

## **INFORMATION SECURITY AND DEVELOPMENT PROBLEMS eGOVERNMENT SYSTEMS IN UKRAINE**

In this research paper we discuss current information Cyber Security problems of Governments in Europe. We discuss related issues in Europe and particularly in Ukraine. Additionally we discuss Cyber Security in state administration and on the objects of information activities, as well as offering recommendations for creating a system of their information security using modern technological methods solutions by applying modern technological methods.

**Keywords:** identification, information security, eGovernment, ensuring the organization of information security, Cyber Threat.

### **1. INTRODUCTION**

#### **FORMULATION OF THE PROBLEM**

The issue of ensuring information security (IS) of state information systems today is not only not losing relevance, but with the development of the concept of eGovernment in countries and an increase in the number of e-services, it is becoming increasingly important.

The uncontrolled growth of the influence of information and communication technologies (ICT) on the post-industrial society, the emergence of the danger of a gap between the information elite and consumers has led, in turn, to a significant complication of the task of extracting data necessary for governments to make weighted, adequate to the conditions of the situation, and also their protection from all sorts of destructive influences – challenges, in fact, undisguised cyber crimes and threats [1].

One of the main conditions for the transition of ukrainian society to the state of a developed information society is to ensure the necessary and sufficient level of IS. The success of creating a sustainable e-state system directly depends on how protection against modern Cyber Threats will be implemented. An effective level of IS is the timely identification and assessment of new risks and current cyber threats, regular assessment of the security of eGovernment infrastructure components. The state of IS eGovernment of Ukraine essentially depends on threats that may cause irreparable harm to the entire state system. That is why the study of the main threats and the assessment of IS objects of information activities (OIA) for the construction of effective information systems is relevant.

The Law of Ukraine “On the Basic Principles for the Development of the Information Society in Ukraine for 2007-2015” points out that solving the IS problem should be done by creating a fully functional information infrastructure of the state and ensuring the protection of its critical elements; increasing the level of coordination of the activities of state bodies in identifying, assessing and forecasting threats to information security, preventing such threats and ensuring the elimination of their consequences, and implementing international cooperation on these issues [2].

More and more scientists are showing interest in the information society, which quickly began to develop as a concept for a new social order. The basic principles and problems of its development were examined in the works of R. Abdeev, R. Aron, D. Bell, N. Wiener, M. Zgurovsky, M. Castells, S. Kuchinsky, E. Masuda, A. Rakitova, E. Toffler, F. Fukuyama and other scientists.

In modern conditions, the problem of information security is not a narrow technological category, but goes into the area of conceptual substantiation of the management of social processes. And especially today, the problems of information security are of particular importance when the government sets itself the task of developing the information society and integrating it into the global information space.

The globalization of the information space and the development of the information society (eGovernment) leads to the emergence of problems that are rather difficult to cope with in the

country. All these problems require further and in-depth study. Unfortunately, a comprehensive study of the problems of eGovernment development, as well as related information security issues, was not enough. Therefore, the purpose of this article is to study information security, the problems of the formation and development of eGovernment in the European Union (EU) and Ukraine, as well as the study of possible ways to create an information and Cyber Security system in our country.

The European Commission planned to shape the directions of eGovernment in Europe. The EU had no direct influence on the administrations of the Member States, but the EU financed a lot of multinational projects within the Research Framework Programme.

On the European's national level, there exists eGovernment Directives and Master plans at EU, but Ukraine just started development of it in the last decade. On the international level the European Commission (EC) sets the posts; so, under the name "Accelerating eGovernment in Europe for the Benefit of All" the i2010 Government Action Plan was developed. The Progress is different in diverse countries in EU, but the general patter of development is similar. In general, one discerns the following four waves [3]:

- Promote access – Web presence;
- Provide (particular) services online;
- Transform the institution so by automating and reengineering of processes;
- Next-Generation-Government (i.e. dropping the "e" as ICT having become self-evident).

They recognized the following challenges:

- Joining up administrations by establishing interoperability and identity management;
- Increasing usage by better designed services and knowledge enhancement;
- Opening up to Public Governance with systems supporting e-Participation and e-Law.

The track record of sustainable eGovernment initiatives in rural areas is difficult to measure [4]. In Richard Heeks's classic paper on eGovernment "Most eGovernment-for-Development Projects Fail" informed that 85% of eGovernment projects in developing countries fail [5]. The World Bank reported in a "Task Managers' ICT Toolkit" that projects with Information and Communication Technology components had an "alarmingly high failure rate", with 50% suffering disputes and 80% requiring contract amendments [4]. Prandini et al. informs, that managers embraced this technology as if it simply were a new, enhanced version of World Wide Web. They neglected the less-obvious aspects of the technology, and thus bringing on significant security problems. Malicious attackers could quite easily exploit the vulnerabilities in these systems to hijack the process and lead to wrong decisions [6].

New cyber security threats have been introduced in the last decade or two. Malware developers create more efficient software with the advancement of network security systems. Governmental legislation offers support to companies that operate with sensitive consumer information. Attacks centred on manipulation and fraud of financial markets is one of the top cyber security threats now. Spam, phishing, and spyware were once seen as isolated challenges for organizations, hackers are now creating hybrid threats that can even infiltrate Government systems. Cyber threats such as spam, phishing, spyware and botnets present problems for governments, especially for such young governments as Ukraine or any other developing countries. Hackers create new dangerous mixed threats to circumvent the protection of the organizations information system OIA. The US federal government has taken steps to information protection (IP) the private sector and for government organizations, but efforts must be made as a collective to improve cyber security reporting. Fig. 1 from [7] shows how blended threats may bypass traditional security controls.

On the other hand, as Raiv Sandhu from the University of Texas at San Antonio stated, that the large-scale adoption of internet services across diverse populations is one indicator that the

average consumer is reasonably comfortable with the collateral risks [8]. Many nations and militaries, including Ukraine, are preparing offensive and defensive cyber capabilities.

Improving the lives of people by employing the Internet of Things becomes a reality. On the other hand, we must secure the systems against cybercriminals, hackers, and malicious computer applications or systems, who would certainly want to disrupt such systems or try to breach the privacy of people who will be connected to such networks [9].

Many cybersecurity problems occur on a worldwide scale. Benjamin Edwards, Steven Hofmeyr studied a large high-resolution data set of messages sent from 260 ISPs in 60 countries over the course of a decade.

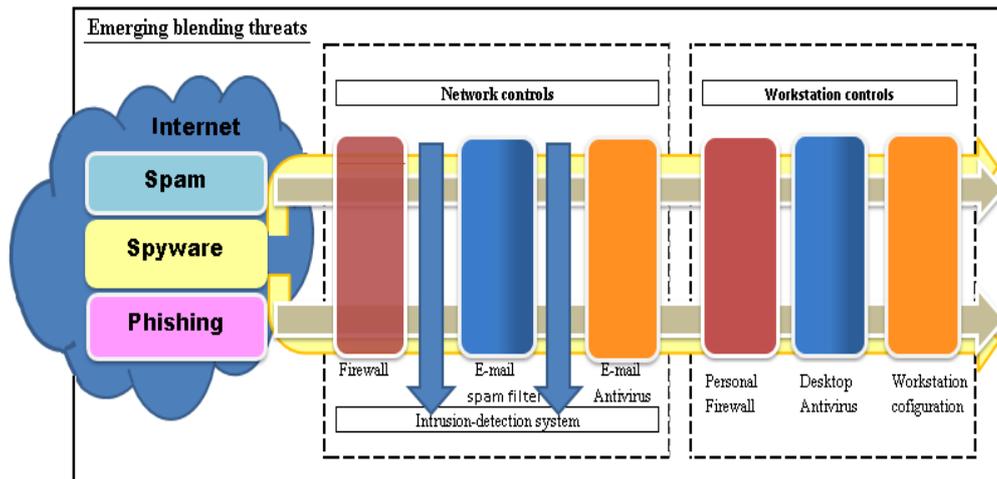


Fig. 1. Blended Threats Bypassing Traditional Security Controls

They found, that many cybersecurity problems occur at a global scale, involving nations, corporations, or individuals whose actions have impact around the world [10]. Another security problem is related to insecure sharing data. "Sharing data is gaining importance in recent years due to proliferation of social media and a growing tendency of governments to gain citizens' trust through being transparent". They stress that privacy enhancement techniques must be used to prevent unsavoury disclosure of personal data [11].

## 2. REPRESENT BASIC MATERIAL EXISTING AND IN-DEVELOPMENT SOLUTIONS

In [12] Malik Shahzad Awan and Peter Burnap investigate stealthy and dynamic techniques and attack vectors used by cyber criminals. They have made network infrastructure more vulnerable to security breaches the organization. Cyberattacks involving advanced evasion techniques often bypass security controls, and even if detected at a later time could still remain in the system for a long time without any monitorable trace. Such types of cyber-attacks are costing billions of dollars to the OIA and for management organizations across the globe. It has been predicted that a 50% increase in security budgets will be observed to rapidly detect and respond to targeted attacks [13].

It's a well know approach to use firewalls between business and process control networks and many believe that this is an ideal solution for plant floor Cyber Security. But research shows that few firewalls are properly configured and that many control system security incidents bypass the firewall [14]. Many organizations have implemented several levels of firewall defences even between different divisions in the same organization. It allows the prevention of a breach in the system if the whole organization firewall was bypassed.

To improve information security and data protection of eGovernment and Governmental information resources and system of systems on the governmental level, the authors propose to analyze security threats before malicious attacks, during attacks and after attacks:

1) Before attacks:

- All equipment and all software, applications and systems must be certified, as is described in [15], especially this is related to all open source systems and proprietary products;
- All critical software must be patched and updated regularly or as fast as possible after any vulnerability or security threat was discovered. Many organizations have their own test labs to test obtained software applications and systems for security risks;
- As we mentioned above, we suggest using several levels of firewall defences even between different divisions in the same organization. It will allow the prevention of a breach in the system more deeply and isolate problem inside of the organization;
- Security information and event management (SIEM) implementation [16];

It is necessary to implement the following information security measures at the OIA:

- Industrial control systems (ICS) and Supervisory control and data acquisition (SCADA) networks for supervisory purposes as well as control capabilities for process management [17];
- Virtual Private Network solutions (VPN); Network Access Control (IAM/NAC);
- Application Control.

2) During attacks:

- Intrusion Prevention System (IPS), which is a technique combining the techniques of the firewall with that of the IDS properly [18]. IDS – is a defence system, which detects hostile activities in a network: to detect and possibly prevent activities that may compromise system security, or a hacking attempt in progress including reconnaissance/data collection phases that involve for example, port scans. One key feature of intrusion detection systems is their ability to provide a view of unusual activity and issue alerts notifying administrators and/or block a suspected connection [19];
- Full packet capture (FPC) [20].
- Antivirus software;
- Email/Web security solutions.

3) After attacks:

- Intrusion Detection Systems (IDS);
- Forensic Capture System (Forensics);
- Security information and event management (SIEM).

As an example of a security web services framework we present a Multi-Level Secure Framework (MLSF) for web services from [21] at Fig. 2.

The demonstrated framework provides essential infrastructure for various operations such as acquiring user information, connectivity, authentication and communication to facilitate secure web services for multiple users. CM is the Client Manager, CWSM is the Composite Web Services Manager, ISM – Institution Service Manager, SM – Service Manager, IDB – Institution DB. More information about shown framework can be obtained from [21].

In turn, considering information security in government organizations and in other OIA, information security should consist of the following parts: audit of point analysis, protection of access to the infrastructure, monitoring at all levels of the network. It is also necessary to conduct an analysis of system vulnerabilities, possible scenarios for the realization of threats, probability of realization of the threats and their origin.

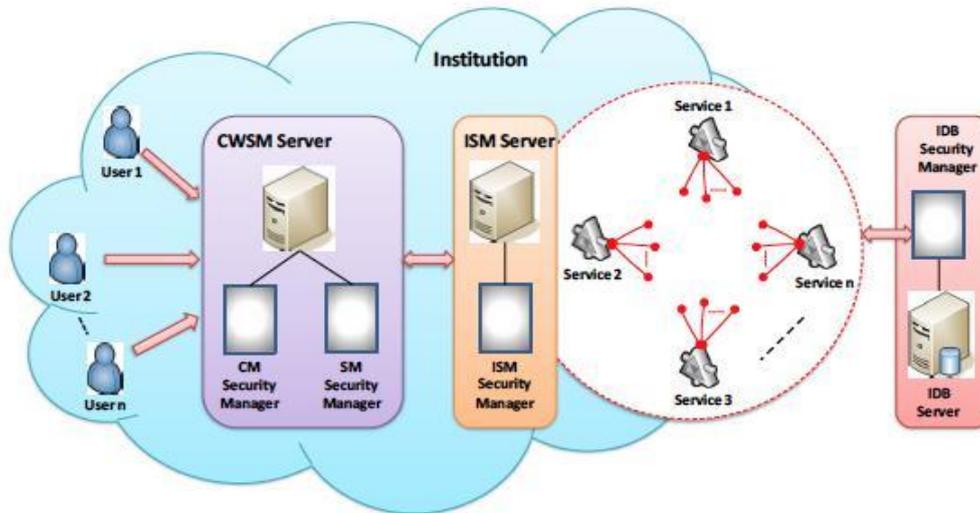


Fig. 2. Architecture for Multi-Level Secure Composite Web Services

The probability of implementing each  $i$ -th threat in relation to the  $j$ -th asset is determined using equation (1):

$$d_{rj} = 1 - p_{ri} \times \prod_{i=1}^m (1 - p_{rji}), \tag{1}$$

where  $n$  – the number of threats;  $m$  – the number of assets;  $p_{ri}$  – possibility of carrying out the  $i$ -th threat;  $d_{rj}$  – the possibility of implementing at least one threat of the  $j$ -th asset.

Implementation scenarios for security objects can be presented by bayesian networks of trust

$$BN_{O3} = \langle A, Tab_{O3} \rangle, \tag{2}$$

where  $A = \{a_i\}_{i=1}^{N_A}$  the plurality of offending actors;  $N_A$  – number of all offender actions;  $Tab_{O3}$  – the set of probability tables for each of the actions  $a_i$  with "parent" actions  $parents(a_i)$  [22].

If we consider dangerous programs as tools of unauthorized exposure, to assess the effectiveness of the organization’s IP tools, the task is to synthesize a complex indicator based on the systematization of the relevant particular indicators and solve it as the task of building an optimal assessment.

It is also necessary to pay attention to the analysis of threats to IS resources in management systems and consider the means of integrated IP as an element of an integrated security system. Since one of the main causes of confidential information leakage (CI) is the human factor, it is advisable for an OIA to proceed from the suggestions of the author. And for the effective solution of questions on IP it is proposed to create a mathematical model of the CI and take appropriate countermeasures.

The following tasks can be solved in this direction:

- a) a study of the motives pushing people to violate contracts and offenses;
- b) the development of mechanisms for managing sensitive information carriers;
- c) development of methods for informational impact on users of automated systems.

When building a model of a problem situation, let us denote by  $i$  the number of the operator-secret carrier:

$$i = \overline{1, N} \tag{3}$$

The next step is to determine the full amount of confidential information  $Q$ :

$$Q = \sum_{i=1}^K q_i \tag{4}$$

where  $q_i$  – is the volume of the CI block used by the  $i$ -th operator.

Then,  $k(q_i)C(q_i)$  – is the "sale price" of the  $q_i$  block for a competitor, where  $k(q_i)$  – is the utility coefficient of the  $q_i$  block for a competitor,  $k(q_i) > 0$ . And  $C(q_i)$  – is the cost of  $q_i$  block, consisting of the cost of its development, implementation and operation at Fig. 3.

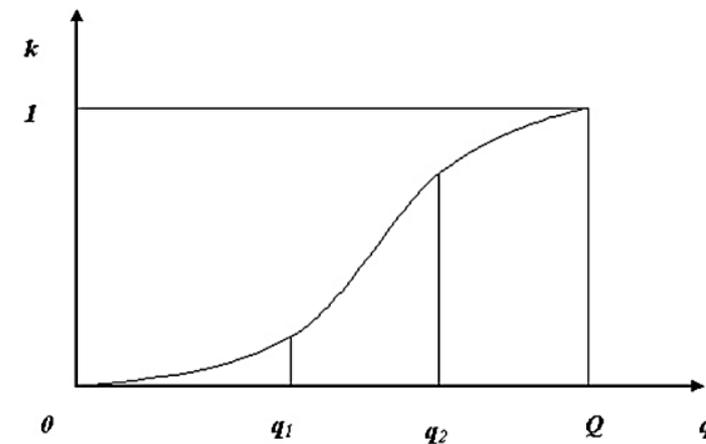


Fig. 3. Typical dependence of the utility coefficient of information  $k(q_i)$  on its volume  $q_i$

A typical dependence of the utility coefficient of information  $k(q_i)$  on its volume  $q_i$  is shown in Fig. 3. To exclude the sale of confidential information, we presume that it is enough to fulfill the condition:

$$pli(nD(q_i) + lB(q_i)) + p2iR(q_i) > k(q_i)C(q_i) - S(q_i) - p3iU(q_i) \quad (5)$$

where  $pli$  – the probability of exposing the seller;  $N$  – the number of months, the seller would work in the organization without offense;  $D(q_i)$  – monthly salary;  $l$  – the number of awards;  $B(q_i)$  – the size of premiums;  $p2i$  – probability of damage in case of exposure;  $R(q_i)$  – the amount of moral and material damage, expressed in money.

If the manager of the  $j$ -th unit acts as the seller of confidential information, then  $i$  and  $q_i$  should be replaced, respectively, by  $j$  and  $m_j$ . If the seller is the administrator, then  $q$  should be replaced by  $Q$  [23].

### 3. CONCLUSION

Cyber security threats such as spam, phishing, spyware, and botnets present challenges to Governments, especially to such young governments as Ukraine or any other developing country. Malicious authors (hackers) are creating new blended threats to counteract advances made in information system security. The new threats produce the capability of bypassing system firewalls, workstation configurations, and various other intrusion-detection systems [7].

Government bodies of many countries have made efforts in cyber security legislation to help protect consumers and themselves. Some legislative efforts focus on the creation of governmental entities that will provide support against systems attacks. Some governmental legislation was created to deal with the prosecution of criminals in an effort to deter criminal activity. Legislation did a good job of laying the groundwork for anti-malware detection, analysis, and internal prevention [7].

To effectively manage against cyber security threats Governments must be involved from process start to process end. Businesses must know where and to whom to report information about security risks and government should support it.

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