WEB3 TECHNOLOGIES ADVANTAGES AND DIFFERENCES FROM WEB1, WEB2 TECHNOLOGIES

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K E Y W O R D S

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A B S T R A C T

This article analyzes Web3 technologies, their advantages and differences from previous generations of web technologies – Web1 and Web2. Web3 represents a new era of the Internet, which emphasizes decentralization, security and user control over data. The article discusses key aspects of Web3, such as blockchain, smart contracts and decentralized applications (dApps). It also discusses the disadvantages of Web1 and Web2, including a centralized structure and limited user control.

With the advancement of technology, the Internet has undergone several stages, each introducing significant changes that shaped new approaches to user-content interaction. The static web pages and limited interactions of Web1 gradually gave way to Web2, which brought dynamism, social networks, and user-generated content. However, growing concerns over privacy, data control, and centralized authorities have led to the emergence of a new model—Web3.

The evolution of web technologies has fundamentally transformed how humans communicate and exchange information online. Through the stages of Web1, Web2, and Web3, this process has become increasingly complex and multifaceted. Web1, characterized by static pages, positioned users as passive viewers. In contrast, Web2 introduced interactivity, social networks, and content creation capabilities, empowering users as active participants and creators. Today, Web3 technologies, driven by decentralization and blockchain, aim to enable true ownership and user control, offering novel possibilities. This article delves into the history and distinctions of web technologies while analyzing their future impact.

Since the beginning of time, growth and development—much like progression—have been inherent in everything. From a woodcutter chopping trees with an axe to a rower steering their boat, and even in a person finding food when hungry, progress has always been a constant over the years. It is this very progress that has led us to the modern technological era. Incredible inventions in science and technical tools have already become an integral part of our lives. The Internet is one such innovation, serving as an unparalleled means of fostering close connections between people across great distances.

The foundational principles of the Internet were first implemented in 1969 on ARPANET, a network created under the directive of the U.S. Defense Advanced Research Projects Agency (DARPA). Building on ARPANET's achievements, the U.S. National Science Foundation established NSFNET in 1984 to facilitate communication between universities and computing centers. Unlike the closed ARPANET, NSFNET was relatively open to connections, and by 1992, over 7,500 smaller networks—including 2,500 outside the U.S.—were linked to it. The transition of NSFNET's core network to commercial use marked the birth of the modern Internet.

Until the 1980s, computer networks were primarily accessible to specialized institutions employees. The advent of personal computers (PCs) during the 1980s spurred demand for networks,

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which previously relied on manual distribution of information. While specialists used networks for research and production tasks, the general public was more interested in personal communication and obtaining popular texts and other files for their PCs. The first mass network technology to address these needs was email, which became the basis for the creation of Usenet, the first large-scale global computer data-sharing network, in 1980.

Regarding file-sharing technologies, many options have been developed over the years, each with unique characteristics, methods, and protocols. However, the most widely used and straightforward option remains the Internet, designed with a few essential features. The Internet continually evolves to be user-friendly. Web developers aim to create machines capable of thinking like humans by integrating new tools, methods, and protocols into the modern Internet.

In summary, the web can be defined as a platform that facilitates the exchange of information, documents, and resources among users via the Internet. This perspective is highlighted in the work of Keshab Nath, Sourish Dhar, and Subhash Basishtha [1]. Moreover, the web serves as a pathway for transmitting data—such as text, images, audio, and video—from servers and displaying it to clients through browsers.

The earliest form of web applications (Web 1.0) emerged in 1989, developed by British scientist Tim Berners-Lee in the HTML format. The invention by Berners-Lee, known as the "Mesh" system, was designed to enable mutual information sharing among researchers at universities and institutes worldwide. However, this system allowed for only one-way access to information, restricting users to viewing data without the ability to process or update it. This invention laid the groundwork for the development of static websites.

Static websites were primarily designed to deliver information to users without interaction. Any updates to the content of these sites required a complete overhaul of the website's structure. This limitation underscored the unidirectional nature of Web 1.0, where the focus was on presenting information rather than enabling dynamic interaction.

Figure 1. Structure of Web 1.0

By the early 21st century, the world had become rich with inventions, and concepts surrounding the Internet began to expand significantly. This development gave rise to "Web 2.0," which evolved into the user-friendly and accessible Internet we know today. Web 2.0, the second generation of the Internet, was officially introduced to the public in 2004 by Dale Dougherty, Vice President of O'Reilly Media.

The second-generation Internet was more engaging for users compared to the first-generation web. Unlike the static, one-way communication of Web 1.0, Web 2.0 technologies allowed users not only to receive information but also to process and update it. During this period, passive users transformed into active participants, fostering collaboration, teamwork, and the emergence of dynamic content. AJAX (Asynchronous JavaScript and XML) technologies enabled data to be updated without requiring the entire page to reload.

Application Programming Interfaces (APIs) and **Mash-up** technologies further enhanced AJAX by providing sophisticated capabilities. These advancements allowed users not only to collect data from aggregated databases but also to organize and utilize the information as they desired. Applications such as Facebook, Twitter, Dropbox, YouTube, Yandex, and Spotify emerged as hallmark examples of this era.

As these programs evolved and attracted a growing number of users, the demand for substantial and efficient data storage systems increased. To address this challenge, "cloud technologies" became the most viable solution, offering a robust and

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scalable framework for handling vast amounts of information.

Technologies required for developing second-generation web technologies:

- AJAX (Asynchronous JavaScript and XML);
- RSS (Really Simple Syndication;
- CSS va HTML5;
- JavaScript framework (jQuery, React, Angular, e.t.c);
- REST (Representational State Transfer) APIs;
- JSON (JavaScript Pbject Notation);
- XML (eXtensible Markup Language);

Figure 2. Web 2.0 technologies

The era of Web 1.0 and Web 2.0 technologies gradually gave way to the emergence of **Web 3.0** technologies. Unlike the technologies used up until that point, Web 3.0 is based on the idea of decentralizing data, rather than aggregating all data in a central hub. The new iteration of the World Wide Web, which incorporates concepts like blockchain technologies and token-based economies, was introduced to the public in 2014 by Ethereum founder Gavin Wood.

Although Web 3.0 was introduced to the public in 2014, its main currency, the **Bitcoin** token, was created back in 2009. The Web 3.0 technology, which is built on decentralization and blockchain, also incorporates **semantic web** technology and integrates **artificial intelligence (AI)** and **machine learning**.

The main advantages of Web 3.0 technology are:

- *High data security*
- *Complete control over personal data for users*
- *Open and transparent platforms*
- *Peer-to-peer interactions without intermediaries*
- *Personalized experiences*

Despite being introduced only six years ago, this technology, which contrasts with older technologies, has gained immense popularity worldwide and has become one of the most widely adopted technologies today.

When discussing Web 3.0 technology, it's impossible not to mention **NFTs (Non-Fungible Tokens)**. NFTs are unique digital identifiers used in blockchain to confirm ownership and authenticity, which cannot be copied or divided. Initially presented as a new class of investment assets, a report from September 2023 highlighted that over 95% of NFT collections held no monetary value.

Anyone can create NFTs, and doing so requires little to no coding skills. NFTs typically include links to digital files such as artwork, photos, videos, and audio. Due to their unique identification, NFTs are distinct from volatile cryptocurrencies, which is why they are called **non-fungible tokens**.

Despite these numerous advantages, Web 3.0 is not without its drawbacks. Below are some of the challenges it faces:

Table 1.

Analytical table on the performance of 3 web technologies

Feature	Web 1.0	Web 2.0	Web 3.0
Primary Function	*Reading*	*Reading-Writing*	*Reading-Writing-Learning*
Control	*Centralized*	*Centralized*	*Decentralized*
Content Creation	*Static*	*Dynamic (UGC - User Generated Content)*	*Decentralized (dApps, DAOs)*
Data Ownership	*Website Owners*	*Platforms (Tech Giants)*	*Users (Blockchain Wallets)*

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Monetization	*Basic Advertising*	*Subscription, Data-Based Advertising*	*Tokens, DeFi, NFTs*
Security	*Low*	*Centralized Security*	*High (Cryptographic, Trustless)*
Trust Model	*Implicit Trust*	*Trust in Platforms*	*Trustless (Smart Contracts, Code)*

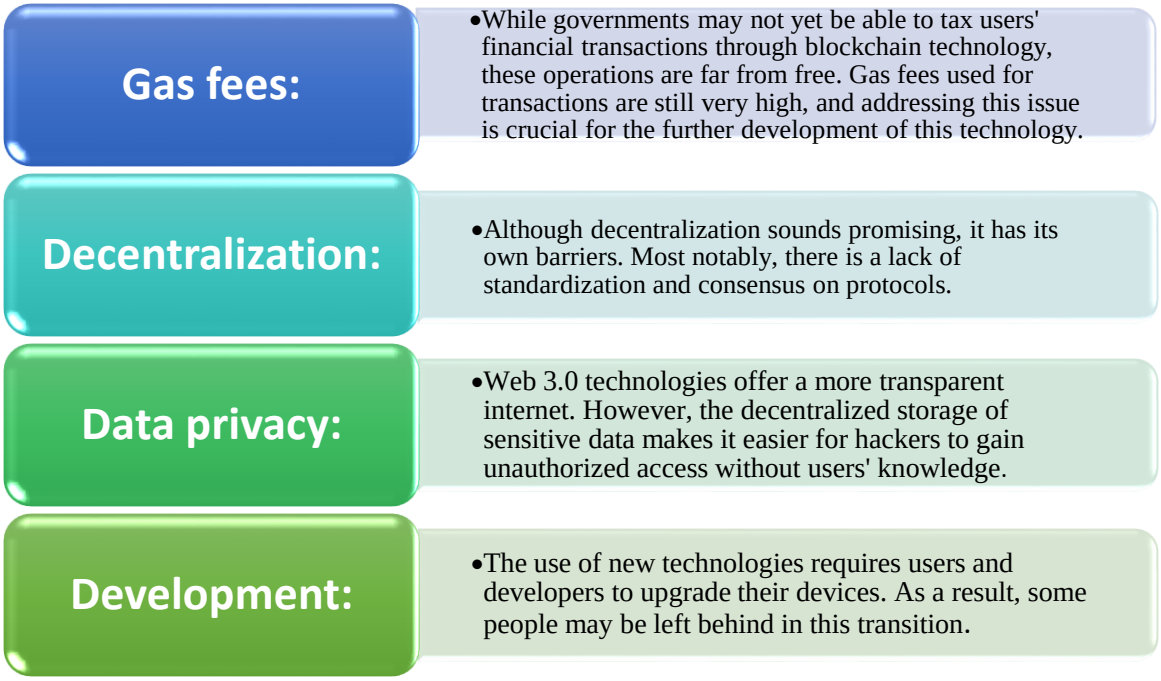

Figure 3. Disadvantages faced in web3 system

In conclusion, Web 3.0 represents a paradigm shift in internet technology, offering unprecedented user capabilities, security, and economic opportunities. Despite existing challenges, the advantages of decentralization, data ownership, and transparent systems position Web 3.0 as the foundation for the next generation of digital innovations.

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