From blockchain to Web3

Creating value for service providers

White paper

Blockchain (BC) has received a great deal of attention in recent years because of its use by crypto currencies. Beyond this narrow use, however, BC-based use cases have been evolving for several years. Enterprises are investing heavily in it and are committed to its adoption. So far, it's not clear that much additional value has been created or, at least, that additional value has been captured. We are early in the hype cycle for BC. In this paper, we look beyond the headlines to understand the merits of the technology and what limitations inhibit wide adoption.

In the telecom sector, BC activities have been ongoing since 2016. Service providers have invested in BC with internal and external-facing use cases including partner roaming settlements, identity services, and 5G monetization. Venture dollars continue to flow in, with billions in investment funds created for BC and Web3-based start-ups.

Web3 represents an application of BC that has the potential to create new use cases, such as distributed governance and the use of tokens. Some see Web3 as synonymous with BC, but we believe Web3 extends BC use cases into a variety of new business models driven by the principles of self-sovereignty over users' data and creations. We argue in this paper that Web3 will be adopted by communities of interest, including telecom operators, who will ultimately use it for service creation. Will Web3 enable better use cases and exploit BC's inherent value propositions fully, leading to greater adoption and revenue generation? This paper investigates the new landscape and how telecom operators can navigate Web3 and BC towards value creation and value capture.

Contents

State of the market for blockchain

Blockchain (BC) rose to prominence with the meteoric rise of crypto currency. At the same time, because of the volatility and speculation in crypto currency markets, it has developed a somewhat questionable reputation. We must separate the two. Cryptocurrency uses BC, but BC as a technology is much more than crypto currency. It is normally described as a decentralized, cryptographic ledger system. Its key attributes and value propositions are transparency, security, immutability, efficiency and traceability.

These features have led to the adoption of BC in various industries, including finance, healthcare, and telecommunications. According to Statista [4], worldwide spending on BC solutions is expected to grow from 4.5 billion U.S. dollars in 2020 to an estimated 19 billion U.S. dollars by 2024. Statista enterprise survey [5] found that 66% of companies had budgets of $1million allocated for BC. The financial services sector is looking for strategies and use cases to participate.

> "I don't know what's going to succeed. What I'm certain of is that we are going to see blockchain solutions, peer-to-peer solutions emerging in our industry, and we want to be close to that development."
>
> Jamie Dimon, CEO JP Morgan Chase

Deloitte has published several surveys on the state of BC adoption within medium and large enterprises and the financial services industry. Their 2019 BC survey [2] showed that 80% of respondents (executives) viewed BC as one of their top five strategic priorities, and 83% agreed that there are compelling use cases for it. A subsequent financial sector-focused survey by Deloitte in 2021 [1] also overwhelming agreed (80%) that there is a compelling business case for BC and even new revenue streams. When asked how many 'strongly agreed' that BC brings compelling business cases, however, the number was only 36%, and only 35% strongly agreed that BC will bring new revenue streams. The significant gap between agreeing and strongly agree can be understood by looking at the challenges and barriers identified in the survey. Regulations, cybersecurity and scalability are among the top reasons identified as barriers or challenges to BC deployment.

Although the BC use cases are numerous and the value propositions are obvious, it is still unclear whether this technology has captured new value. Some critics have pointed out that "many of the BC use cases could have been solved by conventional software systems." [3] Many projects succumb to business realities, which render them BC use cases in name only. For instance, many supply chain efforts, an area identified early on as a key opportunity for BC, have been unsuccessful due to the inherent integration challenges with multiple dependent suppliers. Early projects from the likes of IBM, Maersk, Walmart and others have ended up as centralized deployments or 'forced' use cases, which could have been better solved with traditional centralized software. Further evaluation by the British Blockchain consortia found that "the vast majority of BC projects they surveyed had no well-described rationale, no predetermined criteria for achievement, and no analysis of success or failure."

McKinsey [6] suggests that the short-term value is in reducing costs rather than generating new business models, stating that BC doesn't need to be a disintermediator to generate value. Yet disintermediation is a key tenet of BC's role, allowing for the replacement of centralized authorities or governance bodies by automated, transparent, decentralized models for generating trust.

Unpacking the messages on the state of BC requires a careful fence-walk, based on the market commentary thus far. We are cautiously optimistic. Forecasts from several analysts [10][11] expect 60–90% CAGRs until

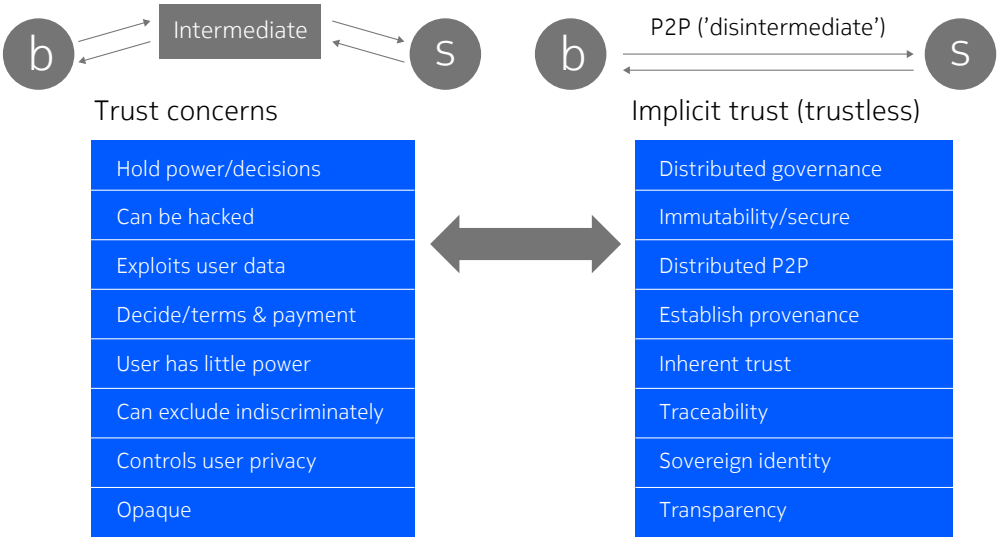
2030, with market sizing in the several hundred-billion-dollar range. Conversely, there are doubters [3] who don't see any fruit from all the noise—more activity than productivity. The current set of use cases is 'forced' and BC in name only', and large BC initiatives from IBM and others have already been shut down for lack of traction.

It's important to view the future success of BC through its value proposition. The fundamental tenet of BC is improved trust. This is accomplished through the technology's attributes: immutability, provenance, traceability, distributed ledger, transparency and so on. Undeniably, these are valuable assets that improve transactional confidence. A true trustless model could be very disruptive to finance and economies; however, proper application and implementation will be needed to move the market.

Today's blockchain use cases

As we look at BC use cases, we should refresh our understanding of BC and its underlying principles. Fundamentally, BC 'disintermediates' a traditional centralized authority with an automated distributed ledger. Rather than a 'trusted intermediary' that facilitates the transaction between the buyer (b) and seller (s) through validation, authentication and settlement services, BC is promoted as trustless (implicit trust). The two models are compared below in Figure 1, with the inherent value of a trustless model shown to the right. The value of the use cases is proportional to their ability to leverage many of these attributes.

Figure 1. Primary objective of BC is to replace intermediaries



While we will not cover the technical aspects, it's worth mentioning the primary limitation of BC. Scalability is the biggest challenge due to the high compute costs (and time) required to validate transactions using proof of work. Proof of work was the original method to validate transactions, but its inherent security strengths were quickly seen as its biggest weakness. New methods such as proof of stake, proof of authority and others improve scalability with some inherent tradeoffs in liquidity and security.

There are numerous use cases for BC, which Table 1 illustrates based on key attributes that are leveraged differently by each industry sector to improve business models and operations. Telecommunications, uniquely, is able to leverage all of the listed attributes, unlike any other sector.

Table 1. BC attributes driving use cases

		Industry sectors							
Attributes	**Description**	**Finance**	**Supply chain**	**Healthcare**	**Identity manegment**	**Digital assets**	**Real estate**	**Energy**	**Telecom**
Immutability	Once a block is added to the blockchain, the data it contains cannot be altered or deleted, providing a permanent and tamper-proof record.	X	X		X				X
Efficiency	Blockchain technology eliminates the need for intermediaries in transactions, making processes faster, more cost-effective, and less prone to errors.	X					X	X	X
Secure	Data stored on a blockchain is encrypted and secured using cryptographic algorithms, making it extremely difficult for unauthorized access.	X		X	X		X		X
Traceability (tempaer evident)	Allows for traveability of assets and information, providing increased transparency and accountability in supply chain management and other industries.		X	X				X	X
Transparency	Transactions can be publicly viewed, allowing for greateer accountability and trust (along with immutability).	X	X			X	X		X
Tokenization	More precise ownership rights, simplified fractional ownership of assets, reduced costs of developing, managing and trading tokenized assets.					X			X

For telecom service providers, all of BC's attributes can be applied to telecom use cases. The TM Forum, for instance, identified multiple use cases such as improved identity, fraud prevention, remittance and settlements, and identity as-a-service in 2019 [6]. They also proposed using BC to eliminate data clearing houses (DCH) for roaming settlements, service level agreement (SLA) monitoring and settlement, and secure online transactions with BC-based digital identity. Figure 2 summarizes some of these use cases, in which BT, Globe Telecom, KDDI, Optus, Orange, Singtel, Telefónica, Ultrafast Fiber and Vodafone participated [6].

Figure 2. TM Forum examples of BC disintermediation

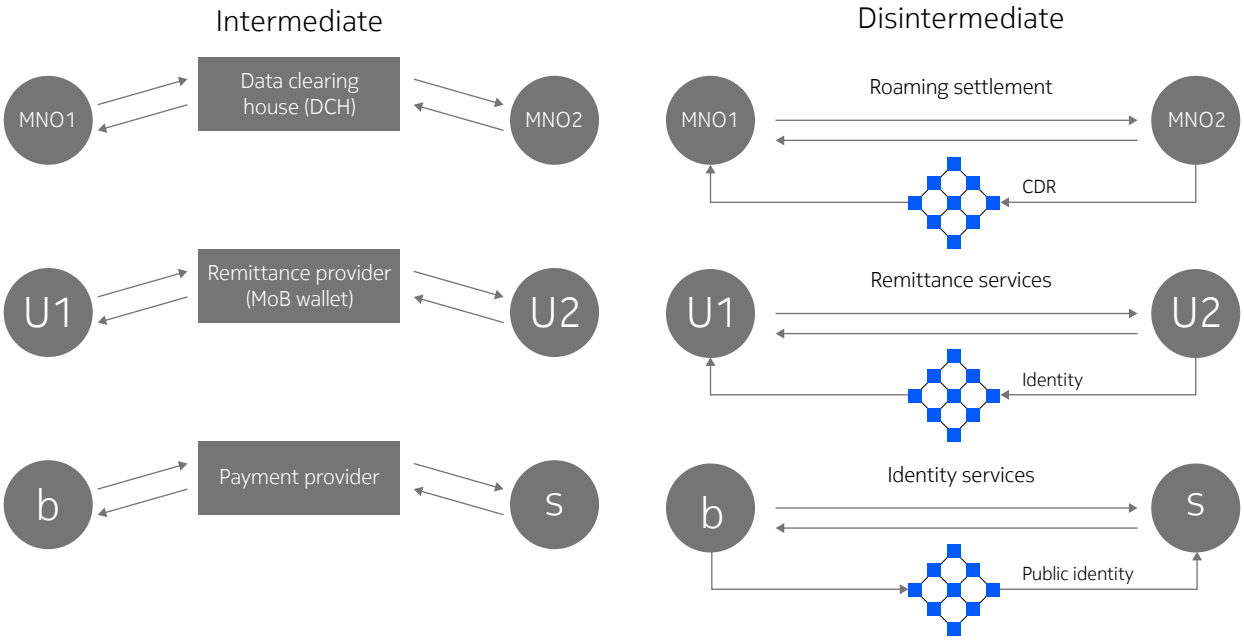


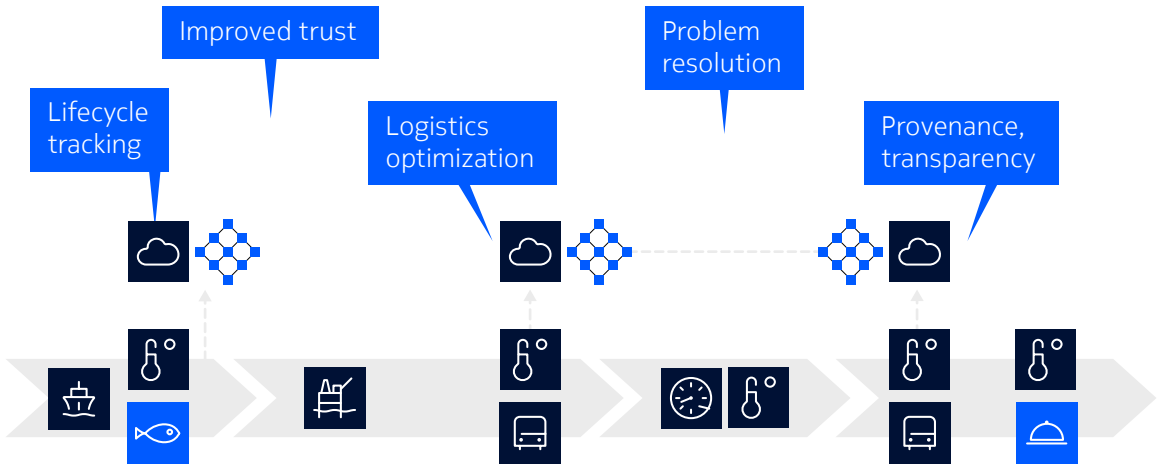
Figure 2 illustrates the use of disintermediation in each use case. Removing the centralized authority and automating settlements reduces operational costs and improves settlement time. Traditional intermediates, such as a clearing house or 'trusted' third party, lack the transparency and immutability of the BC ledger, which enables users to audit and view the execution agreements (i.e., smart contracts).

An important principle in determining the value of a BC solution is how fully its key attributes are embraced. For example, the distributed ledger, which is a key tenet of BC, is often compromised in enterprise BC solutions where the number of validator nodes can be as few as one, which effectively means it is centralized. In contrast, public, decentralized BC architectures depend on a network of nodes (validators) that could number in the thousands, which increases trustworthiness. We will come back to the issue of trust and trustworthiness in our Web3 discussions. Trust is critical to the success or failure of BC use cases because businesses thrive based on the expectation of fair practices and trustworthy platforms.

The other key observation from Figure 2 is that BC facilitates a peer-to-peer transaction or an agreement between two parties. Many business models, like supply chains, are multi-party and complex. Concerns around trust are naturally more prevalent. This means that they can potentially get more value from a properly executed BC solution. Provenance, for instance, is key to trust, especially in perishable goods supply chains such as agriculture or seafood. These sectors have attributes that are ideally suited to BC solutions.

Many telecom operators have been active in supply chain applications, including ATT, Telstra, Verizon, Vodafone, and China Mobile. On the issue of provenance, supply chain management tracking increasingly employs IoT, which is where global telecom operators have a unique role to play. Thus, using BC along with IoT for supply chain is an often-promoted use case. Figure 3 illustrates a typical use case where IoT and BC are used for provenance and transparency, as well as pure logistics issues such as product temperature, arrival schedules, etc., to ensure compliance and product quality standards. BC's distributed ledger can create additional trust between suppliers, delivery, and retailers.

Figure 3. BC for supply chain



Given the complexity of this use case, service providers often work with partners to deliver an end-to-end solution. For instance, ATT, Verizon, Telstra and Vodafone announced partnerships with IBM, which has, since 2016, invested over $200 million [9] in BC IoT initiatives, including research and development, partnerships, and acquisitions. It's reported that IBM alone has 1,000 researchers working on the IoT supply chain. Verizon is a member of the Blockchain in Transport Alliance (BiTA), a group of transportation and logistics companies that are working to develop BC standards for the industry.

BC-as-a-service (BCaaS) solutions offered by several webscalers use Ethereum and Hyperledger (an open-source BC built by IBM) to accelerate and simplify deployment. Telefonica developed an operating system (TrustOS) based on the Hyperledger platform to enable quick integration of BC into enterprise applications. TrustOS is an abstraction layer to hide the complexity of the BC layer, enabling simplified access to multiple BC technologies through HTTP APIs. Traceability for asset tracking, tokenization of assets, contract enforcement, and IoT integration applications are APIs within TrustOS. A Web3 distributed application developed on TrustOS will be discussed below.

Conclusions on the state of blockchain

Reflecting on the use cases, we can see how almost any industry can benefit from the improved transactional confidence that BC promises. Increased corporate investments in BC and venture capital funding seem to ensure that it will be around for the foreseeable future. Value creation is likely to grow as adoption becomes more widespread. In what follows, we will unpack the role of Web3 in driving BC adoption and creating new, compelling opportunities.

Defining Web3

> "Everything you don't understand about money combined with everything you don't understand about computers"
>
> John Oliver (Last Week Tonight)

Widely touted as the democratization of the web, Web3 espouses the virtues of decentralization over today's more centralized web models. Andreesen Horowitz, in its State of Crypto [13], writes that the primitive "world-wide web" allowed people to read information online, Web 2.0 let people create content, and Web3 now allows people to "own a piece of the internet". Web 2.0 introduced a number of technologies to allow people to create content, such as blogs and vlogs, share their content and interact with each other on platforms like Facebook and TikTok. Web 2.0 technologies allowed users to freely sort information for improved retrieval, offered dynamic content tailored to the user's inputs, introduced evaluation ('likes') and commenting, as well as multimedia streaming and participation in social media.

This proved revolutionary compared to the world-wide web's passive web browsing. Yet it had notable drawbacks in terms of privacy, trust, and the exploitation of user data for targeted advertising, which was the business model for these centralized Web 2.0 platforms. The issues go beyond the exploitation of user data for marketing purposes. Algorithmic curating of content on these platforms is now widely recognized as having an undue and unwanted influence on social and political attitudes and choices as well. Web 2.0 platforms, whether offering streaming services, e-commerce or social media, play the role of centralized trusted intermediaries, but because they have control over data storage and management, they have disproportionate power in the marketplace and, potentially, beyond.

BC and Web3 are both decentralized ways of addressing the issue of trust by removing the intermediaries of Web 2.0 and the centralization of power and revenue to a few centralized platforms and players. Web3 increases user agency, enabling individuals to solely capitalize on their value without having to surrender value to the intermediary in the form of their data and online identity. Table 2 highlights the key differences between Web3 and Web 2.0.

Table 2. Web 2.0 principles vs Web3 principles [7]

Web 2.0 Principles	Web3 Principles
Control's user identity	Verifies user identity
Monetization platform	Data owner/innovator platform
Liquidity - analogue (cash)	Liquidity - digital (token)
Competition - winner takes all	Co-opetition - win-win

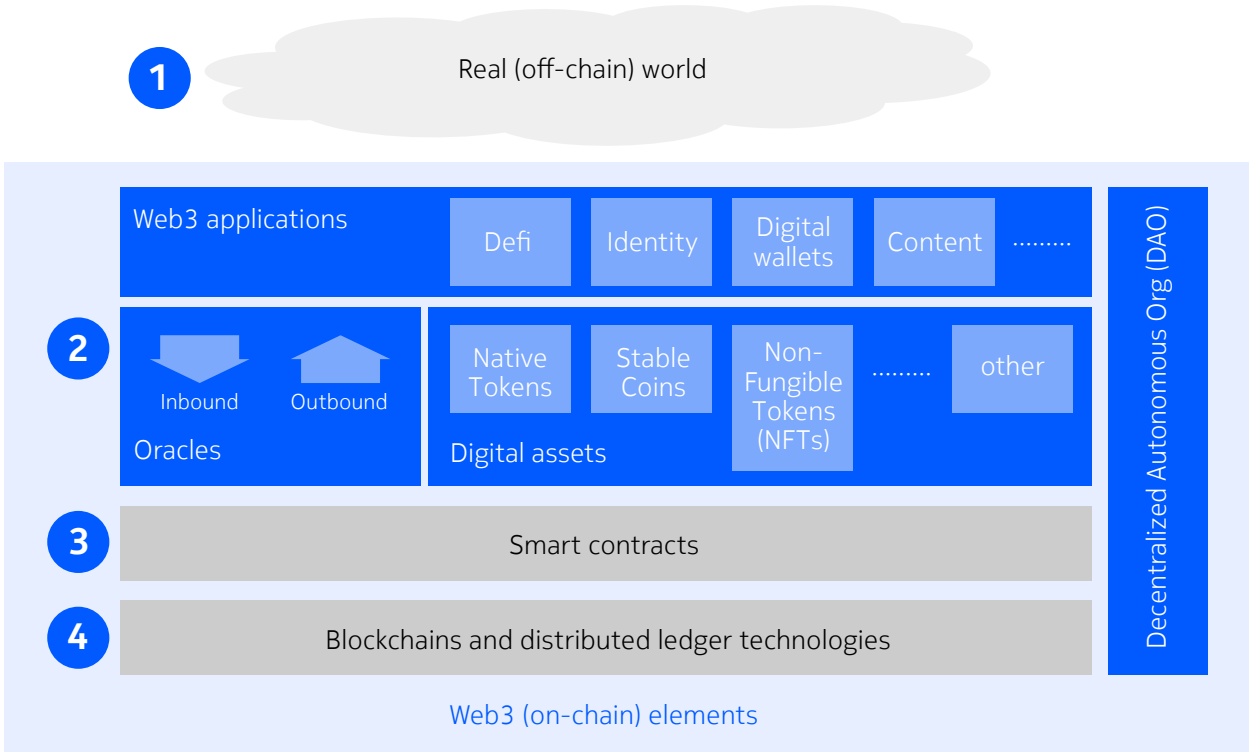
McKinsey states it succinctly: "Web3 effectively enables traditional revenue streams to accrue to the users of a platform, enhancing the user value proposition relative to their Web2 equivalents" [14]. This altruistic goal is not easily achieved because of the nature of capital markets, which seek to maximize shareholder value. Jack Dorsey (Dec 21), the founder of Twitter and Square Financial Services, warns that as "venture capitalists and limited partners own Web3, it will never escape their incentives. It's ultimately a centralized entity with a different label."

Web3 elements

The general building blocks of Web3 are shown in Figure 4. The Web3 elements shown in (2)–(4) are referred to as 'on chain' elements, implying their role is secured by the BC. While (1) indicates that real-world, off-chain actors are not secured by the BC, it does interact with and depend on the data from real-world sources. Thus, its reliability depends on the integrity of those sources.

BC and Smart Contracts are shown as items (4) and (3) in the diagram and highlighted in grey to indicate their distinction from Web3, highlighted in blue. Items (2) include the Web3 applications, digital assets, and oracles. The DAO (decentralized autonomous organization) is shown vertically on the right, representing that it is distinct from the technology functions and serves as a governance structure. Some argue that BC also implies digital assets and that its box should be grey as well. The reason for separating them is that digital assets are ever-expanding; new forms of digital assets and tokens, such as NFTs (non-fungible tokens), are constantly being created.

Figure 4. Web3 elements or components



NFTs are often discussed as digital art or digital trading cards, but NFTs can also represent unique physical assets such as a driver's license or ownership of a physical asset such as a car or home. In contrast, fungible tokens are interchangeable, meaning that one unit of a fungible token is equal in value to any other unit of the same token and is used as currency.

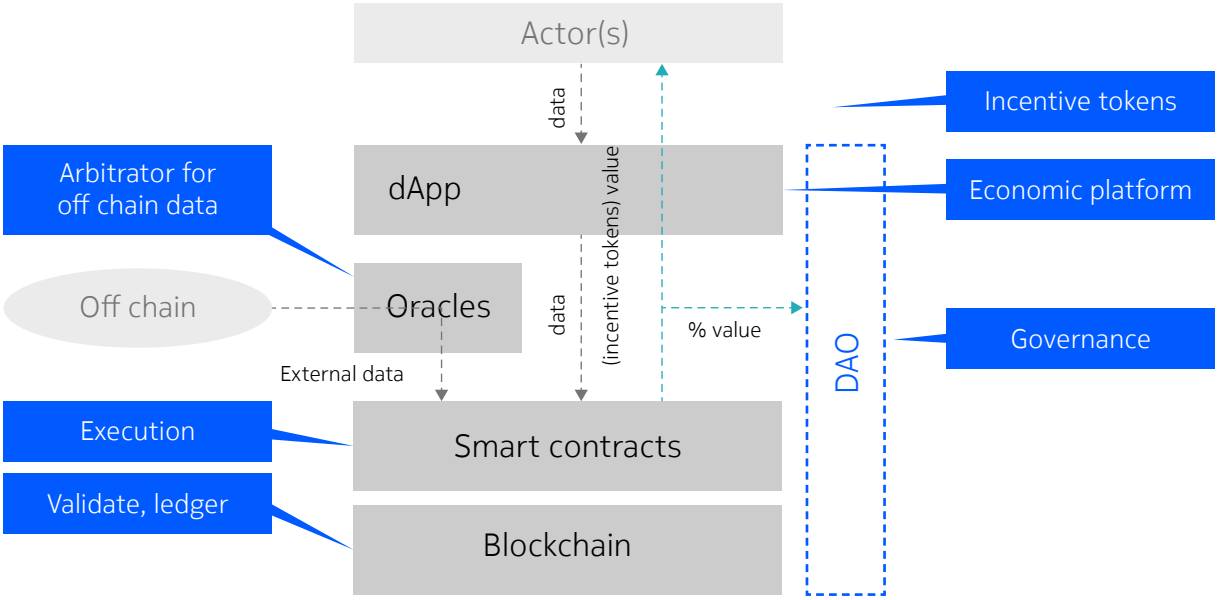
Eric Bauer, Bell Labs Fellow, writes in Practical Web3 Considerations [8] that "tokenization links a physical asset or virtual asset to a cryptographic token stored on a BC. The cryptographic token represents ownership, custody, or permission for some underlying physical or virtual asset." BC-based tokens reduce transaction costs, shorten settlement time, offer increased liquidity, precise ownership, greater confidence, and simplify fractional ownership.

Oracles and DAOs in Web3 deserve some explanation. BC provides secure transactions with immutable records, but to execute the smart contract decision, data needs to be provided to the smart contract. This data often arrives 'off-chain' from a variety of sources, which could be stock prices, credit reports, telemetry (IoT) data, weather, or any other credible source. Additionally, data often needs to leave the Web3 application in some cases to inform the real world of the transaction. The transaction could include sending a digital key to an actuator to open a vault or door to an office or house, for example. There are many important implications of the oracle's role, as while the BC is inherently secure and trustworthy, its efficacy depends on the oracle ensuring that its decision data (criteria) is also trustworthy.

The DAO is shown vertically in the diagram because its function is very different from that of the other Web3 elements. DAO is a governance function that provides the structure for how the Web3 application works. DAO governance is decentralized and executed dynamically through smart contracts. DAO creators (actors) are rewarded based on their contribution to the DAO, usually in crypto currency or tokens. Those with more tokens are given more voting rights (more contributions, more voting authority). The DAO is automated, and only when governance changes do individuals get involved or vote—specific examples will be shown later.

Figure 5 illustrates these functions in operation. The Web3 application, also known as the distributed application (dApp), is the economic platform that interfaces with the users (actors). Users share data with the platform, for which they are rewarded via tokens. Normally, the governance platform (DAO) is given a small percentage of each transaction (sometimes called a 'gas tax') to deal with operational costs. The platform may require external (off-chain) data to execute the contract, and this is managed by the oracle. Finally, the smart contract and BC provide the execution and validation of each transaction. These principles of Web3 operation are discussed using examples in the following section.

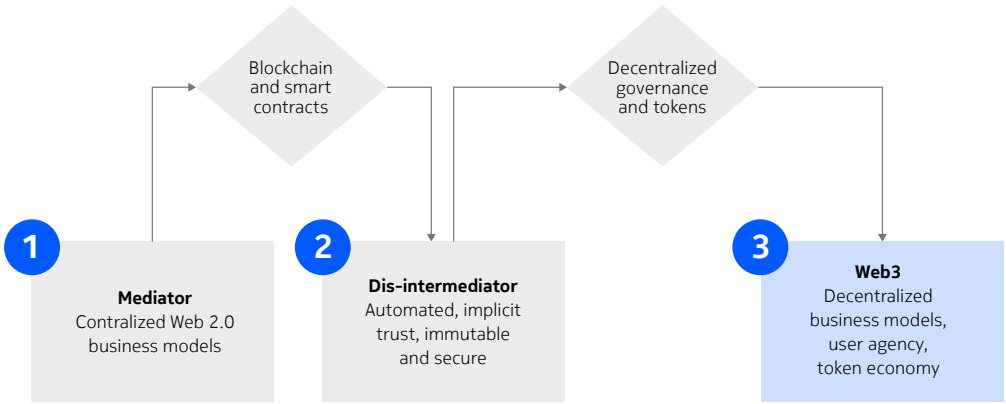
Figure 5. Web3 simplified operation



Moving from blockchain to Web3

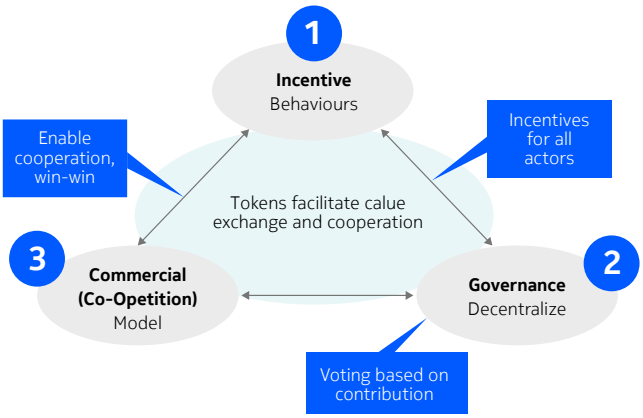
The BC value proposition is to increase trust using a distributed ledger, while Web3 focuses on leveraging BC to change the economics of the internet. With Web3, all actors are incentivized to collaborate and contribute. Increased participation results in platform growth. Chris Dixon (Andreessen-Horowitz) writes: "Token networks align network participants to work together toward a common goal—the growth of the network and the appreciation of the token." A key part of the transition from BC to Web3 encompasses the governance model enabled by the token, which is represented in Figure 5 by the dotted line between Actors and DAO. Web3 has a distributed governance function designed to incentivize community participation and democratize the benefits in an equitable manner. As stated before, BC replaces the central arbitrator, because it is implicitly a better trust authority, as represented in Figure 6.

Figure 6. Moving from BC to Web3 use cases.



The question remains: in a capitalistic economy driven by maximizing shareholder return, how do we encourage this participatory behavior? Eric Bauer, Bell Labs Fellow, writes in Practical Web3 Solutions that in "centralized web2 platforms generally, a single company uses investors' money to kickstart a winner-take-most business from which they can extract monopoly rents to pay healthy returns to those investors" [8]. The author suggests a concept called the value exchange model, which entices ecosystem actors to voluntarily work in a way to achieve the Web3 objectives, as pictured in Figure 7.

Figure 7. Web3 operation - value exchange model

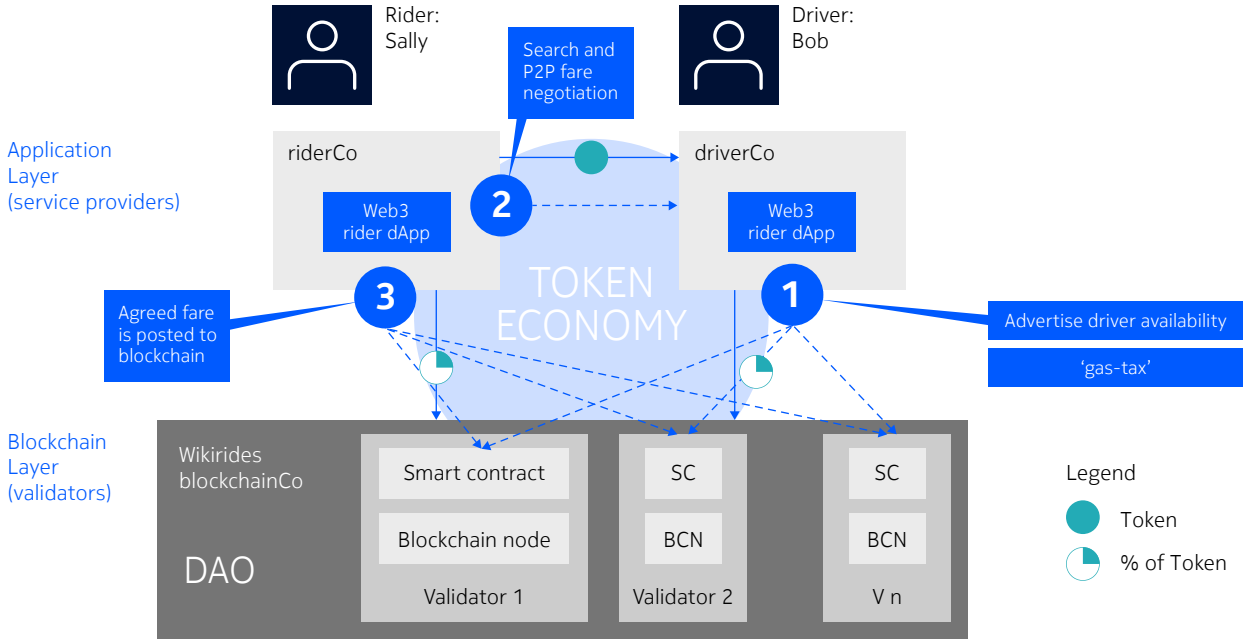


This model is based on three principles: (1) incentives (e.g., tokens) that shape behavior; (2) decentralized governance that defines platform (model) rules intended to equitably reward contribution; and (3) commercial coopetition that agrees on fees and monetization. Tokens underpin the value exchanges as they facilitate all three principles.

Some may argue that these principles are anti-free market because coopetition is a form of collusion that undermines the free market's ability to produce the most efficient and cost-effective solutions. This argument fails to acknowledge the inherent coopetition in all markets, insofar as even in so-called 'free markets' participants have to agree to abide by certain rules such as the legal enforceability of contracts, the use of specific fiat currencies to facilitate transactions, and the payment of taxes to governments for infrastructure and resources that make possible their participation in the market—not to mention a slew of other local, national or international regulatory regimes that define the playing field for a given market, whether it is based on blockchain or any other governance model.

To better illustrate how the value exchange model in Web3 does not undermine the free market mechanism, Figure 8 illustrates a hypothetical Web3 version of a well-known Web 2.0 rideshare application. There are several actors. On the buyer side, there is 'Sally', who represents users needing transportation on demand using the riderCo service. On the seller side, there is 'Bob', who represents the rideshare drivers using the driverCo service. Finally, there is the BC operator 'Wikirides', or blockchainCo.

Figure 8. Principles of a Web3 business – the rideshare example.



This figure illustrates the basic operation of the rideshare service: the driverCo dApp advertises availability announcements (1) to Wikirides subscribers like Sally, and the riderCo dApp searches Wikirides for relevant drivers like Bob. Normally, posting and searching on a BC-based platform are subject to a tax to fund BlockchainCo operations (see the % of Token icon in the legend of Figure 8). The driverCo dApp and the riderCo dApp are paired using the BC's peer-to-peer protocol (2) and Sally and Bob agree on terms. The agreed fare is posted to Wikirides (3) upon successful completion of the ride (ensured by validators), and the entire transaction is stored in the BC.

In the Web 2.0 model, rideCo, driverCo and blockchainCo would all be one operator, such as Uber or Lyft. In the Web3 model, they can all be different, with multiple rideCos and driverCos interacting with one or more blockchainCos. This illustrates that by disaggregating the functions, the rideshare market actually becomes more competitive, not less. It breaks up the monopolizing tendency of winner-takes-all centralized platforms typical of Web 2.0.

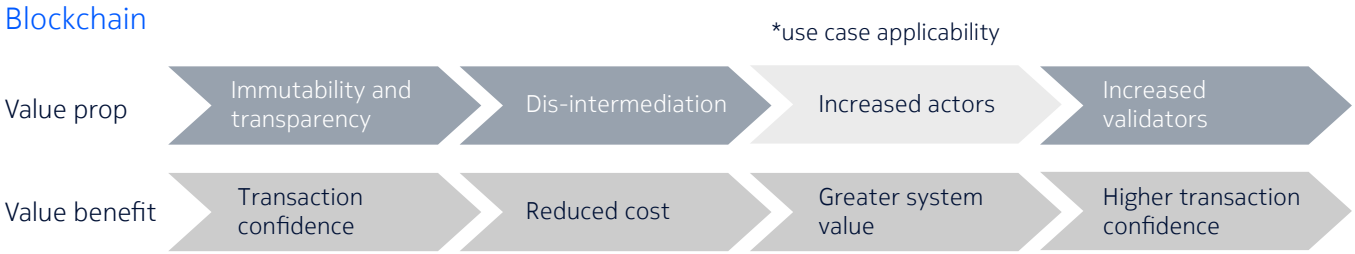
In terms of incentives for riders and drivers, the Web3 value exchange model ensures that users like Sally have access to a wide variety of potential drivers who compete for her business. Drivers like Bob receive the lion's share of the revenue (token) as the provider of the service, and the platform operator receives a small percentage of the token (DOA tax) as payment according to its contribution (and risk capital). The application providers (riderCo and driverCo) and validators' are commensurately rewarded according to the governance model.

There are a number of Web3 distributed applications operating today that attempt to disintermediate well-known Web 2.0 centralized platforms. Many of these operate on the Ethereum BC and have distributed versions of video sharing and streaming, social media, music streaming, decentralized finance and more. Ethereum had over 5,000 Web3 developers at the start of 2023, a 400% rise since 2018. Next, we will look at how Web3 use cases can create new opportunities for BC-based use cases.

Web3 use cases

There were several TM Forum BC use cases mentioned earlier (see Table 1), including roaming settlement, identity management and IoT/supply chain. While these use cases have been deployed for some time, the jury is still out on their success. The benefits of BC are clear, but value creation remains elusive. In Figure 9, we contrast the value propositions against the benefits this provides for insights on how to create additional value for existing BC use cases. The benefits of each value proposition are described below.

Figure 9. BC value proposition and value benefit (or creation)



BC's inherent value is implicit trust, which provides transaction confidence as buyers and sellers can be assured of their exchange. The smart contract will execute the contract when the agreement is met on both sides and the BC provides a permanent record. When disintermediation of the centralized platform occurs through BC, the operational savings of smart contracts occur as clearing houses or TTP (trusted third parties) charge for their services.

Since implicit trust is inherent in BC, use cases with greater trust issues extract more benefit. BC is promoted for supply chains in part because there are many actors and a greater need for trust, thus greater value is possible. Similarly, high-security applications associated with finance and health care receive greater value from BC because it provides trust through transaction validation (or its validators). Validator sufficiency is rewarded because, by design, the more independent validators are, the greater the possible reduction in the possibility of manipulation.

Figure 10. Web3 value proposition and value benefit (or creation)

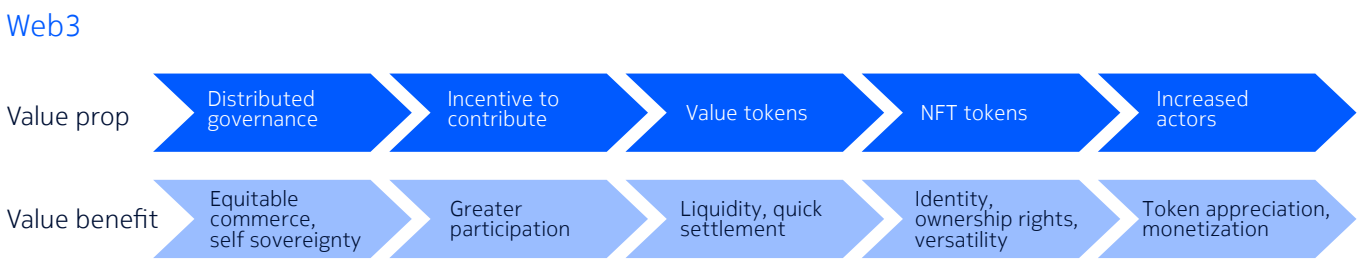


Figure 10 contrasts Web3 value propositions with the value propositions for BC in Figure 9. Web3's main value proposition is to enable more value to be extracted from more actors, achieved through a new distributed governance model. Incentives are key to the Web3 governance structure, which leads to greater actor participation. Value tokens reduce business friction, enabling quick transaction settlement and better liquidity, all of which benefit the business model. The versatility of tokens in terms of value, identity and asset ownership inherently means a wider variety of use cases. Finally, the value exchange model enabled by tokens drives an increased number of actors, which potentially drives token value and increases monetization.

Table 3 compares use cases against these metrics, showing where improvements can be made to increase value.

Table 3. Improving existing use cases through Web3 principles

			Blockchain				Web3				
BC use cases	**Objective**	**Blockchain benefit**	BC immutability	Dis-intermediate	Increased actors	Increased validators	Distributed governance	Incentives	Value Token	NFT Tokens	Increased Actors
Roaming settlement	Remove intermediary, decrease friction and time	Trustless, automation, dis-intermediate	**Y**	**Y**	**O**	**O**	**O**	**O**	**O**		**O**
Remittance	Reduce significant transaction costs	Transparency, provenance	**Y**	**Y**		**O**	**O**	**O**	**O**	**O**	**O**
Spectrum sharing	Spectrum under utilization	Trust/transparency - all parties can see	**Y**					**O**	**O**		**O**
User billing data management	Improve data discrepancies	Synchronized in real time, traceability, distributed storage	**Y**	**Y**			**O**	**O**	**O**		**O**
Supply chain	Achieve lower logistics time and cost	Decentralized, traceability, provenance	**Y**		**O**	**O**	**O**	**O**	**O**	**O**	**O**

Value

Y - Deployed **O** - Opportunity

Increased value

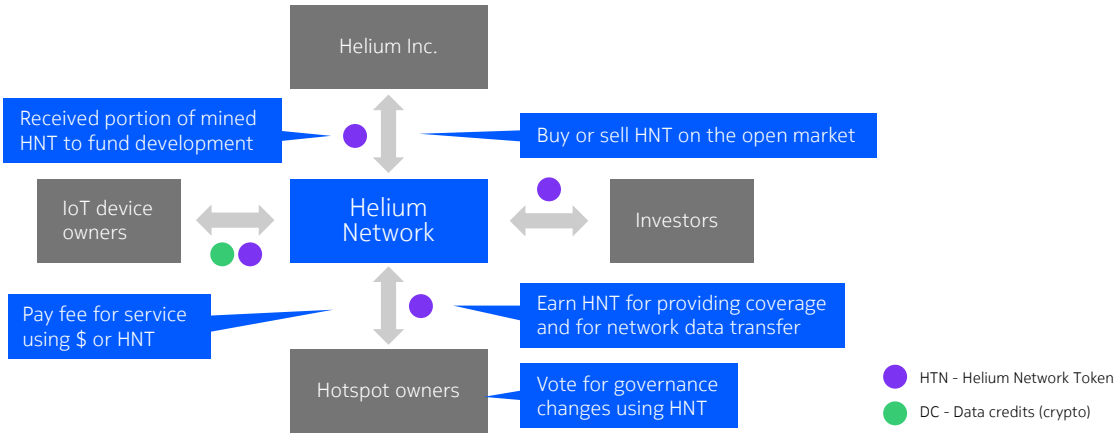
Increasing the number of validators and actors in BC networks also increases the value of the use case. Of course, increasing validators may come at a cost. Increased actors must be an intentional goal of the stakeholders and a goal of the governance model. Thus, for instance, roaming settlements that use a distributed BC network with a greater number of telecom providers (actors) would lead to lower operational costs for all. Creating a Web3 application for roaming settlement could also potentially enable the use of incentives to improve the user experience for mobile subscribers.

Mobile payment and remittances could also benefit from incentives. Mobile app payments could support loyalty with awarded value tokens, or potentially NFTs, geared towards the millennial/Gen-Z demographic that is already comfortable with crypto currency and digital payments.

Web3 distributed governance is intended to reward contributions to the platform, and thus most of the BC use cases could apply this principle. The applicability increases as the number of actors increases per platform. The ability to increase value for these BC use cases in part can be achieved through the applicability of the Web3 value propositions.

While many of the use cases discussed so far are focused on operational costs, we will now look at some revenue- or service-focused use cases. The first Web3 use case encompasses all aspects of the value exchange model. Nova Labs Helium Network is a distributed wireless provider targeted at enterprises and smart cities that concerns IoT devices using LoRaWAN (low range wide area network). Nokia's NGP Capital is a Silicon Valley venture capital firm is an investor in Nova Labs. The network is built in a crowd-sourced manner, with anyone able to become a partial owner of the network. These actors purchase a LoRa hotspot and connect it to the Helium Network. They are awarded tokens based on the traffic that is carried over their hotspot. Distributed (token) governance is key to this use case, as contributors get voting tokens according to their level of contribution. Those with more voting tokens have a bigger say in governance decisions. Developers, investors and hotspot owners all contribute and have equitable (commensurate) voting rights. The revenue generated by the distributed network is passed through to actors in a similar way. The value exchange model is exemplified in Figure 11.

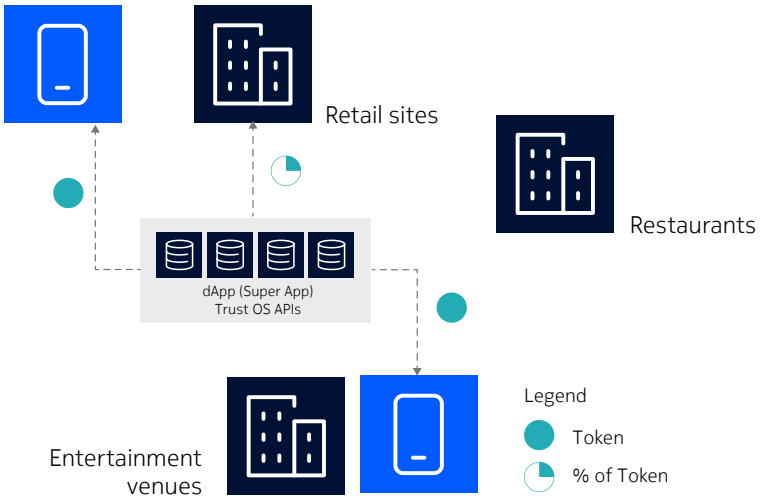
Figure 11. Helium Web3 business mode



Finally, the HNT (Helium Network Token) potentially increases in value as more actors are added to the network as its value to the end customer increases with better coverage—a complete fulfillment of the value chain we discussed in Figure 10. Today, Helium has partnered with telecom operators like Dish and T-Mobile and is nearing a staggering 1 million hotspots globally.

SuperApp, a cutting-edge Web3 application that Telefonica has deployed, is based on their BC as a Service initiative (TrustOS). The app is targeted at tourists visiting Spain, rewarding them with tokens or NFTs as they make purchases and explore the country. Value tokens (i.e., fungible) can be used for perks and benefits, and NFTs can be collected as they visit historical venues such as museums. Another benefit is the possible gamification of tourism through encouraging behaviors such as visits to designated sites or routes (see Figure 12). This type of application is ideal for targeting the mindshare of today's tech-savvy demographic. Additionally, increased adoption of this app can drive retail business, as tourism tokens can be used for purchases or discounts.

Figure 12. Telefonica Web3 tourism application



NTT DoCoMo announced at the end of 2022 that they will invest $4 billion into Web3 initiatives as they seek to be a market leader in this space. NTT sees Web3 as a key technology for solving social objectives, including smarter cities and achieving Environmental, Social and Governance (ESG) targets.

Web3 adoption is still in its early stages, even though telecom and enterprise have widely adopted BC. BC provides the foundation for Web3 applications and facilitates the transition to full Web3. The additional value creation will depend on the use cases aligning with the key tenets of the technology.

Conclusions

BC value recognition remains unclear for now, however, it's evident that enterprises continue to invest in and remain committed to its adoption. There is high value demonstrated by the BC, but scalability and regulatory issues remain to be addressed. Service providers cannot ignore the adoption of this technology by their corporate customers and partners and will need to find use cases that are consistent with those value chains. Web3 looks to add value to existing BC use cases as well as create new use cases based on the value chain created by tokens and distributed governance.

Web3 will initially be driven by communities of interest or networks with common goals, for example, supply chains, credit unions, agriculture cooperatives and of course telecom providers. Telecom providers continue to use BC for disintermediation solutions like roaming settlements, but ultimately, service

creation is the goal. Web3 creates the opportunity for new services driven by incentives from tokens, like tourism in the Telefonica use case. Telecom providers can leverage the Web3 token model to incentivize partners of new 5G services to cooperate, which will accelerate adoption.

Acknowledgment

The author thanks the members of the Network and Cloud Infrastructure (NCI) group at Bell Labs Consulting for their valuable feedback in the preparation of this paper.

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Abbreviations

BC	Blockchain
BiTA	Blockchain in transport
BCaaS	Blockchain as a service
DAO	Decentralized autonomous organization
dApp	Distributed application
DCH	Data clearing house
ESG	Environmental, social and governance
HNT	Helium network token
LoRaWAN	Low range wide area network
NFT	Non-fungible token
SLA	Service-level agreement

References

[1] Pawczuk, L. Massey, R. and Holdowsky, J. (2021). Global blockchain survey. A new age of digital assets. Deloitte.

[2] Pawczuk, L., Walker, R., and Tanco, C. C. (2019). Global blockchain survey. Blockchain gets down to business. Deloitte.

[3] Funk, J., Vinsel L. and McConnell, P. (2022). “Web3, the Metaverse, and the Lack of Useful Innovation,” American Affairs, Winter 2022 / Volume VI, Number 4. http:// Americanaffairsjounral.org/2022.

[4] Taylor, P. (2022). Worldwide spending on blockchain solutions from 2017 to 2024, Statista. https://www.statista.com/statistics/800426/worldwide-BC-solutions-spending

[5] Taylor, P. (2022a). Investment plan for blockchcain technology in organizations over the next 12 months worldwide as of 2020, Statista. https://www.statista.com/statistics/878612/worldwide-investment-plan-blockchain-technology

[6] Carson, B., Romanelli, G., Walsh, P. and Zhumaev, A. (2018). Blockchain beyond the hype: What is the strategic business value? McKinsey. https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/blockchain-beyond-the-hype-what-is-the-strategic-business-value?cid=soc-web

[7] Martin, A. (2021). The Token Economy: Blockchain is really a governance technology, SSRN. https://ssrn.com/abstract=3972111

[8] Bauer, E. (2023) Practical Web3 Solution Considerations, Nokia Bell Labs. https://www.researchgate.net/publication/370124580_Practical_Web3_Solution_Considerations

[9] Higgins, S. (2016). IBM invests $200 million in blockchain-powered IoT, CoinDesk. https://www.coindesk.com/markets/2016/10/04/ibm-invests-200-million-in-blockchain-powered-iot/

[10] Fortune Business Insights (2023). Blockchain market forecast. https://www.fortunebusinessinsights.com/industry-reports/blockchain-market-100072

[11] Grand View Research (2022). Blockchain technology market size and share report. https://www.grandviewresearch.com/industry-analysis/blockchain-technology-market

[12] Investopedia (2022). Web 3.0 explained, plus the history of Web 1.0 and 2.0. https://www.investopedia.com/web-20-web-30-5208698

[13] Kuhn, D. (2022). What Web 3 means to Andreessen Horowitz. CoinDesk. https://www.coindesk.com/layer2/2022/05/17/what-web-3-means-to-andreessen-horowitz/

[14] Banerjee, A., Byrne, R., De Bode, I. and Higginson, M. (2022). Web3 beyond the hype. McKinsey Financial Services. https://www.mckinsey.com/industries/financial-services/our-insights/web3-beyond-the-hype

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Document code: CID213367 (October)