
Pacio
White Paper

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09 August 2018

Pacio
Latin noun, alternative form of pactiō

Pactio
Latin from pacīscor ("agree, stipulate"), from pacō ("make or come to an agreement")

Pronunciation (Classical): IPA: /ˈpak.ti.oː/ (Thus the Pacio pronunciation is Pak.io)

Noun with principal meaning: The act of agreeing or covenanting; an agreement, covenant, contract, bargain, pact, treaty, truce.

Synonyms: agreement, contract: pactum

(From WordSense.eu)

Domain
pacio.io

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Pacio

Data without Boundaries

Data is the key to everything in today's connected world, including power and wealth.

All entities and people, from Australia to Zimbabwe, will need standardised ways to store, access, compare, manage, analyse, exchange, transact, and audit their data.

Yet the reality is far from that, with most data held in isolated incompatible silos, often controlled by others for their benefit rather than for the benefit of the creator. The result is a huge loss of opportunity versus what could be, expensive inefficiencies, loss of control, loss of privacy, and security holes providing a bonanza for criminals.

Pacio will change the reality by delivering the **Data without Boundaries** future to reduce data redundancy, knowledge gaps, fraud, and expense while increasing opportunities, privacy, and security. Data silos will be replaced by harmonised real time knowledge.

This needs a new standard and an environment where data is standardised and controlled by its owner. Pacio is creating this standard.

The Pacio platform will provide the means for applications, wherever they run, to:

- Standardise and simplify the storage, exchange, and comparison of data, both inside an entity and globally, via immutable decentralised data in the semantic blockchain
- Improve security and privacy, with entities and people having full control of their data
- Reduce the cost of storing, managing, comparing, and processing data
- Process Crypto and Fiat transactions quickly, at zero cost to end users
- Include Fiat and Crypto accounting and management as an intrinsic part of the system:
  - Transparent, immutable and incorruptible intra and inter entity accounting to reduce costs and minimise fraud
  - Comparable data across entities and jurisdictions to reduce waste and errors
  - Provide real time business insights to boost bottom-line performance

Pacio has identified that:

- The need to process standardised data interoperably without boundaries will explode
- No existing system adequately addresses the need

Pacio's solution is blockchain and decentralised database based, standardised, semantic and rich in business intelligence.

The founders have pioneered digital accounting and management data practice over four decades and are ideally placed to shape business data in the 21st Century.

1 Overview

Pacio will achieve its **Data without Boundaries** vision via a high performance, scalable, low cost decentralised semantic blockchain based platform that provides a wide range of features and services for applications, wherever they run. Apps powered by Pacio will be 'accounting' or 'management' feature-rich at every level.

Accounting and Management

The focus on accounting and management is a key differentiator for Pacio resulting from the lifetime work of the founders. 'Accounting' and 'management' are used here in a broad sense to cover:

Standardised semantic blockchain

Pacio will use the *Standardised Semantic Information Model (SSIM)* to store data

- in a standardised way to be globally interoperable and comparable across entities, jurisdictions/regions, languages, and accounting standards, thereby reducing confusion and duplication, resulting in great productivity and efficiency savings
- of any type whether financial or not in a semantic way = data referenced by its content or what it is about

to implement the standardised semantic blockchain. This will allow sematic querying, and standardised semantic reporting with interfaces to international standards and data/report languages such as *XBRL*.

The semantic blockchain will unlock the wealth of information and knowledge contained in entity and online data, for easy access via market specific or niche apps, which will help realise semantic web 3.0 hopes – Data without Bouandaries.

Totally flexible data definition ability via *SSIM Taxonomies* will help apps bridge older, traditional methods, to the new.

Privacy Protection

Pacio data will be private or public as set by its creator or owner, including for just part of a record eg a person's name might be public, but not his/her email address or birthdate.

Pacio data storage will involve a network of blockchains, decentralised databases, and decentralised file storage systems. This structure will allow entities to keep their data, other than common index and shared *Triple Entry Accounting* transaction data, in a completely separate distributed database or chain that is private and unique to them. Pacio will tie this network together via a shared index, akin to the Internet's DNS (Domain Name System) that was one of the first distributed databases.

Any data aggregation for analysis or research will be on a selective opt-in basis, with the default always being to opt out. Homomorphic encryption will be considered for any data aggregation services. (Homomorphic encryption permits analysis without the raw data being decrypted i.e. the original data need never be seen in plain text form by any analysis system.)

Business Improvement via TARI®

TARI® (Target Average Rate Index), invented and developed by Pacio founders Dr Keith Cleland and Trevor Watters, is a management methodology built into Pacio. TARI® allows feedback to effect business improvement in real time, rather than only by analysis after the event. TARI® has proved to be the most effective and least expensive means of improving productivity and bottom line performance of business across the spectrum of manufacturing, retail, trade, transport and commercial services in general. TARI® also has potential for positive impact on national productivity at no cost to government.

Other accounting and management features

Other 'broad integrated accounting and management' features are:

- recording transactions in any fiat or crypto currency, or a mixture, with on the fly conversions
- traditional double entry Dr and Cr accounting
- blockchain triple entry accounting, or *Triple Entry Accounting* as Pacio calls it
- activity data is an important part of calculating and tracking productivity, and is used by TARI®, but is not recorded by most accounting packages
- controls over access to data so that the data creators control or own it, with data public or private at the creator's wish
- inter person, inter entity, and inter app transactions, including triggering via events for staged processes such as *Interoperable Business Documents*
- inter blockchain transactions, because Pacio does not assume that one chain will rule them all, but the opposite, that the decentralised future will see a plethora of chains that Pacio can support and interconnect

Accounting and management levels

The accounting and management features are available at one, two, or three levels as applicable to the app:

- for the app, and possibly the app developer if different from the entity running the app
- for the entity running the app
- for users of the app

The accounting and management need

Every non-trivial app, whether business focussed or not, will benefit from the Pacio 'accounting and management' facilities, yet current blockchains lack them, and apps have often skipped or skimped on them, other than those intrinsic to the app, because it is has been too hard, or even impossible when viewed from the perspective of a single app. Apps powered by Pacio will not need to compromise on 'accounting' or 'management' at any level, and therefore will be far more useful to users at all levels.

Wide Range of Features for Applications

Pacio's wide range of features for applications and its broad integrated accounting and management functionality, include some which come as a result of Pacio using 3rd generation blockchain and distributed technologies, and some from Pacio specific services. It is the combination which provides the overall benefit for mass adoption applications. The list of these features will continue to grow over time with community interaction.

Inherited third generation blockchain and decentralised database features

Inherited third generation blockchain and decentralised database features available to apps using Pacio are:

- Improved safety and removal of the concentration of power, wealth, and opportunities for crime of centralised systems, with no central point of control or weakness
- Removal of the need for trusted third parties thanks to blockchain Byzantine fault tolerant consensus, and immutability within the life of the blockchain for relevant data. This can simplify systems, reduce costs, increase speed (of processes), and remove opportunities for fraud.
- Zero cost transactions for apps using the Pacio blockchain or other zero fee blockchains, that will facilitate general apps, and new ones eg micropayment systems. (Transactions for apps using fee based blockchains such as Bitcoin or Ethereum would still involve fees.)

- Scalability – able to handle large scale applications
- Responsiveness with transactions confirmed within seconds for apps using the Pacio blockchain or other high speed blockchains, not minutes or hours as for some current blockchains
- Smart contracts or dApps – distributed apps - for apps using the Pacio blockchain, written in any language that the developer chooses, or other blockchains that support smart contracts

Enhanced blockchain features

Blockchain and 3rd generation blockchain features enhanced by Pacio are:

- Cryptocurrency with multiple purposes, the PIO:
  - is used by app deployers to pay for network, storage, and advanced API use, optionally converted to any other currency at payment time
  - is fully traceable, to provide a clear trail in the event of theft
  - serves as a general cryptocurrency
  - pays an issuance reward of 25% of newly minted PIOs in proportion to the PIOs held
- Governance emphasis re a constitution and voting, including governance app support, and the role of the Pacio Governance Council

Additional services

Services additional to the features listed above will be developed progressively in accordance with community priorities and requests, with an initial proposed list being:

- Global digital identity support for individuals and entities
- Data exchange/monetisation support for decentralised data exchange (DDEX) apps
- Authenticated accounting and other real world data feeds made available for app or oracle use
- Event triggers to initiate intra or inter app/entity app actions based on internal or external events
- Governance support to governance apps to be written
- Ricardian contracts (internet of agreements) support
- An Internet of Things (IoT) interface
- An artificial intelligence interface

How

Pacio features and services will be provided to applications via the Pacio API (Application Programming Interface). Any app or dApp (smart contract), wherever it runs, whether blockchain based or not, will be able to use the Pacio API. Utilities for administration, wallet operations, and real time public data capture processes will support the API services. The technology to be used by Pacio is described in section *6 Technology*.

Pacio is open source. Pacio is committed to working with its community of users and developers to develop the ecosystem for the everyone's benefit. A major part of this will be an emphasis on governance, both within Pacio itself, and via a member controlled Pacio Governance Council. Pacio Core Ltd will provide ongoing development, nurture the ecosystem and help manage its evolution.

The Cost

Pacio crypto transactions and some basic API ops will be free. Database storage and bandwidth, plus more sophisticated API use, will involve a fee to cover the costs of running Pacio and of continuing its development. Fees will be payable by the entity running an app,

not the user of the app, unless the app developer chooses to charge. Fees can be paid in the entity's choice of cryptocurrency, with PIO as the default.

The Result

Pacio will simplify development of powerful market or niche specific apps. Apps powered by Pacio will:

- provide real time feedback to improve business results
- efficiently process zero fee crypto, fiat, or other payments/transfers/transactions between people and entities
- eliminate double entries for inter entity exchanges
- minimise opportunities for fraud
- reduce costs
- provide far better privacy protection
- increase safety
- reduce disputes
- speed payments
- permit inter entity/jurisdiction/app operations or comparisons
- facilitate audit where needed

This will enable developers to open new ways of doing business, all with integrated automatic accounting and real time management.

Data ownership and control will be returned to its creators, who will be able to benefit from the value their data represents if they so choose, rather than large centralised organisations.

The PIO will be attractive as a general safe cryptocurrency beyond direct Pacio use. However, Pacio will also support other cryptocurrencies, so the choice of crypto will be up to the user.

In these ways Pacio will achieve its **Data without Boundaries** vision.

The Pacio concepts have been decades in the making. The confluence of third generation blockchains, and ICOs for funding, make them achievable.

2 Market

Target Market

Pacio's market is application developers - the entities and individuals developing applications, dApps, or chatbots – who are developing and deploying apps involving data storage and processing. Pacio is especially relevant for:

- Apps seeking to scale via inter entity/person/app networking
- Apps involving inter app, inter entity, inter blockchain, inter jurisdiction, inter language data or transactions
- Apps involving querying or comparison across entities or jurisdictions or languages
- Apps involving money whether fiat or crypto or both
- Apps offering private data ownership/control/exchange facilities
- Apps involving accounting
- Apps involving management whether of businesses or non-business entities such as NGOs, Charities, Governments…

Pacio can help developers produce such apps to meet their customers' needs better, more quickly, and cheaply. Data based apps may beneficially use Pacio whether general and broad, narrow and niche, or in between in nature.

Target Market Groups

Pacio's marketing can be refined to be specific to the needs of various developer groups:

- An app developer using the Pacio Blockchain
- An app developer using another blockchain
- A non-blockchain based app developer eg a web cloud-based app
- Entities using private blockchains/distributed ledgers
- Entities still using centralised systems
- The developers and suppliers of BaaS systems such as Microsoft, Oracle, HPE, IBM, Amazon et al
- Vertical market suppliers such as Intuit, Sage, Xero, Exact, Myob, GreatSoft, etc for the accounting and financial statements preparation market...
- 3rd generation blockchain developers eg Ælf (Aelf), Æternity (Aeternity), Aion, AlphaPoint, Apla, Blockstack, Cardano, Cosmos, Credits, Devcash, EOS, Genaro, Hyperledger, Icon, Komodo, Metaverse, Multichain, NEO, Red Belly, SophiaTX, Tezos, Universa, Wanchain, and Zilliqa, as listed in section 10.1 Pacio Blockchain

Breadth

Thanks to Pacio's flexibility, performance, and zero transaction cost, apps could be focussed eg bee keepers in Cuba, organic tea houses, Indian export manufacturers, teenagers into house music, remittances to The Philippines, UK final accounts production, etc for tens of thousands of possible markets. Target markets could be broader too eg anybody selling personal online activity data, a decentralised "Facebook", a WeChat alternative, or a distributed data or crypto exchange.

Market Size

How large is the application developer market? To answer that, the markets the app developers can target need to be considered.

The potential market for application developers using Pacio is entities and people who use data based apps. That is close to all entities globally and all people with a smart phone or computer.

Entities

Estimates of the number of entities in the world vary widely according to definition, but for Pacio the widest definition applies. A World Bank Group study suggests there are between 365-445 million MSMEs in emerging markets: 25-30 million are formal SMEs; 55-70 million are formal micro enterprises; and 285-345 million are informal enterprises.

When developed world entities are included, and a wider definition of entity applicable to Pacio of "businesses of all sizes and types, DAOs or Decentralised Autonomous Organisations, charities, NGOs or non-governmental organisations, Governments, or any grouping whatsoever wanting to record and organise transactional data whether financial or not" is considered, then the number of entities in the world is over 500 million and is probably of the order of 750 million.

People

The number of people with internet access in 2018 is approximately half the world's population or some 3.5 billion people. The number with smart phone or computer access is approximately 2.5 billion.

Application Developers

Thus application developers have a market of some 750 million entities and 2.5 billion people. That has resulted in a larger number of entities and individuals being involved with app development, and that number is sure to continue to increase.

One estimate from the Evans Data Global Developer Population and Demographic Study 2017 Vol. 1 was that there were 18.2 million software developers worldwide in 2017, a number projected to rise to 26.4 million by 2019.

Developer numbers of that magnitude give a market of the order of several million developer entities which could beneficially use Pacio.

Competition

Pacio competition can be considered in 3 categories:

- Pacio Blockchain or MVP competition
- Pacio additional features (services) competition
- Competition to apps that could be developed using Pacio

Competition for the initial MVP release of Pacio is discussed in section *11 Minimum Viable Product (MVP)*.

There is no direct competitor to all that the full release of Pacio will provide, and the apps that could be built using Pacio.

Non-Pacio accounting, management, data market/exchange, or oracle apps, will be unlikely to challenge the Pacio based equivalents due to the superior power, scope, interoperability, and flexibility of Pacio. That will be the case for any app using Pacio, but especially those running on the Pacio Blockchain, or others with zero cost transactions.

Competitors may actually be seen as potential partners, to be converted to using Pacio as the "operating system" to assist them meet their objectives.

The competitors or potential partners are listed in the separate document "Pacio Competition".

Conclusion

The potential market for Pacio is hundreds to thousands of developers in the early years, growing to millions in time. The people or entities running the apps in turn have a market of millions of entities, and billions of end users, with the potential revenue involved in the whole ecosystem being trillions of dollars.

Pacio's competitive strengths mean that Pacio can realistically become established as a major platform for apps seeking to use decentralised technologies to organise, track, and keep account of their data in a standardised, easy to use, semantic, safer way, and then to maximise the benefits.

3 Value Propositions

As Pacio is a platform for application developers its value propositions apply to developers of various types of applications.

For All Application Developers

Pacio will allow application developers to build and deploy more useful/powerful decentralised applications, whether blockchain based or not, faster for less, with integrated accounting and management of the app plus the performance, scalability, security, features, and low costs required for mass adoption.

Plus for Developers of Consumer or Personal Applications

In addition to the value provided for all application developers, Pacio will allow developers of consumer or personal applications to create apps that provide end user benefits of increased security, control over personal data and zero transaction costs. This is an improved alternative to current centralised web systems and opens new market segments such as zero cost remittances, micropayments and data exchange/markets.

Plus for Developers of Business Applications

In addition to the value provided for all application developers, Pacio will allow developers of business applications to create more competitive and useful apps that provide the consumer benefits above for the customers of a business running the app, and for the business itself, producing profitable outcomes through processing of business activity more comprehensively with TARI® feedback and full accounting for more insightful semantic analysis and reporting, all in real time.

Plus for Developers of Charity/NGO/Government/Regulatory etc Applications

In addition to the value provided for all application developers, Pacio will allow developers of applications for charities, NGOs, governments, regulators, foundations etc. to create more useful apps that provide the consumer benefits above for the users of the entity running the app, and for the entity itself, improve its management and operation through processing of activity more comprehensively with full accounting for more insightful semantic analysis and reporting.

4 PIO - The Pacio Cryptocurrency

The Pacio cryptocurrency is called the PIO. It will be the native or intrinsic and tradeable cryptocurrency of the Pacio blockchain.

PIO Uses and Rights

PIOs will:

- entitle the holder to a share of 25% of newly minted block PIOs as an issuance reward in proportion to the number of PIOs held, with the other 75% being the reward for block producers, akin to miners' rewards for Bitcoin and Ethereum. At a 5% annual issuance or inflation rate this amounts to a new issuance reward for holding PIOs of 1.25% pa.
- allow optional participation in the delegated proof of stake Pacio blockchain consensus block building process by providing stake
- provide a voice in the governance of the Pacio ecosystem via voting rights as per the Pacio Constitution
- act as the default currency for payment of Pacio fees, though other currencies will be acceptable also
- be a cryptocurrency for trading, payments, value storage, and capital gain, as for Bitcoin and Ether etc, with these additional benefits:
  - extensive account security and management facilities provided by the blockchain software
  - speed – transaction confirmation is expected within seconds, or fast enough for real time use
  - no transaction fees that, with the speed, will make micropayment systems possible
  - be fully traceable in the event of theft, to help deter criminals

Thus, PIOs have clear uses, but they would be classified as a Security token under USA (SEC) regulations. The PIO features will make PIOs "safe money" and attractive as a general use cryptocurrency.

PIO Details

- One billion or 1,000,000,000 tokens to be minted initially
- No cap but subject to the following restrictions/rules:
  - Issuance of no more than the maximum defined in the Pacio Constitution, proposed as 5% pa
  - Issuance of more possible, if appropriate due to growth in use of PIO, but only if recommended by the Pacio Governance Council and agreed to by a Governance Council AGM (Annual General Meeting) or EGM (Extraordinary General Meeting)
- Smallest denomination to be one trillionth of a PIO to be called a Pico so that there are one trillion or 1,000,000,000,000 or 10^12 Picos in one PIO. The trillion factor was chosen to be small enough for micropayment use, even if the PIO value grows to be thousands of US$ like Bitcoin, but to be within human scale – well almost anyway.

  By comparison there are 1,000,000,000,000,000,000 or 10^18 of the smallest Ethereum denomination, known as Wei, in an Ether, and 100,000,000 or 10^8 of the smallest Bitcoin denomination, known as Satoshi in one Bitcoin. Our view is that Ethereum has taken the smallest denomination factor further than is needed, but Bitcoin not far enough.

Privacy

Pacio blockchain accounts will not be public by default, as Ethereum and other blockchain accounts are. Just as for everything else stored via Pacio, users will be able to choose whether accounts are public or private, with the default for accounts being private.

This will enable people to avoid the risk of being targeted by criminals if ownership of an account with a large balance becomes known. The Kidnapping of Bitcoin Exchange Executive Showed Importance of Financial Privacy article shows the need for this.

PIOE – The DAICO Token

For the Pacio Seed Presale, Private Placement and the Pacio DAICO an Ethereum EIP20 (ERC20) token called PIOE is being used. Once the Pacio blockchain has been launched, PIOE tokens will be convertible one for one to PIO tokens.

Because PIOEs have not so far been registered with the SEC in the USA, PIOEs are not available for purchase by US citizens or residents. This could change at some point for US accredited investors if Pacio opts to go through with the registration process.

Trading PIOs and PIOEs

It is expected that exchanges will trade PIOs once the Pacio blockchain has launched. As an intrinsic cryptocurrency, it will appear in the Currencies tab at CoinMarketCap.com like Bitcoin and Ether.

Prior to launch the PIOE would appear in the Assets tab like other Ethereum tokens. Exchanges will be approached to list the PIOE once the Private Placement is underway.

5 Governance

Good governance of the entire Pacio ecosystem will be essential to achieving the Pacio Vision.

The article Blockchain Governance: Programming Our Future describes the importance of governance:

> **Why Blockchain Governance Matters**
> As with organisms, the most successful blockchains will be those that can best adapt to their environments. Assuming these systems need to evolve to survive, initial design is important, but over a long enough timeline, the mechanisms for change are most important.

Accordingly, governance related processes are planned for Pacio at three levels:

- The *Pacio Blockchain*:
  - managing delegates in the expected Delegated Proof of Stake consensus protocol
  - account management
  - constitution contract management
  - managing protocol proposals
  - voting on proposed changes
- The *Governance Support* Service via the API will allow apps to be written to interact with the Pacio Blockchain governance aspects listed above. With appropriate access controls, such apps will make it easy for people to become involved. Taking an interest in governance matters will not require special expertise or effort.
- The Pacio Governance Council (below) will be the main governance body for Pacio.

5.1 Pacio Governance Council

The Pacio Governance Council will act as the governance body for Pacio. Its responsibilities and role will be defined fully by the Pacio Constitution. The expected or suggested elements of its role and operation are:

- Odd number of council members to avoid deadlocks, of at least five people, including chair person
- Council members to be remunerated in PIOs
- Meetings to be virtual monthly, or on an as needed basis, plus a physical Annual General Meeting (AGM) to be held in a different location (continent) each year
- All meetings to be public ie recorded and posted online
- AGM to include voting of Pacio Members on council member continuation/appointment
- Council to make governance decisions for execution by Pacio Core covering:
  - setting the annual issuance rate up to the Constitution maximum, expected to be the conservative rate of 5%, for responsible money management as part of maintaining and increasing token value, and minimising the risk of inflation causing a fall in value
  - deciding if issuance of more than the Constitution maximum is appropriate in any given year due to growth in use of PIO as a currency, with the recommendation to be put to a Pacio Member vote
  - defining the rewards to block producers in terms of newly minted PIOs, initially proposed to be 75% for block producers and 25% for PIO holders
  - advising on fees for Pacio use
  - propose/approve protocol upgrades/changes with membership voting for non-routine fixes

- establishing and running upgrade and request proposal mechanisms, like Ethereum's ERC Ethereum Request for Comments and EIP Ethereum Improvement Proposal

6 Technology

There are six key aspects to the Pacio Technology:

- *Pacio Blockchain*
- *Pacio Database*
- *Core Technologies*
- *Application Programming Interface (API)* to make everything available to apps
- *Application Support Tools*
- *The Pacio Architecture*

6.1 Pacio Blockchain

Pacio will build on an existing third generation blockchain for the security, immutability, and cryptocurrency strengths of blockchain technology. This will not restrict use of Pacio to applications running on the same blockchain.

Available blockchain and distributed ledger contenders to act as the host for Pacio are: Ælf (Aelf), Æternity (Aeternity), Aion, AlphaPoint, Apla, Blockstack, Cardano, Cosmos, Credits, Devcash, EOS, Genaro, Hyperledger, Icon, Komodo, Metaverse, Multichain, Multiversum, NEO, Red Belly, SophiaTX, Tezos, Universa, Wanchain, and Zilliqa.

Ælf (Aelf), Aion, AlphaPoint, Cosmos, Icon, Wanchain, and possibly others include or plan to include inter blockchain capability. Aion, Icon, and Wanchain are co-operating via the Blockchain Interoperability Alliance.

Other inter blockchain technologies or options as part of a system, mostly still in development include Ark, Blocknet, ConnectionChain, Interledger, Metronome, OmiseGo, OTN, Polkadot, and Quant.

What a cornucopia of choice! Which is wonderful, but also difficult.

Observations

Some observations and deductions can be made, however:

- The 3rd generation blockchain and interoperable blockchain systems field is very active but in a state of flux at the time of writing in Q1 2018
- No one chain will rule them all
- Many contenders will survive, although some will fail or be absorbed by other projects

Conclusions

The conclusions for Pacio are:

- Pacio will support inter blockchain operations
- Pacio will develop modular code/systems that can be used with multiple blockchain hosts, or be moved from one to another, in the event of any blockchain becoming dominant or clearly superior to the one chosen initially
- Pacio needs to choose as its initial development blockchain the one which best meets the above requirements

Cosmos Choice

Pacio has chosen Cosmos as its development blockchain host. Note that this decision does not preclude use of another contender in the future.

Cosmos is described as “a network of blockchains whose purpose is to solve long-standing problems in cryptocurrency and blockchain communities. The end goal is to allow many

sovereign and easy-to-develop blockchains to scale and interoperate with each other, creating an Internet of Blockchains."

Cosmos also describes the architecture, interoperability, scalability, developer friendliness, and decentralised credentials of Cosmos. This approach corresponds with Pacio philosophy.

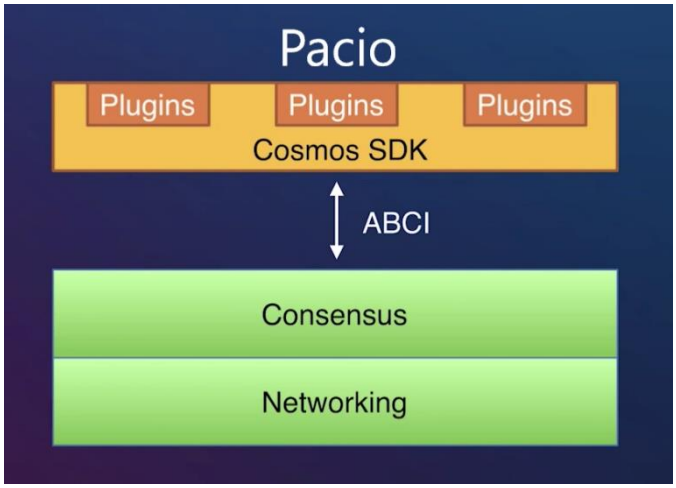
The Cosmos-SDK Alpha Release article describes the Cosmos-SDK (Software Development Kit), which "is a generic framework that comes with all the tooling to enable you to construct your own blockchain, called a zone, in the context of the Cosmos Network." The Many Chains, Many Tokens, One Ecosystem video referenced there is especially informative.

See also Understanding the value proposition of Cosmos.

Relevant to Pacio are:

- the apparently better Tendermint BFT (Byzantine Fault Tolerant consensus algorithm), which is
  - a Delegated Proof of Stake (dPoS) protocol that is not energy intensive like Bitcoin's Proof of Work. (EOS also uses dPoS but with delegate defined differently as 21 "block producers". A comparison from the Tendermint perspective is here, refuted by Dan Larimer of EOS here.)
  - fast, supporting thousands of transactions per second at 1000ms latencies and a mean block time of 1 to 3 seconds
  - can scale
  - secure, including handling explicitly malicious behaviour
  - has no upper limit to the number of delegates, so allowing wide decentralisation. The minimum number is 4, but Pacio when live would start with well beyond 4.
- ability to plug in alternative BFT systems if another proves to be better than Tendermint
- blockchain interoperability
- modular design
- smart contract capability using any developer preferred language which can use the Cosmos ABCI interface which is any modern language i.e. not restricted to Solidity and a few others as for Ethereum, or C++ as for EOS
- zone idea with applications being able to run their own blockchains
- scalability by horizontal and vertical means with horizontal being particularly applicable to Pacio re different applications (services)
- fact that "forking" to do things our way for the Pacio blockchain is not an issue as it possibly is with other options, as the whole system is set up to allow this
- retention of sovereignty
- flexibility in both a technical and business sense.

The Comos/Tendermint architecture provides a starting point for Pacio node development:



where the Cosmos/Tendermint core is in green, and a Pacio node in yellow is implemented via plugin modules built using the Cosmos SDK, linked by the Tendermint Application BlockChain Interface (ABCI).

6.2 Pacio Database

The Pacio Database will store the following in a distributed database in a semantic, structured way organised via the *Standardised Semantic Information Model (*SSIM):

- Member (PIO holder, potentially an app developer, either an entity or an individual) data
- Entity data
- People (individuals) data
- Transactional and accounting data
- Non-transactional data
- any other data whether financial or not, public or private, that a Pacio member (app developer) chooses to add
- activity logs

The data will be flexibly defined using *Smart Data Objects (SDOs)* and *SSIM Taxonomies* q.v. for more on the types of data to be stored. It will be possible to store historical, or traditional system data in its original form.

Data will be private or public as set by its creator or owner, including for just part of a record eg a person's name might be public, but not his/her email address.

Data will be stored in NoSQL SSIM form. Other protocols will also be available externally for interaction with the database via the API, as described in section *6.4 Application Programming Interface (API)*.

The database will involve a network of blockchains, decentralised databases, and decentralised file storage systems. This structure will allow entities to keep their data, other than common index and shared *Triple Entry Accounting* transaction data, in a separate distributed database or chain that is private and unique to them. Pacio will tie this network together via a shared index, akin to the Internet's DNS (Domain Name System) that was one of the first distributed databases.

Any data aggregation for analysis or research will be on a selective opt-in basis, with the default always being to opt out. Homomorphic encryption will be considered for any data aggregation services. (Homomorphic encryption permits analysis without the raw data

being decrypted i.e. the original data need never be seen in plain text form by any analysis system.)

The database network is expected to include private instances of an entity's preferred blockchain eg EOS, a Cosmos zone, or a distributed ledger such as Hyperledger etc, and instances of a distributed database such as BigchainDB. Particularly interesting for Pacio is the fact that BigchainDB 2.0 is Byzantine Fault Tolerant using Tendermint as used by Cosmos, the blockchain chosen for Pacio development. Scalability of Bigchain is proposed to be achieved using Cosmos!

Other parts of the database hierarchy could be Holochains, IPFS for files, and IPLD, the data model of the content-addressable web. Other technologies may also be considered as they evolve.

Pacio also plans to work with The Web Ledger Protocol 1.0, a format and protocol for decentralized ledgers on the Web, as that develops, possibly offering SSIM for inclusion in the project.

The Pacio ideal is for people and entity index data to be global with only one record per person or entity, for data integrity and better reporting reasons, plus the avoidance of out of date or inconsistent information errors from differently updated duplicate records. For example, if a person is a director of multiple companies, there should be only one database entry for that person, referenced by the SDO for Directors in the entity records for the companies. Entities will be handled similarly. For example, an accounting practice that audits multiple companies should occur in the database only once and be referenced by the companies' SDO for Auditors. Attaining this global, one record only per person or entity ideal, will entail some reconciliation and possible conversions, regarding the order of addition of people and entities to the database. The *Reconciliation and Registration* aspect of the proposed *Global Digital Identity Support* service covers this.

The *Querying and Reporting* service will provide database querying and reporting facilities. GraphQL, described as "a query language for APIs and a runtime for fulfilling those queries with your existing data. GraphQL provides a complete and understandable description of the data in your API, gives clients the power to ask for exactly what they need and nothing more, makes it easier to evolve APIs over time, and enables powerful developer tools." will be a part of the system.

6.3 Core Technologies

Pacio will include the following core or intrinsic (built in) technologies:

- *Standardised Semantic Information Model (SSIM)*
- *Target Average Rate Index (TARI®)*
- *Triple Entry Accounting*
- *Interoperable Business Documents*
- *Pacio Messaging System (PMS)*
- *Pacio Scripting Language (PSL)*
- *PIO Technology*

6.3.1 Standardised Semantic Information Model (SSIM)

The Standardised Semantic Information Model (SSIM) is Pacio's way of storing and managing accounting and other data. SSIM is fundamental to Pacio's semantic blockchain.

SSIM data is standardised to be comparable across entities, jurisdictions/regions/countries, and accounting standards.

SSIM data is semantic because any piece of data can be indexed or referenced by what it is about ie what the item of data applies to, optionally tagged to any required level of detail.

SSIM, like all of Pacio, is open source, and will be made available for use by others, and for potential adoption as a standard protocol.

Semantic Blockchain

The semantic blockchain via SSIM is a key part of Pacio and its contribution to the web 3.0 future.

For more on the goals and purpose of the Semantic Blockchain see:
Strategies for integrating semantic and blockchain technologies
Semantic blockchain
A more pragmatic Web 3.0: Linked Blockchain Data

SSIM Protocol Interfaces

Pacio will be multi-lingual, able to work with multiple data protocols, as part of supporting inter entity transactions, and international standards.

Pacio works with SSIM internally, and apps and users will be able to work with SSIM directly, but are not required to do so, as interfaces will be developed for any data description or exchange protocol for which there is demand. SSIM will be designed and built to allow easy addition of additional interface protocols. The protocols expected to be supported are:

- SSIM native document format
- **UBL** or International Standard ISO/IEC 19845 "specifies the OASIS Universal Business Language (UBL), which defines a generic XML interchange format for business documents that can be restricted or extended to meet the requirements of particular industries. Specifically, UBL provides the following:
  - A suite of structured business objects and their associated semantics expressed as reusable data components and common business documents.
  - A library of XML schemas for reusable data components such as "Address", "Item", and "Payment", the common data elements of everyday business documents.

- A set of XML schemas for common business documents such as "Order", "Despatch Advice", and "Invoice" that are constructed from the UBL library components and can be used in generic procurement and transportation contexts."

What is UBL? Further describes it. From that page: "The commercial invoice is but one of a family of 65 document types formally described as semantic business objects in business documents, each with an associated XML schema, in the OASIS Universal Business Language (UBL) Standard, also internationally standardized as ISO/IEC 19845."

- **Open EDI** or International Standard ISO/IEC 14662:2010 "describes, through two perspectives of business transactions, significant aspects relevant to the interoperability of information technology systems used by Open EDI Parties engaging in Open-edi. The perspectives are:
  - business aspects such as business information, business conventions, agreements and rules among Open-edi Parties;
  - information technology aspects which are necessary in the Open-edi systems to support the execution of business transactions."
- **RDF** or Resource Description Framework. From the RDF W3C page: "RDF is a standard model for data interchange on the Web. RDF has features that facilitate data merging even if the underlying schemas differ, and it specifically supports the evolution of schemas over time without requiring all the data consumers to be changed.

  RDF extends the linking structure of the Web to use URIs to name the relationship between things as well as the two ends of the link (this is usually referred to as a "triple"). Using this simple model, it allows structured and semi-structured data to be mixed, exposed, and shared across different applications.

  This linking structure forms a directed, labelled graph, where the edges represent the named link between two resources, represented by the graph nodes. This graph view is the easiest possible mental model for RDF and is often used in easy-to-understand visual explanations.
- **Ocean** is A Decentralized Data Exchange Protocol to Unlock Data for AI. From the site: Ocean Protocol is supported by a Singapore based non-profit foundation (Ocean Protocol Foundation Ltd), whose mandate is to ensure open access to the protocol and platform, provide data governance, encourage the network ecosystem growth and take measures to ensure that the platform becomes ever more decentralized with time.

  What is Ocean Protocol?
  Ocean Protocol is a decentralized data exchange protocol that lets people share and monetize data while guaranteeing control, auditability, transparency and compliance to all actors involved.

  Data Providers and Custodians need to feel safe before they will comfortably share data and Ocean Protocol is the solution.

  How Ocean Protocol Works
  Ocean Protocol provides the underlying technical foundation that data marketplaces need to connect data providers with data consumers in a trusted environment. It nurtures a data ecosystem and community.

  Ocean Protocol also enables developers to create new and innovative services for leveraging data.
- **XBRL** (eXtensible Business Reporting Language) a standard language for reporting on or comparing business information. XBRL has been adopted by most developed countries for the benefit of shareholders and government to standardise business and financial reporting to increase the transparency and accessibility of business information by using a uniform format.

XBRL is, as its name says, a reporting language. It is not appropriate for data storage definition purposes, so the SSIM/XBRL interface will be output only. SSIM, by comparison, is applicable for data definition, data transfer, and reporting. SSIM is simpler than XBRL, yet more powerful, more elegant, and understandable by business people without need for training or study. SSIM is a chart of accounts alternative while XBRL is not. SSIM builds upon David Hartley's work with software for the Accounting Profession over 40 years, and the work of David and Charles Woodgate, a UK accountant, in 2011-2013 following the introduction of mandatory XBRL company reporting in the UK.

There are likely to be other protocols supported over time.

Smart Data Objects (SDOs)

SSIM Data will be stored in NoSQL database form as smart named objects, called Smart Data Objects (SDOs), whose structure is defined via taxonomies. SDOs are flexible and may be simple – a single key/value pair – or "smart", with the ability to hold lots of information, and to process it too. SDOs provide much of the power of SSIM. They are a powerful addition to previous data protocols, and will allow SSIM to cope with data or query/report requirements of any complexity, while keeping things simple enough for understanding by business or individual users without in depth study.

For example, in the entity/business case SDOs replace Charts of Accounts used in traditional accounting systems, with only a small number, only 1,000 or fewer SDOs being needed to hold all SSIM data for any entity, compared with tens of thousands of accounts in some Charts of Accounts based systems.

Data held in SDOs is indexed in various ways, including via any number of tags, that are organised by role, folio and properties applicable to SDOs. The tagging supplies the semantic information about a data item. Tagging is like that used by XBRL but is more flexible, more understandable by untrained users, and is applied at the input/data creation point for every piece of data, rather than in aggregate form later in the process as for XBRL.

SDOs can include code and be upgraded to handle special cases. SDOs will supply smarts and flexibility that no accounting or storage system has ever had before. Individual SDOs could be thought of, in blockchain terms, as smart contracts, only ones which can be upgraded to cope with change and evolution. Some SDOs will stay simple but others will become quite big with lots of code, but code which can be maintained, and be set to do data updates, as well as cope with jurisdictional differences. Development and maintaining SDO "smart contracts", along with the taxonomies, will be a major part of the development of the Pacio ecosystem. How about a fixed asset SDO specialist? Or a tax SDO expert?

SDOs know about, optionally differently for individual members of the object, where applicable or allowed:

- the sort of data they hold by reference back to the taxonomies
- whether the data is for entity, member, individual, or public use by reference back to the taxonomies
- whether the data is for specific app(s), or any app by reference back to the taxonomies
- if/how the data can be edited/updated. If the item is updateable then:
  - whether the data is transactional in nature and is to be held immutably, or not, and if not, whether changes need to be logged or not.
  - form of updating if numeric eg sum/replace
- the folio(s) apply with any property exclusions
- indexing
- country/region/jurisdiction/language applicability

- country/region/jurisdiction/language exclusion
- whether text values are to be held as a set by language
- relationship(s) to other object(s)/member(s)
- individual detailed description if required by tagging by folio-property with controls from the taxonomy to prevent silly or inconsistent tagging. This tagging at the source or lowest level is part of what makes SSIM understandable to humans – people know how to describe an individual piece of data when it is being added to Pacio, even if they might not know what higher level category it might be aggregated to for a financial report, for example. This bottom up approach with the ability to add any number of tags to an item, is the fundamental difference between SSIM and top down or after the fact approaches such as XBRL.
- periods – timing of something if applicable
- jurisdiction/country/region/language if applicable
- whether static or dynamic. (Dynamic data can be included or excluded from queries or reports according to nominated criteria eg for different liability risk assessments, different depreciation calculations, provisions etc.)
- what sums (additions) are to be performed with numerical data if any
- what additional checks if any should be performed with the data
- how to compare and convert the data for export and output, including output XBRL

SDOs will also have user and entity specific settings for:

- whether the data is public or private
- verification state for person or entity, including KYC and AML checks
- whether the data is available for the Pacio *Authenticated Accounting and Real Time Feed for Oracles or Apps*
- whether the data is available for the Pacio *Data Exchange/Monetisation* service, and if so, by what method and price in PIOs

One SDO can hold lots of data. As an example, a SDO named PPE could hold all data for all Property Plant & Equipment assets. SDOs at the core of SSIM prevent many errors ever getting started.

SSIM Taxonomies

SSIM will use flexible taxonomies (data description dictionaries), a lot of them, to describe the data to be stored in SDOs, including:

- Data ownership types: entity, individual, member (PIO holder), app developer, app
- Data storage types: eg Json, Jasonb, binary, text, date/time, integer number, floating point number, file, image, etc with names by language
- Countries, regions, jurisdictions, and languages
- Other taxonomies eg XBRL taxonomies
- Entity types, including blockchain structures such as DAOs, and sub-entity types such as branch
- Entity data. This will need to cover many things including settings with provision for app and entity specific extensions
- Sub-entity data
- Business types eg bank, stock exchange, manufacturer, farmer etc with names per country/region/jurisdiction/language

- Business terms eg price, invoice, receipt, purchase order, quote, accounts payable/creditors, accounts receivable/debtors etc, with name per country/region/jurisdiction/language
- People (individual) including digital identity data
- Member (PIO holder) data
- App developer data
- App data
- Transaction types, with name per country/region/jurisdiction/language
- Transactions and fields – id, date/time, cryptocurrency, fiat currency, unique transaction identifier (UTI), etc
- Activities
- *Interoperable Business Documents*
- *Pacio Scripting Language (PSL)* Scripts
- *Pacio Messaging System (PMS)* Messages
- *Triple Entry Accounting* data
- *Target Average Rate Index (TARI®)* data
- *Ricardian Contracts* data
- *Internet of Things (IoT)* data
- *Artificial Intelligence Interface* data
- Real time public data such as exchange rates, crypto and stock prices etc
- Ledger type data eg accounts receivable/debtors, accounts payable/creditors, inventory, prices, bills of materials, human resources/payroll, asset management with depreciation, tax accounting, and owners' equity management, with jurisdictional variations supported
- Files, tables, charts, images, music, videos, blobs … non-transactional data
- Lists of anything eg cities, phone codes, stock exchanges ….
- Folios and properties used to further tag or describe data (next section)
- Logs
- Any other data whether financial or not, public or private, that a Pacio member (app developer) chooses to define and add

There will be global (universal or master) taxonomies and private, member/person/app/entity specific ones. Any data that is intended for inter entity exchange or comparison must use a global taxonomy. The global taxonomies will be maintained by Pacio Core in cooperation with Pacio members.

SSIM Text Format (STF)

SSIM data will be able to be serialised ie converted to a text form (STF) like Json for export or output. STF data can be imported or passed to API functions.

6.3.2 Target Average Rate Index (TARI®)

Section *8 Business Improvement via TARI®* service describes the TARI® methodology and usefulness.

TARI® is a layer above SSIM providing real time actual vs target feedback. With SSIM providing real time support for the calculation of the value added per unit of activity in each sale, apps using TARI® can deliver the information as the sale is being processed.

Via SSIM and the *Data Processing with Accounting* service Pacio ensures that everything needed for TARI® is available to the *Business Improvement via TARI®* service.

6.3.3 Triple Entry Accounting (TEA)

Accounting built into Pacio and SSIM will allow a single immutable (no fiddling it afterwards) transaction on the blockchain to be a part of the record of both entities involved in a counterparty transaction, to make "Triple Entry Accounting" or TEA available to apps using Pacio.

TEA will greatly reduce opportunities for fraud and reduce the need for auditing. Reducing fraud can be a major benefit to business, as the sums involved are large – US$4 Trillion[1] for occupational or insider fraud alone. Yes, trillions, not mere billions. How many more trillions will other types of fraud involve? Nobody knows! All we can be sure of is that the figure is large, and that TEA can help reduce it – by a lot!

The single blockchain entry aspect of this advance did lead to Pacio thinking of calling it

SEA = Single Entry Accounting done right!

with the “done right!” to distinguish it from single entry bookkeeping with no checks or balances at all, as used before the advent of double entry accounting with Friar Pacioli in the 15th century. However, as this form of accounting has become known as "Triple Entry Accounting", that is the term that Pacio will also use.

The “triple” is because the transaction is also recorded in the books of both entities in normal debit/credit manner = 3 entries. This might seem like more work, but it actually can greatly reduce the work required to complete, confirm, and audit inter party transactions, while helping to fight fraud, so TEA is a big plus, and of course Pacio will handle the “work” automatically anyway.

The TEA term was originally coined in 1989 by Yuji Ijiri as mentioned in the hackernoon Why Everyone Missed the Most Important Invention in the Last 500 Years article, and the Wikipedia entry: Momentum accounting and triple-entry bookkeeping.

Other early references were Triple Entry Accounting in 1995, and Triple Entry Accounting in 2005 by Ian Grigg, who describes the concept as "The Receipt is The Transaction". That paper predates blockchain but introduces the "digitally signed receipt, an innovation from financial cryptography".

Triple Entry Accounting with its current blockchain meaning, building on Ian Grigg’s work, differs from the 1989 Yuji Ijiri momentum accounting meaning, and has replaced the initial meaning of the term. The blockchain meaning has become generally accepted usage since about 2014 with Triple Entry Bookkeeping With Bitcoin.

The first attempt to apply the concept of TEA was with a ConsenSys system named Balanc3. Work commenced in 2015 as described in this video: Balanc3 - Triple Entry Accounting and references the 2005 Triple Entry Accounting paper by Ian Grigg. The book “Blockchain Revolution” 2016 by Don & Alex Tapscott devotes a section to Triple Entry Accounting, and also mentions Balanc3.

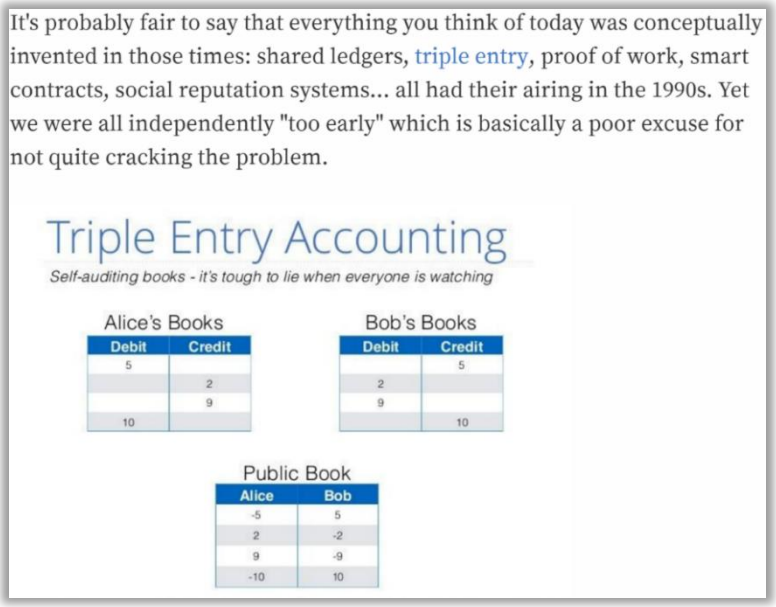
No real systems using TEA are yet in use. Pacio will change that. TEA will be an intrinsic and automatic part of inter entity transactions via Pacio. Apps will get it for free. And Pacio will provide the means to overcome the entity identity and scaling issues that have prevented TEA taking off in the real world.

Within an entity, either for the entity impact of a TEA transaction, or for a transaction with no external party involved, Drs and Crs and double entry accounting will still be involved,

[1] 2018 GLOBAL STUDY ON OCCUPATIONAL FRAUD AND ABUSE page 8. Thank you for this insightful report, Bruce Dorris, J.D., CFE, CPA, President and CEO, Association of Certified Fraud Examiners.

but the core idea that will reduce auditing complexity and reduce opportunities for fraud, is the single entry on the blockchain for transactions involving another party.

Ian Grigg of the seminal 2005 paper is now a partner in block.one, the company building the EOS 3rd generation blockchain. A reference to TEA in the EOS blog, I am iang, posted by Ian in April 2017 was:



6.3.4 Interoperable Business Documents

Interoperable business documents define business processes and the stages, or steps, or choreography involved.

Pacio will be multi-lingual, able to work with multiple business document protocols, as part of supporting inter entity transactions, and international standards, as described in *SSIM Protocol Interfaces* including SSIM native document format, *UBL*, *Open EDI*, and *RDF*.

These protocols define common business documents such as "Order", "Despatch Advice", and "Invoice", 65 of them in the case of UBL.

Pacio permits extension of document definitions, or the creation of new ones.

Interoperable business documents will define business processes and the stages, or steps, or choreography involved.

The *Pacio Messaging System* will be the means of controlling or triggering, and recording, the movement through the stages, of both inter entity and intra entity business processes defined by interoperable business documents. The messages will provide a progress trail.

Application Support Tools will include provide interoperable business document templates, and a JavaScript library to assist apps in creating and then maintaining specific documents with the help of the *Administration* utility.

6.3.5 Pacio Messaging System (PMS)

Pacio will implement a general and flexible intra app, inter app, and inter entity messaging system.

Apps will be able to create custom messages via the Administration service.

Messages will be used to trigger events within an app (intra app messaging), within another app for the same entity (inter-app messaging), or within another entity by whatever app processes it (inter entity messaging).

Messages will be the means of controlling or triggering, and recording, the movement through stages, or a choreography as it is sometimes called, of both inter entity and intra entity business processes using *Interoperable Business Documents*. The messages will provide a progress trail.

Messages will have the following properties:

- can be sent and received (processed) by any app using Pacio. That includes external oracles.
- have a body for transmitting data if so defined.
- can be specific or be a broadcast type message.
- may optionally include an expiration time.
- will be able to ask for acknowledgment of receipt.
- will specify the sender (entity, user, and app), and the recipient or recipients (entity{, user{, app}}) if not a broadcast type message
- terms eg invoice, will be taxonomy based to adjust according to jurisdiction and language of the entity and app user.

Examples of messages are:

- Message not understood – for use if the receiving entity or app lacks a process for handling the message
- TEA transaction created
- Request quote, quote request received
- Request proposal, proposal request received
- Send purchase order, purchase order received, purchase order item(s) unavailable – part ship or cancel, amend purchase order, purchase order modification received and accepted/rejected, cancel purchase order, item on back order, etc re purchase orders
- Order being processed, order shipped, order delivered, order received
- Approved (for xxxx), not approved (for xxx)
- Invoice sent, invoice received, invoice part paid, invoice fully paid, etc re invoices
- Current price (or anything as per a taxonomy term) is xxxx {valid for xxxx}
- Market xxxx has opened/closed
- ….

Given that interoperable business document protocols specify many document types (65 in the case of UBL), it is likely that thousands of messages will need to be defined to handle all the possible interactions.

The messaging system is expected to be widely used by Pacio based apps, including for applications not yet imagined.

Web and Phone App Use

Web and phone apps will be able to create custom messages, send messages, and receive (process) messages with the help of the Pacio Messaging JavaScript library.

Smart Contract Use

In the Pacio Blockchain case smart contracts will be able to send messages. Smart contracts will be able to be triggered by receipt of a message.

For other blockchain smart contracts, such as Ethereum ones, the associated web or phone app could handle the Pacio messages, or the smart contract could do so by means of a system to enable external calls to be made, such as iExec. Libraries may be developed to assist with this process on a blockchain by blockchain basis.

6.3.6 Pacio Scripting Language (PSL)

Pacio will include PSL as a general scripting language that allows free form text.

PSL scripts will be used for:

- Running queries and generating reports via the *Querying and Reporting* service
- Defining Event Triggers
- Defining how to capture data for the *Real Time Public Data Capture* utility
- For passing to some API functions to be run in the context of the function to generate the return value(s).
- As general admin scripts eg for export

A possible language to be used to develop PSL is zygomys. From the github page:

> why use zygomys?
>
> zygomys allows you to create a Domain Specific Language to drive your program with minimal fuss and maximum convenience.
>
> It is written in Go and plays nicely with Go programs and Go structs, using reflection to instantiate trees of Go structs from the scripted configuration. These data structures are native Go, and Go methods will run on them at compiled-Go speed.
>
> Because it speaks JSON and Msgpack fluently, zygomys is ideally suited for driving complex configurations and providing projects with a domain specific language customized to your problem domain.

PSL will be able to call API functions, subject to permissions.

It is not intended that PSL will be able to generate payment transactions, but it could generate a list of payments for an app to perform.

PSL will be able to embed database and calculated results in its output. A PSL script can optionally have arguments, so that it can be invoked with different values passed to it.

For reporting on entity, people, transactional and ledger data stored using *Smart Data Objects (SDOs)*, PSL will make use of the power of SDOs for much of its work, including generating XBRL output when requested.

PSL scripts used to generate HTML reports can include page numbers, cross references, and links.

6.3.7 PIO Technology

Pacio will implement extensions to the cryptocurrency facilities provided by the chosen blockchain software to implement the additional features described in section *4 PIO - The Pacio Cryptocurrency*.

6.4 Application Programming Interface (API)

The Pacio Application Programming Interface (API) will make Pacio data and technologies available as a set of *Core* Services and *Utilities* to any app that can call an API via the Internet with the help of the JavaScript libraries from *6.5 Application Support Tools*.

The value of the API approach is explained by the Shedding Light on APIs as a Market Differentiator article.

The app, or the app's device, will not need to do anything special such as run node software, or use a special browser plugin such as Metamask. This aspect of the API may be thought of as being like the Infura API for the Ethereum blockchain but will go beyond that in scope eg wallets and real time data feeds, while also being easier to use.

The Pacio API will make it simple for phone, browser (web page), computer, and smart contract apps to use Pacio. That will allow developers to incorporate Pacio services in their applications, without needing to invest time and money in development apart from learning to use the API.

Data Interchange Format

The API will support the following data interchange formats, though some of them only for certain service, utility, or function calls for which they would be appropriate:

- SSIM Text Format (STF)
- Json (JavaScript Object Notation) data-interchange format as the default
- Jsonb, a binary form of Jason
- Data protocols for which *SSIM Protocol Interfaces* have been defined
- Streams or files where the result from a service/API call is a stream or file

Smart Contract Use

In the Pacio Blockchain case smart contracts will be able to directly call some API functions, those that return discrete amounts of data eg not a stream or an html page.

For other blockchain smart contracts, such as Ethereum ones, the associated web or phone app could make the Pacio API calls, or the smart contract could do so by means of a system to enable external calls to be made, such as iExec. See also Blockchains Need iExec: The Market Just Hasn't Realized It Yet. Libraries may be developed to assist with this process on a blockchain by blockchain basis.

6.5 Application Support Tools

Pacio will provide and continue to develop tools to support application use of Pacio. These will include:

- Wallet apps, including multisig ones
- JavaScript libraries for calling the API, organised by service
- A JavaScript library for processing messages
- Frameworks for apps ie a starting point for the development of apps
- Templates for interoperable business documents with a JavaScript library to assist in creating specific documents

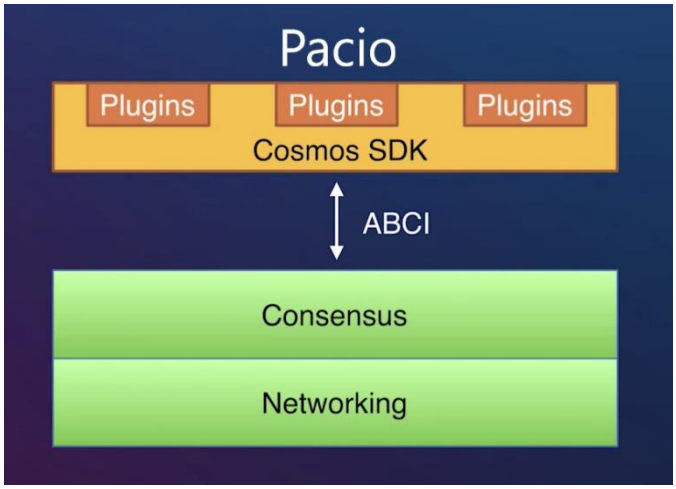
- JavaScript libraries for assisting Pacio *Administration* utility operations
- Sample apps
- Internationalisation support

6.6 The Pacio Architecture

The Pacio Architecture will involve:

- Node software that implements:
  - the Pacio blockchain
  - the Pacio Database
  - the PIO implementation
  - the Pacio API services and utilities
- web gateway access to nodes for apps, like Infura provides for Ethereum, so that apps do not need a local node

Detailed architectural design decisions will be made during development starting with the Cosmos/Tendermint SDK (Software Development Kit) as described in *Pacio Blockchain*:



where the Cosmos/Tendermint core is in green, and Pacio node software in yellow is implemented via plugin modules built using the Cosmos SDK, linked by the Tendermint Application BlockChain Interface (ABCI).

7 Core Services

The Pacio *Application Programming Interface (API)* will make Pacio data and technologies available via a set of Services (described in this and the following two sections) and *Utilities* to any app that can call an Internet API.

Developers will be able to incorporate Pacio services and utilities in their applications easily, without needing to invest time and money apart from learning to use the API.

Services will provide inter entity, inter app, and inter blockchain operation where applicable.

This section describes the core services covering *Payments and Transfers*, *Data Processing with Accounting*, and *Querying and Reporting*.

Payments and Transfers

Pacio will be an attractive platform for payments or transfers of crypto or fiat money, including micropayments, since:

- It will overcome the scalability, delays, and high fee problems afflicting some current cryptocurrency systems eg Bitcoin and Ethereum
- It will avoid the expense and delays of current bank systems
- Zero fee fast transactions made possible by the Pacio blockchain or other zero fee blockchains will permit micropayment systems to be established, and in time to become common
- The greater safety provided by Pacio wallets when a Pacio wallet is the one being used
- The greater safety of PIOs when PIO is the currency being used
- The built-in accounting

The Payments and Transfers service will facilitate app payment or transfer operations via:

- Wallet operations via the *Wallet* utility, including on the fly crypto to crypto, fiat to crypto, or crypto to fiat conversions
- Inter blockchain transactions when required
- The processing of the actual transaction and accounting via *Data Processing with Accounting* below. This could include triggering other events.

Data Processing with Accounting

All Pacio transactions and database updates whether financial or not will use “Data Processing with Accounting”, with “Accounting” happening automatically where it is applicable.

Transactions that are not financial in nature eg registering a vote, or ownership of an asset, and database updates that are non-transactional in nature will use this service directly.

The service will work with *Smart Data Objects (SDOs)* defined via the *Standardised Semantic Information Model (*SSIM) to store and update all data held by Pacio.

Anything processed through this service could be the target of an *Event Trigger*.

When an app calls the service to add/update/delete data, the app, entity, user, and SDO for which the call is made will tell Pacio, with the help of taxonomy references:

- whether the data is transactional and is to be stored immutably (within the life of the Pacio blockchain), or not
- whether a unique transaction identifier (UTI) is involved or not

- what data is mandatory for the operation requested, and what is optional eg re activity data for TARI® for certain SDOs
- what accounting, if any, is to be performed
- for an update of numeric data, whether summing or replacement is involved
- whether logging is to be performed
- what indexing is to be performed

The service will work in conjunction with SSIM and the Pacio *Utilities* to cover:

- Inter entity transactions, managed via *Pacio Messaging System*. These will include:
  - *Triple Entry Accounting* transactions
  - Progress through business processes using *Interoperable Business Documents*. (Messages will be the means of controlling or triggering, and recording, the movement through stages, or a choreography as it is sometimes called, of inter entity business processes using interoperable business documents. The messages will provide a progress trail.)
- Intra entity transactions within an app. This would include traditional double entry accounting Dr and Cr postings. If interoperable business documents are involved, then messages would also apply.
- Intra entity inter app transactions for a given entity. These would also use messages as for inter entity transactions, and similarly have a progress trail.

Exactly how transactions are referenced (indexed) will be defined by the SSIM taxonomy and schema applicable to the entity or entities in question. This could be purely SSIM based for a modern or new app, or it could include traditional accounting elements such as an account code for a chart of accounts. This flexibility will assist apps that seek to build bridges between older or traditional accounting systems and modern blockchain ones.

Querying and Reporting

Querying and Reporting will allow apps to query the database, and to generate reports.

Querying

Queries could use either of:

- *Pacio Scripting Language (PSL)* scripts, either pre-defined ones, or ones generated by apps on the fly eg for ad-hoc user queries, assisted by the PSL tools of the *Application Support Tools*.

  PSL script query output could be in various formats as specified for the query or the script including:
  - Json
  - *SSIM Text Format (STF)*
  - Plain UTF-8 text
  - CSV (comma separated value) UTF-8 text
  - XBRL text for data held in *Smart Data Objects (SDOs)* that know about their XBRL output format
- GraphQL, described as “a query language for APIs and a runtime for fulfilling those queries with your existing data. GraphQL provides a complete and understandable description of the data in your API, gives clients the power to ask for exactly what they need and nothing more, makes it easier to evolve APIs over time, and enables powerful developer tools.” will be a part of the system.

as best suits the app.

Reporting

Reports will be generated by *Pacio Scripting Language (PSL)* scripts, usually pre-defined ones, though it would be possible for an app to generate a report script on the fly as for an ad-hoc query.

Report output will be either:

- plain UTF-8 text, with specified new line format (Windows, Max, Unix)
- HTML
- HTML including XBRL

If the report is an HTML one it can include cross references and page numbers, as defined by the PSL script.

If an app needs a more complex report, it is expected that it will assemble it from report segments generated here, or from queries, though if there is a demand from app developers for Pacio to generate more complex reports in full, including in PDF or other formats, then that could be done as one of the planned additional services.

8 Business Improvement via TARI® Service

The Business Improvement via TARI® Service allows business apps to incorporate TARI® to improve their offering.

Many programs can produce monthly accounts with budgets and variances, play around with ratios, and do cash flow projections, but no others can do what TARI® does, that is to see accounting from an interactive and holistic perspective - the woods through the trees!

TARI® can model (and re-model) the business, track it through time and change, and extract key data from day to day activities to aid immediate decision-making. TARI® can be likened to a GPS system guiding management to an improved bottom-line performance.

To put it simply, the concepts underlying TARI® will replace what is currently known as management accounting.

"XYZ sends out numerous invoices, each aimed at recouping cost of inputs, expenses and a margin of profit. In common with current accounting systems, the feedback focuses on financial data only, leaving XYZ unaware that the physical unit of key activity driving the business was operating at less than 55% of potential…."

TARI® is a layer above SSIM providing real time actual vs target feedback. With SSIM providing real time support for the calculation of the value added per unit of activity in each sale, apps using TARI® can deliver the information as the sale is being processed.

Pacio TARI® identifies and tracks the key activity fundamental to bottom-line profitability, measuring input, output and the added value result of the activity continuously and in real time, nudging management to achieve improved results.

Apps using Pacio TARI® can handle all the normal processes of business – invoices, quotes, direct sales – plus have the ability to handle relevant IoT devices feeding in data at an enormous rate. This will all work automatically with the help of AI systems for front end applications to make it all easy, transparent, automatic, and business transforming.

TARI®, including Good Invoice-Bad Invoice®, invented and developed by Accounting Professor, Dr Keith Cleland, and his IT partner Trevor Watters, has been shown to significantly boost the bottom line of businesses, large and small, some dramatically so.

Why Good Invoice-Bad Invoice®?

Because at a click:

- the bottom-line impact of any invoice or quote is revealed
- there is a real time 'fix' on where the business is 'at' compared with target.

How is this achieved?

Sales, cost of sales, added value/gross profit and the number of key units of activity driving output, are extracted, permitting comparison of the bottom line impact of an invoice with target and total invoices with target for period to-date.

Where could this lead?

Good Invoice-Bad Invoice® will provide software developers with a unique opportunity to boost the bottom line of their clients.

The TARI® service will enable apps to be developed that provide real time guidance or business improvement, and thus real time management, as a better replacement for what is currently known as management accounting.

Despite the successes and the glowing testimonials from people who have used TARI®, it has not achieved the scale it deserves, because current accounting systems do not store the

activity data that it needs. (TARI® has been implemented in software, but not as an integral part of a general accounting package.) Pacio will fix the missing data problem by including activity data in all relevant accounting records, and thus make TARI® available to all businesses via apps embodying TARI®.

Some of TARI®'s successes are described in Keith's latest book Improving Profit | Using Contribution Metrics to Boost the Bottom Line. See also the following TARI® Testimonials section.

Much more about TARI® is available through the many books and papers published by Keith, as listed at TARI Info.

See the following example.

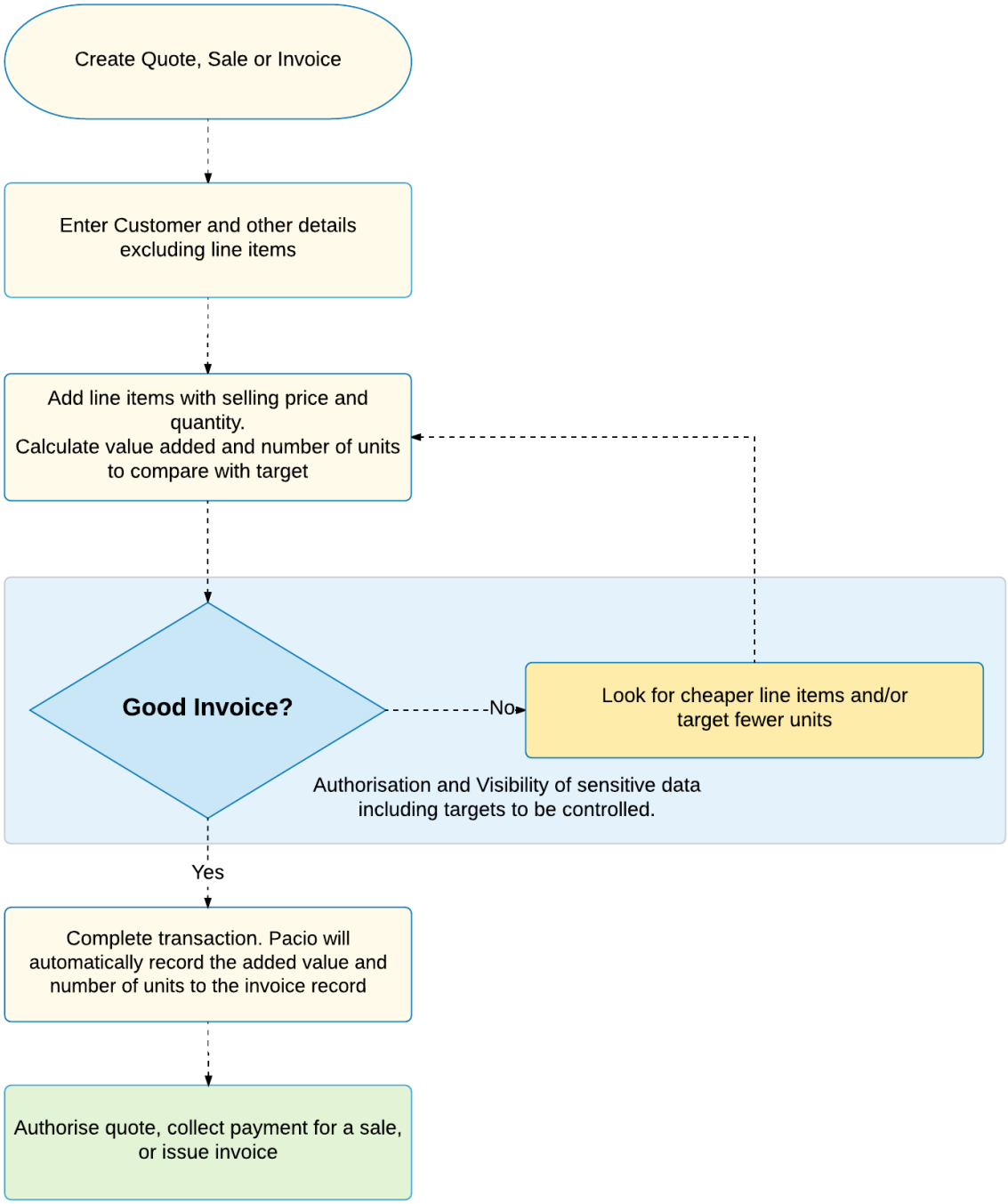
Example: Calculating TARI® for a business engaged in manufacturing/trade/service

A	Targeted expenses for year	=		$390,000
B	Targeted profit for year	=		$100,000
C = (A + B)	Target added value(AV)/gross profit(GP) for year	=		$490,000
D	Hours paid for year	=	10,000	
E	Targeted Productivity %	=	70	
F = (D × E)	Target hours billable	=		7,000
G = (C ÷ F)	Target Ave GP per hour (Tari®)	=		$70

Invoice No.	Sales A	Cost of Materials B	AV/GP C = A – B	Units (Hours) D	Average AV/GP per unit E = C ÷ D	Tari® F	Variance Per Unit G = E - F
100097	2,475	980	1,495	21	75	70	+5
Total to date	420,877	168,132	252,745	4,212	60		
Target to date	500,000	200,000	300,000	4,286	70		
Variance	**79,123**	**31,868**	**47,255**	**74**	**-10**		

Good Invoice but total output units (hours) and Av/GP per unit (hour) behind target.

The process is shown in the following diagram.



TARI® Testimonials

Extensive Testimonials can be found at TARI Info Testimonials. A few of them follow:

Deputy Finance Director, Shipping and Trucking Transport

"Benefits from this concept are difficult to overestimate. For me, an economist by education the TARI® approach was an absolute revelation. It became clear that the reporting mechanism of Company is not perfect and should be improved. My recommendations to management concerning quotation of services and improving reporting mechanism are now being applied in practice."

Gary Morcom & Associates, CPA's, Albert Park, Victoria, Australia

"A fabricating client had rung up losses of $166,158 the previous financial year and a further loss of $80,000 for the seven months ending January this year.

We got him onto the TARI® program and within a matter of weeks he was into profit. In eight months February through September (with one week to go) he has recorded a net profit of $138,481.

As requested, we asked him to give his reasons for the changes and here they are: confidence when he quotes because he can compare the quoted, contribution with his benchmark; speed that he gets weekly results – each Friday after closing on Wednesday; and speed that he gets monthly results – 4 days instead of 6 weeks."

Fin Director of a major consulting group in respect of a wholesale/retail chain with $12 billion in sales and 70,000 employees

"Movement of profitability analysis to the invoice level basis provides management with on-line tools for benchmarking and productivity control. Combined with an appropriate IT solution, it lets management identify poor as well as outstanding performance at the time of invoicing."

Paul M Cooper, CPA, Brisbane 4110, Australia

"I can certainly see that there would be some doubters in believing that a simple management of a few key indicators can cause a major turnaround in business, but as I have mentioned to you, this has been achieved in the past and is a daily part of my practice…

There are many cases I can relate which that from corner stores to workshops making elevators and coal train wagons all of which whom are thriving on the simple aspects of TARI®."

Managing Director of a South African Bank

I feel happy, I feel happy, I feel terrific !!! and transformed.

That was one of the best residentials I have ever attended. My whole banking career revolved around Financial Analysis and lending. TARI® was an amazing discovery. I also got new knowledge of how to interpret financial statements which books, school or my working experience failed to instil in my head.

Financial Consultants and business people need TARI® more than anything to transform and turnaround their operations and processes. Thank you once again Prof.

9 Additional Services

Additional services will be added progressively following the initial launch of Pacio. The services to be added, or the order of release could be changed, according to member requests. Some proposed services are:

- *Global Digital Identity Support*
- *Data Exchange/Monetisation*
- *Authenticated Accounting and Real Time Feed for Oracles or Apps*
- *Event Triggers*
- *Governance Support*
- *Ricardian Contracts (Internet of Agreements™)*
- *Internet of Things (IoT) Interface*
- *Artificial Intelligence Interface*

9.1 Global Digital Identity Support

People

Digital identity for people will play a large role in the distributed blockchain era, as this Forbes article explains Moving From Static Identity To Digital Identity. Digital identity is a foundation stone of Estonia's Bold Plan to Build a Digital Country on the Blockchain, and other such initiatives around the world.

One of the United Nations 2030 Sustainable Development Goal is for everyone on the planet to have a legal identity, in a project named the ID2020 Alliance. As part of that, Accenture and Microsoft are building a digital ID network using blockchain technology, to provide legal identification to 1.1 billion people worldwide with no official documents. As a Reuters article about that initiative says, “Having a digital identity is a basic human right.”

Accordingly, online activity will increasingly involve use of digital identities, so apps using Pacio’s other services are also likely to need digital identity services. Thus, the Digital Identity service will provide apps with Digital Identity capabilities to extend what is natively available via the Pacio Blockchain.

Entities

Pacio will extend the digital identity concept to include entities because of the advantage in the Pacio ecosystem for entities, as well as people, to have just one global database existence. This will include details such as company registration numbers as used in the jurisdiction of registration. This part of the digital identity service would involve interacting with national business registration services, and the Legal Entity Identifier (LEI) system:

> Legal Entity Identifier is a 20-character identifier that identifies distinct legal entities that engage in financial transactions. It is defined by ISO 17442. Natural persons are not required to have an LEI; they’re eligible to have one issued, however, but only if they act in independent business capacity. The LEI is a global standard, designed to be non-proprietary data that is freely accessible to all. As of January 2018, over 1 million legal entities from more than 195 countries have been issued with LEIs.

Verification, KYC and AML

The Digital Identity service will assist apps to process and record verification of identity stages, including for KYC (Know Your Customer) and AML (Anti Money Laundering) requirements. *Smart Data Objects (SDOs)* will include storage for and knowledge about these processes. This service could include interacting with current or future KYC/AML service providers.

Reconciliation and Registration

The Pacio goal is to have just one global index database record per person or entity, for data integrity and better reporting reasons, plus the avoidance of out of date or inconsistent information errors from differently updated duplicate records, as described in the *Pacio Database* section.

Attaining this goal will involve reconciling people and entity records added by different apps, possibly not in the best order. For example, an app working with entities might add a director who is unknown to Pacio, resulting in a person being added to the database who is unverified, with no digital identity. Then, when or if, the same person is added by another app, potentially the person him/herself, there is a danger of a duplicate record being created. As part of trying to minimise such duplicate records, this service will include methods for reconciling apparent duplications and reducing them to just one record.

Because of the value to the whole ecosystem of minimising duplicate record issues, Pacio will run a registration and reconciliation service. This will encourage people and entities to create their own Pacio record and to verify it, as well as assisting people and entities to remove duplicate records.

Deployment

Pacio will develop its digital identity service to work in conjunction with:

- Open source technology and standards as listed in Decentralized Digital Identities and Blockchain:
  - Decentralized Identity Foundation (DIF)
  - Decentralized Identifiers (DIDs) – a W3C spec that defines a common document format for describing the state of a Decentralized Identifier
  - Identity Hubs – an encrypted identity datastore that features message/intent relay, attestation handling, and identity-specific compute endpoints.
  - Universal DID Resolver – a server that resolves DIDs across blockchains
  - Verifiable Credentials – a W3C spec that defines a document format for encoding DID-based attestations.
- Existing digital identity participants:
  Civic, DID (Decentralized ID), Essentia, Estonia, Legal Entity Identifier (LEI), OpenID, Persona, uPort, the United Nations ID2020 programme, VeriMe
- Other initiatives that gain traction

As with all aspects of Pacio, the Digital Identity service will be open, and designed to readily accommodate new standards or services as they become available.

9.2 Data Exchange/Monetisation

Blockchains and Pacio return ownership and control of data to its creators. That provides many opportunities for people or entities to exchange or sell access to their data, through decentralised data exchange (DDEX) apps.

Data owners will be able to specify through this service and *Smart Data Objects (SDOs)* the parts of their data that are for sale, and if so by:

- what method or methods:
  - historical on request
  - stream initiated on request
  - triggered on new transactions/updates
- at what price in PIOs per available method

- with what payment method
  - micropayment on use
  - aggregated per:
    - xxx number of uses
    - time period eg hour. Day, week, month
- for payment in what currency, crypto or fiat

with owner default settings for these options being stored, potentially varied for particular SDOs.

The Data Exchange service will allow apps to match sellers of data with buyers, and to establish contracts from the SDO information for the delivery of the data via the *Authenticated Accounting and Real Time Feed for Oracles or Apps* service.

A fee will be payable for data market use, as described in *API Fees* in section *12.2 Pacio Business Aspects*.

9.3 Authenticated Accounting and Real Time Feed for Oracles or Apps

The inspiration for this Pacio service is the Town Crier project.

The following data will be made available via this service for use by oracles and apps:

- Data from *Smart Data Objects (SDOs)* with this service enabled, and with a fee payable if the data is also subject to a data market contract, for:
  - Accounting (transaction derived) data from entity SDOs, these values being considered "Authenticated Accounting" in the case of TEA transactions between parties, and just "Accounting" data for intra entity transactions
  - Other data from entity SDOs
  - Data from member SDOs
  - Data from individual SDOs
- Free public data being collected by the *Real Time Public Data Capture* utility, with the data being made available as a single value via a call, or as a stream to be fed to the requesting app
- Subscription/paid for external data such as that provided by Thomson Reuters, Bloomberg etc with arrangements to be put in place

9.4 Event Triggers

The Event Triggers service will allow apps to initiate intra app, inter app or inter entity actions based on internal or external events.

This will enable apps to respond to real world events, actions by oracles, the app itself, other apps, or other entities, so permitting development of staged, control, monitoring, or automation apps, including for IoT devices This is in addition to the events involved in progressing through the steps of interoperable business documents.

The Event Triggers service will provide a *Pacio Messaging System* (PMS) message for an app to respond to on a specific event, defined via a PSL script.

The service will allow for trigger requests to be initiated, extended, varied, and terminated.

The possibilities opened up by this apps having access to this capability are many and varied. Some example of triggers that could be established are:

- Time reaches xxx

- Time reaches yyyy years/months/weeks/days/hours/minutes/seconds from now or zzzz
- Price of xxx moves above/below yyyy
- A change in xxx, optionally by more than yyy
- Transaction of type xxx to yyyy being posted
- Activity by xxxx
- Market/exchange xxx opened/closed, optionally in yy minutes
- etc for millions of possible events that might be defined

9.5 Governance Support

This service will allow apps to be written to interact with the Pacio Blockchain re the Pacio good governance emphasis described in section *5 Governance*:

- managing delegates in the expected Delegated Proof of Stake consensus protocol
- account management
- constitution contract management
- managing protocol proposals
- voting on proposed changes

With appropriate access controls, governance apps will make it easy for people to become involved. Taking an interest in governance matters will not require special expertise or effort.

9.6 Ricardian Contracts (Internet of Agreements™)

The Ricardian Contract, invented by Ian Grigg, is described in Wikipedia as "a method of recording a document as a contract at law, and linking it securely to other systems, such as accounting, for the contract as an issuance of value."

The Mattereum project involves developing a so called Internet of Agreements™ using Ricardian Contracts, with the Internet of Agreements™ described as:

> The Internet of Agreements™ is the bridge between the Internet and the deals, contracts, rules and regulations that support our lives. As the web has accelerated the spread of ideas, and e-commerce has changed how we buy and sell, IOA will give us new ways to specify, manage, and execute agreements between people, businesses and governments. Built with blockchains, smart contracts and AI, IOA offers a vision for global supply chains and logistics, facilitating trade that is free, fair and frictionless.

The "Mattereum | Smart Contracts. Real Property | Mattereum creates smart contracts with the legal force of natural language contracts" draft paper, with Ian Grigg as one of the authors, describes the project in more detail.

Given the Pacio accounting focus, its *Interoperable Business Documents* and *Pacio Messaging System (PMS)* technology to help control progress through the stages of an interoperable business document, the inclusion of a service to integrate Ricardian Contracts is a logical progression.

Pacio will seek to develop this in conjunction with Ian Grigg and/or the Mattereum project.

9.7 Internet of Things (IoT) Interface

From Wikipedia:

> The Internet of things (IoT) is the network of physical devices, vehicles, home appliances and other items embedded with electronics, software, sensors, actuators, and network connectivity which enables these objects to connect and exchange data. Each thing is

uniquely identifiable through its embedded computing system but is able to inter-operate within the existing Internet infrastructure.

Experts estimate that the IoT will consist of about 30 billion objects by 2020. It is also estimated that the global market value of IoT will reach $7.1 trillion by 2020.

Many smart IoT systems will need:

- micropayment and accounting services, that Pacio is ideally capable of supplying via its *Core Services*
- the ability to respond to events elsewhere, and the ability to trigger events to happen elsewhere, that Pacio can provide via the *Event Triggers* service
- better security that the Pacio IoT Interface would provide. See The Solution to IoT is Blockchain Security.

Thanks to the throughput capability of the Pacio Blockchain, and the Pacio database, Pacio will be able to handle the large number of transactions that IoT systems are likely to generate.

This service will add any additional IoT specific requirements that app developers might request.

9.8 Artificial Intelligence Interface

Artificial Intelligence (AI) use is now common and will become ubiquitous as a normal part of many, computer, phone, Internet and blockchain systems.

As Pierre Rognion put it in My Most Valuable Crypto Market Insights For 2018 and Beyond "Combine blockchain and AI and you could manage transportation services with fully autonomous electric cars, build streets and buildings to save energy, use smart contracts for emergency responses, utilities, crime monitoring, and many other things that my imagination hasn't touched (yet)."

All those application will need the data processing and accounting that Pacio will supply!

Yes, apps using AI will proliferate. Apps or "bots" that are AI agents will perform many functions previously performed by humans, including making financial decisions and making payments.

Such apps will be able to use Pacio services like any human driven app, so nothing special will be required for many aspects of AI agent apps.

However, AI learning or training, especially so called deep learning, involves processing a large amount of relevant data, and this service could be developed as an extension of Pacio's *Authenticated Accounting and Real Time Feed for Oracles or Apps* service to specifically cater for this need.

As well this service could include support for specific AI based systems in general use. One example of that is Amazon's Alexa: Alexa for Business likely to win in smart office, leverage AWS, Echo, developers and consumers. The Pacio *Event Triggers* service is an ideal adjunct to systems such as Alexa eg for the "Alexa, turn off the lights in the office at 7 p.m." instruction example in that article.

Another as yet only potential example is AI agents becoming a part of the Pacio blockchain consensus process.

10 Utilities

The Pacio API will be organised as a set of services and utilities for ease of understanding, learning, and use, though an app will be able to use any appropriate service or utility, subject to permissions.

The utilities provide “nuts and bolts” support, and cover:

- *Administration*
- *Wallet*
- *Real Time Public Data Capture*

10.1 Administration

The Administration utility will provide apps, and via apps, entities, and individuals, with access to all the administrative processes involved with using Pacio according to permissions, covering:

- Add/edit/delete users, including setting/changing permissions and individual settings, including wallet, and *Data Exchange/Monetisation* settings. The permissions system will be extensive. These functions will extend or work with applicable Pacio Blockchain account operations.
- Add/edit/delete entities, including setting/changing options and settings, including wallet, Authenticated Accounting and Real Time Feed for Oracles or Apps and *Data Exchange/Monetisation* settings, and optional app entity extensions.
- Manage *SSIM Taxonomies*, schemas, folios, and properties – add/edit/delete with checks
- Add/edit/delete *Smart Data Objects (SDOs)* definitions, with checks re used SDOs
- Add/edit/delete *Interoperable Business Documents* definitions, with checks re use
- Add/edit/delete *Pacio Messaging System (PMS)* message definitions, with checks re used or current messages
- Add/edit/delete Querying and Reporting *Pacio Scripting Language (PSL)* scripts
- Add/edit/delete *Event Triggers* scripts
- Add/edit/delete/activate/deactivate *Real Time Public Data Capture* scripts
- Add/edit/delete PSL scripts used for passing to some API functions where it will be possible to pass a script to be run in the context of the function to generate the return value(s).
- Add/edit/delete/run admin PSL scripts eg for export
- Export and import operations
- Backup

10.2 Wallet

The Pacio blockchain will already include good account and wallet facilities, including for multi-sig operations. The Pacio Wallet utility will make these available to apps, extending them for fiat use and making them available for other Pacio utilities and services, while keeping them easy to use and implement.

Pacio wallets are private, of course, but so also are Pacio blockchain accounts private by default, unlike for Ethereum and other blockchains where they are public.

This utility will provide on the fly crypto to crypto, fiat to crypto, or crypto to fiat conversions.

10.3 Real Time Public Data Capture

Pacio will capture free real time public data, as specified by a set of data capture PSL scripts, for information such as exchange rates, crypto and stock prices as defined in the taxonomy. Thousands or tens of thousands of data sources are available. As an example of one list of a set of data APIs is Public APIs.

The resulting data will be available to apps via the *Querying and Reporting* and *Authenticated Accounting and Real Time Feed for Oracles or Apps* services.

The data capture scripts will be managed as one of the *Administration* utilities.

11 Minimum Viable Product (MVP)

MVP

The Minimum Viable Product (MVP) planned for 5 quarters post funding (section *12.3 Funding)* is:

- Pacio as the Pacio Blockchain with smart contract capability using any developer preferred language which can use the Cosmos ABCI interface which is any modern language i.e. not restricted to Solidity and a few others as for Ethereum, or C++ as for EOS
- PIO implemented including issuance rewards
- DB and file storage ability (though not yet SSIM and full taxonomy support)
- Scalability
- Some inter blockchain support courtesy of Cosmos
- Some app support JavaScript incl at least a wallet
- The design for SSIM complete, and work started
- The design for TEA, TARI® and planned services completed
- Governance via Pacio Governance Council functioning

Note: It would be possible to build a TARI® for Business or TariSaaS like app at this stage, though without the full integration with an entity's accounting records that Pacio with functioning SSIM and Interoperable Business Documents will permit.

Inputs

Creating the MVP will involve use of:

- Cosmos SDK
- Cosmos Hub
- Tendermint Core
- BigChainDB
- HoloChain
- IPFS
- plus the usual Javascript and html front end tools

Timing

A 15 month target is reasonable for this MVP given:

- That the overall Pacio design work is complete as detailed in this paper
- CA (Chief Architect) and CTO plus small (no more than 5) team to be dedicated to the task from early in the 15 month period
- The state of Cosmos progress – see The Cosmos roadmap
  It might be appropriate for some of the Pacio team to join the Cosmos open source community. It could also work the other way as a source of potential developers for Pacio.
- That Cosmos and the Cosmos SDK are modular and facilitate bolting together
- That the whole task involves using much existing open source work or work in active development

MVP Features and Benefits

What this MVP would give us on the way to full Pacio is:

- the switch from PIOEs to PIOs with the launch of the Pacio Blockchain, like Tron leaving Ethereum ERC20 with the launch of their own blockchain in May 2018
- a 3rd generation application platform similar to or better than others in development or being launched listed in section *6.1 Pacio Blockchain*
- the hub and zone capability via Cosmos providing great flexibility to app developers
- inter blockchain capability courtesy of Cosmos
- an Ethereum competitor (better scalability, zero transaction fees, choice of languages, DB/storage, more flexible, better design e.g. not 256 bit ints etc)
- an EOS competitor (better BFT thanks to Tendermint, better flexibility, inter blockchain capability courtesy of Cosmos)
- a competitor to Sia, Storj etc distributed storage systems
- a good step on the path to full Pacio with SSIM, TEA, TARI® etc as detailed in this paper.

MVP Competition

There will be plenty of competition to this interim MVP release of Pacio i.e. virtually all of the 3rd generation blockchain contenders mentioned in section *6.1 Pacio Blockchain* but the Pacio MVP will be distinguished by:

- the PIO issuance features
- the Pacio Governance
- the clear road map to semantic blockchain via SSIM
- the TARI® plans
- the TEA and Interoperable Business Documents etc plans as per the Technology and Services sections of this paper
- Pacio marketing and story telling to inform the world about the full Pacio plans and how the MVP is a step on the path to that
- The Pacio ecosystem nurturing
- The Pacio funding given ICO success. (That funding will not nearly as much as for EOS or Tezos and some others but more than others, with significant funds allocated to marketing and ecosystem building.)

with the SSIM, TARI®, TEA, accounting and management of the full platform being the ultimate differentiators for Pacio.

12 Pacio Core Ltd and Funding

The main Pacio developer, and the entity that nurtures the Pacio ecosystem in conjunction with the Pacio community, is Pacio Core Ltd (PCL), a Saint Lucia International Business Corporation (IBC). Pacio Core has run a seed presale and prepared this document to define the Pacio plans.

Pacio governance aspects will be decided by the *Pacio Governance Council*.

12.1 Pacio Core Ltd

Pacio Core Roles Up to Launch

In the period up to launch, Pacio Core will:

- get PIOEs listed on some exchanges
- execute the planned private placement and ICO
- expand the team and build the software, initially to Minimum Viable Product (MVP) stage in preparation for launch
- start building an active Pacio Community online and offline via with meetups around the world and conference participation
- draft the Pacio Constitution in consultation with token holders
- establish the Pacio Governance Council in accordance with the constitution
- launch the Pacio blockchain when development permits

Pacio Core Continuing Roles

Post launch Pacio Core will:

- execute governance decisions for the Pacio Blockchain and the PIO cryptocurrency made by the Pacio Governance Council
- build, market, and nurture Pacio and its ecosystem in a broad sense, to deliver the Pacio Vision and thereby help increase the value of the PIO token
- continue development of the Pacio blockchain and the Pacio API indefinitely, using directly employed or contracted developers, remote as well as local, and by co-ordinating the efforts of open source contributors.
- manage the monthly distribution of newly minted PIO issuance rewards to PIO holders
- foster an active Pacio Community with meetups around the world, conferences, and possibly including a Pacio Apps market
- provide or organise venture capital, joint venture, or ICO type funding for application developers with promising proposals in need of funding
- develop and run a limited number of apps as described below.
- run a digital identity registration and reconciliation service for people and entities because of the value to the whole Pacio ecosystem of minimising duplicate record issues, as discussed in the *Reconciliation and Registration* part of the *Global Digital Identity Support* service section.

  This service will encourage people and entities to create their own Pacio record and to verify it, as well as assist people and entities to remove duplicate records. It will use Pacio developed apps but will also inevitably involve establishing and running a customer service operation, potentially quite a large one as the numbers grow.
- develop and maintain the global *SSIM Taxonomies* in collaboration with members

- partake in the role of setting standards for the accounting world whether overtly or in a defacto manner by achieving market adoption of TARI®, TEA, SSIM, and other Pacio technologies
- manage the operation, tokens, fiat money, and income of PCL, with the objective of covering costs and maintaining reserves for five years' budgeted expenses, with fees or newly minted PIO rewards to be reduced and or ecosystem support activities to be increased if reserves should increase to more than that
- set fees for Pacio use as advised by the Governance Council but also taking into account the need for long term financial viability as per the previous point, and the objective of maintaining and increasing PIO token value
- provide financial and administrative support for the Pacio Governance Council
- pay staff, contractors, suppliers, and Governance Council members on an arm's length market rate basis in PIOs

Pacio Apps

Pacio will not generally deploy apps that would compete with apps being developed by Pacio members but will do so in certain global cases where the app will benefit everyone, and to help build the application library.

One such app would be a registration service for people and entities, as discussed above.

As part of kick starting Pacio applications growth, Pacio will take an active role in some initial apps, either directly, or with partners whom Pacio recruits, in addition to the wider planned support of developers. Some possible apps are:

- A wallet and transfers app
- A general accounting app for a specific sector in a particular country eg real estate in the UK, which developers with a focus on other sectors and markets could clone and adapt
- A TARI® app
- A financial reporting app
- An audit app
- An oracle app
- A cryptocurrency trading app
- A digital assets app
- A market specific "ecommerce" app, which again developers could clone
- A payment app that integrates with the ecommerce app
- An agreements (trust) app
- A data exchange/data market app
- Others as suggested by the community …

12.2 Pacio Business Aspects

Business aspects of Pacio involve:

- Pacio Core Ltd (PCL)
- Other entities running Pacio blockchain delegate (block producing) nodes as for-profit ventures
- People and entities using Pacio to help run their applications, either for profit or not according to their mission

The entity to be considered here is Pacio Core Ltd which requires funding to perform its development and ecosystem nurturing roles.

A fundamental difference from pre-blockchain/cryptocurrency ventures is explained by the ICOs Are Already Changing Tech Startups You Know article:

> Effectively sales revenue is being replaced with asset appreciation, with payroll covered through the early years with proceeds from the coin "offering."
>
> …
>
> Our business model shifted from taking a cut, like a 40 percent or 50 percent cut - like YouTube and Facebook do today - [to instead] benefit from the growth in the token and the ecosystem.

Token issuance and token value growth will form the major part of long term "income" or funding for Pacio, though there will also be actual or traditional revenue via API use fees.

The primary business objective of PCL is to achieve the Pacio Vision, and thereby achieve growth in the value of the PIO, which is in alignment with the objectives of individual PIO holders.

As stated in the *Pacio Core Continuing Roles* section above, Pacio Core will "manage the operation, tokens, fiat money, and income of PCL, with the objective of covering costs and maintaining reserves for five years' budgeted expenses, with fees or newly minted PIO rewards to be reduced and or ecosystem support activities to be increased if reserves should increase to more than that".

API Fees

Core Services use will be free for users of apps (unless an app deployer chooses to impose a charge), but there will be fees payable by applications using Pacio for:

- Storage
- Bandwidth
- API use beyond the Core Services ie for *Business Improvement via TARI®* Service and *Additional Services*, with fees to be set by service, with some possibly also free eg the digital identity support service

Storage and bandwidth involve actual real world costs. API use also involves computation, storage access, and bandwidth costs.

One of the roles of PCL will be to set these fees as advised by the Governance Council but also taking into account the need for long term financial viability, and the objective of maintaining and increasing PIO token value.

Umbrella prices for storage and bandwidth are set by current suppliers such as AWS (Amazon Web Services), Google Cloud Platform, Microsoft Azure, and distributed storage providers such as Storj, Swarm, Filecoin and Sia.

For example, Sia says "On average, Sia's decentralized cloud storage costs 90% less than incumbent cloud storage providers. Storing 1TB of files on Sia costs about $2 per month, compared with $23 on Amazon S3."

Initially Pacio fees will be set to be comparable to the prices charged by others. In time, as Pacio blockchain usage grows, and the asset appreciation "income" from newly minted tokens grows, it may prove possible to reduce Pacio fees, though not to zero, as fees also serve to limit spamming. It will be the responsibility of an app to control its transaction (bandwidth) and storage usage.

Fees will be payable in PIOs, but as Pacio will allow other currencies to be converted to PIO on the fly, payment could be made in the cryptocurrency or fiat currency choice of the app making use of the services.

Fees will be split 50% to block producers, with the other 50% to go to Pacio Core.

Total API fees are projected to start at $1 million in the first year after launch and to increase to $300 million by year 4 after launch.

Pacio Budget

Projections have been prepared for 5 years following the planned full ICO. These show revenue growing from zero to $132 million, and expenses from $7 million to $58 million, for a $74 million profit by year 5, with app numbers, user numbers, and revenue increasing in an exponential manner by then. The funding requirement is $36 million.

The major expenses are human resources, especially for development and marketing, plus marketing and ecosystem nurturing.

The gain in PIO token value is projected to be tens of thousands of percent by year 5 due to issuance rewards increasing the number of PIOs held, the continuing development of Pacio, the growth in applications using Pacio, the growth in users of Pacio applications, and the conservative new issuance management of PIOs. Due to all these factors the PIO value is expected to increase in value from $0.10 at the full ICO to $16 by year 5, or by 160 times.

12.3 Funding

The estimate of the total funding required to launch Pacio and take it through to net positive crypto flow is US$36 million, as described in the budget section above.

The required funding is being raised in three phases: a seed presale, a private placement, and a full public ICO.

The ICO numbers shown here would raise US$42 million to provide a $6 million reserve or safety margin vs the estimated requirement. Unlike some ICOs in 2017 which raised large amounts beyond actual project needs, the Pacio plans are more closely tied to actual requirements, with release of funds to the project to be limited as per the revised DAICO proposal described below for the full ICO.

Pacio ICO Token

One billion Ethereum EIP20 tokens called PIOE have been minted for the Pacio Seed Presale, Private Placement and the Pacio ICO. Once the Pacio Blockchain has been launched, PIOE tokens will be convertible one for one to Pacio blockchain PIO tokens.

75% of the tokens or 750 million are allocated for public sale, with 25% allocated to Pacio Core Ltd to cover and help fund ongoing development (R&D), the IPR contributions of the founders, Pacio ecosystem building, and governance via the Pacio Governance Council. Tokens from the initial minting allocated to Pacio Core will not be transferable (saleable) until after MVP launch.

PIOs have many purposes as described in section *4 PIO - The Pacio Cryptocurrency*, with Pacio governance, the Pacio Constitution, the Pacio Governance Council, and Pacio Core intended to work together to preserve and increase the value of PIOs.

However, PIOs and PIOEs would be classified as Security tokens under USA (SEC) regulations. Because PIOEs have not so far been registered with the SEC in the USA, PIOEs are not available for purchase by US citizens or residents. This could change at some point for US accredited investors if Pacio opts to go through with the registration process.

Pacio Seed Presale

The seed presale was for 0.2% of the tokens, or 2 million of them, at a discounted price of the ETH equivalent of US$0.05, half of the 2018 proposed full ICO price, to raise the equivalent of US$100,000. It was successfully concluded in December 2017, as an ETH only sale run via the Pacio site. It used a smart contract written by Pacio Core Ltd, with the code published on GitHub.

Pacio Private Placement

The private placement will be for 3.2% of the PIOE tokens, or 32 million of them, at a discounted price of the ETH equivalent of US$0.0625, 62.5% of the full ICO price of $0.10, to raise the equivalent of US$2 million.

The funds raised will be used by Pacio Core Ltd to:

- expand the team and work on building the software
- run the full public ICO described below

Pacio Full ICO or DAICO

To fund development through to launch, it is proposed to sell another 41.4% or 414 million PIOE tokens, in a public ICO run in three stages, at equivalent price of $0.075, $0.875, and $0.10 per PIOE, to raise the cryptographic equivalent of US$40.2 million, leaving 28% of tokens in reserve for possible future growth funding ICOs if needed.

The DAICO will involve whitelisting or KYC/AML (Know Your Customer/Anti Money Laundering) procedures.

It is proposed to make this ICO more open, responsible, and accountable to subscribers, while also helping to increase the market price of PIOEs, as follows:

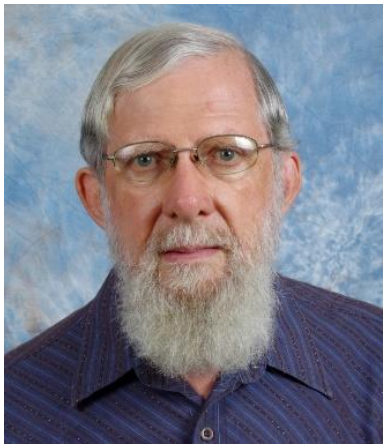
- Adopt the new DAICO structure proposed by Vitalik Buterin to give subscribers the option by majority vote of preventing the release of funds, and even of voting to return any remaining, non-distributed funds, if project progress is judged to be unsatisfactory, with the process to be extended and improved by Pacio. See:
  What is a DAICO, Explained
  Overview of DAICO Crowdfunding Model as proposed by Ethereum Founder, Vitalik How it works
  Vitalik Has a New Idea for ICOs – And It's Being Tested
- Extend the DAICO smart contract to allow control of transferability of tokens separately from vesting so that, for example, PCL and PCL team member tokens might be vested but still have transfer (sale) restrictions applied until certain benchmarks are reached. (It is not intended that there be any restrictions on the sale of public tokens.)
- Extend the DAICO concept to allow the appointment of proxies for voting to make it easier for people to vote
- Include a transfer procedure for Seed Presale and Private Placement contributors to bring them up to whitelist standard, with refunds to be issued to any who do not complete the KYC/AML procedures
- Release the ICO funds to the project progressively, as per the DAICO methodology, as work proceeds and benchmarks are achieved.

Once the Pacio Blockchain has launched and the PIO cryptocurrency is available, PIOEs will be converted to PIOs on a one for one basis. PIOs would then be listed on exchanges as a native cryptocurrency, and any further ICOs would be for PIOs, using new smart contracts running on the Pacio blockchain, rather than Ethereum.

Use of Funds

ICO token sales will be used to fund Pacio Core to develop the software and build the ecosystem to achieve the Pacio Vision.

13 The Team



David Hartley

View my profile on LinkedIn

Founder and Chief Architect

David became one of Australia's leading entrepreneurs in the 70s and 80s, supplying solutions (software and hardware) for the Accountancy Profession and enterprises in 15 countries around the world. David's business life also involved Hong Kong, New Zealand, UK, Antigua & Barbuda, Panama, and now Saint Lucia.

The systems developed by David's various firms have produced and continue to this day producing financial statements for millions of businesses.

David undertook a period of research about modern accounting and financial reporting needs post XBRL in 2011 to 2013, then blockchain from 2014, including formal study in 2017 via B9Lab Academy leading to Ethereum Blockchain Developer certification. David conceived the idea of combining his knowledge and work with that of his co-founders, and 3rd generation blockchain advances, to deliver the Pacio solution.

David is currently acting as CEO and CTO.

David's personal page provides more details.

Dr Keith N. Cleland BA, MA, PhD, Dip Ed.(Tertiary), FCPA, MACE

View my profile on LinkedIn

Founder and Executive Director

Professor and Head, Financial Management Department, IBR School of Executive Management, Steinbeis University Berlin.

Professor Cleland's background includes full professor and Head of Departments of Accounting and Business Studies at three universities, chairman of private and public companies and co-founder of the International Christian Chambers of Commerce.

For the past twenty-five years, Keith has actively consulted with the accounting profession and their business clients, helping identify and provide solutions for underlying business problems, which led to the crystallisation of TARI® software currently installed in numerous accounting practices and adopted by numerous businesses, small and large, with turnovers ranging from $250,000 to $12,000,000,000+.

Keith has published many papers and books on accounting and TARI® as listed here.

Trevor Watters B.Bus (Accty), CPA

Founder and Executive Director

View my profile on LinkedIn

Moved from a banking background to grow a CPA Public Practice around business clients from manufacturing, service, contracting and retail sectors.

Developed and sold 'TaxPrep' in 1980 - the first Australian Income Tax Preparation software.

As Technical co-director of Focus Based Management Pty. Ltd., Trevor was instrumental in developing TARI® related software to help business advisers and their clients apply the findings flowing from the research undertaken by Dr Cleland, which was taking place at the coal-face of business.

His software became a key tool in speedily identifying and eliminating the key obstacles to an improved bottom line. Businesses experiencing difficulties and winning only 1 in 16 quotes found they were now winning 1 in 4 quotes; businesses putting 25% on their jobs to cover profit and never ending up with more than 5%, found themselves achieving profits they could never have imagined. And not just manufacturing and service sectors, distributors and retailers also shared in a new way of looking at their businesses seeing change for the better within a matter of weeks.

Trevor supervised support and upgrades for more than 750 accounting practices in Australia and overseas and conducted introductory and advanced workshops in management advisory techniques.

Marcell Nimfuehr

CMO Chief Marketing Officer

View my profile on LinkedIn

Marcell has 24 years of experience in technology, start-ups, communications, lobbying, advocacy, fundraising including via ICOs, and in training in developing countries. He is a software engineer by training who has gravitated towards writing and strategic planning for startups, with the visual arts as a passion.

Marcel was previously Chief Of Operations at Tradershub and a blockchain journalist at Bitcoinblase.at

Marcel is moving to Saint Lucia from his home city of Vienna to work at the core of Pacio full time. His presence on island, coupled with his knowledge and ideas, will not only be great for Pacio, but will also help with the development of Saint Lucia as a cryptographic and decentralised technology centre.

His personal motto which is relevant to getting Pacio's message out to the world is "Everything can be told as a story. Nothing can be told without a story. I find it and tell it to the world."

Ken Fontius

View my profile on LinkedIn

Web site and Videos

With over 25+ years of all things digital, Ken partners with design teams to execute and build beautiful, progressive Web user interfaces and design systems, with a strong focus on responsive design, performance, and accessibility, using the latest front-end design techniques.

Starting in the mid-nineties, Ken began his career as a non-linear film editor on Avid systems with a strong focus on compositing in Adobe After Effects. Film-making exposed him to the web as the ultimate distribution tool and he has been hooked ever since.

Ken has a passion to create decentralised applications for blockchain companies. He has been working with Pacio full time since August 2017.

Francisca Vaessen

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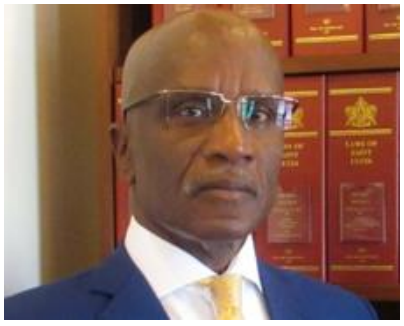
Internationalisation Coordinator

Fransisca is an international person, with European and African heritage, who lives and was educated in Holland, which has long been a country of internationalists. The second formative aspect to Fransisca for her role with Pacio, is her involvement with technology, web design and marketing since her teenage years when she started with HTML, CSS, and JavaScript, plus Photoshop for the graphics. Francisca has acted in a managerial role assisting the CEOs of two European companies, Panormus (Milan), and BioSyntec (Paris). With Panormus, Francisca helped with strategies, acquisitions, websites, branding, and online/mobile marketing campaigns.

As well as her international outlook and knowledge, Fransisca brings the ability to communicate Pacio's vision in five languages: Dutch, English, Swahili, French and German.

Francisca's role will involve translating documentation, blogs, and social media posts to the languages she knows personally, and coordinating contractors to handle the other languages which Pacio plans to support: Chinese (Mandarin), Japanese, Korean, Russian, Spanish, and Portuguese.



Nicholas John LLB

View my profile on LinkedIn

Legal matters and ICO Advisor

Nicholas John graduated with an LLB. (Hons.) degree from the London School of Economics and Political Science and in 1978 was called to the Bar as a Barrister-at-Law of Lincoln's Inn. Mr. John was subsequently admitted in 1980 to the Bar in St. Lucia and in Trinidad & Tobago. Mr. John is a member of the Society of Trust and Estate Planners.

Nicholas John & Co. is a full-service business law firm providing legal services to both international and local clients, including Pacio Core Ltd. The firm has a full support staff and is involved in advising and assisting in the formation of all types of offshore entities including investment and trading companies, offshore banks, offshore mutual funds, offshore captive insurance companies, offshore trusts and other vehicles. A large part of

the firm's work is the provision of legal opinions on the structuring and financing of international transactions utilising a Saint Lucian international business company.

David Gardner
Strategic Advisor

View my profile on LinkedIn

David is a senior Business Development leader with 20 years of success in driving the adoption of enterprise software, including 18 years at Microsoft in the UK, US and Asia, where he held senior UK and global roles (Gates -3), and most recently has focused on start-ups and SMEs in the blockchain / AI market.

Most recently, David has worked alongside the owners of start-up and emerging businesses in the Blockchain and AI world, including Pacio, building partner and channel strategies, supporting product design, pre-sales and marketing activity.

Kerry Hogan
Advisor

View my profile on LinkedIn

Kerry has worked with David Hartley in previous companies and brings to the group a mix of technical, marketing and accounting experience.

Kerry has a background with large-scale strategic projects and leading-edge technology in a variety of industry sectors. Kerry has worked as lead-person on several world first initiatives.

Kerry applies a practical and hands-on approach to her involvement with technology to ensure its acceptance and applicability to the intended market.

Martyn Rivett
Advisor

View my profile on LinkedIn

Martyn is an expert technologist and proven business, project and sales leader, who mentors organisations to understand and unlock the potential of technology in the real world.

By combining wide experience in private and public sector, deep technology skills and commercial acumen with curiosity and an entrepreneurial mindset, he can guide organisations to discover new value using creativity, thought leadership and industry cross fertilisation - and then implement with agility, insight and discipline.

Martyn has wide technical, operational and architectural competencies and experience across platforms and applications, network communications and IT security, web, cloud, mobile and the full IoT stack in practical operation in the field. He is competent in

CRM/AIM/ERP systems, SAAS, new tech such as AI, bitcoin / blockchain, P2P, automation etc. Highly literate in data management and quality practices.

Benjamin Zorio

View my profile on LinkedIn

Funding Advisor and Conference Representative

Benjamin has helped numerous companies raise and manage funds over a 20-year period, initially as a Financial Advisor, later Senior International Financial Advisor, with the Merrill Lynch Private Client and Global Wealth Management groups. Benjamin and David Hartley met in Panama in 2005 during Benjamin's Merrill Lynch time and have stayed in touch ever since.

Since 2009 Benjamin has been operating independently, working with long term clients from Latin America and the Middle East, regarding tech, aviation, real estate, and raw materials company funding and investments. He collaborated on the raising of $300 million for Miami International Holdings for the MIAX electronic options exchange located in Princeton and Miami.

Most recently Benjamin has studied crypto currencies, exchanges and the ICO market. His investments included participation in the Pacio seed presale.

Benjamin is keen to see Pacio succeed and will facilitate introductions to potential ICO investors, assist with ICO publicity, and to represent Pacio at Conferences.

Zahid Imran

View my profile on LinkedIn

Funding Advisor

Zahid is from Dubai, in the United Arab Emirates. He brings a lot to Pacio.

Zahid's approach is to find really disruptive companies offering a real solution to a real need, which can be already implemented into the market.

He is an ICO Activist Investor, with experience in private equity, assurance, and advisory; participated in 11 potential ICOs projects in Energy, Sports, Pharmaceuticals, Food safety,IT, E-commerce, Robotics services, finance and Consumer Goods sectors from the UK, US, New Zealand, Malaysia, Singapore, China, Russia, Estonia, Hong Kong, UAE, Canada and South Africa, advised top executives of private equity portfolio company on operations and efficiency enhancements.

Alex Cort

View my profile on LinkedIn

Social media campaigns

Alex helps with social media campaigns in an intern capacity. He has much experience with promoting ICOs via social media and is active in the blockchain cryptocurrency world.

Hi is co-founder of the Washington University Blockchain and Cryptocurrency club.

Appointments to be made as Presale and team building proceeds

- CTO, with David Hartley to fulfil the CEO and Chief Architect roles
- Blockchain (API and services) developers
- Front end developers
- JavaScript library developers
- Mobile developers for chatbots etc
- Accountants for the taxonomy and schema, plus sample apps work

Appointments to be made as MVP Launch Approaches

- Pacio Governance Council Members
- CEO, with David Hartley to assume Chief Architect role only
- CFO
- Marketing personnel
- Administrative staff

14 Conclusion

In achieving its plans to empower online applications to realise the capability of decentralised blockchain technology to provide safer, more inclusive, fairer, more productive, lower cost systems and new opportunities for society, business, and government, Pacio can both do good, and become a successful venture which generates good returns for its supporters.

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Appendix A: Features and Benefits

This appendix repeats some of the *Overview* information presented in features and benefits form:

Feature	Benefit
Accounting and Management	
Standardised semantic blockchain via *Standardised Semantic Information Model (SSIM)*	
Data stored in a standardised way to be globally interoperable and comparable across entities, jurisdictions/regions, languages, and accounting standards	Reduction in confusion and duplication, resulting in great productivity and efficiency savings
Data of any type whether financial or not stored in a semantic way = data referenced by its content or what it is about	Querying and reporting (of standardised data) will be easier and more human friendly.
SSIM Protocol Interfaces to convert to or from any other required data protocol	Data protocols used by other systems can be handled without forcing conversions or bridges to be created
Smart Data Objects (SDOs) smart data objects for storing data	SDOs are a powerful addition to previous data protocols, allow SSIM to cope with data or query/report requirements of any complexity, while keeping things simple enough for understanding of the data without in depth study of SSIM.
SSIM Taxonomies or data dictionaries	Provide totally flexible data definition ability to cope with new or changed data requirements, and help bridge older, traditional methods, to the new.
Standardised semantic blockchain in total	The semantic blockchain will unlock the wealth of information and knowledge contained in entity and online data, for easy access via market specific or niche apps, which will help realise semantic web 3.0 hopes.
Business Improvement via TARI®	
TARI® (Target Average Rate Index) real time management methodology allowing feedback to effect business improvement in real time, rather than only by analysis after the event	TARI® has proved to be the most effective and least expensive means of improving productivity and bottom line performance of business across the spectrum of manufacturing, retail, trade, transport and commercial services in general. TARI® also has potential for positive impact on national productivity at no cost to government beyond promoting its use.
Other accounting and management features	
Recording transactions in any fiat or crypto currency, or a mixture, with on the fly conversions	Total flexibility re currency transactions and processing

Feature	Benefit
Traditional Dr and Cr accounting	Handles traditional double entry accounting requirements still needed as part of modern systems
Blockchain triple entry accounting	A **single** transaction on the blockchain as part of the record of both entities involved in a counterparty transaction greatly reduces opportunities for fraud and reduces the need for auditing.
Activity data stored	Activity data is an important part of calculating and tracking productivity, and is used by TARI®, but is not recorded by most accounting packages
Controls over access to data	Data creators control or own their data, with data public or private at the creator's wish, allowing the creator to profit from access to the data if desired, rather than a centralised entity
Inter person, inter entity, and inter app transactions, including triggering via events for staged processes such as *Interoperable Business Documents*	Enables development of apps handling interactions between multiple people or entities, and apps, which will be a common real world requirement.
Inter blockchain transactions	Enables apps to work with multiple blockchains, which is what Pacio expects that the decentralised future will entail.
Accounting and management features available at one, two, or three levels as applicable to the app: • for the app, and possibly the app developer if different from the entity running the app • for the entity running the app • for users of the app	Enables development of apps with flexible, no compromise, accounting and management facilities, tailored to each level involved in the app
The accounting and management features in Total	Every non-trivial app, whether business focussed or not, needs these 'accounting and management' facilities, yet current blockchains lack them, and apps have often skipped or skimped on them, other than those intrinsic to the app, because it is has been too hard, or even impossible when viewed from the perspective of a single app. Apps powered by Pacio will not need to compromise on 'accounting' or 'management' at any level, and thus will be much more useful to users at all levels.

Feature	Benefit
Wide Range of Features for Applications (in addition to the Accounting and Management ones above)	
Inherited third generation blockchain and decentralised database features	
Decentralisation, with no central point of control or weakness	Improved safety plus removal of the concentration of power, wealth, and opportunities for crime of centralised systems
Blockchain Byzantine fault tolerant consensus, and immutability within the life of the blockchain for relevant data	Removal of the need for trusted third parties can simplify systems, reduce costs, increase speed (of processes), and remove opportunities for fraud
Zero cost transactions for apps using the Pacio blockchain or other zero fee blockchains	Removal of a major nuisance and disincentive of initial blockchains, facilitating general apps, and new ones eg micropayment systems
Scalability	Ability to handle large scale applications
Responsiveness with transactions confirmed within seconds for apps using the Pacio blockchain or other high speed blockchains	User experience matching that of centralised systems, without the delays of minutes or hours for some current blockchains
Smart contracts or dApps – distributed apps - for apps using the Pacio blockchain or other blockchains that support smart contracts	Full distributed application power. (Apps that are not blockchain based can still use the Pacio API and gain many of the advantages of decentralisation via Pacio.)
Enhanced blockchain features	
Pio cryptocurrency with multiple purposes	• is used by app deployers to pay for network, storage, and advanced API use, optionally converted to any other currency at payment time • is fully traceable, to provide a clear trail in the event of theft • serves as a “safe” general cryptocurrency • pays an issuance reward of 25% of new minted PIOs in proportion to the PIOs held
Governance emphasis re a constitution and voting, including governance app support, and the role of the Pacio Governance Council	Good governance of the whole Pacio ecosystem will be part of achieving the Pacio Vision. Evolution is sure to occur and be needed, so the mechanisms for managing change are important.

Feature	Benefit
Additional services to be developed progressively	
Global digital identity support for individuals and entities	Will assist apps needing digital identity, and the Pacio goal to have just one global database record per person or entity, for data integrity and better reporting reasons, plus the avoidance of out of date or inconsistent information errors from differently updated duplicate records, as described in the *Pacio Database* section.
Authenticated accounting and other real world data feeds	Will enable apps or oracles to make use of 'authenticated' (when blockchain based) data, or other data such as prices, temperatures, market opens/closes etc for reporting, analysis, or event triggering purposes
Data exchange/monetisation support	Will facilitate development of decentralised data exchange (DDEX) apps
Event triggers to allow apps to initiate intra app, inter app or inter entity actions based on internal or external events	Will enable apps to respond to real world events, actions by oracles, the app itself, other apps, or other entities, so permitting development of staged, control, monitoring, or automation apps, including for IoT devices This is in addition to the events involved in progressing through the steps of interoperable business documents.
Governance support to governance apps to be written	Will allow governance apps to be written to interact with the Pacio Blockchain
Ricardian contracts (internet of agreements) support	Will facilitate development of apps using Ricardian contracts
An Internet of Things (IoT) interface	Will facilitate development of apps interfacing with IoT devices
An artificial intelligence interface	Will facilitate development of apps involving AI
Others to come as prioritised by the community…	To meet the community requests

Appendix B: Use Case Examples

Pacio can assist development and running of apps in a vast number of end user markets, for many developers and environments, as follows:

End User Markets

- Consumer or personal applications
- Business applications
- Charity/NGO/Government/Regulatory/Foundation etc applications

all potentially tailored for niche requirements or region/language

Developers and Environments

- An app developer using the Pacio Blockchain
- An app developer using another blockchain
- A non-blockchain based app developer eg a web cloud-based app
- Entities using private blockchains/distributed ledgers
- Entities still using centralised systems
- The developers and suppliers of BaaS systems such as Microsoft, Oracle, HPE, IBM, Amazon et al
- Vertical market suppliers such as Intuit, Sage, Xero, Exact, Myob, GreatSoft, etc for the accounting and financial statements preparation market...
- 3rd generation blockchain developers eg Ælf (Aelf), Æternity (Aeternity), Aion, AlphaPoint, Apla, Blockstack, Cardano, Cosmos, Credits, Devcash, EOS, Genaro, Hyperledger, Icon, Komodo, Metaverse, Multichain, NEO, Red Belly, SophiaTX, Tezos, Universa, Wanchain, and Zilliqa, as listed in section *6.1 Pacio Blockchain*

Use Case Examples

The following table provides a few use case examples of the millions of possible combinations to give some appreciation of how Pacio can be used to help applications achieve their objectives.

Actors	Pacio Components Used	Results
A personal non-financial social media type app running on the Pacio Blockchain		
• The app developer • The entity running the app, possibly the same as the developer • The user of the app	• Pacio blockchain • Pacio blockchain dApp (smart contract) • Pacio database and Standardised Semantic Information Model (SSIM) • Pacio API from the dApp • Pacio API from the web app • Pacio web toolset • Semantic blockchain querying • Digital identity support • Accounting - for the entity re app deployment (storage & bandwidth fees), API use fees, & end user monetisation if any • Management of app performance, stats… • Pacio Messaging System (PMS) • Pacio Scripting Language (PSL)	• User experience as good as current centralised systems • Zero transaction fees for user • An app with the capability, performance and scalability to grow to challenge existing centralised incumbents

Actors	Pacio Components Used	Results
A business remittances app running on another blockchain		
• The app developer • The entity running the app, could be the same as or different from the developer • The user of the app, the sender • The recipient • Receiving entity if an agent is involved	• Pacio database and SSIM • Pacio API from the dApp by means of a system to enable external calls to be made from the other blockchain • Pacio API from the web app • Pacio web toolset • Semantic blockchain querying • Digital identity support • Inter entity transactions with 2 or 3 entities/people involved: sender, receiver, receiving entity if an agent in the receiver's country is involved • Crypto <-> fiat conversions • Accounting - for the entity re its revenue & costs incl API fees through to financial statements, & for end user balances & fees • Management of app performance, stats… • Pacio Messaging System (PMS) • Pacio Scripting Language (PSL)	• User experience better than current centralised systems being faster, cheaper, and easier • A competitive app with the capability, performance and scalability to challenge existing centralised incumbents
A business accounting web app for a country specific sector eg real estate in the UK		
• The app developer • The real estate agent entity running the app • Agent staff users of the app • Owners of listed properties • Prospects and customers of the agent • Creditors (accounts payable) of the agent • Professional advisors eg accountants and lawyers • Banks • Tax, industry, regulatory, & reporting bodies eg HMRC and Companies House	• Pacio database and SSIM • Pacio API from the web app • Pacio web toolset • Semantic blockchain querying • Financial reporting including XBRL support • Digital identity support • Inter entity transactions using interoperable business documents with 2 or more entities/people involved eg for settlements: agent, seller, buyer, bank, lawyers • Possible crypto <-> fiat conversions • Accounting - for the entity re its revenue & costs incl API fees through to financial statements, & for owners, sale or rental revenue & costs • Management of app performance, stats… • Monitoring and tracking of business performance with feedback for improvement via the TARI® service • Pacio Messaging System (PMS) • Pacio Scripting Language (PSL)	• Agent and customer user experiences better • Payment aspects safer, faster, cheaper, and easier • Inter entity aspects much better • An app with the capability, performance and scalability to improve real estate agent efficiency and profit, and thus to challenge existing solutions

Similar use cases could be listed for many other apps such as:

- Personal stock and/or crypto trading and investment apps
- Personal information manager apps
- Apps for manufacturers
- Apps for services businesses eg hairdresser, accountancy practice, legal firm
- A financial reporting app
- An audit app
- An oracle app
- A digital assets app
- Any market specific “ecommerce” app
- A payment app that integrates with the ecommerce app
- An agreements (trust) app
- A data exchange app
- A data market app
- An IoT management app
- An AI service app

Or others and combinations as developer ideas germinate, and markets develop or evolve.

Appendix C: The Roadmap

- Q3 2018
  - Conclude the Private Placement
  - Complete the DAICO smart contracts and get them audited
  - Continue web site and document updating
  - Document Pacio's SSIM and semantic data plans in more detail than in this paper
  - Produce simple explanations for Pacio's semantic data plans for general understanding
  - Appoint an ICO platform group for marketing and hosting the DAICO, or appoint contractors to work for Pacio to fulfil that role
  - Build and engage with the community, marketing the sale
  - Start building the core team with HR structure in place
  - Start building Pacio core blockchain for the MVP.
- Q4 2018
  - Run the DAICO including KYC audit
  - Release of first of funds on soft cap being reached
  - Continue MVP development
  - Develop the Constitution in consultation with interested token holders
  - Start marketing Pacio to developers
  - Community building via meetups and conference attendances
  - Appoint initial Pacio Governance Council members
- 2019
  - Release of funding tranches 2 and 3
  - Continue team building
  - Continue MVP development
  - Commence SSIM development work
  - Community building via meetups and conference attendances
  - Marketing of Pacio to developers
  - End of Q4: Launch Pacio Blockchain testnet and alpha MVP
  - Give grants to external developers working with the Pacio Blockchain
  - Start development of a TARI® app as one of the sample Pacio apps
- 2020
  - Q1: Launch of MVP
  - Release of funding tranches 4 and 5
  - Continue team building
  - Continue SSIM development
  - Develop other core technologies, services, and utilities
  - Continue marketing and ecosystem building activities
  - End of Q3: Launch of full Pacio Blockchain with SSIM
  - Implement TARI® on Blockchain with recipients of grants.
- 2021
  - Continue development, including for additional services
  - Continue marketing and ecosystem building activities
  - Initiate growth phase through network growth of developer numbers, and industry partnerships
  - Have interfaces to all relevant accounting and management data software systems.

- 2022 and onwards
  - Continue development, including for additional services
  - Continue marketing and ecosystem building activities
  - Achieve sustainable profit from new issuance and fees to continue growth
  - Achieve network effect exponential growth
  - Build multi-billion dollar value delivering the Pacio Vision