ChronoChain - Blockchain Proof of Uptime

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ChronoChain is an innovative blockchain platform designed to reward nodes based on continuous **uptime and active participation**. Unlike traditional blockchains that reward miners or validators immediately, ChronoChain implements a Proof of Uptime mechanism, where nodes accumulate rewards over time. By **sending periodic heartbeat signals to the network**, nodes prove their sustained activity, ensuring a highly reliable and resilient network. Transactions are recorded every 10 minutes, and all transaction fees, together with periodic bonus tokens, are collected into a centralized reward pool (re-pool) to be distributed fairly among eligible nodes.

The tokenomics of ChronoChain are carefully structured to maintain long-term sustainability and fairness. The genesis block releases a fixed supply of 1,000,000 tokens, while bonus tokens of 1,000 are introduced every 100 days and gradually decay by 5% every 300 days. Only nodes that maintain a minimum of 100 locked tokens and run continuously for at least 30 days are eligible to claim rewards. This dual layer reward system combining **Elder Rewards** for the longest-running nodes and **Party Rewards** for all valid nodes encourages network stability, long-term participation, and equitable distribution of incentives across the entire ecosystem.

Key Features

1. Supports transfers of unlimited amounts using **bigint** type data.

2. Blockchain records transactions every **10 minutes** (new block).

3. Transaction fee is **0.05%** of the transaction amount.

Blockchain Structure

1. New transactions are stored in the **tx-pool / transaction pool** (similar to Bitcoin's mempool).

2. All transaction fees are accumulated in the **re-pool / reward pool**.

3. Every **5 minutes**, nodes broadcast a **heartbeat-chain** signal to the blockchain as proof of their active status.

4. The **genesis block** releases **1,000,000 tokens**.

5. Every **100 days**, a **bonus token** of **1,000 tokens** is created and added to the re-pool / reward pool.

6. Every **300 days**, the bonus token amount decreases by **5%**.

7. No additional tokens are created beyond the **genesis release** and **bonus tokens**.

Reward Distribution

1. Nodes **do not receive immediate rewards** when creating a block.

2. After **30 days**, the re-pool rewards are fully distributed among all eligible nodes according to the following rules:

   o **Elder Reward**: 10% of the total reward is allocated to the **top 10% longest-running nodes**.

   o **Party Reward**: 90% of the total reward is allocated to **all valid active nodes***.

   Nodes eligible for the Elder Reward also receive a share of the Party Reward.

*Only nodes that have been running continuously for **30 days** and maintain a **minimum of 100 locked tokens** during operation are considered valid for reward distribution.*

```
+---------------+           +---------------+
|    Users      |  TX       |    tx-pool    |
| (send/receive)|--------->| (pending TX)   |
+---------------+           +---------------+
                                   |
                                   |  Select TX for new block
                                   v
                           +---------------+
                           |  Blockchain   |
                           | (10-min block |
                           |   creation)   |
                           +---------------+
                                   |
                                   |  Fees collected
                                   v
                           +---------------+
                           |   re-pool     |
                           | (reward pool) |
                           +---------------+
                                   |
                    +--------------+--------------+
                    |                             |
                    v                             v
            +---------------+             +---------------+
            | Elder Reward  |             | Party Reward  |
            | Top 10% nodes |             | All valid nodes|
            +---------------+             +---------------+
```
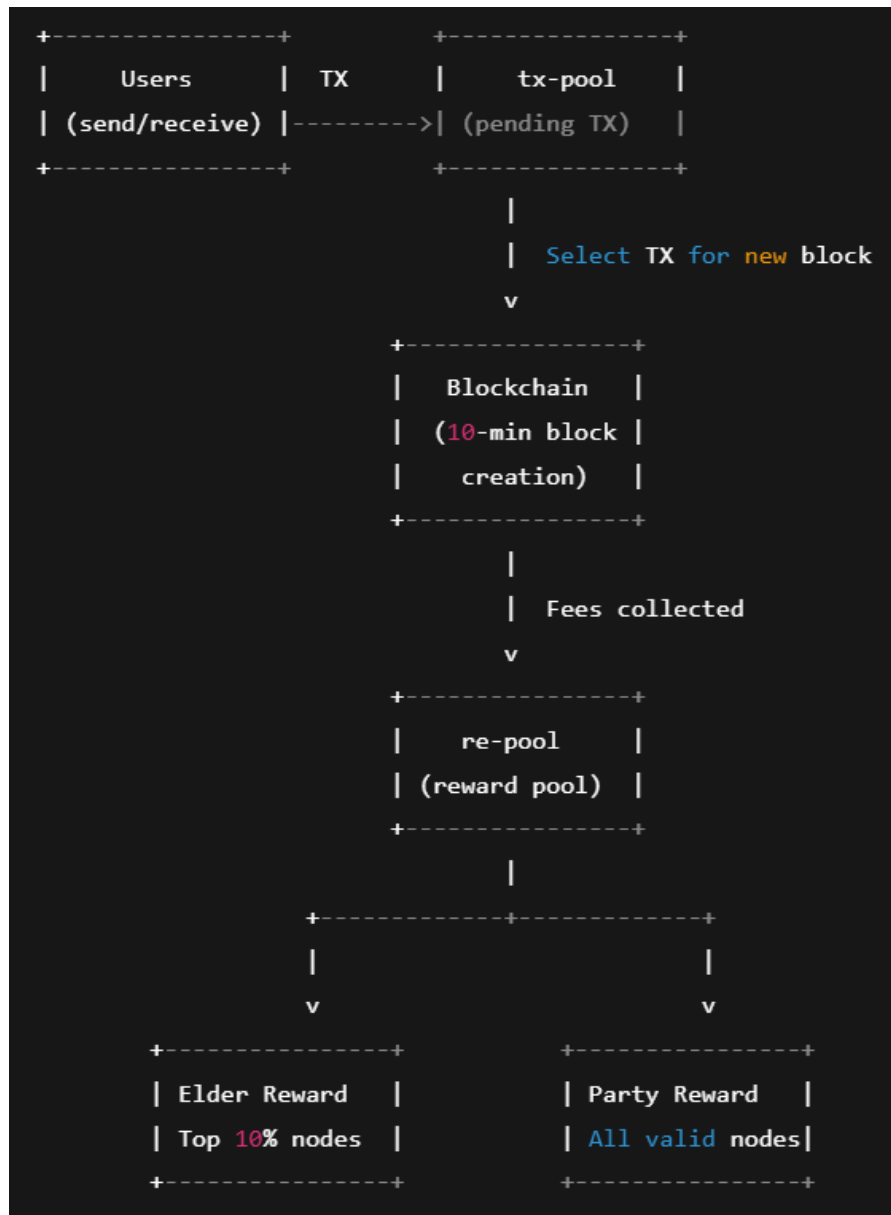
```json
{
  "blockchain": {
    "chain_id": "proof_of_uptime_chain",
    "genesis": {
      "timestamp": "2025-01-01T00:00:00Z",
      "initial_supply": 1000000,
      "bonus_rule": {
        "interval_days": 100,
        "amount": 1000,
        "decay_interval_days": 300,
        "decay_percent": 5
      }
    },
    "blocks": [
      {
        "height": 1,
        "timestamp": "2025-01-01T00:10:00Z",
        "previous_hash": "0x000000",
        "hash": "0xabc123",
        "transactions": [
          {
            "txid": "0xtx001",
            "from": "addr_user1",
            "to": "addr_user2",
            "amount": 500,
            "fee": 0.25,
            "status": "confirmed"
          }
        ]
      },
      {
        "height": 2,
        "timestamp": "2025-01-01T00:20:00Z",
        "previous_hash": "0xabc123",
        "hash": "0xdef456",
        "transactions": [
          {
            "txid": "0xtx002",
            "from": "addr_user3",
            "to": "addr_user4",
            "amount": 2000,
            "fee": 1,
            "status": "confirmed"
          }
```

```json
        ]
      }
    ]
  },
  "pools": {
    "tx_pool": [
      {
        "txid": "0xtx005",
        "from": "addr_user5",
        "to": "addr_user6",
        "amount": 100,
        "fee": 0.05,
        "status": "pending"
      },
      {
        "txid": "0xtx006",
        "from": "addr_user7",
        "to": "addr_user8",
        "amount": 250,
        "fee": 0.125,
        "status": "pending"
      }
    ],
    "re_pool": {
      "balance": 1250.375,
      "sources": {
        "fees": 250.375,
        "bonus_tokens": 1000
      },
      "last_distribution": "2025-01-31T00:00:00Z"
    }
  },
  "nodes": [
    {
      "node_id": "node01",
      "uptime_days": 45,
      "stake_locked": 100,
      "last_heartbeat": "2025-02-01T12:05:00Z",
      "status": "active"
    },
    {
      "node_id": "node02",
      "uptime_days": 32,
      "stake_locked": 100,
```

```json
      "last_heartbeat": "2025-02-01T12:05:00Z",
      "status": "active"
    },
    {
      "node_id": "node03",
      "uptime_days": 12,
      "stake_locked": 100,
      "last_heartbeat": "2025-02-01T12:04:00Z",
      "status": "inactive"
    }
  ],
  "reward_distribution": {
    "period": "2025-01-01 to 2025-01-31",
    "total_reward": 1250.375,
    "rules": {
      "elder_reward": "10% untuk 10% node terlama",
      "party_reward": "90% untuk semua node valid (uptime >= 30 hari + 100 token locked)"
    },
    "eligible_nodes": ["node01", "node02"],
    "distributed": {
      "elder_reward_total": 125.0375,
      "party_reward_total": 1125.3375,
      "per_node": {
        "node01": 688.70625,
        "node02": 561.66875
      }
    }
  }
}
```