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DESIGN STUDY

Edge servers for 60 plants: 180 units to be staged, baselined and certificate-enrolled centrally, and shipped ready to rack

Complete design on current platforms

CAPABILITY	INDUSTRY	SETTING
Implementation Services	Manufacturing	Manufacturer
DOCUMENT	**VERSION**	**DATE**
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Document control

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Sign-off	"An engagement under this design is signed by the practice lead before any build proceeds."		

Contents

1 · Scope 3
1c · Public implementations this design follows 4
2 · Requirements register 4
3 · Architecture overview 6
4 · Design by subsystem 6
5 · Failure behavior 7
6 · Limits 7
7 · Lessons learned 8
8 · The author 8

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CONVENTIONS

Source tags. [S] figure read from the vendor's or publisher's own current page on Sep 24, 2026 · [S*] figure from the publisher's summary or a secondary report, where the publisher's full text could not be read on that date · [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 27, 2026	1.0	First issue.
Oct 10, 2026	1.1	Approval line now reads: approved by the Founder, issued by Symbeeo. Steve Phillips remains the author.

1 · Scope

Who it is for. The head of plant infrastructure at a manufacturer putting a small server cluster into every factory, where no plant has a server engineer, a line stoppage is measured in lost output, and the security team will not accept a server that arrives with factory credentials or an unknown firmware level.

Typical buyer [A]. A manufacturer with 60 plants. Each plant receives a three-node edge cluster for its manufacturing execution and line applications: 180 servers in total. Plants have a comms cabinet or a small server room on the shop floor, with dust and heat above office levels. The client's certificate authority and credential vault are central. The plant network is in place.

What is in. Receipt; central staging at an integrator area; burn-in; firmware baseline; out-of-band, credential and certificate enrollment; per-plant rendering of names and addresses; first-article plant; kitting, labeling and dispatch; the plant install with a remote engineer; the record; handover. **What is out.** The edge platform's design and its hypervisor (SDD-DC-001 path); the plant network (Networking capability); the line applications; plant electrical works.

Assumptions. HPE is the server vendor: HPE ProLiant DL145 Gen11 [A]. Staging at an integrator area (SRA-IMP-001 D1, second option), because 180 units through 60 plant rooms would put burn-in on the shop floor [A]. Ten plants a week after the first article [A]. A plant electrician racks and powers the kit while a Symbeeo engineer works remotely [A].

Related documents, read Sep 24, 2026.

- SRA-IMP-001, SDD-IMP-001, STP-IMP-001 — this capability's reference architecture, design and test plan
- HPE ProLiant DL145 Gen11 QuickSpecs, version 22, Sep 8, 2026, read in full Sep 27, 2026 — https://www.hpe.com/us/en/collaterals/collateral.a50009217enw.html
- DMTF, Redfish release 2025.3 — https://www.dmtf.org/content/redfish-release-20253-now-available
- NIST SP 1800-34, Validating the Integrity of Computing Devices — https://www.nccoe.nist.gov/publication/1800-34/
- HPE Factory Express Level 4 data sheet, a50003229enw Rev. 5 (PDF dated Jun 29, 2026; the landing page still labels it Rev. 4), read Sep 27, 2026 — https://www.hpe.com/us/en/collaterals/collateral.a50003229enw.html
- HPE press release on a US fuel-and-convenience chain's 800+ gas service station stores using HPE ProLiant servers at the edge, Dec 13, 2023, read Sep 27, 2026 — https://www.hpe.com/us/en/newsroom/press-release/2023/12/racetrac-revs-up-customer-experience-for-800-gas-service-station-stores-using-hpe-proliant-servers-at-the-edge.html

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- NetBox v4.6 release notes — https://netboxlabs.com/docs/netbox/release-notes/version-4.6

1c · Public implementations this design follows

Table 2. Public implementations this design follows

Implementation	Who published it · date	What it settles for this design	URL
Redfish 2025.3 adds a CertificateEnrollment schema for automatic certificate enrollment by SCEP or ACME	DMTF · release 2025.3, posted Oct 13, 2025 · vendor documentation, used to build our own design	R8: where the BMC implements it, the certificate is enrolled and renewed without a hand-made CSR	https://www.dmtf.org/content/redfish-release-20253-now-available
HPE Factory Express Level 4: slotting, cabling, BIOS and firmware settings, OS load and power-on self-test at the factory; no burn-in duration stated	HPE · data sheet a50003229enw Rev. 5, PDF dated Jun 29, 2026 · vendor documentation, used to build our own design	SRA-IMP-001 D1: why the factory line was not chosen: it publishes no burn-in duration to meet R5	https://www.hpe.com/us/en/collaterals/collateral.a50003229enw.html
Acceptance testing of delivered computing devices against their platform certificates with the HIRS attestation CA	NIST NCCoE, SP 1800-34 · final Dec 2022 · published guidance, used to build our own design	R4, where the manufacturer issues a platform certificate for the unit	https://www.nccoe.nist.gov/publication/1800-34/
A US fuel-and-convenience chain put HPE ProLiant servers in every one of its 800+ gas station and convenience stores, running pumps, checkout, payment and inventory on site	HPE press release · Dec 13, 2023 · public deployment	§1 and R1: one server platform put into every one of hundreds of sites is an established pattern; this plan applies it to 60 plants	https://www.hpe.com/us/en/newsroom/press-release/2023/12/racetrac-revs-up-customer-experience-for-800-gas-service-station-stores-using-hpe-proliant-servers-at-the-edge.html

The Redfish and SP 1800-34 rows are [S*]: the figures are from the publishers' summaries; the Redfish posting date and the SP 1800-34 publication date (NIST CSRC, https://csrc.nist.gov/pubs/sp/1800/34/final) were confirmed on Sep 27, 2026. The Factory Express row was read in full on Sep 27, 2026: it lists power-on self-test and solution testing and states no burn-in duration [S]. The fuel-and-convenience chain row, read Sep 27, 2026, is HPE's release about another organization's stores, not plants and not a Symbeeo engagement; it names no server model and no staging method, so it is cited for the pattern only.

2 · Requirements register

Table 3. Requirements register

#	Requirement	Value	Source
R1	Units	180 servers · 60 plants · 3 per plant	[A]

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#	Requirement	Value	Source
R2	Server	HPE ProLiant DL145 Gen11: 2U, one AMD EPYC 8004 processor up to 64 cores or EPYC 8005 up to 84 cores (225 W); 16 in deep without the bezel filter, about 20 in with it; up to 55 °C with HPE's -5–55 °C configuration and high-temperature trigger kit, at which HPE lists every EPYC 8005 processor as supported with the standard heat sink but not the 8004 8324P, 8434P or 8534P; up to 6 E3.S drives; an EPYC 8005 processor is ordered	[S] HPE QuickSpecs version 22, Sep 8, 2026, read in full Sep 27, 2026; [A] processor choice
R3	First article	one plant kit staged, shipped, installed and signed before volume starts	[T]
R4	Receipt integrity	180 of 180 match the order by serial and component inventory; platform certificate verified where HPE issues one	[A]; [S*] SP 1800-34; SRA-IMP-001 R4
R5	Burn-in	manufacturer diagnostics plus 72 h load; zero uncorrected errors	[A]; SRA-IMP-001 R5
R6	Firmware baseline	100 % of units at the baseline, read back over Redfish after burn-in	[T]; SRA-IMP-001 R6
R7	Credentials	factory credentials replaced by a unique credential per BMC, held only in the client's vault	[T]; SDD-IMP-001 §4.5
R8	BMC certificate	issued by the client CA; by Redfish automatic enrollment (SCEP or ACME) where the BMC supports it, otherwise by CSR	[S*] Redfish 2025.3; [A] fallback
R9	Per-plant rendering	hostname, addresses and cluster name rendered from the source of truth; zero typed at the plant	[T]; SRA-IMP-001 R8
R10	Staging network	no route to any client plant or corporate network	[T]
R11	Throughput	30 servers a week (10 plants); the remaining 177 in 6 weeks after the first article	[T]
R12	Ship-ready kit	per plant: 3 servers labeled to the plant's elevation, cords, asset file, shock logger	[A]
R13	Plant install	racked, powered and joined to the cluster in ≤ 4 h per plant, inside a planned line stop or outside production hours	[T]
R14	Record	every unit's serial, plant, position, firmware, certificate and burn-in result in NetBox 4.6	[S] NetBox 4.6; [A] tool choice

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Fourteen rows; two carry a vendor figure read in full, two a summary figure, three are design assumptions, seven are design targets.

3 · Architecture overview

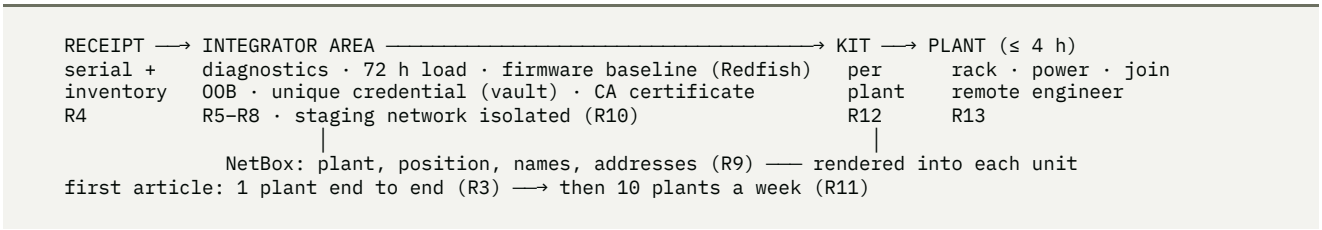


Figure 1. Central staging and plant deployment

All the work that needs an engineer happens in one place; what reaches a plant is three servers that already know which plant they belong to. The plant's part is mechanical and the remote engineer's part is to watch the cluster form.

Table 4. Architecture overview

Role	Product (exact model)	Qty	Capacity used	Why this unit
Edge server	HPE ProLiant DL145 Gen11	180	3 per plant [A]	short-depth 2U for edge sites, up to 55 °C in the high-ambient configuration, high-dust and high-vibration rated [S]
BMC interface	DMTF Redfish	per unit	firmware read, credential and certificate set [A]	automatic certificate enrollment from release 2025.3 [S*]
Source of truth	NetBox 4.6	1	60 plants, 180 units [A]	v4.6.0 released May 5, 2026; v4.6.10 on Sep 1, 2026 [S]
Staging	integrator area, burn-in positions for 30 units	1	30 units a week at a 4-day cycle [T]	SRA-IMP-001 D1 [A]

4 · Design by subsystem

4.1 Receipt.

Every server scanned by serial at the dock against the order, and its component inventory recorded [A]. Where HPE issues a platform certificate for the unit, it is verified by the SP 1800-34 method [S*]; where it does not, the inventory record is the check and this is stated in the record [A]. A mismatch is quarantined (SRA-IMP-001 F1).

4.2 Burn-in.

Thirty positions with A/B power, out-of-band and staging-network ports, inlet temperature logged [A]. Diagnostics, then 72 h load; any unit with an uncorrected error is held and replaced from staging stock so the plant kit leaves complete [A].

4.3 Baseline and identity.

After burn-in: firmware, BIOS and BMC set to the baseline and read back over Redfish (R6); factory credentials replaced by a unique credential written straight to the client's vault (R7); BMC certificate from the client CA (R8). Redfish 2025.3

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defines automatic enrollment by SCEP or ACME [S*]; whether the DL145 Gen11's BMC implements it is confirmed at the first article, and the CSR path is the fallback [A]. The staging network has no route to any client network (R10).

4.4 Per-plant rendering.

Each plant is a site in NetBox with three positions; hostnames, management and cluster addresses and the cluster name are rendered from it and applied at staging (R9) [T]. Labels are printed from the same record, so the label and the configuration cannot disagree [T].

4.5 First article.

One plant's kit goes through every step, ships, is installed and signed before the second plant starts (R3). Anything learned there changes the build sheet by change order (SDD-IMP-001 §8.1) [A].

4.6 Dispatch and install.

Kit per plant: three servers, cords, asset file, shock logger (R12). At the plant, the electrician racks and powers; the remote engineer confirms the three BMCs over out-of-band, then watches the cluster form (R13) [A]. Plant install is booked inside a planned line stop or outside production hours [A].

5 · Failure behavior

Table 5. Failure behavior

Failure	Behavior	Source
Unit fails receipt check	quarantined; HPE replaces; plant kit waits or takes staging stock	[A]; SRA-IMP-001 F1
Unit fails burn-in	held; replaced from staging stock; kit ships complete	[A]; SRA-IMP-001 F2
BMC does not support automatic enrollment	CSR path used; certificate expiry tracked in the record	[A] R8
Firmware drift found at read-back	unit re-baselined and its firmware read back again; the diff is kept	[A]
Shock logger tripped in transit	remote power-on test before the unit joins the cluster	[A]
Plant cannot give a line stop	install moves to the plant's next non-production window; staging continues	[A]

6 · Limits

- DL145 Gen11 figures come from the full QuickSpecs, version 22 of Sep 8, 2026, read Sep 27, 2026 [S]; HPE has issued 22 versions since Sep 3, 2024, so the signing engineer checks the current version, and its temperature table, before ordering.
- Platform-certificate verification depends on HPE issuing one for this model; if it does not, receipt integrity rests on the inventory record.
- Redfish automatic enrollment is a DMTF schema; support on the BMC is a firmware fact confirmed at the first article.
- Thirty burn-in positions set the ceiling; faster delivery needs more positions, not shorter burn-in.

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- Plant electrical capacity and cabinet space are assumed; a plant that cannot take the kit is surveyed separately.

7 · Lessons learned

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

8 · The author

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SYMBEEO

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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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