Developing Open and Interoperable DLT/Blockchain Standards

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How will these standards drive global blockchain adoption and take development of the technology ecosystem to the next level?

FROM THE EDITOR

The field of blockchain or distributed ledger is growing rapidly. The lack of consensus on definitions, implementation, management, and core attributes is driving the need for standardization. Blockchain is often confused with cryptocurrencies like Bitcoin or Ethereum, but the potential applications of this technology in diverse fields, such as smart contracts, buying and selling energy, and so much more, make distributed ledger technologies one of the high-potential technologies for the future. –F.D. Wright

A common set of distributed ledger technology (DLT) or blockchain standards and a focus on interoperability and scalability are among several industry requirements that are essential for the survival and mass adoption of this technology. This column describes standardization efforts in the field.

Recent studies have shown that, by 2025, blockchain applications will represent 10% of global gross domestic product. Blockchain is defined as the new Internet layer of value, adding the so-called trinity of Ts—trustability, transparency, and traceability—to any asset-class web transaction (information/data and physical goods) that can be authenticated, validated, traced, and registered in a distributed, peer-to-peer digital ledger system.

These unique characteristics open new possibilities for services and applications, boosting today’s Internet capability. Blockchain is also part of the broader scope of DLT and is
considered the driving force behind all of the latest technology advances related to cryptocurrency, smart contracts, and the initial coin offering (ICO) frenzy. Blockchain is not only related to Bitcoin and cryptocurrency transactions; it is also becoming the underlying layer of the future Internet, creating a new wave of decentralized applications, called DApps, that will be introduced to replace most of today’s centralized, cloud-based Internet applications. Blockchain will allow businesses to experience a complete transformation of their current models by removing intermediaries, reducing costs, and improving the trustworthiness of the Internet—and, therefore, enable a new wave of decentralized services.

THE IMPORTANCE OF DLT STANDARDS AND WHY WE NEED THEM

Currently, the blockchain market is completely fragmented, and there is no consistent standardization among different technologies and platforms to address these issues. The release of multiple ICOs has spurred a great deal of innovation in this space. Almost every day, there are new proposals for disruptive token- and cryptocurrency-based start-ups, bringing great open-source innovation. However, most of these small and disruptive companies may not survive in the long run. It is expected that most of these new companies will follow the same trends as the initial public offering bubble of web-centric start-ups back in the early 2000s.

On the other hand, there are still major misconceptions about what blockchain is and the value and benefits it provides. In most cases, blockchain has been mistaken as synonymous with Bitcoin/cryptocurrency; in fact, it is more than that. Blockchain, particularly within a broad DLT definition, is considered an enabling technology of new IT enterprise systems and processes. Cryptocurrencies—along with the associated financial technology (fintech) industry—were only the first application to benefit from the use of blockchain technology. In addition, the emergence of and hype about cryptocurrencies have helped promote blockchain awareness. But this has come at the price of misunderstanding the true value of blockchain in creating a new, disruptive technology. Also, very substantial work has been developed on the private enterprise- and consortium-based blockchain side, addressing real IT problems and vertical-market solutions.

But, even recognizing the importance of blockchain in driving a new level of IT decentralization and the introduction of new services and applications, standards for global mass blockchain adoption are still lacking. Therefore, standards and interoperability are becoming important topics that need to be addressed for the DLT industry ecosystem to survive. In this regard, several industry-driven organizations and standards-development organizations (SDOs) are currently working to address the need for global-reach DLT/blockchain standards.

A common set of standards and the focus on interoperability and scalabil- ity are among several industry blockchain requirements that are essential for the survival and mass adoption of DLT as an enabler of Web 3.0 and the decentralized Internet. However, the overriding question is how quickly these standards can be developed and catch up with the disruptive innovation being introduced in the blockchain technology landscape. This requires that new standards be flexible to avoid stifling innovation and, at the same time, adaptable since DLT/blockchain innovation is a moving target, with new technologies being introduced almost daily.

In a higher-level and more futuristic definition, DLT/blockchain is considered to be the next-generation decentralized Internet of Value, where transactions and assets will be registered, authenticated, and processed in a distributed ledger. This creates a new paradigm for the industry in which all IT processes, applications, and network infrastructure must be redesigned and rethought to address the decentralization and disintermediation requirements for this new technology, moving from a traditional cloud-based centralized approach toward a decentralized and distributed Web 3.0 architecture.

Hence, to speed up blockchain standards development, some fundamental advances need to take place. First, blockchain, as an enabling technology, needs to be demystified and disassociated from cryptocurrency. DLT is a new technology that needs to be recognized and treated as an added layer on IT enterprise industry processes. This demystification, together with the continuing education about what blockchain is and the differences between public (permissionless) and private (permissioned) solutions, needs to be addressed. The next step is to devise a generic framework, architecture viewpoints, and reference models to map, classify, and create the ontology necessary to define where the standards need to be developed first.

WHAT IT TAKES TO DEVELOP A DLT STANDARD

Blockchain standards started emerging in late 2017. Currently, several organizations have intensified their efforts to derive a set of standards for the DLT/blockchain industry by 2019. However, the main challenges today are understanding what blockchain is, how it works, and how it impacts enterprises and governments by creating initial generic terminologies and identifying the critical issues to address. Therefore, a top-down development approach is
recommended, where generic frameworks can create a 360-degree bird’s-eye view of what needs to be addressed. The first obvious necessary clarification is that standards should define DLT as a broad and encompassing technology (and not only blockchain, because it is just a subcategory of DLT). A broad and generic scope is recommended during this first phase of standards development.

It is also essential that interest groups, forums, and associations, together with subject matter experts, work to create a critical mass and provide strong contributions to and participation in a collaborative development process. Doing so requires a great deal of communication and interaction because not everyone involved in this development is knowledgeable about the technology. In some cases, a vibrant and engaged community is all that is needed to quickly develop open-source DLT/blockchain coded frameworks, using, for example, Github as the development repository. But most SDOs require a structured and formal procedure to produce world-class standards.

In most standards-development processes, it is a wise choice to focus on the essence of DLT as the driving force behind the next-generation decentralized Internet and as an enabler of a new IT enterprise layer, avoiding any inclusion of cryptocurrency-related processes.

**METHODOLOGIES TO CREATE A DLT STANDARDS FRAMEWORK**

DLT is a new technology; hence, there are many vendor-specific implementations and little available information that defines, classifies, and creates new and generic blockchain/DLT frameworks. To launch this creative process, an initial framework is built to encompass generic, technology/vendor-agnostic approaches and define the main subsystem components of the technology. One of these techniques is to adopt the methodology specified by International Organization for Standardization (ISO)/IEC/IEEE 42010-2011, Systems and Software Engineering—Architecture Description. In this case, a system-of-systems model is created as a first step, identifying the key stakeholders, concerns, architectural viewpoints, and systems of interest. Then, a set of use cases is identified, mapped, and customized onto these generic frameworks. Finally, the mapping is revised and refined to modify and adapt the initial reference model in an iterative process. This is shown in Figure 1.

Another approach is to start with the industry-specific use case, but this process may lack the 360-degree, top-down view required to build generic and overarching system architectures.

**DLT INTEROPERABILITY: THE NEW STANDARDS FRONTIER**

Most of today's blockchain standards activities are focused on specifying and developing generic frameworks, interfaces, and technology modules that work in self-contained or specific platform environments. As more complex uses of DLT are required across multiple enterprise segments or between multiple enterprises to run more complex use cases and implementations, there will be a strong need for end-to-end interoperability standards.

It is expected that, in the coming years, there will be an urgent call for cross-chain interoperability among different enterprise-grade (permissioned) and public (permissionless) DLT/blockchain systems, with various platforms interacting with each other to make the development of DApps much easier and more pervasive. Multiple sidechains (a special class of blockchain) will be required, and the interoperability among these multiple network segments will be defined using a common-ground protocol, network entity (for instance, a gateway), or gateway artifact. This will be the ultimate requirement for the creation and consolidation of DLT technologies as the future of decentralized networks and services.

**CLASSIFICATION OF DLT STANDARDS**

Essentially, there are four broad categories of DLT/blockchain standards, as classified and shown in Figure 2. These categories are defined by their viewpoints, level of depth, boundaries, and demarcation points, including the industry collaboration for each part of the system and subsystems addressed by the technology.

**Generic Framework Standards**

Ideally, this is where all new technology standards development should start—by defining and framing the
right concepts, demystifying and clarifying the scope of the technology, and creating the initial architectural layers and building-block mechanisms that can help create other standards, organizing them into the right context and then adapting to this generic framework. New standards should follow this overarching architectural archetype and be developed based on these principles and guidelines to avoid creating a blockchain Babel of standards. These generic reference frameworks should focus on establishing the interfaces and interconnections between different actors and helping establish the methodologies to define the classification and subclassification of several parts of complex systems, including the definition of the terminology and classification of each subsystem.

Usually, this type of standard is defined as a system-of-systems standard, where systems engineering and interoperability designing principles and methodology apply. This model can also adopt an iterative approach to test and validate these preliminary model assumptions, using real use-case scenarios and applications to further refine the initial approach and provide real and meaningful value to end users and main stakeholders. This type of standard should refrain from defining any technology concept or implementation: a clear set of boundaries and demarcation points should be established to adopt a vendor- and technology-neutral approach. The IEEE DLT/blockchain standards, the work of the ISO/TC 307 on blockchain and distributed ledger technologies, and the ITU-T Focus Group on Application of Distributed Ledger Technology (FG DLT) are some examples of standards-defining generic frameworks.

Figure 3 shows an example of the IEEE DLT/blockchain standards contribution (under development), identifying the key stakeholders, concerns, architectural viewpoints, and systems of interest, including the main elements and subsystems to define and specify DLT technologies, mapped onto the IEEE 42010 framework.4

Enabling Technology Standards
This type of standard focuses on the enabling mechanisms and key building blocks of DLT technologies, such as data formats, consensus algorithms, client interfaces, decentralized identity management specifications, and so forth, as subsystem components. This is an important area to address because of the ever-evolving technology development of open-source interfaces and specifications tied to the main DLT/blockchain platform solutions. The IEEE, Enterprise Ethereum Alliance (EEA), International Telecommunication Union (ITU), and World Wide Web Consortium (W3C) are some examples of providers of this type of standard.

Platform-Specific Standards
This variety of standard is also related to enabling technologies but from a systemic and higher-level view. It is driven by platform-specific technology implementations, such as Hyperledger, Corda, and Ethereum. The combination of these DLT/blockchain platforms can also be offered in a new blockchain-as-a-service, or BaaS, category (for example, IBM, Microsoft, Amazon, VMWare, and others).

Vertical-Industry-Specific Standards
These focus on building customized industry solutions derived from the generic framework standards and adding customized modules of enabling technologies to create a business-driven, use-case-specific standard for the vertical industry addressed. Generic DLT/blockchain standards drive the creation of these vertical-industry-specific standards, providing models, generic frameworks, and definitions tailored to address the specifics of each vertical industry. Examples of this type of standard are those applied to blockchain in energy, health care, supply chain, logistics and transportation, manufacturing, telecom, and so on. A high level of industry involvement, knowledge, and expertise is required to create and drive these standards; therefore, it is expected that these benchmarks will come in a later stage, after the more generic framework standards are established.

Global SDOs Creating Blockchain Standards
It is also important to note that currently there are quite a few global SDOs driving and creating DLT/blockchain standards. Still, a reasonable number of country-based SDOs, industry consortia and alliances, and enabling technology- and platform-based standards organizations is working to develop such benchmarks. In some cases, entities in this latter category move quickly because of their specific industry focus, special interest groups, and membership-structure programs.
Architecture Description

Purpose of the Architecture: This architecture framework defines the basis of the blockchain IoT architecture. It uses IEEE 42010 as a reference model to map the key stakeholders, concerns, architecture viewpoints, and description into a cohesive solution.

Figure 3. The IEEE DLT/Blockchain Reference Framework, per IEEE 42010 (work in progress).
MAIN GLOBAL DLT STANDARDS DEVELOPMENT

Currently, there are several standards-development initiatives going on worldwide. These processes are carried out by global SDOs and industry associations and alliances, with the latter involving great support from the development community and the end users of these platform-specific standards. Most of these standards are currently under way, with just a few first drafts having been released for review; the great majority are still in the preliminary draft stage. More work and preliminary documentation of these DLT/blockchain standards are expected to be released around 2019.

There are several global and country-specific DLT standards and technical specifications being developed worldwide, but the most relevant currently under consideration are described in the following.

IEEE DLT/blockchain standards: The IEEE is developing the IEEE P2418 series, which is focused on the creation of generic frameworks and architectures, interoperability, enabling-technology building blocks, and vertical-industry standards.5

ISO/TC 307 blockchain and DLT: TC 307 is one of the most active global standards efforts, driven by the Australian standards body and the ISO. TC 307 is in the early stages for ISO 307. There are several focus areas here, including architecture and taxonomy, use cases, security and privacy, identity, smart contracts, governance, and interoperability between blockchain applications.6

EEA: The EEA is one of the most active industry alliances, with more than 500 members working on open, standards-based architectures and specifications to accelerate the adoption of Enterprise Ethereum and focusing on the development of technical specifications and certification of Ethereum for enterprise.7

ITU-T: The ITU has created an open-participation ITU-T FG DLT to analyze the standardization demands of applications and services built on DLT.8

W3C: The W3C has a Blockchain Community Group working on a Web Ledger Protocol to generate message format standards for blockchain based on ISO 20022 and produce guidelines for the use of storage, including torrent, public blockchain, private blockchain, and sidechain. This group will study and evaluate new technologies related to blockchain and such use cases as interbank communications.9

REFERENCES


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CYBERTRUST (continued from page 101)


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