

GalaCloud

Distributed Encryption Storage Network

(A Zeepin Chain dApp)

White Paper V1.0

27 July 2018

Supported by the Zeepin Foundation

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1. Introduction

Centralised data storage, as being extremely vulnerable to a variety of security threats and attacks, has given rise to data leakage and loss. To eliminate all the threats that may harm the security of data, Zeepin team has thrived into creating a storage network with noticeable advantages, a distributed encryption cloud storage network (GalaCloud). Files, after accepting GalaCloud client-side encryption, will be split into multiple shards and stored in a network composed of a sheer number of distributed nodes. It can minimise the likelihood of a storage glitch and security threats since it maintains the integrity of data by means of retrieval and storage. Given the fact that the private key is in the possession of individual owner so as to prevent any unauthorised access and tampering, it's impossible to crack the code even if a small portion of file is accessible to attackers. In addition, the data storage market opens access to everyone, allowing more participants to provide storage space in order to mitigate the cost of various storage services.

GalaCloud is a distributed encryption storage network, a key component of the Zeepin ecosystem. It provides a distributed storage space and service, which is one of the indispensable infrastructures of Zeepin public chain. Furthermore, it will help Gala coin to reach its greatest extension of application.

GalaCloud DESnet refers to the distributed storage system provided by GalaCloud, which is composed of a basketful of GalaHub nodes and GalaBox nodes. In the entire distributed storage network, GalaHub will perform to dispatch the sharding of files, searching for addresses in a way to coordinate all GalaBoxes. Storing the encrypted shards of files in the client side, GalaBox focuses on providing service for data shard storage, receiving requests for uploading and downloading and storing received encrypted files on disk in a distributed way.

GalaCloud will open access to Android, IOS and WEB users. While Gala will act as a poof of shared staking for GalaCloud to store files, users have to pay Gala for storage space. Gala earned from this will be distributed to each single node.

2. Why GalaCloud?

Since the vast majority of cloud storage suppliers are centralised, their vulnerabilities to safety threats and attacks have eventually led to data leakage and loss of both individual and entity users. Besides, it is in no way to truly protect data from malware, data theft and other malicious attempts relying on traditional client-side standards and centralised system to manage private keys. In recent years, data security has been an issue invariably challenging lots of major user data and cloud storage suppliers. The centralised storage is so powerless to remove these obstacles.

To clear out all the threats that may harm the safety of data, Zeepin team has created a storage network with noticeable advantages, a distributed encryption cloud storage network known as GalaCloud. Here are highlights and advantages of GalaCloud:

A. Distributed storage

As it is distributed, it becomes a place free of centralised nodes where any third-party centralised system or organisation will be unnecessary. It's your call to decide when and where to upload or download files such as texts, pictures, soundtracks or videos.

Cloud Storage that exclusively relies on the datacenter-based organisations has to shift the accountability of maintaining the security of data to those parties as well, which exposes inherent weakness to attackers. GalaCloud is decentralised that allows all files, being sharded and encrypted, to be stored in a distributed network. What's more, dynamic copies will be simultaneously generated. You are the only owner of your data unless you share your private key with others.

B. Distributed autonomous network

GalaCloud, on a basis of smart contract of Zeepin public chain, has adopted a set of standard management protocol to manage. As nodes will automatically operate in the network according to the standard protocol, trust based on centralised system is replaced by trust built on protocols. This is how an entirely autonomous network comes into being.

C. Revenue earned from mining

While the Zeepin foundation fully supports this project, Gala will function as a shared proof of staking for GalaCloud. Users have to pay Gala for storage space according to the management protocol of GalaCloud. Gala earned from this will be distributed to each single node that provides storage service and space.

D. Disaster prevention (Attack-proof)

All information, sharded and encrypted, will be stored in distributed network and travel to each distributed node of GalaBox. Shards generate Hash that will be automatically maintained by nodes. In case of sharding redundancy failing to make it to security threshold, new nodes will be generated and distributed to new data nodes. Users will keep their private key to themselves. Data loss will never happen unless users delete data by themselves.

E. Application Sync

In an era of a massive stream of blockchain-based applications exposed to users, they are becoming more demanding when it comes to data privacy and security. GalaCloud will be applying to Zeepin public chain as a blockchain-based infrastructure that can provide distributed storage and enable Synchronisation of data storage of multiple dApps. For instance, Source code storage of ZeeRights will be seamlessly connected to GalaCloud, in a move to provide distributed storage service that is secured and encrypted.

3. GalaCloud DESNet Distributed Encryption Storage Network

3.1 Components of GalaCloud network

GalaHub: GalaHub serves as a dispatcher of files sharding and enables searching of addresses in a way to collaborate all GalaBoxes. Meanwhile, information concerning activeness and usage of GalaBox will be cached accordingly. Each GalaHub receives the same source.

GalaBox Pro: It's a robust data storage disk cluster, focusing on offering data storage service, receiving requests for files uploading & downloading, and storing encrypted shards on the device. It will make its debut in 2019.

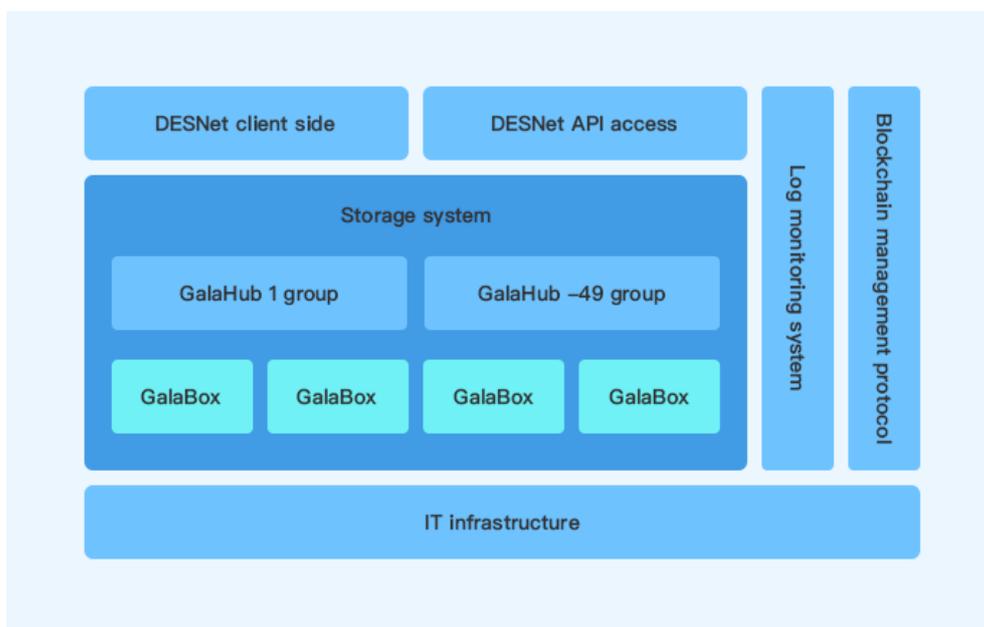
GalaBox: It mainly focuses on offering data storage service, receiving requests for files uploading & downloading, and storing encrypted shards on the device.

GalaCloud API: GalaCloud API is a perfect fit to enable mass API access to a variety of dApps, which creates an infrastructure to support decentralised applications in Zeepin ecosystem.

3.2 DESNet (Structure of DESNet)

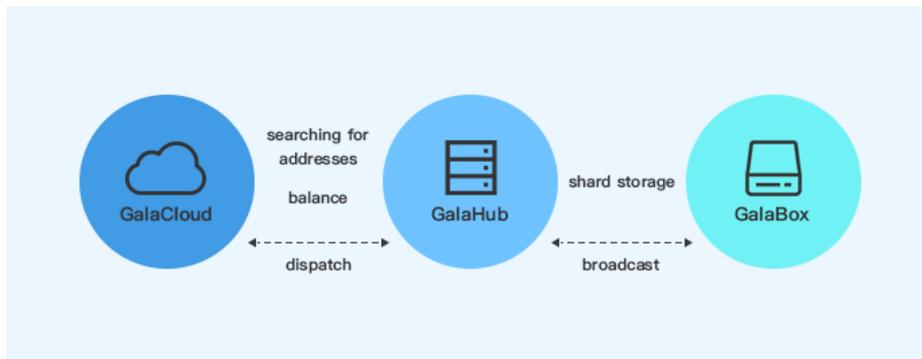
DESNet includes loads of GalaHub nodes, GalaBox nodes and GalaBox Pro nodes. It strictly complies with terms and conditions specified in protocol of Zeepin public chain to perform its duty. A challenge-response interaction called Heartbeat will be implemented to monitor the state of GalaBox. First of all, GalaBox will broadcast its own state to GalaHub via Heartbeat, including how long it's been active, how disks are used and what's going on with the service. Then each GalaBox will broadcast this information to GalaHub on a regular basis. Each GalaHub receives exactly the same information as others, and each GalaHub is able to perform its duty. Therefore, in case of some GalaHub's failure to work, GalaBox can broadcast the information to another active GalaHub. If one GalaBox is offline or discontinues its work, GalaHub will detect this and remove this out-of-order GalaBox.

Figure1. Structure of DESNet



3.3 Storage structure of DESNet

Figure 2. Storage structure of DESNet



First of all, the client side of GalaCloud will issue written requests to GalaHub. Assessing the performance of each GalaBox (such as the capacity, load and availability), Gala will select a couple of high-performance neighbour GalaBoxes. When this is done, client side will write an array of encrypted sharding data into selected GalaBoxes. GalaBox can accept stream data.

Information describing GalaBox will be recorded by GalaHub when write performance is ongoing. With the help of this, it's easy to recognise which GalaBox stores the shards. GalaBox also records the hash of shards, and will be routing such sharding hash to the client side. The client side can access the files according to the sharding hash.

When client side reads the file, he has to visit GalaHub in the first place since GalaHub can find a series of GalaBox matching the encrypted shards. Finally, the client side can read data after connecting the GalaBox based on information collected to identify the correct GalaBox.

3.4 GalaBox node

GalaBox is a node of data storage cluster. The node of each GalaBox can be understood as an encrypted storage device that can store uploaded encrypted shards from users. Files will be placed into a proper catalog following a set of defined rules. When switched on, GalaBox will automatically connect to GalaHub, broadcasting Heartbeat information on a regular basis.

Besides, GalaBox can also back up files. Based on instructions given by GalaHub, GalaBox will decide whether or not it's necessary to back up some local files and save them on a neighbour GalaBox. By means of this, the security and availability of files can be ensured.

3.5 GalaHub

GalaHub describes itself as a network server provided by applicants to configure suitable storage space and offer high-performance bandwidth. GalaHub also sees itself as a device to search addresses and as a dispatcher. During GalaHub's communication with GalaBox, it can obtain key information of Heartbeat of GalaBox, collect service from client side and dispatch the API service.

3.6 Coding of files

Coding of files not only minimises the data redundancy but also enables high-speed access to data. DESNet is built on multiple nodes. Although performance of GalaBox node is comparatively steady, glitches such as network outage and power failure will disconnect a distributed network and make nodes inaccessible. DESnet has come up with a solution to tackle this issue by designing a set of redundancy scheme. By which, data of files still remains intact in case of part of a node failing to perform its duty. After encryption of shards, it is possible to retrieve. The combination of hash value, private key and GUID of files defines the exclusivity of coding.

4. GalaBox Hardware

GalaBox is dedicated to providing storage space for encrypted shards. With a distributed network covering a variety of GalaBox, stability and security of files is certainly ensured. GalaBox is created by BrandSky-a brilliant team from ZeePin community.

Figure 3. Galabox Design



4.1 Key features of GalaBox

A. Detachable design

The detachable design allows users to easily insert disks

B. Health alert

Indicator light with intuitive design reports glitches caused by any module.(Such as malfunction of hard disk, fan or system board)

C. Quality assurance and after-sale service

Warranty period lasts for one year, and long-term commitment to providing after-sale service.

D. Smart label

Files will be automatically categorised with application of smart label, which allows users for a quick search.

E. Upgrade maintenance

System upgrade will be processed on a regular basis in order to ensure smooth operation

F. Gala reward

Valid reads and writes by client side will be rewarded with Gala. The incentive plan can be expected to enable organic growth of users.

G. Real-time data feeds to mobile users

There will be a multi-language APP with customised UI system catering for global users. Users can download it to track the real-time state of their GalaBox revenue, movement and latest market data feeds.

H. Easy-to-use at home, high-tech style

It's a product that is easy-to-use at home and has distinctive high-tech features.

4.2 How to obtain the GalaBox

Anyone who wants to have a GalaBox can participate in crowdfunding issued by the ZeeFund platform. ZeeFund is one of the key dApps in Zeepin ecosystem, dedicated to providing crowdfunding service for creative projects in the global creative industries. The total supply of GalaBoxes will be around 60,000, and the number will increase gradually depending on the needs for storage space.

GalaBox will be sent to user via carrier. Once received, users can insert hard disk to join in distributed storage network for mining. Multiple GalaBoxes will be tied to one client side so as to form a cluster, which can drive up mining yields.

5. Data security

5.1 Smart transfer of Data

The main reason to implement smart transfer of Data is to maintain the performance of system and protect the integrity of files. If one node suffers from physical damage on GalaBox, it could lead to the decrease of total number of nodes which will compromise the integrity of files. To avoid being affected by node failure, smart transfer of Data is introduced to remove the failed node from the service list and bring a new node from GalaBox into the system. Meanwhile, files stored in prior failed node, after being restored by algorithm, will be transferring to the same new node of GalaBox.

5.2 Catalog management

Catalog management serves to support the management over files stored on distributed file system and enable the query function for users.

5.3 Encryption management

Files are basically categorised into 2 types, public files and private files. While the public key is used to encrypt and decrypt public files, the users private key will be applied to encrypt and decrypt their private files.

5.4 Management of private key

Each user must create or add his own private key to the client side. Private is solely stored in the client side, which is irretrievable if lost.

5.5 Cheat-proof solution

As file access relies on algorithm to split files into disparate shard and write into different GalaBox nodes, it requires a sheer amount of Gala to consume in order to cheat. In theory, it's unfeasible to get rewards by means of cheating.

5.6 Operation on large files

Given the proven ability of distributed file system to handle large files by sharding, GalaCloud can also make it to encrypt and store big files in the form of shards.

When transmitting large files, a linked list is introduced to use collation to download data shards so as to improve the efficiency. In this case, users can retrieve exactly the same files (such as pictures, soundtracks and videos).

6. Node selection and incentive mechanism

6.1 Node selection and quit of node selection

If a ZPT holder wants to join GalaHub cluster, he can submit a mortgage application to the GalaHub participation page. At the first stage, it will recruit up to 49 GalaHub nodes. Sorting(ranking) entirely depends on the amount of mortgage. If a candidate can make it to the top 49, he will be included in the cluster pool. The community management commission will require candidates in the pool to submit relevant information to verify the authenticity. If a candidate requests to quit from node selection, he will be disqualified for the next round of node selection.

Node	Number of	Incentive plan	percentage
GalaHub	49	GalaHub incentive curve	20%
GalaBox	~ 60000	Distribute according to optimal coefficient	70%

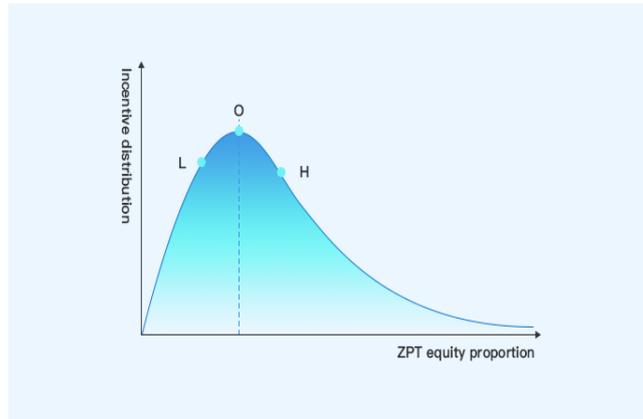
6.2 Node incentive mechanism

In order to gain access to storage space, users need to pay a sum of Gala. Gala earned from this will be distributed to each node. 70% will be distributed to GalaBox nodes, 20% to GalaHub and 10% to GalaCloud Foundation. In addition, Zeepin Foundation will compensate each node at an early stage.

6.2.1 Introduction of GalaHub incentive model

Figure 4 is the incentive curve of GalaHub, describing the relation between equities of GalaHub node participated in node selection and the proportion of incentive distribution. The more ZPT mortgaged for node selection, the higher proportion of incentives shall be distributed. However, when mortgage reaches a cap of O, more ZPT mortgaged will lessen the incentive of Gala. For anyone who expects to maximise his profit, he has to decide a "proper" amount to mortgage. A dynamic balance formed by GalaHub provides a perfect two-tiered system that embraces fairness and decentralisation to manage the entire node network.

Figure 4. GalaHub incentive curve



Coefficient of incentive distribution of a single GalaHub node: H_j

Coefficient of incentive distribution can be queried based on the ZPT mortgage amount according to the incentive distribution curve.

GalaHub H_t

Total coefficient of incentive distribution of the entire GalaHub nodes: H_t

To calculate H_t , we need to add all H_j together.

$$H_t = \sum_{j=1}^m H_j$$

GalaHub $P_j\%$

Ratio of incentive distribution of a single GalaHub node: $P_j\%$

$$P_j\% = \frac{H_j}{H_t}$$

GalaHub R_j

Total revenue of a single GalaHub node on a weekly basis: R_j

$$R_j = P_j\% \times [(G_r \times 20\%) + G_{f1}]$$

G_r : Total amount of Gala earned from storage of the entire GalaCloud network.

G_{f1} : Total amount of Gala compensated to GalaHub node on a weekly basis

m : Number of valid GalaHub nodes across the entire GalaCloud

6.2.2 Introduction of GalaBox incentive model

All GalaBox obtained from crowdfunding can join GalaCloud storage network and become storage miners.

GalaCloud DESNet will calculate parameters such as the total amount online time of each GalaBox node, amount of online time on a weekly basis, total sharing space, used space, upload amount, download amount ,intraday download speed and upload speed.

Coefficient of weekly contribution of GalaBox:

S: Average storage space on a weekly basis-Unit: TB.

U: Average upload bandwidth-Unit: Mbps. U_0 is recommended bandwidth.

If $U > U_0$, $U/U_0 = 1$.

D: Average download bandwidth-Unit: Mbps. D_0 is recommended bandwidth.

If $D > D_0$, $D/D_0 = 1$.

T: The amount of time being online-Unit: Hour(s)

C_i : Coefficient of weekly contribution of each GalaBox

$$C_i = \left(\frac{S}{4T}\right) \times \left(\frac{U}{U_0}\right) \times \left(\frac{D}{D_0}\right) \times \left(\frac{T}{168}\right)^2$$

C_t : Coefficient of weekly contribution of all GalaBox across the entire network

$$C_t = \sum_{i=1}^n C_i$$

GalaBox R_i

Total revenue of a single GalaBox node on a weekly basis: R_i

$$R_i = \frac{C_i}{C_t} \times [(G_r \times 70\%) + G_{f2}]$$

G_r : Total amount of Gala earned from storage of the entire GalaCloud network.

G_{f2} : Total amount of Gala compensated by Zeepin Foundation on a weekly basis

n : Number of valid GalaBox nodes across the entire GalaCloud

When using GalaBox to store files, the system will define daily contribution coefficient according to parameters including storage space, the amount of time being online, upload & download bandwidth. This daily coefficient also helps to calculate the weekly coefficient so that the revenue of tokens across the entire network will be clear. The revenue(Gala tokens) will be distributed to Zeepin wallet that is added to GalaCloud on the client side. Users can query the distribution record via GalaCloud.

7. Roadmap

