What is Web 3.0 (Web3)? Definition, guide and history

September 2023

TechTarget

What if the web could conjure up exactly the information you needed in exactly the format you wanted -- before you knew enough to ask for it? This could someday be the reality of Web 3.0, the next version of the web. This guide provides answers to common questions and has hyperlinks to articles that go into depth about the business opportunities and risks. It also has detailed explanations of key Web 3.0 concepts, such as the effects of decentralization on web governance and data management, and what enterprises can do today to test the Web 3.0 waters.

TechTarget

What is Web 3.0 (Web3)? Definition, guide and history

DAVID ESSEX, INDUSTRY EDITOR; SEAN MICHAEL KERNER; ALEXANDER S. GILLIS, TECHNICAL WRITER AND EDITOR

What if the web could conjure up exactly the information you needed in exactly the format you wanted -- before you knew enough to ask for it?

It would certainly be a much different, maybe even desirable -- if a little creepy -- internet experience. Yet it could someday be the reality of Web 3.0, the next version of the web.

Thanks to the changes that proponents of Web 3.0 claim it will bring, the internet will be much smarter, because artificial intelligence will be ubiquitous. All the world's data will be unified in a so-called [Semantic Web](#). Everyday users will have more say than wealthy corporations about how their personal information is used. Banks will be irrelevant as people exchange digital currencies and records without intermediaries.

Whether Web 3.0 comes to pass, especially in the form currently envisioned, remains an open question. What's clear is that interest in Web 3.0 has never been higher. Enterprises are ready to learn enough about Web 3.0 to decide what actions to take, if any.

TechTarget

This guide provides answers to common questions and has hyperlinks to articles that go into depth about the business opportunities and risks. It also has detailed explanations of key Web 3.0 concepts, such as the effects of decentralization on web governance and data management, and what enterprises can do today to test the Web 3.0 waters.

WHAT IS WEB 3.0 (WEB3)?

Web 3.0 describes the next evolution of the [World Wide Web](#), the user interface that provides access to documents, applications and multimedia on the internet.

Web 3.0 is still being developed, so there isn't a universally accepted definition. Even the proper spelling isn't nailed down, with analyst firms like Forrester, Gartner and IDC toggling between "Web3" and "Web 3.0."

What is clear, though, is that Web 3.0 will place a strong emphasis on decentralized applications and probably make extensive use of [blockchain](#)-based technologies. It will also use machine learning and [AI](#) to empower a more intelligent and adaptive web.

TechTarget

EVOLUTION OF THE WEB

If it comes to pass, Web 3.0 will be the successor to two previous generations of the web.

The first generation, referred to as Web 1.0, was invented in 1989 by Tim Berners-Lee, a British computer scientist who applied the hypertext concepts for linking digital text proposed in 1963 by Ted Nelson, an American information technology pioneer. Besides programming the first browser, Berners-Lee wrote the Hypertext Markup Language (HTML), which tells browsers how to display content, as well as the Hypertext Transfer Protocol (HTTP) specifying how web servers transfer files to browsers. He also started designing software for a "Semantic Web" that would link data across web pages, but hardware constraints prevented its implementation.

The public was not much aware of the web until 1993 with the release of Mosaic, the first popular browser, later renamed Netscape Navigator. Similar user-friendly graphical browsers followed, including Microsoft Internet Explorer and, much later, Apple Safari. The first popular search engines -- familiar names like Yahoo! Search, Lycos and AltaVista -- arrived on the scene, but by 2004 Google had put many of them out of business.

Around the turn of the millennium, experts began promoting the idea of an upgraded web that would be more interactive, calling it Web 2.0. They started referring to the

TechTarget

existing web of basic connectivity to mostly static websites as *Web 1.0*. Berners-Lee fleshed out his Semantic Web concept by co-authoring an article in *Scientific American*. Publisher Tim O'Reilly helped promote Web 2.0 by starting a conference dedicated to it.

The dream of an interactive web came to fruition several years later with the skyrocketing popularity of social networks like Facebook. The World Wide Web Consortium, the web's standards body, released a Semantic Web standard. Around the same time, two essential Web 3.0 technologies were born: cryptocurrency and blockchain. Prominent journalists and technologists, including Gavin Wood, co-founder of Ethereum, a prominent blockchain platform, began to popularize the terms *Web 3.0* and *Web 3* to signify a decentralized, semantically aware version of the web.

TechTarget

The evolution of the web

The internet was a clunky network for techies, academics and governments until hyperlinked World Wide Web browsers made its content easy to read and search.

1963
Computing pioneer and philosopher **Ted Nelson** coins the term **hypertext** to describe text pages linked by hyperlinks.

1989
Referencing hypertext, computer scientist **Tim Berners-Lee** proposes a "universally linked information system" he later calls the World Wide Web.

The first internet service providers offer **dial-up connections** to the internet.

1993
Marc Andreessen and Eric Bina release **Mosaic**, the first popular browser. Its graphical user-friendliness sparks the early-90s internet boom.

Jonathan Fletcher creates **JumpStation**, a software robot that crawls, indexes and searches web content, the three core capabilities of search engines.

1995
Microsoft introduces **Internet Explorer** and bundles it with Windows, starting a browser war with Netscape. It eventually achieves dominant market share.

Yahoo! Search debuts, soon followed by popular search engines AltaVista, Excite, InfoSeek, Lycos and Magellan.

Sun Microsystems releases James Gosling's **Java programming language**, which comes to dominate development of apps running in browsers.

1999
Web designer **Darcy DiNucci** introduces the term *Web 2.0* to describe a new way of connecting applications and sharing content. The existing approach of mostly static web pages is increasingly referred to as *Web 1.0*.

2003
Apple releases **Safari**, the dominant browser on Apple devices.

2006
Developed by Harvard dropout **Mark Zuckerberg** as a social network for collegians, **Facebook** opens to the public. By 2010 it has half a billion users.

Journalist John Markoff uses the term **Web 3.0** in a *New York Times* article to describe a semantic web guided by common sense.

2014
Gavin Wood, co-founder of blockchain platform Ethereum, writes an influential blog post detailing Web 3.0.

1969
The U.S. Defense Department launches **ARPANET**, a decentralized, packet-switched network connecting military and research organizations. It uses TCP/IP, a key internet protocol.

1990
Berners-Lee writes the first web browser and server software and begins developing the **Hypertext Markup Language** (HTML), the standard for describing the contents and appearance of pages.

ARPANET is decommissioned. The internet now crosses continents.

1994
Berners-Lee founds the **World Wide Web Consortium**, the web's main standards organization.

Andreessen and Jim Clark found **Netscape**, releasing a Mosaic-based browser soon renamed Navigator.

1998
Netscape founds the predecessor to the nonprofit Mozilla Foundation, which develops **Firefox**, a popular open source browser released in 2004.

Larry Page and **Sergey Brin** found **Google** to commercialize a search engine they wrote as Stanford Ph.D. students. Google goes public in 2004, and a decade later is a Web 2.0 behemoth, dominating web search and advertising.

2001
Berners-Lee co-authors a *Scientific American* article, "The Semantic Web," elaborating on his 1989 vision for connected data that is a distinguishing feature of Web 3.0.

2004
Publisher **Tim O'Reilly** helps popularize Web 2.0 by starting a conference to highlight the emerging generation of interactive apps.

2008
"**Satoshi Nakamoto**," a pseudonymous person or group, publishes a paper describing bitcoin, the first cryptocurrency, and blockchain, the distributed ledger technology it runs on. Both become foundational to Web 3.0. A bust of Nakamoto is displayed in a park in Budapest.

2015
At MIT, **Berners-Lee** begins work on Solid, an open source Semantic Web stack not built on blockchain. He later founds Inrupt to commercialize the technology.

2021
Blockchain cryptocurrencies and **NFTs** go mainstream, metaverse hype takes off and Web 3.0 gets new life as a catchall for futuristic internet technology.

WHY IS WEB 3.0 IMPORTANT?

If decentralizing the web's architecture delivers even a portion of the benefits promised by Web 3.0 proponents, it could fundamentally alter how people interact on the web and how companies make money from goods and services.

Web 2.0 giants like Amazon, Google and Facebook parent Meta grew quickly by collecting and centralizing petabytes of customer data and monetizing it in myriad ways. Web 3.0's global peer-to-peer network could be the great leveler that makes it hard for such companies to grow by hoarding data. Individuals will have more control over web content and who can access and profit from their personal data.

[Web 3.0 business](#) opportunities, by contrast, are likely to center around exploiting this new ability to tailor web products and services to the individual. For example, [Web 3.0 marketing](#) capabilities could help companies strike a better balance between privacy and personalization than is possible with today's web. The downside: They may find Web 3.0's strong privacy protections a barrier to how they already do digital marketing.

The greater transparency provided by immutable blockchain ledgers could improve customer service, as both parties have access to the record of their transactions. Businesses could more easily monitor their supply chains by using decentralized apps to break down data silos and see suppliers' activities. Sharing real-time

TechTarget

information among supply chain participants could reduce shortages and speed up deliveries.

Web 3.0 is also important as the infrastructure for the metaverse, a proposed 3D virtual world in which digital representations of people, called *avatars*, interact and conduct business. The metaverse, like Web 3.0, doesn't exist yet, and it will likewise rely on blockchain or a comparable decentralized technology for its data infrastructure and finances, as well as on AI to make it more responsive to the wishes of users.

The metaverse and Web 3.0 are interdependent at the technical and conceptual levels and, therefore, likely to evolve in tandem. The metaverse probably won't come to pass until its Web 3.0 underpinnings are firmly established.

HOW WILL WEB 3.0 WORK?

In Web 1.0 and 2.0, HTML defined the layout and delivery of webpages. It will continue to be foundational in Web 3.0, but how it connects to data sources and where those data sources reside will probably be different.

Many websites and nearly all applications on Web 2.0 rely on some form of centralized database to deliver data and enable functions in applications. On Web

TechTarget

3.0, applications will instead use a decentralized blockchain that lacks an arbitrary central authority. In theory, this more democratic way of creating and affirming information will give users more control over the web and how their personal data is used.

Another [difference between Web 2.0 and 3.0](#) is that Web 3.0 will give AI and machine learning more prominent roles in delivering relevant content to each user, instead of content others have chosen to provide. While Web 2.0 essentially enables users to contribute to and sometimes collaborate on site content, Web 3.0 will most likely turn these jobs over to the Semantic Web and AI.

Web 3.0 will thus be more "intelligent" and responsive because data will be more logically organized in the Semantic Web structure that Berners-Lee envisioned for the first version of the web, and AI will be more adept at understanding it.

The decentralized autonomous organization ([DAO](#)), an emerging governance mechanism in today's blockchain and Web 3.0 communities, could also revolutionize management of the web by wresting control from central authorities and devolving it to self-governed digital communities.

And because Web 3.0 also fundamentally relies on [cryptocurrency](#) rather than government currency, financial transactions will be conducted on decentralized blockchains rather than through the current financial service companies.

TechTarget

Both Web 1.0 and Web 2.0 were primarily built with the [IPv4 addressing space](#). As a function of the web's massive growth over the decades, Web 3.0 will need far more internet addresses, which is what [IPv6](#) provides.

Web 2.0 vs. Web 3.0

Web 2.0	Web 3.0
Centralized Application delivery, cloud services and platforms are governed and operated by centralized authorities.	**Decentralized** Edge computing, peer-to-peer and distributed consensus increasingly become the norm in Web 3.0.
Fiat currency Payments and transactions occur with government-issued currency such as $USD.	**Cryptocurrency** Transactions can be funded with encrypted digital currencies such as Bitcoin and Ethereum.
Cookies Using cookies helps to track users and provide personalization.	**NFTs** Users can get unique tokens that are assigned value or provide some form of perk.
CSS and Ajax Web 2.0 is defined by layout technologies that provide more dynamic control than Web 1.0.	**AI** Smarter, autonomous technologies, including machine learning and AI, will define Web 3.0.
Relational databases Databases underpin the content and applications of Web 2.0.	**Blockchain** Web 3.0 makes use of blockchain immutable ledger technology.
Social networks Web 2.0 ushered in the era of social networking, including Facebook.	**Metaverse worlds** With Web 3.0, metaverse worlds will emerge to meld physical, virtual and augmented reality.

TechTarget

KEY WEB 3.0 FEATURES AND TECHNOLOGIES

Several key [Web 3.0 features](#) define what this third generation of the web will likely be all about:

- **Decentralized.** Unlike the first two generations of the web, where governance and applications were largely centralized, Web 3.0 will deliver applications and services through a distributed approach that doesn't depend on a central authority.

- **Blockchain-based.** [Blockchain decentralization](#) is the enabler for Web 3.0's distributed applications and services. With blockchain, data is managed and validated on a broadly distributed, peer-to-peer network. Blockchain also employs a theoretically immutable ledger of transactions and activity, which helps to verify authenticity and build trust among blockchain participants.

- **Cryptocurrency-enabled.** Cryptocurrency is a key feature of Web 3.0 that is expected to largely replace the "fiat currency" issued by government central banks.

- **Semantically organized.** The idea behind the Semantic Web is to categorize and store information in a way that helps "teach" an AI-based system what data means. Websites will be able to understand the words in search queries the same way a human would, enabling them to generate and share better content.

- **Autonomous and artificially intelligent.** More overall automation is a critical feature of Web 3.0, and it will largely be powered by AI. Websites equipped with AI will filter through and provide the data individual users need.

TechTarget

Centralized vs. decentralized blockchain

	Centralized	Decentralized
INFORMATION FLOW	To and from center	Multiple routes
DECISION-MAKING	Usually hierarchical	Democratic
CONTROL	Central entity	Software code
PROS	Simpler decision-making, less expensive hardware, more control	Immutability, transparency, member-owned
CONS	Single point of failure, trust issues, data silos	Anonymity for criminals, more expensive hardware, user conflict
EXAMPLES	Binance, Coinbase	Bitcoin, Ethereum

©2023 TECHTARGET. ALL RIGHTS RESERVED. TechTarget

WEB 3.0 USE CASES AND APPLICATIONS

[Web 3.0 use cases](#) are expected to draw heavily on the web's emerging, AI-driven ability to understand users' intentions and preferences and tailor the content it delivers to them based on personal data that the users control. Much of the content will be automatically curated and delivered, saving companies time and money.

TechTarget

With blockchain at its foundation, Web 3.0 will enable new applications and services based on blockchain technologies in active use today. They include the following:

- **NFTs.** Non-fungible tokens ([NFTs](#)) are a type of unique cryptographic asset used to create and authenticate ownership of digital assets. NFTs will be important in how things of value are created and exchanged on Web 3.0.

- **DeFi.** Decentralized finance ([DeFi](#)) is an emerging blockchain technology that could be the basis for Web 3.0's decentralized financial services.

- **Cryptocurrency.** Cryptocurrencies like Bitcoin are blockchain-based digital currencies that use cryptography to secure the processes involved in generating monetary units, conducting transactions and verifying changes of ownership. Crypto will be the Web 3.0 coin of the realm, according to supporters.

- **dApps.** Decentralized applications (dApps) are open source applications built on decentralized blockchains. They can be augmented by others, with a record of such changes recorded on the blockchain's distributed ledger. There are already dApps for middleware, charitable donations and social media platforms, among thousands of others.

- **Smart contracts.** A type of dApp, the [smart contract](#) is already the basis for emerging blockchain applications and is expected to play a central role in Web 3.0. Smart contracts execute business logic in response to events. They're program code, not contracts in the legal sense -- their legal status has yet to be determined in most jurisdictions -- but they're more responsive to changing

conditions than traditional contracts. They'll be powerful Web 3.0 mechanisms for blockchain users and apps to interact in trusted ways.

- **Cross-chain bridges.** Blockchains will be numerous in the Web 3.0 world, and enabling a degree of interoperability across them is the purpose of [cross-chain bridges](#).

- **DAOs.** DAOs could be the organizing entities that provide the structure and governance needed to make a decentralized approach to Web 3.0 services practical.

WHAT ARE THE POTENTIAL BENEFITS OF WEB 3.0?

[Web 3.0 advantages and disadvantages](#) are hard to state confidently because most Web 3.0 components are new or still on the drawing board -- all of them hyped by partisans who tend to leave out the downsides. Nevertheless, here are some of the benefits you can expect from a decentralized web governed by its users:

- **Control and privacy.** Users will grab back control of their online identity and data from central providers.

- **Transparency.** Web 3.0 will enable better visibility into transactions and decisions.

- **Resilience.** Applications delivered on decentralized networks are less vulnerable to single points of failure.

TechTarget

- **Predictive intelligence and personalization.** AI- and ML-enabled prediction and personalization will make the web more responsive to users.

- **Decentralized finance.** This will provide the ability to conduct transactions, including buying and selling products and services, as well as securing loans, without needing approval from intermediaries.

Coming to a screen near you

Anticipated Web 3.0 apps and benefits

More efficient and secure smart contracts automatically developed and updated as conditions change.

Increased data security and privacy of personal information due to decentralized networks and blockchain technology.

Better, more personalized advertising and highly targeted marketing to consumers due to AI and machine learning technologies.

Content automatically created and curated to be relevant to users and promote stronger customer experiences and brand loyalty.

Decentralized loyalty programs automatically issue unique offers enhanced by a physical item or digital experience.

Stronger online communities that offer members-only discounts and access to special product features and exclusive merchandise.

Sophisticated omnichannel experiences in which companies distribute content across different digital platforms and maintain a unified branding message.

More interactive, metaverse-like online experiences so consumers can immerse themselves in products before making a purchase.

ICONS: FONIKUM/GETTY IMAGES   ©2023 TECHTARGET, ALL RIGHTS RESERVED. TechTarget

WHAT ARE THE POTENTIAL CHALLENGES OF WEB 3.0?

Web 3.0 has serious potential drawbacks that enterprise leaders need to know about. They include the following:

- **Complexity.** Decentralized networks and smart contracts pose significant learning curves and management challenges for IT, not to mention everyday web users.

- **Security.** The complexity of these foundational technologies makes [Web 3.0 security](#) a real challenge. Smart contracts have been hacked, and security incidents on blockchains and cryptocurrency exchanges make national news.

- **Regulatory concerns.** The lack of a central authority means the regulatory and compliance regimes that help keep online commerce and other web activities safe for users are ineffective or nonexistent.

- **Technical requirements.** Blockchains and dApps are often resource intensive and require expensive hardware upgrades, in addition to the environmental and monetary costs of their energy use.

Technology selection could be another challenge for companies trying to develop Web 3.0 applications, as tools for blockchain, cryptocurrency, NFTs and smart contracts proliferate. There's also an alternative decentralized data technology called Solid proposed by none other than Berners-Lee, the web's inventor. He says blockchains are too slow, expensive and public to be viable data stores for personal information, and he founded a company, Inrupt, to commercialize Solid.

TechTarget

WHEN WILL WEB 3.0 BE RELEASED?

Much of Web 3.0 is already here, since blockchain and its applications are increasingly becoming a reality. Still, it took over 10 years to transition from Web 1.0 to Web 2.0, and most observers expect it to take just as long, if not longer, to fully implement and reshape the web into Web 3.0.

Some of the [Web. 3.0 trends](#) that have been on experts' radars for a few years are bearing fruit. Tokenization of web assets is already happening. Gartner predicts that 25% of businesses will have decentralized apps by 2024 but will wrap them inside centralized applications. Social media companies, notably Meta, are beginning to offer metaverse content created by users. Major brands including Starbucks and the NBA have started offering NFTs.

Separate *semantic webs* have been around for years in the search engine optimization that websites use to structure information so that search engines like Google can scan and summarize their pages more accurately. Semantic webs are often geared to specific categories or functions, such as products or employee skills, to help narrow the task of cataloging words.

Web 2.0 heavyweights, including Google, Meta and Microsoft, recently added blockchain features to some of their products and labeled them "Web 3.0," perhaps to capitalize on the Web 3.0 hype.

TechTarget

Nonetheless, predictions about Web 3.0's arrival are notoriously unreliable. Some optimists expected it to be here 15 years ago. Given that its core technologies are still emerging and just becoming practical, Web 3.0 is probably at least a decade off -- a view largely confirmed by industry analysts.

HOW CAN YOU PREPARE FOR WEB 3.0?

The best way to get ready for Web 3.0 is first to acquire a basic understanding of its core technologies, and then to get experience working with longtime web development languages such as JavaScript, but also Rust, a newer language that is becoming popular for Web 3.0 projects. Also, it's important to get familiar with the top [blockchain platforms](#), including Ethereum, Hyperledger Fabric and IBM Blockchain. Front-end development, such as user experience and dApps design, is expected to be among the important [Web 3.0 skills](#).

In addition, [Web 3.0 tools](#) for developing most of the key components are available and growing in popularity. For example, Alchemy, Chainstack and OpenZeppelin help developers build blockchain dApps, [cryptocurrency wallets](#) and NFTs, while tools like Chainlink and Fluree are geared to integration and [data management](#). Others, including Casper, Ethernal and Solidity, focus on smart contract development.

TechTarget

The heavy lifting that is so clearly needed to construct something as huge as Web 3.0 could turn out to be a communal effort spread across millions of contributors. If everyone does their part, the future of the internet could finally look more like the symbiosis between people and the global digital "brain" of collective knowledge that visionaries like Nelson and Berners-Lee had in mind.

MORE WEB 3.0 FAQS

Below are some frequently asked questions people have about Web 3.0.

IS WEB 3.0 THE SAME THING AS THE SEMANTIC WEB?
The Semantic Web is one of Web 3.0's essential pieces because it's what makes the meaning of web content and user commands comprehensible to AI, which in turn drives the greater responsiveness and personalization that are key Web 3.0 benefits. However, Web 3.0 requires other technical underpinnings besides the Semantic Web -- in particular, blockchain.

IS WEB 3.0 THE SAME AS THE METAVERSE?
You can think of the metaverse as a user experience supercharged with 3D augmented and virtual reality that turns the internet into a single, shared virtual space, enabling people to do things that aren't possible in the physical world. The metaverse will require blockchain, the most important part of Web 3.0, to decentralize and secure its digital content and tokenize assets. Web 3.0 could, in theory, exist

TechTarget

before the metaverse, but the opposite is unlikely. For a single, virtual world -- a metaverse -- to be created, Web 3.0 will need to replace the fundamental infrastructure of today's web, or at least major parts of it.

HOW ARE WEB 3.0 AND BLOCKCHAIN RELATED?
Blockchains are the basic infrastructure for Web 3.0's decentralized data model. Blockchain-based technologies -- especially cryptocurrencies, dApps, NFTs and smart contracts -- are expected to play major roles in Web 3.0's highly distributed, more personalized web experience.

WHO CREATED WEB 3.0?
No one person or organization came up with the idea or the technical components. If you had to name one, it would be Tim Berners-Lee, who invented the World Wide Web and has strongly advocated for the Semantic Web, a key differentiator of Web 3.0 from previous generations. However, the creators of blockchain and the technologies that run on it -- cryptocurrency, smart contracts and DAOs -- as well as the nonprofits and companies that are commercializing blockchain, also deserve credit for building the pieces that, if they come to dominate the internet, will mean Web 3.0 has effectively arrived.

CAN WEB 3.0 BE HACKED?
Despite the extreme claims of blockchain "true believers," major blockchains and cryptocurrencies have suffered occasional hacks. There's little reason to believe that

when it finally comes along, Web 3.0 won't also be vulnerable, since blockchain is the most important piece in its foundation.

WHAT ARE WEB 3.0 CRYPTO COINS?

Web 3.0 coins will be the same coins as Web 3.0's underlying cryptocurrencies, such as Bitcoin and Dogecoin, which are already in use.

HOW CAN YOU INVEST IN WEB 3.0?

An obvious, well-trod first step is to invest in one of the better-known cryptocurrencies. Few of the vendors that specialize in Web 3.0 technology are publicly traded, but a handful of exchange-traded funds (ETFs) have emerged to group the stocks of Web 3.0 companies in a single fund for investors to buy into. There are also ETFs and mutual funds that bundle cryptocurrencies. It's early to consider more established companies like Google and Meta as direct Web 3.0 investments, since their Web 3.0 efforts are a small fraction of their businesses, but that could [soon change](#).

David Essex is an industry editor who covers enterprise applications, emerging technology and market trends, and creates in-depth content for several TechTarget websites.

Sean Michael Kerner is an IT consultant, technology enthusiast and tinkerer. He has pulled Token Ring, configured NetWare and has been known to compile his own

TechTarget

Linux kernel. He consults with industry and media organizations on technology issues.

Alexander Gillis is a technical writer for the WhatIs team at TechTarget.

▼   **CONTINUED READING**

- **Web 2.0 vs. Web 3.0 vs. Web 1.0: What's the difference?**

- **Core features of Web 3.0 technology**

- **Top Web 3.0 use cases and examples**

TechTarget