

# Chapter 1

# Introduction

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## Network models

### Protocols and standards

#### Data communications

Components

Data representation

Data Flow

#### Networking

Internet

LANs and WANs

Distribution processing

Criteria

Structure

# Data Communications

- Objective
- System Components
- Data Representation
- Data Flow

# Objective of Data Communications

- Delivery

$A \rightarrow B$

ជា  $A \rightarrow B$  មួយការងារត្រូវបាន  
 $\searrow C$

ស្ថិតិភាព

- Accuracy

(a. ក្នុងនៅពេលបានផ្តល់ទៅ)

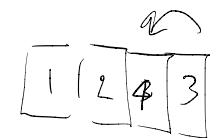
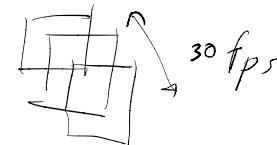
kmth  $\rightarrow$  kmth  $\times$

- Timeliness

email  $\rightarrow$  5 min

- Jitter

ជំរើងក្នា ✓

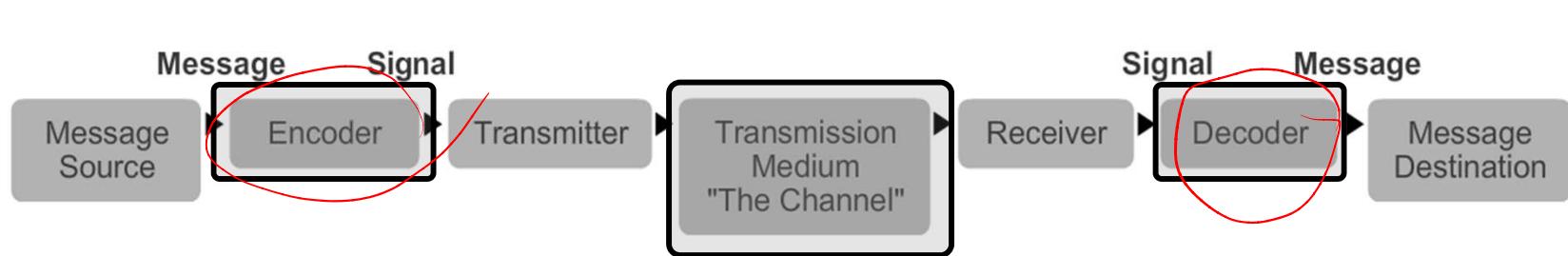
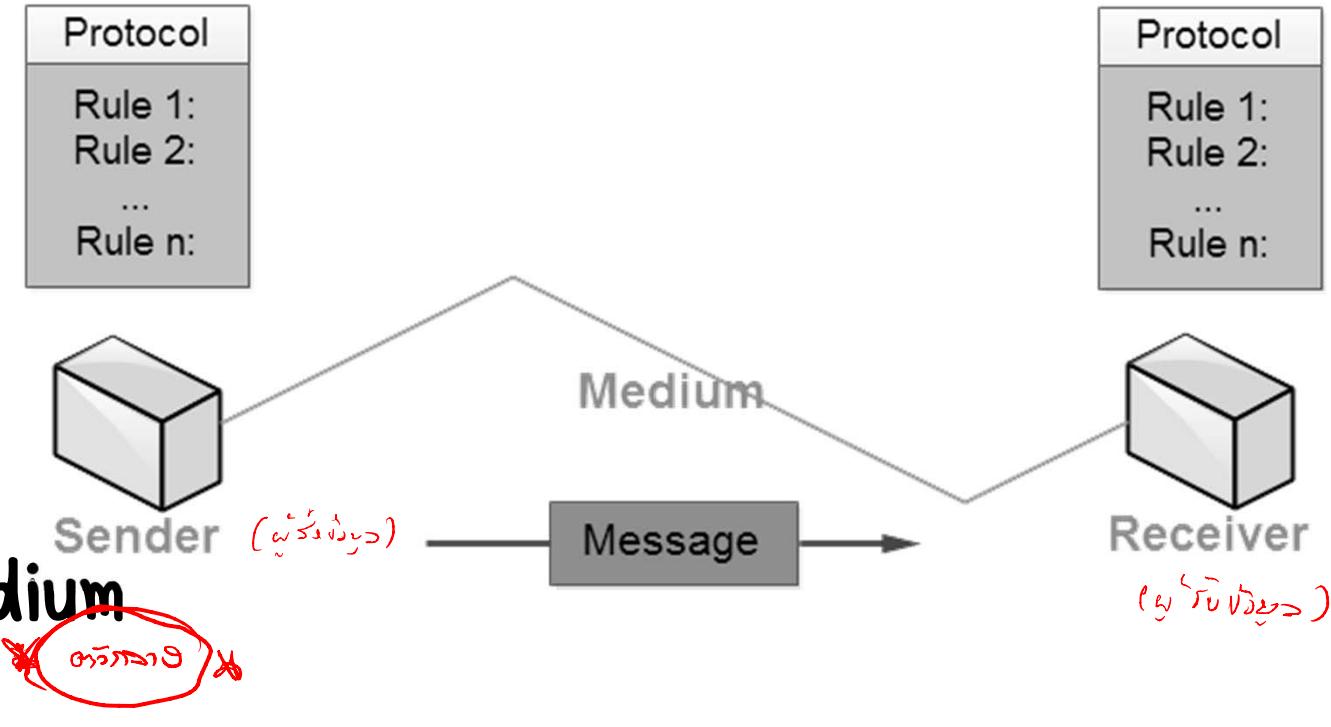


$A \oplus C \rightarrow A \oplus C$

$A \oplus C \rightarrow C \oplus A$

# System Components

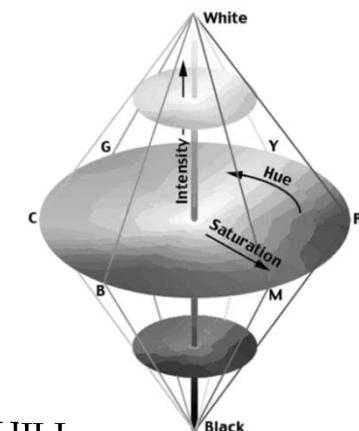
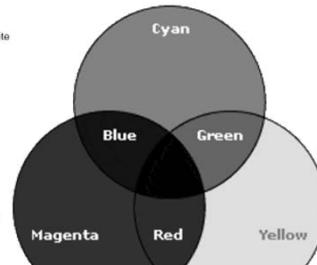
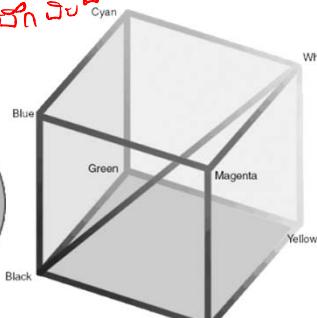
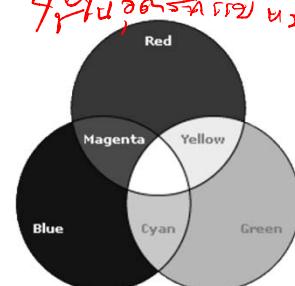
- **Message**
- **Sender**
- **Receiver**
- **Transmission medium**
- **Protocol** ප්‍රසුලුම්, හිජැයීම්



# Data Representation

a - z 26  
A - Z 26  
0 - 9 10  
 $2^8 = 256$

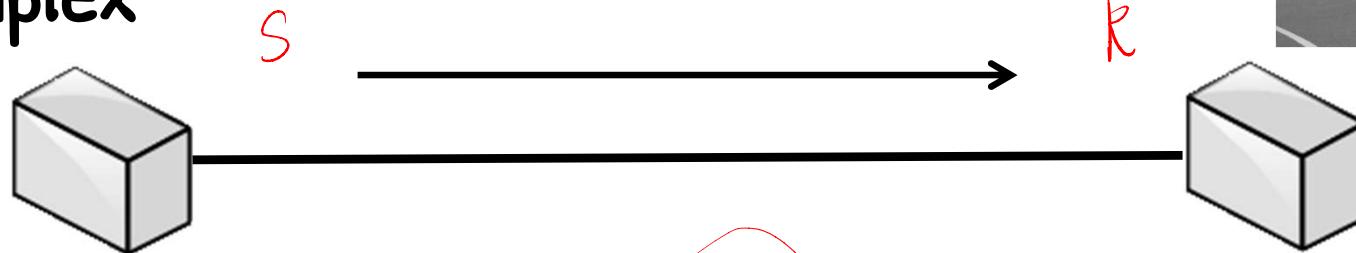
- Text
  - ASCII (The American Standard Code for Information Interchange)
  - Unicode used 32 bits represent a symbol or character used in any language in the world.
- Number : base 10 (decimal), base 2 (binary), base 8 (octal), base 16 (hexadecimal), base 256
- Images : Binary Image, Gray-level Images, Color Image (RGB, CMY<sub>k</sub>, YC<sub>b</sub>C<sub>r</sub>, HIS)
- Audio
- Video



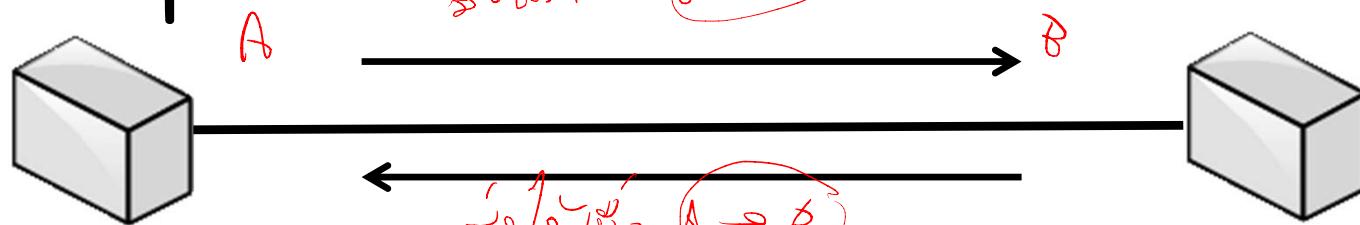
# Data Flow



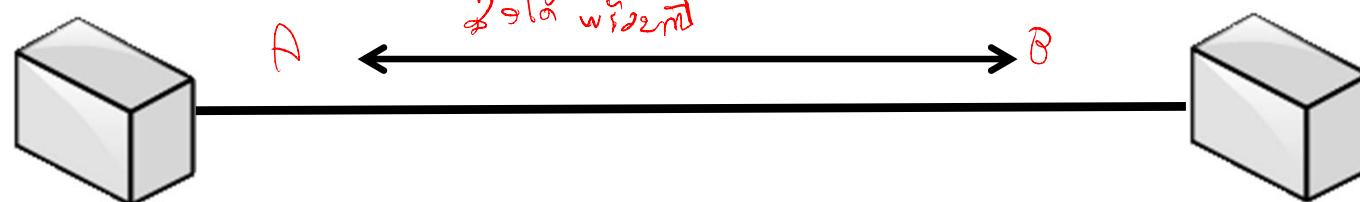
- **Simplex**



- **Half-Duplex**



- **Full-Duplex**



## Network models

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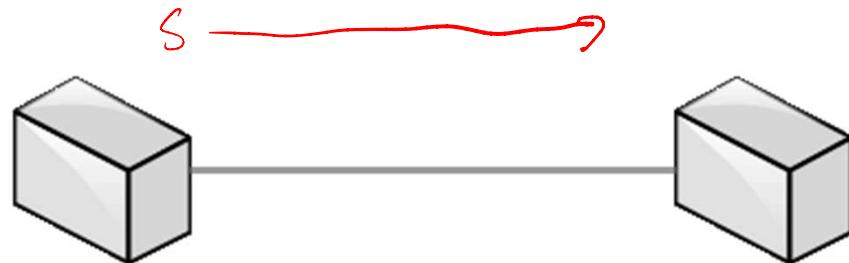
Structure

# Networks

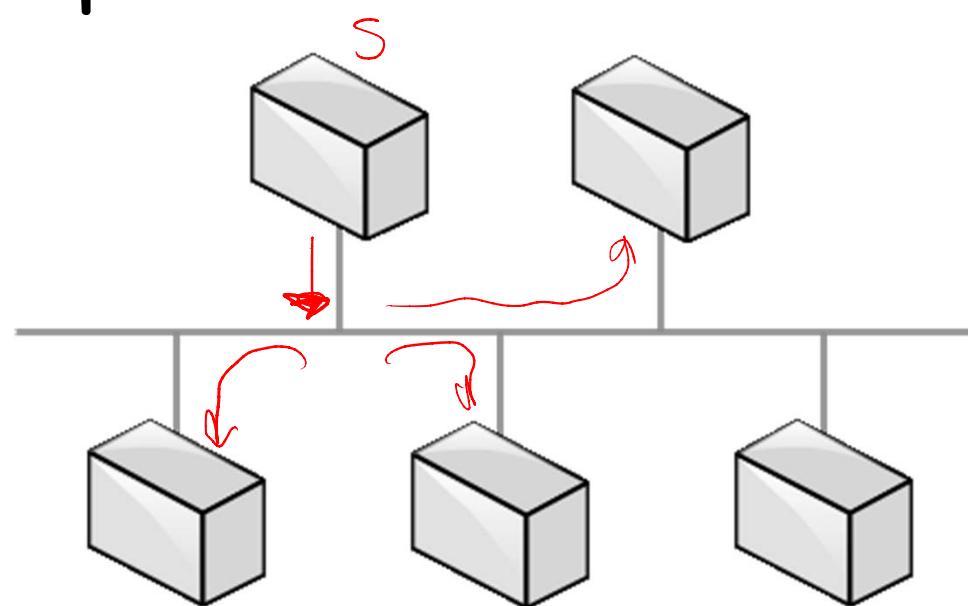
- Distributed Processing
- Physical Structures
- Categories of Networks

# Distributed Processing

- Point-to-Point



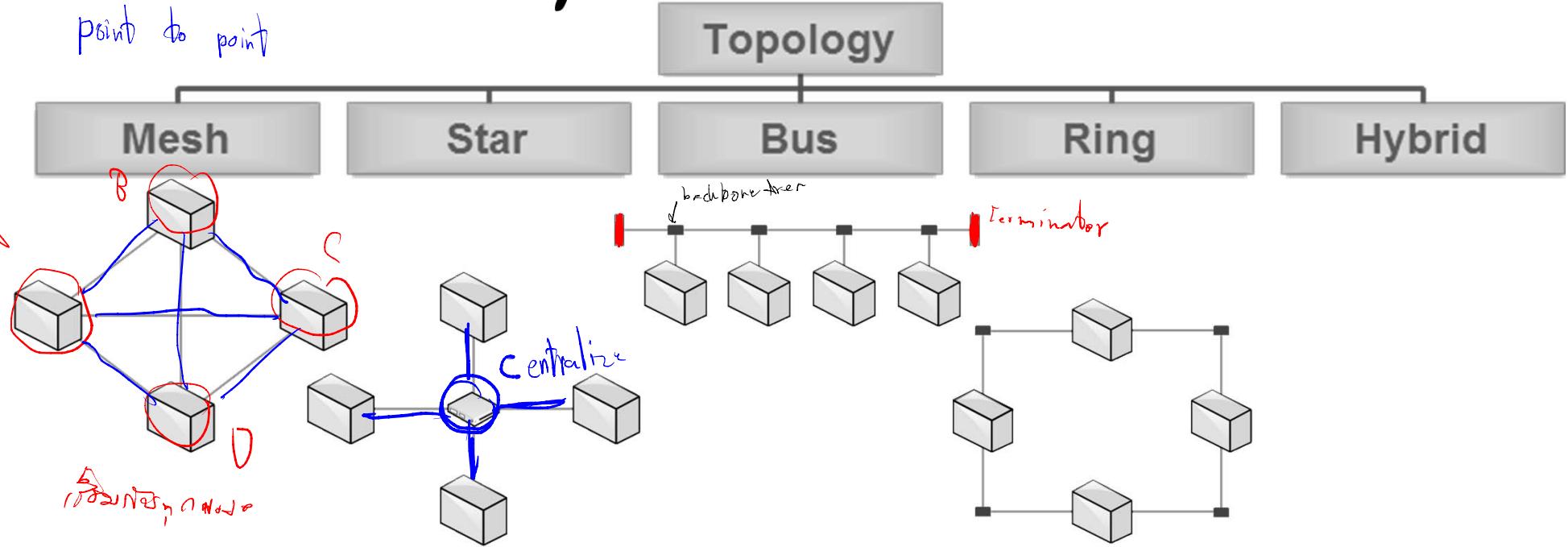
- Multipoint



# Physical Structures



point to point



- Transmission speed
- Reliable (damage link)
- Privacy, Security
- Fault Detection
- Cost (Installation and Maintenance)
- Expansion and Modification

$$2 \leq 5 \rightarrow (2 \times 2) + 1 = 5$$

$$5 > 1 \rightarrow (5 \times 2) + 1 = 11$$

$$5 \geq 3(4)$$

# Physical Structures

Transmission speed (High -> Low)	mesh > star > Ring > Bus Time of failure Sensitivity
Reliable (damage link) (High -> Low)	Mesh > star > Ring > Bus
Privacy, Security (High -> Low)	Mesh > star > Ring > Bus
Fault Detection (Easy -> Hard)	Mesh > Star > Ring > Bus
Cost (Installation and Maintenance) (Low -> High )	Bus < Star < Ring < Mesh
Expansion and Modification (Easy -> Hard)	star > ring > bus > mesh

# Categories of Networks

- Local Area Network
- Metropolitan Area Networks
- Wide Area Network
- Interconnection of Networks: Internetwork
- *Personal Area Network*
- *Wireless Local Area Network*

# The Internet

- A Brief History
- The Internet Today (ISPs)

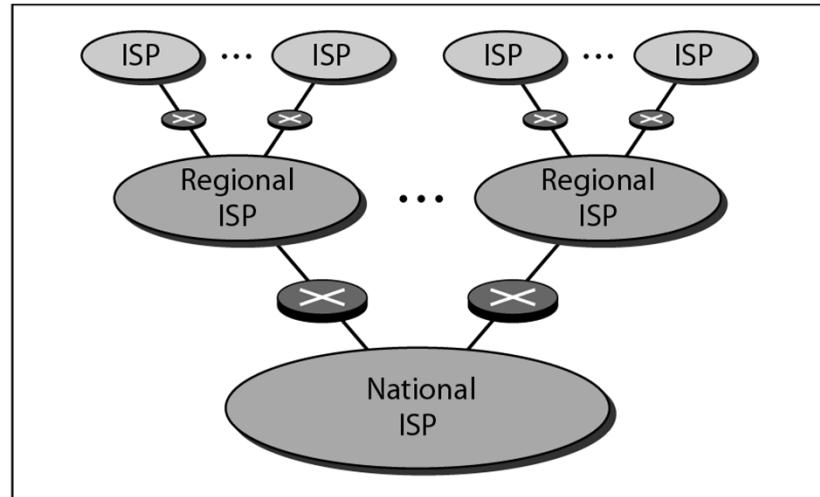
# A Brief History

- In the mid-1960s
  - Mainframe computers
    - Research organizations
    - Standalone devices
  - Advanced Research Projects Agency (ARPA) in Department of Defense (DoD)
    - Connect computers
- 1967
  - Association for Computing Machinery (ACM) meeting
    - ARPA presented its ideas for ARPANET
    - Host attached to specialized computer called IMP (Interface Message Processor)

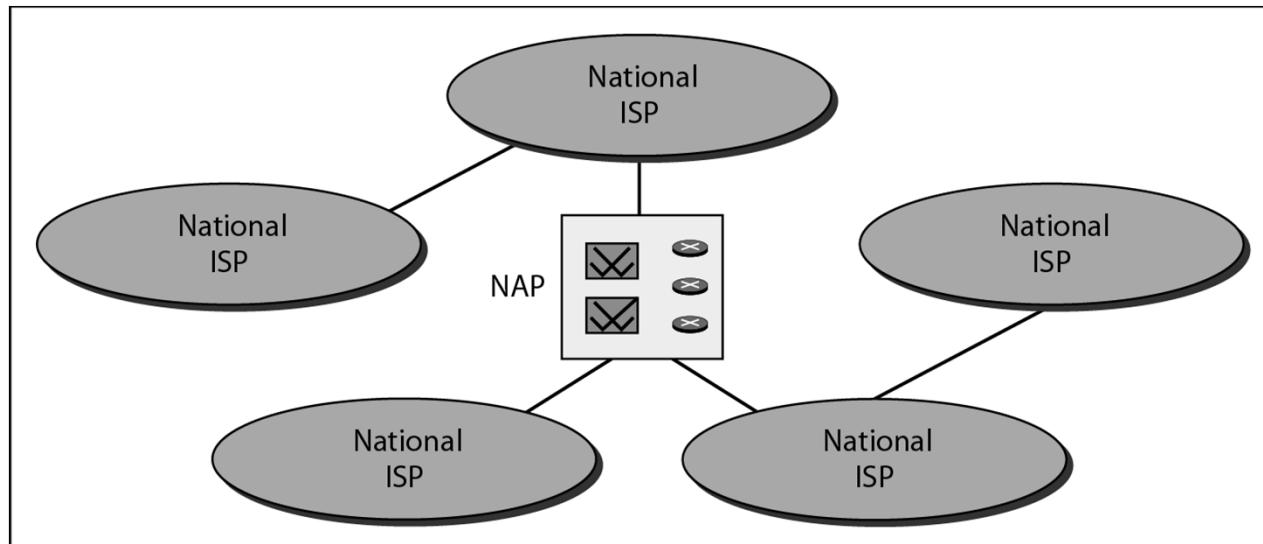
# A Brief History

- 1969
  - ARPANET : Network Control Protocol (NCP)
    - Communication between the hosts (4 nodes)
      - The University of California at Los Angeles (UCLA)
      - The University of California at Santa Barbara (UCSB)
      - Stanford Research Institute (SRI)
      - The University of Utah
- Vint Cerf and Bob Kahn
  - 1972 : Internetting Project
  - 1973 : Transmission Control Protocol (TCP)
    - the protocols to achieve end-to-end delivery of packets
  - Shortly thereafter : split TCP into two protocols
    - Transmission Control Protocol (TCP)
    - Internetworking Protocol (IP)

# The Internet Today



a. Structure of a national ISP



b. Interconnection of national ISPs

# Protocols and Standards

- Protocols
- Standards
- Standards Organizations
- Internet Standards

# Protocols

- Basically set of rules

Humans

Can learn protocols

Example : Conversation Protocols , Driving Protocols

Sometimes break down

Computer Network

Normally, Can't Learn Protocols

Example : Communication Protocols

Break down => Network crash

- The key elements of a protocol

— Syntax

— Semantics

— Timing

# Internet Protocols

- A protocol is a set of rules. Internet protocols govern communication within and between computers on a network.
- Many protocols consist of a suite (or group) of protocols stacked in layers.
  - Devices and computers connected to the Internet use a protocol suite called TCP/IP to communicate with each other.
- The main functions of protocols:
  - Identifying errors
  - Compressing data
  - Deciding how data is to be sent
  - Addressing data
  - Deciding how to announce sent and received data
- The information is transmitted most often via two protocols, TCP and UDP.



# Standards

- de facto (meaning "by fact" or "by convention")
  - Standard not been approved by organization body
  - Widespread
- de jure (meaning "by law" or "by regulation")
  - Standard been approved by organization body

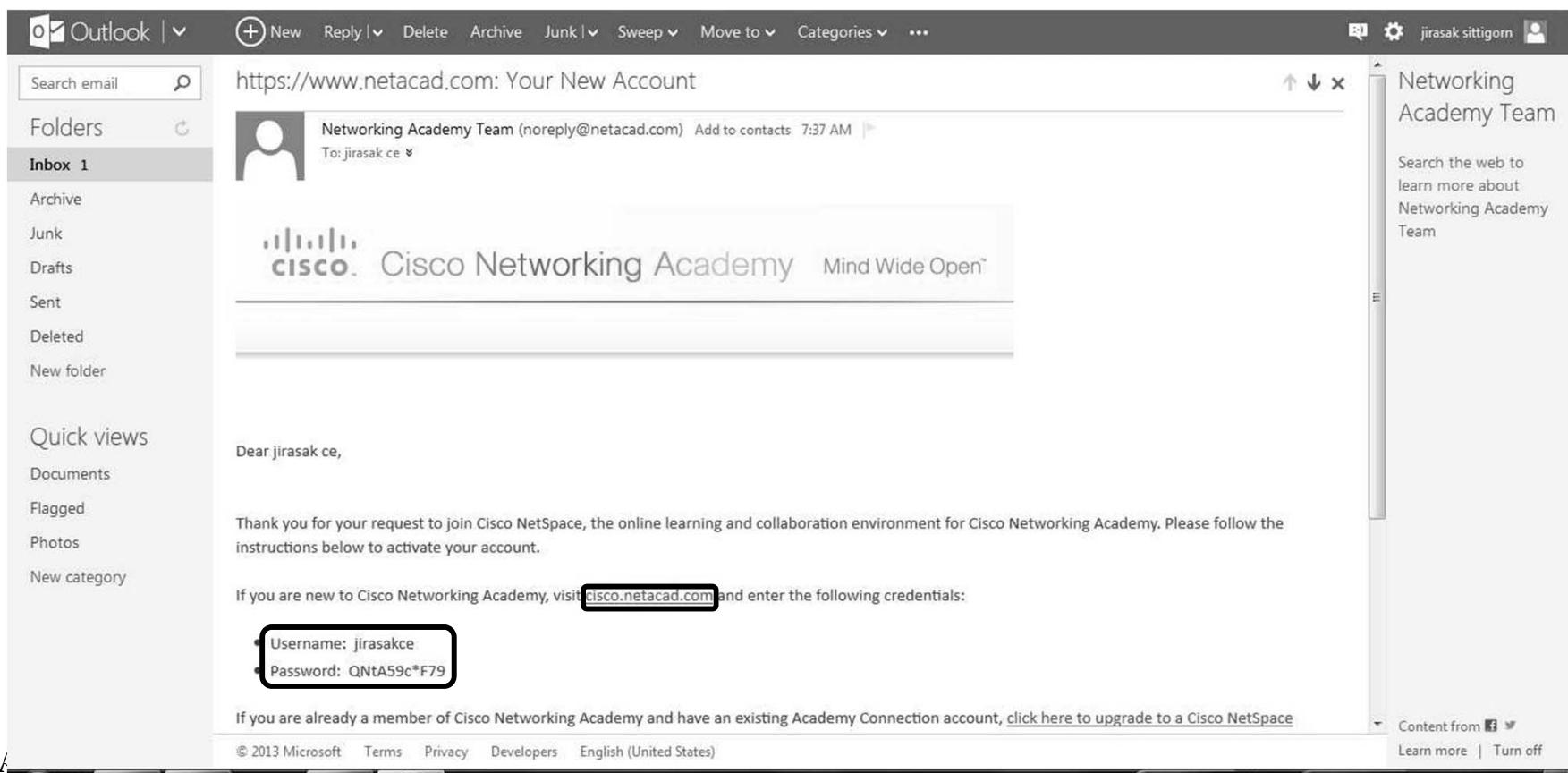
# Standards Organizations

- Standards Creation Committees

	Name	Type	Standards	Established
ITU-T	ITU Telecommunication Standardization Sector (formerly CCITT)	one of the three Sectors of the International Telecommunication Union	Standards covering all fields of telecommunications	Became ITU-T in 1992
IEEE	Institute of Electrical and Electronics Engineers	A non-profit, technical professional association	Standards for the computer and electronics industry	1884
ISO	International Organization for Standardization	A network of the national standards institutes of 157 countries	Promote the development of international standards agreements	1947
IAB	Internet Architecture Board	A committee; an advisory body	Oversees the technical and engineering development of the Internet	1979; first named ICCB
IEC	International Electrotechnical Commission	Global organization	Standards for all electrical, electronic, and related technologies	1906
ANSI	American National Standards Institute	Private, non-profit organization	Seeks to establish consensus among groups	1918
TIA/EIA	Telecommunications Industry Association / Electronic Industries Alliance	Trade associations	Standards for voice and data wiring for LANs	After the deregulation of the U.S. telephone industry in 1984

# ลงทะเบียนสำหรับทำแบบฝึกหัด

- ลงทะเบียนข้อมูลส่วนตัว  
<https://goo.gl/forms/xybgsS8WrWCeZoGu1>
- เช็ค email เข้าระบบลงทะเบียนทำแบบฝึกหัด Online



The screenshot shows an Outlook inbox with one message from "Networking Academy Team (noreply@netacad.com)" to "jirasak ce". The message subject is "Your New Account". The body of the email includes the Cisco Networking Academy logo and a welcome message. It instructs the recipient to visit [cisco.netacad.com](https://cisco.netacad.com) and enter the provided credentials. A callout box highlights the "Username: jirasakce" and "Password: QNtA59c\*F79" fields.

Outlook | + New | Reply | Delete | Archive | Junk | Sweep | Move to | Categories | ...

jirasak sittigorn

Networking Academy Team

Search the web to learn more about Networking Academy Team

Inbox 1

Folders

Archive

Junk

Drafts

Sent

Deleted

New folder

Quick views

Documents

Flagged

Photos

New category

https://www.netacad.com: Your New Account

Networking Academy Team (noreply@netacad.com) Add to contacts 7:37 AM

To: jirasak ce

CISCO Cisco Networking Academy Mind Wide Open™

Dear jirasak ce,

Thank you for your request to join Cisco NetSpace, the online learning and collaboration environment for Cisco Networking Academy. Please follow the instructions below to activate your account.

If you are new to Cisco Networking Academy, visit [cisco.netacad.com](https://cisco.netacad.com) and enter the following credentials:

Username: jirasakce

Password: QNtA59c\*F79

If you are already a member of Cisco Networking Academy and have an existing Academy Connection account, [click here to upgrade to a Cisco NetSpace](#)

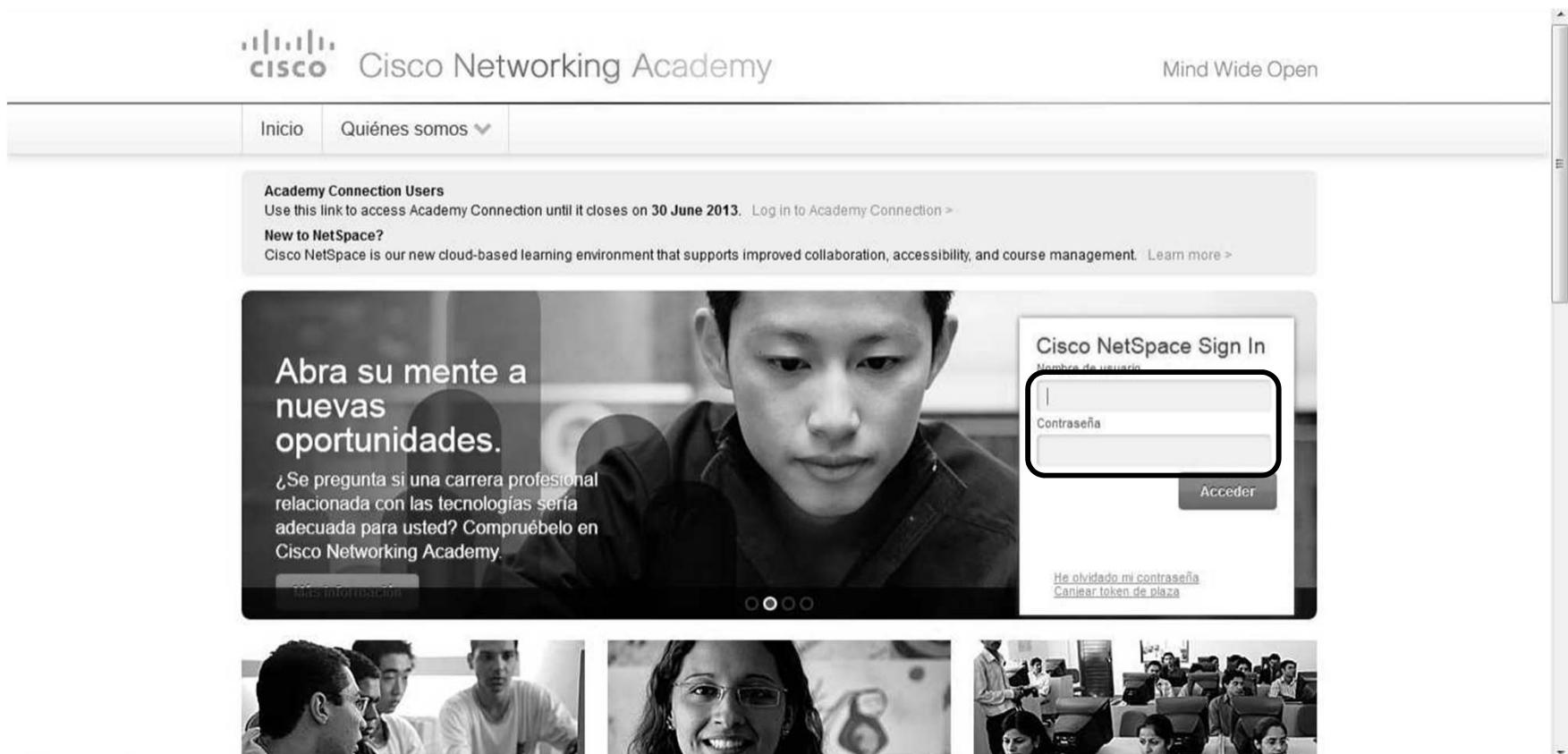
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# ลงทะเบียนสำหรับทำแบบฝึกหัด

- ใช้ Username และ Password ที่ส่งมาใน email ในการลงทะเบียน : <https://www.netacad.com/>



# ลงทะเบียนสำหรับทำแบบฝึกหัด

- อ่านข้อกำหนด



- เลือก

— ประเทศไทย Thailand

— เดือน-วัน-ปีกิต (ปี พ.ศ. เท่านั้น)

— เลือก I have read and agreed to  
the terms of use

— เลือก Submit

# ลงทะเบียนสำหรับทำแบบฝึกหัด

- กำหนด Password ใหม่เอง โดยมีเงื่อนไข
  - ประกอบด้วย อักษรตัวเล็ก อักษรตัวใหญ่ และตัวเลข
  - อย่างน้อย 8 ตัว
  - ห้ามซ้ำกับ Password เดิม
  - ห้ามมีส่วนของ Screen Name (Username) ที่จะตั้งใหม่ (ห้ามต่อนต่อไป)

Password Rules:

- Passwords must include a lowercase (e.g. abc), an uppercase(e.g. ABC), and a number (e.g. 123)
- Passwords must be at least eight (8) characters
- Previous passwords may not be used

Password

Enter Again

# ลงทะเบียนสำหรับทำแบบฝึกหัด

- ป้อนข้อมูลส่วนตัวต่างๆ : Screen Name เป็น Username ในการ Login

Networking Academy User Profile  
This is your User Profile. You can return here anytime to change your preferences by clicking on your name in the help corner at the top of the page. Please make sure all required fields (identified with \*) are completed before proceeding.

User ID: 006175660  
Academy Connection ID: 26435889

First Name (Native Language):   
Last Name (Native Language):   
Region/State/Province (Native Language):   
City Name (Native Language):   
Phone Number:   
Country/Region Code:   
Gender \*:

Prefix:   
First Name \*:   
Last Name \*:   
Title:   
Email Address \*:   
 Update my notification preferences email address in the classroom

Screen Name:   

Country/Region:   
Closest State \*:   
Closest City \*:   
Language:

Time Zone:   
Birthday:

Notification Preferences  
 Subscribe to NetAcad Program emails  
 Participate in Recognition Program  
 Subscribe to partner emails  
 Ask me to provide program feedback  
 Do you want to be able to receive communication from other users?  
 Allow other users to search for me

The Cisco Networking Academy Program is interested in better understanding students' goals for taking courses. Please choose the one option below that best describes your goal or motivation for taking Cisco Networking Academy courses.

The Cisco Networking Academy Program would like to understand how much experience students have in IT or networking fields before taking Cisco Networking Academy courses. Please indicate how much practical experience you have in the IT or networking field, gained either from working or engaging in other activities.

Change Password

Link To Your Academy Connection Account  
If you have an existing Academy Connection account, please click below to link this account to it. This will ensure a smooth continuation of your data. This process will only take a few minutes.

Certificates And Letters  
This area displays all your classes. When you meet the associated eligibility criteria, you will be able to open these files.

Certification Exam Discounts and Vouchers  
Certifications and Discounts FAQs