The Loop of the Rings: A Distributed Cooperative System

Arash Vaezi
Department of Computer Engineering, Sharif University of Technology
avaezi@ce.sharif.edu

Parsa Mohammadian
Sharif University of Technology
pmohammadian@ce.sharif.edu

Sara Azarnoush
Sharif University of Technology
sa.azarnoush@sharif.edu

Abstract

We introduce a decentralized and distributed collaborative environment denoted by LoR, which stands for "The Loop of the Rings". The LoR system provides a secure, user-friendly cooperative environment for users who can offer particular services to each other. The system manages to provide reliability and security using randomized techniques in a well-structured environment. These technics together provide consensus and trust for the groups of collaborator parties. This platform carries a blockchain-based distributed database to save important information.

The LoR system deals with cooperation rather than transactions. The system should manage and verify the collaboration between each group of participants who work with each other from the start to the end of the collaboration.

The unique structure of the LoR system makes it a secure and reliable middleware between a (distributed) database and a service provider system. Such a service provider could be a freelancer or an IoT management system. The 5G-related services can be organized to be managed by the LoR platform.

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1 Introduction

A collaborative system is designed to help people involved in a common task to achieve their goals. Douglas Engelbart first envisioned collaborative computing in 1951 and documented his vision in 1962 [11]. In the larger family of distributed applications, collaborative systems are distinguished by the fact that the agents in the system are working together towards a common goal and have a critical need to interact closely with each other: sharing information and resources, exchanging working requests with each other, and checking in with each other on their status.

Many applications provide platforms for people to present their products or services to other people in the current world. Home delivery applications and online stores are among the many examples. In such an application, let alone the administrators, one user pays for a
service, and one or more other users provide a service. In LoR, we call the users who pay as investors and all other users who serve services as workers, regardless of the task a worker may choose. Denote such a group of coworkers by a cooperation ring. The participants of a cooperation ring do not know who is selected to work with them. A random procedure chooses the collaborators of each cooperation ring. No matter who works with whom, every user tries to participate in more cooperation rings to earn more money. The LoR platform administers parallelism for various cooperation rings. Every cooperation ring has one investor and one or more workers. So, there could not be more than one investor in one cooperation ring. The LoR system uses an internal monetary system. The goal of designing this system is not to propose a new crypto-currency. This currency helps the collaborators to trade their services with each other.

The LoR system can be seen as a more generalized platform that administrators can use to implement various applications. An implementation of the LoR system is called an instance of the system. Each instance of the system contains many cooperation rings. We assume that for providing the LoR protocol, there is a system administrator that determines which services are required and suitable for their work. The administrators should specify the list of the services. Note that users cannot define a new service themselves. Although LoR provides a comprehensive workplace, a service to be allowed to be defined in an instance of the system should meet some conditions that we will mention later. Examples of such services that administrators can define in their own instances of the LoR system are video streaming, providing storage, peer-reviewing, providing a particular general service, and even renting hardware such as CPU or GPU. A user’s task is to choose a service from the list of available services. The structure and the policies of the system guarantee a trustworthy environment with a high probability that it is safe enough to be reliable for the users.

1.1 Related and Previous Works

Various distributed cooperative systems have been proposed previously \cite{22, 19}; this article intends to introduce a general platform. Everyone who has access to an instance of the LoR system via the internet or any internal network can work on the platform provided by this system.

The LoR system provides a cooperative environment. The most popular cooperative systems are based on a platform named blockchain. Blockchain creates a decentralized database that would store and verify transactions between different parties without any intermediaries, and in a verifiable and permanent way. The LoR system also uses blockchain to implement a trustful background for saving a database.

The blockchain system is a growing list of records, called blocks, which are linked using cryptography \cite{14, 20}. This system has already passed the phase of just being a monetary system. Various methods have been used to facilitate financial transactions, such as proof-of-work or proof-of-stake \cite{8}. One of the well-known downsides of the blockchain system is its very low concurrency. In the past years, teams of researchers such as \cite{21}, tried to resolve this problem. However, a universal solution has not been proposed yet. Some protocols provide a solution to the problem of scalability. It enables users to perform transactions off-chain and massively cut down data processing on the blockchain. Solutions like payment channels, channel factories, payment channel hubs, side-chains, and commit-chains have been stated in the literature \cite{15}. The LoR system only uses blockchain as a repository that safely saves some information. The low concurrency performance of the blockchain system does not affect the platform’s performance provided by LoR.

In the following we describe a few other related collaborative workplaces and designs. In
2021 I. Afrianto et al. [1] introduced a prototype model of a freelance market system using blockchain technology based on smart contracts. A freelancer is an independent laborer who earns wages on a per-job or per-task basis, typically for short-term work. A freelancing marketplace is a site or platform in which freelancers can find employers and transact digitally. Afrianto’s proposed system is distributed and decentralized. Implementing such a system in LoR makes it even more secure and customizable. The tasks can be considered as services, and the cooperation rings specify the cooperation between users. LoR guarantees that users work correctly and that no one can abuse the system.

In 2019 M. Gandhi et al. [15] presented a practical implementation of the decentralized freelancing system based blockchain named HireChain. Also, recently in 2022 K. S. Shilpa et al. [30] investigates how a freelancer marketplace can be implemented using the Ethereum blockchain and smart contracts.

These three works aimed to solve current issues of freelancing platforms, including unreliability, late payment, and delayed work. LoR introduces a general middleware that uses energy efficiency and flexible structure to solve these issues.

In 2019 Bo Tang et al. [31] published a blockchain-based trustful framework for collaborative IoT. It allows IoT platforms to construct arbitrary trustful relationships with one another, with precise criteria for intended partnerships enforced by a mix of smart contracts. Considering LoR flexibility, an administrator can define such services on the new platform and benefit from the system’s security and reliability.

In addition, with the development of faster wireless technologies, such as 5G [29], IoT is anticipated to be quite popular. LoR is a convenient solution to 5G and IoT early challenges such as decentralization, transparency, risks of data interoperability, network privacy, and security vulnerabilities [27].

In 2021 Liang Yuan et al. [34] introduced a blockchain-based distributed platform called CoopEdge, which drives and supports cooperative edge computing by building trust and incentives between users. Edge computing delivers proximity to data at its source. CoopEdge is a distributed computing framework that brings enterprise applications closer to data sources such as IoT devices or local edge servers.

On the CoopEdge platform, there are four roles. An edge server (Task Publisher) can publish a computation task for other edge servers to contend it. Task Candidates are to respond to express their interest in executing the task. A Task Executor is selected from candidate edge servers based on their reputation. Reputation deals with maintaining a value for each peer that reflects the peer’s past system behavior. In a reputation-based system, a peer with a good reputation is more likely to receive better services than a peer with a bad reputation. In CoopEdge, after the completion of a task, Task Recorder records the Task Executor’s performance in executing the task.

In 2008 Bocell et al. [6] designed a reputation-based incentive scheme for large-scale, fully decentralized peer-to-peer collaboration networks to encourage the participants to share their resources such as bandwidth and storage space and to edit and vote for documents that are shared to make shared history better and increase the reputation to get better services. This design is not blockchain-based.

In 2009 Bocell et al. [5] presented PeerVote, a decentralized voting mechanism in a peer-to-peer collaboration application. PeerVote is not blockchain-based and offers a strategy to maintain the quality of documents after each modification in the presence of malicious peers.

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2 For more information on smart contracts see: [https://www.ibm.com/topics/smart-contracts](https://www.ibm.com/topics/smart-contracts)
The LoR system looks at the world more comprehensively. Structural randomized procedures provide security for the systems. There is a table, a database, that holds the information of the participants. This table can be implemented via a decentralized approach. A blockchain-based approach makes LoR a decentralized collaborative system that can be used for providing various types of services. The flexibility of the LoR design makes it easy to use alternative approaches for implementing the subsystems and procedures of the system. For example, we will see that there are teams of parties who verify the cooperation rings, one who prefers to use a reputation-based approach can choose the members of the verification teams based on a reputation computing method. Here, we use a randomized method and prove that every team is highly reliable. As a secure middleware LoR can provide a reliable environment for edge computing services. The protocol guarantees trust in the running task on the data at its source for all the users.

### 2 The Summary of the Overall System

In the current society, people’s requirements are satisfied by others’ services. We introduce a system that makes it easy for anyone to present a service or to invest in acquiring that service. Reliability and trustfulness are the key factors in this system.

There are a number of pre-determined services in the system denoted by a list of available services. The LoR system sees a general capability of a user as a type of currency and denotes it as a coin (e.g., cpu-coin for a user willing to provide CPU as a service). Generally, the users are called traders as they are supposed to be able to work together and exchange their services with each other. This system uses an internal crypto-currency which is called ARA. One unit of ARA is denoted by $A$. A user should purchase a specified amount of ARA to be able to take part in the system. Users can make many requests and cooperate in as many collaborations as they want. The type of a request also indicates if a trader needs a service or wants to provide a service, either way the trader should pay for the request. Each request will be converted into a coin structure. Then, coins will be assembled into cooperation rings. A cooperation ring consists of at least two participants. There is one investor who needs a job to be done, whereas all the other participants are the workers.

If a trader refuses to do their duty correctly, others cannot continue their contribution anymore. So, there are suitable managing and punishment policies in the system. Participants are assigned to each other randomly by the system, and participants cannot choose their collaborators. So, the co-workers cannot be anticipated, and there could not be any collusion. The LoR system provides a trustful platform because of its unique design. We will prove that the system is secure with a high probability if it has enough traders. In fact, there are additional duties that traders should do to keep the system secure. We can consider these tasks as consensus algorithms. The system selects random traders to play roles in teams that are called verification teams. Verification teams check and verify cooperation rings and their participants in a periodic manner. The traders should gather a collection of the cooperation rings and submit it to the system. This collection is called a fractal ring. Corresponding to every fractal ring, there is a verification team that periodically checks the status of the cooperation rings. A trader has to run a randomized algorithm to submit a fractal ring. All cooperation rings in a submitted fractal ring are to start almost simultaneously. Every participant in a fractal ring can only receive their money after the confirmation of the verification team. Note that the complexity of the system is transparent to the users (traders or administrators).

The traders are motivated to cooperate in various services. If the volume of the provide
Requests for one specific service gets large enough, collaborating in other services becomes more beneficial for traders. That is why we expect a large number of traders to be able to provide different types of services.

The system carries specific time-stamps named Checkpoints. These checkpoints indicate approximate time periods for the LoR system. The time between two checkpoints is the expected time required for a collaboration to start and end successfully. Although requests can be broadcasted at any time, they will be taken into account only during the upcoming checkpoint. We divide the period between every two checkpoints (CPs) into a large number of smaller cycles. Denote each such cycle as a Round (see Figure 1). The system can dynamically estimate and change the number of rounds between the checkpoints. By the arrival of each checkpoint, a process called checkpoint-process starts. The checkpoint process is a time span during which the system runs some procedures. A round-process also takes a little time, and by the arrival of each round, the system checks the status of every running cooperation. The system runs continuously, and these procedures help the system to keep being secure and reliable.

A cooperation ring must be submitted to the system successfully for its traders to be able to start working with each other. For a cooperation ring to be submitted, a trader must put it in a fractal ring and submit the fractal ring to the system. The submission process of a fractal ring is to verify all the cooperation rings involved in it. The fractal rings should be constructed by traders and verified by verification teams. The verification process includes making sure that the new cooperation rings are compatible with the previous status of the system. The previous status of the system is saved in a hierarchical storing structure. The structure needs to be mutually excluded for the verification teams to be able to write in it. During a successful verification process, the information of the newly submitted fractal rings will be saved. This ends a successful submission process (see Figure 2).

After successful submission, each group of coworkers in the cooperation rings of a fractal ring start to work by the arrival of the next checkpoint, say $CP_a$. Between $CP_a$ and $CP_{a+1}$ there are many rounds, say a hundred. In a round process, a verification team that
was assigned to this fractal ring before \( CP_a \) checks if every cooperation is verified by all the members of the cooperation ring. If there is a trader who is not satisfied with the collaboration, the whole cooperation ring is not allowed to continue working anymore. A verification team also checks if a trader accomplished their duties correctly as a member of other previous verification teams. We discuss the duties of a verification team later in the policy section.

There is a hierarchical structure for saving the status, accounts and the required information of the system. The system uses four tables for this hierarchical storage:

1. 1) Coin Table
2. 2) Cooperation Table
3. 3) Ring-Control-Block (\( RCB \))
4. 4) Traders-Control-Block (\( TCB \)).

The \( TCB \) table saves the information of the whole system permanently. All the information from other tables will be summarized in the \( TCB \) table. Only verification teams are allowed to write in this table, and it is mutually excluded for these teams.

From a user side: A user pays to receive an appropriate amount of \( ARA \) to enter the \( LoR \) system. Next, the new trader requests a (or more) coin(s) by running a function. The function decreases from the trader’s account and creates a coin table. The coin is now available in the system with a unique ID. The trader runs another procedure to create cooperation rings. This procedure selects random coins and binds them to each other to create a cooperation ring. The cooperation ring gets available in the system with a cooperation table and a unique ID. Then, the trader assembles enough cooperation rings to run another random function that creates a fractal ring. Creation of a fractal ring results in invoking a function that selects a verification team out of the traders in the system. This team checks all the traders with at least one coin in this fractal ring. Consider the checkpoint where a fractal ring is verified. All the cooperation rings in this fractal ring should start working by the beginning of the next checkpoint. During their collaboration, the verification team checks all the participants periodically. Note that all the random methods used are irreversible or non-predictable. The \( LoR \) system provides an iterative random procedure. This procedure enforces the correct behavior, and even if traders do not trust each other, everything should work out correctly.

3 The \( LoR \) system in details

This section reveals how the \( LoR \) system works. Note that we assume that there is a system administrator who intends to implement an instance of the \( LoR \) system for their application. Based on the requirements of the users of that application, the administrator can create an instance of the system. See the following to be more familiar with the details of the elements of an instance of the \( LoR \) system.

3.1 Traders

Every trader has an account, a wallet, a unique ID, and several other information that are all stored in an entry in the \( TCB \) table, which we will discuss later. The wallet has a private key and a public key, and it works exactly as those wallets miners [2] have in the older systems.

A new trader has to receive enough internal crypto-currency (\( ARA \)) from an older trader already inside the system. The least amount of \( ARA \) a trader needs to be able to start working in a cooperation ring equals the cheapest service defined by the administrator.
3.2 Coins

A system administrator can define several types of services based on the general services that their users (traders) can provide. Each trader may contribute to different types of services. A service will be demonstrated in a structure called a coin. So, an instance of the LoR system has different classes of coins specified by the system administrator. There are some particular classes of coins called investment coins. If a trader requests an investment coin, they indicate that they intend to invest for collaboration to begin.

![Figure 3](image.png)

**Figure 3** The coin table and the cooperation table. The left table includes all information required for each currency. The right table illustrates the cooperation table, which includes the information required for a cooperation ring in a fractal ring.

As mentioned, every coin is represented by a structure. This structure is denoted by a coin table (see Figure 3). The coin table is unique and fixed in the system. It has one column and a few rows. Each row stands for one specification. This structure helps bind collaborators to each other to create cooperation rings.

As mentioned before, there is a leading currency, called ARA, in the LoR system, and the cost value of every coin is based on this currency. One unit of this currency is denoted by $A$.

Every cooperation ring has exactly one trader named investor who invests in collaboration to get started by a group of coworkers. A trader who wants to be an investor in a cooperation ring has to request investment coins. When a trader $t$ requests for some type of coin, there is a standard general function $f$ in the system that creates a coin table based on the request of $t$ (a request sent by trader $t$ for coin $c$ is denoted by $R(t, c)$).

The entries of a coin table are explained below:

1. **Coin-ID**: Every coin has a unique ID. This ID will be generated by $f$.
2. **Amount-based-on-One-Unit**: This entry reveals how much the coin costs based on ARA e.g. 0.45A.
3. **Status**: There are four values for this entry: Run, Blocked, Expired, Paid. If a coin is used in a cooperation ring, the Status is Blocked. If collaboration is finished and the coin is in the memory of an investor, its Status will be changed to Expired. If the coin is from an investor in the memory of other traders as their payment, the Status will be changed to Paid. If a coin is free for a trader to bind it to a group of other coins, its Status should be Run i.e. it is a newly created coin based on a request.
4. **Type**: This entry shows the type of a coin. The types of coins are read-only. Note that no trader can add or remove any type of coin to the system. Each coin type must have a clear exchange rate from that type to ARA.
5. **Next/Previous-in-cooperation ring**: A group of coworkers has to be bound to each other.
on a cooperation ring. This ring is created on the coins and not the traders. A trader may take part in many cooperation rings by using frequent coins. Two links in coin tables help construct cooperation rings.

6. **Bind-on**: When a coin is blocked in the memory of another trader, this entry reveals whose memory is that. We use a strategy to create an artificial lock. This entry is used for that strategy. The locking strategy makes traders who request investment pay before they receive any services, and also, this strategy ensures that all the worker traders do their work correctly before they get paid.

7. **Owner**: The owner of a coin is the trader who requested the coin previously.

### 3.3 Cooperation Ring

A group of traders who are chosen to work with each other is demonstrated in a cooperation ring structure. A cooperation ring has a specific storing structure, called "cooperation table" which is illustrated in Figure 3. A cooperation table allows a trader to create a fractal ring by selecting a proper subset of the available cooperation rings presented in the system. Traders who participated in a cooperation ring are only allowed to start working from a specific system’s checkpoint. The system policies guarantee reliable and trustful cooperation with high probability. These policies are presented in Section 5.1.

Suppose some traders are chosen to work together. They need others’ cooperation to accomplish a task. Suppose there is one investor who previously requested an investment coin to invest in hiring a set of employers with different capabilities. This group of traders is selected by a random strategy to assemble a cooperation ring. To implement a random mechanism, we can use the same strategy used in [16], which is based on the verifiable-random-functions [25].

#### 3.3.1 The Lock Strategy

Each involved coin of a trader in a cooperation ring is bound to the memory of another trader. The status of these coins will be changed to *Blocked*. This is an intentional lock of the traders waiting for each other. The system (a verification team) blocks the coins in the distinctive memory specified for a trader until the end of cooperation or a force termination by the system. This mechanism is helpful in implementing fair payment policies for the *LoR* system (see Section 5.1 for the payment policies). In fact, no traders will be paid (or make benefit from a collaboration) until all the trades in a cooperation ring be satisfied with that amount of the work. The structure of a cooperation ring creates simple links for coins to be accessible to verification teams.

An example of a lock graph is illustrated in Figure 4. After the lock, the status of each coin will be changed to *Blocked*. To have a faster payment process, verification teams modify the coins (probably with a partitioned amount) and move them to the trader’s memories based on the lock graph (see Figure 4); however, if a cooperation ring terminates, the system acts differently for payments. See the policies in Section 5.1 for the system for more details.

As mentioned previously, the *Bind-on* entry of a coin table should be set to the trader-ID of the trader who keeps that coin in their memory. The entries in the cooperation table (Figure 3) are described in subsection 5.2 in detail.

Every trader should run Algorithm 1 to create a cooperation ring. In this algorithm, the investment coins specify which coins of what traders should cooperate in a cooperation ring. Based on the investing requests, the algorithm finds appropriate collaborators randomly.
Figure 4 An example to show how a cooperation ring works. This is how we use a lock to make sure no one can access used coins in their own cooperation rings without the system’s permission. Note that a trader who is not an investor will receive some extra money based on his contribution. Trader $t_1$ owns one investment coin, trader $t_2$ has two W-Coin, and trader $t_3$ has one S-coin in their memories individually. These coin names stand for a calculating work (W-coin) and provide enough space as storage (S-coin). The system has already selected these three traders to be in a group for cooperation. In the lock graph, $t_1$ must pay $t_2$ and $t_3$ based-on their contribution. In this group $t_3$ and $t_2$ are waiting for $t_1$ to pay them. The trader $t_1$ is waiting for $t_3$ and $t_2$ to provide its requirements resource.

Algorithm 1 Algorithm to create cooperation rings

```
procedure RANDOMIZED
2: define
   $CR =$ The output cooperation ring.
   $M =$ A selected investment coin.
   $|M| =$ The number of required coins.
   $F_i =$ A deterministic algorithm to assign the right type of coins to $CR$.
for $i = 2 ; i \leq |M| ; i++$ do
4: $CR[i] = F_i(SHA_{256}(M))$
Return $CR$
```

3.4 Fractal Ring

A fractal ring is a block of cooperation rings created by a trader and verified by a verification team. A trader $t$ should assemble a random number of at least 500 cooperation rings to create a fractal ring (see Figure 5). The ring structure provides a simple way to access the cooperation rings and verify them. The number of cooperation rings required for creating a fractal ring is random. A cooperation ring is a fractal element of a fractal ring; any cooperation ring that exists in the system from any joined instances of the LoR system can be assembled for a fractal ring to be created. Since a ring cannot be constructed deterministically, no one can abuse the system’s policies. In fact, if we fix a number, say 1000, for the number of cooperation rings required in a fractal ring, then there might be a competition in gathering the last cooperation rings. Also, the malicious traders might split their coins and request with low weighted transactions, and the high-weight transactions might starve. Algorithm 2 reveals how many cooperation rings are required to be in $FR$ for
Algorithm 3 reveals how a trader should create a fractal ring $FR$. We need to ensure that there are no common cooperation rings in two different fractal rings created by the traders. The status of all the cooperation rings a trader participates in is saved in the system’s tables. If a cooperation ring is already submitted, it cannot get submitted in another fractal ring.

Consider a fixed frame moment of the system, suppose that, on average, there is $\lambda$ number of cooperation rings available in the system. Algorithm 3 uses $\lambda$ to create a fractal ring. In this algorithm, $C_f$ denotes the number of required cooperation rings to submit a successful fractal ring.

**Algorithm 2** Randomized Algorithm to find the number of cooperation rings required to submit a fractal ring

```
procedure RANDOMIZED
    define $C_f = 500$, $H = Random number$; Set the minimum number of cooperation rings in fractal ring to be 500.
    while $C_f != H$ do
        for $i = 500 ; i <= C_f ; i++$ do
            $H = F(SHA_{256}(H, Fractal[i]))$
        $C_f++$
    Return $C_f$
```

![Fractal Ring Diagram](image)

**Figure 5** A fractal ring. A verification team can easily trace all the fractals in their corresponding fractal ring.
Algorithm 3 Randomized Algorithm to submit a fractal ring

```
function RANDOMIZED
2: define
   \lambda = \text{The average number of fractal rings in the current state of system,}
   |\mathcal{FR}| = \text{The number of cooperation rings required to create } FR,
   CR_i = \text{The } i\text{th cooperation ring of } FR.
   CR_1 = \text{A cooperation ring which is verified for } t \text{ to start } FR.
3: \text{While } F(SHA_{256}(CR_j)) \mod \lambda = 0 \text{ do } CR_1 = CR_j
4: \text{for } i = 2; i \leq |\mathcal{FR}|; i++ \text{ do }
   CR_i = F_i(SHA_{256}(CR_{i-1}))
6: \text{return } FR
```

In Algorithm 3, the function \( F \) assigns a Cooperation-ID to a random number created by \( SHA_{256} \) (we used \( SHA_{256} \) as the required random function).

Every fractal ring hands over a randomly selected team as a verification team. This team is selected by a random selection among all the available traders of the system. Every trader could submit a fractal ring in the system if they did their duties as a verification team in the system previously. So, a trader is better to do its job as a verification member correctly. See the system’s policies for more information in Section 5.1.

Note that each trader will be assigned to work on a verification team with the same probability as other traders (see the 16th policy).

A trader, to create a fractal-ring \( FR \) must compute Algorithm 4 to assign a verification team to verify \( FR \). This team has \( |VT| \) members who are randomly chosen among all the available traders in the system.

Algorithm 4 Selecting members of a Verification Team for a fractal ring \( FR \)

```
function VERIFICATION TEAM
1: define \(|VT| = 503 \leq \text{Random Number} \leq \text{the number the members of } FR;\
2: define \( VT_i \) = The \( i \text{th} \) member of the current verification team.
3: for \( i = 1; i \leq |VT|; i++ \) do
4: \( VT_i = SHA_{256}(i, Users[i] in VT) \mod |VT| 
5: i++
6: \text{return } VT
```

\( \triangleright \) Observation 1. Any verification team chosen in the LoR system via the random procedures is a reliable and trustful team for the users of the system.

**Proof.** We need to make sure that with a high probability, the majority of the members (traders) of a verification team are reliable.

Suppose there are \( n \) traders currently in the system. Without loss of generality, consider a verification team \( VT \) that has \( X \) members. We intend to find a lower bound \( L \) on the number of users in a verification team to ensure that this team is reliable. Set \( L \geq \frac{X}{2} \). In the following, we show that the probability of being more than \( L \) malicious traders in one verification team is extremely low. The ratio of all the malicious traders is denoted by \( \alpha \).

Note that we already know that the cooperation rings are independent.
Pr_z = \binom{n\alpha}{X-z}\binom{n(1-\alpha)}{z} = \frac{(n\alpha)!(n(1-\alpha))!(n-X)!X!}{(X-z)!(n\alpha-(X-z))!z!(n(1-\alpha)-z)!n!}

In the above formula, z is the number of users in a verification team we are expecting to be trustful. So if we sum Pr_z for z’s greater than \(\frac{X}{2}\), we find the probability of more than half the users being trustful. We denote this by Pr.

\[
Pr = \sum_{i=\frac{X}{2}}^{X} Pr_i > 1 - \epsilon
\]

If we set \(\alpha = \frac{1}{3} \approx 0.333\), by the Stirling’s approximation, we have:

\[
Pr \approx 0.999997516160304 > 1 - \epsilon
\]

We simply set: \(n = 10^6\), \(\epsilon = 10^{-5}\), \(X = 500\). We can see that these numbers satisfy the above inequality.

Setting \(\alpha = \frac{1}{3}\) is a very strong assumption because, in fact, we assumed that more than \(\frac{2}{3}\) of all the traders of the system are reliable (trustful).

Let set \(\alpha = \frac{1}{2} - \delta\), which \(\delta\) is a really small number. A similar analysis reveals that Pr will be high enough, and so the verification teams are trustful enough. This fact is illustrated\(^3\) in Figure 6. In fact, the model presented here is a random network, and there is a sharp threshold on \(\alpha = \frac{1}{2}\) for the verification teams to be trustful.

\[\text{Figure 6} \quad \text{This plot shows how Pr changes with respect to } \alpha \text{ which is the ratio of malicious traders.}\]

It does not matter which trader creates a fractal ring because every trader can trust the verification teams. The more fractal rings are created with the traders, the sooner the trader’s work starts. So, traders are motivated to create fractal rings.

The duties of a verification team are declared in policies Section 5.1.

\(^3\) All the calculation can be found on [github.com/Loop-of-Rings/trust-probability](https://github.com/Loop-of-Rings/trust-probability)
3.5 Ring Control Block, Traders Control Block and Checkpoints

The information of every fractal ring is saved in a table denoted by $RCB$. Each entry of the $RCB$ table considers one cooperation ring in a fractal ring. Each trader in a fractal ring and the traders joined in the corresponding verification team carries a copy of this table.

Similar to a cooperation ring, a fractal ring has a unique universal ID that can be traced in the $TCB$. The coin table, cooperation table, $RCB$, and the traders’ information, namely their financial status, cooperation rings, start point, and endpoint of a cooperation ring (based on the round number defined in the system), are saved in the trader’s memory. So, there exist replicas of the data in the traders’ memories. The complete set of all these cache memories defines $TCB$. Every trader has a copy of this database, but this copy only includes the information the trader needs.

This database should get updated when a newly fractal ring is verified (submitted) by a verification team. Every verification team checks the status of its corresponding fractal ring. This checking includes; computing the payments of the traders up to the last checkpoint. See policies 5.1 for more details.

To implement the $TCB$ database, we can use any distributed storage platform such as the Swarm [8] of the Ethereum[4]. Note that a system designer needs to develop a solution to provide mutual exclusion for the $RCB$ and $TCB$ tables. This problem has been considered previously, see [28, 32].

In the following, we provided a set of calculations helpful in tuning and configuring the LoR instance. The average submission rate of the cooperation rings in a fractal ring in the system is denoted by $\lambda$. Since we have about $C_f$ cooperation rings in a fractal ring, the time required for a fractal ring to end is at most $C_f \lambda$. A system administrator can change this number ($C_f$) according to the system’s conditions. Furthermore, we set a dynamic function to compute $\lambda$. The time required for a cooperation ring $CR$ to be complete is denoted by $\Phi$. The expected value (average value) of $\Phi$ is considered a checkpoint in the LoR system. In these checkpoints, the system pays the traders based on the previous rounds they have worked successfully. We define some number of rounds, say $r$ rounds, between every two checkpoints. A round’s time can be calculated as shown here, in which $r$ equals the number of rounds between two checkpoints.

$$E[\Phi] = A \times r \quad r = \frac{E[\Phi]}{A} \quad A = K \times \lambda$$

. The value $K$ is a regulator, and depending on the requirements of an instance of the LoR system, one can set $K$ to provide a different round-time.

\(\triangleright\) Observation 2. The LoR system can support long-term collaborations.

See the 14th policy in Section 5.1 for the reason.

4 Discussion

This paper deals with introducing a new system that uses randomization to create a reliable environment for its users to cooperate without forcing them to pay much money or provide such powerful hardware. The system can work permanently; that is, the passage of time will not impact the system’s efficiency. The users can trust each other more easily and work
The Loop of the Rings

together reliably. The system is beneficial in providing safety for freelancing projects and IoT management systems.

The LoR system is designed chiefly based on the basic concepts of operating systems and distributed systems. The system uses two types of rings with a randomized electing structure. The infinite loop of these rings’ starting and terminating events runs and verifies the collaborations.

This research introduces the fundamental basics of LoR. The exact implementations and applications can be described accordingly in collaboration with the industry.

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5 Appendix

5.1 Payment Rules and Policies of the LoR System

The LoR system rules and policies are listed below:

1. Terminating Suspicious Cooperation Rings: By the event of the passage of each round, each verification team corresponding to every fractal ring checks if each cooperation ring is verified by all the traders involved in that cooperation ring. A verification team does this checking based on the shared information of the checkpoints in the \( TCB \) and the \( RCB \) tables of the majority members of a fractal ring. If at least one trader is not satisfied with the collaboration in a cooperation ring, that collaboration is not valid anymore. Such a cooperation ring will be terminated. Other traders does not need to create another fractal ring as the first fractal ring was submitted successfully. However, as we supposed that more than \( \alpha \), say \( \frac{1}{2} + \epsilon \), of the traders and their collaborations are reliable, we can conclude that a reasonable amount of the cooperation rings in a fractal ring are trustworthy. See Observation [1] for more information on the reliability of the verification teams.

2. Incomplete Cooperation: Suppose cooperation \( x \) in a fractal ring needs \( R \) rounds to be accomplished. By the end of a round \( i \), a trader in \( x \) denoted by \( t \) declines that the last round was successful. For the round \( i \), that \( t \) refuses to accept a successful transaction; the system decreases \( \frac{1}{R} + \delta \) percent of the payments of all the traders involved in that cooperation ring, where \( \delta \) is a small number. That is because it is hard to distinguish the person who was trouble-making or distinguishing any other reason that may disturb the communications between the traders. So, the system punishes every trader of this cooperation ring for ensuring such unsuccessful collaborations will not get plentiful in the system. Note that \( \delta \) should be a small number; for example, it may equal half of the payment of a successful round.

We know that less than \( R \) rounds where successful. The system pays a percentage (\( p \)) of each trader’s fee for each successful round in such a situation; for example, ninety percent. In fact, we do not pay all the settlements expected by the trader for a particular cooperation ring or even just a round of a cooperation ring. This way, we intend to keep the primary currency (\( ARA \)) of the LoR system valuable in time. The value of \( p \) could be adjusted by the passage of time in the system so that the inflation of the primary currency gets around zero.

3. Note that an approximate consistency is working for the LoR system, and we can assume that the majority of the traders involved in a fractal ring are eventually consistent. In addition, a system designer may use the firing squad synchronization methods [4] to sync the system’s traders once in a while. Briefly, with this method by starting from a trader and walking through other traders, the goal is to reach an state that all the traders are agreed.

4. The LoR system will pay the traders based on their corresponding weights in their cooperation ring. In each cooperation ring, the paid fee depends on the type of a coin and its amount. The weight of a coin can be calculated according to its amount and type.

5. Consider a trader, who can request an investment coin, or two worker-coins. By default this trader will receive more money by working than investing. In fact, the system pays some more extra money to those who work than those who invest. This way, we make sure that traders are motivated to work than saving money. A system designer may define different coefficients to pay the traders for different types of coins in an instance of the LoR system based on that system’s required incentives.
Note that the extra money is going to be distributed among the workers based on their cooperative weights in the transactions. However, as every cooperation ring needs an investor, the number of investors may decrease with the passage of time. So, the traders have to invest more to create more cooperation rings and help themselves to speed their collaborations to get started sooner. The following item reveals that the traders are also an incentive to invest in starting cooperation. A system administrator may consider this trade-off in an instance of the system to keep the system balanced.

6. A trader who invests some investment coins will receive his work, or storage, or anything defined in the system as a type of a coin. Others will receive their portion of the primary-currency invested for that cooperation plus some extra money. By the end of each checkpoint, the system pays the traders (investors) who have some expired coin (which for sure was not a previous investment coin) with an $\epsilon$ amount of $ARA$. This is just for the traders to be more motivated being an investor. However, an investor does need to start a work, for example, the trader may need to borrow a computer for computational work that is defined in an instance of the system. So, the investors are motivated already.

Note that the verification teams carries the information about the investors and their expired coins so no one can bring other expired coins and lie about the coins.

7. A trader who owns more blocked coins receives more extra money ($ARA$). This extra money should be considerable to make the traders be incentive to work with only one account.

8. We have the following IDs in the LoR system: 1- Trader-ID, 2- Coin-ID, 3- Cooperation-ID, 4- Fractal Ring ID: which is the same as the corresponding Fractal-ID. Round-number: which should be an increasing unique number, and Checkpoint-numbers are numbers that illustrate approximate time periods for the system and we can make them to be unique too.

Each of the IDs must be unique in the whole system. In order to generate a unique ID for traders, we can merge their public and private keys. We can use other random generators to create unique IDs. Even big numbers are unique in such systems with high probability [14].

9. Mutual Exclusion:

When a cooperation ring is submitted in the tables of the system. No other trader can use this cooperation ring to assemble a fractal ring. The tables of the system are mutually excluded so no two cooperation rings may get submitted simultaneously.

10. When a verification team verifies a fractal ring if even one cooperation ring was not valid, or anything else was not correct the fractal ring is not valid and the trader who sends it must resubmit it for the next Checkpoint. So everyone should submit a valid fractal ring on the very first try.

11. How to Start LoR? We assumed that there were enough traders and different types of coins and cooperation ring in the system. In the beginning, the system would be launched by one of the popular systems, namely Ethereum.

In addition to generating the coins that need to bootstrap the protocol, starting with a well-known cryptocurrency will incentive the users of old systems to join the new ones. To start the LoR system in case a system designer needs to sync some of the joined traders to agree on a checkpoint, the designer can use a well-mannered strategy called firing-squad. This strategy is maybe useful at the start of the system for everyone to be synced on the first checkpoint. The firing-squad strategy was first proposed by John
Myhill in 1957 and published (with a solution) in 1962 by Edward Moore. A lot of papers worked on this strategy [4] [13] [17].

12. **Entrance:** Anyone who intends to play a role as a new trader in the system should receive an enough amount of ARA from another already existing trader. This amount must be at least equal to the chipest service provided in the system. Their settlements are unrelated to this system.

13. A policy related to verification teams: Consider a situation where a trader $t$ participated in at least one cooperation ring of a fractal ring $FR$. A new verification team $VT$ is assigned to check $FR$. One of the duties of the members of $VT$ is to check if $t$’s opinion was matched with the majority of the members of the previous verification team that $t$ plays a role in, and this verification team validates a successful fractal ring in a previously passed checkpoint. If $t$ had confirmed some invalid cooperation rings, the trader cannot submit a fractal ring during the two subsequent next checkpoints of the system. Every successful verification process passed periodic checks of cooperation rings. A cooperation ring must be checked during each round to be satisfied by its participants. So, the above-mentioned policy makes the traders in a verification team to actually check the status of the cooperation rings in a fractal ring and tell the truth.

So, a trader $t$ should complete those duties as a verification team member in the checkpoints and the system rounds. During an upcoming checkpoint, $t$ requested to start new cooperation. A new verification team will be assigned to verify that the fractal ring $t$ is joining. First, this team should check if $t$ had the same opinion as the majority of its joined previous teams; if so, $t$ is allowed to submit fractal rings and submit them to the system. Otherwise, $t$ can only wait for others to submit fractal rings, including the cooperation rings that $t$ broadcasted.

Additionally, for a trader whose opinion fails to be matched with the majority of the traders in a verification team, the system can set a punishment by decreasing the trader’s account. This punishment made the traders more careful. Also, the verification teams are going to be more reliable.

14. **Submission Process:** Every fractal ring should get submitted to the tables of the system by a ‘verification team’. A fractal ring $FR$ that is assigned be verified by a verification team $VT$ is denoted by $FR_{(VT)}$. Suppose the current state of the system is in the checkpoint $CP_p$, and $CP_{p+1}$ is the next checkpoint. Suppose a number of requests, say $j$ requests, are currently broadcast in the system before $CP_p$, and $k$ requests are broadcast after $CP_p$. Note that each coin created was previously a request in the system. Also, the fractal rings generated by the traders are broadcast in the system and will be considered in the next checkpoint.

The verification team $VT$ should confirm every cooperation ring $CR$ of $FR$ in the following cases:

a. The coins in $CR$, should be broadcast in the system before $CP_p$.

b. The trader $t$ should own enough money in her account before $CP_p$ to request such a coin ($c$).

c. The verification team should check the decrease of enough money from the account of $t$ and the creation of the coin table for $t$. A coin table created for every coin should get verified to ensure that all of its entries are correct.

d. The cooperation table of every $CR$ should be checked and verified to have correct entries. For example, the weight of a cooperation ring should be computed correctly. If $VT$ does not confirm one of the above-mentioned cases, then $FR$ cannot get submitted. Otherwise, it is ready to be submitted in the tables of the system, and its cooperations
are allowed to start their work from \( CP_{p+1} \). Note that the time \( VT \) can spend to do the verification tasks related to the cooperation ring \( CR \) equals to the time between \( CP_p \) and \( CP_{p+1} \). If the work \( CP_{p+1} \) gets passed, a designer can allow an extra checkpoint for the verification team to do their jobs. However, the default policies of the system is to punish the team so that none of them can create a fractal ring for the next two checkpoints.

If \( FR \) gets submitted in the system successfully, every cooperation should get started by the arrival of \( CP_{p+1} \).

So to briefly express the duties of a verification team: Suppose that a verification team \( VT \) is assigned to a fractal ring \( FR \) to verify it. During the upcoming checkpoint of the system, \( VT \) checks all the receives requests of the \( FR \)'s trader. No trader can request a specific coin without having enough money in her account. Next, the accounts of the traders in the \( TCB \) table should get updated, and the corresponding coin tables should be created for every individual trader in \( FR \). During the following checkpoints, \( VT \) should pay the traders who finish their transactions successfully, and the account numbers and the corresponding entries in the \( RCB \) and \( TCB \) tables should get updated.

15. **How system supports long-term transactions (cooperation)?**

After passing a checkpoint, based on the checkpoint time period (by the end of a checkpoint process), the \( TCB \) table will be updated, and the system needs to pay the traders who have at least one round of a successful transaction, and their remaining rounds equals zero. If there still remained some rounds required for a cooperation ring in a fractal ring to get finished, then the payment of that ring should be postponed to the next checkpoint, and the remaining-round field in the \( TCB \) table should get updated. The remaining-round column is a field that specifies how many rounds is still remained for the cooperation to get finished.

16. **Earning ARA:** Although the primary goal of the LoR system is not introducing a cryptocurrency, the system owns an internal currency. So, we need to know how a user can earn ARA. Many systems provided various ways for their users to make money based on their cryptocurrencies. In the LoR system, a user can only receive some ARA form another older user who owns some money (probably with an outline settlement), or the user can participate in a cooperation ring and work or invest on an actual collaboration and receive some ARA. That is the user receives the stipend and also some extra money based on ARA.

So, one cannot use the LoR system to earn money effortlessly. This is another incredible characteristic of the LoR system.

17. **The probability of a trader joining a verification team is the same for all the traders:** A trader could participate in many cooperation rings with at least one coin. These cooperation rings may be scattered in many fractal rings. There is an entry in the \( TCB \) table that illustrates which verification teams have been assigned to a trader. Suppose each of these fractal rings has \( k \) members. So, if we set the members of every verification team to be at least \( k \), then each trader is joined in at least one verification team with probability one. As the verification team members are selected with a uniform random function, even if we choose comparably fewer traders than the members of a fractal ring, the probability that a trader is chosen to do the duties of a verification team is the same for all the traders. So, overall, after a long time, the number of verification teams that each of the traders worked for is the same.

As a result, the traders are not motivated to run away from being joined by a verification team.
5.2 Cooperation Table Entries

In this subsection, we describe the entries of a cooperation table.

1. Cooperation-ID: Every cooperation ring has a unique ID, which is a universally unique ID throughout the LoR system from the beginning.

2. Number-of-cooperation-members: Indicates the number of traders involved in the corresponding cooperation ring.

3. Weight: This is the summation of all coins amount involved in the cooperation ring, based on \( ARA \). The amount of a coin demonstrates its cost value in the system and can be calculated based on its amount and type. The Weight of a cooperation ring is calculated based on the cost values of all of its coins. This entry can help the verification team calculate the budget that the system should consider for the cooperation ring as payments.

4. Next-in-fractal ring: Indicates the next cooperation ring in a fractal ring assembled by a trader.

5. Previous-in-fractal ring: Indicates the previous cooperation ring in a fractal ring assembled by a trader.

6. investor: Which is the ID of the trader who invest to start a cooperation ring.

5.3 Requirements for a Valid Service in the LoR System

This subsection reveals what requirements a general capability or service should meet for a system administrator to be able to define a Coin in an instance of the LoR system.

1. It must be qualified to be propagated through the Internet or an intranet.

2. It must be quantifiable. That means a coin must have a basic unit such that any request could be expressed as a factor of that unit. This division should be based on three main characteristics; qualification class, time-sharing, and space-sharing of a resource.

3. Most of the users must be capable of providing such type of service for other traders. That is a service that is defined as a type of coin that should not be provided by just a specific particular number of traders. The system has a random binding procedure between different traders with different types of coins. So, if using any other type of coin requires a specific resource, a reasonable number of traders must have access to those resources.

4. LoR has some running rounds. A coin type should have the capability of getting split into as many rounds as it takes for cooperation to get finished. Suppose after, say three rounds, the connection between the corresponding traders gets lost for a reason. We must be capable of computing the payments of those traders who worked in the three previous rounds. So, a service that a coin is defined based on that should be dividable into some flexible rounds, and even one round means something and worth being paid.

5.4 Attacks

This section considers a few attacks to reveal how the LoR’s policies prevent relevant attacks to happen. See [33, 24] for more information about various types of attacks that may happen in a system.
5.4.1 Double Spending

Double Spending in LoR means one coin gets used twice.

As we mentioned previously, there is a verification team VT corresponding to each fractal ring FR. Before the submission of FR, VT checks all the coins with RCB and TCB tables. Since these tables are mutual excluded, no two transactions can be submitted simultaneously in the system. However, a system designer may repeat this check by the end of all rounds to make a more reliable system, but if a designer decides to add an extra check the system will be slower. This is a trade-off that depends on the needs that a system designer may consider.

5.4.2 Long Delay Attack

This attack means a user proposes a job that takes a long time and the system stop progressing due to this job.

A user cannot add any new type of service to the LoR system, but the work the users are cooperating on may need a quite large period of time. However, the system supports long-term cooperation (see the policies in Section 5.1). Moreover, in each round, the system checks if the coworkers are satisfied with their cooperation. In fact, the LoR system creates a reliable environment so that these users can cooperate. So, if a user is not satisfied in a specific round, the system stops that cooperation from running (see policies of the system for the details).

5.4.3 Theft of resources

This attack considers a user that has a method to sabotage the system such that attacker uses the resources but will not pay for it.

In the LoR system, a user must first pay some primary currency so that he/she can start a transaction. The only way someone might abuse a resource is to invest some investment coin and then refuses to admit that he/she was using the resources of another user. First of all, this can only happen during one round. Because other collaborators will not be satisfied in the next round, the system closes that cooperation. However, if a user does this according to the system policies, he/she will lose more than what he/she invests for one round in the first place (see Section 5.1 item 2).

5.4.4 Honesty

The Honesty attack means that if a user said he provides a job or paid money, the dishonest behavior must be discouraged.

The LoR system will check the users periodically. The liars will be punished but also those who were in cooperation with a liar. However, the victims will be harmed in only one round. According to the setting of the system one can set round time to be really small. Based on the conditions of a system one can accept that his/her system needs more privacy, and define smaller rounds, but his/her system will be slower accordingly.

5.4.5 Iterative False Generation

Attacks like Sybil and Peer Flooding create many pseudonymous identities and leverage them to obtain disproportionately large influence, get closer to a specific object or a group of objects, and slow down or subvert the service’s mechanism. For more information on these classes of attack see [33].
As each user has to purchase enough amount of $ARA$ to be able to contribute to the $LoR$ system, an attacker must spend a significant amount of money creating many accounts and targeting them to complete a kind of attacks such as Sybil and Peer Flooding. Also, in the $LoR$ protocol, the selection of the collaborators is random and can not aim at a specific user.

As a result, the likelihood of a successful Sybil and Peer Flooding attack is remarkably low.

### 5.4.6 Adversarial Centralization of Consensus Power

This type of attack uses consensus power in a voting system that needs verification by most users. If a group of users works together, they could have control over a system.

Considering the below-mentioned policies, these types of attacks cannot happen in an instance of the $LoR$ system. The members of a verification team are selected randomly from all the system users. This team should verify the collaboration of all the users in the fractal ring at each round and checkpoint. Suppose one or more trader does not work correctly in a cooperation ring. In that case, the verification team reports the cooperation, and the collaboration in that cooperation ring would be failed to continue. Creating new accounts needs more money, making it hard for the users to be motivated to create many fake accounts. Bribery needs money, and the randomness makes it hard to access the verification teams frequently. Suppose a verification team member reports a different opinion that is incompatible with the majority of the team’s opinion. In that case, that member is going to be recognized later, and such a member cannot submit a fractal ring for two consequent checkpoints, and the system will punish this trader by decreasing a little amount of $ARA$ from the trader’s account. So it would be tough to convince strangers to do something wrong.

### 5.5 Alternative Approaches

The $LoR$ system owns an incredibly flexible design. That is based on different requirements a designer may want to use other strategies instead of those we introduce in this original introduction of the $LoR$ system. This subsection introduces a few alternative approaches a system designer may consider while dealing with this system. The $LoR$ system default policies make it highly secure. However, note that two instance of $LoR$ should get merge to each other only if both of them had used the same set of approaches for designing their systems. See these approaches:

- In order to provide a more secure system, a system designer can force a trader to pay some money for not being consistent with others; however, this approach has a risk, because the system is decentralized and there might be delays in the system, and so there is a probability that the trader might not be faulty.
- Another approach is to set credit for every trader, and if a trader did something wrong, then the trader loses some credit (a number), and traders with low credits are not allowed to submit high-weighted cooperation rings. The credit system could support a procedure that increments credits constantly and decreases them exponentially.
- As an alternative approach to the randomized approach proposed here, a system designer may use a reputation mechanism to select liable verification teams out of the users. A number of factors can be used to calculate a user’s reputation based on the user’s behavioral history in the system. In such a system, a user with a higher reputation is more likely to be chosen for the verification teams. The frequency of the completed tasks, completed tasks ratio, the stability, and the time that a user has spent in the system can be counted as influential factors to compute the users’ reputations.
5.6 The LoR Characteristics

The spirit of all the previously collaborative decentralized systems might be different from the LoR system in the below-mentioned features:

1. Simplicity: That is, even someone with a low level of knowledge in computer-based systems can use this platform.
2. Distribution: According to Tanenbaum’s definition [3], a distributed system is a transparent system that tries to hide the complexities from its users. Combining these definitions, a distributed system is a middleware that connects with a variety of distributed hardware and software to coordinate the activities of several processes running on various platforms of computers over a communication network so that all components cooperate to perform a set of related tasks aimed at a common goal [20].
3. Transparency: In a cooperation ring, every participant only worries about their task, and the tasks of other participants in that cooperation will be checked and verified by the LoR system, so a participant does not need to worry about others’ duties. The verification process is distributed among the system users as a part of their tasks. A participant can participate in cooperation without worrying about others’ behavior. The system guarantees that anyone who works in the system benefits only by being righteous and honest.
4. Standard Services: A user who intends to perform a service in an instance of the LoR system can only provide that specific service based on a few standard rules specified as the rules of that service by the administrator. Recall that the administrator themselves should admit the policies of the LoR-system to define a service in their own instance of the system.
5. Generality: Users should be able and allowed to perform any of the services defined in an instance of the system. In other words, a participant may choose to do various types of tasks that exist in the system. The system guarantees that there are always enough available tasks so that participants can construct their cooperation rings easily.
6. Large Scale: the system starts working when there are more than one million users available. We will see that after this number of users join the system, it can guarantee safety for the users.
7. Reliability: A user cannot use the LoR system unless they invest some money. In fact, for a user to participate in cooperation in an instance of the LoR system, they should buy enough amount of the internal crypto-currency used by the system.
8. Homogeneous: Currently available applications do not provide a unique platform to be implemented as a general system. The LoR system provides such a general platform so that many applications can be proposed as an instance of the LoR system. They can be merged and operate together simultaneously. The services must be implemented by system administrators according to the various requirements of people.
9. Security: There are a lot of complex strategies used by the parties in the currently available systems to provide security [7, 10, 23]. However, a decentralized random procedure, as well as an intentional lock mechanism used in LoR, makes this platform highly secure.
10. Easy to Use: We know that a system programmer is more expert in developing. Many popular applications could be implemented in the core of the LoR system without anyone involving personal implementation. Even traditional poor-knowledge people can work based on the LoR platform and implement their business ideas.
11. Scalability: As mentioned in the previous paragraph, even those who do not own much money or knowledge to work on computer-based systems can cooperate with others in
this system and make money based on their contribution. So, the LoR system provides a job for an extensive range of people. Moreover, recall that the instances of the system can join and provide a larger system.

12. Dateless: We come up with a strategy which is not losing its performance and utilitarian by the passage of time (Except that if we implement the database based on the blockchain system, it should eventually move from blockchain to another platform. That is because the blockchain system loses its efficiency by the passage of time [10 23]).

13. Working Legitimately: That is, every user should actually work in the system to earn money. A user should either provide a service or invest in a service. No waste of energy there is in the LoR system.

14. Fractal Structure: The LoR system enjoys a fractally structure that can help the system to be highly flexible. The recovery of the system would be easy. No matter which services you are working on, any cooperation ring can be used in a fractal ring. This helps the verification teams to be spread through all the network of the trades from any joined instance.

The LoR system does not deal with the issues that have been occurred due to the lack of motivated users. This problem has also been studied by [7 10 23].