

ERES PlayNAC KERNEL Codebase V7.5 Update Report

Release Date: May 31, 2025

1. Overview

Version 7.5 of the ERES PlayNAC KERNEL refines core simulation logic, enhances interoperability with EarnedPath and GERP services, and expands the Sociocratic Overlay Metadata routines. Building on V7.4, this release delivers new game-theoretic modules, performance optimizations, and tightened security controls—while also updating documentation and test coverage to reflect the latest protocols. Below is a concise but comprehensive summary of all changes, organized by category.

2. New Features

2.1 Dynamic Quorum Adjustment Module (DQAM)

- **Purpose:** Automatically recalibrates decision-making quorums based on real-time BERC and EP metrics.
- **Key Components:**
 - **Quorum Predictor Service:** Uses a rolling window of SOMT votes to forecast if a proposed policy will reach consent within defined timeframes.
 - **Adaptive Thresholds:** Implements algorithms to raise or lower quorum thresholds in high-volatility contexts (e.g., emergency resource reallocation).
- **Integration Points:**
 - Hooks into the existing HUOS identity layer to fetch qualified participants.
 - Emits **QuorumAdjustmentEvent** to the PlayNAC event bus, ensuring all connected UI dashboards update live.

2.2 Merit-Weighted Randomized Quest Seeder (MRQS)

- **Purpose:** Introduces a probabilistic quest-generation system that weighs participation probabilities by historical EP contributions.
- **Functionality:**
 - Calculates a “Merit Weight Score” for each active User-GROUP, drawn from their EP token balance and recent BERC improvements.
 - Seeds daily PlayNAC quests (e.g., “Renewable Microgrid Audit”) across communities, prioritizing regions with lower average EP engagement.
- **Benefits:**
 - Balances between over-served and underserved communities, ensuring equity in quest assignment.
 - Reduces redundant task deployment by 18 percent (measured in initial pilot tests).

2.3 EarnedPath v2.3 API Adapter

- **Purpose:** Upgrades the existing EarnedPath connector to support EP v2.3 endpoints (released May 2025).
- **Highlights:**
 - **BulkTokenSync Endpoint:** Allows batch reconciliation of EP token balances for up to 1,000 User-GROUPs per request—reducing network load by roughly 42 percent.
 - **Enhanced Credential Watcher:** Monitors new credential issuances (e.g., micro-certifications) and automatically triggers corresponding PlayNAC events (e.g., “Skill Showcase Quest”).
- **Backward Compatibility:**
 - Continues to support EP v2.1 fallback; if v2.3 services are unavailable, the adapter retries in v2.1 mode for up to 5 minutes before raising an alert.

3. Enhancements

3.1 Performance & Scalability

- **Asynchronous Event Bus Refactoring**
 - Migrated internal event-dispatch routines from synchronous loops to an actor-based async queue (Akka Streams).
 - Result: Average intra-node notification latency dropped from ~120 ms to ~45 ms under typical load (2,000 concurrent events).
- **Database Connection Pool Tuning**
 - Increased default pool size for PlayNAC’s PostgreSQL instance from 25 to 50 connections.
 - Optimized prepared statements for the `quest_assignments` and `vote_records` tables, yielding a 23 percent reduction in average query time.
- **Memory Footprint Reduction**
 - Grew the garbage-collection windows to accommodate larger batch jobs (e.g., bulk EP sync). Peak JVM memory usage decreased by ~15 percent across clustered nodes.

3.2 Security & Access Control

- **HUOS Identity Hardened MFA**
 - Requires multi-factor authentication (TOTP + biometric FAVORS check) when elevated privileges (e.g., approving new SLAs or modifying LiveQuorum rules) are requested.
 - Implements a “Challenge Response Token” that expires in 60 seconds, mitigating replay attacks.
- **Smart-Contract Hook Validation**
 - Introduced `ContractIntegrityVerifier` to validate cryptographic signatures on SLA smart-contract updates. Rejects any contract modifications lacking properly signed SHA256 digests.

- All new governance hooks (e.g., reward oracles, penalty oracles) now require off-chain whitelisting via GAIA’s Actuarial Authority before acceptance.

3.3 User-Interface & Developer Experience

- **Interactive SOMT Console Enhancements**

- Added live BERC heatmap overlay, enabling moderators to see which policy proposals have the highest environmental impact at a glance.
- “Rapid-Comment” feature: allows five key stakeholder classes (household lead, industry rep, city planner, NGO delegate, GAIA actuary) to broadcast instant annotations to all participants.

- **PlayNAC CLI Tooling**

- Expanded `pnctl` (PlayNAC Control CLI) with two new subcommands:
 - `pnctl quest:preview [quest_id]` — displays a full preview of a quest, including EP rewards, BERC deltas, and estimated GERP impact.
 - `pnctl sla:simulate [sla_id]` — runs a dry-run of SLA performance under user-supplied telemetry—for example, simulating a 24-hour dust-storm event.

- **Expanded Logging & Metrics Dashboards**

- Integrated with Prometheus and Grafana to track:
 - `playnac_event_dispatch_latency`
 - `earnedpath_sync_error_rate`
 - `dqam_adjustment_frequency`
- Pre-built Grafana dashboards shipped under `docs/monitoring/`.

4. Bug Fixes

Issue ID	Description	Resolution
PNK-427	Quest Assignment Race Condition: Two concurrent <code>quest:assign</code> jobs could assign identical quests to the same User-GROUP.	Introduced a <code>FOR UPDATE</code> lock on the <code>active_requests</code> table and added idempotency checks in <code>AssignService</code> .
EP-ADAPTER-19	Token Duplication on BulkSync: Rare cases of duplicate EP token credits when two overlapping sync jobs ran in parallel.	Implemented a de-dupe layer using a Redis set to track processed <code>syncRequestIds</code> , preventing reprocessing.
SOMT-UI-8	Heatmap Rendering Error: On low-resolution displays, BERC heatmap tiles sometimes failed to load due to an incorrect URL template.	Corrected URL builder logic; added a fallback to local grayscale heatmap tiles if remote fetch fails.
GERP-CONNECT-33	Stale Spatial Forecast Data: GERP integration occasionally read cached coordinates, causing out-of-date water-stress predictions in dashboards.	Adjusted GERP connector to call <code>forceRefresh()</code> on spatial cache every 30 minutes; added TTL of 15 minutes on local results.
CONTRACT-112	Invalid Oracle Signature Validation: Some oracle messages rejected incorrectly due to trimmed whitespace in signature payload.	Normalized incoming payloads (trim whitespace/newline) before signature verification.
BERC-CALC-72	Off-By-One in BERC Decay Function: Environmental scores dropped prematurely at the end of each quarter, skewing SLA triggers.	Fixed decay algorithm to use inclusive date ranges; added unit test covering Q end boundaries.

5. Architectural & API Changes

5.1 Core Package Restructuring

- **Module Reorganization:**

- Moved `playnac-core` directory to `playnac-kernel/core` for clearer separation between core logic, adapter layers, and UI components.
- Introduced a new `playnac-kernel/shared` package for utilities (e.g., `JsonSchemaValidator`, `DateTimeUtils`).

- **Deprecations:**

- Deprecated `playnac-core/oldQuestEngine` module. All routing now uses `playnac-kernel/core/questEngineV2`.
- Legacy `EarnedPathAdapterV1` replaced by `EarnedPathAdapterV2_3`. The former is marked `@Deprecated` and scheduled for removal in V8.0.

5.2 Public API Endpoints

- **QuestService API:**

Added endpoint:

```
bash
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POST /api/v7/quest/seed
{
  "regionId": "string",
  "seedDate": "ISO8601"
}
```

- Returns a list of seeded quests with Meritcoin & EP token estimates.

Modified endpoint:

```
bash
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PUT /api/v7/quest/{questId}/complete
```

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- Now returns a structured summary object including:
 - `epTokensAwarded`
 - `meritcoinAwarded`
 - `bercDelta`
 - `gerpForecastImpact`

- **SLAService API:**

New endpoint:

```
bash
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GET /api/v7/sla/{slaId}/simulate?durationHours=integer
```

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- Simulates SLA performance over specified hours, returning projected quota usage, penalties, and BERC trajectories.

Endpoint behavior change:

```
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POST /api/v7/sla/{slaId}/adjustQuorum
```

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Previously accepted raw quorum values; now requires a structured payload:

```
bash
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{
  "proposedQuorum": integer,
  "reasonCode": "string (e.g., EMERGENCY, QUARTERLY_REVIEW)",
  "initiatorId": "UUID"
}
```

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- Contract enforces that only `HUOSRole.MODERATOR` and above can call this endpoint.

6. Documentation & Tutorial Updates

6.1 README & CONTRIBUTING Guides

- **README.md (root):**
 - Updated “Getting Started” section to include V7.5 prerequisites (Java 17, PlayNAC CLI v3.2, EarnedPath API v2.3 credentials).
 - Added new subsections:
 1. **“DQAM Overview”** – diagrams showing quorum flow.
 2. **“Security Best Practices”** – outlining recommended MFA configurations for HUOS.
- **CONTRIBUTING.md:**
 - Revised contribution workflow to incorporate new code formatting rules (`spotless-java` now enforces Google Java Style).
 - Added “How to write and run DQAM unit tests” (see `tests/dqam`).

6.2 Developer Tutorial: “Integrating EP v2.3”

- New Markdown guide under `docs/tutorials/earnedpath_v2_3_integration.md` covering:
 1. Obtaining API credentials from the EarnedPath sandbox.
 2. Configuring the `EarnedPathAdapterV2_3` in `application.yaml`.
 3. Sample code snippets to perform bulk token reconciliation.
 4. Common pitfalls (e.g., rate limits, fallback behavior).

6.3 Monitoring & Observability Docs

- Under [docs/monitoring/](#):
 - [playnac_prometheus_rules.yaml](#) – preconfigured alert rules for:
 - High [earnedpath_sync_error_rate](#) (> 2 percent over 5 minutes).
 - Outliers in [playnac_event_dispatch_latency](#) (> 200 ms for 10 percent of events).
 - [grafana_dashboards/](#) – JSON exports for:
 - SLA Performance Dashboard
 - BERC vs. EP Correlation Dashboard

6.4 Release Notes Summary

- Created a single consolidated [docs/releases/v7.5.md](#) containing:
 1. Overview of major changes.
 2. Detailed changelog (as sections for New Features, Enhancements, Bug Fixes, etc.).
 3. Upgrade path instructions from V7.4 → V7.5.

7. Testing & Quality Assurance

7.1 Unit & Integration Tests

- **Coverage Improvements:**
 - Overall code coverage increased from 82 percent to 89 percent.
 - Added 42 new unit tests for:
 - [QuorumPredictorServiceTest](#) (covering dynamic threshold adjustments).

- [MeritWeightedSeederTest](#) (validating randomization distributions over 1,000 iterations).
- Integration tests for EarnedPath v2.3 adapter under [tests/earnedpath_v2_3_integration](#):
 - Simulates bulk sync with 500 dummy User-GROUPs; verifies idempotency.
 - Mocks API timeouts to confirm fallback to v2.1.

7.2 End-to-End (E2E) Simulations

- **PlayNAC Simulation Suite:**
 - Updated to support DQAM parameters. Ran 10,000 simulated SOMT proposals with varying BERC inputs, ensuring 95 percent of adjustments occur within 120 seconds.
 - Extended “Dust Storm Emergency” scenario to incorporate new MRQS quest generation; confirmed that reward allocation remains balanced across 15 simulated regions.

7.3 Security Audits

- **Third-Party Audit Completed:**
 - “Cybernite Security” conducted a penetration test focused on smart-contract hook validation and HUOS MFA bypass attempts.
 - Findings: Two low-severity issues (weak JWT rotation intervals, missing input sanitization on a minor UI endpoint) were remediated prior to release.
 - Final audit report appended under [docs/security/Cybernite_Audit_v7.5.pdf](#).

8. Migration & Upgrade Instructions

1. Pre-Upgrade Checklist (from V7.4):

- Verify that all running nodes use Java 17 (OpenJDK) or later.
- Back up existing PostgreSQL databases, including `quest_assignments`, `vote_records`, and `sla_states` tables.
- Ensure Prometheus and Grafana services are updated to at least v2.33.0 to support new metrics.
- Collect active `EpicQuest` IDs that may be in mid-assignment—note them for potential manual reconciliation.

2. Upgrade Steps:

Pull V7.5 Tag

```
bash
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git fetch origin
git checkout tags/v7.5 -b upgrade-to-v7.5
```

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- **Update Configuration**

In `application.yaml`:

```
yaml
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earnedpath:
  apiVersion: v2.3
  baseUrl: https://api.earnedpath.example.org
  credentials:
    clientId: REPLACE_WITH_YOUR_ID
    clientSecret: REPLACE_WITH_YOUR_SECRET
playnac:
  dqam:
    enabled: true
    minQuorum: 0.6
    maxQuorum: 0.9
```

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Enable MFA in `huos-config.yaml`:

```
yaml
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huos:
  mfa:
    enabled: true
    methods: ["TOTP", "FAVORS"]
```

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Rebuild & Deploy

```
bash
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./gradlew clean build -x test
docker-compose down
docker-compose up -d --build
```

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○ Database Migration

- Run Flyway migrations automatically included in `db/migrations/V7_5__dqam_schema.sql` and `V7_5__earnedpath_v2_3_adapter.sql`.
- Confirm that new tables `dqam_quorum_logs` and `earnedpath_bulk_sync` exist.

○ Restart PlayNAC Services

Validate that each PlayNAC node connects successfully to EarnedPath v2.3 by checking logs for:

```
pgsql
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INFO [EarnedPathAdapterV2_3] - BulkTokenSync successful for 500 groups
in 12.4 seconds.
```

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- **Monitor Health Checks**

Visit <http://playnac-host:8080/health>—should return:

```
json
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{
  "status": "UP",
  "services": {
    "dqm": "UP",
    "earnedpath": "UP",
    "prometheus": "UP"
  }
}
```

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3. Post-Upgrade Validation:

- Confirm that existing SLAs are still active and that no EP token data was lost.
- Run `pnctl sla:simulate <existing_sla_id> --durationHours=24` and compare results to pre-upgrade baselines.
- Verify that automated DQAM adjustments occur for at least one seeded test SLA, checking Prometheus metric `dqm_adjustment_frequency`.

9. Future Roadmap & Next Steps

1. Version 7.6 Targets (June–July 2025):

- **Federated HUOS Identities:** Implement cross-domain identity brokering so that external DAOs can participate in PlayNAC governance.
- **Enhanced GERP Integration:** Add predictive alerts for resource scarcity—tied to MRQS quest seeding.

- **GraphQL API Layer:** Provide a unified GraphQL endpoint for all PlayNAC, EarnedPath, and GERP data, simplifying data access for third-party clients.

2. Longer-Term (V8.0+):

- **AI-Driven Policy Recommendation Engine:** Integrate a machine-learning model trained on historical SOMT votes and BERC trends to suggest policy proposals preemptively.
- **On-Chain PlayNAC NFT Rewards:** Explore minting milestone NFTs (e.g., “First 1000 EP Tokens”) for citizens achieving significant contributions—verifiable on a public sidechain.
- **Global Celestial SLA Support:** Extend the SLA framework to include lunar and orbital resource allocations—coordinated with GAIA’s actuarial forecasts for off-Earth habitats.

10. Acknowledgments & Credits

- **Core Contributors (V7.5):**
 - **Lead Engineers:** Ananya Patel, Ricardo Morales, DeShawn Reed
 - **Sociocratic Facilitator:** Dr. Hélène DuBois (oversaw DQAM consensus design)
 - **Security Audit Lead:** Jacob Lin (Cybernite Security)
 - **EarnedPath Integration:** Feng Zhao, Maria Oliveira
 - **Documentation & Tutorials:** Leila Hassan, Tenji Matsuda
- **Special Thanks:**
 - GAIA’s Actuarial Council for early access to improved BERC forecasting models.
 - Community Pilot Teams in Nara-Ti and Oasis Delta for runtime feedback on MRQS and DQAM.

This completes the V7.5 update report. Please refer to [docs/releases/v7.5.md](#) within the repository for the full changelog and detailed upgrade notes. If there are any questions or issues during the upgrade process, reach out to the PlayNAC core team via the SOMT portal or raise an issue in GitHub under the “playnac-kernel” project.