gravity

Distributed Ledger Solutions for Small and Medium Enterprises. Legally and Financially Compliant.

Abstract

Gravity is a two-tier ecosystem consisting of the Gravity Protocol blockchain and the Gravity Solutions company. Gravity Solutions' (GS) mission is to help small and medium-sized companies optimize business processes using blockchain-based solutions, while maintaining their legal validity. GS is developing the Gravity Business Framework (hereinafter "GBF"), which operates based on the Gravity Protocol. GBF's architecture will be outlined in full in the next sections of this document.

This document only aims to give an overview of the Gravity Protocol regarding the aspects that are utilized in the development of the GBF. Other important components of Gravity Protocol, such as governance, the consensus algorithm implemented, the role of the token and the principles of its emission can be found in Gravity Protocol's technical paper.[1]

SMEs' Problems

In developed countries, small businesses (Small and Medium Enterprises, hereinafter "SME") constitute a large share of all enterprise, producing over half of GDP. For example, 62% of China's GDP (6.9 trillion US dollars), is produced by SMEs; about half of Germany's and the United States' GDP (57% and 52% respectively) is produced by small and medium-sized businesses.[2]

At the same time, both small and medium-sized enterprises have a number of problems:

Enterprise growth and development is limited due to a lack of knowledge and financial opportunities. Financial limitations, as well as shortfalls in company growth and a downturn in development, result in a lack of competent, qualified employees. This has a knock-on effect which hinders scaling and international expansion and in turn, means that companies are unable to further develop.

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[1] https://www.gravityprotocol.org/gravity_yellow_paper.pdf

[2] http://www.atkearney.co.uk/paper/-/asset_publisher/dVxv4Hz2h8bS/content/sme-clients-do-it-smart-win-their-hearts/10192

Problems faced by small business:

Process Inefficiency in Documentary Workflow

Companies spend large amounts of human resources working with documents and the processes related to their agreements. According to research from the International Data Corporation (IDC) in their paper entitled "Bridging the Information Worker Productivity Gap", workflow based on-paper documents reduces a company's productivity by 21.3%.[3] The average employee spends 27 hours a week on activities related to searching, structuring and verifying documents.

Financial Barriers and Audit Complication

Companies face difficulties attracting investment to be used in developing the organization.[4] In addition, SMEs face difficulties accessing banking and financial services, caused by problems in the process of proving the company's reliable status in the form of a Certificate Of Good-Standing. Information asymmetry slows down decision-making processes and risk assessment during the process of issuing a loan, while a company's internal processes, in addition to the business history of the enterprise, are not adequately transparent for the lender or investor. During this time, limited financial prospects hinder payment of planned costs.[5] Financial services such as factoring and loans are usually used to cover the cash-flow deficiency, but obtaining them is complicated due to the factors outlined above.

Reviewing Counterparties and Partners

There are difficulties which arise when trying to verify new counterparties that do not have the requisite documentation. These difficulties lead to an increase in the human resources needed to audit and validate their activities. According to financial cryptographer Ian Grigg, the cost of KYC can reach up to 30% of transaction volume.[6]

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[3] https://warekennis.nl/wp-content/uploads/2013/11/bridging-the-information-worker-productivity-gap.pdf

[4] https://www2.deloitte.com/content/dam/Deloitte/sg/Documents/financial-services/sea-fsi-digital-banking-small-medium-enterprises-noexp.pdf

[5] https://www.journalofaccountancy.com/issues/1999/oct/boerl.html

[6] https://medium.com/humanizing-the-singularity/ian-grigg-on-how-the-banking-system-is-about-to-collapse-and-how-to-fix-it-c6c8c1bb6681

The problems outlined above limit enterprise growth potential and complicate business processes: SMEs are forced to use available resources inefficiently.

Small businesses use the following solutions to improve their process flow and expand their opportunities for growth:

- Software as a Service solutions (ERP, ERM) for business management;
- Banking services for medium-sized businesses;
- Marketplaces and B2B e-commerce platforms, for example Amazon Business, Alibaba and SAP Ariba.

Let's consider the advantages and disadvantages of these solutions.

Existing Solutions for SMEs

SaaS for Business Management

To optimize their workflow processes, small and medium enterprises implement different SaaS solutions which help reduce transaction costs.

SaaS world market volume will reach 75.7 billion dollars in 2020[7]

38.5	46.3	55.1	64.8	75.7
2016	2017	2018	2019	2020*
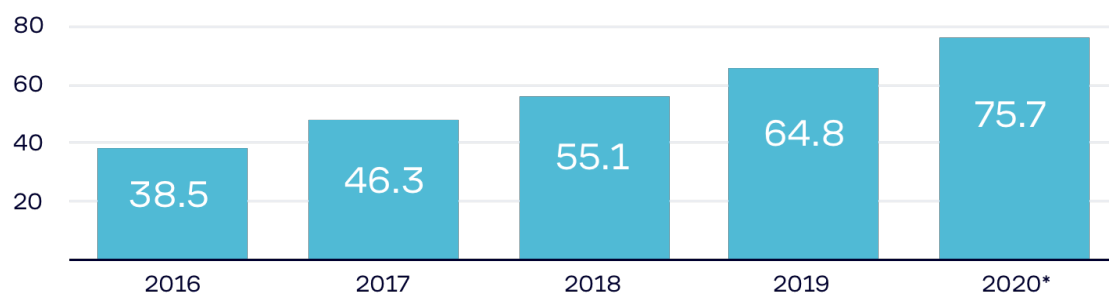
The applications available allow companies to rapidly and easily adapt to changing business environments. Some of the most popular products include ERP and ERM systems, Digital Signatures and electronic document flow services, accounting and transport management systems (TMS), and various other tools for managing and monitoring a company's activities.

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[7] https://financesonline.com/2018-saas-industry-market-report-key-global-trends-growth-forecasts/

These solutions have caused a real breakthrough in optimizing and synchronizing organizational workflow. However, solutions available on the market do not create an environment for seamless interaction among independent businesses within a single ecosystem. For example, data/document flow and circulation between counterparties in a single system doesn't take place due to a lack of trust.

Banking Solutions for Small Businesses

The most popular banking services, besides account maintenance and cash management, are services which offer finance to small and medium-sized businesses. Small companies often contact financial institutions to obtain a loan, overdraft, or lease. However, obtaining these kinds of services is complicated by having to prove the Good-Standing of the company. One of the most significant complications is the lack of audit ability of internal processes and financial indicators of the company. Moreover, the costs of the bank carrying out an audit of the company can exceed the potential profit from doing business with them.[8]

As a result, banks refuse to issue loans to small companies. Where a bank approves the financing, loans are issued at higher rates in order to mitigate the risks of debt default. Banking services, in general, come with various commission fees and monthly account support payments, which in turn, act as additional barriers.

Marketplaces and Counterparty Interaction

Various B2B marketplaces are essential drivers of small business growth. They offer companies the possibility to find customers, suppliers, and contractors around the world, while also boosting the company's international exposure. The worldwide volume of e-commerce platforms for corporate clients was 7.7 trillion USD at the end of 2017.[9] Moreover, this category of services can be complemented by systems that bring together different counterparties: contractors, suppliers, performers, and so forth. For example, the number of active business users on Alibaba's platform includes participants from 240

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[8] http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.653.9072&rep=rep1&type=pdf

[9] https://www.shopify.com/enterprise/global-ecommerce-statistics

countries and is rapidly approaching half a billion,[10] while SAP Ariba state that their platform's turnover exceeds $50 billion a year and allows companies to interact with 34 million potential buyers from 190 countries around the world.[11]

Such platforms can greatly help small businesses make sales, find new customers and grow. However, all of these advantages come with the obligation to pay a platform for its intermediary role in the form of various commissions and fees. For example, Alibaba's membership fee is 1,500 USD year, while companies also are obligated to pay commissions totaling 5-8% of the value of each transaction.[12] The price for subscribing to the Ariba Network is 2,250 USD, with a limited number of transactions (499 per year).[13] There is also an additional commission fee in cases where turnover exceeds 50,000 USD.

> The solutions available based on internet server architecture (http/https) do not offer the opportunity to create fundamentally new processes with legal validity. This includes: the guarantee of data integrity and authenticity, verification of the transacting parties' ID and lower risks of a data breach. However, these solutions, commonly described as the Internet of Agreements, can be created using blockchain protocols.

[14]

[10] https://www.statista.com/statistics/226927/alibaba-cumulative-active-online-buyers-taobao-tmall/

[11] https://www.ariba.com/ariba-network

[12] https://www.feedough.com/alibaba-business-model-how-does-alibaba-make-money/

[13] https://www.ariba.com/-/media/aribacom/assets/pdf-assets/ariba-network-fulfillment-orders-and-invoices-supplier-fee-schedule.pdf

[14] https://medium.com/humanizing-the-singularity/tagged/internet-of-agreements

Blockchain Opportunities for Business

Blockchain offers business a real breakthrough in opportunities and possibilities. It provides: convenient and fast payments, secure registries for database management, in addition to smart contracts. These opportunities give companies the opportunity to digitize, protect and optimize some critical business processes such as payments, factoring transactions, leasing operations, licenses, permits, contracts and any records related to business activities.[15]

According to the International Data Corporation's (IDC) forecasts, the Blockchain Business market will be worth 9.2 billion USD by 2021,[16] thereby making blockchain technology an essential segment of the worldwide SaaS market.

> According to Research & Markets estimations, the market for services based on blockchain technology will reach $13.96 billion by 2022, with an average annual growth rate of 42.8%

[17]

According to the UN data, the transfer of trade documents into digital format will allow for a reduction in the time it takes to file the documents necessary for the export of goods.[18] HSBC believes that the blockchain is ideal for use in the registration of trading operations, reducing 10 days of document workflow to just 24 hours.

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[15] http://ledracapital.com/blog/2014/3/11/bitcoin-series-24-the-mega-master-blockchain-list

[16] https://cryptonews.com/news/be-ready-to-get-your-share-in-usd-9-2-billion-blockchain-pie-1184.htm

[17] https://globenewswire.com/news-release/2018/03/29/1455677/0/en/Global-Blockchain-Technology-Market-2022-Market-is-Expected-to-Reach-Revenue-of-13-96-Billion.html

[18] https://unite.un.org/sites/unite.un.org/files/session_3_b_blockchain_un_initiatives_final.pdf

Blockchain technology is also being actively studied and integrated by governments and corporations. The technology has proven its applicability in many processes between economic agents, related to workflow optimization, data verification, and financial transactions. The key business processes in which this technology has proved its applicability are detailed below.

Key Business Uses for Blockchain

Electronic Document Flow with Verification of Transacting Parties

Digital Signatures allow for the identification of an individual or a company behind a particular action, transaction or message. In order for this to become legally valid using blockchain, existing KYC providers should verify the identity of transacting parties as required by the particular jurisdiction where the transaction is taking place. A Digital Signature affixes a cryptographic seal to the document which renders it tamper proof, while also providing evidence that it was signed by a particular party. There is currently a growing number of eNotary solutions across various jurisdictions which give legal validity to Digital Signatures, such as New Zealand, United Kingdom, Texas, California, North Carolina, New York, Utah and others.

Financial Services: Payments and Money Transfers

Blockchain-based technology allows companies to transfer money safely and directly around the world. Moreover, regardless of the transfer amount, the transaction can be instantaneous with lower transaction costs in comparison with traditional payment services.

Current Blockchain Market

The market for blockchain solutions is mainly focused on the needs of governments and large international corporations.

Large technology companies, financial corporations, logistics companies, and governments are developing their own, private blockchain solutions for processing transactions, managing and synchronizing financial obligations and supply chains. These solutions also simplify auditing processes as well as documentation storage. Big companies are cooperating with consortiums as the

Enterprise Ethereum Alliance, R3 CEV and Mobility Open Blockchain Initiative, that consist of the largest financial organizations, logistics companies and the biggest players in the automotive industry.

Blockchain-based Solutions in the Financial Sector

The market volume of banking products based on blockchain technology will reach $400 million USD by 2019, according to an estimation from McKinsey.[19]

R3 Corda's platform[20] is an important player in this market, allowing companies to manage their obligations before different financial institutions. It also allows for the use of smart contracts to perform various banking transactions. The platform features some key players such as Barclays, BBVA, UBS, HSBC and others.

Ripple should also be mentioned here as a platform which was created for payment systems and is focused on financial transactions. Financial organizations and leaders in the international banking sector use such Ripple products as RippleNet, xCurrent, xRapid, xVia for cross-border, remission payments.

Blockchain Solutions in the Public Sector and for Non-profit Organizations

The governments of various countries around the world are considering the possibility of creating a blockchain register for real estate. Blockchain can simplify the process of buying and selling properties and can optimize the asset audit process by financial institutions. The implementation of the technology will reduce corruption in the public services. One of the more notable examples is the Smart Dubai initiative, which aims to transfer the entire document flow of the Emirate to the blockchain by 2020.[21]

Blockchain Solutions in Real Sectors of the Economy

Companies from the real sector also see great potential in the development of blockchain and its integration into internal business processes. The most

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[19] https://ripple.com/insights/mckinsey_2016/

[20] R3 Corda is relies on Distributed Ledger Technology on which blockchain functions.

[21] https://www.opengovasia.com/articles/uae-government-launches-blockchain-strategy-2021

important advantage of the technology for the corporate sector is the ability to optimize document workflow and simplify the interaction between counterparties.

Such solutions are mainly developed by large companies and international corporations. For example, the Hyperledger project has created the Hyperledger Fabric platform, which allows companies to create smart contracts with specified business conditions. It can also be implemented as a decentralized network which can be used for the verification of data authenticity.

IBM (in collaboration with Walmart, Nestle, Tyson Foods, Unilever and McCormick & Co.) have launched Big Blue, their own blockchain-based system for securely recording and tracking supply chains and transactions. It is also worth mentioning that IBM, in cooperation with the shipping giant Maersk, is implementing technology into the document workflows related to shipping and the tracking of cargo. This allows the ability to track the movement of millions of containers more effectively while reducing the amount of time spent on organizing related documents. SAP SE has also recently announced a Cloud Platform Blockchain for supply chains, while in October 2017, Oracle announced the launch of the Oracle Blockchain Cloud Service.

Obstacles Preventing Blockchain Implementation in SME Processes

Blockchain implementation and integration is more or less the initiative of large multinational corporations and governments. Such solutions do not correspond to the SMEs' requirements or look to solve their problems. However, solutions based on blockchain may optimize and improve various SMEs' business processes. [22] [23] [24]

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[22] https://www.forbes.com/consent/?toURL=https://www.forbes.com/sites/theyec/2017/12/21/are-the-benefits-of-blockchain-out-of-reach-for-small-and-mid-size-businesses/

[23] https://btcmanager.com/5-key-areas-small-business-can-benefit-blockchain-technology/

[24] https://www.entrepreneur.com/article/305853

However, some issues do hinder large-scale blockchain adoption amongst SMEs:

Lack of Blockchain Related Expertise

Implementation of blockchain-based technologies requires specific resources and expertise that are not currently adequate to satisfy the market.

Small Companies Cannot Afford Custom Development and the Creation of a Solution That Corresponds to Their Specific Needs

SMEs require products, not technologies. Current blockchain solutions primarily customized for the enterprises in question and so, there are very few SaaS solutions that can be used as turnkey products to serve the wide-ranging needs of whole sectors.

No Legal Framework for Legal Entities to Use Smart Contracts

Smart contracts were created to make business processes more straightforward, however their implementation requires a lot of legal work. Thus far, there is no common legal standard or framework that defines how smart contracts correspond with certain legal documents.

Cryptocurrency Asset Volatility and Associated Risks

Cryptocurrency usage carries a certain risk and unpredictability which is caused by the volatility of the crypto market. Companies are not able to hold accounts in cryptocurrencies because of price volatility and the complexity of carrying out audits.

> Gravity Solutions gives SMEs innovative payment and paper workflow tools to optimize processes and discover new opportunities to grow their business.

Gravity Business Framework

Gravity Business Framework (hereinafter "GBF") is a legally and financially compliant set of blockchain solutions which utilizes the Gravity Protocol: a graphene-based distributed ledger, that offers a framework for development and blockchain solutions for SMEs.

GBF consists of three fundamental architectures:

- Technical architecture
- Legal architecture
- Financial architecture

Technical
Architecture

GBF

Legal
Architecture

Financial
Architecture

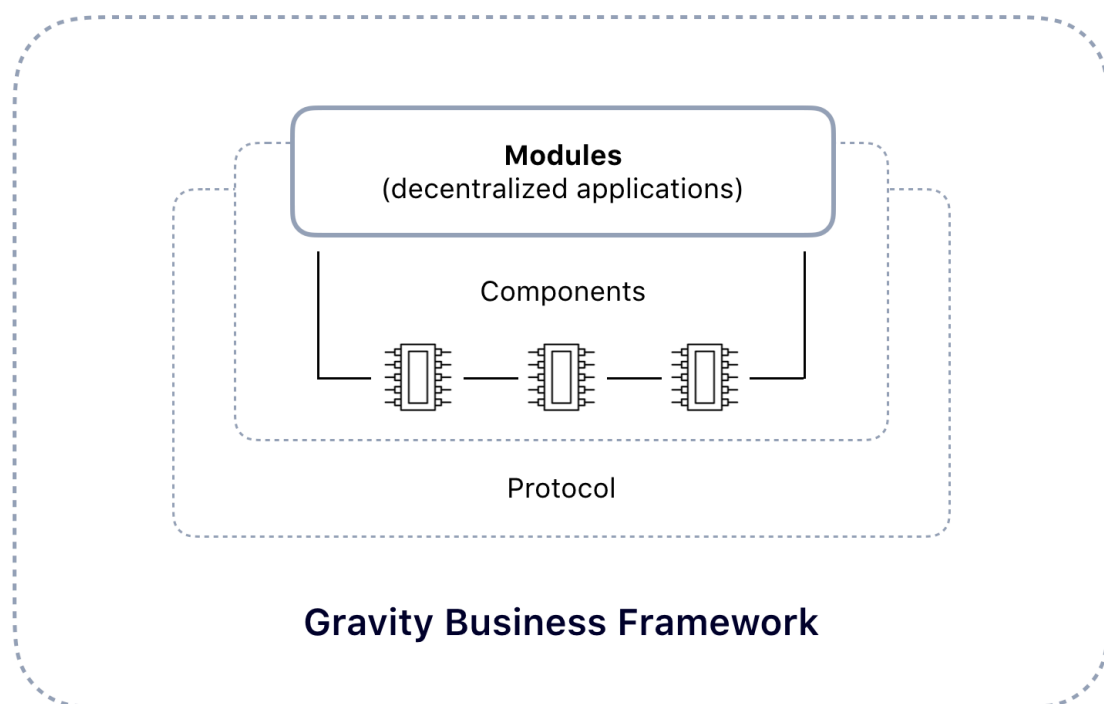Pillars of Gravity Business Framework.
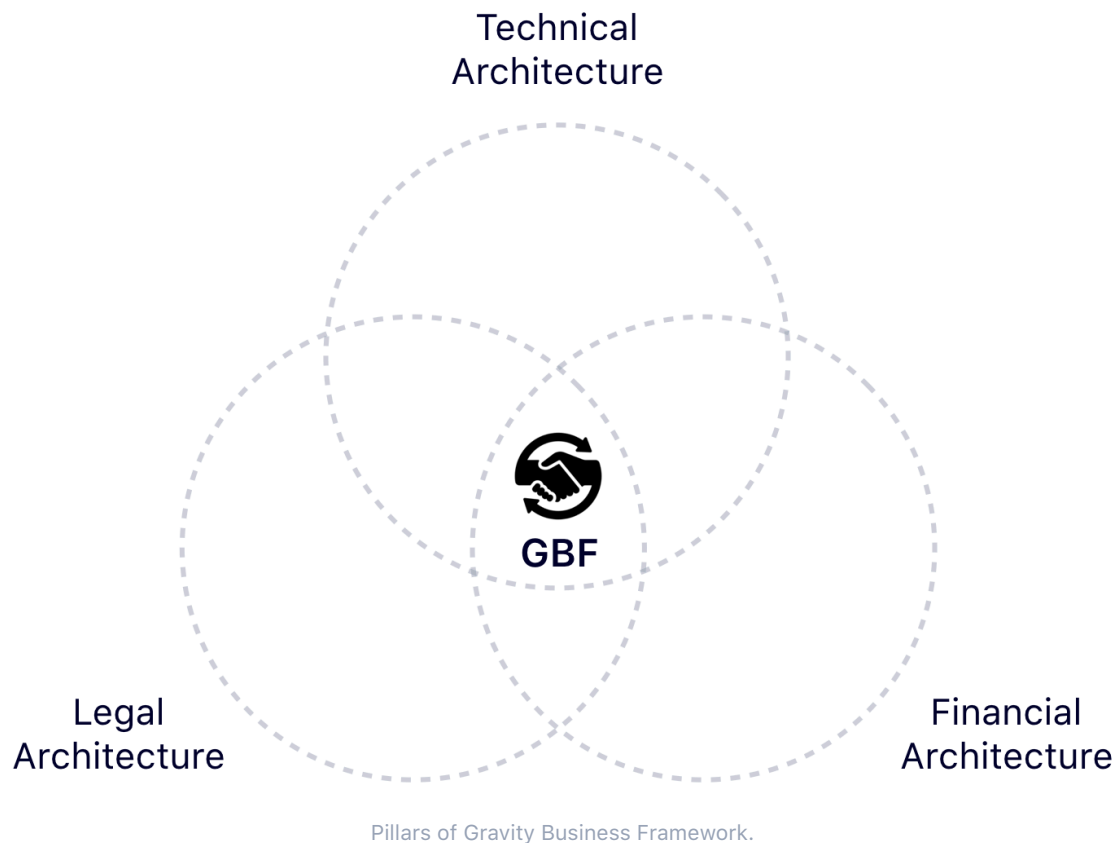
Technical Architecture

GBF's Technical architecture is a set of blockchain-based modules and components which determine the commonality of the protocol and the mechanics of the solution provided. It has unified set of tools to build

applications and make them interoperable. Therefore, every new product interacts with the ecosystem as a whole and is capable of utilizing all of its functions to operate. The ability to create new products based on existing ones creates an ideal environment for the development of blockchain solutions.

As mentioned above, GBF consists of *modules* and *components*.

1. The *components* bring about a working and easy to use accessible interface because of their ability to solve certain tasks (storage, identification, payment gateway, etc.). Components are used as building blocks for modules.

2. The *modules* (decentralized applications) are extensible, customized and optimized aggregations of relevant components that solve specific business problems. Various combinations of components give SMEs powerful capabilities by utilizing the technological advantages of the blockchain.

Modules
(decentralized applications)

Components

Protocol

Gravity Business Framework

Layers of Gravity Business Framework.

These components and modules have been developed based on Gravity Protocol architecture in order to build solutions that satisfy the needs of SMEs. Applications' operations and interactions with external services are carried out

through an API connection to the components and modules of the Gravity Business Framework.

The usage of applications' is simplified via the **Library of Legal Templates**, which will be described in the next chapter in more detail.
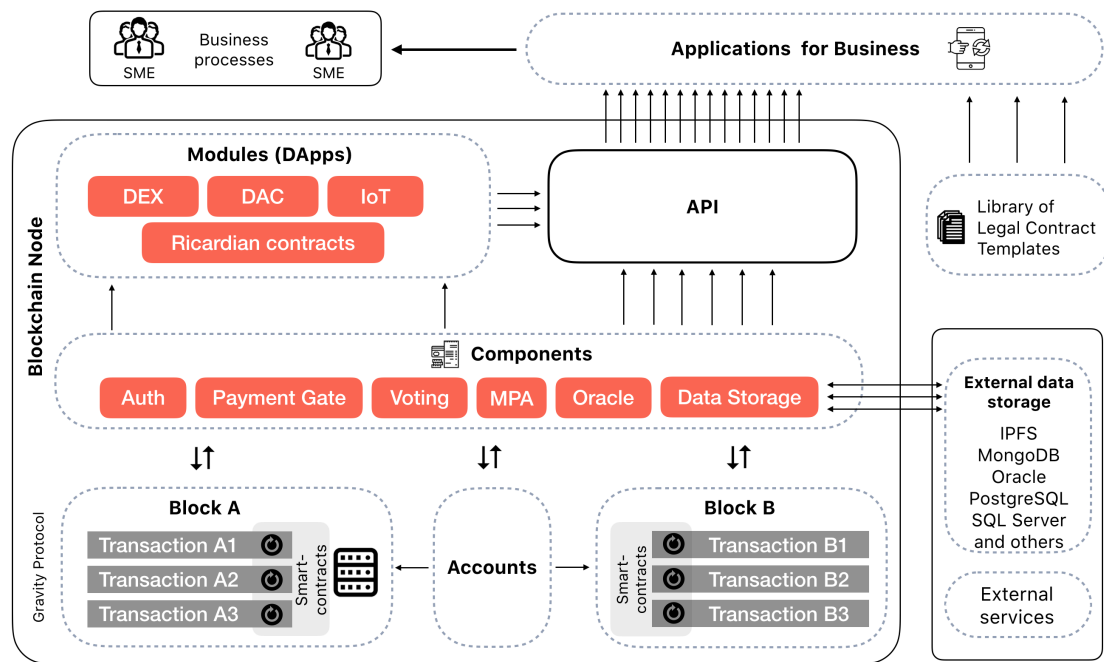
The following diagram shows the framework layers and the way in which they interact.

Components

1. **Data Storage**

   Data storage also provides for backup and recovery, availability and privacy solutions, while also optimizing the costs of storing data on the blockchain. It also allows for data owners to transfer data externally, allowing the owner to manage and completely control it directly. The files can be stored via either distributed decentralized databases (IPFS, etc.), or classic RDBMS (PostgreSQL, Oracle, SQL Server, etc.).

   Distributed systems split data and spread it in parts between multiple computers, thereby organizing a large P2P interchange network with great scalability and capacity. Blockchains address limited data storage capacity via a cryptographic hashing mechanism called a Merkle tree. It works by creating cryptographic signatures from transactions, with the resulting "root

hash" being a sum of several initial transactions. This root hash is the product of several other hashes, and by reversing the hash calculations, one can verify the validity of the transactions. Moreover, the root hash is a single piece of data and therefore takes up less space. The root hash is then placed in a block to serve as the address of the file. Any unauthorized changes to the data will inevitably result in a hash mismatch. This prevents forgery and data tampering. Consequently, the address specified in the blockchain will always refer only to the original data. The owner can make authorized changes by moving updated data to decentralized storage, obtaining a new hash and sending the corresponding signed transaction with it to the blockchain.

Such systems imply simplified and low-cost (according to Storj — 10 times cheaper than centralized storage[25]) management of protected data and are in high demand in areas such as Big Data, AI Deep Learning, Internet-of-Things, Smart House, CCTV.

Blockchain-stored information becomes linked to a specific owner and can be tokenized, exchanged, sold or disclosed whether partially or in full. Data may be automatically sold upon the fulfillment of certain conditions, such as the receipt of a payment, a specified time elapses, the result of an external event occurring, etc.

2. **AUTH**
   This component allows participants to gain authorization from open protocols like OAuth and OpenID. It also provides an API to connect to any KYC services providing for identification of individuals and legal entities. This API allows not only for the use of existing infrastructure as mentioned above but also renders the system future proof by allowing for the use of new and better solutions once they become available.

3. **OpenAPI**
   GBF's API is an application programming interface for external software products. It is made up of modules, classes, structures and constants for developers.

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[25] https://bitcoinmagazine.com/articles/storj-vs-dropbox-decentralized-storage-future-1408177107/

Unlike other ecosystems, Gravity Protocol has no centralized service which allows access to non-public API requests after successful authentication. Gravity authentication is based on asymmetric public key encryption, avoiding access via third parties, which is a significant advantage.

While key objects are typically defined on the protocol level, Gravity Protocol differs in that it is designed for extensibility, so it supports objects defined by various applications. The latter allows for interaction with a high level of abstraction, for example, with the contents of the current state of the database. Consequently, this field of application relates to unprocessed objects, such as accounts, assets, committee members, as well as orders, offers and balances.

4. **Payment Gate**

   This component is a multi-payment gateway that allows fiat remittance.

5. **User tokens**

   Each account can issue its own tokens, derived from any object, good, service or right, which will circulate in the ecosystem similarly to the Gravity Core Token.

   For example, SMEs can issue derivative tokens for future or current goods, or assets as a securitization or tokenization.

6. **Voting**

   In addition to the consensus mechanism that ensures consistency throughout the network, there is a much more *multi-purpose* voting system:

   a. Option for any private or public communities to make decisions.
   b. Decisions can technically be taken regarding any issue whatsoever, provided that the participants or oracles have already created proper blockchain entities for interactions. Moreover, all protocol updates and changes require user approval via a two-level voting process with the participation of all members.
   c. Option to transfer voting rights between accounts allows for multi-level decision making. Voting rights may be transferred to

high-level representatives or an anonymous proxy. The number of levels in such a voting system is unlimited.

Any organizations can use this multi-purpose facility for decision making by voting. For example, if a group of partners consolidate their businesses with an agreement that their voting powers on the board of directors will depend on the share of their revenue in respect to total group revenue. Consequently, since the facility can operate with any object available to an oracle, partners can implement additional conditions (e.g. exclusion from voting where licenses are revoked).

7. **Oracle**

Oracles are used to interact with external objects that can not be reached directly by the decentralized network itself. This is done by connecting protocol requests with parameters of objects external to the blockchain.

Oracles provide data about events and objects external to the blockchain to smart contracts as required by Extended GS Contracts. Moreover, in some cases, in addition to information provision, oracles can manage external assets by blockchain-based commands.

Oracles allow the automation and secure processes that require actual updates of real-world data for its operations. Also, oracles add records about the conditions of external business processes and changes to their status. Courts ensure the fulfillment of obligations by informing society that unfulfillment leads to unavoidable punishment. Blockchain streamlines such processes.

8. **Market Pegged Assets**

Market Pegged Assets (MPA) are a type of Gravity Protocol-based token that tracks the value of an external asset and can be settled for the value of that external asset in Gravity Core Tokens (ZGV). MPA can be derived from any liquid asset that has market value, for example currencies, commodities, etc.

In fact, MPAs are IOU enforced by the protocol with Gravity Core Token (ZGV) collateral. Due to the high volatility of ZGV, the amount of collateral has to be several times greater than the value of MPA. This is necessary to manage the risk of a sharp drop in the value of ZGV.

MPA allows users to tokenize external objects, such as US dollars, oil, sugar, etc., coincidently saving their value and adopting them as instruments for internal payments, or accounting within the ecosystem.

Consequently, MPA that tracks fiat currencies may serve as an alternative option for remittance.

All MPA-related operations, including creation and settlement, are conducted in a decentralized, automatic and rapid fashion. However, there are particular problems in the way such assets are reflected in SMEs' balance sheets due to the current low level of legal framework development for cryptocurrencies.

Modules

1. **DEX**

   This module is a cross-functional, decentralized, Gravity Protocol-based exchange, which allows for the trading of any assets without having to trust a counterparty. As one of the options, this module may serve as a trading platform for all types of orders.

   However, it is more pertinent for SMEs to use this module as a marketplace to sell goods, with better liquidity, sales volumes and to make purchases with various options and at lower prices, due to the market being highly competitive.

2. **Ricardian**

   This module provides Ricardian Contract functionality, as described in more detail in the next chapter.

3. **DAC (DAO)**

This module allows users to create Decentralized Autonomous Organizations: companies, that conduct all of their business processes as blockchain transactions. For instance, in order to facilitate asset distribution and perform and execute any agreements, DAO uses vesting contracts and smart contracts respectively. Generally speaking, DAO has faced zero restrictions from legal authorities thus far, but at the same time it also has limited business application.

4. **IoT**

The Internet-of-Things module simplifies the interaction of smart technology, such as web-services, SOA components, and virtual objects. Blockchain can seamlessly utilize the autonomous behavior of IoT objects, collecting and analyzing data from various sources due to its decentralized nature as well as the number and distribution of its nodes. This module can be used to build enterprise logistics management systems and administer the entire production process. The IoT module allows SMEs to react dynamically to changing market demands and optimizes production networks in real time.

Relations with External Developers

We believe that no single solution could efficiently handle the complete range of business problems or solve just one of them over a long period of time unless it is continuously updated and developed further. For that reason, we are creating an ecosystem that can create new solutions, customize existing solutions for new requirements and update existing solutions as best practices evolve.

To that end, the primary goal of Gravity Solutions is to maintain and develop a unified standard for Gravity Protocol-based software operations. Clear and precise standards simplify the interactions between ecosystem applications and also provide new developers with the advantage of network scale since it allows existing solutions to be used in developing applications. As the number of participants and existing applications in the ecosystem grows, so does the ease of creating new solutions that can interoperate with other existing applications.

The simplicity of integration, openness of the system, and the number of existing applications all contribute to an environment that incentivizes external developers to join and participate. The creation of a system that supports and attracts new developers is the strategy for long-term scaling of the ecosystem and one of Gravity Solutions' main goals.

Not only does the ecosystem provide a complete tool set, but also a well-defined market that has demand for the IT products created by the participants of the ecosystem. Clarity and focus on a well-defined niche gives the developers an understanding of what products to create, a simple way to reach new customers, and clear ways to monetize their products.

Legal Architecture

GBF legal architecture is based on **Extended GS Contracts**, which provide legal value to all business processes and counterparties' interaction within the Gravity Ecosystem.

Extended GS Contracts consist of the **Ricardian Contract** and a decentralized operational infrastructure that provides its execution. This includes authentication and data storage subsystems, as well as **Smart Contracts** that are necessary to initiate, execute and manage contract agreements.

Being both human and machine-readable, Ricardian Contracts contain everything necessary for an operation to take place, including counterparties' details and contracts' terms and conditions. Smart contract code automatically carries out transactions in line with the Ricardian Contract agreement without any 3rd party involvement (in a decentralized way). Since Ricardian Contracts contain certain standards and structured parameters, the algorithm that forms the smart contract code is always clear about all the details and avoids any misunderstanding between human and machine-readable forms.

In order to make an agreement legally valid, a Ricardian Contract must be signed with parties' **Digital Signatures.**

In any blockchain protocol, the combination of private/public key is already a form of Digital Signature that allows the identification of the owner of an account. However in order to make it valid in accordance with existing legislation, a KYC procedure should be conducted to identify the human or organization behind the public key.

Digital Signature verification is carried out by authorized KYC providers that generate special data objects with verification results. These objects cannot be stored publically in the blockchain due to privacy reasons. They are usually stored off-chain in IPFS or other types of centralized or decentralized storage. Consequently, a blockchain account is linked with a file hash, and then following the verification, via private key along with the Digital Signature, the **Ricardian Contract** can be signed.

However digital identification requires certain legal standards, that are currently being developed by companies such as Mattereum,[26] and will be introduced based on specific legal cases.

Although the definition of what constitutes a Digital Signature varies, so far, the following jurisdictions recognize them: the United States (26 out of 51 states), China, Great Britain, New Zealand, Ireland, Estonia, Hong Kong, Singapore, Russia, Moldova, and Kyrgyzstan.

The applicable legislation varies by jurisdiction, but the most popular method is electronic certification of signature/private electronic key by a notary (or eNotary). While specific legislation varies from country to country, the basis for cross-border legal validity of Digital Signatures revolves around explicit contractual declaration of arbitration jurisdiction, the admission of which is derived from the New York Arbitration Convention, signed by 159 countries. In general, most countries are moving towards digitalization of contractual processes, thus gradually increasing the number of markets where the use of Digital Signatures is legal and therefore may be used within our system.

[26] https://www.mattereum.com/

Each application developed on the Gravity Business Framework uses information and input data with as set out by this agreement system for counterparties.

Extended GS Contract Activation Procedure

To simplify business use and reduce the probability of mistakes taking place, Gravity Solutions creates an open and user expandable **Library of Legal Contracts Templates**, that covers all standard business processes, including buying and selling, rent, leasing, labor contract, trust management, loans, deferred payment contracts, agency agreements, cessions, investments, etc. Templates may be used directly or individually customized.
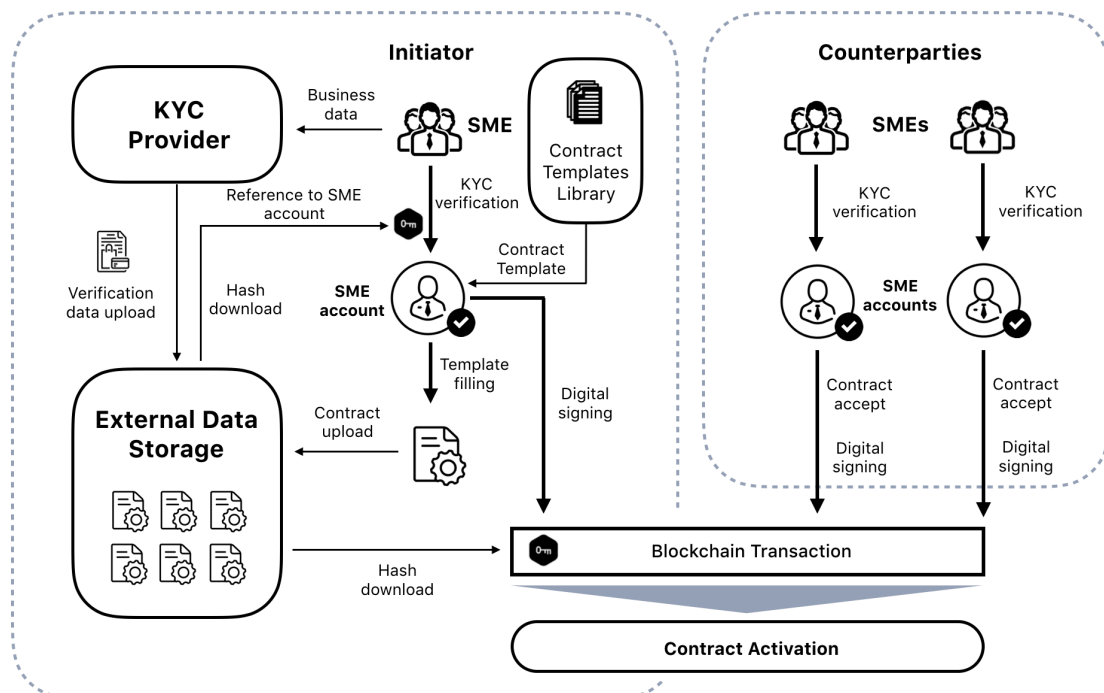
Extended GS Contract Activation Procedure.

The first step of Extended GS Contract activation is to fill in the template with information on participants and the conditions of the deal, with parameters and categories specified in the contract. Completed templates are then automatically verified in order to avoid errors and omissions.

After successful a contract has been successfully created, the creator uploads it to storage, sends a blockchain transaction with a file hash, and signs it with their Digital Signature.

At this point, other parties can get acquainted with the contract description, terms and conditions, as well as the data on the business record of each counterparty, which requires permission from the initiating party as to whether fully or partially disclose details.

Once they come to an agreement, all parties have to sign the initiator's transaction via contract hash with their Digital Signatures, which will subsequently endow the contract with legal significance in accordance with the duration and relevance of the contract.

Each party may initiate additions or changes to the conditions or parties by uploading an updated contract to the storage and sending the transaction with hashes of new and old versions to the blockchain. If all other parties accept the changes, they sign the new transaction with their digital signatures, and an updated version comes into effect.

A transaction that includes hashes from the relevant documents (such as delivery notes) and is signed by all parties can serve as proof of fulfillment of obligations.
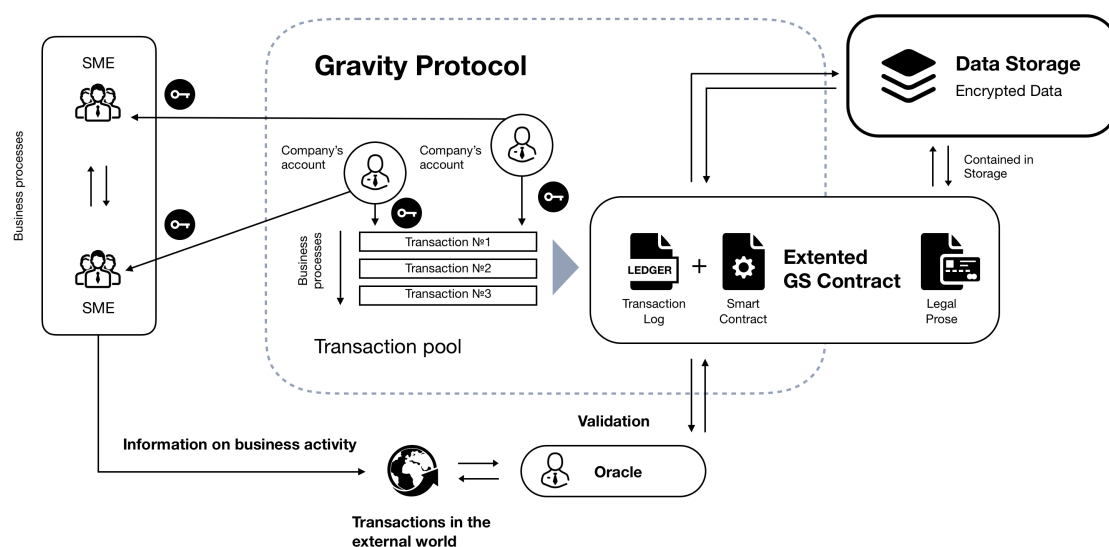
Following diagram shows how GS Extended Contract fits into larger Gravity Business Framework.

Oracles are another way to control the fulfillment of obligations. They provide the Extended Contract with external data, e.g. evidence of a change in assets ownership acquired from state registers.

If the parties involved in the contract agreed to use of oracles for specified objects and that the oracle shall monitor them, objective data will be collected and automatically signed for corresponding transactions. In this event, legal confirmation of the fulfillment of obligations will not require any further signatures.

Advantages of the System

Due to the usage of Extended GS Contract, companies will have the opportunity to use and create a dynamic electronic document workflow, which is human-readable and bears legal significance due to Ricardian Contracts and Digital Signatures.

Blockchain's cryptographic component in addition to management of data stored in distributed file storages (e.g. IPFS) provides for the immutable recording of time, parties to the contract, and the conditions of the agreement.

Blockchain automatically saves the chronological sequence of digital signatures as well as any changes to documents. This allows participants to verify information about all the changes to documents. Moreover, the status of contracts at each step of contract negotiation and fulfillment is therefore conducted in a structured way. The history of all transactions of the parties involved in the deal can also be easily checked.

As such, the possibilities of a data breach taking place, counterfeiting, substitution of notions, or unilateral change of the contract data are impossible. These features and principles help to build an ecosystem that is safe and simple to use. It also makes the creation of dynamically adaptable agreements possible. This is important for SMEs in the current, rapidly changing environment of the market.

Financial Architecture

Gravity's financial architecture serves as a basis for an easily and seamlessly integrated financial ecosystem, comprising of payment gateways, stable coins and banking solutions that introduce the non-crypto world to blockchain.

The financial ecosystem has several payment options, distributed among 2 levels:
- Protocol level
- Solution level

In turn, the following tools are provided at the protocol level:
- Gravity Core Token
- Custom Tokens
- Market Pegged Assets

The solution level provides for the creation of Gravity Stable Coins.

Gravity Core Token

Gravity Core Token is an internal ecosystem token and is the basis of the Gravity Protocol. It is used: to power all transactions; in governance; and as a method to exchange assets within the network.

The key characteristic of the token is the way in which its emission can adapt based on network size and total business activity. Tokens are distributed proportionally across all current ecosystem users in relation to the volume of business activity and importance index, thus creating an incentive for SMEs to transfer a greater number of their processes to the GS ecosystem.

The emission mechanism and other Core Token Gravity features are described in more detail in the Gravity Protocol Technical Paper.[27]

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[27] https://www.gravityprotocol.org/gravity_yellow_paper.pdf

Custom Tokens

Gravity Protocol enables users to create and exchange custom tokens. Moreover, custom tokens can represent any asset, good or service. More details on the subject are provided in a corresponding Components section.

Market Pegged Assets

MPA is a stable coin that is collateralized by Gravity Core Tokens and solves the volatility problem at the protocol architecture level. This solution is adopted from Bitshares and is described in more detail in its respective Components section.

However, we realize that collateral in the form of stable coins may result in legal compliance difficulties, and this could deprive processes and transactions of legal value. This is why another solution has been developed for the Gravity Business Framework, one which endows ecosystem payments with legal validity.

Gravity Stable Coins

Gravity Solutions solves the issue of payment compliance by developing a new option for remittance: **Gravity Stable Coins** (hereinafter "GSC") — digital tokens which have value that is secured by fiat currencies. Such coverage reduces GSC volatility and makes them a plausible payment option.

GSC are created by single or a group of financial institutions in exchange for a deposit amount equivalent in fiat currency. The issuer of GSC is called a **Guarantor** and can be a bank, microfinance, credit or other financial organization. These companies perform required legal arrangements for each GSC type in the corresponding jurisdiction, where underlying fiat currency is stored, in order to endow legal validity to Gravity Ecosystem's internal instruments. For instance, a European Guarantor will require a British API Licence (Authorized Payment Institution, issued by the Financial Conduct Authority[28]) that permits operations throughout the 28 EU countries via a system of certification. As such, Guarantors act within legal frameworks.

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[28] http://www.legislation.gov.uk/uksi/2017/752/pdfs/uksi_20170752_en.pdf

The Guarantor holds fiat currency on their accounts in an amount that is equal to or greater than the number of circulating GSC of the same type. Deposits are not used for any risk-related operations and are not lent to anyone or invested in any financial assets. As such, the Guarantor makes a public and irrevocable offer for any amount of GSC equal to the corresponding amount of fiat currency to be redeemed at any time. That offer secures GSC's value and liquidity for internal payments within the Gravity Ecosystem. Accepting GSC, or delegating the Gravity Ecosystem to accept GSC on their behalf, SMEs can be sure to receive an equal payment in traditional fiat currency, such as dollars or euros.

Such a system imparts legal value to GSC in circulation in accordance with the legal framework of the Guarantor's country of residency. Earnings and expenditure are reflected as remittances with Guarantors, pass compliance and can be disclosed in official reports. Current GSC balance can be disclosed as "other financial assets".
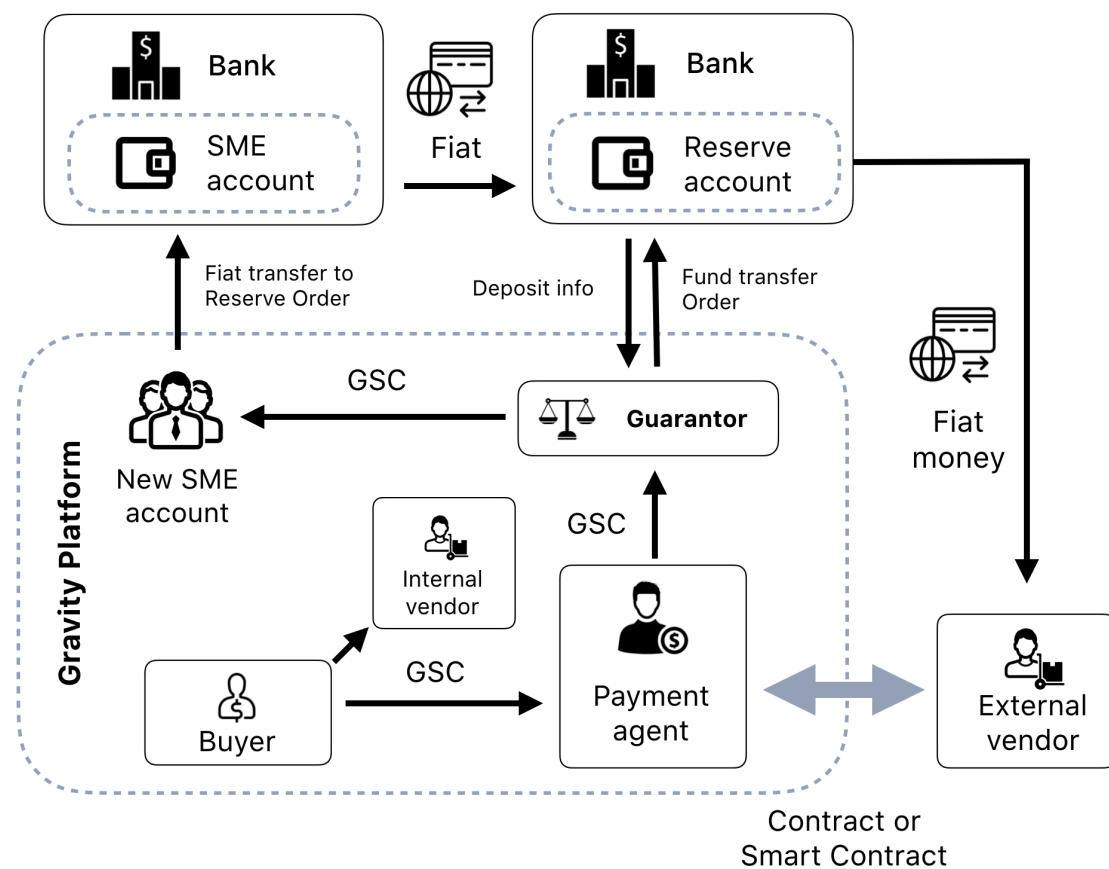

Diagram showing GSC usage, both internal and with payment agent.

In the events that SMEs face any inconvenience with disclosing GSC for their accounting or tax reports, (for example, where the legal framework of the country of residence is poorly developed) the Gravity Business Framework provides SMEs with the opportunity to use a payment agent that will process all GSC remittances and redemptions. SMEs will receive corresponding payments only in fiat currencies.

Moreover, SMEs have a significant advantage in instant international remittances with low commissions and automatic exchange to the local currency of their counterparty. The rate offered comes from an internal decentralized exchange, based on the DEX module. However, the utility of that option is limited by network size, since counterparties are needed in the ecosystem. Notably, the correlation between utility value and the size of the network is quadratic.

Another advantage of the ecosystem is its integrated e-document management and financial accounting system, in which its utility directly correlates to the ratio of processes that are transferred to the ecosystem. A standard bank statement does not provide the same amount of precise information on the financial situation of a company as the internal accounting information which includes a summary of all business operations where the organization agrees to disclose such data.

Gravity Business Framework Usage

This usage scenario highlights how the components and modules of Gravity Business Framework interact to simplify a business transaction between economic agents. This scenario is only one of many possible combinations of various tools provided as part of GBF.

Procurement is a complex, lengthy and multiphasic process with each stage having its own importance, with interdependent stages. One of the most difficult and important tasks in procurement is the choice of the supplier, as well as preparation of the relevant paperwork to register the deal legally.

The set of components and modules available on the platform facilitate and automate some of the many stages of the procurement process. The platform helps to eliminate intermediaries that currently occur at different stages of the business chain.

Procurement includes several stages. First of all, the vendor has to create a company account on the GBF platform. Using the **AUTH Component**, D**ata Storage**, and **Payment Gate**, the supplier confirms the data about their company, opens their wallet and creates a Digital Signature. Using this set of tools, the company will be able to complete transactions and create agreements. The **Data Storage** component, in this case, will be used to store verified data from the counterparty.

After the account has been created and the KYC process has been carried out successfully, the supplier will be able to create a contract using the Extended GS Contract template library. The template only requires the subject of the contract, conditions, and circumstances of the shipping procedure. Once this agreement has been prepared, the supplier can use it to close a contract with the buyer. The supplier can find the buyer of these produced goods using the **DEX module** or other methods as they wish. One of the main features of the DEX module is the absence of borders, which allows companies to find counterparties all over the world with minimal transaction costs.

At the next stage, information about the second party is added to the Extended GS Contract by the **AUTH component**. Information created by this agreement, including the terms of the contract and details about the parties, is stored off-chain and encrypted in the external distributed storage provided by the **Data Storage** component. The agreement key is available to each of the contracting parties. This storage method simplifies the document workflow and audit. Timestamps indicate the sequence of actions during negotiation as well as fulfillment of the agreement, and can also be used later on to resolve any disputes that may arise between the parties.

The buyer then makes a decision after reviewing the information from the proposed agreement, and this decision is recorded in the Gravity Protocol ledger. Once all parties agree to the terms of the contract, they sign it with their private keys and the agreement becomes legally valid. The **AUTH component**

makes sure that the private keys have identified persons or entities behind them. After signing the agreement, each party receives a certified copy, which helps optimize documentary workflow between the contracting parties. Each step, action, and event is automatically recorded as part of the Extended GS Contract. All parties can monitor the current stage of the agreement in a dynamically changing contract.

After the goods are shipped, the supplier records the fulfillment of their part of the agreement. At this moment, automatically within the framework of the agreement, reporting documents will be formed confirming the shipment of the goods and where the goods are received. If there is no disagreement between parties, the buyer signs to confirm receipt using their own Digital Signature. A record of successful execution will be automatically recorded in the Extended GS Contract.

In accordance with the Extended GS Contract and within the GBF, automatic payment takes place using the Payment Gate component, which gives companies an opportunity to pay with minimal transaction fees. For transactions between legal entities, companies can use the GSC, thereby eliminating risks associated with the volatility of crypto-assets and the current lack of regulatory framework.

In the case of a disagreement between the parties, customer or vendor, the conflict can be easily resolved by analysing the agents' actions within this contract. If, henceforth, the dispute remains unresolved, the aggrieved party is able to use the legally valid copy of the agreement and may appeal to the authorities of the jurisdiction specified in the contract. The aggrieved party must provide a copy of the Extended GS Contract, confirmed by the Digital Signatures of each party, with all details of the transaction, timestamp, and the history of the agents' interaction within this agreement. The history of interactions must also be confirmed by the Digital Signatures of each party. The process as outlined above, reduces bureaucratic procedures and court expenses.

Gravity Ecosystem

The Gravity ecosystem consists of:

- **Gravity Protocol**: a self-governing blockchain, the principles of Gravity Protocol are described in this Technical Paper[29];
- **Gravity Solutions GmbH**: a company registered in Switzerland, which develops the Gravity Business Framework (GBF) as described in this document;
- **Gravity Solutions' partner companies** who specialize in the implementation of SaaS solutions for small businesses, and in the creation of a legal framework for business solutions;
- **The Gravity community**, which includes developers, lawyers, integrators, business developers and entrepreneurs who create different products and various solutions for SME companies.

An essential part of the GS ecosystem is the commonality of the development protocol, which promotes simplified integration and full compatibility of GS products which were created in the ecosystem. Using the principles of the protocol, development of new products is made simple. Developers can create new products and solutions via templates, using available and finished products and various GS components. This simplicity is necessary for the creation of the ecosystem and it provides an attractive development environment for external developers, the absence of which would reduce the incentives for using the platform as well as the subsequent transferring of processes into GS ecosystem.

Glossary

Business processes with legal validity: a set of activities that lead to the creation of a product or service, whose fulfillment leads to legally enforceable obligations amongst the agreeing parties. Where there is a disagreement about the aforementioned activities, a third party can use the legal validity of the evidence provided to adjudge which party has been wronged.

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[29] https://www.gravityprotocol.org/gravity_yellow_paper.pdf

Extended GS Contract: a system of decentralized agreements which is built on the principles of Ricardian Contracts and its decentralized operational infrastructure, including authentication and data storage subsystems, integration of smart contracts for the execution of initiation processes, coordination, establishment, and support of both contracts and generated transactions. It also provides a set of records for executed contracts in an easy to use manner.

Ricardian Contract: defined as a single document that is (a) a contract offered by an issuer to holders (b) for a valuable right held by holders, and managed by the issuer, (c) easily readable (like a contract on paper), (d) readable by programs (parsable like a database), (e) digitally signed, (f) carries the keys and server information, and (g) is allied with a unique and secure identifier. The concept of the Ricardian Contract was introduced by Ian Grigg in 1996.

Gravity Protocol: a graphene-based Delegated Proof-of-Importance distributed network, that offers development frameworks and off-the-shelf software for SMEs.

Gravity Business Framework (GBF): a complex set of principles, norms and conditions for the interaction between economic agents. This set of principles ensures the platform functions and all of the ecosystem's components (technical, legal and financial) interconnect.

Gravity Protocol-based solution: a ready-made solution or application which is based on Gravity Protocol.

SMEs: small and medium-sized enterprises. Businesses whose number of employees are below a certain limit, usually 250 people.

Components of GBF: a set of functional solutions that are based on blockchain which provide business with the opportunity to reduce costs, and optimize workflow processes and interaction between economic agents.

Gravity Solutions GmbH: a company registered in Switzerland which develops Gravity Business Framework (GBF), as described in this document.

Library of legal templates: an internal database of legal document templates. Use of these templates means economic agents can choose the purpose and nature of the contract. After filling the form, the contract becomes a legally valid agreement.

KYC (Know Your Client/Counterparty): the process of identifying the counterparty/client before providing a service or financial transaction. KYC is an obligatory process for the provision of GBF platform services. KYC is accompanied by the generation of keys which are used to form a personal Digital Signature.

Relational database management system (RDBMS): a collection of programs and capabilities that enable IT teams and others to create, update, administer and otherwise interact with a relational database. Most commercial RDBMS use Structured Query Language (SQL) to access the database, although SQL was invented after the initial development of the relational model and is not necessary for its use.

OpenID: an open, standard and decentralized authentication protocol. Promoted by the non-profit OpenID Foundation.

Digital Signature: a mathematical process for demonstrating the authenticity of digital messages or documents. A valid Digital Signature gives the recipient reason to believe that the message was created by a known, or valid sender. Digital Signatures are a standard element of most cryptographic protocol suites.

OAuth: an open standard for access delegation, commonly used as a way for internet users to grant websites or applications access to their information on other websites, without giving them the passwords.

Distributed Database (Data Storage): a database in which storage devices are not all attached to a common processor. The database may be stored across multiple computers, located in the same physical location; or may be dispersed over a network of interconnected computers.

InterPlanetary File System (IPFS): a protocol and network designed to create a content-addressable, peer-to-peer method of storing and sharing hypermedia in a distributed file system. IPSF is a form of decentralized database.

Gravity Stable Coins (GSC): digital tokens with a value that is secured by fiat currencies.

Guarantor: A business entity that issues and backs GSC.