Optimization of a communication model of customs bodies

Denis Fomenko¹,², Ruslan Shmatkov²

¹Siberian Customs Administration, 74, Timiryazeva st., 630049, Novosibirsk, Russia
²Siberian Transport University, 191 Dusi Kovalchuk st., 630049, Novosibirsk, Russia

E-mail: doncarlito911@mail.ru

Abstract. The purpose of this article is to justify the need to develop a system for monitoring communications of the customs bodies of the Siberian region, which will serve as a key tool and help in solving the critical transport problem of the Siberian region related to expediting the goods turnover and logistics operations. The research methods used to achieve the stated objective are as follows: analysis of occurrence of emergency situations; description of the software analogs used in the EU countries. In this article, taking into account the created unified network of electronic customs offices and electronic declaration centers, the main communication problems during the information exchange between the customs bodies of the Siberian region are considered. The prerequisites for the development of domestic communication equipment along with the domestic software are provided. The main areas for the development of communication technologies, which can lead to their efficient operation and acceleration of the recording of emergency situations that arise when working with software, and the adoption of timely management decisions on these situations are defined. The typical requirements to the information and communication infrastructure of the customs bodies of the Siberian region are provided. Keeping track of the identified deficiencies will contribute to the efficient operation of the unified automated information system of the customs bodies and the reduction in the occurrence of emergency situations during operation of information and communication systems.

1. Introduction

Currently, Novosibirsk region is the largest logistics and transit hub in the Eastern part of the Russian Federation, which connects the European and Asian parts of the continent. The main transport routes of the Russian Federation, running in every direction (the Far East, Central Asian countries, Mongolia, the Northern regions, the Republic of Kazakhstan), are located in Novosibirsk region, which is a leading factor in the investment potential of the region, playing a crucial role in social and economic processes.

Due to the high workload of the transport system in Novosibirsk region, the processes of expediting the goods turnover with respect to remote and neighboring foreign states and timely receipt of revenue into the federal budget are in a vulnerable state. To address the above problems, the customs bodies need to be provided with automated customs control and customs operations, which would expedite the movement of goods across the customs border and the customs control processes. Thus, we need to optimize the communications of the customs bodies of the Siberian region. This would allow us to efficiently organize the work on quick elimination of emergency situations, provide uninterrupted operation of the information systems and technologies of the customs bodies of the
Siberian region, eliminate the faults in the communications of the customs bodies, which will ultimately contribute to relieving the pressure of the transport system in Novosibirsk region.

To expedite the goods turnover and logistics operations, we need to optimize the communications of the customs bodies of the Siberian region by creating a system for monitoring communications of the customs bodies of the Siberian region.

In this paper, we look into the main communication problems that arise during the operation of information and communication technologies (hereinafter, ICT) by the customs bodies of the Siberian Customs Administration (hereinafter, SCA).

The creation and further development of information and communication technologies (hereinafter, ICT) operated by the customs bodies using the unified automated information system of the customs bodies (hereinafter, UAIS CA) are the key aspects in improving the customs control of the goods transported across the customs border of the Eurasian Economic Union (hereinafter, EEU) and fulfillment, by the customs bodies, of their duty to ensure the economic security of the Russian Federation.

The most challenging issues in the customs bodies communications are as follows:
1) reducing time allocated for the customs control;
2) improving the quality of customs operations;
3) ban introduced by the EU countries and the USA on the supply of high-performance routers and switches of Cisco Systems, the largest manufacturer of networking equipment, into the Russian Federation;
4) dependence of the domestic communication equipment market on foreign supplies, reaching 90% [8];
5) delay in the maintenance of communication equipment;
6) increase in the number of emergency situations (hereinafter, ES) during the operation of the UAIS CA;
7) operation of computers past their service life [3].

Currently, in this research area, for the last five years, the customs bodies have been using the automated ES control system. However, due to the increase in the number of customs declarations submitted to the customs bodies, the system requires additional software to optimize the load on IT divisions with respect to eliminating ES.

In this research area, the countries of the European Union (hereinafter, the EU) have implemented a certified software that allows customs bodies to receive and process information electronically. This software is distinguished by a number of advantages, the main of which are as follows: expediting the movement of goods and reducing the transport costs up to the customs body. The use of information and communication technologies of the customs bodies of the EU countries plays a decisive role in ensuring the software functioning.

The EU countries have applied various approaches to creating a unified system of information exchange between the customs bodies and participants of the foreign economic activity. The conditions for accessing electronic systems of various EU countries differ, which impedes the coordination of actions of the customs bodies and may jeopardize the uninterrupted operation of information systems of the customs bodies of the EU countries. In accordance with the decision of the European Parliament and the Council of the European Union, the creation of safe information and communication systems of the customs bodies for data exchange and simplification of the customs procedures was initiated [9].

The scientific novelty of the research subject lies in the development of ICT used by the customs bodies through the performance of works aimed at import substitution of information and communication equipment in the area of operation and elimination of ES arising during the operation of the UAIS CA, including the software suites used by the customs bodies to organize and implement customs control and perform their duties and tasks.

With the establishment of regional electronic customs offices, electronic declaration centers, customs offices and control checkpoints, the development of ICT will allow us to:
create favorable conditions for complete and timely receipt of revenue into the federal budget;
- ensure compliance with prohibitions and restrictions;
- protect domestic goods producers and intellectual property [1];
- reduce costs of participants of foreign economic activity related to the customs operations and create conditions for expediting the goods turnover across the customs border [2].

The development of information and communication technologies is extremely useful for many countries [10].

Thus, the purpose of this research is to justify the need for the development of a system for monitoring communications during transfer and exchange of information between the customs bodies of the Siberian Customs Administration (hereinafter, SCA).

2. The main areas for development of communications of the customs bodies of the Siberian region

Note that the ICT infrastructure supports operation of the customs bodies of the Russian Federation, namely: Central office of the Federal Customs Service of Russia; regional customs administrations (hereinafter, RCA) and specialized regional customs administrations; customs offices directly subordinate to the Federal Customs Service of Russia; customs offices subordinate to RCA; customs checkpoints subordinate to customs offices.

For ICT to function efficiently, it is necessary to assess the risks, which must be defined as the probability of an event, which can have a negative impact on achieving the objectives set, which are as follows:
- automation, information and communication support of the customs bodies;
- provision of public services by the customs bodies;
- creation of favorable conditions for the foreign economic activity participants;
- implementation of functions providing the day-to-day activities of the customs bodies.

To achieve the above objectives, the FCS of Russia has defined the main areas of ICT development:
- need for a phased transition to using ICT equipment and software due to creation, development, and upgrading of the agency’s information systems and more efficient activity planning and budget spending;
- improving communication technologies and electronic inter-agency interaction between the customs bodies;
- creating conditions that ensure stable functioning of the ICT infrastructure of the customs bodies and implementation of innovations in ICT;
- implementation of a unified hardware/software systems in the customs bodies paper [5].

To develop innovations in communication technologies and reduce the number of ES, several analogs with Russian certificates of conformity, which can replace the existing foreign operating systems, are being considered. These include: Mobile System of Armed Forces 5.0. operating system, Zarya operating system, Alt Linux, Astra Linux, and ROSA [9].

The transition to new database management system software is no less relevant. The recent testing of Russian database management systems (hereinafter, DBMS) has revealed that a complete analog of the ORACLE DBMS has not yet been developed. The main national DBMS candidates are: Progress Pro, created on the basis of SQL-DBMS Progress, and Linter DBMS, which meets all information security requirements. The foreign candidate is Tibero DBMS, the main advantage of which is its almost complete compatibility with ORACLE.

With the establishment and functioning of regional electronic customs offices, in order to ensure uninterrupted operation of software, the implementation of the following steps approved by Order No. 2005 of the Federal Customs Service of Russia of December 18, 2017 On Decision of the Board of the Federal Customs Service of Russia of November 30, 2017 On Measures to Improve the Information Systems and Resources of the Customs Bodies of the Russian Federation to Ensure Fulfillment of the
Comprehensive Program for the Development of the Federal Customs Service of Russia up to 2020 is required:
- automation of declaration processes and the activity of checkpoints at the customs border;
- creation of electronic profiles of the foreign economic activity participants and monitoring of the goods tracking system;
- creation of an analytical UAIS CA central database repository;
- implementation of separate software in the centralized architecture.

The implementation of the above measures will ensure faster transfer and processing of data when performing customs operations, increase the level of fault tolerance of information software, reduce the time required to update information in the information resources of the central database of the UAIS CA, and will eliminate the cases when the same information is stored in various information resources.

When switching to filing customs declarations through the electronic customs offices, the main workload related to processing and storage of data should be transferred from RCA, customs offices, and customs checkpoints to the federal level, to the Main Center for Processing of Data of the FCS of Russia.

The electronic customs offices created with centralization of declaration filing within the territorial electronic declaration centers must meet increased requirements to ensure uninterrupted operation of IT equipment and software as well as the efficiency of communication channels.

To optimize server infrastructure management, the deployment of typical solutions of key information software for the customs bodies is required. These typical virtual servers will be able to significantly simplify and accelerate the recovery of services after ES, and will ensure the reliability of information software of the UAIS CA.

Currently, 563 customs units are equipped with uninterruptible power supply systems (hereinafter, the UPS systems). 78.9% customs bodies are equipped with such systems. When installing the UPS systems and standby UPS at the customs bodies [2].

The communication channels of the customs bodies are based on administrative and territorial division:
- the FCS of Russia is connected with RCA;
- RCAs are connected with the customs offices within their regions;
- the customs offices are connected with the subordinate customs checkpoints.

When this structure is used, if a problem arises in the communication channel at the level of the Federal Customs Service of Russia, RCA, the work of the entire region will be paralyzed.

The electronic customs offices and control customs offices will be located at the place of registration of the foreign economic activity participants and movement of goods; thus, the principle of administrative and territorial division will lose its primary significance.

The creation of “horizontal” communication channels will allow us to connect electronic declaration centers with control customs offices in the most optimal way, and organize the dispatching of goods declarations in a manner that is convenient for the business.

In accordance with the Standard Requirements to Information and Communication Infrastructure of Regional Electronic Customs Offices, Electronic Declaration Centers, Customs Offices and Control Checkpoints, IT equipment includes the following systems:
1) integrated structured cabling system;
2) local area network;
3) communication system;
4) uninterruptible power supply system;
5) information security system.

A structured cabling system is defined as a finished set of communication cables and switching equipment that meets the requirements of the corresponding regulations. The structured cabling system should be developed in accordance with the effective regulations, including industry regulations, used to design project documentation during the construction of buildings and structures.
in the Russian Federation and international standards and recommendations (GOST, European standards, administrative standards, sanitary and epidemiological regulations, electrical installations code).

A local area network is a computer network that interconnects the computing means of a facility and connects the automated workstations of staff to centralized computing resources using up-to-date and advanced network technologies, Fast Ethernet, Gigabit Ethernet.

A communication system is a method of transferring information that provides the facility’s internal and external communication, connects it to the integrated telecommunication network of the FCS of Russia, and has access to the public communication network.

An information security system means an integral part of the works to create and operate segments of the UAIS CA, which is implemented at all stages of its creation, during operation and decommissioning through adoption of organizational and technical measures to protect information aimed at blocking (neutralization) of threats to information security in the information system within the information security system (subsystem).

3. The Feasibility of Creating a System for Monitoring Communications of the Customs Bodies of the Siberian Region

The main cause of delays in the performance of customs operations related to registration (refusal of registration) and issuance of goods declarations is the occurrence of ES (which account for 40% of the total amount of delays in registration (refusal of registration) and issuance of goods declarations), as reflected in software failures [10, 11].

There are currently 11 customs offices (Altai; Buryat; Irkutsk; Kemerovo; Krasnoyarsk; Novosibirsk, Omsk; Tomsk; Tuva; Khakassia and Chita) and 69 customs checkpoints subordinate to the customs offices under the control of the Siberian Customs Administration.

With the creation of a regional electronic declaration center of the regional electronic customs office of the Siberian region, which will accumulate the major portion of declarations, the work on eliminating ES will be transferred to the initial level of ensuring uninterrupted operation of information systems of the regional electronic declaration center and control checkpoints.

The structure of interaction between the Central Information Technology Customs Department (hereinafter, CITCD) and the Siberian Customs Administration (hereinafter, SCA) is shown in Figure 1.

![Figure 1. Interaction between the CITCD and the SCA on the ES management.](image)

In the shown structure, the core element in the interaction system is the software/hardware system of the CITCD. The software/hardware system of the SCA, which solves system tasks at the regional level, is at the next level in the hierarchy.

The interaction of the automated ES management system of the CITCD with the automated ES management system of the SCA takes place in the subsystem of the information systems of customs bodies, which integrates the automated ES management systems and is designed to automate the
exchange of information about ES between the CITCD and the SCA as it relates to the transfer of information on ES from the level of customs checkpoints, customs offices of the Siberian region, as well as the Siberian Customs Administration to the Central Information Technology Customs Department with subsequent automatic transfer of results of the work to the specialists of 24-hour technical support of the IT service of the Siberian Customs Administration.

With the functioning of the regional electronic declaration center, the workload of one officer will greatly increase. For example, the workload related to goods declarations of one officer of the electronic declaration center of Novosibirsk Customs Office constitutes 20 to 30 goods declarations per day. In this scenario, the occurrence of emergency situations could create mass delays in the release of goods. In view of the above, a need for optimization of customs operations arises, which will be reflected in the following.

The intensity of the work related to emergency situations elimination ($\lambda(t)$), is calculated using the following formula [5]:

$$\lambda(t) = \frac{Q}{T * N}$$

where $Q$ is the quantity of goods declarations submitted at a customs checkpoint within a certain period of time; $T$ is a goods declaration registration time; $N$ is the number of ES recorded within a certain period of time.

This formula will allow us to determine the time spent on the work related to ES elimination when working with the information resources of the customs bodies.

In this regard, we believe it would be useful to develop a system for monitoring communications of the customs bodies of the Siberian region.

The development of the system for monitoring communications of the customs bodies of the Siberian Customs Administration includes several stages:

1) survey of automation, the end result of which will be the preparation of a feasibility study, namely:
   - facility commissioning;
   - description of the existing management system and the system for monitoring communications under development;
   - identification of limitations of the monitoring system;
   - forecasting of the expected technical and economic results of the system for monitoring communications of the customs bodies of the SCA;
   - conclusion on the test facility and proposals for improving the test software;
2) performing works in accordance with the Standard Requirements to Information and Communication Infrastructure of Regional Electronic Customs Offices, Electronic Declaration Centers, Customs Offices and Control Checkpoints;
3) development of a working project with a view to implement it (creating diagrams, drawings; description of the program and its elements, which are components of the system; training officers to operate the facilities).

The main objective of the system for monitoring communications of the customs bodies of the Siberian region is to ensure uninterrupted operation of software systems used by the customs bodies, by using which the customs bodies perform the tasks assigned to them by the EAEU law and the customs legislation.

The system for monitoring communications is designed to perform the following functions:
- quick registration and processing of ES information;
- arranging interaction with the information systems used by the customs checkpoints;
- ES category management;
- adoption of timely (quick) solutions to eliminate the ES that have arisen.

The system for monitoring communications should provide stable functioning of units responsible for processes automation, interaction of 24-hour technical support divisions, employees of IT divisions, officers and employees of the customs bodies responsible for maintenance and operation of
information systems, units that support them at the customs bodies when processing ES arising in the UAIS CA.

The principle of operation of the system for monitoring communications of the customs bodies of the Siberian Customs Administration is as follows.

In the event of improper operation, failures, continuous processing of data in the information and software systems used by the customs checkpoints and customs functional divisions, an officer should quickly create an ES and send it to the IT division of the customs body. For prompt dispatching of ES to the IT division, we deem it necessary to provide each software unit with a special function that will create and forward information about the causes of ES and its description (the process described will be started by selecting the function, which will enable the transfer of information about ES in less than one minute). In addition to the above, the IT division will monitor (track), at the level of the customs offices and customs checkpoints, the failures detected in software.

When a failure is detected by own means, as well as by the customs checkpoint officers, an employee of the IT division of the customs checkpoint should determine the degree of complexity of this failure and its category, following which he/she will send information about this failure to the IT division of the customs office so that a management decision to eliminate this failure could be made.

4. Conclusion
The article provides a system for monitoring communications of the customs bodies of the Siberian region. As shown in Section 2, due to the establishment of a regional electronic declaration center for the regional electronic customs office of the Siberian region, which will accumulate the major portion of declarations, the workload of an officer related to goods declarations will increase significantly. In view of the above, a need to optimize the performance of customs operations by creating a system for monitoring communications of the customs bodies of the Siberian region arises.

Currently, the system for monitoring communications is considered innovative, and its software will be a significant addition to the automated emergency situations management system.

Taking into account the workload of the transport system in Novosibirsk region, the system for monitoring communications of the customs bodies of the Siberian region will, first of all, allow reducing the number of emergency situations, arranging the work on timely and efficient elimination of emergency situations that have arisen when operating the unified automated information system of the customs bodies, and will also expedite the goods turnover and set up automatic customs control. The set of these advantages will ultimately enable optimizing the communications of the customs bodies of the Siberian Customs Administration, eliminating the faults in the communications of the customs bodies of the Siberian region, which will contribute to relieving the pressure of the transport system in Novosibirsk region and eliminating the delays of transport vehicles that are transporting goods. The reduction and quick elimination of emergency situations will contribute to uninterrupted operation of the information systems and technologies of the customs bodies, and will allow creating the conditions for expediting the goods turnover, reducing costs (including transportation costs) of foreign economic activity participants, as well as for complete and timely receipt of revenue into the federal budget.

Thus, the creation of the system for monitoring communications of the customs bodies of the Siberian region will help solving a fundamental problem in the transport sector not only in Novosibirsk region, but in the Siberian Federal District as well.

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