Information Technology
Inside and Outside
- David Cyganski & John A. Orr

Part I. Introduction

1. What is the Information in the Information Revolution?

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Have been studied/developed

- Informations and Communications Network / Security in ADD (1987.2-1998.1)
  - C3I Network : Command, Control, Communication and Intellectural Network (X.25 Packet network)
  - Korea Defense Network : X.25 Packet Network
    - ✓ Above 10 sites: Seoul, Taejeon, Taegu, Pusan, Kwangju..
  - Defense Conference System/moving image: T1 Network
  - Defense Automatic Alarm System : less than T1(Osan)

IT/BT/NT/ST/ET/CT

- IT(Information Technology) : 정보기술
- BT(Bio Technology) : 생명공학기술(유전자)
- NT(Nano Technology) : 나노 기술(10^{-9})
  - 마이크로기술(10^{-6})
- ST(Space Technology) : (우주)공간기술
  - 로켓트/우주선발사, 위성체발사, 인공위성 등
- ET(Environmental Technology) : 환경공학기술
- CT(Cultural Technology) : 문화자원기술

IT 기술 수준 (국내)

- CDMA 세계 최초 상용화: PCS 폰(016/018/019)→ 1.8GHz
  - 셀룰라폰(011/017) → 800MHz =0.8GHz 주파수대
- ADSL 고속 인터넷 : 600만 가입자 확보(세계 최대)
  - 미국 인터넷 인구 :1억5000만 중에서
    ISDN 고속 서비스 가입자는 300만 이하임
- IMT-2000 : 동영상 전화기 상용서비스 실시(2002년)
  - 한국은 세계 IT 분야 시험 모델 국가역할 → 2.0GHz
- 동서대학교 : 모바일 PDA 폰에 의한 강의 서비스
  - 2001년도 교양부문평가 1위/ 디자인분야 전국 6위

1. What is the Information in the Information Revolution?

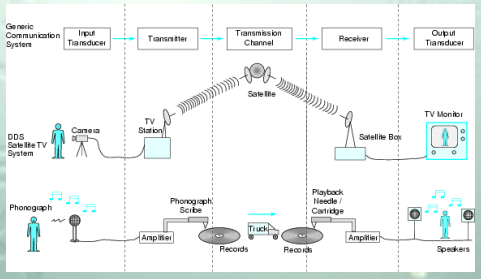
- ``***Information economy***,'' ``***information technology***,'' or ``***information age***.''
  - The precise definition and explanation of what information is, and the important distinctions among the terms ``information,'' ``message,'' and ``signal'';
  - The names and functions of components that make up information systems, including the transducer, transmitter, channel, storage, and receiver;
  - The arrangement of these components in common information systems such as the telephone system;
  - The distinctions between analog and digital information; and
  - The reasons why digital information systems are quickly replacing analog systems.

1.2 Information, Messages, and Signals

- ***Information*** : ``Knowledge communicated or received concerning some fact or circumstance; news.''
- ***Signal*** : the actual entity (electrical, optical, mechanical, etc.) that is transmitted from sender to receiver. For example, birds send out mating signals, which are specific sound patterns they create. Similarly, human vocal cords send out audible signals such as speech.
- ***Message*** : the knowledge that is transmitted. For example, in the case of the birds, the message might be ``It's mating season and I'm available.''
- Whereas the signal is a specific sequence of sound waves, the message is the meaning conveyed by that sequence.
- ***Message*** and ***information*** are quite closely related, and in some (not all) situations may be used interchangeably.

1.3 Examples of Information Systems

- **1.3.1 The Phonograph(1)**



1.3 Examples of Information Systems(2)

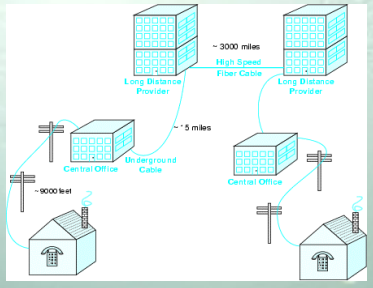
- **1.3.1 The Phonograph(2)**
  - An ***input transducer*** (the device that converts a physical signal from a source, in this case sound, to an electrical,electro magnetic, or mechanical signal more suitable for communicating): in this case, the vibrating diaphragm during recording;
  - A ***transmitter*** (the device that sends the transduced signal): in this case, the recording stylus;
  - A ***transmission channel*** (the physical medium on which the signal is carried): in this case, the wax cylinder or other recording medium;
  - A ***receiver*** (the device that recovers the transmitted signal from the channel): in this case, the playback stylus; and
  - An ***output transducer*** (the device that converts the received signal back into a useful physical quantity): in this case, the vibrating diaphragm during playback.

1.3 Examples of Information Systems(3)

- **1.3.1 The Phonograph(3)**
  - ***Signals:*** the original sound waves, the mechanical vibration of the recording stylus, the pattern on the wax cylinder,the mechanical vibration of the playback stylus, and the recreated sound waves are all signals.
  - ***Message:*** the content of the recording is the message, whether a song, a speech, or some other recorded sound.
  - ***Information:*** whatever the content of the recording conveys to the listener constitutes the information.

1.3 Examples of Information Systems(4)

- **1.3.2 The Telephone(1)**



1.3 Examples of Information Systems(5)

- **1.3.2 The Telephone(2)**
  - **The *transmitter*,** which responds to the input sound and converts it to electrical energy.
  - **The *transmission medium*,** which conveys the electrical energy from one end to the other. This may be as simple as a wire.
  - **The *receiver*,** which accepts the electrical energy and converts it back to audible sound.
  - **The *switching system*,** which connects one particular transmitter to a particular receiver (and also the corresponding reverse direction for two-way communication).
  - **A *signaling system*,** which tells the switches what connections to make.

1.3 Examples of Information Systems(6)

- **1.3.2 The Telephone(3)**
  - Several types of ***transmission systems***
    - ***Wires*** strung on poles from the local telephone central office to the houses,
    - ***Wire cables*** laid underground between some central offices, and
    - High-speed ***fiber optic cable*** connecting major telephone switching centers.
  - The telephone system is transitioning from radio-like electronics(***analog***) to computer-like electronics(***digital***).

1.3 Examples of Information Systems(7)

1.3.3 The Camera and Other Image Recording Devices

- The ***human artist*** as an image recording device
- ***Cameras*** / several other types of ***image storage*** technologies have been developed,
- Video, motion pictures, facsimile, digital photography, photocopying, and file storage.

- **To send a photo of a human face to someone using a facsimile:**
  - ***Signal* :** a pattern of electrical impulses sent over the telephone system
  - ***Message* :** the image itself (note how the received message may be quite degraded from the original message, depending on the quality of the fax transmission)
  - ***Information* :** depend to some extent on the purpose to which the image will be put

1.4 Representing and Quantifying information

- ***Fidelity* :** a measure of the difference between the original and reproduced forms of the information.
  - For example, the message ``You have won $1,000,000." Most of the information content is contained in the distinction between ``won" and ``not won."
- ***Information* :** ``knowledge communicated or received."
  - The unit of information is the ``bit" or *binary digit*.
- ***Knowledge* :** ``everything that your brain is capable of dealing with, interpreting, using, and that you may have some desire to remember."

1.4 Representing and Quantifying information (2)

- ***Some examples of information*** common to our everyday lives : the date, the temperature, and the address of your residence.
- The ***unit*** of information is the ``**bit**" or ***binary digit***.
- In the binary number system there are only two digit :
  - ***zero*** and
  - ***one***.
- The formal definition of information allows us to determine (in bits) exactly how much information is in a given sample of data.
- That is, the bit is used as a measure of information.

1.4 Representing and Quantifying information (3)

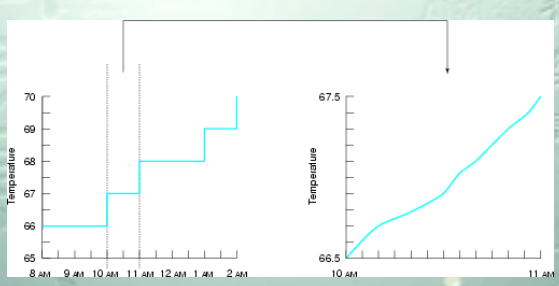
- If you listen to a three-hour broadcast of a football game but are only interested in whether the New England Patriots won or lost, then for you there is only one bit of information (won or lost) in those three hours (ignoring the possibility of a tie, and including the half time show).
- This is true even though the data rate may have been something like 28,800 bits per second for that entire period. If, on the other hand, you are intently listening to the entire game and interested in each play, comment, and commercial, then every one of those data bits (which are converted in the receiver into the broadcast of the game) potentially contained real information. The information content for those three hours would then apparently be(28,800 bits/ seconds/ minutes) = 311,040,000,or over 311 million bits.

1.5 Analog and Digital Information

- The basic telephone, phonograph, and camera are examples of ``***analog***'' information storage and receiving systems.
- We use ***analog*** to refer to the natural world, where time is continuous, and most parameters (like light and sound intensity, temperature, position, etc.) can vary smoothly and continuously over some range, taking on an infinite number of possible values
- In ***discrete*** (***digital***) parameters, examples include the days of the month, games won or lost, and the squares on a checkerboard.
- At least for human consumption, this conversion takes advantage of the fact that humans have limited sensory acuity; that is, we cannot resolve small differences.

1.5 Analog and Digital Information(2)

- **Figure 1.4:**Outside temperature; a discrete and continuous view.



Cf. Digital Transmission

- Concerned with content
- Integrity endangered by noise, attenuation etc.
- Repeaters used
- Repeater receives signal
- Extracts bit pattern
- Retransmits
- Attenuation is overcome
- Noise is not amplified

Cf. Advantages of Digital Transmission

- Digital technology
  - Low cost LSI/VLSI technology
- Data integrity
  - Longer distances over lower quality lines
- Capacity utilization
  - High bandwidth links economical
  - High degree of multiplexing easier with digital techniques
- Security & Privacy
  - Encryption
- Integration
  - Can treat analog and digital data similarly

1.6 The Move Toward Digital Information Technology

- Within a period of 10 years, phonograph records, which had been the sound recording norm for 100 years, essentially disappeared. How did this happen? Such fundamental changes happen as a result of two conditions:
  - ***(1) the new system either enables some totally new capability or is much better than the one it replaces; and***
  - ***(2) the cost of the new system is reasonably low compared to people's willingness to pay.***
- Why were the phonograph's electronics expensive? The answer to this lies at the heart of the information revolution:
  - ***the phonograph is an analog device, and analog electronics are expensive;***
  - ***conversely, digital electronics are cheap!***

1.6 The Move Toward Digital Information Technology(2)

- Similarly, telephone systems, cameras, and virtually all other types of information systems in use have converted to, or are in the process of converting to, digital versions.
- *Digital information systems*, almost without exception, have proven to be more reliable and less expensive than the analog systems they have replaced.