

Comparative analysis of artificial intelligence regulatory concepts

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Abstract. The emergence and explosive growth of artificial intelligence has undoubtedly been the most significant technological phenomenon of recent years. Although the technology has recently come to the spotlight, we are not necessarily talking about a new technology, but rather about the proliferation of new uses of a technology that was already established. Artificial intelligence as a technology has been with us for decades. The theoretical foundations were already laid in the 1950s, but it is only through virtual assistants in the 2010s that the general public has been introduced to it on a large scale. The real breakthrough came with the introduction and general availability of Generative AI in the 2020s. Today, we have reached the point where it is no longer possible to tell whether a text, an image or even a video is ‘real’ or generated by AI. This has led to a situation in which we have to ask ourselves from time to time what information we can trust and what we can regard as authentic. It could also be said that, from time to time, we are forced to question the reality that surrounds us – or at least the range of phenomena that we accept as reality.

This proliferation of artificial intelligence in everyday life poses serious challenges for national and supranational regulators. Regulation of a new technology must focus not only on the fundamental challenges of the technology, but also on its actual use. In the case of artificial intelligence, it is the diversity of uses and the constant changes in actual use that pose the greatest challenge. In our study, we seek to explore the legal challenges that the spread of generative AI has generated. In addition to a critical analysis of the scientific literature, we have examined the legislation governing AI-related issues, with a particular emphasis on extraterritorial legislation, and we have also collected the most influential court decisions on AI. To understand the regulatory challenges and possible obstacles, it is necessary to address the theoretical issues of regulating these new technologies, which some authors have described as ‘disruptive’ technologies. Having identified these challenges, we review the main regulatory trends and solutions in recent

years. The analysis of regulatory solutions was not limited to the European Union, but was also compared with US and Chinese solutions.

Regulatory issues related to AI may extend beyond the narrow regulation of the technology into a number of other areas of law, including personal data protection rights, intellectual property rights, liability and accountability, but may also have criminal law implications. Given that these issues cannot be regulated by a single piece of legislation, attention has also been paid to examining recent changes in sectoral legislation, but also to case law, highlighting recent court decisions affecting AI and their expected impact for the future. On the basis of the above research, we have attempted to identify the main trends in regulation and jurisprudence and to identify the issues that remain to be regulated in the future. It is hoped that our research findings will shed sufficient light on the current issues and challenges of AI regulation and will be of interest not only to researchers but also to practitioners.

Keywords: AI, regulation, law

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1. Introduction

1.1. Current issues in technological regulation

Technologies traditionally classified as part of Industry 4.0 [13] - such as cloud computing, blockchain, social media, and the phenomenon of user-generated content that underpins it - are often referred to by researchers as disruptive technologies. [2] This range of technologies is further enriched by artificial intelligence, which, although it has become widely known through generative AI, has actually been with us for many decades. Why do many authors use the term “disruptive”? The emerging technologies of Industry 4.0 are characterized by the interconnection of various digital technologies, the convergence of new technologies [19], and as such, develop and transform very quickly, their potential applications are extremely broad, and their practical applications and the tasks they perform are often completely different from what the developers of the technologies originally had in mind. Technological development as a process is accompanied by the emergence of new human (social) behaviors shaped by new opportunities, which also change our daily lives. One characteristic manifestation of this is the emergence of new, previously nonexistent channels and media for discourse and mass communication, and the emergence of the information society, which can be identified as one of the driving forces behind the ongoing development of digitalization.

Ultimately, new behaviors lead to new living conditions, which must also be reflected in the law. We can also say that the fundamental task of the law in relation to emerging technologies is to find reassuring answers to the new life situations generated by those technologies. Although individual technologies have a significant impact on everyday life (e.g., the social media platforms or cloud computing are undeniably shaping society), it is noticeable that regulation often only appears years after the technology has emerged.

The main reason for this is probably exponential development. Technologies related to Industry 4.0 almost always emerge faster than legislators can respond to them. Moreover, they are based on the combination of various new and novel technologies or the atypical use of existing ones, and their long-term effects are therefore not necessarily apparent at the time of their emergence. Accordingly, uncertainty naturally arises in the legislator's mind regarding the ideal regulation. The social changes behind technology often manifest themselves in consumer needs, which the law cannot no longer ignore. [17] These technologies must therefore be regulated in some way. One of the main questions is when and how to regulate, and this question is best captured by the Collingridge dilemma. The essence of the Collingridge dilemma can be summarized as follows: Although the innovations inherent in emerging technologies can be traced back to fundamental social and individual benefits, early (over)regulation can limit the realization of these benefits (it is easy to see that restricting the possibilities of use through regulatory instruments or making use subject to prior authorization may discourage a wide range of potential users from using the technology), However, the absence of regulation may lead to a loss of social control over the technology, which in turn may result in social and individual harm.[3] In this sense, the primary task of legislators and legal scholars is to find solutions that do not significantly hinder the development and spread of technology, but adequately protect the interests of society and individuals.

1.2. Identification of possible legal responses in the world of AI

The above leads to the main question of our research: What responses can the law provide to technological challenges? The most obvious solution is to regulate the challenges generated by technology through legislation. However, this is not always a viable option. Although individual states or supranational organizations with legislative powers may issue binding rules, these are generally only effective within the territory of the state or confederation in question. That is why the adoption of the European Union's first extraterritorial legislation, the GDPR was such a significant development, essentially requiring all countries outside the EU to comply with the rules laid down in the regulation if they wish to provide services to the EU market. It is no coincidence that the influence of EU regulation is clearly evident in the data protection legislation subsequently adopted by non-EU states, as demonstrated by the Personal Information Protection Law of China (PIPL). The phenomenon in which legislation that is mandatory in the EU and has an extraterritorial effect also indirectly influences the legislation of other countries has recently been referred to in the literature as the Brussels effect.[1]

If we opt for legislation, further questions arise: Can a technology be regulated in a single code?

Since the areas of application of emerging technologies are difficult to predict and the risks arising from technology are difficult to assess in advance, it is difficult to imagine, for example, an AI code covering every possible detail. Furthermore, such a code would be less dynamic and would find it difficult to respond to social

demands arising from technological change. Moreover, technologies related to Industry 4.0 affect several areas of law at the same time. Typical examples include data protection law, civil law, intellectual property law, and competition law, but other areas, such as criminal law, have also faced new challenges. Based on the above, only regulations that are consistent with other legislation governing the above areas can be considered, and harmonization is a further task for legislators. If this harmonization is to be achieved within a union of states, it carries with it a number of potential sources of error. [10]

Based on the above, the question may also arise as to whether specific legislation on a particular technology is necessary at all or whether it is sufficient to consider amending existing legislation. What issues must be addressed in specific legislation and which can be regulated by amending existing legislation?

Looking beyond the legislation, we must also examine the application of the law. Detailed legal regulation is *ex ante* or preventive in nature. The fundamental function of law is to influence the behavior of legal entities, but this can be achieved not only through the text of the law but also through judicial practice. In the latter case, the judicial activities of individual authorities and courts are decisive. These bodies influence the behavior of legal entities through their decisions (e.g., the imposition of sanctions). Of course, these *ex-post* solutions also presuppose a set of rules, but not necessarily a uniform, technology-specific legal regulation, but rather, where appropriate, the consistent application of existing legal provisions to the issue at hand.

Finally, the question of soft law and industry (usually sector-specific) self-regulation also arises. There is an approach that suggests that this issue should not be regulated by legislation, but rather left to industry self-regulation, inevitably emerging standards and good practices for the regulation of the development and operation of artificial intelligence. This approach leaves the solution to the sound judgment of industry players: they will make their products and business practices safe and acceptable to users in order to gain their trust, because they do not want to risk losing market share to their competitors. The protection of the sphere of privacy, the guarantee of equal treatment and the absence of abuse have become values that significantly influence people's business and consumer decisions. Of course, this solution also has its risks.

In the following, we examine the implementation of the above solutions in the case of three key actors, the European Union, the United States, and China, identifying and categorizing the legal responses of the actors. We will then attempt to determine the current situation and outline possible future scenarios, but before doing so, we must clarify the legal interpretation of artificial intelligence.

2. Artificial intelligence as a technology

The interest in artificial intelligence is not a new phenomenon. Turing's theory established the concept of artificial, autonomous, and intelligent machines as early as 1950.[18] The term artificial intelligence itself was born six years later, during

Minsky and McCarthy's summer research project called the Dartmouth Summer Research Project on Artificial Intelligence. [7] Over the next two decades, interest in AI-based technologies remained strong, but the debates were largely theoretical. Since AI has not yet become part of everyday life, it has not significantly affected social interactions, and no specific regulations have been introduced during this period. Enthusiasm for the technology waned after the initial debates, and the AI winter only ended in the last decade of the 20th century with the spread of the internet, when the potential of neural networks was rediscovered and scientific results became truly realizable thanks to technological advances.[4] This feasibility (profit potential) meant that large companies devoted more and more resources to AI research and development, presenting their results from time to time. One spectacular and well-known milestone in this process was when Google's AlphaGo program defeated the reigning world champion in the game of Go.[7] With the emergence and spread of Web 2.0, the popularity of the technology grew further. From the 2010s onwards, neural networks and deep learning methods, as well as Big Data as a new technology, played a key role in the development of AI.[23] AI has thus become a typical Industry 4.0-based technology, with all its characteristics and challenges. 2022 is an important date in the history of AI, as it was when the large language model ChatGPT became widely available, allowing almost anyone to try it out, albeit in a limited way. With this, generative AI has also become the focus of scientific and everyday discourse within AI technology.

But what do we actually mean by artificial intelligence? John McCarthy defined artificial intelligence as the "science and engineering of making intelligent machines", and in particular intelligent computer programs. Intelligence is the computational part of the ability to achieve goals in the world. Varying kinds and degrees of intelligence occur in people, many animals, and some machines.[11] McCarthy's definition is functional and, although general, highlights that the basic element of intelligence is the ability to achieve certain goals. If an artificially created machine is capable of doing this for certain calculations, then the machine must be considered intelligent. Max Tegmark's popular definition[16] emphasizes the imitative nature of artificial intelligence, as he believes that AI should be viewed as systems capable of imitating human intelligence. Intelligence is also a defining feature for Tegmark, who characterizes it as a property that enables AI to achieve complex goals.

What conclusions can we draw from the above definitions? The essence (or indeed the goal) of artificial intelligence is the creation of intelligent or intelligence-imitating artificial devices whose main feature is that they are capable of achieving certain goals or performing certain activities independently, i.e. without direct human intervention. Although the basics of the technology are defined by the above definitions, it is not at all clear from the mere concepts how exactly and to what extent it has changed living conditions and created new phenomena.

For this reason, it is worth examining the issue from a different angle and starting from the areas of application of artificial intelligence. This perspective may also present potential challenges, as the range of tasks to be performed by artifi-

cial intelligence and the means of implementation are constantly and significantly changing. Accordingly, we can only capture the range of phenomena that we classify as manifestations of artificial intelligence at a given moment in time. From a regulatory perspective, however, it is often precisely these activities performed by artificial intelligence that are of interest, as regulation must respond to the challenges posed by technology.

If we attempt to catalog the AI-based technologies that have received the most attention to date, we arrive at the following list: machine decision-making (such as self-driving cars or autonomous weapons), automated decision-making (in civil law, but increasingly also in public administration and the justice system), predictive analytics, issues related to intellectual property (primarily driven by generative artificial intelligence).

Based on the potential applications of artificial intelligence, it is easy to identify the most important risks and threats that the law needs to address. In addition to data protection concerns, these include the black box phenomenon, decisions based on flawed, incorrect or at least non-reconstructible logic, discrimination by AI in automatic decision-making from time to time, and copyright issues arising from the widespread use of generative AI. This list has recently been supplemented by global challenges such as the possibility of massive job losses (see, for example, the recent announcement by the CEO of Duolingo [8]) or fears about the emergence of autonomous generative AI.

3. AI regulation in the EU, the US and China

3.1. The European Union's regulatory approach

The European Union is increasingly regulating issues related to new technologies in a normative manner (see: DSA, DMA, GDPR), with a focus on protecting human rights and the interests of citizens.

The first EU regulation relating to modern technologies that caused a significant impact was the General Data Protection Regulation, which entered into force in 2016 and became applicable in May 2018. As secondary legislation, EU regulations have primacy and direct applicability in Member States, which meant that the GDPR had to be applied in all Member States instead of national legislation. The latter could only apply if the GDPR itself provided for their application with regard to the subject matter of the data processing or for the purpose of laying down certain detailed rules. We have already mentioned that geographical limitations on applicability are a natural consequence of legislation, given that legislators can only lay down rules that are binding on everyone within their own jurisdiction. The EU has overcome this obstacle by applying extraterritorial jurisdiction. The scope of the GDPR (cf. Article 3 of GDPR) covers all persons and organizations that provide services within the EU, so if a company did not comply with the rules of the GDPR, it effectively withdrew from the EU market. This solution has led to the adoption of legislation in an increasing number of countries that is consistent

with the EU's data protection regulation, as the ability to provide services within the EU has a decisive impact on competitiveness.

Approaching the issue from the perspective of a framework for the implementation of trustworthy AI, the European Commission first set up a high-level expert group on AI, which issued ethical guidelines on artificial intelligence (European Commission Expert Group on Artificial Intelligence, 2019). The move from a non-binding (so-called soft-law) legal approach to detailed regulation was taken with the draft regulation on artificial intelligence published in April 2021 (COM(2021)206 final), which was a comprehensive proposal for the adoption of EU-wide harmonized legislation on the development, placing on the market, and use of artificial intelligence tools in line with European values and, in particular, fundamental rights. Following its publication, the draft underwent significant changes, precisely because of the rise of generative AI, the need to regulate which contributed greatly to the delay in its preparation. The AI Act finally entered into force on the first day of August 2024.

In terms of regulatory technique, the EU AI Act is reminiscent of the GDPR in many respects, given that it also has extraterritorial reach, and the European Commission has made no secret of its ambition to become a leading player on the global stage. The regulation is not code-like and therefore does not seek to regulate all aspects of artificial intelligence. The starting point for AI regulation in the EU was the product safety and product conformity approach, according to which the main task of regulation is to classify products into categories based on the risks they pose and then describe in detail the requirements that products in each category must meet.^[22] The Regulation therefore takes a fundamentally risk-based approach, establishing four risk levels to which different obligations are assigned. The highest risk is posed by AI systems that present an unacceptable risk, clearly endangering the safety, health, and rights of individuals. The AI Act prohibits eight specific practices in this area, like manipulation and deception based on harmful AI, social scoring or individual criminal risk assessment or prediction.

Compliance is accompanied by strict transparency requirements, which impose a disclosure obligation on all service providers in relation to the use of AI systems. In some respects, the rule is reminiscent of the logic of the GDPR, as informed decisions about the use of a service can only be made if the person wishing to use it has all the relevant information, including whether certain operations are carried out using artificial intelligence in the course of providing the service.

The regulation will gradually become applicable by 2 August 2026 and is expected to create, together with the GDPR and other regulations, a clear and strict framework for artificial intelligence, which nevertheless does not preclude the application of Member State law in specific legal disputes (e.g. disputes based on copyright or plagiarism).

The European Parliament and the Council have clearly sought to create a regulatory environment based on legislation, while attempting to ignore the effects that are regularly cited against strict and detailed legislation.

3.2. Regulation in the US – competitiveness and self-regulation

The US does not have comprehensive legislation similar to the AI Act that applies to all member states. One reason for this is the unique relationship between the state and federal levels.

The other, more significant reason is to be found in the regulatory philosophy. In the US, the prevailing view is that industry players have a more comprehensive understanding of the issues to be regulated. According to Grajzl and Baniak[6], self-regulation is essentially nothing more than the delegation of regulatory powers. This solution has a number of advantages: fewer external and top-down rules actually promote competition and also result in significant savings for the state. The lack of central regulation and the above philosophy are also reflected in the fact that, unlike the European Union or China, the US does not have directly applicable federal data protection legislation. This is indeed the case even if the California Consumer Protection Act contains extraterritorial elements.

This does not mean, of course, that there have been no legislative initiatives at either the state[12] or federal level. According to DePaula et al.[5], it was precisely the integration of artificial intelligence into political discourse that led to the issuance of President Biden's executive order. The political discourse was based on fear of competitors (China and the EU) and a reaction to EU regulation.[14] In the summer of 2023, the Biden administration finally accepted voluntary commitments from several leading artificial intelligence development companies. On October 30, 2023, President Joe Biden issued Executive Order 14110, "The Safe and Trustworthy Development and Use of Artificial Intelligence," which sets out principles for the development of safe and trustworthy artificial intelligence. The executive order sets out a number of action plans. The order itself did not contain any specific obligations for service providers and users, but it did require individual government agencies and legislators to establish directly applicable rules. This represents a clear shift towards the EU model. The extent to which this model was divisive and seemed alien to the previous regulatory philosophy of "competitive advantage above all else" is clearly illustrated by the fact that the Trump administration withdrew the implementing regulation in early 2025, immediately after the new president took office, citing economic competitiveness (Presidential action January 23, 2025). In the US, therefore, the classic model continues to dominate, with self-regulation and decentralization ultimately prevailing.

3.3. Regulation in China – efforts to establish a leading role

China is in a special position, given that the transatlantic cooperation that regulates the basic principles of AI has little or no impact on the country.

Accordingly, the state has developed a comprehensive regulatory framework for the use of artificial intelligence (AI) in various sectors, which differs in many respects from that of the EU and the US. China has made no secret of its ambition to become a leader in AI technologies, and the political system is explicitly supportive of these efforts.

The Chinese regulations are unique in that they focus heavily on development, including through direct state intervention (subsidies). In the summer of 2017, the Chinese State Council published its strategy for the development of artificial intelligence in the country, entitled “New Generation Artificial Intelligence Development Plan”. The strategy outlined China’s goals to become a global leader in artificial intelligence by 2030, to grow the value of the artificial intelligence industry to 1 trillion yuan, and to play a leading role in the development of ethical norms and standards for artificial intelligence. As a result of the strategy, large amounts of state subsidies have flowed to AI developers.

Although sectoral regulations are emerging in China, the country wants to establish centralized, normative regulation, as it did previously in the field of data protection with the PIPL. The first product of this is the Interim Measures for the Management of Generative Artificial Intelligence Services issued by the Cyberspace Administration of China (CAC) in 2023. These regulations (interim measures) are binding, but they are not considered final law, so it is ultimately assumed that the final regulations will eventually be enshrined in law. A distinctive feature of the regulation is that it does not contain provisions on AI as a whole, but only on generative AI. The fundamental objective of the Interim Measures is to promote the healthy development and regulated use of generative artificial intelligence, while protecting national security, public interests, and the rights of citizens and organizations (Interim Measures, Article 1). The restrictions are specifically party-political in nature, so that, while certain generally protected values (non-discrimination, transparency) are respected, criteria appear that can only be interpreted in the context of the state system, such as respect for socialist values and social morality.

Overall, human rights are less prominent in the regulations, but this is perhaps not surprising in a country that has been operating a social credit system [15] for years (which is already prohibited in the EU).

4. Trends observed in court practice

We have already highlighted the importance of administrative and judicial practice. Recently, a number of cases involving generative AI have been heard in the EU, the US and China.

Most of these cases focus on intellectual property and automated decision-making (and, in this context, profiling and predictive analytics). In the latter area, an important decision of the CJEU is the *UI v Österreichische Post AG* judgment (Case No. C-300/21), which, although primarily focused on data protection issues, contains findings that may determine the lawfulness of AI-based profiling. According to the facts of the case, the Austrian postal service sought to identify the political opinions of Austrian citizens through algorithmic profiling, on the basis of which it would have used targeted advertising. It attempted to estimate the political views of citizens for advertising purposes. The judgment is precedent-setting because it interprets the ethical consequences of profiling by AI as harmful. A similarly important judgment was handed down in the preliminary ruling pro-

ceedings between the Bundeskartellamt (German Federal Cartel Office) and Meta (Facebook) – CJEU (Case No. C252/21). The case focused on the processing of data collected by Facebook’s algorithms (AI-driven recommendation systems and ad management). In its judgment, the Court found that data profiling carried out by AI systems is punishable under competition law and data protection law, which could set an important precedent for similar cases involving AI tools.

In the US, the first high-profile case involving AI-based profiling was EEOC v. iTutorGroup Inc. (Case No.: 1:22-cv-2565–PKC-PK). The case was based on iTutorGroup’s practice of using automated systems to screen job applicants, which automatically rejected applicants of a certain age. The court pointed out that the use of automated recruitment algorithms does not exempt anyone from the prohibition of discrimination. An important decision was also made in the case of U.S. v. Meta (Case No.: 22 Civ. 5187), which was based on the Housing and Urban Development (HUD) excluding certain profiles from certain advertisements. Although no damages were awarded in this case, Facebook was forced to make voluntary commitments to improve transparency and modify its advertising system.

In China, profiling cases have a particular flavor due to the ongoing operation of a state social credit system based on profiling, although similar activities by individual companies are already subject to strict conditions. Although the Hangzhou Intermediate People’s Court rejected a lawsuit challenging targeted advertising in the Zhu v. Taobao (Alibaba) case in 2020, it also recognized the importance of ensuring transparency in profiling and that users must be adequately informed about how AI works. Subsequent judgments, such as the Hangzhou Internet Court’s decision on Meituan Platform’s personalized prices, have clearly established that users may suffer disadvantages from profiling, thereby creating a basis for accountability for businesses using AI for profiling.

Although the above court decisions are based on different legal systems and different legal and political cultures, they contain a number of similar conclusions, with all the legal systems examined emphasizing the prohibition of discrimination in profiling and the obligation to ensure transparency and accountability.

A similar process can be observed in the context of legal disputes relating to intellectual property. In the field of intellectual property, the rise of generative AI has raised a number of new questions, as there is a proliferation of works in the online space whose creation was initiated by the user giving simple text instructions. The most important question in this regard is whether such works are eligible for legal protection. The issue is complex, as each case must be examined in light of the intellectual property laws of the relevant jurisdiction. One of the most influential cases in the European Union is Infopaq International A/S v. Danske Dagblades Forening (Case C-5/08) which is key to determining the conditions under which a work, including works created using automated or AI systems, is eligible for legal protection. According to the judgment, a text is eligible for copyright protection if it is based on the author’s original intellectual creation. The latter condition is independent of the length of the text produced, but emphasizes intellectual contribution as a fundamental condition for legal protection. The decision indirectly

confirmed the view that a sufficient level of human contribution can justify copyright protection. On this basis, there have been a number of recent judgments in Member States expressing the view that a work in which AI has been involved in its creation but which is essentially based on human effort may be eligible for legal protection (Federal Court of Justice, Germany, case No.: X ZB 5/22).

In the US, there have been a number of judgments on this issue, and although they typically reject the claim, an increasing number of decisions suggest that hybrid works may also be eligible for protection if sufficient human contribution can be demonstrated (United States Court of Appeals for the district of Columbia Circuit Case No. 23-5233 “Thaler v. Perlmutter”) The question is rather what the law will consider to be sufficient contribution.

China’s case law on copyright is more permissive than that of the EU or the US, as several decisions [9] have recognized the copyright protection of AI-generated works based on the complexity of human-initiated prompts. At the same time, they have taken decisive action against infringing AI platforms, such as in the Ultraman cases[21] - resulting in the emergence of a complex and differentiated legal practice.

5. Conclusion and possible scenarios

In our paper, we identified the difficulties and current trends in technology regulation (in particular AI regulation), comparing the regulatory solutions of the EU, the US, and China.

In doing so, we found that the countries and supranational organizations we looked at are going down different paths, focusing on different values that need to be protected, and applying different legal responses to the issues that come up. Based on experience with technology regulation, this may hinder expansion and development in the global market in the longer term, as developers will have to comply with multiple laws, standards, or other sectoral regulations simultaneously. At the same time, it has been shown that similar issues have arisen in different courts, with similar motives emerging in their decisions.

How can we predict the future of AI regulation based on this? Based on our research, several possible scenarios are conceivable. It is not out of the question that the first extraterritorial legislation, the EU AI Act, will begin to dominate and become as influential as the GDPR did years ago. However, doubts may arise in this regard. The EU is simply too insignificant in terms of artificial intelligence, and the market is not necessarily responding positively to the AI Act[20].

A scenario is also conceivable in which convergence in case law will bring about harmonization. In the two AI-related issues examined (AI-based profiling and intellectual property), the courts appear to be following a similar path, which suggests that they will reach similar conclusions over time.

However, it cannot be ruled out that uniform legal responses will not be found and that developers will have to operate in a fragmented and diverse global legal environment. The impact this may have on the market remains to be seen, but it is likely to result in distortions.

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