# СЕКЦИЯ «СИСТЕМЫ И СЕТИ ИНФОКОММУНИКАЦИЙ»

## STATIC NETWORK SIMULATION BASED ON NS-3: PACKET NODE COMMUNICATION EXPERIMENT

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**Annotation.** In this paper, the method of packet node communication experiment using NS-3 network simulator is discussed. By building a static network with nine nodes, and using the CSMA protocol and UDP echo application, packet switching and data transmission between nodes are realized. Experimental results show that the NS-3 simulator can effectively simulate the communication process of packet nodes, and provides a powerful tool for network performance analysis and optimization.

**Keywords:** NS-3, packet node communication, CSMA protocol, UDP echo.

**Introduction.** With the continuous development of network technology, packet switching technology has become the core of modern networks. In packet-switched networks, data is split into small packets and transmitted through network devices. Node grouping is an important concept in packet-switched networks, which can divide nodes in a network into different groups for easy management and optimization of network performance. NS-3 is an open-source network simulator that provides a rich set of network models and tools that can be used to simulate various network scenarios and protocols.

**The main part.** Network topology construction: NS-3 [1] was utilized to establish a static network comprising nine nodes, which were then partitioned into three groups, each consisting of three nodes. The nodes within each group were interconnected through CSMA network devices, while the groups themselves were linked via point-to-point connections.

Protocol configuration: Inside each group, the nodes were connected using the CSMA protocol [2], with IP addresses assigned accordingly. The CSMA protocol [2], a form of media access control, facilitates the sharing of a communication medium among multiple nodes. It operates by requiring each node to sense the medium's availability before transmitting data, thereby reducing the likelihood of data collisions and enhancing network efficiency.

Application Configuration: A UDP echo [3] server was installed on the master node of each group, with UDP echo clients set up on the remaining nodes to facilitate packet exchange and data transfer between nodes. The UDP echo [3] application is a straightforward network application where a client sends a packet to a server, and the server echoes the packet back to the client.

Analysis of experimental results: The performance of packet node communication was evaluated by monitoring network traffic and packet loss rates. The experimental outcomes indicated that the CSMA protocol [2] effectively prevents data collisions and improves network efficiency. Packet node communication was found to be a reliable method for data transmission between nodes, and the network's performance was analyzed and optimized based on these experimental results.

**Packet node communication experiment.** In the experiment, as shown in Figure 1, in the packet node communication experiment, the master node of each group acts as a UDP echo server [3], while the other nodes act as clients, sending UDP packets to the server. After receiving the packet, the server performs an echo operation to send the packet back to the client. By monitoring key performance indicators such as network traffic and packet loss rate, the communication performance between packet nodes is analyzed in detail.

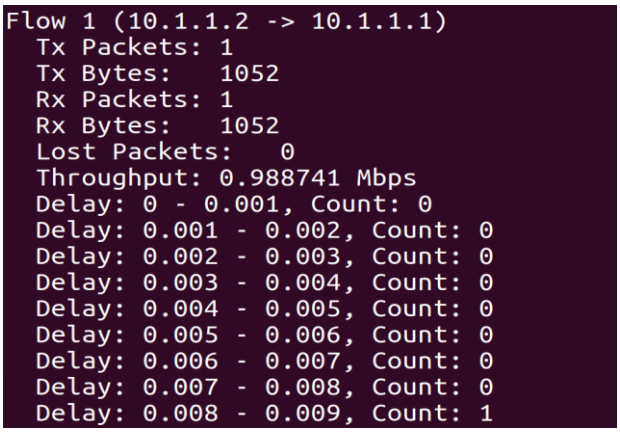


*Figure 1. Schematic diagram of a UDP packet node communication experiment*

**Performance comparison and experimental analysis**. Experimental results show that the NS-3 simulator [1] can effectively simulate the communication process of packet nodes, and provides a powerful tool for network performance analysis and optimization. By adjusting the parameters of the CSMA protocol [2] and the network topology, the network performance can be optimized, and the data transmission efficiency and reliability can be improved.

**Conclusion.** In this paper, the method of using NS-3 network simulator for packet node communication experiments is introduced, and the effectiveness of NS-3 simulator [1] is verified by experiments. Experimental results show that the NS-3 simulator can effectively simulate the communication process of packet nodes and provides a powerful tool for network performance analysis and optimization. In the future, the influence of packet node communication protocol and network topology on network performance can be further studied, and the application of NS-3 simulators in other network scenarios can be explored.

***List of references:***

*1. ns-3 documentation: https://www.nsnam.org/docs/release/latest/*

*2. CSMA protocol: https://en.wikipedia.org/wiki/Carrier_sense_multiple_access*

*3. UDP echo protocol: https://en.wikipedia.org/wiki/Echo_protocol*