

# **Cocos BlockChain Expedition**

A Development and Operating Environment for Decentralized  
Gaming Applications and Digital Assets

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## **Abstract**

In this Whitepaper, we introduce the concepts and implementations of Cocos BlockChain Expedition (“Cocos-BCX” or the “Platform”) for developing, operating, managing and exchanging decentralized applications (“dApps”) and in-app assets (“dAssets”) on blockchains. The Platform includes (1) a software framework for multi-system, multi-blockchain development, (2) a visual, script-based and data-oriented IDE for dApps and dAssets production, and (3) a blockchain system based on Graphene™ framework customized for high-performance applications (“CocosChain”). Essential system components such as a decentralized account system, a crypto wallet system and a crypto exchange system are also provided.

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# **1. Introduction**

## **1. Economic Background of Blockchain Gaming**

Blockchain technologies and cryptocurrencies have been under research and debate since the debut of Bitcoin in 2009. Among the sectors affected heavily by blockchains is the gaming industry.

In games content is created, used, priced and exchanged online, and natively suitable for the valuation and denomination by cryptocurrencies. In addition gaming is a mature market with a solid business model, user base, and developer community.

We believe the gaming sector will pioneer the development of the blockchain-enabled digital economy and we are building Cocos-BCX to help accelerate this process.

## **2. Our Value Proposition**

Cocos-BCX is an easy-to-use development and operating infrastructure for game developers, many of whom are not familiar with decentralized applications or the economic mechanisms of blockchain applications.

Cocos-BCX will help developers offer better experiences using various software architectures and economic incentives.

In the long-term, the Cocos-BCX Platform may help transform the business model of gaming from fee-based to asset-based. Games developed using Cocos-BCX may improve the overall gaming industry value proposition when stakeholders align to achieve the common objective of digital asset appreciation vs. using pay to play models.

### 3. The Four Phases of Blockchain Gaming

#### 3.1. Fungible Token as a Settlement Measure of In-Game Economy

In the beginning, tokens are virtual currencies that measure the economic inputs and outputs inside the games. Ethereum ERC-20 based tokens are commonly used in this scenario for their high compatibility, transferability, and traceability. The key value provided to game players includes:

- Transparency of the circulation of in-game currencies
- Transfer and conversion of in-game currencies across different games
- Conversion of in-game currencies settlement into various cryptocurrencies

*The War of Plane* (<https://shooter.candy.one>) is an example where tokens are used to settle game results. Users pay 100 Candy tokens to start a game and control the shooter to score game points by destroying enemy aircrafts and clearing the stages.

A game ends when a player clears all stages or her/his shooter crashes. The game points are converted into Candy tokens at a certain ratio. The Candy tokens can be used in other applications and traded in external crypto exchanges.

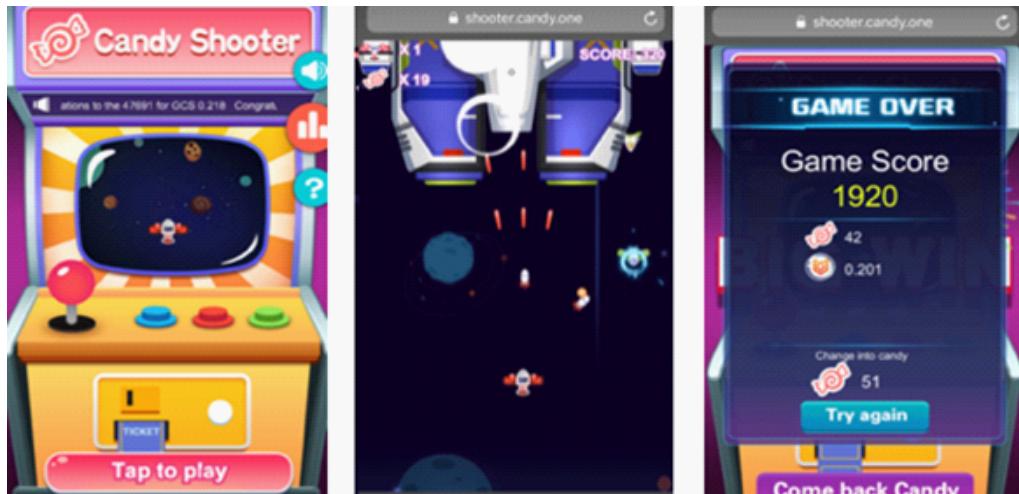


Exhibit 1 Screenshot of *The War of Plane*

### **3.2. Exchange and Inter-conversion of Game Currencies and Assets**

Ethereum ERC-20 tokens are quantitative measurements of objects with identical attributes, such as scores and units. In contrast, the objects of unique qualitative properties also need a form of expression, and Non-fungible Token Standard ERC-721 was therefore introduced on Ethereum blockchain. The popular game *Cryptokitties* is an example of the application of ERC-721 non-fungible tokens. In this game, a kitty is a qualitative token with a unique combination of breed attributes. The kitties with rare attributes are traded at a premium for their scarcity.

At this stage, all the digital objects in games—such as items and user accounts—are tokenized. Game item generation, purchase, trade activities are processed as token exchange events. Under this mechanism, game players can transfer their digital possessions across games, applications, and blockchains.

### **3.3. Key Game Algorithms on Blockchains**

At this stage, key game algorithms such as drop-off, battle results, lotteries and card dealing are executed on blockchains to assure fairness and transparency.

Key algorithms are implemented as smart contracts on blockchains, taking a “treasure box” in games as an example. A treasure box is a contraption where players obtain random items. To program multiple treasure boxes in a scene, a developer may

- create a smart contract that contains the index struct of randomness for the items in all the treasure boxes. The contract is executed once upon the loading of the scene without later consumption of additional computation and data storage. System response is fast and users enjoy the smooth interactive experience. However, the pre-determined indices are not ad-hoc enough when the item generation is highly derivative to the contextual variables of the scene.

- create serial smart contracts of index struct to be executed at every time a treasure box is opened. It imposes heavy a load on the blockchain systems but offers greater flexibility on the item generation.

Blockchain systems are anticipated to be under heavy load when more games and applications run as smart contracts. Algorithms-on-chain are more feasible to the games where time intervals exist between user interactions (such as round-based strategy games). The trade-off of decentralization and system performance remains to be the bottleneck before any fundamental technology breakthrough, such as high-caliber consensus mechanism and direct-acyclic-graph (DAG) infrastructures.

### **3.4. Whole Games on Blockchains**

The final phase is when full game codes run in blockchain environments. Computation, storage, and networking are fully decentralized, and games themselves become smart contracts. Reliable, high-throughput operating environment and light blockchain nodes are necessary for this stage.

At this final stage, Cocos-BCX aims to provide a full set of solutions including:

- light, full blockchain nodes hosted on users' devices
- servicing stacks operating in blockchain environments
- game engine clients as nodes
- a development environment consisting of an engine, IDE, and blockchain interoperable interfaces
- asynchronous consensus task-clusters, validated by the key identifiers of the function object codes among the nodes to assure their integrity
- code execution in trusted virtual machines controlled by the engine. And computation of key smart contracts in a trusted compartmentalized environment
- Smart contracts witnessed by nodes of fast response or high economic relevance

### **3.5. Our Progress**

Cocos-BCX currently supports the development of games with the key features described in *Section 1.3.1 and 1.3.2*. In-game fungible and non-fungible items can be generated, recorded on ledgers and exchanged on the Cocos-BCX Platform. We are now attempting to break through the third phase, where the rules of asset creation are executed on-chain. This is a critical step for the decentralized economy, as the value proposition of digital assets can only be validated by consensus-legitimized supplies.

## 2. System Architecture

### 2.1. Summary

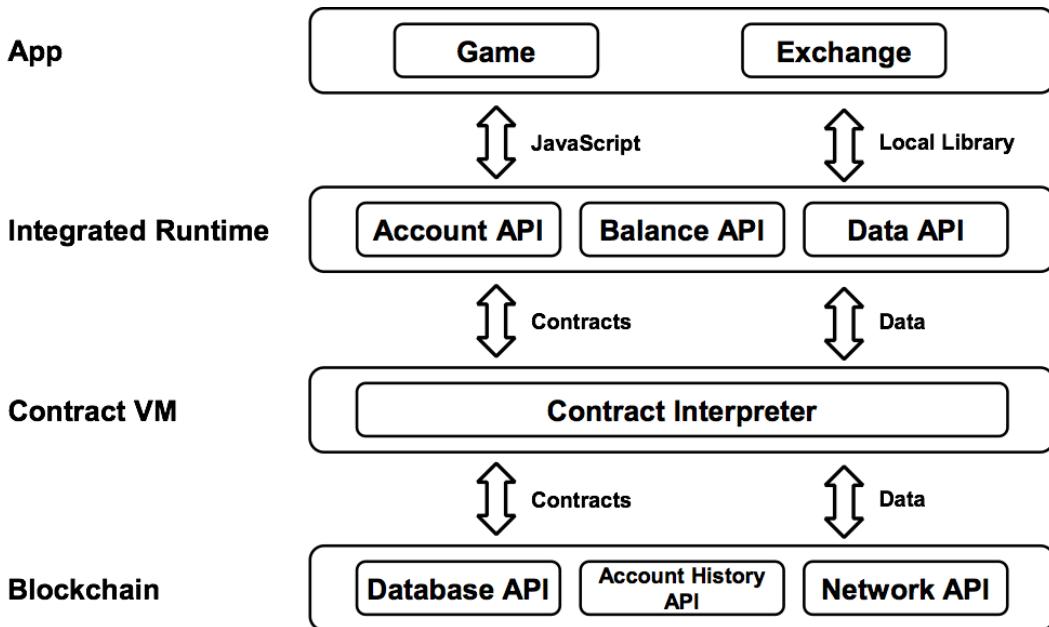


Exhibit 2 Architecture of Cocos-BCX Run-time Environment

The Cocos-BCX Platform provides a series of products and protocols including:

1. CocosChain, a blockchain based on the Graphene™ framework and substantially improved for high-calibre applications, along with essential functionalities including a crypto wallet, a user account system, and a block explorer
2. Operating engine and integrated development environment (“IDE”) for multiple blockchain systems
3. Protocols for universal asset creation, customization, and exchange

The maximum theoretical throughput of CocosChain is at 100,000 transactions per second (“tps”). We observed and tested 3,500 tps with block intervals of 3 seconds in our experimental environment. The performance can be further improved by achieving contract-defined, partitioned consensus, multi-chain scaling, and witness delegation.

Key algorithms of the most games can be migrated on blockchains under this high-response operating environment.

CocosChain is designed to deliver the following features:

1. Interoperable interfaces and multi-system, multi-device adaptability
2. An inter-blockchain exchange gateway for converting fungible and non-fungible tokens of different data structures and standards
3. Improved Delegated Proof-of-Stake (DPoS) based consensus mechanism
4. Syntax support to compartmentalized consensus processing
5. Improved data transmission, and high-performance virtual machine solution
6. Delegate-type transaction
7. Smart contracts executable across blocks
8. Smart contracts support to key game functions such as timer, standby and keep-alive
9. Trustable on-chain randomness generation

Our IDE is a visual, script-based and data-oriented content production platform, by which developers can directly deploy the games and applications on multiple blockchain systems.

## **2.2. Run-time Environment with Interoperable Interfaces and Multi-System Compatibility**

### **2.2.1. Integrated Development and Operating System**

Cocos-BCX runtime has (1) full blockchain operating interfaces, (2) downward opacity inheritance, (3) encapsulated atomic operations, and (4) compatibility to multiple operating systems and/or device platforms including Android, iOS, PC Web, and HTML5.

We will integrate Cocos-BCX runtime with our application SDK to make blockchain operation transparent and structured. With our IDE, developers can deploy games via the SDK and developers will not have to cope with the complexity of different blockchain systems.

### **2.2.2. Interoperable Interfaces**

The data exchange on CocosChain is conducted through JavaScript interfaces and local DLL.

CocosChain can be accessed via WebSocket and HTTP. Database activities such as user account generation, asset exchange and game data editing are carried out through Database APIs and AccountHistory APIs (Exhibit 2). To increase compatibility and customizability, our system does not parse encapsulated data. Game developers may structure their on-chain data at greater flexibility, and choose to parse the data by client software or Platform add-ons.

CocosChain has already developed the data interfaces such as token inquiry and transfer, which will be included in the first stage of our product release.

### **2.3. Inter-Blockchain Token Conversion and Exchange Gateway**

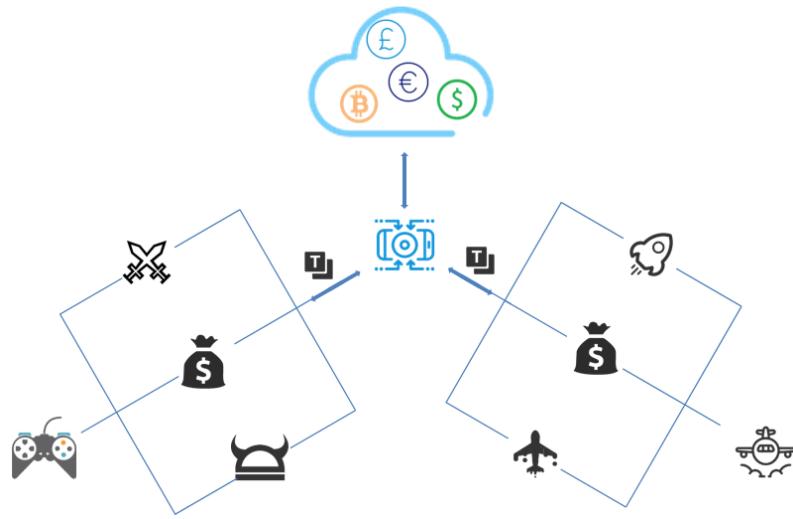


Exhibit 3 CocosChain Gateway

A gateway for universal token exchange is under development to enable the circulation of fungible and non-fungible tokens among different games and blockchains.

### 2.3.1. Exchange of Fungible Game Tokens

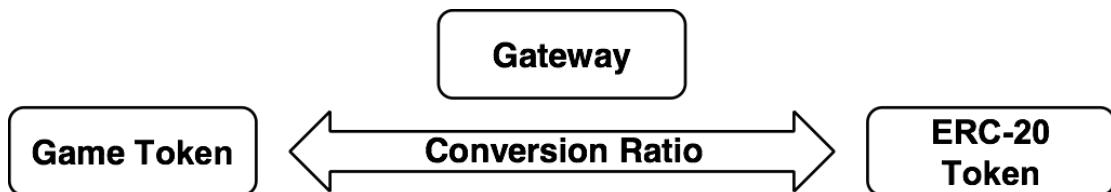


Exhibit 4 Fungible Game Token to ERC-20 Token

The gateway supports the two-way conversion and exchange of fungible game tokens to ERC-20 tokens among blockchains or consortium blockchains.

### 2.3.2. Conversion and Exchange of Non-fungible Game Tokens

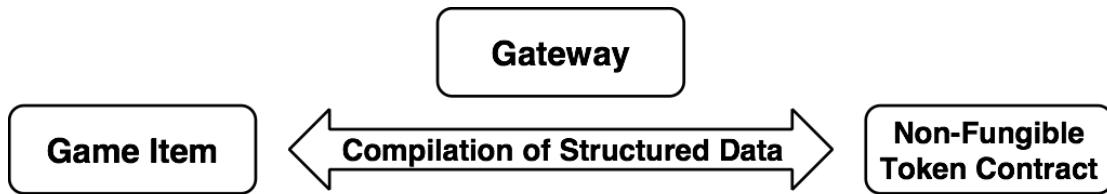


Exhibit 5 Game Items to Non-Fungible Token Smart Contracts

Cocox-BCX gateway will support non-fungible token smart contracts such as ERC-721 and ERC-875. The conversion of game items to non-fungible token contracts is carried out by a compiler. Structured data are translated for the two-way conversion and exchange of tokenized items.

Compared to ERC-721 and its modifications ERC-841 and ERC-821, ERC-875 is a simplified standard of non-fungible tokens, defining functions including name, symbol, balanceOf, transfer, transferFrom, totalSupply, ownerOf and trade. We expect ERC-875 to gain more traction and have closely followed its development.

## 2.4. CocosChain: Improvement and Extension to the Existing Blockchains

### 2.4.1. Structure of Improved Non-homogeneous Assets

Non-homogeneous digital assets are a type of digital assets applied to distributed ledger network with unique assets instance. Optimized structure of non-homogeneous digital assets facilitate more flexible service to blockchain gaming.

Project BCX redesigns data structure and adds custom data storage to contain possible game data and extended content. Meanwhile, consensus, witness, block generation and other crucial process should also be adjusted to map onto new data structure. Cocos-BCX item data keeps full record in block data in the case of generation and attribute change. In the common transaction and transfer, only hash pointer will be recorded to prevent block size from growing too fast from accumulated transactions.

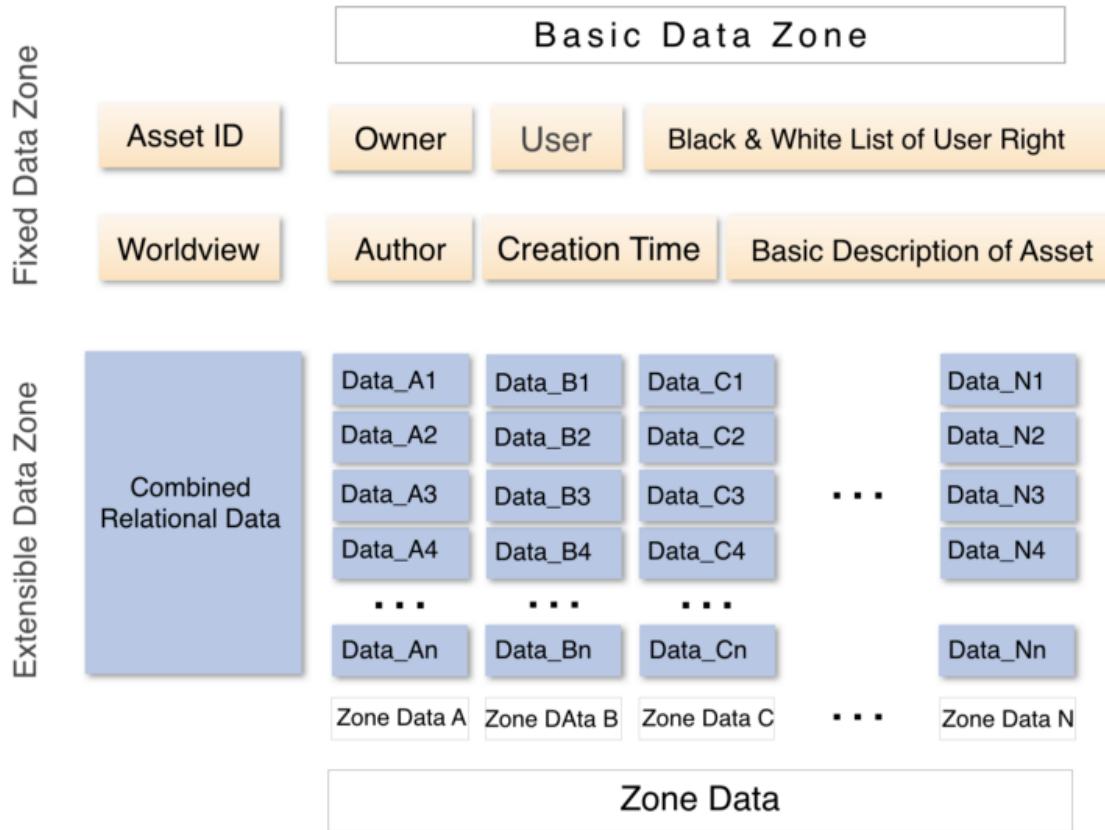


Exhibit 6 Relationship Between Each Part of Non-homogeneous Assets And Data Structure

Blockchain divides non-homogeneous digital assets data structure into fixed data zone and extensible data zone.

The former stores the basic information of non-homogeneous digital assets, including assets ID, worldview statement and basic data field. Assets ID is the unique identification of assets instance in distributed ledger account, and the unique proof to visit, check and modify the assets. Worldview statement includes worldview ID, supported game and world, and currencies supporting assets circulation in the network. Basic data field consists of assets owners, producers, production time and assets basic attributes, such as prop strength.

Extensible data zone supports attribute extension of non-homogeneous digital assets, and stores specific transaction data under supported worldview, including zone data and

data with combination relationship. Different games or other business entities have exclusive zone identity and data area in terms of zone data, which is isolated from each other. Zone data is stored in the form of key-value pairs of zone identity and data, representing the data of specific games, such as Attack, Defense and Durability. Extensible data zone stores data with combination relations, describing the combined, nested and affiliated relationship of assets.

Compared with other non-homogeneous digital assets standards in Ethereum, Cocos BCX-NHAS-1808 has many advantages, such as separated storage of assets and contracts, extensible and customized data zone and compatibility with other non-homogeneous assets standards.

Asset Features	ERC-721	ERC-1155	ERC-998	BCX-NHAS-1808
Uniqueness	Different contract assets	Different contract assets	Different contract assets	Different contract assets
Extensible Data	Support custom data types	Support multiple custom data types	Support custom data types	Support multi-extensible custom data zone
Nested Combination	No native nest design	No native nest design	Support assets nest combination and other linkage modes	Support assets nested portfolio and other linkage modes
Authority Control	The same authority design with homogeneous assets	White list controls the assets visit authority	The same authority design with homogeneous assets	Extensible zone data controls assets visit authority
Relationship With Contract	Data storage in contract database	Data storage in contract database	Data storage in contract database	Separation of assets data and contracts in chain network

Exhibit 7 Comparison of the Existing Non-homogeneous Digital Assets Standards

#### 2.4.2. Extended Block Size

The block size on CocosChain is extended. The general block size of 2 million bytes for general Graphene™ based systems is not enough for on-chain key algorithms and whole games.

#### 2.4.3. On-chain Custom Data Structure

Existing blockchains are not designed for games fully operate fully on-chain. Besides

the block size issue discussed in section 2.4.1, these systems only support simple data structures, and only a few use cases such as ledger recording can be achieved today. Moreover, contract interpreters are not extendable, further limiting the use of complex data structures.

We enable custom data structures and adjusted the consensus, witness and block production mechanisms accordingly.

On CocosChain, transaction logs, game files, and rules can be queried with block numbers and entry IDs. User data inputs can be retrieved, restored and traced from chain records.

The attributes of non-fungible tokens are recorded in full on our blockchain when they are generated and modified. Cocos-BCX only logs hash pointers for regular transactions to minimize our chain size.

#### **2.4.4. Improved DPoS Consensus Mechanism**

The consensus layer of CocosChain is based on an improved DPoS consensus algorithm.

The default block interval of DPoS based systems is 5 seconds, and common practices use 3 seconds to accelerate network broadcasting and improve overall throughputs. In the case when the delegated witness does not function at the required time slots, a new witness is elected to produce the block at the next time slot.

On CocosChain, 11 to 21 Active Witnesses (“AWs”) are elected by the Platform token holders. Each AW has the same probability of block production. For better system security, stability and fairness, our Platform initially sets 12 hours or less to re-elect the witnesses, compared to 24 hours on general Graphene™ based blockchains.

	PoW	PoS	DPoS
High Throughput	No	Yes	Yes
Speedy Confirmation	No	No	Yes
Low Resource Consumption	No	Yes	Yes
Community Incentive	No	Yes	Yes

Exhibit 8 Comparison of Popular Consensus Mechanisms

Following the principles of DPoS, CocosChain delegates witnesses and time slots to predict block producers and production time. The number of AWs on the main chain is always more than the forks. As a result, the block height of the main chain is always taller than the forks. Universal voting is also used to prevent concentration of witnesses and to enhance network security.

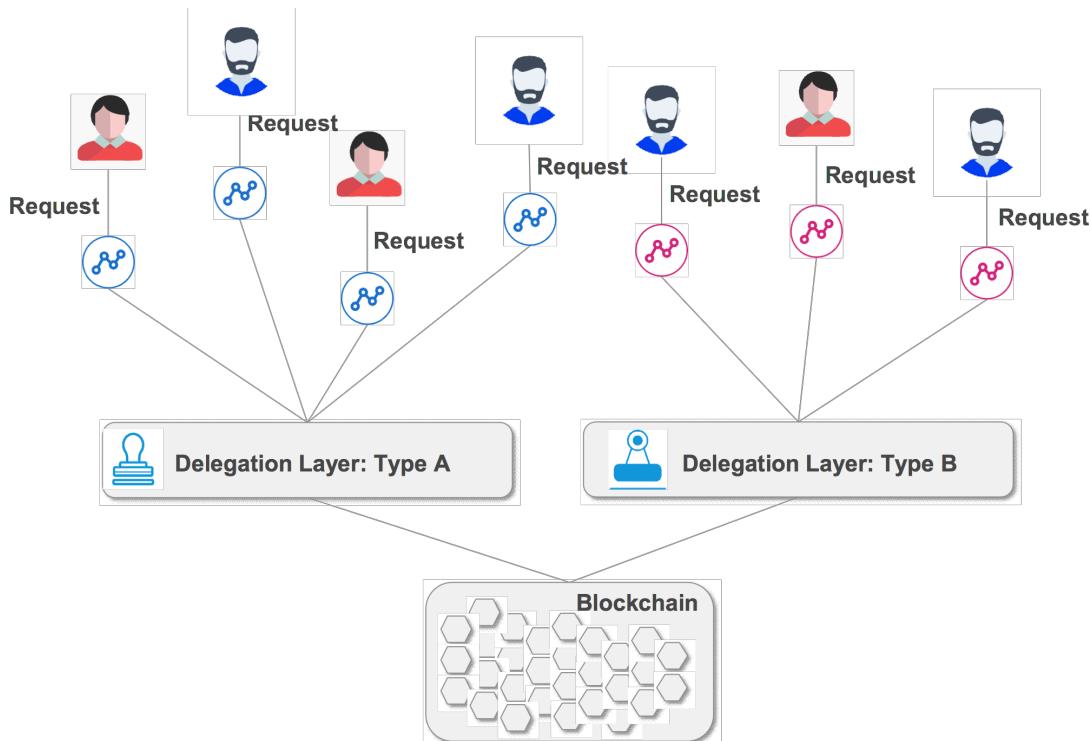


Exhibit 9 Partitioned Delegation Consensus

#### **2.4.5. System Cryptography**

We use elliptic-curve cryptography (ECC) on our Platform. ECC is an approach to public-key cryptography based on the algebraic structure of elliptic curves over finite fields. Attempts to breach the encryption without keys are impractical because of the massive time required.

#### **2.4.6. Low Risk of Forking**

Under the Proof-of-Work (“PoW”) mechanism of Bitcoin and Ethereum, forking occurs when miners simultaneously produce two blocks. The shorter blockchain is abandoned by the “longest chain rule” after 6 blocks. However, if a certain number of nodes disagree to surrender the short chain, a soft fork is triggered and exists until the upgrade of blockchain software. In the case that a group of miners refuse to update their software clients, a hard fork takes place and two separate blockchains are formed.

#### **2.4.7. Merges of Multi-Operation to Ensure Atomicity**

Prop producing for blockchain games is atomic. The prop producers create props based on the demands, materials and assets submitted by the players. Upon completion, the props are transferred to the players. This process engages a series of operations (OP), including generation of digital assets, setting of prop properties, and transfer of asset ownership to users. To ensure the consistency in the operational results, we combine the operations into one transaction, that is, one atomic operation. In this case, all the operations inside the transaction will succeed or fail at the same time.

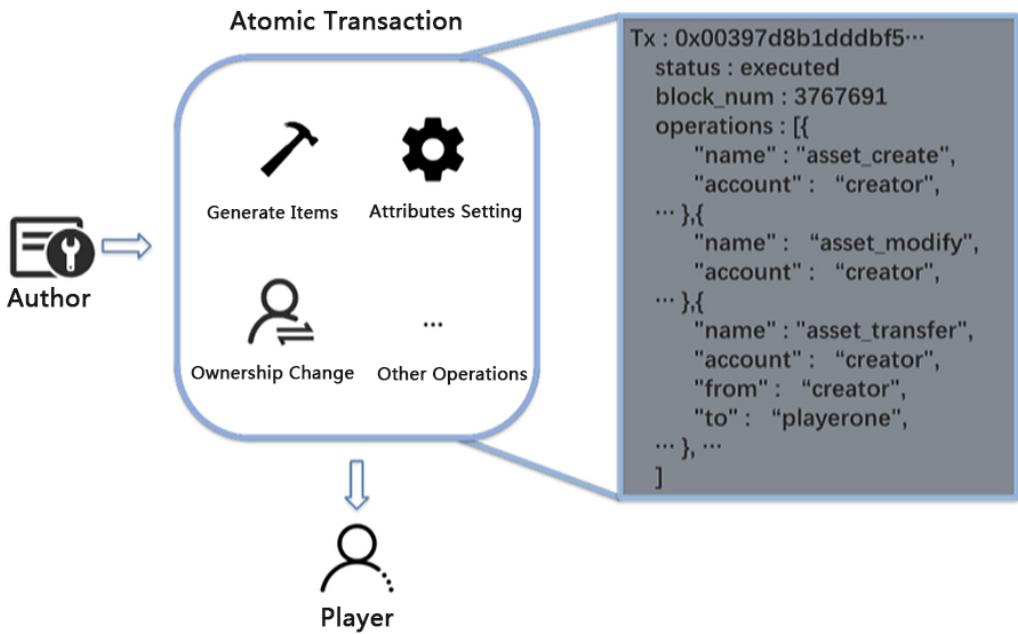


Exhibit 10 Atomic Merges of Operation

Another application of atomic combination is dis-intermediated assets exchange of Project BCX, aimed to help seller gain more and buyers consume less. The dis-intermediated circulation platform does not store data about users' assets but act as a medium for marrying node-to-node requests. Game manufacturers can flexibly design their own data structures for game assets. The exchangeable content goes beyond homogeneous assets within games to cover props, equipment, game data and other non-homogeneous assets. When users make a request for sale on the circulation platform, the related game assets (currency or props) shall be locked and cannot be used until the request is cancelled. The request contains the mainchain ID of the seller and the content of the assets to be sold. When the request is fulfilled, the system shall automatically change the assets ownership and transfer to the seller the assets that the buyer has paid. By then, the whole circulation request is completed.

When asset exchange begins, the sale or purchase shall be submitted to the circulation platform in the form of a request. The transfer of assets and the change of ownership shall be deemed as a one-off indivisible operation. In other words, the behaviors of both sides shall be recognized by consensus. If one party's change in assets is not recognized by the mainchain block, the whole transaction shall be rolled back. That is, the change of asset ownership or transfer of assets throughout the exchange shall be

packed inside one transaction. The state of the two acts shall be consistent. When the transaction is completed normally, a unique transaction ID shall be available for checking on chain.

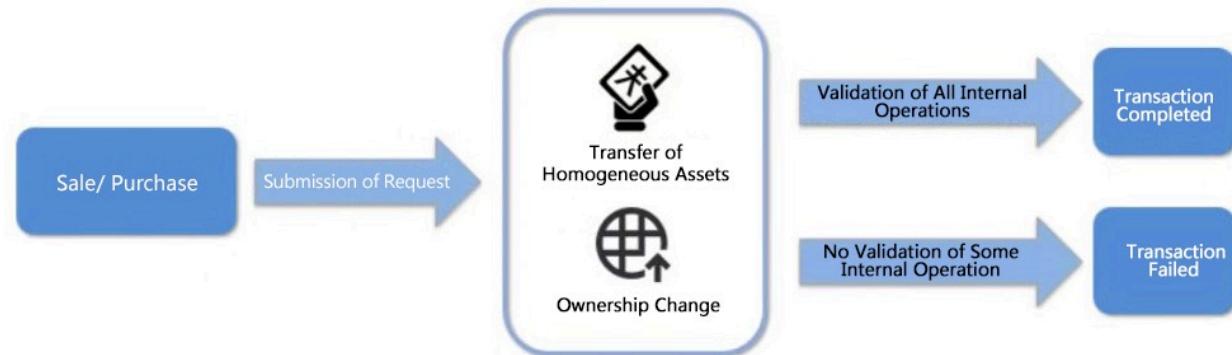


Exhibit 11 Determining State of Atomic Transaction

#### 2.4.8. Multi-Chain Interoperability

The Platform will offer multi-chain interoperability in addition to our token and contract conversion gateway. For instance, Cocos-BCX will support the storage of smart contracts and data on IPFS in the next phase of development.

#### 2.5. CocosChain: High-Performance Throughput and Virtual Machine

Based on DPoS, CocosChain is designed at a theoretical throughput of 100,000 TPS, and able to meet the system requirements for multi-player online games.

In practice, the data transmission in multi-player online games is massive. The peak concurrent users reached 600,000 for *DNF* and 14.2 million on Steam Platform. No distributed system is able to stand the load if all the data transactions are unanimously agreed. CocosChain adopts Delegated Templates that designate witnesses to work for contextually correlated, instead of all, games. Under this model, data transactions and consensus of different games are conducted asynchronously. And data validation is

completed by on-chain database services.

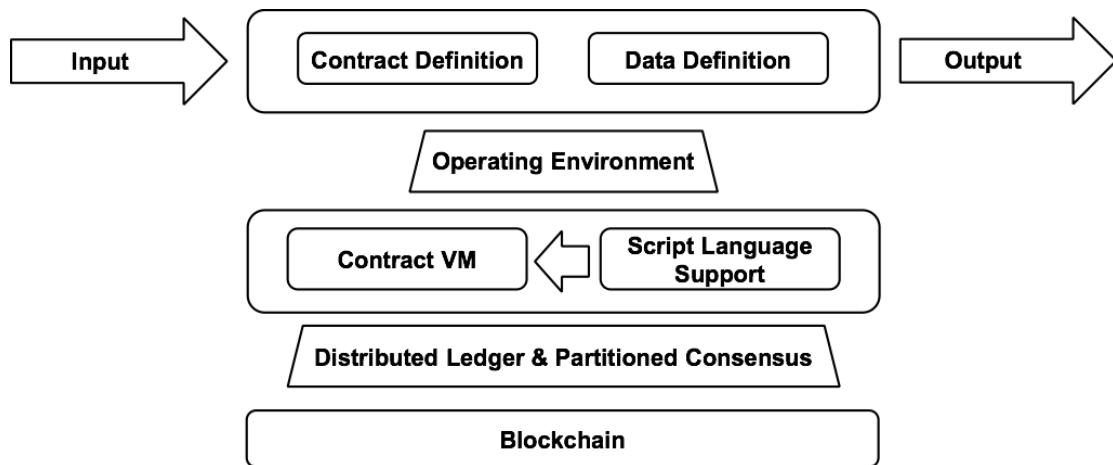


Exhibit 12 Architecture of CocosChain Smart Contract

The smart contracts on CocosChain are also executed under DPoS. Smart contracts are self-executing codes that carry out predetermined tasks under compiler rules. Smart contracts can be used to input, store, and output information. The codes of smart contracts are recorded on every node, and outcomes of execution are witnessed by the blockchains and confirmed by system consensus.

We provide a virtual machine for programming and executing smart contracts using LUA, the same language used for our game SDK and APIs. With improved operating efficiency and interoperable interfaces, CocosChain virtual machine will substantially extend the use cases of smart contracts from monetary transaction to the creation of game rules, characters, scenarios, and even maps.

## 2.6. Use Cases, Events and Task-Types

### 2.6.1. Asset Exchange

On CocosChain, the listing and bidding of assets are structured as a multi-step atomic operation backed by system functions. Transfers of game items and payments are

logged simultaneously. Transactions are rolled back if any transfer or payment events is not confirmed on the chain.

The sale of item(s) is not conducted by the sell function, but by sending the sell request to an Over-the-Counter token exchange. When a listing is effective, the Platform records the orderObject and the seller ID, and locks the item in the game. When a bidding is requested, a peer-to-peer exchange of the item and payment is executed by the smart contracts. Transaction IDs are generated on the blockchain upon the completion of the trades. Our system supports the exchange of tokenized virtual currencies, items and user data without the involvement of intermediaries.



Exhibit 13 Exchange Process of Tokenized Items

### 2.6.2. Asset Customization—the Smiths

On our Platform, Smiths are the accounts with authentication to produce and modify game items using smart contracts. Users give out tokens to Smiths, and Smiths return modified tokens to users. The two transactions together are processed as a single trade. Both transactions are recorded on-chain to ensure data integrity, fairness and security. Smiths are authorized, governed and managed by developers, players, and communities under the same contextual narratives, and can be independent to specific games.

Content providers may grant permissions to the Smiths to generate items within certain contextual boundaries. For example, a sword in *Final Fantasy II* may be forged by a Smith and traded to *Final Fantasy IV* with proper authorization from the games' copyright owner Square Enix.

### 2.6.3. Crypto Wallet and Block Explorer

Cocos-BCX offers a crypto wallet for the users to store game tokens and ERC-20 Tokens. Our wallet will be secured by finance-level encryption methodologies and runs on mainstream operating systems including Andriod, iOS and Windows.

A block explorer with query and redirection functions is also provided and integrated with the crypto wallet. Users can monitor token transactions and atomic operations on CocosChain.

### 2.6.4. Item (Token) Exchange Procedure

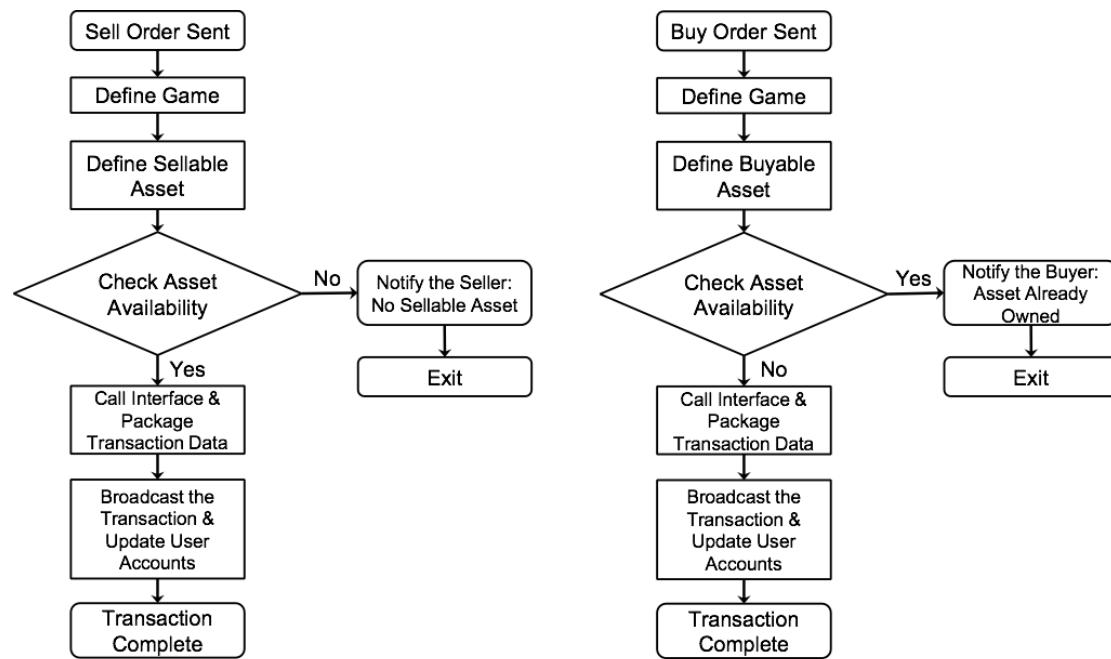


Exhibit 14 Item (Token) Exchange Procedure

### 2.6.5. Contextual Circulation of Game Assets

Many game items are used for general purposes. A piece of bread, for example, functions similarly in many games. To make the games more fun and to reduce the

redundancy of asset production, we introduce the idea of contextual circulation. An item can be traded into, and used in other games under similar contextual narratives, such as storylines, worldview and player groups. In our view, the value of game items are determined by the experiences they provide to the players. The context connects the value proposition of game items and sets economic coordinates, based on which users may evaluate, compare, and trade. And this is the ultimate purpose Cocos-BCX Platform serves.

As illustrated in Exhibit 11, for example, the power engine obtained from Game B can be used for the transport machinery in Game A and Game C.

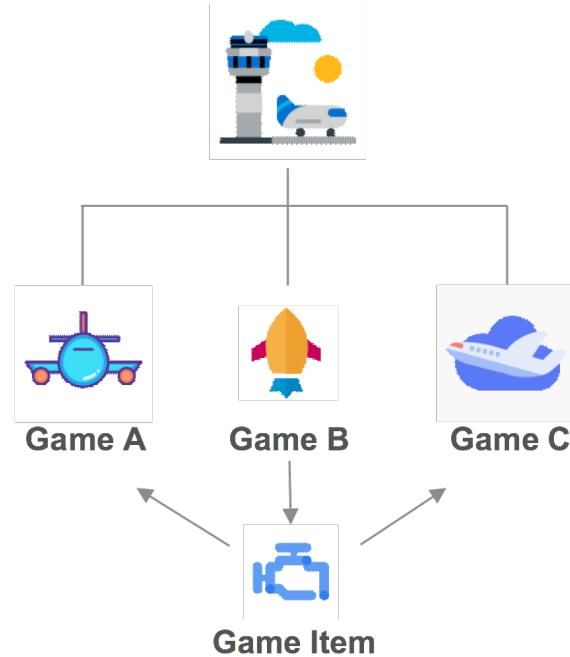


Exhibit 15 Contextual Circulation of Game Items

Another example is the *Final Fantasy* games produced by Square Enix. The game franchise has spawned 15 main series and numerous spin-offs and metaseries. The storylines are contextually connected, allowing the users to judge and trade on the relative value of items and characters across the games.

## **2.6.6. Player Autonomy and Asset Security**

The node toolkit of CocosChain is made public for developers, players and other third-parties to participate in the node election. The Platform also encourages the participants to establish narrative context, based on which they can form consensus committee and eventually launch narrative-dedicated blockchains.

All the information on blockchains is transparent, and accounts of high worth are vulnerable to hacking and cyber-attacks. Cocos-BCX provides the following strategies and mechanisms to ensure the security of the accounts on the Platform:

- Role-based permission to manage account assets
- Atomic operation procedure on all transactions
- Extendable multi-step identity verification such as auxiliary password and CAPTCHA.

## **2.6.7. Visual Smart Contract Editor**

Cocos-BCX visual editor is a key component for various level of developers to edit smart contracts. Advanced features are also available for programmers with proficiency in script languages.

Using the software *Click Wizard* as an example, a visual IDE enables developers to code in an interactive environment.

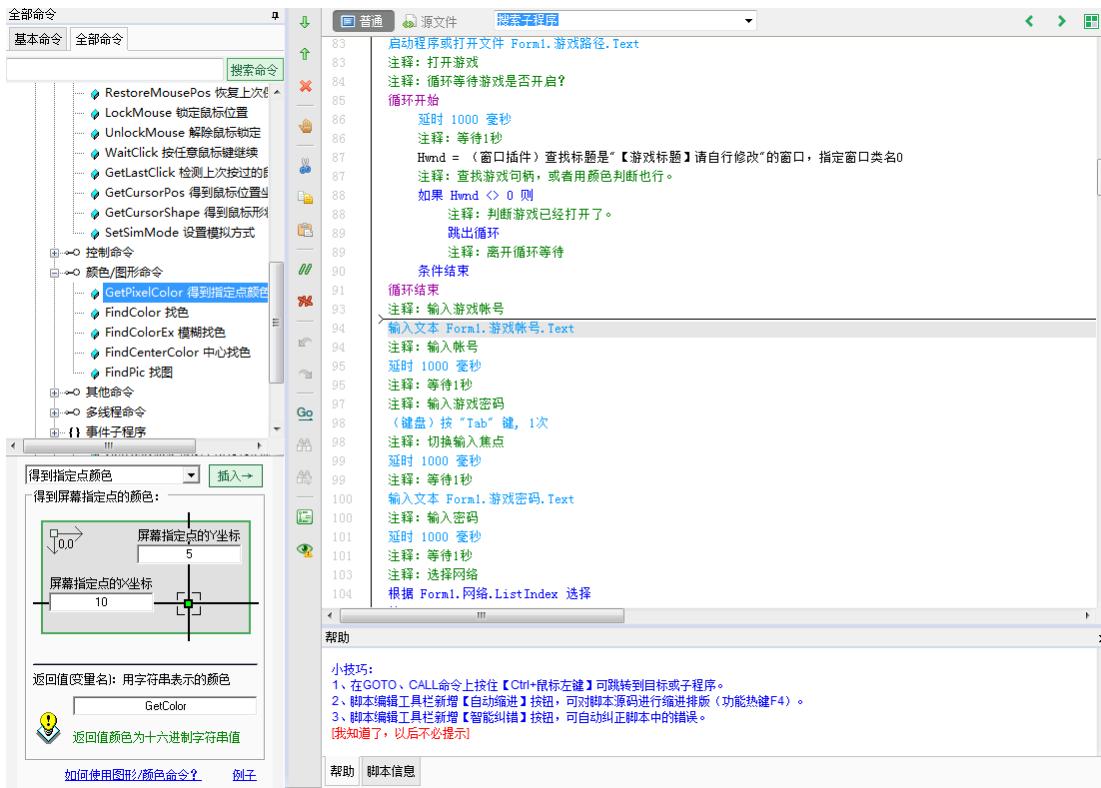


Exhibit 16 Visual Editor of Click Wizard

## 2.7. Further Enhancement to the Existing Blockchains for Gaming

Several key issues are to be resolved before game algorithms can be migrated on blockchains:

- The heavy load to the nodes on data transmission and storage. Smart contracts can only run on full nodes. And it is unpractical for the users to host nodes that require massive system resources, networking, and time to synchronize.
- Algorithm codes exceeding the block size. The sizes of algorithm smart contracts may be larger than system block size, especially when game logics are complicated.
- Inter-block smart contract execution. Game algorithms may run continually at time durations beyond block intervals.
- Feasibility of critical features such as on-chain timer and keep-alive. Timer and keep-alive, along with their sync security requirements, are necessary to execute

scheduled or conditioned smart contracts. No solution is available for these building-blocks today.

- System latency. Events are responded and confirmed by block production with a time interval, while most games require prompt interactions.

Accordingly, CocosChain proposes these preliminary designs and features that substantially improve the existing blockchains:

- Reduced data volume and sync time on nodes
- Syntax support to compartmentalized consensus processing
- Continual execution of smart contracts
- Delegate-type transaction and randomness generation
- On-chain timer
- Minimum latency to event execution

### **2.7.1. Light Nodes**

A Light Node is an operating environment with interoperable interfaces to CocosChain. Light nodes only synchronize the necessary components of smart contracts and environmental data instead of full blocks.

Games on CocosChain are smart contracts running on local light nodes. Consensus-based and non-consensus-based tasks are separately marked up, compartmentalized, and processed (Please refer to section 2.8.2 Syntax Support to Compartmentalized Consensus Processing) by different groups of nodes. As illustrated in Exhibit 13, data consistency and integrity under this asynchronous architecture can be secured at the same level as on the blockchains. Moreover, light nodes are validated by the operating environment and data inputs (i.e. a trustable environment validation), compared to the process and result validation on the existing blockchains. The design of light nodes enables smart contracts of various size to run at high efficiency and low latency.

## 2.7.2. Syntax Support to Compartmentalized Consensus Processing

We intend to support compartmentalized consensus processing in the programming syntax. By marking up the keywords in the smart contracts, the system interpreter identifies, extracts and broadcasts the task types that require consensus to the nodes.

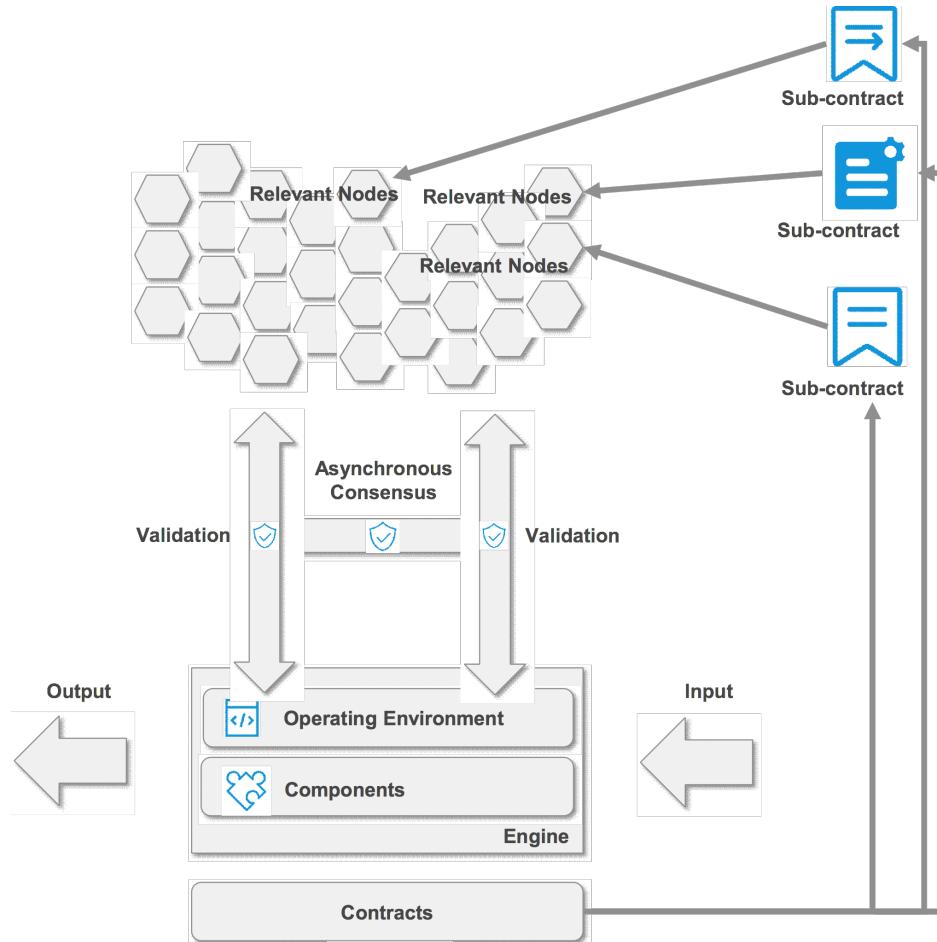


Exhibit 17 Light Nodes and Asynchronous Smart Contract Execution

The execution of smart contracts is an asynchronous procedure combining the local, non-consensus-based algorithms and on-chain, consensus-based tasks. The consensus-based tasks of the smart contracts are extracted as independently executable sub-contracts.

### **2.7.3. Continual Execution of Smart Contracts**

The proposed design of Light Node makes it possible to run whole games as smart contracts continually in a validated environment, unrestricted from block intervals and sizes.

### **2.7.4. Session**

To help developers establish sessions on CocosChain, we also provide an interface to create authorized user lists in public datasets. Users in the same sessions are permitted to push tasks to their peers.

### **2.7.5. Concurrent Task Processing**

CocosChain prioritizes the consensus result pool, selects and packages the completed, senior tasks, and broadcast them to the chain. We made this variation from the popular, serial block packaging methods to avoid system failure caused by endless looping or infinite recursion.

As illustrated in Exhibit 14, the senior consensus tasks are marked up, extracted, and broadcasted to the nodes for execution. The block producers receive and pool the results from the nodes. When the number of results reaches a certain threshold, the block producers confirm these tasks and write them onto the block cache.

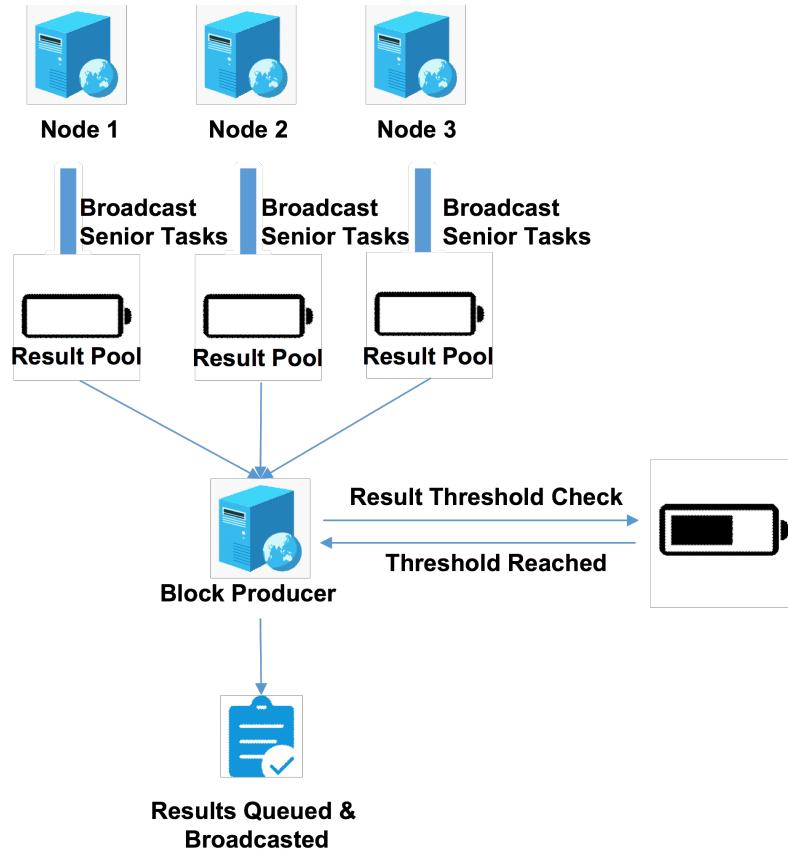


Exhibit 18 Concurrent Task Processing

### 2.7.6. Delegate-Type Transaction and Randomness Generation

On CocosChain, delegated-type transactions are mainly designed for the cases that yield uncertain, different results on different nodes, such as random number generation. To ensure data integrity and security, however, this transaction type is only applied to requests not involving user data. The nodes and node-clusters required for the consensus can be marked in the smart contracts. When the number of task equals to one, a node (or a designated node) is assigned to process the task. When the number of tasks is larger than one, the nodes in a cluster are assigned to the tasks.

With delegate-type transactions, the generation of random numbers on-chain is made possible. Furthermore, users may request the trusted nodes to maintain the public data of the smart contracts, and developers may implement function callbacks inside the

smart contracts.

### 2.7.7. On-Chain Timer

To enable connection detection and session establishment, Cocos-BCX proposes the design of an on-chain timer.

Time synchronization is the precondition of implementing a timer. In the typical computer systems, time is usually set from external, authentic sources. But by the untrusting nature of blockchain mechanism, time can only be set within the systems. CocosChain uses the timestamps of blocks to set time. Synchronization takes place on the nodes when a block is received. System time is reset at every block broadcasting. As a result, an on-chain timer can be materialized. It has a minimal time span equal to the block interval. Since standard time is used for timestamps, the timer is not affected by geographical and networking factors.

### 2.7.8. Low Latency

Existing blockchains confirm task results after the nodes receive, execute, validate and record the data on the blocks. A task is pended upon submission and executed in the next block production cycle, resulting in system latency.

Our asynchronous processing mechanism instantly broadcasts the task and returns its hash value upon the reception of a transaction request, offering the users immediate response.

Users can track task with its hash values, and be updated by the live push of task status. We are inspired by the hash tracing feature on Ethereum, and add the dynamic status push to improve the system response efficiency.

Moreover, CocosChain adopts a partitioned consensus, a design that designates nodes to process certain types of tasks or smart contracts.

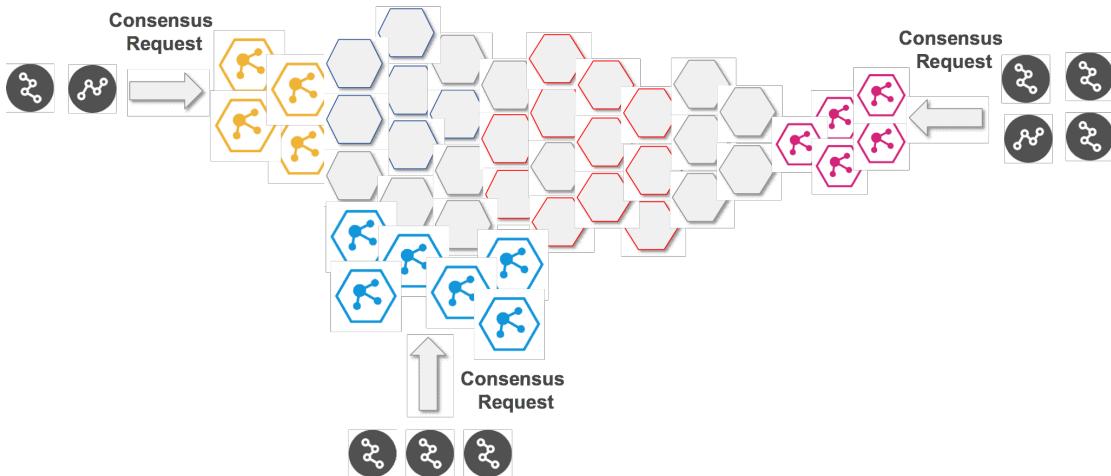


Exhibit 19 Partitioned Consensus Design of CocosChain

Partitioned consensus mechanism distributes system resources efficiently by matching the nodes of different specialities to different task types. For example, floating point processing is assigned to the computing nodes, and structured data processing is assigned to the storage nodes.

### 2.7.9. On-Chain, Trustable Randomness

On-chain randomness is essential to gaming. The challenge is to generate unpredictable results using smart contracts that are open-source. This generation process can only be initiated by inputs of random noises from the nodes. Other nodes, however, may not be able to verify the original noises and cannot complete the consensus.

Cocos-BCX proposes two solutions to this issue:

1. Generate and maintain one or multiple pools of random numbers in the on-chain dynamic datasets, where the block producers package the random results in the encrypted data field with a closed-source encryption procedure. All the nodes have

the same randomness pools, and the numbers are packaged in a pipeline. The output of random numbers is in the order of first-in-first-out.

Applications call the random numbers from the pool. The process is secured since (1) any I/O action irreversibly changes the pool, (2) input of the numbers is done by the closed-source dynamic encryption library, and (3) the generator is unable to predict the addresses and users of the random numbers.

2. Delegate a trusted node to generate random numbers and return the results. This method requires (1) the delegated nodes are validated, trusted execution environment, (2) the delegated nodes use dynamic encryption library to generate and publish the random number(s), and (3) the delegated nodes have to be verified and identified by the requesting party with Zero-Knowledge Proof or other cryptographic methods.

### **3. Token Economics**

#### **3.1. Gaming Industry, to Be Decentralized and Improved**

General users do not favor a “blockchain game” by its underlying technology or name. However, the decentralized economic nature of blockchain games will change user behavior and significantly grow the gaming industry.

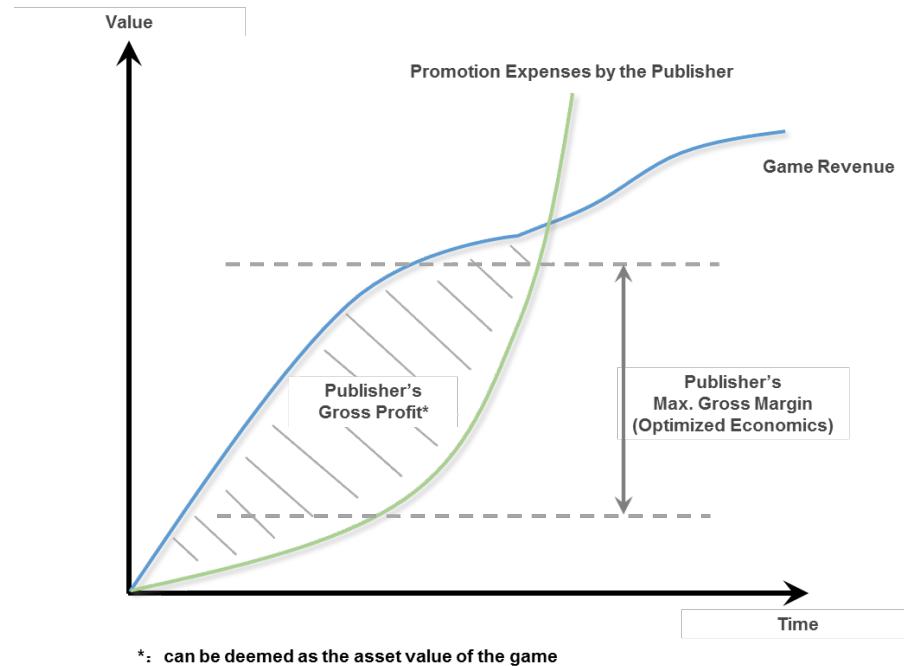
Today, gaming is a services based industry where players spend their money, time, and behavioral data in exchange for digital entertainment experience. In contrast, decentralized infrastructures advance the digital experience into asset-like subject by validating its economic value—scarcity of supply and ownership. As a result, users no longer pay for transitory services, but trade the title and rights of their digital subjects to exchange the underlying experience. We believe the transition from “pay-for-service” to “trade-of-assets” will significantly change the market behavior and dynamics of the gaming industry. To further explain:

1. Digital content as assets. Games and in-game digital content can both be deemed as assets on blockchains because of (1) technologically validated scarcity of supply. The supply of content on blockchains can be limited, assuming economic value to the content, and (2) technologically validated, transferrable ownership. The titles of the content are irreversibly recorded, and can be transferred under the proof of their tokens.
2. Asset pricing model. Under the current pay-for-service model, conflict of interest exists among developers, publishers and users, and significantly weakens the benefits of each party. For instance, to maximize the investment-output efficiency of web traffic, a Chinese publisher often heavily promotes a game for less than a month after launch and shifts to other games. With a short window to make profit, the developer start charging the users after several hours of game time. Users are generally unhappy about being pushed, but have to pay and play. This dynamic

causes the parties to speculate on short-term interest and therefore limits the potential life-time value of the games, although we agree that not all the game genres are designed for the long-term.

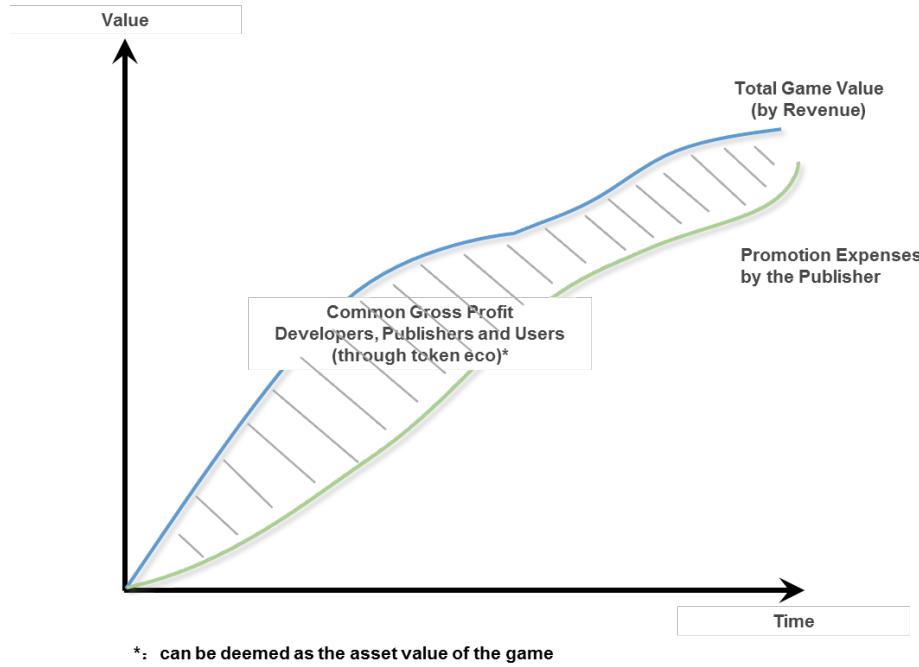
The publishers are usually blamed for impairing user experience and squeezing the profit of developers. Various technological and commercial efforts—such as HTML5 games and independent publishing—were tested to bypass the intermediary, but the industry landscape remains unchanged.

We believe the problem stems from the fundamental interest misalignment among developers, publishers and users. Digital games are creative businesses with significant uncertainty, and developers hope to maximize the overall value of a proven game. Publishers monetize on web traffic, prioritize time-justified profitability, and care less on the total life-time value of a game. Users demand game experience at reasonable costs of their money, time and behavioral data. It appears that developers and users share the common interest and de-intermediary improves the industry efficiency. However it is practically unrealistic for the digital content to reach the users without professional promotion. The radical conflict remains. And games, if treated as assets, are under a pricing framework with radical fallacies.



[Exhibit 20 Pay-for-Service Asset Pricing Model]

In blockchain environments, the asset pricing model may shift based on token economics. By possession of the game tokens, developers, publishers and users share the common, long-term interest. Their action tends to serve the objective of maximizing the game value. Furthermore, the liquidity of token transfer allows intermediaries to promote games with flexibility. In theory, a game may be promoted by various publishers on a continual basis. Any individual or institutional intermediary may join or exit the promotion base on its own economics. The industry interest relatively aligns and the maximum value of games may be achieved.



[Exhibit 21 Trade-of-Assets Asset Pricing Model]

These trends also apply to general digital asset classes beyond games, which we will support in the next phases of our project.

### 3.2. Design Principles of Cocos-BCX Economy

The underlying value of our platform economy is the digital assets created by the developers using Cocos-BCX infrastructures and features. The scale of the economy continues to grow as more assets are created.

Our objective is to advance the gaming industry by solving the problems in the real world, where behavior and psychology are complex and imperfect. The economic rules on Cocos-BCX are designed to be the minimal viable tools to offer the users at maximal flexibility. Meanwhile, we aim to incorporate the existing values of the global developer community to be our governance principles:

1. Self-sustaining: the project is sustainable with a solid business model.

2. Autonomy: to eventually form a consensus-based community, where key decisions are made by votes to the maximum level of practicality.
3. Self-evolving: challenges to the community shall be encouraged and rewarded to ensure our long-term competitiveness.

### **3.3. Token Circulation**

COCOS tokens are introduced and assumed with three objectives: (1) medium of exchange, (2) proof of stake for delegated consensus mechanism, and (3) proof of participation in and governance on community activities such as bounty tasks.

We initially propose the supply of 100,000,000,000 (one hundred billion) COCOS token, with the minimal unit of  $10^{-18}$  COCOS, under ERC-20 standard on the Ethereum platform. The number of total supply remains constant. After the launch of CocosChain, the token holders can convert their ERC-20 COCOS to native COCOS under the ratio of 1:1.

#### **3.3.1. Distribution and Acquisition of COCOS Token**

COCOS tokens can be acquired by the participants in the eco-system through:

1. Asset creation, based on (1) production value. Developers are rewarded for the games and in-game items they produce. The incentives are positively correlated with the effective aggregate value of their assets, and negatively correlated with the life duration and total asset value of the Platform. The amount of value-production based incentives are capped, and (2) exchange value. Developers are rewarded if the assets they produce are traded frequently. The incentives are positively correlated to the total trading value of specific assets. The amount of value-exchange based incentives is unlimited.
2. Contribution to the Platform community. We reward the participants who contribute

- to our community tasks, such as code submission and bug reporting, by offering tokens or other assets. These rewards are allocated from Cocos Foundation with no limit in amount.
3. Trading. Users may sell the in-game items for COCOS tokens. The supply and value of in-game items are determined by the game developers and the market participants.
  4. User interaction. COCOS tokens are distributed to the users who conduct effective behaviors such as account generation, trial use of new games, etc. The incentives are positively correlated to user activities, and negatively correlated with the size of Cocos-BCX user base and life duration of the Platform. The amount of user-interaction based incentives is capped.
  5. Reward to consensus workload and block production on CocosChain.

### **3.3.2. Use and Consumption of COCOS Token**

COCOS tokens can be used in the cases including but unlimited to:

1. Payment to the suppliers for the exchange of game development tools, features, and materials (such as the design of characters, user acquisition, etc.).
2. Payment to the trading counterparties
3. Rewards for bounty tasks

Cocos-BCX charges certain COCOS tokens on every circulation event and uses them for the development of the Platform.

### **3.3.3. COCOS Token, the Native Pricing Medium of Digital Assets**

COCOS token has the potential to be the native pricing medium for general digital assets:

1. CocosChain supports the general exchange of fungible and non-fungible tokens

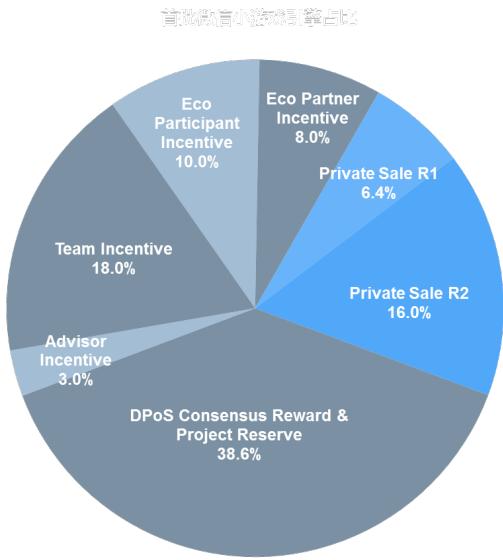
- under various standards, making COCOS token technically viable as the native, universal pricing medium.
2. For digital assets produced on Cocos-BCX, the price denomination by COCOS token measures the productivity and value chain. As a result of market dynamics, the asset pricing by COCOS represents the economic value-adding rather than a value-tagging.
  3. Our proposed economic circulation under contextual narratives establishes intrinsic connections based on user experience. The exchange activities denominated by COCOS do not only serve as capital investments but also establish a system for the users to compare and trade by the actual value of use.

### **3.4. Allocation of COCOS Token**

82% of the COCOS tokens are allocated for the development of our Platform initially. 38.6% are reserved for DPoS consensus contribution and Cocos Foundation. 10% are distributed to developers and users by means such as air drop and development funding. 8% are used to establish alliance with strategic partners such as blockchain eco-systems. 3% reward the advisors to our global development. An aggregate of 22.4% were exchanged with institutional investors for the project funding.

The recycled COCOS Tokens (section 3.3.2) will be used to replenish these allocation pools.

18% of the COCOS are reserved for team incentives. We expect the market for blockchain gaming and Cocos-BCX to be proven in three years. Accordingly, the token held by the team will be granted and unlocked evenly at the end of the three years, with the first vesting starts at the end of the 12th month after the token generation.



Use	%	NOTE	DISTRIBUTION & LOCKUP
Eco Participant Incentive	10%	Reward to the effective activities of the developers and users on Cocos-BCX	Flexible
Eco Partner Incentive	8%	Reward to individuals or institutions for strategic resources for the growth of the Platform	Flexible
Private Sale R1	6.4%	Proof of contribution to the participants of Private Sale R1	1. 55% distributed and unlocked upon generation 2. 15%, 15%, and 15% distributed and unlocked at the end of 2 <sup>nd</sup> , 4 <sup>th</sup> , and 6 <sup>th</sup> month after generation
Private Sale R2	~16%	Proof of contribution to the participants of Private Sale R2	2. 15%, 15%, and 15% distributed and unlocked at the end of 2 <sup>nd</sup> , 4 <sup>th</sup> , and 6 <sup>th</sup> month after generation
DPoS Consensus Reward & Project Reserve	38.6%	Reward to contributors of consensus and reserve for future use	Flexible
Advisor Incentive	3%	Key advisors	Distribution and lockup by contribution
Team Incentive	18%	Team members	33.3%, 33.3%, and 33.4% distributed and unlocked at the end of 1 <sup>st</sup> , 2 <sup>nd</sup> , and 3 <sup>rd</sup> year after generation
Total	100%		

[Exhibit 22 Initial Token Allocation]

## 4. Team Profile

Haozhi Chen, Founder, is a serial Internet entrepreneur of 20 years in China, with extensive experience in global gaming and developer community since 2009. He founded Chukong Technology, a leading Chinese game developer and publisher with operations in US, Japan and Korea. Chukong is the main sponsor of Cocos-2dx, the No. 1 game engine in Asia and No. 2 worldwide by market share. Since 2009, 1.1 million developers registered on Cocos community, while 3 million developers are estimated to have used Cocos engine. The ad network arm of Cocos covers 14 million daily active. Prior to Chukong, he founded Yeeyan, XCar and Joyo.com, all known as the leading startups in their time.

<https://www.crunchbase.com/person/haozhi-chen>

<https://www.linkedin.com/in/%E6%98%8A%E8%8A%9D-%E9%99%88-51b805108/>

Richard Yang, Founder, has 14 years of experience in technology entrepreneurship and investment. He co-founded a leading live streaming platform in China in 2005 that later merged with a Chinese listed company at a combined market capitalization of USD 6 billion. He also participated in transactions of over USD 1 billion in aggregate value as a professional private equity investor. He is a partner at a leading technology fund with operations in China and US. He also advises hedge funds and corporates on their multi-asset-class macro investment strategies. Together with Haozhi, the founding team has the domain knowledge, experience and resources of digital asset creation and exchange.

<https://www.linkedin.com/in/xiaolong/>

K. Yin, Chief Technology Advisor, is a seasoned blockchain system and game developer. He was an award winner of National Olympiad in Informatics, and a guest advisor to regional ACM contests. He has over 15 years of programming experience in compiled language and distributed computing architecture, and has been an active contributor to Cocos code library for 6 years.

Reed Hong, Chief Technical Expert, graduated from Web Lab of Peking University, Former developer for Tencent and developed the main program of Fishing Joy 3, a famous online game. Reed has 10+ years of product R&D experience in web, p2p and turned to gaming industry then, with 6 years of experience in game R&D. In 2017, he entered blockchain industry, engaging in R&D of blockchain wallet, DApps and other products related, and has an in-depth study of ETH and EOS ecosystem.

<https://www.linkedin.com/in/hongzhixiong/>

Caterina Zhang, Executive Director, is a seasoned executive in blockchain industry. She spent her latest 4 years working within open source communities of various edge cutting disciplines such as blockchain, VR, AR, AI, etc. Before joining Cocos-BCX she was Head of global marketing and community operations at NEO Blockchain. She made continuous efforts in promoting blockchain technology and education globally. As a blockchain enthusiast she became early investor of various blockchain projects. She graduated from University of Roma Tre with M.A. in International Communications.

<https://www.linkedin.com/in/caterina-keke-zhang-947913a9/>

Alvin Huang, Operating Director of Chinese Community, has 5 years of blockchain investment experience and years of experience as product manager for domestic&overseas internet product, as well as extensive experience in blockchain product operating. Alvin is a partner mainly for overall planning and operating of ONE.TOP, a rating platform for blockchain projects. He ever worked for Shenzhen Leyi Network(a famous game company) and operated types of games, among which Blaze of Battle has over 4.44million users, ranking top 100 in US store by revenue. Alvin has a deep understanding in game industry.

J. Jin, Director of Eco-Alliance, owns 20 years of experience in developer community operation and strategic partnership. She runs the online developer community CocoaChina and CVP. Previously, she headed the developer partnership and ecosystem efforts for Lucent, Nortel, Nokia and Intel in China. She is also a member of the Blockchain Committee, Chinese Software Industry Association.

James Jeon, Co-Head of Korea. He established the Korean operation of Chukong Technology, led its expansion to an annual revenue of USD 30 million, and completed its IPO. Before Chukong, James served as Business Lead for NEXON Mobile, one of the prominent game companies in Korea. He was also a Consultant specializing in the market research and strategy development in Chinese market at KBB. James received his MBA from KHU, and B.A. degree in business and economics from CNU. He is fluent in Korean and Mandarin Chinese.

Frederick Lim, Co-Head of Korea. He previously served as Co-CEO at Chukong Korea, and was heavily involved in the commercialization and marketing of Cocos2d-x game engine and various mobile games. Before Chukong, Frederick was with Hyundai Group in charge of Internet, communication and telecom (“ICT”) investments. He also worked extensively with government agencies such as World Bank and WeGo to develop ICT projects. In prior, Frederick led the marketing team at the Korean subsidiary of Friedhelm Loh Group (German). He started his career as a member at KOTRA Zagreb office as a marketing specialist and foreign investment consultant. Frederick holds MBA and B.A. from HUFS in business and South Slavic languages. He is fluent in Korean, English and South Slavic languages.

H. Fujita, Advisor of Japanese Eco-System, has been active in the technology startup and gaming community in Japan for 10 years. Mr. Fujita is the founder of a game company, and worked with a leading Chinese game publisher as its Chief Representative in Japan. He studied at the University of Tokyo as a Ph.D. candidate in Cultural Anthropology.

Focus Wang, Director of Marketing, joined the gaming industry in 2009, working on various positions in marketing at Zhongguancun Online (zol.com), Han Wei Xin Heng (the organizer of ChinaJoy) and Chukong Technology. With rich experience in event organization, business cooperation and media, he has led and participated in the execution of ChinaJoy, the Chukong Game Conference, the Cocos Developer

Conference and the Cocos National Developer Tour, among others.

Xiangyu Wang, Head of Marketing Communication, is responsible for marketing communication work of Cocos BCX. Xiangyu ever worked for Perfect World and changyou.com, leading Chinese game giants.

He joined Chukong in 2013 as Marketing Director, taking charge of gaming products promotion. With years experience in products and projects promotion, he led teams successfully release and promote series of games for Chukong.

Juan Pan, Project Director, joined Chukong Technology in 2012, taking charge of Cocos user system, PunchBox platform quality and is project director now. She ever worked for many famous internet companies including fantong.com and KaiTone. She participated in CRF/anti-fraud system building and SAS scheme for banks including CGB, Huaxia, etc, involved in GIS system construction and design of precise marketing scheme for Zhejiang Branch of China Mobile. Juan is also an early starter of O2O takeout business. With years efforts, she has accumulated rich experience in project management, quality & process control and data analysis.

Zhe Wang, Advisor, is CEO of Xiamen Yaji Software and Founder of Cocos2d-x game engine. Since its inception in 2011, Cocos2d-x has 1.1 million registered developers in 200 countries and regions. With long-term cooperation with leading enterprises such as Microsoft, Google, ARM, Intel, Qualcomm, Samsung, Huawei and Tencent, Xiamen Yaji has established a gaming ecosystem including engine R&D, game distribution, vocational training and game incubation.

Edith Yeung, Advisor, is the head of 500 Startups Greater China and leads the blockchain accelerator program. She is selected by Inc's Magazine as one of the Silicon Valley investors you must know. Edith has invested in over 50 blockchain, mobile, AI startups including Lightyear/Stellar, Nebulas, The Republic, Metadium, Solana, Libra Network, Hooked, DayDayCook, AISense, Castbox, Silk Labs (acquired by Apple), Chirp (acquired by Apple), Fleksy (acquired by Pinterest), Human (acquired by Mapbox) and many more. Before 500, Edith ran marketing for Dolphin Browser, a

Sequoia-backed mobile browser with over 150 million installs worldwide. Edith also worked with many Fortune 500 companies such as Siebel, AMS, AT&T Wireless and Autodesk.

Chris McCann Advisor. Chris is an advisor for Nervos, HTC Exodus, Nebulas, and Dekrypt Capital, among others. He is an early investor in 0x, Solana, Republic Protocol, Libra Credit, and more. He created Crypto Weekly, the largest crypto publication in the SF Bay Area. Formerly, he started and led the community program at Greylock Partners, a San Francisco based venture capital firm with \$3.5 billion under management that is also an investor in Facebook, LinkedIn, Dropbox, and Coinbase, etc. Before he joined the firm, he was the co-founder of StartupDigest (acquired by Techstars), and was an early advisor for the Thiel Fellowship & StartX at Stanford University.

#### Li Ping, Advisor

Li Ping is founder of XIANLE GAME and EOSUnion, also co-founder of Byte Capital. With the technical background of an architect, he has 13 years of heavy involvement in blockchain, and participated in Bitcoin, Ethereum, Lisk, EOS community construction in depth. As a senior investor of blockchain, he invested in projects including TokenPocket, Cell Evolution, Coinsuper, BitForex and Vena Network etc., with his long-range focus on the development of blockchain game industry.