

Chapter 14

Software–Defined Networking in Aviation: Prospects, Effectiveness, Challenges

Roman Odarchenko

National Aviation University, Ukraine

EXECUTIVE SUMMARY

Aviation telecommunications is one of the main means of providing guidance to civil aviation and air traffic control. Proper organization of communication is one of the main conditions for ensuring the safety and regularity of aircraft operations as well as the production activities of enterprises and civil aviation organizations. The new networks will focus on significantly improving the quality of service. The basis for their construction will form SDN networks. Therefore, the chapter analyzed the advantages and disadvantages of two SDN implementing methods. It was developed the mathematical method to assess their complex effectiveness, which considers QoS requirements of implementing service through special weights for scalability, performance, and packet delay. There were simulations of overlay networks by using soft switches to verify the adequacy of the proposed method. The results showed that the use of SDN networks more efficiently by using IP networks for large volumes of traffic and with a large amount of network equipment.

INTRODUCTION

Aviation telecommunications is one of the main means of providing guidance to civil aviation and air traffic control. Proper organization of communication is one of the main conditions for ensuring the safety and regularity of aircraft operations, as well as the production activities of enterprises and civil aviation organizations. The telecommunication of civil aviation is a set of centers, communication stations, terminals, various telecommunications equipment, interconnected by telecommunication networks (ICAO, 1999). Aviation telecommunications performs the following main functions: the transfer of instructions, orders and various types of messages to ensure the safety and regularity of air traffic, messages at all stages of the flight; the interaction of air traffic control centers (points) in the process

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of air traffic control, planning and organization of flights; operational interaction between the services of airlines; transfer of administrative-management and production information; data transfer of various applications of civil aviation. Basic requirements for civil aviation telecommunications: timeliness of communication; reliability and continuity of communication; ensuring the required information transfer rate; securing the necessary secrecy in the transmission of information; maximum efficiency and economy of telecommunication operation.

One of the main parts of these modern aviation telecommunication systems is computer networks. Modern networks are not without disadvantages, such as: the complexity of network management, the high cost of network equipment, etc. The main drawbacks of modern networks, which are used, including in aviation, are:

1. *Difficulties in managing.* Many corporations use shared networks for voice, data and video transmission. Although existing networks can provide differentiated QoS levels for each type of traffic, resource allocation in many cases requires manual control. Administrators must configure each manufacturer's device individually and configure parameters such as bandwidth and QoS based on sessions and applications, since the static nature of the networks does not allow dynamic adaptation when changing traffic, applications, and user queries.
2. *Difficulties in scaling.* Existing network technologies include many different sets of protocols, designed for reliable communication between hosts at arbitrary distances, different channel throughputs and topologies. The industry has developed a set of network protocols that provide higher performance, reliability and security. Protocols solve a specific problem. This generates one of the main constraints - the complexity. For example, to add or remove a particular device, network administrators should make adjustments in multiple switches, routers, firewalls, and more. The topology of the network, manufacturers and models of switches, software versions should also be taken into consideration. Such complexity leads to relative static networks, since administrators seek to minimize the risks brought by the service.
3. *The need for highly skilled specialists.* The disadvantages of the networks described above result in significant difficulties in configuring a variety of proprietary network equipment, since the interfaces for interacting with them and the sets of commands are different. It is clear that this puts much higher requirements for the qualification of the administrators.
4. *High cost of the network.* Modern IP networks require a variety of hardware (routers, switches, and various middleboxes - network equipment that transforms, filters, checks, or otherwise manipulates traffic for purposes other than routing. Examples of middleboxes: firewalls, load balancers, IDS / IPS, etc.). This equipment is quite expensive (especially for large networks), which leads to high costs for building and scaling the network. Large networks require significant network maintenance due to the need to attract qualified specialists for their configuration, management and control.

These and many other shortcomings have led the world of telecommunications to the need to transpose the modern network organization concept. As a result of this transforming process new class of networks appeared – Software-Defined Networks.

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