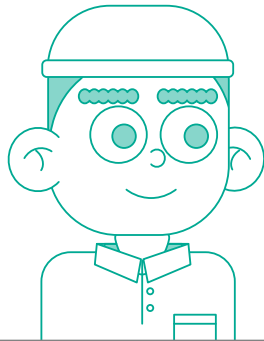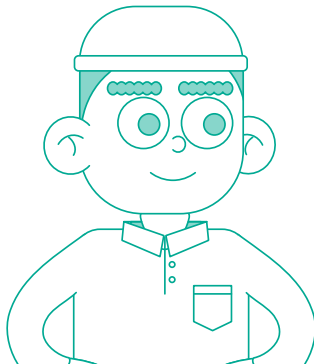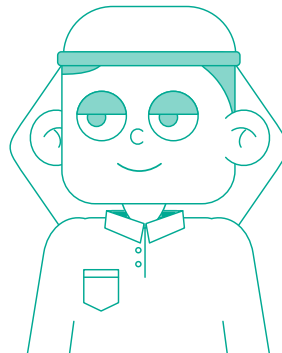# Introduction to Network

1

Imagine you want to send a gift to a friend in another city.
You'll need to prepare it, and decide how to send it.
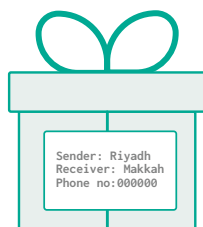Will you deliver it yourself, or will you use a shipping company?

2

Riyadh

Makkah

You choose to send it via a shipping company now you and your friend need
to agree on the delivery method. Will the shipping company bring it to
your friend's home, or will he pick it up at the branch?

3

Sender: Riyadh
Receiver: Makkah
Phone no:000000

You will wrap the gift and include the
receiver's information, including your
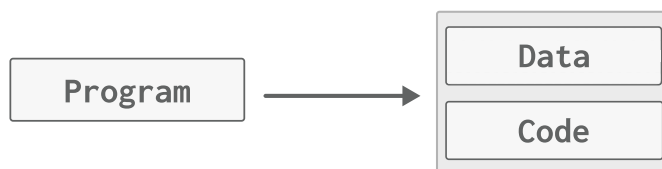friend's city, neighborhood, and contact
details.

4

SHIPPING
COMPANY

The shipping company will proceed with the
task using the receiver's information you
provided, based on your agreed-upon method.

Step 01 What does the Program Contain?

The program includes data and code, with the data being numerical values represent-
ing the application data.

```
Program  ──────▶   ┌─────────────┐
                   │    Data     │
                   ├─────────────┤
                   │    Code     │
                   └─────────────┘
```

Step 02 How does a Program Receive Different Types of Data?

The program receives and processes various input forms, such as text, images,
and user interactions, converting them into numerical representations that can
be understood and manipulated. This allows it to manage and share this infor-
mation effectively and then it converts them from numbers to any other form to
make it easier for the user to understand.

Input Device   Output Device

| Sound | ──▶ | | ──▶ | Sound |
| Text | ──▶ | | ──▶ | Text |
| Image | ──▶ | | ──▶ | Image |

Step 03 Can Programs Communicate?

Can a calculator program communicate with a text file to store results, so that the output of the calculator is sent as an input to the text file for saving?

CALCULATOR

2+3−1=
4

Result.file

Applications can communicate with each other by sharing data, this data is sent as a series of numbers.

For example, when a calculator is communicating with a text file to store its results, so the calculator acts as the sender, and the text file serves as the receiver.

APP
01

send data

Data

APP
02
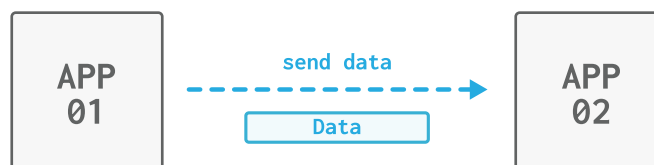
## Step 04 How do Programs in the Same Computer Communicate?

To send data between two programs on the same computer that contains more applications, we must include the unique application numbers of the sender and the receiver to the data being sent.

App
01

App
02

App
03

App
04

Sender Receiver

Packet 04 02 Data
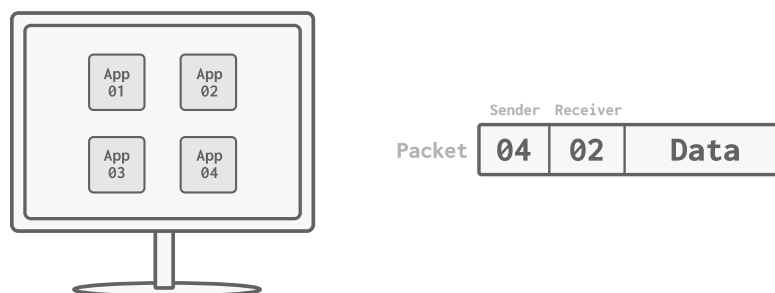
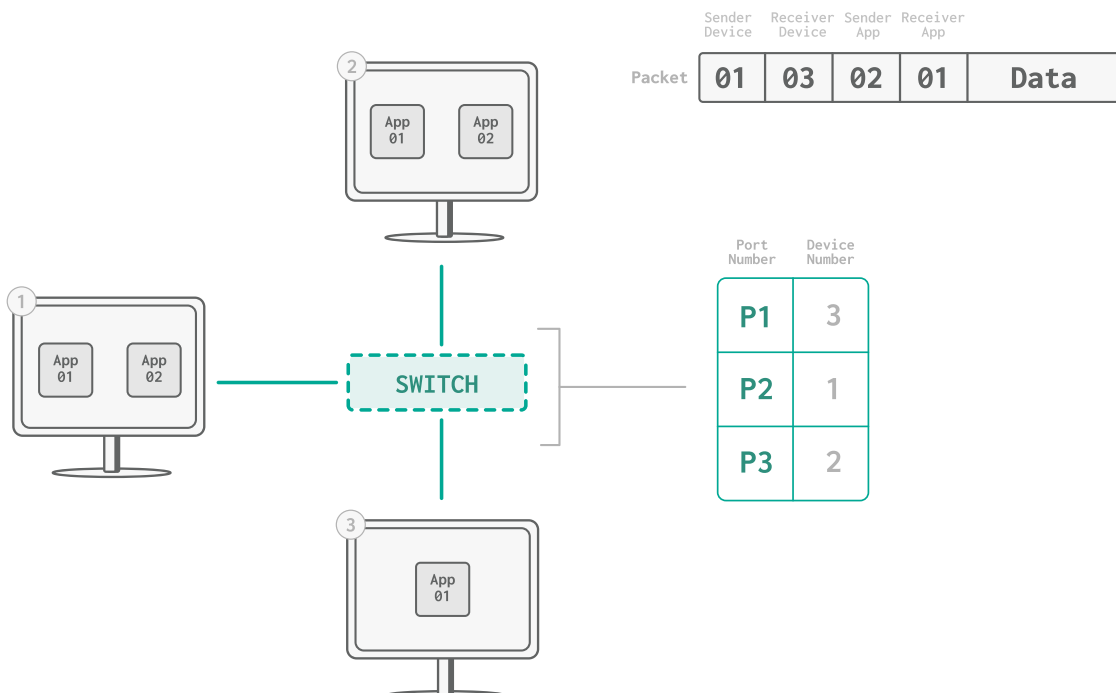## Step 05 How can Two Programs on Two Different Computers Communicate?

The applications communicate with each other on different computers within the same network. Each computer and application has a unique number.

Network consists of two or more computers that transmit and exchange data with each other.
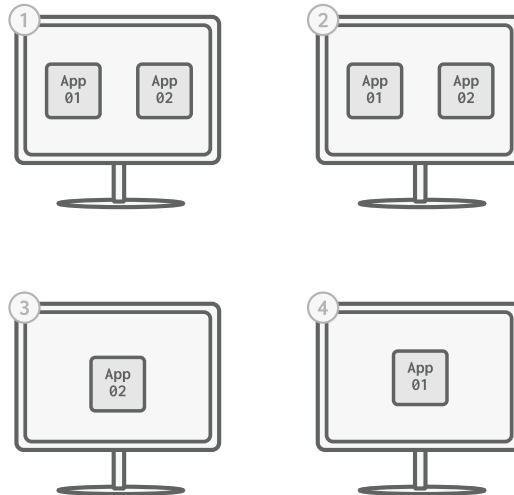
Step 06 How can we Link these Computers?

When we connect more than two computers, we build a network that requires a switch. The **switch** maintains a table that includes the port numbers (P#) and the computer numbers to allow the connected computers to communicate, share data, and interact with each other.

	Sender Device	Receiver Device	Sender App	Receiver App	
Packet	01	03	02	01	Data

Port Number	Device Number
P1	3
P2	1
P3	2

Step 07 What is a Switch?

A switch is a fundamental component of computer networks, designed to connect computers that are connected via a switch forms a local area network(LAN). It facilitates device communication by receiving, processing, and forwarding data to its destination. Switches minimize unnecessary traffic and ensure data reach their destination quickly.

Step 08 How does the Switch Determine the Computer to Send the Data?

A network switch determines the correct computer to send a data by utilizing addressing information. It maintains a MAC address table, essentially a list of computer addresses connected to its ports. This allows the switch to deliver data efficiently.

Step 09 What is a MAC Address?

A MAC (Media Access Control) address is a unique identifier assigned to the network interface card (NIC) of a computer. serve as the primary means by which computers are identified on a

local network. Every computer has a unique MAC address, ensuring that no two computers on the same network share the same identifier.

> **NOTE**
> A Network Interface Card (NIC) is a hardware component that allows a computer to connect to a network, and enable communication between computers on a network by providing a connection to the network medium, such as Ethernet cables or wireless signals.

01 Learning Phase:

When a computer sends a data, the switch reads the source MAC address and associates it with the port the computer is connected to and this information is stored in the switch's MAC address table.

02 Forwarding Phase:

When the switch receives a data, it examines the destination MAC address. If the destination MAC address is already in its table, the switch forwards the data to the corresponding port. If the destination MAC address is not in the table, the switch broadcasts the data to all ports (except the one it came from) in a process called flooding.

Step 10 How can Two Computers on Different Networks Communicate?

The applications communicates with other applications on different networks using a **router**.

NETWORK 01   NETWORK 02

| Packet | 01 | 02 | 01 | 03 | 02 | 01 | Data |
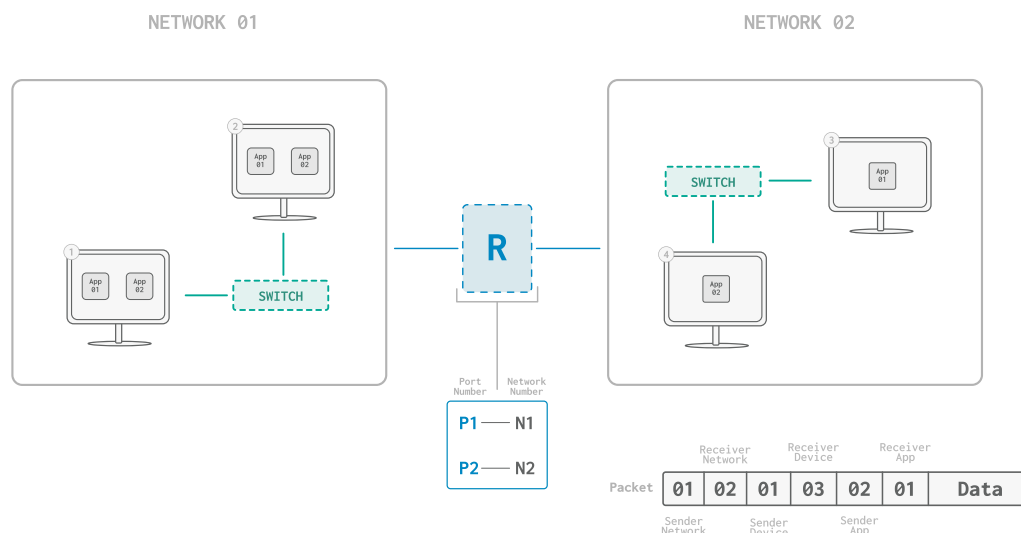
Step 11 What is a Router?

A router is a device that helps connect multiple networks and allows them to communicate with each other. It has a crucial role in managing, and directing network traffic, and ensuring that data are sent to the correct destinations.

Step 12 How does a Router Work?

01 Receiving Data Packets

When a device sends a request, it is broken into smaller pieces called **data packets.**

02 Analyzing Destination

The router reads the destination address in these packets to determine where they need to go.

03 Routing the Packets

Based on its routing table, the router forwards the packets to their next stop, which could be another router or the destination device.

Step 13 What is a Routing Table?

A routing table is a data table stored in a router or a network-enabled device that contains information about the paths, or routes, to different destinations within networks. the routing table is like a map for the router, telling it where to send data based on the destination IP address.

Step 14 What is an IP Address?

IP Address (Internet Protocol Address) is a unique numerical identifier assigned to each device connected to a network, enabling it to communicate with other devices over the network. allowing data packets to be sent and received between devices.

Step 15 What is a Packet?

The data sent over the network is divided into smaller units called packets, which are transmitted independently across the network. Each packet contains three main parts:

01 Header

Contains metadata and control information, such as:

- Source and destination IP address.

- Source and destination MAC address.

- Protocol Type.

- Port Numbers.

02 Payload

This is the actual data being transmitted

03 Trailer

optional in some protocols, Contains additional information.

	Header			Payload	Trailer
Source & destination MAC Address	Source & destination IP Address	Port Numbers	Protocol	DATA being transmitted	Optional depending on the type of protocol

Step 16 What is a Protocol?

To communicate between two applications, we need to establish a common language with clear rules so that both parties understand what is meant by the message. This is what we call the protocol, and one of the important protocols is TCP(Transmission Control Protocol).