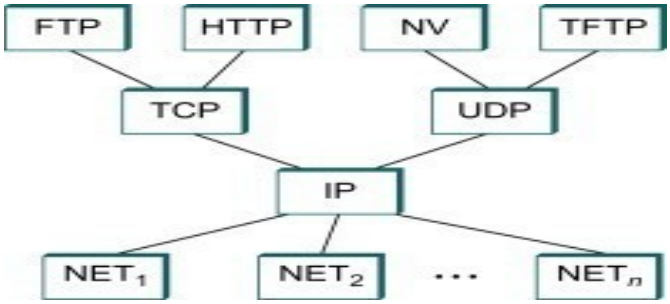
Unit 5 -Basics of Internet Architecture

- What is the *Internet* architecture?
- It is by definition a meta-network, a constantly changing collection of thousands of individual networks intercommunicating with a common protocol.
- The Internet's architecture is described in its name, a short from of the compound word "inter-networking".
- This architecture is based on the specification of the standard *TCP/IP* protocol, designed to connect any two networks which may be very different in internal hardware, software, and technical design.
- Once two networks are interconnected, communication with TCP/IP is enabled end-to-end, so that any node on the Internet has the near magical ability to communicate with any other no matter where they are.
- This openness of design has enabled the Internet architecture to grow to a global scale.
- In practice, the Internet technical architecture looks a bit like a multi-dimensional river system, with small tributaries feeding medium-sized streams feeding large rivers.
- For example, an individual's access to the Internet is often from home over a modem to a local Internet service provider who connects to a regional network connected to a national network.
- At the office, a desktop computer might be connected to a local area network with a company connection to a corporate Intranet connected to several national Internet service providers.
- In general, small local Internet service providers connect to medium-sized regional networks which connect to large national networks, which then connect to very large bandwidth networks on the Internet *backbone*.
- Most Internet service providers have several redundant network cross-connections to other providers in order to ensure continuous availability.

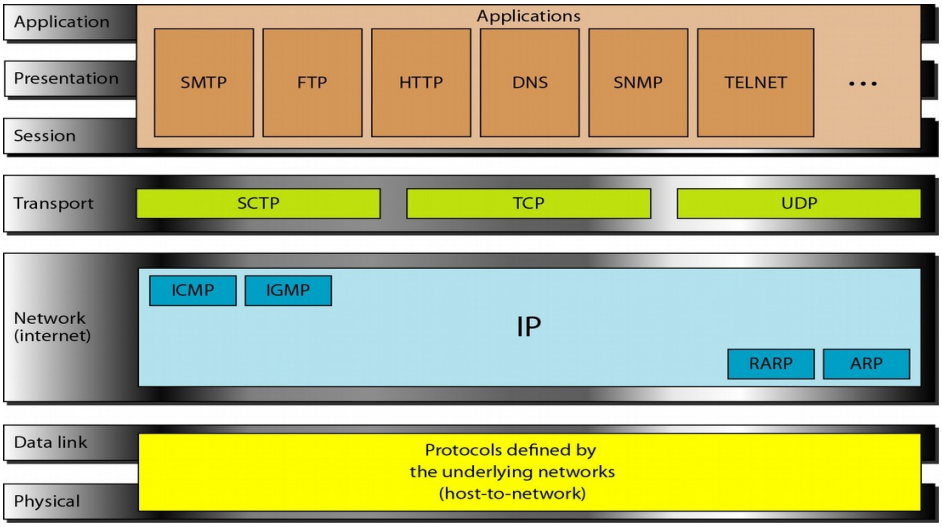
- The companies running the Internet backbone operate very high bandwidth networks relied on by governments, corporations, large organizations, and other Internet service providers.
- Their technical infrastructure often includes global connections through underwater cables and satellite links to enable communication between countries and continents.
- As always, a larger scale introduces new phenomena: the number of packets flowing through the switches on the backbone is so large that it exhibits the kind of complex non- linear patterns usually found in natural, analog systems like the flow of water.
- Each communication *packet* goes up the hierarchy of Internet networks as far as necessary to get to its destination network where local *routing* takes over to deliver it to the addressee.
- In the same way, each level in the hierarchy pays the next level for the bandwidth they use, and then the large backbone companies settle up with each other.
- Bandwidth is priced by large Internet service providers by several methods, such as at a fixed rate for constant availability of a certain number of megabits per second, or by a variety of use methods that amount to a cost per gigabyte.
- Due to economies of scale and efficiencies in management, bandwidth cost drops dramatically at the higher levels of the architecture.
- The Internet architecture, which is also sometimes called the TCP/IP architecture after is two main protocols, is given in the figure given below.
- The Internet architecture evolved out of experiences with an earlier packet-switched network called the ARPANET.
- Both the Internet and the ARPANET were funded by the Advanced Research Projects Agency (ARPA), one of the research and development funding agencies of the U.S. Department of Defense.

- The Internet and ARPANET were around before the OSI architecture, and the experience gained from building them was a major influence on the OSI reference model.



TCP/IP Network Model Vs OSI Model

- The figure given below shows the comparison of TCP/IP and OSI network models.



Addresses in TCP/IP

MAC Address

IP Address

Port Address

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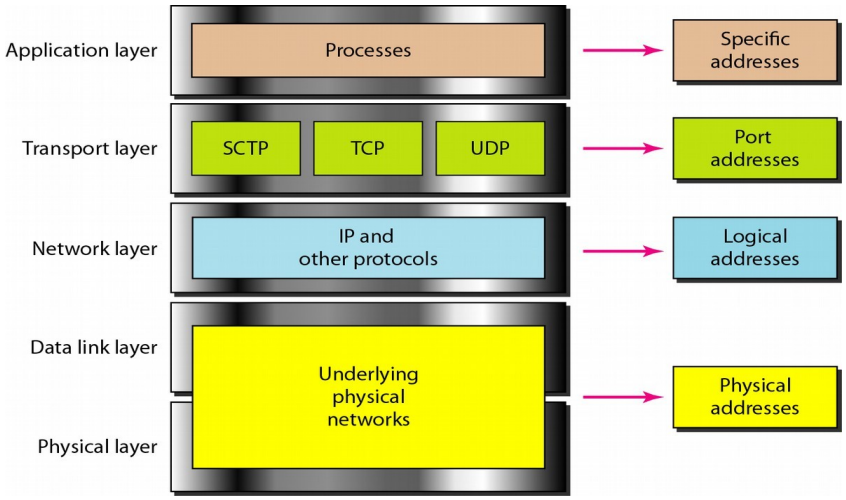
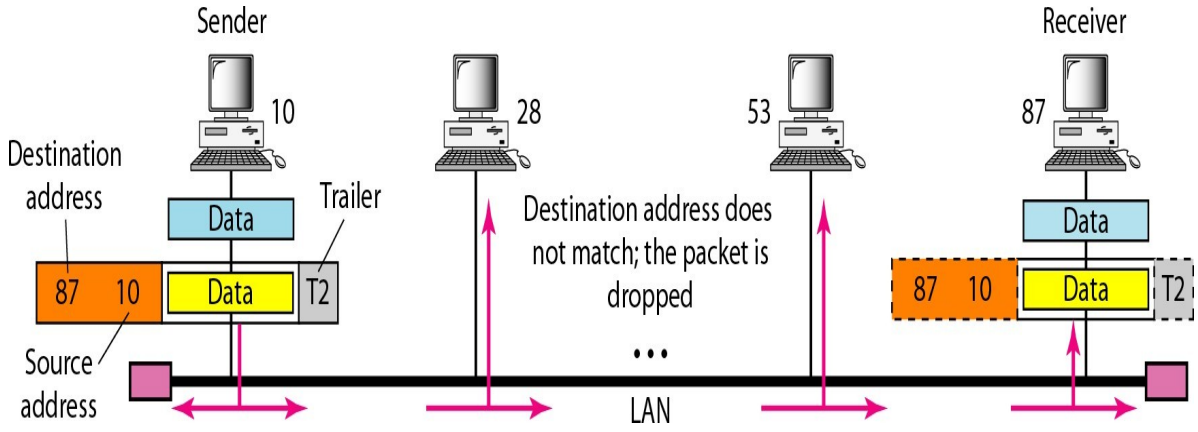
Relationship of layers and addresses in TCP/IP



MAC Addresses



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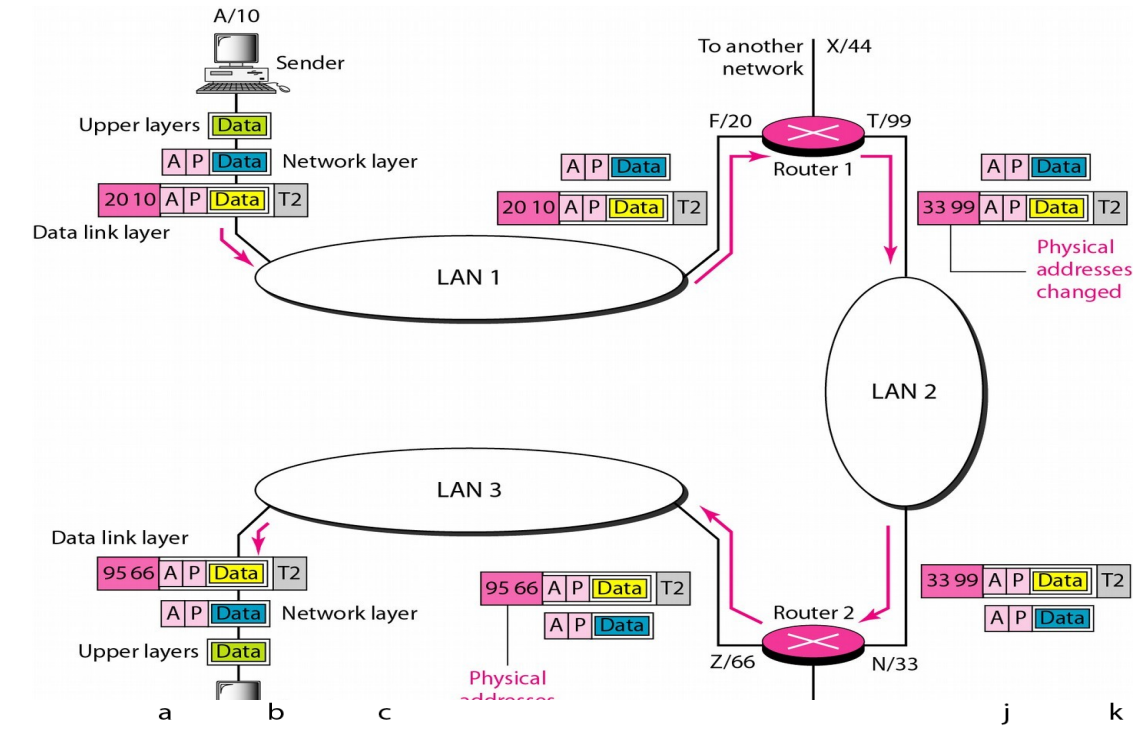
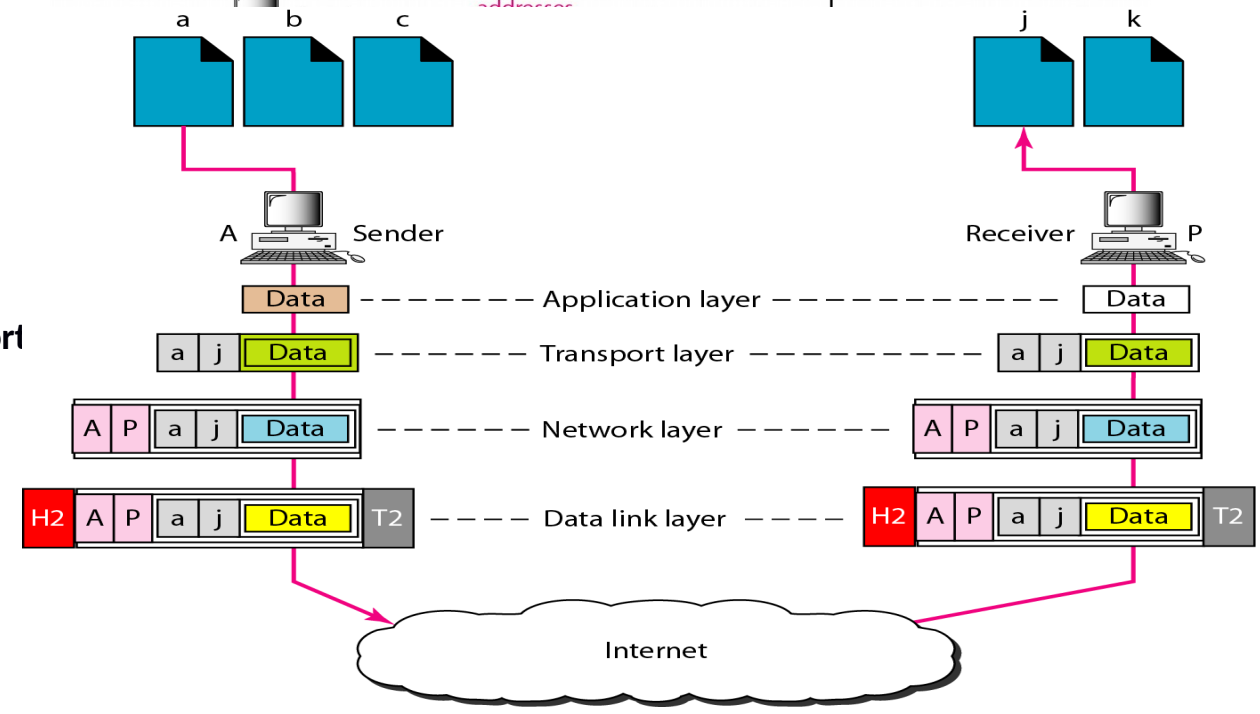
IP addresses



Port



- The physical addresses change from hop to hop, but the logical and port addresses usually remain the same.

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References

1. Data Communications and Networking by Behrouz A. Forouzan, McGraw-Hill Forouzan Networking Series
2. https://www.sciencedirect.com/topics/computer-science/internet-architecture
3. https://www.livinginternet.com/i/iw_arch.htm