Functional Requirements

This document may require updates pending changes to Canopy Super App: Scanopy Spec V2.

1. System-Wide Functional Requirements

1.1 Authentication & Session Management

- FR-AUTH-001: The system SHALL provide unified authentication across all four components using a single session
- FR-AUTH-002: The system SHALL support session timeout with adaptive timeouts (longer for reading operations, shorter for transaction operations)
- FR-AUTH-003: The system SHALL implement automatic wallet locking after configurable inactivity periods
- FR-AUTH-004: The system SHALL maintain user context and preferences across all components

1.2 Cross-Component State Synchronization

- FR-STATE-001: The system SHALL synchronize user balances, staking positions, and LP positions across all components in real-time
- FR-STATE-002: The system SHALL provide unified transaction history across all components
- FR-STATE-003: The system SHALL maintain consistent CNPY token data across all components

1.3 Notification System

- FR-NOTIF-001: The system SHALL provide centralized notifications for staking rewards, trading activities, and governance proposals
- FR-NOTIF-002: The system SHALL support configurable notification preferences per component
- FR-NOTIF-003: The system SHALL provide real-time alerts for validator performance degradation and slashing events

2. Launchpad Component - Functional Requirements

2.1 Template-Based Chain Creation

- FR-LP-001: The system SHALL provide predefined templates
- FR-LP-002: Each template SHALL allow parameter customization including utility and basic economics
- FR-LP-003: The Simple Template SHALL enable token + chain creation with automated liquidity bootstrapping in under 10 minutes
- FR-LP-004: Templates SHALL abstract complexity for non-blockchain engineers to deploy production-ready chains

2.2 GitHub Integration

- FR-LP-005: The system SHALL provide one-click import functionality for existing GitHub repositories
- FR-LP-006: The system SHALL analyze imported code and suggest appropriate Canopy Core modules
- FR-LP-07: The system SHALL provide deployment cost preview and configuration validation

2.3 Liquidity Bootstrapping

- FR-LP-08: The system SHALL implement linear bonding curves with constant price increase per CNPY paired with chain tokens
- FR-LP-09: The system SHALL support Liquidity Bootstrapping Pools (LBP) with dynamic weight transitions from 95/5 to 20/80 (Token/CNPY)
- FR-LP-010: LBPs SHALL support customizable duration from 3-30 days with automated rebalancing

2.4 Deployment Process

- FR-LP-011: The system SHALL provide one-click deployment process with the following stages: template selection, configuration validation, testnet deployment, optional manual review, mainnet launch
- FR-LP-012: The system SHALL perform automated launch with monitoring setup
- FR-LP-013: The system SHALL provide automated validator bootstrapping for mainnet launch
- FR-LP-014: The system SHALL provide real-time performance dashboards and alert systems post-launch
- FR-LP-015 New chains SHALL appear in the Cross-Chain Explorer within 5 minutes of deployment

2.5 Project Management

- FR-LP-016: The system SHALL allow upload of basic project information including website, description, socials, logo, and colors

- FR-LP-017: The system SHALL provide built-in marketing tools for community building and validator onboarding

3. Cross-Chain Explorer - Functional Requirements

3.1 Chain Discovery and Ranking

- FR-EX-001: The system SHALL provide multi-dimensional ranking by total stake, trending volume, and new chain status
- FR-EX-002: The system SHALL implement color-coded risk assessment matrix based on validator count, chain age, and code audits
- FR-EX-003: The system SHALL provide opportunity filtering by staking requirements, lock-up periods, and rewards ranges
- FR-EX-004: The system SHALL display social proof indicators including community activity, developer engagement, and transaction volume
- FR-EX-005: The system SHALL implement two-tier staking model distinguishing "Safe" staking from "Alpha" staking
- FR-EX-006: The system SHALL provide predictive analytics with ML-based staking opportunity recommendations

3.2 Staking Discovery Interface

- FR-EX-007: The system SHALL provide staking opportunity dashboard with risk-adjusted rewards rankings
- FR-EX-008: The system SHALL support filtering and sorting by rewards, risk levels, and validator requirements
- FR-EX-009: The system SHALL provide staking amount simulation with slippage estimates
- FR-EX-010: The system SHALL enable one-click delegation through integrated wallet
- FR-EX-011: The system SHALL provide real-time data aggregation with sub-second updates for critical staking metrics

3.3 Validator Management

- FR-EX-012: The system SHALL provide validator performance metrics including slashing history, reward tracking, and risk monitoring
- FR-EX-013: The system SHALL display validator performance across multiple Nested Chains in unified dashboard
- FR-EX-014: The system SHALL provide transparent penalty history with severity classifications
- FR-EX-015: The system SHALL track block-by-block reward accumulation with auto-compounding options

- FR-EX-016: The system SHALL provide automated alerts for validator performance degradation

3.4 Delegator Interface

- FR-EX-017: The system SHALL provide portfolio aggregation showing all staking positions across chains
- FR-EX-018: The system SHALL provide performance benchmarking against chain averages and top validators
- FR-EX-019: The system SHALL track unstaking status and present timing information to eliminate uncertainty
- FR-EX-020: The system SHALL provide reward tracking with auto-compounding options

3.5 Analytics and Reporting

- FR-EX-021: The system SHALL provide historical trending analysis for 7-day, 30-day, and 90-day periods
- FR-EX-022: The system SHALL cross-reference data from multiple node endpoints for validation
- FR-EX-023: The system SHALL provide developer activity tracking including GitHub commits and module usage
- FR-EX-024: The system SHALL display chain creation and bootstrapping progress metrics

4. AMM Component - Functional Requirements

4.1 CNPY Hub Model

- FR-AMM-001: The system SHALL implement CNPY as hub asset where every liquidity pool pairs external assets with CNPY
- FR-AMM-002: The system SHALL provide continuous liquidity through bonding curve mechanics
- FR-AMM-003: The system SHALL ensure CNPY is always one side of every liquidity pool

4.2 Pool Management

- FR-AMM-004: The system SHALL implement dynamic fee structures with governance-controlled parameters
- FR-AMM-005: The system SHALL set base trading fees at 0.3% per swap (0.25% to LPs, 0.05% to treasury)
- FR-AMM-006: The system SHALL provide automatic pool creation for new chain tokens with CNPY pairs

4.3 Cross-Chain Trading

- FR-AMM-007: The system SHALL provide chain abstraction allowing users to select assets without managing underlying chains
- FR-AMM-08: The system SHALL implement automatic network switching to optimal chain for each trade
- FR-AMM-09: The system SHALL support cross-chain swap routing with multi-hop swaps
- FR-AMM-010: The system SHALL provide transaction bundling for gas efficiency
- FR-AMM-011: The system SHALL provide real-time transaction tracking across all chains

4.4 Liquidity Provision

- FR-AMM-012: The system SHALL provide rewards opportunities ranked by risk-adjusted returns
- FR-AMM-013: The system SHALL enable liquidity provision to multiple pools

4.5 Price Discovery and Analytics

- FR-AMM-014: The system SHALL provide comprehensive market data and analytics for all trading pairs
- FR-AMM-015: The system SHALL provide rewards projections and historical performance data
- FR-AMM-016: The system SHALL display pool TVL and volume metrics integrated with explorer rankings

5. On/Off Ramp - Functional Requirements

5.1 Atomic Swap Order Book

- FR-RAMP-001: The system SHALL implement one-sided sell-only order books for CNPY to USDC/USDT
- FR-RAMP-002: The system SHALL support cross-chain atomic swaps for Ethereum and Solana USDC/USDT pairs
- FR-RAMP-003: The system SHALL provide order aggregation allowing users to buy from multiple orders
- FR-RAMP-004: The system SHALL ensure atomic execution with trustless cross-chain swaps
- FR-RAMP-005: The system SHALL enable market-driven pricing through competitive order placement

5.2 Order Book Interface

- FR-RAMP-006: The system SHALL display real-time order book with price levels and available liquidity
- FR-RAMP-007: The system SHALL provide order grouping at same price levels for visual clarity
- FR-RAMP-008: The system SHALL implement color-coded depth chart showing liquidity distribution
- FR-RAMP-009: The system SHALL enable one-click buying with single transaction execution
- FR-RAMP-010: The system SHALL not support partial fill functionality for large trades

5.3 Supported Trading Pairs

- FR-RAMP-011: The system SHALL support primary pairs: ETH USDC→CNPY, ETH USDT→CNPY, SOL USDC→CNPY, SOL USDT→CNPY
- FR-RAMP-012: The system SHALL support secondary pairs: Nested Chain tokens → CNPY (lower priority)

6. Wallet Component - Functional Requirements

6.1 Multi-Wallet Management

- FR-WALLET-001: The system SHALL generate addresses across all supported chains from single seed phrase
- FR-WALLET-002: The system SHALL provide native support for Metamask and Canopy wallets
- FR-WALLET-003: The system SHALL implement account abstraction with simplified UX
- FR-WALLET-004: The system SHALL provide unified balance view aggregating balances across all accounts and chains
- FR-WALLET-005: The system SHALL enable cross-account operations for transferring assets between accounts and chains

6.2 Portfolio Management

- FR-WALLET-006: The system SHALL provide real-time balance updates with sub-second refresh rates
- FR-WALLET-007: The system SHALL automatically detect LP positions, staked assets, and lending positions
- FR-WALLET-008: The system SHALL provide historical performance tracking with P&L calculations
- FR-WALLET-009: The system SHALL display asset allocation charts by chain, protocol, and asset type
- FR-WALLET-010: The system SHALL support custom account labeling and categorization

- FR-WALLET-011: The system SHALL provide watch-only address monitoring without importing private keys

6.3 Staking Management

- FR-WALLET-012: The system SHALL provide integrated validator discovery and evaluation across all chains
- FR-WALLET-013: The system SHALL display clear unstaking timelines and penalty calculations
- FR-WALLET-014: The system SHALL support multi-chain staking with unified management interface
- FR-WALLET-015: The system SHALL track validator performance and provide automatic redelegation options
- FR-WALLET-016: The system SHALL integrate governance voting directly from staking interface

6.4 Governance Integration

- FR-WALLET-017: The system SHALL provide unified view of governance proposals across all chains
- FR-WALLET-018: The system SHALL provide AI-powered proposal summaries and impact assessments
- FR-WALLET-019: The system SHALL calculate real-time voting power based on staked amounts
- FR-WALLET-020: The system SHALL support delegate management with override capabilities
- FR-WALLET-021: The system SHALL enable batch voting on multiple proposals simultaneously
- FR-WALLET-022: The system SHALL provide voting history tracking and outcome monitoring
- FR-WALLET-023: The system SHALL send notifications for new proposals and voting deadlines

6.5 Security Features

- FR-WALLET-024: The system SHALL implement multiple verification steps during wallet creation
- FR-WALLET-025: The system SHALL provide secure key import/export functionality
- FR-WALLET-026: The system SHALL implement adaptive session timeouts based on activity type
- FR-WALLET-027: The system SHALL provide automatic wallet locking after inactivity periods

7. CNPY Token Economics - Functional Requirements

7.2 Economic Mechanisms

- FR-CNPY-001: The system SHALL accumulate trading fees partially in CNPY across all AMM operations
- FR-CNPY-002: The system SHALL require CNPY bonding for validators and LP providers
- FR-CNPY-003: The system SHALL provide CNPY holders with governance rights over platform parameters and treasury
- FR-CNPY-004: The system SHALL implement deflationary mechanisms through fee burning and treasury operations

8. Integration Requirements

8.1 Cross-Component Integration

- FR-INT-001: New chains launched via Launchpad SHALL automatically appear in Cross-Chain Explorer within 5 minutes
- FR-INT-002: AMM SHALL automatically create CNPY pairs for all newly launched chains
- FR-INT-003: Wallet SHALL automatically detect and add newly launched chains to supported networks
- FR-INT-004: All components SHALL share unified user authentication and session management
- FR-INT-005: Trading activity SHALL be immediately available in AMM component after chain launch

8.2 Data Consistency

- FR-INT-006: The system SHALL maintain consistent CNPY balance and staking data across all components
- FR-INT-007: The system SHALL synchronize validator and delegation information between Explorer and Wallet
- FR-INT-008: The system SHALL provide unified transaction history across all components
- FR-INT-009: The system SHALL maintain consistent chain state and metadata across all components

9. Performance Requirements

9.1 Response Times

- FR-PERF-001: Chain deployment via Launchpad SHALL complete in under 10 minutes for Simple Template

- FR-PERF-002: Balance updates SHALL occur with sub-second latency across all components
- FR-PERF-003: Cross-chain swap execution SHALL provide real-time transaction tracking
- FR-PERF-004: Staking metrics SHALL update with sub-second refresh rates in Explorer

9.2 Availability and Reliability

- FR-PERF-005: The system SHALL provide 99.9% uptime across all components
- FR-PERF-006: The system SHALL implement multi-source validation for critical data
- FR-PERF-007: The system SHALL provide automated failover for node endpoint failures
- FR-PERF-008: The system SHALL maintain service availability during high transaction volume periods