**Network Fundamentals Lecture 5 Notes**

**OSI Reference Model**

The need for standardization

* Over the past couple of decades many of the networks that were built used different hardware and software implementations, as a result they were incompatible and it became difficult for networks using different specifications to communicate with each other.
* For an effective network device, it must be:

1. Compatible
2. Able to communicate with each other

* The international organization for standardization (ISO) researched various network schemes to resolve this issue.
* The ISO established a need to create a global network model

The OSI model History

* Development started in 1977
* Draft publish in 1979
* Ratified in 1984 as an international standard
* Objective was open systems interconnection (OSI)

Provides

* Common terminology
* Frame work for networking
* The primary architecture model for inter – computer communications
* OSI is still widely used today

The OSI Reference Model

* Ensures greater compatibility and interoperability between network technologies
* Describes how information/data makes its way from application programs through a network medium (wires etc.) to another application on another network
* Divides the problem of moving information between devices over a network into seven smaller and more manageable problems.

OSI Reference model overview

* Each layer has a specific function/task
* The layer approach reduces complexity
* Each layer provides a service to the layer above
* The lower 4 layers are concerned with the flow of data from end to end (layers 1 – 4)
* Upper four layers are focused more toward services to the applications, layers (5 – 7)

Layers

1. Physical layer
2. Data link layer
3. Network layer
4. Transport layer
5. Session layer
6. Presentation layer
7. Application layer

* Networking people utilize the OSI model extensively
* It is very common to refer to layers by number or name
* Networking devices are associated with a particular layer

Layer 1: Physical

* Deals with the physical characteristics of the transmission medium (hardware)
* It defines the specifications for communications between physical link and the end systems
* Deals with such characteristics as:
* Voltage levels
* Timing of voltage changes
* Physical data rates
* Maximum transmission distances
* Physical connectors
* Examples: - EIA/TIA – 232, RJ45

Layer 2: Data link

* Provides access to the networking media and physical
* Deals with transmission across the media
* Location of the intended destination
* Can provide reliable transit of data across a physical link by using the Media Access Control (MAC) addresses.
* Uses the MAC address in order for multiple stations to share the same medium and still uniquely identify each other
* Concerned with network topology, network access, error notification, ordered delivery of frames and flow control.
* Examples: - Ethernet, Frame Relay, FDDI

Layer 3: Network

* Defines end-to-end delivery of packets
* Defines logical addressing
* Defines how routing works and how routes are learned so that the packets can be delivered
* How to fragment a packet into smaller packets to accommodate different media
* Routers operate at layer 3

Layer 4: Transport

* Regulates information flow to ensure end-to-end connectivity between host applications reliably and accurately.
* Segments data from the hosts’ system and reassembles the data into a data stream on the receiving hosts’ system.
* Layer 4 protocols include TCP (Transmission Control Protocol) and UDP (User Datagram Protocol)

Layer 5: Session

* The session layer defines how to start, control and end conversations (called sessions) between applications.
* It uses a dialogue control for management of multiple bi-directional messages.
* It synchronizes dialogue between two hosts’ presentation layers and manages their data exchange
* It offers provisions for efficient data transfer

Layer 6: Presentation

* Ensures that the information that the application layer of one system sends out is readable by the application layer of another system
* It translates between multiple data formats by using a common format
* Provides encryption and compression of data

Layer 7: Application

* The OSI layer that is closest to the user
* It provides network services to the users’ applications
* It does not provide services to any other OSI layer, only to applications
* It checks the availability of intended communication partners
* It synchronizes and establishes agreement on procedures for error recovery and control of data integrity

Layer Protocol Envelopes

* Data is moved from local application process to remote application process
* Protocol information is used as an envelope at each layer
* Protocol control is added and removed at each layer

Comparisons of OSI and TCP/IP

* Application + Presentation + Session = Applications (TCP/IP)
* Transport = Transport (TCP/IP)
* Network = Internet (TCP/IP)
* Datalink = Network Interface (TCP/IP)
* Physical = Hardware (TCP/IP)

Connection and connectionless transport

* Connection – oriented TCP is used for transport when there is a need for delivery assurances
* Applications can assure reliable delivery
* Connectionless UDP is used when the application performs any needed recovery
* In request/response applications
* By repeating the request after a timeout
* This can cause a duplicate operation if the response was delayed
* Connectionless UDP is also used for:
* Broadcast
* Real – time e.g. VOIP

Other Protocols

* Novell’s protocols, including internetworking packet exchange (IPX)
* IPX is similar to IP
* The key client/server application runs over it
* IBM’s systems network architecture (SNA) protocols
* SNA includes many different layers
* Supports business transaction applications

The importance of networking standards

* The use of standards is fundamental to open systems
* Independence from vendor proprietary approaches
* Open procurement
* Interoperability
* Standards should be international in scope
* It is important to track new standards
* Knowing when it is ‘safe’ to use an emerging standard

Organisations that produce networking standards

* International standards organization (ISO)
* European telecommunications standards institute (ETSI)
* The TCP/IP internet engineering task force (IETF)
* Publishes request for comments (RFC)
* Institute of electrical and electronics engineers (IEEE)
* American national standards institute (ANSI)

The fast track to new standards

* The standardization process is used to follow the successful development of some capability
* Such as programming language or a type of modem
* The process might take 5 or 6 years, therefore products would be obsolete
* ‘Fast Track’, the process occurs in parallel with the product development
* Vendors often release products before the standard is complete