**Time-Weighted Snapshot Mechanism**

To ensure fairness and resilience against market manipulation, the governance system will adopt a **time-weighted snapshot mechanism** for voting power calculation.

1. **Core Concept**
   * Voting power is not determined solely by token holdings at a single block.
   * Instead, it reflects the **average balance over a defined time window**, weighted by the duration of continuous holding.
   * This discourages short-term accumulation of tokens for opportunistic influence, such as flash loan attacks.
2. **Operational Flow**
   * At the beginning of each governance cycle, the system defines a snapshot window (e.g., the past 14 days).
   * For each participant, token balances are recorded periodically within this window.
   * A **time-weighted average** is computed, granting higher influence to long-term holders.
   * The aggregated results form the final voting power used in proposals and decisions.
3. **Advantages**
   * **Defense against manipulation**: Prevents actors from acquiring tokens temporarily to sway critical votes.
   * **Long-term alignment**: Rewards participants who demonstrate sustained commitment to the ecosystem.
   * **Balanced participation**: Maintains inclusivity by avoiding excessive concentration of influence in short-term speculators.
4. **Integration with Governance**
   * The mechanism is embedded in the Snapshot Module of the governance contract.
   * Voting rights are locked for each cycle, ensuring stability throughout the decision-making process.
   * Results are transparent and verifiable on-chain, reinforcing trust among stakeholders.

**Time-lock Mechanism**

To enhance security and transparency in governance execution, the protocol will implement a **time-lock mechanism**that introduces a mandatory delay between the approval of a proposal and its execution.

1. **Core Concept**
   * A time-lock acts as a buffer period, ensuring that even after a proposal passes the required quorum and approval threshold, it cannot be executed immediately.
   * This delay provides the community and stakeholders with an additional window to review, audit, and raise objections if necessary.
2. **Operational Flow**
   * Once a proposal is approved, it is queued in the **Time-lock Contract**.
   * The proposal remains locked for a predefined duration (e.g., 48–72 hours).
   * During this period, all transaction details are publicly available on-chain, allowing the community and security auditors to verify their integrity.
   * After the delay elapses, the proposal becomes eligible for execution.
3. **Advantages**
   * **Enhanced security**: Protects against malicious or rushed governance attacks by providing reaction time.
   * **Transparency**: Stakeholders are informed in advance about upcoming actions.
   * **Risk management**: Offers an opportunity to cancel or amend proposals if vulnerabilities are discovered before execution.
4. **Integration with Governance**
   * The Time-lock is directly linked to the Governor contract, serving as the mandatory final step before execution.
   * Proposals that fail to execute within a specified grace period after the delay are automatically canceled.
   * Combined with the snapshot and multi-signature verification, the time-lock creates a layered security framework for governance.

**Multi-signature (Multi-sig) Security**

To reinforce execution security during the time-lock period, the protocol integrates a **multi-signature (multi-sig) approval process**.

1. **Core Concept**
   * Transactions require approval from **multiple independent signers (M-of-N)** rather than a single private key.
   * This structure prevents unilateral control and reduces the risk of compromised keys.
2. **Operational Flow (Simplified)**
   * Proposal enters the time-lock period.
   * Multi-sig signers review details during the delay.
   * Only when the required threshold of signatures is collected, the proposal becomes executable.
3. **Advantages**
   * **Enhanced security**: Protects treasury and governance actions from single-point failures or malicious actors.
   * **Checks and balances**: Ensures critical proposals undergo independent verification before execution.
   * **Resilience**: Even if one signer loses access, the system can operate as long as the threshold is met.
4. **Integration with Governance**
   * Multi-sig approval is mandatory for all queued proposals during the time-lock stage.
   * Signers are distributed across trusted community members or sub-committees to ensure decentralization.
   * Combined with the snapshot and time-lock, multi-sig creates a **three-layer defense framework** for governance security.