

Physical Layer

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Overview

- Bottom-most layer in the OSI Model
- Consists of the physical devices and cables that make up networks
- Responsible for the raw data streams over the network
- Data is transferred as electrical signals, radio waves, or pulses of light depending on the medium being used
- Each individual signal is a bit
- Defines how the 1's and 0's (bits) being transmitted are encoded
- Controls the data rate (how fast data can be transmitted)
- Includes the physical topologies that make up networks (ring, star, bus, etc.)



Devices/Protocols

- Wires, including Universal Serial Bus (USB), Ethernet, Coaxial, Fiber Optic, etc.
- Network adapters and Network Interface Cards
- Antennas
- Network hubs and repeaters
- Layer 1 switch
- Modems

Example Protocol: Etherloop



Interactions

- Data Link Layer
 - This layer is the closest to the physical layer and relies on the physical layer to transmit bits from hosts.
- Network Layer
 - This layer interacts with the data link layer by making the connections needed to transmit data, which in turn, relies on the physical layer to be able to do so.
- Transport Layer
 - The transport layer requires all of the layers below it to function. Without the physical layer, no data transmission would be possible.

Interactions, cont.

- Session Layer
 - The session layer manages and controls connections between applications and without the physical layer, none of this would be possible.
- Presentation Layer
 - This layer translates data formats, encryption, and compression. The physical layer allows it to transmit the data needed to present.
- Application Layer
 - The application layer manages the user interface and experience. It uses the physical layer to transmit data from servers to hosts.

Challenges

Bandwidth Limitations: Every physical medium has a maximum bandwidth it can handle, so exceeding the bandwidth limits can cause poor performance and/or signal distortion.

Latency: Transmission speed from sender to destination can affect the network's performance. The transmission speed and the length of the path can both contribute to latency

Signal degradation: Signal degradation is the reduction in quality or strength of a signal. It can be caused by distance, interference, noise, or imperfections in the transmission medium. Signal degradation can lead to reduced data integrity and more errors.

Security: The physical layer can be affected by weather, people, and anything in the real world. Therefore physical attacks are the biggest concerns. This can disrupt networks and hurt company communications and operations.

Compatibility and Standardization: Even though most hardware has been updated to have USB type C or ethernet, some older computers lack the capability to handle ethernet or high speed ethernet. Some PC parts don't support USB type C, which means you cannot use a wifi adapter.

References

Overview - <https://www.geeksforgeeks.org/physical-layer-in-osi-model/>

Devices/Protocols - <https://www.bmc.com/blogs/osi-model-7-layers/>

<https://osi-model.com/physical-layer/>

Challenges-

<https://medium.com/@kavib/security-challenges-across-network-layers-osi-model-d03d5d187c7>