SET 4573: Data Communication and Switching System

Chapter 2: Protocol Architecture (ISO & TCP/IP)

Lecturer:

Alias Mohd

Telecommunications Department

Faculty of Electrical Engineering

UTM

Protocol Architecure

- The task of data exchange between several machines
  - Involves complex procedures
  - Needs the tasks to be broken into subtasks
  - Can be implemented based on modules
- In protocol architecture
  - The modules are arranged in stacks called layers
  - Each layer performs a set of functions serving other layers on top and below
  - The functions follow certain rules called protocol

Key elements of a Protocol

- Syntax
  - Format of data packet to be transferred
- Semantics
  - Control information for coordination of the data packet
- Timing
  - Speed matching and sequencing of the packet transmission

OSI Protocol Architecure

- Developed by International Standards Organization (ISO)

- An 'open system' that allows any 2 differents system to communicate regardless of their architecture

- OSI is a model for network architecture
  - With layered framework
  - 7 layers related to each other
  - Each layer to perform different functions

OSI Model

Layer	Functions
Application	Information services
Presentation	Data syntax, encryption
Session	Manage connections
Transport	Flow control, error recovery
Network	Routing, switching
Data Link	Flow control, error detection
Physical	Signal transmission

TCP/IP Protocol Architecure

- Developed by US Department of Defense Advanced Research Project Agency (DARPA)

- A condensed version of OSI Model for data communication network

- Consists of 4 layers
  - Application
  - Transport
  - Internet
  - Network Access

- Used by global network, Internet

TCP/IP Model

Layer	Functions
Application	Application services to users
Transport Layer	Transmission service for application
Network Layer	Routing, switching
Network Access Layer	Interface to the network, physical transmission of data

Network Access Layer

- responsible for the exchange of data between an end system and attached network

- concerned with issues like :
  - hardware address
  - access to & routing data across a network link between two attached systems

- examples:
  - LAN (Ethernet, Token Ring)
  - Frame Relay
  - ATM

Internet Layer (IP)

- routing functions and switching across multiple networks using IP protocol

- implemented in end systems and routers

- routers connect two networks or more and relays data between them

Transport Layer (TCP/UDP)

- provides common layer shared by all applications

- provides connectionless and connection-oriented delivery of data

- example:
  - TCP
  - UDP

Application Layer

- provide support for user applications

- need a separate module for each type of application

- determines protocol and data syntax rules at the application level

Transmission Control Protocol (TCP)

- provides a reliable connection for transfer of data between applications
  - 3-phase connection
    - Link establishment
    - Data transfer
    - Link disconnection
- TCP tracks segments between entities for duration of each connection
  - Using sequence number
  - Flow control

TCP Header

Source Port (16)			Destination Port (16)	
Sequence Number (32)				
Acknowledgement Number (32)				
Data offset	Reserved (6)	Flags (6)	Window (16)	
Checksum (16)			Urgent (16)	
Options and Padding				
Data (Varies)				

User Datagram Protocol (UDP)

- provide connectionless transmission as an alternative to TCP
    - no guaranteed delivery
    - no preservation of sequence
    - no protection against duplication
    - minimum overhead

UDP Header

Source Port (16 bits)	Destination Port (16 bits)
Length (16 bits)	Checksum (16 bits)
Data....	

Addressing Requirements

- two levels of addressing required
- each host on a subnet needs a unique logical global network address
  - e.g IP address
- each application on a host needs a unique address within the host
  - known as a port
  - port 80 for http, port 21 & 22 for FTP, port 25 for smtp

IP Header

4-bit version	4-bit Header len	8-bit type of service	16-bit total length (in bytes)	
16-bit identification			3-bit flags	13-bit fragment offset
8-bit time to live (TTL)		8-bit protocol	16-bit header checksum	
32-bit source IP address				
32-bit destination IP address				
Options (if any)				
data				

TCP/IP Applications

- have a number of standard TCP/IP applications such as
    - Simple Mail Transfer Protocol (SMTP)
    - File Transfer Protocol (FTP)
    - Telnet, ssh
    - Hypertext Transfer Protocol (HTTP)