



GENERAL SIR JOHN KOTELAWALA DEFENCE UNIVERSITY

Communication Networks

ET 3102



Classroom > Communication Networks - ET 3102



Photonic and Laser Engine...

Stream

Classwork

People

Grades



Next Generation Cellular N...

Communication Technology

Communication Theory

Communication Systems

Deep Learning

Machine Learning

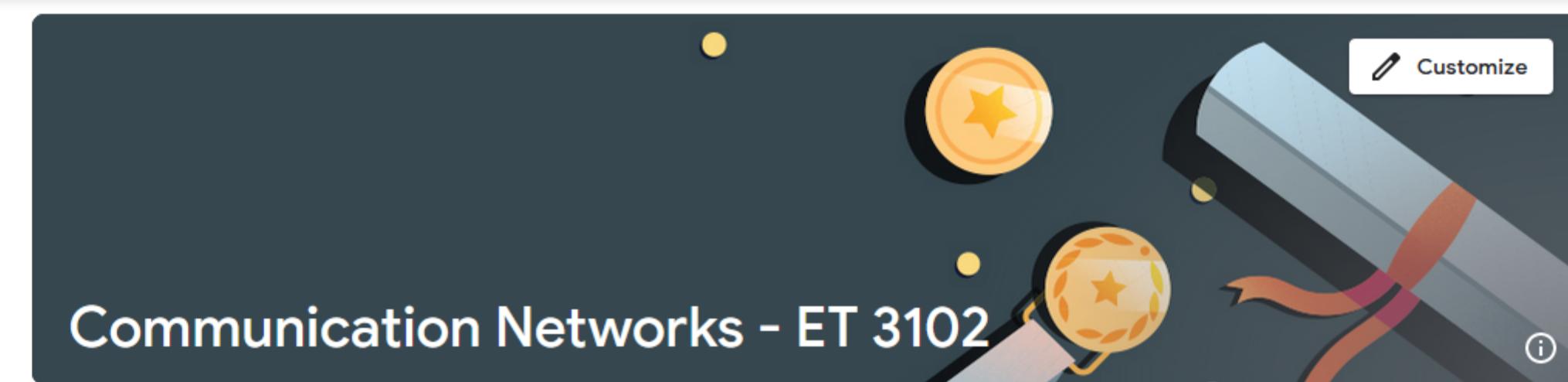
35th Intake : EE & ET

Individual Design Project (...)

Random Signals and Proce...

Archived classes

Settings



Class code



nhqhb2c



Announce something to your class



Upcoming

No work due soon

View all



This is where you can talk to your class

Use the stream to share announcements, post assignments, and respond to student questions



Stream settings



Outline

Overview on ISO/OSI reference model for open systems, packet and distributed systems and Topologies.

Physical and Data Link Layers.

Network (IP) and Transport Layers (TCP/UDP).

Session Layer, Presentation and Application Layer.

Local Area Network and Wide Area Networks.

Overview on ISO/OSI reference model for open systems, packet and distributed systems and Topologies

Goal

The goal of telecommunication architectures is to provide people (and machines) with telecommunication services.

Telecommunication Services - Defined

- the transfer of information.
- In a telecommunication service at least three actors are usually involved:
 - one or more sources;
 - a carrier;
 - one or more receivers

Example:

- ✓ Email
- ✓ FTP
- ✓ Web access
- ✓ Video Conferencing
- ✓ DB access
- ✓ Client/server applications

Practical 1

1. Type <Cmd> in the search box.
2. Open <Command Prompt>
3. Command: <netstat -a>

Practical 1

```
Command Prompt - netstat -a
C:\Users\DELL>netsat -a
'netsat' is not recognized as an internal or external command,
operable program or batch file.

C:\Users\DELL>netsat -a
'netsat' is not recognized as an internal or external command,
operable program or batch file.

C:\Users\DELL>netstat -a

Active Connections

Proto Local Address          Foreign Address        State
TCP   0.0.0.0:135            DESKTOP-NVM4B0B:0    LISTENING
TCP   0.0.0.0:445            DESKTOP-NVM4B0B:0    LISTENING
TCP   0.0.0.0:2343           DESKTOP-NVM4B0B:0    LISTENING
TCP   0.0.0.0:5040           DESKTOP-NVM4B0B:0    LISTENING
TCP   0.0.0.0:5357           DESKTOP-NVM4B0B:0    LISTENING
TCP   0.0.0.0:6881           DESKTOP-NVM4B0B:0    LISTENING
TCP   0.0.0.0:19575          DESKTOP-NVM4B0B:0    LISTENING
TCP   0.0.0.0:19576          DESKTOP-NVM4B0B:0    LISTENING
TCP   0.0.0.0:19577          DESKTOP-NVM4B0B:0    LISTENING
TCP   0.0.0.0:49664          DESKTOP-NVM4B0B:0    LISTENING
TCP   0.0.0.0:49665          DESKTOP-NVM4B0B:0    LISTENING
TCP   0.0.0.0:49666          DESKTOP-NVM4B0B:0    LISTENING
TCP   0.0.0.0:49667          DESKTOP-NVM4B0B:0    LISTENING
TCP   0.0.0.0:49668          DESKTOP-NVM4B0B:0    LISTENING
TCP   0.0.0.0:49669          DESKTOP-NVM4B0B:0    LISTENING
TCP   0.0.0.0:59110          DESKTOP-NVM4B0B:0    LISTENING
TCP   0.0.0.0:59111          DESKTOP-NVM4B0B:0    LISTENING
TCP   127.0.0.1:5939          DESKTOP-NVM4B0B:0    LISTENING
TCP   127.0.0.1:49705         DESKTOP-NVM4B0B:0    LISTENING
TCP   127.0.0.1:49705         DESKTOP-NVM4B0B:50807 ESTABLISHED
TCP   127.0.0.1:49705         DESKTOP-NVM4B0B:53096 ESTABLISHED
TCP   127.0.0.1:49705         DESKTOP-NVM4B0B:53452 ESTABLISHED
TCP   127.0.0.1:49705         DESKTOP-NVM4B0B:53456 ESTABLISHED
TCP   127.0.0.1:49855         DESKTOP-NVM4B0B:49856 ESTABLISHED
TCP   127.0.0.1:49856         DESKTOP-NVM4B0B:49855 ESTABLISHED
TCP   127.0.0.1:49859         DESKTOP-NVM4B0B:49860 ESTABLISHED
TCP   127.0.0.1:49860         DESKTOP-NVM4B0B:49859 ESTABLISHED
TCP   127.0.0.1:53007         DESKTOP-NVM4B0B:53008 ESTABLISHED
TCP   127.0.0.1:53008         DESKTOP-NVM4B0B:53007 ESTABLISHED
TCP   127.0.0.1:53096         DESKTOP-NVM4B0B:49705 ESTABLISHED
TCP   127.0.0.1:53452         DESKTOP-NVM4B0B:49705 ESTABLISHED
```

Telecommunication Services

Taxonomies According to Different Criteria

- Symmetry
- Configuration
- Initialization
- Communication mode.

Symmetry

- Unidirectional Services
 - Bidirectional Asymmetric Services
 - Bidirectional Symmetric Services
- Example:
- ✓ TV broadcasting
 - ✓ Web browsing
 - ✓ Telephone conversation

Configuration

- Point-to-point services
- Multi-point services
- Broadcast Services

Initialization

- Call-based services
- Reservation-based services
- Permanent-mode services.

Communication mode

- Synchronous services
 - Session appears as a continuous stream of traffic,
 - Usually requires fixed and limited delays.
 - e.g., voice.
- Asynchronous services.
 - Session appears as a sequence of messages,
 - Typically bursty.
 - e.g., interactive sessions, file transfers, email.

Communication Mode

- Connection oriented services,
 - Long sustained session
 - Orderly and timely delivery of packets
 - e.g., Telnet, FTP
- Connectionless services.
 - One time transaction
 - e.g., email

Communication facilitation

- Interactive services
- Broadcast services.

Interactive services

- Conversational services
- Messaging services
- Information retrieval services.

Broadcast services

- Without session control
- With session control.

Taxonomies of Information Sources

- Constant bit rate (CBR) - e.g., ITU G.711 standard
- Variable bit rate (VBR). -- e.g., ITU G.718 standard

Practical 2

- Browse following URLs for more information on constant and variable bit rate standards:
 - <https://www.itu.int/rec/T-REC-G.711/en>
 - <https://www.itu.int/rec/T-REC-G.718/en>

Telecommunication Networks

Practical 3

The screenshot shows the Windows Defender Firewall with Advanced Security interface. The main window displays a list of existing inbound rules, including entries for AnyDesk, CDA Server, CDArecovery, ChemDraw, EasyPrinterManagerV2, EPM2AlertList, EPM2Migrator, EPM2OrderSupply, Firefox, Format Factory, HP ColorLaserJet M153-M1, HP Device Setup (HP Color), HP Network Communicato, MathWorks Update Installer, and MathWorks Update Installer. A context menu is open over one of these entries. A secondary window, titled 'New Inbound Rule Wizard - Name', is displayed, prompting the user to specify the name and description of the new rule. The 'Name' field is empty, and the 'Description (optional)' field is also empty. The wizard steps are listed on the right: Rule Type, Protocol and Ports, Action, Profile, and Name.

Windows Defender Firewall with Advanced Security

File Action View Help

Inbound Rules Outbound Rules Connection Security Rules Monitoring

Windows Defender Firewall with Advanced Security on Local Computer

Actions

New Inbound Rule Wizard

Name

Specify the name and description of this rule.

Steps:

- Rule Type
- Protocol and Ports
- Action
- Profile
- Name

Name:

Description (optional):

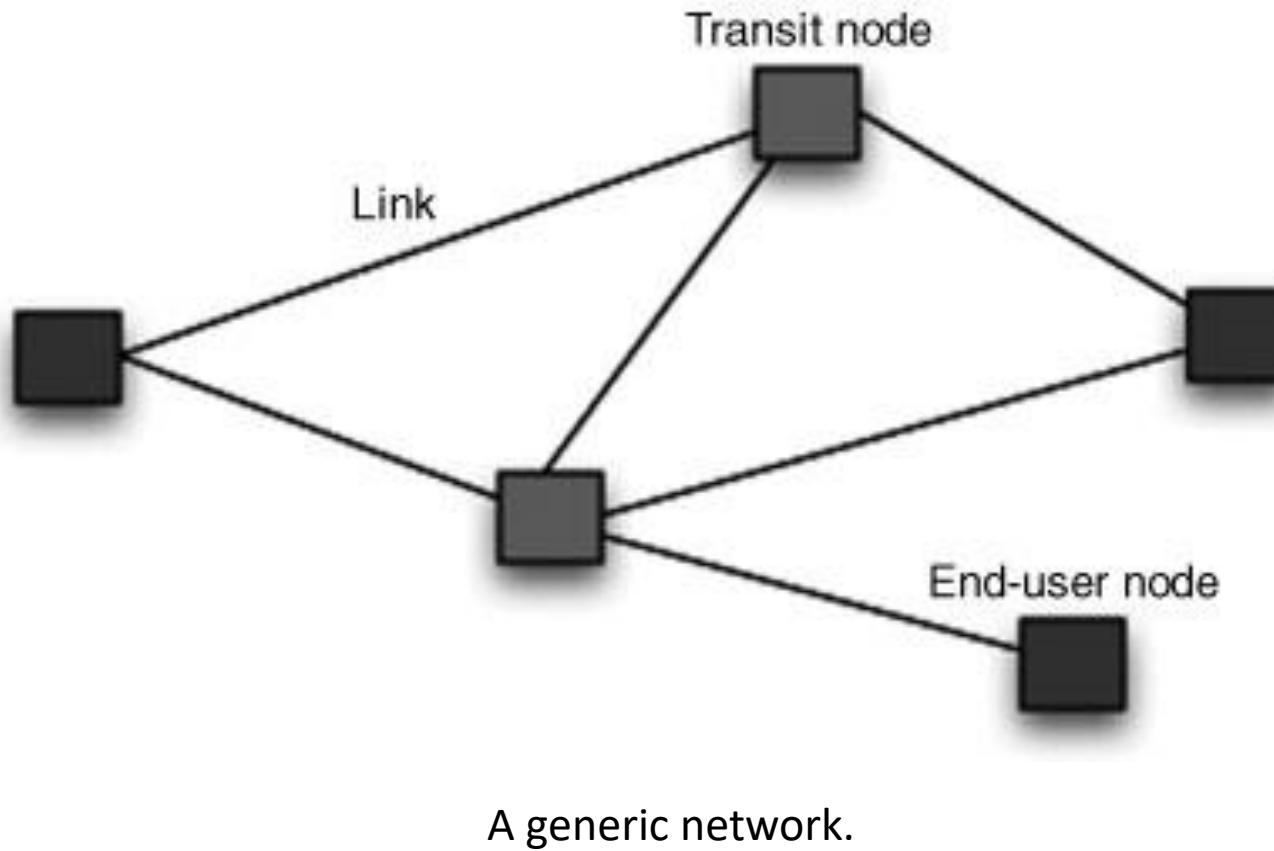
< Back Finish Cancel

Type here to search

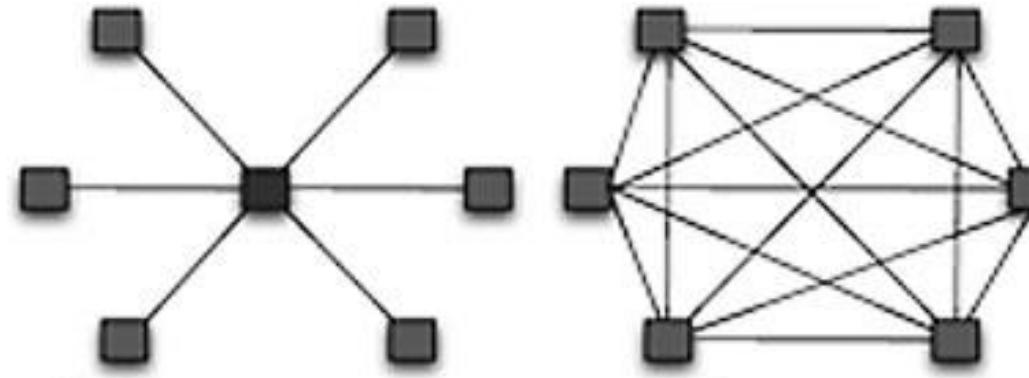
82°F 10:24 AM 1/4/2024

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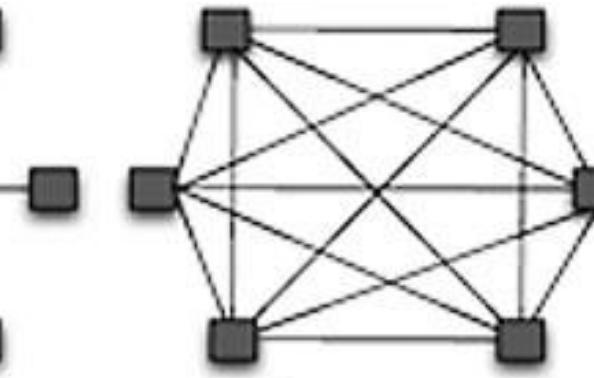
Introduction



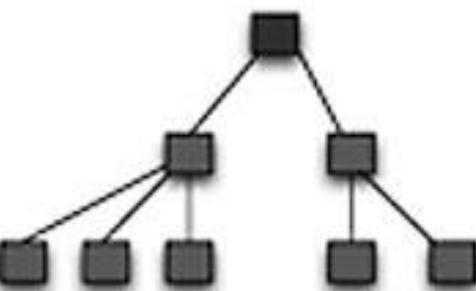
Network Topologies



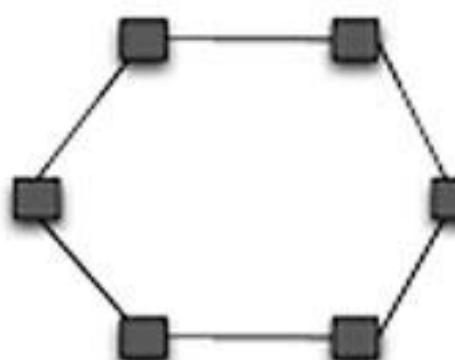
(a) Star



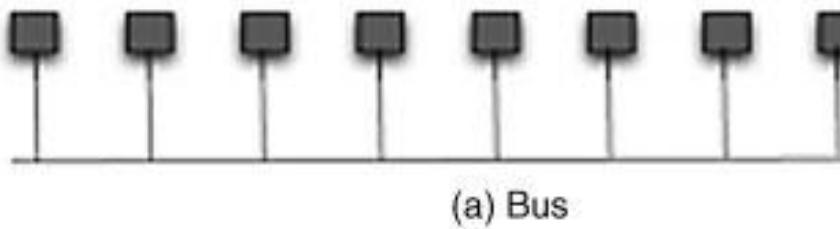
(b) Mesh



(a) Tree



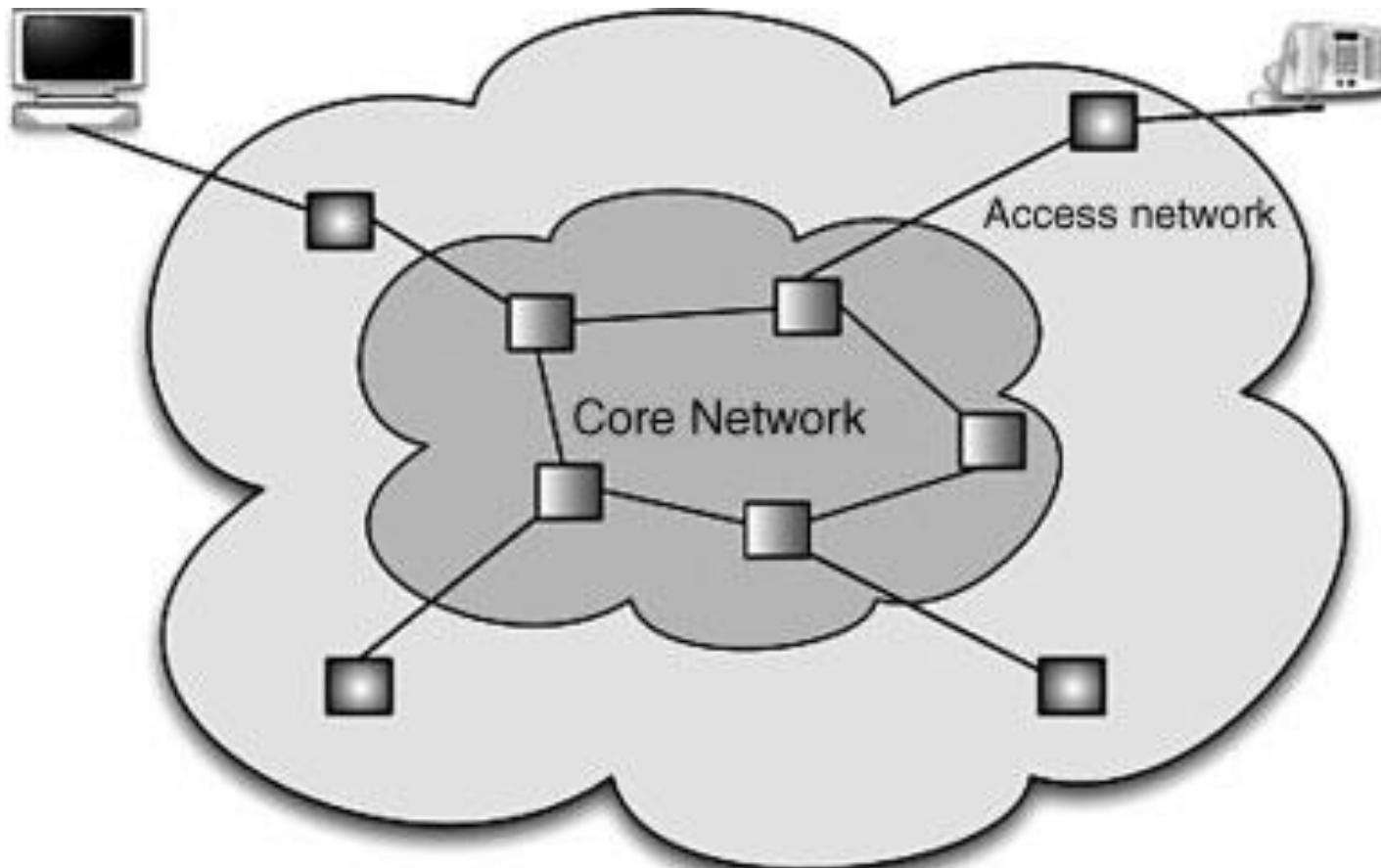
(a) Ring



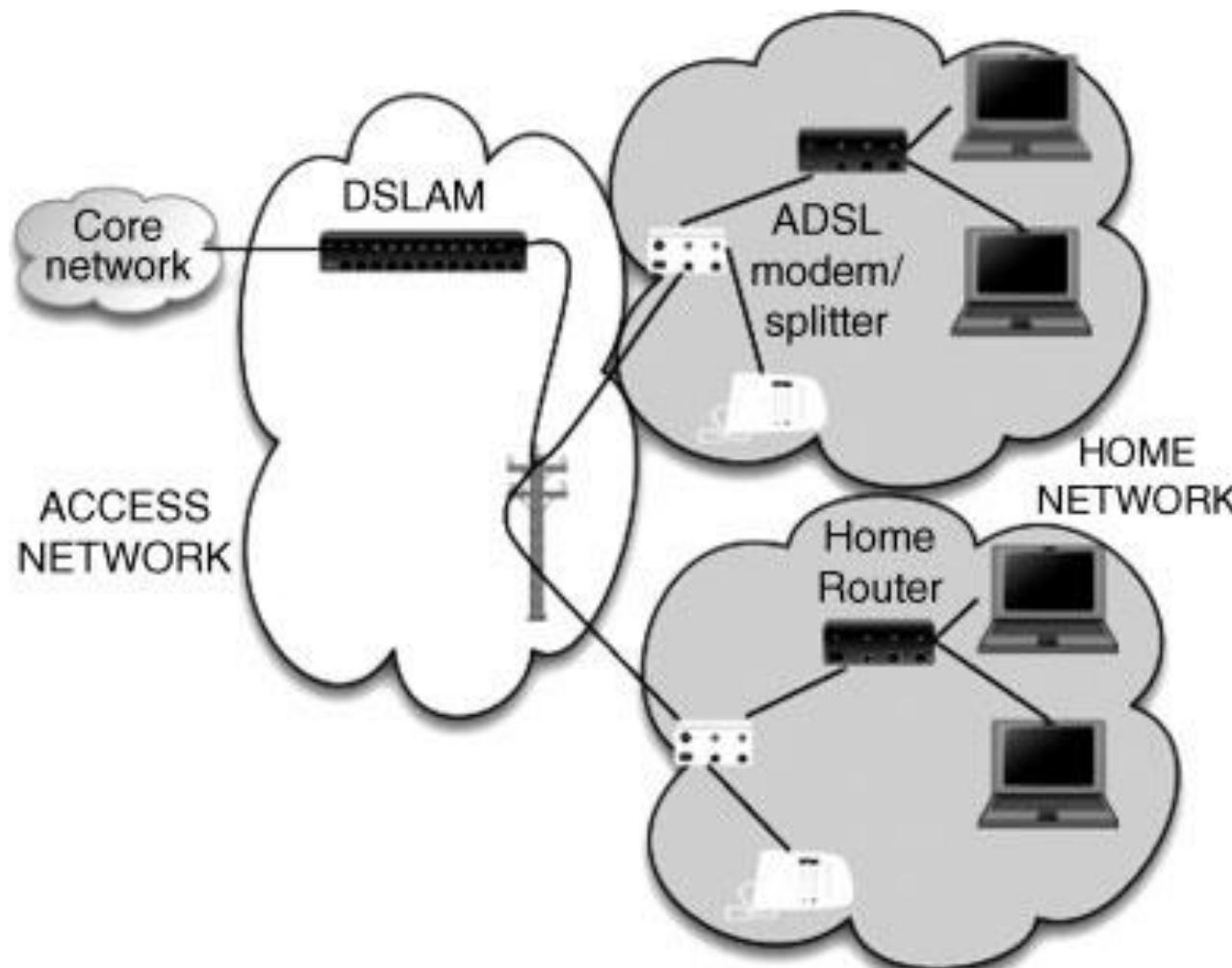
(a) Bus

k.

Access Network and Core Network

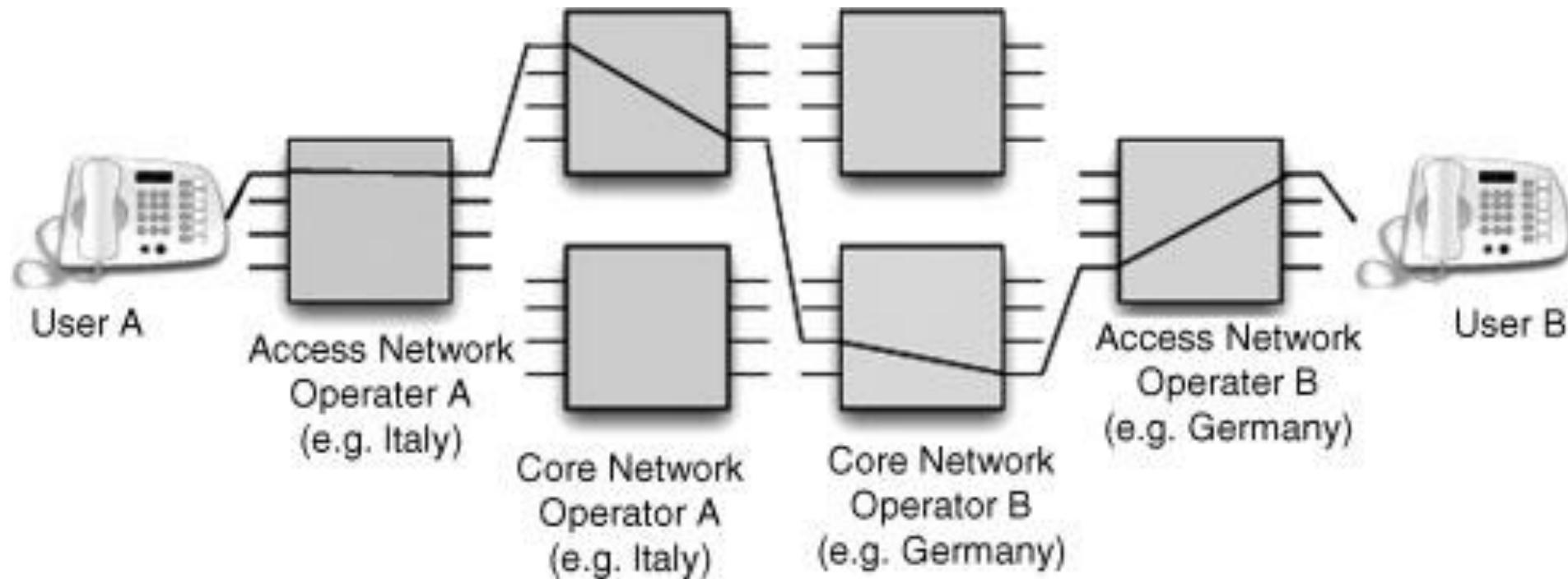


Access Network and Core Network – ADSL Service



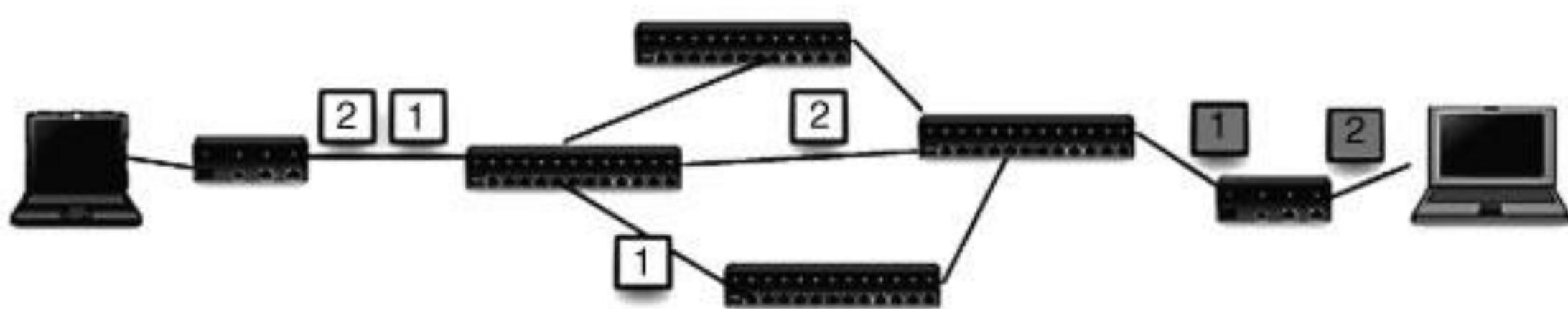
Switching Modes

Circuit-Switched Communication Mode



- Dedicated resources, Fixed path, if capacity is used calls are blocked.
- Advantages: Fixed delays, guaranteed continuous delivery
- Disadvantages: Circuits are not used when session is idle, Inefficient, uneconomic for bursty traffic, typically fixed rate: e.g., 64 kbps, if require call set up and setup time is longer than messages, hence not economical.

Packet-Switched Communication Mode



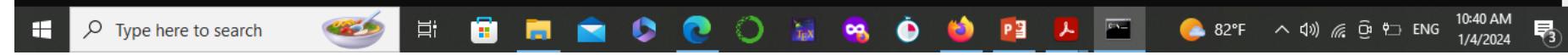
- Datagram packet switching - connectionless
 - Routed on packet-by-packet basis, different packets follow different routes,
 - packets may arrive out of order at destination
 - e.g., IP protocol
 - Virtual circuit packet switching – connection oriented
 - All packets associated with a session follow same path.
 - Route is chosen at the start of the session.
 - packets are labeled with a VC# designating the route.
 - need unique source and destination address.
 - e.g., ATM
- Advantages:**
- Efficient for bursty data.
 - Bandwidth on demand with variable rates.
- Disadvantages**
- Variable delays.
 - Difficult to provide QoS assurance.
 - Packets can arrive out of order.

Practical 4

```
ca Command Prompt
Microsoft Windows [Version 10.0.19045.3803]
(c) Microsoft Corporation. All rights reserved.

C:\Users\DELL>python
Python 3.10.11 (tags/v3.10.11:7d4cc5a, Apr  5 2023, 00:38:17) [MSC v.1929 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license" for more information.
>>> import socket
>>> tcp_socket = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
>>> udp_socket = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)
>>> exit()

C:\Users\DELL>
```



To create a TCP socket using IPv4, you would call: `socket.socket()` function as follows:
`tcp_socket = socket.socket(socket.AF_INET, socket.SOCK_STREAM)`

To create a UDP socket using IPv4, you would use the following code:
`udp_socket = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)`

To close a socket:

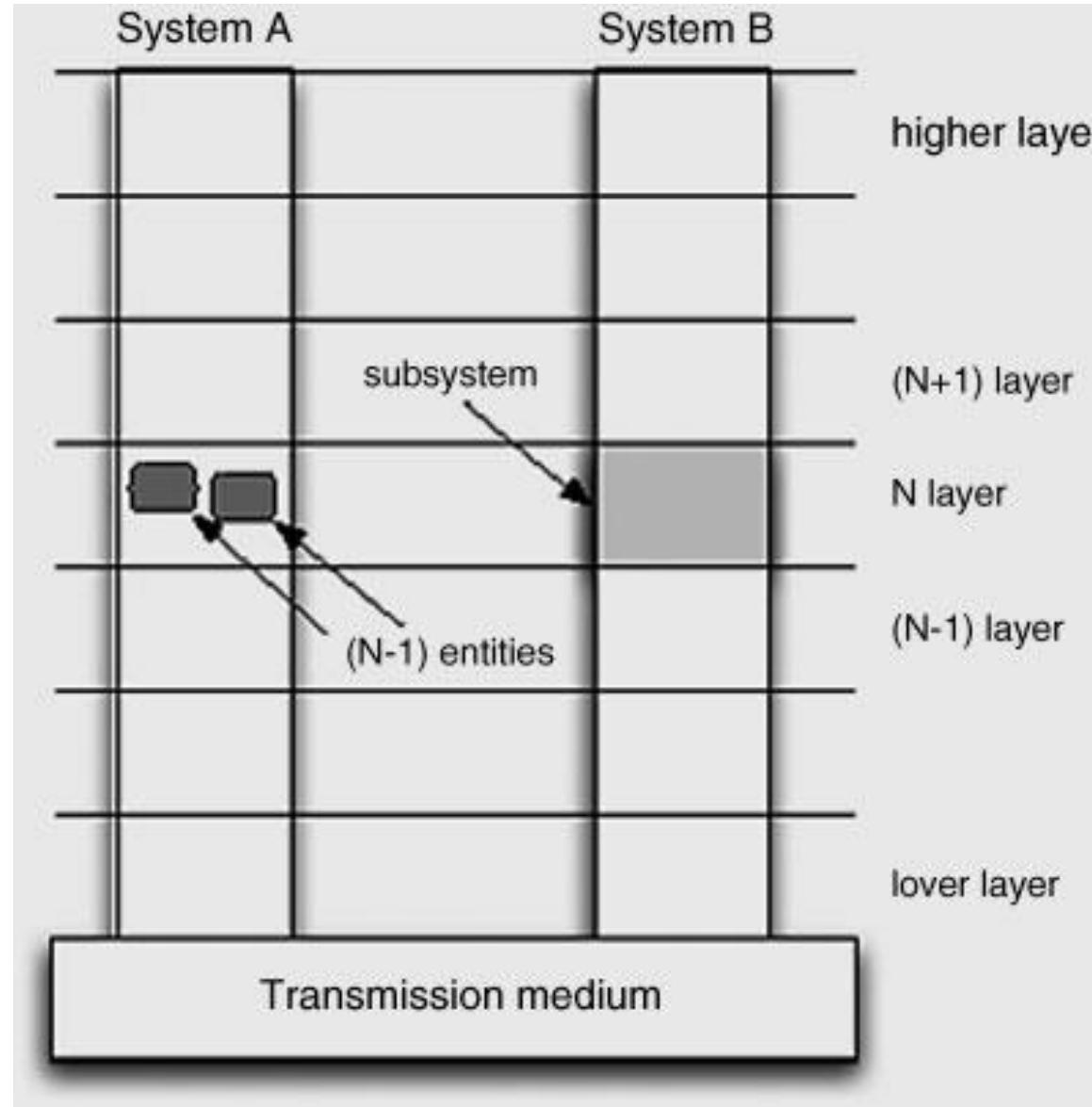
`tcp_socket.close()`

The ISO/OSI Model

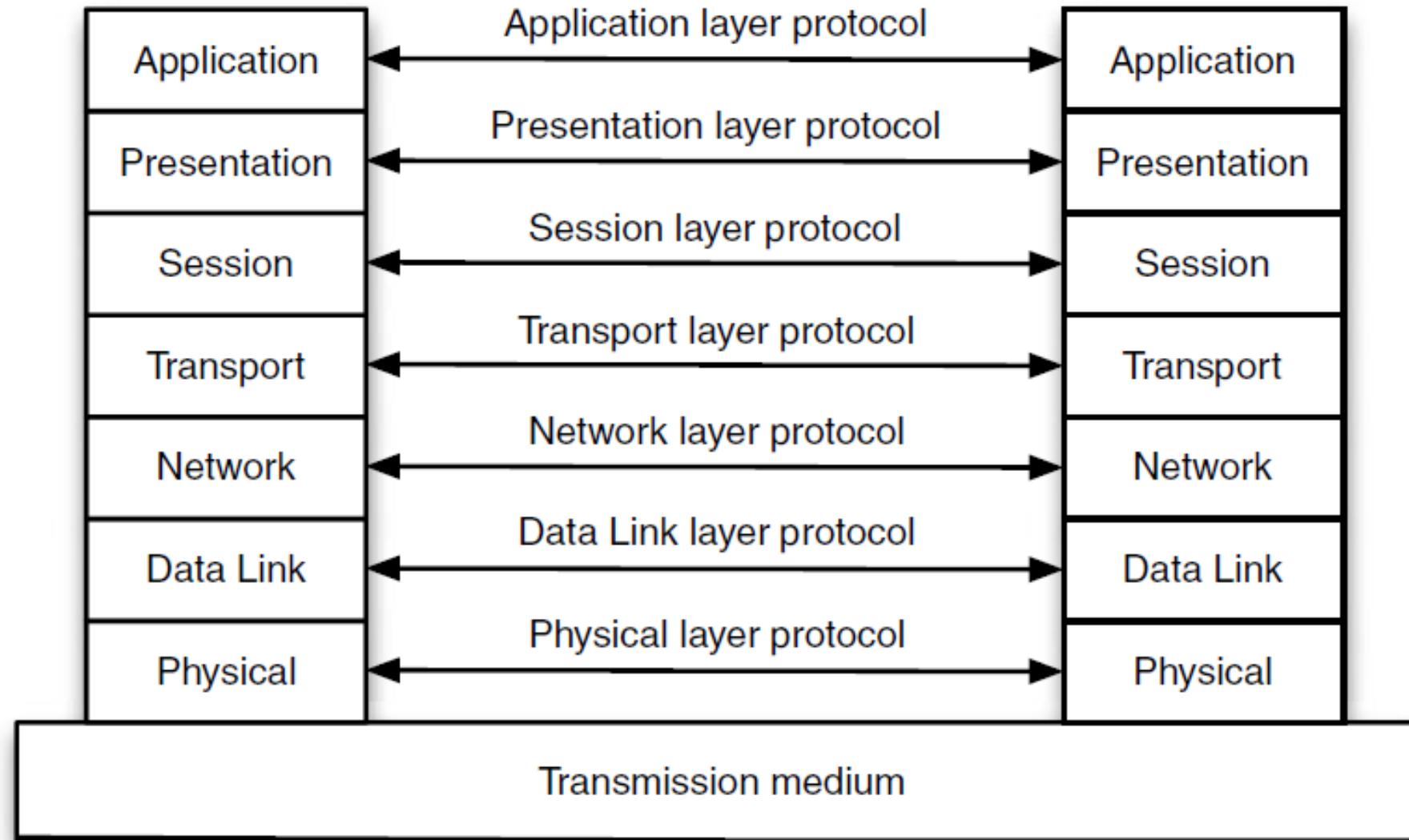
Protocol

- First we introduce the notion of protocol as a set of rules defining telecommunication systems interact.
- To reduce the unavoidable confusion that could be generated by describing protocols without any guideline, a kind of template has been defined to enable :
 - a consistent definition of different protocols;
 - an easier comparison between them; and
 - a translation of one protocol into another, through a suitable conversion.

The Layered Model



The ISO/OSI Model



Signaling

Signaling

- The communication between two end-points involves two *planes*:
 - a *user* plane and
 - a *control* plane.

Signaling

The control flow of information is called signaling.

Control plane protocols are called signaling protocols.

A coordinated set of signaling protocols and entities is called a signaling system.

References

1. Nevio Benvenuto and Michele Zorzi, (2011). Principles of Communications Networks and Systems, John Wiley.
2. Thomas Robertazzi, (2011). Basics of Computer Networking (Springer Briefs in Electrical and Computer Engineering), Springer

Exercise One

