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INSTANT MESSAGE EXCHANGE SYSTEMS IN THE PRACTICE OF PUBLIC GOVERNANCE. CLASSIFICATION, SECURITY, INTEROPERABILITY AND REMOTE CYBER EDUCATION

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СИСТЕМИ ОБМІНУ МИТТЄВИМИ ПОВІДОМЛЕННЯМИ У ПРАКТИЦІ ПУБЛІЧНОГО УПРАВЛІННІ. КЛАСИФІКАЦІЯ, БЕЗПЕКА, ІНТЕРОПЕРАБЕЛЬНІСТЬ ТА ДИСТАНЦІЙНА КІБЕРОСВІТА

Abstract. The article scientifically considers the essence of modern digital communication systems. The factual analysis of modern means of digital communications and their use in the field of public administration and cyber education is carried out. The use of artificial intelligence in the digital communications of public authorities is considered. The definition of "Instant (digital) messages" and "chatbot" is defined. The issue of cryptographic protection of digital messages and the impact of the COVID-19 pandemic on the development of digital communication systems are considered. The typology of instant messaging services by main functions is offered. A system of criteria for choosing a means of digital communications by field of application is proposed.

Анотація. У статті науково розглянуто сутність сучасних систем цифрових комунікацій. Проведено фактологічний аналіз сучасних засобів цифрових комунікацій та їхнього використання у сфері публічного управління та кіберосвіти. Розглянуто використання штучного інтелекту в цифрових комунікаціях органів публічної влади. Визначено дефініцію «Миттєві (цифрові) повідомлення» і «чатбот». Розглянуто проблематику криптозахисту цифрових повідомлень та вплив пандемії COVID-19 на розвиток систем цифрових комунікацій. Запропоновано типологію сервісів миттєвих повідомлень за основними функціями. Запропоновано систему критеріїв вибору засобу цифрових комунікацій за сферою використання.

Keywords: public administration, cyber education, instant messaging, messengers, digital transformations, interoperability, artificial intelligence, chatbot, digital communications, COVID-19.

Ключові слова: публічне управління, кіберосвіта, миттєві повідомлення, месенджери, цифрові трансформації, інтероперабельність, штучний інтелект, чатбот, цифрові комунікації, COVID-19.

Introduction. The urgency of the problem is that with the development of digital technologies, systems of personal and group (corporate) communications are becoming more widespread. Wired and mobile telephony systems, as well as radio communication systems, including digital ones, have a serious competitor – instant messaging systems or messengers.

Analysis of recent research and publications. The issue of digital transformations in the field of public administration has been the subject of research by many foreign and Ukrainian scholars, so, in our opinion, it is worth mentioning the thorough scientific achievements of P.Dunleavy, H. Margetts, S. Bastow and J. Tinkler, A. Williams and H. Hay, K. Schwab, G. Pocheptsov, V. Namesnik, O. Karpenko. Authors in previous studies have already considered both the imperatives of digital governance in Ukraine and the issue of digital communications in public authorities [1], while the unresolved part of the general problem of the study is the issue of practical implementation of digital communications in the activities of public administration and cyber education.

The purpose of the article is to scientifically and theoretically substantiate the feasibility, analyze the benefits, and predict the possible risks of using digital communication technologies in various areas of public administration in Ukraine and cyber education.

Presenting main material. Instant messaging (IM) is a digital telecommunications service for exchanging text messages between users' digital devices over

digital communication networks and computer networks (primarily the Internet). With the development of technology, other text messages have been added to other functions, such as transferring files, images, sound and messages, video, and joint actions.

In the case where a public network is used to exchange such messages, a client program is required for communication instant. An messaging client is often referred to as an Internet pager or messenger. A feature of instant messaging is that the exchange of messages takes place in real-time, communication between users is maintained constantly and the sent message is immediately transmitted to the user. Also, it can be carried out as a group exchange of messages between several interlocutors (conference, chat), and mass mailing of messages by network members on a certain basis, or by prior "subscription" to such actions.

The instant messaging system works according to a certain server or server-free protocol. The server protocol provides a connection to the central server of the messaging network. Messengers in such a system are clients. In serverless protocols (FChat, NASSI, UChat) messages are transmitted directly from one interlocutor to another on the principles of decentralized, or peer-to-peer (P2P – peer-to-peer) network – an overlay digital network based on equality. and participants. Often in such a network, there are no dedicated servers, and each node is both a client and serves as a server. Hardware and software-hardware messengers should be singled out, which can exchange both text messages and other data (telemetry, GPS-tags) at the device level, both server-side (paging, SMS-messages), server-free (DMR Tier 1, dPMR) and mixed protocols (DMR Tier 2, APCO P25, TETRA, LTE D2D (LTE + DMR, LTE + APCO-25)).

According to recent research, instant messaging is the most popular service used by 89% of Internet users in the world [2]. At the same time in Ukraine, the largest share of use among all mobile applications belongs to instant messaging clients, so the application Viber is used by 85%, Facebook Messenger – 48%, Telegram – 41%, WhatsApp – 29% [3].

The greatest spread of instant messaging services came with the spread of mobile computing. Thus, as of 2019 in Ukraine, the share of regular users of mobile devices was 66% [4]. It is mobile computing that has changed the general paradigm of the conditional evolution of the development of Internet technology concepts. A new interpretation of the definition of Web 4.0 – "Mobile Web", which describes the Internet as a platform for adaptation to the mobile environment. Web 4.0 connects all devices in the real and virtual world in real-time [5].

Instant messaging systems can be distinguished by the main functional media of information content by:
– clients for exchanging text messages;
– clients for exchanging graphic messages;
– customers for exchanging voice messages;
– clients for video messaging.
Such systems can use their functions for both personal and group and mass communications. Such systems are fully implemented, the models of external

interaction – G2C (Government-to-Citizen), G2N (Government-to-Nonprofit – government agencies – non-profit and non-governmental organizations, NGOs), G2B (Government-to-Business, state-business) and others, which are focused on improving and simplifying the processes of interaction between all segments and groups of citizens, business structures and public authorities, as well as the internal communication system, within the G2G interaction models, Government-to-Government for public authorities, interdepartmental interaction of authorities), E2E (Employees-to-Employees, civil servants for civil servants, horizontal interaction between responsible officials).

Almost all modern instant messaging clients are universal and can perform all these functions, but for classic messengers, the main functions are the exchange of text and picture messages, and video conferencing services are primarily intended for group visual communication. So for Facebook Messenger, Telegram, WhatsApp, and other similar messengers, the basic function is the transmission of text and picture messages. Instead, Rakuten Viber, Microsoft Skype, Zello, and others were originally classic voice over IP (VoIP) systems – real-time media technologies using the TCP / IP family of protocols. At the same time, Zoom, Microsoft Teams, and others are video conferencing clients for video conferencing.

With the growth of Internet coverage and connection speed in Ukraine, the role of mobile operators will radically change, the main component of the activity will be data transmission. One of the main problems of messengers is the protection of user information. And, although the owners of services and numerous ratings make Viber and Telegram one of the safest, we should not forget that all critical information is on the side of the developer and is likely to become a target for hackers and intelligence services [6]. In early May, WhatsApp, owned by the Internet giant Facebook, discovered a weak spot in the Internet telephony service, which allowed to infect smartphones through an Internet call [7]. Serious vulnerabilities have also been found in the Zoom video conferencing client through which hackers have stolen users' data, such as passwords [8].

Recently, however, almost all messenger developers have begun to use end-to-end encryption (E2EE), a method of data transmission in which only users involved in communication have access to messages, which prevents access to cryptographic keys. by third parties [9]. At the same time, Zoom introduced version 5.0 with support for 256-bit AES encryption, which provides additional data protection and greater resistance to hacking.

Today's challenges are changing the landscape of digital communications. During the COVID-19 coronavirus pandemic, video calling and video conferencing programs became the only alternative to direct communication, including and in the fields of public administration, education, medicine, etc. In 2020, most of the world's leading digital companies have stepped up their work on communication

applications or features for video conferencing systems. So in the form of independent applications are actively developing: Zoom, Microsoft Teams, Google Meet, Join.me, Proficonf, Linkchat, WebEx, and others. Most of these applications have both free, disabled, and commercial versions, with advanced feature sets that are tailored to specific communication tasks. Also, video conferencing features have appeared in classic messengers – Facebook Messenger Rooms, WhatsApp, Viber.

An example of the active use of the above communication applications, in the context of the spread of COVID-19, are training and educational activities that continue to maintain communication and the level of knowledge of IT professionals of Ukrainian cyber companies at the appropriate level.

Even though the distance learning mode is quite common for cyber education, the unexpected and forced transition to "WorkFromHome" has become a great challenge. After all, cybersecurity units needed to transform 100% of educational processes in a relatively short time. Thus, EPAM Ukraine, which is a software manufacturer, explains that such tasks are a time of mobilization of organizational capabilities, strengthening of horizontal interactions between locations and prompt implementation of new internal tools for the organization of distance learning.

Of course, external offline conferences and workshops have been particularly affected – such events have, of course, been minimized. But, for example, Sigma Software has found a way out: to compensate for this period of stagnation, employees are constantly preparing and updating lists of relevant online courses, books, and training platforms so that professionals can increase their competence at home. Sofia Belenkova, head of the Kyiv office of ELEKS, also notes the successful organization of educational events: "Communications with clients continue remotely, communications in teams – the same. Also, regular online meetings with top management have appeared at the company level, making it easier to ensure the timeliness and quality of first-hand information" [10]. At the same time, according to cyber defenders, standard services such as Microsoft Teams or Skype are used to organize such events, and in the case of large-scale events – Zoom, Gotowebinar, Mentimetr, ClickMeeting, etc.

There is training for teachers and relevant coaches. For example, Sigma Software, a company that provides technology solutions and services in the field of cybersecurity, has upgraded its trainers for online teaching – special pieces of training were conducted to ensure high-quality education and comfort for participants. Also, the company has a huge archive of online learning materials that have been collected over the years and is regularly updated.

Educational activities using the latest digital technologies are also organized at the state level. Thus, the Ministry of Education and Science has developed a program to teach Ukrainian citizens digital literacy in the national online course "Digital Literacy for Civil Servants". This online course was developed to implement the Program of the Cabinet of Ministers of Ukraine, approved by the Cabinet of Ministers of Ukraine dated September 29, 2019, № 849 [11] (Program of the Cabinet of Ministers of Oleksiy Honcharuk for 2019). The course aims to provide each citizen with appropriate digital skills. Both civil servants and servicemen and senior executives of the national cybersecurity system can take the online course.

It is also worth noting the emergence of problematic issues in the organization of cybersecurity units, which appeared after the introduction of quarantine, and which are not always possible to organize with the help of "remote work" and digital communications. For example, March, April, and May are the season of large conferences, various trainings, and exercises, which used to take place in a stationary format with the involvement of foreign experts. Coronavirus forced most organizers to postpone the date of such events to the fall, someone went online so as not to take risks. A significant disadvantage is the suspension of student internships; as educational institutions are closed for quarantine. However, companies are working to provide full mentoring support to students in projects through video calls and video conferencing, even under such conditions [12].

In general, the feedback of cyber experts on the development of communication applications and changes in the format of training, according to EPAM Ukraine – is quite positive, they reacted to the situation with understanding. And saving time on the road, which they now use for educational activities, almost all respondents call a big "plus".

Having a large number of software products for instant messaging in the market of information services, the question of choosing their range within the communication activity arises. To do this, first of all, it is necessary to determine the scope of use of such products – it's internal and external communications.

Internal (corporate) communication policy should identify the best systems to ensure the process of internal communication, ensure internal interoperability and take into account personal requirements, such as transmission channels of geographical data, telemetry, states, etc. If there are specific requirements for confidentiality and cryptocurrency, it can be not only public systems but also their commercial versions, which can be customized to specific requirements or personally designed communication products. Such systems, depending on the needs, can use their own, including secure communication channels.

The mobile Internet audience is growing every year. The most promising channel of interaction between public authorities and citizens can be messengers, where, in addition to the direct process of communication, provides quick access to news, reference information, and information services at the request of the user via chatbots.

Chatbot – is a computer program developed on the basis of artificial intelligence (AI), neural networks, and machine learning technologies, which conducts

communication using auditory or textual methods. Chatbots are used to achieve a specific goal (for example, to provide the necessary information). Chatbots are used in dialogue systems for a variety of practical purposes, including customer service or information retrieval, including in the service activities of public authorities. Chatbots can use sophisticated human language processing systems. The "work" of a chatbot, as an automatic consultant, is enough to load the most modern public authorities, then the chatbot "knows" to answer questions asked by employees of real employees who call at the right places, or call through digital communications.

Chatbots come in two different types – one type works from a list of rules or commands, and the other type uses machine learning. A rule- or command-based chatbot offers limited interactions because it only responds to a specific set of rules or commands. If you ask this bot a question that hasn't been programmed into its database, the bot doesn't know how to respond. A rule-based chatbot is only as smart as its programming. Machine learning is the ability of a computer to learn without being programmed. A chatbot that uses machine learning is another way of describing AI, Artificial Intelligence. This type of bot understands language, not just a list of rules or commands. The key difference is that a chatbot that uses machine learning actually learns from human conversations and uses that information to provide better answers in the future. This type of chatbot is an intent-based program [13].

Benefits of the chatbot tool:

– reducing costs. There is no need to pay for call center services;

– elimination of the human factor. Protection from difficult customers and the stress of their calls;

– convenience. According to Google, 65% of users would rather write to companies than call them [14];

– simplification of navigation. Chatbots are able to find the necessary materials on the site upon request. At the same time, they are able to recognize more word forms than traditional search, so communication with it is more convenient;

– adaptation of information. Correspondence with the bot gives the visitor exactly the amount of data he needs. It is not necessary to read the text on the site pages - in conditions of information overload, this is a great advantage;

– 24/7 support. The virtual assistant can support users by answering FAQs. Unlike "live" specialists, it is available for contact at any time of the day.

The program of activities of the Cabinet of Ministers of Ukraine in 2020 identifies as long-term priorities of the Government: ensuring the translation of the most popular public services into the electronic form [15]. Messengers should become one of the most promising channels of interaction between public authorities and citizens. To implement an effective communication system, including digital, it is necessary to form an interoperable communication strategy, which describes a systematic set of means of communication, which covers tactical and operational goals and objectives and provides communication interaction.

Conclusions and suggestions for further research. Thus, analyzing the possibilities and approaches to building digital communication systems based on instant messaging systems, we can conclude that the use of messengers in the practice of public administration and the field of digital educational technologies and cyber education in the digital transformation as a governance communication technology. At the same time, subject to the principles of interoperability, the toolkit of instant messaging systems provides enhanced opportunities to improve the efficiency of digital interaction of public administration, both internally and in external communications, which should increase efficiency and trust public authorities in general.

Further research should focus on studying the world experience in the mechanisms of digital transformation in public administration and local self-government, in particular, the use of digital communication systems in information and communication systems of public authorities, introduction of elements of artificial intelligence and expanding the practice of comprehensive cyber education, including among civil servants. accelerating the transition of Ukraine to a new evolutionary level of social power – ubiquitous digital governance.

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