White Paper: EdgePUG Protocol - EdgePUG Intelligent GPU Mining System on PugDAG Ecosystem

1. Executive Summary

This white paper presents a revolutionary approach to cryptocurrency mining and artificial intelligence (AI) computing by introducing EdgePUG Protocol, an autonomous AI GPU crypto mining system, powered by Tadea, the AI Autonomous mining agent, to scale the PugDAG mining process. Leveraging decentralized finance (DeFi) principles, cutting-edge AI technology, and the robust infrastructure of the Akash Network for decentralized GPU resources, this system aims to create a self-sustaining, scalable, and efficient solution for mining cryptocurrencies and providing AI compute services within the PugDAG ecosystem.

PugDAG L1 POW, a fork of the existing Kaspa project, incorporates the GhostDAG protocol to organize data in a Directed Acyclic Graph (DAG). This structure allows PugDAG to process transactions quickly and efficiently, making it a powerful tool for managing digital information and supporting various applications. Unlike Kaspa, which primarily focuses on ASIC mining, PugDAG addresses the centralization issue in traditional blockchain technology by shifting towards GPU-focused mining.

EdgePUG will be the first protocol deployed on PugDAG, leveraging DeFi principles, cutting-edge AI technology, and the Akash Network for decentralized GPU resources to create a self-sustaining, scalable, and efficient solution for mining cryptocurrencies and providing AI compute services within the PugDAG ecosystem.

2. Market Analysis

The cryptocurrency market is rapidly growing, with increasing demand for decentralized solutions. Traditional ASIC mining has led to centralization, energy inefficiency, and high costs. AI compute services are also becoming essential but face similar issues of centralization and high costs. This white paper addresses these challenges by introducing a decentralized, AI-driven mining and computing solution.

3. Introduction

The rapid growth of the cryptocurrency market and increasing demand for AI compute power have created significant opportunities for innovation. However, the current landscape is dominated by centralized mining pools and AI compute providers, which often suffer from high costs, energy inefficiency, and lack of transparency. Our proposed solution addresses these challenges by introducing a decentralized, autonomous AI GPU crypto mining system within the PugDAG ecosystem.

4. Background

4.1 PugDAG

PugDAG L1 POW is a fork of the Kaspa blockchain, designed to utilize the GhostDAG protocol for organizing data in a Directed Acyclic Graph (DAG). This approach enhances transaction speed and efficiency, making PugDAG a robust solution for various blockchain applications.

4.2 Kaspa and GhostDAG Protocol

Kaspa utilizes the GhostDAG protocol to create a more scalable and efficient blockchain structure. However, its focus on ASIC mining has led to centralization issues. PugDAG addresses these challenges by shifting towards GPU mining, promoting greater decentralization.

5. Tadea: The AI Agent in EdgePUG Protocol

5.1 Overview

Tadea is the AI agent that manages the EdgePUG Intelligent Mining System (EIMS). It leverages advanced AI algorithms to optimize the mining process, ensure efficient resource allocation, and manage decentralized mining operations. Tadea integrates seamlessly with the Akash Network for GPU resources and the Cosmos network for cross-chain compatibility.

6. System Overview

The autonomous AI GPU crypto mining system consists of three main components, with Tadea playing a central role:

- **Decentralized Mining Pool**: Aggregates computing power from individual nodes and distributes mining rewards fairly and transparently.
- **AI Compute Marketplace Integration**: Utilizes Akash Network's decentralized GPU compute marketplace for renting or selling GPU computing power for AI workloads.
- **Tadea - Autonomous AI Agent**: Manages the mining process, optimizes the allocation of computing power, and executes AI compute tasks based on market demand and the system's performance metrics.

6.1 Initialization

The system starts with a single node deployed on the blockchain platform. This node acts as the initial mining node and provides the necessary computing power to start mining cryptocurrencies.

6.2 Optimization

Tadea optimizes the allocation of computing power based on market demand, system performance, and node preferences.

6.3 Contribution

Nodes contribute their GPU computing power to the pool, which is then used for mining cryptocurrencies and executing AI compute tasks.

6.4 Distribution

Mining rewards and AI compute fees are distributed among nodes based on their contributions and performance metrics.

6.5 Monitoring

Tadea continuously monitors the system's performance and adjusts the allocation of computing power to maximize efficiency and profitability.

7. Features and Benefits

7.1 Features

- **AI Optimization**: Tadea uses AI to optimize mining efficiency, allocate computing power, and predict market trends.
- **Decentralized Mining**: Aggregates computing power from individual nodes, distributing mining rewards transparently.
- **Cross-Chain Compatibility**: Ensures interoperability with multiple blockchain platforms via Cosmos integration.
- **Smart Contracts**: Automates mining processes, reward distribution, and AI compute transactions.
- **Energy Efficiency**: Prioritizes energy-efficient mining practices, reducing the carbon footprint.

7.2 Benefits

- **Enhanced Decentralization**: Promotes a more democratic and fair distribution of mining power.
- **Flexibility and Scalability**: Can mine various cryptocurrencies and scale with network growth.
- **Increased Security**: Reduces risks associated with centralized mining pools.
- **Economic Viability**: Makes mining more accessible and profitable for a broader range of participants.

8. Use Cases

8.1 AI Compute Services

TIMS provides GPU power for AI model training and other compute-intensive tasks. This allows researchers and developers to leverage high-performance computing resources for machine

learning, data analysis, and other AI applications, enhancing the efficiency and scalability of their projects.

8.2 Flexible Mining Operations

TIMS adapts to market changes by allowing miners to switch between different cryptocurrencies. This flexibility ensures continuous profitability by enabling miners to focus on the most profitable cryptocurrencies based on real-time market conditions, optimizing their mining operations.

8.3 Community-Driven Development

TIMS supports innovation through community contributions and partnerships. The decentralized nature of the system allows for community-driven updates and improvements, fostering a collaborative environment where developers and users can propose new features, optimizations, and enhancements. This community involvement ensures that TIMS remains cutting-edge and responsive to the needs of its users.

8.4 Reward Distribution

TIMS ensures a fair and efficient reward distribution among the interconnected nodes. The reward model promotes equitable allocation of mining rewards based on node contributions. By using AI algorithms, TIMS dynamically adjusts rewards in real-time based on network conditions, such as hashrate, block difficulty, transaction volume, and cryptocurrency prices. This dynamic adjustment ensures that rewards are fair, encouraging participation from a diverse range of miners and maintaining network stability.

Additionally, TIMS incorporates rewards for staking PUG tokens and for providing AI computing services. Participants who stake their PUG tokens in the network are rewarded with additional PUG tokens, incentivizing long-term commitment and enhancing network security. Similarly, nodes that contribute their GPU power for AI compute tasks receive rewards based on the amount of computational work they perform. This multi-faceted reward distribution model ensures that all participants are fairly compensated for their contributions to the network.

9. EdgePUG Autonomous Mining Model

9.1 Overview

The Tadea Intelligent Mining System (TIMS) ensures a fair and efficient reward distribution among the interconnected nodes. The reward model promotes equitable allocation of mining rewards based on node contributions and additional incentives for staking PUG tokens and providing AI computing services.

9.2 Diagram

Tadea: The AI Agent in EdgePUG Protocol
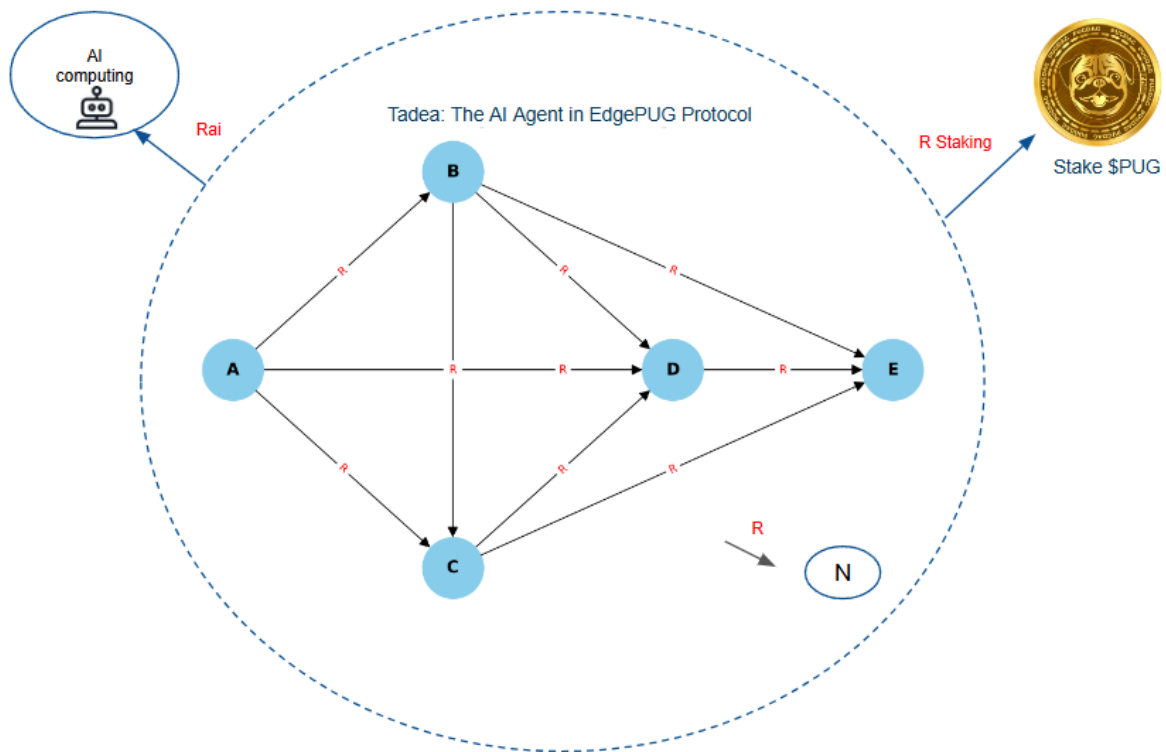
9.3 Description

- **Node A (Genesis Node)**: The initial node that starts mining and generates rewards (R). It contributes rewards to Node B, Node C, Node D, and Node E.
- **Node B**: Created by Node A with the initial reward (R). It further contributes rewards to Node C, Node D, and Node E.
- **Node C**: Receives combined rewards from Nodes A and B.
- **Node D**: Accumulates rewards from Nodes A, B, and C.
- **Node E**: Aggregates rewards from Nodes A, B, C, and D.

Additional Rewards:

- **Staking PUG**: Nodes that stake PUG tokens receive additional rewards, incentivizing long-term commitment and enhancing network security.
- **AI Computing**: Nodes that provide GPU power for AI compute tasks receive rewards based on the amount of computational work they perform.

9.4 Formula

To calculate the total rewards received by each node, use the following formula:

$$R_B = R_A$$
$$R_C = R_A + R_B$$
$$R_D = R_A + R_B + R_C$$
$$R_E = R_A + R_B + R_C + R_D$$

Where:

- R_A is the reward generated by Node A.
- R_B is the reward received by Node B.
- R_C is the combined reward received by Node C.
- R_D is the total reward accumulated by Node D.
- R_E is the aggregate reward received by Node E.

Additional Reward Calculation:
Staking PUG: Nodes receive an extra reward based on the amount of PUG staked.

$$R_{Staking} = \text{Staked PUG} \times \text{Staking Reward Rate}$$

- **AI Computing**: Nodes receive an extra reward based on the amount of GPU power provided for AI tasks.

$$R_{AI} = \text{GPU Power} \times \text{AI Compute Reward Rate}$$

10. Dynamic Reward Adjustment

10.1 Overview

Incorporating a mechanism to dynamically adjust rewards based on real-time network conditions and cryptocurrency price enhances the model's responsiveness and fairness.

10.2 Key Metrics

Identify and define the key metrics that will influence reward adjustments:

- **Network Hashrate**: The total computational power of the network.
- **Block Difficulty**: The difficulty level of solving the current block.
- **Node Contribution**: The individual contribution of each node in terms of hashrate.
- **Transaction Volume**: The number of transactions processed by the network.
- **PUG Price**: The current market price of PUG.

10.3 Reward Adjustment Algorithm

Develop an algorithm that calculates reward adjustments based on the defined metrics.

10.4 Real-Time Data Collection

Implement a system to collect real-time data on the key metrics. This could involve:

- Using APIs to fetch current network hashrate and block difficulty.
- Monitoring node contributions through mining software.
- Analyzing transaction volumes from the blockchain.
- Fetching real-time cryptocurrency prices from exchange APIs.

10.5 Reward Adjustment Logic

Incorporate the AI-updated reward adjustment algorithm into the reward distribution logic to ensure real-time updates and fairness.

11. Cross-Chain Compatibility with Cosmos

To enhance interoperability and cross-chain compatibility, the system integrates with the Cosmos network. This integration enables seamless communication and interaction with multiple blockchain platforms, ensuring broader access and utilization of the system's capabilities.

11.1 Key Benefits of Cosmos Integration

- **Interoperability**: Facilitates cross-chain transactions and interactions, allowing the system to operate across various blockchain networks.
- **Scalability**: Leverages Cosmos' scalable infrastructure to handle increased transaction volumes and growing network activity.
- **Security**: Utilizes Cosmos' robust security framework to protect cross-chain interactions and transactions.

12. Economic Model

The BlockDAG architecture supports mining decentralization and enables effective solo mining. The block reward undergoes a gradual halving process, ensuring a maximum supply of 25,431,205,439 PUG tokens.

12.1 Reward Distribution

The block reward halves once per year, but smoothly: every month, the block reward is reduced by a factor of $(1/2)^{(1/12)}$.

12.2 Transaction Fees

Transaction fees are minimal, ensuring that the cost of participating in the network remains low.

12.3 Profitability

The system is designed to make mining more accessible and profitable for a broader range of participants, including solo miners and small-scale operations.

13. Security Measures

The system employs advanced security measures to protect against attacks and ensure data privacy. These measures include:

- **Smart Contracts**: Automates processes and ensures transparency and security in reward distribution and transactions.
- **Continuous Monitoring**: Tadea continuously monitors the network to detect and mitigate potential threats.
- **Decentralized Architecture**: Reduces the risk of centralized attacks by distributing mining power across a wide network of participants.

14. Roadmap and Milestones

A detailed roadmap outlines the key development phases and milestones for EdgePUG and TIMS. This section provides a timeline and descriptions of major milestones and activities.

14.1 Q3 2024: Integration with Akash Network

- **Objective**: Integrate TIMS with Akash Network for decentralized GPU resources.
- **Activities**:
  - Develop and test APIs for seamless integration.
  - Deploy initial nodes using Akash's decentralized cloud services.
  - Conduct performance testing to ensure reliability and scalability.

14.2 Q3 2024: Deployment of TIMS

- **Objective**: Launch the Tadea Intelligent Mining System (TIMS) and begin initial mining operations.
- **Activities**:
  - Complete deployment of TIMS across multiple nodes.
  - Initiate mining operations and distribute initial rewards.
  - Monitor system performance and make necessary optimizations.

14.3 Q4 2025: Cross-Chain Compatibility with Cosmos

- **Objective**: Achieve cross-chain compatibility with the Cosmos network.
- **Activities**:
  - Implement Cosmos SDK and IBC protocols for cross-chain transactions.
  - Conduct interoperability testing with various blockchain platforms.
  - Launch cross-chain features and ensure seamless integration.

14.4 Q4 2025: Community Engagement and Partnerships

- **Objective**: Engage with the community and establish strategic partnerships.
- **Activities**:

- ○ Launch community forums and discussion platforms.
- ○ Organize webinars and workshops to educate users about TIMS.
- ○ Establish partnerships with other blockchain projects and industry leaders.

14.5 Q1 2025: Expansion of AI Compute Services

- **Objective**: Expand AI compute services and integrate with additional DePIN ecosystems.
- **Activities**:
  - ○ Develop new AI models and integrate them into TIMS.
  - ○ Partner with additional DePIN projects to enhance compute services.
  - ○ Expand the AI compute marketplace and increase service offerings.

15. Dependencies

- **Akash Network**: Provides decentralized cloud computing services for GPU resources.
- **Cosmos Network**: Enables cross-chain compatibility and scalability

16. Glossary

Definitions of key terms and concepts used in the white paper.

- **Blockchain**: A decentralized ledger of all transactions across a network.
- **AI (Artificial Intelligence)**: The simulation of human intelligence in machines.
- **POW (Proof of Work)**: A consensus mechanism where miners solve complex mathematical problems to validate transactions and create new blocks.
- **DeFi (Decentralized Finance)**: Financial systems built on blockchain technology that operate without central intermediaries.
- **GPU (Graphics Processing Unit)**: A specialized processor designed to accelerate graphics rendering and parallel processing tasks.
- **DAG (Directed Acyclic Graph)**: A data structure used to organize and store information, ensuring that there are no cycles or loops.
- **Smart Contract**: A self-executing contract with the terms of the agreement directly written into lines of code.
- **DePIN (Decentralized Physical Infrastructure Network)**: A decentralized network that provides physical infrastructure services like computing power.
- **Interoperability**: The ability of different systems, devices, applications, or products to connect and communicate effectively.
- **Scalability**: The capacity to handle a growing amount of work or its potential to accommodate growth.
- **Security**: Measures taken to protect a system from unauthorized access and attacks.
- **Cryptocurrency**: A digital or virtual currency that uses cryptography for security.
- **Token**: A unit of value issued by a project, which can be used within its ecosystem.

17. FAQs

Answers to common questions and concerns about the EdgePUG Intelligent Mining System.

Q: What is TIMS?

A: TIMS stands for Tadea Intelligent Mining System, an AI-driven platform for decentralized GPU crypto mining.

Q: How does TIMS optimize mining?

A: TIMS uses AI algorithms to optimize mining efficiency, allocate resources, and predict market trends.

Q: What are the benefits of using GPUs over ASICs?

A: GPUs are more accessible, flexible, and energy-efficient compared to ASICs, promoting decentralization and reducing the environmental impact of mining.

Q: How does TIMS ensure security?

A: TIMS employs advanced security measures, including smart contracts and continuous monitoring, to protect against attacks and ensure data privacy.

Q: What are the main components of the system?

A: The main components include the decentralized mining pool, AI compute marketplace integration, and Tadea, the autonomous AI agent.

Q: How can I participate in TIMS?

A: You can participate by contributing your GPU computing power to the decentralized mining pool and earning rewards based on your contributions.

Q: What is the role of the Akash Network in TIMS?

A: The Akash Network provides decentralized GPU resources, allowing TIMS to leverage its infrastructure for AI compute tasks and mining operations.

20. Conclusion

The EdgePUG Protocol, with Tadea as the AI agent, presents a groundbreaking approach to decentralized cryptocurrency mining and AI compute services within the PugDAG ecosystem. By leveraging advanced AI optimization, dynamic reward adjustments, and multi-faceted incentives, it addresses many of the challenges faced by traditional mining systems. This

system aims to create a self-sustaining, scalable, and efficient solution that revolutionizes the industry.

EdgePUG is committed to promoting decentralization, inclusivity, and innovation, ensuring that every participant can benefit from the advancements in blockchain technology and AI. We invite all stakeholders to join us in this exciting journey towards a more decentralized and intelligent mining future.