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DESIGN STUDY

# Immutable backup and 4-hour recovery for a hospital group

Complete design on current platforms

| CAPABILITY | INDUSTRY | SETTING |
|---|---|---|
| Data Center | Healthcare | Hospital group |
| **DOCUMENT** | **VERSION** | **DATE** |
| DC-004 | 1.3 | Oct 10, 2026 |

WRITTEN BY

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## Document control

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CONVENTIONS

**Source tags.** [S] figure read from the vendor's own current page on Sep 18, 2026 · [S*] figure from the vendor's page summary where the page itself could not be opened · [A] design assumption, to be confirmed by the signing engineer · [T] design target: the record's outcome figure and anything derived from it. No figure comes from any engagement, file or asset. A row with more than one tag is counted once: as a published figure if any tag is [S] or [S*], otherwise as an assumption if any tag is [A], otherwise as a design target.

**Table 1.** Revision history

| Date | Version | Change |
|---|---|---|
| Sep 18, 2026 | 1.0 | First issue. |
| Sep 20, 2026 | 1.1 | Public implementations added; figures reconciled with published sources. |
| Sep 27, 2026 | 1.2 | Figures and platform details rechecked against published sources. |
| Oct 10, 2026 | 1.3 | Approval line now reads: approved by the Founder, issued by Symbeeo. Steve Phillips remains the author. |

# 1 · Scope

**Who it is for.** The CIO of a hospital group whose backup passes its nightly job report and has never been asked to bring the record system back from nothing, under a clock, with the production storage assumed lost.

**Typical buyer [A].** A hospital group with 9 sites and one shared electronic record system. Record system: 40 VMs, 24 TB of data on NetApp ONTAP; 15 % daily change. Total estate 900 VMs, 420 TB. Two data centers 12 km apart, each with a NetApp AFF; production in DC-A, standby in DC-B. Backup today: single Windows repository on the same VLAN as production.

**What is in.** Backup software, the hardened on-site repository, the second-copy appliance in DC-B, the storage-snapshot tier, the 3-2-1-1-0 mapping, the quarterly 4-hour restore test of the record system. **What is out.** Application-level database backup inside the record system (vendor-run, [A]); endpoint and Microsoft 365 backup; the network between the data centers (assumed 2 × 100 GbE, [A]).

**Assumptions.** Veeam is the backup vendor, Dell the repository and appliance vendor, NetApp the production storage vendor [A]. Restore target for the record system is the DC-B AFF, with hosts already present [A]. Backup traffic has its own VLAN and its own firewall rule set [A].

**Related documents, read Sep 18, 2026.**

- Veeam Backup & Replication 13, hardened repository (the page gives a summary only) — `https://helpcenter.veeam.com/docs/vbr/userguide/hardened_repository.html?ver=13`
- Veeam Backup & Replication 13, about hardened repository (the page gives a summary only) — `https://helpcenter.veeam.com/docs/vbr/userguide/hardened_repository_about.html?ver=13`
- Veeam Backup & Replication, hardened repository requirements and limitations — `https://helpcenter.veeam.com/docs/vbr/userguide/hardened_repository_limitations.html`
- Dell PowerEdge R7725 technical guide — `https://www.delltechnologies.com/asset/en-us/products/servers/technical-support/poweredge-r7725-technical-guide.pdf`
- Dell PowerProtect Data Domain DD6410 — `https://www.dell.com/en-us/shop/ipovw/power-protect-dd6410`

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- NetApp AFF A70 key specifications — https://docs.netapp.com/us-en/ontap-systems/a70-90/a70-key-specifications.html
- NetApp ONTAP SnapLock — https://docs.netapp.com/us-en/ontap/snaplock/
- NetApp, lock an ONTAP snapshot for protection against ransomware attacks, page dated May 8, 2026 (read Sep 27, 2026) — https://docs.netapp.com/us-en/ontap/snaplock/snapshot-lock-concept.html
- Dell, Data Domain Retention Lock frequently asked questions (read Sep 20, 2026) — https://www.dell.com/support/kbdoc/en-us/000079803/data-domain-retention-lock-frequently-asked-questions-faq
- Veeam, hardened Linux repository best practices (read Sep 20, 2026) — https://www.veeam.com/blog/hardened-linux-repository-best-practices.html
- Veeam, two-hospital UK trust customer story (read Sep 20, 2026) — https://www.veeam.com/resources/customer-stories/bedfordshire-hospitals-nhs-foundation-trust.html

## 1c · Public implementations this design follows

Deployment rows are real public deployments, each dated. Where no public deployment matches, the row is Vendor documentation: the vendor's document that this design, Symbeeo's own, is built on.

**Table 2.** Public implementations this design follows

| Implementation | Who published it · date | What it settles for this design | URL |
|---|---|---|---|
| **Vendor documentation.** ONTAP tamperproof snapshots: from ONTAP 9.12.1 a snapshot on a non-SnapLock volume is locked with the SnapLock compliance clock and cannot be deleted before its expiry; needs the SnapLock license (in ONTAP One) and an initialized compliance clock; retention set in the snapshot policy; in-place restore only from the most recent locked snapshot; clones allowed | NetApp ONTAP documentation · May 8, 2026 | Copy 1 in R11 and §4.1: the lock mechanism, its prerequisites and the clone-based restore path | https://docs.netapp.com/us-en/ontap/snaplock/snapshot-lock-concept.html |
| **Vendor documentation.** Data Domain Retention Lock: Governance locks can be reverted by an administrator, Compliance locks cannot; minimum period 12 hours, maximum 70 years; Compliance needs a separate security-officer user | Dell support knowledge base · modified Jun 30, 2026 | The retention-lock mode on the DC-B appliance in §4.3 and the 30-day period's bounds | https://www.dell.com/support/kbdoc/en-us/000079803/data-domain-retention-lock-frequently-asked-questions-faq |
| **Vendor documentation.** Hardened repository build rules: Ubuntu, Red Hat or SUSE; 4 GB RAM per CPU core; OS on its own RAID 1 of at least 100 GB; data on RAID 6/60 with a roaming spare | Veeam blog · Jan 23, 2023, updated Feb 25, 2026 | The Linux build and memory rule for the two R7725 repository nodes in §4.2 | https://www.veeam.com/blog/hardened-linux-repository-best-practices.html |

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| Implementation | Who published it · date | What it settles for this design | URL |
|---|---|---|---|
| **Deployment.** A two-hospital trust with 8,000 staff and more than 500 TB moved to isolated, immutable, encrypted Veeam repositories under a 3-2-1 rule; recovery "in minutes" for users | Veeam customer story · modified Jan 27, 2025 | An estate of R1's order, on the same backup platform, with the same copy rule as R5 | https://www.veeam.com/resources/customer-stories/bedfordshire-hospitals-nhs-foundation-trust.html |

Applied in this design: the DC-B appliance lock in §4.3 is Retention Lock Compliance with the vendor's period bounds; copy 1 (R11, §3, §4.1) is ONTAP tamperproof snapshot locking on ordinary volumes, not SnapLock Compliance snapshots.

## 2 · Requirements register

**Table 3.** Requirements register

| # | Requirement | Value | Source |
|---|---|---|---|
| R1 | Estate | 900 VMs · 420 TB · 9 sites · 2 DCs | [A] |
| R2 | Record system | 40 VMs · 24 TB · 15 % daily change | [A] |
| R3 | Recovery time, record system | 4 hours from declaration to clinicians logged in | [T] |
| R4 | Recovery test | quarterly, full restore of the 40 VMs to DC-B, timed | [T] |
| R5 | Copy rule | 3 copies · 2 media · 1 off-site · 1 immutable · 0 restore errors | [T] |
| R6 | Primary repository | Veeam hardened repository on Linux; certificate-based authentication, SSH cannot be used | [S] Veeam requirements and limitations |
| R7 | Immutability | backup files cannot be moved, modified or deleted during the period; can be copied | [S*] Veeam hardened repository summary |
| R8 | Immutability period | 30 days on the hardened repository | [A] |
| R9 | Repository hardware | 2U, 2 × AMD EPYC 9005, up to 24 × 2.5-inch SAS/SATA or 40 × E3.S NVMe | [S] PowerEdge R7725 |
| R10 | Second copy | deduplicating appliance in DC-B, 12–256 TB usable, up to 19.2 PB logical, 2U | [S] PowerProtect DD6410 |
| R11 | Fastest tier | ONTAP snapshots on the production AFF, locked with tamperproof snapshot locking on ordinary (non-SnapLock) volumes: ONTAP 9.12.1 or later, SnapLock license, compliance clock initialized; cannot be deleted before expiry | [S] NetApp snapshot locking, page dated May 8, 2026, read Sep 27, 2026 |

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| # | Requirement | Value | Source |
|---|---|---|---|
| R12 | Production storage | AFF A70, 4U, 48 drive slots, 6.6096 PB max raw per HA pair | [S] |
| R13 | Restore throughput needed | 24 TB in ≤ 2.5 h of the 4 h = 9.6 TB/h ≈ 2.7 GB/s | [T] derived from R2, R3 |
| R14 | Verification | every backup of the 40 VMs boots and passes a health check | [T] "0 errors"; [A] method |

Fourteen rows; six carry a vendor figure, four are design assumptions, four are design targets.

## 3 · Architecture overview

```
DC-A production: NetApp AFF A70 ── tamperproof locked snapshots (copy 1, fastest)
     │ Veeam backup, own VLAN
     ↓
DC-A: Veeam hardened repository, Dell PowerEdge R7725, Linux, 30-day immutability (copy 2)
     │ backup copy job, 2 × 100 GbE inter-DC
     ↓
DC-B: Dell PowerProtect DD6410, retention-locked (copy 3, off-site, second medium)
Quarterly: 40 record-system VMs restored to DC-B AFF, clock runs 4 h, result recorded
```

**Figure 1.** Three backup copies and the quarterly restore

Three copies on three different things: a locked snapshot on the array, a locked file on a Linux server nobody can SSH into, and a locked object on a deduplicating appliance 12 km away. The 4-hour test is run against the middle copy because that is the one an attacker who owns the array cannot reach.

**Table 4.** Architecture overview

| Role | Product (exact model) | Qty | Capacity used | Why this unit |
|---|---|---|---|---|
| Backup software | Veeam Backup & Replication 13 | 1 | 900 VMs [A] | hardened repository, immutability [S*] |
| Hardened repository | Dell PowerEdge R7725 | 2 (DC-A, N+1) | 420 TB full + 30 days at 3 % estate change ≈ 800 TB, ≈ 400 TB at 2:1 compression, of 737 TB raw per node (24 × 30.72 TB E3.S) [A] | up to 40 × E3.S NVMe, 2 × EPYC 9005 [S] |
| Second copy | Dell PowerProtect DD6410 | 1 (DC-B) | ≈ 800 TB logical, ≈ 200 TB usable at 4:1 dedup [A], of 256 TB usable [S] | Veeam listed as compatible software [S] |
| Snapshot tier | NetApp AFF A70, ONTAP tamperproof snapshot locking | 1 pair (DC-A) | 7 days of hourly snapshots [A] | locked snapshots cannot be deleted before expiry [S] |
| Restore target | NetApp AFF A70 (DC-B) | 1 pair | 24 TB during test [T] | 24 × 200 GbE and 36 × 100 GbE ports for restore ingest [S] |

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# 4 · Design by subsystem

### 4.1 Copy 1, ONTAP snapshots.

Hourly snapshots on the record-system volumes, seven-day retention [A], locked with ONTAP tamperproof snapshot locking. From ONTAP 9.12.1 a snapshot on a non-SnapLock volume can be locked with the SnapLock compliance clock so that it cannot be deleted until its expiry; the cluster needs the SnapLock license (included in ONTAP One) and an initialized compliance clock, snapshot locking is enabled on each volume, and the seven days are the retention period in the volume's snapshot policy; a volume holding unexpired locked snapshots cannot be deleted [S] (NetApp, page dated May 8, 2026, read Sep 27, 2026). The record-system volumes stay ordinary volumes: no SnapLock Compliance volume is needed for this tier. Restore path, used when the array is intact and the damage is logical: a volume clone from the chosen locked snapshot, presented to the hosts in minutes [A]; an in-place snapshot restore works only from the most recent locked snapshot and fails while later unexpired ones exist [S]. Rejected: SnapLock Compliance or Enterprise volumes for this tier. They commit files to WORM [S] (SnapLock overview), which is not how the record system's live database volumes are written [A], and Enterprise mode allows an audited privileged delete [S]; the point of this tier is that no administrator can delete a copy inside its period.

### 4.2 Copy 2, hardened repository.

Two PowerEdge R7725, each 2U with 24 of 40 E3.S bays filled with 30.72 TB NVMe **[S][A]**, running the Linux build Veeam supports for a hardened repository; the requirements page states certificate-based authentication only and that SSH cannot be used [S]. Veeam describes the immutability as the period during which files "cannot be moved, modified or deleted, but can be copied" [S*]; the design sets 30 days [A]. The Veeam Infrastructure Appliance option has its host-management web UI disabled, as the vendor recommends [S]. Rejected: the existing Windows repository — same credentials as production, no immutability (R5).

### 4.3 Copy 3, appliance in DC-B.

DD6410: 12–256 TB usable, up to 19.2 PB logical, 2U [S], Veeam named on the vendor's page as compatible software [S]. Backup copy job from the hardened repository nightly over the 2 × 100 GbE inter-DC link [A]. Retention Lock Compliance on the appliance, the mode an administrator cannot revert, with a separate security-officer user [S] (`https://www.dell.com/support/kbdoc/en-us/000079803/data-domain-retention-lock-frequently-asked-questions-faq`); the period is set to 30 days [A] inside the vendor's 12-hour to 70-year bounds [S]. Rejected: Retention Lock Governance — an administrator can remove it, which fails the reason copy 3 exists. Rejected: a second hardened repository in DC-B — same medium as copy 2, fails the "2 media" clause of R5.

### 4.4 The 4-hour restore.

Declaration at T+0. T+0:15: DC-B hosts and the DC-B AFF A70 confirmed clean [A]. T+0:15 to T+2:45: 40 VMs restored from the hardened repository to the DC-B AFF at 2.7 GB/s sustained [T], across 4 × 100 GbE from the two repository nodes [A]. T+2:45 to T+3:30: application vendor starts the record system, database consistency check [A]. T+3:30 to T+4:00: clinicians log in at two sites [A]. The throughput figure is the design target the quarterly test measures; the AFF A70's 36 × 100 GbE and 24 × 200 GbE host ports [S] are not the limit at 2.7 GB/s.

### 4.5 Quarterly test.

Same runbook every quarter, to the DC-B AFF, with production untouched; the clock starts at declaration and the result is recorded as pass or fail against 4 hours, with the measured restore throughput [T]. Any restore error in the year's four tests fails the "0" clause of R5 until fixed [T].

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### 4.6 Verification.

Every backup of the 40 VMs is booted in an isolated network and checked for OS start, database service start and a login page response before the copy job runs [A]; a failed check blocks the copy and pages the on-call engineer [A].

## 5 · Failure behavior

**Table 5.** Failure behavior

| Failure | Behavior | Source |
|---|---|---|
| Production array encrypted by an attacker | copy 1 lost with the array; copy 2 intact, no SSH path from production; restore from copy 2 in 4 h | [S] hardened repository authentication; [T] R3 |
| Backup server compromised | files on the hardened repository within the period cannot be deleted from the backup server | [S*] immutability; [A] period 30 days |
| One hardened repository node down | second node holds a full copy; restore throughput halves | [A] N+1 |
| DC-A lost entirely | copies 1 and 2 lost; restore from DD6410 in DC-B, slower than 4 h; time recorded | [A]; [T] out of R3 scope |
| Inter-DC link down | copy 3 lags; copies 1 and 2 continue; alarm at 24 h of lag | [A] |
| Verification boot fails | copy job blocked; on-call paged; previous restore point kept | [A] §4.6 |

## 6 · Limits

- 2.7 GB/s sustained is a target, not a measurement; the first quarterly test sets the real number.
- The 4-hour target covers loss of the production array, not loss of DC-A; that case restores from the appliance and is timed separately.
- Repository sizing at 30 days of 3 % estate change and 2:1 compression is an assumption; a month of real change data resizes it.
- Veeam's immutability-period bounds for the hardened repository were not read from a vendor page and the 30 days is marked [A]; the appliance's bounds (12 hours to 70 years) are [S] per §4.3.
- Application-level consistency of the record system database is the application vendor's procedure, not this design's.
- ONTAP does not support tamperproof snapshots on consistency groups or with FabricPool [S] (NetApp, May 8, 2026); the record-system volumes are therefore not placed in an ONTAP consistency group or a FabricPool tier [A].

## 7 · Lessons learned

None yet — this is a design study; populated after the first build against it.

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## 8 · The author

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SYMBEEO

Each vendor's tool shows you their option. We show you all of them against one requirement.

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Figures are as published by their sources on the dates given in this document; figures marked [A] are assumptions.

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