

Critical Telecommunication Infrastructure Management in Express Mail Industry

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Abstract – Critical infrastructure is a term used to describe items that are essential for the functioning of some system. Critical telecommunication infrastructure in express mail industry mainly refers to communication between dispatcher and courier. This type of communication on one hand is the most demanded one and on the other hand very important for service quality achievements. The purpose of this paper is to propose technical solution for this system that would lead to high quality of service.

Keywords – Critical infrastructure, Telecommunications, Express mail industry.

I. INTRODUCTION

Critical infrastructure is a term used usually by governments to describe assets that are essential for the functioning of a society and economy. Speaking about Express mail industry, critical telecommunication infrastructure refers to communication between all entities participating in technological process. But the most demanded one is communication between dispatcher and courier. Therefore, the main aim of this paper is to designate crucial parameters for this telecommunication system design.

Implementation of the adequate telecommunication system between dispatcher and courier is important not only for reducing the costs and increasing the productivity but also for higher service quality achievements.

II. THE IMPACT OF TELECOMMUNICATION SYSTEM DISPATCHER – COURIER ON TECHNOLOGICAL PROCESS

In this chapter, manual and automated technological process, depending on the use of appropriate communication means, will be presented. In the first case, communication with the courier is done via mobile phone, by calling the courier or by sending him/her SMS messages. The other, automated system; uses the modern GPRS terminals.[1] Although the second case provides an opportunity for improvement of work processes in several points of the

production chain, which will be discussed in the following text, it is still used in practice in a very small percentage. The reason for this phenomenon lies in the fact that this system is part of the public communication system, which does not provide an adequate level of quality network required for express and courier service.

The scheme of manual technological process is presented in Fig. 1. Technological process begins with client's giving the mail at Post Office counter or, like more common case, by calling the Call Center in order to ask for the courier to come to client's home or business address. Request of the sender is registered at the central server and forwarded to dispatcher. He/she has to determine to which courier the request should be sent. With the mention request, the courier must obtain information about the sender, recipient, type of required services, some specific services, weight and shipping volume, the way of payment and others.

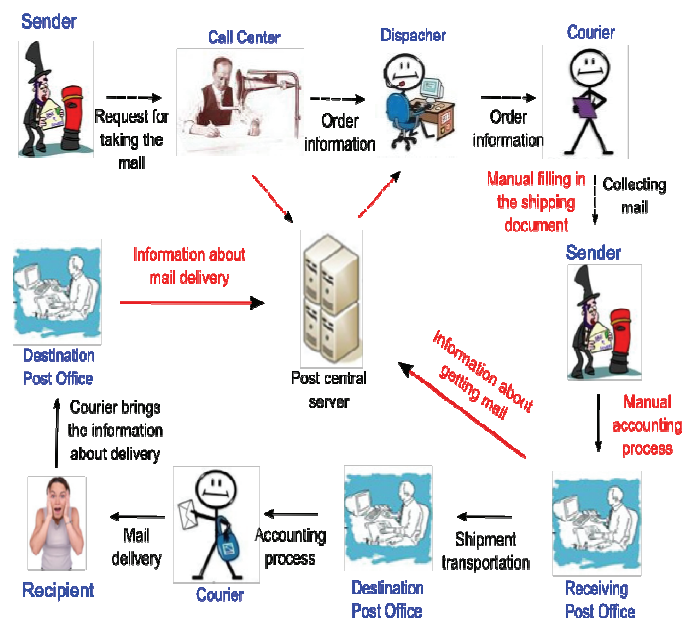


Fig. 1. Manual technological process of express mail transportation

In the manual technological process, courier receives the information via SMS or in direct conversation via mobile phones. Problems that arise in this kind of work may be various. One of them is the small capacity of the SMS message. All the necessary information can not be always conveyed in a single SMS message. Then, the cost of calls via mobile phones can significantly increase the cost of services. Also, if the conversation takes place during the drive, it results in courier's reduced security, because courier needs to note the data for following pick up. In these circumstances, it is a great possibility that an error occurs in the work.

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When the courier arrives at the location in order to take the mail, shipping document should be filled in. The courier manually fills in the document with data obtained from dispatcher, but after they are verified by sender. The sender gets a copy of shipping document like the evidence that the shipment was submitted to the transportation. The other copies follow the mail during the transportation.

The items collected during the working day, courier brings to the Receiving Post Office. Shipments are unloaded from the vehicle and enter the sorting process. Courier has an obligation to visit the accounting worker to give the evidence about the mail that has been taken this day and to deliver all collected money, if some senders paid the postage in cash. Accounting worker has to register every item, entering the data into computer. Working in manual technological process means that each shipping document should be handled manually.

When the shipment arrives at the destination point, couriers need to charge the shipments for delivery. For this purpose, every courier gets the delivery book, representing the document where all the items to be delivered are listed. In this delivery book, the recipient puts its signature as a proof that the mail has been delivered.

After the delivery of all shipments, courier returns to the Destination Post Office, to the accounting worker. Accounting worker reads from delivery book information about delivered mail and the time of delivery and puts it into computer. This is the end of manual technology process.

What has brought the technological process to automatic one is the implementation of modern GPRS mobile terminals. They greatly facilitated phase of receiving shipment. In this case, all data received in the call center, are available to courier via GPRS terminal in electronic form. As previously mentioned, it is data about shipments, types of service, the sender, recipient, the way of payment, special services, etc. Compared to mobile phone conversation, this kind of work brings to cost savings and increased courier's security in moment of driving.

This way of technological process leads to the reduction in errors and better collection of postage. One of the numerous advantages is that the postage is automatically calculated. All data received in the call center are available to the courier during mail collection. After sender's confirmation, the postage is automatically calculated.

The next advantage of automated process that refers to collecting mail is in filling shipping document. Having in mind that all data in electronic form are available to courier over the server, there is no need for manual filling in the shipping document. Courier just has to print it using GPRS terminal. In this way time saving is made. On printed document, there is also a bar code, so there are savings as well on bar code labels. Even more importantly, the courier does not waste the time on hand writing the shipping document. This reduces the time spent on collecting location, i.e. accelerates the technological process, reduces the enterprise's costs and increases productivity.

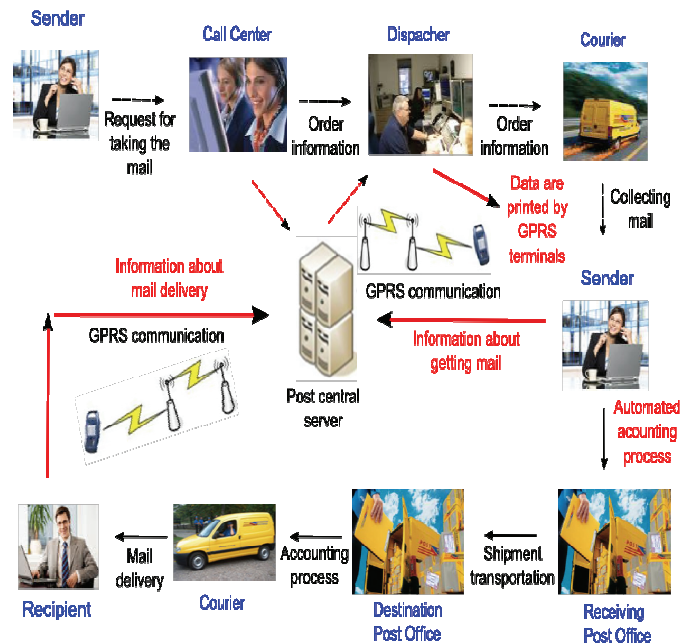


Fig. 2. Automated technological process of express mail transportation

Since the GPRS terminals are in relation to the central server, there is on-line transmission of information about collected shipment and therefore enables connection with Track and Trace system for tracking shipments.

Upon arrival in the Receiving Post Office, courier's discharge procedure is much simpler and shorter because all data are already on central server. Therefore, there is less employees working on the computer entry, resulting in a reduction of total costs.

In the delivery phase, when the GPRS terminal are used, delivery book exists only to be signed by recipient like a paper proof that the shipment is received. All the remaining necessary data is entered into the mobile terminal. Also, the delivery information is immediately transmitted to the central server, although the courier has not yet returned to the Post Office. Automatically, the data are ready for discharge before his return and accounting employee only check whether a particular assigned shipment status is correct. In this stage, there is also on-line transmission of information on the status of delivery of items, i.e. monitoring the delivery in real-time, supporting the Track and Trace system in this way.

Comparing manual and automated production process, it can be concluded that there are many advantages in using the GPRS terminal at several points of production cycle. These benefits greatly contribute to reducing costs, increasing speed of providing services, better utilization of labor, increasing the quality of services and better productivity. However, beside all these advantages, the automated system is implemented in a very small number of cases. The most common reason for this is poor availability of GPRS terminals because the system is designed to be part of a public communication network. As a potential solution to this problem, some of the Private Mobile Radio systems can be implemented. In further text, some parameters for adequate communication system design will be presented.

III. PARAMETERS FOR COMMUNICATION SYSTEM DESIGN

As in any other liberalized market, organizations operating in express mail industry face the key business challenges of delivering profits. Innovative communications technologies are being adopted to achieve new targets in efficiency and productivity. Yet the myriad of options available makes selection particularly difficult.

As it was investigated, the existing communication system that was part of the public network has not met the expectations. Therefore, the new communication system should be introduced. As a possible solution, Private Mobile Radio systems, also known as communication systems for closed user groups, can be implemented. In further text, some basic expectations of these systems will be introduced.

Coverage. Closed user groups require a high level of geographical coverage of their mobile communication systems. This implies that the inaccessible regions, such as the basements or distant warehouses where the couriers often collect or deliver items, should not introduce any restrictions regarding the possibility of connection. Lack of coverage significantly reduces the operational efficiency of couriers, which leads to pure quality of express mail service.

Availability. It is important that express mail industry has the access to communication services with acceptable quality level. Quality level of mobile communication systems must meet the traffic needs in peak hours. The network must be flexible enough to support communications in emergency situations such as the failure of some element of network. In order to provide the required level of quality, mobile communication system must support access to voice and data services using and combining some of the following mechanisms:

- Preemption, i.e. if all network resources are busy, the user must have the possibility of initiating a priority call. There should be the procedure that can free up resources needed for establishing this kind of call,
- The assignment and management of the frequency band dedicated to the customers in terms of congestion in the network,
- Facilitating the management in case of network congestion can be achieved by direct communication between two mobile stations without using the base stations.

Reliability and flexibility. One of the key requirements is that the infrastructure has maximum flexibility with a sufficient number of redundant elements, so that individual failures can not cause system failure. Individual components in the network must have the ability to communicate in different ways, so in case of broken link, communication can be achieved through a local base station that covers a specific operational area.

Security. Security and confidentiality are fundamental to the activities of closed user groups. The network must be protected against misuse and unauthorized access to data and resources, including expanded encryption techniques and user authentication.

In addition to the above requirements, there are some other requirements, such as a high quality audio for use in noisy environments, support for GPS positioning, full colour display for accurate display of pictures and maps.

Very important feature of every communication system is its possibility of expansion. Some users can start with small number of people in group, with low rate of communication services utilization. After some time, demands usually arise and network should be able to adjust, for example to add new users, increase coverage (geographical or in-building), work in multiple dispatcher system etc.

In order to deliver flexibility and reduce training overheads, some key elements must be considered when selecting terminals like a common user interface across mobiles and portables, one-touch functions and ease-of-configuration.[2]

In the past, several digital trunked Professional Mobile Radio systems have been developed by different manufacturers for public and nonpublic applications. In the United States these systems are known as digital *specialized mobile radio* (SMR), whereas in Europe this service is called *public access mobile radio* (PAMR). The first attempts to develop digital systems of this type date back to the second half of the 1980s.[3]

In Europe one of the most popular systems of this type are TETRA, EDACS and TETRAPOL. Most of these systems no longer play a significant role with one exception – TETRA, because manufacturers strongly promote this communication system.

Communication system iDEN holds a significant market share in the United States and many other countries.

Professional Mobile Radio systems have variety of application possibilities. They are used by Police, Military, Fire Departments, Ambulance, Transportation companies and other industries. In next section, the possible implementation in postal sector is presented.

IV. THE IMPLEMENTATION OF PROFESSIONAL MOBILE RADIO IN POSTAL SYSTEM

The importance of adequate communication system for the efficiency of technological process in postal system, especially in express mail industry is presented in the second chapter of this paper. By analyzing the situation in the postal system of Serbia it can be concluded that there are huge opportunities for improvement in the field of communications. As a potential solution some of the systems for Professional Mobile Radio can be applied.

In the process of communication system design it is necessary to take into account the economic parameter, i.e. the costs. In that sense, good characteristic of Professional Mobile Radio system is that more departments or services using communication for closed user groups may use a common infrastructure but to have a separate functioning. Thus, the introduction of such system should involve coordinating the various administrations interested in use of communication system for closed user groups. Many independent organizations (public or private) can form their own sub-

systems within a single infrastructure and thus work smoothly with the simultaneous distribution of the total investment cost.

Given that many postal systems are state-owned and that many Professional Mobile Radio users are also state organizations, such as police, fire department, ambulance, etc. in this case it is very useful to form an integral state strategy for communication development. In Figure 3 it is presented that different services can work independent within a common infrastructure.

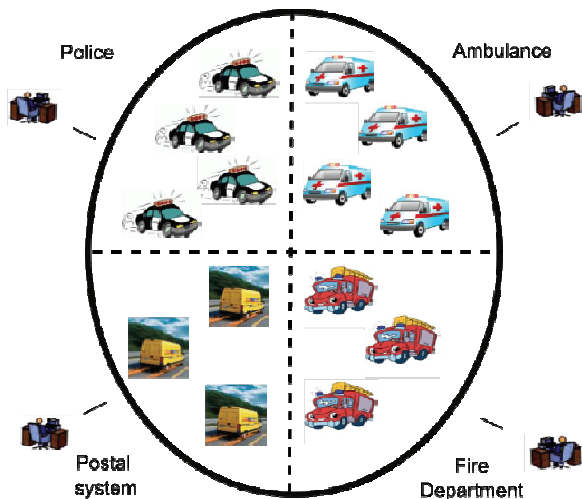


Fig. 3. Independent networks within a common infrastructure [4]

When some government plans to improve communications for their public services, it has two options available:

1. To build one or more independent networks to serve one or more groups of users or
2. To implement the required services in public mobile networks with the necessary protection mechanisms and support systems.

Regarding Serbian integral strategy, one should have in mind that TETRA communication system [5] is already implemented in Serbian Police Department. It would be useful to use the existing infrastructure as well for other services.

TETRA has from the beginning been designed as a trunked system that effectively and economically supports shared usage of the network by several organizations, yet maintaining privacy and mutual security. Virtual networking inside the TETRA network enables each organization to operate independently, but still enjoy the benefits of a large, high-functionality system with efficient resource employment. [6]

Elements of infrastructure owned by provider and terminals owned by users can be from different manufacturers, and total score results in lower costs and better equipment. One such network, which uses equipment from different manufacturers, was represented in Greece. Motorola, Nokia and Siemens were selected to provide the secure two-way radio communications system that will be used by public safety agencies during the 2004 Olympic Games in Athens. There

were two TETRA networks in function. Motorola and Nokia provided the terminals, while Siemens and Motorola were responsible for communication systems with dispatcher. This new network, with over 100 base stations built in time of 10 months, during the Olympic Games served approximately 17,000 users and over 200,000 calls a day. Such examples of efficiency TETRA network can be found throughout Europe.

Speaking about the implementation of TETRA systems in Serbian Post, the use may be broader than those described in express mail service. This system could be a good support to other projects in postal system, like the project of APM (Automatic Vehicle Monitoring) or CAS (Centralized Alarm System). It is possible to set TETRA system as the basic network for transmission of information about the location and status of vehicles that are monitored by the APM system and transmission of alarm signals and data to the operational center of the CAS.

V. CONCLUSION

The optimization of technological process in express mail industry greatly depends on adequate communications. Efficient communication system design leads to improved quality of service and saving in materials, labor and working time. In this paper, basic expectations about communication network for postal system are presented. As one of the possibilities for adequately communication, TETRA system is introduced.

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