Complete Utility Token Management Platform

Technical Specification Document

Project Overview

This specification outlines the technical requirements for developing a comprehensive, self-hosted utility token private sale and vesting platform. The platform must provide complete control over investor data while maintaining regulatory compliance through KYC/AML processes, digital SAFT agreements, and sophisticated vesting mechanisms.

Project Timeline: 30 days maximum completion **Code Ownership:** Exclusive ownership rights transfer to project owner upon delivery

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System Architecture Overview

Core Architecture Requirements

- **Frontend:** Single-page application (SPA) with responsive design
- **Backend:** RESTful API architecture with comprehensive token management
- **Database:** PostgreSQL with optimized indexing and audit capabilities
- **Blockchain Integration:** Smart contract interaction for token and vesting management
- **Infrastructure:** European hosting with GDPR compliance and data sovereignty

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Core Platform Components

1. Frontend Application

Investor Portal Features

- **User Registration & Authentication**
  - Secure account creation with email verification
  - Multi-factor authentication support
  - Password security with strength requirements
  - Social login integration options

- **KYC/AML Submission Interface**
  - Document upload functionality with drag-and-drop
  - Real-time validation and feedback
  - Progress tracking through verification stages
  - Mobile-responsive document capture

- **Investment Dashboard**
  - Portfolio overview with token allocations
  - Vesting schedule visualization with interactive calendar

- Token claiming interface with one-click functionality

  - Transaction history with blockchain verification links

  - Real-time balance updates

- **Governance Interface**
  - Proposal viewing and voting mechanisms

  - Vote delegation functionality

  - Voting history and power calculations

  - Governance token balance tracking

Administrative Panel Features

- **Investor Management**
  - Comprehensive investor oversight dashboard

  - KYC/AML status tracking and approval workflows

  - Bulk operations for efficient processing

  - Communication tools for targeted messaging

- **Sale Management**
  - Private sale configuration and monitoring

  - Token allocation tracking and cap management

  - Payment verification and processing oversight

  - Real-time analytics and reporting

- **Vesting Controls**
  - Vesting schedule creation and modification

  - Emergency pause/resume functionality

  - Batch operations for multiple investors

  - Vesting analytics and behavioral insights

- **Compliance Dashboard**
  - Regulatory reporting automation

  - Audit trail visualization

  - Risk assessment monitoring

  - Document management system

2. Backend API System

Core API Endpoints

- **User Management API**
  - Registration, authentication, and profile management

  - Role-based access control (RBAC)

- Session management with JWT tokens
- Password reset and security features
- **KYC/AML Processing API**
  - Document processing with OCR integration
  - Risk assessment engine
  - Sanctions screening automation
  - Compliance scoring system
- **Investment Management API**
  - Multi-cryptocurrency payment processing
  - Real-time exchange rate integration
  - Token allocation calculations
  - Purchase workflow automation
- **Vesting Management API**
  - Smart contract interaction for vesting schedules
  - Token claiming functionality
  - Vesting calculations and tracking
  - Emergency controls and modifications
- **Governance API**
  - Proposal management system
  - Voting mechanism integration
  - Token holder registry management
  - Governance analytics

Data Processing Features

- **Automated Document Processing**
  - OCR for information extraction
  - Document validation and verification
  - Address and identity confirmation
  - Corporate documentation handling
- **Payment Processing**
  - Multi-cryptocurrency support (ETH, BTC, stablecoins)
  - Real-time price feed integration
  - Payment verification and confirmation tracking
  - Failed payment handling and resubmission
- **Communication System**
  - Automated email notifications

- SMS integration for critical updates

- In-app messaging system

- Compliance communication templates

3. Smart Contract Infrastructure

Token Contract Features

- **ERC-20 Token Implementation**
  - Standard token functionality with governance features

  - Transfer restrictions during vesting periods

  - Snapshot capabilities for governance

  - Burn and mint functionality (if required)

Vesting Contract System

- **Configurable Vesting Parameters**
  - Cliff periods (0 to multiple years)

  - Vesting durations (months to years)

  - Release intervals (daily, weekly, monthly, custom)

  - TGE unlock percentages (0-100% with decimal precision)

  - Multiple vesting schedules for different investor tiers

- **Advanced Vesting Logic**
  - Linear vesting for steady token releases

  - Step vesting for predetermined chunk releases

  - Accelerated vesting based on milestones

  - Emergency pause mechanisms

  - Gas-optimized claiming operations

Treasury Management

- **Multi-Signature Wallet Implementation**
  - Configurable approval thresholds

  - Secure key management protocols

  - Transaction approval workflows

  - Comprehensive audit logging

Governance Contracts

- **Voting Mechanisms**
  - Proposal creation and lifecycle management

  - Token-weighted voting systems

- Vote delegation functionality

- Proposal execution automation

4. Database Architecture

Core Data Models

- **User Management Schema**
  - User profiles with complete KYC data

  - Role assignments and permissions

  - Authentication and session data

  - Audit trails for all user actions

- **Investment Tracking Schema**
  - Purchase histories with multi-cryptocurrency support

  - Token allocation records

  - Payment verification data

  - Refund and adjustment tracking

- **Vesting Management Schema**
  - Flexible vesting schedule parameters

  - Claiming history and remaining balances

  - Emergency modifications and approvals

  - Performance analytics data

- **Compliance and Audit Schema**
  - Complete regulatory reporting data

  - KYC/AML verification records

  - Risk assessment scores and updates

  - Document storage with versioning

- **Governance Data Schema**
  - Token holder registries

  - Proposal lifecycles and voting records

  - Delegation tracking

  - Governance analytics

5. KYC/AML Compliance System

Identity Verification Components

- **Personal Information Collection**
  - Legal name validation

  - Date of birth verification

- Nationality and residency confirmation
  - Government ID document processing
- **Address Verification**
  - Utility bill validation
  - Bank statement verification
  - Lease agreement confirmation
  - Age restrictions and validation rules
- **Document Processing Engine**
  - Automated OCR for information extraction
  - Document authenticity verification
  - Cross-reference validation
  - Quality assessment and rejection handling

Risk Assessment Framework

- **Enhanced Due Diligence**
  - PEP (Politically Exposed Person) screening
  - Source of funds declarations
  - Beneficial ownership disclosure
  - Corporate structure analysis
- **Automated Risk Scoring**
  - Country risk assessment
  - Transaction amount evaluation
  - Behavioral pattern analysis
  - Historical compliance review
- **Sanctions Screening**
  - Real-time OFAC list checking
  - EU sanctions compliance
  - UN sanctions verification
  - Automated updates and monitoring
- **Ongoing Monitoring**
  - Transaction pattern analysis
  - Suspicious activity detection
  - Manual review triggers
  - Compliance alert system

6. Digital SAFT Management

Document Generation System

- **Automated SAFT Creation**
  - Template-based agreement generation
  - Dynamic content population
  - Investor-specific customization
  - Jurisdiction-specific variations

- **Template Management**
  - Individual investor agreements
  - Corporate investor documentation
  - Multi-jurisdiction support
  - Legal review workflows

Digital Signature Integration

- **Electronic Signature Workflow**
  - Multi-party signature coordination
  - Automated reminder systems
  - Signature verification and validation
  - IP address and timestamp logging

- **Document Security**
  - Cryptographic hash generation
  - Document integrity verification
  - Version control and audit trails
  - Secure storage with encryption

7. Investment Management System

Multi-Cryptocurrency Processing

- **Supported Cryptocurrencies**
  - Ethereum (ETH) integration
  - Bitcoin (BTC) support
  - Major stablecoin processing (USDC, USDT, DAI)
  - Real-time exchange rate calculations

- **Payment Workflow**
  - Amount selection and validation
  - Payment method confirmation
  - Wallet address specification
  - Transaction verification and confirmation

- **Token Allocation System**
  - Real-time supply monitoring
  - Automatic sales suspension at limits
  - Investor allocation summaries
  - Distribution tracking with blockchain references

8. Governance Integration

Token Holder Management

- **Registry Maintenance**
  - Current balance tracking
  - Vested vs. claimed token calculations
  - Voting power determinations
  - Snapshot capabilities for governance events

Proposal Management System

- **Proposal Lifecycle**
  - Creation interfaces for authorized parties
  - Detailed description and parameter setting
  - Voting period management
  - Execution status tracking
- **Voting Infrastructure**
  - Secure voting interfaces
  - Voter verification systems
  - Duplicate prevention mechanisms
  - Vote delegation functionality

Analytics and Reporting

- **Participation Metrics**
  - Voting engagement tracking
  - Demographic analysis
  - Proposal outcome reporting
  - Token-weighted result calculations

Technical Requirements

Technology Stack Specifications

- **Frontend Framework:** React.js, Vue.js, or Angular

- **Backend Framework:** Node.js with Express.js
- **Database:** PostgreSQL with proper indexing
- **Blockchain Integration:** Web3.js or ethers.js
- **Authentication:** JWT with bcrypt hashing
- **File Processing:** Secure upload with virus scanning
- **Email Integration:** European service provider

Performance Requirements

- **Scalability Design**
  - Horizontal scaling architecture
  - Database optimization for complex queries
  - Caching layers for improved response times
  - API rate limiting implementation

- **High Availability Setup**
  - Automatic failover capabilities
  - Load balancing implementation
  - Master-slave database replication
  - Point-in-time recovery systems

Security Framework

- **Data Protection**
  - End-to-end encryption for sensitive data
  - Role-based access controls
  - Comprehensive audit logging
  - GDPR compliance implementation

- **Smart Contract Security**
  - Security audit preparation
  - Gas optimization strategies
  - Emergency pause mechanisms
  - Multi-signature treasury controls

Infrastructure Requirements

European Hosting Requirements

- **Data Sovereignty**
  - European data center deployment
  - GDPR compliance infrastructure

- Data residency requirements
- Privacy-by-design implementation

Monitoring and Maintenance

- **System Monitoring**
  - Application performance tracking
  - Database health monitoring
  - Smart contract interaction logging
  - Automated alerting systems

- **Deployment Infrastructure**
  - Automated deployment pipelines
  - Rapid update capabilities
  - Security patch deployment
  - Rollback functionality

Integration Capabilities

Third-Party Service Integration

- **Payment Processors**
  - Traditional banking integration (where legally permitted)
  - Fiat on-ramp capabilities
  - Multi-currency support
  - Compliance with local regulations

- **Communication Services**
  - Email service provider integration
  - SMS notification capabilities
  - European data residency compliance
  - Transactional and marketing communications

API Architecture

- **RESTful API Design**
  - Third-party integration capabilities
  - Portfolio management tool connections
  - Investor relations platform integration
  - Webhook notification systems

- **Authentication and Security**
  - OAuth 2.0 implementation

- Scope-based permissions

- API rate limiting

- Comprehensive access logging

Blockchain Network Support

- **Multi-Network Compatibility**
  - Ethereum mainnet integration

  - Layer 2 solution support

  - Cross-chain bridging capabilities

  - Backup RPC provider failover

Development Guidelines

Code Quality Standards

- **Development Best Practices**
  - Clean, maintainable code architecture

  - Comprehensive documentation

  - Unit and integration testing

  - Code review requirements

- **Security Implementation**
  - Secure coding practices

  - Input validation and sanitization

  - SQL injection prevention

  - XSS protection mechanisms

Testing Requirements

- **Comprehensive Testing Strategy**
  - Unit testing for all components

  - Integration testing for API endpoints

  - Smart contract testing and simulation

  - Security testing and penetration preparation

Documentation Requirements

- **Technical Documentation**
  - Architecture overview and design decisions

  - API documentation with examples

  - Database schema documentation

  - Smart contract documentation

- **User Documentation**
  - Administrator user guides
  - Investor platform tutorials
  - Troubleshooting guides
  - Security best practices

Deliverables

Phase 1: Core Platform (Days 1-10)

- Complete frontend application with responsive design
- Backend API with user management and authentication
- Database design and implementation
- Basic KYC/AML functionality
- Payment processing integration
- Administrative dashboard foundation

Phase 2: Advanced Features (Days 11-20)

- Smart contract development and deployment
- Advanced vesting system implementation
- Digital SAFT agreement integration
- Enhanced KYC/AML with risk assessment
- Governance system foundation
- Security implementation and testing

Phase 3: Integration and Optimization (Days 21-30)

- Third-party service integrations
- Performance optimization and scaling
- Comprehensive testing and bug fixes
- Security audit preparation
- Documentation and training materials
- Production deployment and monitoring setup

Final Deliverables

- Complete source code with full documentation
- Deployed and configured production environment
- Smart contracts with comprehensive documentation
- Administrator and user documentation
- Security assessment preparation

- Training materials and knowledge transfer
- Complete ownership rights transfer to project owner

Success Criteria

Functional Requirements

- All platform features operational as specified
- Successful smart contract deployment and integration
- Complete KYC/AML compliance workflow
- Functional vesting system with all configuration options
- Operational governance mechanisms
- Comprehensive administrative controls

Technical Requirements

- GDPR-compliant European infrastructure deployment
- Security best practices implementation
- Performance optimization for scalability
- Complete documentation and knowledge transfer
- Successful production deployment
- 30-day maximum development timeline adherence

Ownership Transfer

- Complete source code delivery with ownership rights
- All intellectual property transferred to project owner
- No third-party dependencies requiring ongoing licensing
- Full platform control and customization capabilities