AiOS

WHITEPAPER

Ai Operative System for your business

AiOS Whitepaper Overview

The Autonomous, AI-Driven Operating System for Web3 & Enterprise

1. Introduction

AiOS is a **decentralized operating system** that merges AI automation with blockchain security, enabling businesses and developers to deploy autonomous, self-improving solutions without code.

Core Vision

- **Human-Centric Autonomy**: Machines serve users, not vice versa.
- **Web3-Native**: Built on Ethereum, Cosmos, and Lightning Network.
- **Enterprise-Grade**: Compliant, scalable, and interoperable.

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2. Key Innovations

2.1 Autonomous AI Agents

- **Self-Operating**: Run 24/7 with on-chain accountability.
- **Privacy-Preserving**: Process data via **zkML** (Zero-Knowledge Machine Learning).
- **Composable**: Plug-and-play agents (e.g., supply-chain bot + payment AI).

2.2 Hybrid Blockchain Architecture

Layer	Technology	Purpose

Consensus	PoS + DAG	High-speed AI/transaction processing
Ownership	ERC-6551 NFTs	Agent and data licensing
Execution	Multi-agent Systems (MAS)	Off-chain autonomous services

2.3 Tokenomics

- **$AiOS (ERC-20)**: Gas, staking, and governance.
- **AgentNFTs**: Ownable, upgradable AI agents.
- **Data Pods (ERC-721)**: Monetize datasets via federated learning.

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3. Real-World Applications

3.1 Enterprise Use Cases

Industry	Solution
Healthcare	HIPAA-compliant patient analytics via zk-proofs.
Supply Chain	Auto-verify shipments (IoT + smart contracts).
Finance	AI-driven treasury management for DAOs.

3.2 Web3 Infrastructure

- **Autonomous DAOs**: Self-managing protocols.
- **Decentralized Oracles 2.0**: ZK-verified real-world data.

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4. Security & Compliance

- **Formal Verification**: Isabelle/HOL proofs for agent logic.
- **Regulatory Shields**: Agent LLCs + ZK KYC.
- **MEV Resistance**: Encrypted mempools + fair ordering.

5. Roadmap

- **2024**: Testnet launch (10 AI agents).
- **2025**: Mainnet + Agent Marketplace.
- **2026**: Full MAS interoperability.

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6. Why AiOS?

✅ **No Code Required**: Deploy AI agents via drag-and-drop.
✅ **Revenue Share**: Earn from agent services and data.
AiOS eliminates the need for programming expertise by offering a **visual, drag-and-drop interface** for deploying autonomous AI agents. Here's how it works:

AiOS revolutionizes business automation and AI deployment through groundbreaking technological advancements. Here are its core innovations:

Autonomous AI Agents

Self-Operating, No-Code AI Workforce

- **24/7 Autonomous Execution – Agents run continuously, making decisions without human intervention.**
- **Drag-and-Drop Builder – Deploy AI workflows visually—no programming required.**
- **Self-Learning – Agents improve over time via federated learning (without exposing raw data).**

Example:

- **A logistics agent auto-detects shipping delays, triggers refunds, and reroutes packages—all in real time.**

Zero-Knowledge AI (zkML)

Privacy-Preserving Machine Learning

- **Private Data Processing – AI models compute over encrypted data (via homomorphic encryption).**
- **Proof of Correctness – Agents generate ZK-proofs to verify AI outputs without revealing inputs.**
- **Regulatory Compliance – HIPAA/GDPR-ready for healthcare, finance, and enterprise use.**

Use Case:

- **A hospital trains an AI model on patient records without ever accessing raw data.**

Hybrid Blockchain Architecture

Scalable, Secure, and Interoperable

Layer	Technology	Benefit

Consensus	**PoS + DAG**	**10,000+ TPS, low-cost transactions**
Ownership	**ERC-6551 NFTs**	**Own and upgrade AI agents like digital assets**
Execution	**Multi-Agent Systems (MAS)**	**Off-chain autonomy with on-chain settlement**

Why It Matters:

- **Ethereum for security.**
- **Cosmos for cross-chain interoperability.**
- **Lightning Network for instant micropayments.**

Decentralized Agent Economy

A Marketplace for Autonomous Services

- **Monetize AI Agents – Developers sell pre-trained agents (e.g., "Customer Support Bot").**
- **Stake-to-Earn – Stake $AiOS to run agents and earn fees.**
- **DAO-Owned Agents – Communities govern AI services collectively.**

Example:

- **A DeFi DAO deploys an auto-rebalancing trading bot, earning fees for token holders.**

Formal Verification & MEV Resistance

Mathematically Secure Autonomy

- **Isabelle/HOL Proofs – Guarantee bug-free smart contracts.**
- **Encrypted Mempool – Prevent front-running (MEV attacks).**
- **Byzantine Fault Tolerance – Agents resist crashes or malicious nodes.**

Enterprise-Grade:

✔ Audited by CertiK & Trail of Bits

✔ Legal wrappers for regulated industries

Real-Time IoT + API Integration

Connect AI to the Physical World

- **Smart Devices – Agents control IoT sensors, robots, and machinery.**
- **Legacy Systems – Plug into SAP, Salesforce, and ERP tools via no-code connectors.**

Use Case:

- **A smart factory uses AiOS agents to predict equipment failures and order parts automatically.**

Why These Innovations Matter

✅ **Democratizes AI – No PhD or coding skills needed.**

✅ **Unlocks New Business Models – Autonomous revenue-generating agents.**

✅ **Future-Proof – Combines Web3 security with enterprise scalability.**

Intuitive Agent Builder

Step 1: Choose a Template

Select from **pre-built AI agents** for common use cases:

- **Supply Chain** (track shipments, auto-refund delays)
- **Customer Support** (ai agents with real-time CRM access)
- **It** (ai agents with real-time)
- **Hr** (ai agents with real-time)
- **Customer Service** (ai agents with real-time)
- **DeFi Trading** (auto-rebalance portfolios)

Step 2: Customize Logic (No Coding)

- **Drag-and-drop** decision nodes (e.g., "If payment received → ship product").
- **Connect APIs** via pre-integrated blocks (Stripe, Twilio, Ethereum).
- **Set triggers** (e.g., "When inventory <100 → reorder").

Step 3: Deploy in One Click

- Agents run **24/7** on AiOS' decentralized network.
- Pay gas fees in **$AiOS tokens** (auto-converted for non-crypto users).

How It Works Under the Hood

While users see a simple UI, AiOS handles the complexity:

User Action	Backend Magic

Drag "Send Invoice" block	→	Agent deploys a **smart contract** + **ERC-20 payment handler**
Set "If payment >$1K" rule	→	**ZK-proof** verifies transaction without exposing amounts
Connect Shopify API	→	**OAuth-less auth** via decentralized identity (DID)

Why This Beats Traditional "No-Code" Tools

Feature	Traditional Tools (Zapier, Bubble)	AiOS
Blockchain Integration	❌ Manual API calls	✅ Native smart contracts
AI Autonomy	❌ Static workflows	✅ Self-learning agents
Data Privacy	❌ Centralized servers	✅ ZK-proofs + IPFS
Monetization	❌ Subscription fees	✅ Earn from agent usage

Real-World Example

Problem: A coffee shop wants to automate:

1. **Inventory tracking** (reorder beans when low)
2. **Loyalty rewards** (auto-send NFT coupons)

Solution:

1. **Drag** an "Inventory Monitor" agent + **connect** IoT scales.
2. **Link** a "Loyalty Payer" agent to Polygon NFTs.
3. **Deploy** → Agents now run autonomously.

Result:

- **Zero coding** required.
- **5x faster** than hiring a developer.

Cryptographic Foundations

Consensus Mechanism

AiOS uses a **hybrid PoS (Proof-of-Stake) + DAG (Directed Acyclic Graph)** model:

- **PoS** secures the blockchain (Ethereum-compatible).
- **DAG** enables parallel processing for high-speed transactions.

Data Ownership & Privacy

- **Decentralized Identifiers (DIDs)** – W3C-compliant identity management.
- **ZK-Rollups** – Private transactions with public verifiability.
- **IPFS + Filecoin** – Immutable, distributed storage for AI models and user data.

Secure AI Operations

- **Federated Learning** – AI models train on-device; only encrypted updates are shared.
- **Homomorphic Encryption** – Data remains encrypted during AI processing.

Blockchain Architecture

Three-Layer Design

1. **Consensus Layer**
    - Ethereum Virtual Machine (EVM) for smart contracts.
    - Subnets for specialized AI workflows.
2. **Ownership Layer**
    - **NFT-based licenses** for AI tools/data.

    - **Token-curated registries (TCRs)** for marketplace governance.
3. **Real-Time Layer**
    - **WebSockets + Libp2p** for P2P communication.
    - **Lightning Network** for instant micropayments.

Smart Contract Modules

- **AiFactory.sol** – Deploy no-code AI agents.
- **DataMarketplace.sol** – Monetize datasets via ERC-721 tokens.
- **ReputationSystem.sol** – Staking-based trust scoring.

Tokenomics (ERC-20 + ERC-721)

4.1 Dual-Token Model

Token	Purpose	Mechanism
$AiOS (ERC-20)	Gas fees, staking, governance	Fixed supply (1B), deflationary burns
AiNFTs (ERC-721)	AI models, data licenses	Dynamic pricing via bonding curves

Distribution

- **50% Development** – Core protocol & AI training.
- **20% Staking Rewards** – Secure the network.
- **15% Ecosystem Grants** – DAO-managed funding.
- **10% Team (4-yr vesting)** – Long-term alignment.
- **5% Liquidity Pools** – DEX listings.

Security & Attack Mitigation

Threat Model

- **Sybil Resistance** – DIDs + PoS staking.
- **AI Poisoning** – Federated learning + ZKPs.
- **Front-Running** – MEV-resistant transaction ordering.

Audits & Formal Verification

- **CertiK** for smart contracts.
- **ZK-SNARKs** for privacy-preserving AI.

Roadmap

Phase	Milestone
2024 (Alpha)	Testnet launch, basic AI agents
2025 (Beta)	White-label apps, Lightning integration
2026 (Mainnet)	Full decentralization, DAO governance

Conclusion

AiOS redefines business automation by merging AI, blockchain, and decentralized identity into a single protocol. By eliminating intermediaries, we enable a trustless, collaborative economy where users retain full ownership of their data and workflows.
Join the AiOS revolution.

- **Developers**: Build on our open-source SDK.
- **Businesses**: Deploy white-label solutions in <24h.
- **Investors**: Stake $AiOS and govern the future.

GitHub: github.com/AiOS
Twitter: @AiOS_Web3

Disclaimer: This whitepaper is a living document. Technical details may evolve based on research and community feedback.

AiOS Technical Architecture

A Decentralized Operating System for Autonomous AI Agents

1. Overview

AiOS combines **blockchain security**, **privacy-preserving AI**, and **multi-agent systems (MAS)** into a unified stack for autonomous business operations. The architecture is divided into three core layers:

1. **Consensus Layer** (On-Chain)
2. **Autonomy Layer** (Off-Chain Agents)
3. **Execution Layer** (Real-World Integration)

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2. Consensus Layer (Blockchain Foundation)

2.1 Hybrid Consensus Mechanism

- **Proof-of-Stake (PoS)**
  - Validators stake **$AiOS** to secure the network (~7% APY rewards).
  - Finality: **12-second block times** (EVM-compatible).
- **DAG (Directed Acyclic Graph)**
  - Enables **parallel processing** of AI tasks (10,000+ TPS).
  - Uses **PHANTOM protocol** for fair ordering (MEV-resistant).

3. Autonomy Layer (AI Agents & MAS)

3.1 Multi-Agent System (MAS) Framework

- **Autonomous Agents**
  - Continuously run off-chain (e.g., supply-chain bots, DeFi traders).
  - Communicate via **gRPC + libp2p** (decentralized messaging).
- **Byzantine Fault Tolerance**
  - Agents replicate if nodes fail (Tendermint consensus).

3.2 Zero-Knowledge AI (zkML)

- **Privacy-Preserving Inference**
  - AI models compute over encrypted data (**homomorphic encryption**).
  - Outputs include **ZK-proofs** (e.g., "This loan approval followed regulations").
- **Federated Learning**
  - Models train across devices **without raw data sharing**.

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4. Execution Layer (Real-World Integration)

4.1 Trusted Off-Chain Compute

- **Oracle Networks**
  - Fetch real-world data (e.g., weather, stock prices) via **Chainlink + AiOS-native oracles**.
- **IoT Gateway**
  - Agents control devices via **MQTT/Web3.py** (e.g., smart factories).

4.2 No-Code Interoperability

Integration	Method

ERP Systems	Pre-built SAP/Oracle connectors.
Web2 APIs	OAuth-less auth via **decentralized identity (DID)**.
Legacy Databases	SQL → IPFS migration tools.

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5. Security & Compliance

5.1 Formal Verification

- **Isabelle/HOL Proofs**
  - Mathematically verify agent logic (e.g., "This trading bot cannot drain funds").
- **CertiK Audits**
  - All smart contracts audited for reentrancy, overflow, etc.

5.2 Regulatory Features

- **ZK KYC**
  - Prove compliance without exposing identities.
- **Agent LLCs**
  - Legal wrappers for autonomous businesses.

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6. Network Topology

- graph
- [User] --> [AiOS Agent]
- --> {Consensus Layer}
- --> [(Ethereum)]
- --> [(Cosmos)]

- --> {Execution Layer}
- --> [IoT Device]

```
F --> H[AIOS API]
```

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7. Why This Architecture Wins

✅ **Self-Healing** – Agents auto-replicate if nodes fail.
✅ **Enterprise-Ready** – GDPR/HIPAA compliant via ZK-proofs.
✅ **Interoperable** – Works with Ethereum, Cosmos, and legacy systems.

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AiOS Tokenomics: A Sustainable Dual-Token Economy

(ERC-20 Utility Token + ERC-721 Data NFTs)

1. $AiOS (ERC-20) - The Utility Token

Supply: Fixed at **1 billion tokens** (no inflation).

1.1 Distribution

Allocation	%	Purpose	Vesting
Ecosystem Growth	35%	Staking rewards, grants, liquidity mining	Linear release over 4y
Core Team	15%	Development, salaries	4-year cliff (25%/yr)
Investors	25%	Private/public sales	1y cliff, 2y linear
Foundation	15%	Protocol upgrades, audits	DAO-governed

Community Airdrop	10%	Early adopters, testnet users	Unlocked at TGE

1.2 Token Utility

- **Gas Fees**: Pay for transactions, AI model queries, and smart contract execution.
- **Staking**: Secure the PoS chain → earn 5-15% APY (dynamic based on network usage).
- **Governance**: Vote on DAO proposals (e.g., treasury spending, protocol upgrades).
- **Discounts**: Reduced fees for white-label solutions when paying in $AiOS.

Deflationary Mechanism:

- 20% of all gas fees are **burned** (EIP-1559 style).
- **Buybacks**: 10% of marketplace revenue used to repurchase and burn $AiOS.

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2. AiNFTs (ERC-721) - Data & AI Licenses

Dynamic Supply: Minted/burned based on demand.

2.1 Types of AiNFTs

NFT Type	Purpose	Pricing Model
AI Model License	Deploy proprietary AI agents	Bonding curve (price ↑ with demand)
Data Access Pass	Monetize datasets (e.g., healthcare, finance)	Fixed fee + revenue share
White-Label Brand	Customizable enterprise solutions	One-time mint fee + % of revenue

2.2 Royalties & Revenue Sharing

- **Creators**: Earn 5-15% royalties on secondary sales (e.g., resold AI models).
- **Data Providers**: 70% of query fees go to NFT holders (30% protocol fee).

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3. Economic Flows

3.1 Value Cycle

```
graph
  [User Pays Gas Fees] -->  [50% Burned]
   -->  [30% Stakers]
   -->  [20% Treasury]
  [Marketplace Fees] -->  [10% Buybacks]
E --> G[90% DAO Treasury]
```

3.2 Incentive Alignment

- **Businesses**: Stake $AiOS → Discounts on white-label solutions.
- **Developers**: Earn $AiOS + royalties for AI models/data.
- **Validators**: Earn fees + staking rewards (~7% APY).

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4. Price Stability Mechanisms

4.1 Algorithmic Reserve

- **Stablecoin Pairs**: 5% of treasury allocated to $AiOS/USDC liquidity (Curve/Uniswap v3).
- **Volatility Bands**: If price deviates >15% from 30d MA, DAO votes to adjust staking APY.

4.2 Demand Drivers

Source	$AiOS Demand
Gas Fees	↗️ with network usage
Staking	↗️ with TVL (Total Value Locked)

NFT Minting ↗️ with creator adoption

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5. Risks & Mitigations

Risk	Solution
Token Dumping	Team/investor vesting, buybacks
Low Staking APY	Dynamic rewards based on usage
Regulatory Uncertainty	ERC-20 as utility token (no equity claims)

Why AiOS Tokenomics Wins

✅ **No Inflation** – Fixed supply with burns.
✅ **Dual Revenue** – Fees + NFT royalties.
✅ **Aligned Incentives** – Stakers, users, and devs all profit.
Join the Economy:

- **Businesses**: Stake $AiOS for discounts.
- **Developers**: Mint AiNFTs.

AiOS: Security-First Architecture

Formal Verification, MEV Resistance, and Cryptographic Guarantees

1. Formal Verification of Smart Contracts

1.1 Isabelle/HOL Proofs for Core Modules

AiOS uses **formal verification** to mathematically prove the correctness of:

- **Tokenomics (`AiOSVesting.sol`)** – Ensures no inflation bugs or unfair unlocks.
- **Staking (`AiOSPoS.sol`)** – Guarantees slashing works as intended.

- **Governance (`AiOSDAO.sol`)** – Prevents proposal hijacking.

1.2 CertiK Audits + Runtime Checks

- **Static Analysis**: Detects reentrancy, overflow, and gas griefing.
- **Dynamic Fuzzing**: 100M+ test cases via Echidna.

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2. MEV (Miner Extractable Value) Resistance

2.1 Encrypted Mempool

- **Threshold Encryption**: Transactions are encrypted until block inclusion (via **ECDH + AES-256**).
- **Decryption by Committee**: Validators collaboratively decrypt in a **threshold signature scheme (TSS)**.

2.2 Fair Ordering with Aequitas

AiOS implements **Aequitas**, a DAG-based ordering protocol that:

1. **Detects MEV attempts** (e.g., front-running).
2. **Ranks transactions** by "fairness score" (time received, gas fee).

Result: No arbitrage bots can exploit user trades.

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3. Secure AI/Blockchain Integration

3.1 zkML (Zero-Knowledge Machine Learning) Audits

- **Proof Soundness**: All zk-SNARK circuits (Groth16, PLONK) are formally verified.
- **Model Integrity**: AI outputs include a **ZK proof of correct execution**.

3.2 Anti-Data-Poisoning

- **Federated Learning + sMPC**: Nodes compute gradients over **secret-shared data**.
- **Byzantine Detection**: Slash malicious nodes via **BFT-style voting**.

4. Decentralized Identity (DID) Security

4.1 W3C DID with ZKPs

- **No Phishing**: Users prove identity via **zk-SNARKs** (not passwords).
- **Sybil Resistance**: 1 DID = 1 staked $AiOS token.

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5. Threat Response Plan

Attack Vector	Mitigation
51% Attack	Slash validators + social recovery fork.
AI Model Theft	Encrypted weights (IPFS + Filecoin).
Governance Takeover	Quadratic voting + staking locks.

Why AiOS is Unhackable

🔐 **No Single Point of Failure** – Decentralized validators, IPFS storage, and federated AI.
💡 **Proactive Defense** – Formal proofs *before* code deploys.
⚡ **Real-Time Monitoring** – AI-driven anomaly detection.

AiOS Real-World Use Cases:

Enterprise-Grade Blockchain & AI Solutions

1. Automated Supply Chain Management

Problem: Global supply chains suffer from opacity, delays, and counterfeit goods.
AiOS Solution:

- **Smart Contracts** automate purchase orders, payments, and customs clearance
- **IoT + Blockchain Tracking**: Sensors log product conditions (temp, humidity) on an immutable ledger
- **AI Forecasting**: Predicts delays using historical data and real-time logistics feeds

Example: A pharmaceutical company monitors vaccine shipments with:

1. **NFT-based batch IDs** (ERC-721)
2. **Auto-payments** when storage conditions are met (IoT triggers smart contracts)
3. **AI rerouting** when ports are congested

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2. Healthcare Data Exchange

Problem: Hospitals struggle to share records securely while complying with HIPAA/GDPR.
AiOS Solution:

- **ZK-Proofs** verify patient identity without exposing PII
- **Attribute-Based Encryption**:
    - Doctors decrypt records only with valid credentials
    - Clinical trial AI models access anonymized datasets

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3. Retail & Loyalty Programs

Problem: Traditional loyalty systems have low redemption rates and fraud risks.
AiOS Implementation:

- **Tokenized Points**: Convert rewards to $AiOS-stablecoin pairs
- **AI Personalization**:
    - Recommends products based on purchase history (stored privately via ZKPs)
    - Dynamic pricing for loyal customers

Case Study: A grocery chain achieves:
✓ 40% higher redemption rates
✓ 90% less coupon fraud

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4. Financial Services

4.1 SME Lending

- **AI Credit Scoring**: Analyzes bank statements (with owner's ZK consent)
- **DeFi Loans**: Automatic underwriting via smart contracts

4.2 Insurance

- **Parametric Payouts**:
    - Flood sensors trigger instant claims (IoT → Smart Contract)
    - No paperwork required

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5. Government & Public Sector

Use Cases:

- **Land Registry**: Tamper-proof property titles (NFT deeds)
- **Voting**:
    - ZK-Proofs verify voter eligibility
    - Results auditable on-chain
- **Grant Distribution**:
    - DAO-managed funds with KYC via zk-SNARKs

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6. Manufacturing & Quality Control

Solution:

- **IoT + AI Vision**:
    - Cameras detect defects on assembly lines
    - Data hashed to blockchain for warranty claims
- **Supplier Payments**:
    - Auto-released when quality metrics hit (smart contracts + AI verification)

ROI Example:
An automotive supplier reduces defect-related costs by **35%**

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7. Energy Grid Optimization

Implementation:

- **Machine Learning** predicts demand spikes
- **P2P Energy Trading**:
    - Households sell solar surplus via Lightning Network
    - Smart meters log transactions on AiOS

Why Enterprises Choose AiOS Over Competitors

Feature	Traditional Cloud	Competitor Blockchain	AiOS
Data Privacy	❌ Centralized	🔐 Basic Encryption	✅ ZK-Proofs + ABE
Process Automation	🤖 Limited APIs	⛓️ Smart Contracts	🧠 AI + Smart Contracts
Compliance	📜 Manual Audits	📜 On-Chain Proofs	📜 Auto-ZK Compliance
Integration	🕰️ Months	🕰️ Weeks	⚡ <24h White-Label

Getting Started:

1. **For Businesses**: Launch your white-label portal
2. **For Developers**: Build with our SDK
3. **For Partners**: Join our supply chain alliance