BLUEDOT

COMMUNITY EDITION · 1.4.0 GA

BlueDot Quantum IPoE BNG

Features — Data Plane & Control Plane

The feature summary for the BlueDot Quantum IPoE BNG, and the companion to the Theory of Operations. Every capability under Data Plane, Control Plane, and Management ships and runs in this Community Edition GA release; planned additions are gathered under Coming Next.

Document Type	BlueDot Feature Summary
Component	Quantum IPoE BNG (IPv4, Phase 1)
Edition	Community Edition — 1.4.0 GA
Audience	ISP Operators, NOC & Technical Evaluators
Companion To	Quantum IPoE BNG — Theory of Operations
Source Tree	`ipoe/bng` @ `v1.4.0`
Classification	**BlueDot Proprietary**
Date	October 2026

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Every item below is implemented and running in this build. Designed-but-not-yet-shipping capabilities are listed only under Coming Next.

Data Plane Features

Forwarding & Identity

- L3-routed IPoE forwarding (/32 in FIB)
- IP-keyed sessions (framed IP)
- Anti-spoof source-IP guard
- Shared edge-router next hop
- Deny-by-default forwarding

Rate Limiting & QoS

- RFC 2698 two-rate three-colour policing
- Per-direction CIR/PIR (up + down)
- Green / yellow / red colouring
- Per-subscriber colour × direction counters
- Node-wide QoS band counters
- Zero-burst-safe policer
- Optional DSCP marking per direction (green AF11 / yellow AF12; off by default)

Filtering & Interception

- Captive walled-garden filter (DNS/HTTP/HTTPS)
- DHCP intercept & punt

Data-Plane Platform

- Userspace VPP on DPDK
- Access + core/uplink NICs (Intel E810)
- Multi-worker-correct counters
- Bulk counter RPC
- Duplicate-address protection

Control Plane Features

Subscriber Lifecycle

- Five-state session machine
- Live re-rate (no re-DHCP)
- Operator disconnect, re-plan and activate
- Plan and status changes written to the subscriber record, cascading to the live session
- Re-adoption of sessions the data plane retained through a recovery cycle
- Standard RFC 2866 terminate causes

Embedded DHCP & Addressing

- Embedded DHCPv4 server
- CIDR pools, first-free allocation
- Option 82 identity (circuit / remote-id)
- giaddr topology pool selection
- Infrastructure-IP reservation
- Retransmit-safe onboarding
- Pool-driven leases
- DHCP Option 114 captive-portal URL (RFC 7710 / 8910) for native OS detection
- Dedicated onboarding pipeline with request batching and de-duplication

Authentication & Service Plans

- AAA source selected at `/bng/aaa`: open (accept-all) or local
- Subscriber records keyed by operator-assigned account identity, with explicit locators
- Bulk local-AAA provisioning (500–650 CPE/s)
- Local plan catalog (named plans)
- Default-plan guarantee (never unpoliced)
- Captive re-auth on activation

Captive Portal & Prepaid

- Walled-garden onboarding
- Portal-only DNS steering
- Prepaid expiry → captive (keeps IP)
- Activate endpoint (top-up)
- Short portal lease for faster activation; additional walled-garden TCP ports

Accounting

- Start / Interim / Stop orchestration
- Counter refresh before final record
- Stable Acct-Session-Id
- Restart-safe counter pre-load
- Open records reconciled and tagged across an unclean restart
- Local CDR / usage export for by-usage billing without RADIUS

Timers & Scale

- Batched interim loop ("tickler")
- Counter-derived idle detection
- Batched teardown cascade
- One-shot offer / lease timers
- Idle timeout defaults to 1 hour (per-subscriber override)

Persistence & Recovery

- Durable SQLite session state
- Timer rebuild from timestamps
- Three recovery modes
- Clean stale-session close
- Config & keys preserved on upgrade
- DHCP punting re-subscribes after a bridge or controller restart; health reports the real state

Configuration & Integration

- Ownership-split config (file vs API)
- Poll-over-push integration
- Role-based API-key auth
- Audit log of mutating calls

Management, Platform & Roadmap

Management & Observability

- Versioned REST API (`/v1/bng/*`)
- OpenAPI spec + ReDoc reference
- Single-status health rollup (ok / degraded / fault)
- Accounting read path (`/bng/accounting/records`)
- Telemetry read path (`/bng/counters`)
- Live pool / plan / router config API
- Rotating JSON audit log
- Prometheus `/metrics` with alerting rules, IPMI chassis sensors and a scoped read proxy
- RADIUS diagnostics — decoded, linted exchanges on the audit timeline (opt-in)

Platform & Capacities

- IPoE, IPv4
- RFC 2698 policing (per sub, per direction)
- VPP / DPDK userspace data plane
- Commodity x86 (Dell R360-class)
- Intel E810-class NICs
- Ubuntu 24.04 / kernel 6.x, validated on 6.8 / x86_64
- ~100k subs/node target; validated at 5,000, run to 18,750
- Horizontal scaling (add nodes)
- Free-tier cap of 1,000 sessions, raised by a capacity licence activated from the console
- Capacity-only enforcement: a missing or expired licence reverts to the free tier

New in 1.4.0

- **Account-keyed subscriber model** — records keyed by an operator-assigned account identity with explicit locators, replacing line-id keying. Not backward compatible: the subscriber base is re-provisioned under the account model
- **AAA source at** `/bng/aaa` (open or local), replacing the local-AAA mode field
- **Record-driven changes** — writing the subscriber record cascades plan and status into the running session, replacing the separate per-session plan and revoke calls
- `PUT /bng/session` **is a partial merge** — omitted fields are preserved
- **Faster onboarding** — a dedicated DHCP worker pipeline with batching and de-duplication raises the sustained join rate and smooths bursts
- **Reboot resilience** — DHCP punting re-subscribes after a restart, and health reports the real state instead of OK while delivering nothing
- **Session re-adoption** after a data-plane recovery cycle
- **Accounting across an unclean restart** — open records reconciled and tagged
- **Captive refinements** — short portal lease, extra walled-garden TCP ports
- **Idle timeout default raised to 1 hour**, sized for always-on subscribers
- **Capacity licensing end to end** — the console now reads status, shows the fingerprint and activates a licence; the controller side landed in 1.3.0

Coming Next

- Production RADIUS client (sockets, failover, CoA)
- RADIUS accounting on the wire (gigawords, Class)
- PEN 65664 QoS vendor attributes + Filter-Id
- IPv6 / dual-stack (DHCPv6, PD)
- Per-worker session tables (~400–500k)
- Session reclamation under sustained churn at scale (fixed in controller 1.5)
- Platform lifecycle: update checking, in-place upgrade, rollback

Scope & Caveats

- IPoE only (no PPPoE / 802.1X)
- L3-routed access, no per-sub VLAN / QinQ
- Policing, not shaping (no AQM)
- Pull-based telemetry (SNMP is an add-on)
- Data caps are enforced by plan/status overlays, not a hard data-plane byte counter
- Local AAA this build (RADIUS deferred)
- IPv4 only
- Session reclamation lags under sustained churn above ~7,500 sessions until controller 1.5
- Moving from 1.3 requires re-provisioning subscribers under the account model

Prepared from the BlueDot Quantum IPoE BNG source tree (`ipoe/bng`, tag `v1.4.0`). Field-level request/response shapes are authoritative in the generated OpenAPI spec and the source. *© 2026 BlueDot Insight LLC. BlueDot Proprietary.*