



Chapter 1: Introduction

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Problem 1:

통신기술은 언제 어떻게 태동하
고 발전했을까?

● 전파 (Radio Wave)

- 전기가 흐를 때 그 주위에 전계가 발생하며 전계의 변화가 주변에 자기장을 형성하고 또 이렇게 형성된 자계가 주변의 전계를 변화시키면서 **전계와 자계가 순차적으로 전달되어 파동이 발생** → Maxwell Equation

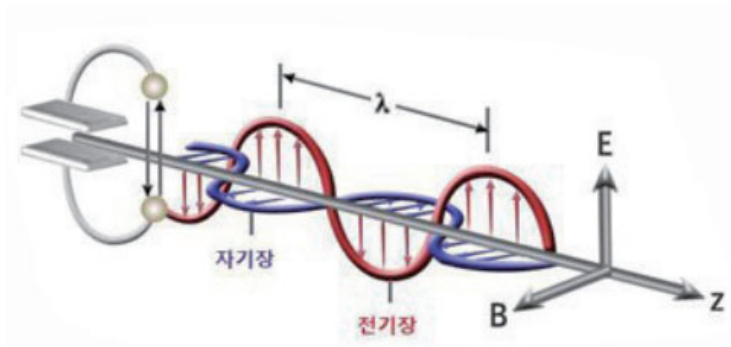


그림 1. 전계와 자계의 파동 원리



무선통신에 사용되는 주파수를 포함하여 적외선, 가시광선, 자외선, X선, 우주선 등을 총칭하여 넓은 의미의 전파로 정의할 수 있으며, 맥스웰 방정식을 이론의 근거로 삼고 있다.

통신기술의 발전

● 전파 통신 발전의 계기

■ 1912년 타이타닉

- 승객 2,228명 중 1,523명 사망
- 타이타닉호 (최첨단 무선통신 장착)
 - 무선통신을 통해 침몰 상황 전달 (5명의 영웅)
 - 마르코니 무선전신회사
- 전파기술로 인해 엄청난 비극 속에서도 그나마 700명 구조
- 전파 활용의 일대 전환

● 전파 통신 발전의 계기 2

- 2차 세계대전의 전세를 뒤바꾼 대표적 무기는?
- 원자폭탄?
- NO. 레이더 기술

2차 세계대전 초반 영국은 독일보다 훨씬 뒤쳐진 군사력으로 독일의 공격을 막아냈고, 반면에 일본은 일방적인 진주만 폭격 후 미드웨이 해전과 필리핀 해전에서 막강한 해군력이 몰락하고 말았는데, 그 내막을 들여다보면 모두 전파 기술이 자리 잡고 있다. 2차 세계대전이 발발한 지 얼마 되지 않았을 때 막강한 군사력을 보유한 프랑스를 6주 만에 항복시킨 독일은 도버 해협 너머의 영국을 공습할 준비를 하고 있었다. 해군력은 열세였지만 막강한 공군력을 바탕으로 몇 주만 공습하면 어렵지 않게 영국을 항복시킬 수 있으리라 생각했던 독일은 의외의 복병과 마주치게 되었다. 독일의 수많은 폭격기와 이를 호위하는 전투기들이 프랑스 해변 비행장에서 이륙하면 매번 도버 해협 상공에서 영국 전투기와 마주치는 것이었다.

통신기술의 발전

그런데 영국이 세계 최초로 레이더를 상용화하게 된 것은 아이러니하게도 적국인 일본 사람 덕분이었다. 1926년, 야기 히데츠구라는 일본 교수와 그의 조수 우다 신타로는 역사적인 야기우다 안테나(Yagi-Uda antenna)를 발명해냈다. 이 안테나는 야기 안테나로 불리며 지금도 전 세계적으로 많이 사용되고 있다. 예전에 옥상에 달려 있던 TV 안테나나 길거리에서 흔히 볼 수 있는 중계기 안테나는 모두 야기 안테나이다.

야기 교수는 전파를 특정 방향으로 송신할 수 있다는 군사적 활용 방안을 일본 군부에 보고했으나 일본군
은 이 저파 형식이 가너르 캐다지 모체 브러버리구 마야다 이보으 니미 1000~1015년에 미국에 디자인 아
그림 23 초창기 레이더 기술을 보여주는 야기 안테나와 야기 안테나를 장착한 전투기

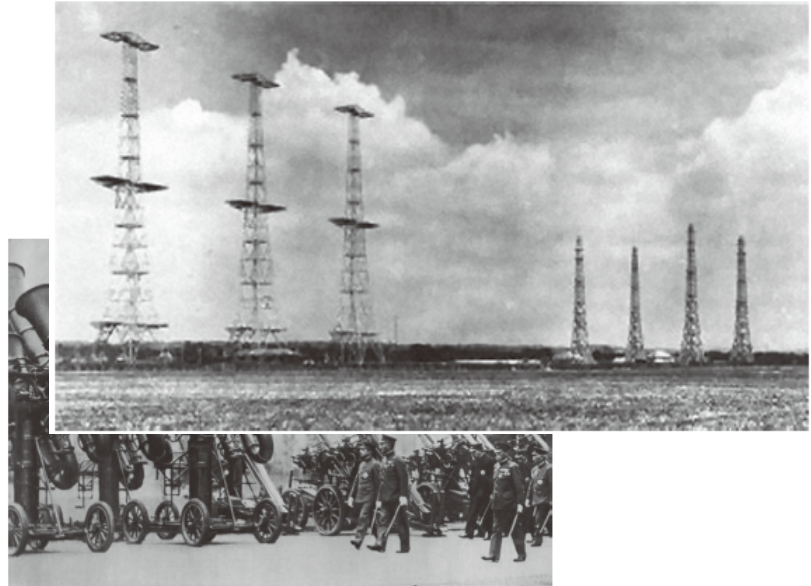


영국이 독일의 공습을 재빨리 알아채고 대응할 수 있었던 것은 세계 최초의 레이더 기술을 보유하고 있었기 때문이다. 레이더를 이용해 독일 폭격기의 공습을 미리 알아내고 영국 전투기가 도버 해협에서 마중을 나갈 수 있었던 것이다. [그림 22]는 이때 도버 해협을 따라 설치되었던 세계 최초의 레이더이다.

그림 21 다양한 대공 청음기



그림 22 독일의 공습으로부터 영국을 지켜준 세계 최초의 레이더



Keyword of the lecture 1:
Terms and Internet

Contents

1. Data Communications
2. Networks
3. Network Types
4. The Internet
5. Protocols and Standards

1-1 DATA COMMUNICATIONS

*The term **telecommunication** means communication at a distance. The word **data** refers to information presented in whatever form is agreed upon by the parties creating and using the data. **Data communications** are the exchange of data between two devices via some form of transmission medium such as a wire cable.*

Topics discussed in this section:

Components

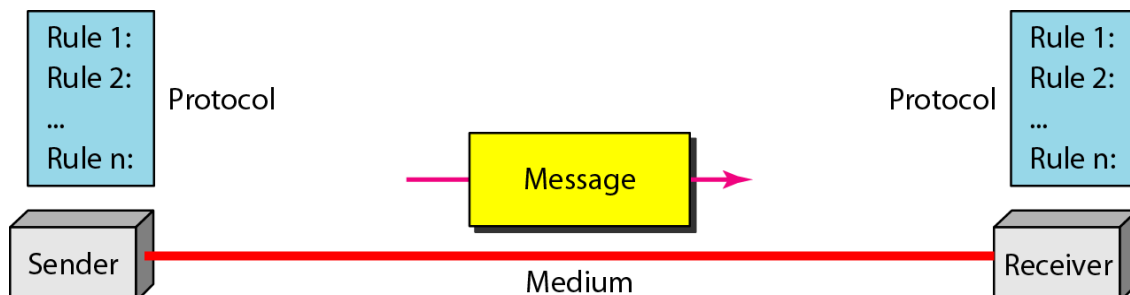
Data Representation

Data Flow

Five Components

- Message
 - Information (data)
- Sender
 - The device that sends the data message
- Receiver
 - The device that receives the message
- Transmission Medium
 - The physical path by which a message travels
- Protocol
 - A set of rules that govern data communications

Figure 1.1 *Five components of data communication*



- Simplex

- Unidirectional as on a one-way street

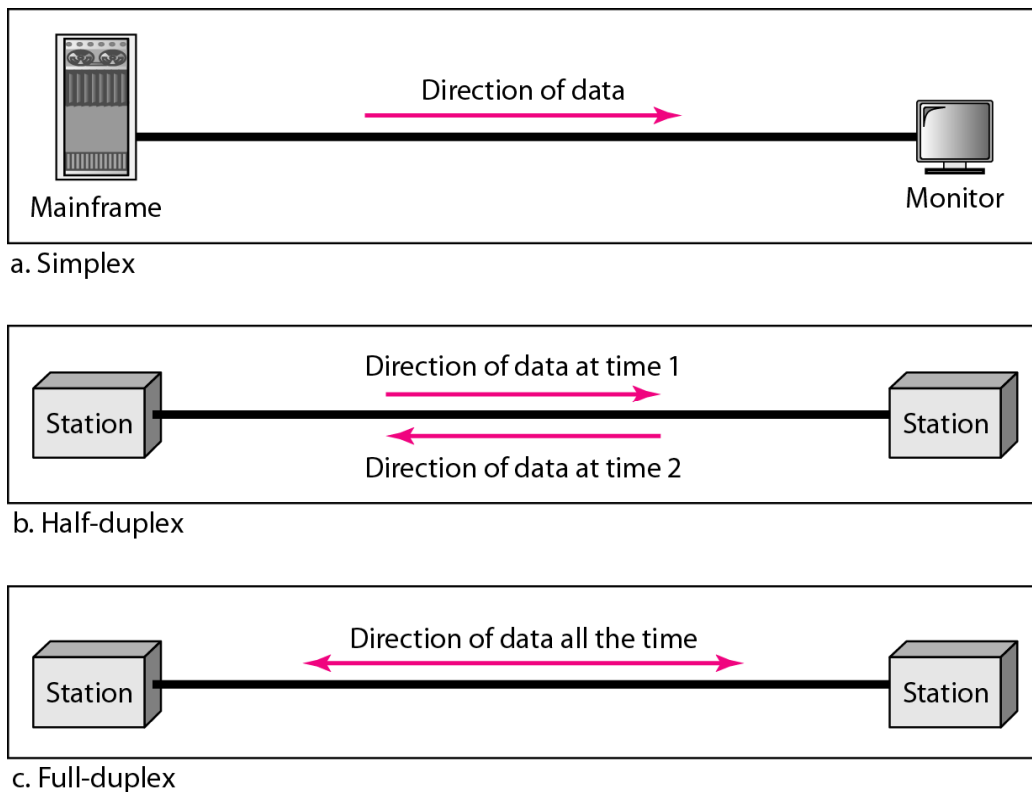
- Half-duplex

- Each station can both transmit and receive, but not at the same time

- Full-duplex

- Both stations can transmit and receive simultaneously

Figure 1.2 *Data flow (simplex, half-duplex, and full-duplex)*



1-2 NETWORKS

A **network** is a set of devices (often referred to as **nodes**) connected by communication **links**. A node can be a computer, printer, or any other device capable of sending and/or receiving data generated by other nodes on the network.

Topics discussed in this section:

Network Criteria

Physical Structures

Network Models

Categories of Networks

Interconnection of Networks: Internetwork

Network Criteria

● Definition

- A certain number of criteria should be satisfied in a network

● Type

- Performance
- Reliability
- Security

● Type of connection

- Point-to-Point

- Multipoint

● Physical topology

- Mesh

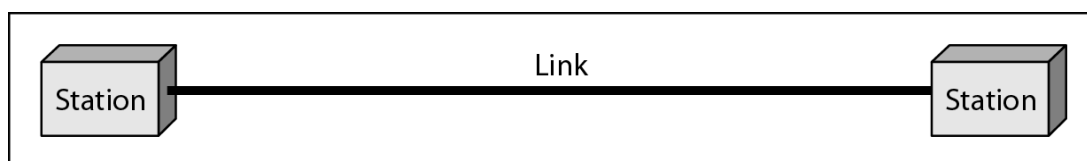
- Star

- Bus

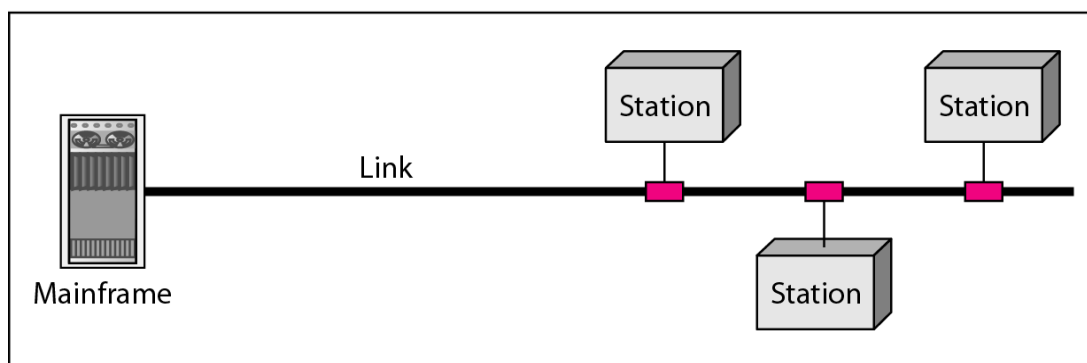
- Ring

- Hybrid

Figure 1.3 *Types of connections: point-to-point and multipoint*



a. Point-to-point



b. Multipoint

Figure 1.4 *Categories of topology*

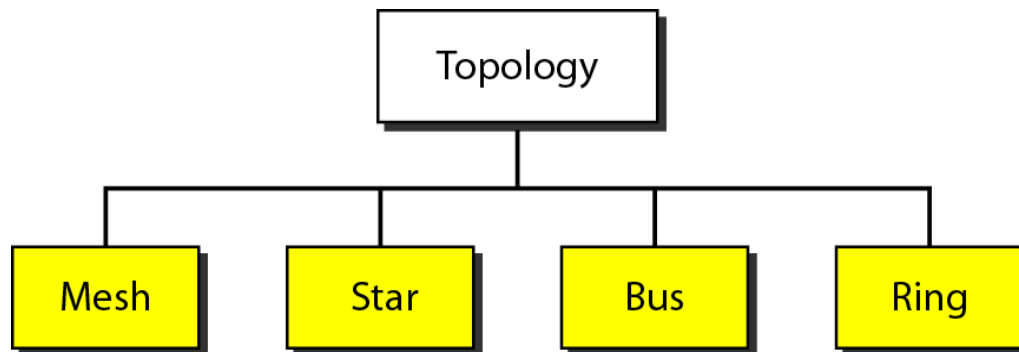


Figure 1.5 *A fully connected mesh topology (five devices)*

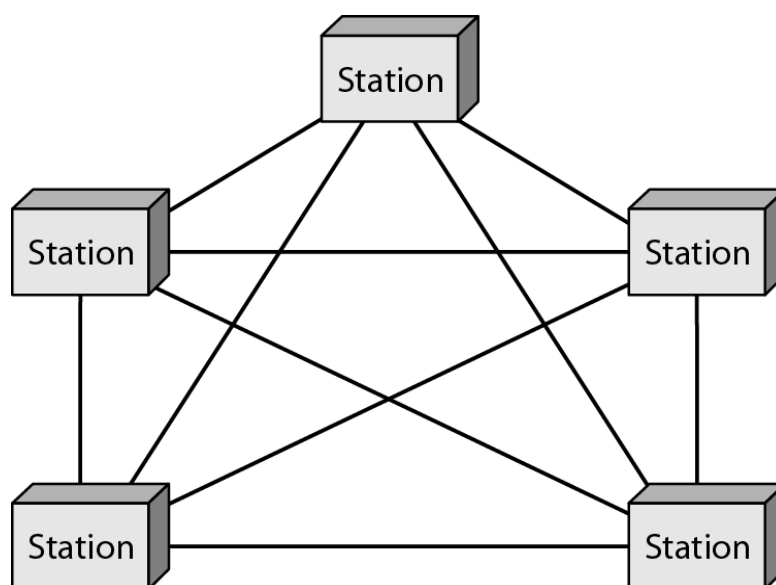


Figure 1.6 *A star topology connecting four stations*

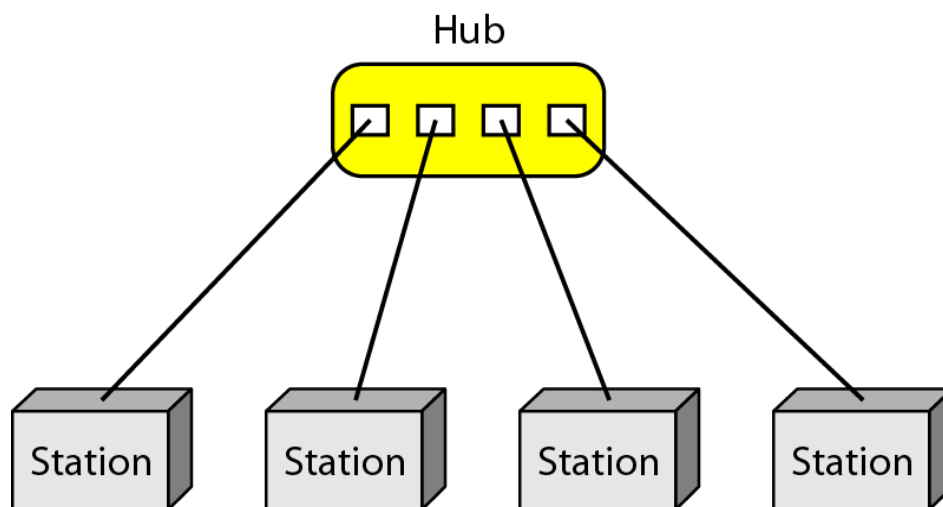


Figure 1.7 *A bus topology connecting three stations*

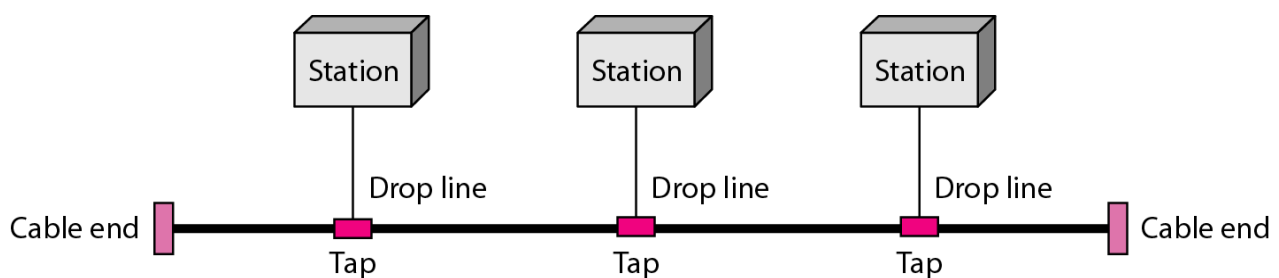


Figure 1.8 *A ring topology connecting six stations*

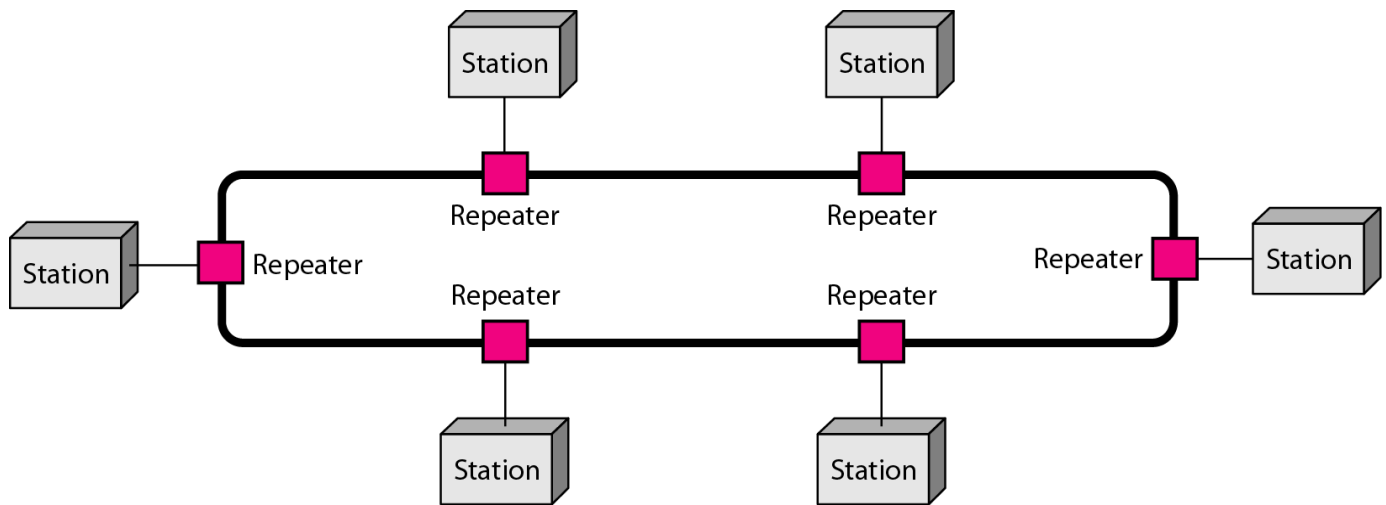
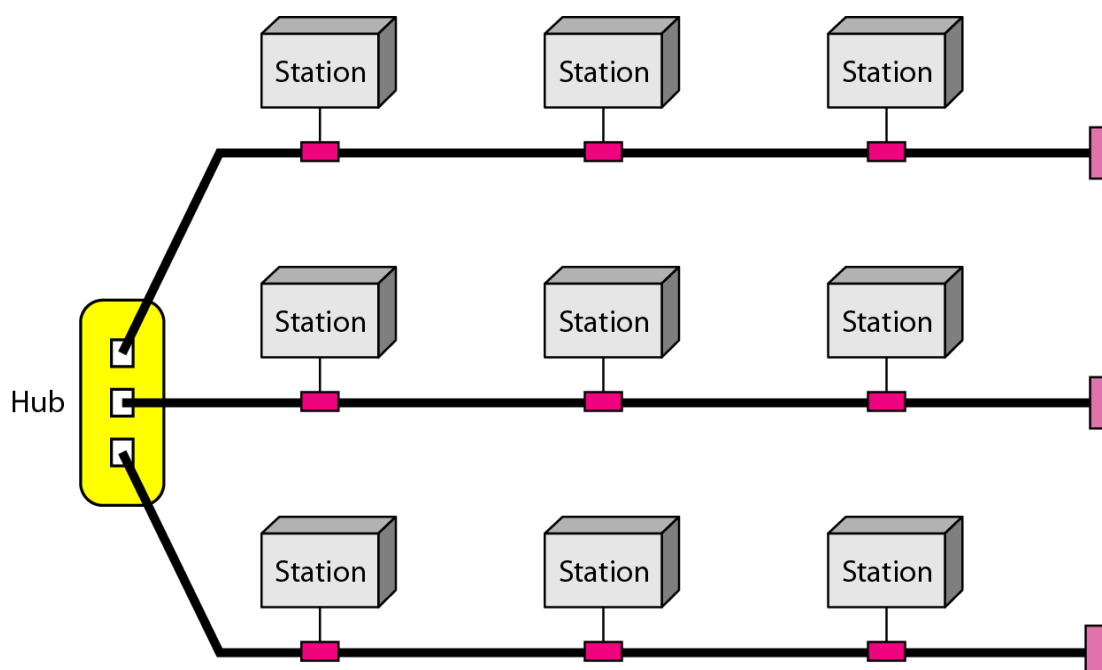


Figure 1.9 *A hybrid topology: a star backbone with three bus networks*



1.3 Network Types

- Local Area Network (**LAN**)
 - privately owned
 - links the devices in a single office or building
- Wide Area Network (**WAN**)
 - provides long-distance transmission
- Metropolitan Area Network (**MAN**)
 - is a network with a size between a LAN and a WAN

Figure 1.10 *An isolated LAN connecting 12 computers to a hub in a closet*

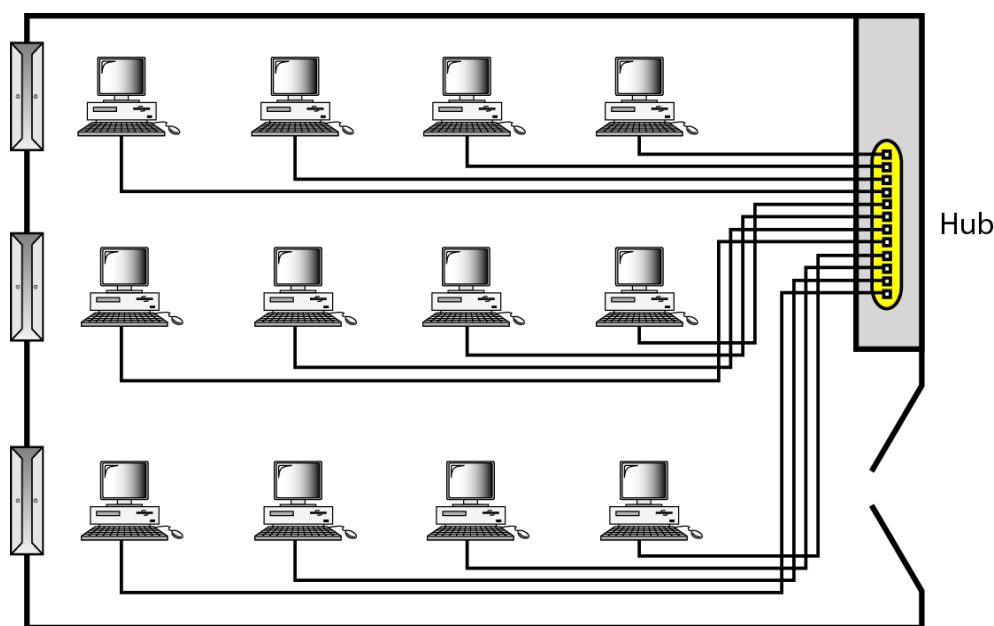


Figure 1.11 *WANs: a switched WAN and a point-to-point WAN*

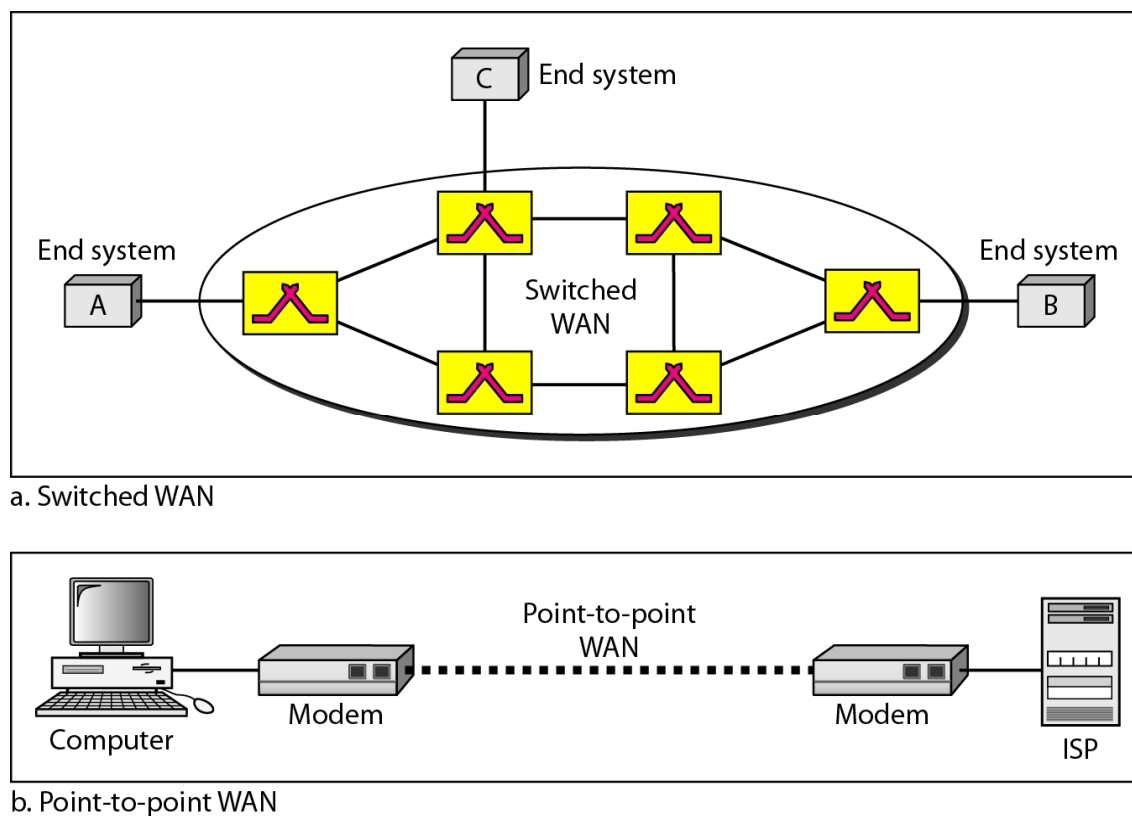
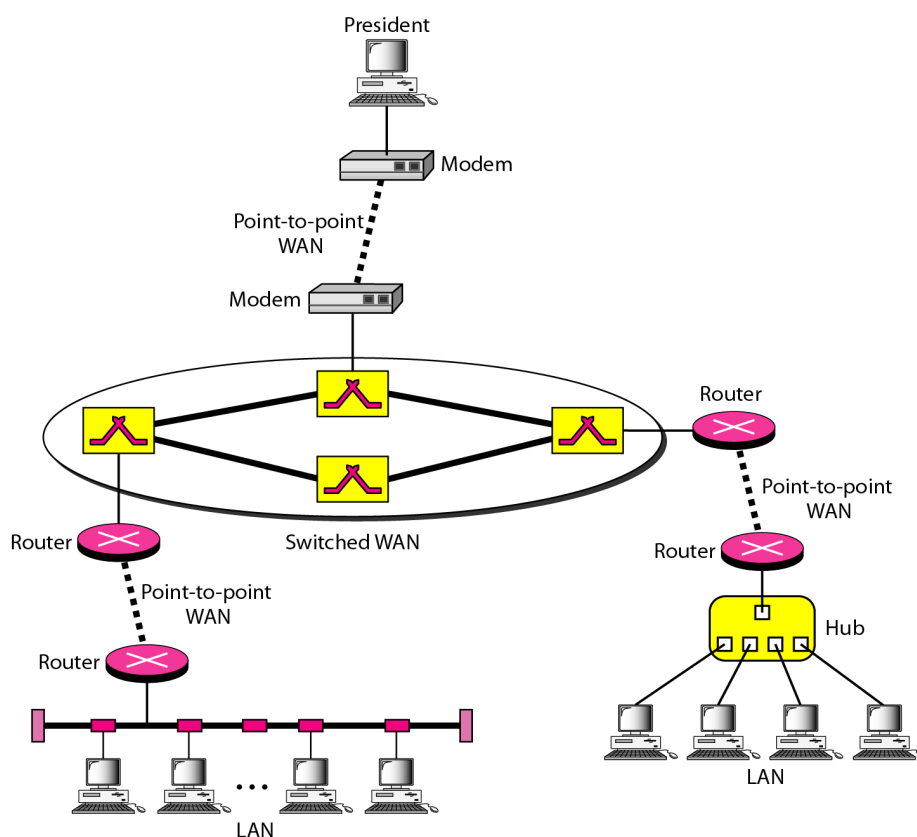


Figure 1.12 *A heterogeneous network made of four WANs and two LANs*



1-4 THE INTERNET

*The **Internet** has revolutionized many aspects of our daily lives. It has affected the way we do business as well as the way we spend our leisure time. The Internet is a communication system that has brought a wealth of information to our fingertips and organized it for our use.*

Topics discussed in this section:

A Brief History

The Internet Today (ISPs)

Internet

- **protocols** control sending, receiving of msgs
 - e.g., TCP, IP, HTTP, FTP, PPP
- **Internet: "network of networks"**
 - loosely hierarchical
 - **national backbone providers (NBPs)**
 - interconnect (peer) with each other privately, or at public Network Access Point (NAPs)
 - **regional ISPs**
 - connect into NBPs
 - **local ISP**, company
 - connect into regional ISPs
 - public Internet versus private intranet
- Internet standards
 - IETF: Internet Engineering Task Force
 - RFC: Request for comments
 - TCP service : RFC703
 - UDP service : RFC768

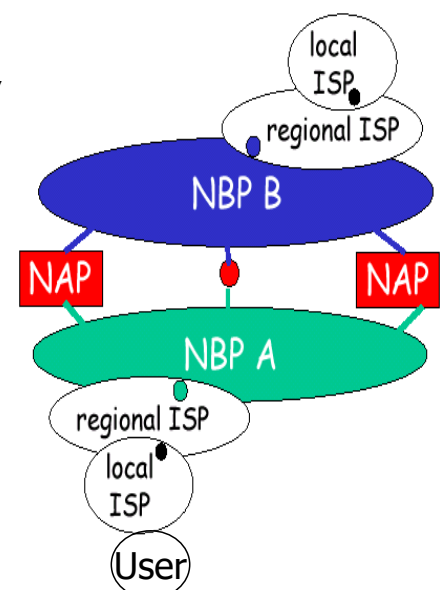
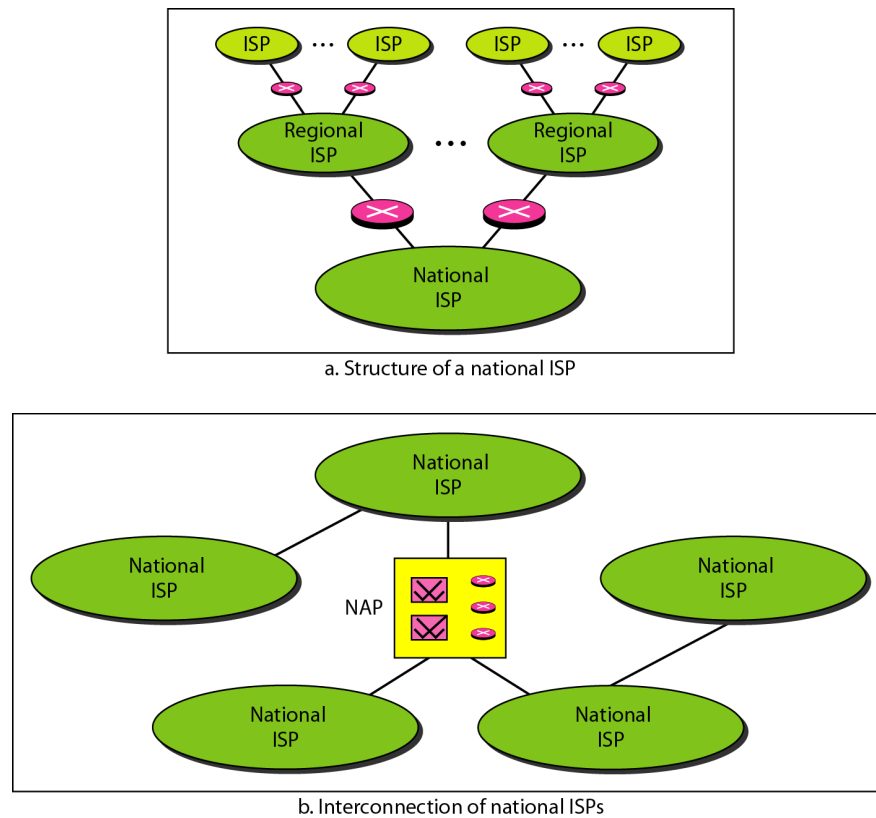
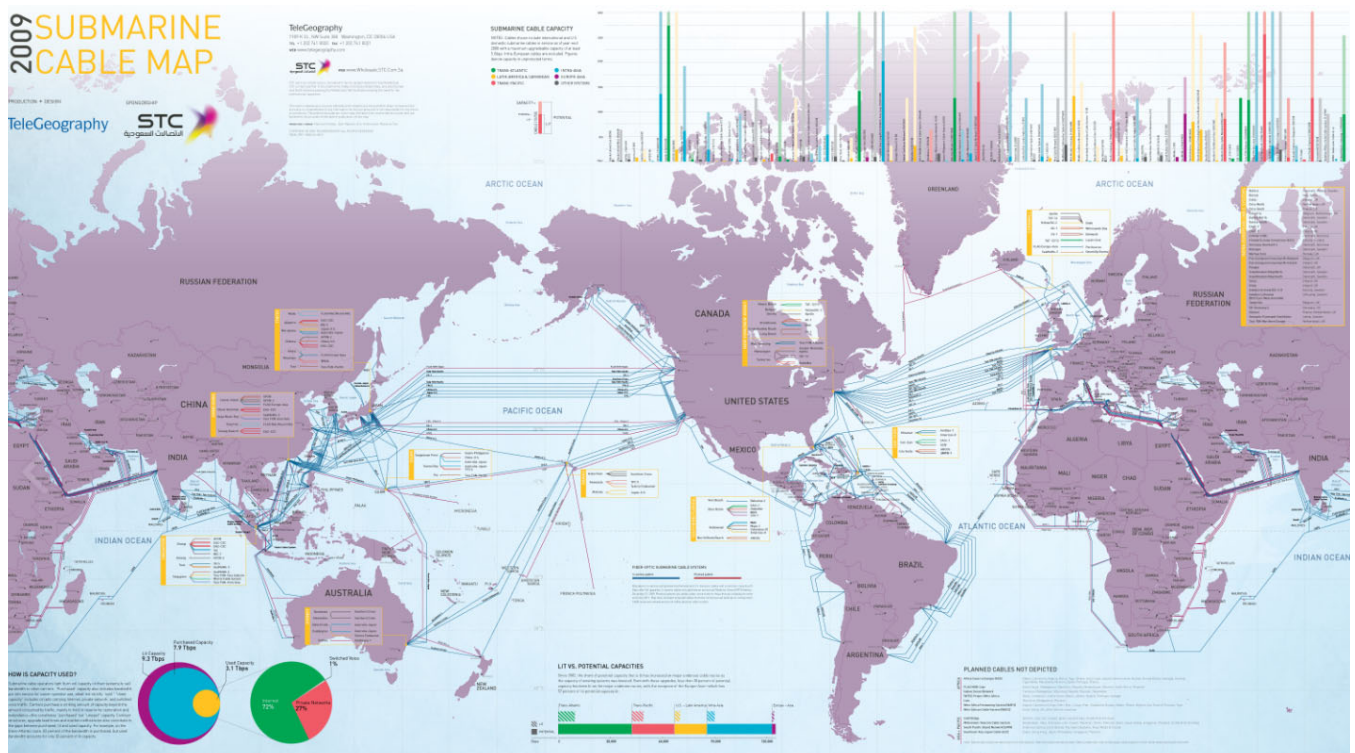


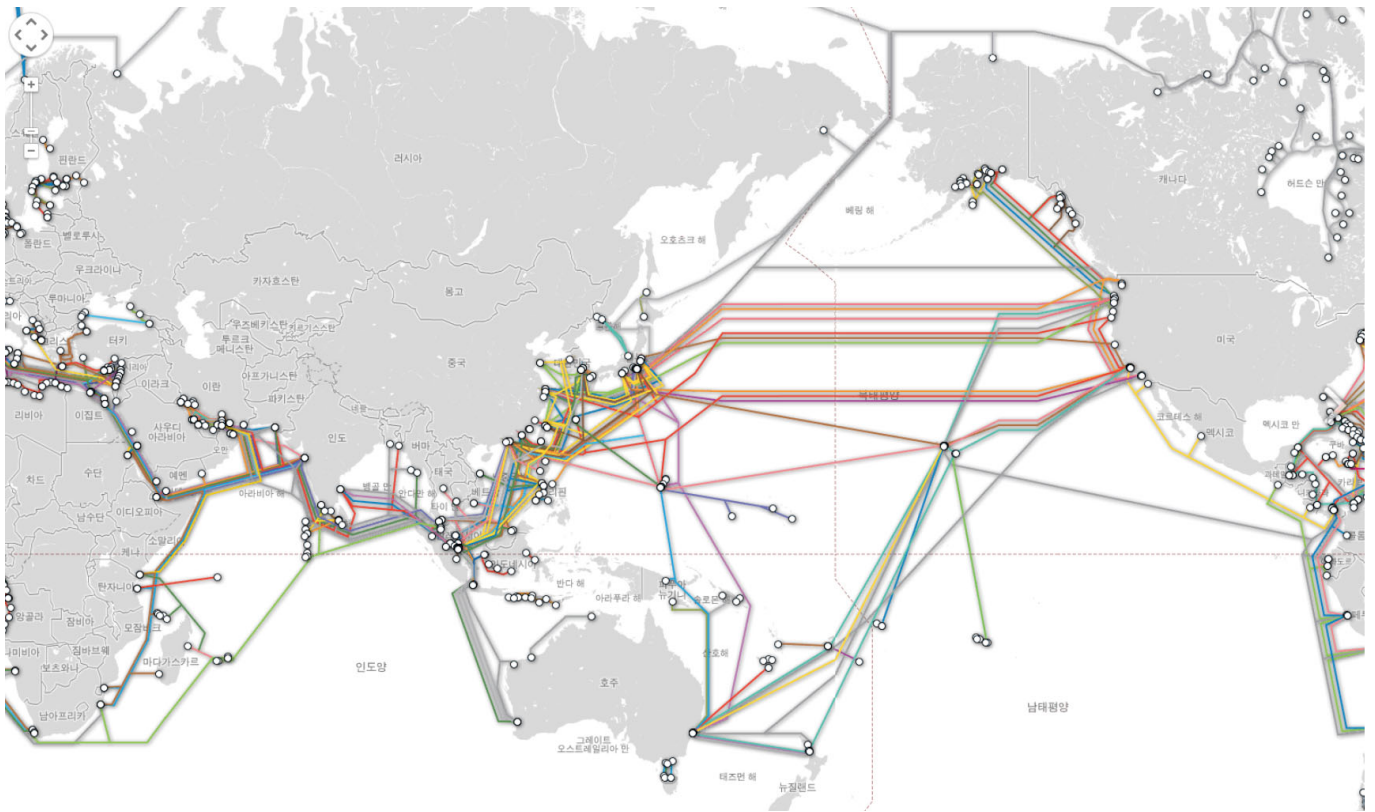
Figure 1.13 *Hierarchical organization of the Internet*



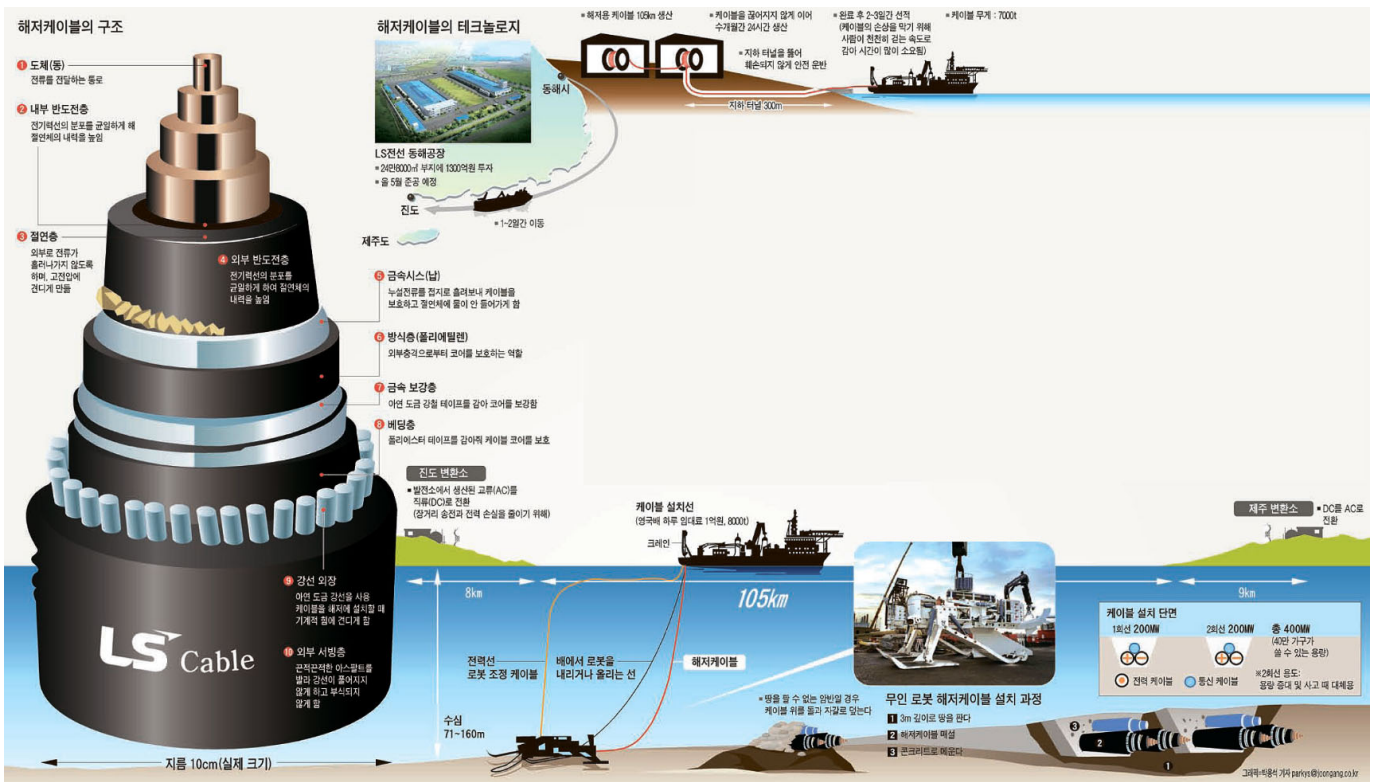
해저 광케이블 맵: World Wide



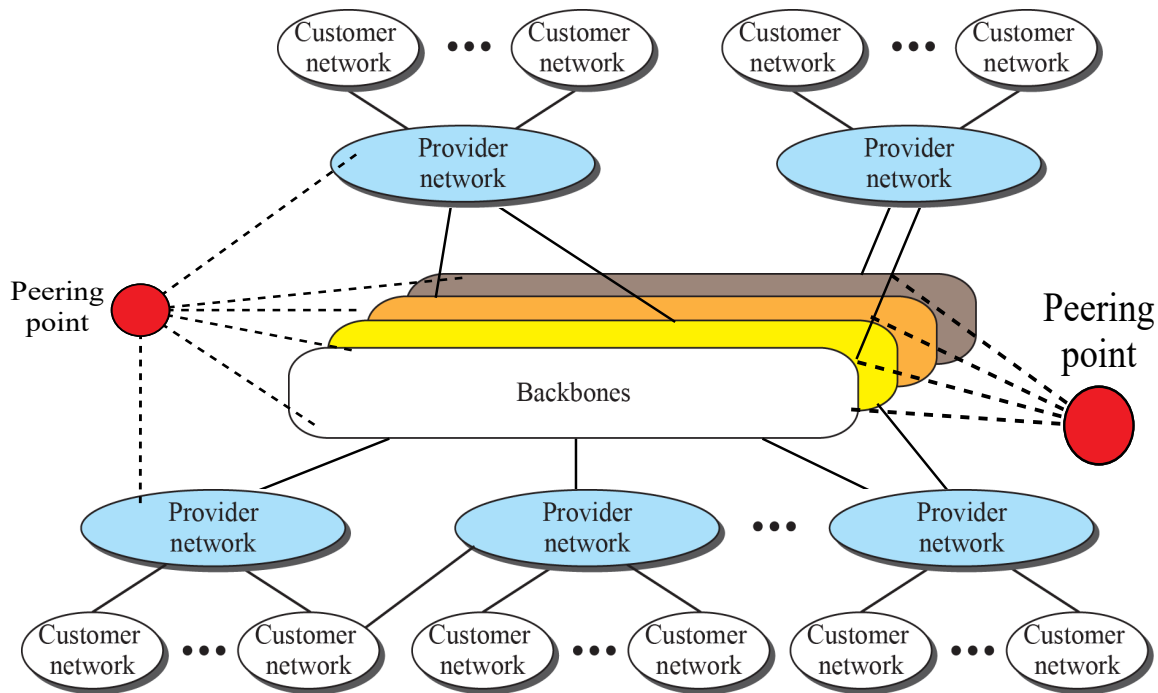
해저 광케이블 맵: 대한민국



해저 광케이블 매립 방법



- A packet passes through many networks



Internet History

Now that we have given an overview of the Internet and its protocol, let us give a brief history of the Internet. This brief history makes it clear how the Internet has evolved from a private network to a global one in less than forty years.

Early History

*There were some communication networks, such as **telegraph and telephone networks**, before 1960. These networks were suitable for **constant-rate communication** at that time, which means that after a connection was made between two users, the encoded message (telegraphy) or voice (telephony) could be exchanged. A **computer network**, on the other hand, should be able to handle bursty data, which means data received at **variable rates** at different times. The world needed to wait for the **packet-switched network** to be invented.*

Birth of the Internet

*In 1972, Vint Cerf and Bob Kahn, both of whom were part of the core ARPANET group, collaborated on what they called the Internetting Project. They wanted to link dissimilar networks so that a host on one network could communicate with a host on another. There were many problems to overcome: diverse packet sizes, diverse interfaces, and diverse transmission rates, as well as differing reliability requirements. Cerf and Kahn devised the idea of a device called a **gateway** to serve as **the intermediary hardware to transfer data from one network to another.***

*Today, we witness a rapid growth both in the infrastructure and new applications. **The Internet today is a set of peer networks that provide services to the whole world.** What has made the Internet so popular is the invention of new applications.*

1-5 PROTOCOLS AND STANDARDS

*In this section, we define two widely used terms: **protocols** and **standards**. First, we define protocol, which is synonymous with rule. Then we discuss standards, which are agreed-upon rules.*

Topics discussed in this section:

Protocols

Standards

Standards Organizations

Internet Standards

● Definition

- A protocol is a set of rules that govern data communications

● Role

- defines what is communicated, how it is communicated, and when it is communicated

Standards

● Essential in creating and maintaining an open and competitive market for communications

● Two categories

■ De factor

- Standards that have not been approved by an organized body but have been adopted as standards

■ De jure

- Standards that have been legislated by an officially recognized body

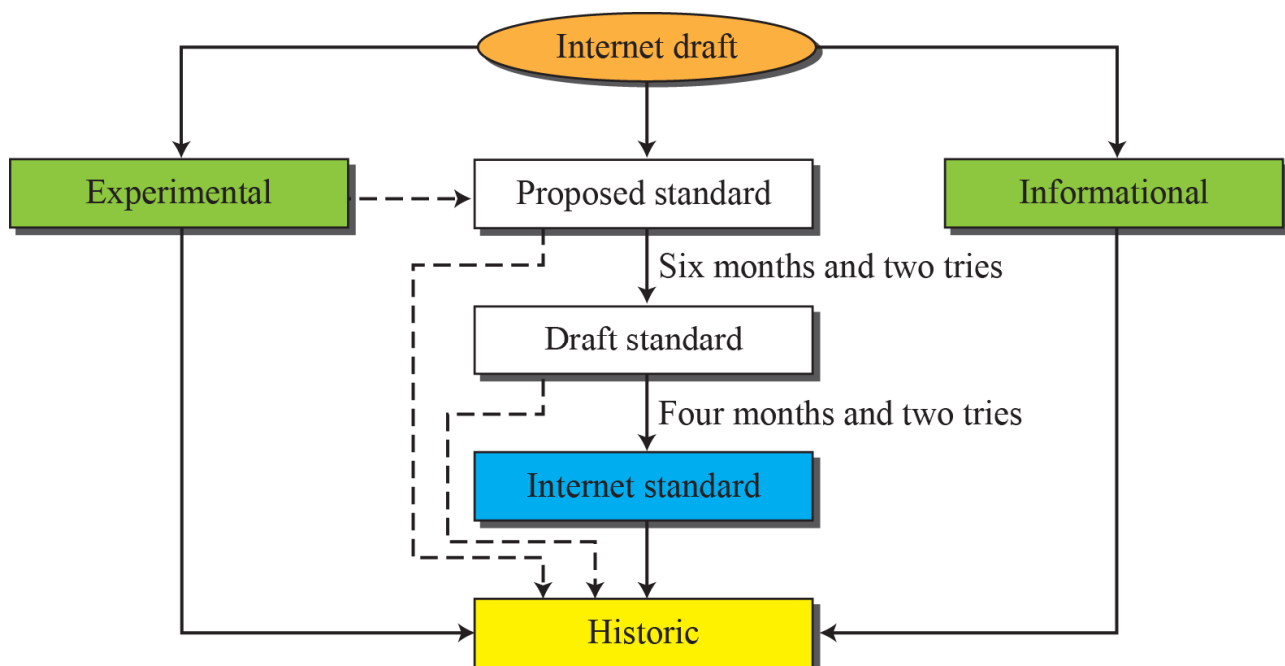
Standards Organizations

● Standards Creation Committees

- ISO
- ITU-T/ITU-R
- ANSI
- IEEE
- EIA
- 3GPP/3GPP2
- IETF
- TTA

● Forum

Maturity Levels of an RFC





Appendix

파동(Wave)의 전달



그림 2. 파동의 전달

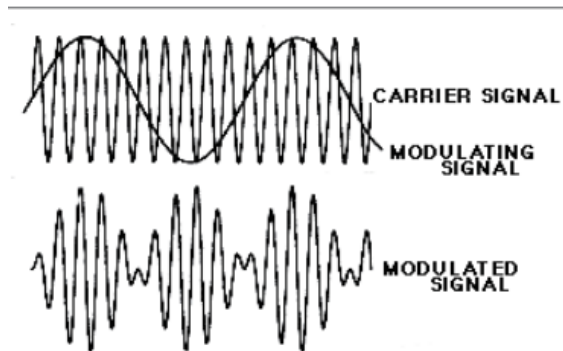


그림 6. 진폭 변조의 원리