



Public Blockchain White Paper

A Universal Blockchain Protocol Enabling Cross-ledger
Access through Business Modularization

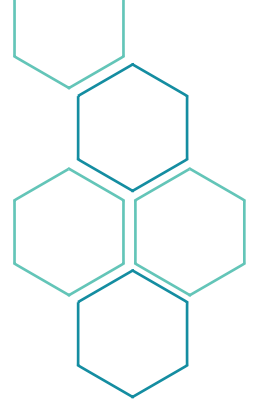


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Overview of OneLedger



An Interoperable Blockchain Protocol Built for Business

OneLedger is a cross-ledger agnostic protocol that enables high-performance scaling using a sharded and modified practical Byzantine Fault Tolerant consensus scheme -- which allows for either a permissionless or permissioned setting. By coupling public key infrastructure (PKI) with identity management, nodes (and node operators) will have a defined trust hierarchy that allows them to participate in the consensus of the OneLedger chain or any sidechain. OneLedger sidechains can be synchronized with the current state of other networks (Ethereum, Bitcoin, etc.). Any cryptocurrency that supports hashed time lock contracts (HTLC) and payment channels could be deposited into an account or address with the amount credited onto the OneLedger sidechain. This allows for a scalable and transparent solution that is off the main network or chain and is now off-loaded to the OneLedger sidechain. An arbitrary number of transactions between users can occur on a OneLedger sidechain prior to the final user requesting a withdrawal of their balance from the hashed time lock address / account on the main chain to the address / account of their choice. Essentially, OneLedger provides a scalable `off-chain` solution from any main chain and offloads the consensus to the corresponding OneLedger sidechain which inherits all of the properties of the OneLedger protocol.

By using role control with PKI, enterprises can also launch their own permissioned sidechains. Businesses will be able to define the precise role of node operators that participate on their sidechain. In addition, by utilizing OneLedger's unified framework, companies can develop their distributed ledger technology application with a single codebase and simultaneously launch their product across multiple infrastructure networks of their choosing.

1.1 Context and Mission of OneLedger

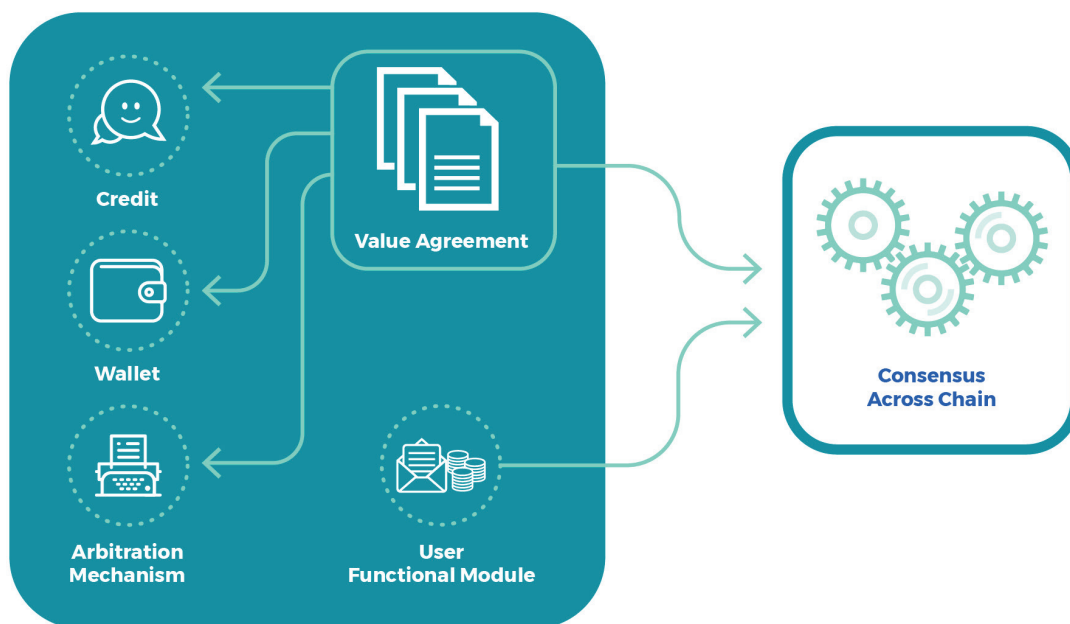
From small business owners to enterprises, OneLedger's mission is to simplify businesses' adoption of blockchain technology and its integration into their specific business applications and products. Through OneLedger, both businesses and individuals can leverage the platform to create both public and private blockchains with their own uniquely-identified network consensus. With the use of role control, enterprises can also separate read and write access on their permissioned network. Some industries, like healthcare, require people with the appropriate roles to view certain records. In addition, businesses will be able to create and manage their own community-owned digital wallet and credit system.



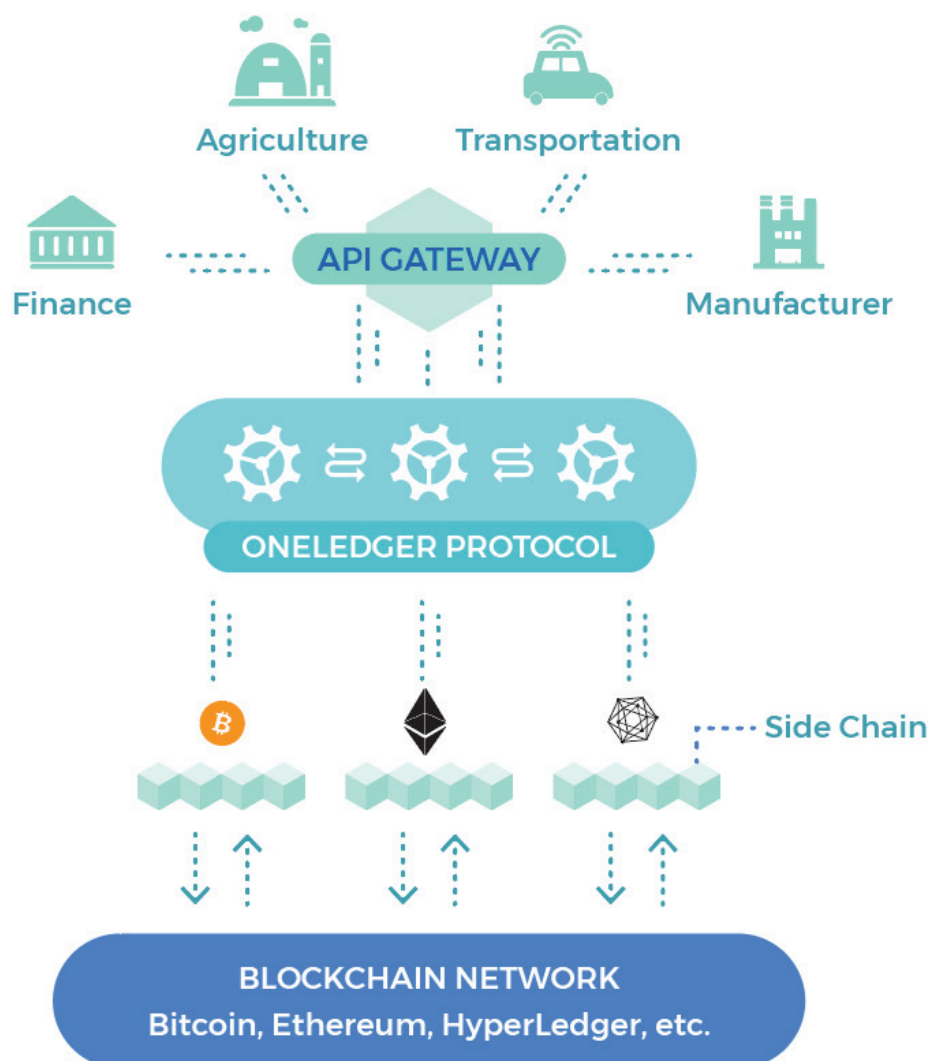
By leveraging the platform's provided blockchain-based business tools, modern-day companies can efficiently and effectively adapt their business models to our blockchain technology.

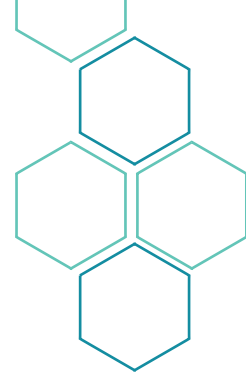
Part of the foundation of OneLedger's protocol is its use of public key authentication which allows for the creation of personal accounts with highly configurable digital wallets, credit systems, and arbitration mechanisms. The OneLedger digital wallet provides individuals and institutions the abilities of a modern-day digital wallet with the normal functions such as deposits, withdrawals, and payment, as well as the additional benefit of being able to trade and purchase services across multi-business networks. By maintaining a digital identity on the OneLedger platform, businesses and consumers can accumulate a credit score through the transaction and behavior within the network. OneLedger arbitration mechanism can create the arbitration basis by supervising all transaction history and execution process.

OneLedger supports consensus across different blockchains; the ability to expand and query data in other chains is made possible through compatibility with other blockchain networks by leveraging side-chains.



The OneLedger value network is composed of various levels of service regions and business logic. All transaction data and real source records are written into distributed nodes by an open source validation mechanism of data sharing through the blockchain underlying protocol. The real data becomes more simplistic and reliable through the enablement of IPFS protocol. Individuals participating in business activities can effectively become their own smart contract performers and data sharing peer. Safety and reliability of transactions is further promoted and ensured through the common data validation mechanism. OneLedger forms a realizable and verifiable blockchain network which is modularized from real-world functionality, based on the sharing and immunity mechanisms provided by blockchain techniques.

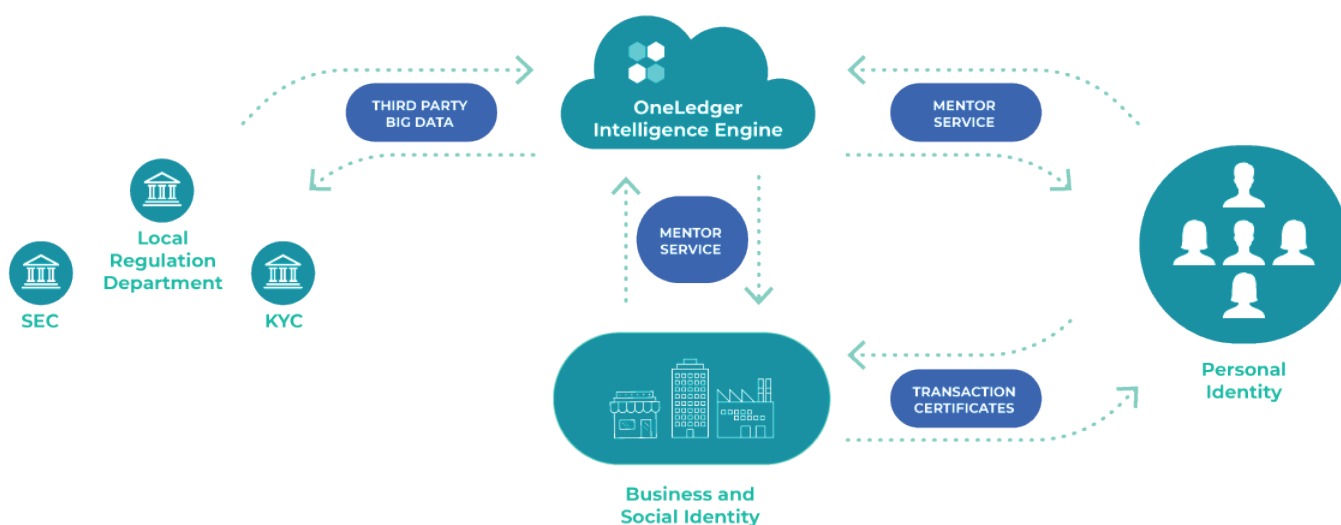




2 System Functions

2.1 Smart Identity Management Platform

Managing an identity, pseudonymous or otherwise, across multiple distributed networks can be done by assigning a master private / public key-pair to an identity. This master key-pair can then be used to associate any other public keys to this identity by digitally signing a message with the private key of the master key-pair. OneLedger offers a universal identity solution to keep track of users' assets that are stored on multiple distributed databases. In addition, OneLedger provides a way for one identity to assign a trust value to another one, thus creating a hybrid decentralized "web of trust" combined with PKI.

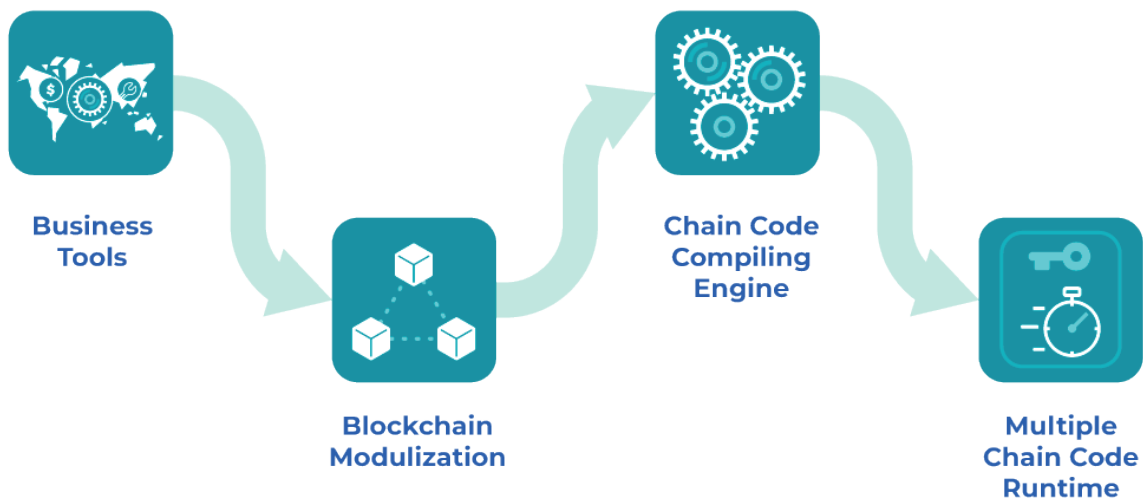


2.2 Blockchain Services

With OneLedger, anyone can launch a side-chain to run on the OneLedger consensus protocol. This side-chain can be permissioned or permissionless. In the case of permissioned, a user can use OneLedger's Smart Identity Management System and search for identities with a particular trust rating and who provide infrastructure services, i.e. node operators that may store or validate distributed ledgers, and assign particular identities to various roles in order to maintain the side-chain. Also, any public distributed ledger, regardless of its consensus protocol, that supports hashed-time lock contracts and payment channels can be synchronized with a corresponding OneLedger side-chain.

2.3 Chaincode Service

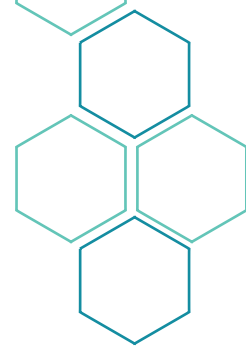
Often, businesses or individuals may wish to deploy dAPPs on multiple platforms. As such, developers have to write and deploy smart contracts on each platform of choice, potentially in multiple languages. OneLedger is developing an SDK that eases this process of porting and deploying smart contracts across multiple platforms. OneLedger's SDK will allow for users to define a "master smart contract" that specifies the smart contract written in each language of choice. The developer can then launch the dAPP on multiple platforms at once by specifying the desired platforms within the master smart contract.



2.4 Programming Interface

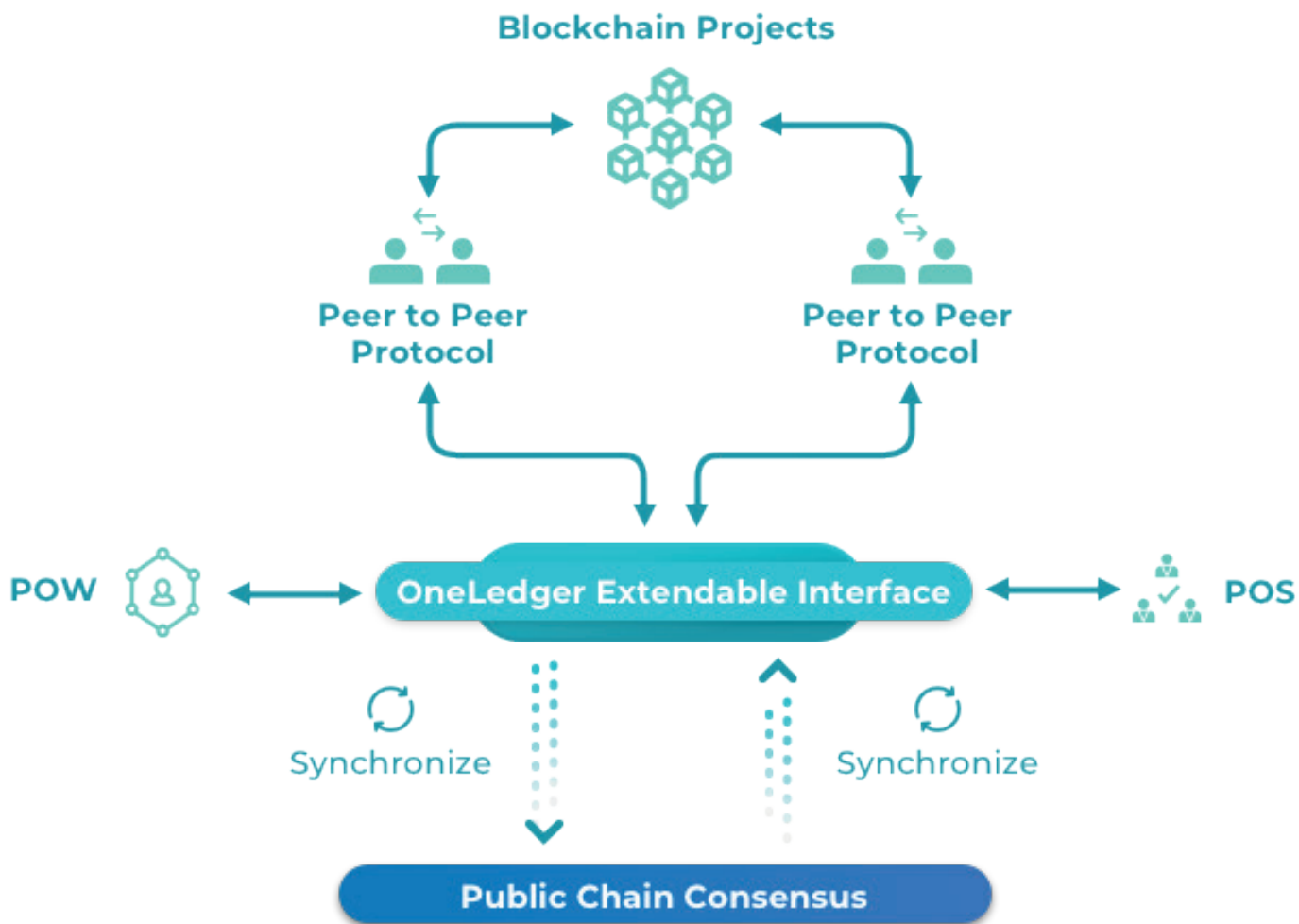
The primary client-side interface is a REST API allowing applications to register users, query the blockchain, and issue transactions. A set of APIS are made available for chaincode to directly interact with the stack to execute transactions and query transaction results.

The service-side programming interface is a business portal for users to effortlessly build business models and functions to project real world functions onto blockchain.



3 OneLedger Extendable Interface

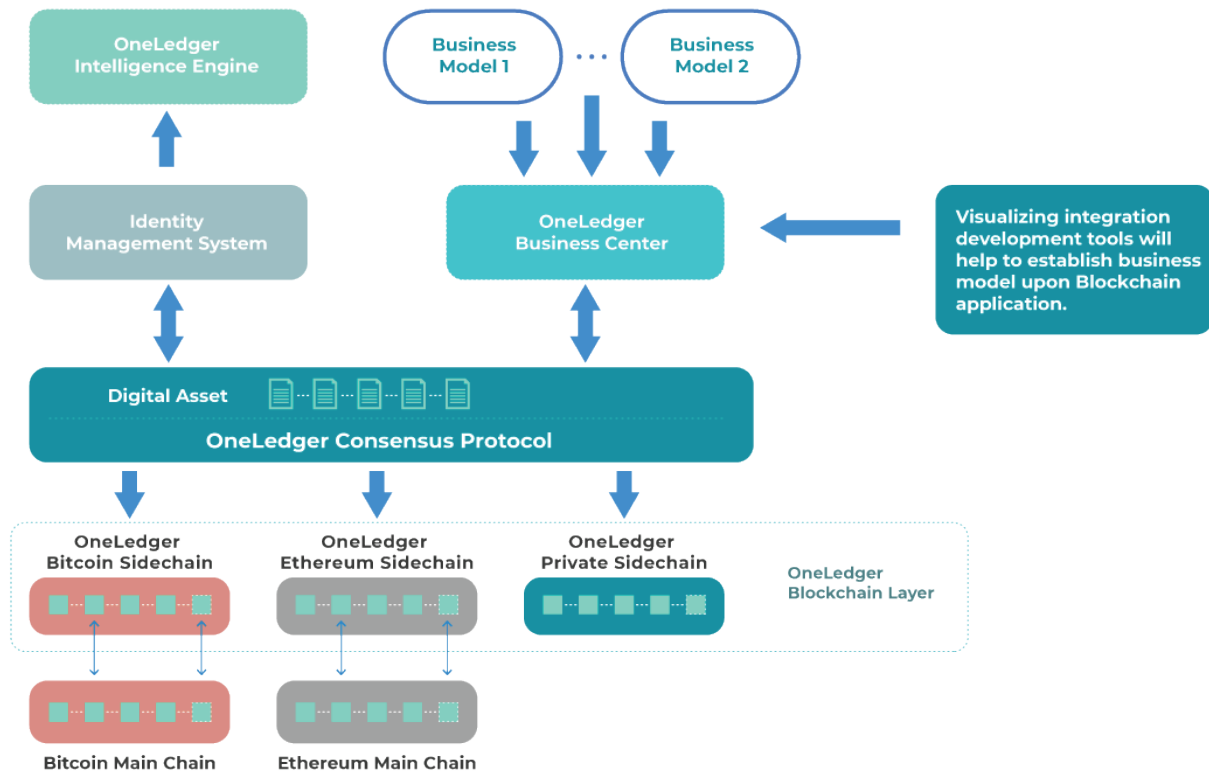
We will develop an extendable interface that is fast, safe, extendable and agnostic, allowing for easy deployment of decentralized applications (DApps) and cross-ledger communication. At its core, the purpose of the extendable blockchain interface is to effectively access and communicate across multiple ledgers.





4 OneLedger Architecture

This decentralized framework changes the basis upon how applications are built by ultimately unifying and realizing the real world into its blockchain parallel.



4.1 OneLedger Business Center

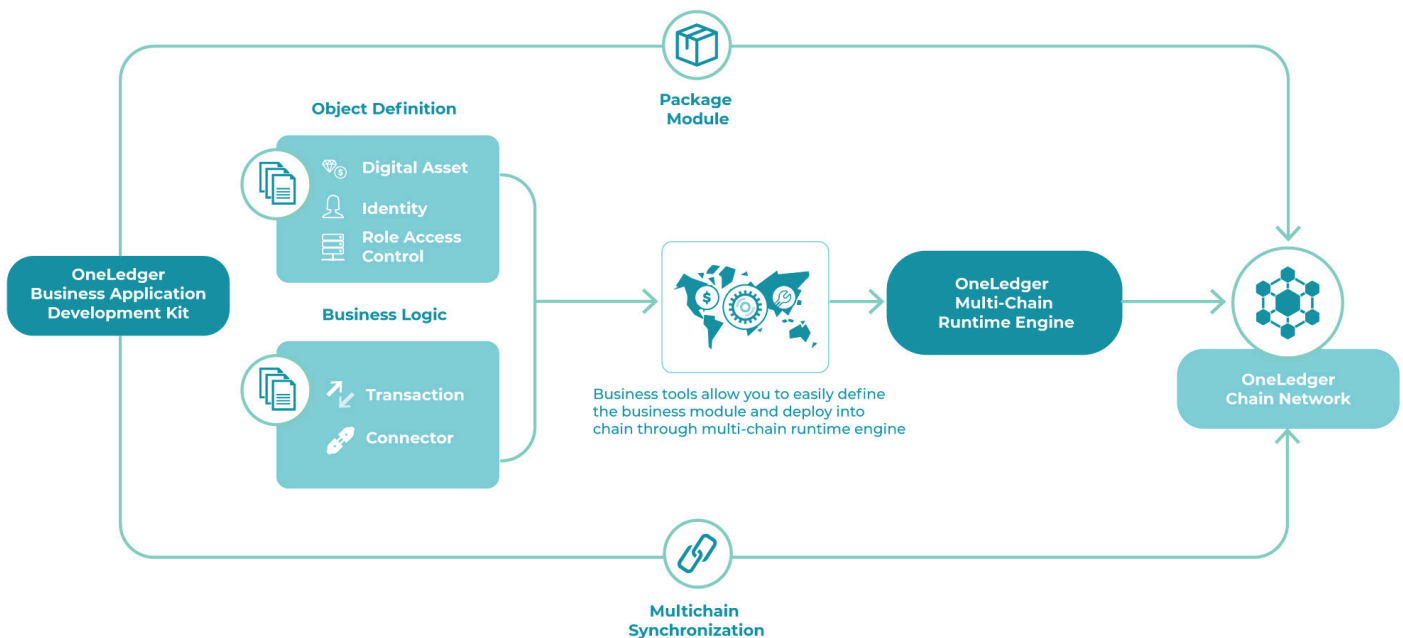
OneLedger will develop tools within the business portal, enabling users with any level of blockchain experience to map their business module onto the blockchain, generate chaincode through developer-defined modules, and tag the process throughout the flow. The Extendable OneLedger API will help in transforming business models into blockchain applications through modularity. For example, OneLedger will connect businesses with independent module developers and provide suggestions for the development of a seamless plugin that integrates multiple modules for particular business flows. For instance, a shopping plugin on OneLedger can be split into multiple components, i.e. a catalog, a cart, order submission, shipping, payment, etc. All of these modules can be built by different developers and integrated together to create a bespoke shopping flow plugin.

The platform will enable users to set up their own service agreement in both a transparent and fair manner.



Through the platform's portal business tools, the originator can then quickly set up the agreement and service template in circulation such as supply chain, law service agreements, and distribution agreements. The originator may assign a public identity to a group and can also define roles to individual identities or to all public identities in a group created by the originator. At the same time, the circulation defines the implementation of the agreement in order to ensure the interests of the parties involved are accounted for. Once completed, this service or agreement would be translated into a Solidity contract or other chaincode. Once the circulation starts, all parties involved immediately binds the participant to circulate and execute in the form of an intelligent contract.

The principal tools of the OneLedger Business Application Development Kit are listed below:

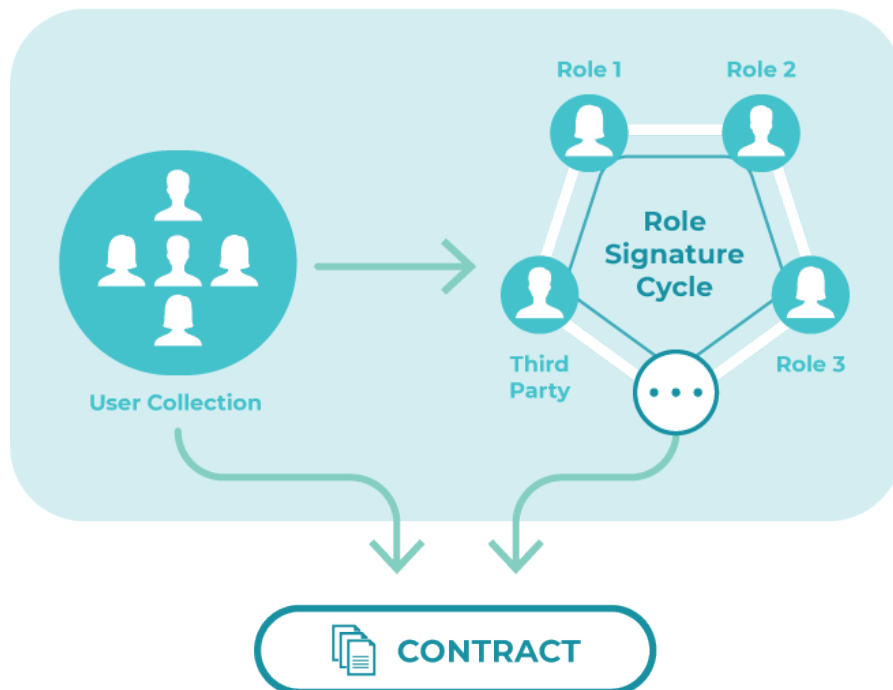


1. **Digital Asset:** The initiator can define assets in both the flow and process including financial, production, or content assets;
2. **Module:** Contains complex business logic. Includes aggregation of workflow and process; and
3. **Workflow/Process:** Basic unit used to build a module - function that can be executed based on OneLedger protocol to complete certain tasks including transaction with crossing blockchain, business flow mapping, and runtime data synchronization.

4. **Role Access Control:** The decentralized signature system will sign and validate the user together with the associated identifier information whether it be password, organization information, or role; once validated, access information can be packed into the payload and delegated to modules.
5. **Transaction:** Runtime environment for asset and its workflow/process where a transaction can come across from different blockchains based on OneLedger protocol.
6. **Channel:** A P2P channel with emphasis on speed and security to connect two nodes within a single or multiple blockchains.
7. **Connector:** Enterprise-level integration tool for various Business regions; connector integrates OneLedger Public Blockchain data with existing centralized commercial network, and establishes a hybrid application combining blockchain and centralized services.

4.2 OneLedger Consensus Protocol

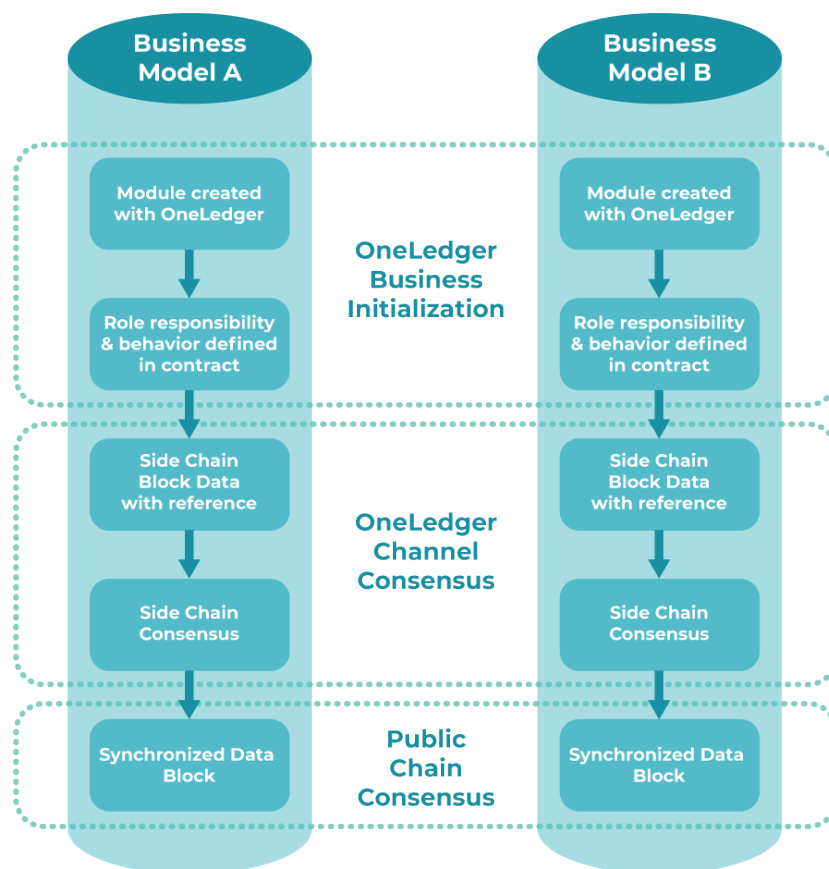
4.2.1 Business Logic Modularization



Business Logic will use a configurable role-based consensus methodology leveraging hierarchical grouping similar to the Merkle Tree. The role will be determined by business participants. Each role is linked to an independent node that participates in consensus; business logic will then determine how each role is fed into node data. The role consensus is subject to second level verification. Through their defined key and digital signature, Users can be correctly linked to their role in the business. This enables transparency and traceability, allowing identification of the user who had written data onto the Blockchain, and their respective role.

4.2.2 OneLedger Consensus Protocol Hierarchy

We define a Three Layer Consensus concept to enable OneLedger to integrate effectively between different Blockchain products.



4.2.3 OneLedger Business Initialization

The Three Layer Consensus begins with a Business Initialization where a contract is defined to indicate the roles and their respective behaviours of business participation. The contract defined for the business model is a generalized contract which will be compiled and generated to a contract recognizable and executable for different underlying public blockchains, such as Bitcoin and Ethereum. The generated contract will then be deployed with a proper method for nodes within OneLedger running different blockchain code. In Ethereum nodes, the contract is executed in the form of a Smart Contract, and in Bitcoin nodes, the contract is replicated from the genesis contract when nodes are created.

4.2.4 OneLedger Channel Consensus

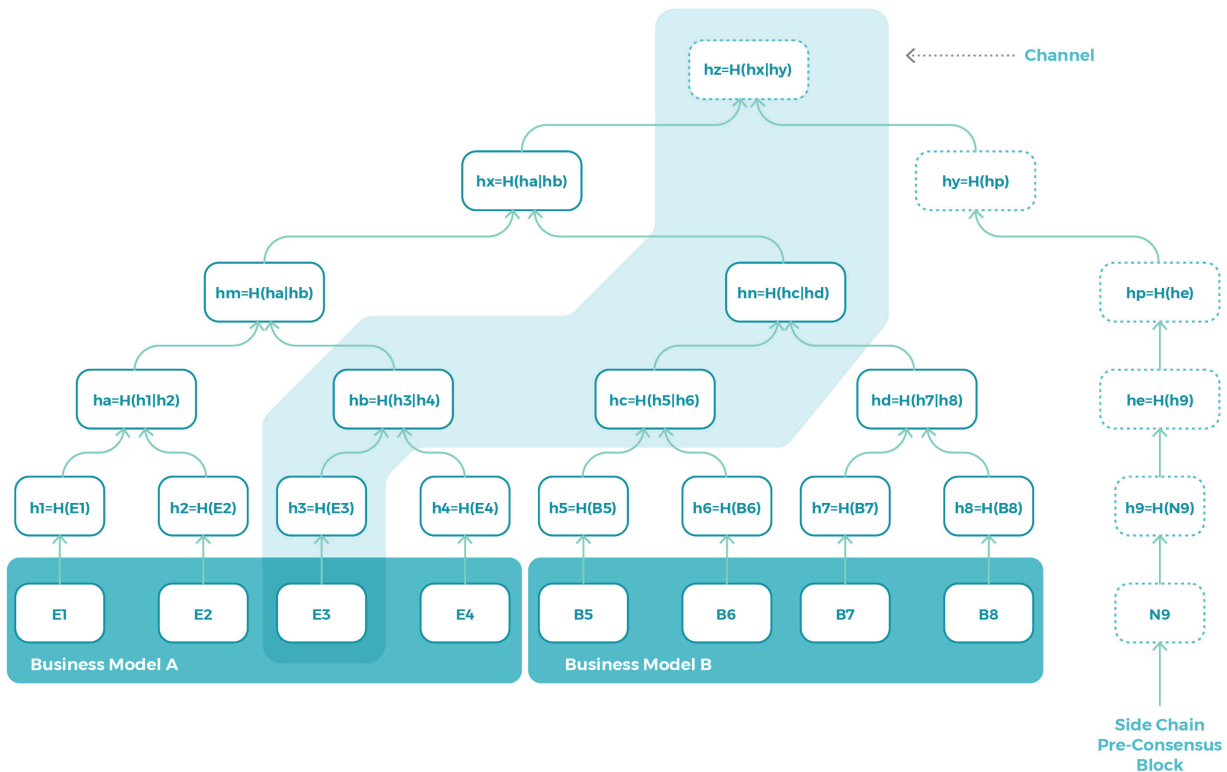
OneLedger proposes a concept of Channel Consensus to execute interactions (transaction or any business behavior) between roles as defined in the contract. These roles can come from either one or two business models. When new block data wants to record any action conducted, a sidechain consensus (Details in 4.4.2) based on Byzantine Fault Tolerant Partial Synchronization is conducted within the channel among all its participants. This Sidechain Consensus will require all participants to vote, and Sidechain Consensus is reached upon more than $\frac{2}{3}$ agreement among voters. If the Channel crosses two different business models in the Sidechain, Sidechain Consensus is achieved by counting votes of participants of each model. Channel Consensus is achieved only after both models have reached consensus. Note that when the consensus is achieved in the Channel, the written block data is broadcasted to all nodes in this channel and stored.

Contracts without a defined role are considered general contracts where the Channel concept does not apply. Consensus can only be reached throughout the entire blockchain network.

VOTE	
Height	Round
Type	Channel
Block Hash	
Signature	
Role Signature	

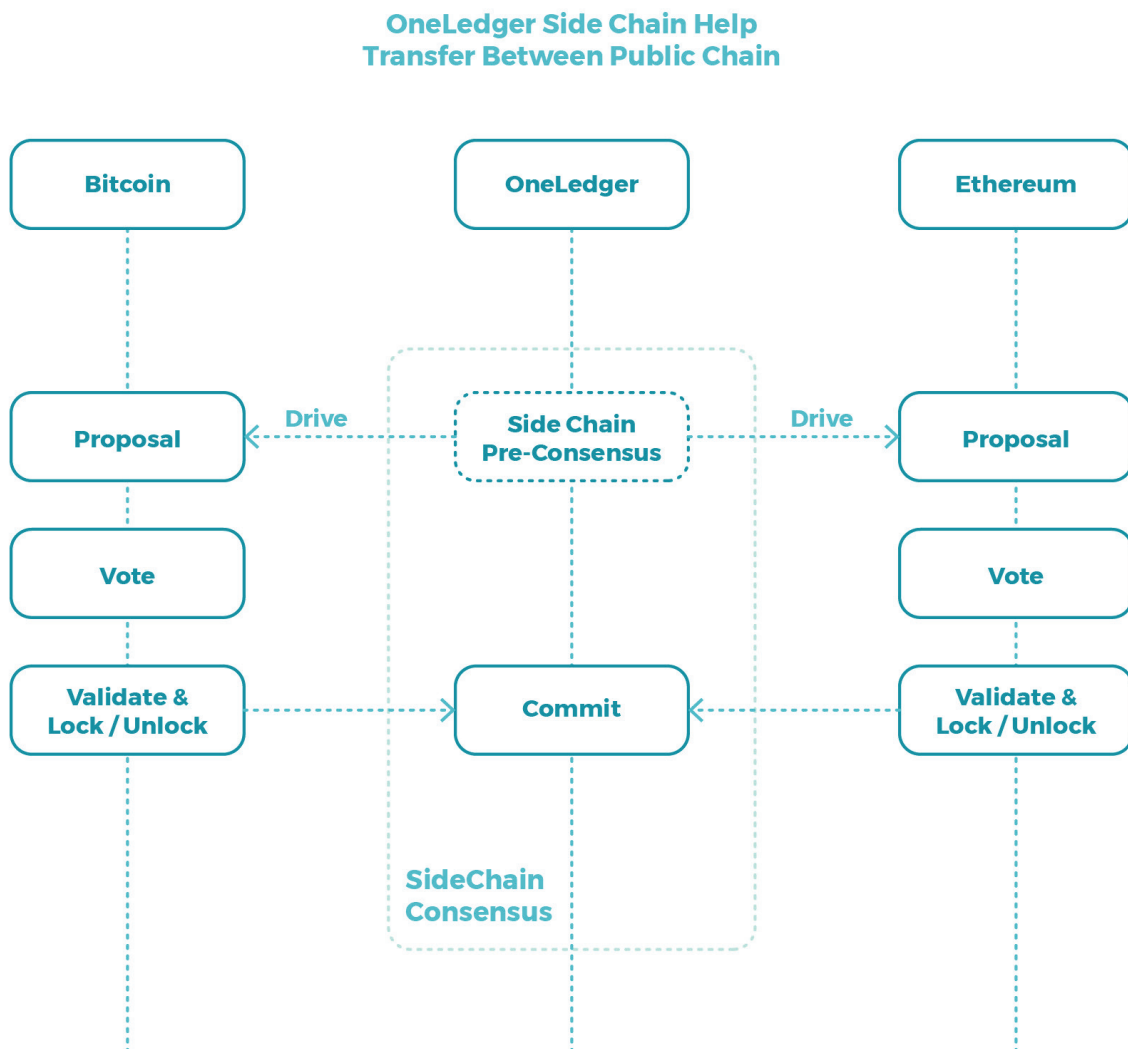
A vote message structure

Since nodes can be assigned to different channels and blocks are stored based on channels, the blockchain height on nodes can differ. The implementation of Resilient Distributed Blocks (RDB) allows the system to trace the lineage relation of each block in sidechains with the help of the Merkle Tree reference stored in the reference field of the block data.



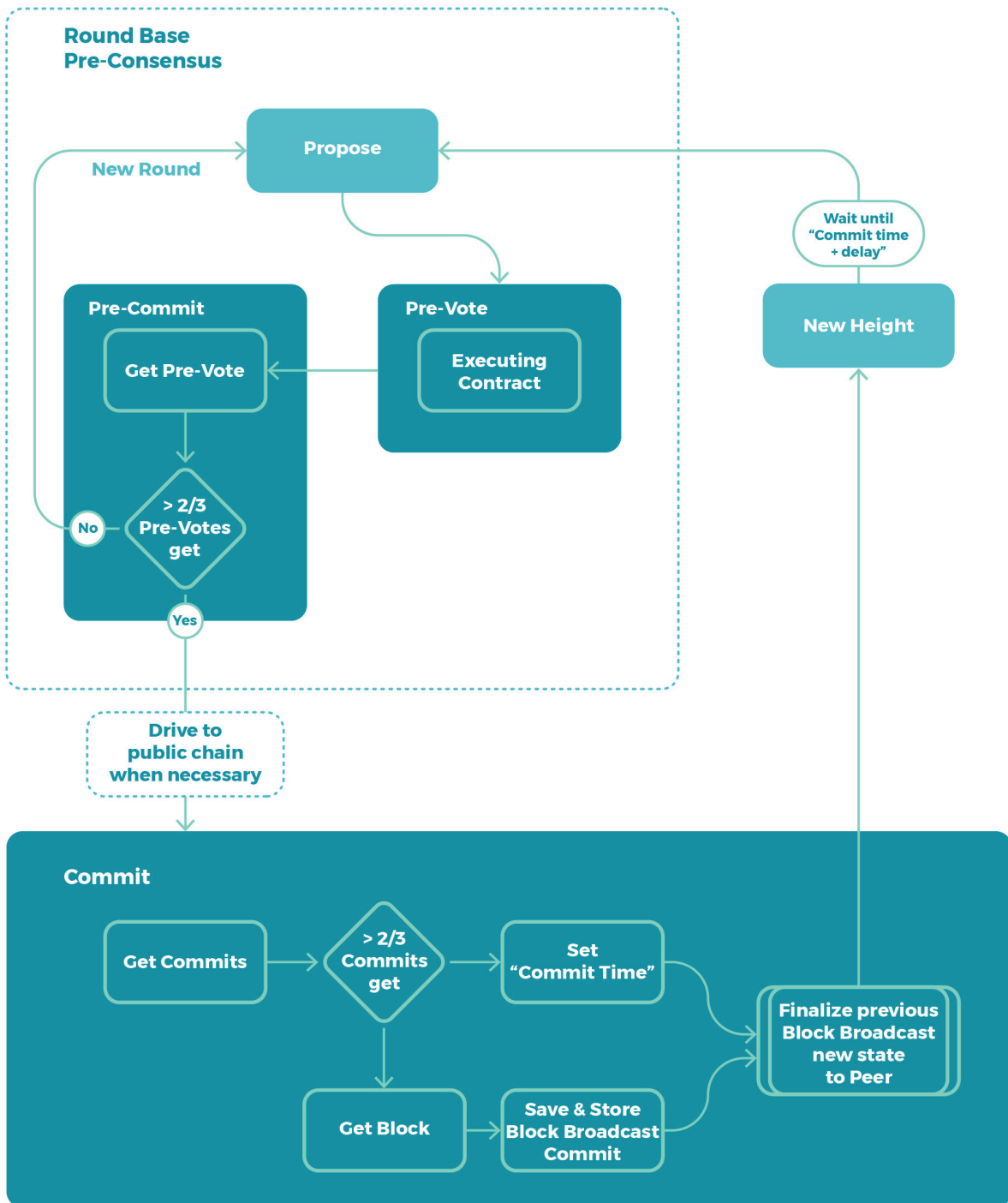
4.2.5 OneLedger Public Chain Consensus

OneLedger Sidechain Consensus helps initiate transfers between public chains. When a transfer between public chains is requested, the pre-consensus step is conducted in the OneLedger Sidechain, and a pre-consensus block (the N9 block in the previous diagram) will drive a proposal to the public chain. The proposal will be voted by validators of the public chain to validate the lock or unlock action for assets on the public chain. If the proposal is returned successfully from both public chains, the pre-consensus block will be committed. Once $\frac{2}{3}$ of the sidechain nodes commit this block, it will be finalized in OneLedger. Transactions across public chains are made available due to OneLedger's use of a hybrid combination of federation and drive chain to make it possible to synchronize between public chains and OneLedger.



4.2.6 Sidechain Consensus Algorithm

The Sidechain Consensus algorithm consists of two phases. The first phase is a “Round Based Pre-Consensus” to get a Consensus Proposal that more than $2/3$ of the node in the scope has agreed with. The scope will be within the channel if a channel is used; alternatively, the scope will be all nodes if a channel is bypassed. All functionalities binded by the contract will be executed in the Pre-Consensus phase. A round consists of three steps where time allocated to each step is evenly distributed in thirds. A node is chosen to propose a block broadcasted through its scope. All nodes receiving the proposed block will pre-vote based on their respective contract. The broadcasted pre-vote is collected by nodes in the scope, and once more than $2/3$ of the pre-votes are collected in a node, it will pre-commit the proposed block. If a node didn't receive enough pre-votes in the round time, a new round with more time will begin until a pre-commit is achieved. In the second phase, the Pre-Consensus block will drive to the public chain if the proposal is a cross public chain. In this case, each node will validate that exactly one committed Pre-Consensus Proposal is signed by more than $2/3$ of the nodes in the scope. Once validated, the block is broadcasted and the previous block is finalized.



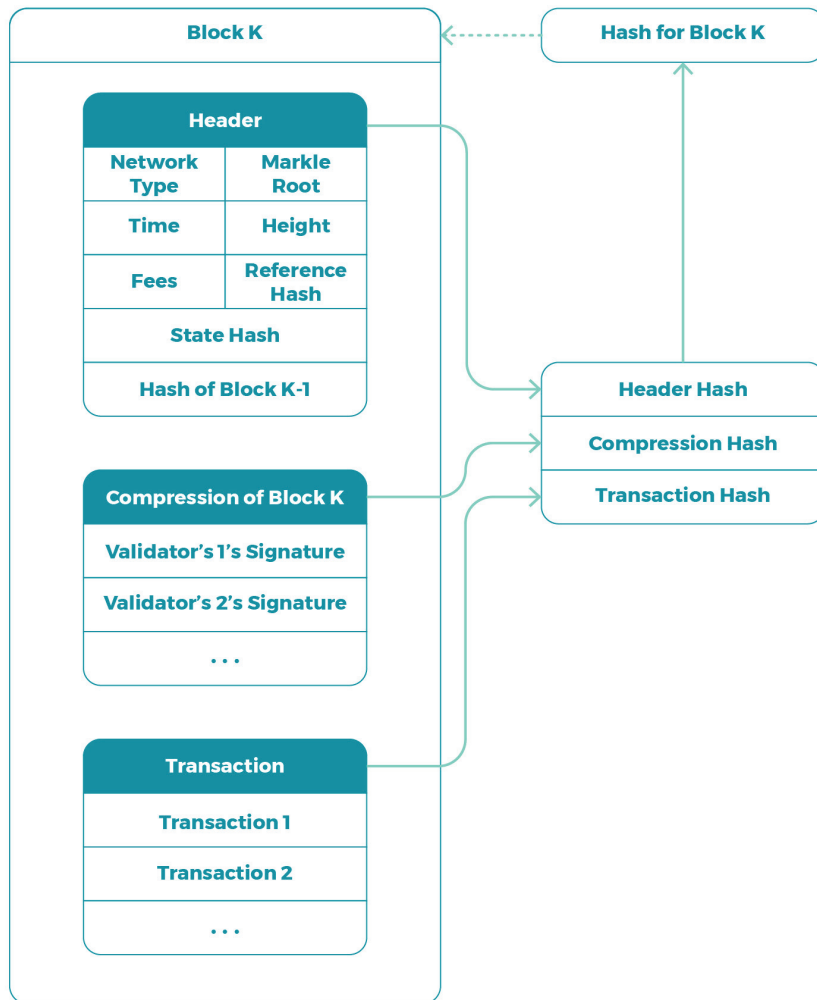
Side Chain Consensus



4.2.7 Arbitration Mechanism

Since only partial consensus within a channel is achieved, a participant in the channel can ask for arbitration when concerns are raised. When arbitration is requested, a consensus bypass within the channel will be conducted for all participants in OneLedger.

4.2.8 Block Structure



OneLedger will use a block hash of the previous block to link the blockchain, and verify through the use of the Merkle tree root. The Network Type field will record if this block is either stored in the Ethereum or Bitcoin node. We introduce a RDB concept where each block is distributed and stored in OneLedger sidechains and referenced by the reference hash to the node in Merkle tree lineage.



5 OneLedger: Use Cases

OneLedger’s protocol and interface enables interaction with an arbitrary number of core infrastructure networks in a highly scalable manner. Numerous use cases can come from this interoperability; however we describe one primary use case: a cross-chain decentralized exchange.

To begin, our protocol uses the notion of hash timelocks contracts (HTLC). A hash timelock contract is a combination of a hashlock and a timelock. A hashlock is a restriction on a receiving address or account in that the owner must publicly reveal a piece of data in order to lift the restriction. Likewise, a timelock on a transaction restricts the time when a transaction can be spent. By combining these two pieces, a HTLC allows for cross-chain transactions. Thus, a user will deposit into an account or address and then be credited the corresponding amount on OneLedger. The user can then trade this asset between any other asset type and not be limited to the “normal” base pair markets of Bitcoin or Ethereum. As users trade, their account on the corresponding sidechain on OneLedger is credited accordingly, and they can choose to withdraw their new coins to an address of their choice at any time, i.e. by spending the HTLC.

We note that because of sharding and the use of sidechains, the number of trades that can occur in a small time can be exceedingly high. This fact stems from the idea that if a user trades Litecoin for Dogecoin (within the OneLedger framework), then this transaction only has communication between the Dogecoin and Litecoin sidechains and does not affect the performance, for instance, of the Bitcoin or Ethereum sidechains.

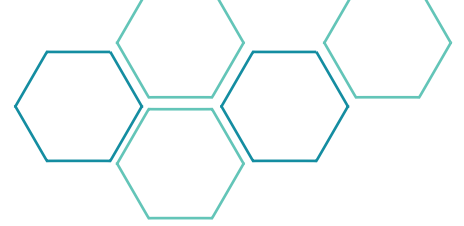
OneLedger is more than a cross-ledger decentralized exchange. With the use of smart contracts and our business integration APIs, we will make the process of on-boarding businesses to use distributed ledger technologies for their particular applications, whether it be supply chain / inventory management, accounting, digitization of assets, etc., much easier.

Other use cases of OneLedger include:

- ability to move business traffic into sidechain with high performance
- ability to deploy and migrate DApp with ease
- enablement of cross-chain access and consensus through OneLedger protocol
- standardized communication between DApps within OneLedger protocol

- asset identification and transparent flow such as asset registration, donation process
- BaaS offering to help users create business modules with open source DApps within the business portal ie. Supply chain and eCommerce flow (Catalog, cart could be built as service and hooked up flexibly)
- help businesses and individuals with AI support and flow optimization
- transparency and traceability of process through tagging of business flows





6 Token Economics

1 billion OLT tokens will be premined. Each OLT token will initially be mapped to one corresponding ERC20 token so early adopters of OLT can use them on Ethereum ecosystem as the OneLedger ecosystem is being developed.

As the OneLedger ecosystem matures, there are three major participants in the OneLedger token economics: users, network supporters (nodes), and developers. OneLedger will also build a marketplace, which is a decentralized application on OneLedger platform.

Users

Users, including businesses, need to pay a network fee to nodes to use any services on the OneLedger platform. They can either acquire OLT tokens from other token holders, or they can run a node themselves to start acquiring tokens to reuse for business use cases. Users might need to pay OLT tokens to access services sold in the marketplace based on the distribution smart contract set by the developers.

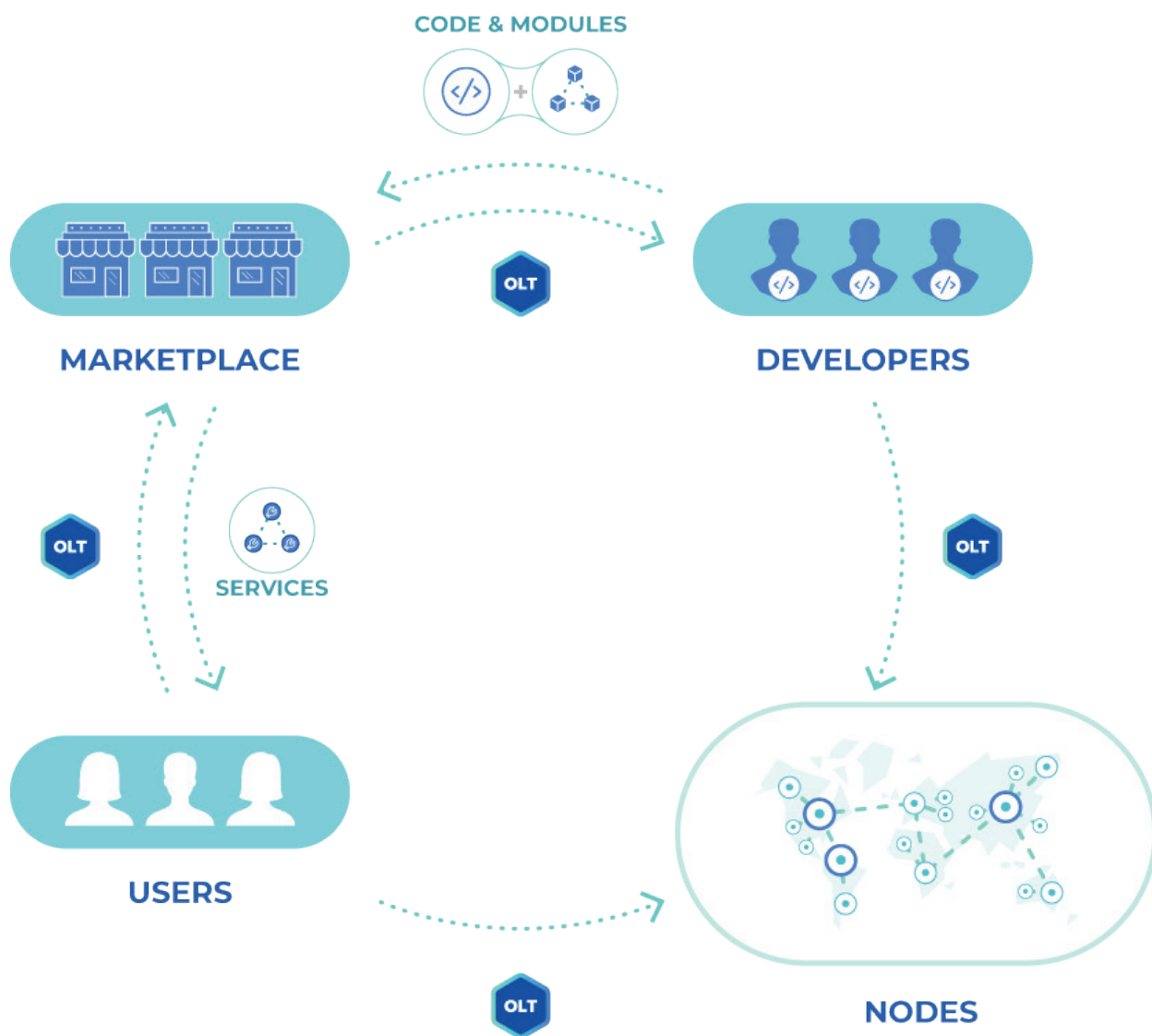
Network Supporters (Nodes)

Network supporters (nodes) will receive OLT tokens as network fees. In the early phase, OneLedger's software will allow everyone to run a node. After a period of time, a staking amount may be established to ensure commitment and quality of the network.

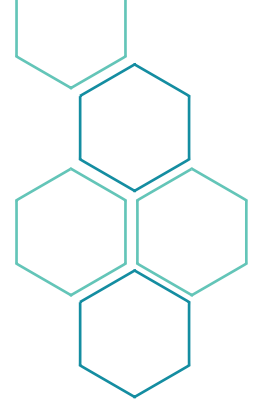
Developers

Developers will range from individual contributors, to enterprise teams, to consulting firms. Developers need OLT tokens to deploy their modules to OneLedger platform. They can submit modules and code to OneLedger Marketplace with a smart contract that defines the terms of sale. For instance, these services can be free, or users need to pay developers a one-time fee to unlock the service, or developers can even implement the smart contract as a subscription business model so users will need to pay OLT tokens monthly to keep accessing the services. Additionally, OneLedger will give a development grant to the best developers and most qualified projects by leveraging the 25% of tokens reserved for the community.

OneLedger will use the 25% community reserved tokens only to benefit the growth of the ecosystem. Besides incentivizing developers, OneLedger can also leverage the tokens for community engagement such as managing events and funding development workshops. OneLedger will focus on building a healthy blockchain development ecosystem that developers will enjoy and see the value in contributing to.



Team



David Cao Founder

David is the Founder of OneLedger. With over 3 years of blockchain experience and over 10 years of enterprise architect experience, David worked on a magnitude of technical projects for several Fortune 500 enterprises. He also worked at IBM Toronto Lab on the development of DB2 and WebSphere Commerce core engine. As a specialist in supply chain, payments, e-commerce, and as an experienced J2EE enterprise architect, David has helped large enterprises grow exponentially, including Home Depot, Sears, and Toshiba. David is an active member in both the Hyperledger and blockchain community.

Kerry Husbands President

Kerry is a KPI-driven business development professional with an entrepreneurial spirit, tenacious attitude, and extensive experience in strategizing and executing a broad range of partnership initiatives. Kerry's sales experience and leadership qualities will be instrumental for OneLedger in developing business strategies and onboarding clients looking to adopt blockchain technology.

Edwin Zhang Co-founder & Managing Director

Edwin is a veteran in the blockchain startup and investment space. He is a former Software Engineering Lead spearheading blockchain-related R&D for TribalScale – an innovation firm specializing in emerging technologies. Edwin has a vast technical background as both a blockchain developer, with Solidity and Ethereum smart contract development experience, and software developer. He brings to the table extensive investment experience backed by a technical foundation, and a wide global reach within the cryptocurrency community.

Bob Binns Chief Strategy Officer

Bob is a recognized innovator, providing strategic consulting services for companies managing change and/or seeking growth. He has held executive level positions in companies including IBM, Bank of Montreal, Microsoft and Unisys Corporation. Bob was a driving force on several major business transformation initiatives across multiple industries – from the conception and launch of start-up ventures to the successful transformation of companies facing business or dramatic growth. He has also been CEO of global private software companies including customized software, SaaS, and Cloud offerings, two of which were subsequently acquired. Bob is a mathematics graduate of Queen's



University and has studied extensively at Harvard Business School (Program for Sustainable Competitive Advantage), Kennedy School of Government and Queen program for Public Executives. He has served on the Boards of Junior Achievement, Ottawa and the Information Technology Association of Canada (ITAC).

Aly Kassam Director of Product

Aly brings with him a tremendous amount of experience in software development, and building products from start to finish. He has over 10 years of experience in implementing enterprise solutions for companies like Freckle IoT, Oracle, CrossCap etc. Having completed his degrees in Computer Science and Business, Aly is well-versed in striking a perfect balance between technology and business.

Alex Lan Co-Founder & Blockchain R&D

Alex is a data science expert. He holds a master's degree in Computer Science with an emphasis on machine learning and big data application. Alex is a former Business Intelligence Engineer at Amazon, and is currently a Data Engineer at an industry-leading innovations company with a breadth of big data resources. Alex became exceptionally passionate about Blockchain technology after he realized that it can potentially disrupt every industry. He has gained extensive experience in blockchain protocol and consensus algorithm development.

Pavan Kappara Software Architect

Pavan has over ten years of experience working in different software development roles. He has been a part of a gaming startup and helped them architect and build a cross-casino gaming platform. He has also helped big retail companies in India launch into e-commerce space with novel omni-channel solutions. Some of his employers over the last ten years include Disney Interactive Studios, SecureKey Technologies Inc., Lithium Technologies and Arvind Internet.

Sahir Parmar Community Director

Sahir has been an active member of many Telegram communities in the past, and his enormous experience in public relations is something which will create a good balance between the team and the community. Regarding his role, he stated "I want to help the OneLedger community grow. The driving force behind every successful blockchain project is the community supporting it. I am pursuing this position with an open-mind and would like to work WITH the community to bring a change in the blockchain world and make OneLedger a front-runner in their area of expertise.





8 Advisors

Trevor Koverko CEO of Polymath

Trevor is one of Canada's most successful angel investors with early positions in ShapeShift.io, Luminex and Royalty Exchange among several others. As of lately, Trevor has been focusing all his attention on blockchain – having bought into Bitcoin in 2012, he's continued to seed and advise crypto-based companies and ICOs including the Ethereum project. Trevor is currently the CEO of Digital Assets International, and the CEO of Polymath Network – the first decentralized marketplace for tokenized securities.

Matthew Niemerg Distributed Ledger Technology & Security Advisor

Matthew is a former IBM Center of Excellence Postdoctoral Fellow in High Performance Computing at Oak Ridge National Laboratory. Matthew has been involved in the blockchain space since 2014 and provides consultation related to security and consensus models, cryptographic schemes, and business development for blockchain-based projects.

Jor Law Founder at VerifyInvestor.com & Homeier Law PC

Jor is a pioneer in building out the ecosystem for digitizing and trading securities on the blockchain and other distributed ledger technologies. A corporate, finance, and securities attorney, he is most well-known for his expertise in alternative finance, including EB-5, venture capital, crowdfunding, and initial coin offerings (ICOs). He is a co-founder of VerifyInvestor.com, the dominant accredited investor verification service in the world and a founding shareholder of Homeier Law PC. He is an expert on attracting and verifying accredited investors.

Mervyn Chng ICO Advisor & Partner at Gwei Capital

Mervyn graduated with a degree in Banking and Finance from Nanyang Business School in Singapore before fast tracking a management career. He served as General Manager for an oil trading firm managing 50 million USD in revenues before making the career switch to cryptocurrency. As managing partner and CIO at his venture firm, he focuses on infrastructure and “fat protocols” with early stage multi million dollar investments in RChain, Zilliqa, Bluzelle, Elastos, Dragonchain, POA, Wanchain, Theta, Chainlink and others like Quantstamp, Gifto, Kyber Network. With years of Cryptocurrency experience, he specializes in helping projects through the entire ICO process from whitepaper to token sales structure and connections with the top influencers, reviewers, funds and exchanges. In his spare time, he serves as a community cooperator for the RChain Coop.

Craig Brown Partner at Fasken

An expert in the areas of mergers and acquisitions and corporate finance, Craig provides strategic legal and business advice to help companies realize their potential in both Canada and in new foreign markets. While Craig’s practice is sector-agnostic, he has for the past decade been extensively engaged with a wide variety of leading participants in the dynamic Ontario innovation ecosystem. In addition to providing excellent legal advice, Craig seeks to intermediate opportunities for all clients, including sourcing qualified investment targets for VC and private equity clients and introducing promising early-stage companies to strategic partners and investment groups capable of providing transformational growth capital.

Daniel Fuke Partner at Fasken

Daniel is a Partner in the Fasken’s Securities and Mergers & Acquisitions group and also advises clients in the investment funds and blockchain industries. In his practice, Daniel frequently advises public and private entities on equity and debt financings, share and asset purchase transactions, investment fund formations. In the blockchain area, Daniel has advised clients on initial coin offerings, cryptocurrency exchanges and investment fund formation. Daniel has also written and presented on a number of topics affecting blockchain companies, with a focus on securities law issues.