

Shaping Web 4.0

Bitkom's Feedback to the European Commission's Survey »Shape Web 4.0. Virtual worlds & Web 4.0 governance«

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Why are the topics of virtual worlds and Web 4.0 governance relevant to you?

We view Virtual Worlds and Web 4.0 as the next evolutionary stage of the Internet. As the German digital association Bitkom, we are committed to supporting and promoting the development towards Web 4.0. To this end, the [metaverse forum by bitkom](#) brings together providers of software, services, hardware and infrastructure from the Web 4.0 sector as well as companies that are using these technologies.

What does Web 4.0 mean for you? What are the key functions, benefits and pitfalls of Web 4.0 that you foresee?

Web 4.0, sometimes referred to as the Metaverse or virtual worlds, is a 3D extension of today's internet. It is not a completely new technology, but brings together existing technologies – from AI, digital twins and blockchain to Augmented, Mixed and Virtual Reality. Bringing these technologies together opens up new potential.

The central feature of Web 4.0 is the merging of real and virtual worlds. Devices can understand and interpret our surroundings and provide us with additional information. Virtual content can also be displayed realistically in our environment. Real machines, entire factories and buildings have virtual digital twins that are linked to their real counterparts in real time.

The link between the real world and the virtual world has two further essential characteristics of Web 4.0: it needs to run in real time and be persistent.

It is also central to Web 4.0 that it is designed to be interoperable. In its ideal conception, it should not consist of many interoperable applications, but rather be a common, permeable Web 4.0.

To date, Web 4.0 is still a vision; it does not yet exist. There are still technological challenges to overcome on the way to Web 4.0. One key challenge is the issue of interoperability – although this is a challenge that is currently being worked on intensively. Another challenge is that both the design and operation of Web 4.0 are still

complicated and unfamiliar to many. The added value of Web 4.0 also remains hidden to many.

Especially in the private and social media area of Web 4.0, there is still a lack of clear rules. It still needs to be clarified, for example, what constitutes an insult, how it should be dealt with and who is responsible for penalising it.

Data ownership is another challenge. This raises questions such as: Who owns the data, what information is passed on? How are classified/confidential data components handled (e. g. federal information that may not leave air-gapped data-centers, or should not be modified when consumed by other parts of a data-pipeline).

A fundamental challenge – similar to today's Internet – is the question of who is responsible for what in a global Web 4.0. This starts with international data transfers and extends to the question of where business actually takes place in a Web 4.0 purchasing process.

Similar to today's Internet, but possibly even more pressing, is the issue of secure digital identities in Web 4.0. For many transactions, products and services, it will be necessary to identify oneself securely and unambiguously. At the same time, however, it must be ensured that other parts of Web 4.0 can be used anonymously.

However, despite these challenges and although the ideal Web 4.0 does not yet exist, some of its components and individual precursor solutions can already be used productively. They are already providing great benefits. Similar to today's Internet, Web 4.0 is beneficial for very different areas of application in various sectors: from training and education to collaboration, marketing, events, trade fairs, sales and industry. Here are a few examples of the opportunities opened up by Web 4.0:

In industry, companies can save time, resources and costs by using virtual prototypes of products or factories before a physical product is manufactured or a physical factory is realised. Individual factories are already being tested and optimised virtually before construction has even started. And future employees can already be trained virtually.

Take collaboration and inclusion, for example: Web 4.0 enables employees to collaborate and share ideas in real time, regardless of their physical location. This can also help to revitalise rural areas and ease the housing shortage in cities if people from small communities are better able to work virtually in offices and factories in urban centres. Web 4.0 also offers opportunities for inclusion, as it makes physical barriers more overcomeable and enables people with physical disabilities to better participate in work and leisure life.

Take the ageing population as an example: In the private sphere, Web 4.0 gives the elderly the chance to stay in more direct and emotional contact with children and grandchildren living far away. In the business environment, it offers the opportunity to preserve the knowledge of experienced employees who are retiring and make it accessible to younger people.

Another example is the democratisation of data and knowledge: In an accessible, interoperable Web 4.0, all users have access to a wealth of data and knowledge. This is easily accessible and can be visualised in a lifelike way. For the first time, thanks to Web

4.0, people also have the opportunity to transfer their field of view and share it with others. This makes it easier to convey emotions.

Take sustainability, for example: It's not just factories and buildings that can be planned and operated more sustainably thanks to Web 4.0 (see above). Business trips and commutes can also be reduced thanks to Web 4.0. In addition, when shopping online, returns can be reduced and Web 4.0 technologies such as Augmented Reality can be used to visualise clothing, shoes or furniture in their original size and realistic appearance before purchasing.

The immersive and interactive features of virtual worlds are among the main drivers of the evolution of the internet towards Web 4.0. Which of the following trends, in your opinion, will have the biggest impact on the transition of the internet to Web 4.0? Please select up to 5 top trends.

- Integration of advanced technologies to enable a seamless and immersive experience**
- Emergence of new digital assets and Web 4.0 business models**
- Increasing power concentration with few dominant players driving the development toward Web 4.0 and virtual worlds
- Diverging attitudes and trust toward emerging technologies (ranging from enthusiasts to techno-sceptics)**
- Varied approaches to government intervention in virtual worlds and Web 4.0
- Changing social norms and behaviours with regard to virtual worlds and Web 4.0
- Rising geopolitical tensions and the emergence of new forms of hybrid and cyber aggression
- Advancement of blockchain technologies
- Increasing accessibility and maturity of immersive technologies, such as AR/VR**
- Prevalence of virtual private networks that bypass the public internet
- Advancements in connectivity (e. g., 5G/6G) driving the adoption of Web 4.0 applications**
- Other, please specify

Which Web 4.0 technology clusters are the most critical to the evolution toward Web 4.0 and virtual worlds? Please select the top 3.

- AI and natural language processing (NLP)**
- Spatial computing
- Internet of things (IoT) and ambient intelligence**
- Edge, cloud, and fog computing
- Next generation networks, 5G, and 6G
- Blockchain and distributed ledger technologies, DAO, and NFT
- Semantic web (Web 3.0)
- Brain-computer interface (BCI)
- Quantum computing
- Virtual reality (VR) & augmented reality (AR)**
- Multisensory modalities (including haptics)
- Cybersecurity technologies
- Internet protocols and routing strategies
- Other, please specify

On the one hand, generative AI is primarily used to create new and original content, such as images, texts, music or virtual environments. Time-consuming processes such as the creation of assets, the design of experiences and the execution of tests are accelerated. On the other hand, it lays the foundation for essential functionalities through the preparation and structured querying of data. AI can recognise speech and gestures to enable natural interactions. Users can give commands, ask questions or interact with their environment. Web 4.0 serves as a front end to give AI-powered chatbots and non-player characters (NPCs) an immersive appearance. This gives users the opportunity to talk to virtual characters, obtain information or fulfil quests.

A central aspect of Web 4.0 is the linking of the real world and the virtual world. This requires devices, machines and buildings with their live data to be integrated into Web 4.0. It is also crucial that devices can understand and interpret the environment. This is why IoT and ambient intelligence are so important.

AR and VR are key access technologies for Web 4.0. Although many Web 4.0 applications also work without AR and VR, they enable complete immersion and the enhancement of the real world with virtual content. This is essential for linking the real world and the virtual world in Web 4.0.

Which of the below are the most challenging to achieve in the transition to Web 4.0, given the current internet architecture? Please select up to 5 top challenges.

- Achieving scalability to handle exponentially growing traffic**
- Ensuring interoperability between technologies and platforms**
- Enhancing security and trust**
- Strengthening privacy
- Ensuring sustainable and efficient resource usage in technology development
- Delivering a secure and user-centric online identity framework**
- Achieving data processing capabilities to enable seamless experiences**
- Deploying the latest generation communication protocols and advanced connectivity standards
- Leveraging distributed technologies to advance application decentralisation
- Achieving real-time data transmission capabilities for immersive technologies
- Strengthening network resilience
- Other, please specify

A central idea of Web 4.0 is interoperability. It should not consist of self-contained individual applications, but should be interoperable and permeable. Both end users and companies should be able to use their data, avatars and assets anywhere in Web 4.0. Only then will Web 4.0 realise its great added value. Efforts still need to be made on the way there, even if there are initial important developments towards interoperability.

Security and trust are already key challenges in today's Internet. Even though great progress has been made in this area in recent decades, they remain a challenge. Especially in a Web 4.0 that closely links the physical world and the virtual world. This is the same reason why a user-centred online identity framework is so important. For many transactions and services, it will be necessary to identify oneself securely and unambiguously. At the same time, however, it must be ensured that other parts of Web 4.0 can be used anonymously. Reliable solutions must be found for this.

As with today's Internet, it is important to be able to cope with the growing data streams. The past – in video streaming, for example – has shown that the amount of data transmitted per stream can be reduced by using optimised codecs. However, as more and more users make use of the option to stream, the overall traffic naturally increases. This will also be the case in Web 4.0 and especially in virtual worlds.

Please indicate to what extent you agree or disagree with the following statements on the transition to Web 4.0.

	Fully disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Fully agree	No Opinion
The TCP/IP stack and its underlying principles should be maintained to ensure continuity and stability				x		
The distributed nature of the internet should be preserved to ensure resilience and performance					x	
New concepts and protocols enabling Web 4.0 should promote openness and neutral access					x	
New concepts and protocols enabling Web 4.0 should promote universal accessibility, including in low-bandwidth conditions					x	
Network management and interactions in the development of Web 4.0 should be transparent					x	
Environmental sustainability should be a core consideration in Web 4.0 infrastructure development					x	
Ease of deployment should be prioritised when introducing new features, such as APIs and protocols				x		
Web 4.0 standards and protocols should be developed through a consensus-driven, inclusive, and multi-stakeholder process					x	
Enter another option						

What are the key steps that need to be taken to facilitate the transition to Web 4.0 in multi-stakeholder settings?

Explain Web 4.0: Citizens are still unfamiliar with the concept of Web 4.0 or Virtual Worlds/Metaverse. Often it also evokes fears, influenced by dystopian literature or movies. For example, 63 per cent of Germans aged 16 and over are afraid that the Metaverse (Web 4.0) will create a virtual parallel world. And this despite the fact that the aim of Web 4.0 is to better connect the real world and the virtual world. 66 per cent state that it will be even more difficult to find out who you are actually dealing with. Education, training and qualification are therefore necessary: To make the EU a leading and central actor in the development Web 4.0, a coordinated education and information campaign on Web 4.0 would be desirable.

Build on existing regulations, do not create a new Lex Web 4.0: We share the view that the EU already has a strong legal framework to address potential impacts of virtual worlds on aspects such as competition, cybersecurity, artistic creation, data protection and consumer protection. This should be built upon as we move into Web 4.0. It can then be observed whether the existing legal framework (for example the General Data Protection Regulation, Digital Services Act, Digital Markets Act, Net Neutrality Regulation and the Unfair Commercial Practices Directive) is fit for purpose. If not, it could then be adapted in a targeted manner. We therefore reject a new fundamental Web 4.0 regulation or a kind of Lex Web 4.0. Moreover, an all-encompassing Web 4.0 regulation could hardly do justice to all the very different Web 4.0 use cases from the areas of consumer, enterprise and industrial Web 4.0. In particular, B2B use cases of the industrial Web 4.0, for example, must be considered differently than B2C use cases of the consumer Web 4.0. A regulatory approach that is oriented towards the B2C environment could hinder B2B use cases – i.e., precisely those use cases where Europe has a particularly good starting position.

Dismantle regulations that hinder the development of Web 4.0: The Web 4.0 will be built on the basis of a continuous development of various existing technological building blocks. For this reason, the development of Web 4.0 must be supported by a critical review of existing regulations rather than implementing new ones. Regulations that make the use of Web 4.0 applications impossible or difficult must be identified and dismantled. This is the case, for example, if existing regulations prevent remote training or remote counselling respectively training and counselling in virtual worlds, or if a strict written form requirement stands in the way of the digital conclusion of contracts. In case rule sets are deemed unavoidable: enable the stakeholders to create technical rules through the existing institutions creating specifications and standards, instead of enforcing inhibiting laws.

Create clarity on potentially unresolved legal issues: The use of photo sensors and cameras in devices for augmented applications, such as remote maintenance in public spaces, is a challenge. Legislators and regulators should create practicable framework conditions in good time. As digital versions of analogue goods exist in the industrial sector of Web 4.0, the question also arises as to the transferability of intellectual property and personal rights (e. g. right to a name, right to one's own image) to virtual replicas. The validity of property rights and personal rights in Web 4.0 must therefore be clarified.

Create clarity for digital identities: For many transactions, products and services, it will be necessary to identify oneself securely and unambiguously. At the same time, however, it must be ensured that other parts of Web 4.0 can be used anonymously. Reliable solutions need to be found for this.

Create clarity in data ownership: It is important to clarify what happens to the data in Web 4.0, who has a right to it, how it can be ensured that data cannot be duplicated without authorisation and that data can be transferred securely.

Build on existing standards and specifications: When setting up Web 4.0, it is essential to build on existing standards and specifications and not to confuse actors by reinventing the wheel. In many cases, established solutions already exist in the areas of Augmented and Virtual Reality, 3D data, but also Industry 4.0. Forums such as the Metaverse Standards Forum or the European and International Standardization Bodies are already established places where Web 4.0 stakeholders work together to make standards fruitful for Web 4.0. When it comes to creating new standards for Web 4.0, unilateral European approaches should be avoided. Instead, it is important to support international approaches such as the Joint Standardisation Evaluation Group for the Metaverse of ISO and IEC and to secure the European vision of an interoperable Web 4.0 within its framework. The ISO and IEC structures, for example, enable participation of all stakeholders, increasing legitimacy, trust, and related adoption. The past has shown that successful standards have usually emerged bottom-up, from industry and users.

Think global: Like today's internet, the future Web 4.0 or virtual worlds will not be limited to the EU. Global data transfers will be an integral part of it. Therefore, international data transfers must be legally secure. A logic according to which Web-4.0-related data needs to be stored only in Europe will not be possible to implement. Current discussions for international data transfers in the Data Act and the well-known hurdles the GDPR put in place for global data flows need to be kept in mind – a functioning Web 4.0 will need a legally secure framework in the future for global data flows, data processing and data storage.

Create protected experimental spaces in which Web 4.0 can be tried out. The freedom of such spaces can make a significant contribution to the further development of Web 4.0 in Europe and to shaping it in line with European values and ideas. They can also help to accelerate the development of Web 4.0 in Europe and prevent it from falling behind internationally.

What foundational values and principles should underpin the governance of virtual worlds and Web 4.0? Please select up to 5 principles that you think are most important.

- Transparency and accountability in decision-making**
- Inclusivity and representation of all stakeholders
- Protection of privacy, data security, and user rights**
- Ethical use of technology and respect for human rights**
- Fair competition and prevention of monopolies
- Global coordination and alignment across jurisdictions
- Safeguarding users' rights in virtual economies and the monetisation of virtual goods**
- Freedom of expression and protection from harassment
- Fostering innovation and new business opportunities**
- Efficiency in the provision of massive energy consuming services (environmental focus)
- Other, please specify

Web 4.0 will no more be a virtual parallel world than the Internet is today – in fact, it will be even less so: it will link the real world and the virtual world. In this respect, it is crucial that the same values and protection mechanisms apply in it as in our real world. It is important to protect privacy, data security and user rights and to ensure ethical use. At the same time, however, the protection of these core values must not lead to innovation and new business models being hindered. We in Europe should seize the opportunity to shape Web 4.0 from the outset. Only then will we have a chance of safeguarding European values. If, on the other hand, we resist change, other players will build Web 4.0 without taking European considerations and values into account.

As Web 4.0 evolves, how challenging do you expect the following governance and ethical issues to be in managing virtual worlds and their integration with real-world systems?

	Not challenging at all	Slightly challenging	Moderately challenging	Very challenging	Extremely challenging	No opinion
Privacy and data security risks					x	
Difficulties in integrating digital and physical spaces				x		
Obstacles to ensuring interoperability between platforms				x		
Ethical concerns related to the use of virtual worlds				x		
Ensuring inclusivity and equitable access			x			
Managing digital identity and representation				x		
Intellectual property rights protection				x		
Legal jurisdiction and enforcement			x			
Enter another option						

In many areas of Web 4.0, we can draw on our decades of experience with the Internet. Challenges that have already been mastered do not all have to be overcome again. Nevertheless, the new possibilities of Web 4.0 raise some new questions. Privacy and data security remain a major challenge, especially if Web 4.0 links the physical world and the virtual world even more closely than today's Internet. This linking of the real and physical worlds poses the challenge of connecting them seamlessly and in real time. Productively, efficiently and securely.

As Web 4.0 thrives on interoperability, barriers to data permeability still need to be removed and interoperability between applications established. Efforts still need to be made to achieve this, even if there are initial important developments in the direction of interoperability.

Reflecting on the above challenges, how suitable are the current internet governance mechanisms for future virtual worlds and Web 4.0?

- Current mechanisms are adequate to deal with virtual worlds and Web 4.0
- Current mechanisms are adequate but need to be adjusted to deal with virtual worlds and Web 4.0**
- Completely new governance mechanisms are needed to address virtual worlds and Web 4.0

With the above challenges in mind, what adjustments are needed to the current internet governance mechanisms for a successful transition to virtual worlds and Web 4.0? Please select the top 3 areas where improvements are necessary.

- Better definition of roles and responsibilities among stakeholders
- Increased representation of key stakeholders in decision-making processes
- Enhanced technical expertise in governance bodies
- Greater flexibility to adapt to rapidly advancing technologies and changing circumstances**
- Greater accountability for long-term implications and sustainability of outcomes
- Improved global coordination and collaboration across governance structures**
- Stronger emphasis on protecting users' rights and privacy
- Streamlined regulatory environment to foster innovation**
- Other, please specify

In relation to the top three areas of improvement you selected, what should change in the internet governance model to make it fit for the transition to virtual worlds and Web 4.0?

In general, we are of the opinion that the current Internet governance mechanisms are largely sufficient to cover Web 4.0 issues. They should be used as a starting point.

During the development of Web 4.0, it can then be evaluated whether they are fit for purpose. If not, it could then be adapted in a targeted manner.

For Europe to be able to act sovereignly in virtual worlds, it must help shape them from the outset and also make up for the shortcomings of recent years in digitalisation. It should be in Europe's interest to play an active role in the development of virtual worlds through innovation partnerships and interoperability. The aim should therefore not be regulation, but active international cooperation in favour of openness, standards and interoperability.

How can stakeholders (users, governments, private sector, technical sector, small businesses, civil society, the public) be adequately represented in internet governance processes? Please select up to 5 most important elements.

- Open and inclusive consultation processes for all stakeholders, regardless of expertise or background**
- Capacity-building initiatives to provide underrepresented stakeholders with the necessary skills, resources, and information
- Enhanced coordination between discussions to prevent overlaps, fragmentation, and siloed efforts
- Transparent mechanisms showing how stakeholder input is incorporated into decisions**
- Shared responsibility among all stakeholders for the outcomes of the discussions
- Recognition of the importance of diverse viewpoints and the value they bring to decision-making**
- Robust conflict resolution mechanisms for addressing disagreements among stakeholders**
- Processes governed by the rule of law, upholding human rights, constitutional principles, and legal frameworks
- Adaptable processes that can respond to changing technological, geopolitical, and emerging issues
- Fair and equitable discussions that address the distinct needs, capacities, and vulnerabilities of all stakeholders**
- Other, please specify

Looking from the user perspective, how could users' rights (e. g. privacy and data protection, universal access, freedom of expression) change or evolve in Web 4.0 and virtual worlds?

As with today's internet, data security and data protection must be guaranteed. Decades of experience can now be drawn on here, which also applies to Web 4.0.

A new dimension will be that users will be able to interact with each other much more directly than is the case on today's Internet. Contact will not only be made via text, photos and recorded videos, but live in real time. This brings virtual interaction closer to real communication. What is said live in a specific situation, gestures and facial expressions also become more central in the online sphere, creating presence. On the one hand, this creates more closeness, empathy and compassion. On the other hand, there will also be harassment and threats in the virtual world. In response to this, most providers of social VR platforms have already taken measures. For example, users can define protected zones around themselves respectively their avatars that other avatars cannot enter or that are only accessible to friends.

In general, we can draw on many years of experience with Web 2.0 when it comes to rules of conduct, appropriate behaviour and freedom of expression. Unlike at the beginning of Web 2.0, we are in the fortunate position of not having to make all the same mistakes again when it comes to privacy and data protection, universal access and freedom of expression.

As far as accessibility to Web 4.0 is concerned, there are no fundamental differences to the previous Internet. Web 4.0 will also be usable with familiar and widespread devices such as smartphones, tablets, PCs and notebooks. Web 4.0 does not necessarily require new devices. Even Augmented Reality can be experienced with smartphones and tablets.

In terms of freedom of expression, Web 4.0 will be a decisive step closer to our real world. Not only text, images and video will be available as forms of expression, but also complete movement, natural facial expressions and natural gestures, including dance and ballet.

Are you aware of any existing initiatives or practices that are pertinent to the development of virtual worlds and Web 4.0 governance? These can be local, national or international. Examples include coordination mechanisms, voluntary or mandatory obligations in relation to virtual worlds or Web 4.0.

<https://xrsi.org/https://metaversesafetyweek.org/>

<https://www.digitalfinland.org/>

metaverse forum by bitkom <https://forum-metaverse.de/>

Focus Group »Immersive Technologies« of the OECD Global Forum on Technologies
<https://www.oecd.org/en/networks/global-forum-on-technology.html>

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