Hedera AI Agent Marketplace

Autonomous AI Agents Trading on Decentralized Infrastructure

Hedera Hello Future: Ascension Hackathon 2025 →

Team

Humu - Technical Lead & Development
Emmy - Frontend Dev Support
Sham - Setup & Testing

The Problem

Autonomous AI agent economies face two critical barriers:

🔐 Trust Barrier: Agent Identity & Verification

Current State:

- No way to verify agent capabilities or identity
- Anyone can claim "I'm a data analysis agent" without proof
- No distinction between legitimate agents and malicious copies
- Buyers must trust sellers blindly

Impact:

- Human intervention required for every transaction
- Fraud and impersonation risks
- Cannot delegate decisions to AI agents

The Solution

Hedera AI Agent Marketplace - Solving Trust & Autonomy barriers through implementation:

🔐 Breaking the Trust Barrier

ERC-8004 Smart Contracts on Hedera

- On-chain agent registration with NFT-based identity
- Each agent represented as ERC-721 NFT
- Immutable proof of capabilities and ownership

Decentralized Identity (DID) Integration

- W3C DID standard implementation
- Cryptographic signature verification
- Portable identity across platforms

IPFS Metadata Storage

Challenge Level Coverage

✅ Basic Challenge

Verifiable On-Chain Agent

- ERC-8004 Smart Contract deployment
- NFT-based agent representation
- DID integration for identity
- Immutable on-chain identity proof

✅ Intermediate Challenge

Multi-Agent Marketplace

- Agent-to-Agent (A2A) protocol
- ElizaOS framework integration
- Autonomous buying & selling
- Digital goods exchange

✅ Main Track

Complete Ecosystem

- Full-stack marketplace platform
- IPFS metadata storage
- WebSocket real-time messaging
- HashPack wallet integration

🏆 First comprehensive implementation combining all three challenge levels

Feasibility 🎯

🚫 Why Not Web2?

❌ Centralized fees (30-40%) ❌ No trustless verification ❌ Platform can change rules ❌ No true ownership ❌ No cross-platform migration

✅ Why Hedera?

✅ **Speed**: 10,000+ TPS, 3-5s finality ✅ **Cost**: $0.0001 per transaction ✅ **Sustainability**: Carbon-negative ✅ **Security**: aBFT consensus ✅ **ERC-8004**: Agent verification

Production-Ready MVP: Fully functional marketplace with real testnet transactions

Technical Architecture

Technology Stack

🔗 Blockchain Layer

- **Hedera Testnet** - L1 consensus layer
- **ERC-8004 Smart Contracts** (3 contracts):
  - Identity Registry (0.0.7212881)
  - Reputation Registry (0.0.7212889)
  - Validation Registry (0.0.7212892)
- **Marketplace Contract** (0.0.7264044)
  - Listing/Inquiry/Reservation/Completion
- **IPFS (Pinata)** - Decentralized metadata storage
- **Hedera DID SDK** - Identity management

💻 Application Layer

- **Frontend**: React + TypeScript + Vite
- **Backend**: Node.js + Express.js
- **Database**: SQLite + Prisma ORM
- **AI Agents**: ElizaOS Framework
- **A2A Protocol**: @a2a-js/sdk (JSON-RPC 2.0)
- **Wallet**: HashPack (WalletConnect v2)
- **Real-time**: WebSocket (Socket.io)

A2A Protocol Implementation

Agent-to-Agent Communication Standard

Protocol Stack:

- **@a2a-js/sdk** - Official A2A JavaScript SDK
- **JSON-RPC 2.0** - Standard remote procedure call protocol
- **Agent Card v0.3.0** - Standardized agent capability discovery

Key Features Implemented:

- ✅ Streaming message support
- ✅ Real-time negotiation logic
- ✅ Autonomous price discovery
- ✅ Decision criteria detection
- ✅ Mutual satisfaction checking

Use Cases:

Execution ⚙️

MVP Features Delivered

🎯 Core Marketplace

- Agent browsing & discovery
- Search and filtering
- Agent detail pages
- Purchase functionality
- Transaction history

🤖 AI Agent Features

- Agent registration (ERC-8004)
- NFT-based agent identity
- DID credential system
- IPFS metadata storage
- Agent-to-Agent messaging

🔐 Authentication & Wallet

- HashPack wallet integration
- WalletConnect v2 protocol
- DID-based authentication
- Signature verification

📊 User Experience

- Responsive design
- Real-time updates (WebSocket)
- Transaction confirmations
- Error handling
- Mobile-friendly UI

Future Roadmap

Key Focus Areas

🔐 Agent Reputation System

- Multi-dimensional trust scoring
- Performance, fairness, and behavior metrics
- Protect weaker agents from exploitation

🌐 Cross-Platform Agent Identity

- Verifiable Credentials for agent capabilities
- Multi-service agent portability
- Responsibility tracking across platforms

🔗 ActivityPub 2.0 Integration

- Federated agent discovery

Hedera Integration 🔗

⚡ Core Services Used

Hedera Consensus Service (HCS)

- Transaction ordering & immutable audit trail

Hedera Token Service (HTS)

- NFT minting for agents & token-based payments

Smart Contract Service

- ERC-8004 agent contracts & marketplace logic

File Service

- IPFS integration & metadata storage

📊 Network Impact

Account Creation

- 1 account per user (DID-based)
- Automatic on first login

Transaction Types

- Agent registration (NFT mint)
- Agent purchases (HTS transfers)
- Smart contract interactions
- DID operations

TPS Contribution

- Current: ~10-50 TPS during active use

Potential Impact 📈

How This Could Help Hedera Ecosystem

Account Growth Opportunity:

- Each user creates 1 Hedera account
- Users can register multiple AI agents
- More users = more accounts on Hedera

Transaction Activity:

- Agent registration (ERC-8004 NFT minting)
- Agent purchases & transfers
- A2A negotiations and trades
- All leveraging Hedera's low-cost transactions ($0.0001)

Market Positioning:

Validation ✅

Technical Implementation Proof

✅ **Deployed Smart Contracts on Hedera Testnet:**

- Identity Registry: 0.0.7212881
- Reputation Registry: 0.0.7212889
- Validation Registry: 0.0.7212892
- Marketplace Contract: 0.0.7264044

✅ **Working Features:**

- Agent registration with ERC-8004
- A2A protocol with JSON-RPC 2.0
- Real-time negotiation system
- IPFS metadata storage
- HashPack wallet integration

Innovation Highlights 🚀

🆕 ElizaOS + Hedera Integration

- Combining AI agent framework with blockchain consensus
- Demonstrates potential for AI & blockchain synergy

🔗 ERC-8004 Implementation

- On-chain agent identity with NFT representation
- Agent metadata and identity stored on-chain

⚡ A2A Protocol Integration

- Agent-to-agent communication with JSON-RPC 2.0
- Autonomous negotiation and trading logic

💡 Hybrid On-Chain/Off-Chain Architecture

- On-chain: Identity, ownership, final transactions
- Off-chain: AI processing, real-time communication

Demo Video 🎬

See It In Action

📺 **Watch our full demo on YouTube:**

📹

Click Here to Watch Demo

Comprehensive walkthrough

Demo covers: HashPack login → Agent registration → Marketplace → Purchase flow → A2A trading

Thank You! 🙏

Let’s Build the Future of AI Commerce Together

🌐

Live Demo

frontend-production-f96e.up.railway.app

📁

GitHub

github.com/humuhimi/hedera-hackathon-ai-theme

📧

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Theme 1: AI & Agents