

Chapter 1

Introduction

Jirasak Sittigorn

Department of Computer Engineering
Faculty of Engineering
King Mongkut's Institute of Technology Ladkrabang

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

ການផ្តល់ទៅ.

- Timeliness

ព័ត៌មាន

ចាប់បើការណែនាំស្មោគ ឬចាន់។

- Accuracy

បានដូចត្រូវ

- Jitter

ឈរមុនឡាតាំងទៅបំបាត់

ឱ្យខ្សោយដឹងបំបាត់បំបាត់

System Components

- Message (សែវ)

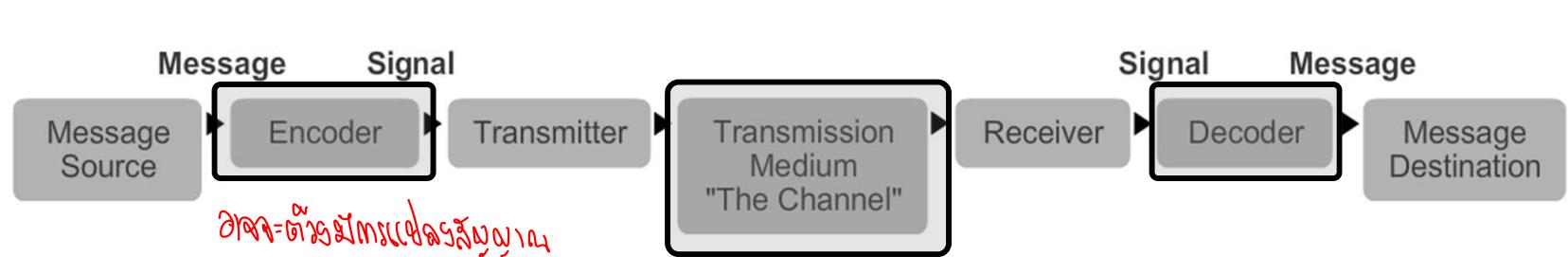
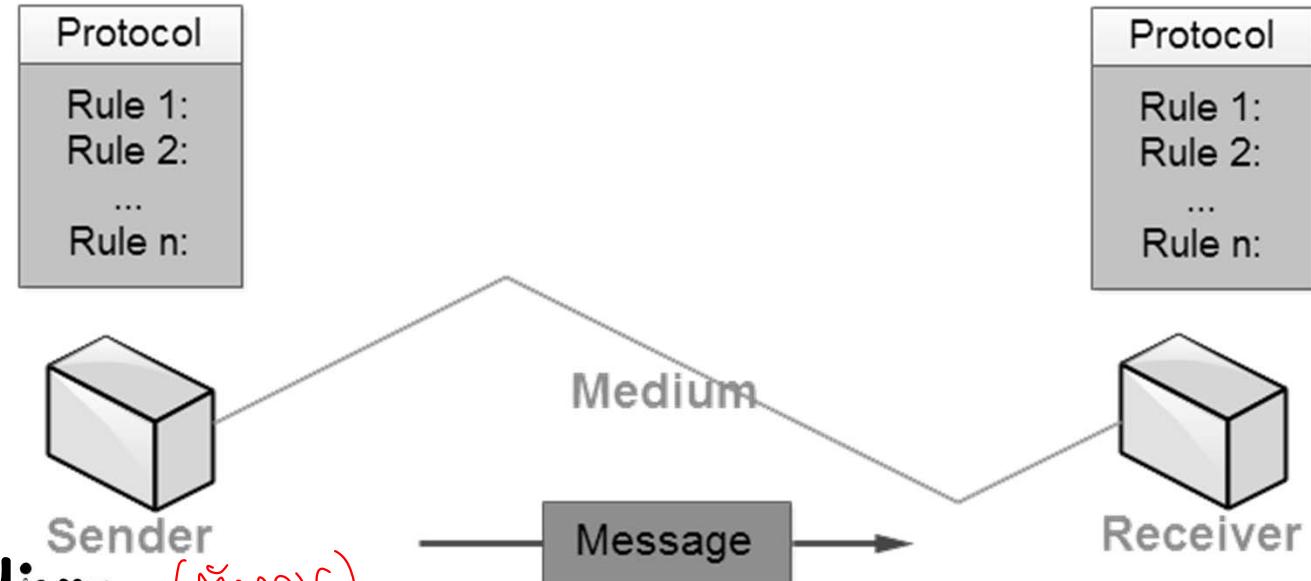
- Sender (ផ្តល់)

- Receiver (ទទួល)

- Transmission medium (ចំណេះទំនាក់ទំនង)

- Protocol (បញ្ជីរបាយការពិនិត្យសែវ)

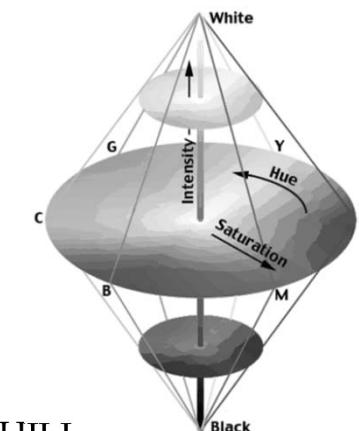
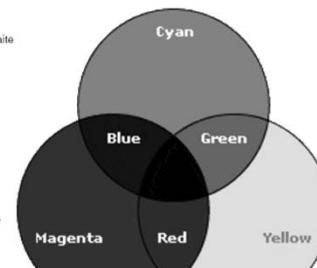
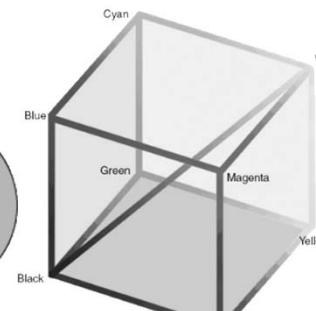
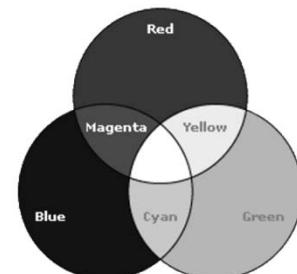
↳ លក្ខណៈការងារខែគ្នា



Data Representation

- 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, YC_bC_r, HIS)
- Audio
- Video

$$2^{24} \text{ (bit)} \quad 2^{20} \times 2^4 = 1M \times 16 = 16M$$



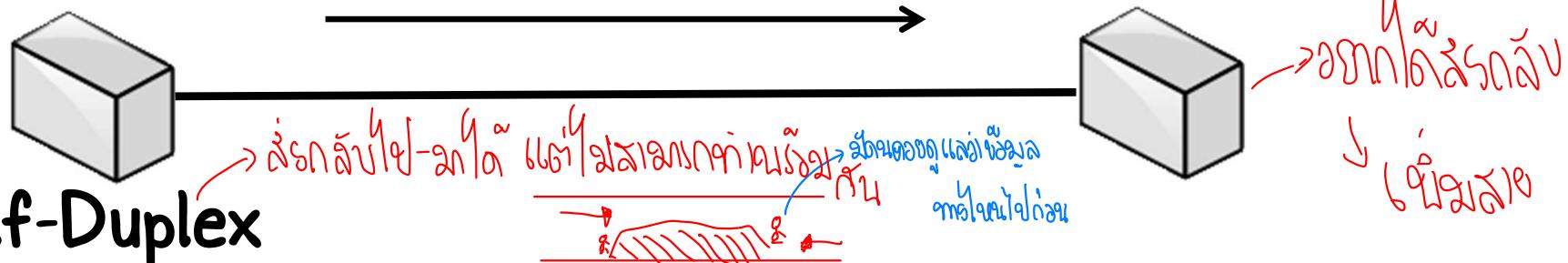
Data Flow

Simplex → Duplex



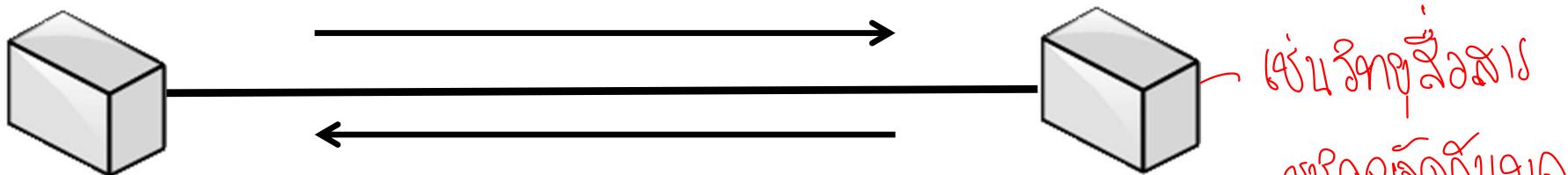
- **Simplex**

ໄດ້ຕາມເດືອນ
ເຮັດວຽກ, ອົກສອກຫົວໜາຍ



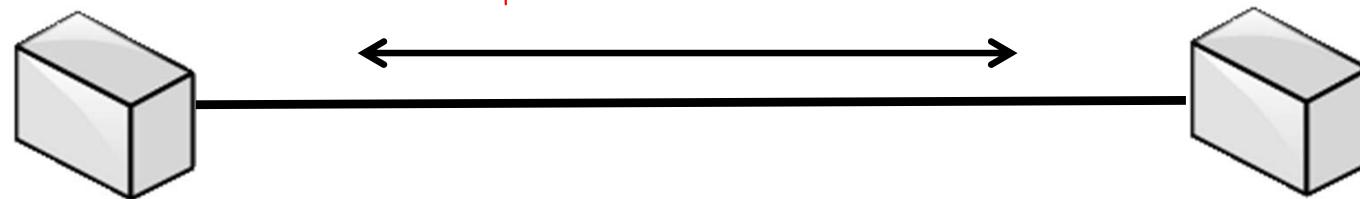
- **Half-Duplex**

ສ່ວນລົບໄປ-ຂົດ
ແຕ່ໄຟລະເວທິການ
ກຳໄຟລະນຸ້ມ



- **Full-Duplex**

ສ່ວນຮັບຖືກີ່ໃດໆ
2 ຖິດທາງ
ເຮັດວຽກ



Network models

Protocols and standards

Data communications

Components

Data representation

Data Flow

Networking

Internet

LANs and WANs

Distribution processing

Criteria

Structure

Networks

- Distributed Processing
- Physical Structures
- Categories of Networks

Distributed Processing

ក្រសួងបច្ចេកទេស (នគរណ៍)

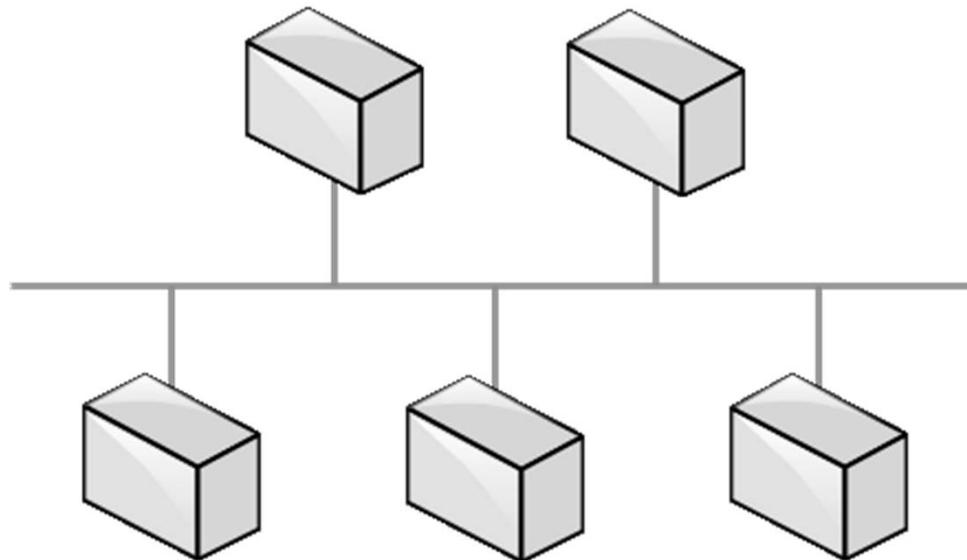
• Point-to-Point



ແພិតពេល point to point

- ↳ មិនមែន ៥ ឧបតាថ្ន ដូចជាអំពី ១ ចំណាំក្នុងពេលវេលា
- ↳ ចុងតិច
 - ↳ ការងារបានរាយការណ៍នៃការប្រើប្រាស់
 - ↳ មិនមែនប្រើប្រាស់ក្នុងការ ការប្រើប្រាស់
 - ↳ node to node → ការងារប្រើប្រាស់ក្នុងការប្រើប្រាស់
- ↳ ចុងតិច
 - ↳ ៩ តិចខាងក្រោម node នៅក្នុង
 - ↳ ក្នុងមេដៃក្នុងប្រព័ន្ធដឹងទាក់ទង

• Multipoint



Multipoint

- ↳ មិនមែនការប្រើប្រាស់តិចទេ ប៉ុន្មានការប្រើប្រាស់នៅក្នុងក្នុង
- ↳ ភ្លាមឱ្យចិត្តសម្រាប់មិនមែនអាជីវកម្ម គ្មាន
- ↳ ចុងតិច
 - ↳ ភ្លាមឱ្យចិត្ត
 - ↳ ដែលមែន node នឹងក្នុង
- ↳ ចុងតិច
 - ↳ បានការប្រើប្រាស់ក្នុងប្រព័ន្ធ
 - ↳ ព័ត៌មានត្រូវការប្រើប្រាស់ក្នុងការប្រើប្រាស់
 - ↳ ក្នុងមេដៃក្នុងប្រព័ន្ធដឹងទាក់ទង

របៀបបង្ការ (topologies)

↳ Bus topology

↳ អ្នកបង្ការទីនៅក្នុងបណ្តុះបណ្តាល គាំប៉ូមចំរួញនិងដោតស្ថាបន្ទាត់រៀង “backbone”

↳ ចំណាំ

↳ រៀង, ឱ្យរឹងបង្ហាញ

↳ មិនមាន node ពីរ

↳ ភ្លាមៗនៃការបង្ហាញ

↳ ចំណាំលេង

↳ ឬនៅ backbone នៅ = ឈើរៀង

↳ មានចំណាំជាមុនក្នុងបណ្តុះបណ្តាល

↳ Star topology

→ ឬនៅ switch

↳ ត្រូវបានចំណាំរៀងលើលើមិនមែនលើមិនមែន

↳ ចំណាំ

↳ សងបន្ទាក់ក្រោម-ក្រោមរាល់រាល់

↳ គឺការចំឡើងចំណាំ switch , hub (ស្ថាបន្ទាត់)

↳ ចំណាំផ្លូវ

↳ មិនមែនប្រើប្រាស់បាន

↳ មិនមែន port សំរាប់ពេលវេលា node

↳ តាមរយការទាំងអស់ = ១១

↳ Ring topology

↳ ចំណាំ

↳ ភ្លាមៗនៃការបង្ហាញ , ទំនាក់ទំនងទីនៅ

↳ ចំណាំផ្លូវ

↳ មានចំណាំជាមុនក្នុងបណ្តុះបណ្តាល

↳ Mesh

↳ សម្រួលនូវការ (មេរិចត្រូវការពិនិត្យ) , ភាពស្ថិតិយាល័យ

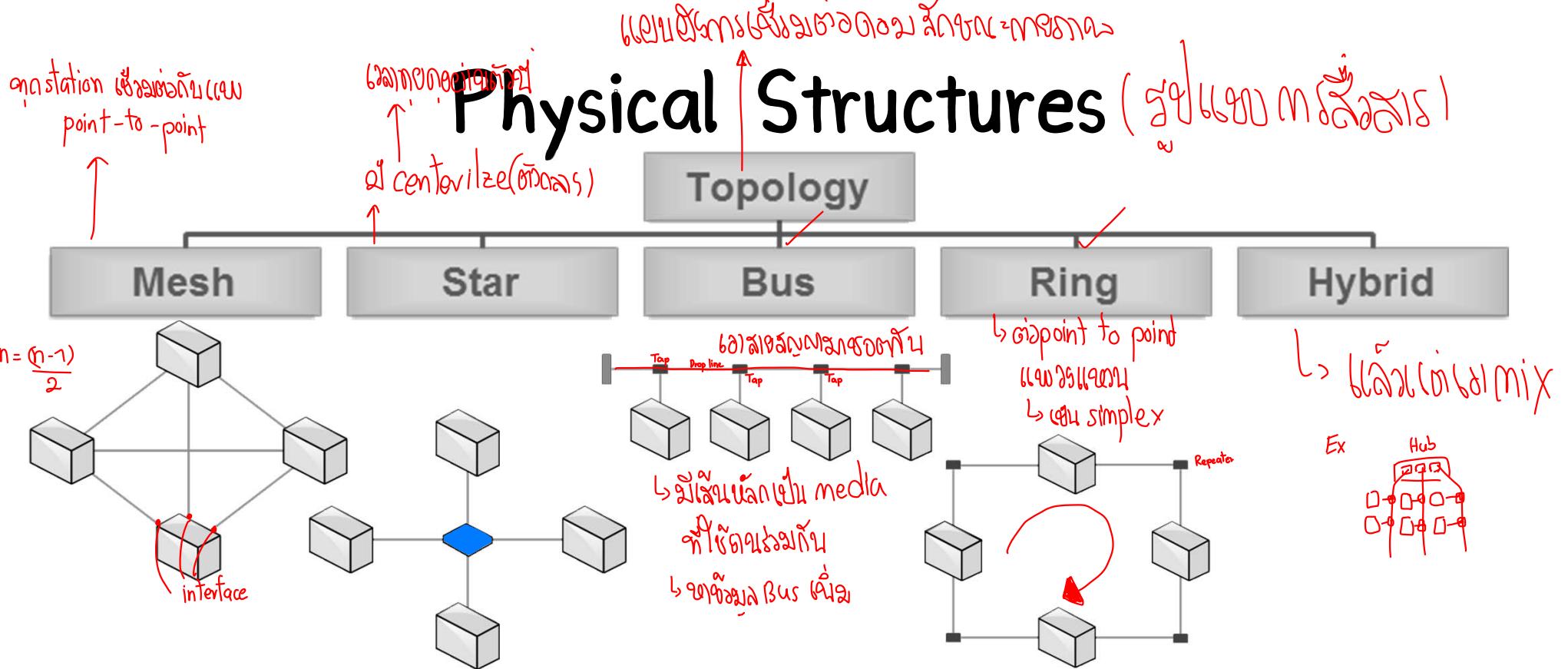
គ្មានបានប៊ូមចំរួញ (Peer2peer)

↳ មិនមែនប្រើប្រាស់បាន

↳ មិនមែន server

↳ មិនមែនប្រើប្រាស់បាន

ឬនៅក្នុងបណ្តុះបណ្តាល



- Transmission speed Mesh ត្រឹមត្រូវ
- Reliable (damage link)
- Privacy, Security
- Fault Detection
- Cost (Installation and Maintenance) Mesh ត្រឹមត្រូវ → ត្រឹមត្រូវ , មិន interface
- Expansion and Modification

Physical Structures

	Mesh	Star	Ring	Bus
Transmission speed (High -> Low)				
Reliable (damage link) (High -> Low)	Mesh	Star	Ring \approx Bus	$\overbrace{\text{bus}}^{\text{bus}} \overbrace{\text{bus}}_{\text{bus}}$
Privacy, Security (High -> Low)	Mesh	Star	Ring	$\overbrace{\text{ring}}^{\text{ring}} \overbrace{\text{ring}}_{\text{ring}}$
Fault Detection (Easy -> Hard)	Mesh	Star	Ring	Bus
Cost (Installation and Maintenance) (Low -> High)	Bus	Star $\xrightarrow{\text{centralize}}$	Ring $\xrightarrow{\text{interface (so-ni) star}}$	Mesh
Expansion and Modification (Easy -> Hard)	Star	Ring $\xrightarrow{\text{long distance}}$	Bus (Mesh

B. A. Forouzan, Data Communications and Networking, 4th edition, McGRAW-HILL

Categories of Networks (ස්ථානික නෙට්වර්ක්)

- Local Area Network (ස්ථානික නෙට්වර්ක්)
- Metropolitan Area Networks (මහාන්ත්‍ය නෙට්වර්ක්)
- Wide Area Network (උග්‍රාන්ඩ්) (ලො)
- Interconnection of Networks: Internetwork (many of MAN)
- Personal Area Network → අවන නෙට්වර්ක් , ගැස්පූ , තුව්‍යමන්ත්‍ර
- Wireless Local Area Network

ឧបតាថ្មីសង្គម network

↳ repeater / hub

↳ ការទាមពុល physical layer

↳ ការផ្តល់ព័ត៌មានសម្រាប់លើសង្គមជាបន្ទូយ port

↳ bridge

↳ ការទាមពុល physical , data link layer

↳ ការផ្តល់ព័ត៌មានសម្រាប់លើសង្គមជាបន្ទូយ segment ជាអំពី protocol ដែលវារីន

↳ ability > hub/repeater

↳ អាយុវត្សិភាព segment និងវារីន , លើកចេតនាលើ ឬហាងី ឬ collision domain តិចខ្លះរួច

↳ អាយុវត្សិភាព MAC

↳ បញ្ចប់លើសង្គមជាបន្ទូយ

↳ switch

↳ ការទាមពុល bridge ឬសំណើលើកសង្គម port នានា (សំណើលើកសង្គម)

↳ អាយុវត្សិភាព layer 2, 3

↳
↳ បញ្ចប់លើកសង្គម
↳ ការទាមពុល bridge

↳ router

↳ ការទាមពុលសំណើលើក physical , data link , network layer

↳ ការផ្តល់ព័ត៌មានសម្រាប់លើសង្គមជាបន្ទូយ ក្នុងប៊ូតិចក្នុង

↳ ការបង្កើតសំណើលើក ឬសំណើលើក ឬសំណើលើក protocol និង config ។

The Internet

- A Brief History
- The Internet Today (ISPs)

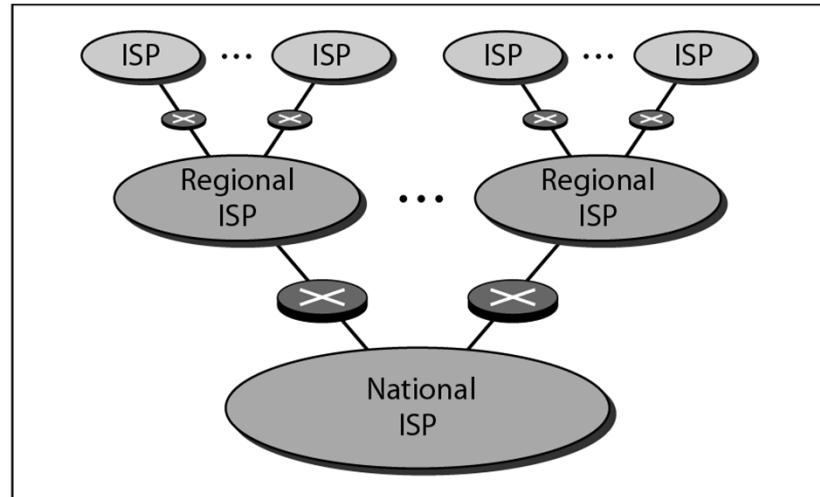
A Brief History

- 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)

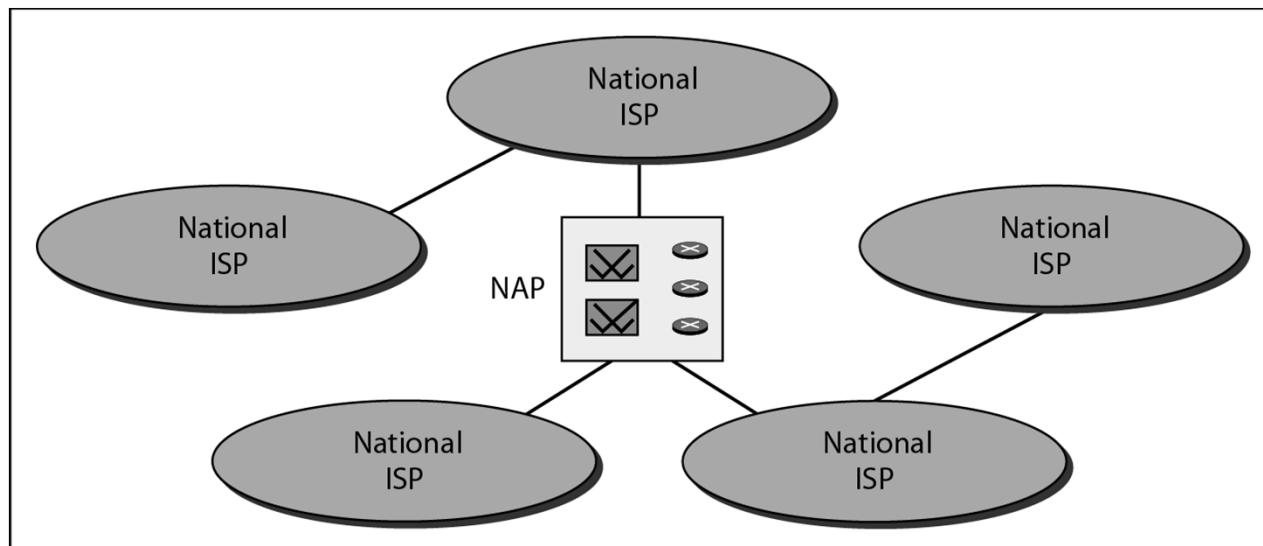
A Brief History

- 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 → ឧបត្ថម្ភដែលការពន្លឹងការប្រព័ន្ធដែលត្រូវការពារណ៍របស់ក្រុមហ៊ុនទាំងអស់និងក្រុមហ៊ុនទាំងអស់ទាំងអស់
- 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 បែងចែកពេលវេលា
 - Deciding how data is to be sent ចែនតម្លៃគាន់ទៅ
 - Addressing data អាជីវការណ៍រយៈ
 - Deciding how to announce sent and received data ចែនតម្លៃគាន់រៀបចំបញ្ជី
- 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

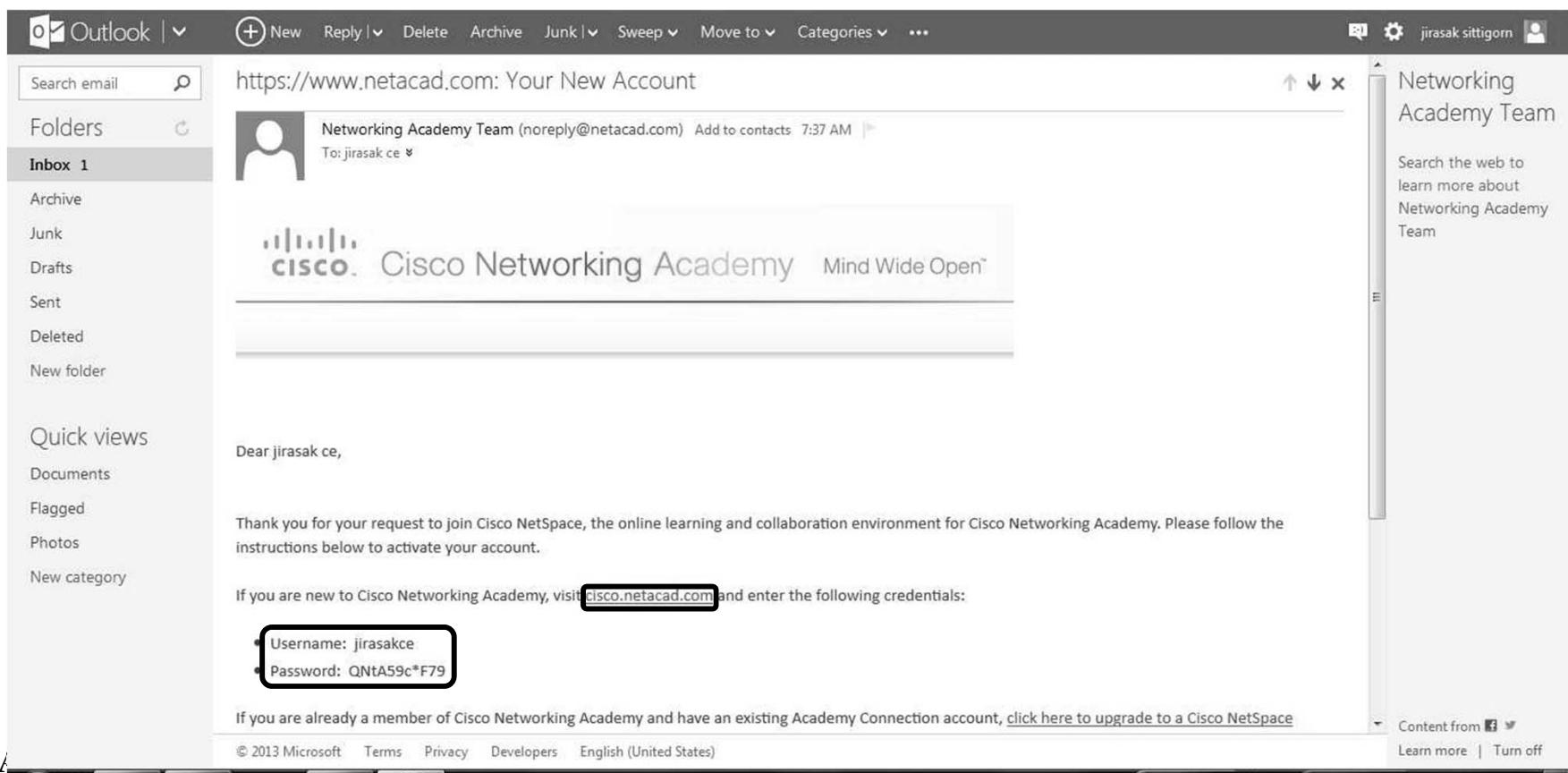
Standards Organizations

- 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

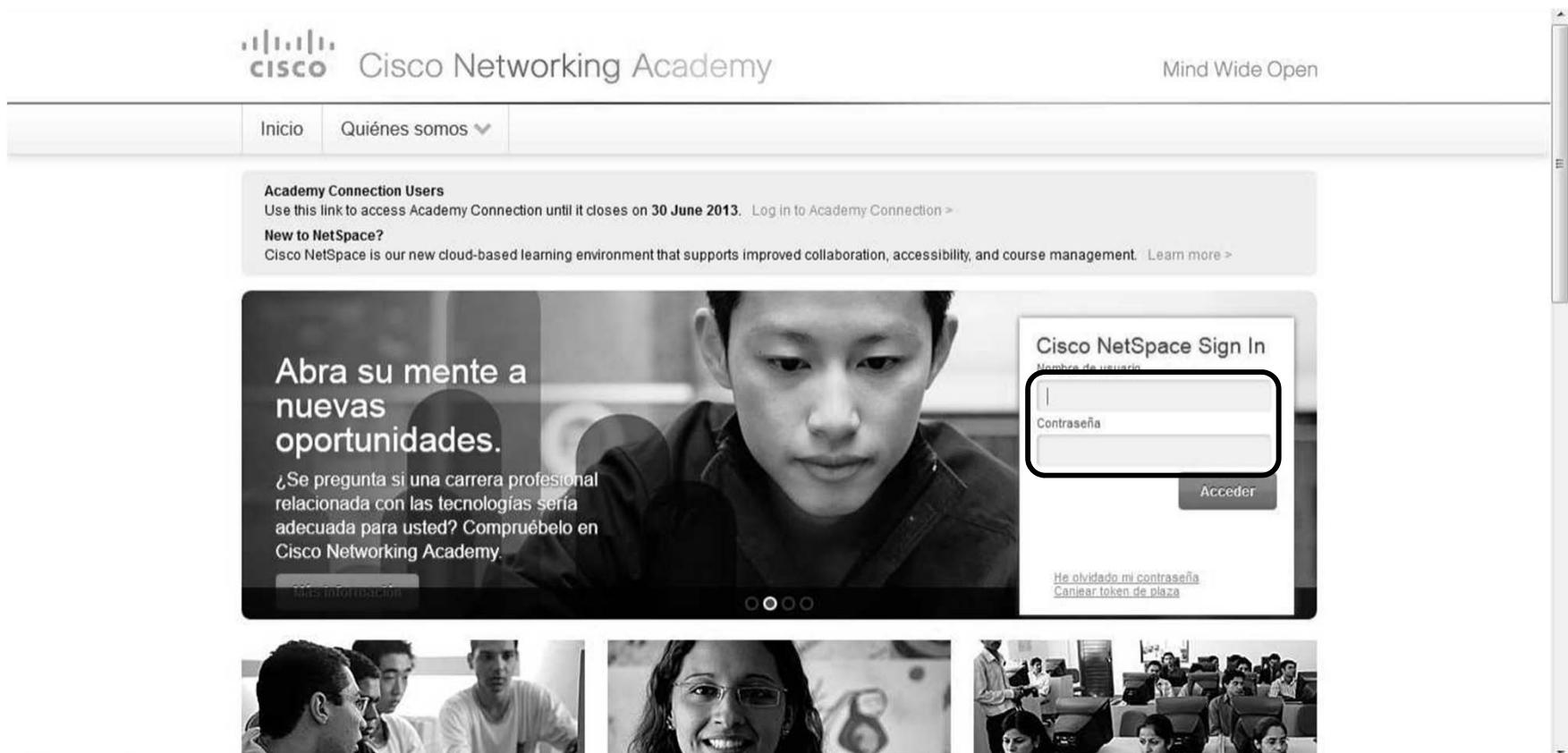
ลงทะเบียนสำหรับทำแบบฝึกหัด

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



ลงทะเบียนสำหรับทำแบบฝึกหัด

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



ลงทะเบียนสำหรับทำแบบฝึกหัด

- ## • อ่านข้อกำหนด

- เลือก

— ປະເທດ Thailand

— ເດືອນ-ວັນ-ປຶກີຕ (ເປັນ ດົກ ເທິງໝັ້ນ)

—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: 009175660
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: Thailand
Closest State *: Select One
Closest City *: Select One
Language: English
Time Zone: (UTC) Coordinated Universal Time
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.
 Please choose an option

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.
 Please choose an option

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.
[Link to existing Academy Connection Account](#)

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