

# C3 ALLIANCE

## TECHNICAL IMPLEMENTATION GUIDE

**Cosmic Commons Cooperative Alliance**

A Colorado Limited Cooperative Association

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# PART A: Architecture & Infrastructure

## Section 1: Introduction & Executive Summary

### 1.1 Document Purpose

This Technical Implementation Guide provides comprehensive specifications for developers, architects, and technical teams implementing the C3 Alliance decentralized autonomous cooperative organization (DACO) infrastructure.

#### 1.1.1 Intended Audience

- Blockchain developers implementing Cardano/Plutus smart contracts
- System architects designing distributed infrastructure
- Security engineers implementing cryptographic identity systems
- DevOps teams deploying multi-signature vault infrastructure
- Technical reviewers conducting security audits

#### 1.1.2 Document Structure

Part	Title	Scope
<b>A</b>	Architecture & Infrastructure	System architecture, blockchain infrastructure, identity systems, vault architecture
<b>B</b>	Token Systems & Smart Contracts	Token taxonomy, Aiken smart contracts, token flow mechanics
<b>C</b>	Marketplace & Governance	C3DEX marketplace, Vickrey auctions, governance mechanisms
<b>D</b>	Operations & Deployment	Security framework, APIs, integration protocols, deployment

### 1.2 System Overview

The C3 Alliance implements a novel economic coordination system called Cyber-Mutualist Futurist Economics, which reconciles Austrian School economic principles with cooperative economics through blockchain-based infrastructure. The system creates parallel infrastructure for essential life services (energy, shelter, nourishment, health, mobility, data sovereignty) that makes extractive economic models obsolete.

### 1.2.1 Core Design Principles

**Infrastructure Principle:** For basic life infrastructure, for-profit control is never the rational solution. Collaborative conatus is the only rational choice. This principle drives the architectural decision that governance IS economics rather than being separate from it.

**Reciprocal Sovereignty:** Each member's sovereignty is protected through the mutual commitment of all members. This Cyber-Mutualist principle ensures that rights derive their force from collective participation, not from transcendent discovery.

**Contribution-Based Authority:** Stewardship rights are earned exclusively through verified contribution (labor, capital, care, maintenance). Claims based on arbitrary authority, inherited status, or passive ownership are not recognized.

### 1.2.2 Technology Stack Overview

Layer	Technology	Function
Settlement (L1)	Cardano	Native assets, UTXO model, Plutus/Aiken smart contracts, finality
Scaling (L2)	Hydra	High-throughput transactions, isomorphic state channels, instant finality
Privacy	Midnight Network	Zero-knowledge proofs, selective disclosure, confidential transactions
Identity	DID/SBT	Sovereign Entity Identifiers, soulbound credentials, ZKP-KYC
Smart Contracts	Aiken	Functional contract language, formal verification, UPLC compilation
Storage	Self-Hosted/IPFS/Arweave	Decentralized content storage, permanent data availability

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## Section 2: System Architecture

### 2.1 Entity Hierarchy

The C3 Alliance implements a four-level entity hierarchy, each with distinct cryptographic identifiers and governance capabilities. This hierarchy balances individual sovereignty with collective coordination through clearly defined boundaries and interfaces.

#### 2.1.1 Entity Identifier Types

Identifier	Esperanto Name	English Name	Description
<b>SEID</b>	Suverena Enta Identigilo	Sovereign Entity Identifier	Individual natural person identity anchor
<b>KEID</b>	Klana Enta Identigilo	Clan Entity Identifier	Family/kinship group collective identity (DACO)
<b>FEID</b>	Fakcio Enta Identigilo	Faction Entity Identifier	Functional group identity (Union, Guild, Syndicate)
<b>NEID</b>	Noda Enta Identigilo	Node Entity Identifier	Local commons community identity (N3 Node)

#### 2.1.2 Authorization Hierarchy

Entity Type	Authorized By	Status	Amendment Path
<b>FEID</b>	Articles of Organization	Constitutional	75% supermajority + 60 days
<b>KEID</b>	Operating Agreement	Operational	60% majority + 30 days
<b>NEID</b>	Operating Agreement + Node Adoption	Operational	Local governance
<b>SEID</b>	Registration Protocol	Ongoing	N/A (individual right)

#### 2.1.3 Namespace Architecture

All entity identifiers follow a hierarchical namespace structure:

- **SEID Format:** `did:c3:seid:[network]:[unique-hash]`
- **KEID Format:** `KEID:[node-identifier]:[unique-klano-id]`
- **FEID Format:** `FEID:[node-identifier]:[faction-type]:[instance-id]`

- **NEID Format:** NEID:[network]:[geographic-or-thematic-id]
- **Sub-KEID:** KEID:[klano-id]:S:[sekto-id]:C:[cef-id]:B:[branch-id]

## 2.2 Network Topology

The C3 Alliance operates as a federated network of autonomous N3 Commons Nodes, each implementing the full stack of infrastructure while maintaining interoperability through shared protocols and token standards.

### 2.2.1 Network Layers

**La Montoceno (The Mountain Range):** The complete C3 Alliance network spanning all N3 Commons Nodes globally. Provides network-level governance standards, cross-node credential portability, and inter-node economic coordination.

**La Monto (The Mountain):** A single N3 Commons Node representing a local cooperative community. Each node is autonomous in operational matters while adhering to constitutional standards. The first implementation node is Komuna Kampuso in Hardin County, Texas.

**Pintoj (Peaks):** The six domains of infrastructure cultivation within each node:

- Rikolta Pinto (Nourishment)
- Fajruja Pinto (Dwelling)
- Fulmina Pinto (Energy)
- Vekica Pinto (Cultivation)
- Kerna Pinto (Sovereignty)
- Horizonta Pinto (Mobility)

### 2.2.2 Inter-Node Communication

Nodes communicate through standardized protocols enabling:

- Cross-node XPT credential verification and portability
- Inter-node Impact Offer coordination via C3DEX
- Shared governance standards and constitutional compliance verification
- Token bridge operations for cross-node liquidity

## 2.3 Data Flow Architecture

The system implements a layered data architecture separating settlement, computation, and storage concerns:

### 2.3.1 On-Chain Data (Cardano L1)

- Native asset token balances (COMM, PPT, XPT, C-Bills)
- Multi-signature vault UTXOs and transaction history

- Smart contract state (Plutus datums)
- Governance proposal hashes and voting records
- Entity registration anchors (SEID, KEID, FEID, NEID)

### 2.3.2 Layer 2 Data (Hydra)

- High-frequency Impact Offer bid submissions
- Real-time PPT micro-transactions
- Intra-node payment channels
- Batch settlement preparation

### 2.3.3 Privacy Layer (Midnight)

- KYC/AML verification proofs without PII disclosure
- Confidential transaction amounts where required
- Selective credential disclosure for service access

### 2.3.4 Off-Chain Data (IPFS/Arweave)

- Impact Offer detailed specifications
- XPT credential metadata and verification evidence
- Governance proposal full text and deliberation records
- Persona NFT landing pages and profile data

## Section 3: Blockchain Infrastructure

### 3.1 Cardano Layer 1 Implementation

The C3 Alliance builds on Cardano as the settlement layer due to its extended UTXO model, native asset support, formal verification capabilities, and proof-of-stake consensus providing energy efficiency aligned with cooperative values.

#### 3.1.1 Network Configuration

Parameter	Configuration
<b>Network</b>	Cardano Mainnet (production) / Preview (testing)
<b>Era</b>	Babbage (current), Conway (governance features)
<b>Plutus Version</b>	Plutus V2 (primary), V3 for advanced features
<b>Smart Contract Language</b>	Aiken (primary), Plutus Tx (legacy compatibility)

Parameter	Configuration
Token Standard	CIP-25 (metadata) / CIP-68 (programmable)
Identity Standard	CIP-100 series (DID/VC integration)

### 3.1.2 UTXO Model Considerations

**Datum Design:** Contract state is encoded in datums attached to UTXOs. The C3 Alliance uses typed datums with versioning to enable schema evolution without breaking changes.

**Concurrency Handling:** Multiple users attempting to interact with the same UTXO creates contention. The system implements batching through Hydra L2 for high-frequency operations and UTXO splitting for parallelization of vault operations.

**Reference Inputs:** Read-only access to UTXOs without consuming them enables efficient credential verification and governance parameter lookups without state contention.

### 3.1.3 Native Asset Configuration

Token	Policy Type	Minting Authority	Transferability
COMM	Multi-sig + Contract	N3-Node Vault (via PPT conversion)	Transferable (with ROFR)
PPT	Contract-controlled	N3-Node Vault (on IO completion)	Soulbound (non-transferable)
XPT	Contract-controlled	N3-Node Vault / Teknologia Instituto / Kampusu Kuirejo	Soulbound (portable)
C-Bills	Multi-sig + Contract	N3-Node Vault (on subscription)	Restricted transfer
JLZ	Contract-controlled	Protocol (algorithmic)	Freely transferable

## 3.2 Hydra Layer 2 Integration

Hydra provides isomorphic state channels enabling the same Plutus contracts to run on L2 with instant finality and near-zero fees, settling to L1 for security guarantees.

### 3.2.1 Hydra Head Configuration

Parameter	Specification
Head Participants	N3-Node signatories (3-5 participants per head)

Parameter	Specification
Contest Period	24 hours (configurable per head)
Commit Capacity	Up to 1000 UTXOs per participant
Transaction Throughput	1000+ TPS within head
Finality	Instant (within head), L1 finality on close

### 3.2.2 Head Lifecycle Management

**Initialization:** Head participants commit UTXOs to the head contract on L1. The committed state becomes the initial head state.

**Operation:** Participants execute transactions within the head using consensus. All participants must sign each transaction, ensuring unanimous agreement.

**Fanout:** When closing the head, the final state is published to L1. A contest period allows dispute resolution before finalization.

### 3.2.3 Use Cases for Hydra

- C3DEX bid submission and revelation (sealed-bid phase)
- High-frequency PPT micro-distributions for ongoing work
- Real-time governance vote tallying
- Intra-KEID treasury operations requiring multiple signatures

## 3.3 Midnight Network Privacy Layer

Midnight Network provides programmable privacy through zero-knowledge proofs, enabling selective disclosure of information while maintaining regulatory compliance.

### 3.3.1 Privacy Architecture

**Compact (Public Ledger):** Stores commitments and proofs without revealing underlying data. Used for public verifiability of compliance.

**Dust (Private State):** Off-chain encrypted data accessible only to authorized parties. Used for sensitive PII and transaction details.

**ZK Circuit Integration:** Custom circuits enable proving statements about private data without disclosure (e.g., proving age > 18 without revealing birthdate).

### 3.3.2 Privacy Use Cases

Use Case	Implementation
<b>KYC/AML Verification</b>	ZKP proving identity verification without exposing documents
<b>Accredited Investor Status</b>	Prove net worth threshold without revealing exact amounts
<b>Credential Verification</b>	Verify XPT qualifications without full credential disclosure
<b>Confidential Transactions</b>	Hide transaction amounts while proving validity
<b>Sealed-Bid Auctions</b>	Commit to bids without revealing values until reveal phase

### 3.3.3 Cross-Chain Bridge

Midnight operates as a Cardano sidechain with bidirectional asset bridges:

- Lock assets on Cardano L1, mint wrapped assets on Midnight
  - Execute private transactions on Midnight
  - Burn wrapped assets, unlock originals on L1 with proof
- 

## Section 4: Identity Infrastructure

### 4.1 Sovereign Entity Identifier (SEID)

The SEID is the foundational identity primitive of the C3 Alliance, providing cryptographic sovereignty over personal identity, credentials, and economic assets. Every member must establish a SEID as a prerequisite for participation.

#### 4.1.1 SEID Architecture

The SEID implements the W3C Decentralized Identifier (DID) standard with Cardano-specific method:

did:c3:seid:mainnet:addr1qx...

Key components:

- **DID Document:** Contains public keys, service endpoints, and verification methods
- **Controller:** The SEID holder with exclusive private key possession
- **Verification Methods:** Ed25519 signatures for authentication and assertion

- **Service Endpoints:** IPFS-hosted profile, credential repository references

#### 4.1.2 SEID Vault Structure

Property	Specification
<b>Key Control</b>	Exclusive possession by SEID holder; no backdoors, escrow, or recovery by third parties
<b>Portability</b>	Full interoperability across N3 Commons network and compatible systems
<b>Privacy</b>	ZKP-enabled selective disclosure; verify attributes without exposing data
<b>Resistance</b>	Technical immunity to seizure, censorship, or unauthorized access
<b>Exit Preservation</b>	All credentials, tokens, and reputation retained upon separation from any node

#### 4.1.3 SEID Registration Process

1. **Sponsor Introduction:** Prospective member receives invitation from existing member or founder
2. **Key Generation:** Member generates Ed25519 keypair using approved wallet software (hardware wallet recommended)
3. **DID Document Creation:** Construct DID document with public key and initial service endpoints
4. **On-Chain Anchoring:** Publish DID document hash to Cardano L1 as registration anchor
5. **SBT-DID Credential Issuance:** Receive soulbound identity credential linking SEID to verification attestations
6. **N3 Node Registration:** Register SEID with local Commons Node for governance participation

## 4.2 Soulbound Token (SBT) Credentials

Soulbound tokens are non-transferable NFTs permanently bound to a SEID, representing earned credentials, achievements, and verified attributes that cannot be sold or transferred.

#### 4.2.1 SBT Properties

- **Non-transferable:** Smart contract rejects any transfer transaction
- **Permanently linked:** Immutable association with originating SEID
- **Owner-revocable:** Only the holder can retire/burn the credential
- **Externally non-revocable:** No external party can strip credentials from a holder

## 4.2.2 Credential Types

Credential Type	Issuing Authority	Purpose
<b>SBT-DID Identity</b>	N3 Node Registration	Human personhood verification, KYC attestation
<b>XPT Credential</b>	Teknologia Instituto / Kampusa Kuirejo	Skill certification, competency verification
<b>Governance Role</b>	N3 Node Governance	Covenant Guardian, Adjutant, Signatory certification
<b>Membership Status</b>	N3 Node / KEID	Active membership, faction affiliation, standing
<b>Pontisto Recognition</b>	N3 Node Governance	Successful sponsorship achievement

## 4.3 Zero-Knowledge KYC Compliance

The C3 Alliance implements privacy-preserving identity verification through zero-knowledge proofs, enabling regulatory compliance without exposing personal data.

### 4.3.1 ZKP-KYC Architecture

**Identity Proofing (Off-chain):** Member submits identity documents to approved verifier (legal, accounting, or compliance firm). Verifier validates identity and generates attestation. Attestation is signed and stored encrypted.

**Proof Generation:** Member generates ZK proof that they possess valid attestation from approved verifier. Proof reveals only required attributes (e.g., is accredited investor) without exposing documents.

**Proof Verification (On-chain):** Smart contract or service verifies ZK proof against known verifier public keys. Verification result determines access without learning private details.

### 4.3.2 Verification Attributes

Attribute	Proving Statement	Use Case
<b>Age Verification</b>	Age $\geq$ 18 OR Age $\geq$ 21	General eligibility
<b>Accreditation</b>	Net worth $>$ \$1M OR Income $>$ \$200K	C-Bills investment eligibility

Attribute	Proving Statement	Use Case
Jurisdiction	Resident of permitted jurisdiction	Securities compliance
OFAC Clearance	Not on sanctions list	AML compliance
Investment Limit	Investment < 10% of income/net worth	Non-accredited limits

## 4.4 Multi-Signature Vault Architecture

The N3-Node Multi-Sig Vault is the primary treasury management infrastructure, implementing distributed trust through threshold signature requirements.

### 4.4.1 Vault Configuration

Parameter	Specification
Implementation	Cardano Native Multi-Sig Script
Signature Scheme	M-of-N Threshold (Default: 3-of-5)
Key Distribution	5 distributed signatories across stakeholder roles
Custody Model	Non-custodial (on-chain smart contract)
Hardware Security	Hardware wallet required for each signatory

### 4.4.2 Signatory Structure

Signatory Role	Keys	Responsibility
Node Steward	1	Day-to-day operations, local oversight, transaction initiation
Member Council #1	1	Elected member representative, community voice, Producer/Procurer/Promoter rotation
Member Council #2	1	Second elected representative, different faction than #1
C3 Alliance	1	Network oversight, compliance monitoring, inter-node coordination
External Trustee	1	Independent third-party, fiduciary duty to investors

#### 4.4.3 Transaction Authorization Matrix

Transaction Type	Threshold	Additional Requirements
C-Bills Issuance	3-of-5	Verified subscription + KYC
Treasury Disbursement > \$10K	3-of-5	Documented rationale
Capital Allocation (Zone Investment)	3-of-5	Governance approval
PPT Minting	3-of-5	Verified IO completion
PPT-to-COMM Conversion	3-of-5	Conversion window open
Signatory Key Rotation	4-of-5	7-day delay + member notice

#### 4.4.4 Multi-Sig Script Implementation

```
{  
  
  "type": "atLeast",  
  
  "required": 3,  
  
  "scripts": [  
  
    { "type": "sig", "keyHash": "<node_steward_key>" },  
  
    { "type": "sig", "keyHash": "<member_council_1_key>" },  
  
    { "type": "sig", "keyHash": "<member_council_2_key>" },  
  
    { "type": "sig", "keyHash": "<c3_alliance_key>" },  
  
    { "type": "sig", "keyHash": "<external_trustee_key>" }  
  
  ]  
  
}
```

#### 4.4.5 Key Management Requirements

- **Hardware Security:** Each signatory must secure their key using hardware wallet (Ledger, Trezor, or equivalent)

- **Geographic Distribution:** Signatories should be geographically distributed to prevent single-point-of-failure
- **Backup Procedures:** Each signatory maintains secure seed phrase backup per hardware wallet best practices
- **Key Rotation:** Signatory transitions require 4-of-5 approval with 7-day delay for member notification

## 4.5 Persona NFT System

Personas are soulbound NFTs representing distinct identity contexts, enabling members to maintain separate public and private identities while preserving accountability through permanent linkage to the master SEID.

### 4.5.1 Persona Types

Persona Type	Description & Use Cases
<b>Private Persona</b>	Personal, esoteric, or inner-circle contexts. Limited visibility, trusted interactions only.
<b>Public Persona</b>	Business, professional, or market-facing contexts. Full visibility, client and external interactions.
<b>Agent Persona</b>	AI agents, automated systems, or delegated actors. Operates within defined parameters.
<b>Clan (DACO) Persona</b>	Owned by KEID, represents Klano in collective contexts. Requires vault threshold for minting.

### 4.5.2 Persona Namespace

@Persona:[SEID|KEID]:[sovereign-hash]:[persona-hash]

Example namespace assignments:

- @Persona:SEID:jw-001:purpura-alkemisto — Individual's private persona
- @Persona:SEID:jw-001:plausible-potentials — Individual's public persona
- @Persona:KEID:hardin-n3:klano-pontisto — Clan's shared persona

### 4.5.3 IPFS Landing Page

Each persona maintains an IPFS-hosted public profile containing:

- @Persona Handle: Verified identity display
- XPT Score: Current reputation score
- Credential Badges: Active certifications and endorsements

- Faction Standing: Union/Guild/Syndicate participation levels
- Verification Hash: On-chain reference for independent verification

## PART B: Token Systems & Smart Contracts

### Section 5: Token Taxonomy

#### 5.1 Token System Overview

The C3 Alliance implements a sophisticated multi-token economic system designed to separate concerns between contribution tracking, economic stake, credentials, investment instruments, and operational currency. This separation enables precise economic coordination while preventing capture through any single mechanism.

##### 5.1.1 Token Classification Matrix

Token	Full Name	Type	Transferability	Primary Function
<b>JLZ</b>	Joules	Stablecoin	Fully Transferable	Internal currency
<b>PPT</b>	Patronage Proof Token	Soulbound	Non-Transferable	Contribution record
<b>COMM</b>	Commons Coin	Membership	Restricted (ROFR)	Economic stake
<b>XPT</b>	Experience Proof Token	Soulbound NFT	Non-Transferable	Credentials
<b>C-Bills</b>	Commons Bills	Security	Restricted	Investment
<b>TIT</b>	Tokenized Intelligent Tool	RWA NFT	Node-Restricted	Asset ownership

##### 5.1.2 Physics-Based Token Metaphor

**JLZ (Energy):** Represents potential energy in the system. Named after James Prescott Joule, it functions as the medium of exchange for all economic activity within the ecosystem.

**PPT (Work):** Represents applied energy through verified contribution. PPT documents that work has been performed, transforming potential (JLZ) into demonstrated value.

**COMM (Mass):** Represents accumulated stake in the commons. Like mass accumulating through energy conversion, COMM is created only through PPT conversion.

**XPT (Crystal Structure):** Represents crystallized achievements. Like atoms arranging into stable crystal lattices, XPT credentials represent permanent, verifiable competency structures.

## 5.2 JLZ (Joules) Stablecoin

JLZ serves as the internal transaction currency for the C3 Alliance ecosystem, providing stable unit of account and medium of exchange for Impact Offers, services, and internal commerce.

### 5.2.1 Technical Specification

Parameter	Specification
Token Standard	Cardano Native Asset (CIP-25)
Decimals	6 (micro-JLZ precision)
Peg Target	1 JLZ = 1 USD (soft peg)
Collateralization	Node treasury assets + operational reserves
Minting Authority	N3-Node Multi-Sig Vault (3-of-5)
Redemption	On-demand conversion to USDC/fiat via approved channels

### 5.2.2 JLZ Minting Conditions

JLZ may only be minted under the following authorized conditions:

- C-Bills subscription proceeds deposit (1:1 with USD received)
- External revenue receipt from Impact Offer completion
- Approved capital contributions from members
- Treasury diversification from ADA or other digital assets

### 5.2.3 Stability Mechanism

JLZ maintains peg stability through treasury reserve backing, transparent on-chain collateral verification, and arbitrage incentives for approved market makers. The stability mechanism does not rely on algorithmic mechanisms but rather on direct collateral backing.

## 5.3 PPT (Patronage Proof Token)

PPT is the fundamental contribution-tracking token within the C3 Alliance ecosystem, creating an immutable on-chain record of patronage that forms the basis for economic participation and governance influence.

### 5.3.1 Technical Specification

Parameter	Specification
Token Standard	Cardano Native Asset (CIP-25/CIP-68)
Token Type	Soulbound (Non-Transferable)
Decimals	0 (whole units only)
Minting Authority	N3-Node Multi-Sig Vault upon verified IO completion
Burning Authority	Holder only (via governance burn or COMM conversion)
Supply	Unlimited (minted on verified contribution)

### 5.3.2 Faction-Tagged PPT Variants

Variant	Faction	Default Share	Contribution Type
PPT-PDT	Producers (Union)	50-60%	Labor, services, direct value creation
PPT-PCT	Procurers (Guild)	25-35%	Capital, resources, infrastructure
PPT-PMT	Promoters (Syndicate)	10-20%	Coordination, sales, community

### 5.3.3 PPT Earning Mechanisms

**Primary: Impact Offer Completion** — PPT is allocated to IO participants based on role and contribution weight upon successful completion and multi-sig verification attestation.

**Secondary: C-Bills Conversion** — C-Bills investors receive 1 PPT per \$1.00 principal at maturity (1.10 PPT for early investors within 90-day window).

**Tertiary: Milestone Achievements** — Pioneer milestones, community development, governance participation, and other verified achievements outside the IO framework.

### 5.3.4 PPT Dual-Path Utility

PPT provides holders with a strategic choice between two mutually exclusive utility paths:

PATH A: GOVERNANCE	PATH B: WEALTH
Burn PPT to mint proposal-specific governance influence tokens	Accumulate PPT and convert to COMM during designated windows
Vote weight = $\log_2(\text{PPT\_burned} + 1) \times \text{Faction\_Multiplier}$	COMM_received = PPT_converted $\times$ Base_Rate $\times$ Tenure_Multiplier
Result: Control without capital accumulation	Result: Capital accumulation without governance burn

**NOTE:** *The dual-path design creates natural governance equilibrium: those seeking control sacrifice future COMM wealth, those seeking wealth forgo governance influence. No single mechanism enables capture.*

### 5.3.5 PPT Metadata Schema

```
{
  "721": {
    "<policy_id>": {
      "PPT": {
        "name": "Patronage Proof Token",
        "description": "Verified contribution record - C3 Alliance",
        "holder_seid": "<seid_identifier>",
        "earning_source": "IO" | "C-BILLS" | "MILESTONE",
        "source_reference": "<io_id | cbill_id | milestone_id>",
        "timestamp": "<unix_timestamp>",
        "amount": <quantity>,
        "faction": "PRODUCER" | "PROCURER" | "PROMOTER"
      }
    }
  }
}
```

```

}
}
}

```

## 5.4 COMM (Commons Coin)

COMM is the primary economic stake token representing proportional ownership interest in the N3 Commons community. COMM is the wealth-building token earned through sustained contribution, transforming PPT records into transferable economic value.

### 5.4.1 Technical Specification

Parameter	Specification
<b>Token Standard</b>	Cardano Native Asset (CIP-25/CIP-68)
<b>Token Type</b>	Transferable (with restrictions)
<b>Decimals</b>	6 (micro-COMM precision)
<b>Primary Source</b>	PPT Conversion only (no pre-mine, no direct purchase)
<b>Transfer Restriction</b>	Right of First Refusal (ROFR) - 30-day notice period
<b>Recipient Requirement</b>	Verified SEID with KYC compliance

### 5.4.2 COMM Utility Rights

- Proportional economic stake in N3 Commons community assets and operations
- Surplus distribution eligibility (patronage dividends when node generates surplus)
- Operational governance weight on non-constitutional matters
- Staking eligibility for VELOC collateralization and infrastructure backing
- Exit rights via transfer (subject to ROFR) or approved buyback programs

### 5.4.3 PPT-to-COMM Conversion Formula

$$\text{COMM\_received} = \text{PPT\_converted} \times \text{Base\_Rate} \times \text{Tenure\_Multiplier}$$

Where Base\_Rate is initially 1.0 COMM per 10 PPT (adjustable by governance within 0.5-2.0 range), and Tenure\_Multiplier rewards long-term contribution:

SEID Age	Tenure Multiplier
< 6 months	1.00× (base)

SEID Age	Tenure Multiplier
6-12 months	1.05×
12-24 months	1.10×
24-36 months	1.15×
> 36 months	1.20× (maximum)

#### 5.4.4 Conversion Windows

PPT-to-COMM conversion occurs during scheduled quarterly windows:

- Primary conversion windows: January, April, July, October (14-day periods)
- Minimum conversion threshold: 100 PPT per transaction
- 30-day advance notice via on-chain governance announcement
- No maximum limit per conversion (holders may convert any amount above minimum)

#### 5.4.5 VELOC (Vault Equity Line of Credit)

COMM holders may access liquidity without selling through the VELOC mechanism:

- **Collateralization Ratio:** Maximum up to 115% LTV (borrow up to 115% of COMM value)
- **Interest Rate:** Variable rate set by governance (initial: 3% APR)
- **Repayment:** Interest accrues continuously; principal due on demand or upon exit
- **Liquidation Threshold:** If COMM value drops below 125% of loan, collateral may be liquidated
- **Benefit:** Retain surplus distribution rights on collateralized COMM

### 5.5 XPT (Experience Proof Token)

XPT is a soulbound NFT credential providing verifiable, portable skill attestations for workforce development and N3 network access. Credentials belong to the individual, not the institution.

#### 5.5.1 Technical Specification

Parameter	Specification
Token Standard	Cardano Native Asset NFT (CIP-25/CIP-68)
Token Type	Soulbound NFT (Non-Transferable)
Issuing Authorities	N3-Teknologia Instituto + Kampusu Kuirejo + Academic Partners
Portability	Cross-network (recognized across all N3 Nodes)

Parameter	Specification
Revocation	NOT PERMITTED (sovereign ownership)
On Exit	Retained permanently by holder

### 5.5.2 Credential Tier System

Tier	Requirements	Training Hours	Unlocks
Foundation	Orientation + basic assessment	4-8 hours	Basic IO eligibility
Practitioner	Training + supervised practice	40-80 hours	Independent IO work
Specialist	Advanced training + portfolio	120-200 hours	Lead IOs, train others
Expert	Mastery + 1yr practice + peer review	300+ hours	Curriculum dev, cross-node

### 5.5.3 XPT Credential Domains

#### Technical Domains (Teknologia Instituto)

- TIT Fleet Operator: Server management, GPU scheduling, monitoring, maintenance
- ML Model Deployment: Model training, fine-tuning, inference optimization, MLOps
- Cardano Developer: Plutus/Aiken smart contracts, token minting, dApp development
- Multi-Sig Operator: Vault operations, transaction signing, key management
- Solar Technician: PV installation, inverter config, battery management

#### Food Systems Domains (Kampusu Kuirejo)

- Aquaponics Operator: Water chemistry, fish health, plant nutrition, system balancing
- AgTech TIT Specialist: Sensor deployment, IoT integration, on-chain asset tracking
- Food Systems Designer: Integrated closed-loop design, nutrient cycling, optimization
- Permaculture Practitioner: Sustainable land management, polyculture, regenerative agriculture

#### Governance Domains

- Covenant Guardian: Mediation, arbitration, Natural Law interpretation
- Governance Facilitator: Consent process, proposal development, meeting facilitation
- Treasury Signatory: Multi-Sig ops, financial controls, audit protocols
- Node Steward: Operations management, community leadership, strategic planning

#### 5.5.4 XPT Metadata Schema

```
{  
  
  "name": "XPT-AgTech-TIT-Specialist-Practitioner",  
  
  "domain": "FOOD_SYSTEMS",  
  
  "tier": "PRACTITIONER",  
  
  "holder_seid": "<holder_seid>",  
  
  "issuer": {  
  
    "primary": "Kampusu Kuirejo",  
  
    "co_issuer": "Teknologia Instituto",  
  
    "academic_partner": "Texas A&M University",  
  
    "multi_sig": ["<kk_key>", "<ti_key>", "<tamu_key>"]  
  
  },  
  
  "issuance": {  
  
    "date": "<unix_timestamp>",  
  
    "training_hours": 65,  
  
    "assessment_score": 92,  
  
    "portfolio_ipfs": "<ipfs_hash>"  
  
  },  
  
  "validity": {  
  
    "permanent": true,  
  
    "recertification_recommended": "<interval>" | null  
  
  }  
  
}
```

},

"verification\_url": "https://verify.c3alliance.org/<credential\_id>"

}

## 5.6 C-Bills (Commons Bills)

C-Bills are investment instruments representing a contribution to Commons infrastructure, secured by the N3-Node Multi-Sig Vault and convertible to PPT upon maturity.

### 5.6.1 Technical Specification (Proposed-Not Final)

Parameter	Specification
<b>Regulatory Framework</b>	Regulation A+ Tier 2 (SEC Qualified)
<b>Maximum Offering</b>	\$75,000,000 per 12-month period
<b>Minimum Investment</b>	\$1,000 USD
<b>Denomination</b>	1 C-Bill = \$1.00 USD
<b>Maturity</b>	36 months from issue date
<b>Security</b>	N3-Node Multi-Sig Vault assets
<b>Conversion</b>	1 PPT per \$1.00 at maturity (1.10 PPT for early investors)

### 5.6.2 Holder Requirements

- Verified SEID with SBT-DID credentials
- KYC/AML compliance verification (ZKP-encrypted where available)
- Accredited investor status OR non-accredited investment limits
- SEID Vault established for C-Bills custody

### 5.6.3 Use of Proceeds

Category	Allocation	Amount
TIT Fleet Acquisition (40-60 units)	35%	TBD
La Deponejo Construction (Depot + Academy)	25%	TBD
E2C Acquisitions (2-3 contractors)	15%	TBD
Housing & Bunkhouse	10%	TBD

Category	Allocation	Amount
Working Capital & Operations	10%	TBD
Offering Costs (Legal, SEC, Marketing)	5%	TBD
<b>TOTAL</b>	<b>100%</b>	<b>\$75,000,000</b>

### 5.7 TIT (Tokenized Intelligent Tool)

TIT represents tokenized real-world assets (RWA) including autonomous systems, robotics, and infrastructure equipment. Each TIT maintains on-chain identity, reports telemetry, and participates in the cooperative economic model.

#### 5.7.1 Technical Specification

Parameter	Specification
<b>Token Standard</b>	Cardano Native Asset NFT (CIP-25/CIP-68 + CIP-721 extension)
<b>Token Type</b>	Real-World Asset NFT (unique per physical asset)
<b>Ownership</b>	N3-Node Multi-Sig Vault (collective ownership)
<b>Transferability</b>	Node-restricted (requires governance approval)
<b>Revenue Attribution</b>	IO completion linked to TIT deployment

#### 5.7.2 TIT Categories

Category	Examples	Revenue Model
<b>Energy Services</b>	Inspection drones, hazmat robots, survey units	IO fees from pipeline/refinery contracts
<b>Mobility</b>	Robo-taxis, delivery drones	Per-trip fees, subscription services
<b>Humanoid</b>	Facility robots, service units	Facility maintenance IO allocation
<b>Infrastructure</b>	Solar arrays, battery systems, servers	Energy production, compute services

---

## Section 6: Smart Contract Specifications

### 6.1 Development Framework

C3 Alliance smart contracts are developed using Aiken, a modern functional programming language designed specifically for Cardano. Aiken compiles to Untyped Plutus Core (UPLC), providing formal verification capabilities and optimal on-chain execution efficiency.

#### 6.1.1 Technology Stack (Proposed-Not Final)

Component	Technology	Purpose
Contract Language	Aiken v1.0+	Primary development language
Compilation Target	UPLC (Untyped Plutus Core)	On-chain execution format
Testing Framework	Aiken built-in + Property-based	Unit and integration testing
Off-chain SDK	Lucid / Mesh.js	Transaction building and submission
Node Integration	cardano-node + Ogmios	Chain synchronization and queries

#### 6.1.2 Contract Architecture Principles

**Validator Pattern:** All state-changing operations use validator scripts that verify transaction conditions rather than executing imperative logic. Validators return true/false based on redeemer conditions.

**Datum Storage:** Persistent state is stored in UTXOs using Plutus Datums. Complex state is hash-referenced with full data stored off-chain (IPFS) for cost efficiency.

**Minting Policies:** Token creation is controlled by minting policy scripts that enforce authorized issuance conditions (multi-sig, time-locks, contribution verification).

**Reference Scripts:** Commonly used validators are deployed as reference scripts to reduce transaction costs through script referencing.

### 6.2 Multi-Signature Vault Contract

The N3-Node Multi-Sig Vault is the core treasury management contract, implementing threshold signature requirements for all collective asset operations.

## 6.2.1 Contract Interface

-- Vault Validator (Aiken)

```
validator vault {  
  
  fn spend(  
  
    datum: VaultDatum,  
  
    redeemer: VaultRedeemer,  
  
    ctx: ScriptContext  
  
  ) -> Bool {  
  
    let VaultDatum { signatories, threshold, nonce } = datum  
  
    let tx = ctx.transaction  
  
  
    // Verify threshold signatures present  
  
    let sig_count = count_signatures(tx.extra_signatories, signatories)  
  
    expect sig_count >= threshold  
  
  
    when redeemer is {  
  
      Spend { amount, recipient } ->  
  
        verify_spend(datum, amount, recipient, tx)  
  
      RotateKeys { new_signatories } ->  
  
        verify_rotation(datum, new_signatories, tx)  
  
      UpdateThreshold { new_threshold } ->
```

```

    verify_threshold_update(datum, new_threshold, tx)
  }
}
}

```

### 6.2.2 Datum Structure

```

type VaultDatum {
  signatories: List<VerificationKeyHash>, // 5 authorized signers
  threshold: Int, // Required signatures (3)
  nonce: Int, // Replay protection
  spending_limits: SpendingLimits, // Per-transaction limits
  time_locks: Option<TimeLockConfig>, // Optional time delays
}

type SpendingLimits {
  single_tx_max: Int, // Maximum per transaction (in lovelace)
  daily_aggregate_max: Int, // Maximum daily total
  requires_delay_above: Int, // Amount triggering time lock
}

```

### 6.2.3 Redeemer Actions

Action	Threshold	Description
<b>Spend</b>	3-of-5	Standard disbursement from vault
<b>RotateKeys</b>	4-of-5	Replace signatory key (with 7-day delay)
<b>UpdateThreshold</b>	4-of-5	Modify signature threshold

Action	Threshold	Description
<b>EmergencyFreeze</b>	2-of-5	Temporary freeze (requires 4-of-5 to unfreeze)

## 6.3 PPT Minting Contract

The PPT minting policy controls issuance of Patronage Proof Tokens, enforcing that tokens are only minted upon verified contribution completion.

### 6.3.1 Minting Policy

-- PPT Minting Policy (Aiken)

```
validator ppt_mint {  
  
  fn mint(  
  
    redeemer: PPTMintRedeemer,  
  
    ctx: ScriptContext  
  
  ) -> Bool {  
  
    let tx = ctx.transaction  
  
    when redeemer is {  
  
      MintForIO { io_id, recipients, amounts } -> {  
  
        // Verify IO completion attestation  
  
        expect verify_io_completion(io_id, tx)  
  
        // Verify vault signatures  
  
        expect verify_vault_auth(tx)  
  
        // Verify amounts match IO allocation  
  
        expect verify_allocation(io_id, recipients, amounts)  
  
        // Verify recipient SEIDs are valid
```



```

input_datum: PPTDatum,

output_datum: PPTDatum,

ctx: ScriptContext

) -> Bool {

    // PPT can only move if burned or same holder

    let is_burn = output_datum.amount == 0

    let same_holder = input_datum.holder_seid == output_datum.holder_seid

    is_burn || same_holder

}

```

## 6.4 COMM Conversion Contract

The COMM conversion contract manages the PPT-to-COMM burn-to-mint mechanism, enforcing conversion windows and ratio calculations.

### 6.4.1 Conversion Validator

-- COMM Conversion Contract (Aiken)

```

validator comm_conversion {

    fn spend(

        datum: ConversionDatum,

        redeemer: ConversionRedeemer,

        ctx: ScriptContext

    ) -> Bool {

        let tx = ctx.transaction

        let ConversionDatum { window_start, window_end, base_rate } = datum

```

```
// Verify within conversion window

let current_time = get_tx_time(tx)

expect current_time >= window_start

expect current_time <= window_end

when redeemer is {

  Convert { ppt_amount, holder_seid } -> {

    // Verify minimum threshold

    expect ppt_amount >= 100

    // Verify PPT burn in transaction

    expect verify_ppt_burn(tx, holder_seid, ppt_amount)

    // Calculate COMM amount with tenure multiplier

    let tenure = get_seid_tenure(holder_seid)

    let multiplier = calculate_tenure_multiplier(tenure)

    let comm_amount = (ppt_amount * base_rate * multiplier) / 10

    // Verify COMM mint matches calculation

    expect verify_comm_mint(tx, holder_seid, comm_amount)

    True

  }

}

}
```

```
}
```

#### 6.4.2 Tenure Multiplier Calculation

```
fn calculate_tenure_multiplier(tenure_days: Int) -> Int {
```

```
  if tenure_days < 180 {
```

```
    100 // 1.00x (base, represented as 100 for integer math)
```

```
  } else if tenure_days < 365 {
```

```
    105 // 1.05x
```

```
  } else if tenure_days < 730 {
```

```
    110 // 1.10x
```

```
  } else if tenure_days < 1095 {
```

```
    115 // 1.15x
```

```
  } else {
```

```
    120 // 1.20x (maximum)
```

```
  }
```

```
}
```

### 6.5 Governance Burn Contract

The governance burn contract implements the Path A burn-to-mint mechanism, converting PPT to proposal-specific vote tokens with logarithmic scaling.

#### 6.5.1 Vote Weight Calculation

```
-- Governance Burn Contract (Aiken)
```

```
validator governance_burn {
```

```
  fn spend(
```

```
    datum: ProposalDatum,
```

```
redeemer: VoteRedeemer,  
  
ctx: ScriptContext  
  
) -> Bool {  
  
  let tx = ctx.transaction  
  
  let ProposalDatum { proposal_id, domain, deadline, vote_tally } = datum  
  
  
  // Verify proposal still open  
  
  expect get_tx_time(tx) < deadline  
  
  
  when redeemer is {  
  
    CastVote { voter_seid, ppt_burned, direction, faction } -> {  
  
      // Verify PPT burn  
  
      expect verify_ppt_burn(tx, voter_seid, ppt_burned)  
  
      // Calculate vote weight with log scaling  
  
      let base_weight = log2(ppt_burned + 1)  
  
      let faction_mult = get_faction_multiplier(faction, domain)  
  
      let raw_weight = base_weight * faction_mult / 100  
  
      // Apply 10% individual cap  
  
      let total_votes = vote_tally.for_votes + vote_tally.against_votes  
  
      let max_weight = (total_votes + raw_weight) / 10  
  
      let final_weight = min(raw_weight, max_weight)  
  
      // Verify vote token mint
```

```
expect verify_vote_mint(tx, voter_seid, final_weight, proposal_id)
```

```
True
```

```
}
```

```
}
```

```
}
```

```
}
```

### 6.5.2 Faction Multiplier Matrix (Proposed-Not Final)

Domain	Producer	Procurer	Promoter
Labor/Operations	1.5×	0.8×	1.0×
Capital/Investment	0.8×	1.5×	1.0×
Community/External	1.0×	0.8×	1.5×
General/Cross-domain	1.0×	1.0×	1.0×

**NOTE: IMMUTABLE PROVISION:** *The 10% individual influence cap cannot be modified, suspended, or circumvented by any governance action. This cap is constitutional bedrock embedded in the contract logic.*

## 6.6 XPT Credential Contract

The XPT minting policy manages credential issuance with multi-party attestation from training institutions and academic partners.

### 6.6.1 Credential Minting Policy

-- XPT Credential Minting Policy (Aiken)

```
validator xpt_mint {
```

```
  fn mint(
```

```
    redeemer: XPTMintRedeemer,
```

```
    ctx: ScriptContext
```

```
) -> Bool {  
  
  let tx = ctx.transaction  
  
  when redeemer is {  
  
    IssueCredential {  
  
      holder_seid, domain, tier, issuers  
  
    } -> {  
  
      // Verify all required issuer signatures  
  
      let required_sigs = get_required_issuers(domain)  
  
      expect all(required_sigs, fn(issuer) {  
  
        tx.extra_signatories |> has(issuer)  
  
      })  
  
      // Verify holder SEID is valid  
  
      expect verify_seid(holder_seid)  
  
      // Verify no duplicate credential for this domain/tier  
  
      expect !has_existing_credential(holder_seid, domain, tier)  
  
      True  
  
    }  
  
  }  
  
}
```

```

fn get_required_issuers(domain: Domain) -> List<VerificationKeyHash> {
  when domain is {
    Technical -> [teknologia_instituto_key]
    FoodSystems -> [kampusa_kuirejo_key, texas_am_key]
    Governance -> [c3_alliance_key, node_steward_key]
  }
}

```

## 6.7 Contract Deployment

### 6.7.1 Reference Script Deployment

# Deploy reference scripts

aiken build

cardano-cli transaction build \

--tx-in \$FUNDING\_UTXO \

--tx-out "\$SCRIPT\_ADDRESS+5000000+\$(cat vault.plutus)" \

--tx-out "\$SCRIPT\_ADDRESS+5000000+\$(cat ppt\_mint.plutus)" \

--tx-out "\$SCRIPT\_ADDRESS+5000000+\$(cat comm\_conversion.plutus)" \

--change-address \$CHANGE\_ADDRESS \

--out-file deploy-refs.tx

### 6.7.2 Contract Addresses (Testnet)

Contract	Script Address (Preview Testnet)
<b>Vault Validator</b>	addr_test1wp...[to be deployed]
<b>PPT Minting Policy</b>	addr_test1wp...[to be deployed]

Contract	Script Address (Preview Testnet)
COMM Conversion	addr_test1wp...[to be deployed]
Governance Burn	addr_test1wp...[to be deployed]
XPT Minting Policy	addr_test1wp...[to be deployed]

## Section 7: Token Flow Mechanics

### 7.1 Conservation Principles

The C3 Alliance token system operates under strict conservation principles ensuring that no value is created from nothing, all token flows trace to real contribution, and the system maintains economic coherence.

#### 7.1.1 Energy Conservation Analogy

**First Law (Conservation):** Total economic value in the system is conserved. Value enters through external revenue (IO completion for external clients), capital contributions (C-Bills subscriptions), and physical asset acquisition (E2C, TIT fleet). Value exits through distributions, redemptions, and operational costs.

**Second Law (Entropy):** Economic activity naturally flows from high-potential (JLZ) to low-entropy states (locked COMM, permanent XPT). The system's design encourages contribution and long-term commitment over extraction and speculation.

### 7.2 Primary Token Flows

#### 7.2.1 Impact Offer Revenue Flow

When an Impact Offer is completed, value flows through the system:

1. Client pays IO price in JLZ (or external currency converted to JLZ)
2. Vickrey auction surplus (B2-B1 delta) captured by N3 Commons treasury
3. Winning DACO receives B2 settlement amount
4. PPT minted to individual contributors based on faction allocation
5. XPT milestones triggered if completion criteria met

#### 7.2.2 PPT-to-COMM Conversion Flow

During quarterly conversion windows, PPT holders may convert to COMM:

1. Holder initiates conversion during open window (min 100 PPT)
2. PPT is permanently burned (sent to burn address)
3. Tenure multiplier calculated based on SEID age
4. COMM minted at calculated rate:  $PPT \times Base\_Rate \times Tenure\_Multiplier$
5. COMM credited to holder's SEID Vault

### 7.2.3 Governance Burn Flow (Path A)

When exercising governance influence through PPT burn:

1. Holder selects active proposal and vote direction
2. PPT amount submitted to governance burn contract
3. PPT is permanently destroyed
4. Vote weight calculated:  $\log_2(PPT\_burned + 1) \times Faction\_Multiplier$
5. 10% individual cap applied if weight exceeds threshold
6. Proposal-specific vote tokens minted (expire after proposal resolution)

## 7.3 Surplus Distribution Waterfall (Proposed-Not Final)

N3 Node operating surplus is distributed according to a strict priority waterfall:

Priority	Allocation	Description
1	C-Bills Revenue Obligations	6% APR interest payments to C-Bills holders
2	Operating Reserves	Maintain 3-month operating reserve
3	Infrastructure Maintenance	TIT fleet maintenance, facility upkeep
4	Growth Reserve	12% of remaining surplus for expansion
5	COMM Holder Distribution	Remaining surplus as patronage dividends

### 7.3.1 Distribution Formula

$Holder\_Distribution = Distributable\_Surplus \times (Holder\_COMM / Total\_COMM\_Supply)$

## 7.4 Sponsorship Economics

The sponsorship model creates ongoing economic relationships between sponsors and sponsored members through pass-through economics:

### 7.4.1 Pass-Through Structure (Proposed-Not Final)

Generation	Recipient	Pass-Through Share
Gen 1	Direct Sponsor	Largest share (set by governance)
Gen 2	Sponsor's Sponsor	Reduced share
Gen 3	Sponsor's Sponsor's Sponsor	Minimal share
Gen 4+	None	Pass-through terminates

### 7.4.2 Incentive Alignment

The sponsorship economics model creates aligned incentives:

- Help sponsored member succeed → Increased transaction volume → Increased pass-through
- Abandon sponsored member → Reduced activity → Reduced pass-through
- Exploit sponsored member → Member exits or reduces activity → Reduced pass-through
- Coerce sponsored member → Member exits → Pass-through terminates

**NOTE:** *The optimal sponsor strategy is: onboard well, mentor generously, release fully, and benefit passively from the network you helped build.*

## 7.5 C-Bills Lifecycle

### 7.5.1 Investment Phase

1. Subscriber completes KYC/AML and establishes SEID Vault
2. Subscription agreement executed with investment amount
3. Payment received (fiat, USDC, ADA, or approved digital assets)
4. C-Bills minted and credited to subscriber's SEID Vault
5. JLZ minted to N3-Node Vault (1:1 with USD received)
6. Proceeds deployed per use of proceeds allocation

### 7.5.2 Maturity/Conversion

At maturity (36 months) or upon conversion event:

1. Conversion window opens for C-Bills holders
2. C-Bills burned (sent to burn address)
3. PPT minted at conversion ratio (1:1 base, 1.1:1 for early investors)
4. PPT credited to holder's SEID Vault

- Holder may then use PPT for governance (Path A) or convert to COMM (Path B)

## 7.6 Emergency Mechanisms

### 7.6.1 Deficit Allocation

If IO revenue is insufficient to cover obligations, deficits are handled:

- First: Draw from operating reserves
- Second: Reduce/suspend COMM holder distributions
- Third: Deficit carried forward against future surplus

**Protected:** C-Bills principal is protected; only revenue payments may be reduced in extreme circumstances per C-Bills Terms.

### 7.6.2 Vault Emergency Freeze

Emergency freeze mechanism (2-of-5 signatures) temporarily halts vault operations:

- Triggered by suspected security breach, legal compliance requirement, or systemic threat
- All disbursements paused pending investigation
- Requires 4-of-5 signatures to unfreeze
- Maximum freeze duration: 30 days without governance extension

## 7.7 Token Lifecycle Summary

Token	Creation	Destruction	Terminal State
<b>JLZ</b>	Capital inflow	Redemption to fiat/USDC	Circulating or redeemed
<b>PPT</b>	IO completion, milestones	Governance burn or COMM conversion	Always burned (consumed)
<b>COMM</b>	PPT conversion only	Buyback burn (governance)	Perpetual ownership stake
<b>XPT</b>	Credential issuance	Never destroyed	Permanent credential
<b>C-Bills</b>	Investment subscription	Maturity conversion to PPT	Converted (always)
<b>TIT</b>	Asset acquisition	Asset decommission	Burned when asset retired

---

# PART C: Marketplace & Governance

## Section 8: C3DEX Marketplace

### 8.1 Vickrey Auction Mechanism

C3DEX implements second-price sealed-bid auctions for Impact Offer (IO) coordination. Bidders submit encrypted bids; winner pays second-lowest price (B2). Delta between B1 and B2 captured for N3 Commons.

#### 8.1.1 Auction Phases

- **Phase 1 - IO Posting:** Requestor posts scope, timeline, budget; escrow funded
- **Phase 2 - Sealed Bidding:** DACOs submit encrypted bids with commitment hashes
- **Phase 3 - Reveal & Award:** 24-hour reveal window; lowest bid wins at B2 price

#### 8.1.2 Surplus Capture

Commons surplus flows: B2-B1 delta + budget surplus → N3 Commons treasury → C-Bills revenue obligations → operating reserves → infrastructure → COMM distributions.

### 8.2 Impact Offer Structure

Field	Description	Example
io_id	Unique identifier	IO-2024-001
category	EXTERNAL/INTERNAL/GOVERNANCE	EXTERNAL
scope	Deliverables and requirements	TIT fleet deployment
timeline	Bid deadline, milestones, completion	90-day contract
ppt_allocation	Faction distribution percentages	55/30/10/5

### 8.3 Aiken Contract: IO Coordinator

```
validator io_coordinator {
```

```
  fn submit_bid(datum: IODatum, redeemer: BidAction, ctx: ScriptContext) -> Bool {
```

```
when redeemer is {  
  
  SubmitBid { bid_hash, bidder } -> {  
  
    expect Some(deadline) = datum.bid_deadline  
  
    expect tx_valid_before(ctx, deadline)  
  
    verify_bid_deposit(ctx, datum.min_deposit) && store_commitment(bid_hash, bidder)  
  
  }  
  
  RevealBid { bid_amount, salt } -> {  
  
    expect in_reveal_window(ctx, datum)  
  
    hash_matches(bid_amount, salt, datum.commitments)  
  
  }  
  
  AwardIO { winner } -> {  
  
    expect reveal_complete(datum)  
  
    winner == find_lowest_bidder(datum.revealed_bids) && pay_at_second_price(ctx, winner,  
datum)  
  
  }  
  
  }  
  
  }  
  
}
```

---

## Section 9: Governance Implementation

### 9.1 Constitutional vs Operational

**Constitutional matters** (Articles amendments, Bill of Rights, dissolution):  
One-member-one-vote, 75% supermajority required.

**Operational matters** (budgets, IOs, parameters): COMM-weighted voting with PPT burn enhancement, subject to 10% individual cap.

### 9.2 Burn-to-Mint Vote Weight

$\text{Vote\_Weight} = \log_2(\text{PPT\_burned} + 1) \times \text{Faction\_Multiplier}$

Domain	Producer	Procurer	Promoter
Labor/Compensation	1.5×	0.8×	1.0×
Capital/Investment	0.8×	1.5×	1.0×
Community/External	1.0×	0.8×	1.5×

### 9.3 Proposal Lifecycle

1. **Submission:** Any member submits with domain classification
2. **Discussion:** Minimum 7-day deliberation period
3. **Burn Window:** 5-day PPT burning period opens
4. **Calculation:** Smart contract computes weights, applies caps
5. **Resolution:** Simple majority for operational; supermajority for constitutional

### 9.4 Anti-Capture Mechanisms

#### 9.4.1 Individual Influence Cap (IMMUTABLE)

No individual may exercise >10% influence on any proposal.

$\text{Effective\_Vote} = \min(\text{Calculated\_Vote}, \text{Total\_Votes} \times 0.10)$

**Cannot be amended.**

#### 9.4.2 Three-Faction Balance

Major decisions require cross-faction consensus. Union checks capital extraction; Guild checks labor exploitation; Syndicate checks resource mismanagement.

### 9.4.3 Adjutant System

Fiduciary advocates for minority interests, vulnerable members, and future stakeholders. Selected by minority vote or sortition.

---

## Section 10: Entity Governance

### 10.1 Entity Hierarchy

Entity	Identifier	Authorization	Governance Rights
Individual	SEID	Registration	Full optionality
Klano (Family)	KEID	Operating Agreement	Full optionality
Faction	FEID	Articles (Constitutional)	Full optionality
Commons Node	NEID	OA + Local Adoption	Full optionality

### 10.2 Universal Governance Path Restriction

Only primary entities (SEID, KEID, FEID, NEID) may burn PPT for governance. Sub-entities restricted to wealth accumulation path only. Prevents Sybil attacks via subdivision.

### 10.3 External Unity, Internal Sovereignty

All collective entities operate with unified external voice but complete internal autonomy. K3 Alianco does not regulate internal hierarchies, voting thresholds, or organizational structures.

### 10.4 Klano Kooperativo Structure

- **Tier 1 - Klano:** Full clan confederation; holds KEID
- **Tier 2 - Sekto:** Major subdivision (regional/philosophical)
- **Tier 3 - Ĉeffamilio:** Primary household unit
- **Tier 4 - Branĉfamilio:** Derivative household

Depth is optional. Flat structures permitted. Internal politics are exclusively internal business.

---

# PART D: Operations & Deployment (Draft)

## Section 11: Deployment Strategy

### 11.1 Alpha Tranche Architecture

The C3 Alliance Alpha Tranche deploys infrastructure through a Pinnacle Peak model, where each Peak represents a specialized domain of sovereign stewardship infrastructure. The first Alpha Tranche node (N3 Fulmina Pinnacle Node) is located in Hardin County, Texas, targeting the Southeast Texas Energy Corridor.

#### 11.1.1 N3 Fulmina Pinnacle Node Overview

Parameter	Specification
Node Name	N3 Fulmina Pinnacle Node, LLC
Legal Structure	Colorado Limited Cooperative Association (CLCA)
Location	Greater Houston Metro, Texas (Energy Tech Corridor)
Target Raise	\$75,000,000 (Regulation A+ Tier 2 C-Bills)
Primary Offering	C-Bills (Commons Bills) - 36-month term, 6% annual yield
Conversion	1 PPT per \$1.00 principal at maturity (1.10 PPT for early investors)

#### 11.1.2 Pinnacle Peak Domains

Each N3 Commons Node cultivates six infrastructure domains (Pinnacle Peaks), each representing a critical dimension of sovereign stewardship:

Peak (Esperanto)	English Domain	Infrastructure Focus
Fulmina Pinto	Energy	Solar arrays, battery storage, compute infrastructure
Fajruja Pinto	Community Care/Dwelling	Elder care, childcare, behavioral health, housing
Rikolta Pinto	Nourishment	Aquaponics, food production, agricultural systems
Vekiga Pinto	Cultivation	Training academies, XPT certification, workforce development
Kerna Pinto	Sovereignty	Identity infrastructure, data systems, governance

Horizonta Pinto	Mobility	Transportation, logistics, delivery systems
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## 11.2 Exit-to-Cooperative (E2C) Acquisition Strategy

The primary deployment mechanism is Exit-to-Cooperative (E2C) business acquisition, converting operating businesses to multi-stakeholder cooperative ownership. E2C addresses the estimated 2.9 million small business succession events expected over the next decade as baby boomer owners retire.

### 11.2.1 E2C Value Proposition

Stakeholder	E2C Benefit
Retiring Founders	Legacy preservation, tax-advantaged exit, ongoing involvement options
Workers	Ownership stake, governance voice, patronage dividends
Clients/Residents	Service continuity, community voice, protected mission
Community	Local ownership, permanent infrastructure, economic multiplier

### 11.2.2 Target Sectors

- **Energy Services Contractors:** Pipeline inspection, maintenance, industrial services (15-50 employees, \$2-10M revenue)
- **Skilled Trades Operations:** HVAC, electrical, plumbing, specialty construction
- **Professional Services:** Engineering firms, surveying, technical consultancies
- **Community Care (Fajruja):** Elder care, childcare, behavioral health facilities
- **Food & Agriculture:** Local food production, distribution, processing operations

### 11.2.3 E2C Acquisition Criteria

- Profitable or breakeven operations (no turnaround situations)
- Owner willing to participate in 12-24 month transition period
- Workforce with interest in cooperative ownership
- Assets that can be tokenized as TIT fleet components
- Revenue streams compatible with C3DEX coordination

## 11.3 Use of Proceeds

Category	Allocation	Amount	Description
E2C Acquisitions	40%	\$30,000,000	Business transitions, seller financing, conversion capital
TIT Fleet Buildout	25%	\$18,750,000	Revenue-generating embodied AI assets, robotics, drones

Infrastructure Construction	15%	\$11,250,000	La Deponejo (Depot), Academy, Housing
Working Capital & Operations	18%	\$13,500,000	Operating reserves, staffing, network costs
Offering Costs	2%	\$1,500,000	Legal, SEC qualification, compliance, marketing
TOTAL	100%	\$75,000,000	

## 11.4 Physical Infrastructure Zones

### 11.4.1 Infrastructure Zone Overview

Zone	Esperanto	Function
The Depot	La Deponejo	TIT fleet operations, micro data center, AI compute infrastructure
Tech Institute	Teknologia Instituto	Training academy, XPT certification, technical workforce development
Campus Kitchen	Kampuso Kuirejo	Food production, aquaponics R&D, agricultural training
Power Center	Potenco Centro	Solar array (500kW target), battery storage (2,500kWh target)
The Lodge	La Loĝejo	Member housing, pioneer quarters, visiting steward accommodations

### 11.4.2 La Deponejo Technical Specifications

#### Micro Data Center:

- Rack Capacity: 5 full-height server racks (42U each)
- Power Capacity: 50-100 kW compute load
- Cooling: Dedicated HVAC + liquid cooling for GPU racks
- Network: Fiber backhaul + Starlink redundancy

#### TIT Fleet Composition:

TIT Type	Applications	Target Fleet Size
Inspection Drones	Pipeline, flare, tank inspection	10-20 units
Hazmat Robots	Tank cleaning, vessel entry, confined space	4-8 units
Robo-Taxi	Member transport, local logistics	4-12 vehicles
Delivery Drones	Package logistics, supply chain	20-30 units

Humanoid Units	Facility operations, care augmentation	6-10 units
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## Section 12: Identity Infrastructure Deployment

### 12.1 Phased Infrastructure Hosting

Identity infrastructure deployment follows a transitional hosting model, beginning with Cloudflare-hosted services and migrating to self-hosted infrastructure at La Deponejo as operational capacity develops.

#### 12.1.1 Phase 1: Cloudflare-Hosted Infrastructure (Transitional)

Component	Cloudflare Service	Purpose
API Gateway	Cloudflare Workers	Identus Agent API endpoints
DID Document Storage	Cloudflare R2	IPFS-compatible object storage
Resolver Cache	Cloudflare KV	Low-latency DID resolution
JSON-LD Context	Cloudflare Pages	Schema and context hosting
Credential Schemas	Cloudflare R2 + Pages	Schema versioning and distribution
Source Control	GitHub	Identus fork and deployment configs

#### 12.1.2 Phase 2+: Self-Hosted Infrastructure (La Deponejo)

Upon La Deponejo data center becoming operational, identity infrastructure transitions to self-hosted N3 Node infrastructure, providing complete sovereignty over identity services.

### 12.2 SEID Registration Deployment

The Sovereign Entity Identifier (SEID) infrastructure deploys via the did:c3:seid method specification, using Cardano as the anchor chain, Hyperledger Identus as the identity agent, and Midnight Network for privacy-preserving verification.

#### 12.2.1 Identity Infrastructure Roadmap

Phase	Components	Target Timeline
Phase 1	SEID registration, basic resolution, SBT-DID credential	Q1 2025
Phase 2	KEID/FEID support, Vault migration, key rotation	Q2 2025
Phase 3	Midnight integration, ZKP-KYC, selective disclosure	Q3-Q4 2025

#### 12.2.2 SBT-DID Credential Deployment

The SBT-DID (Soulbound Token - Decentralized Identifier) is a CIP-68 compliant non-transferable token minted to a member's Vault upon successful SEID registration. It serves as the on-chain anchor linking Cardano L1 to the off-chain DID Document.

Property	Value
Standard	CIP-68 Reference NFT
Transferability	Soulbound (non-transferable)
Quantity	Exactly 1 per SEID
Mutability	Reference token datum updatable by authorized parties
Revocability	Status flag only; never burned

## 12.3 API Endpoints

Endpoint	Method	Description
/api/v1/seid/register	POST	Create new SEID
/api/v1/seid/{did}	GET	Resolve SEID
/api/v1/seid/{did}	PUT	Update DID Document
/api/v1/seid/{did}/deactivate	POST	Deactivate SEID
/api/v1/seid/{did}/credentials	GET	List credentials for SEID
/api/v1/seid/{did}/credentials	POST	Issue credential to SEID
/api/v1/io/submit	POST	Submit Impact Offer
/api/v1/io/{id}/bid	POST	Submit sealed bid
/api/v1/ppt/balance/{seid}	GET	Query PPT balance
/api/v1/governance/proposal	POST	Submit governance proposal
/api/v1/governance/vote	POST	Cast governance vote

## Section 13: Security Framework

### 13.1 Multi-Sig Vault Security

The N3-Node Multi-Sig Vault implements a 3-of-5 threshold signature scheme with distributed key management. This represents the minimum threshold until node population can support expanded M-of-N multi-sig governance.

#### 13.1.1 Signatory Structure

Signatory Role	Keys	Responsibility
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Node Steward	1	Day-to-day operations, local oversight, transaction initiation
Member Council #1	1	Elected representative, Producer/Procurer/Promoter rotation
Member Council #2	1	Second representative, different faction than #1
C3 Alliance	1	Network oversight, compliance monitoring, inter-node coordination
External Trustee	1	Independent third-party, fiduciary duty to investors

### 13.1.2 Protected Transaction Classes (Minimum Threshold)

Transaction Type	Threshold	Additional Requirements
C-Bills Issuance	3-of-5	Verified subscription + KYC
Treasury Disbursement >\$10K	3-of-5	Documented rationale
Capital Allocation	3-of-5	Governance approval
PPT Minting	3-of-5	Verified IO completion
PPT-to-COMM Conversion	3-of-5	Conversion window open
Signatory Key Rotation	4-of-5	7-day delay + member notice

### 13.2 Smart Contract Security

- Formal verification of critical validators (Aiken property-based testing)
- Multi-stage auditing: internal review, external audit, community security review
- Time-locked upgrades with governance approval
- Emergency pause mechanisms with multi-sig control (2-of-5 freeze, 4-of-5 unfreeze)
- Rate limiting on sensitive operations

### 13.3 Hardware Security Requirements

- **Signatory Keys:** Hardware wallet required for each vault signatory (Ledger, Trezor, or equivalent)
- **Geographic Distribution:** Signatories geographically distributed to prevent single-point-of-failure
- **Backup Procedures:** Secure seed phrase backup per hardware wallet best practices
- **Production SEIDs:** Hardware wallet required for mainnet; software wallets permitted only for preview/preprod

## Section 14: Deployment Procedures

### 14.1 Phase 1: Foundation (Months 1-6)

#### Identity & Registration Infrastructure:

- Deploy did:c3:seid method on Cloudflare infrastructure
- Initialize Identus Cloud Agent (forked) with C3-specific schemas
- Launch SBT-DID credential minting on Cardano Preview (testing)
- Establish SEID registration workflow with pioneer members

#### Treasury & Compliance:

- Initialize N3-Node Multi-Sig Vault contracts on Cardano
- Deploy PPT minting validators
- Launch C-Bills offering infrastructure (Reg A+ qualification)
- Establish pioneer governance framework

### 14.2 Phase 2: Marketplace & Coordination (Months 7-12)

#### E2C Acquisition Pipeline:

- Identify and evaluate first E2C acquisition targets
- Execute initial business transitions with seller financing structures
- Onboard acquired workforce as cooperative members

#### Marketplace Infrastructure:

- Deploy C3DEX Impact Offer coordination contracts
- Launch Vickrey Auction Mechanism (VAM) for IO bidding
- Enable COMM conversion windows (quarterly)
- Deploy XPT credential system through Teknologia Instituto
- Integrate Hydra L2 for high-frequency IO bid operations

### 14.3 Phase 3: Scale & Federation (Months 13-24)

#### Physical Infrastructure:

- La Deponejo construction and commissioning
- Migrate identity infrastructure from Cloudflare to self-hosted
- TIT fleet tokenization and deployment

#### Network Expansion:

- KEID/FEID support for Klano and Faction entity registration
- Cross-node federation protocols
- Midnight Network privacy integration (ZKP-KYC, selective disclosure)
- Full governance transition from Pioneer to member governance
- Initiate planning for additional N3 Nodes (e.g., Fajruja Miami)

## 14.4 Contract Deployment Reference

<b>Contract</b>	<b>Network</b>	<b>Status</b>
Vault Validator	Cardano Preview → Mainnet	To be deployed
PPT Minting Policy	Cardano Preview → Mainnet	To be deployed
COMM Conversion	Cardano Preview → Mainnet	To be deployed
Governance Burn	Cardano Preview → Mainnet	To be deployed
XPT Minting Policy	Cardano Preview → Mainnet	To be deployed
SBT-DID Minting Policy	Cardano Preview → Mainnet	To be deployed
IO Coordinator	Cardano Preview → Mainnet	To be deployed