BOOSPOS

Whitepaper — Settlement-Native, Future-Ready Point-of-Sale Infrastructure

Brand: BOOSPOS · **Domain:** boospos.com *(in process)*

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Publisher: BranchlessPay, Inc. (Delaware C-Corp)

Ecosystem: BranchlessPay · Orderly · Monad

Terminology (used consistently throughout)

- **BOOSPOS** — the point-of-sale product described in this document.
- **The ecosystem** — BranchlessPay (integrity/settlement) + Orderly (customer-facing commerce) + Monad (trust fabric).
- **Payment Orchestration Engine** — the multi-gateway, fiat+crypto routing engine (full spec in the companion document).
- **BP Audit Shield** — the anchoring and compliance layer that produces on-chain-verifiable audit evidence.
- **AI Gateway** — the single governed entry point for all AI tasks in BOOSPOS.
- **Ops AI** — operational intelligence (forecasting, inventory, fraud, reconciliation).

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1. Executive Summary

For thirty years, the point-of-sale system has evolved at the surface — better screens, cloud dashboards, more integrations — while its financial core stayed the same: centralized databases, legacy payment rails, and reconciliation done by hand. Commerce, meanwhile, is entering a different era, shaped by artificial intelligence, programmable payments, and rising expectations for transparency and auditability.

BOOSPOS is a next-generation register built for that era. It does three things no conventional POS does together:

1. **Routes every payment across many rails** — card, wallet, ACH/RTP, and regulated stablecoins/crypto — choosing the route with the best *real* outcome, not merely the lowest sticker fee.
2. **Makes every transaction independently verifiable** by anchoring cryptographic proof to the Monad blockchain through BP Audit Shield — without exposing any customer or business data on-chain.
3. **Runs the business, not just records it** — embedded AI for forecasting, inventory, fraud, and continuous reconciliation.

Critically, BOOSPOS is designed to be **installable on the devices merchants already own** — Android phones and tablets, high-end or low-end — and to operate **offline-first**. This is what lets it serve both a US food truck and a 1,400-outlet Indonesian dimsum network running on assorted Android hardware.

BOOSPOS is also the component that makes the entire ecosystem **POS-independent**: a first-party register that lets merchants stop depending on any single incumbent POS while carrying forward everything already built.

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2. Market Problem & Our Solution

2.1 The gap between today's POS and tomorrow's commerce

POS technology has advanced in interface and deployment, but its underlying financial architecture has not. Most systems still rely on centralized databases, legacy payment networks, fragmented software integrations, and manual reconciliation. At the same time, AI is transforming operations, stablecoins are emerging as programmable payment infrastructure, real-time payment networks are expanding, and merchants increasingly expect their in-store, online, delivery, accounting, and engagement tools to work as one. These shifts expose a widening gap between what POS platforms do and what modern commerce requires.

We believe the next generation of point-of-sale must become **intelligent financial infrastructure**, not merely transaction-processing software.

2.2 Five challenges facing the POS industry

Payment costs built for yesterday's economy. Card payments remain reliable and universal, but they carry recurring costs — interchange, processor markups, gateway fees, chargeback risk, settlement delays. For businesses on single-digit net margins, payment processing is one of the largest controllable operating expenses. Regulated stablecoins and blockchain settlement now offer models that can reduce intermediaries and accelerate settlement, yet most POS platforms were never designed to support them.

Unpreparedness for the digital-asset economy. As financial institutions invest in tokenized assets and stablecoin settlement, most POS platforms still treat digital assets as third-party bolt-ons rather than native options — producing fragmented experiences and limited flexibility.

Rising operational complexity. A single merchant may run in-store sales, online ordering, delivery marketplaces, multiple payment providers, inventory, accounting, payroll, marketing, and loyalty — systems that generate valuable data but operate independently. Reconciling them consumes hours weekly and grows faster than staffing.

Underused AI. Many POS systems show dashboards; few actively help operate the business. AI now makes it possible to move from reactive reporting to proactive guidance on purchasing, staffing, pricing, and inventory.

Financial records that are hard to prove. Conventional databases support corrections, refunds, and adjustments — operationally necessary, but they increase the effort of demonstrating that historical records remain authentic and consistent during audits. Trust should be supported by cryptographic verification, not database access controls alone.

2.3 Our solution

BOOSPOS reimagines the register as unified commerce infrastructure for the next 15–20 years, integrating **hybrid payments, embedded AI, autonomous reconciliation, and blockchain-backed transaction integrity** into one platform. Merchants modernize gradually while staying prepared for evolving payment technologies and compliance expectations. Transparency is achieved through **mathematical verification** rather than organizational trust alone — and sensitive data never leaves protected infrastructure.

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3. Product Vision & Design Principles

BOOSPOS is built on six engineering principles, and three locked product decisions.

Principles: Cloud-Native (elastic, global scale) · AI-Native (intelligence embedded in workflows, not an add-on) · API-First (every service accessible via secure APIs) · Privacy by Design (sensitive data protected throughout its

lifecycle) · Compliance by Design (records structured for audit readiness) · Trust by Design (cryptographic verification as independent evidence).

Locked decisions (carried through the whole build):

1. The blockchain is a **trust/verification layer, not the operational database** — only cryptographic commitments are anchored; speed and UX run on cloud-native systems.
2. Payment routing uses an **independent, POS-native AI** whose objective is **expected net value** = `P(approval) × (transaction value − total cost)`, not lowest nominal fee.
3. **Hybrid fiat + crypto is a native day-one capability.** Merchant *adoption* of stablecoin is gradual; the capability is not deferred.

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4. System Architecture

4.1 Component map

Layer	Component	Responsibility	Build note
Edge	**Register App**	Cashier UI, order capture, offline-first	React Native / Expo; runs on Android phones & tablets
Edge	**Local Vault**	Offline transaction store + device signing keys	SQLite/WatermelonDB + Keystore/secure element
Core	**Transaction Engine**	Authoritative order/txn state machine	Reuse/extend Orderly's validated engine
Core	**Payment Orchestration Engine**	Multi-gateway routing (fiat + crypto)	The core IP — see companion spec
Core	**Canonical Builder**	Deterministic canonical record + integrity validation	Shared, versioned schema
Core	**Anchoring Service**	Hash → Merkle batch → Monad anchor	Reuse BranchlessPayCore contract
Intelligence	**AI Gateway**	Single governed entry point for all AI tasks	Model routing, cost/guardrail control
Intelligence	**Ops AI**	Forecasting, inventory, fraud, reconciliation	Async, non-blocking
Data	**Operational DB / Event Bus / Audit Store**	Records, fan-out events, encrypted evidence	Postgres · Kafka/NATS · object storage + KMS
Trust	**BP Audit Shield**	Compliance layer + on-chain verification API	BranchlessPay (modular, pluggable)

4.2 End-to-end transaction flow

```
Customer
  → Order captured (Register App / Orderly online)
  → Transaction Engine assigns authoritative state
  → Payment Orchestration Engine selects rail + gateway (net-value routing)
        ├─ Fiat   → Square / Stripe (US); Xendit / Midtrans → QRIS + e-wallets + VA
(Indonesia)
        │            NMI / Adyen added at hardware/enterprise scale
```

```
        └─ Crypto → CoinGate  (settlement/custody via Fireblocks at scale)
  → Payment result recorded (approval/decline logged per gateway+BIN)   ← trains routing
model
  → Canonical Builder: serialize → validate → SHA-256 hash
  → Anchoring Service: Merkle batch → root anchored on Monad; per-txn proof retained
  → Event Bus fan-out: operational · inventory · payment · accounting · AI-learning ·
compliance
  → BP Audit Shield assembles the verifiable audit package
```

The sale completes on local/cloud systems; anchoring proves what was recorded and never gates checkout. Offline, the sale completes locally and anchors on reconnect.

4.3 AI Gateway (recommended — and warranted)

BOOSPOS has several AI concerns already: payment routing, forecasting, inventory, fraud scoring, and reconciliation, with agent interop later. Rather than wiring each into models directly, BOOSPOS exposes a single **AI Gateway** — mirroring the pattern Orderly already runs for its content/reporting tasks — with one task interface:

```
POST /ai/task  { task_type, context, constraints }  → { result, model_used, cost,
confidence }
```

Responsibilities: route each task to the right model/service; enforce cost, latency, and safety guardrails; centralize logging and observability; and provide a clean interop point with Orderly's AI Gateway and (optionally) BranchlessPay's agents (NADIA/SENTINEL/HERALD) — loose coupling, never a hard dependency. This keeps model choices swappable and costs governed as usage scales across thousands of outlets.

4.4 Recommended stack

App: React Native / Expo (one codebase, broad Android device support). Services: TypeScript for orchestration/APIs, **Python** for ML routing and Ops AI, optionally **Go** for the hot-path router. Data: Postgres · Redis (feature store) · Kafka/NATS · object storage. Chain: BranchlessPayCore (Solidity) on Monad via ethers/viem.

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5. Payment Orchestration Engine (Summary)

The engine treats every gateway — fiat or crypto — through one normalized adapter interface, then chooses the route that maximizes **expected net value**:

```
expected_net_value(r) = P_approval(r | BIN, issuer, amount, time, history)
                        × ( transaction_value − total_cost(r) )
```

It combines a **deterministic cost model**, an **ML approval-rate predictor**, and a **contextual-bandit selector** that exploits the best route while exploring alternatives as gateway performance drifts. Failover, idempotency, and per-attempt outcome logging are mandatory. **The complete developer specification — feature schema, bandit flow, crypto-vs-fiat cost math, and the full adapter contract — is a companion document to this whitepaper** (§ "Payment Orchestration Engine — Technical Specification").

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6. Hybrid Fiat–Crypto Settlement

Goal: neither buyer nor merchant needs to think about the rail — unless they want to.

Buyer: card, wallet, tap-to-pay, ACH/RTP, QRIS (Indonesia), or stablecoin/crypto. Value is **rate-locked at the moment of sale** to remove volatility risk for the merchant.

Merchant settlement preference: 100% fiat (crypto auto-converts) · 100% stablecoin · split (e.g., 80% fiat / 20% USDC).

Adoption vs. capability: hybrid acceptance is built as a native day-one capability; broader stablecoin *uptake* follows customer demand and regulation. Messaging should never imply crypto arrives "years later."

Programmable settlement (later): because settlement can carry logic, BOOSPOS can set aside tax into escrow at the moment of sale, split to suppliers/agents, and run token-based loyalty — all optional and rule-driven.

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7. Technical Architecture & Blockchain Infrastructure

(This chapter is the authoritative trust model; it merges the narrative architecture with the concrete anchoring spec.)

7.1 Separation of concerns

BOOSPOS separates **operational workloads** (cloud database, reporting, inventory, kitchen, accounting, CRM) from **cryptographic verification**. Each layer is optimized for its purpose. Blockchain is explicitly **not** the operational database; it is an independent trust layer that preserves speed, scalability, and user experience while providing strong cryptographic assurances. This anchoring layer is already proven in production across the ecosystem — BP Audit Shield anchors real transaction data from live accounting and commerce integrations today.

7.2 Canonical Transaction (integrity-only)

Each completed sale produces a standardized **Canonical Transaction** containing only what's needed to establish integrity:

```
{
  "schema_version": "1.0",
  "transaction_id": "uuid",
  "timestamp": "RFC3339",
  "merchant_id": "string",
  "terminal_id": "string",
  "items": [{ "sku": "string", "qty": 0, "unit_price": 0 }],
  "tax": 0, "discount": 0, "total": 0,
  "payment_method": "card|wallet|ach|rtp|qris|stablecoin|crypto",
  "settlement_reference": "string"
}
```

No customer names, card data, wallet balances, addresses, or contact details are ever included.

7.3 Serialize → hash → Merkle → anchor

1. **Deterministic serialization** — identical input always yields identical bytes.

2. **SHA-256** (or future NIST successor) → a unique fingerprint; a one-character change produces a completely different hash.
3. **Merkle aggregation** — many transaction hashes are batched; only the **Merkle root** is anchored. Each transaction retains a **Merkle proof** of inclusion. This lets millions of transactions be verified with comparatively few on-chain operations, lowering cost and confirmation time while enabling verification of a single transaction without exposing unrelated records.
4. **Anchor** the root on **Monad** via BranchlessPayCore. Once anchored, altering historical evidence without detection becomes computationally infeasible.

Anchoring cadence (configurable policy): batch by time window and/or transaction count — trading anchoring cost against time-to-finality — set per merchant tier. *(Open decision — §14.)*

7.4 What the chain proves — and doesn't

The anchored root proves a transaction existed, its content is unchanged, it belonged to a specific batch, and it existed before a point in time. The chain contains **only cryptographic commitments** — never customer, payment, or inventory data.

7.5 Continuous audit & verification

Every transaction contributes to an immutable audit chain (creation time, verification status, blockchain reference, reconciliation status, reporting status), producing a continuously verifiable financial history rather than a static archive. BP Audit Shield exposes a verification API: given a transaction and its Merkle proof, any authorized party confirms authenticity and inclusion without seeing other records.

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8. AI & Automation Layer (Independent from BranchlessPay)

Two AI concerns, both **POS-native and independent**, orchestrated through the AI Gateway (§4.3):

Routing AI — the Payment Orchestration Engine (§5).

Ops AI — moving from reporting to guidance:

- *Sales prediction* from historical sales, seasonality, holidays, weather, promotions, menu performance, local behavior, and channel activity — to support staffing, purchasing, and inventory (assistive, not a guarantee).
- *Inventory intelligence* — consumption, reorder timing, supplier variability, shelf life, and forecasts inform purchasing schedules.
- *Fraud detection* — behavioral signals (unusual refunds/voids, duplicate attempts, atypical timing, reconciliation mismatches) produce **dynamic risk scores surfaced for review** per merchant policy, rather than auto-blocking.
- *Financial intelligence* — continuous reconciliation across POS, settlements, inventory, accounting, and anchor status flags inconsistencies early.

Relationship to BP Audit Shield. Audit Shield is BranchlessPay's anchoring/compliance layer; BOOSPOS uses it as a modular, pluggable trust layer. The POS is functionally complete standalone (payments + Ops AI + local verifiable records); Audit Shield elevates those records to on-chain-verifiable.

"Invisible blockchain" UX rule. At checkout and on receipts, use human trust language ("verified," "permanently on record") with **zero** crypto/blockchain wording. Crypto/Web3 framing is reserved for owner/investor materials — including this whitepaper — not for customers.

9. Data Model & API Surface

Core entities: Merchant, Terminal, Catalog/Item, Order, Transaction, PaymentAttempt, Settlement, AuditPackage, AnchorBatch, MerkleProof.

Illustrative API:

```
POST /orders                    create/queue an order
POST /payments/route            best route (net-value)
POST /payments/authorize        authorize (idempotent)
POST /payments/capture
POST /payments/refund
GET  /transactions/{id}/proof   Merkle proof
POST /verify                    verify txn+proof against anchored root
POST /ai/task                   AI Gateway task interface
GET  /reports/daily             ops + reconciliation summary
```

Event pattern: every completed order emits operational, inventory, payment, accounting, AI-learning, and compliance events onto the bus — the mechanism behind "one order becomes many synchronized events."

10. Security, Privacy & Compliance

PCI DSS scope minimization (critical). Card PAN must never touch first-party servers. Use gateway tokenization / hosted fields (Square Web Payments SDK, Stripe.js) or P2PE-validated terminals, targeting the lightest SAQ scope (SAQ A / A-EP for tokenized flows; SAQ P2PE for validated hardware). Confirm exact scope with a QSA before scaling paid pilots.

Encryption. AES-256 at rest, TLS 1.3+ in transit, hardware-backed key management where available, role-based access, key rotation, immutable admin audit logging.

Privacy by design. The blockchain never stores customer identities, payment credentials, wallet balances, addresses, contacts, or purchase history. Sensitive data stays encrypted in the merchant's environment; only cryptographic evidence is published.

Compliance by design. Structured tax and reporting data is captured at transaction time to support daily summaries, tax calculations, jurisdictional reporting, refunds, exemptions, reconciliation, and audit packages. For the US, this simplifies integration with federal/state/local reporting while recognizing that filing obligations vary and may require certified software or providers. The objective is to *support*, not replace, tax professionals.

Zero-knowledge-ready. The architecture anticipates selective-disclosure proofs (prove totals/taxes are correct without revealing underlying transactions) as standards, tooling, and regulatory acceptance mature — designed-for, not launch-blocking.

11. Device & Deployment Strategy

BOOSPOS is deliberately **device-flexible** — a requirement, not a nicety, because its two launch markets sit at opposite ends of the hardware spectrum.

Install anywhere (software-first). The Register App runs on **Android phones and tablets**, high-end or low-end, installable on devices merchants already own. This is essential for large distributed merchant networks where vendors use assorted handsets — no fleet of proprietary terminals required to start.

Design constraints this imposes on the build:

- **Phone-first responsive UI**, not tablet-only layouts.
- **Low-end device performance budget** — modest RAM/CPU, older Android versions.
- **Offline-first is non-negotiable** — intermittent connectivity is the norm in many markets; sales complete locally and anchor on reconnect.
- **Small install footprint** and resilient sync.
- **Localization** (English + Indonesian at launch) and local payment rails (**QRIS** in Indonesia).

Hardware path (sequenced by capital intensity):

1. **BYOD software-only (launch)** — fastest penetration; ideal for food trucks and distributed vendors; screen-only KDS to start.
2. **Certified terminals** — the team is already registered with **PAX Global** and **SUNMI**; these are the target platforms for first-party countertop/handheld units with secure element, EMV/NFC, and P2PE.
3. **Peripherals** — close the kitchen-printer/KDS gap so a merchant can run a kitchen without a third-party POS in the loop.

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12. Go-To-Market & Ecosystem Partnership

12.1 From selling software to building commerce infrastructure

The restaurant technology market is crowded, yet most merchants still assemble POS, ordering, loyalty, payments, accounting, and marketing from multiple providers — producing fragmentation, duplicated data, and higher costs. BOOSPOS's strategy is not to offer one more POS, but to deliver **integrated commerce infrastructure** that unifies ordering, operations, payments, compliance, and AI. Rather than forcing a full rip-and-replace, we meet merchants where they operate and add value progressively.

12.2 The Orderly partnership and POS-independence

Orderly is the customer-facing commerce platform; BOOSPOS and BP Audit Shield are the operational, financial, and compliance backbone. Together they form a continuous workflow: website → online ordering → in-store POS → kitchen → inventory → payment → accounting → BP Audit Shield → blockchain verification → business intelligence. Every completed order automatically becomes an operational, inventory, payment, accounting, AI-learning, compliance, and verification event — network effects that disconnected point solutions can't easily replicate.

Strategically, BOOSPOS is what makes the ecosystem **POS-independent**: able to run integrated with a merchant's existing POS *or* fully standalone. **Owner.com is the explicit benchmark** — BOOSPOS must reach parity on operational basics before leaning on its differentiators.

12.3 Launch markets

United States — food-truck-led, dine-in alongside. Food trucks are the ideal beachhead: mobile, offline-first, low-cost BYOD, high volume, tech-forward owners who iterate quickly. Dine-in restaurants deploy in parallel. Existing tenants are live testbeds. The US market also stress-tests orchestration under the most demanding payment conditions (high card volume, complex interchange, high approval expectations).

Indonesia — distributed UMKM at scale. thereal.dimsum, a dimsum UMKM with roughly **1,400 outlets**, currently runs a mix of different POS brands that is hard to consolidate, with vendors operating on assorted Android devices. BOOSPOS's device-flexible, offline-first, phone-capable design is built precisely for this: a single installable app that consolidates a fragmented estate onto one platform with unified reporting and local rails via **Xendit/Midtrans** (QRIS + e-wallets + bank VA), with stablecoin optional. A network this size is also a powerful proving ground for multi-device robustness and low-connectivity operation.

12.4 Merchant value, plainly

Fewer vendors and less manual reconciliation; lower effective payment cost through net-value routing and optional stablecoin settlement; audit-ready-by-default records; and AI that helps run the business. Adoption is staged (digital commerce → operational efficiency → financial intelligence → compliance automation → next-generation payments), minimizing implementation risk while delivering value at each step.

12.5 Positioning guardrail

Frame everything as **future-ready infrastructure**. Do not attack legacy POS systems, and do not claim Web3 regulation will become mandatory — credibility with US investors, regulators, and enterprises depends on this restraint.

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13. Engineering Roadmap & Execution Plan

Milestones with deliverables and acceptance criteria. Sequencing follows "learn one POS/rail at a time." (Lead dev: Verry.)

M0 — Foundation *(largely in place)* — reuse Orderly transaction engine, BP Audit Shield anchor, Square sync. *Accept:* a live transaction anchors to Monad with a retrievable Merkle proof.

M1 — Software-only Register + Orchestration v1 (US pilot) — React Native app on Android phones/tablets; offline-first Local Vault; Square + Stripe adapters with failover; authorization-outcome logging from day one. *Accept:* a real paid food-truck sale completes offline and reconciles; every attempt logged with gateway+BIN+result.

M2 — Hybrid Fiat–Crypto + Indonesia rails — add **CoinGate** (crypto) and **Xendit and/or Midtrans** for Indonesia (QRIS + e-wallets + VA); rate-lock; merchant settlement preferences; unified reconciliation; Indonesian localization. *Accept:* a crypto/stablecoin sale settles to the chosen currency; a QRIS sale completes on a low-end Android phone; single reconciliation report matches line-by-line.

M3 — Net-Value Routing (learned) — ship approval-rate predictor + contextual bandit; harden guardrails/idempotency/retry. *Accept:* routing measurably improves net value vs. cheapest-fee baseline on pilot data.

M4 — Standalone hardware + KDS independence — PAX/SUNMI terminal build; close the kitchen-printer/KDS gap. *Accept:* a food truck runs end-to-end (order → pay → kitchen → anchor) with no third-party POS.

M5 — Compliance automation + programmable settlement — automated tax set-aside/escrow, structured reporting packages, third-party verification API. *Accept:* an external party verifies a merchant's totals via proof without seeing underlying transactions.

Scale note: the thereal.dimsum rollout (~1,400 outlets) should follow M2 hardening and is gated on multi-device QA across representative low-end Android hardware and a repeatable mass-onboarding flow — not attempted big-bang.

14. Risks & Open Decisions

- **Anchoring cadence & Monad mainnet timing** — batching policy; migration off Testnet.
- **Routing guardrails** — merchant overrides, retry caps, exploration aggressiveness in production.
- **Crypto acceptance & regulatory posture** — which stablecoins/processors; money-transmission/KYC implications in target US states and Indonesian rules (engage the fintech attorney already retained for the ecosystem).
- **PCI scope confirmation** — validate SAQ level with a QSA before scaling paid pilots.
- **Multi-device QA at scale** — representative low-end Android matrix and mass-onboarding tooling before the 1,400-outlet rollout.
- **Focus vs. breadth** — each gateway/POS adapter earns its slot by pilot demand (Square first).

15. Long-Term Vision

The future of commerce technology will be defined not by isolated applications but by connected ecosystems where ordering, payments, operations, compliance, and intelligence function as one platform. BOOSPOS turns the register from a transaction recorder into a **point where trust is issued** — where real-world commerce becomes independently verifiable proof. Over the coming decades: autonomous commerce (terminals that reorder stock, negotiate fees, and set aside tax automatically), the register as a verifiable economic oracle feeding credit and insurance, borderless fiat-and-crypto settlement, and financial identity for previously unbanked merchants earned simply by selling. Merchants gain a flexible foundation that absorbs new payment technologies, AI capabilities, and compliance requirements as they emerge — a durable advantage for merchants and ecosystem partners alike.

Appendix A — Naming (Selected: BOOSPOS)

Name	Character	Note
BOOSPOS *(brand)*	Brand-family fit; cross-ecosystem	Safe, clear default
Tally	Friendly; "always reconciles"	Trademark check (fintech)
Loket	Indonesia/PPOB roots	Strong locally; may feel too local
Certa	"Certainty"; short, international	Trademark check
Meridian	Gateway hub; visionary	Common — clearance needed

Appendix B — Glossary

- **Canonical Transaction** — standardized integrity-only record hashed for anchoring.
- **Merkle root / proof** — batch commitment on-chain + per-transaction inclusion proof.
- **Net-value routing** — selecting a payment route by expected value, not nominal fee.
- **AI Gateway** — single governed entry point for all AI tasks in BOOSPOS.
- **BP Audit Shield** — BranchlessPay's modular anchoring/compliance layer.
- **Invisible blockchain** — customer UX uses human trust language, never crypto terms.
- **QRIS** — Indonesia's standardized QR payment rail.

Unified whitepaper, execution draft. Technical claims, SAQ scoping, crypto/regulatory posture, and financial figures require validation before external publication. Brand: BOOSPOS (domain boospos.com, in process).