A Way to Ensure the Reliability of Information Portals of Regional Executive Authorities

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Abstract— The paper describes an approach to ensure the reliability of operatinginformation portals of regional executive authorities, which is based on a set of developed methods, algorithms, models allowing from a unified methodological point of view to implement the concept of a single information and communication space, taking into account the interrelation of information and communication.

Keywords:situational center, informationportal, operationalreliability, technology intelligencecountermeasures

I. INTRODUCTION

At present, **scientific, technical, information, resource and personnel support of strategic planning**is one of the main goals of strategic planning in the Russian Federation, coordination of state and municipal strategic management and budget policy at the federal level, the levels of the subjects of the Russian Federation and municipalities in goal-setting, forecasting, planning and programming socio-economic development of these levels, the economy and the spheres of state and municipal management, providing national defense, national, state and public security of the Russian Federation, as well as monitoring and control of implementing strategic planning documents which is set by the current Federal law of June 28, 2014 № 172-FZ "On strategic planning in the Russian Federation". As a part of this complex task, an important place is given to the task of **information support of strategic planning** through the use of situational centers (SC), which in accordance with the decree of President of the Russian Federation of July 25, 2013 № 648 "On formation of a system of distributed situational centers operating according to the unified rules of interaction" should ensure operating the *federal information system of strategic planning on the basis of distributed information*, in its turn providing the formation and processing of information contained at all levels of public authority: at the federal level of the subjects of the Russian Federation and municipalities, in their information systems and resources.Development of SCs, their interaction on the basis of a unified regulation make it possible to increase the effectiveness of information support for the implementing state policy and management decisions in the socio-economic, political, military, national security and other spheres.

The goals of effective countermeasuresto technology intelligence in managing the state and state subjectsresult in developing SCs for the Russian Federation in the context of intensifying information war, active technology intelligence thereacquire.

It is necessary to consider that the special role in counteractingtechnology intelligence is caused by fundamental openness of control system of competitors and opponents regarding the channels of obtaining information on our forces and means, i.e. obtaining information on the opposing party assumes existence of information flows from telecommunication lines of the protected data to the control system of the opponent. In addition, **distortion or quality degradation** (one of thereliability indicators) of the information received directly affect the decisions made by the enemy and, through its control system, the methods and techniques of making decisions, i.e. direct contact of the opposing parties is fundamentally necessary at the stages of obtaining information and making decision, and obtaining information should precede the decision and its implementing [1].

For public authorities, including legislative and executive authorities at the level of subjects of the Russian Federation and local self-governing authorities, introduction of SCs opens up important prospects for the development of regional informational support, integration into a single information and technical structure of Russian public authorities, involvement in interdepartmental and interregional information exchange, involvement in managing expert communities, and efficiency growth of resource management. At the same time, a number of features characteristic of information exchange at the regional level can be distinguished [2-3]:

1) heterogeneity of information processed both at the vertical level of the hierarchical structure of the government and at the horizontal level, leading to

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duplication, redundancy and reduced reliability of data processing;

2) peculiarity of solved regional problems of information exchange, reflecting features, interests, uniqueness of a particular region, including:

- monitoring processes, fixing development indicators, values, bursts of activity in the region, industry, among certain groups of the population;

- development of solutions using the information obtained from the monitoring of regional processes;

- development of models for performing solutions based on the selected option and participation in preventing the growth of a crisis situation, taking into account the region peculiarities;

- consolidation and visualization of numerous heterogeneous initial data using hardware and software systems, which use different models of data mining (DM), business intelligence (BI), methods of indicative analysis (KPI, BSC), and other specialized technical solutions (especially for Voronezh, Smolensk, Bryansk, Tambov regions).

3) for decision-makers need of adequate situationinterpretation, qualitative analysis and forecasting specific for the region and requiring more complex models of their dynamic situational, simulation, expert representation and assessment for effective decision-making by regional governing authorities in the process of elimination of risks and/or consequences of crisis/emergency situations.

In the conditions of emerging a single technological base of the common information space, in which the level of a region development is determined by its ability to access, store and process information, the level of developingthe technology of information portals (IP) is of particular importance. This technology allows to solve the problem of effective information management. IP, as the most developed element of information technologies, provides data aggregation, processing and presentation of reporting summary for project management, control over the preparation and implementation of state programs of high priority, coordination of interacting management and control bodies, including the supreme bodies of the state power.

The use of IP technology requires new approaches to meet information needs of cooperative and individual users in the face of uncertainty, processing big amounts of heterogeneous data, processes of transmission, storage and protection of information. Regional information support requires creating a distributed hierarchy of IPs interacting with each other on the basis of a single communication environment. This leads to further integration of telecommunications and information technologies, which is based on the well-known process of *convergence* of telecommunication networks, computing hardware and various information tools.

At present, the required convergence, which iscreating a common infrastructure of SCs, based on TCP/IP protocols is characterized by insufficient stability and efficiency due to the need to ensure the required level of reliability of information and communication processes that provide a specified quality of information assurance.

One of the ways aimed at implementing the requirements of the desired process and, in general, the benefits of convergence in the information and communication environment, is the development of new principles of resource development and SC traffic management, which guarantee different levels of service quality indicators, information services for a large and diverse number of applications implemented by end users. Reliability of information and communication systems and processes plays an important role among such well-known indicators of service quality as bandwidth, delay, jitter, packet loss and others. One of the effective ways to ensure the reliability of information and communication systems and processes is the use of various types of reserves, including structural, information, functional and time. This, in turn, implies the need to develop appropriate theoretical and methodological tools for functional standardization of tools in the environment of the information portal and to ensure its reliability.

Difficulties in ensuring the reliability of information and communication processes are connected with the complexity of describing integrated information flows (volume, format, distribution) and computational complexity, which leads to the transition from model problem solvers to knowledge generation. This, in turn, results in the need for a new interpretation of the concept "reliability of the information portal environment", which should be understood as the ability of the system to operate in the conditions of unauthorized operations.

The development of methods to improve information and communication processes in the communication environment of IPs of executive authorities is carried out in the direction of increasing meeting the requirements made by its representatives to develop the transmission characteristics.

The first direction reveals itself in introducing advanced functionality (AF) provided by information processing algorithms in a certain mode ("Request – Response", "Delivery", "Dialogue").

The second direction is the introduction of special algorithms of information exchange, designed to establish the optimal parameters of data processing in the environment of the information portal due to: the length of the data field of the executive authorityuser in the information array; transmission path parameters used for numbering arrays.

At the same time, it is necessary to point out the factors common for both directions. For example, handshake bandwidth is indirectly related to input and output traffic regulation. Providing an access point to computing resources, information portal resources, applications can be linked with other data sources inside and outside the information portal. Besides, information should be personalized, integrated and aggregated – that is, its presentation is aimed at supporting decision-making processes and solutions to functional objectives and problems.

The revealed contradictions, first of all, act as a result of the main contradiction between the traditional principles and methods of highly reliable information processing in the environment of IP and the changed content of its processing in modern information portals in the conditions of convergence and unauthorized operations.

This makes it necessary to develop methodological foundations of functional standardization of tools in the environment of the information portal and to study the ways to solve the problem of ensuring the reliability of information and communication processes in terms of convergence on the basis of introducing functional and structural redundancy, the development of specialized algorithms for functioning in conditions of unauthorized operations.

To ensure the reliability of functioning of regional information portals in regional executive authorities, the paper,for the first time, proposes a structural and functional approach that extends the methodology of ensuring the reliability of information and communication processes in the communication environment of ITs of regional executive authorities on the basis of introducing structural and functional redundancy, modification of information exchange algorithms and development of a dynamic system of information security in the conditions of convergence and unauthorized operations [5].

The aim of the study is to develop and study tools to ensure the reliability of information and communication processes inIPcommunication environment of regional executive authoritiesby introducing functional and structural redundancy in information processes and developing specialized algorithms for functioning in the conditions of unauthorized operations.

To achieve this aim, it is necessary to solve the following tasks:

1. To analyze the principles of construction and trends in the development of a distributed IP environment of executive authorities.
2. To develop factorial parametric basis of unauthorized operationinIP environment, as well as a set of attenuation functions of theseoperations.

$$CM = \{V, F, R, S, B\},$$

where

V - fuzzy parameter, recording impact on the outside perimeter and inside environmental components;

F - set of fuzzy attenuation functions under the impact of the unauthorized operation on the input of every critical environmental component;

R   - timingfuzzy parameter of sensitivity to initiating the startup of critical component;

S– set of fuzzyparameters influencing the input of critical environmental components;

B – set of fuzzy transversing parameters of factors of unauthorized operations and sensitivity.

1. Development of the method to optimize advanced functionality (AF) for information and communication processes in IP environment of executive authorities.

$$Z = \sum_{k=1}^{\overline{M}} \beta_k \eta_k \tilde{R}_k$$

where $> 0 - \tilde{R}_k$ quantitative measure of effective AF_k implementation;

$\beta_k = 0$ or 1;

η_k– conversion factor to universal ratio;

$\overline{M}$ - number of AFs.

1. Development of the method to analyze the characteristics of information and communication processes in IP environment, allowing to take into account its structure and the sequence of computational stages of data processing, as well as dynamic changes in the characteristics of information and communication processes in them.
2. Development of algorithms to manage information and communication processes in IP environment of executive authorities on the basis of forming limited access groups using advanced functionality and allowing to limit data flows and provide additional protection against threats of forwarding packages and primitives to other addresses.

Let us introduce a set of conditional function of performing moments (FPM) of a continuous variateofinformation and communication processcharacteristics under study g_{xy} with the parameter of states s, defined as $M_{xy}(s) = E[e^{sg_{xy}}]$,where $E$is an averaging symbol over all implementations of process characteristics g_{xy}:

$$M_{xy}(s) = \sum_{R_{xy}} e^{sg_{xy}} f(g_{xy})$$

whereR_{xy}isasetofimplementationsofthecharacteristicsofinformationandcommunicationprocessg_{xy}in following the arc (x, y).

Fordiscretevariate:

$$M_{xy}(s) = \int_{G_g^a}^{G_g^b} e^{sg_{xy}} f(g_{xy}) dg_{xy},$$

where $[G_g^a, G_g^b]$ isthechangerangeofacontinuous variate.

3. Development of the method to analyze the effectiveness of information security in IP environment of executive authorities, taking into account the need for rapid response of information security tools to change the threat space.
4. Simulation modeling and systematization of knowledge on information and communication processes in the distributed IP environment of executive authorities.
5. To conduct computational experiments on the developed simulation model of IP environment of executive authorities and compare their results with the studies on the prototype.

Simulation modeling of information exchange in the

communication environment of regional information portals

of executive authorities is carried outon the example of Bryansk region.The simulation scenario consists of a description of the topology of IP environment in executive authorities, the applied protocols of information exchange and data processing, the amount of work (a number of events that must occur during the simulation) and controlling parameters. As the resulting data, the simulation model generates data on the number of packets containing the information on region management system sent by each source of the portal environment, the number of delivered, lost, and retransmitted packets containing the information of governing bodies which areputinto the trace file.

RESULTS & DISCUSSIONS

Fig. 1. Aggregation of controlling information flow for bandwidth 10 Mbit/sec

The simulator of a typical IP gateway is used as the first component of IP environment in executive authorities. The parameters of voice messages are set by the type of the codec used and are interfaced with the data generated by the data flow generator of the regional management system. The second component of IP environment ofexecutive authoritiesin the simulation model is a dynamic flow-oriented model of the TCP protocol, which provides the delivery of management data at the transport layer of the environment.

Packet delay, jitter, and packet loss percentage were chosen as output metrics according to which the simulation model was calibrated (Fig. 2).There are also considered the parameters affectingIP reliability of executive authorities[7-8] such as the change in the characteristics of data communication links of governing bodies and the behaviour of the average queue in the router when using REDalgorithms and developed algorithms.Thissimulator software is built as a set of "client-server" interacting components.
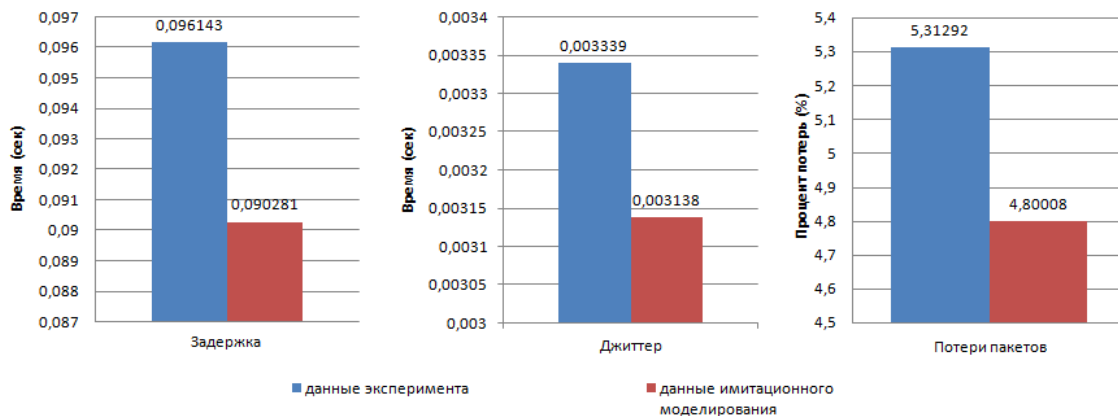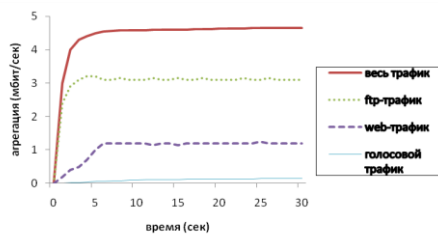
Fig 2. Values of delay, jitter and packet loss for voice data flow, received by using RED and mRED algorithms

The imitative server receives all the necessary parameters to run the simulation script over http using the standard linuxweb-server (apache-type) and brings the simulation results along with the generated graphs back to the client computer.It is established that for algorithms of active queue management a very important parameter is the average queue length – the smoothed value of the real buffer occupancy with the data of governing bodies. Application of the developed algorithms has led to a decrease in this value compared to the classic RED-algorithm, as well as to a decrease in the probability of dropping packets characterizing the data of governing bodies.

REFERENCES

1. RytovM.Yu.Techniqueofanalyzingdataprocessingparametersintheportalsofexecutiveauthorities. Informationsystemsandtechnologies, 2016, vol.97, no. 5, pp.90-98.
2. Eremenko V.T. Modelling the interaction of TCP RENO and TCP VEGAS protocols in a restricted network. Informationsystemsandtechnologies, 2010, no. 1, pp. 109-114.
3. CooperativePortals: definition, historyofdevelopment, objectivesandmeans. Availableat: http://otherreferats.allbest.ru/marketing/d00175610.html
4. EremenkoV.T., RytovM.Yu. Urgent problems of managing data processing in the information portals of executive authorities. Monography. Tiraspol, TransnistrianStateUniversityPubl., 2017, 256p.
5. RytovM.Yu. Problem analysis of interchange data in enterprise networks with cooperativeportals. Bulletin of BSTU, 2015, vol.45, no. 1, pp. 95-100.