MUST

Wisdom & Virtue

MIRPUR UNIVERSITY OF SCIENCE AND TECHNOLOGY (MUST), MIRPUR

DEPARTMENT OF SOFTWARE ENGINEERING

Computer Networks

Lecture [7]: Protocol Layering

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(Lecturer)

Topics discussed in Today's Lectures

- Protocol Layering (Scenarios)
- Principles of Protocol Layering
- Logical Connections

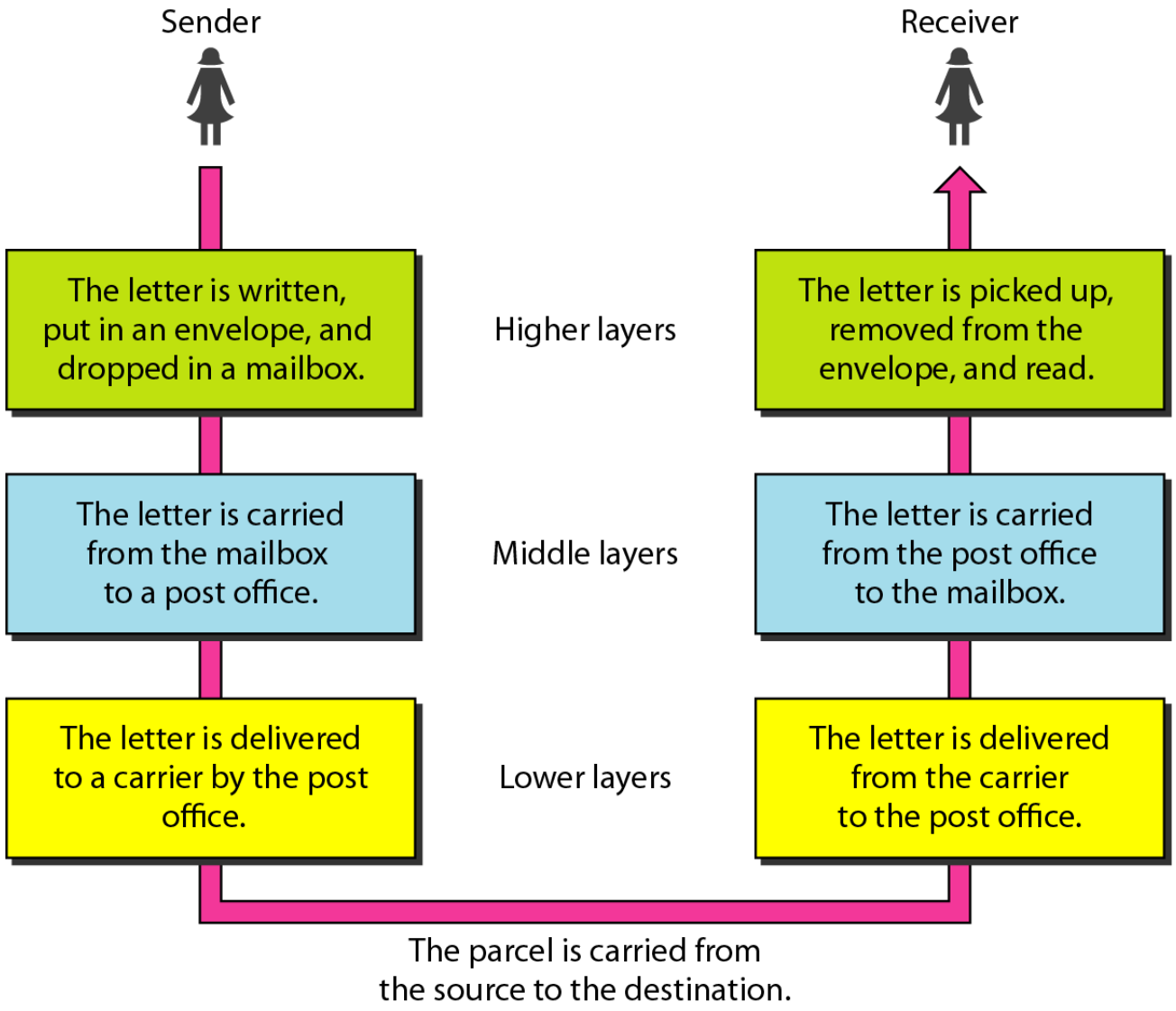
Classification of Interconnected Devices by scale

Interprocessor distance	Processors located in same	Example
1 m	Square meter	Personal area network
10 m	Room	Local area network
100 m	Building	
1 km	Campus	
10 km	City	Metropolitan area network
100 km	Country	Wide area network
1000 km	Continent	
10,000 km	Planet	The Internet

Layered Task

- We use the concept of layers in our daily life
- As an example, let us consider two friends who communicate through postal mail
- The process of sending a letter to a friend would be complex if there were no services available from the post office

Tasks involved in sending a letter



Protocol Layering

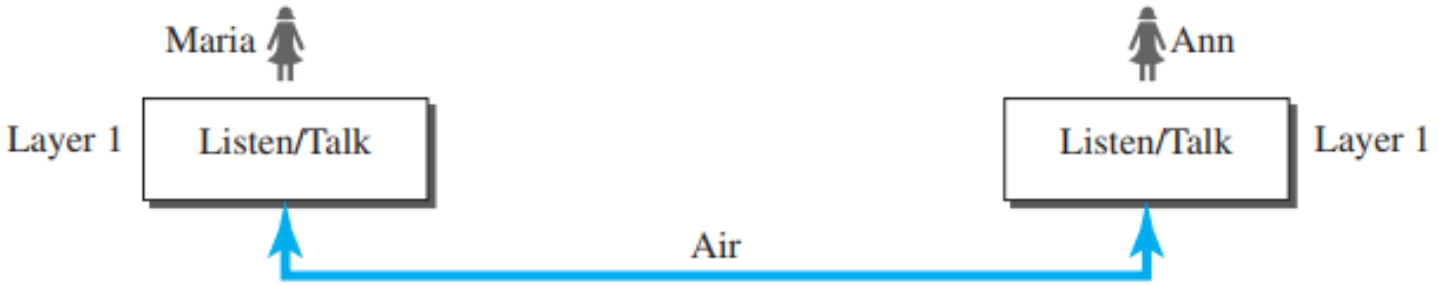
- In data communication & networking (DCN), a **protocol** defines *the rules that both sender & receiver and all intermediate devices need to follow, for effective communication*
- When communication is simple, we may need only one simple protocol
- When communication is complex, we may need to divide the task b/w different layers, in which case we need a protocol at each layer, or **protocol layering**

Protocol Layering - Scenarios

First Scenario

- In 1st scenario, communication is so simple i.e. it can occur in only 1 layer
- Assume Maria and Ann are neighbors with a lot of common ideas
- Communication b/w Maria & Ann takes place in one layer, face to face, in the same language, as shown in Figure 2.1

Figure 2.1 *A single-layer protocol*



Protocol Layering - Scenarios

First Scenario (Contd…)

Set of rules needs to be followed are.

i. Maria and Ann should greet each other when they meet

ii. They should confine/limit their vocabulary to the level of their friendship

iii. Each friend should refrain from speaking when other friend is speaking

iv. Conversation should be a dialog, not a monolog (as in teacher & student): both should have the opportunity to talk about the issue

v. They should exchange some nice words when they leave

Protocol Layering - Scenarios

Second Scenario

- Assume that Ann is moved to another branch located in a city very far from Maria
- Two friends still want to continue their communication & exchange ideas
  - Because they have come up with an innovative project to start a new business when they both retire
- They decide to continue their conversation using regular mail through the post office
- However, they do not want their ideas to be revealed by other people if the letters are intercepted

Protocol Layering - Scenarios

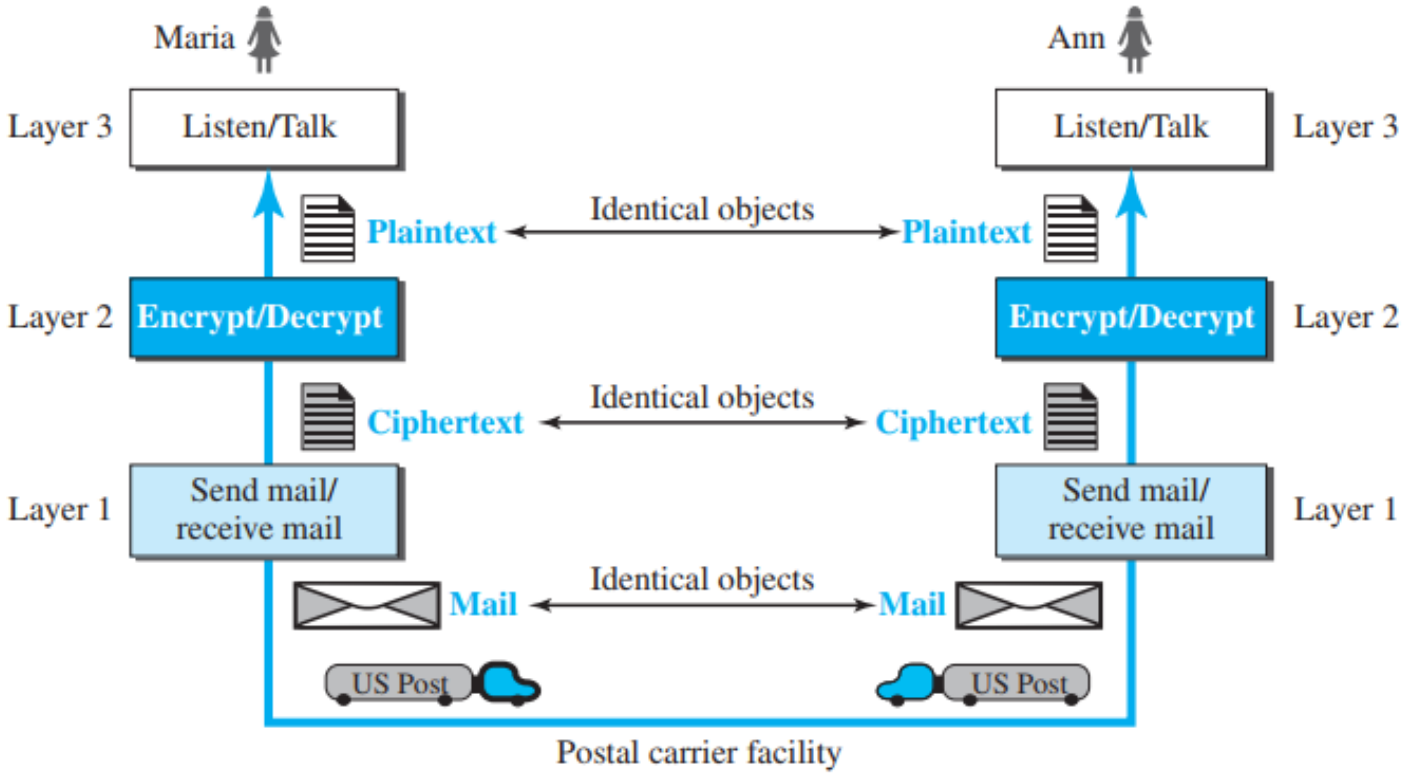
Second Scenario(Contd…)

- They agree on an encryption/decryption technique
- Sender of the letter encrypts it to make it unreadable by an intruder
- Receiver of the letter decrypts it to get the original letter
- Both use one technique that makes it hard to decrypt the letter if one does not have the key for doing so
- So communication b/w Maria & Ann takes place in 3 layers, as shown in Fig.
- Assume that Ann & Maria each have 3 machines (or robots) that can perform the task at each layer

Protocol Layering - Scenarios

Second Scenario(Contd…)

Figure 2.2 *A three-layer protocol*



Principles of Protocol Layering

First Principle

- 1st principle dictates that if we want bidirectional communication, we need to make each layer able to perform two opposite tasks, one in each direction
- For Example, 3rd layer task is to listen (in one direction) & talk (in other direction)
- 2nd layer needs to be able to encrypt and decrypt
- 1st layer needs to send and receive mail

Principles of Protocol Layering

Second Principle

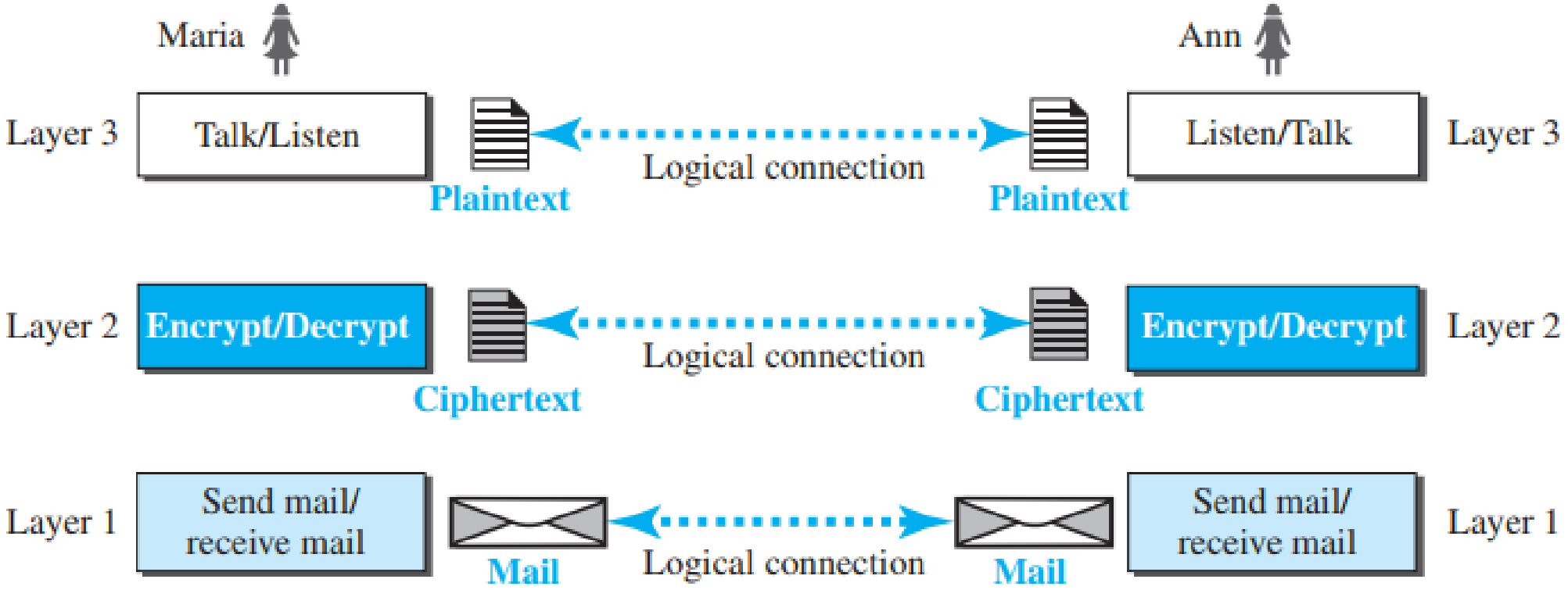
- 2nd principle that we need to follow in protocol layering is that the two objects under each layer at both sites should be identical
- For example, the object under layer 3 at both sites should be a plaintext letter
- The object under layer 2 at both sites should be a ciphertext letter
- The object under layer 1 at both sites should be a piece of mail

Logical Connections

- After following the above two principles, we can think about logical connection between each layer as shown in Fig.
- This means that we have layer-to-layer communication
- Maria and Ann can think that there is a logical (imaginary) connection at each layer through which they can send the object created from that layer
- Concept of logical connection will help us better understand the task of layering we encounter in data communication and networking

Logical Connections

Figure 2.3 *Logical connection between peer layers*



References

Chapter 2

Data Communication and Networking (5th Edition)
By Behrouz A. Forouzan

THANKS