Architecture & Design Principles

Overview

The coordinator-node-starter is a template system for building competition coordinators ("Crunches"). Each coordinator runs a predict → score → rank loop against participant models, fed by live market data.

The architecture is built on five core principles:

1. Canonical schema with JSONB extension
2. Deterministic callable wiring via packs
3. Generated skill files that guide LLM agents
4. Shared runtime library (`coordinator_runtime`)
5. Two-repo separation per competition

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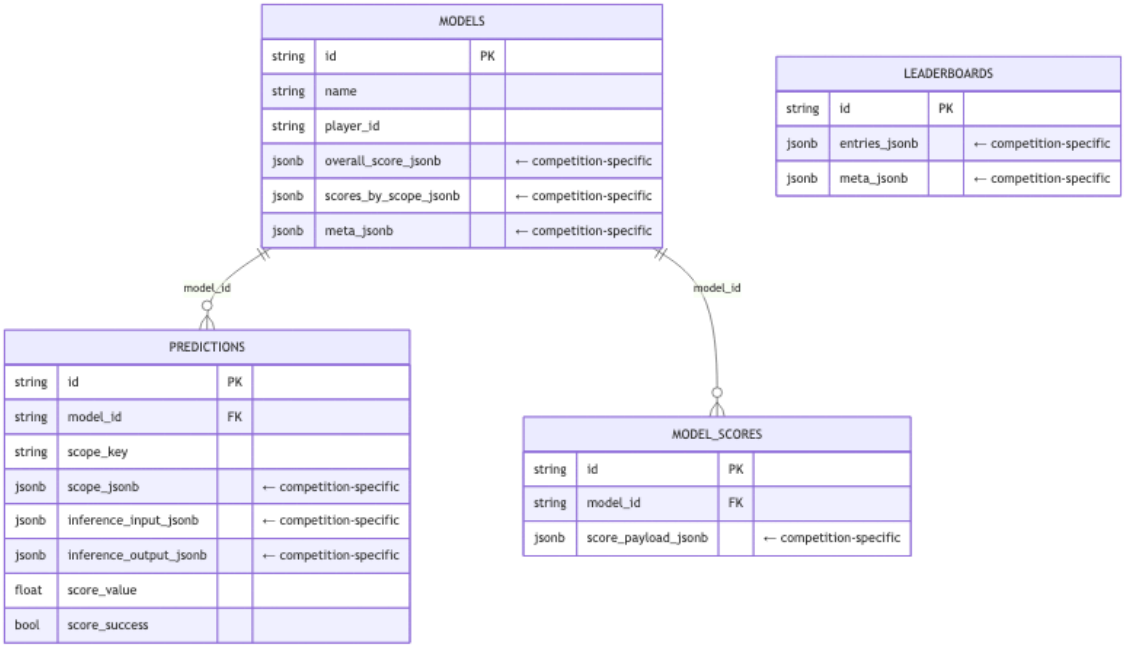
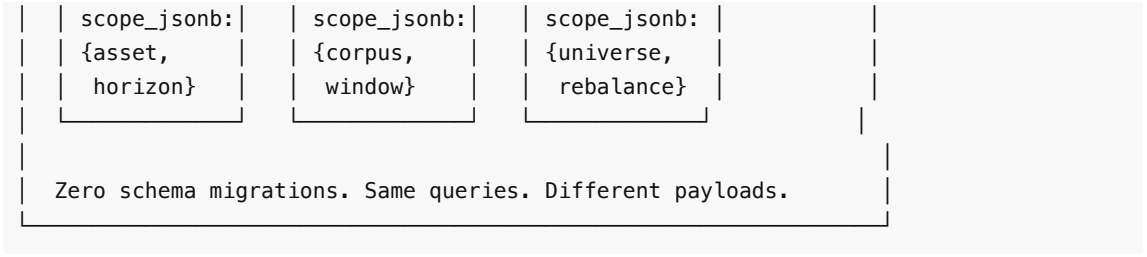
1. Canonical Schema + JSONB Extension

Every coordinator shares the same Postgres table structure. Protocol-required columns are typed and indexed. Competition-specific data lives in JSONB columns.

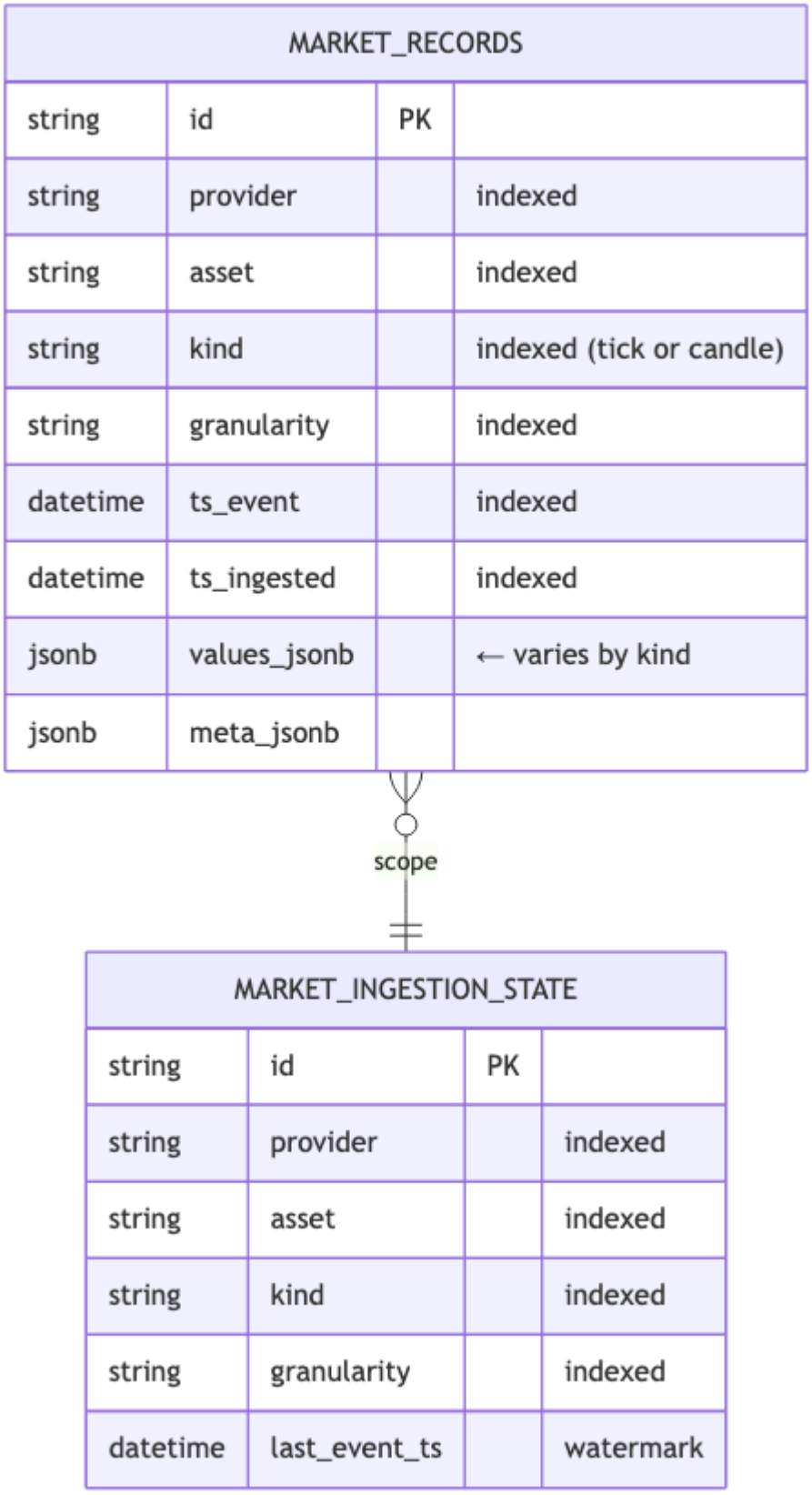


The key insight: **typed columns for protocol queries, JSONB columns for competition-specific payloads**.

```
┌──────────────────────────────────────────────────────────┐
│                    Same canonical tables                 │
│                                                          │
│  ┌──────────────┐   ┌──────────────┐   ┌──────────────┐  │
│  │ BTC Price    │   │ NLP          │   │ Portfolio    │  │
│  │ Predictor    │   │ Sentiment    │   │ Optimizer    │  │
│  │              │   │              │   │              │  │
```



Separately, `market_records` is a **high-volume append table** for raw market data. Each data point is its own row with typed/indexed columns for querying (`provider` , `asset` , `kind` , `granularity` , `ts_event`). JSONB is only used for the per-record value shape, which varies by data kind:


MARKET_RECORDS
string id PK
string provider indexed
string asset indexed
string kind indexed (tick or candle)
string granularity indexed
datetime ts_event indexed
datetime ts_ingested indexed
jsonb values_jsonb ← varies by kind
jsonb meta_jsonb
scope
MARKET_INGESTION_STATE
string id PK
string provider indexed
string asset indexed
string kind indexed
string granularity indexed
datetime last_event_ts watermark

```
 tick row:   values_jsonb = {"price": 44987.5}
 candle row: values_jsonb = {"open": 45000, "high": 45010, "low": 44980, "close":
44992, "volume": 12.3}
```

This is not a JSONB-array-per-feed design. One row per data point, uniquely indexed on `(provider, asset, kind, granularity, ts_event)` for dedup and fast time-range queries.

This means:

- **New competitions don't require schema migrations.** A BTC price predictor and an NLP sentiment ranker use the same tables — they just put different shapes inside the JSONB columns.
- **Core queries work everywhere.** Filtering predictions by model, time range, or scope works identically regardless of what's inside the payloads.
- **The webapp, CLI tools, and report APIs work against known column names** while competition-specific UI (column labels, metric widgets) reads from configurable schema endpoints.

The canonical tables are defined once in `coordinator_core/infrastructure/db/db_tables.py` and shared across all generated workspaces via vendoring.

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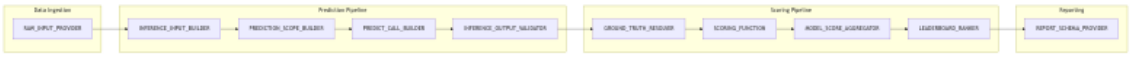
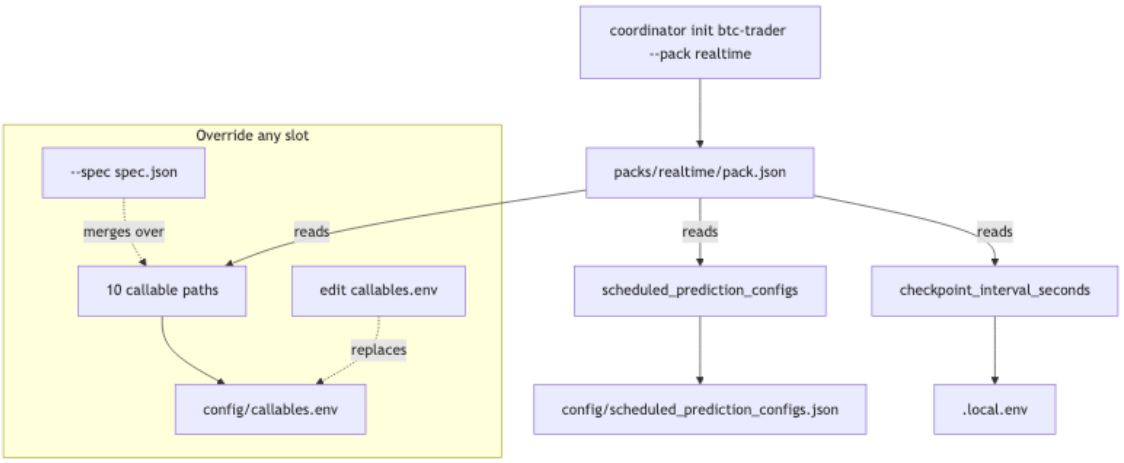
2. Deterministic Callable Wiring via Packs

A coordinator's behavior is defined by **ten callable slots** that form the full predict → score → rank pipeline:



Slot	Responsibility
`RAW_INPUT_PROVIDER`	Fetch/build the raw data payload for a prediction cycle
`INFERENCE_INPUT_BUILDER`	Transform raw input into what models receive
`INFERENCE_OUTPUT_VALIDATOR`	Validate model responses
`SCORING_FUNCTION`	Score a single prediction against ground truth
`GROUND_TRUTH_RESOLVER`	Resolve what actually happened (from market tape or external source)
`MODEL_SCORE_AGGREGATOR`	Aggregate per-prediction scores into per-model scores
`LEADERBOARD_RANKER`	Rank models into a leaderboard snapshot
`REPORT_SCHEMA_PROVIDER`	Define the leaderboard column / metrics widget schema for the UI
`PREDICTION_SCOPE_BUILDER`	Build the scope dimensions for each prediction
`PREDICT_CALL_BUILDER`	Assemble the final model invocation payload

Packs are JSON manifests that pre-wire all ten slots:



Available packs:

- **baseline** — 60s cycles, balanced local development
- **realtime** — 15s cycles, low-latency tournament
- **tournament** — combined in-sample + out-of-sample scopes

Callable paths use Python dotted-module notation (`runtime_definitions.data:provide_raw_input`). Workers load them at startup via `importlib` , so no code changes are needed to swap behavior — just change the env var.

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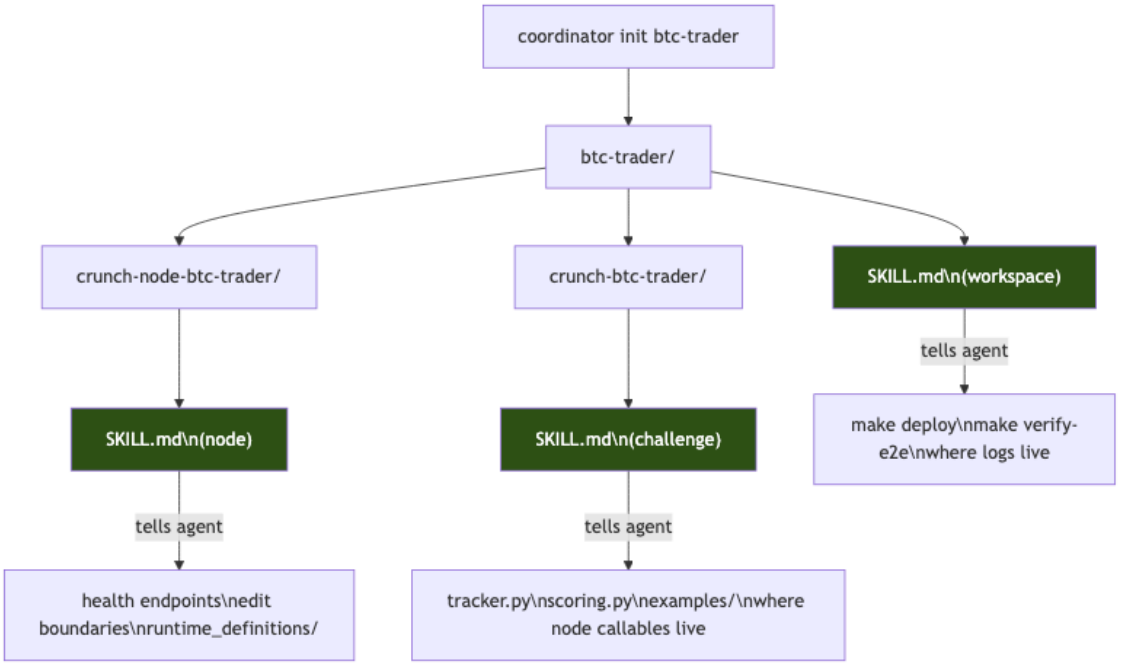
3. Generated Skill Files (LLM Agent Guidance)

Every scaffolded workspace includes three `SKILL.md` files — structured instructions for coding agents:



The idea: `coordinator init` produces the hard 80% (working infrastructure, wired callables, running stack). The SKILL files prompt an LLM to fill in the remaining 20% — the actual competition logic — by pointing it at the right files and explaining the constraints.

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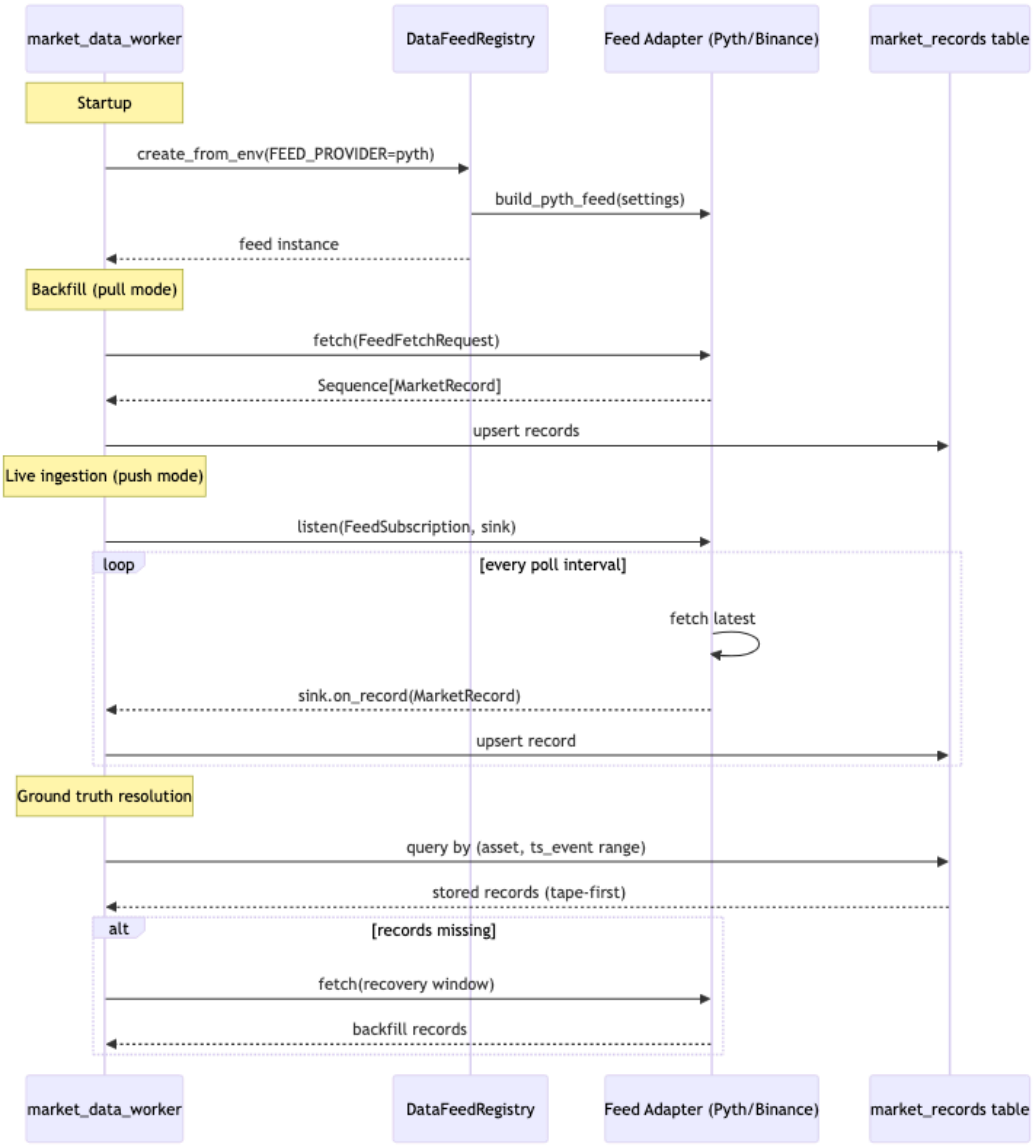
4. Shared Runtime Library (`coordinator_runtime`)

Code that is **common across all coordinators** lives in `coordinator_runtime/` :

Feed Architecture

Provider adapters implement a dual-mode protocol:



Provider adapters prefer SDK packages (e.g. `python-binance`) for external connections, with HTTP fallback if the package is unavailable.

Tape-First Pattern

```
┌─────────────────────────────────────────────────┐
│                Ground Truth Resolution          │
│                                                 │
│   1. Query market_records for (asset, time window)   │
│              │                                  │
│              ▼                                  │
│       Records found? ──yes──► Use stored values     │
│              │                                  │
│              no                                 │
│              │                                  │
```

```
│              ▼                                          │
│   2. Fetch from live feed (recovery)                    │
│              │                                          │
│              ▼                                          │
│   3. Store fetched records for future queries           │
│              │                                          │
│              ▼                                          │
│        Return resolved ground truth                     │
│                                                         │
│   TTL retention based on market time (ts_event)         │
│   not ingest time                                       │
└─────────────────────────────────────────────────────────┘
```

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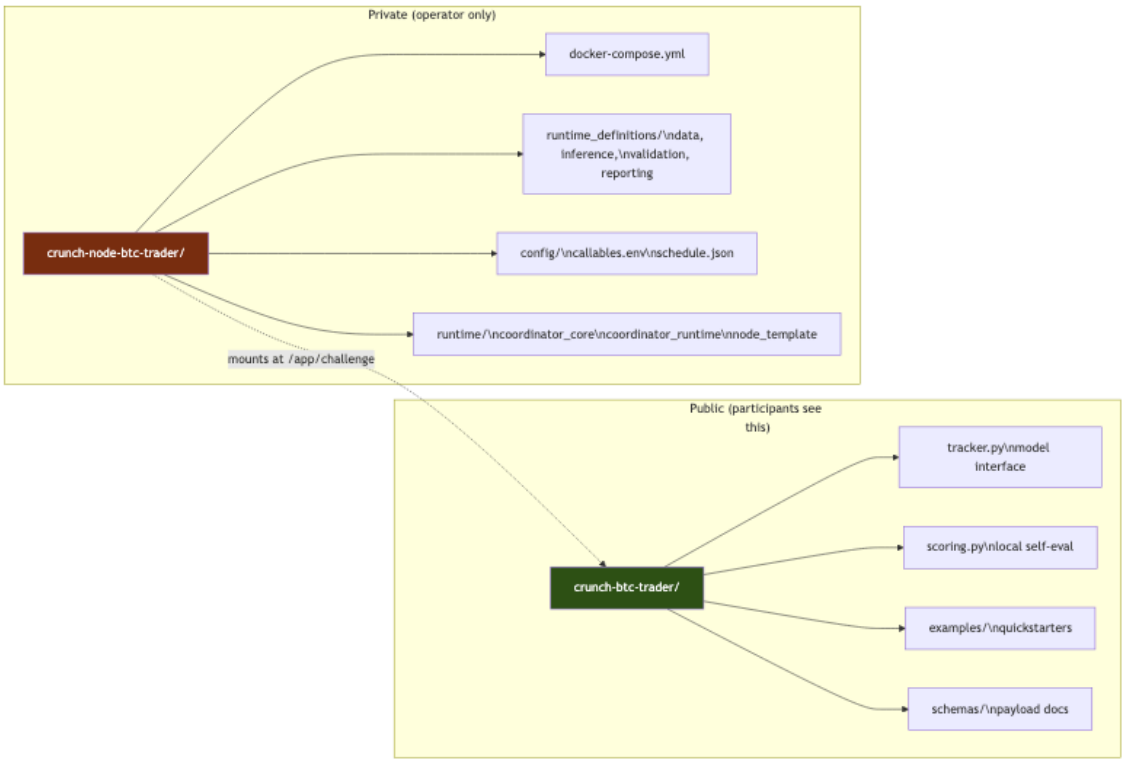
5. Two-Repo Separation

Each competition produces two repositories with a clear visibility boundary:



Repo	Visibility	Contains
`crunch-<name>`	**Public**	Model interface (`tracker.py`), scoring logic, quickstarter examples, schemas
`crunch-node-<name>`	**Private**	Deployment config, callable wiring, runtime definitions, vendored runtime packages

This separation means participants see only the challenge contract — not the infrastructure, scoring weights, or data pipeline internals.

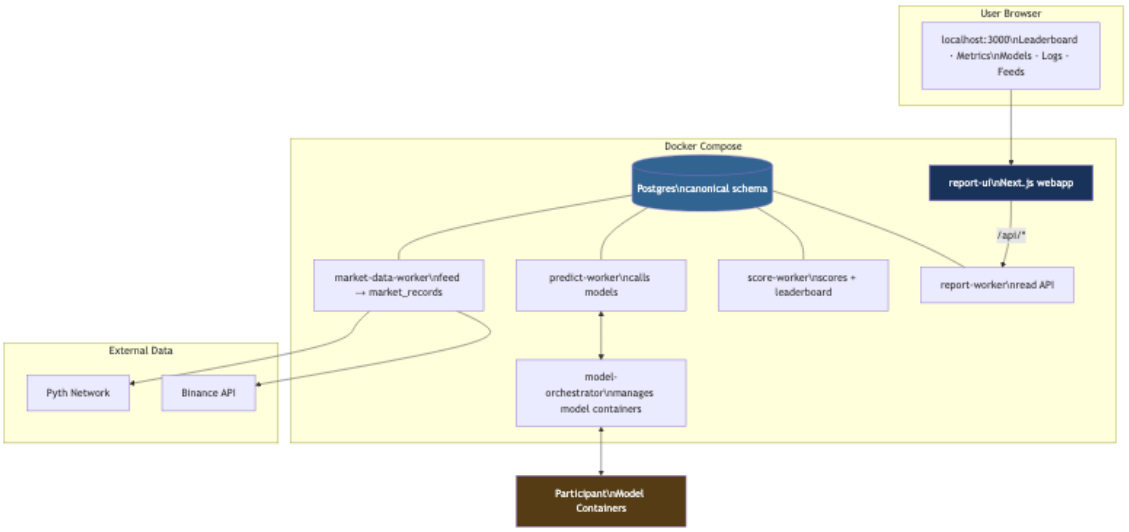
The node workspace is self-contained: it vendors `coordinator_core`, `coordinator_runtime`, and `node_template` into a `runtime/` directory and builds a single Docker image from them. No dependency on the template repo at runtime.

How It Fits Together

Scaffold Output

```
coordinator init btc-trader --pack realtime
│
├─ reads pack JSON (callables, schedule, checkpoint interval)
├─ renders templates (Dockerfile, docker-compose, Makefile, SKILL files)
├─ generates .local.env + config/callables.env with all 10 slots wired
├─ vendors coordinator_core + coordinator_runtime + node_template
│
└─ btc-trader/
   ├─ SKILL.md                        ← workspace agent guidance
   ├─ process-log.jsonl               ← scaffold audit trail
   │
   ├─ crunch-btc-trader/              ← public challenge package
   │  ├─ SKILL.md                     ← challenge agent guidance
   │  ├─ crunch_btc_trader/
   │  │  ├─ tracker.py                ← model interface (fill this in)
   │  │  ├─ scoring.py                ← scoring function (fill this in)
   │  │  └─ examples/                 ← quickstarters for participants
   │  └─ pyproject.toml
   │
   └─ crunch-node-btc-trader/         ← private node runtime
      ├─ SKILL.md                     ← node agent guidance
      ├─ RUNBOOK.md                   ← troubleshooting guide
      ├─ docker-compose.yml           ← all services pre-wired
      ├─ Dockerfile
      ├─ Makefile                     ← deploy/verify/logs targets
      ├─ .local.env                   ← environment config
      ├─ runtime_definitions/         ← node-private callables
      │  ├─ data.py                   ← tape-first input + ground truth
      │  ├─ inference.py              ← input builder
      │  ├─ validation.py             ← output validator
      │  └─ reporting.py              ← UI schema
      ├─ config/
      │  ├─ callables.env             ← all 10 callable paths
      │  └─ scheduled_prediction_configs.json
      └─ runtime/                     ← vendored packages
         ├─ coordinator_core/
         ├─ coordinator_runtime/
         └─ node_template/
```

Running Stack



Key Design Decisions

Decision	Rationale
JSONB for all competition-specific data	No migrations per competition. Same queries, different payloads.
Ten callable slots, not plugin classes	Simple to reason about. One function per concern. Swappable via env.
Packs, not inheritance	Flat JSON config. No class hierarchies. Easy to diff and override.
Tape-first ground truth	Deterministic scoring from stored data. Feed failures don't block scoring.
Vendor at scaffold time	Node workspace works offline. No implicit dependency on template repo.
Generated SKILL files	Agents get structured guidance, not just code. The scaffold is documentation.
SDK-first for external APIs	Explicit, testable dependencies. HTTP fallback for resilience.
Feed visibility in UI is data-driven	Feeds nav appears only when feed data exists. Zero config for the operator.