

DEVELOPMENT OF AUTOMATED MANAGEMENT SYSTEMS OF DIGITAL TELECOMMUNICATION NETWORKS AND MANAGEMENT PROBLEMS AND THEIR SOLUTIONS

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Abstract. *In this article, the importance of the forming automated control systems of telecommunication networks, the main problems that arise in this process and their solutions, are subjectively discussed.*

Keywords: *automated management system, TCO, Juniper Network, Cisco, NAG, Hewlett-Packard (HP), Dell, SNMPv2, SNMPv3, SYSLOG, NETFLOW, "Vendor Lock-In", Integration.*

INTRODUCTION

The volume of technological achievements in the XXI century is growing day by day. We are witnessing fierce competition among leading IT companies in producing "Information Telecommunication Technologies". Also, the number of organizations that purchase software, technical or software-technical tools of these manufacturers and those who use them in telecommunication infrastructures is increasing on a daily basis. This, in turn, creates different demands and proposals. In particular, large manufacturing and service organizations are encountering various problems with the number of employees, daily work volume, and ensuring the continuity of products and services. Especially, there are many issues related to forming of digital telecommunication networks, their connection to different regions, continuous service, management and security. The infrastructure of digital telecommunication networks of organizations, in most cases, exhibits dynamic characteristics rather than fixed characteristics. Infrastructure that is growing dynamically requires regulation and the introduction of a unified control system over time. Major manufacturers (Cisco, Juniper Networks, Hewlett-Packard (HP), Dell, Nag, etc.) that are producing digital network devices have come up with some solutions in order to resolve the issue mentioned above and they have got some advantages and negatives. Frankly speaking, the solutions offered by manufacturing companies, in addition to providing excellent convenience and easy management, in most cases show strong marketing ideas (using only the products of this company) or high prices.

So, why is that so? Does the cost is exorbitant? What are the challenges of creating such an automated system that is dynamic, user-friendly, and non-technologically dependent? In the article, we will try to answer these questions and propose solutions for them.

Firstly, standardizing all digital telecommunication networks.

If infrastructure is being filled out with products of various manufacturers, it is illogical to talk about unified automated control system. For example, the network devices, their software and their settings made by Juniper Networks differ totally from that of Cisco. In most infrastructures,

this is more severe, i.e. the network infrastructure may contain three or more vendor types at the same time.

Therefore, all levels of the network infrastructure should be brought to the same standard. The same vendors, device software, protocols (for example, monitoring protocols - SNMPv2, SNMPv3, SYSLOG, NETFLOW) and settings are among the main requirements of an automated management system.

This is where problem of “Vendor Lock-in” arises, i.e. dependence of the organization on a single producer. Control systems that are being offered by manufacturers mainly implement the same logic. The organizations face various issues while using devices of other vendors. On top of it, the flaws of a company that operate as a monopoly like costly products, poor delivering manners, quality falling below the demand level have to be forgiven since there are no other options.

We need to pay attention to the same standards used by different manufacturers. Relative proximity of software and settings should be ensured.

Despite the fact that the products are produced by different companies, importance should be given to the uniformity of their standards. Various protocols, content of records, supported remote control technologies, uniformity of encryption, monitoring protocols, relative closeness of settings allow integration of products from different manufacturers into automated control systems. For example, in the network infrastructure, there are relatively less problems when integrating the internal devices of the Cisco company with that of NAG company. In addition, not being tied to one manufacturer allows the organization to clearly set its requirements before competing manufacturers.

The second problem is the high cost of developing or purchasing automated control systems.

There are basically two different approaches to the implementation of automated control systems of telecommunication networks. The first is ready-made solutions provided by manufacturers, and the second is solutions developed based on the organization's requirements.

In the first case, most likely, as mentioned above, the problem of "Vendor Lock-In" occurs, and you can become a victim of self-marketing (for example, high prices are given even for the smallest element required for a control system, if the organization rejects such an element or offers an element at a relatively affordable price, it is assumed that the manufacturer does not guarantee the stability of the system).

In the second case, the costs of the developed solution can be very high. Such expenses are accepted differently depending on the financial situation of the organizations. Both situations indicate that there will be cost issues. There is only one solution to such a problem, the extent to which the automated management system will benefit the organization should be evaluated based on the organization's future strategic plans and scale, otherwise, it should be removed from the agenda.

It is highly recommended to use the Total Cost of Ownership (TCO) method in the evaluation.

1. Purchase price. The initial cost of purchasing an automated control system includes the cost of the system, various license fees, and initial setup costs.

2. Development and implementation costs. Development and implementation costs of the automated management system. This may include system development, software customization, and any additional infrastructure requirements.

3. Educational expenses. Costs of training users or employees to use the system effectively. After initial launch, ongoing technical support and training may be required.

4. Service and support costs. Costs associated with maintaining the automated control system in stable mode. This includes software updates, technical support and ongoing maintenance.

5. Warranty costs. Costs associated with new versions of the product, including license fees, migration costs, and potential downtime costs during the upgrade process.

6. Costs of ensuring system continuity. Unplanned Outages The financial impact of downtime or interruptions in normal operations. Downtime can have a serious impact on productivity, revenue and customer satisfaction.

7. Integration costs. If an automated control system is to be integrated with existing systems or other infrastructure, the costs associated with integration should be considered.

By considering all these factors, organizations can make optimal decisions about the benefits of implementing an Automated Management System. TCO analysis is important when purchasing IT technologies or developing solutions, where the initial purchase price of hardware or software can often be only a fraction of the total cost of ownership.

Third problem is not taking dynamic growth of the network infrastructure over time into consideration.

Such problem is observed in every third organization. There are many cases where the overall scale of the network infrastructure, the expansion of the organization, the load of the exchanged information on the network infrastructure, as well as the level of confidentiality of the information are not taken into account. In such cases, the network infrastructure is formed irregularly. As a result, the efficiency of the implemented automated control system and the ability to cover the network infrastructure will be lost. The solution is that the network infrastructure needs to be carefully considered. It is necessary to plan the general topology of the network, the load on the network, the levels of confidentiality of information, the agenda of users and the expansion factors in the growth process of the network, and the formation of permanent monitoring systems in the network infrastructure. It should be taken into account in which cases the network can expand or shrink instead. The formation of operational reserves is also important.

Sufficient qualification of the departments and employees who take care of the network infrastructure is one of the factors that guarantee the non-occurrence of the above-mentioned problems. Organizations should ensure continuous training of departments and employees who take care of the network infrastructure.

In conclusion, the rapid development of digital communication technologies in the 21st century requires the introduction of automated systems for managing telecommunication networks. As noted earlier in this article, the importance of creating and implementing automated management systems for network infrastructures is increasing in the context of increasing competition among leading IT companies around the globe.

Challenges in developing and deploying these systems include the optimal solution for standardized architectures for different vendors, the risk of technology dependency on a single vendor, and the dynamic nature of network infrastructures. To solve these issues, it is necessary to

implement comprehensive measures, such as adopting common standards, reducing the risk of technological dependence, and taking into account the total cost (TCO) of the implementation of automated control systems.

The problem of technological dependence requires comparing common standards in network infrastructures and selecting the most appropriate ones. Such an approach plays a crucial role in the implementation of mutual cooperation between manufacturers. It also reduces the risk of organizations becoming exclusively dependent on one producer. At the same time, it allows organizations to set their own requirements to manufacturers and not be limited to the solutions of a particular one.

Cost issues in developing or purchasing automated control systems. Regardless of whether the organization chooses ready-made solutions from manufacturers or chooses individual solutions tailored to the needs of the organization, the total cost of building the system plays a decisive role. Organizations need to evaluate costs and performance gains, taking into account factors such as initial purchase prices, installation and setup costs, training costs, operational maintenance costs, and potential integration costs.

CONCLUSION

The dynamic growth of network infrastructures cause complications in their management. Scalability, load tolerance of network infrastructure, level of confidentiality of transmitted data and adaptability to changing conditions require careful design. To ensure the effectiveness of automated control systems, organizations must invest in the skills of personnel responsible for continuous monitoring, flexible configurations and network management.

Based on these problems, it is necessary to emphasize the need for a comprehensive approach to the introduction of automated systems of management of telecommunication networks. Organizations must prioritize standardization, evaluate the costs of developing automated management systems, and take into account the dynamic aspects of network infrastructures to take full advantage of these systems in an ever-evolving digital landscape. As technology continues to advance, the successful implementation of automated control systems is critical to seamless communication, operational efficiency, and achieving strategic goals in a digital world.

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