COMMUNICATIONS BUSINESS AUTOMATION NETWORK (CBAN) WHITEPAPER VERSION 1.0

Contributors

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Project Management

itw GLF GLOBAL LEADERS' FORUM

I. INTRODUCTION

I.I Overview

The ITW Global Leaders' Forum ("GLF") has launched the **Communications Business Automation Network ("CBAN")** to develop an automated settlement platform, which will yield operational efficiencies, accelerate product portfolio enrichment and create new revenue streams. The platform is the Information and Communication Technologies ("ICT") industry's first major project focusing on automation of operational and commercial settlement.

Inter-carrier transactions rely on a mix of automated and manual processes, the latter of which can be complex, expensive and time sensitive. It relies on human intervention and is prone to manual error, slow dispute resolution, long payment cycles and exposure to fraud. Existing frameworks are slow to adopt and support emerging traffic types, such as bandwidth on demand, edge network slices or critical IoT, on which future digital services growth will be based. The evolution of an Operational and Commercial settlement infrastructure at the wholesale level is critical to underpin network innovation.

By creating a standardized approach for automated, real-time, trusted settlement of traffic between any two ICT Service Providers ("ICT-SP"), the CBAN will accelerate the development of next generation network services while ensuring that the principle of ubiquitous interoperability - which has been critical in driving the proliferation of telephony services and internet globally over the past decades - sustains into the future.

The CBAN will play three roles fundamental to the development of this approach:

1) Govern the selection, and adoption, of technological standards and certify Technology Provider solutions to guarantee interoperable settlement of traffic for all ICT-SPs in the CBAN ecosystem.

2) Maintain membership registry, govern and oversee the CBAN network, which will be operated by the members.

3) Coordinate the collaborative development of the CBAN architecture and services.

The CBAN will bring together ICT-SPs, Technology Providers and industry associations to ensure that the standards selected are adopted by the industry. Where required, the CBAN will coordinate with industry participants, such as standard definition organizations, to develop new specifications and standards.

The CBAN is the result of collaboration by several large international carriers over the past two years. At launch, its membership consists of ten founding members – A1 Telekom Austria, BTS, Colt Technology Services, Deutsche Telekom Global Carrier, IDT, Orange, PCCW Global, Tata Communications, Telefónica International Wholesale Services, and Telstra. Its objective is to grow its membership to include every willing ICT-SP.

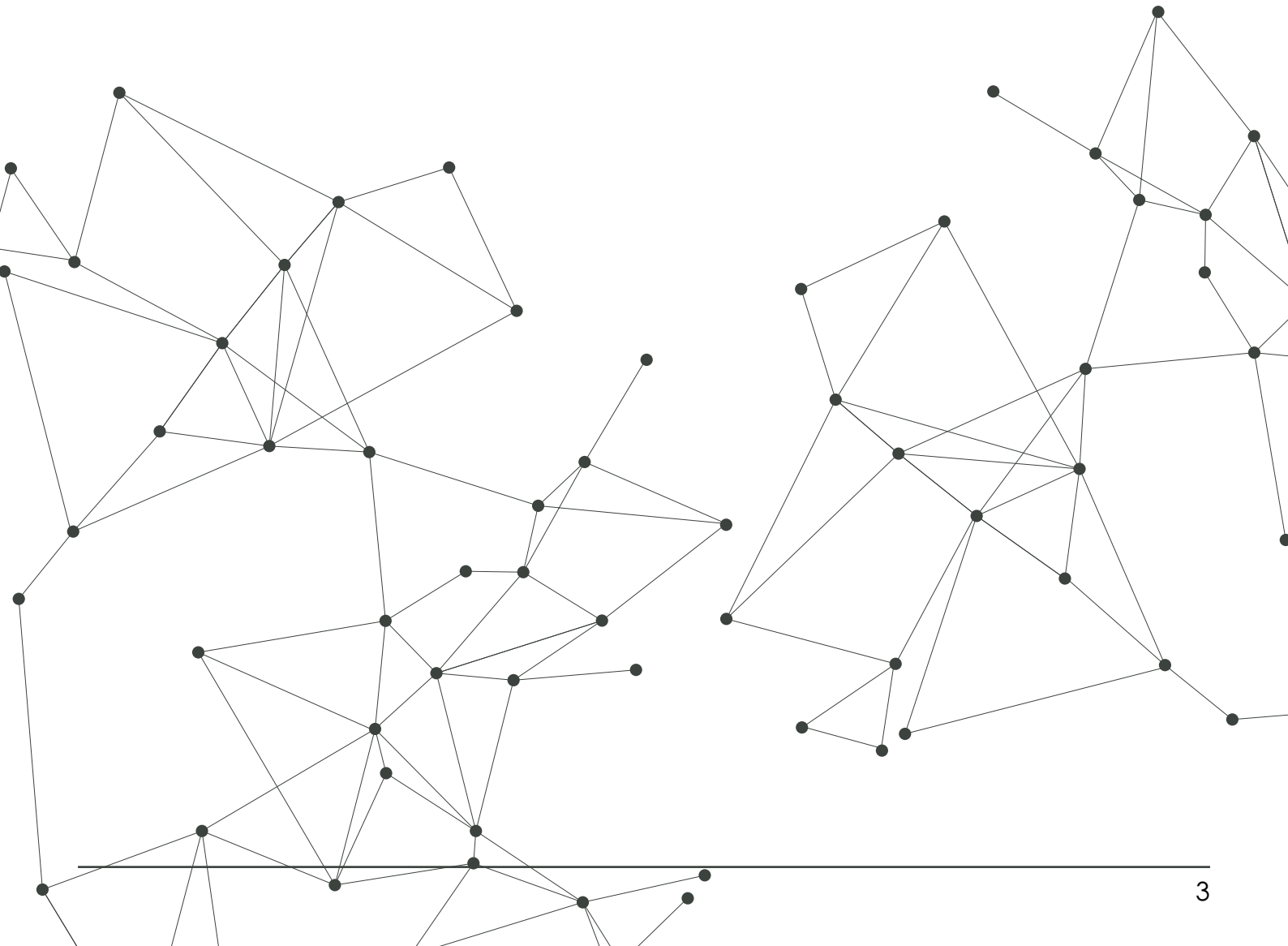
Development of the initial CBAN Reference Architecture and initial use-cases was conducted through collaboration with eleven Technology Providers –Amartus, Clear Blockchain Technologies, ConsenSys, CSG, Difitek, Internet Mobile Communications, Orbs, R3, Subex, Syniverse and TOMIA. Going forward, the CBAN is open to collaboration with all willing Technology Providers that support the principle of interoperability.

A core founding principle of the CBAN is that it must be open and inclusive. As such, any ICT-SP can join as a member, and any Technology Provider or Industry Association is invited to engage and collaborate with the CBAN.

I.II The CBAN Mission Statement

The CBAN's mission is to ensure industry-wide adoption of trusted and automated real-time operation and commercial settlement of traffic among ICT-SPs for any type of transacted network value.

As a neutral representative of the global ICT-SP community, the CBAN will ensure a common, interoperable approach to an automated business environment by coordinating the adoption of standards that enable commercially enforceable contracts between any two parties regardless of their existing relationship or trust.



II. THE NEED FOR AUTOMATED INTER-ICT SERVICE PROVIDER SETTLEMENT

II.I Increasing trust in settlement

ICT-SPs both compete and cooperate with each other for the delivery of services that often require complementing their own network with certain elements that they source from their competitors.

The wholesale connectivity industry is based on bilateral agreements between ICT-SPs transacting in a level playing field. A service may span multiple ICT-SPs but is implemented through a supply chain of bilateral relations between pairs of ICT-SPs.

Distributed Ledger Technology (DLT) is a good fit for ICT-SP wholesale supply chain scenarios, especially when the an individual subscriber is the beneficiary of a supply chain that includes operators, cloud, application developers, on-line stores, points of sale and banks. DLT, through its non-hierarchical nature, allows all stakeholders to be linked together to ensure trusted transactions take place and trusted information is correctly stored, verified, and retrieved by all parties, while maintaining privacy of sensitive information.

II.II The need for automation

The current ICT-SP environment consists largely of operational silos: each ICT-SP has developed its own operational silo where it performs its sales activities and manages the lifecycle of services delivered through its platforms.

While automation of intra-silo/intra-ICT-SP activity already exists in certain places, automation of inter-silo/inter-ICT-SP activities is still in its infancy. Cloud based services already offer automated life cycle management of services deployed on their cloud infrastructure, however, each cloud ICT-SP offers its own unique set of APIs and controls to which all its customers and suppliers must align. An ICT-SP that wants to establish automation of services with multiple Cloud-SPs will have to use dedicated APIs for each and every interconnection.

ICT-SPs coming from the Telco and Mobile background have focused their automation efforts primarily on internal processes and on-net services. Inter-ICT-SP operations and settlement has been given little attention and are for the most part still handled manually.

Because of these manual transactions and operations, timelines for delivery of services can stretch over weeks and months. Such timelines do not meet the needs of today's applications that require an agile network that can respond to demand in real (or near real) time. While it may take only a few minutes to activate a compute or storage resource on a Cloud-SP data-center, it may require weeks to establish a managed connectivity from a customer site to that Cloud-SP resource. Most applications requiring connectivity to Cloud-SP resources resort to the always-on public internet, which does not offer manageability – for example, there may be no guaranteed performance and no security.

The slow operations of ICT-SPs, and the ever growing need for additional unmanaged public-internet bandwidth, have resulted in a deadlock. On one hand, managed services' revenues are declining as such services cannot cope with the agility required by today's applications; on the other hand, more bandwidth, storage and compute resources are installed, which are often left under-utilized, only to support the growth of the low-revenue and low margin public-internet infrastructure.

II.III The CBAN opportunity

There are approximately 3,000 ICT-SPs worldwide. Each uses a Business Support Systems ("BSS") and Operations Supports Systems ("OSS"), which are typically complex and based on multiple sub-platforms with high levels of integration and inter-dependency. As a result, ICT-SPs are typically reluctant to modify their existing platforms and therefore the likelihood that ICT-SPs will migrate their existing BSS/OSS platforms to adopt new information models – that will enable inter-carrier interoperability – is considered low.

The CBAN aims to change this paradigm by initially developing a parallel architecture for an automated platform that will be interoperable with legacy platforms, followed by an upgrade or gradual migration/adaptation of services from legacy platforms to the automated platform.

This automated environment will ensure that the global multi-service, multi-network future can become a reality and interoperability with legacy platforms will manage the transition as ICT-SPs will move at different speeds. To achieve this, new operational and commercial settlement frameworks are required that will allow ICT-SPs to trade network assets and capacity in real-time.

II.IV The benefits of automated settlement

Automating inter-ICT SP settlement will deliver several benefits, including:

1) **Revenue growth** – enable services that are impossible to deliver using manual processes. On-demand type services that require resources for short durations can be commercially offered across different ICT-SPs once the underlying infrastructure is able to perform the lifecycle operations fast enough to match the duration of the requested service.

2) **Speed** – reduce the time required for certain operations, which will yield improved commercial performance. These include faster time-to-market, faster order-to-fulfilment, as well as shorter fault identification and repair timelines. Settlement and billing reconciliation will also become more efficient with shorter timelines

3) **Cost Reduction** – reduction in manual labor and reduction in the number of systems required in the ICT-SP environment. Furthermore, cash flow can be improved by the shortening of the settlement cycles and reduction of accruals required.

II.V Rationale for a DLT approach

DLTs allow for multiple parties, who do not have full trust of one another, to automate shared business processes by collaboratively updating a shared source of truth, under agreed rules, without requiring a neutral third party for enforcement.

This is a powerful tool which can allow automation in the areas of interaction between entities where previously human effort was required. While APIs allow for easy bilateral exchange of messages, that interoperability alone is insufficient for many inter-party commercial relationships. DLT enables both bi-lateral and multi-lateral exchange, with selective disclosure of information, as well as guaranteed enforcement of pre-agreed rules, creating a dependable environment for business interaction.

The use of a DLT approach to automate inter-ICT-SP settlement creates value in six key aspects:

1) **Commercial settlement and netting** – Settlement and netting require a shared source of truth between parties with limited trust and automatic validation of agreements, which DLTs are able to perform.

2) **Use of smart contracts** – Automation of commercial interactions is possible using smart contracts on DLTs, by automatically enforcing adherence to the contract as programmed.

3) **Managed Transparency** – DLTs allow participants to cryptographically attest to information, creating a framework for automated controllable transparency while maintaining privacy by controlling which data is shared and with whom.

4) **Reputation management** – To manage reputation, a central record of events is required to be maintained neutrally. The decentralized nature of DLTs create a neutral record without requiring a third party. DLT can allow association of reputation (e.g. SLA or Financial) to a member without revealing its identity.

5) **Real-time inventory** – Through rapid distribution of information across multilateral ledgers, DLT can prevent "double-spend" or "double-commitment" of available resources.

6) **Performance monitoring and SLAs** – The tracking and enforcement of SLAs require collecting information from the supply chain and correlating, interpreting and disclosing it to agreed commercial terms. DLTs and Smart Contracts provide a powerful framework for implementations that meet these requirements.

While there are other approaches that can achieve some of these benefits, DLTs and their supporting technologies (such as cryptographic identity, byzantine fault tolerance, distributed systems, etc.) are a production-tested method for creating automated and secure ledgers and rule enforcement with multiple stakeholders without the need to use third parties, who can exert control over the whole system.

III. THE ROLE OF THE CBAN

The CBAN ecosystem will be governed by the Communications Business Automation Network Limited ("CBAN Association"), which is a membership organization, whose goal is to ensure that the ecosystem for DLT-enabled automated inter ICT-SP services is inclusive and inter-operable. The CBAN Association will achieve its goal by developing the CBAN Reference Architecture and definitions of attributes for business products to address specific use cases ("Minimum Viable Product" or "MVP"), maintaining the Rules of Engagement related to membership, and operating a certification program.

Specifically, the CBAN Association will perform the following five functions:

i. Provide governance and decide which DLT chains (specific instances of particular ledger technologies) and which services are available, or endorsed, across the ecosystem

ii. Maintain member registry of identities

iii. Specify and provide the Core Services across all chains and MVPs

iv. Coordinate the operation of validating, or "Signatory Nodes" by its members to run all the chains and services

v. Facilitate collaborative development of the architecture and services

III.I Member benefits

The primary benefits of CBAN Association membership to every ICT-SP are:

1) Access to the CBAN ecosystem to establish and maintain contracts and interconnections with other CBAN members to automate commerce with them.

2) Ability to deploy CBAN Certified MVPs and automate the trading and settlement of traffic through the CBAN services, creating new revenue opportunities and cost savings.

3) Ability to participate in the governance of the CBAN and influence the evolution of the CBAN ecosystem.

4) Ability to participate in the development of new MVPs and enhancement of existing MVPs.

III.II Reference architecture

The CBAN Reference Architecture is developed collaboratively by the CBAN members in a manner that does not discriminate for or against any participant based on market share, geography, or type of business or service offered. The design principles call for abstraction and neutrality in a manner that will ultimately allow each abstract element in the architecture to be fully interoperable with its surrounding elements, regardless of the choice of business partner or Technology Provider. The design principles allow for deviations from said approach during the bootstrap phase of the CBAN.

III.III Services and Chains

The CBAN provides shared software services and DLT chains, which are operated and/or provisioned by a group of CBAN members called "Signatory Node Members" for the benefit of all CBAN members. These services include identity, DLT chains, assurance and other services as required to create a software platform on which MVPs can be implemented and settlement and trade executed efficiently and with trust. The specification of these services and chains is decided by the wider CBAN Association membership, with day to day operation handled by the Signatory Node Members.

During the bootstrap phase, the founding members of the CBAN Association will operate the signatory nodes using mutually agreed-upon criteria. In the normal operation phase, once the CBAN will be operational and will have sufficient scale, there will be a finite number of signatory nodes (as will be deemed technically and operationally feasible) operated by the Signatory Node Members.

III.IV Standards for MVPs

The CBAN Association publishes and endorses standards and specifications for MVPs, which use the CBAN services to create an interoperable environment where many kinds of products may be settled using the same common framework and architecture. The currently identified MVPs are International Voice and Data on Demand, of which initial Definitions have been published. More MVPs are expected to be added in the future such as Mobile Roaming, Edge Compute, NB IoT settlement, 5G Network Slicing, Cloud Compute and Storage, and more. The CBAN may publish these specifications and standards itself, or may use existing standards or specifications and align them with the CBAN architecture and services.

III.V Rules of Engagement

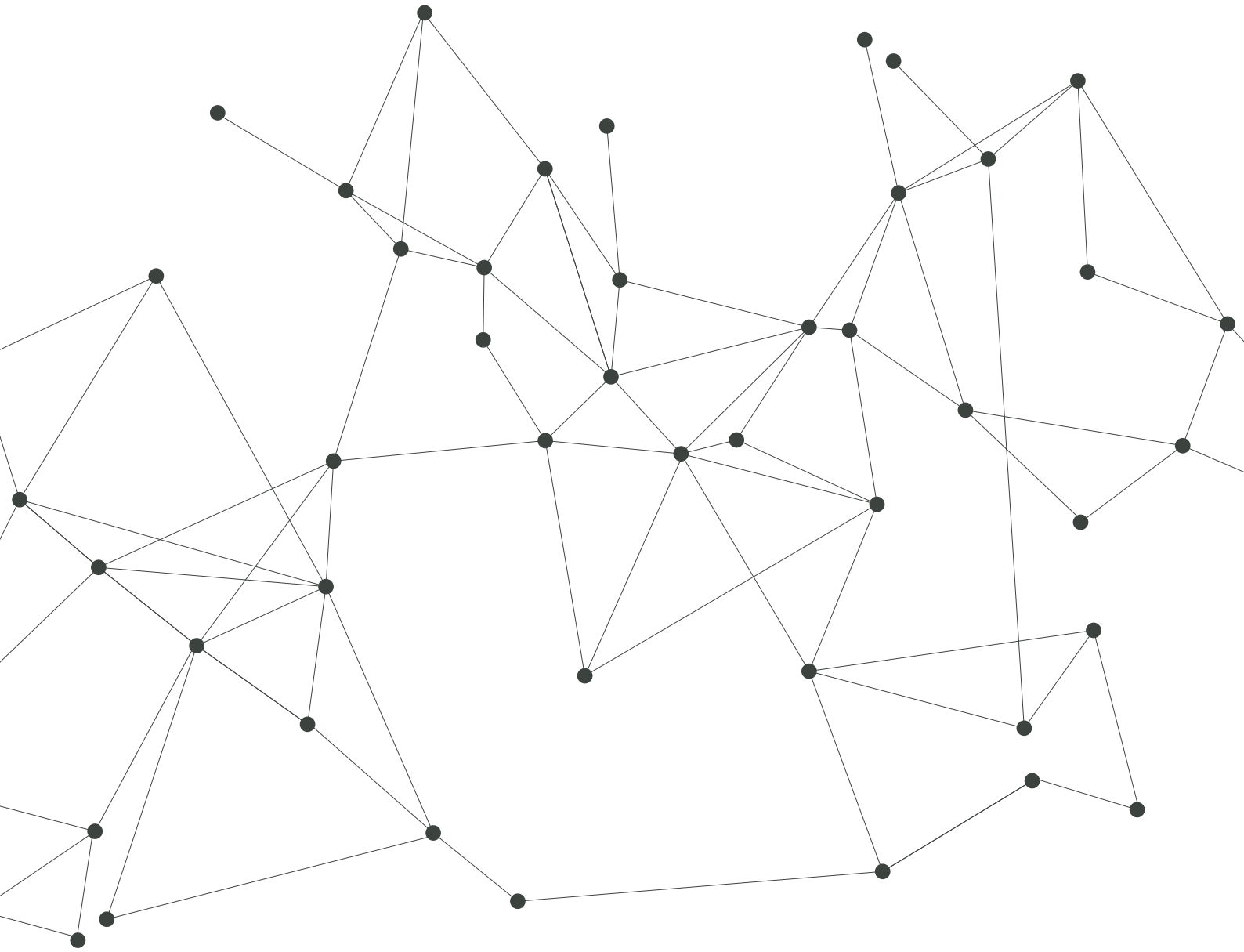
The CBAN Association maintains its membership through acceptance of new members, suspension of membership and revocation of membership based on transparent criteria.

The Board of the CBAN Association will define the Rules of Engagement within its governance framework. There will be a Board approved arbitration process as part of this governance

framework that will determine if an action by a member violated the Rules of Engagement, and the appropriate sanctions. The Board will approve the sanctions for violations of the Rules of Engagement. Participants in the CBAN, who are found to be violating the Rules of Engagement, will be suspended until the violation is resolved. Repeated violations may lead to revocation of membership.

III.VI Certification Program

The CBAN Association will develop and maintain a certification program that attest that a solution offered by a Technology Provider is fully interoperable with certified solutions offered by other Technology Providers based on the CBAN Reference Architecture and as defined for each MVP.



IV. GOVERNANCE

IV.I The CBAN Legal Entity

The CBAN Association is governed by its membership of ICT-SPs and is set up as a Company Limited by Guarantee in Singapore. A Company Limited by Guarantee is suitable for the purpose of the CBAN as it facilitates participation by a large number of members in its governance and it ensures there will be no individual shareholders who will exercise control over the entity and the ecosystem, guaranteeing that it truly represents and acts in the best interest of the industry. Singapore was chosen owing to its established legal framework that is well understood and accepted as a neutral jurisdiction for international business, together with having regulatory environment that supports new innovations.

The CBAN Association is governed by its members, mainly through two committees:

- Board - oversees business aspects of the CBAN (Strategy, Budget, Executive Staff, etc)

- Technical Steering Committee - oversees technical aspects of the CBAN (endorsement of DLT chains, specification of services, endorsement of standards, etc)

Although only ICT-SPs can join as members of the CBAN Association, giving them a vote in the election of the Board, Technology Providers can participate in the Technical Steering Committee as associates.

IV.II Board

The CBAN Association is governed by a Board that consists of representatives from the Membership of ICT-SPs who are elected periodically. The Board outlines the future vision of the CBAN, guides development, keeps the rules of engagement up to date, oversees the Executive Staff and defines membership requirements based on membership consensus. The Board has a number of sub-committees responsible for setting the direction and ensuring the CBAN is governed in compliance with internationally accepted best practices.

The Board has a representation of ICT-SP CBAN Members (both Signatory Node Members and non-Signatory Node Members), and, at first, consists of the Founding ICT-SP Members.

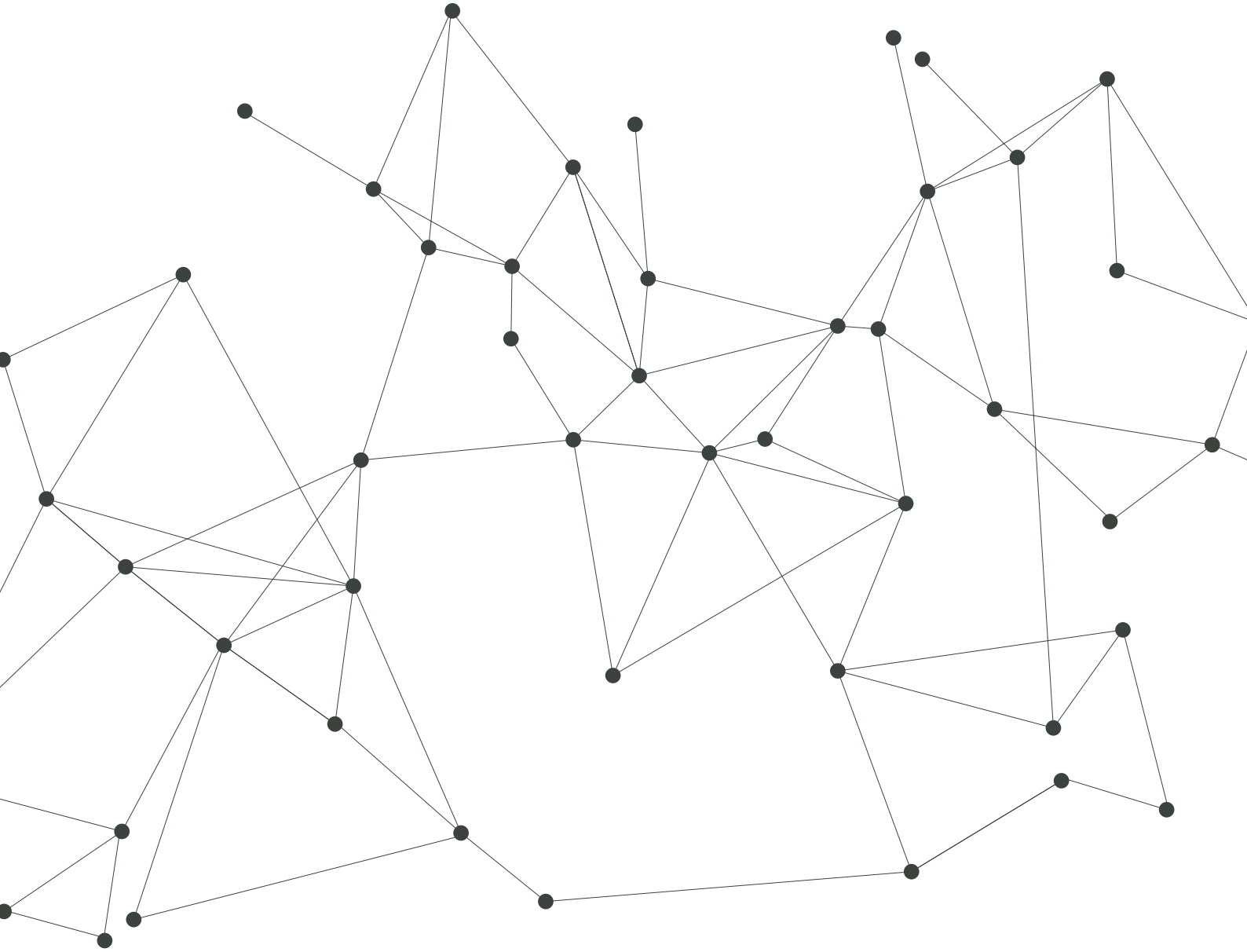
IV.III Technical Steering Committee

The Technical Steering Committee is responsible for the design and development of the Reference Architecture, MVPs, Certification programs and additional technical and operational specifications to be adhered to by the CBAN membership.

The Technical Steering Committee has representation from the ICT-SP members and also Technology Providers, who have contributed to the development of services that are used on the CBAN, and who have paid any relevant Technology Provider associate membership dues.

IV.IV Executive Staff

The executive staff of the CBAN Association is responsible for the on-going operations, marketing, and budget of the CBAN, as well as providing the required facilities for the Board, the Technical Steering Committee and other Board sub-committees to periodically meet.



V. TECHNOLOGY ARCHITECTURE AND MVP

V.I Overview of technology architecture

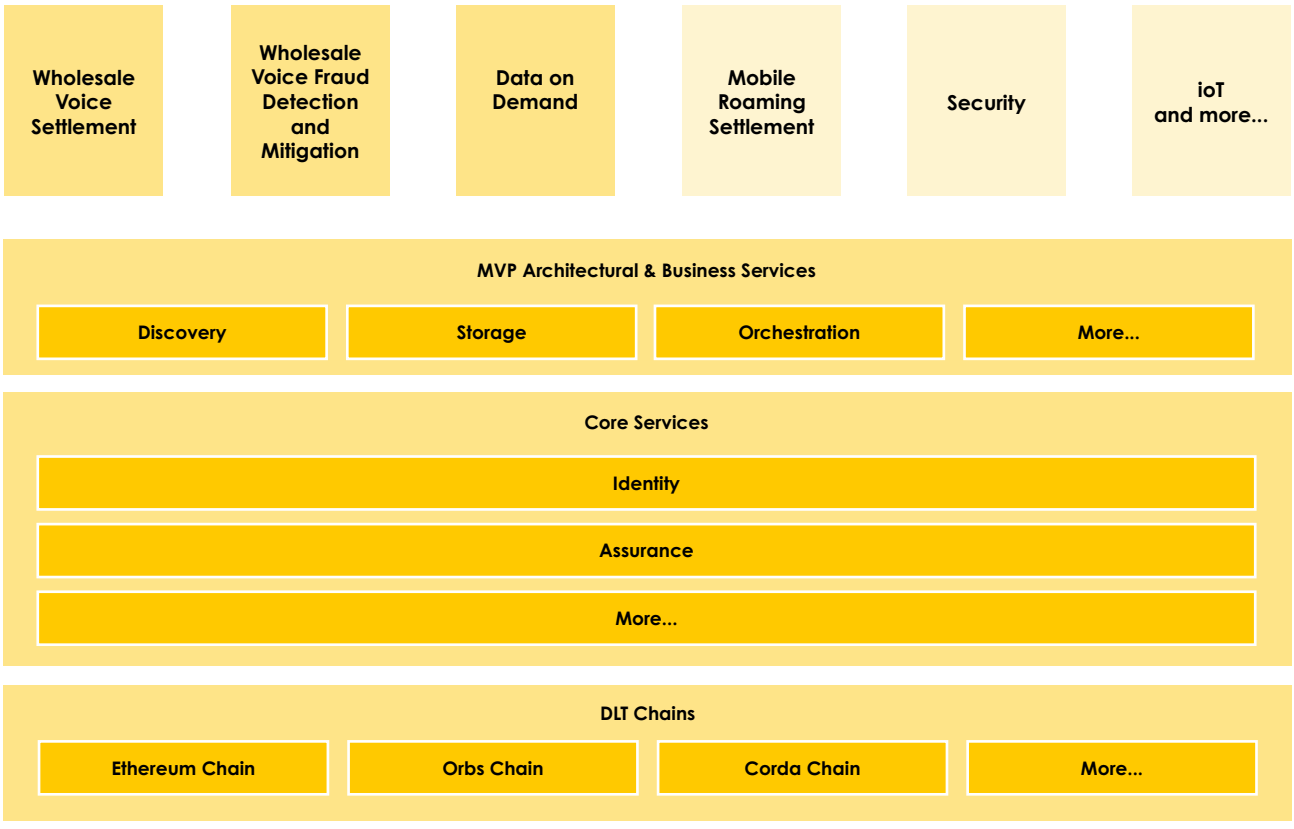
To create an inclusive, future-proof multi-Technology Provider ecosystem the CBAN Association and participating members and Technology Providers will build services based on the CBAN Reference Architecture.

The CBAN Reference Architecture describes the technical architecture for shared services, chains, standardized terminology and interoperable protocols.

The architecture is described in terms of components and interface points between them, as well as the interface points between the components and the external environment. This approach allow Technology Providers to focus on their respective areas of expertise by providing solutions for one or more of the CBAN Reference Architecture functional components and/or solutions for the reference interfaces, while ensuring critical architecture requirements such as interoperability between implementations, MVP solutions, security, and privacy.

The architecture covers services common to all of the CBAN-endorsed MVPs and it has been designed in view of individual MVP requirements. This allows for new MVPs to be easily introduced and supported in a structured manner without changing common parts.

The CBAN Reference Architecture



Common Services covered include:

- Core Services that are the same across all chains and MVPs such as Identity and Assurance
- DLT chain-specific services
- Services that are the same only between two bilateral partners, such as bilateral ledgers, messaging and feature negotiation
- Local services such as off-chain storage, key management and connection to internal systems.

The architecture allows for multiple DLT technologies, multiple ICT-SPs and multiple Technology Provider implementations supporting multiple and evolving MVPs. This will achieve the CBAN Association's ultimate goal which is to avoid vendor lock-in by creating an environment with significant vendor diversity, where participants collaborate to maximize the collective benefit.

The CBAN Reference Architecture is detailed in the CBAN Reference Architecture specification document available at the **CBAN website**.

V.II MVPs

The CBAN can support the settlement of many types of products between ICT-SPs through the use of MVPs. An initial list of MVPs was chosen to cover currently widely used ICT-SP services, which stand to benefit from automated settlement, or represent potential new services that require automation. Further MVPs, covering areas such as Mobile Roaming, are under development. The CBAN Association will coordinate the collaborative development and endorsement of further MVPs in the future. All CBAN members are eligible to propose and develop new MVPs and enhancements to existing MVPs.

V.II.a International Voice

A voice call that involves multiple carriers requires a process that spans multiple business entities. Each party in the path deploys different infrastructure to manage the traffic and business processes, resulting in a variety of formats of the data used for the billing and settlement across the chain of providers. The interfaces between carriers, while mostly automated, still require significant human effort, also contributing to a wide range of fraudulent behavior that is costly to the industry.

The International Voice MVP addresses these issues by providing a framework through which carriers can operate more efficiently and with more accuracy, eliminating some categories of disputes – and dealing with those disputes that remain in an efficient and effective way. The International Voice MVP recognizes that the move to the CBAN system will be one of

evolution. It aims to integrate with existing OSS/BSS systems whose services it will require and allow for continuing interaction with carriers who are not part of the CBAN.

The International Voice MVP is detailed in the International Voice MVP specification document available at the **CBAN website**.

V.II.b Data on Demand

Data on Demand services require federation of multiple operational domains, and effective federation requires rapid alignment of processes and information models across the supply chain. Current federation processes are slow and require significant manual effort and coordination. Through adoption of a unified information modelling approach, unified processes and service definitions, ICT-SPs can unleash the commercial potential of on-demand services and benefit from new revenue streams from existing network infrastructure.

The Data on Demand MVP extends the existing standards (MEF LSO Reference Architecture - MEF 55) into a commercial and operational framework that includes workflows within and between ICT-SPs involved in a wholesale supply chain of data services leveraging decentralized ledgers.

The Data on Demand MVP is detailed in the Data on Demand MVP specification document available at the **CBAN website**.

VI. Commercial approach

The CBAN Association will operate on a cost-recovery basis delivering value to its members by reducing their cost of settlement for existing traffic types and creating the possibility to transact business with new traffic types. During the development phase, the CBAN Association's costs are covered by its members. In the operational phase, once sufficient scale has been reached, the CBAN Association aspires to cover its costs from the membership fees from its members as well as usage fees from Technology Providers offering solutions on the network.

As the CBAN moves from development phase to operation phase, a study will be undertaken to propose the long-term commercial model and funding structure. The objective is to keep the cost of joining the CBAN as low as possible so it does not create barriers of entry to any ICT-SP, or Technology Provider, regardless of their size.

VII. Roadmap

To achieve a rapid roll-out of the CBAN services and to realize value for CBAN members, the following roadmap and timeline are planned:

1) Founding of the CBAN Association - January 2020

2) Development and testing of Core Services and interoperability of MVPs commencing January 2020. Carriers and Technology Providers work together to develop the core services and MVP functionality.

3) Production Launch by end of 2020. Based on development results, the initial set of chains and services is endorsed by the CBAN Association and the first production services and MVPs are launched.

4) Additional Development - Ongoing - MVPs and additional core services are developed and launched, through PoCs and betas.

VIII. Participation

All ICT-SPs are invited to join the CBAN Association. Initially, an ICT-SP is defined as any company that is a communications service provider that transacts value or assets across networks. As the CBAN evolves, participation is likely to be extended to any company that transacts value across networks. During CBAN's development phase, there is currently a $20,000 joining fee to cover the costs of operation. Joining as a member allows ICT-SPs to participate in the development activities, including contribution towards MVP development and alignment, and engagement in the governance activities. Following the launch of the CBAN it will transition to a new commercial approach, as described in Section VI. above.

Whilst the CBAN is in its development phase, all Technology Providers that can confirm adherence to the principles of openness and interoperability are invited to contribute in the technology development and alignment of standards for the CBAN ecosystem. Once the CBAN is launched, a commercial model will be developed for Technology Provider participation that does not create a barrier for entry.