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DESIGN STUDY

Multi-vendor rack staging: 200 racks a year, built and burned in before shipping

Complete design on current platforms

CAPABILITY	INDUSTRY	SETTING
Supply Chain & Integration	Global Service Providers	Cloud provider
DOCUMENT	**VERSION**	**DATE**
INT-003	1.3	Oct 10, 2026

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Document control

Document	INT-003	Version	1.3
Issued	Oct 10, 2026	Status	Issued by Symbeeo
Classification	Public	Supersedes	1.2, Sep 27, 2026
Capability	Supply Chain & Integration	Industry	Global Service Providers
Author	Avinash Dhinakaran	Role	Principal Integration Architect
Credentials	iSAQB Certified Professional for Software Architecture – Advanced Level (CPSA-A), Oracle Certified Consultant – Value Chain Planning, Master Data Management, SCM Cloud		
Approval	Approved by Edwin Ozer, Founder, Oct 10, 2026. Issued by Symbeeo, Oct 10, 2026. Design study: every figure is vendor-published, a design target or a marked assumption.		
Sign-off	"An engagement under this design is signed by the practice lead before any build proceeds."		

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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 · [T] design target (the record's outcome figure and anything derived from it). Every figure carries one tag. No figure comes from any prior 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. Avinash Dhinakaran remains the author.

1 · Scope

Who it is for. The head of infrastructure delivery of a cloud provider opening capacity in three regions who wants racks to arrive on site built, cabled, powered on and tested, so that site work is placement, uplink and acceptance rather than assembly.

Typical buyer [A]. A cloud provider expanding three regions. Rack demand of 200 racks a year across two rack types: a compute rack (Dell and HPE 2U servers) and a network rack (Cisco or Arista 800G switching). Split assumed 160 compute, 40 network [A]. One staging facility serving all three regions [A].

What is in. Intake of vendor shipments; rack assembly to a per-type build sheet; power and network cabling; firmware baseline; 72-hour burn-in; QA gates; labeling and asset capture; crating and dispatch; change-order tracking per project. **What is out.** Site fit-out (power, cooling, cage); the leaf-spine design itself (DC design studies); commercial negotiation with the four vendors.

Assumptions. Compute racks: 16 × 2U servers per rack in either Dell PowerEdge R7725 or HPE ProLiant Compute DL380 Gen12, plus 2 top-of-rack switches [A]. Network racks: 8 × 800G switches, Cisco Nexus 9364E-SG2 or Arista 7060X6-64PE by region standard [A]. Staging hall has burn-in power of 40 kW per bay across 12 bays [A]. These are the design's own figures, not Symbeeo's staging floor, whose size and throughput are not published (SRA-INT-001).

Related documents, read Sep 18, 2026. Dell PowerEdge R7725 product page (https://www.dell.com/en-us/shop/dell-poweredge-servers/new-poweredge-r7725-rack-server/spd/poweredge-r7725/pe_r7725_tm_vi_vp_sb) · HPE ProLiant Compute DL380 Gen12 product page (https://www.hpe.com/us/en/products/compute/proliant/dl380-gen12.html) · Arista 7060X6 Series product page (https://www.arista.com/en/products/7060x6-series) · Cisco Nexus 9364E-SG2 data sheet (https://www.cisco.com/c/en/us/products/collateral/switches/nexus-9000-series-switches/nexus-9364e-sg2-switch-ds.html) · HPE Factory Express Level 4 data sheet, a50003229enw (Rev 4 read Sep 20, 2026; Rev. 5 read Sep 27, 2026) (https://www.hpe.com/us/en/collaterals/collateral.a50003229enw.html) · Dell Rack Integration Services data sheet, March 2024 (https://www.delltechnologies.com/asset/en-my/solutions/infrastructure-solutions/technical-support/enterprise_rack_integration_services_data_sheet.pdf) · An observatory's IT group, ITTN-026, a data-center fiber and copper deployment record, revised Sep 11, 2020 (https://ittn-026.lsst.io/).

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1c · Public implementations this design follows

Each row is labeled. **Public deployment**: a named operator's real deployment, published and dated by the operator, its vendor or a partner, used where one exists. **Our own design**: the dated vendor or standards documentation this design was built from, where no public deployment of the design exists. Labels and dates checked Sep 27, 2026.

Table 2. Public implementations this design follows

Implementation	Who published it · date	What it settles for this design	URL
Our own design, built from published documentation. HPE Factory Express Level 4	HPE · data sheet a50003229enw, Rev. 5 (PDF dated Jun 29, 2026), read Sep 27, 2026; Rev 4 read Sep 20, 2026	The published factory scope is slotting, interface cards, in-rack cabling, cable labeling, BIOS and firmware settings, OS load, power-on with built-in self-test; it states no burn-in duration, so R3's 72 h stays a target; HPE contacts the customer within 7 business days of order acceptance to set a delivery date, and delivery must be received within 180 days	`https://www.hpe.com/us/en/collaterals/collateral.a50003229enw.html` · `https://assets.ext.hpe.com/is/content/hpedam/a50003229enw`
Our own design, built from published documentation. Dell Rack Integration Services	Dell Technologies · data sheet, March 2024	The published deliverable per rack is a rack layout and asset report plus asset tags, uniform firmware, standardized BIOS, and rack stress tests on request; it states no burn-in duration; R13's asset file is that report	`https://www.delltechnologies.com/asset/en-my/solutions/infrastructure-solutions/technical-support/enterprise_rack_integration_services_data_sheet.pdf`
Public deployment. ITTN-026, an observatory data center's fiber and copper deployment record	The observatory's IT group · revised Sep 11, 2020	An operator's per-rack record in the public domain: one 48U rack with its 48-port switch, 24 patch-panel points and 2 PDUs listed by position, with cable types per run; the build sheet and cable schedule in §3 carry the same fields	`https://ittn-026.lsst.io/`

R3 records that neither vendor's factory-integration data sheet publishes a burn-in duration.

2 · Requirements register

Table 3. Requirements register

#	Requirement	Value	Source
R1	Annual throughput	200 racks a year	[T]
R2	Weekly rate	4 racks a week at 50 working weeks	[T] derived from R1
R3	Burn-in duration	72 hours under load per rack before dispatch; neither the HPE Factory Express Level 4 nor the Dell Rack Integration Services data sheet states a duration	[T]; absence [S] (`https://www.hpe.com/us/en/collaterals/collateral.a50003229enw.html`)
R4	Bays in burn-in at once	12; at 72 h plus 1 day turn, 4 days per bay cycle, 15 racks a week capacity	[A]

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#	Requirement	Value	Source
R5	Compute server, option 1	Dell PowerEdge R7725: 2U, 2-socket AMD EPYC 9005, up to 192 cores per socket, 24 DIMM slots, DDR5-6400, iDRAC10	[S] Dell
R6	Compute server, option 2	HPE ProLiant Compute DL380 Gen12: 2U, 2-socket Intel Xeon 6 up to 144 cores, up to 8 TB DDR5-6400, up to 36 E3.S NVMe, iLO 7	[S] HPE
R7	Compute rack power	16 servers; R7725 PSU options 800/1100/1500/2400 W; budget 1,500 W per server typical, 24 kW per rack at burn-in	[S] Dell PSU list; [A] budget
R8	Network switch, option 1	Cisco Nexus 9364E-SG2-O or -Q: 64 × 800G, 102.4 Tbps (Cisco's full-duplex figure), 2 RU, typical 995 W, max 2,270 W, 1+1 PSU	[S] Cisco
R9	Network switch, option 2	Arista 7060X6-64PE: 64 × 800G OSFP, 51.2 Tbps, 2 RU, 165 MB buffer	[S] Arista
R10	Firmware baseline	one version set per rack type, recorded per serial	[A]
R11	Change orders	every deviation from the build sheet logged per project with approver and date	[T]
R12	Site install time	measured against unbuilt kit; target recorded at first build	[T]
R13	Asset record	serial, position (rack, RU), MAC, firmware, burn-in result per unit, exported before dispatch	[A]
R14	Crate and transit	shock-logged; re-check on arrival before power	[A]

Fourteen rows; six carry a vendor figure or a published absence (R3), four are design assumptions, four are design targets.

3 · Architecture overview

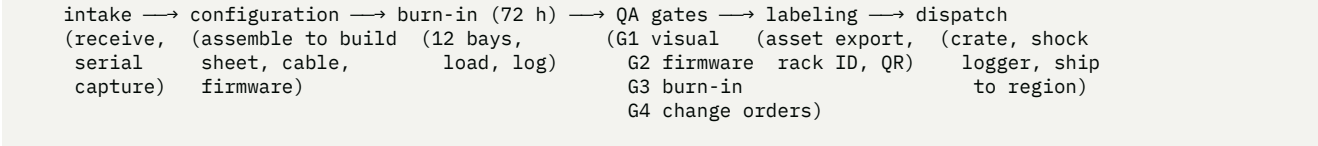


Figure 1. Rack staging flow

A six-stage flow through one staging facility; each stage produces one record; a rack leaves a stage only when the record is complete. The parts table is the QA checklist, because the design is a process.

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Table 4. Architecture overview

Gate	Check performed	Record produced
Intake	every serial on the packing list scanned; damage noted; vendor ship date captured	intake record per shipment
Configuration	rack matches the build sheet position by position; cabling matches the cable schedule; firmware equals the baseline set (R10)	build record per rack, firmware list per serial
Burn-in	72 h under load (R3); power draw, temperature and error counters logged; no uncorrectable error; no PSU or fan fault	burn-in log per rack, pass/fail
QA gate G1 visual	labels, cable dressing, blanking panels, torque marks	G1 checklist
QA gate G2 firmware	second read of every unit's firmware against baseline after burn-in	G2 firmware diff, expected empty
QA gate G3 burn-in review	log reviewed; any unit that failed replaced and re-burned 24 h	G3 sign-off
QA gate G4 change orders	every deviation from the build sheet has a logged change order (R11)	change-order register entry
Labeling	rack ID and QR on both doors; asset export (R13)	asset file per rack
Dispatch	crate, shock logger armed, carrier and region recorded	dispatch record

4 · Design by subsystem

4.1 Intake.

Vendor shipments are received against the purchase order; every serial is scanned into the asset register at the dock, not at assembly, so a missing unit is known on day one [A]. Damage is photographed and claimed within the carrier's window [A].

4.2 Configuration.

Two build sheets, one per rack type, versioned. Compute rack: 16 × Dell PowerEdge R7725 (2U, 2 × AMD EPYC 9005, 24 DIMM slots [S]) or 16 × HPE ProLiant Compute DL380 Gen12 (2U, 2 × Intel Xeon 6, iLO 7 [S]); management by iDRAC10 [S] or iLO 7 [S] respectively; two top-of-rack switches [A]. Network rack: 8 × Cisco Nexus 9364E-SG2 (64 × 800G, 102.4 Tbps, 2 RU [S]) or 8 × Arista 7060X6-64PE (64 × 800G, 51.2 Tbps, 2 RU [S]) by region standard [A]. Firmware is set to the baseline through the management controller before burn-in [A]. Rejected: mixing Dell and HPE in one rack — two firmware baselines and two spares kits per rack [A].

4.3 Burn-in.

12 bays at 40 kW each [A]. A compute rack at burn-in is budgeted at 24 kW (16 × 1,500 W) [A], inside the bay limit; a network rack of 8 switches at the Cisco typical figure of 995 W each is 8 kW, at the maximum figure of 2,270 W each is 18 kW [S]. Load generator drives CPU, memory and NVMe on servers and line-rate traffic on switch ports through loopback optics [A]. 72 h is the target (R3); a unit that fails is swapped and the rack re-burned for 24 h [A].

4.4 QA gates.

Four gates as tabled in §3. Gate G2 exists because firmware can be changed by a burn-in reset; the post-burn-in read is the one that ships [A]. Gate G4 makes the change order the only way a rack differs from its build sheet, which is what

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R11 measures.

4.5 Labeling and asset capture.

Rack ID and QR on both doors; asset file with serial, RU position, MAC addresses, firmware and burn-in result per unit exported before the crate closes (R13) and sent to the region ahead of the rack [A].

4.6 Dispatch and arrival.

Crated with a shock logger; on arrival the logger is read before power is applied; a shock above the crate's rating triggers a re-run of gate G1 and a 4 h power-on test on site [A].

4.7 Throughput.

200 racks a year is 4 a week (R2); 12 bays at a 4-day cycle give 15 a week (R4), a 3.75× margin that absorbs failed burn-ins and quarter-end peaks [A].

5 · Failure behavior

Table 5. Failure behavior

Failure	Behavior	Source
Vendor shipment short	rack held at intake; build sheet not started; procurement notified same day	[A]
Unit fails burn-in	unit swapped from staging stock; rack re-burned 24 h; failure logged against the serial	[A]
Burn-in bay power lost	log shows the gap; the 72 h clock restarts	[T]
Firmware drift found at G2	unit re-baselined; G3 re-run; the diff is kept in the record	[A]
Shock event in transit	on-site G1 re-run and 4 h power-on test before acceptance	[A]
Staging facility capacity exceeded	racks queue at intake; the 3.75× margin (R4) is the buffer; beyond it, a second shift	[A]

6 · Limits

- Power budgets per server and per switch here are vendor PSU ratings and typical figures, not measured draw; the first burn-in sets the real number.
- 12 bays and 40 kW per bay are assumed; the staging hall's actual power decides the throughput ceiling.
- Vendor lead times are outside this design; the flow starts when hardware arrives.
- The install-time saving on site (R12) has no figure until an unbuilt-kit baseline is measured.
- One staging facility for three regions puts transit time into the delivery date; a second facility is a commercial decision.

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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Signed off by Edwin Ozer, Founder.

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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.

INT-003 · Version 1.3 · Oct 10, 2026