

# Ateneo de Manila University

## Introduction to Networks (Supplement)



Department of Information Systems and  
Computer Science

S.Y. 2001-2002

<http://sysads.ateneo.net/wyu/>

[wyy@admu.edu.ph](mailto:wyy@admu.edu.ph)

## Networking

- ★ the art and science of connecting multiple hosts and devices
- ★ computer/data networking is probably the fastest growing field of computer science today
- ★ reasons for the proliferation of data networks:
  - increase in the number of computers and workstations in the 1980's that fueled need to connect them
  - improvements in data networking technology and the growth of the Internet have driven down the cost of network connectivity
  - networking software is now an essential part of any software package and operating system
  - the need to optimize the movement of data

## Section I

# A Bit about Bytes

## Bytes and Octets

- ★ basic unit of data communications is a bit
- ★ eight bits compose an octet
- ★ a byte is strictly the basic unit of data storage of a computer system
  - most modern computer systems use an eight bit byte
  - term is used interchangeably with octet

## Endian Problem (Speaking Different Languages)

- ★ different system order bytes in a different way
- ★ two types of byte ordering exist: little and big endian
- ★ Big Endian: IBM 370, Motorola 68K, Pyramid
- ★ Little Endian: Intel x86, IBM PPC, DEC VAX

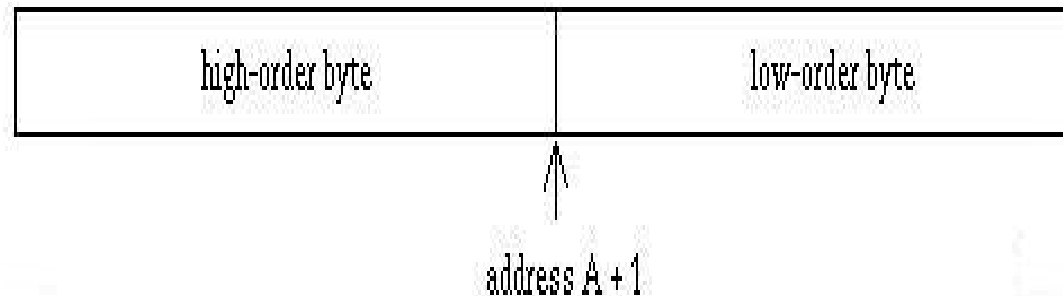


Figure 1: Little Endian Byte Order

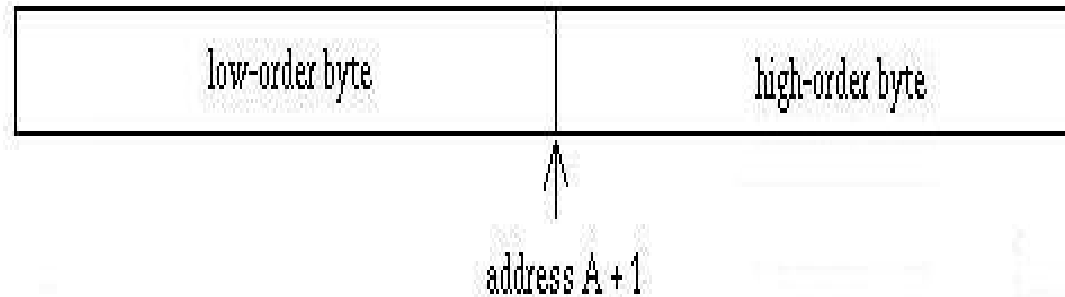


Figure 2: Big Endian Byte Order

- ★ hence, the necessity of reordering data during transmission
- ★ Unix provides a handful of routines for this
- ★ Which is more natural?

## Section II

# Models, Protocols and Layers

## Models, Protocols and Layers

- ★ **models** are used to simplify the task of providing network services by defining appropriate analogies
  - analogous to programming paradigms in software engineering
  - modular, object oriented, functional
- ★ **protocols** can be considered as a language that enables multiple devices to communicate
  - analogous to programming languages in software engineering
  - C, Java, Perl, Pascal
- ★ **layers** to easy implementation and design of network by specializing each layer
  - also done in software engineering
  - each programmer or developer team will focus on a single functionality

## Models for Networking Computing

- ★ models are not mutually exclusive
- ★ Simplified Model
  - the seven layer ISO/OSI model is reduced to four layers
  - the upper three layer of the ISO/OSI model (session, presentation and application) are reduced to the process layer
  - this model is similar to that of the TCP/IP model
- ★ Client-Server Model
  - traditional network computing in which a single host provides the necessary service called a server
  - other network peripherals and devices that connect to this server are referred to as clients
  - examples of these services are: HTTP, SMTP, FTP and others

★ Peer-to-Peer (P2P) Model

- this is a networking model in which there is no difference between a client host and a server host
- all hosts in a P2P network are both clients and servers
- examples of these networks are: napster, kazaa and others

## Protocols

- ★ Are needed to allow computers of all sizes and shapes to communicate
- ★ Need far exceeded initial predictions
- ★ Design must be able to cater to growth
  - AppleTalk
  - IBM NetBIOS
  - IPX/SPX
  - TCP/IP
  - TCP/IP
  - TCP/IP

## Layers

- ★ each layer is responsible for a different facet of communications
- ★ a protocol suite is a collection of different protocols at various layers

## OSI Layers

- ★ Open Systems Interconnect
- ★ de jure standard for networking layers released in 1984 by the International Standards Association(ISO).
  
- ★ Application - provides services directly to applications
- ★ Presentation - formats data in order to provide a common interface
- ★ Session - establishes end connections between two nodes
- ★ Transport - general data delivery-connection-oriented or connectionless
- ★ Network - establishes the connection between two nodes through addressing schemes and routing
- ★ Data Link - frames data and handles flow control
- ★ Physical - transmission of raw signal streams

## Section III

# TCP/IP

## TCP/IP

- ★ Transmission Control Protocol/Internet Protocol
- ★ de facto standard for network communications
- ★ is the suite of communications protocols used to connect hosts on the Internet.  
TCP/IP uses several protocols, the two main ones being TCP and IP. TCP/IP is built into the UNIX operating system and is used by the Internet, making it the de facto standard for transmitting data over networks.

## TCP/IP Layers

### ★ Link

- ★ sometimes called the *data-link layer* or the *network interface layer*
- ★ includes the device drivers contained in the operating systems and corresponding NIC.
- ★ handle interfacing with the physical media

### ★ Network

- ★ sometimes called the *internet layer*
- ★ handles the routing of packets
- ★ IP and ICMP in TCP/IP

### ★ Transport

- ★ controls data flow between two hosts
- ★ dividing chunks into smaller packets to be transmission

- ★ TCP and UDP in TCP/IP

- ★ Application

- ★ handles the details of the particular application or service

- ★ refers to the actual program or service being used

- ★ such as telnet, FTP, SMTP and others

## IP

- ★ Internet Protocol
- ★ is a connectionless protocol that gateways use to identify networks and paths to networks and hosts
- ★ handles the routing of data between networks and nodes on those networks

## TCP

- ★ Transmission Control Protocol
- ★ focuses on getting data across the vast network from one computer to another
- ★ assures that the data gets delivered to the receiving application intact and in the correct sequence
- ★ regulates flow information



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