區域連線 內容

一般 | 驗證 | 進階

連線方式:

SiS 900 PCI Fast Ethernet Adapter

[設定(C)...]

這個連線使用下列項目(O):

- ☑ QoS Packet Scheduler
- ☑ Microsoft TCP/IP version 6
- ☑ Internet Protocol (TCP/IP)

[安裝(N)...] [解除安裝(U)] [內容(R)]

描述

傳輸控制通訊協定/網際網路通訊協定 (TCP/IP)。這是預設的廣域網路通訊協定，提供不同網路之間的通訊能力。

☑ 連線後，將圖示顯示在通知區域內(W)

[確定] [取消]

Internet Protocol (TCP/IP) 內容

一般 | **其他設定**

如果您的網路支援這項功能,您可以取得自動指派的 IP 設定。否則,您必須詢問網路系統管理員正確的 IP 設定。

○ 自動取得 IP 位址(O)

○ 使用下列的 IP 位址(S):

IP 位址(I):

子網路遮罩(U):

預設閘道(D):

● 自動取得 DNS 伺服器位址(B)

○ 使用下列的 DNS 伺服器位址(E):

慣用 DNS 伺服器(P):

其他 DNS 伺服器(A):

進階(V)...

確定 | 取消

Internet Protocol (TCP/IP) 內容

一般

如果您的網路支援這項功能，您可以取得自動指派的 IP 設定。否則，您必須詢問網路系統管理員正確的 IP 設定。

○ 自動取得 IP 位址(O)

◉ 使用下列的 IP 位址(S)：

IP 位址(I)：	140 . 112 . 20 . 222
子網路遮罩(U)：	255 . 255 . 0 . 0
預設閘道(D)：	140 . 112 . 20 . 254

○ 自動取得 DNS 伺服器位址(B)

◉ 使用下列的 DNS 伺服器位址(E)：

慣用 DNS 伺服器(P)：	140 . 112 . 20 . 1
其他 DNS 伺服器(A)：	140 . 112 . 20 . 2

進階(V)...

確定　　取消

The Internet software layers

Application	SMTP, Telnet, FTP, POP3, IMAP
Transport	TCP, UDP
Network	IP: RIP, BGP, OSPF
Link	Ethernet, Wireless LAN, Token Ring Twisted pair, coaxial, microwave, optical fiber
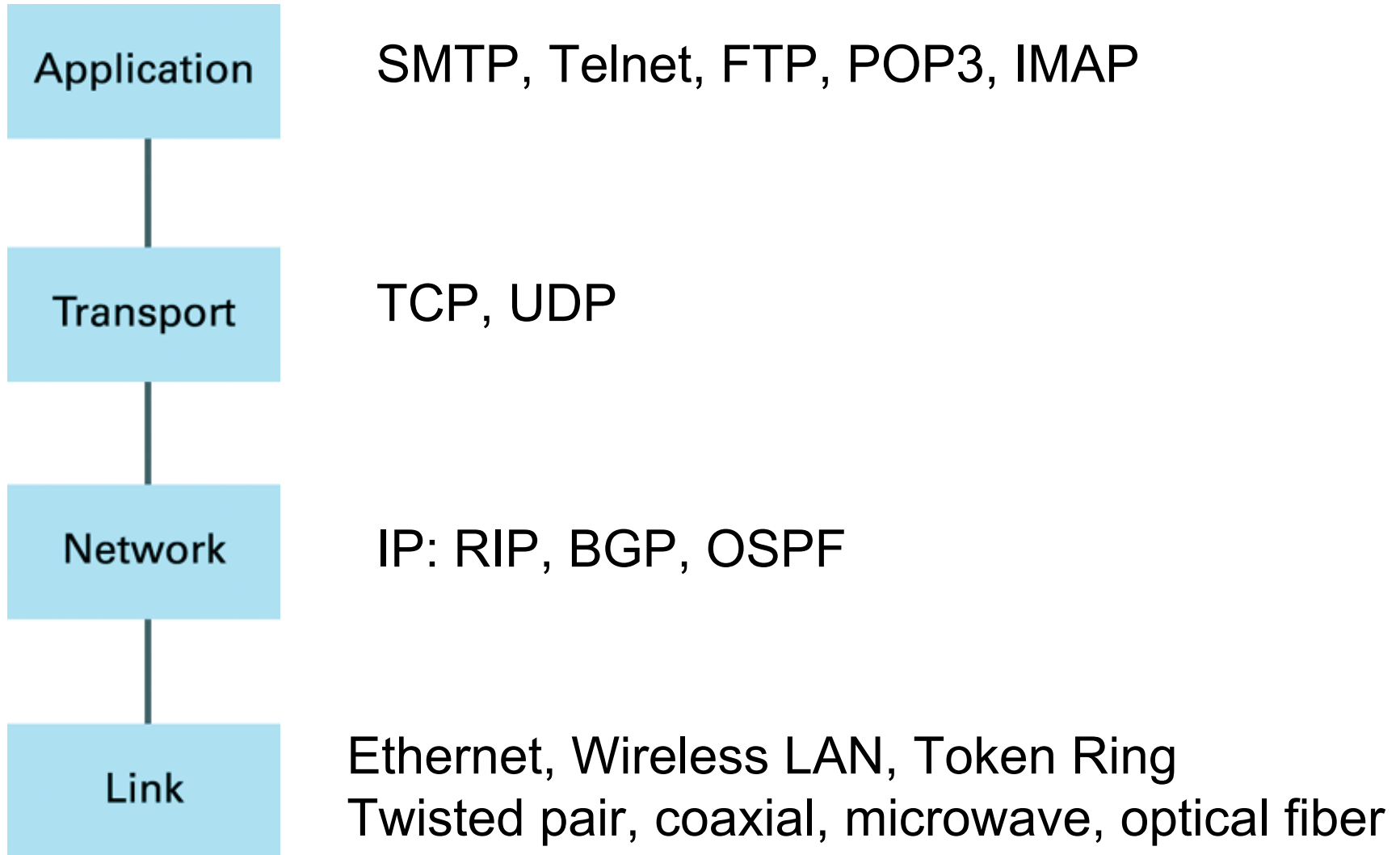
Ethernet

- 1973 Xerox's researcher **Bob Metcalfe**
- Communication over a single cable shared by all devices originally
- DEC, Intel, and Xerox (DIX) drawing up a standard for 10-Mbps Ethernet
- Forming the basis for 802.3
  - 802.X (IEEE standardizing network technologies in February, 1980)
- CSMA/CD

Ethernet Terminology

- **Medium** - Ethernet devices attach to a common medium that provides a path along which the electronic signals will travel. Historically, this medium has been coaxial copper cable, but today it is more commonly a twisted pair or fiber optic cabling.
- **Segment** - We refer to a single shared medium as an Ethernet segment.
- **Node** - Devices that attach to that segment are stations or nodes.
- **Frame** - The nodes communicate in short messages called frames, which are variably sized chunks of information.

- Frames
  - Analogous to sentences in human language
  - **Ethernet protocol:** specifies a set of rules for constructing frames
  - Explicit minimum and maximum lengths for frames
  - Including **destination address** and a **source address**

    (IP address will be addressed later.)

Broadcast address: A frame with a destination address equal to the broadcast address (simply called a broadcast, for short) is intended for every node on the network, and every node will both receive and process this type of frame.

- When computer B transmits to printer C, computers A and D will still receive and examine the frame. However, when a station first receives a frame, it checks the destination address to see if the frame is intended for itself. If it is not, the station discards the frame without even examining its contents.

A Small Ethernet Network
©2003 HowStuffWorks

COMPUTER A

PRINTER C

ETHERNET MEDIUM

COMPUTER B
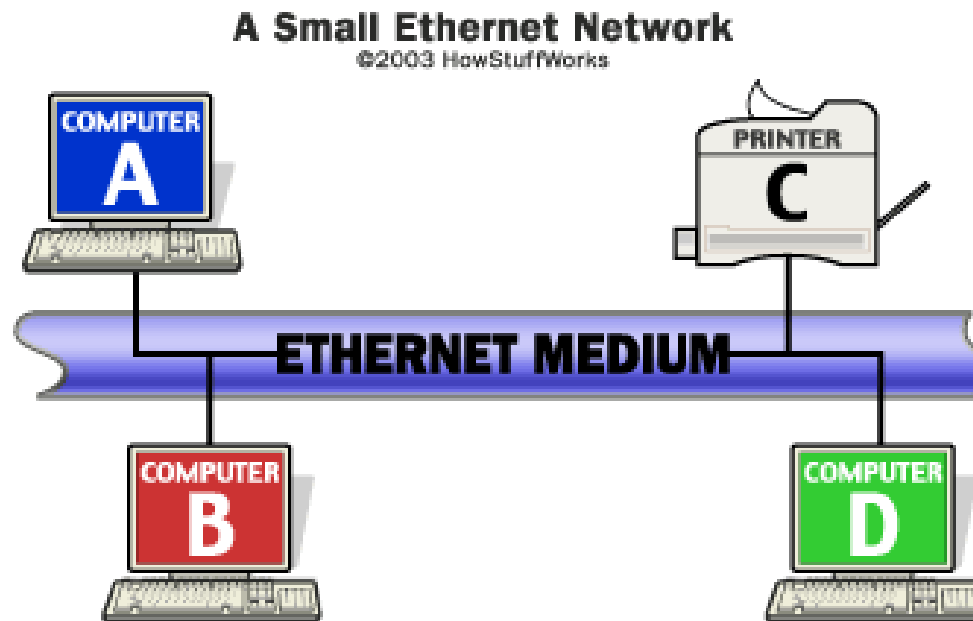
COMPUTER D

CSMA/CD

- **C**arrier **S**ense **M**ultiple **A**ccess with **C**ollision **D**etection
- Multiple access
  - Several computers intend to send data
- Carrier sense
  - Computers sense the carrier to determine whether it's OK to send
- Collision detection
  - Computers detect collision in case of simultaneous transmissions

The Mechanisms

- Each computer listens on the Ethernet
  - If not sensing data on the carrier, OK to send its own data
  - If sensing data on the carrier, check whether the data is addressed for itself
- In case of simultaneous transmissions, (collisions)
  - The computer waits a random period of time before re-send

Properties

- Simple
- Cheap

- The more computers on the LAN, the higher the chance of data colliding

Similar to Having a Polite Conversion

- One speaks at a time
- So each listens and waits until it's quiet
- In case speaking out at the same time, stop and try again

Annoying Person

- Do not listen
- Speak whenever he/she likes
- Refuse to back off

Singapore

- Pretty, clean, organized, efficiency …
- Everything is fine.
- It is also famous for
  - Rules are strictly enforced.
  - Everything is fine.
- It's a FINE city.

Annoying Person

- Do not listen
- Speak whenever he/she likes
- Refuse to back off

Where would the conversation go?

No Where

- The majority of well-behaving people will not be able to communicate with the **misbehaving people**

- The majority of well-behaving people will not be able to communicate with **other well-behaving people** either

Solution

- Kick the annoying guy out

Think This Way

- All participants must follow the same set of rules

Protocol :

Common rules obeyed by all parties, i.e. The rules that govern the communication between different components within a computer system.

Mechanisms of CSMA/CD

- Each computer listens on the Ethernet
  - If not sensing data on the carrier, OK to send its own data
  - If sensing data on the carrier, check whether the data is addressed for itself
- In case of simultaneous transmissions, (collisions)
  - The computer waits a random period of time before re-send

- **Collision domain**: A single Ethernet segment is sometimes called a collision domain.
- **Repeater**: Repeaters connect multiple Ethernet segments, listening to each segment and repeating the signal heard on one segment onto every other segment connected to the repeater.

- **Bridges**
  - Extend the network diameter like a repeater
  - Reduce unnecessary traffic by filtering: e.g. A->B, confining the traffic in segment 1, not in segment 2

An Ethernet Bridge Connecting Two Segments

©2003 HowStuffWorks

STATION A

STATION D

Bridge

SEGMENT 1

SEGMENT 2
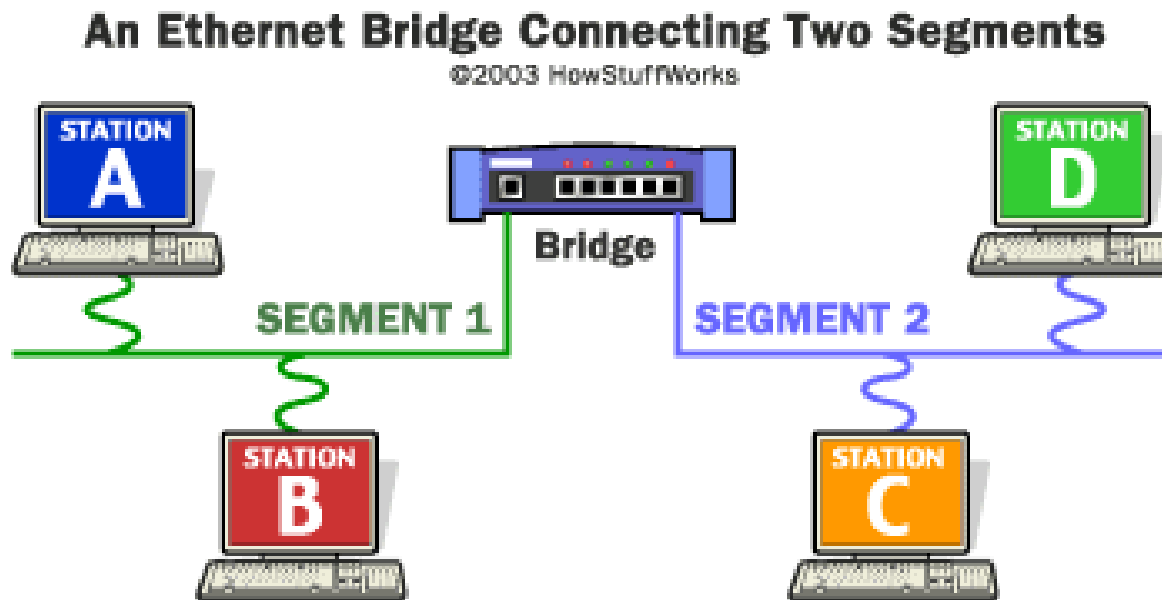
STATION B

STATION C

Switched Ethernet

- a **dedicated** segment for each station => dedicated bandwidth.
- **Switch**
  - like bridges (multi-port bridge) for single-station segments
  - The switch then forwards the frame over the appropriate segment, just like a bridge, but since any segment contains only a single node, the frame only reaches the intended recipient. This **allows many conversations to occur simultaneously on a switched network**. Max. Bandwidth may be   N/2 x (Individual Bandwidth).   E.g. N/2*100Mbps
- **Hub**: **share** the same segment/bandwidth
- It is **full-duplex**（雙工）
  - send and receive data at the same time
  (Legacy Ethernet uses shared medium. It is half duplex.
  ⇒information can move in only one direction at a time)
  Note: simplex(單工): one way, like radio or TV broadcasting
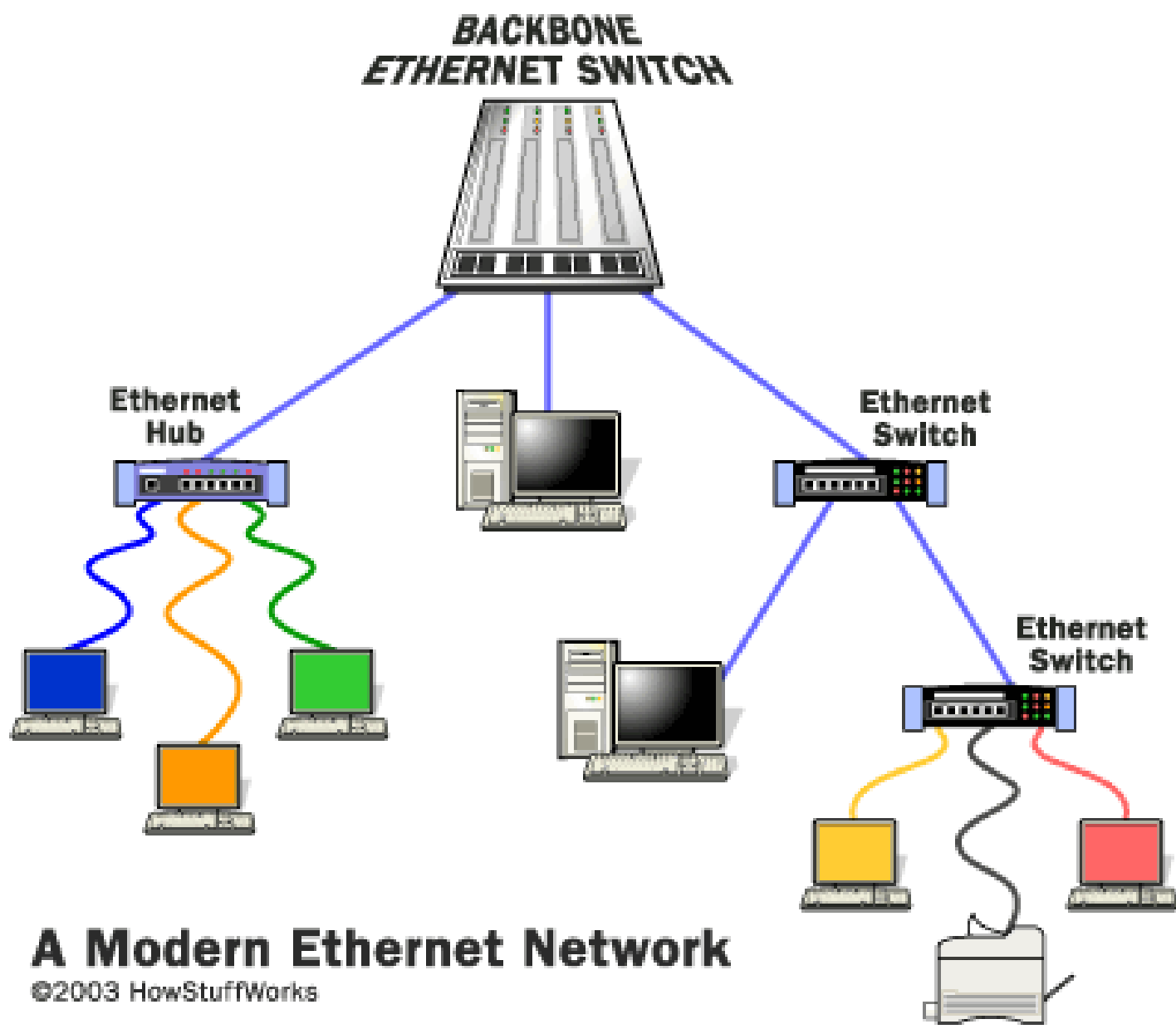
Repeater
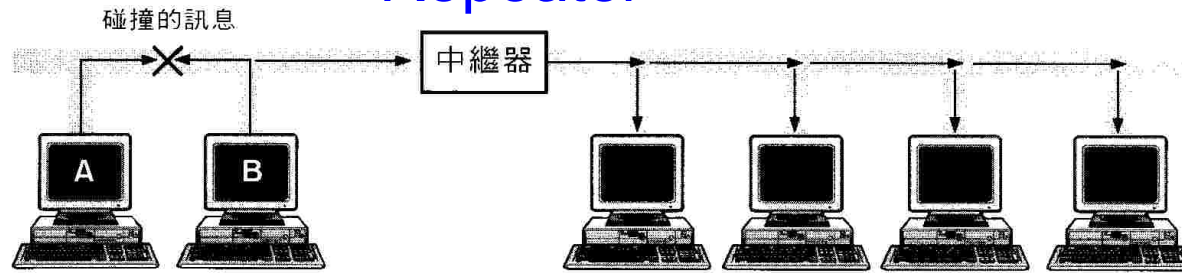
碰撞的訊息

中繼器

A B

圖 5-08　使用中繼器可延長碰撞領域

Switch

100 Mbps 交換器

100 Mbps　　　100 Mbps　　　100 Mbps

A　B　C　D　E　F

圖 03-40　6 Port 100 Mbps 交換器最多可擁有 300 Mbps 的頻寬

BACKBONE *ETHERNET SWITCH*
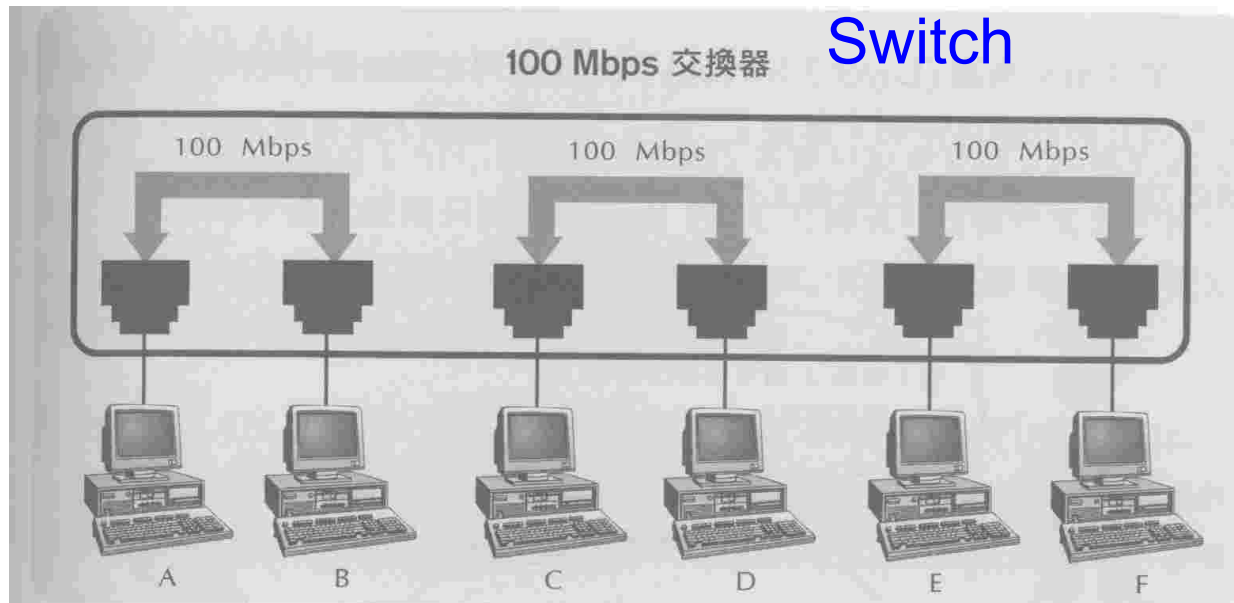
Ethernet Hub

Ethernet Switch

Ethernet Switch

A Modern Ethernet Network

©2003 HowStuffWorks

Ethernet

- Port hub – bus
  - Collision
  - 100Mbps shared ——— Collision avoidance
  - Security problem, harder to manage possibly
  - Cheap
- IP switch - star
  - **No collision**
  - 100Mbps each (Max. = N/2 *100 Mbps)
  - Easier to manage
  - Expensive

Item	10 Base2	10 BaseT	100BaseTX
Medium	Coaxial cable	Twisted pair	Twisted Pair
Plug	BNC	RJ-45	RJ-45
Max Segment L	185 m	100 m	100 m
Topology	bus	star	star

Ethernet is the most popular medium access control protocol.

MAC

- **M**edium **A**ccess **C**ontrol
- The class of protocols that handle medium access problems
- Example
  - Ethernet (IEEE 802.3)
  - Token Bus (IEEE 802.4)
  - Token Ring (IEEE 802.5)
  - Wireless LAN (IEEE 802.11)
  - Bluetooth (IEEE 802.15),
- MAC addressing
  - e.g. 00:A0:C9:14:C8:29, where 00:A0:C9 for Intel

Token Ring

- The ring initializes by creating a **token**, which is a special type of frame that gives a station permission to transmit.

- The token circles the ring like any frame until it encounters a station that wishes to transmit data.

- This station then "captures" the token by replacing the token frame with a data-carrying frame, which encircles the network.

- Once that data frame returns to the transmitting station, that station removes the data frame, creates a new token and forwards that token on to the next node in the ring.

A Small Token Ring Network
©2003 HowStuffWorks

STATION B

STATION A

TOKEN-RING

STATION C

STATION D

Questions?

WAN

- **W**ide **A**rea **N**etwork
- A large number (usually) of connected computers spreading across a wide area

- Connecting LANs
  - A LAN connects to a WAN via a router

Constructing a WAN

- Star, ring, bus?

- A **large number** (usually) of connected computers spreading across a **wide area**
- Large number – not efficient
- Wide area – not economical

Any Shape You Like
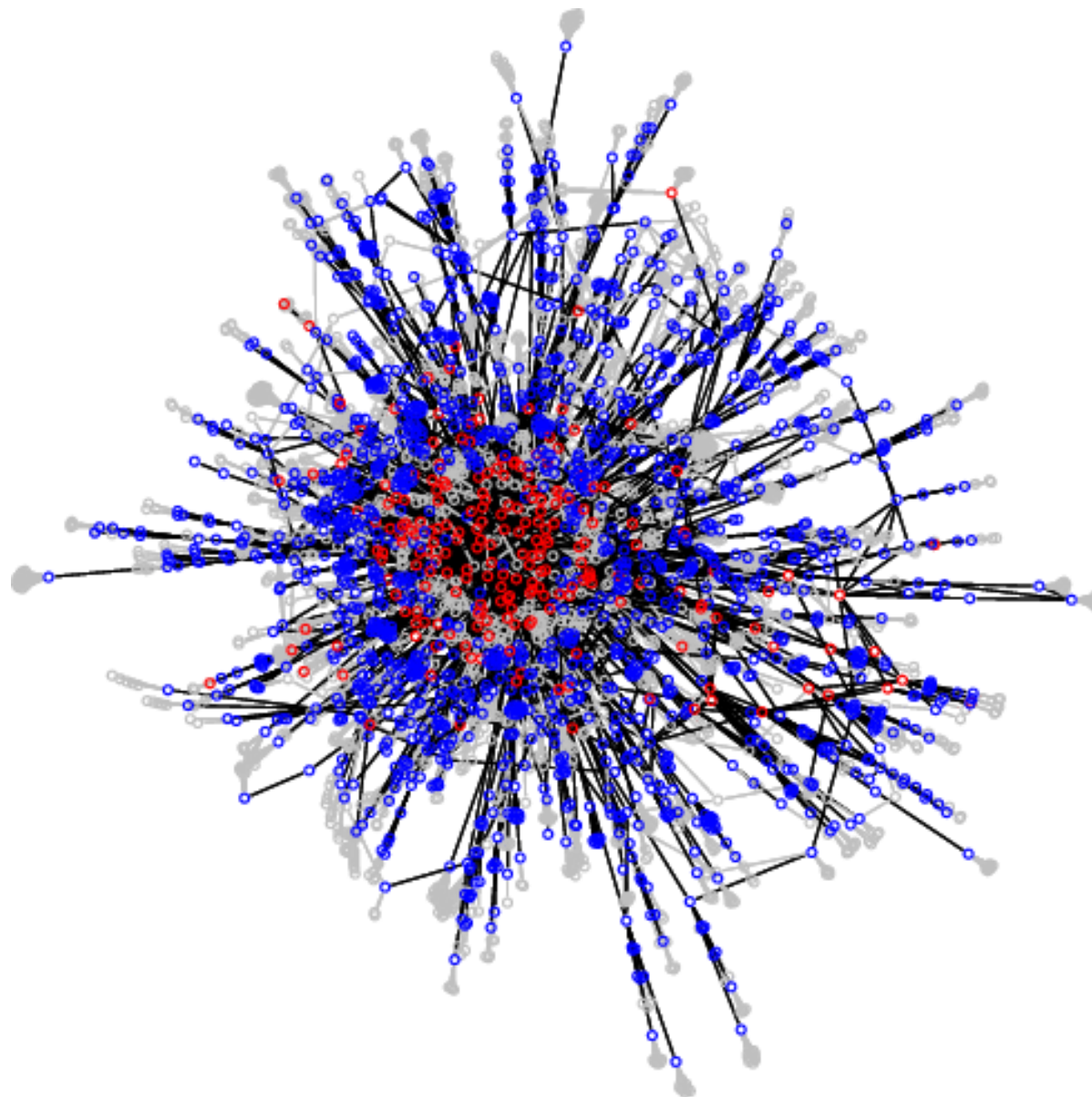
How to get the data to go where you want them to be?

Routing

Finding a route
from the source to the destination

Internet Protocol (IP)

- IP address: a 32-bit number, e.g. 140.112.1.6
  - About 4.3 billion possible combinations
- ICANN (Internet Corporation for Assigned Names and Numbers) http://www.icann.org
- TWNIC (Taiwan Network Information Center) http://www.twnic.net
- Personal or company addresses => ISPs
- IP routing
  - How to get the data to go where you want them to be?

Routing

Finding a route
from the source to the destination

A to B
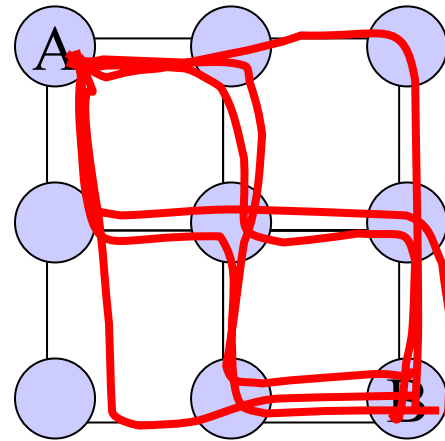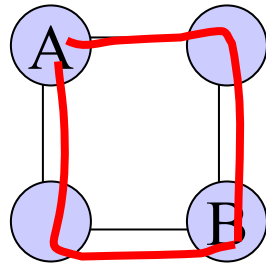
Not That Easy….

Don't have the view of entire network

I tell my neighbors.
You tell yours

The Rules - Initial

- Determine initial table
  - Route and distance to itself and the neighbors
- Select one router to start telling its table to the neighbors

The Rules - Propagation

- Upon receiving a table,
- Check if there exists a shorter path to any destination
- If yes, update table and tell the neighbors of the updated table
- If not, do nothing (already the shortest path table)

Distance Vector Routing

- RIP
- BGP (strictly, path vector)

- Distance Vector – the table in the example

RIP

- **R**outing **I**nformation **P**rotocol
- Works exactly the way above

- Example - campus networks

BGP

- **B**order **G**ateway **P**rotocol
- Slightly more complicated
- Taking policies into consideration
- Propagating paths to prevent loops

- Example - backbone networks

RIP and BGP are two popular routing protocols.

IP Routing

- **I**nternet **P**rotocol Routing
- The class of protocols that handle routing problems
- Example
  - RIP (IETF RFC 1058)
  - BGP (IETF RFC 1771)
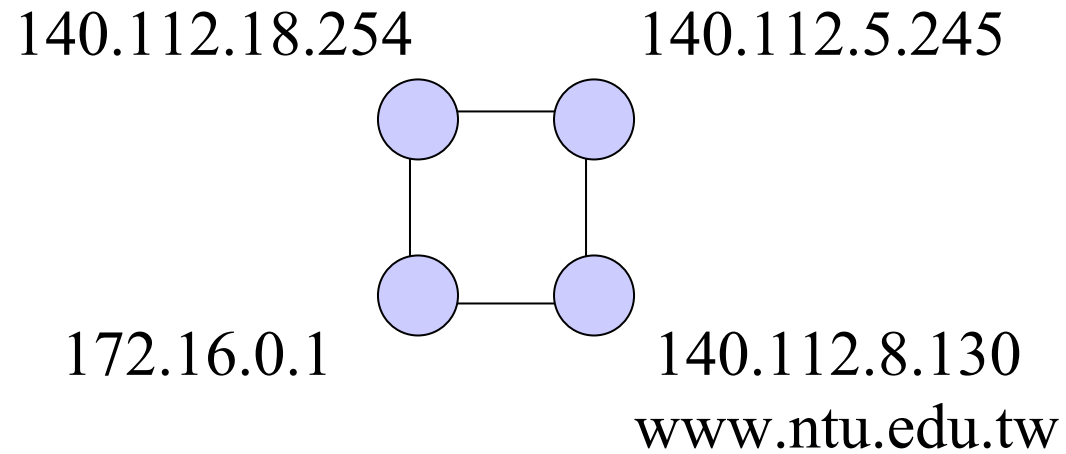 - OSPF (IETF RFC 2328)
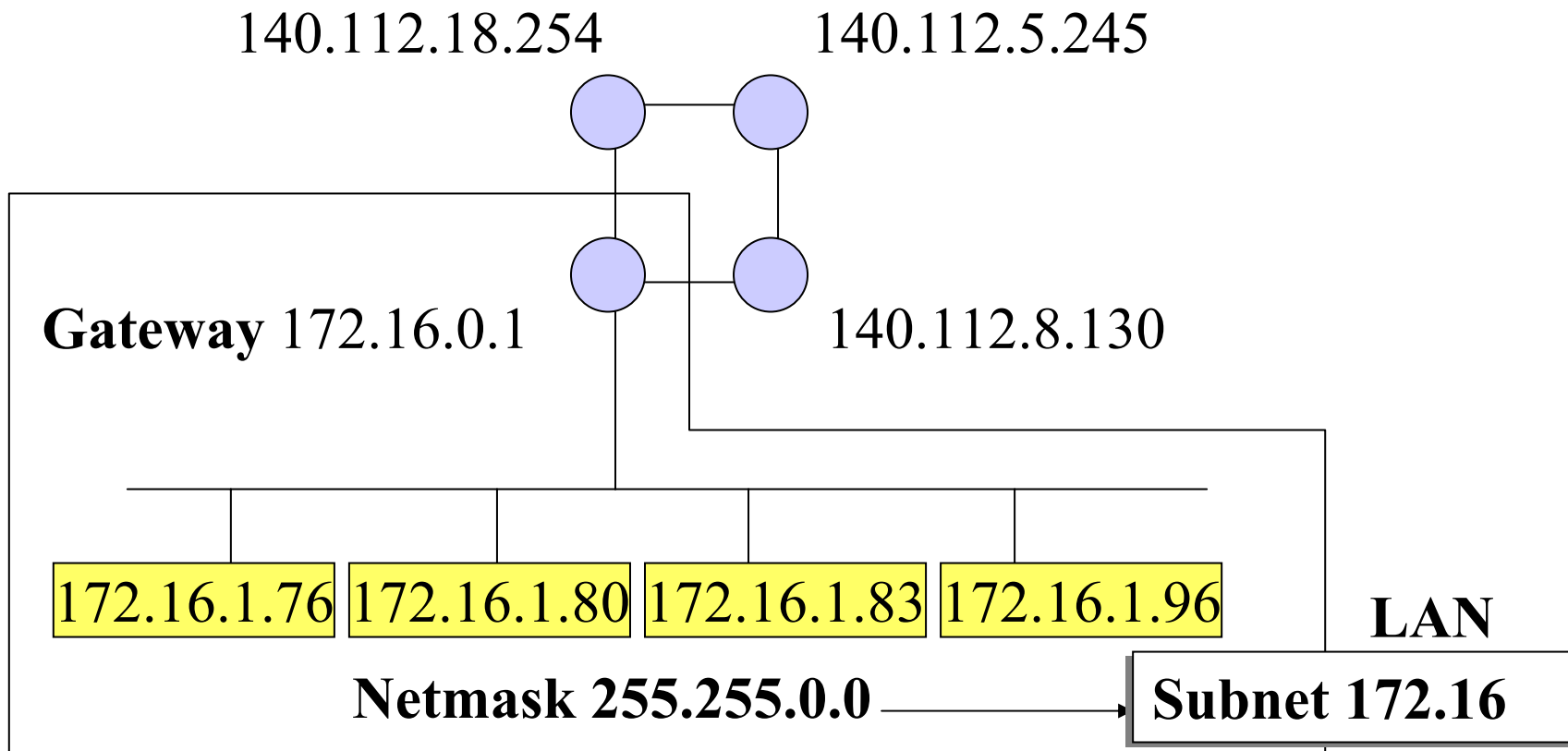
Internet – Structural View
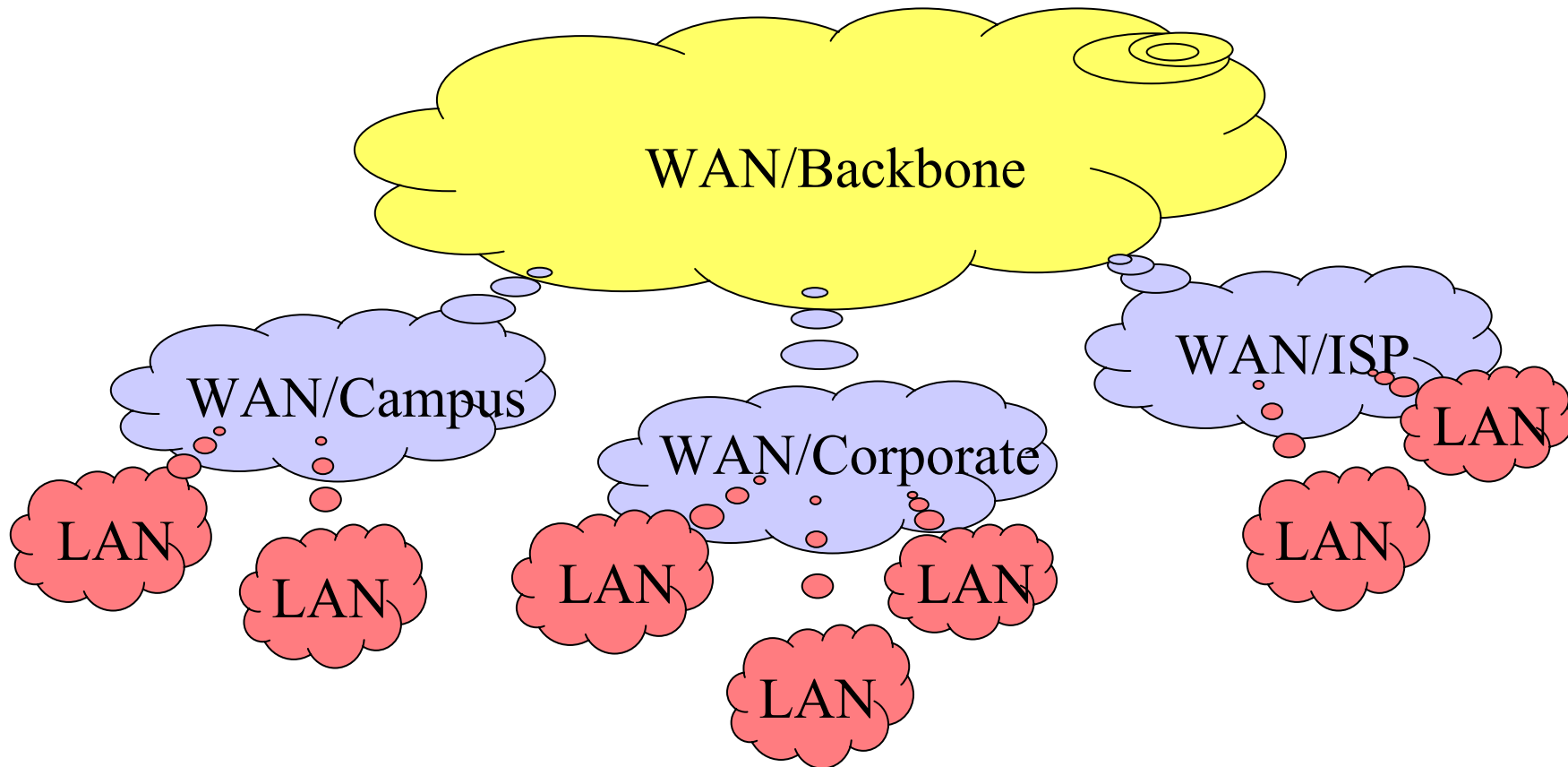
Internet - Protocol View

IP Address

140.112.18.254   140.112.5.245

172.16.0.1   140.112.8.130

Domain Name Service

140.112.18.254   140.112.5.245

172.16.0.1   140.112.8.130

www.ntu.edu.tw

Subnet Concept

140.112.18.254　　　140.112.5.245

Gateway 172.16.0.1　　　　140.112.8.130

172.16.1.76　172.16.1.80　172.16.1.83　172.16.1.96　**LAN**

Netmask 255.255.0.0 ⟶ **Subnet 172.16**
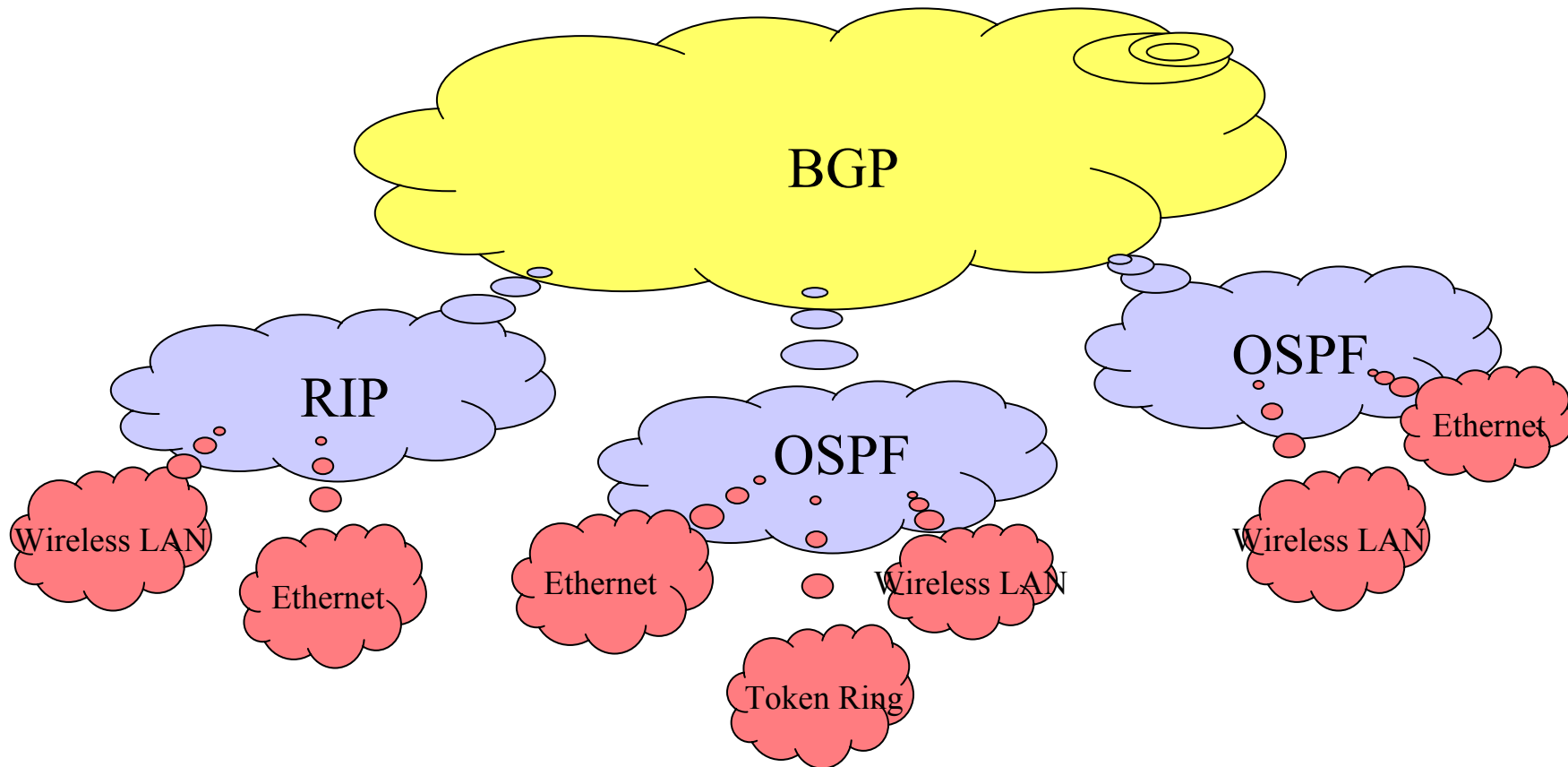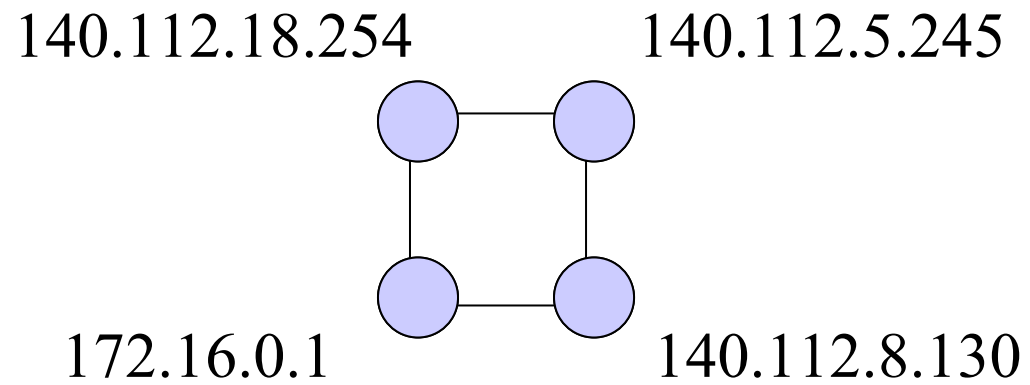
TCP/IP Network Setting

- IP Address
  - The address used to route data around the network
- DNS Server
  - Find the IP address from a computer's name (hostname)
- Gateway
  - The default router to forward data out from the local subnet
- Netmask
  - To determine the size of a subnet

Summary

- The principle
  - Transmission
  - Media and access
- Interconnection
  - LAN and Ethernet
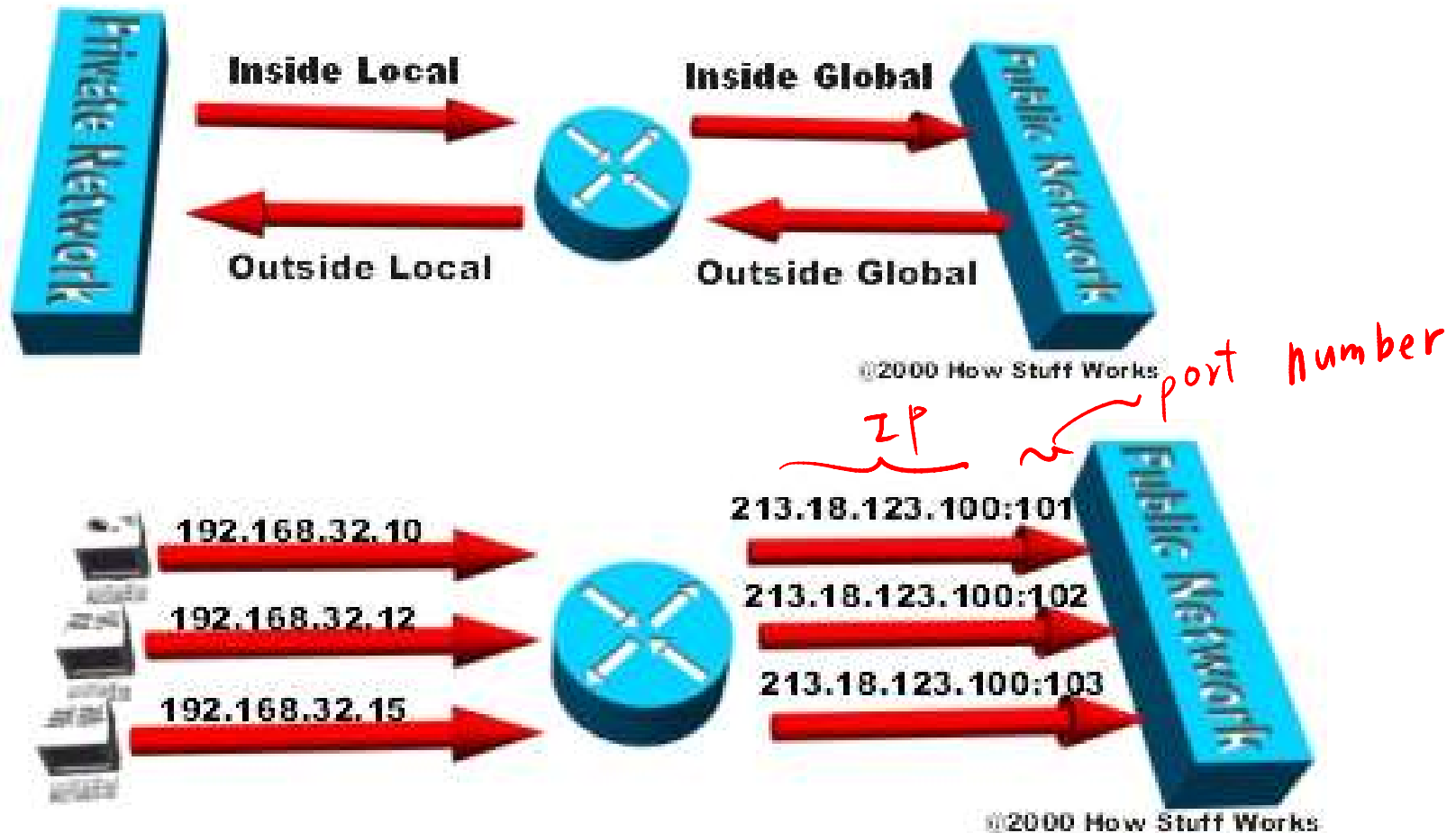 - WAN and DV routing
- TCP/IP Network Configuration

Review

- Hub, bridge, switch, repeater, router, gateway

- DNS (Domain Name Server)

- DHCP (Dynamic Host Configuration Protocol)

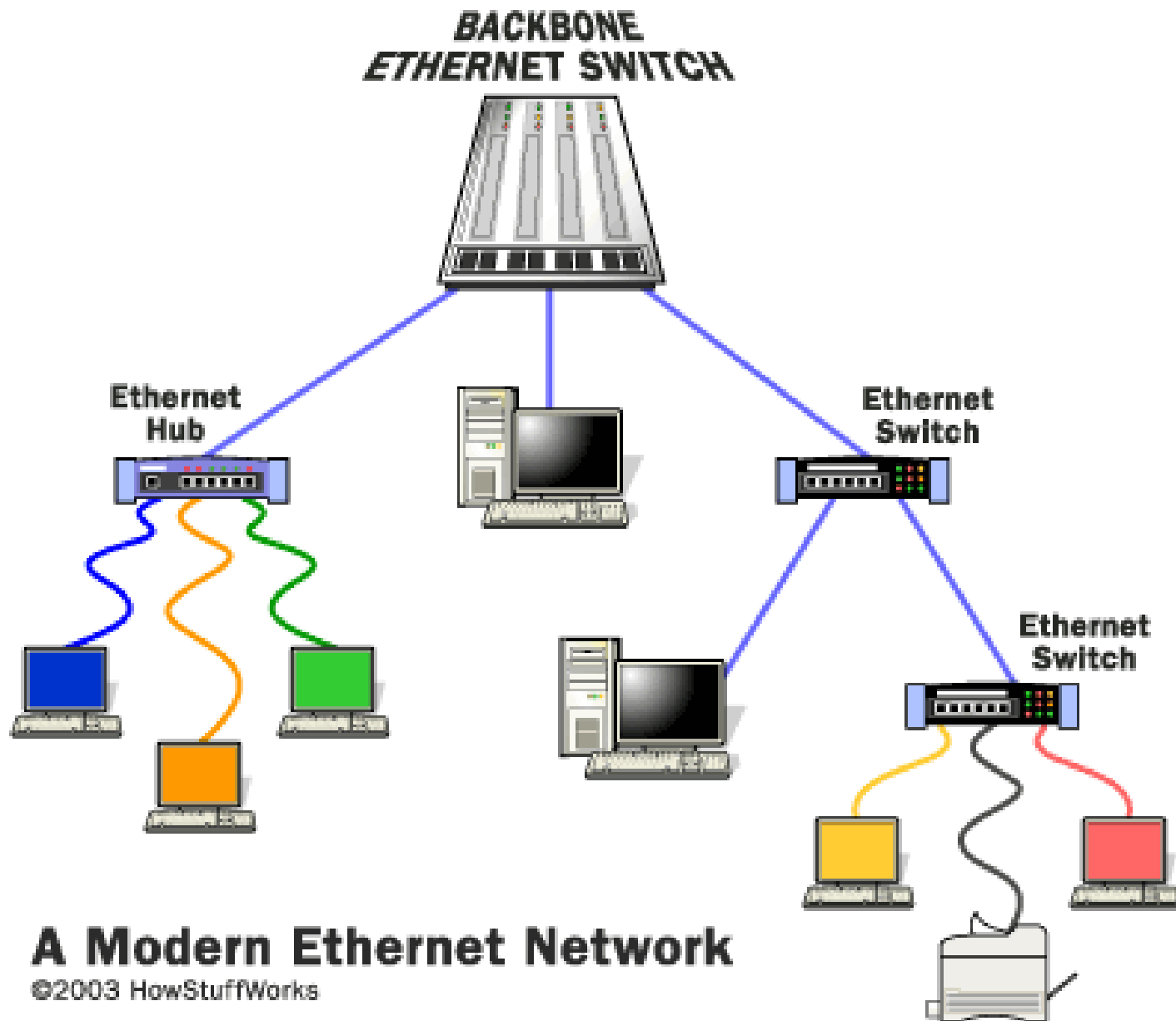# Some Solutions to Shortage of IP Numbers

- DHCP
  - Not every node is online at the same time
  - Dynamic IP number
  - N nodes share P numbers (N>P)
  - Hard to locate due to dynamic IP number
- Local IP
  - NAT, same IP (but different ports) to outside
  - Need forwarding
- IPv6
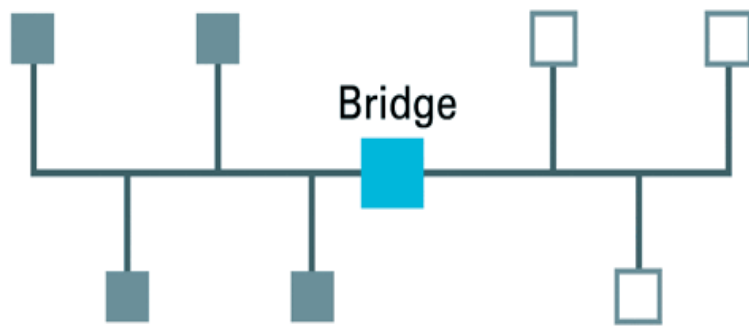 - 32bits => 128 bits

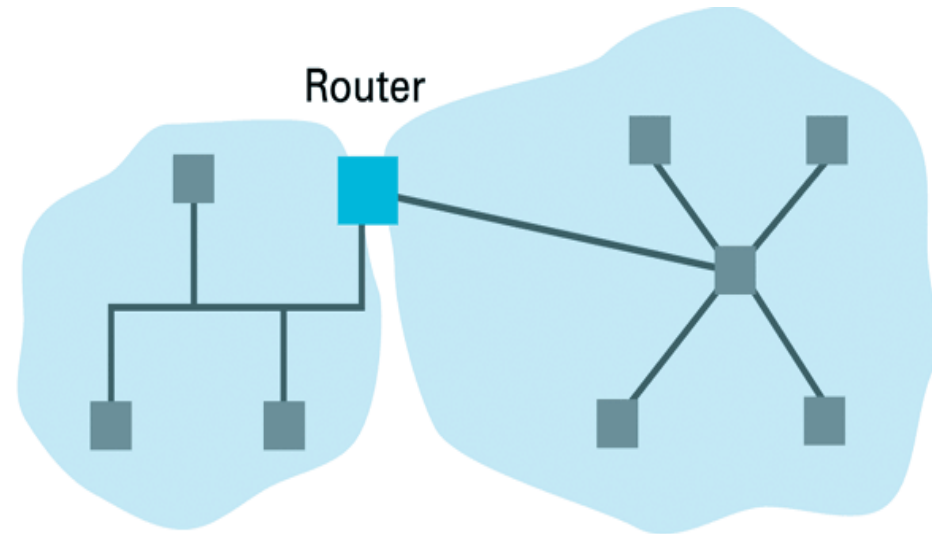# Network Address Translation (NAT)
-- IP sharing

http://computer.howstuffworks.com/nat.htm/printable

BACKBONE ETHERNET SWITCH

Ethernet Hub

Ethernet Switch

Ethernet Switch

A Modern Ethernet Network

©2003 HowStuffWorks

The distinction between a bridge and a router

a. A bridge connecting two bus networks to form one large network

b. A router connecting a bus network to a star network to form an Internet consisting of two networks
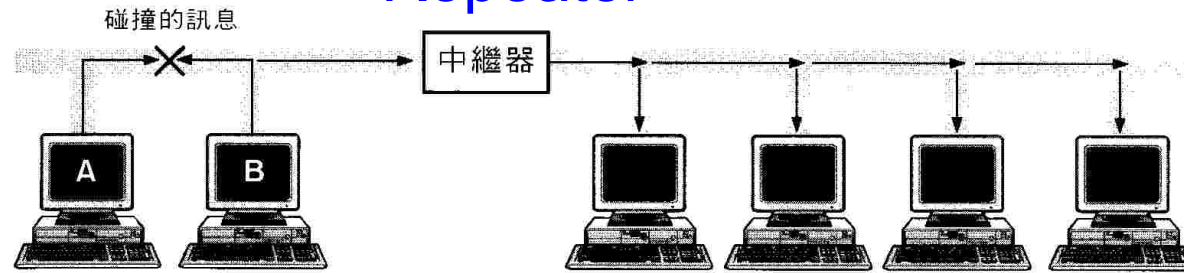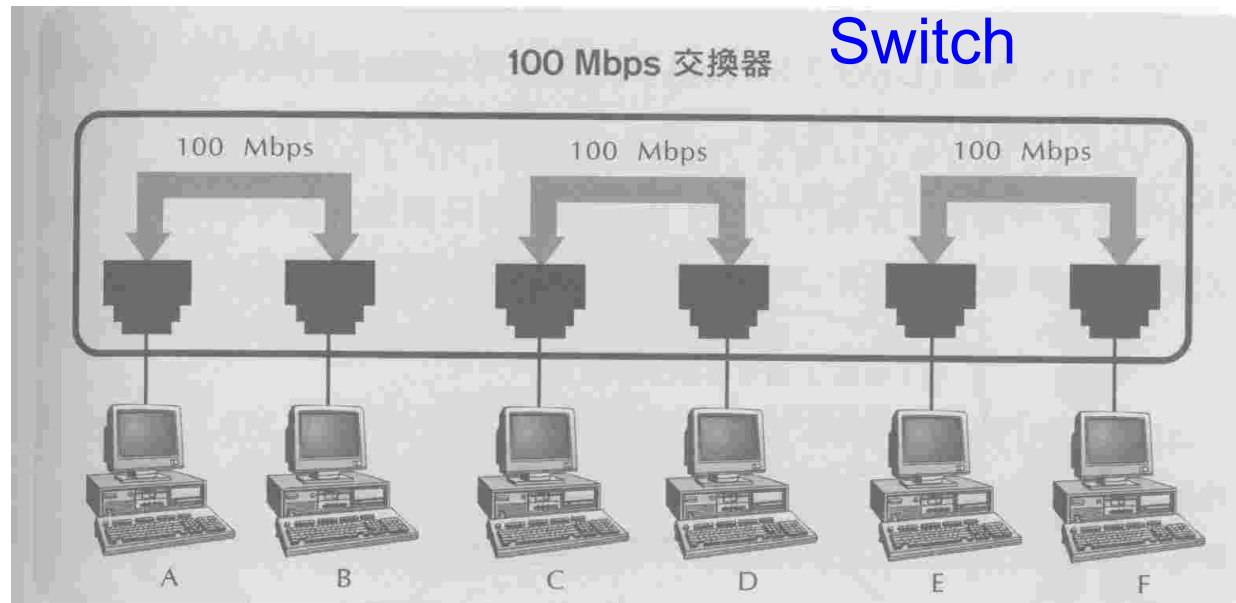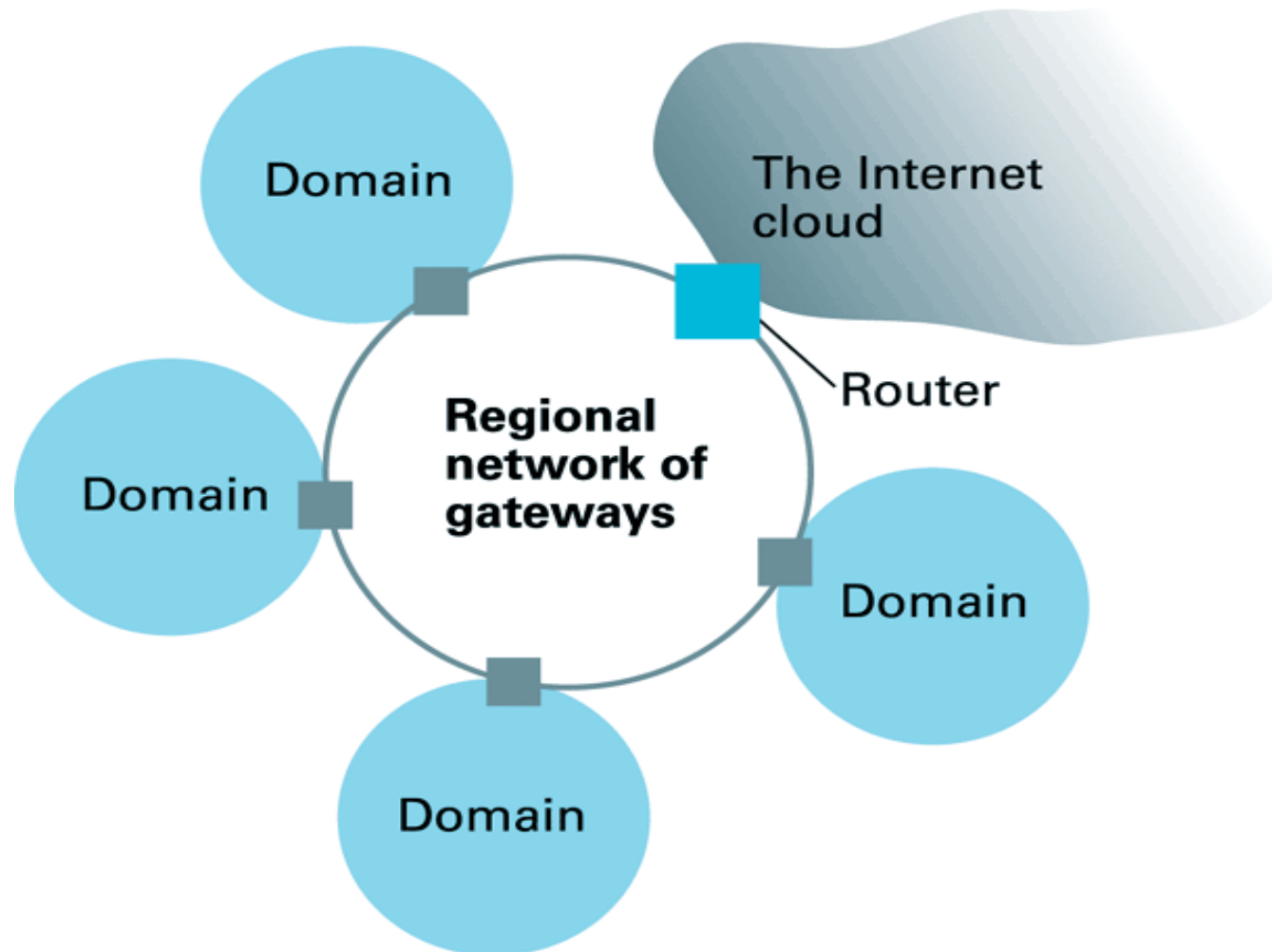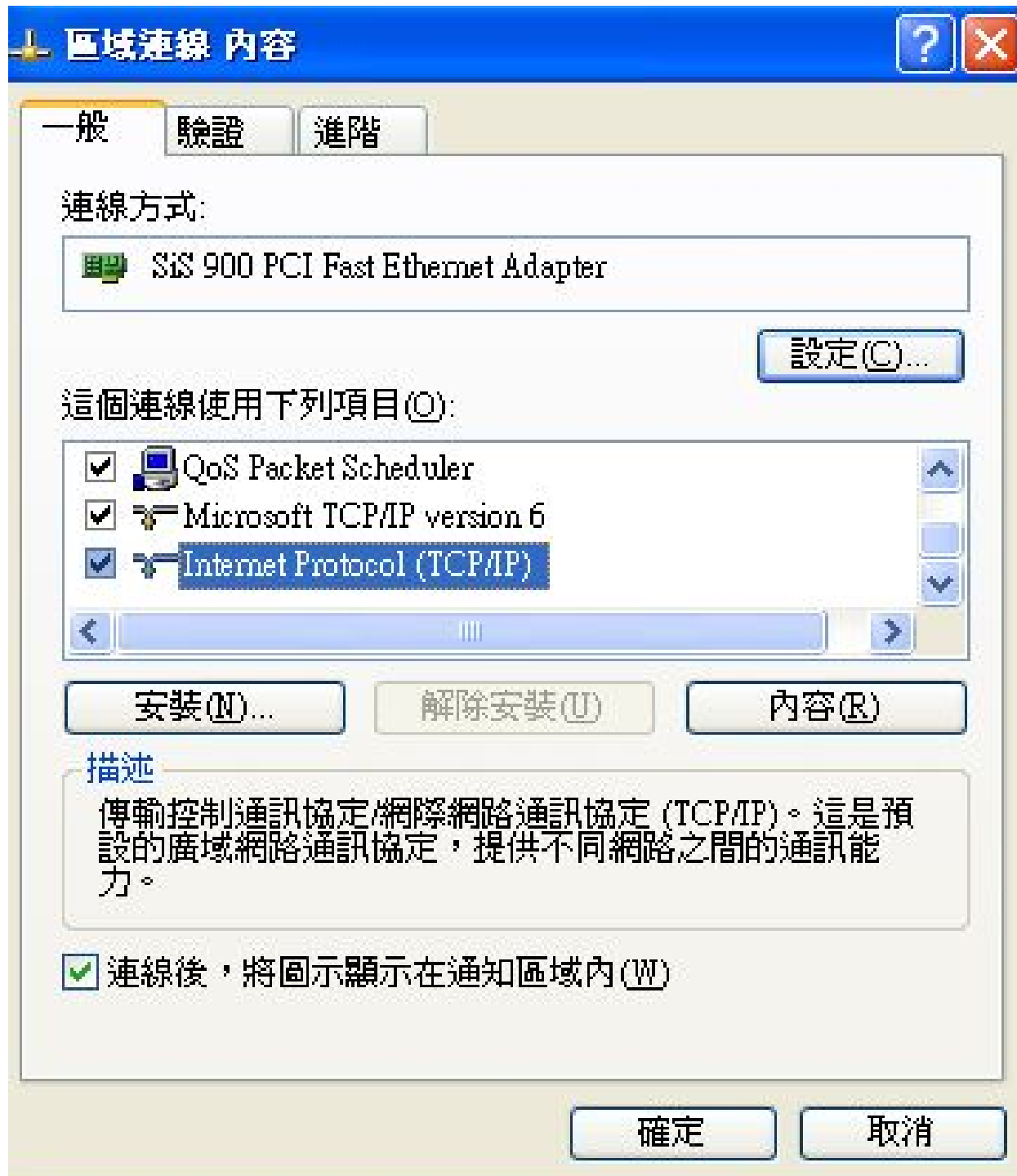
Repeater

圖 5-08　使用中繼器可延長碰撞領域

Switch

圖 03-40　6 Port 100 Mbps 交換器最多可擁有 300 Mbps 的頻寬

A typical approach to connecting to the Internet

區域連線 內容

一般 | 驗證 | 進階

連線方式:

> SiS 900 PCI Fast Ethernet Adapter

[設定(C)...]

這個連線使用下列項目(O):

- ☑ QoS Packet Scheduler
- ☑ Microsoft TCP/IP version 6
- ☑ Internet Protocol (TCP/IP)

[安裝(N)...] [解除安裝(U)] [內容(R)]

描述

傳輸控制通訊協定/網際網路通訊協定 (TCP/IP)。這是預設的廣域網路通訊協定,提供不同網路之間的通訊能力。

☑ 連線後,將圖示顯示在通知區域內(W)

[確定] [取消]

Internet Protocol (TCP/IP) 內容

一般	其他設定

如果您的網路支援這項功能，您可以取得自動指派的 IP 設定。否則，您必須詢問網路系統管理員正確的 IP 設定。

⦿ 自動取得 IP 位址(O)

○ 使用下列的 IP 位址(S)：

IP 位址(I)：

子網路遮罩(U)：

預設閘道(D)：

⦿ 自動取得 DNS 伺服器位址(B)

○ 使用下列的 DNS 伺服器位址(E)：

慣用 DNS 伺服器(P)：

其他 DNS 伺服器(A)：

進階(V)...

確定　　取消

Internet Protocol (TCP/IP) 內容

一般

如果您的網路支援這項功能，您可以取得自動指派的 IP 設定。否則，您必須詢問網路系統管理員正確的 IP 設定。

○ 自動取得 IP 位址(O)

● 使用下列的 IP 位址(S)：

IP 位址(I):	140 . 112 . 20 . 222
子網路遮罩(U):	255 . 255 . 0 . 0
預設閘道(D):	140 . 112 . 20 . 254

○ 自動取得 DNS 伺服器位址(B)

● 使用下列的 DNS 伺服器位址(E)：

慣用 DNS 伺服器(P):	140 . 112 . 20 . 1
其他 DNS 伺服器(A):	140 . 112 . 20 . 2

進階(V)...

確定　　取消

Questions?