

ANALYSIS OF QUALITATIVE AND PERFORMANCE INDICATORS OF DATA  
TRANSMISSION NETWORKS

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<https://doi.org/10.5281/zenodo.7856938>

**Abstract.** *This paper considers the indicators of reliability of data transmission networks. Specific features and components of reliability are given. Definitions of additional private properties of reliability are given: survivability and reliability of information. It is shown that the main operational and technical indicator of reliability for a data transmission network and its elements is the availability factor.*

**Keywords:** *Data transmission network, reliability, non-failure operation, maintainability, durability, performance, survivability, reliability of information, availability factor.*

A data transmission network is any telecommunication network that is intended and (or) can be used for the purposes of receiving, transmitting, processing, storing data and telecommunication messages (including telephone calls, telegraph messages, service and information messages, network packets of data networks) without restrictions according to the used user, transport and network data transfer protocols, with the exception of telecommunication networks that provide services for the on-air broadcasting of television and sound programs, satellite telecommunications [1, 5].

Modern data transmission networks are subject to requirements to ensure reliable operation [2-7].

Reliability is the property of an object (data transmission network) to keep in time within the established limits the values of all parameters characterizing the ability to perform the required functions in specified modes and conditions of use, maintenance, repairs, storage and transportation. Reliability is one of the most important characteristics of the quality of an object - a set of properties that determine the suitability of using it for its intended purpose. Unlike other quality characteristics, reliability has the following specific feature [2, 3].

Reliability is a complex property that includes more simple properties, such as reliability, maintainability, durability, performance. Reliability is the property of an object to continuously maintain operability for some time or some operating time [2, 3].

Maintainability is a property of an object, which consists in its adaptability to the prevention and detection of failures and the restoration of the object's operability either by repairing or by replacing failed components. There are two independent characteristics of maintainability: adaptability to repair (repairability in the narrow sense) and adaptability to replacement during operation (recoverability or replaceability) [2, 3].

Durability is the property of an object to remain operational until the limit state, i.e. before the onset of such a state when the object must either be sent for repair (medium or capital), or withdrawn from operation [2, 3].

Operability is such a state of an object in which it is able to perform the specified functions, meeting the requirements of regulatory and technical documentation. Operability is a characteristic of the state of an object at some point in time.

To characterize the reliability of modern digital technology, these properties are not enough. Therefore, additional private properties of reliability are used in practice: survivability and reliability of information.

Survivability is the property of an object to remain operational (in whole or in part) under adverse conditions that are not provided for by normal operating conditions.

When setting the requirements for the reliability of an object, the normal conditions of its operation are usually indicated. But a number of critical facilities may be required to perform certain functions under conditions that are significantly different from normal (even catastrophically destructive). The survivability requirement can be formulated, for example, as follows: “perform the specified functions at a given time interval after the destructive impact” or “maintain partial performance after the destructive impact”, etc. [2-7].

The reliability of the information provided by the object. The information transmission path can have high reliability, good durability, maintainability and maintainability. However, there may be failures that distort information. This is a no less dangerous situation, and therefore the indicated additional side of reliability is introduced.

The main operational and technical indicator of reliability for a data transmission network and its elements is the availability factor - the probability that at an arbitrary point in time the network or element will be in good condition (healthy, functioning correctly). It is determined by reliability indicators associated with equipment parameters or topological decisions on the structure, and recoverability, determined by the effectiveness of the troubleshooting processes and the elimination of the consequences of their occurrence.

To restore a healthy (operable) state associated with the detection and elimination of defects, accidents and malfunctions, the most effective is the design, implementation and correct use of a diagnostic system, isolated or integrated with a control and monitoring system. Here, the methods and algorithms of test diagnostics play a decisive role, which allow you to detail the location and nature of the malfunction, which reduces the time for its search and elimination. This leads to an improvement in recovery indicators (intensity, average time, etc.), and, consequently, the availability factor [3, 5, 6].

Along with the improvement of the reliability and recoverability indicators, the operational and technical reliability indicators are also improved with an increase in the reliability of the transmission of control information. This happens because the reliability (correctness) of making managerial and other decisions increases, which positively affects the functioning of the data transmission network and its elements [2-7].

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