

QuantumTouch BNG 1.4.0

Release Notes — General Availability

*The first generally available release. These notes describe the product as it ships rather than as a delta between alpha builds. Capacity licensing and usage records are complete; local AAA becomes the authoritative subscriber store; data-cap enforcement is delivered end to end; and accounting no longer depends on the browser. Controller-layer items are marked **[controller]**.*

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This is the first generally available release. Everything before it was alpha, and these notes describe the product as it ships rather than as a delta between alpha builds. Where a change matters because the alpha behaved differently, that is called out against "the alpha" as a whole — individual pre-GA version numbers are not carried forward.

Covers the QuantumTouch BNG appliance and console together with the Quantum BNG controller. Controller-layer items are marked **[controller]**; everything else is the QuantumTouch console, installer and evaluation appliance.

Overview

The box becomes the system of record, and the console operates it.

The alpha staged two capabilities it could not use: capacity licensing, with a page that displayed a licence but could not activate one, and usage records that were held but never produced from live traffic. Both are complete in GA.

Three further capabilities arrive with them. **Local AAA becomes the authoritative subscriber store** rather than a mirror of controller configuration, with enforcement overlays that converge on every reconcile pass. **Data-cap enforcement** is delivered end to end, from the policy an operator sets to the rate applied on the wire. And **accounting no longer depends on the browser**: a background service drains the controller's spool into a durable local ledger every 30 seconds, where records were previously drained only while a page was open.

The console also adds what an operator needs when something is wrong — a single-action support bundle that opens with a written summary, and health reporting that states how often the dataplane connection has dropped rather than only whether it is currently up.

Component versions

What GA ships. Pre-GA component versions are not listed — the alpha is treated as a single prior state rather than a series to diff against.

Component	Version
Quantum BNG controller	v1.4.0
quantum_core	v1.6.0
quantumtouch-bng (console plugin)	0.10.37
quantumtouch-core	v0.10.24
CPESIM plugin	0.4.18
VPP	25.10.0-23 (v25.10.0-23~g744d3c715)
Installer bundle	1.4.0-14

Requirements

- **Ubuntu 24.04 (Noble)**, x86_64, **kernel 6.x**. Ubuntu 24.04.4 ships 6.8, which is the kernel this release is validated on; installer preflight warns below 6.14 because a few DPDK plugins fall back there. If that fallback matters for your NIC, [linux-generic-hwe-24.04](#) provides 6.14 — it is not required.
 - **TPM 2.0** (`/dev/tpmrm0`) on the target is required to activate a capacity licence. The free tier requires no TPM.
 - **VPP stats-segment sizing**. The BNG allocates a forwarding entry and per-session counters for every subscriber, so the statistics segment must be sized to the deployment's subscriber count — VPP's 32 MB default is exhausted well before scale. 1.4.0 sizes this on install; see *No validated VPP sizing profiles* under Known issues for what is and is not automatic.
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Completed for GA

Capacity-tier session licensing — now operable from the console

The alpha shipped the Licensing page and said plainly that it "cannot yet operate activation." It can now. Three defects stood between the page and a working activation, all fixed:

- **The three licence routes were missing their `/v1` prefix** and returned 404 on every call, so the page could not read status or fingerprint at all.
- **A trailing newline invalidated valid licences.** A licence pasted from a text editor or downloaded to a file failed verification for a reason the operator could not see.
- **Activation itself did not work from the console** — the shipped CLI carries the service key, while activation requires `admin_only`.

The page now reads status, shows the fingerprint, and activates a pasted or uploaded licence. The capacity in force, and its provenance, are stated rather than inferred from the number.

Full accounting — records now come from live traffic, and nothing waits on a browser

The alpha marked usage records a **preview**: held, downloadable and prunable, but not produced from live subscriber traffic.

GA produces them. The console now runs a background drain that claims the controller's accounting spool every 30 seconds, writes it to a durable SQLite ledger in one transaction, and **acks only after the commit lands**. That ordering is the one non-negotiable property in the design: a crash before the ack costs a harmless re-drain, while a crash the other way destroys billing records permanently, because the ack prunes them upstream.

Previously the **browser** consumed that queue. Records drained only when someone opened a page, and the ack — which permanently removes what it consumes — was driven from the UI.

The ledger holds immutable CDRs for completed sessions, a live row per open session, and per-subscriber daily usage rollups, with a daily prune and a scheduled export that exports what is about to be pruned rather than the whole ledger every day.

New features

AAA as system of record [console]

Local AAA is now the authoritative subscriber store, not a view over controller config. `subscriber_id` is treated as an exact opaque key everywhere — never folded, never case-normalised, never inferred from a locator. Enforcement overlays converge on every reconcile pass rather than drifting until something rewrites them, and a subscriber the console does not manage has its overlays left alone.

Data-cap enforcement [console]

An operator sets a monthly cap and a consequence; the box applies it. The subscriber drawer carries a data-cap panel showing the policy, the usage against it and the grant history. Disabling enforcement clears every overlay rather than leaving the last one in force.

Static IP assignment [console]

Assign a fixed address from the subscriber drawer. A conflicting address is rejected before it is written rather than after. "Not mentioned" and "unassign me" are now distinguishable, which they were not — an update that simply did not mention an address used to read as a request to remove it.

Per-subscriber raw rate [console]

A raw per-subscriber rate, expressed as a plan, settable from the subscriber drawer — with the consequence for that subscriber's cap stated on the same screen rather than discovered later.

Subscriber sessions [console]

An account's live sessions are listed on its own page, and an operator can end them from there.

Support bundle [console]

One button produces a diagnostic bundle for a ticket. It leads with a written summary rather than a directory dump, and does its own first-pass triage: GRUB drift, a licensed box mislabelled `free_baseline`, a packet capture that caught nothing, VPP workers against rx-queues, retained config revisions.

It collects **intent** as well as running state — what the operator meant to configure, not only what is currently live — and runs detached, because an in-worker collection thread used to take the dashboard down with it.

New in this release: the controller's **cumulative** health counters. `GET /bng/health` is point-in-time and structurally cannot say the dataplane connection has dropped four times today; the bundle samples it three times at ten-second intervals, so it catches a flap only if one happens inside that window.

`connection_lost_count` states it for the whole uptime.

Add-on lifecycle [console]

Update checking that knows when to stay quiet, install from an uploaded tarball for an offline box, a catalogue whose URL an offline mirror can own, and retention of one previous artifact so a failed update can roll back without a download.

Health page

The VPP card now qualifies "Connected" with how often the connection has dropped, and goes amber when connected-but-flapping. A green pill over a link that dropped four times reads as "nothing to see here" to the operator who is on the phone about it.

Alerting and the metrics reference

Six new Prometheus alert rules ship in the bundle, covering data-cap enforcement — which previously had **none**, despite being the subsystem that throttles paying subscribers:

alert	fires when
<code>BngCapEvaluationStopped</code>	the evaluation loop has died — no caps applied, lifted or rolled over
<code>BngCapOverlayFailing</code>	a cap was decided but the push to the controller failed
<code>BngCapEnforcementSpike</code>	mass enforcement against the recent baseline
<code>BngAccountingRecordsQuarantined</code>	a record could not be parsed, so it will not be billed
<code>BngAaaUnmanagedSubscribers</code>	subscribers exist on the box that the console does not manage
<code>BngAaaPartialPushPersisting</code>	pending provisioning pushes have stopped draining

`BngSessionCapApproaching` is also fixed: in the alpha it could never fire, which is worse than no alert because it reads as coverage.

[docs/metrics/prometheus-metrics.md](#) now documents **all 36** exported metric families, up from 18. Everything the 1.4.0 subsystems added — data caps, the accounting drain, AAA reconcile — was previously undocumented, which left half the [/metrics](#) surface unusable for building your own dashboards. The reference now also states which families are emitted on the 60-second accounting-drain tick rather than the 5-second sampler tick, since that changes what a sensible [rate\(\)](#) window looks like.

From the controller [controller]

Delivered upstream in controller 1.4.0 and available to every console in this release:

- **Faster subscriber onboarding.** The DHCP onboarding path runs on a dedicated worker pipeline with request batching and de-duplication, raising the sustained rate at which subscribers can join and smoothing bursts.
 - **Reboot resilience.** After a bridge or controller restart, DHCP punting re-subscribes correctly and health reports the real state rather than reporting OK while delivering nothing.
 - **Session recovery.** A session the data plane retained through a recovery cycle is re-adopted rather than dropped, removing a class of divergence between the controller and the data plane.
 - **Accounting across an unclean restart.** Open accounting records are reconciled and tagged correctly rather than being left open.
 - **Captive-portal refinements.** A short portal lease settles activation faster, and additional TCP ports can be opened through the walled garden.
-

Behaviour changes

Read these before upgrading. None is a bug fix; each changes what the box does.

Licence enforcement for add-ons is now LIVE

This is the most consequential change in the release.

The console read licence entitlements from a field named `features`. The controller reports them as `grants` and has never sent `features`, so every entitlement resolved as unknown — and unknown failed open. **Add-ons installed regardless of licence**, while the console reported that enforcement was not active.

This is corrected. The consequence: **a paid add-on on a box whose licence does not grant it is now denied**. No existing deployment is affected, because the only add-on shipped to date is the Grafana dashboard pack, which is published as permanently free and is permitted by name rather than by grant.

Two related changes:

- The licensing API response field `features` is now `grants`, carrying a map of name to value rather than a list of names, so an entitlement can express a quantity as well as a yes or no.
- Add-on entitlements are named under `addon.*`.

Idle timeout now defaults to 1 hour [controller]

Raised from 5 minutes, sized for always-on subscribers so that an ordinary traffic lull no longer reclaims a live session. Any value can still be set per subscriber.

The Subscriber column is removed from the sessions table

It could not work on controller 1.4.0. `GET /bng/sessions` returns no `subscriber_id` and no `circuit_id / remote_id`, so the column's join had nothing to join on and **every session rendered "unprovisioned."** A column that is always wrong is worse than no column: it actively tells the operator their fleet is unprovisioned.

It returns in 1.5.0, joined on `subscriber_id`, which the controller adds to the session summary in that release.

Breaking changes [controller]

Controller 1.4.0 reworks the subscriber-identity and provisioning contract. A management plane integrated against 1.3 must be updated, and the subscriber base must be re-provisioned — these are not backward compatible.

The console in this release is already built against the new contract, so an operator using the console needs to take no action beyond the re-provisioning below. These matter to anyone driving the REST API directly.

- **Subscriber records are keyed by an operator-assigned account identity** and carry their locators explicitly, replacing the previous line-id keying. **The subscriber base must be re-provisioned under the account model.**
- **The AAA source is selected at a new `/bng/aaa` endpoint.** The previous `open` / `gated` mode field on the local-AAA configuration is removed.
- **A live plan or status change is made by writing the subscriber record**, which cascades into the running session. The separate per-session plan and revoke calls are replaced.
- **Bulk provisioning request and response fields are renamed** to the account identity.
- **`PUT /bng/session` is now a partial merge** — fields omitted from a request are preserved rather than cleared. A caller that relied on omission to clear a field must now clear it explicitly.

The controller's own release notes carry a migration checklist mapping each old call to its replacement, and a Feature Integration Guide with the request and response contract per capability. Both are the authority for integration work; this section only states what breaks.

Bug fixes

Selected; the ones whose absence changed behaviour an operator would notice.

Subscriber simulator (CPESIM)

- **The demo passes traffic again.** CPESIM 0.4.17 shipped without the commands that clear stale veth devices before recreating them, so the simulator's uplink path came up half-built and the demo onboarded subscribers while moving no traffic — ~0 Mbps, with the Simulator page showing subscribers connected and reporting no error, because the engine's failure logging had been dropped in the same build. 1.4.0-14 pins **CPESIM 0.4.18**, which restores both, and makes a burst that moves no bytes report the reason it already had. Measured on an evaluation appliance: 0.001 Mbps before, **1,097 Mbps after**.

Sessions

- **An unavailable session list no longer renders as an empty one.** A failed fetch of the session list reported nothing, so the table came up blank and silent — indistinguishable from "this box has no sessions". That is the most misleading thing the page can say, because the request is most likely to fail precisely when there are a great many sessions to return. The page now says which it is, and a failed *refresh* keeps the last good list on screen rather than blanking a table you are reading. This makes a failure legible; it does not change how the page performs at scale — see *Console polling load* under Known issues.

Snapshots

- **A restore now actually restores.** Per-block PUTs could only restore what had an endpoint a restore could safely drive; the subscriber base, the access-interface set and the switch registration had none, so a REPLACE restore could not put a wiped box back however many blocks it applied. It now applies the controller's whole captured state.
- **A restore would have disabled every access port in the snapshot.** The access-port call sent the wrong key names with no address, which the schema rejected — and that rejection was the only thing preventing worse. The field it read to decide enabled/disabled does not exist on 1.4.0, so it evaluated false for every interface.

Accounting and the ledger

- Three residual ways the daily maintenance could destroy billing data.
- A quarantined billing record is no longer invisible.
- An implausible `retention_days` is refused rather than silently deleting a year.
- A retained live population no longer starves the drain forever.
- CDRs are filtered in SQL, so an old date range is reachable.
- A failed CDR fetch is distinguished from an empty ledger.

Data caps

- Cross-subscriber leakage in the grant panel.
- Disabling enforcement clears every overlay.

- `status()` queries hoisted out of the per-subscriber loop.

Controller state

- **The retained config history is now bounded** (upstream bng#41). Nothing read old config revisions, and unbounded growth cost provisioning latency roughly tenfold at the same subscriber base — a slowdown that survived a restart.
- Importing as non-root no longer dies on the CA probe.

Console

- The captive-portal `portal_ip` save no longer erases the walled garden.
 - The metrics sampler no longer fetches the whole controller config every tick — about 1.9 MB per call at 10,000 subscribers, every five seconds, for a key no controller has ever published.
 - The cap caption no longer says "Community" on a licensed box, and the sessions chart draws the cap line at the cap actually in force.
 - AAA faults surface in the alert centre.
 - The wipe notice names `aaa_source` among what was not restored.
-

Known issues

Issue references below are internal tracking identifiers, not public links. `#NN` refers to the QuantumTouch console and appliance; `bng#NN` to the Quantum BNG controller — the two are numbered separately, so `#38` and `bng#38` are different items. Quote them when raising a support ticket.

Session reclamation at high scale [controller] — bng#50

Under sustained churn at 18,750 concurrent sessions, the controller's session view stops reclaiming released sessions: measured at exactly its high-water mark for 550 seconds with a drain rate of zero, while clients had released down to 8,191. Nothing is lost — orphans were zero in every run — and the cap, dataplane and onboarding paths are unaffected.

Traced upstream to two defects, **both fixed in controller 1.5**: relayed DHCP RELEASEs were dropped entirely (so reclamation only happened on lease timeout), and teardown ran per-packet, capping reclaim at a few hundred per second.

Not reproducible at 7,500 and below across three runs.

Session count under sustained churn [controller] — bng#36

A separate effect from the reclamation issue above, and it presents differently: under sustained high churn the controller's reported session view can **under-count a cohort of otherwise-stable sessions**. The sessions themselves remain bound and carrying traffic; it is the count that is short, and the affected sessions reappear in the view when they next renew.

Reclamation above is a count that stays too *high*; this is a count that reads too *low*. Both are view-level, and neither loses a session. Investigation is ongoing upstream, with verification scheduled for a post-1.4 test cycle.

Practical consequence: during a churn event, treat the session count as indicative and the pool's allocation figure as authoritative.

The Dataplane page reports the BNG's own NICs as unassigned — #49

The console's devbind view sorts NICs into *kernel*, *DPDK* and *VPP*. A NIC is placed under **VPP** only when it appears in the stored port-assignment list; the bucket records the assignment an operator made, not what VPP is driving at that moment. On a box whose ports were never assigned through the console — a hand-configured `startup.conf`, or a commissioning run that stopped before the Dataplane step — the access and uplink NICs are correctly shown as DPDK-bound but never attributed to VPP, even while VPP is forwarding on them.

The display is the smaller half. The same stored list is what makes `/api/dpdk/devbind/bind`, `/unbind` and `/reset-all-to-kernel` refuse an operation on a port VPP is using: with the list empty those endpoints do **not** return `409 VPP_MUST_BE_STOPPED`, so a rebind requested against a live dataplane NIC is carried out instead of refused. The rebind also re-renders `/etc/vpp/startup.conf`. Nothing does this on its own — it needs an operator or a script to ask for it — but the guard that should stop it is not armed.

Workaround. Assign the dataplane ports on the Dataplane page as part of commissioning, before the box carries subscribers. That records the assignment, restores the VPP attribution and re-arms the guard. On a box already in service, do **not** use the bind / unbind / reset-to-kernel controls to fix the display: the operation will be allowed and will interrupt forwarding. Assign the ports during the next planned maintenance window instead.

Affects the console's reporting and that guard only. Subscriber onboarding, forwarding, QoS and the session cap do not consult this list, and the dataplane itself is unaffected — this is visible in the 1.4.0 validation run, where the check for VPP-attributed NICs is the single failing check on a box that passed every forwarding, onboarding and QoS measurement in the same run.

RADIUS is not active — #17

The `/bng/radius` surface is inert in this build; local AAA is the AAA backend. `GET` reports `active: false` and `PUT` is refused, deliberately, so an operator cannot configure a backend that silently does nothing. An ISP that already runs an external AAA or OSS cannot integrate with this release.

There is **no RADIUS page in the console** — it has been unrouted since v1.2, so nothing in the UI invites you to configure a backend that would not work. The Health page reports **AAA** (source, subscriber count, and the unknown-CPE policy) rather than RADIUS server reachability. Earlier builds showed two red "RADIUS Unreachable" cards on every box, which was a false alarm for a subsystem that is inert by design; that is fixed in this release.

External AAA integration is tracked as #17, as a paid plugin covering FreeRADIUS, Splynx, Sonar, UISP and Powercode — provisioning in, records out.

No live coverage that an add-on installs — #38

The add-on install path is thoroughly unit-tested, but every one of those tests mocks the fetch, the hash and the unpack. Nothing verifies that a real pack downloads from its distribution point, installs on a real box and then functions. Tracked for 1.5.0 as #38.

The Subscriber column — #27, restored by #37

Removed — see *Behaviour changes*.

Only subscribers reconcile after a controller upgrade — #31

See *Upgrading*. The controller discards its configuration replica on upgrade, and **nothing re-pushes it automatically**. The console is the authority, but it has no drift-triggered full-state reconciler in 1.4.0: there is no `config_hash` drift detection in the console at all, and the only reconciler that exists operates on the AAA store.

Recovery is therefore operator-initiated: take a snapshot first and restore it. That works — see *Upgrading* for the two restore paths and what each covers — but it is a manual step, and a box upgraded without one has to be reconfigured by hand. #31 is the full-state reconciler that would make it automatic.

No durable per-subscriber usage history — #33

Accounting interim records are collapsed into one mutable row per open session plus a daily rollup, which discards the time dimension. So "how much did this subscriber use, by hour, last week" cannot be answered from the box.

Current and cycle-to-date usage are correct and are what data-cap enforcement acts on — this affects history only. Note the controller's own per-session rate history is an in-memory ring (~10 minutes, deliberately lost on restart), so until #33 lands there is no durable per-subscriber series on either side.

No validated VPP sizing profiles — #29

The stats segment is now sized by the installer. Earlier releases left it at VPP's default, so it had to be set by hand. GA sets it to 1 GiB on install, raises a smaller existing value, and never lowers a larger one — if you sized it up yourself, your value is kept.

The figure is a deliberate margin rather than a calculation. Measured on a 25,000-session-licensed box, usage is **a fraction of a percent** of that 1 GiB, and it scales with the VPP worker-thread count and the number of interfaces and graph nodes — **not** with the number of subscribers online. A box with more workers needs more at any subscriber count. The margin is there because the segment is cheap on any supported host and because the behaviour under a recovery replay, which is where exhaustion would be worst, is not something these figures cover.

1.4.0 sets `processor_statseg_size_mb = 1024` on install, raises a smaller existing value, and never lowers a larger one. If you sized it up yourself, your value is kept.

What is still missing is the **per-tier** part: 1024M is a known-good ceiling for 25,000 sessions, not a derived minimum, so it may be over-provisioned for smaller deployments. There are no profiles for other subscriber or throughput targets, and worker counts and buffer sizing are still derived by the operator outside the tested configuration. #29 tracks shipping validated profiles.

You can watch it: `GET /api/compute/memory_breakdown` returns `vpp_stats_segment` with `total_kb`, `used_kb` and `free_kb`, and the console's memory panel renders it — so approaching the limit is visible rather than something you discover under load.

Console polling load scales with session count and open tabs — #14, #15

Two separate effects, neither of which affects correctness:

- The sessions view fetches the **whole** session list every 5 s and differences it client-side to derive rates. At 25,000 sessions that is a large repeated read. The controller endpoints that let us replace it with a server-side top-N and per-session rate land in controller 1.5 (bng#38); retiring the full-list pull is #14.
- Each open browser tab runs its own polling loops, so controller load scales with (tabs x pages x loops). Coalescing them through the backend is #15.

Operationally: on a large deployment, prefer fewer simultaneously-open console tabs during a scale test or a maintenance window.

A licence activated on the evaluation appliance can revert to the free tier — bng#52

You do not need a licence to evaluate. The evaluation appliance runs on the free tier, which needs neither a licence nor a TPM, and licence activation is not part of the supported evaluation path. If you never activate, this issue cannot affect you.

If you do activate a capacity licence on the evaluation appliance, it can later report **EXPIRED**, and the session cap returns to the free tier's 1,000. It has been seen after a power cycle, but the validity check also re-runs every 60 seconds while the box is up, so the box does not have to be restarted for the state to change.

What is *not* happening is as useful as what is. The machine fingerprint is unchanged across the restart, and the sealed licence material is still read back successfully — a licence that could not be unsealed would report NOT_ACTIVATED rather than EXPIRED. Identity and sealing are intact; the validity window itself is being computed wrongly. That window is derived from the TPM clock, and on the evaluation appliance the TPM is emulated. Whether a discrete hardware TPM behaves the same way has not yet been measured; bng#52 tracks that.

Workaround. Re-submit the same licence file on the Licensing page. It returns to VALID with the full capacity immediately, and no other state is disturbed. Otherwise evaluate on the free tier, which is unaffected.

Capacity is the only thing this touches. Licence enforcement in this release is capacity-only: no feature is gated on holding a licence, only quantity is, and a missing, expired or tampered licence reverts to the free tier rather than withdrawing function. Configuration, subscriber onboarding, forwarding, QoS, accounting and the console all continue to work normally at up to 1,000 sessions.

Usage Records is slow to appear on a box with a large ledger — #57

The Usage Records page reads the whole stored CDR ledger in one request. On a box that has been carrying subscribers for a while that request is large, and until it finishes the page shows **two dashes in place of the Stored CDRs and Live sessions figures, and an empty table**. On a lab box holding 609,000 records it took about 45 seconds; it scales with how many records you are holding.

Nothing is wrong with the data while this is happening. The figures and the records are intact and arrive in full once the read completes — the page is slow to render them, not missing them.

Workaround. Narrow the read before you load it. The **Since / Until** and **Subscriber ID** filters are applied by the server, so a filtered view returns promptly on any ledger size. Filtering to the period or the subscriber you are actually reconciling is both faster and usually what you wanted. **Export CSV** and **Export JSON** are also server-side and unaffected.

If you have a very large ledger and the page is unresponsive rather than merely slow, prefer the exports, and prune the ledger on its normal schedule.

Billing is unaffected. The accounting drain, the stored records, the daily usage totals and the exports all behave normally; this is a display path only.

Installing and upgrading

A fresh install is the expected path for GA, and the one the release is validated on. Follow the [Baremetal Quick Start](#); nothing in this section applies.

The rest of this section is for a box currently running an alpha build. Note first that the subscriber model changed — see *Breaking changes* — so an alpha box's subscriber base must be re-provisioned under the account model regardless of how the software gets there. For many alpha deployments a fresh install plus a re-provision is simpler than an upgrade.

Upgrading from an alpha build

The controller **wipes its configuration replica on upgrade**, by design: the console is the authority and the controller's copy is a disposable replica.

Take a snapshot before upgrading. This is required, not advisory.

What the wipe discards is the controller's whole replica: `pools`, `access_interfaces`, `uplinks`, `edge_routers`, `captive_portal`, `plans`, `session`, DNS, and the local AAA store (`aaa_local`, `aaa_source`).

Nothing is re-pushed automatically on drift in this release — there is no drift-triggered full-state reconciler (#31). An upgrade without a snapshot leaves a box that onboards nobody, because its access interfaces and pools are gone.

The snapshot is what puts it back, and it has two paths:

- **Replace** (normal) — the snapshot carries the controller's own whole-state envelope, and the restore applies it via a single `POST /v1/quantum/persistent/state/latest`. This returns the entire configuration, including the subscriber base and the access-interface set.
- **Merge** (fallback, when a snapshot has no envelope) — per-block writes covering DNS, pools, plans, RADIUS, the captive portal, access ports and uplinks. This path **cannot** fully restore a wiped box: the subscriber base, the access-interface set and the switch registration have no endpoint a per-block restore can safely drive. The restore reports which path it took.

Both paths are materially better than in the alpha, including a fix for a restore that could not restore an access interface's address at all (#30) — which is why the snapshot is now the documented recovery route rather than a precaution.

Installer bundle **1.4.0-14**. Standard procedure, unchanged from the alpha.

Appendix — every change in this release

Every change between the last alpha build and GA — **248** commits, grouped by kind. The *Bug fixes* section above is a selection; this is the complete record. Generated from [v1.3.0-09..69e614a](#); the commit that writes this appendix is necessarily not listed in it.

Features (60)

- [a692e82](#) feat(alerts): watch data caps, and fix an alert that could never fire (#35)
- [db09e49](#) feat(health): qualify "Connected" with how often it has dropped (#28 part 2)
- [8766f0c](#) feat(support): cumulative health counters — a flap was invisible (#28)
- [6547841](#) feat(support): say whether the box is licensed, and why the cap disagrees
- [159900e](#) feat(events): AAA faults in the alert centre
- [a7d3d75](#) feat(controller): bound the retained config history (bng#41)
- [6e66f4c](#) feat(support): collect intent, not just running state; fix the capture
- [1ddc2cb](#) feat(support): consolidate the bundle and lead with a written summary
- [6c998af](#) feat(support): one-button diagnostic bundle for a support ticket
- [d27b574](#) feat(aaa): subscriber_id is an exact key everywhere (#25)
- [dd2ad55](#) feat(rates): A-06 in the subscriber drawer, with the cap consequence stated
- [dbf33ec](#) feat(rates): A-06 — a raw per-subscriber rate, expressed as a plan
- [a93def0](#) feat(caps): wire the per-subscriber surfaces an operator could not reach
- [6520bf5](#) feat(billing): customer_ref reaches exported CDRs — closes the G-11 gap
- [f350e5d](#) feat(caps): data-cap panel on the subscriber drawer
- [e938fa5](#) feat(caps): Data Caps page and its client
- [51768fa](#) feat(caps): the operator API for data-cap policy
- [d490741](#) feat(caps): run the evaluator on the drain tick, publish bng_cap_*
- [4c8c146](#) feat(aaa): converge enforcement overlays every reconcile pass
- [52f51d9](#) feat(caps): declare the data-cap webhook events at registration
- [e12bee1](#) feat(caps): evaluate_once -- usage in, enforcement rows out
- [5c33019](#) feat(caps): resolution and decision, as pure functions
- [92c7914](#) feat(caps): sum usage over a cap cycle window
- [c807ca0](#) feat(caps): CapPolicyStore -- allowances, overrides, grants, cycle state
- [442dd65](#) feat(caps): the cap cycle calculator
- [a2f89b5](#) feat(aaa): surface unmanaged subscribers with adopt and remove
- [fa36791](#) feat(aaa): run the reconciler and publish what it does
- [2800a25](#) feat(aaa): write durably before pushing to the controller
- [9dacdcd](#) feat(aaa): detect a wiped controller and restore the base

- [5a09424](#) feat(aaa): converge the controller onto our store
- [8c1ba55](#) feat(aaa): one-time adoption of the controller's subscriber base
- [5268a80](#) feat(aaa): durable subscriber store
- [a86eecf](#) feat(accounting): the page becomes a view over the ledger
- [303fc76](#) feat(accounting): publish drain lag, age and errors
- [b2673e8](#) feat(ledger): daily prune and scheduled export
- [cf5ca6a](#) feat(accounting): read and export the ledger
- [3c3544d](#) feat(ledger): 13-month retention and historised identity
- [c6cf03e](#) feat(accounting): drain the spool server-side, ack only after commit
- [5e77571](#) feat(ledger): daily usage by differencing cumulative counters
- [dd94744](#) feat(ledger): durable accounting store
- [7e5c82b](#) feat(about): stamp the wheel with the commit it was built from
- [1290760](#) feat(subscribers): show an account's sessions, and let an operator end them
- [6be6c4d](#) feat(static-ip): assign an address from the subscriber drawer
- [39829b6](#) feat(static-ip): reject a conflicting address before it is written
- [02aa0eb](#) feat(static-ip): CSV columns, and rename the observed address
- [1654ede](#) feat(static-ip): reject an address the pool will later lease
- [0caca48](#) feat(capacity): make a full box impossible to miss
- [da92855](#) feat(add-ons): close the update-checking half of the lifecycle
- [90312bb](#) feat(marketplace): brighter selector, and Check now shows its work
- [92f2797](#) feat(marketplace): restore the page selector between Licensing and Add-ons
- [605f411](#) feat(bundle): pin upstream v1.4.0 and core 0.10.17
- [82cc22c](#) feat(webui): two AAA controls, and delete the inert recovery-age knob
- [079b383](#) feat(aaa): locators, subscriber_id keying, and the new bulk shape
- [e1e70d0](#) feat(aaa): source selector replaces the removed mode field
- [ac535aa](#) feat(webui): Licensing leads with the fingerprint and the cap in force
- [86d43d0](#) feat(webui): Marketplace section with the Add-ons page
- [c6a45af](#) feat(addons): update checking that knows when to stay quiet
- [5b2e3f2](#) feat(addons): both modules install from an uploaded tarball
- [8086199](#) feat(addons): the catalogue, with a URL an offline mirror can own
- [e313512](#) feat(addons): retain one previous artifact, and roll back to it offline

Fixes (91)

- [66c8283](#) fix(sessions): an unavailable session list must not render as an empty one
- [d05ed72](#) fix(webui): drop two false claims from the topology, and stop the session drawer opening blank
- [5f31de2](#) fix(statseg): the sizing axis is threads, not subscribers
- [6a47925](#) fix(install): the statseg fix wrote a key core never reads — bundle -10 is a no-op

- [ccc0c56](#) fix(docs): the stats segment IS measurable — I checked the wrong route
- [21c5c10](#) fix(install): size VPP's stats segment — nothing in the product did (#42)
- [72862b3](#) fix(health): two red RADIUS cards on every healthy 1.4.0 box were a false alarm (#39)
- [00d05df](#) fix(webui): the Topology page had no AAA element at all, and Pools read DNS from a key that does not exist (#39, #40)
- [c2e9128](#) fix(restore): verify an access-port write landed instead of trusting 200 (#30)
- [1389fed](#) fix(sessions): drop the Subscriber column for 1.4.0; restore it in 1.5 (#27)
- [c180ff6](#) fix(licensing): read [grants](#), not a field the controller never sent (#32)
- [4936c90](#) fix(snapshots): a restore would have disabled every access port (#30)
- [b2d734c](#) fix(webui): the cap caption said "Community" on a licensed box
- [991ab53](#) fix(sessions): draw the cap line at the cap actually in force
- [c1c9ed3](#) fix(licensing): activation works from the console
- [f116a40](#) fix(licensing): a trailing newline was invalidating valid licences
- [8259ab9](#) fix(snapshots): make restore actually restore
- [4f6d033](#) fix(captive-portal): stop the portal_ip save erasing the walled garden
- [af961cf](#) fix(support): run the collection detached — an in-worker thread killed the dashboard
- [e0f8175](#) fix(support): parse BUNDLE_VERSION; bundle 1.4.0-05
- [7de3579](#) fix(webui): an unprovisioned subscriber_id is a write key, not a join key (#25)
- [3ad4709](#) fix(tests): stop the suite running production daemons (#21)
- [cb2468f](#) fix(aaa): deleting a capped subscriber no longer strands its overlay
- [012e639](#) fix(controller): importing as non-root must not die on the CA probe
- [348244e](#) fix(aaa): leave unmanaged subscribers' enforcement overlays alone
- [c2addbc](#) fix(webui): data-caps client uses fetchWithAuth; input bounds match server
- [6c8b8f6](#) fix(aaa): make post-reprovision overlay replay non-fatal
- [6fa4654](#) fix(caps): hoist status() queries out of the per-subscriber loop
- [e7fa291](#) fix(caps): add grants_in_window; drop two dead helpers
- [b4f01ba](#) fix(caps): disabling enforcement now clears every overlay
- [5eb75a0](#) fix(caps): stop cross-subscriber leakage in the grant panel
- [0434621](#) fix(caps): surface write failures, drop grant form, protect settings draft
- [fc1a2ad](#) fix(caps): fix round 1 -- connection leak, coercion 500s, test gaps
- [7947075](#) fix(aaa): guard enforcement convergence against non-controller failures
- [c87dac5](#) fix(caps): test coverage and boolean logic for NULL handling
- [1524590](#) fix(tests): stop the suite running a live metrics sampler
- [2bdae92](#) fix(api-keys): survive, and repair, a keys file still in the bare-list shape
- [9ca5d80](#) fix(proxy): close the third door into the AAA subscriber base
- [de1c146](#) fix(aaa): drop a subscriber from the unmanaged list once it becomes ours
- [d52c944](#) fix(aaa): restore the merge base for a record we do not hold
- [52f9e41](#) fix(webui): the wipe notice must name aaa_source among what was not restored

- [b415e3c](#) fix(aaa): debounce the wipe guard, tell its conditions apart, and correct \$5
- [eca818e](#) fix(aaa): close the two proxy routes that write only the controller
- [b2b5c08](#) fix(aaa): merge over the record, not over the controller
- [06475c5](#) fix(aaa): stop an orphan annotation poisoning the whole restore
- [46e073d](#) fix(aaa): say the switch may need re-registering before the plans
- [678e419](#) fix(aaa): stop a refused restore wedging the reconciler, and say why
- [a4d6665](#) fix(aaa): let the circuit decide which line a mint may reuse
- [b72441b](#) fix(aaa): roll back a rejected apply, and stop one bad row killing reconcile
- [c39b7e3](#) fix(aaa): record a bulk import before pushing it, closing the set
- [a5aff25](#) fix(aaa): close the delete and mint holes the inversion opened
- [169b7a2](#) fix(aaa): surface reactivation_history through get_subscriber
- [3ccbb2c](#) fix(ledger): three residual ways the daily maintenance could destroy billing data
- [31c7730](#) fix(accounting): a quarantined billing record must not be invisible
- [2bc628c](#) fix(accounting): a retained live population must not starve the drain forever
- [8e33280](#) fix(ledger): export what is about to be pruned, not the whole ledger daily
- [41f7a9b](#) fix(accounting): filter CDRs in SQL so an old date range is reachable
- [9afd934](#) fix(ledger): refuse an implausible retention_days instead of deleting a year
- [ebcc8c3](#) fix(accounting): distinguish a failed CDR fetch from an empty ledger
- [4b8a749](#) fix(accounting): count a raised drain cycle as an error too
- [f0bf65f](#) fix(ledger): drain thread's sqlite connection was unusable cross-thread
- [863b36e](#) fix(accounting): page forward within a cycle instead of re-fetching a static window
- [53bede3](#) fix(accounting): review fix wave -- vacuous tests, reset heuristic, late-interim double-credit
- [7cb61c2](#) fix(ledger): per-record SAVEPOINT so a DB error on delete can't split a record
- [9257da3](#) fix(ledger): make write_records genuinely atomic
- [8b4a2e0](#) fix(build): only tracked changes make a build dirty
- [ef6a848](#) fix(static-ip): narrow the unassign sentinel to framed_ip/subnet_mask
- [ecb0da7](#) fix(static-ip): check zero-padded addresses, and two tests that could not fail
- [7084e34](#) fix(subscribers): a failed session fetch is not an empty account
- [92c0810](#) fix(aaa): stop the raw subscriber PUT proxy erasing a static IP
- [b4838f2](#) fix(static-ip): tell "not mentioned" apart from "unassign me"
- [1e42a42](#) fix(static-ip): wire framed_ip/subnet_mask into compute_diff
- [2d27b9b](#) fix(webui): restore the markup two descriptions lost to a narrow type
- [cc8aa10](#) fix(typecheck): clear the 16-error backlog exposed by the tsconfig rootDir fix
- [3dadea1](#) fix(add-ons): the primary Install button never said Installing...
- [75e652e](#) fix(add-ons): restore the expander that described what the pack contains
- [6a4062e](#) fix: the eval appliance HAS a TPM — correcting a wrong premise
- [9b694ef](#) fix: two error states that lied, and the CPESIM pin

- [d52be84](#) fix(eval-appliance): find the bundle our own build script produces
- [5b1d434](#) fix(aaa): merge subscriber PUT over stored record, not just match
- [6061b2e](#) fix(1.4.0): whole-branch defects — locator erasure, bulk crash, false alert
- [fa7e334](#) fix(webui): guard health.radius reads against the 1.4.0 shape
- [cd3e05e](#) fix(health): stop fabricating a radius block in degraded fallbacks
- [2958fee](#) fix(portal): voucher redemption can finally activate a session
- [35e8775](#) fix(aaa): carry locator columns through the upload pipeline, spec-validate the two rewritten bulk tests
- [fa03fd3](#) fix(aaa): rewrite the two route-level tests Task 3s rewrite broke
- [9f75262](#) fix(aaa): delete the cascade planner that never fired
- [131f376](#) fix(deps): declare jsonschema/referencing as dev extras
- [0568042](#) fix(webui): API Keys page rendered blank on every box; replace two screenshots
- [6a8b3f8](#) fix(appliance): clear intermittent first-boot hang with rcu_normal; ship 1.3.0-13
- [d89225f](#) fix(licensing): the three controller paths were missing /v1 and 404d

Performance (2)

- [c29a377](#) perf(metrics): stop shelling out every 5s for counters we discard (#36)
- [b8c4d3c](#) perf(metrics): stop fetching the whole controller config every tick (#14)

Documentation (57)

- [84ae8d6](#) docs: point the dataplane known issue at its real issue number (#49)
- [7aeebba](#) docs: record the dataplane port-assignment issue and its workaround
- [9a12835](#) docs(release): regenerate the appendix against 433b916 (243 commits)
- [433b916](#) docs: roll the 1.4.0 doc set to bundle 1.4.0-13 / plugin 0.10.36
- [75a7bcc](#) docs(release): frame 1.4.0 as GA, with everything prior as one alpha bucket
- [897c4bb](#) docs(release): append the complete commit record
- [9e7b755](#) docs(release): the commit count was stale — 229, not 204
- [51ed4d4](#) docs(release): carry the controller and VPP side of 1.4.0 (#43)
- [7d3dd4f](#) docs(release): remove internal framing and the "shim" terminology
- [84c7f4b](#) docs(release): bundle 1.4.0-10, and say what the installer now does about statseg
- [efee8aa](#) docs(aaa): correct a comment I generalised from one configuration
- [236b0ee](#) docs(release): say what the console actually shows for RADIUS and AAA
- [c7ace1e](#) docs(release): 1.4.0 notes — known issues now cover the open set, and Upgrading no longer over-promises
- [d586aff](#) docs(metrics): document all 36 families, and guard against the drift (#34)
- [8f1e614](#) docs(lifecycle): mark §4 and §9.3 superseded by the state-envelope restore

- [10eb38a](#) docs(spec): record the #24 amendments
- [a998128](#) docs(spec): §5.2's enabled_ts floor is day-granular — state the limit
- [2ec2311](#) docs(plan): sub-project E implementation plan
- [dcb9614](#) docs(spec): sub-project E — data-cap enforcement
- [0e5682a](#) docs(plan): AAA as system of record (sub-project F)
- [d7eb45c](#) docs(spec): AAA as system of record (sub-project F)
- [96aeea3](#) docs(lifecycle): QuantumTouch takes ownership of AAA
- [8e1f111](#) docs: state ownership and lifecycle — what the controller must persist
- [8a6be39](#) docs(spec): the binding spec described behaviour that was deliberately deleted
- [b186183](#) docs(plan): accounting ledger (sub-project D)
- [1aab859](#) docs(spec): accounting ledger (sub-project D)
- [3ff8da5](#) docs(plan): sub-project C — static IP and subscriber sessions
- [a939894](#) docs(spec): static IP and subscriber sessions (sub-project C)
- [bc4c816](#) docs: preserve the 1.4.0 port execution ledger; ignore vagrant state
- [7c96972](#) docs(artifacts): the _test endpoints are NOT served in production — correction
- [d6b4baf](#) docs(artifacts): correct the health.radius claim — twice wrong
- [366f931](#) docs(plan): implementation plan for the controller 1.4.0 port
- [c818b2e](#) docs(spec): the cascade has never fired, and sessions do carry subscriber_id
- [2504d03](#) docs(spec): controller 1.4.0 port — design for sub-project A
- [e109e42](#) docs(artifacts): import the 1.4.0 controller API spec and evaluate it against our tree
- [50c3bdb](#) docs: direct upload for disconnected boxes; URL path is the orchestrator seam
- [5163235](#) docs: rename About to System and reserve it for platform lifecycle
- [12aeee9](#) docs: correct -- capacity licences are perpetual, not subscriptions
- [ca3fdbe](#) docs: draw the licence expiry cliff, and free amber for it
- [2bea687](#) docs: record the three capacity bands, and two consequences of replace
- [978203b](#) docs: scope the design to QuantumTouch; hand the store findings off
- [99699d5](#) docs: session cap replaces rather than stacks
- [845b417](#) docs: nav group is Marketplace, holding Licensing and Add-ons
- [9e81489](#) docs: CPESIM need not stay pinned -- the blocker is an unversioned engine API
- [b7a1e27](#) docs: read-only operator gets an "ask an administrator" fingerprint card
- [536dee1](#) docs: machine fingerprint leads the Licensing page
- [fc25bad](#) docs: speed caps replace rather than stack; interface config is a prerequisite
- [16bcc14](#) docs: design for the add-ons + entitlements console section
- [3bbe2f4](#) docs: publishing instructions for the 1.3.0 docs web implementer
- [b627fa5](#) docs: state survey ahead of lifecycle management
- [d248b24](#) docs(grafana): customer guide for the dashboard pack; pack is free and unlicensed
- [bcba0c](#) docs: capacity licensing is staged for 1.4.0, not a 1.3.0 capability

- [19b9f6d](#) docs: correct the licensing documentation — the console flow does not work
- [2e437fc](#) docs: response to the feature-query interface proposal (#33)
- [7b9796a](#) docs: re-shoot the console screenshots, and fix two things they caught
- [68cbb67](#) docs: update the operator guides for 1.3.0
- [3027512](#) docs: review the 19 published QuantumBNG docs against 1.3.0

Tests (14)

- [56f8baa](#) test(radius): tag lab-dependent tests so a release run can drop them
- [d4707f4](#) test(aaa): cover the branches that had none, and verify each catches its regression
- [a10af89](#) test(aaa): prove the reconciler is actually reachable from the drain thread
- [c0b397a](#) test(aaa): pin remove_unmanaged's unreachable-controller ordering
- [dd5741a](#) test(accounting): assert the test drain thread does not outlive its test
- [e4c55ad](#) test(ledger): pin the INSERT OR IGNORE rule at the statement itself
- [d650317](#) test(accounting): pin the real lag computation, and ship spec 8's second alert
- [3225513](#) test(subscribers): cover the session client directly, not through the drawer
- [12140d1](#) test(subscribers): replace a vacuous role="alert" check with a real one
- [17b91b7](#) test(static-ip): pin the conflict/generic-failure routing to the error code
- [6fadfa6](#) test(health): update happy-path fixture to the 1.4.0 aaa shape
- [abbe19b](#) test(aaa): fix stale mode fixture, cover radius rejection
- [0e75d2a](#) test: a controller double that enforces the real 1.4.0 contract
- [5457c62](#) test(webui): repair two stale Dashboard tests and the pool card router context

Build and chores (7)

- [fe8dc75](#) chore(deps): lock @quantumtouch/core to the v0.10.23 commit
- [da25223](#) chore(deps): core 0.10.23 for plugin webhook event registration
- [a6ea37e](#) chore(deps): lock @quantumtouch/core to the v0.10.22 commit
- [e63c9d9](#) chore(deps): core 0.10.22, and a guard so the two pins cannot drift
- [4cbcab9](#) chore(deps): quantumtouch-core 0.10.21 — accessible Field labels
- [ab40ce3](#) chore(bundle): cut 1.4.0-02
- [54acdd4](#) chore: ignore .worktrees/

Release (9)

- [69e614a](#) release: bundle 1.4.0-14, plugin 0.10.37, CPESIM 0.4.18
- [a47b639](#) release: bundle 1.4.0-13, plugin 0.10.36
- [a79fa2a](#) release: cut installer bundle 1.4.0-12

- [04ed60a](#) release: bundle 1.4.0-11
- [44a426a](#) release: plugin 0.10.34 — the version never moved across 1.4.0
- [2caaa9f](#) release: bundle 1.4.0-10
- [d4807b8](#) release: record the bundle 1.4.0-09 version bump that shipped to the rig
- [1fcf348](#) release: bundle 1.4.0-04
- [8673133](#) release: bundle 1.4.0-03

Other (8)

- [915dc44](#) Merge release/1.4.0-13: sessions fetch-failure fix + 1.4.0 doc set
- [c5db7c5](#) Revert the Pools DNS change: #40 was not a bug, and my test disproved it
- [be425dd](#) Merge support-bundle health counters, snapshot access-port fix, cap caption
- [cd0f367](#) Merge A-06: per-subscriber raw rate override
- [ae00fbf](#) Merge #24 follow-ups: billing interop, wired cap surfaces, overlay ownership
- [d39660c](#) Merge sub-project E: data-cap enforcement
- [0f0fc5f](#) Restore installedLinks, capability reload, and backstop poller on Add-ons
- [cc432d3](#) Merge feat/controller-1.4.0-port: port to controller 1.4.0