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## **Security aspects of strategic co-operation of Ukraine and EU with regard to network and information systems**

### **Aspekty bezpieczeństwa strategicznej współpracy Ukrainy i UE w odniesieniu do sieciowych i informatycznych systemów**

**Abstract:** On the basis of an analysis of the EU regulatory framework on network and information systems security, the authors share the opinion that the geopolitical and economic factors of development, Ukraine may apply for inclusion in the global information infrastructure intended to connect all telecommunication and computer networks in globally, and is emerging to address complex issues such as security, privacy, hardware and software compatibility, identity management, digital rights management, and more. It is a European vector of integration of Ukraine for the creation of next-generation digital networks. However, it requires not only the proclamation of these directions as a priority but also the political will of the authorities and the establishment of a mechanism of interaction between public authorities and civil society institutions with the involvement of Ukraine's strategic partners. The development of balanced interaction with the global digital infrastructure, strategic programming of digital preservation development and data processing, including energy and telecommunications infrastructure, creation and implementation of macro models inclusive development of Ukraine as a guarantee of information security.

**Keywords:** security of network and information systems, global information infrastructure, electronic communications, Internet of Things, next generation networks, broadband, 5G.

**Zarys treści:** Na podstawie analizy ram regulacyjnych UE dotyczących bezpieczeństwa sieci i systemów informatycznych autorzy podzielają opinię, że geopolityczne i ekonomiczne czynniki rozwoju Ukrainy mogą ubiegać się o włączenie do globalnej infrastruktury informacyjnej, mającej na celu połączenie wszystkich telekomunikacyjnych i komputerowych sieci w skali globalnej i coraz częściej pojawia się ten postulat w celu rozwiązania takich problemów, jak bezpieczeństwo, prywatność, zgodność sprzętu i oprogramowania, zarządzanie prawami cyfrowymi. Europejski wektor integracji Ukrainy został wybrany w celu tworzenia sieci cyfrowych nowej generacji. Wymaga to jednak nie tylko ogłoszenia tych priorytetowych kierunków, ale także woli politycznej władz i wyboru mechanizmu interakcji między władzami publicznymi a instytucjami społeczeństwa obywatelskiego przy zaangażowaniu strategicznych partnerów Ukrainy. Rozwój zrównoważonej interakcji z globalną infrastrukturą cyfrową, strategiczne programowanie rozwoju ochrony zasobów cyfrowych i przetwarzania danych, w tym infrastruktury energetycznej i telekomunikacyjnej, tworzenie i wdrażanie makropoleceń – stanowią gwarancję bezpieczeństwa informacyjnego Ukrainy.

**Słowa kluczowe:** bezpieczeństwo sieci i systemów informatycznych, globalna infrastruktura informacyjna, komunikacja elektroniczna, internet rzeczy, sieci nowej generacji, internet szerokopasmowy, 5G.

The future of humanity is being promoted today as a high-tech society that promotes inclusive, sustainable, secure, secure and innovative growth through digital transformation through the convergence of the physical and virtual worlds. On this basis, the reproduction system of a new technological system is being formed, at the core of which is digital infrastructure, which is considered as a complex of technologies, products and processes that will determine global economic development in the next decade. The main criterion for the development of digital infrastructure in the modified concept of such technological determinism is considered not so much the level of technological development as the level of use of external energy (energy not consumed by man in the form of man-hours, but received and consumed by machines in the form of kilowatt-hours). This approach, proposed by Nobel laureate in the field of physical chemistry, Frederick Soddy in "Wealth, Virtual Wealth and Debt"<sup>1</sup>, is the basis for the formation of a digital network infrastructure that is resistant to space weather.

Developed countries such as the US, UK, Japan are now implementing Next Generation Converged Digital Infrastructure (NG-CDI) programs with a fundamentally new architecture for the Internet of Things and Telecommunications Infrastructure that can predict changes in demand for digital networks, accordingly configuring the infrastructure with the minimal human intervention<sup>2</sup>. As a result,

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1 Wealth Virtual Wealth and Debt by Frederick Soddy (n. d.). [www.ru.scribd.com](http://www.ru.scribd.com). Retrieved from <https://ru.scribd.com/doc/95145241/Wealth-Virtual-Wealth-and-Debt-by-Frederick-Soddy> (viewed 25.07.2019) [in English].

2 NG-CDI: Next Generation Converged Digital infrastructure (n. d.). [www.ifm.eng.cam.ac.uk](http://www.ifm.eng.cam.ac.uk) Retrieved from <https://www.ifm.eng.cam.ac.uk/research/asset-management/research-projects/next-generation-converged-digital-infrastructure> (viewed 25.07.2019) [in English].

new functions of accelerating communications and payments, a new level of comfort, increasing the speed and standardization of services, “uberization” of medicine, education, transport, the sphere of services with simultaneous digital transmission of voice, video, data and other network services under the traditional schemes of the public telephone network are emerging switching.

The G20 Ministerial Declaration on the Digital Economy identified the need for all countries to accelerate access to a modern and secure digital infrastructure as a prerequisite for the development of the digital economy and regards it as a powerful driver of inclusive growth and sustainable development<sup>3</sup>. The convergence of the telecommunications, media and information technology sectors mean that all electronic communications networks and services must be covered by a common regulatory system for electronic communications networks and services<sup>4</sup> and harmonized regulatory use of the radio frequency spectrum by all electronic communications networks<sup>5</sup>.

Ukraine can confidently claim a modern place in the global information infrastructure, which can occupy, apart from existing three main goals – to promote competition, internal market development and end-user interests, but also to pursue an additional objective formulated in terms of wide access to very high-value networks capacity and their use on the basis of reasonable price, effective and fair competition, open innovation, efficient use of the radio spectrum, general rules and predictable regulations arable approaches domestically.

The plan for the implementation of the measures set out in the Association Agreement between Ukraine, on the one hand, and the European Union, the European Atomic Energy Community and their Member States, on the other hand, regulates the fulfilment of obligations to promote the development of proper infrastructure and the enhancement of market integration. In recent years, Ukraine has made a number of steps towards regulatory convergence, but it is not keeping pace with the pace of updating EU legislation to develop strategic goals where the

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3 G20 Digital Economy Ministerial Declaration (n. d.). [www.g20.utoronto.ca](http://www.g20.utoronto.ca) Retrieved from <http://www.g20.utoronto.ca/2018/2018-08-24-digital.html> (viewed 06.08.2019) [in English].

4 Directive 2002/21/EC of the European Parliament and of the Council of 7 March 2002 on a common regulatory framework for electronic communications networks and services (Framework Directive) (n. d.). [www.eur-lex.europa.eu](http://eur-lex.europa.eu) Retrieved from <https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX%3A32002L0021> (viewed 17.07.2019) [in English].

5 Directive (EU) 2018/1972 of the European Parliament and of the Council of 11 December 2018 establishing the European Electronic Communications Code (Recast) Text with EEA relevance. (n. d.). [www.eur-lex.europa.eu](http://eur-lex.europa.eu) Retrieved from [https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L\\_.2018.321.01.0036.01.ENG](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2018.321.01.0036.01.ENG) (viewed 07.08.2019) [in English].

availability and use of very high-power digital networks make it possible to make extensive use of products, services and programs in the digital single market.

At present, Ukraine is lagging behind European and international competition in the deployment of digital infrastructure, which in the future may lead to even more lagging behind the leading countries of the world and the ultimate loss of opportunity to change the economic situation in the country. The individual structural elements of digital infrastructure available in Ukraine and the legal and regulatory field of their functioning are not integrated into a single system, so the results of these elements have no synergistic effect, which should be an initiative to build a digital infrastructure aimed at a new transformation into a global information infrastructure.

The creation and development of digital infrastructures, as a basis for harnessing the benefits of the digital world and a platform for achieving economic efficiency in Ukraine, is stated in the Concept of Development of the Digital Economy and Society of Ukraine for 2018–2020 and the approved plan of measures for its implementation<sup>6</sup>. Researches conducted by domestic scientists to build a low-orbital telecommunications satellite system to provide the Internet of Things, indicate a significant high-tech potential in Ukraine to increase the capacity of domestic telecommunications systems. However, in the domestic discourse on this issue, to some extent, only the updating of certain neologisms is observed, and terms appearing that relate to new generation networks and the formation of digital infrastructures. However, these neologisms do not reflect world trends and the need for Ukraine to fulfil important economic and social tasks.

Ukraine's transport telecommunication network is now formed from a multitude of digital networks that differ in purpose, type and characteristics, which are being developed on technologies, taking into account the prospects of development of mobile communication and the Internet. The development of domestic telecommunication networks is conditioned by the rapid development of the element-technological base thanks to which the high speeds of information transmission in digital packet form. The multiservice communication network is successfully implemented, which allows forming common system solutions ensuring compatibility and interaction of existing digital networks. However, the significant increase in the functionality of information devices and the ability

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6 Про схвалення Концепції розвитку цифрової економіки та суспільства України на 2018–2020 роки та затвердження плану заходів щодо її реалізації: розпорядження Кабінету Міністрів України № 67-2018-р від 17.01.2018 [E-source]. Available at: <https://zakon.rada.gov.ua/laws/show/67-2018-%D1%80> [in Ukrainian].

to generate and receive high-speed digital signals from such devices necessitates the formation of a next-generation digital network infrastructure, which requires:

- development and implementation of the general scheme of long-term development of communication networks;
- identifying the needs of the digital economy for domestic electronic services and storage and processing technologies;
- identifying the needs of public authorities and local governments in digital infrastructure for data storage and processing, as well as in system and application services;
- ensuring the availability of electronic data storage and processing services throughout the territory for citizens, businesses and authorities;
- providing broadband access to the Internet to the executive authorities and local self-government, population and business, taking into account the technical requirements of digital technologies;
- adopting regulations to create a Wi-Fi network, including simplifying the procedure for registering low power access points;
- creation of mechanisms for stimulating the investment activity of telecommunication operators for the development of digital infrastructures of communication networks on the basis of advanced technologies, including payment for the use of the radio frequency spectrum.

The European regulatory framework in this area of legal regulation forms a considerable array of directive and regulatory documents that regulate:

- common legal frameworks for electronic communications networks and services<sup>7</sup>;
- authorization of electronic communications networks and services<sup>8</sup> [3];

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7 Directive 2002/21/EC of the European Parliament and of the Council of 7 March 2002 on a common regulatory framework for electronic communications networks and services (Framework Directive) (n. d.). [www. eur-lex.europa.eu](https://eur-lex.europa.eu) Retrieved from <https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX%3A32002L0021> (viewed 17.07.2019) [in English].

8 Directive 2002/20/EC of the European Parliament and of the Council of 7 March 2002 on the authorisation of electronic communications networks and services (Authorisation Directive) (n. d.). [www. eur-lex.europa. eu](https://eur-lex.europa.eu) Retrieved from <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32002L0020> (viewed 12.07.2019) [in English].

- access and connection of electronic communications networks and related equipment<sup>9</sup>;
- universal services and user rights related to electronic communications networks and services<sup>10</sup>;
- security issues of network and information systems<sup>11</sup> and others.

Accordingly, each European country undertakes to ensure that providers of publicly available electronic communications networks or publicly available electronic communications services take appropriate and proportionate technical and organizational measures to properly manage the security risks of network and information systems and electronic services. Enhancing cybersecurity and protecting the digital economy and society from the increasingly negative effects of cyberattacks and other cyber incidents in EU countries. That should be a requirement for all businesses operating in industries that are vital to the economy and society, largely deployed on digital infrastructure.

The key principles that underpin Europe's next-generation digital infrastructure are gigabit connectivity for all major socio-economic programs, uninterrupted 5G coverage for all urban areas and major land routes, and access to at least 100 Mbps connectivity/s for all households. These principles are being implemented at various stages of broadband policy implementation, which include a series of interrelated steps:

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9 Directive 2002/19/EC of the European Parliament and of the Council of 7 March 2002 on access to, and interconnection of, electronic communications networks and associated facilities (Access Directive) (n. d.). [www.eur-lex.europa.eu](http://www.eur-lex.europa.eu) Retrieved from <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32002L0019> (viewed 25.07.2019) [in English].

10 Directive 2002/22/EC of the European Parliament and of the Council of 7 March 2002 on universal service and users' rights relating to electronic communications networks and services (Universal Service Directive) (n. d.). [www.eur-lex.europa.eu](http://www.eur-lex.europa.eu) Retrieved from <https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX:32002L0022> (viewed 30.07.2019) [in English].

11 Directive (EU) 2016/1148 of the European Parliament and of the Council of 6 July 2016 concerning measures for a high common level of security of network and information systems across the Union (n. d.). [www.eur-lex.europa.eu](http://www.eur-lex.europa.eu) Retrieved from <https://eur-lex.europa.eu/eli/dir/2016/1148/oj> (viewed 25.07.2019) [in English].

- implementation of the European Electronic Communications Code in accordance with the Directive (EU) 2018/1972 of the European Parliament and of the Council of 11 December 2018 to achieve the investment goals of the gigabit society<sup>12</sup>;
- the implementation of a European action plan for fifth-generation telecommunications systems<sup>13</sup>;
- WiFi4EU initiatives to support free Wi-Fi in public buildings, medical centres, parks, squares, public buildings, libraries and museums in European cities;
- initiatives to support the financing of broadband infrastructure by Connecting Europe to Broadband Fund;
- creation of a European network of national offices for broadband competence;
- initiating public-private partnerships for the development of next-generation infrastructure and joint decision-making on architecture, technology and standards;
- implementation of the technological foundations of mobile Internet and high-capacity networks for the data-driven economy;
- measures to reduce the cost of deploying high-speed electronic communications networks<sup>14</sup>;
- RF spectrum policy development and the like.

According to the definition of Norwegian scientists O. Henfridsson and B. Bygstad, digital infrastructure is interpreted as “a set of technological and human components of networks, systems and processes that contribute to the functioning

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12 Directive (EU) 2018/1972 of the European Parliament and of the Council of 11 December 2018 establishing the European Electronic Communications Code (Recast)Text with EEA relevance. (n. d.). [www.eur-lex.europa.eu](https://eur-lex.europa.eu) Retrieved from [https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L\\_2018.321.01.0036.01.ENG](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_2018.321.01.0036.01.ENG) (viewed 07.08.2019) [in English].

13 Communication – 5G for Europe An Action Plan and accompanying Staff Working Document (n. d.). [www.eur-lex.europa.eu](https://ec.europa.eu/digital-single-market/en/news/communication-5g-europe-action-plan-and-accompanying-staff-working-document) Retrieved from <https://ec.europa.eu/digital-single-market/en/news/communication-5g-europe-action-plan-and-accompanying-staff-working-document> (viewed 25.07.2019) [in English].

14 Directive 2014/61/EU of the European Parliament and of the Council of 15 May 2014 on measures to reduce the cost of deploying high-speed electronic communications networks Text with EEA relevance (n. d.). [www.eur-lex.europa.eu](https://eur-lex.europa.eu) Retrieved from <https://eur-lex.europa.eu/legal-content/en/TXT/?uri=cele-x%3A32014L0061> (viewed 15.08.2019) [in English].

of the social and technical elements of information systems that focus on the development of modern communication infrastructure” and information technology<sup>15</sup>.

Simplified Global Digital Infrastructure Model, as defined by Rob Van Kranenburg, founder of the European Council on the Internet of Things, is a unification of:

- objects (things) at the hardware level with their own data collection and processing functions and identification means;
- customer service systems – the integration of objects at the network and application level, allowing remote management, data analysis and information processing;
- ecosystems of the Internet of Things, either locally or nationwide, that give new opportunities to local systems, and
- the global ecosystem of the Internet of Things.

Common requirements for implementing digital network infrastructure in Europe are:

- recognition of digital infrastructure as a separate industry;
- promoting broadband communication;
- strengthening Europe as a strategic data centre;
- development of easier and more efficient administration processes;
- implementation of national strategies, etc.

The most common examples of internationally developed digital infrastructure in international practice are<sup>16</sup>:

- Internet networks for the interconnection of continents, nations and regions;
- Broadband fixed telecommunication infrastructures;

15 The Generative Mechanisms of Digital Infrastructure Evolution (n. d.). [www.olahenfridsson.com](http://www.olahenfridsson.com)  
Retrieved from [http://www.olahenfridsson.com/Ola/Publications\\_files/Henfridsson%20and%20Bygstad\\_accepted\\_late%20version.pdf](http://www.olahenfridsson.com/Ola/Publications_files/Henfridsson%20and%20Bygstad_accepted_late%20version.pdf) (viewed 14.08.2019) [in English].

16 13 Examples Digital Infrastructure (n. d.). [www.simplicable.com](https://simplicable.com) <https://simplicable.com/new/digital-infrastructure> (viewed 12.08.2019) [in English].



- mobile telecommunication infrastructures;
- digital television, radio and technological infrastructures;
- network infrastructures, such as Wi-Fi networks, data centres, cloud computing, virtualization;
- platforms for the development, deployment and operation of cloud-based software services;
- software systems related to process automation;
- software with mobile applications for users;
- application interfaces for information exchange;
- end-user devices such as mobile phones and laptops;
- Internet of Things (robots, machines, sensors, objects, infrastructure, products, vehicles, and environments) that are operated through an Internet connection and more.

According to Y.S. Kravtsov<sup>17</sup> on the basis of such network infrastructure there is another, more sophisticated “kind of virtual reality – network reality in the form of an interactive environment”, based on the network and information systems to which they refer<sup>18</sup>:

- a) electronic communications networks – systems and, where appropriate, switching or routing equipment and other resources that allow the transmission of signals by wire, radio, optical or other electromagnetic means, including fixed satellite networks (switching and packet channels, including the Internet); and mobile global networks, electrical cable networks within which they are used<sup>19</sup>;

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17 Суб’єктивні підстави події як інтенційні основи дискурсивної моделі комунікації [E-source]. Available at: <https://grani.org.ua/index.php/journal/article/view/374> [in Ukrainian].

18 Directive (EU) 2016/1148 of the European Parliament and of the Council of 6 July 2016 concerning measures for a high common level of security of network and information systems across the Union (n. d.). [www.eur-lex.europa.eu](http://www.eur-lex.europa.eu) Retrieved from [https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L\\_.2016.194.01.0001.01.ENG&toc=OJ:L:2016:194:TOC](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2016.194.01.0001.01.ENG&toc=OJ:L:2016:194:TOC) (viewed 05.08.2019) [in English].

19 Directive 2002/21/EC of the European Parliament and of the Council of 7 March 2002 on a common regulatory framework for electronic communications networks and services (Framework Directive) (n. d.). [www.eur-lex.europa.eu](http://www.eur-lex.europa.eu) Retrieved from <https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX%3A32002L0021> (viewed 17.07.2019) [in English].

- b) devices that perform automatic processing of digital data;
- c) stored digital data that is processed or transmitted by the elements for the purpose of their exploitation, use, protection and maintenance.

This kind of network-oriented approach reflects the system of interconnected and dynamic network and information systems by which business entities interact, collaborate and create value.

For EU digital infrastructure operators, which identify the main service providers and digital service providers, the security requirements for network and information systems are defined by a basic European regulatory document – the Network and Information Systems Security Directive<sup>20</sup>. It is envisaged that the regulation of the activities of digital infrastructure operators is carried out by the relevant industry competent authorities involved in the security of network and information systems. Criteria for identifying essential service providers are identifiable economic entities that provide services that are essential to critical social and/or economic activities (Annex 1).

The Directive also provides for the establishment in each country of a contact centre for the security of energy and telecommunications infrastructures to ensure strategic trans-regional cooperation and exchange of information with other countries and the EU Cyber Security Network and Information Security Collaboration Group.

This model of global digital infrastructure requires the adaptation of the national legislative and regulatory framework to the European one, namely:

- 1) Identification of the main directions of digital infrastructure formation and:
  - eliminating differences in access to digital infrastructure between geographical areas and major digital services;
  - Initiation of scientific researches on the development of models of the formation of the digital infrastructure of the new generation.
- 2) Consideration of individual aspects of the institutional and regulatory framework regarding:

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<sup>20</sup> Directive (EU) 2016/1148 of the European Parliament and of the Council of 6 July 2016 concerning measures for a high common level of security of network and information systems across the Union (n. d.). [www.eur-lex.europa.eu](http://www.eur-lex.europa.eu) Retrieved from [https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L\\_.2016.194.01.0001.01.ENG&toc=OJ:L:2016:194:TOC](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2016.194.01.0001.01.ENG&toc=OJ:L:2016:194:TOC) (viewed 05.08.2019) [in English].

- digital reach of end users in different sectors of the economy;
- developing and implementing a methodology for estimating the demand for digital services and connected devices;
- coordinating efforts across sectors to integrate digital services provided with the latest digital infrastructure;
- joint planning with digital organizations of projects for creation of digital infrastructure value chains, which include a wide range of assets and connection of domestic infrastructure to the global digital infrastructure. International initiatives, such as the Global Infrastructure Connection Alliance, endorsed by G20 leaders, are designed to foster synergies and collaboration between infrastructure connectivity programs;
- cross-sectoral coordination for the deployment of digital infrastructure to save capital costs, increase labor productivity, also by avoiding duplication, limiting potential adverse environmental and social impacts;
- introducing mechanisms for the use of international practices and ensuring the sustainability of digital infrastructure;
- developing technical standards of interoperability based on the principles of openness, transparency, coherence, interoperability and consensus to foster innovation and deploy digital infrastructure;
- international coordination of the exchange of information on incident response, enhancement of protection of digital infrastructure and related services.

3) Promoting investment and creating a competitive environment:

- stimulating private sector investment to accelerate the deployment of digital infrastructure and improve the availability and quality of telecommunications services;
- establishing a mechanism for interaction between public authorities, the private sector, civil society institutions, with the involvement of representatives of international organizations and strategic partners of Ukraine, to expand the geographical area

to attract investments in digital infrastructure to less attractive areas;

- efficient use of radio frequency spectrum;
- developing and adopting a national strategy for critical infrastructure protection and provision of essential services;
- developing a legislative and regulatory framework for the development of a single digital policy.

As broadband electronic communications networks become more diverse in terms of technology, topology, uses and ownership, regulatory regulation must rely on detailed network deployment information to be effective and target areas where is a need. Nowadays, new ICTs have created unprecedented opportunities to aggregate and combine information (content) from various sources and provide digital services across a comprehensive digital infrastructure. As digital services depend on digital infrastructure, universal and global access to communications becomes a prerequisite for social inclusion and reducing disparities in access to and use between geographical areas, age, income levels and the specific needs of citizens. It is about supporting enhanced broadband, infrastructure sharing models and expanding networks in areas such as:

- mobile networks that include the development of high-speed broadband 3G (UMTS), 4G (LTE) and 5G access networks;
- fixed broadband networks (fixed network infrastructures in terms of cable and fibre networks);
- transmission networks providing national or international communications through fibre-optic cables or high-capacity satellites, as well as transmission networks for digital terrestrial television;
- provision of services in the public sector (e-governance, e-health, e-business) and in various industries (automotive, electricity, healthcare) supported by the ICT infrastructure;
- Broadband infrastructure for next-generation networks and satellites, etc.

Many countries around the world are now working to create the Next Generation Network (NGN), a Global Information Infrastructure (GII) that is designed to connect all telecommunications and computer networks around

the world and is being designed to solve complex issues such as security, privacy, compatibility of identification and management hardware and software, digital rights management, and more. Convergence Based<sup>21</sup> on fixed and mobile communication in GII, there are opportunities to provide services to end users regardless of the technologies used.

In Ukraine, there is an urgent need for targeted implementation of smart and interconnected digital network infrastructure. Understanding these processes is extremely important, since Ukraine's competitiveness depends heavily on the stability and security of the network and information systems. Given the rapid development of technology, the exponential growth rates of broadband traffic and the increasing demand for electronic services, the objectives outlined in the Action Plan for the Digital Economy and Society of Ukraine for 2018–2020<sup>22</sup> and measures to improve access to the mobile Internet<sup>23</sup> should be considered at this stage of development as an absolute minimum, and Ukraine should strive to set more ambitious goals to ensure maximum coverage of the territory of Ukraine by rolling networks (the fifth generation), providing broadband Internet access, gaining the benefits and opportunities of the digital world everywhere for Ukrainian citizens, especially in the fields of education, medicine, e-commerce, administrative services, and the development of e-democracy.

The main priority areas for network and information systems security include the following:

- concluding a cooperation agreement on cyber crisis management with the European Network and Information Security Agency (ENISA);
- creation of the National Committee of Strategic Initiatives for the Development of Network and Information Systems;
- improvement of the legislative base in terms of the regulatory definition of the legal status of the state information cloud platform, as well as the composition, rights and responsibilities of participants in its creation and operation;

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21 Addition. Network convergence is called the movement of heterogeneous networks and systems to a single environment where next-generation networks (NGNs) are the final stages of such a movement.

22 On Approval of the Digital Economy and Society Development Concept of Ukraine for 2018-2020 and Approval of the Action Plan for its Implementation: Order to the Cabinet of Ministers of Ukraine № 67-2018-p від 17.01.2018 [E-source]. Available at: <https://zakon.rada.gov.ua/laws/show/67-2018-%D1%80> [in English].

23 About some directions of improvement of the mobile Internet access [E-source]. Available at: <https://www.president.gov.ua/documents/4972019-27953> [in English].

- introduction of regulatory acts and conceptual provisions on the introduction and development of telecommunication operators in Ukraine by 5G mobile radio networks, including radio frequency spectrum conversions according to the IMC-2020 international mobile communication standard<sup>24</sup>;
- coverage by the Internet of the needs of the economy and society for the interconnection of regions and the transfer of citizens data, businesses and authorities exposed by digital technologies;
- implementation of a unified national storage and data processing infrastructure to provide citizens, business and government throughout the country with affordable, sustainable, secure and cost-effective services;
- ensuring interoperability and standards to improve regulatory procedures and enhance interoperability with the seamless interoperability of multiple IT devices, data warehouses and services;
- development of trust and security of online user transactions (reduction of threats from malware, coordinated response to cyber-attacks, strengthened rules on the protection of personal data);
- use of information and communication technologies for solving social problems (reduction of energy consumption, support of vital activity of the population, reform of medical services, improvement of quality of public services, digitization of cultural heritage), etc.

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<sup>24</sup> 5G and “IMT for 2020 and beyond” [Spectrum Policy and Regulatory Issues] (n. d.). [ieeexplore.ieee.org](https://ieeexplore.ieee.org) Retrieved from <https://ieeexplore.ieee.org/document/7224717> (viewed 15.08.2019) [in English].

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### Addition 1

List of operators of essential services by type of economic activity in the EU, that have an important meaning of ensuring critical social and economic activity

№	Sector	Subsector	Entity
1.	Energy	a) electric	Electricity companies that carry out the function of supplying electricity Distribution system operators Transmission System Operators
		b) oil	Oil pipeline operators Extraction, processing and purification operators Oil pipeline operators
		c) gas	Supply companies Distribution system operators Transmission System Operators Storage system operators Operators of LPG systems Natural gas companies Wastewater treatment plant operators
2.	Transportation	a) air transport	Carriers Airport management bodies Traffic control operators
		b) railroad transport	Infrastructure managers Railway enterprises
		c) maritime transport	Inland, sea and coastal passenger and freight water transport companies designated for maritime transport Port management authorities Operators of shipping services
		d) road transport	Road authorities Intelligent transport systems operators
3.	Banking		Credit institutions
4.	Financial market infrastructure		Operators of trading floor Central counterparties
5.	Health Care	Healthcare systems (including hospitals and private clinics)	Healthcare professionals
6.	Supply and distribution of drinking water		Water Suppliers and Distributors
7.	Digital infrastructure		Internet traffic exchange points Domain name system service providers Top-level domain name registers

Source: based on [6, 7, 9].