Digix's Whitepaper: The Gold Standard in Crypto-Assets (English ／ 中文)

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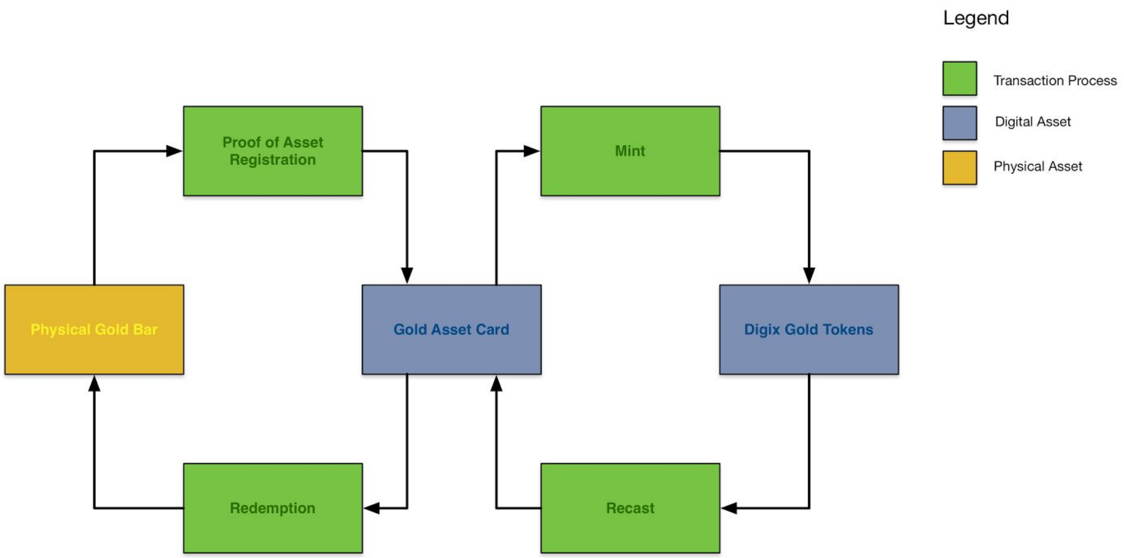
Abstract

Digix provides a use case for the tokenisation and documentation of physical assets through its **Proof of Asset (PoA)** protocol. The PoA protocol utilises Ethereum[1] and the InterPlanetary Files System (IPFS)[2] to track an asset through its chain of custody. This allows for the open and public verification of an asset's existence without a centralised database. Digix also offers an API allowing other applications to be built on top of our asset tokenisation service.

Technical Overview:

Product Life Cycle



[1] "[English] White Paper · ethereum/wiki Wiki · GitHub." 2014. 29 Dec. 2015

[2] Benet, Juan. (September 11 2015) "The IPFS Project - How it works". IPFS

Key Products

1. **Proof of Asset (PoA) Asset Cards**

   PoA Asset Cards consist of the below information permanently uploaded onto the decentralised database:

- Time Stamp of card creation
- SKU of the gold bar
- Bar Serial number
- Chain of Custody digital signatures (Vendor, Custodian, Auditor)
- Purchase Receipt
- Audit Documentation
- Depository Receipt
- Storage fees due

   PoA Asset Cards are kept in an Ethereum Wallet.

2. **Digix Tokens (DGX)**

   Dgx Tokens are minted via a Minter Smart Contract. Each DGX token represents 1g of Gold and divisible to 0.001g. For every PoA Card that is sent to the Minter Smart Contract, DGX tokens will be issued in return. For instance, a 100g PoA Card sent to the Minter Smart Contract returns 100 DGX tokens to the user.

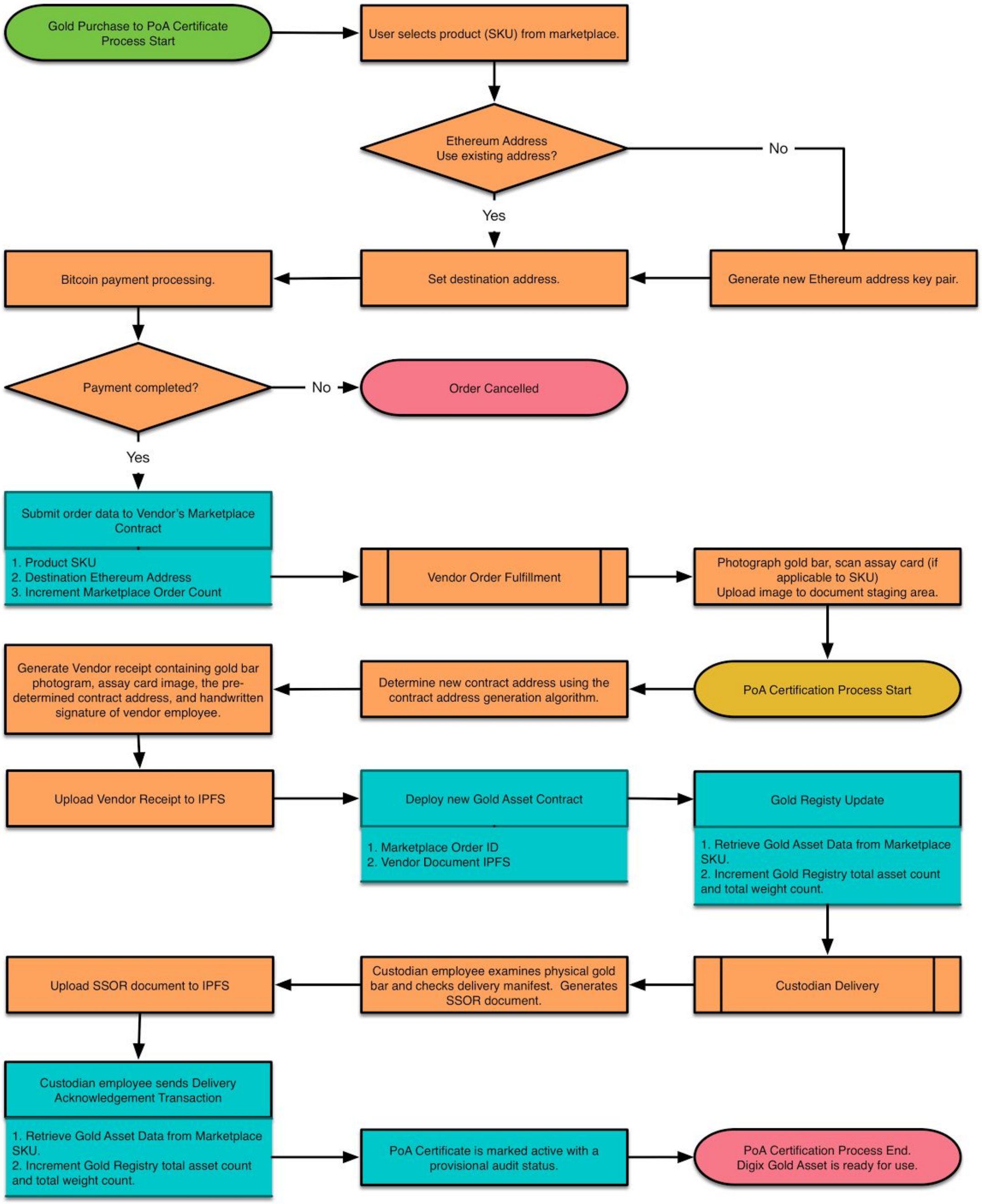
   Digix Tokens are held in an Ethereum Wallet.

Key Processes

There are 3 modular processes that Digix uses to provide a proof of existence and fungibility for an asset, 1 for redemption of physical assets, and 1 that encourages Đapp Development. Those processes consist of:

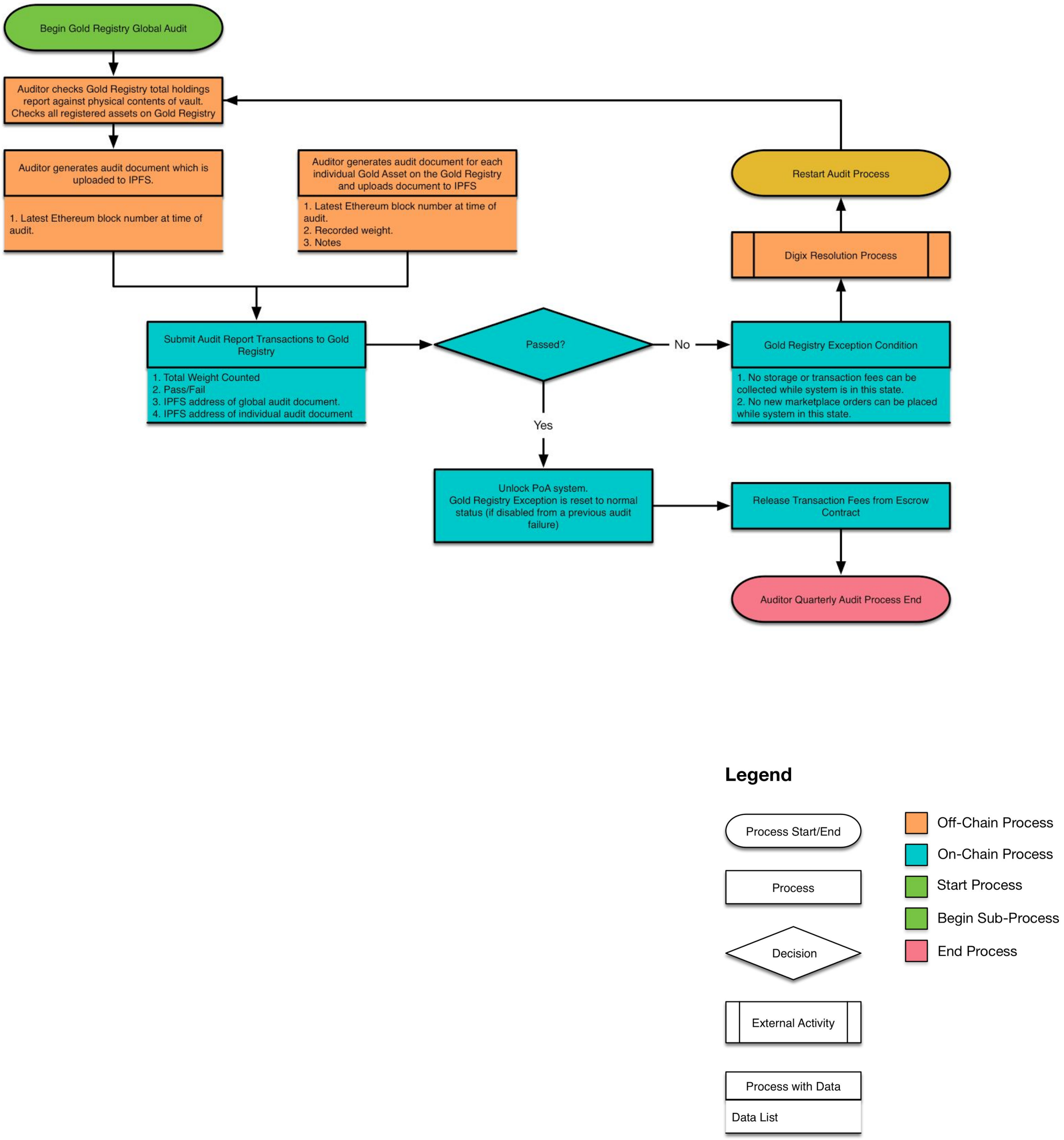
1. **Proof of Asset (PoA) Verification** process which records and provides an audit trail of an asset on Ethereum to create PoA Asset Cards. The asset cards are certified using sequential digital signatures from the entities in the chain of custody, namely, the **Vendor, Custodian**, **Auditor**, which are further validated with proof of purchase and depository receipts provided and uploaded onto IPFS for permanent record (Fig i).

Figure i: Digix Asset Registration Process


Gold Purchase to PoA Certificate Process Start
User selects product (SKU) from marketplace.
Ethereum Address Use existing address?
No
Yes
Generate new Ethereum address key pair.
Set destination address.
Bitcoin payment processing.
Payment completed?
No
Order Cancelled
Yes
Submit order data to Vendor's Marketplace Contract
1. Product SKU
2. Destination Ethereum Address
3. Increment Marketplace Order Count
Vendor Order Fulfillment
Photograph gold bar, scan assay card (if applicable to SKU)
Upload image to document staging area.
PoA Certification Process Start
Determine new contract address using the contract address generation algorithm.
Generate Vendor receipt containing gold bar photogram, assay card image, the pre-determined contract address, and handwritten signature of vendor employee.
Upload Vendor Receipt to IPFS
Deploy new Gold Asset Contract
1. Marketplace Order ID
2. Vendor Document IPFS
Gold Registy Update
1. Retrieve Gold Asset Data from Marketplace SKU.
2. Increment Gold Registry total asset count and total weight count.
Custodian Delivery
Custodian employee examines physical gold bar and checks delivery manifest. Generates SSOR document.
Upload SSOR document to IPFS
Custodian employee sends Delivery Acknowledgement Transaction
1. Retrieve Gold Asset Data from Marketplace SKU.
2. Increment Gold Registry total asset count and total weight count.
PoA Certificate is marked active with a provisional audit status.
PoA Certification Process End.
Digix Gold Asset is ready for use.

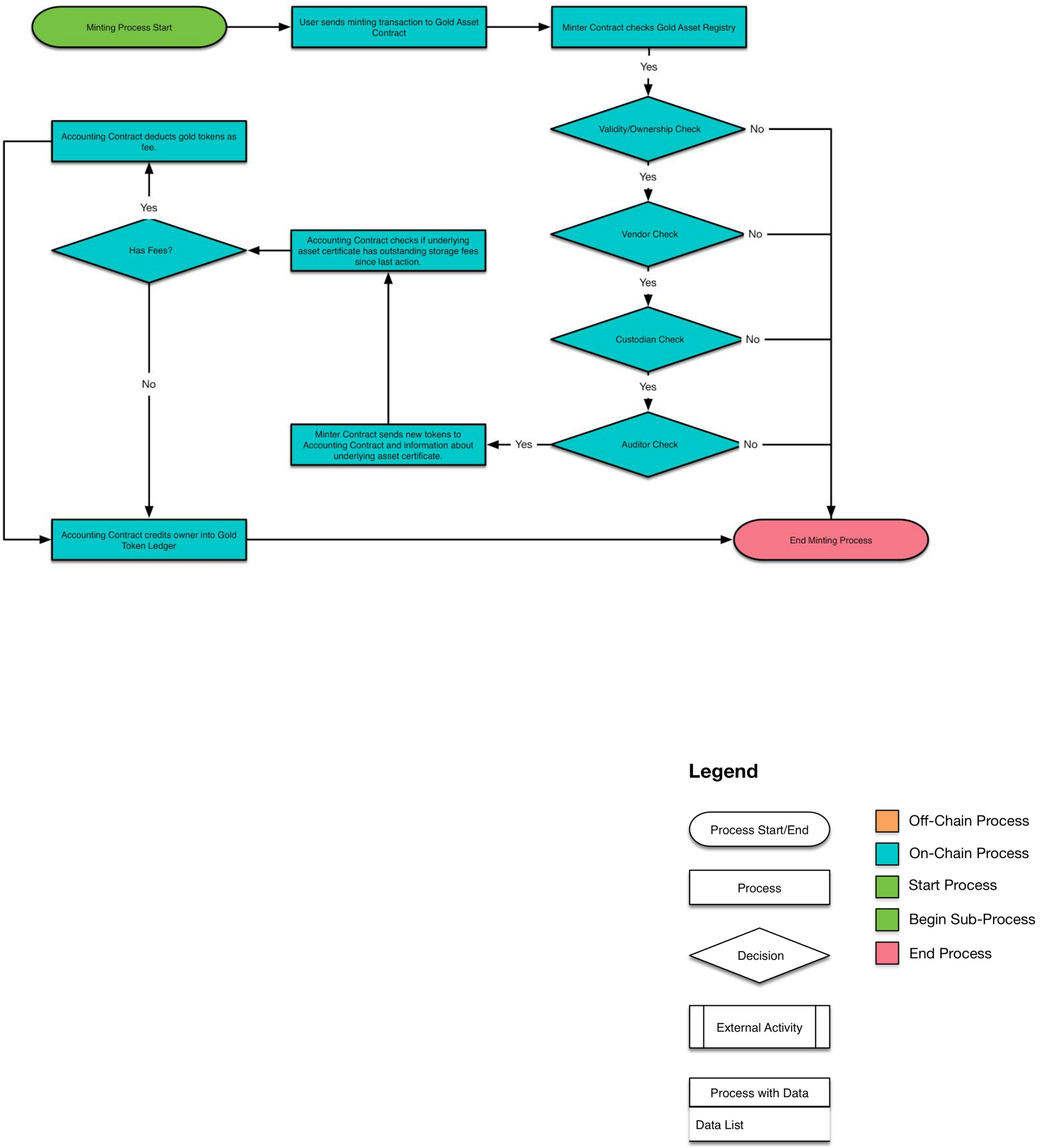
The PoA Verification contains a sub process for regular audits as shown in (Fig ii).

Figure ii: Audit Process


Begin Gold Registry Global Audit
Auditor checks Gold Registry total holdings report against physical contents of vault. Checks all registered assets on Gold Registry
Auditor generates audit document which is uploaded to IPFS.
1. Latest Ethereum block number at time of audit.
Auditor generates audit document for each individual Gold Asset on the Gold Registry and uploads document to IPFS
1. Latest Ethereum block number at time of audit.
2. Recorded weight.
3. Notes
Submit Audit Report Transactions to Gold Registry
1. Total Weight Counted
2. Pass/Fail
3. IPFS address of global audit document.
4. IPFS address of individual audit document
Passed?
No
Yes
Gold Registry Exception Condition
1. No storage or transaction fees can be collected while system is in this state.
2. No new marketplace orders can be placed while system in this state.
Digix Resolution Process
Restart Audit Process
Unlock PoA system.
Gold Registry Exception is reset to normal status (if disabled from a previous audit failure)
Release Transaction Fees from Escrow Contract
Auditor Quarterly Audit Process End
Legend
Process Start/End
Process
Decision
External Activity
Process with Data
Data List
Off-Chain Process
On-Chain Process
Start Process
Begin Sub-Process
End Process

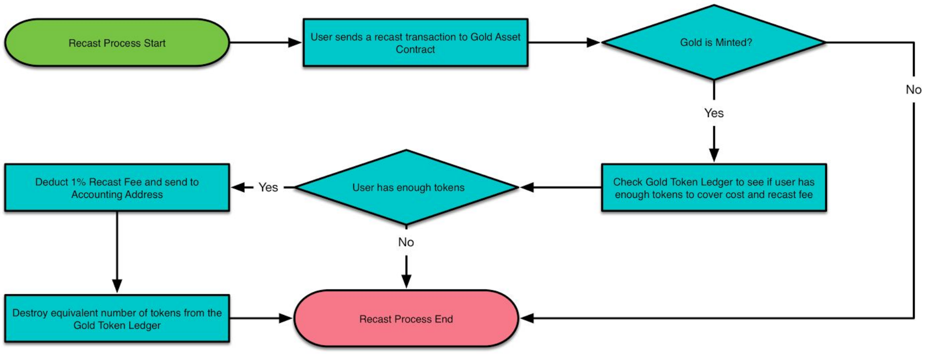
2. **Minter Smart Contract** to create fungible DGX tokens, that accepts or holds PoA Asset Cards in exchange for DGX tokens (Fig iii).

Figure iii: Minting Digix Gold Asset Cards into Digix Gold Tokens


Minting Process Start
User sends minting transaction to Gold Asset Contract
Minter Contract checks Gold Asset Registry
Yes
Validity/Ownership Check
No
Yes
Vendor Check
No
Yes
Custodian Check
No
Yes
Auditor Check
No
Yes
Minter Contract sends new tokens to Accounting Contract and information about underlying asset certificate.
Accounting Contract checks if underlying asset certificate has outstanding storage fees since last action.
Has Fees?
Yes
Accounting Contract deducts gold tokens as fee.
No
Accounting Contract credits owner into Gold Token Ledger
End Minting Process
Legend
Process Start/End
Process
Decision
External Activity
Process with Data
Data List
Off-Chain Process
On-Chain Process
Start Process
Begin Sub-Process
End Process

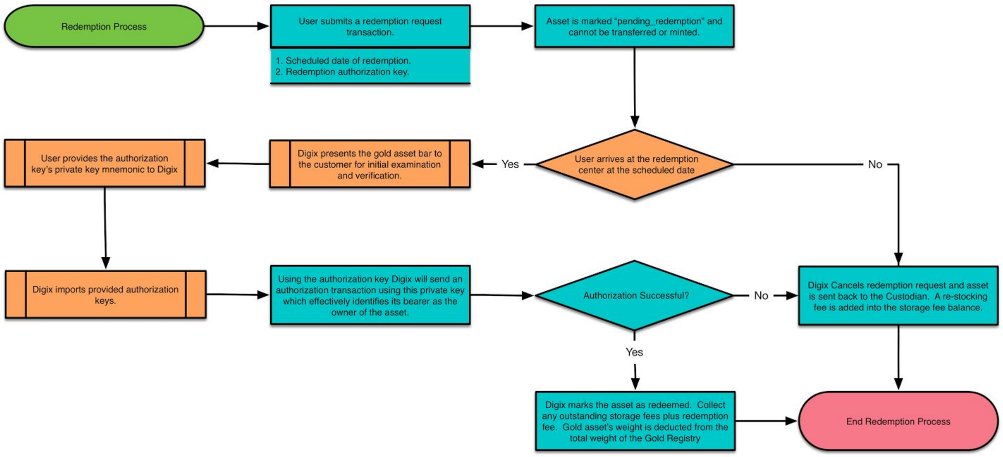
3. **Recaster Smart Contract**, which is used to exchange DGX tokens back into PoA Asset cards. (Fig iv).

Figure iv: Recasting Digix Gold Tokens into Digix Gold Asset Cards


Recast Process Start
User sends a recast transaction to Gold Asset Contract
Gold is Minted?
No
Yes
Check Gold Token Ledger to see if user has enough tokens to cover cost and recast fee
User has enough tokens
Yes
Deduct 1% Recast Fee and send to Accounting Address
No
Destroy equivalent number of tokens from the Gold Token Ledger
Recast Process End

4. **Redemption Process**, for redeeming physical gold bar with PoA Asset cards. (Fig V).

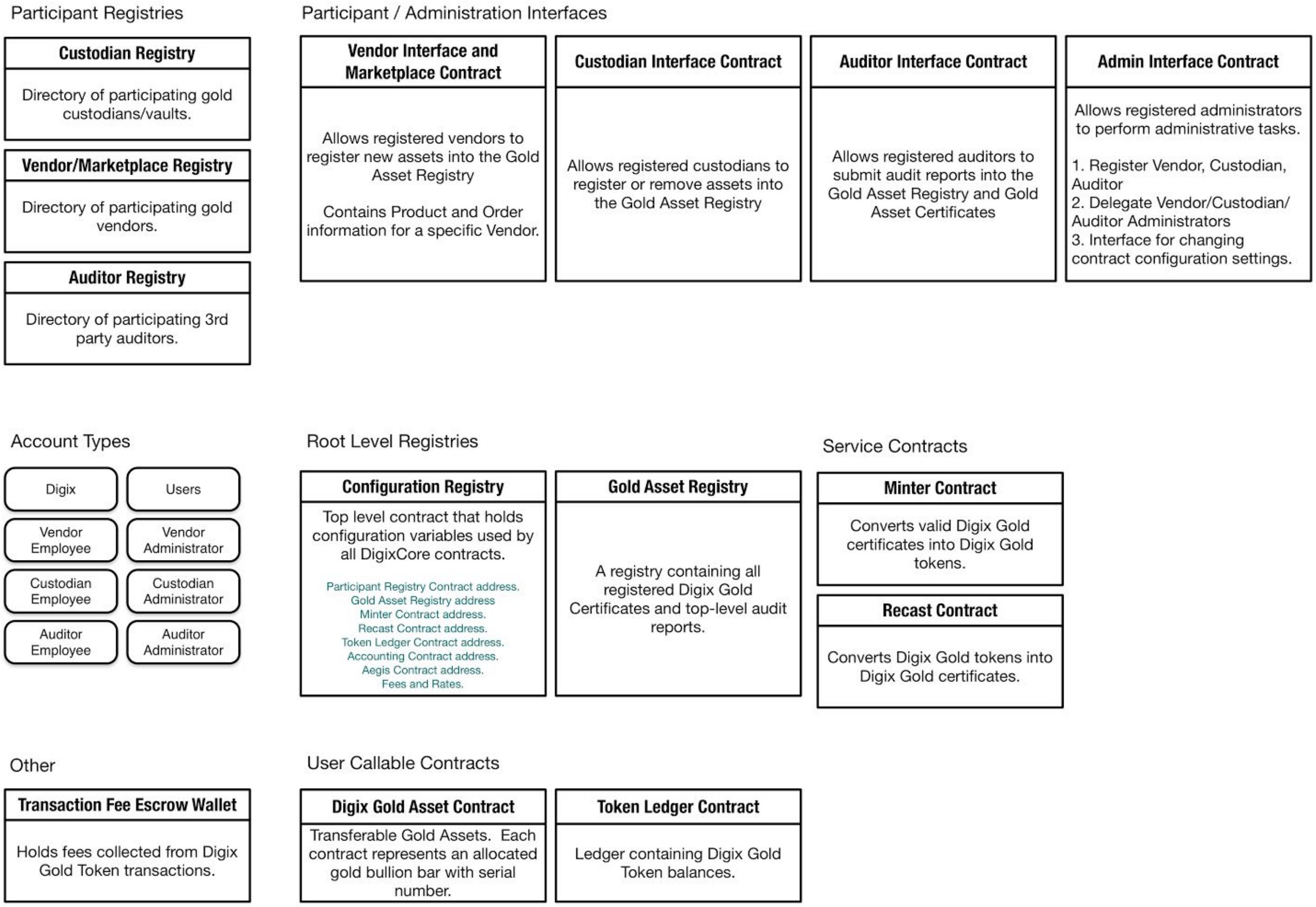
Figure V: Digix Gold Redemption and Token Based User Identification


Redemption Process
User submits a redemption request transaction.
1. Scheduled date of redemption.
2. Redemption authorization key.
Asset is marked "pending_redemption" and cannot be transferred or minted.
User arrives at the redemption center at the scheduled date
Yes
No
Digix presents the gold asset bar to the customer for initial examination and verification.
User provides the authorization key's private key mnemonic to Digix
Digix imports provided authorization keys.
Using the authorization key Digix will send an authorization transaction using this private key which effectively identifies its bearer as the owner of the asset.
Authorization Successful?
No
Digix Cancels redemption request and asset is sent back to the Custodian. A re-stocking fee is added into the storage fee balance.
Yes
Digix marks the asset as redeemed. Collect any outstanding storage fees plus redemption fee. Gold asset's weight is deducted from the total weight of the Gold Registry
End Redemption Process

5. **Generic I/O Contracts,** allowing developers to utilize PoA Cards or DGX tokens for Ðapp development.

Ethereum Smart Contracts Stack

The diagram below shows the individual Digix smart contracts deployed on the Ethereum blockchain that make up the core processes above.



Participant Registries

Custodian Registry

Directory of participating gold custodians/vaults.

Vendor/Marketplace Registry

Directory of participating gold vendors.

Auditor Registry

Directory of participating 3rd party auditors.

Participant / Administration Interfaces

Vendor Interface and Marketplace Contract

Allows registered vendors to register new assets into the Gold Asset Registry

Contains Product and Order information for a specific Vendor.

Custodian Interface Contract

Allows registered custodians to register or remove assets into the Gold Asset Registry

Auditor Interface Contract

Allows registered auditors to submit audit reports into the Gold Asset Registry and Gold Asset Certificates

Admin Interface Contract

Allows registered administrators to perform administrative tasks.

1. Register Vendor, Custodian, Auditor
2. Delegate Vendor/Custodian/ Auditor Administrators
3. Interface for changing contract configuration settings.

Account Types

Digix

Users

Vendor Employee

Vendor Administrator

Custodian Employee

Custodian Administrator

Auditor Employee

Auditor Administrator

Root Level Registries

Configuration Registry

Top level contract that holds configuration variables used by all DigixCore contracts.

Participant Registry Contract address.
Gold Asset Registry address
Minter Contract address.
Recast Contract address.
Token Ledger Contract address.
Accounting Contract address.
Aegis Contract address.
Fees and Rates.

Gold Asset Registry

A registry containing all registered Digix Gold Certificates and top-level audit reports.

Service Contracts

Minter Contract

Converts valid Digix Gold certificates into Digix Gold tokens.

Recast Contract

Converts Digix Gold tokens into Digix Gold certificates.

Other

Transaction Fee Escrow Wallet

Holds fees collected from Digix Gold Token transactions.

User Callable Contracts

Digix Gold Asset Contract

Transferable Gold Assets. Each contract represents an allocated gold bullion bar with serial number.

Token Ledger Contract

Ledger containing Digix Gold Token balances.

Digix's Proof of Asset Participants
(Blockchain Oracle Entities)

Asset Vendor

ValueMax Singapore, a publicly listed company, supplies London Bullion Market Association (LBMA[3]) certified gold bullion bars through the Digix Marketplace. Established in 1988, they provide pawnbroking services, retail and trading of pre-owned jewellery, gold and luxury timepieces.

Independent Auditor

Bureau Veritas Inspectorate will carry out quarterly checks on the quality and quantity at our custodian vault to ensure accounting is upheld. They are a multinational group with capabilities in an extensive range of commodities, providing independent inspection, sampling and testing services of precious metals.

Every gold bullion is rigorously tested with precision instruments at Audit. We perform such measurements using Ultrasonic Gauge Measurements (UTM) and densometers. UTM is a method of performing non-destructive measurement (gauging) of the local thickness of a solid element basing on the time taken by the ultrasound wave to return to the surface. Densometers are devices that measure the density of objects with water displacement.

Participating Custodian Vault

Malca-Amit's state of the art facility near Singapore Changi International Airport is located in the Le Freeport of Singapore, a 25,000 sqm high-security and climate-controlled facility featuring cutting edge security technologies enhanced by green building engineering.

Multi-party Trust Mechanism

The Digix system relies on multiple independent participants to provide a transparent platform for the tokenization of physical assets. We can assume that miners in a Proof of Work based crypto-currency system will act rationally, that is, that they would act in a way to maximize and protect their long term profits by performing their role of transaction verification. We assume that a cartel of rational miners would not collude to perform double spending attacks as such attacks would cause reputational damage to the entire system. We must therefore assume that in the Digix system which is the tri-party system consisting of asset providing vendors, the asset custodian in charge of storing and securing the asset from theft, and the auditor in charge of

[3] "LBMA - FAQs". The London Bullion Market Association.

ensuring the authenticity of the reported assets in custody are all acting in a rational manner who are trying to maximize their profits from the fees that they collect for their service.

Mitigating Potential Points of Failure with Real World Governance

Dishonest Entities and collusion in the chain of custody

Digix works with entities in jurisdictions that provide stringent regulatory oversight and corporate governance. The entities we have engaged with are either publicly listed or well known in the industry for providing their niche service. Each entity that we have engaged with performs a separate function to prevent cheating. For instance, the asset vendor for physical assets cannot also be the asset custodian. The interest in the service has to be independent of one another. While the risk of collusion is a real possibility, it is at the cost of severe reputational and legal damages to the colluding participants. As these entities provide similar other services to other customers and such reputational and legal damages to their core business would be detrimental to their business, we can make a fair assumption that they will act in a rational manner.

Key Benefits

No centralised database management of Crypto Asset records

All chain of custody information is fully managed by the Ethereum blockchain. This blockchain ledger is immutable with data upload taking significantly less time than on the Bitcoin blockchain.[4]

No Web-based log-in

There is no web form log-in. Users will download desktop clients from Digix. The application itself can also be compiled from source on Github and is publicly auditable.[5] There is significantly less chance of a Man in the Middle attack compared to traditional user web-based log-in.[5]

Secure Cold Storage of Crypto-Assets

Digix's Aegis Vaults is a cold storage wallet custodial service for crypto-assets and crypto currencies on Ethereum.

Perpetual Existence of Digital Assets

[4] CryptoBond. (September 16, 2015) Why Is Ethereum Different to Bitcoin. CryptoCompare

[5] Hjemlvik, Erik. (March 27, 2011) Network Security Blog. "Network Forensic Analysis of SSL MITM Attacks". NETRESEC

All asset data is recorded on the blockchain and exists indefinitely. Even if Digix folds, every proof generated can be verified and are admissible in a court of law in the applicable jurisdiction.

Ex post facto Incentivization Mechanism

The Proof of Asset process requires that regular quarterly or more frequent audits to be performed by a 3rd party auditor on the entire collection of gold assets held at the custodian vaults. The auditor performs a complete audit of each gold bar which includes verification of its authenticity, weight, and physical examination to detect anomalies or defects. The auditor submits a record on the Gold Registry contract for each and every single bar that has been audited, which contains an IPFS reference to a signed paper documentation, the auditor's Ethereum identity, and a pass or fail result.

Digix receives its revenues through the collection of transaction fees paid in the form of Digix gold tokens. These tokens are held in an escrow contract which can only release the tokens to a specified address after the successful completion of a 3rd party audit.

Generic I/O Contracts and Đapp Development Opportunities

The generic I/O contract provided at Digix allows developers to utilize PoA Asset Cards or Digix tokens for Đapp development and event logging. Our vision is to create an ecosystem for developers to utilize DGX tokens as a framework for various Đapp developments. Code samples will be provided on our Github.

Wealth Inheritance

Dead man's switch can be built as a service to allow wealth to be passed on in the form of Crypto Assets to the mentioned Ethereum address under the Digix system.

Gamification

In legal jurisdictions, DGX tokens can be used like bitcoin to facilitate in game currency or as gaming tokens.[6] The PoA protocol can also be used for the issuance of digital gaming assets.[7]

Escrow

DGX tokens can provide a better and less volatile store of value for Escrow services on the blockchain.

[6] Farivar, Cyrus (January 22, 2013). "Bitcoin-based casino rakes in more than $500,000 profit in six months". Ars Technica.
[7] Addison, Ian. (December 22, 2015) "Game-changers FreeMyVunk and Digix allow video gamers ..." IB Times.

Crowdfunding

A Đapp can provide crowdfunding opportunities with crypto-currencies and crypto-assets, or offer convertibility of cryptocurrencies to DGX tokens as a hedge to price volatility.

Gold Backed Crypto Currency Developments

Cryptocurrencies can stake a portion of its value with DGX Gold tokens and Gold Assets, backing its value with Gold.

Crypto Exchanges and Wealth Management Đapps

When exchanges integrate DGX tokens as a cryptocurrency pair, they will be able to offer a gold hedge to cryptocurrencies as part of their service offering. Wealth management services that adjusts your cryptocurrency / crypto asset holdings can be developed to manage an individual's crypto financial risk profile.

P2P Lending and Microfinance

Đapps can utilize DGX Gold for peer to peer lending. A borrower can call for funding through a Đapp based on his risk profile and reputation and negotiate a rate of return on the borrowed funds. Interest / yield payments can be serviced at regular intervals with a penalty system in place for late payments. This has already been done with bitcoin[8], but due to the price volatility of cryptocurrencies, lenders may lose more of their asset value than what can be earned from the interest during the period of the loan. The price stability of DGX Gold Tokens can facilitate the adoption rate of such services.

Collateral services

Privately held assets can be safely and efficiently used as collateral without going through lengthy verification process to ascertain an asset's existence and authenticity.

Conclusion

Digix will provide a transparent, audit friendly, safe protocol that leverages the full potential of Ethereum's decentralized consensus ecosystem and IPFS to facilitate crypto assets on the blockchain.

[8] Shieber, Jonathan (June 5, 2014). "BTCJam Brings Its Bitcoin-Based Lending Service To Emerging Markets". TechCrunch.

Digix白皮书：密码学资产中的黄金标准

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V1.02

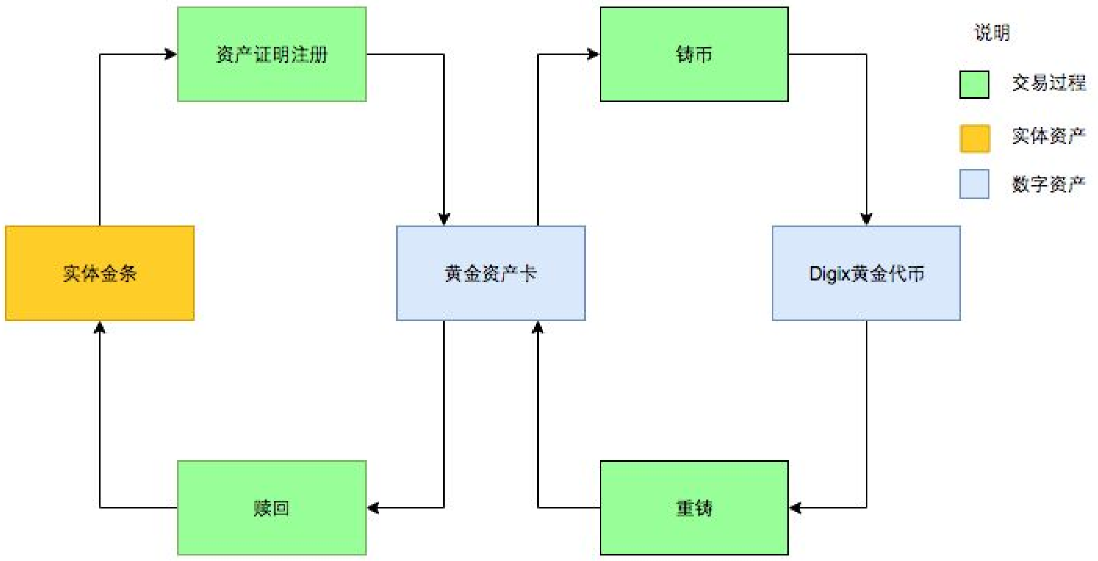
翻译：Ethfans--少平

摘要

Digix通过它的资产证明（PoA）协议为实体资产代币化和文档化提供了使用实例。PoA协议利用以太坊[9]和星际文件系统（IPFS）[10]通过监管链（chain of custody）追踪资产。它实现了开放和公开的资产存在性认证，无需一个中心化数据库。Digix也提供一个应用程序接口（API），允许其它应用建立在我们的资产代币化服务之上。

技术总览：

产品生命周期:



[9] [英文] 白皮书· ethereum/wiki Wiki · GitHub. " 2014. 29 Dec. 2015

[10] B enet, Juan. (September 11 2015) " IPFS项目：它是如何运行的". IPFS

核心产品

1 资产证明（PoA）资产卡

PoA资产卡由以下信息构成，被永久性地上传到去中心化数据库：

- 资产卡创建时间戳
- 金条库存单位（SKU）
- 金条序号
- 监管链数字签名（供应商、托管商、审计商）
- 购买收据
- 审计文档
- 存储收据
- 存储费用

PoA资产卡被保存在以太坊钱包中。

2 Digix代币（DGX）

DGX代币通过铸币智能合约生成。每个DGX代币代表1克黄金，可以细分到0.001克。每一个PoA资产卡被发送到铸币智能合约时，相应的DGX代币就被发行出来。例如，用户发送一个100克黄金的PoA卡到铸币智能合约，将获得100个DGX代币。

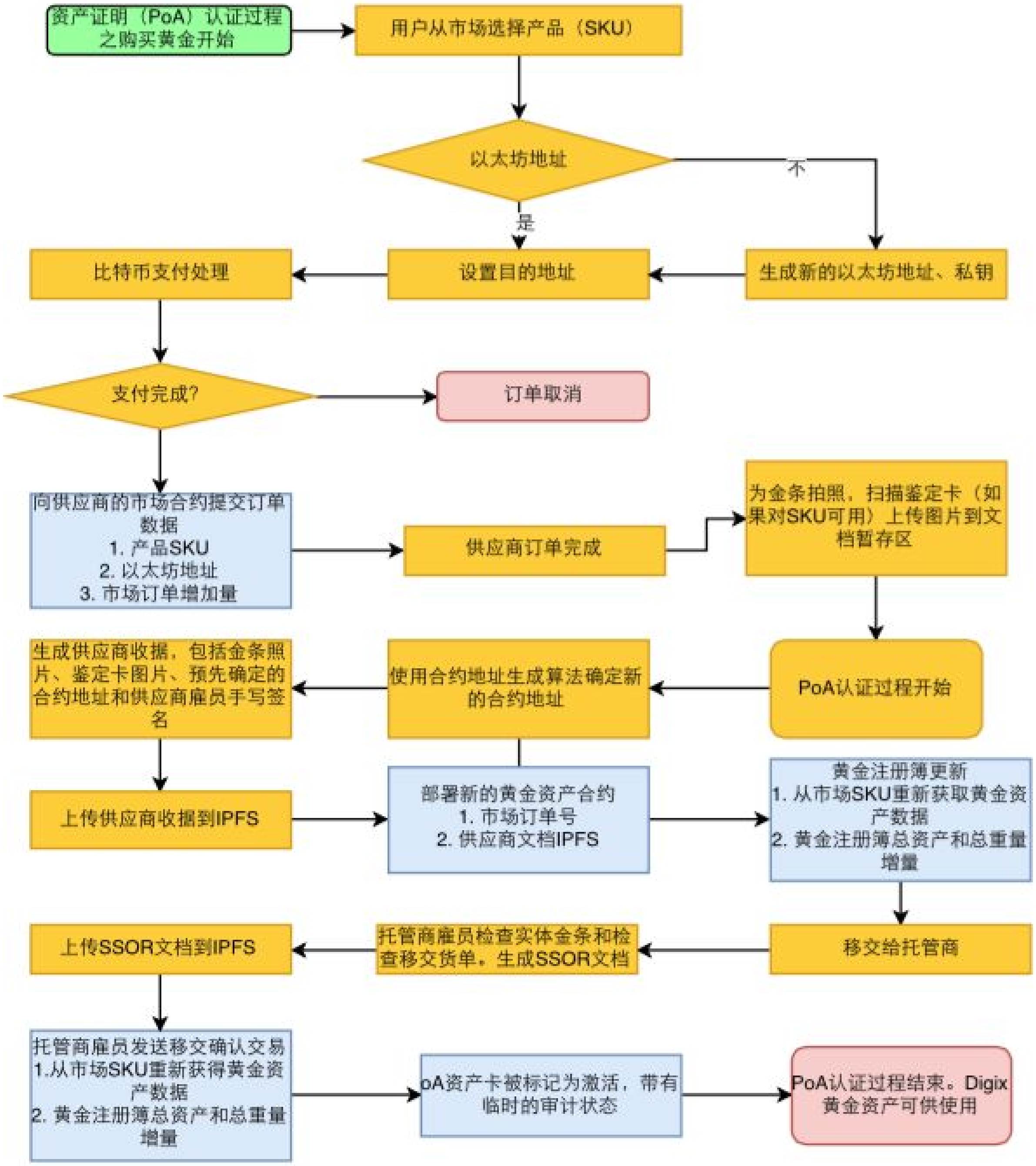
Digix代币被保管在以太坊钱包。

核心过程

3个模块过程—Digix使用它为一项资产提供存在证明和可替代证明，1个实体资产赎回过程和1个鼓励去中心化应用（Dapp）开发过程。这些过程包括以下部分：

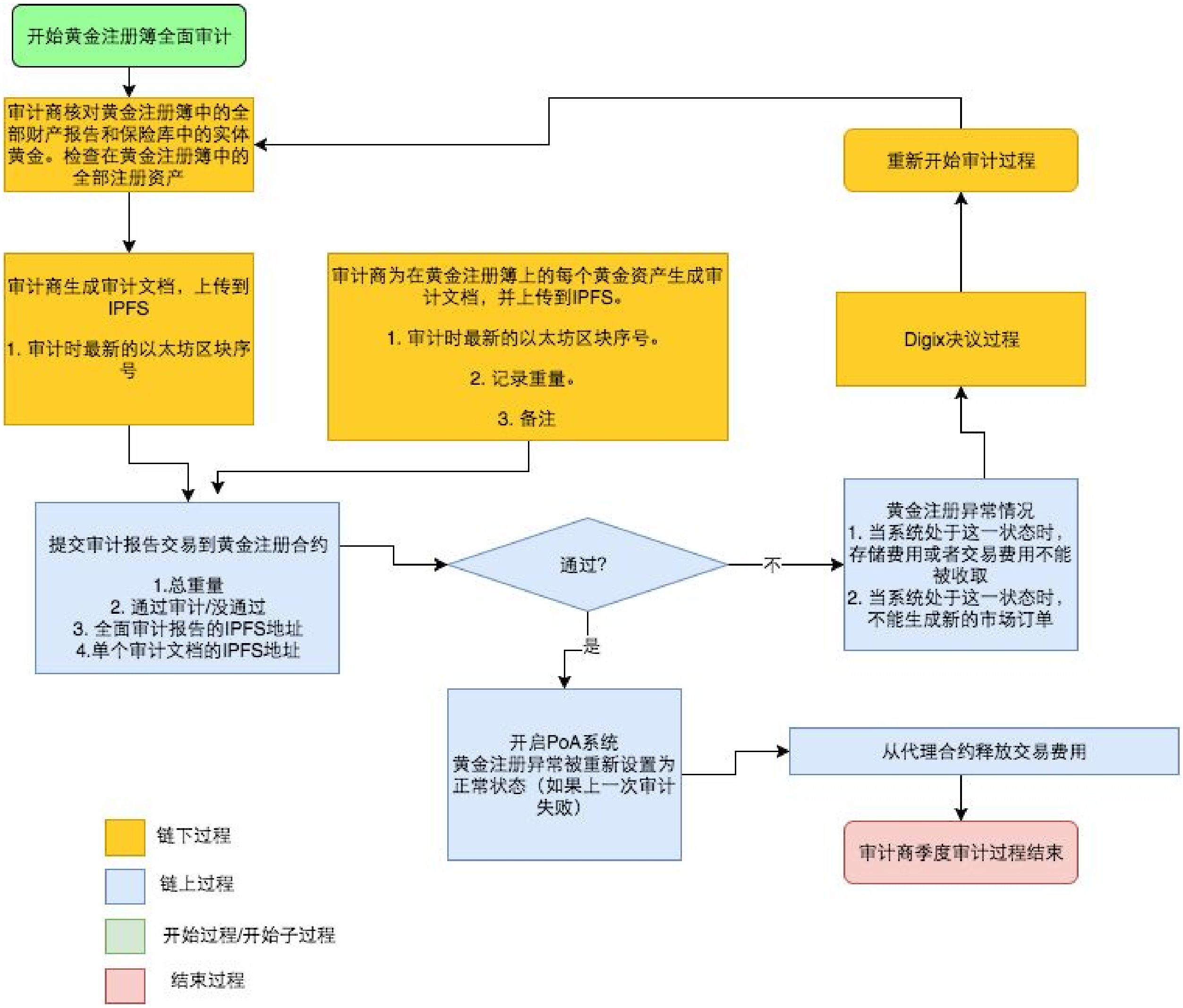
1. 资产证明（PoA）认证过程在以太坊上记录和提供一项资产的审计跟踪，用以创建PoA资产卡。这些资产卡通过来自于监管链参与者（即黄金供应商、托管商、审计商）的连续数字签名获得认证，数字签名进一步通过被提供和上传到IPFS所永久保存起来的购买和存储收据证明所确认。

图表 i ：Digix资产注册过程


资产证明（PoA）认证过程之购买黄金开始
用户从市场选择产品（SKU）
以太坊地址
不
是
生成新的以太坊地址、私钥
设置目的地址
比特币支付处理
支付完成?
订单取消
向供应商的市场合约提交订单数据
1. 产品SKU
2. 以太坊地址
3. 市场订单增加量
供应商订单完成
为金条拍照，扫描鉴定卡（如果对SKU可用）上传图片到文档暂存区
PoA认证过程开始
使用合约地址生成算法确定新的合约地址
生成供应商收据，包括金条照片、鉴定卡图片、预先确定的合约地址和供应商雇员手写签名
上传供应商收据到IPFS
部署新的黄金资产合约
1. 市场订单号
2. 供应商文档IPFS
黄金注册簿更新
1. 从市场SKU重新获取黄金资产数据
2. 黄金注册簿总资产和总重量增量
移交给托管商
托管商雇员检查实体金条和检查移交货单，生成SSOR文档
上传SSOR文档到IPFS
托管商雇员发送移交确认交易
1.从市场SKU重新获得黄金资产数据
2. 黄金注册簿总资产和总重量增量
oA资产卡被标记为激活，带有临时的审计状态
PoA认证过程结束。Digix黄金资产可供使用

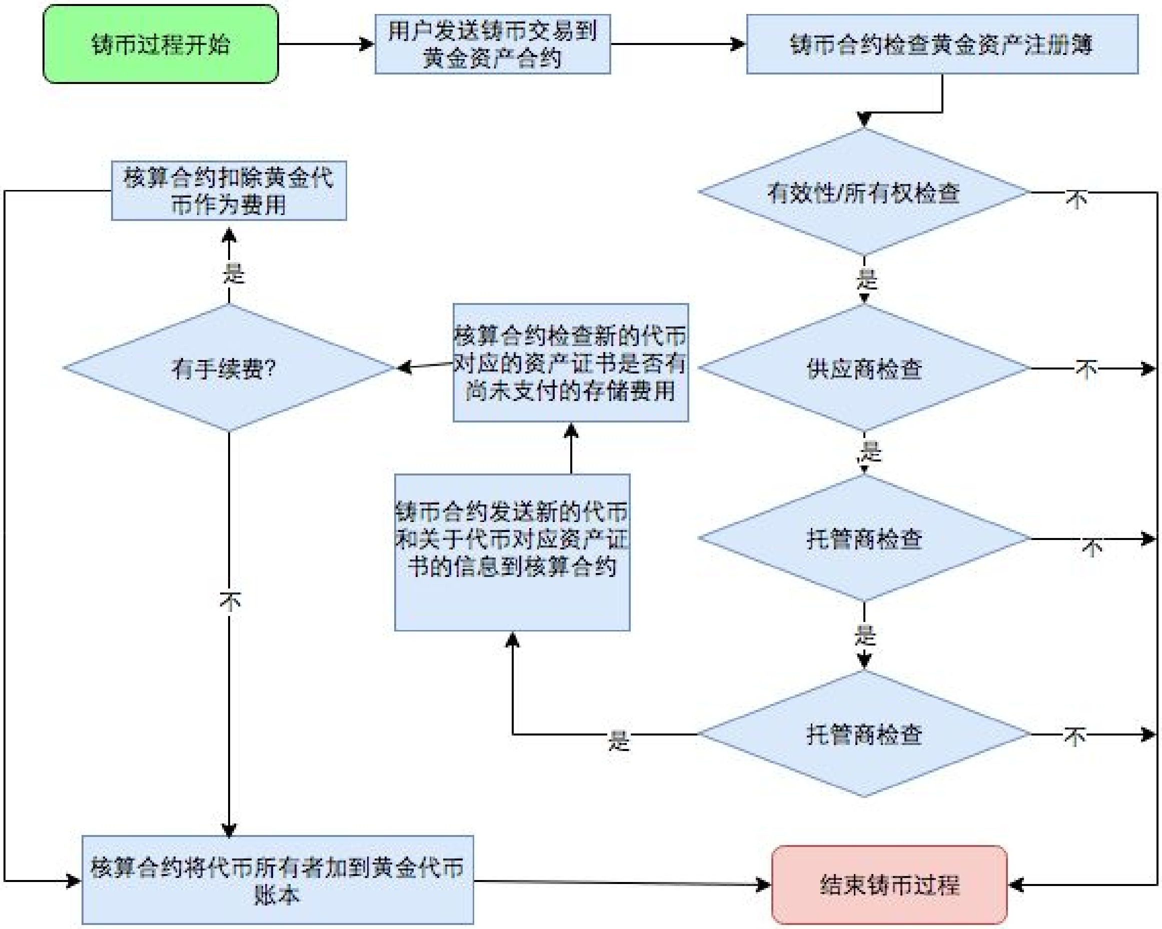
PoA认证包括一个定期审计子过程，如图表ii所示。

图表ii：审计过程


开始黄金注册簿全面审计
审计商核对黄金注册簿中的全部财产报告和保险库中的实体黄金。检查在黄金注册簿中的全部注册资产
审计商生成审计文档，上传到IPFS
1. 审计时最新的以太坊区块序号
审计商为在黄金注册簿上的每个黄金资产生成审计文档，并上传到IPFS。
1. 审计时最新的以太坊区块序号。
2. 记录重量。
3. 备注
提交审计报告交易到黄金注册合约
1.总重量
2. 通过审计/没通过
3. 全面审计报告的IPFS地址
4.单个审计文档的IPFS地址
通过?
不
是
黄金注册异常情况
1. 当系统处于这一状态时，存储费用或者交易费用不能被收取
2. 当系统处于这一状态时，不能生成新的市场订单
Digix决议过程
重新开始审计过程
开启PoA系统
黄金注册异常被重新设置为正常状态（如果上一次审计失败）
从代理合约释放交易费用
审计商季度审计过程结束
链下过程
链上过程
开始过程/开始子过程
结束过程

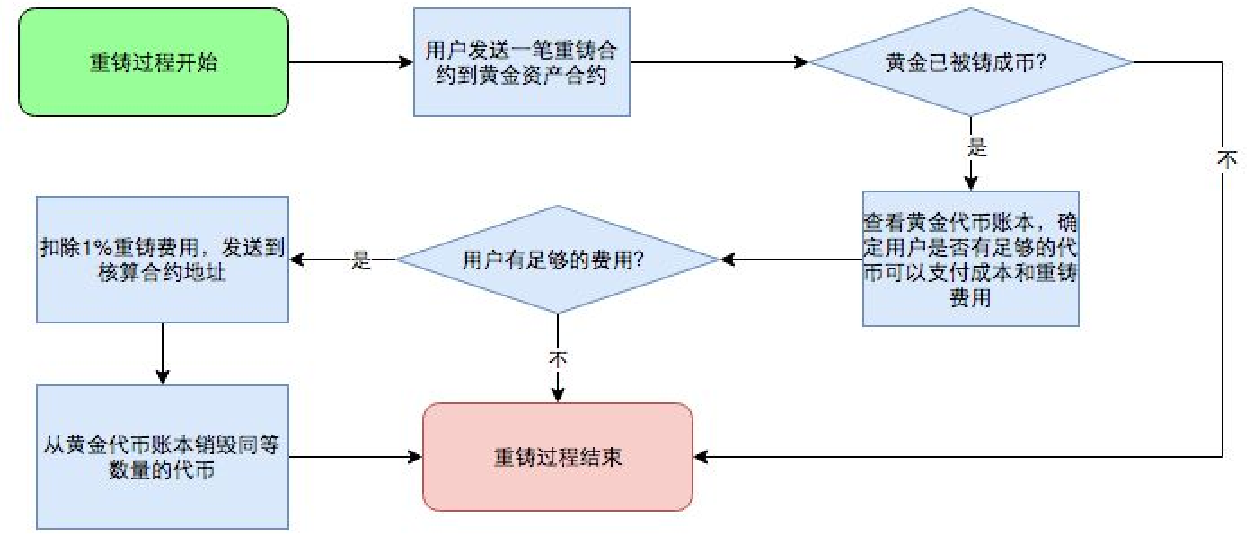
2 铸币智能合约，创建可替代的DGX代币，它接受或持有PoA资产卡，向用户返回DGX代币。

图表iii：将Digix黄金资产卡铸为Digix黄金代币


铸币过程开始
用户发送铸币交易到黄金资产合约
铸币合约检查黄金资产注册簿
有效性/所有权检查
不
是
供应商检查
不
是
托管商检查
不
是
托管商检查
不
是
铸币合约发送新的代币和关于代币对应资产证书的信息到核算合约
核算合约检查新的代币对应的资产证书是否有尚未支付的存储费用
有手续费?
是
核算合约扣除黄金代币作为费用
不
核算合约将代币所有者加到黄金代币账本
结束铸币过程

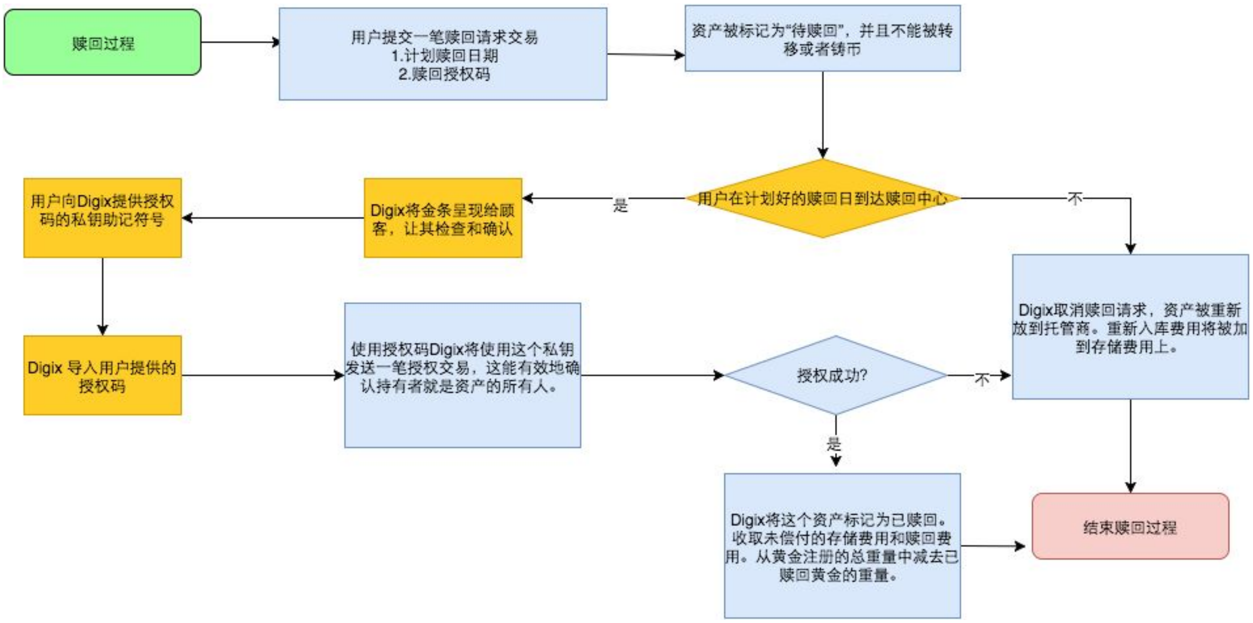
3 重铸智能合约，将DGX代币重铸为PoA资产卡。（图表iv）

图表iv：将Digix黄金代币重铸为Digix黄金资产卡


重铸过程开始
用户发送一笔重铸合约到黄金资产合约
黄金已被铸成币?
是
不
查看黄金代币账本，确定用户是否有足够的代币可以支付成本和重铸费用
用户有足够的费用?
是
扣除1%重铸费用，发送到核算合约地址
不
从黄金代币账本销毁同等数量的代币
重铸过程结束

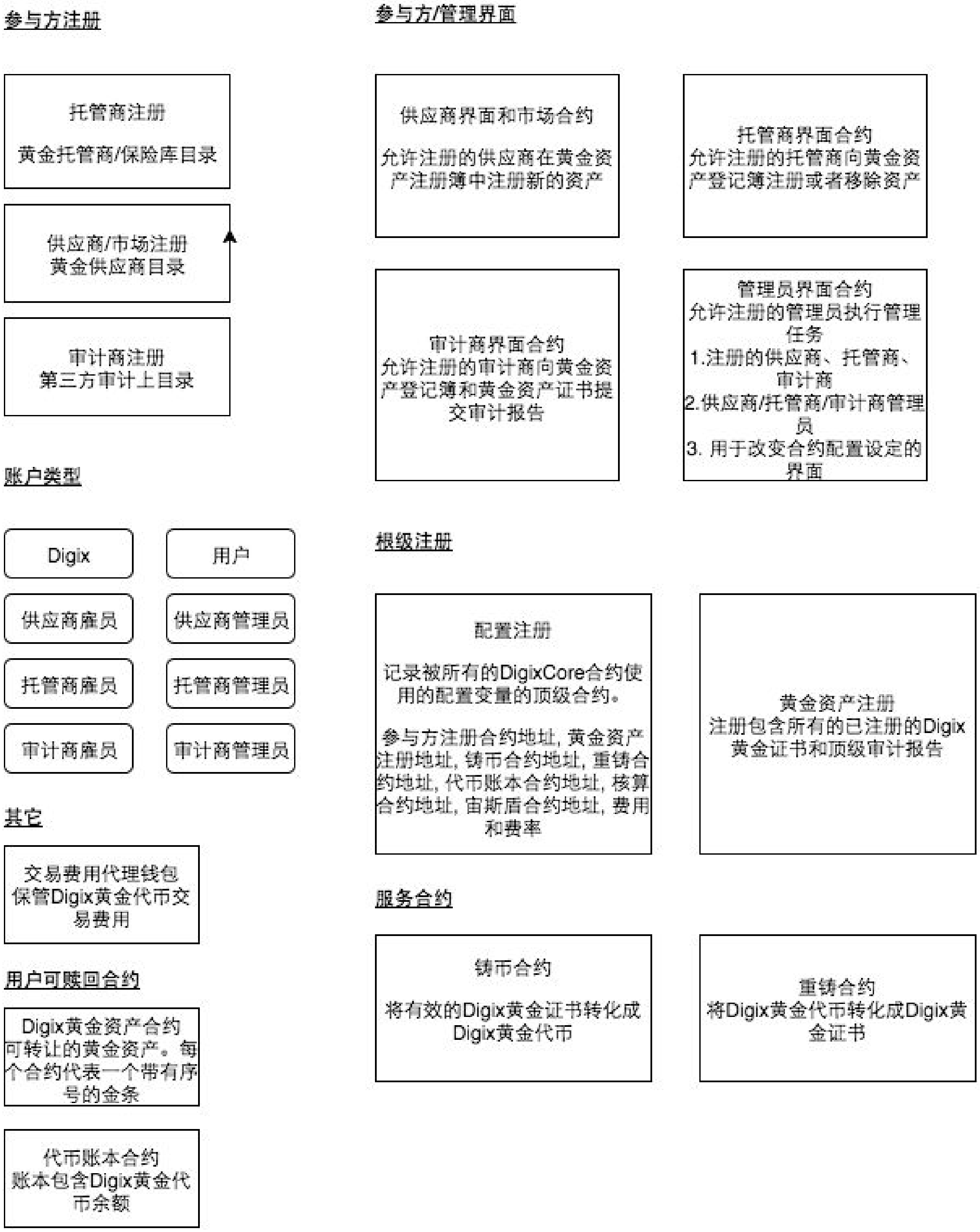
4 赎回过程，利用PoA资产卡赎回实体金条。（图表v）

图表V：Digix黄金赎回和基于代币的用户身份证明


赎回过程
用户提交一笔赎回请求交易
1.计划赎回日期
2.赎回授权码
资产被标记为“待赎回”，并且不能被转移或者铸币
用户在计划好的赎回日到达赎回中心
是
Digix将金条呈现给顾客，让其检查和确认
用户向Digix提供授权码的私钥助记符号
Digix 导入用户提供的授权码
使用授权码Digix将使用这个私钥发送一笔授权交易，这能有效地确认持有者就是资产的所有人。
授权成功?
是
Digix将这个资产标记为已赎回。收取未偿付的存储费用和赎回费用。从黄金注册的总重量中减去已赎回黄金的重量。
不
Digix取消赎回请求，资产被重新放到托管商。重新入库费用将被加到存储费用上。
不
结束赎回过程

5 通用输入/输出（I/O）合约，运行开发者利用PoA资产卡或者DGX代币进行去中心化应用（Dapp）开发。

以太坊智能合约栈。下面的图表展示了包含以上过程的Digix智能合约如何部署在以太坊区块链上。



参与方注册

托管商注册

黄金托管商/保险库目录

供应商/市场注册
黄金供应商目录

审计商注册
第三方审计上目录

账户类型

Digix

用户

供应商雇员

供应商管理员

托管商雇员

托管商管理员

审计商雇员

审计商管理员

其它

交易费用代理钱包
保管Digix黄金代币交易费用

用户可赎回合约

Digix黄金资产合约
可转让的黄金资产。每个合约代表一个带有序号的金条

代币账本合约
账本包含Digix黄金代币余额

参与方/管理界面

供应商界面和市场合约

允许注册的供应商在黄金资产注册簿中注册新的资产

托管商界面合约
允许注册的托管商向黄金资产登记簿注册或者移除资产

审计商界面合约
允许注册的审计商向黄金资产登记簿和黄金资产证书提交审计报告

管理员界面合约
允许注册的管理员执行管理任务
1.注册的供应商、托管商、审计商
2.供应商/托管商/审计商管理员
3. 用于改变合约配置设定的界面

根级注册

配置注册

记录被所有的DigixCore合约使用的配置变量的顶级合约。

参与方注册合约地址，黄金资产注册地址，铸币合约地址，重铸合约地址，代币账本合约地址，核算合约地址，宙斯盾合约地址，费用和费率

黄金资产注册
注册包含所有的已注册的Digix黄金证书和顶级审计报告

服务合约

铸币合约

将有效的Digix黄金证书转化成Digix黄金代币

重铸合约
将Digix黄金代币转化成Digix黄金证书

Digix资产证明参与者
（区块链线下实体）

资产供应商

ValueMax新加坡是一家上市公司，在Digix市场上提供伦敦金银市场协会（LBMA[11]）认可的金条。ValueMax新加坡成立于1988年，他们提供典当服务和二手珠宝、黄金、名表的零售和交易服务。

独立审计商

Bureau Veritas Inspectorate将对我们的黄金托管商库存金条的重量和质量进行季度审计，确保DGX代币有实体黄金支撑。他们是一家跨国集团，涉足多个商品领域，为贵金属提供独立的检查、取样和检测服务。

每个金条在审计时都将被用机密检查设备严格地检测。我们使用超声波计量器（UTM）和密度计执行这些检测。UTM是一种基于超声波返回物体表面所用时间测量物体局部厚度的无损测量方式。密度计是使用排水量测量物体密度的设备。

托管商保险库

MalcaAmit的现代化设备靠近新加坡樟宜国际机场，位于新加坡自由港，它是一个面积达25000平方米的高度安全和可空调控制温度的保险库，以通过绿色建筑工程实现的最前沿安全技术著称。

多方信任机制

Digix依赖多方独立的参与者为实体资产代币化提供一个透明的平台。我们可以假定基于工作量证明（PoW）的密码学货币系统中的矿工将理性行动，即他们将通过履行交易确认职责，实现收益最大化和保护他们的长期利润。我们假设，理性矿工的垄断联盟将不会合谋进行双花攻击，因为这样的攻击将造成整个系统的声誉受损。我们因此假设Digix系统中三个参与方--负责提供黄金的供应商、负责保管和保证资产安全的托管商、负责保证托管商资产的真实性，都将以理性的方式行事，通过收取服务费用实现利用最大化。

利用现实世界的管理解决潜在的单点故障

[11] **“ LBMA常见问题". l伦敦金银市场协会。**

监管链上不诚实的参与者和共谋

Digix与提供严格监管和公司管理的公司合作。我们的合作公司不是上市公司就是因他们的专业服务而在行业知名的公司。为了方式欺诈，我们的合作每个公司只能从事一种只能。例如，实体资产供应商不能再充当资产托管商。一项服务的利益必须独立另一项服务。尽管共谋的风险是真实存在的，但是对于共谋者来说，信誉和法律成本是极高的。因为这些公司还为其他顾客提供类似的其它服务，核心业务的信誉和合法性受损对他们是有害无利的，我们可以做一个合理的假设，他们将以理性的方式行事。

核心益处

没有中心化数据管理加密资产记录

所有的监管链信息完全由以太坊区块链管理。这个区块链账本以永久上传数据，花费的时间也明显少于在比特币区块链上传数据[12]。

没有基于网页的登陆

没有网页形式的登陆。用户将从Digix下载桌面客户端。这个应用也可以从Github上的源代码编译出来，公开可审计。与传统的基于网页的用户登陆相比，Digix的用户登陆方式极大地降低了中间人攻击[13]。

安全的加密资产冷存储

Digix的宙斯盾保险库是以太坊上面的密码学资产和密码学货币的冷存储钱包托管服务。

数字资产永久存在

所有的资产都被记录在区块链上，永久存在。即使Digix倒闭，已经生成的每个证明在可适用的司法辖区可以被法庭承认和采纳。

事后激励机制

[12] **CryptoBond. (September 16, 2015)为什么以太坊不同于比特币？. CryptoCompare**

[13] **Hjemlvik, Erik.（March 27, 2011) 网络安全博客. “SSL MITM攻击的网络分析". NETRESEC**

资产证明过程要求常规的季度审计或者更加频繁的审计需要由第三方审计商执行，审计商需要对托管商保险库中所有的黄金资产进行审计。审计商对每个金条进行一次完整审计，包括核实金条的真实性、重量和物理检测，以检测异常和不合格品。审计商为已经审计过的每个金条在黄金登记合约上提交一份记录，该记录包含对签字的纸质文档的一个IPFS引用、审计商在以太坊上的身份信息和是否通过审计。

Digix通过交易费用获得收入，交易费是用Digix黄金代币支付的。这些代币被保存在一个代理合约，只有经过第三方审计后这些代币可以被发送到一个特定地址。

通用输入/输出（I/O）合约和去中心化应用（Dapp）开发机会

Digix提供的通用I/O合约允许开发者将PoA资产卡或者Digix代币进行于Dapp开发和事件记录。我们的愿景是为开发者创建一个生态系统，将DGX代币用作各种各样的Dapp开发的架构。代码例子将在我们的Github上提供。

财富继承

去世用户的财产转移可以被做成一项服务，允许财富以密码学资产的形式被转移到Digix系统中被提到的以太坊地址。

博彩

在司法辖区，DGX黄金代币可以像比特币一样，被用作博彩货币或者博彩代币[14]。PoA协议也可以被用于数字博彩资产的发行[15]7。

代理

DGX代币可以区块链上的代理服务提供一个更好的、波动更小的价值储存手段。

众筹

Dapp利用密码学货币和密码学资产可以提供众筹机会，或者将密码学货币转换为DGX代币，对冲价格波动。

[14] **Farivar, Cyrus (January 22, 2013). " Bitcoinbased casino rakes in more than $500,000 profit in six months". Ars Technica.**

[15] **Addison, Ian. (December 22, 2015) " Gamechangers FreeMyVunk and Digix allow video gamers ..." I B Times.**

由黄金支持的密码学货币开发

密码学货币可以利用DGX黄金代币和黄金资产支持它的部分价值。

交易所和财富管理Dapp

当交易所整合DGX代币作为密码学货币交易对的一方时，它们将能够为密码学货币提供与黄金对冲的服务。开发能够调整你的密码学货币/密码学资产的比例财富管理服务，管理个人的密码学金融资产风险。

点对点（P2P）借贷和微金融

App可以将DGX黄金代币应用到P2P借贷。借款人可以通过一个基于他的风险组合和信誉的Dapp寻找资金，并和出借人商定一个资金回报率。利息/收益支付可以每隔一段时间付一次，还要有一套惩罚系统，支付迟了要收到惩罚。这些已经在比特币上实现了[16]，但是由于密码学货币的价格波动，在债务期出借人损失的资产价值可能比获得的利息价值更多。在DGX黄金代币的价格稳定将促成这些服务的应用。

抵押服务

私人持有的资产可以安全有效地被用作抵押品，不用通过冗长的认证过程确定一项资产的存在性和真实性。

结论

Digix将提供一个透明、对审计友好、安全的协议，该协议利用以太坊的去中心化共识系统和IPFS的全部潜力在区块链上实现密码学资产。

[16] **Shieber, Jonathan (June 5, 2014). "BTCJam Brings Its BitcoinBased Lending Service To Emerging Markets". TechCrunch.**