# Communication protocols

* A communication protocol is a set of rules specifying the way of writing (syntax)
* the meaning of individual messages in (network) communication and the synchronization of these messages.
* In doing so, a communication protocol is neither implementation-dependent nor implementation
* details. Network communication protocols thus allow networking
* systems with different architectures, different operating systems and use them to
* different communication media.

# Functions of communication protocols

* Communication protocols must provide at least:
* detection of the physical link medium, detection of nodes, end devices
* handshake - setting of connection parameters between communicating devices
* negotiation of connection parameters
* marking and detection of the beginning and end of a message
* message formatting
* error detection
* error correction method
* termination of the connection

# ISO/OSI network model

* In order for devices from different companies to operate on the same computer network, it was necessary to
* to standardise network software. ISO developed standards called OSI
* (Open Systems Interconnection) that specify the various elements of a network
* Communications

# The role of each layer in the ISO/OSI reference model

Physical layer

* technical standards to ensure network compatibility (voltage
* levels, timing of data transmission, rules for connection establishment, mode selection
* transmission), connectors and interfaces, bit conversion, encoding, modulation

link layer

* aggregates data into frames, adds to the beginning and end of the message
* marker (header, footer), optionally checks for errors in the frame. Controls the flowdata, access to shared media. The message can only be delivered to the direct
* neighbour (a node with which it has a direct connection).

network layer

* forms data blocks into data packets, ensures delivery
* packet to the addressee, routing, solves the problem of network congestion

transport layer

* its purpose is primarily to adapt the offered
* to the requirements, it deals with error detection and error recovery,
* multiplexes multiple data streams into a single link, controls the rate of transmission
* messages, optionally offers reliability and coupled transmission. It is implemented up to
* in the end nodes, not in routers, bridges or repeaters

Session layer

* deals with session management in the network, user administration
* (login, logout, password checking, statistics), manages the initiation and termination of
* sessions, is responsible for system recovery after a network outage

presentation layer

* its role is to ensure the equivalent meaning of data between
* sender and receiver, responsible for the conversion of different encodings,
* formats, determines the shape of the data available to the user, performs encryption and compression
* data

## application layer

* programs for network communication, e.g. electronic mail,
* database management, file server software. This layer communicates with
* the user, acting as an interface through which applications access network
* services

# TCP/IP architecture

* TCP/IP is a family of protocols used in computer networks (e.g.
* Internet) for data transmission. In addition to protocols, the term TCP/IP is also used for network
* architecture based on these protocols.
* The origin of TCP/IP dates back to the 1960s and is associated with the military project
* of a computer network where data transmission would not be continuous

## Network interface layer

* Allows access to the physical transmission medium, is directly dependent on
* implementation, varies for each transmission technology. This layer is not within the
* TCP/IP, there are no protocols for it within TCP/IP.
* The transmission mechanisms used in the network interface layer come from the used
* transmission technology.
* The transfer services used by the network interface layer are used to transfer blocks of data
* (called frames in this layer) between neighbouring nodes of a computer network.

## The network layer

* The primary task of the network layer is to find a path for blocks of data (called in this layer
* packets), not only between immediate neighbors, but between any two nodes on the network.
* It searches for the most appropriate path to the destination, caring not about reliability but about what
* the fastest data transmission. Once a suitable path is found, it ensures that the packet is transmitted sequentially through
* intermediate nodes in the path, wrapping the packet in a frame and using the layer
* the network interface layer, it forwards the packet to its immediate neighbour. At the neighbouring node, the frame
* is again received by the network interface layer, which unpacks it and forwards the packet to its network
* layer, which again finds the most appropriate path to the destination and, through its
* network interface layer sends the data to the next neighbouring node (see figure).
* The most important protocol of the network layer is the IP protocol, there are also network layer
* protocols ICMP, IGMP, ARP, RARP and their variants are available on the network layer.

## Transport layer

* This layer and the layer above it (application layer) are no longer present on all network
* nodes, but are implemented only on the end nodes of the network.
* The transport layer provides optionally connected and reliable data transfer, the application
* can choose to use the faster, but unreliable and disconnected data transfer
* UDP protocol or the more reliable, coupled TCP protocol.
* The transport layer routes data directly to the requesting applications (lower layers
* differentiate only the node, not individual applications within a node). In addition to
* TCP and UDP, protocols are defined for block transfer, stream
* and packet-sequence-controlled protocols DCCP, SCTP, RUDP.

## Application layer

* This is the layer of applications (programs) that use network data transmission. The original
* application layer services are electronic mail, remote login and remote