DigiByte Quantum Shield Network – Technical Spec

DigiByte Quantum Shield Network – Technical Specification (v1)

1. Scope

This document defines the inputs, normalisation functions, weighting scheme, and level thresholds used by the dqsn_engine risk model in its initial prototype form.

2. Inputs

QuantumRiskInput: - sig_entropy (float) – Shannon entropy of signature bytes, 0.0–8.0 bits/byte. - sig_repetition (float) – Ratio of repeated bytes, 0.0–1.0. - mempool_spike (float) – Normalised mempool stress indicator, 0.0–1.0. - reorg_depth (int) – Latest observed reorganisation depth in blocks. - cross_chain_alerts (int) – Count of external alerts in the current window.

3. Normalisation

All inputs are mapped into a 0.0–1.0 risk factor:

- f_entropy = (8.0 - sig_entropy) / 8.0, clamped to [0, 1]. Lower entropy → higher f_entropy, signalling increased risk.

- f_repetition = clamp(sig_repetition, 0.0, 1.0).

- f_mempool = clamp(mempool_spike, 0.0, 1.0).

- f_reorg = clamp(reorg_depth / REORG_HIGH_THRESHOLD, 0.0, 1.0) with REORG_HIGH_THRESHOLD = 4.

- f_alerts = clamp(cross_chain_alerts / CROSS_CHAIN_ALERT_THRESHOLD, 0.0, 1.0) with CROSS_CHAIN_ALERT_THRESHOLD = 3.

4. Aggregation

Risk score is calculated as a weighted sum:

risk = f_entropy * 0.30 + f_repetition * 0.25 + f_mempool * 0.15 + f_reorg * 0.15 + f_alerts * 0.15

The result is clamped to [0.0, 1.0].

5. Level Thresholds

The final risk score is mapped to a discrete level:

- risk < 0.25 → "normal" - 0.25 ≤ risk < 0.50 → "elevated" - 0.50 ≤ risk < 0.75 → "high" - risk ≥ 0.75 → "critical"

6. Engine Guarantees

- No external network calls are made from dqsn_engine. - All computations are deterministic given the same inputs. - The module does not depend on FastAPI or any web framework. - It is safe to embed inside node software, monitoring agents, or offline analysis tools.

7. Future Extensions

Future versions may add:

- Time■series features over multiple blocks or windows. - Separate models for different asset tiers (retail vs institutional flows). - Configurable thresholds and weights loaded from a policy file.