

SECTION VI

TECHNICAL

Landscape Assessment of Standards in Blockchain for Industry

TECHNICAL STANDARDS MAPPING

Building upon the work of GSMI 1.0 which mapped 34 technical standards, the GSMI 2.0 technical mapping matrix includes updates to existing mapped standards, removing two dormant standards initiatives, and five additional standards, expanding the net total mapping to 37 blockchain and distributed ledger technology (DLT) standards.

This landscape assessment updates the state of standardization for blockchain technology and DLT and specific examples of some of these efforts discovered in our research. Three case studies are highlighted: 1) ITU, 2) MOBI, 3) IWA TFF, as well as an update summary of technical upgrade proposals, and we conclude with next steps for GSMI 3.0 in 2022.

FORMAL ORGANIZATIONS

ENTITY *Denotes New	GEOGRAPHY	PURPOSE	TOPIC
Baseline Protocol ^{142*}	GLOBAL	The Baseline Protocol is an open-source initiative that combines advances in cryptography, messaging, and blockchain to execute secure and private business processes at low cost via the public Ethereum Mainnet. The protocol will enable confidential and complex collaboration between enterprises without leaving any sensitive data on-chain.	Data; Tokens; Security; Zero Knowledge Proofs (Cryptography)
BSI ¹⁴³	UNITED KINGDOM	The British Standards Institution (BSI) is the national standards body of the United Kingdom. It aims to share knowledge, innovation and methodologies to help people and organizations make excellence a habit.	DLT requirements
CCSA China Communications Standards Association ^{144*}	CHINA	The China Communications Standards Association is a professional standards organization responsible for developing communications technology standards. 1. Blockchain Innovation and Intellectual Property Development White Paper: 33 blockchain standards were included. 2. Financial Distributed Ledger Technology Application Guideline is the first financial blockchain international standard project led by China. It was approved in 2020. China wants to use this standard as a framework to: Contribute to the planning and layout of the financial blockchain international standards system; Create sub-standards such as reference frames, risk control, security and privacy protection, and financial blockchain business specifications in various fields.	Communication Technology

CEN ¹⁴⁴ CENELEC ¹⁴⁵	BELGIUM	The European Committee for Standardization (CEN provides a platform for the development of European standards and other technical documents in relation to various kinds of products, materials, services and processes European Committee for Electrotechnical Standardization (CENELEC) prepares voluntary standards in the electrotechnical field, which help facilitate trade between countries, create new markets, cut compliance costs and support the development of a Single European Market.	Defence & Security, Quantum Technologies, Artificial Intelligence, Smart Grids, Environment and Sustainability, Cybersecurity, Digital Society,
CESI ¹⁴⁶	CHINA	The China Electronic Standardization Institute (CESI) works with standardization, conformity assessment, and measurement activities in the field of electronic information technologies. In the past couple of years, CESI has come up with a vision to introduce three blockchain standards on smart contracts, privacy, and deposits in a bid to better guide the development of the blockchain industry in the country The 2021 Global Industrial Internet Conference opened in Shenyang, the capital city of northeast China's Liaoning Province, on Oct. 19, 2021. CESI released the White paper on the Integration and Development of Blockchain and Industrial Internet at the Conference. According to the "Made in China 2025" national strategic plan and the current development of industrial blockchain in China, the White Paper aims to accelerate the adoption of industrial blockchain applications by making a standard system for industrial blockchain in China.	Tokens; Security
DCSA ¹⁴⁷	NETHERLANDS	The Digital Container Shipping Association (DCSA) was created to develop standards that facilitate the interoperability of technology solutions across the container shipping industry.	Cross-technology interoperability
ETSI ¹⁴⁸	FRANCE	The European Telecommunications Standards Institute (ETSI) provides the opportunities, resources and platforms to understand, shape, drive and collaborate on globally applicable standards.	Permissioned distributed ledgers
GS1 ^{149*}	BELGIUM	GS1 develops global standards for business communication. Best known for the barcode, GS1 standards aim to improve the efficiency, safety and visibility of supply chains across physical and digital channels. Blockchain technology is addressed by certain standards.	Data; traceability
IEC ¹⁵⁰	SWITZERLAND	The International Electrotechnical Commission (IEC) promotes quality infrastructure and international trade in electrical and electronic goods.	Internet of things (IoT), Infrastructure Development, Sustainable energy
IEEE ¹⁵¹	U.S.	The purpose of the Institute of Electrical and Electronics Engineers (IEEE) is to promote the development and application of electrotechnology and allied sciences for the benefit of humanity, the advancement of the profession and the well-being of its members.	Internet of things (IoT); cryptocurrency exchange and payment; tokens; energy; digital assets; - Focus on Blockchain in Healthcare (IEEE P2418.6) - Agriculture DLT (IEEE P2418.3) - Blockchain Governance (IEEE P2145 & IEEE P3212) - Smart Legal Contracts (IEEE P2963)
IETF ¹⁵²	U.S.	The purpose of the Internet Engineering Task Force (IETF) is to make the Internet work better by producing high quality, relevant technical documents that influence the way people design, use, and manage the Internet.	Cryptocurrency payment, Internet of Things (IoT), Security and Privacy

International Chamber of Commerce (ICC) ¹⁵³	FRANCE	The ICC launched the Digital Standards Initiative (DSI) to enable interoperability between blockchain and other technology platforms in the global trade space.	Digital interoperability
IRTF ¹⁵⁴	U.S.	The Internet Research Task Force (IRTF) aims to promote research for the evolution of the internet.	Identity; digital assets
ISO ¹⁵⁵	SWITZERLAND	The International Organization for Standardization (ISO) is an independent, non-governmental, international organization that develops standards to ensure the quality, safety and efficiency of products, services and systems.	Security; privacy; identity; interoperability; governance; smart contracts
ITU-T ¹⁵⁶	SWITZERLAND	The International Telecommunication Union Telecommunications (ITU-T) sector ensures the efficient and timely production of standards covering all fields of telecommunications and information communication technology (ICTs) on a worldwide basis, and defines tariff and accounting principles for international telecommunication services.	Security; IoT; identity; DLT requirements; mobile payment security; digital financial inclusion; digital assets including digital currency
SAC ¹⁵⁷	CHINA	The Standardization Administration of the P.R.C. (SAC) exercises administrative responsibilities by undertaking unified management, supervision and overall coordination of standardization work in China.	DLT requirements
Standardization Technical Committee of China Food Association New*	CHINA	The Standardization Technical Committee is responsible for verifying all drafted standards and making development strategies for the Association. Recent updates: Management Requirements for Food Traceability Blockchain Application (under released).	Standardization Technical Committee of China Food Association
Standards Australia ¹⁵⁸	AUSTRALIA	Standards Australia coordinates standardization activities and facilitates the development of Australian standards.	Security; DLT taxonomy
WIPO ¹⁵⁹	SWITZERLAND	The World Intellectual Property Organization (WIPO): 1) promotes the protection of intellectual property throughout the world through cooperation among states and, where appropriate, in collaboration with any other international organization; and 2) ensures administrative cooperation among unions.	Application of blockchain to intellectual property
W3C ¹⁶⁰	N/A	The Worldwide Web Consortium (W3C) is developing protocols and guidelines that ensure long-term growth for the web. It is an agreement amongst 4 host participants: MIT, INRIA (France), Keio University (Japan), and Beihang University (China) + its nearly 400 members.	Identity, Verifiable claims
Zhejiang Blockchain Standardization Technical Committee*	CHINA	The Blockchain Standardization Technical Committee was initiated by the Economy and Information Technology Department of Zhejiang Province with committee members like Zhejiang University, Ant Financial and 8BTC. The Committee is working to promote the advancement of the blockchain industry by undertaking and developing blockchain standards for Zhejiang Province.	dApps, DID

INDUSTRY GROUPS

ENTITY *Denotes New	GEOGRAPHY	PURPOSE	TOPIC
BIA ¹⁶¹	ESTONIA	The Blockchain Industrial Alliance (BIA) seeks to promote cross-blockchain transactions and interconnectivity. The goal of this alliance is to create a globally accepted standard for connecting blockchains and to bring innovations together.	Interoperability, Smart Chains, Blockchain Platforms
BIG ¹⁶²	CANADA	The Blockchain Industry Group (BIG) is dedicated to the advancement and adoption of blockchain technologies through the development and promotion of blockchain standards, education, certifications and collaboration.	DLT requirements (in progress), Governance, Education
BiTA Standards Council ¹⁶³	U.S.	The Blockchain in Transport Alliance (BiTA) Standards Council is seeking to develop and embrace a common framework and standards from which transport/logistics/supply-chain participants can build blockchain applications.	Interoperability; DLT requirements
EEA ¹⁶⁴	U.S.	The Enterprise Ethereum Alliance (EEA) builds, promotes, and broadly supports Ethereum-based technology methodologies, standards and a reference architecture.	Interoperability; security; cross chain, NIST-compatible Ethereum;
GDF ¹⁶⁵	UK	Global Digital Finance (GDF) is an industry membership body that promotes the adoption of best practices for cryptoassets and digital finance technologies, through the development of conduct standards, in a shared engagement forum with market participants, policy-makers and regulators.	DLT requirements
Hyperledger Foundation ¹⁶⁶	U.S.	The Hyperledger Foundation is an open-source community focused on developing a suite of stable frameworks, tools and libraries for enterprise-grade blockchain deployments. It serves as a neutral home for various distributed ledger frameworks, including: Hyperledger Besu, Burrow, Fabric, Sawtooth, Iroha, and Indy; tools such as Hyperledger Avalon, Caliper, Cactus, Cello, Explorer, and Firefly; domain-specific projects such as Hyperledger Grid; and libraries such as Hyperledger Ursa, Aries, Quilt, and Transact.	Interoperability; tokens; blockchain platforms; identity
Institute of International Finance (IIF) and TSVCM ¹⁶⁷	U.S. AND GLOBAL OFFICES OF IIF	The Taskforce on Scaling Voluntary Carbon Markets (TSVCM) is a private sector-led initiative working to scale an effective and efficient voluntary carbon market to help meet the goals of the Paris Agreement. The task force is led by the Institute of International Finance (IIF) The Taskforce's unique value proposition has been to bring all parts of the value chain to work intensively together and to provide recommended actions for the most pressing pain-points facing voluntary carbon markets.	Core Carbon Principles (CCPs), Governance, Legal Principles & Contracts Credit Level Integrity in Voluntary Markets
IWA ¹⁶⁸	U.S.	The InterWork Alliance (IWA) is working to: develop standards-based interworking specifications at the token and smart contract level; simplify and standardize multi-party exchanges; and build specifications and tools to define tokens and smart contracts in a platform-neutral way. IWA does not focus on the underlying technology, as digital interchanges of value must work regardless of the underlying technology to grow at scale. Instead, IWA focuses on defining token/smart contract requirements, and developing taxonomies and definitions for tokenization and smart contracts for identified use cases such as carbon markets and debt/equity issuance.	Interoperability; tokens (Token Taxonomy Framework); smart contracts (InterWork Framework); carbon markets; debt/equity issuance

JWG ¹⁶⁹	U.S. AND UK	The Joint Working Group on interVASP Messaging Standards (JWG) identified the need for VASPs to adopt uniform approaches and establish common standards to enable them to meet their obligations resulting from the FATF recommendations as they apply to affected entities. To tackle this, a cross-industry, cross-sectoral joint working group of technical experts was formed in December 2019 and a new technical standard developed by the group.	Tokens
MOBI ¹⁷⁰	U.S.	The Mobility Open Blockchain Initiative (MOBI)'s Vehicle Identity Working Group (VIWG) aims to use DLT to make mobility safer, greener, cheaper and more accessible.	Vehicle identity; usage-based insurance; electric vehicle grid integration; connected mobility and data marketplace; supply chain and finance; securitization and smart contracts
National Blockchain and Distributed Ledger Technology Standardization Technical Committee ¹⁷¹	CHINA	This is a group of organizations that have joined a national committee focused on creating standards for blockchain technology.	DLT requirements; DLT terminology

MAJOR STANDARD-SETTING EFFORTS – PROPOSALS

- Bitcoin improvement proposals (BIPS)¹⁷²
- Ethereum improvement proposals (EIPs)¹⁷³
- zCash improvement proposals (ZIPs)¹⁷⁴
- -XRP ledger amendments¹⁷⁵
- Diem improvement proposals (DIPS)¹⁷⁶

CASE STUDY #1:

ITU-T STANDARDIZATION SECTOR

STANDARDIZATION WORK ON DLT UPDATE

BACKGROUND

The FG DLT was established in May 2017 and completed its work in 2019. It aimed to:

- Identify and analyze DLT-based applications and services
- Draw up best practices and guidance
- Propose a way forward for related standardization work in ITU-T study groups.

STANDARDS

Several specifications and reports have been made available through the FG DLT, such as DLT terms and definitions, DLT use cases and assessment criteria for DLT platforms. Next to the FG DLT, ITU-T consists of several study groups focusing on a specific topic together with DLT.

In particular, Question 22 of ITU-T Study Group 16 focuses on multimedia aspects of DLT related systems and their use in e-services (e.g., healthcare, supply chain logistics, telecom, financial services, etc.). Study items in Question 22 include, but are not limited to:

- concepts, coverage, vision, and use cases of e-services based on DLT;
- characteristics and requirements for e-services based on DLT;
- architectural framework and communication technologies of e-services based on DLT;
- analysis and evaluation of the current status of DLT and its maturity to support e-services;
- investigate the relations between DLT, digital fiat currencies and crypto tokens, including management, exchange and transactions, etc.;
- define general requirements and framework for DLT;

- research security and privacy aspects related to e-services based on DLT;
- examine means for extending online trust in the context of e-services using DLT;

In addition, other study groups where standardization work on DLT is happening include:

- ITU-T Study Group 3: Economic and Policy Issues. The standardization work on DLT here focuses on its application in accounting/settlement process in telecoms
- ITU-T Study Group 13: Future networks, with focus on IMT-2020, cloud computing and trusted network infrastructures
- ITU-T Study Group 17: Security
- ITU-T Study Group 20: Internet of things (IoT) and smart cities and communities (SC&C)
- ITU-T Focus Group on Environmental Efficiency for Artificial Intelligence and Other Emerging Technologies (FG-AI4EE)

Following the completion of the work of the ITU-T Focus Group on Digital Currency including Digital Fiat Currency in 2019, the ITU established the Digital Currency Global Initiative in collaboration with Future of Digital Currency Initiative of Stanford University in 2020. The Digital Currency Global Initiative work is to investigate areas where technical standards would be needed for integrating central bank digital currencies, stablecoins and cryptocurrencies to existing payment system and also study the applications of DLT in enabling this to happen. The Digital Currency Global Initiative consists of three working groups:

- Policy & Governance,
- Architecture, Interoperability Requirements and use cases

CASE STUDY #2:

MOBI UPDATE

The standards developed by MOBI serve as a foundation for the mobiNET network. The mobiNET will offer mobility stakeholders and related businesses an open and inclusive core services infrastructure for decentralized transactions at the edge. The goal is to unlock monetization opportunities across mobility and transportation services by allowing application interoperability and multi-party data sharing.

- New standards from the Vehicle Identity (VID), Electric Vehicle Grid Integration (EVGI), Connected Mobility Data Marketplace (CMDM), Finance, Securitization, and Smart Contracts (FSSC), and Supply Chain (SC) working groups

Updated description for the VID working group:

The VID working group aims to define a digital document that is a verifiable link to a specific vehicle, a minimum representation of that vehicle's digital twin. VID can be used to establish existence, manage access control, confirm ownership history, and contain key events in the life of a vehicle.

Descriptions for the other working groups:

The EVGI working group aims to aid the increasing adoption of electric vehicles by creating interoperable systems for governments, utilities, and the mobility industry alike. These systems will enable a better way to manage the grid load, calculate carbon offsets, and generate carbon credits, facilitating the implementation of peer-to-peer services. The first standard defines the system, and data requirements for three core use case areas: Vehicle to Grid (V2G), Peer to Peer (P2P), and Tokenized Carbon Credits (TCC).

The CMDM working group aims to enable a DLT-based data marketplace for all stakeholders of the mobility ecosystem — including OEMs, insurance providers, infrastructure operators, and others — to effectively share data with their business

partners while complying with emerging regulatory and industry best practices for preserving data privacy and property rights. The CMDM Standards provide a foundation for a multitude of applications, including but not limited to V2X data exchange, connected vehicle commerce, and sharing/monetizing AV driving data for better driving algorithms through machine learning.

The FSSC working group strives to improve accuracy and transparency, create operational efficiencies, minimize fraud risks, and save on costs and time in the execution of financings, including securitizations, for all entities in the financing lifecycle. The FSSC Standards leverage distributed ledger technologies to create a trust layer for transactions and data exchange within a shared digital ecosystem.

The SC working group assesses the value proposition of blockchain in mobility supply chain management for stakeholders of the procurement, logistics, and finance or accounting divisions, including Original Equipment Manufacturers, N-tier suppliers, and further business partners. The group aims to create interoperability standards to bring operational efficiencies and increased visibility through the N-tiers; enable provenance, tracking, and authenticity of parts and vehicles; and improve conflict resolution and settlement with distributed ledger technology (DLT).

MOBI are also working on a layer above the mobiNET, which is named Citopia. Citopia is a multimodal mobility payments platform built on blockchain that allows for the monetization of infrastructure use (i.e., road usage) and other new mobility services. The following information was pulled from the MOBI website on the specific [MOBI Working Group standards](#): MOBI has a number of working groups that are creating different types of standards. Anyone can gain full access to their white papers and use cases and business requirements documents and partial access to the technical

specifications and reference implementation architectures. MOBI members are provided full access to the technical specifications and the reference implementation architectures.

0001 – Business White Papers (WP)

MOBI Business White Papers are high-level business reviews that discuss issues and propose solutions to the world's most pressing transportation challenges with consideration to ecosystem stakeholders, new strategies, emerging technologies, and global policies.

0002 – Use Cases and Business Requirements (UC)

MOBI Use Cases and Business Requirements documents describe pain points, stakeholder responsibilities, and high-level business requirements potential solutions must meet in order to resolve stakeholder needs. UCs also detail workflows for particular applications and are technology-agnostic.

0003 – Technical Specifications (TS)

MOBI Technical Specifications define recommended minimum interfaces between systems/modules and data specification exchanged in the process leading up to a reference implementation. This process allows independently developed systems to be interoperable.

0004 – Reference Implementation Architectures (RI)

MOBI Reference Implementation Architectures prescribe and recommend a solution architecture stakeholders can refer to when they deploy solutions, ensuring that stakeholder requirements described in TS and UC are met in the process. RIs are vendor-agnostic.

Standards in Vehicle Identity (3 new/updated standards since GSMI 1.0)

- MOBI VID0001/WP/2021 — VERSION 2.0 – VID Business White Paper
- MOBI VID0003/TS/2019 — VERSION 1.0 – VID I Technical Specifications
- MOBI VID0002/UC/2021 – VERSION 2.0 – VID II Use Cases and Business Requirements
- MOBI VID0004/RI/2021 – VERSION 1.0 – VID II Reference Implementation Architecture

Standards in Electric Vehicle Grid Integration (EVGI) (new since GSMI 1.0)

- MOBI EVGI0001/WP/2020 – Version 1.1 – EVGI Business White Paper
- MOBI EVGI0003/TS/2020 – Version 1.0 – EVGI Technical Specifications

Standards in Connected Mobility Data Marketplace (CMDM) (new since GSMI 1.0)

- MOBI CMDM0001/WP/2021 – Version 1.0 – CMDM Business White Paper
- MOBI CMDM0003/TS/2021 – Version 1.0 – CMDM Technical Specifications

Standards in Finance, Securitization, and Smart Contracts (FSSC) (new since GSMI 1.0)

- MOBI FSSC0001/WP/2021 – Version 1.0 – FSSC Business White Paper
- MOBI FSSC0003/TS/2021 – Version 1.0 – FSSC Technical Specifications

Standards in Supply Chain (SC) (new since GSMI 1.0)

- MOBI SC0002/UC/2021 – Version 1.0 – SC Use Cases and Business Requirements
- MOBI SC0004/RI/2021 – Version 1.0 – SC Reference Implementation Architecture

CASE STUDY #3:

TOKEN TAXONOMY FRAMEWORK OVERVIEW, SPECIFICATIONS, AND IMPLEMENTATIONS

Tokens will disrupt global economics and radically change how commerce will be transacted. While various implementations exist today for tokens specific to numerous blockchain platforms, the industry lacks a venue for all participants to collaborate on a shared description and approach – resulting in a lack of interoperability, reuse, and common ground to address regulatory issues. The IWA is a member-led non-profit with over 30 organizations mapping requirements and artifacts into a variety of use cases. The IWA working groups are developing a clear definition and scope of the token concept including use cases, taxonomy and terminology, and a specification neutral to the underlying technology.

BACKGROUND

The Token Taxonomy Framework (TTF) is an open-source, extendable framework for defining and tokenizing digital assets, and serves as one of the core technical frameworks for the InterWork Alliance (IWA), a GBBC initiative focused on creating standards around tokenization to promote interoperability and cooperation. The goal of the TTF is to provide a language by which tokens can be discussed, architected, and standardized across industry verticals.

The view of the TTF is that a token can be broken down into a core set of attributes: a token base type (e.g., fungible or non-fungible), properties (data contained in the token, e.g., manifest data), and behaviors (e.g., transferable, burnable, etc.). Using these artifacts, one can construct a whole new token based on a repository of artifacts that are contributed by the IWA membership. This open source, composable framework allows for artifacts to be repurposed to meet the requirements of new use cases.

The Token Taxonomy Framework bridges the gap between developers, line of business executives, and regulators, allowing them to work together to model existing and define new business models based on tokens. The Framework's purpose is to:

- Clearly define common token concepts and terms in non-technical and cross-industry language using real world, everyday analogies so that business, technical, and regulatory participants can understand them.
- Produce token definitions that have clear and well-understood requirements for token properties and behaviors that are implementation neutral for developers to follow and standards organizations to validate.
- Establish a base Token Classification Hierarchy, driven by metadata, that is simple to understand and navigate for anyone interested in learning and discovering tokens and underlying implementations.
- Deliver tooling meta-data that enables the generation of visual representations of classifications, and modelling tools to view and create token definitions mapped to the taxonomy.
- Produce standard artifacts and control message descriptions mapped to the taxonomy that are implementation neutral and provide base components and controls that consortia, startups, platforms, or regulators can use to work together.
- Encourage differentiation and vertical specialization while maintaining an interoperable base.



RESOURCES

[REAL-WORLD TTF \(7-STEP JOURNEY\)](#)

[TOKEN TAXONOMY FRAMEWORK PUBLIC GITHUB](#)

[INTRODUCTION TO TOKEN TAXONOMY FRAMEWORK](#)

[TOKEN TAXONOMY SPECIFICATIONS](#)

TOKEN TAXONOMY IMPLEMENTATIONS

[TOKEN TAXONOMY AND CENTRAL BANK DIGITAL CURRENCY \(CBDC\)](#)

[TOKEN TAXONOMY AND VOLUNTARY ECOLOGICAL MARKETS WHITE PAPER](#)

[CARBON REMOVAL AND THE DIGITAL MEASUREMENT, REPORTING & VERIFICATION FRAMEWORK BUILT WITH THE TOKEN TAXONOMY FRAMEWORK](#)

[HEDERA & THE HBAR FOUNDATION ANNOUNCE THE FIRST OPEN SOURCE TTF REFERENCE IMPLEMENTATION FOR PARTNER ECOSYSTEMS.](#)

IWA OPEN-SOURCE TOKEN DESIGNER TOOL

[GITHUB – INTERWORKALLIANCE/TOKEN-DESIGNER: VS CODE EXTENSION THAT FACILITATES MANIPULATION OF ARTIFACTS IN THE TOKEN TAXONOMY FRAMEWORK](#)

GSMI 1.0 WEF APPENDIX A

[REFERENCE ARCHITECTURE COMPARISON: FUNCTIONS OF STANDARDS IN KNOWLEDGE-INTENSIVE INDUSTRIES](#)

NEXT STEPS

Blockchain and DLT standards, both formal and industry-led, continue to evolve and remain at nascent stages. Areas of further technical mapping include interoperability, Layer 2 protocols, DeFi protocols, Decentralized Autonomous Organizations (DAOs), and other standards bodies which emerge as the industry evolves in 2022 for GSMI 3.0. In addition to mapping technical standards, there is development work in the areas of standards in blockchain / DLT audit, certification, security, and environmental impact metrics which may be explored in the future. The GSMI Technical Working Group welcomes suggestions for improvements and additions.