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ОПРЕДЕЛЕНИЕ РАЗМЕРА ПАКЕТА ДАННЫХ ДЛЯ МАКСИМИЗАЦИИ СКОРОСТИ ПЕРЕДАЧИ В ДЕЦЕНТРАЛИЗОВАННЫХ СЕТЯХ

DETERMINING THE SIZE OF A DATA PACKET TO MAXIMIZE TRANSMISSION SPEED IN DECENTRALIZED NETWORKS

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Аннотация. В данной статьей рассмотрено определение размера пакета данных для максимизации скорости передачи в децентрализованных сетях.

Одноранговая, децентрализованная или пиринговая сеть — оверлейная компьютерная сеть, основанная на равноправии участников. Часто в такой сети отсутствуют выделенные серверы, а каждый узел как является клиентом, так и выполняет функции сервера. В отличие от архитектуры клиент-сервера, такая организация позволяет сохранять работоспособность сети при любом количестве и любом сочетании доступных узлов

Annotation. This article discusses the determination of the data packet size to maximize the transmission speed in decentralized networks.

Peer—to-peer, decentralized or peer-to-peer network is an overlay computer network based on the equality of participants. Often there are no dedicated servers in such a network, and each node is both a client and performs server functions. Unlike the client-server architecture, such an organization allows you to maintain the network operability with any number and any combination of available nodes

Ключевые слова: децентрализованные сети, P2P, хост.

Keywords: decentralized networks, P2P, host.

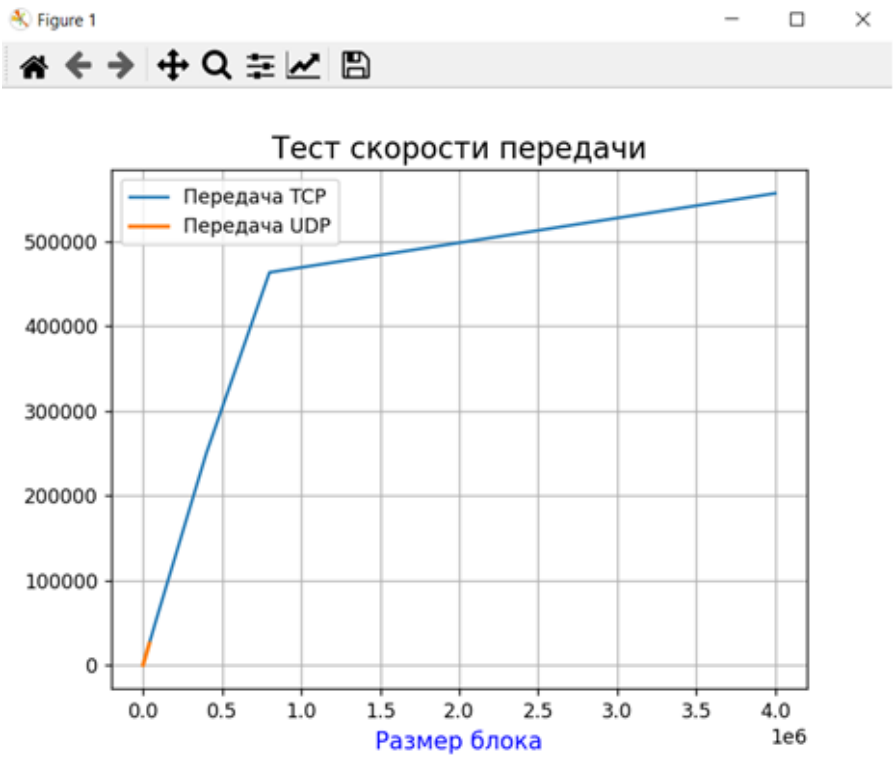
The transfer rate of the peer-to-peer network depends not only on the number of copies, but also on the size of the transmitted block [1]. For example, in the bittorrent protocol, according to the official specification, "...all current implementations use 215 (32KB), and close connections that request a volume exceeding 217 (128KB)." In general, the optimal block size is a debatable issue [2].

With the help of a Docker-based virtualization environment [3], as well as on the basis of a local network of several computers, the transmission of blocks of various lengths and transmission speed measurements were carried out.

Three hosts with local IP addresses were allocated for use as nodes of a decentralized network. It was also decided to use Docker technology for node deployment to speed up and simplify this process.

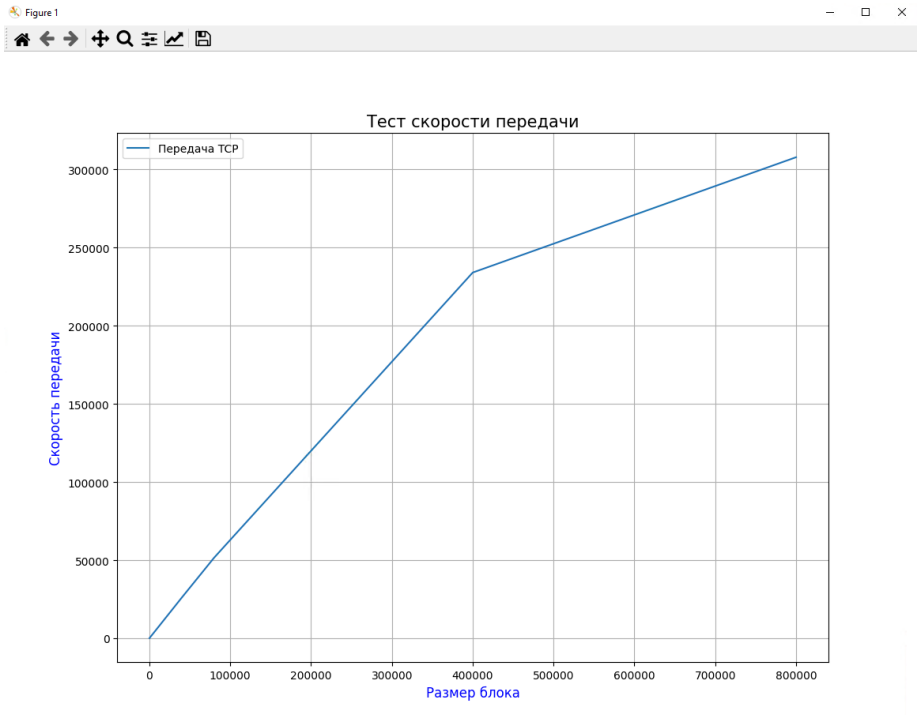
Blocks of the size were used for testing: 100, 400, 800, 4000, 8000, 40000, 80000, 400000, 800000, 4000000 bytes. The number of transmitted blocks in all tests is 100.

Transmission testing in a Docker-based virtualization environment is shown in Picture 1. The maximum increase in transmission speed was observed with a packet length not exceeding 800 kb.



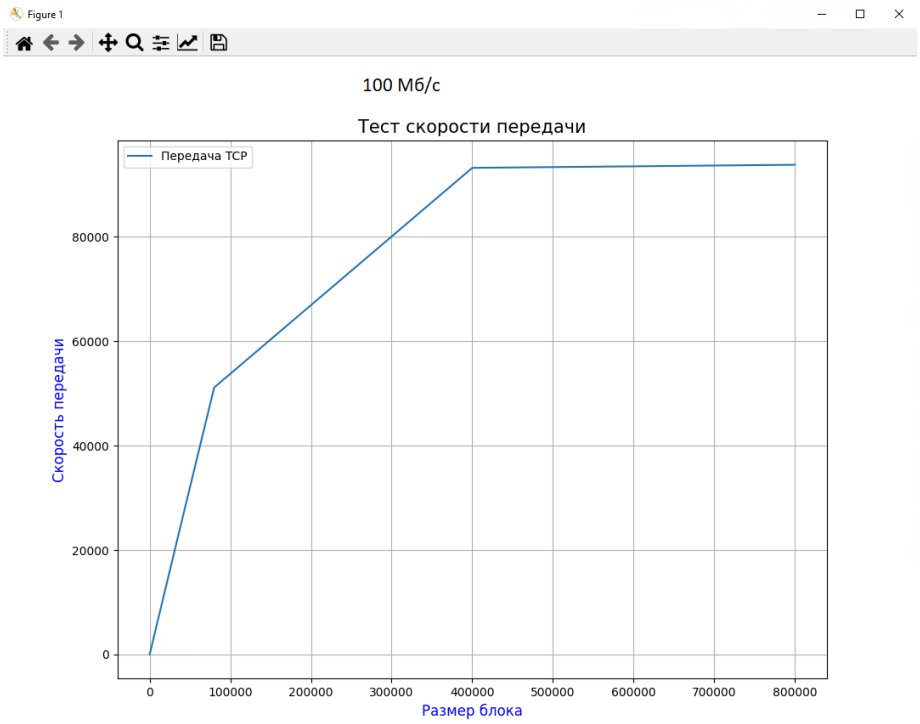
Picture 1 – Transfer rate test in Docker virtualization environment

Testing of transmission in a local network at a network interface speed of 1 GB /s is shown in Figure 2. The maximum increase in transmission speed was observed with a packet length not exceeding 400 kb.



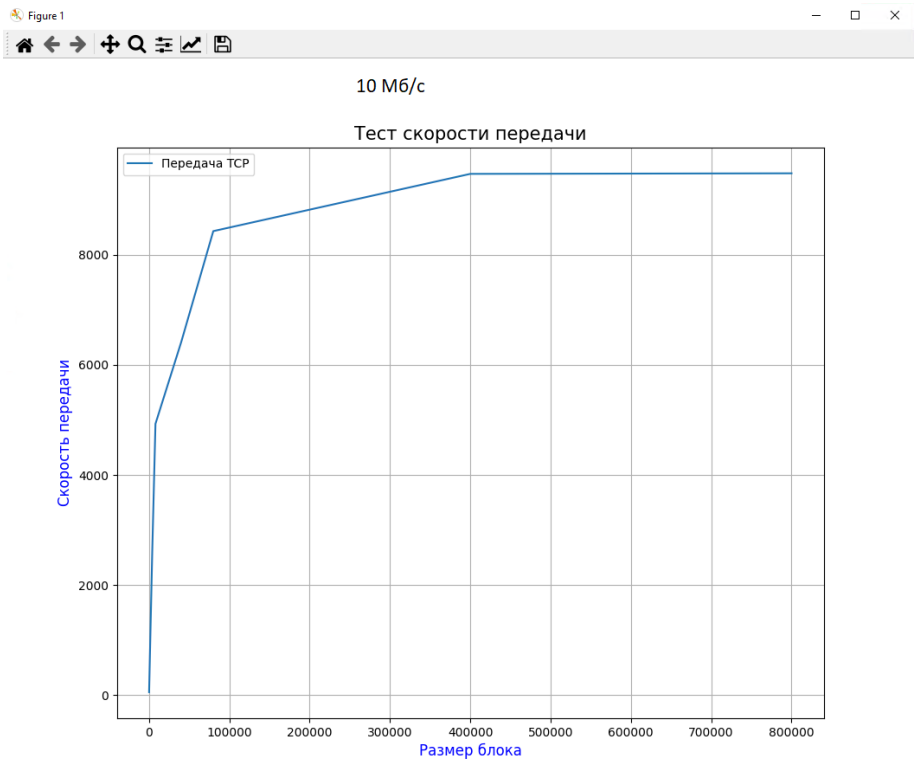
Picture 2 –Test of the local network transmission rate from the packet length at a network interface speed of 1 GB/s

Testing of transmission in a local network at a network interface speed of 100 MB/s is shown in Picture 3. The maximum increase in transmission speed was observed similarly to a 1 GB/s connection with a packet length not exceeding 400 kb.



Picture 3 –Test of the transmission speed in the local network from the packet length at a network interface speed of 100 MB/s

Testing of transmission in a local network at a network interface speed of 10 MB /s is shown in Picture 4. The maximum increase in transmission speed was observed with a packet length not exceeding 80 kb.



Picture 4 –Test of the transmission rate in a local network from the packet length at a network interface speed of 10 MB/s

```
Thread TCP: received 82.4 kb in time 1.5584609508514404 sec with the speed 52.87267541415271 kb/sec
Thread UDP: received 82.4 kb in time 1.5737054347991943 sec with the speed 52.36049782754566 kb/sec. Packet loss: 0.0 %
Thread TCP: received 402.4 kb in time 1.5578906536102295 sec with the speed 258.2979742945919 kb/sec
Thread UDP: received 402.4 kb in time 1.574185848236084 sec with the speed 255.62420120273575 kb/sec. Packet loss: 0.0 %
Thread TCP: received 802.4 kb in time 1.5556182861328125 sec with the speed 515.8077705519427 kb/sec
Thread UDP: received 802.4 kb in time 1.57122802734375 sec with the speed 510.6833546983646 kb/sec. Packet loss: 0.0 %
Thread TCP: received 4002.4 kb in time 1.5540366172790527 sec with the speed 2575.4862887386544 kb/sec
Thread UDP: received 4002.4 kb in time 1.569711446762085 sec with the speed 2549.7679896874884 kb/sec. Packet loss: 0.0 %
Thread TCP: received 8002.4 kb in time 1.554445505142212 sec with the speed 5148.0736851356405 kb/sec
Thread UDP: received 8002.4 kb in time 1.56984543800354 sec with the speed 5097.571905025949 kb/sec. Packet loss: 0.0 %
```

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Thread TCP: received 40002.4 kb in time 1.5605955123901367 sec with the speed
25632.779078503278 kb/sec
Thread UDP: received 40002.4 kb in time 1.5737721920013428 sec with the speed
25418.164206554917 kb/sec. Packet loss: 0.0 %
```

Picture 5 –Transmission rate testing log in Dockers environment

The results of the study of the data transfer rate through the network protocol stack are summarized in Table 1.

Table 1 – Dependence of the data transfer rate through the network protocol stack on the packet length.

Testing Environment	Block size for maximum transfer rate, bytes
Dockers Platform	< 800 000
1 GB/s network	< 400 000
Network 100 MB/s	< 400 000
Network 10 MB/s	< 80 000

Thus, as a result of testing the packet transfer rate, depending on their size, maximum packet values were obtained, not exceeding 390 kb for fast connections and 80 kb for slow ones.

Testing also showed that the TCP transmission protocol "passes" better through various network interfaces and routers, unlike UDP.

Conclusions

To maximize the speed of data transmission over the network, studies were conducted on the effect of packet size on transmission speed, which showed that the size of the transmitted data packet should not exceed 390 kb for connections with speeds over 100 MB /s, and when the connection speed decreases to 10 MB /s, the packet size decreases to 80 kb. This result is consistent with the recommendations for the organization of peer-to-peer networks, which limit the size of the transmitted packet to 128 or 265 kb [4, 5].

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