Using blockchain technology for government auditing

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Abstract — **The current study aim at providing blockchain technology for government auditing that conduct by government auditors in the public sector. The main idea of this research is to draw the issue and technique to blockchain technology for government auditing. This approach allows to consider auditing process like chess since controlled processes are studied from all interrelated and affiliated sides, taking into account the time factor. As a result we reached to conclusion that using day-to-day blockchain and digital technologies is a perfect way to prevent any kind of fraud with budget money.**

Keywords - government auditing; blockchain technology; public sector; budget; digital technology; government.

I. INTRODUCTION

The current study is aimed at providing blockchain technology for government auditing process that conduct by government auditors in the public sector in general.

Nowadays there is a difficult challenge, particularly for government officials who lack the institutional support, knowledge, and experience to achieve the conditions necessary to hold their governments to account. Government agencies and entities face multiple stakeholders with potentially conflicting interests. There is the gap between stakeholder expectation and audit mandates for government auditors which work helps safeguard taxpayers' money. Well known that **Government Auditing** defines as essential to the government's responsibility of accountability to the public [1]. Government auditing are intended to provide an independent, objective, nonpartisan assessment of the stewardship, performance, and cost of government policies, programs, and operations [9, 10, 16]. The government audit is designed to vouch for the reliability of the financial statements, not the soundness of the finances they portray. The *government audit* should focus attention on how budget resources are spent. Assessment procedures of government auditing serve to avoid misrepresentation and fraud in government financial statements [1, 14 - 17].

Yet, beyond challenging government management and services, the true potential of blockchain technologies is their capacity to enable open-source distributed consensus. And while these systems may present innumerable opportunities to government, they also threaten those unable to respond to their development, fundamentally challenging conventional approaches to public sector regulation. But Governments are tasked with identifying the appropriate balance between fostering innovation and safeguarding security [GAO Security]. The essential virtue of blockchain is the ability to automate mechanism of trust without of central authority (such as a central bank, government, or military), wich mitigates risk and enables all manner of efficiences of government context. Potential uses for blockchain is supply chain auditing, i.e. give supply chain partners and consumers a way to verify the otigin of products and component materials, for example, that «green» products are actually sourced from environmentally conscientious suppliers. [2]

According to Evangeline & Wilner, **Blockchain** is best understood as a digital distributed ledger used to record and share information throughout a peer-to-peer network. Identical copies of the ledger are maintained and collectively validated by network members, with accepted information aggregated into ‘‘blocks,’’ which are added to a chronological ‘‘chain’’ of existing, previously validated blocks, using a cryptographic signature. Each new block is timestamped—a process of digitally encoding time that corresponds to the creation of new and immutable data—and contains information referencing the block that preceded it, ensuring that any attempt to tamper with the blockchain would require the alteration of every block previously created, a near-impossibility given the decentralized nature of the technology [8]. Among its many attributes, the technology is perhaps most remarkable for its ability to ensure digital authenticity without third-party intervention, ultimately ensuring ‘‘trust’’ through cryptographic proof in inherently trust-less environments [12].

The blockchain technology is also both highly secure and resilient, employing public key cryptography— to protect value transfer and ownership. Furthermore, blockchain can be highly efficient, enabling peers to transfer value directly to one another without intermediaries, permitting quick and low-cost transmission of information and value across vast networks. Also, the blockchain technology is transparent, providing an immutable record of all transactions that have ever occurred on the protocol's distributed ledger [11]. In addition, blockchain technology has evolved over time through the creation of new and diverse systems, each serving specific functions through the incorporation of permissions, rules, smart contracts, digital signatures, and various other features. [18].

There is important to notice that directly search for such keywords as: “blockchain AND SU(public administration) AND (government auditing) AND (auditing in public sector)” found 0 results in 10 Proquest databases for last 12 months (Accessed 26.03.2018). Due to this, study to theoretical foundations in using blockchain technology for government auditing from different points of view is impossible until now. Therefore, the following paragraph is very important.

II. THE ESSENSE OF BLOCKCHAIN TECHNOLOGY FOR GOVERNMENT AUDITING

Using blockchain technology government auditor considers audittee's activity as a whole bearing in mind all kind of chain related to time factor. To understand it let consider essence of block chain technology.

Chains are the part of the economic environment, and play the role of connecting the parts into a whole, the individual elements into a system, incidentals into the regularities, individual operations into the production process, individual units into integrated production organisms of an institutional unit, and so on. Chains provide reciprocal transfers between one part of the system and another. The principle of the general interconnection of objects and phenomena is one of the basic principles of cognitive activity. The components of any chain are the cause or causal action, i.e. the process of transfer of cause into effect, and the effect itself. The connection is represented graphically in Figure 1 as a unidirectional movement.

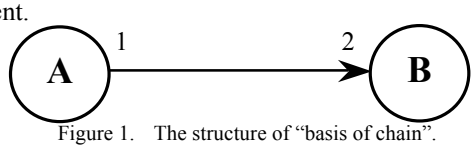

Figure 1. The structure of "basis of chain".

A and B points in Figure 1 are two sides, which relate to each other, where A is a cause, and B is a result or effect of the cause. The arrow 1-2 on the figure represents the action, i.e. the process of transfer of cause into effect. The whole chain forms a system – A, 1 – 2, B – and becomes a unit. But immediately the generated part – effect B – in turn is the cause in the next chain and so on, ad infinitum. The essence of the chain appears in its motion. Before the motion, the chain is static. With the beginning of the movement, static chains become dynamic and change over time. This dynamic chain will interest us in the account the follows. Without motion, the chain can be noted, but its implementation, the transfer of cause into effect, cannot occur.

Transfer between numbers 1 - 2 is the bridge that connects the two sides, the two things, two phenomena and through which their unity is ensured. At the same time it what maintains the chain, so hereafter we call it 'the basis of chain'. As a basis there can be physical, economic, social and other processes, which connect the poles – cause / effect, goods / money, seller / buyer, etc. If, for example, organization A gives a loan and organization B receives a loan, then the basis of the relationship between the institutional units A and B will be lending, i.e., the principle that unites these organizations in the economy (Figure1). In other words, in addition to reflecting on the characteristics of the separate part in the chain, it is important to show the connection with other parts. To understand the characteristics of the separate chain, it is necessary to see it in the context of the system.

If the motion is continuous, it can be defined only partially, but it is impossible to quantify, because any number reflects only the final quantity. Therefore, in order to describe the movement quantitatively, it should be stopped and the nodal points of the interruption measured. These points will be the separate moments of the movement. If we consider the system of relationships, then in order to reflect it, nodal points must be at the intersection of different processes and work (services). These joints will be the most mature in the system and, at the same time, the moments of transfer of cause into effect. Thus, the features of the dynamic chain are the following: chain is a specific form of cause-and-effect relation. It is an elementary system consisting of 3 parts: cause, effect and basis on which the cause becomes effect. Boundary chain parameters are the joints between contiguous work/events. They can be quantified through events.

If we consider the production process of the national product, all chains of this process are equally important: the failure of one of them, even one of its events, suspends traffic in the chain system, breaks the chain of production technology and makes it impossible for normal movement of production. Here we have chain subordination, i.e. subordination of one connection and the other, stemming from their relative position in time within a single production process. The preceding link is always directed to perform subsequent chain and therefore subject to them. This ratio is a law of subordination of present to future. According to this law, the future chain is the goal, but the previous - means towards this end. In case of breaching the law the stable chain system turns into "the aggregate of accidents". The most important condition for coherence units in their joint production is subordination of temporal parameters of their work to temporal parameters, which determine the movement towards the ultimate goal. There is the management system as a whole and chains are the factors, which create system and the fundamental law of its organization - the mechanism of coordination.

The material basis of this mechanism is the material flows, and regulator of its movement – service/production technology. In practice, this also means that on the basis of money consistency in the economy and society cannot be ensured, it is impossible to provide crisis-free economic development and social development without large conflicts and wars. It also means that the role of money increases no more than the role of many other factors, such as multiplication table, mathematical methods, and computerization. Even the country's budget is unpractical to draw up without the production and material balances. Budgeting based only on the dynamics of finances is similar to guessing. Without taking into account the availability, range and location of resources it is impossible to audit any government/administrative unit. Only synchronism of material and financial flows account can be used in government auditing. When the recording of financial flows, i.e. direct money transfer, divorced from the material flow or not taken into account from whom material flow was left, from whom resources were written off - excellent and highly attractive environment for fraud/criminality is created. For instance, material flow supposedly has gone from the supplier, but is not written off from anyone and never put on the record. Wherein the recipient didn`t receive the material flow, because it didn`t exist and budget money that listed on the transfer of false memo content have put into officials pockets.

The deliberate systematic management of all connections in budget resources movement involves regulation of both material and time ratios between adjacent processes. That means the need to implement it on all the major management activities: counting and regulating the number, registration, identification of management unit opportunities, planning, evaluation, promotion of affairs unit, etc. It is necessary to

manage all three components - the base and the two events. Managing of the connection base, works, is a traditional works management process, and should be carried out by the executors of these works. Scheduled link of the institutional unit connects two parts of a single property and is binding on both parties not only in terms of their responsibilities to each other, but also in some of the responsibilities of both of them in front of this unit. Therefore, management of scheduled connection should carry most of the institutional unit. This is true for the institutional units of any type of property.

The events themselves, as separate states of the whole process, change only when the services/work at the bottom of the chain is being performed. In other words, the parameters of a given chain are determined by the parameters of other chains, and in general by the parameters of the motion of the entire process. At the same time, accompanying the movement of material flows, time becomes objective and "flows through connections," as if on a vascular system. Events in the chain can be compared with pipeline valves, which can be open or closed. With an open state that corresponds to the flow movement, time flows without "delay," when closed, when the flow stops, the flow of object time also stops. Since the events of any connection always belong to several connections, and each connection by means of other connections is connected with the initial and final events of the system, the question of changing the parameters of individual events should be considered only as part of the whole, as the moment of the time structure of the entire process.

This movement ends successfully only when the responsibilities of all units for this service/production are met. Its real result is the release of the finished product. Relations between the cooperating links of the chain are derived from their place in this chain. This is clearly seen in the fragment (see Figure 2). The number inside cycles means cod of operation/transaction. All of auditee operations must be account and calculate. The feature of blockchain auditing is taking into account financial transaction related to any others side of auditee life.

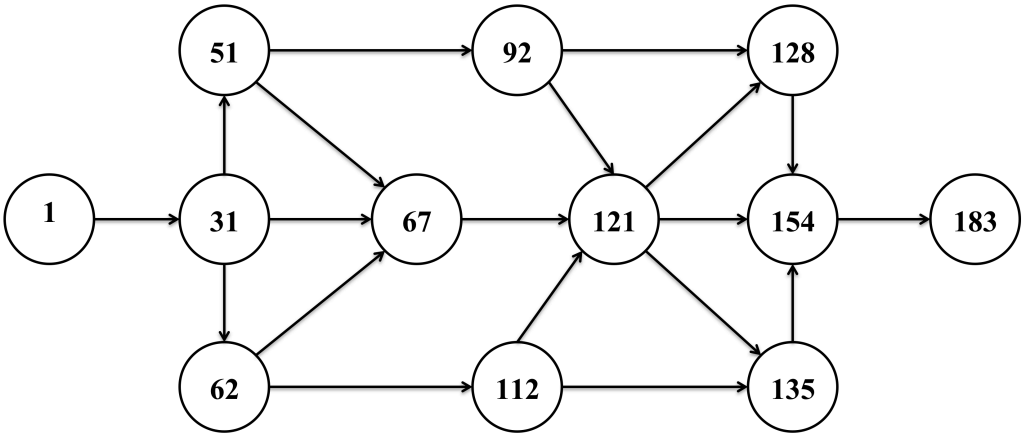

Figure 2. The blockchain fragment.

Therefore, bearing in mind the essence of blockchain we can draw the technique (see Figure 3).

Governments need to be careful because blockchain technologies, particularly public permissionless systems, can be abused for illicit purposes. This is primarily a result of their ability to facilitate pseudonymous—and in some cases fully anonymous—cryptocurrency transactions across international borders quickly and without third-party oversight or intervention. Lacking the strict governance structures (like Supreme Audit Institutions) of traditional fiat payment systems, permissionless blockchains are unable to impose any obligation on users to verify user identity or cross-check watch-lists or embargoed countries. As both currencies and payments infrastructures, public permissionless blockchains have received significant attention from central banking authorities worldwide. So developments of public permissionless blockchain systems thus require long-term monitoring by governments and central banks.

While assessments have demonstrated that crypto currencies fail to satisfy full requirements of ‘‘money’’ from an economic perspective due to their high price volatility and low acceptance rate—and thus pose little threat to national monetary stability in their current form—concerns have been raised that future iterations of crypto currencies might yet influence national monetary policy objectives. Advanced analytics give program administrators the ability to not only detects fraud, but to build models capable of predicting it. To enable predictive modeling, data sets must comprise transactions considered suspicious and the outcomes of investigations. Combining observations and their outcomes allows supervisors to begin to build the link needed to predict future occurrences of purchase card misuse. Advanced techniques allow transaction supervisors to consider the multiple indicators of fraud [19].

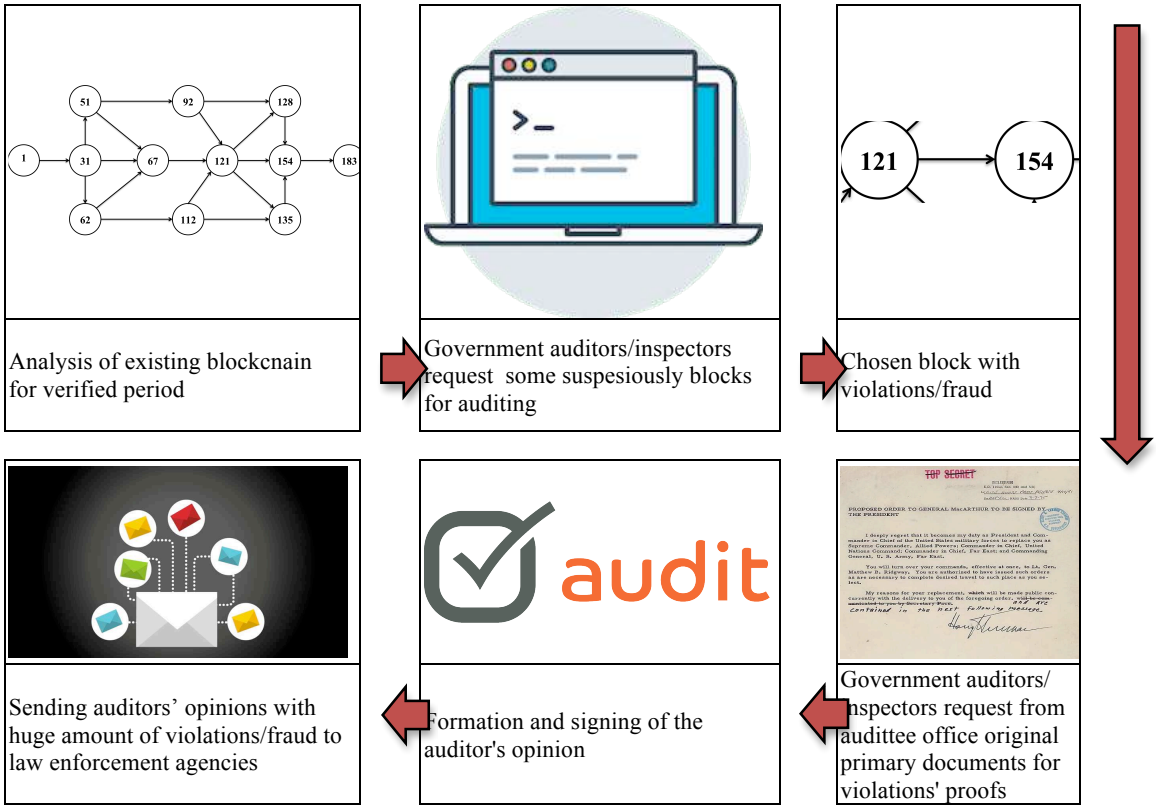

Figure 3. Blockchain using technique for government auditing.

Source: Own imagination.

Suspicion scoring is a powerful method often used to reflect the degree of suspicion assigned to each transaction/ operation. A suspicion score can simply be the probability that the transaction is fraudulent based on a single indicator. At a more complex level, the suspicion score could be a composite of a series of detection findings, or indicators, such as the number of primary rules broken, the number of secondary rules broken, and probability of fraud type. Combining multiple indicators into a suspicion score is often based on a weighting scheme that considers the relative importance of each indicator. The higher suspicion scores merit the highest priority for investigation [3].

III. BLOCKCHAIN IMPLEMENTATION'S FRAMEWORK

This framework may use in any country because blockchain technology is similar from country to country. Blockchain implementation's framework consists of three blocks:

A. Standardization
B. HR Management
C. Data Management

Author elaborated block-scheme of Blockchain implementation's that shows on Figure 4.

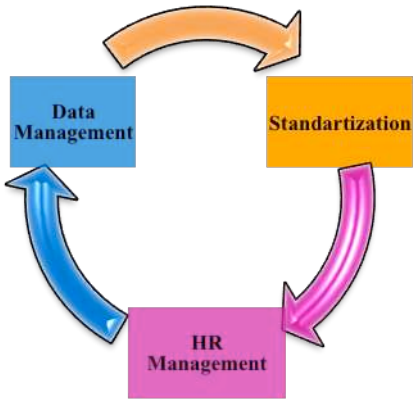

Figure 4. Scheme of chain technology implementation.

A. Standardizations

To unify verification procedure Blockchain Data must be standardized. Standardization can help to maximize compatibility, interoperability, safety, repeatability, or quality. It can also facilitate commoditization of formerly custom processes. The idea of standardization is close to the solution for a coordination problem, a situation in which all parties can realize mutual gains, but only by making mutually consistent decisions. In the context of supply chain management and materials management, standardization covers the process of specification and use of any item the company must buy in or make, allowable substitutions, and build or buy decisions. The

"blind spot" of nowadays standardizations is that current regulatory point of view considers just a traditional auditing which estimates only the balance-sheet value of assets and cash flows, but not virtual/digital actives.

B. HR Management

It is well known that "cadres decide everything." In the face of global competition can not continue to base education on the use of cheap labor. Principles of formation and staffing of personnel policy are determined by the new requirements of the government auditing body in terms of improving the quality of the training process and scientific research, its results and the reflection in government auditing. To achieve quality auditing, it is necessary to develop and effectively implement operations throughout the value chain organization, and this will require the development of knowledge, skills and abilities of auditors. It is advisable to develop a scheme for premium pay for auditing services, depending on their quality, meeting deadlines. There is no need for initiatives to award or the number of procedures performed. There should be rewarded for results. There is another issue in designing the reward - is the choice of the number of criteria. Indicators formulated in accordance with auditing strategy should be consistent with two or three strategic areas (such as more efficient use of assets).

In auditing, the priority is given to auditors, who can draw a general picture of the cause-and- effect relationships that unite the various factors to achieve results. Activated involvement in auditing activities related to the priority areas, increasing the number of scientists and adviser is changing the structure of the load in the direction of its greater focus on research.

The effectiveness of human resource management can also help and a clear allocation of responsibilities and accountability. In addition, the leadership of the government auditing body needs to keep track of the passage of the regular training of the teaching staff. It is also very important to include measures to reduce the potential for conflict of interest in the audittee environment. This is important for the creation of a positive atmosphere in the team with the approved policies and procedures.

The professional qualifications and the academic learning route in counter fraud study is a fresh approach to tackling the problem of fraud. In addition to the benefits of effective audit, there have been a number of other positive developments. With a more educated and specialist workforce, government audit bodies are now taking on managerial and policy roles that previously may have been the domain of generalist civil servants. In turn, this gives government auditing work greater credibility and a more informed approach [12].

C. Data Management

Data Management means the need to implement it on all the major management activities: counting and regulating the number, registration, identification of management unit opportunities, planning, evaluation, promotion of affairs unit, etc. It is necessary to manage all three chain components - the base and the two events. Managing of the connection base and works, is a traditional works management process, and should be carried out by the executors of these works.

In addition Data Management allows continuous monitoring of blockchain systems. Surfing flows of transactions are continuously monitored, identifying transactions that match certain pre-determined integrity constraints and, in the event of a constrain violation, alert the government auditor and copy the transaction data to a file from blockchain system. First step in implementing blockchain techniques is to determine to appropriate transactions in the context of an agency's day-to-day life. Because these guidelines vary by agency and program, it is important for agency administrators and subject-matter experts to collectively brainstorm the common-sense ways that online operation may be used, as well as the ways they should not be used [5].

Whether a public sector transaction supervision system is automated or manual, auditors should explore ways to integrate business rules and rule violations into the governmental audit process. Agencies will likely find that transaction data itself is insufficient to validate rules and identify rule violations. Supplemental information from different stakeholders may be necessary. Data sources valuable for fraud identification may originate internally or externally and reach across numerous departments, including finance, accounting, and others. As part of the initial process of determining appropriate Budgetary Operations/Transactions, agency leadership should identify data sources and facilitate coordination throughout the organization to build a Budgetary Operations/ Transactions data repository.

Wherein an effective notification system operates over the Treasury central server, delivers event messaging to predefined employees in "real time," as the event occurs, and is sent directly to the employees and their smart devices. This level of event notification ensures that the people who need to know about an incident are made aware in a timely manner and fosters immediate and unified response as required. Exploratory analysis and trending allow program administrators to identify patterns and detect anomalous behavior. Basic statistics like mean, standard deviation and skew, along with commonly accepted "tests," help identify transactions that are unusual. Such outliers and anomalies should raise red flags with supervisors and indicate the need for further investigation. Some commonly accepted techniques test for detecting potentially fraudulent transactions [5, 7].

Assigning suspicion scores to transactions in an entire population would allow agencies to establish benchmarks for acceptable behavior and set performance goals for improvement. Employing advanced analytic techniques requires both adept staff and technological support. If agency reviewers are well-versed in statistical methods, packages like SPSS, SAS or STATA are effective tools that can be applied to existing datasets. Agencies looking for more out-of-the-box solutions might find audit-specific tools, referred to as computer-aided audit technology, more effective. While powerful, data analytics is only one tool in combating fraud — the role of engaged and supportive program administrators cannot be overstated. Managers are essential to implementation of the internal controls necessary to prevent fraud and in coordinating across offices for the effective deployment of data analytic practices [3].

As an agency's ability to collect and manage data matures, more analytic techniques can be considered. Exploratory analysis empowers agencies to flag suspicious transactions that are not immediately obvious to reviewers and do not violate business rules. With robust data, exploratory analysis can be conducted using tools ranging from Microsoft Excel® to advanced statistical packages or transactional analysis software. Establishing rules and performing exploratory analysis are complementary techniques, and the process of establishing what is and is not acceptable purchase card use should be viewed as evolving rather than linear. Over time, any budgetary transactions should begin to reflect predictable patterns of use.

IV. Conclusions

The current wave of public sector modernization driven by blockchain technology has resulted in a period of opportunity for citizens, and the Governments economy. This emerging technology has offered incumbent government auditing institutions an opportunity to replace existing infrastructure and seek larger effectiveness through technological modernization at the precise moment where they concurrently face mounting international competition and regulatory scrutiny. Bearing in mind the essence of blockchain author has drawn blockchain-using technique for government auditing.

This technology threat existing approaches to regulation and legislation. More broadly, the effects of blockchain technology on deeply integrated and internationally interconnected budget systems is not known or appreciated; uncertainty can lead to instability. Depending on the activities undertaken, government audit bodies employing blockchain technologies may be subject to federal, provincial, or territorial legislation related to public sector activity.

Wait-and-see and systematic methodological approaches have allowed government policymakers and regulators to remain neutral as markets dictate whether and where these technologies will achieve significant adoption, and to draw on observable data to inform a deeper understanding of the risks created over time. This reactive regulatory approach can even facilitate technological innovation, allowing regulators to better understand the technical fundamentals of these new technologies, as well as the benefits and applicability of their uptake, prior to regulatory intervention. To date, no single regulatory approach to blockchain technologies has garnered widespread endorsement. While Russia, Thailand, and China have attempted to institute a ''restrictive'' approach to this technologies by banning or limiting use, these efforts have been largely unsuccessful or have been subsequently reversed [8].

To improve auditing procedures government auditors must use modern blockchain and digital technologies; strengthen investigative powers; encourage more professional designation; support the international transparency. In addition, using day-to-day blockchain and digital technologies is a perfect way to prevent any kind of fraud [3-5,7].

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I am grateful to my father, Valentin Tsytovich, who taught me to think. Unfortunately, he passed this world away too soon and suddenly in 2000. This paper is author's interpretation of some father's ideas.

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