Description of IP packet structure

An IP packet consists of a header and a data field. The header has the following structure:

1. 4 bits contain the packet version: IPv4 or IPv6.
2. 4 bits contain the length of the Internet header.
3. 8 bits contain the packet priority and route selection criterion.
4. 16 bits contain the total packet length including the header and data field.
5. 16 bits contain the identification tag, which allows the restoration of the packet from several fragments.
6. 3 bits contain fragmentation-related features. Set DF bit prohibits the router to fragment this packet, and set MF bit indicates that this packet is an intermediate (not the last) fragment. The third bit is reserved.
7. 13 bits contain information about the offset (in bytes) of the data field of this packet from the beginning of the whole data field of the original packet subjected to fragmentation. The offset must be a multiple of 8 bytes.
8. The 8 bits contain the time to live (TTL), which determines the number of transitions (through computers, routers, network devices, etc.) that the packet is allowed to make before it disappears.
9. 8 bits contain the protocol (TCP, UDP, ICMP, etc.).
10. 16 bits contain the header checksum used in error detection.
11. 32 bits contain the source IP address.
12. 32 bits contain the destination IP address.

It is also possible to have an optional field, usually intended only for debugging the network (specific control functions), as well as an alignment field, which allows you to make sure that the IP header ends at the 32-bit boundary (zeros carry out alignment). After that comes the data that the packet carries.

The difference between TCP/IP and OSI

1. TCP/IP is a standard protocol used to establish a connection over a network, while OSI is not a protocol, but a reference (conceptual) model used to understand and design the architecture of systems.
2. TCP/IP has four layers and OSI has seven layers.
3. TCP/IP is widely used in practice, while the OSI model has never been used in practice.
4. OSI is developed in ISO and TCP/IP in Arpanet.
5. OSI is concerned with open systems interconnection, while TCP/IP is concerned with the data transfer control protocol.
6. The OSI model helps to standardize routers, switch, routers, and other equipment, while TCP/IP helps to establish communication between different types of computers.

The difference between TCP and UDP

TCP and UDP are the main transport layer protocols. They differ significantly from each other.

The peculiarity of the TCP protocol is that it guarantees the delivery of data packets in an unchanged form, and sequence and without a loss (or duplication). To implement such features, a logical connection between hosts is established. Thus TCP belongs to the class of protocols with an established connection. So this protocol is suitable for sending important data because it controls the process of data exchange. But for such reliability, you have to pay high resource consumption and slower speed (compared to UDP).

UDP protocol does not require connection establishment and does not control anything except the integrity of received messages (datagrams). Thus, datagrams can be lost, duplicated, or arrive late, and in a changed order. This imposes restrictions on the use of this protocol in those areas where the aforementioned lack of control over data is not critical. These are streaming video, video communication, voice communication, and network games. After all, there from the loss of the packet, full or partial, nothing changes, it is not necessary to repeat the request, but the download is much faster. Thus, the UDP protocol allows you to provide high bandwidth and fast data exchange, with moderate resource consumption.