plan, backup, spare parts or recorder failover. Automatic failover, central management resilience and server-side analytics appliances are outside this baseline.

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Storage, bandwidth and power

Decimal units are used throughout: 1 TB = 1,000,000,000,000 bytes. RAID capacity is separated from raw disks, filesystem reserve and the required video pool.

Calculation	Example result
48 cameras x 1 stream x 3 Mbps	144 Mbps aggregate
144 x 1,000,000 / 8 x 86,400 x 30 / 1,000,000,000,000	46.656 TB raw video
46.656 x 1.20	55.9872 TB target with 20% headroom
Per recorder: (6 disks - 2 parity disks) x 8 TB	32 TB after RAID parity
Per recorder: 32 x (1 - 0.05)	30.4 TB available for video after assumed reserve
2 x 30.4 - 55.9872	4.8128 TB capacity above the planning target
144 Mbps x 1.25	180 Mbps aggregate planning network allowance
24 cameras x 12 W x 1.25	360 W minimum planning PoE budget per switch



Retention sensitivity at the assumed 3 Mbps

Continuous retention	Raw video	With 20% headroom	Compared with 60.8 TB
15 days	23.328 TB	27.9936 TB	Within illustrative capacity
30 days	46.656 TB	55.9872 TB	Within illustrative capacity
45 days	69.984 TB	83.9808 TB	Additional storage required

Network allowance excludes additional live viewing, export, replication and management traffic. Verify uplinks and concurrency. PoE uses an invented 12 W per camera; validate peak IR/heater loads and standards. A capacity calculation does not establish recorder performance, hardware support or guaranteed retention.

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Preliminary bill of materials

The BOM distinguishes physical equipment quantities from entitlement reconciliation. Planning class identifiers are not orderable manufacturer SKUs. Prices and lead times are intentionally not invented.

ID	Design item / quantity	Planning class	Basis / release condition
B-01	Recording server chassis/compute / 2	REC-CLASS-A	8-core/32 GB planning profile; storage and OS disks listed separately. Confirm supported CPU, memory, OS, throughput, warranty, and orderable SKU.
B-02	8 TB surveillance data disk / 12	HDD-CLASS-8TB	Six disks per recorder, RAID 6; 8 TB is decimal raw capacity per disk. Confirm compatible disk list, workload rating, RAID controller, and usable capacity.
B-03	OS solid-state disk / 4	SSD-CLASS-OS	Two OS disks per server in RAID 1, separate from the video data pool. Confirm capacity, endurance, boot mirror, and support.
B-04	Replacement outdoor camera / 16	CAM-CLASS-4MP	Eight exterior-door and eight perimeter positions; 4 MP functional specification. Confirm model/lens, environment, image objective, firmware, recording, and analytics support.
B-05	Camera channel entitlement / 48	LIC-CHANNEL-REVIEW	48 required recorded streams; existing rights and new purchase quantity are not established. Reconcile entitlements, transfers, version/edition, and current licence part numbers.
B-06	Managed 24-port PoE switch / 2	SWITCH-CLASS-POE	24 cameras and at least 360 W planning PoE budget per building; verify actual loads. Confirm port count, PoE standards, uplink capacity, power budget, and support.
B-07	UPS system / 2	UPS-LOAD-REVIEW	One per recording location; rating and runtime depend on a measured equipment load. Confirm watts, VA, required runtime, outlet types, and shutdown integration.
B-08	Camera mount/junction set / 16	MOUNT-SITE-REVIEW	One compatible mounting set per replacement position. Confirm surface, weather sealing, aiming range, and camera compatibility.
B-09	Server rack/rail set / 2	RACK-FIT-REVIEW	One per server; no new rack assumed in the example. Confirm rack depth, mounting, weight, ventilation, and electrical capacity.
B-10	Camera patch lead / 48	PATCH-CLASS	Illustrative allowance of one tested patch lead per camera. Confirm length, category, environmental rating, and cable certification scope.

Procurement treatment

B-01 covers compute/chassis only; B-02 and B-03 cover its separate data and OS disks. Do not substitute a fully populated recorder and also order duplicate disks without reconciling its included configuration. The 32 retained cameras are scheduled assets, not new purchase lines.

B-05 requires 48 licensed recording channels in the example. That is not an instruction to buy 48 new licences: existing entitlements, migration/upgrade rights and the confirmed shortfall determine purchase quantity. Services are described in the implementation scope, not equipment lines.

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Camera interoperability and features

Video recording, image functions, metadata and analytics are separate findings. Basic connectivity cannot establish all four.

Function / scope	Evidence or test required	Example disposition
Recording path / All 48 cameras	Exact model, firmware, target VMS version, driver/device pack, and stream limits	Pending pilot
ONVIF S/T / Retained and replacement models	Device and client evidence plus an end-to-end stream/event test; profile alone is not universal compatibility	Pending evidence
ONVIF G / Not required in baseline	Add storage, replay and recovery tests before enabling an edge-recording design	Out of baseline
ONVIF M / metadata / 16 replacement positions	Verify camera event support, receiving platform, event mapping, and licence/processing dependencies	Pending evidence
Image functions / By camera group and scene	Day/night sample images, target distance, lens, motion blur, exposure, and illumination	Pending scene test
Object alerts / 16 replacement positions	Confirm edge analytics capability, platform/driver event support, licence rights, and acceptance performance	Pending pilot
Audio / PTZ / dewarping / Not required in baseline	Introduce separate feature tests and permissions if the scope changes	Out of baseline
Server-side analytics / Not included	If camera-side capabilities cannot meet the requirement, define supported processing and capacity before adding hardware	Separate design decision

How a camera would qualify for release

Record the exact device model, firmware, target software version and integration path. Confirm that the receiving platform exposes each requested function, then capture the pilot result and its limits. Keep observed behavior separate from manufacturer-documented support.

Profile S/T/G/M entries are validation questions, not statements that a camera or platform is conformant. Missing model, firmware, client or feature evidence remains unresolved. No active manufacturer certification registry is represented by this example.

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Licensing and commercial readiness

Separate the required system capacity from existing rights and new purchase quantities. A missing entitlement record must not become either a free licence or an automatic new purchase.

Domain	Design requirement	What must be resolved
Video channel rights	48 / 48 recorded single-sensor streams	Inventory existing licences; identify transferable and reusable rights; purchase only the confirmed shortfall
Management/server software	2 / Two independent recorder roles	Confirm the chosen platform's server/management licensing and supported edition; server count is not automatically a licence count
Object-alert features	16 / 16 replacement positions requested in the example	Verify included versus paid features and camera/platform processing; no paid entitlement is assumed
Upgrade/maintenance	Pending / Existing entitlement history is not supplied	Verify rights to the selected software version; do not infer coverage from installed software
Optional access/cloud work	Excluded / No access hardware or cloud subscription is included	Scope and licence separately if requested

Quote release sequence

1. Reconcile installed and owned recording channels, editions, versions, terms and transferable rights against the target design.

2. Confirm which requested analytics are included, separately licensed, camera-dependent or dependent on additional processing.

3. Replace every planning equipment class with a supported, current orderable identifier. Confirm accessories, quantities, availability and lead times.

4. Apply approved commercial pricing and service scope only after compatibility, capacity and entitlement decisions are resolved.

5. Carry each unresolved item into the customer summary and purchase approval; do not label the package quote-ready while those conditions remain open.

Commercial scope boundary

This example shows the structure of a procurement review without confidential pricing or fabricated SKUs. No customer discounts, margins, licence keys, subscription identifiers or account records are present.

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Phased migration and rollback

Use a representative pilot before broad rollout. Each eight-camera group has an acceptance checkpoint and a reversible change record.

Phase / owner	Work and evidence	Rollback or hold point
M-01 / Discovery and baseline Engineer + owner	Record camera/firmware/VMS identities, exports, time sync, accounts, current retention, and entitlements. Evidence: Approved inventory and recoverable configuration backup.	Do not change the live system until backup and credentials are validated
M-02 / Build and harden Integrator + network team	Prepare supported recorder OS, storage pools, network segmentation, updates, roles, and logging. Evidence: Storage/health evidence and approved connectivity tests.	Keep existing recording authoritative
M-03 / Representative pilot Engineer + operator	Test one retained indoor camera, one retained outdoor camera, and each replacement class before broad rollout. Evidence: Live/playback/export, events, timestamps, image quality, and bitrate recorded.	Revert the pilot camera to its documented original path if acceptance fails
M-04 / Phased cutover Integrator + operator	Move one eight-camera group per approved window; confirm new recording before releasing the old path. Evidence: Group-level recording, events, operator sign-off, and support ownership.	Restore that group's recorded original configuration if recording or agreed features fail
M-05 / Retention and endurance Engineer + operator	Review measured bitrate and storage growth; test replay and export; check disk and network health. Evidence: Capacity recalculation and a final 30-day retention check when enough history exists.	Keep legacy playback available for the agreed historical-retention period
M-06 / Handover and closure Integrator + owner	Deliver as-built schedules, backups, training, open-item register, recovery steps, and licence records. Evidence: Signed acceptance with unresolved items explicitly owned.	Retire old equipment only after approval and the agreed data-disposal process

Operational rules

Do not stop or remove the old recording path until the pilot demonstrates the approved cutover method. Confirm camera connection limits before attempting concurrent old/new recording. Preserve access to historical video for the agreed period; moving cameras does not migrate their existing archives automatically.

Stop the affected group if recording, time synchronization, operator access or an agreed feature fails. Restore the documented prior configuration and verify recovery. Do not decommission old equipment until retention, evidence preservation and disposal approvals are complete.

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Validation and risk register

Each open item has an owner, required evidence and decision point. The pending state in this synthetic register is intentional; it does not imply an untested product is approved.

ID / decision	Owner / timing	Evidence required
V-01 / Camera identity and firmware	Engineer Before camera selection	Exact model/firmware inventory and current support evidence
V-02 / Image objectives	Owner + engineer Before replacement orders	Agreed target size/distance and day/night pilot images for each scene class
V-03 / Server platform and storage	Engineer + vendor Before recorder orders	Supported OS/CPU/storage configuration, actual usable video capacity, write/throughput and rebuild evidence
V-04 / Bitrate and retention	Engineer Pilot and final retention check	Measured representative streams and storage-growth check; update workbook and confirm 30-day objective
V-05 / Recording and metadata interoperability	Engineer Before broad cutover	Native/ONVIF/RTSP feature test on the exact camera, firmware, VMS, and driver combination
V-06 / Licence rights and purchase shortfall	Owner + integrator Before quote approval	Current entitlement records, edition/version needs, and current orderable identifiers
V-07 / Power and network	Network team Before installation	Switch PoE budget, measured device load, uplink traffic, UPS runtime, and approved paths
V-08 / Recovery and historical access	Integrator + owner Before first cutover	Tested restore, documented rollback triggers, and old-video access period
V-09 / BOM procurement release	Integrator + engineer Before purchase	Every line has confirmed identity, quantity, compatibility, price, lead time, and owner approval
V-10 / Final operator acceptance	Owner + operator Before closure	Recording, search, replay, exports, role permissions, events, training, and open-item sign-off

Risks that change the design

Higher measured bitrate can exceed retention capacity. Unusable retained cameras increase replacements and licensing work. Missing analytics event support may change the camera or processing architecture. Unsupported server/OS combinations require a different recorder configuration. Each change must update the camera schedule, storage, BOM and acceptance plan together.

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Implementation scope and responsibilities

The following work packages illustrate how the engineering assessment becomes an implementation plan. Execution dates, prices, staffing and service commitments are agreed separately.

Work package / owner	Included activity	Deliverable / acceptance evidence
W-01 / Engineering assessment Engineer	Review fictional brief, inventory, camera actions, design assumptions, calculations, and open items	Assessment, camera schedule, and validated design basis
W-02 / Recorder and network preparation Integrator + network team	Build the approved server/storage configuration, network paths, power and account controls	Configuration record, health tests, and backups
W-03 / Camera refresh Integrator	Replace 16 approved positions and validate the 32 retained positions	Camera schedule, aiming records, images, firmware and connectivity tests
W-04 / Software and entitlement setup Integrator + owner	Deploy approved software and reconcile entitlements without assuming upgrade rights	Version/edition record and licence reconciliation
W-05 / Pilot and migration Engineer + operator	Execute M-03 through M-05 with a group-level rollback path	Pilot log, cutover checklist, measured bitrate and capacity review
W-06 / Handover Integrator + owner	Deliver as-built documents, configuration backups, operator instruction, and an owned open-item register	Acceptance record and recovery/handover package

Customer / operator responsibilities

Provide authorized access, a responsible decision owner, current inventory and entitlement evidence, maintenance windows, network and power approvals, retention requirements, and operator acceptance. Agree data handling and disposal before moving historical recordings or retiring equipment.

Optional services - separate scope

Optional service	Agreement required
Operator/admin training	Agree roles, attendees, topics and duration separately.
Extended maintenance	Agree support coverage, response hours, software rights and term separately.
Access/intercom integration assessment	Capture door/station counts and integration needs; size hardware and licences in a separate workstream.
Additional cybersecurity assessment	Define hardening, vulnerability review and compliance evidence separately; no certification is asserted.

Exclusions: No prices, discounts, customer-specific commercial terms, manufacturer-certified compatibility, exact orderable SKUs, automatic recorder failover, LPR, face recognition, access/intercom hardware, cloud subscription, trenching, new structured cabling, or compliance certification are included. Services are scoped separately from the equipment BOM.

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Customer summary and handover

Client Campus can use this preliminary plan to review the intended outcome, approve validation work, and understand what must happen before ordering or cutover.

Proposed outcome

Provide a documented 48-camera video refresh with 32 retained positions, 16 replacement positions and two independently operated recording servers. Each recorder handles 24 cameras at an assumed 72 Mbps. The 30-day planning target is 55.9872 TB across both recorders; the illustrative disk configuration provides 60.8 TB after RAID parity and a 5% reserve.

Decisions to make before procurement

Agree the image objective and replacement cameras; confirm exact recording and event interoperability; validate the server/OS/storage configuration; reconcile owned licence rights and purchase shortfalls; approve equipment pricing, work windows and the migration/rollback plan. The design remains preliminary until those decisions are supported.

Acceptance checklist

1. Every in-scope camera records to the assigned recorder and displays the agreed timestamp and image.

2. Live view, playback, search, and export succeed for retained and replacement camera classes.

3. Agreed object events reach the receiving platform at the 16 replacement positions, or the unresolved dependency is documented before release.

4. Measured stream rates and actual usable capacity support the retention target; repeat the retention check after sufficient recording history exists.

5. Approved role permissions, network restrictions, recovery, and group rollback are demonstrated.

6. BOM, camera schedule, server plan, licence records, as-built settings and the open-item register agree at handover.

Handover package

Deliver the executive assessment, 48-camera schedule, server assignments, storage workbook, reviewed BOM, compatibility/feature matrix, licence reconciliation, phased migration and rollback record, implementation scope, configuration backups and owned validation register. Store final revisions together so the customer-facing documents reflect the same approved design.

This public example contains invented names and inputs only. Its purpose is to show the depth, relationships and review process a customer can expect from an engineering deliverable.