THE FUTURE OF THE WEB: A LOOK AT WEB 3.0

Abstract

Web 3.0 which denotes the next evolution of the Internet marked by the integration of blockchain technology, artificial intelligence, and the Internet of Things. This paper aims to outline the progression of Web 3.0, analyze its fundamental elements, explore its future possibilities, and examine how it has the potential to transform the internet experience. Technology has created numerous opportunities and challenges for web-based systems, and Web 3.0 is poised to revolutionize the way we interact with the Internet. Through this paper, we provide insights into the next generation of web experiences and their implications.

Keywords: Web 3.0, Blockchain, non-fungible token, the Internet of Things, artificial intelligence.

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I. INTRODUCTION

In the context of Web 3.0, the combination of artificial intelligence (AI), the Internet of Things (IoT), and blockchain technology enables the monitoring and analysis of vast amounts of data generated by our interconnected lives. This convergence holds significant implications for various aspects of our daily routines and activities. By harnessing the power of AI, IoT, and blockchain, we can gain valuable insights, optimize resource allocation, improve decision-making processes, and enhance overall system efficiency. The integration of these technologies in Web 3.0 paves the way for a data-driven future, unlocking new possibilities in our interconnected world. The majority of data produced on the internet is kept in centralized data centers. These data centers are owned and controlled by tech giants such as Google, Facebook, and Twitter. Although these companies can use user data to provide personalized experiences, privacy concerns remain. Blockchain technology offers users control over their data and content, allowing them to trade or sell their data and content without sacrificing ownership or privacy. Additionally, users can access websites without being tracked. In 2006, John Markoff, a journalist at The New York Times, coined the term "Web 3.0" to describe what he saw as the future development of the internet and the web as a whole.

A variety of defining features characterize Web 3.0.

1. **Semantic Web:** The Semantic Web integrates into the latest version of the Internet, enabling Web technologies to produce, distribute, and link the content by capturing the words and their meanings rather than relying on keywords and numbers.

2. **Artificial Intelligence:** Computers can process information in a human-like manner to offer quicker and more pertinent outcomes by examining patterns and merging semantic abilities with the help of natural language processing (NLP).

3. **3D Graphics:** In Web 3.0, 3D design is widely utilized in various websites and services such as digital museums, PC games, e-commerce platforms, geospatial contexts, and more.

4. **Ubiquity:** Web 2.0 has already made internet content available anytime and anywhere throughvarious devices that can access the internet, such as smartwatches and other devices.

5. **IoT:** With the growth of IoT (The Internet of Things) devices, this ubiquity is being taken to the next level.

6. **Blockchain:** Blockchain technology allows for the protection and encryption of user data, which in turn prevents large technology companies from accessing users' personal information.

7. **Decentralized:** Web 3.0 is characterized by decentralized data networks that maintain ownership of user data, enabling users to browse the internet without worrying about being tracked. With the incorporation of semantics and machine learning, computers are now able to understand the meaning behind the information, learn about user interests,

and provide faster and more relevant results. As an example, while driving a car in Web 3.0, you can search for the "best Japanese restaurants," and the search results will be personalized based on your location, taking into account the reviews on social media. Additionally, by analysing your previous search history, the search engine can suggest better options for you.

II. LITERATURE REVIEW

This paper, titled "Comparative Study of Web 1.0, Web 2.0, and Web 3.0," by Umesh Naik and Dr. D. Shivalingaiah[2], discusses the emergence of three generations of the web and distinguishes their key features and associated systems. The main focus of the paper is to provide a concise summary of the three generations and their impact on web systems.

Rajiv and Manohar Lal in their paper titled "Web 3.0 in Education and Research", attempt to demystify the concept of Web 3.0 by referring to various terms and definitions. Given that there is no concrete definition of Web 3.0 yet, the authors seek to simplify it and provide relevant details regarding the technology, systems, and components that can be used under this framework.[1] The majority of the paper is focused on exploring the potential applications of Web 3.0 in the education and research sectors. It also highlights the tools and components that are already being utilized in this domain.

Preethi Kasireddy's blog post titled "The Architecture of a Web 3.0 Application" outlines the technical aspects of Web 3.0 and provides relevant illustrations. The blog discusses both the opportunities and challenges presented by this newer version of the web. Moreover, it sheds light on the potential use cases that can be developed with Web 3.0 and highlights its key functional components. [6]

Mr. Rikus Bruwer and Mr. Riaan Rudman's paper, "Web 3.0: Governance, Risks, and Safeguards," provides guidance to management on implementing Web 3.0 and identifying key areas of focus. The paper examines corporate risks that may arise from the use of Web 3.0 technologies and their impact on business drivers that are relevant to most industries and companies. The study focuses on incremental risks associated with Web 3.0 and re-evaluates risks associated with previous Web generations as the underlying technology has evolved. [5]

III. WEB GENERATIONS

To better comprehend Web 3.0 and its functionality, it is essential to have an understanding of the history of the Internet. [2] It is reasonable to assume that there must have been previous versions, namely Web 1.0 and Web 2.0, for there to be a third version.

1. **Web 1.0: Ready-Only, Static:** Web 1.0 refers to the earliest version of the Internet, considered the initial iteration of the Web. [2]Unlike the modern web, Web 1.0 mainly consisted of a collection of web pages linked through hyperlinks, devoid of modern interactive features such as visuals, form controls, and inputs. Experts often refer to Web 1.0 as a "read-only" web, as users could only view plain textual content. Web 1.0 was highly decentralized, and search engines were non-existent. In simpler terms, users could only visit websites and follow links to other websites without altering or modifying the content.

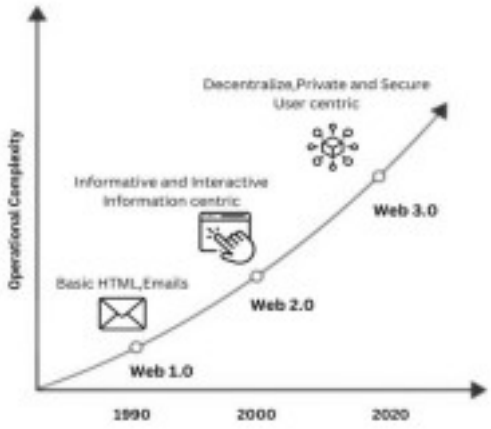

Figure 1: The Evolution of the Web

2. **Web 2.0: Centralized by Tech Giants:** Web 2.0 is the current web iteration and is widely used. It focuses on user-generated content and has enhanced usability for end-users compared to Web 1.0. This version is referred to as the "read-write web" or the "social web," as it allows interaction between users and sites. Websites and applications enable users to produce and distribute content with the help of social networks and cloud technology. However, a small number of big tech companies such as Google, Meta (Facebook), YouTube, and Twitter have significant control over the user data associated with Web 2.0. [2]

   The emergence of the Internet of Things (IoT) has contributed to the rise in the rate of data creation, with an estimated 2.5 quintillion bytes of data being generated daily. Google alone processes more than 20 petabytes of data daily, mostly from 3.5 billion search queries. As of 2020, there are around 44 zettabytes of data on the internet, with an estimated 175 zettabytes by 2025, considering the rate at which data is created daily.

   All this data is stored in centralized databases owned by tech giants such as Google, Meta (Facebook), etc. The data gathered across all services, platforms, products, and devices is used to generate a profile that can be used for marketing and advertising purposes. The profile includes an individual's gender, age range, job industry, and interests, which helps these companies target campaigns and advertisements that align with an individual's personal interests.

3. **Web 3.0: Decentralized Web:** Web 3.0 is the latest version of the internet that employs blockchain technology, which gained popularity among cryptocurrency enthusiasts in 2021. The main focus of Web 3.0 is scalability and privacy for users, aiming to reduce the control of large tech companies over the Internet. Although some, such as Elon Musk, have argued that Web 3.0 is just a buzzword, it is expected to expand the range of machine and human interactions in ways that were previously unimaginable. The new interactions will include secure payments, seamless web experiences, trusted data transfers, and complete anonymity of user profiles. [2]

4. Web 3.0 Components

- **Block chain:** The technology known as "blockchain" is composed of blocks that hold records of transactions. These blocks are linked together in a chain-like structure through peer-to-peer connection nodes, forming a distributed database. This digital ledger requires a digital signature from the owner to authorize each transaction, which ensures the transaction's authenticity and protects it from any tampering. Therefore, the data stored in these digital ledgers is highly secure. The advantages of utilizing blockchain technology are:

  The advantages of utilizing block chain technology include:

  - Cryptographic keys
  - a type of computing that stores the transactions on the network.
  - a peer-to-peer network. [3]

  In the realm of cryptography, there are two types of keys: the public key and the private key. These keys are used by individuals to create a secure digital identity reference, known as a "digital signature," that is used to authenticate and control transactions. The digital signature is then combined with the blockchain, a peer-to-peer network in which multiple parties act as authorities and use the signature to agree on contracts and execute transactions. These transactions are then verified by mathematical algorithms to ensure their security. In Web 3.0, the blockchain will serve as a central component, allowing for a decentralized architecture. User data will be stored in anonymous blocks, which will prevent issues such as data privacy breaches.

- **Mining:** In the realm of research papers, the act of incorporating transactional data into the digital ledger is commonly known as "mining." Although this phrase is often linked to Bitcoin, it can also encompass alternative blockchain technologies. Mining entails the creation of a hash for each block transaction, which plays a crucial role in upholding the security of the entire blockchain network, thereby obviating the necessity for a centralized system.

- **Bitcoin:** Bitcoin is a digital currency that was created in January 2009 and is based on blockchain technology. The balances of Bitcoin transactions are kept on a public ledger that is accessible to everyone. Mining is used to computationally verify all Bitcoin transactions. Bitcoin is not owned or backed by any government, bank, or individual. Its popularity has led to the emergence of other cryptocurrencies, referred to as altcoins, and is commonly abbreviated as BTC. Bitcoin mining involves generating a new hash for a given transaction, which requires solving computationally difficult puzzles. Once a hash or block is generated, it is added to the blockchain. In the context of Web 3.0 systems, Bitcoin has the potential to become the next dominant currency.

- **Non-fungible tokens:** Non-fungible means something that is unique and cannot be replaced by something else. For instance, if you trade one Bitcoin for another, you are still getting the same thing, so Bitcoin is fungible. However, a non-fungible item, such

as a rare trading card, is always unique, and you will receive something unique in exchange for it. NFTs, or non-fungible tokens, are part of the Ethereum blockchain, which is a type of cryptocurrency like Bitcoin or Dogecoin. NFTs can represent any digital asset, such as paintings, songs, or music, but they are mostly associated with digital art. NFTs enable individuals to assert their ownership over exclusive digital assets, which can be tracked via the public ledger of Ethereum's blockchain. NFTs are covered by smart contracts that assign ownership to the NFTs. When someone creates an NFT, they execute code stored in smart contracts that conform to various standards, such as ERC-721. The data is incorporated into the blockchain that oversees the management of the NFT. NFTs will play a significant role in Web3.0 as the online world shifts from Web 2.0 to Web 3.0. NFTs will be used to maintain ownership of digital assets, and they will be the foundations of digital economics and assets. [4]

- **Artificial Intelligence:** Artificial intelligence (AI) is a computer science discipline that seeks to emulate human intelligence and behavior in machines. This field involves creating algorithms and models that can learn from data and make decisions autonomously. Machine learning, which is a subset of AI, pertains to programs that can improve their performance without explicit instructions by automatically learning from data. AI finds applications in various domains, such as image recognition systems, spam filters, self-driving cars, and others. With its potential to deliver personalized experiences, AI is anticipated to play a significant role in Web 3.0 systems.

Artificial intelligence, in the future, can play a crucial role in automated decision-making within decentralized systems, optimizing resource allocation, and enhancing efficiency. AI-based smart contract verification tools will ensure the correctness and reliability of smart contracts, mitigating risks and vulnerabilities. Moreover, AI will facilitate automated governance mechanisms, enabling decentralized autonomous organizations (DAOs) to make informed and efficient decisions.

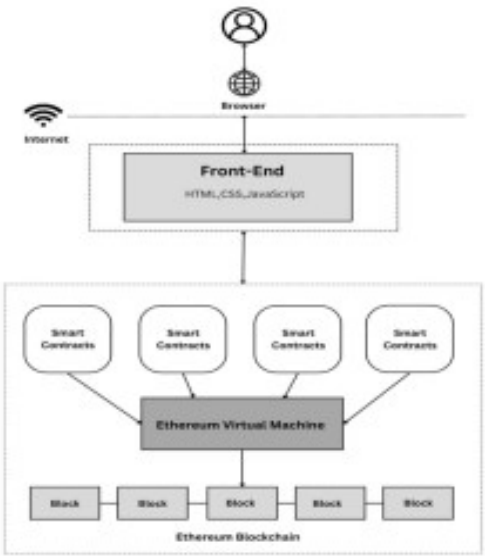

Figure 2: The Architecture of Web3 [6]

- **Internet of Things:** IoT refers to a network of interconnected computing devices that work together to solve problems. The "things" in IoT can be living or non-living and are associated with an internet protocol address to send and receive data over the internet. IoT systems are made up of web-enabled devices such as processors, sensors, and hardware devices that communicate with each other over the internet. These devices collect sensor data that is sent to a gateway or other edge device for local analysis. IoT devices can also communicate with other related devices and take actions based on the results without requiring human intervention.

  Examples of IoT devices include health trackers, smartwatches, farming devices, and home automation systems.

  Web 3.0 is characterized by the absence of middleware. This means that there is neither a central server responsible for managing the application logic nor a centralized database for storing the application state. Instead, decentralized state machines are built and maintained using blockchain technology, with anonymous nodes on the internet.

  A state machine is a type of machine that maintains a program's state for a given period as well as for future states. Blockchains are state machines that are initialized using a genesis state and operate under strict rules that govern how state changes can occur. The Ethereum blockchain is one example of a state machine that uses a peer-to-peer network of nodes to manage state changes. These state machines are designed so that anyone in the world can access and write to them. They are not owned or controlled by any individual, company, or entity but are instead collectively owned by everyone in the network.

  One significant advantage of this architecture is that no single individual or company owns or controls the decentralized state machine. Instead, it is collectively and anonymously maintained by everyone on the network. While data can be written to the blockchain, it cannot be updated by any one person or entity. Web 3.0 facilitates the development of intelligent agreements, known as smart contracts, which delineate the underlying principles of applications and are subsequently implemented on a decentralized state machine.

  The Ethereum blockchain serves as an exemplar of such a state machine, offering a platform for executing smart contracts that govern the dynamics of state modifications transpiring within the blockchain. Since smart contracts are scripted using high-level programming languages and stored on the Ethereum blockchain, the entire network enjoys the capacity to verify the application logic embedded within these smart contracts.

  Ethereum Virtual Machine (EVM) assumes the critical role of handling the computational operations within smart contracts and facilitating the execution of state modifications on a universally accessible state machine. Nevertheless, the EVM lacks the ability to interpret high level programming languages directly, necessitating the compilation of these languages into bytecode for seamless execution within the EVM environment. The front end component encompasses the user interface (UI) logic and

establishes communication with the backend application defined by smart contracts. The coordination between the front end and smart contracts is effectively managed through Ethereum providers.

IV. CONCLUSION

With the swift progress of technology, we are transitioning towards a new generation of web systems. With the emergence of technologies like blockchain, IoT, and AI, a new wave of the internet revolution is underway. Web 3.0 has the potential to offer users a superior digital experience and an enhanced version of the internet. If implemented effectively, Web 3.0 has the potential to solve many problems, not only boosting productivity but also saving time. As a result, we can anticipate an improved internet experience that will revolutionize the way users interact with the web.

REFERENCES

[1] Rajiv & Lal, Manohar. (2010). Web 3.0 in Education & Research. BVICAM's International Journal of Information Technology (BIJIT) ISSN 0973-5658. 3. 6.
[2] Naik, Umesha & Shivalingaiah, D. (2009). Comparative Study of Web 1.0, Web 2.0 and Web 3.0. 10.13140/2.1.2287.2961.
[3] https://www.dailyarticlespk.com/2022/09/what-is-blockchain-and-advantages-of.html
[4] https://www.linkedin.com/pulse/understanding-nfts-basics-remy-carpinito
[5] Bruwer, R. (Hendrik J., & Rudman, R. (2015). Web 3.0: Governance, Risks and Safeguards. Journal of Applied Business Research (JABR), 31(3), 1037–1056. https://doi.org/10.19030/jabr.v31i3.9241
[6] https://www.preethikasireddy.com/post/the-architecture-of-a-web-3-0-application

