Digital Communications and Computing

資 訊 與 數 位 通 訊

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Evolution towards A Network Era

- **Mainframe Minicomputer**
- **Centralized Computing**
- **Host-based Networks**

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- **Personal Computer**
- **Personalized Computing**
- **Distributed Computing**
- **Client-server Networks**

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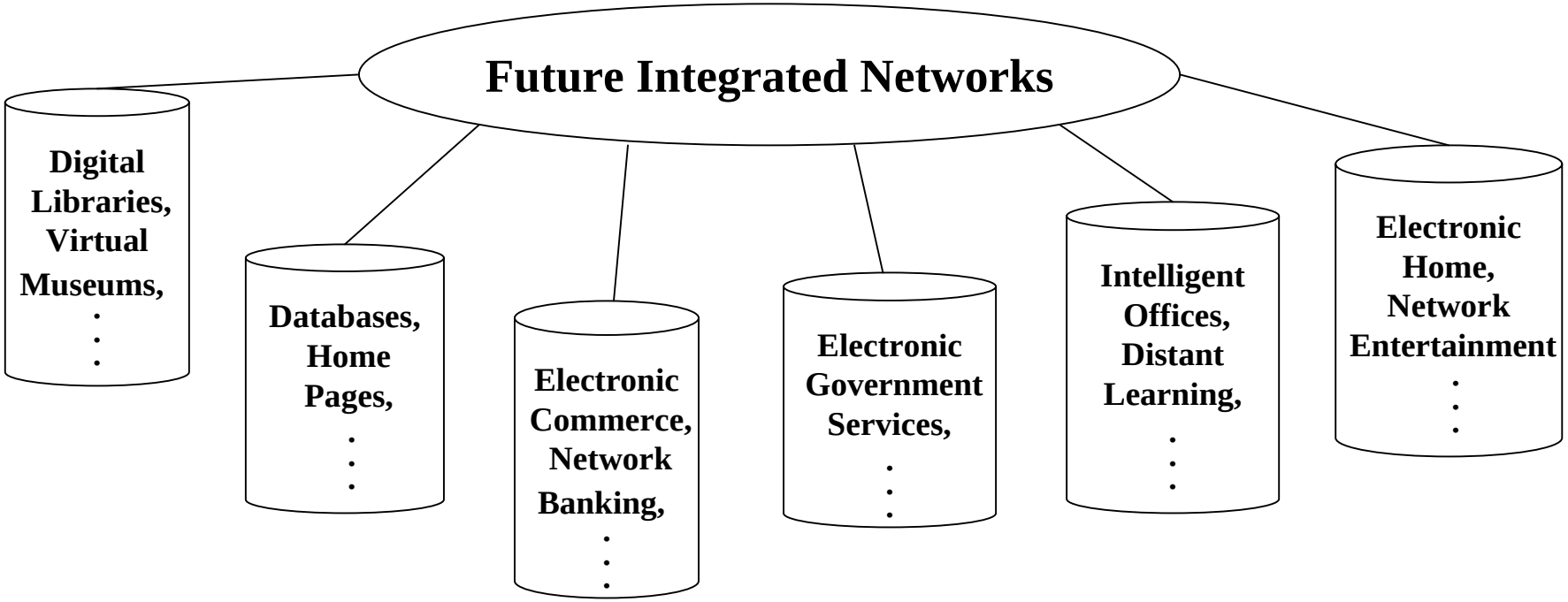
- **Terminal Equipments:**
  - Personal Computer
  - TV Sets
  - Telephone Set
  - Handset, PDA
  - Satellite Receiver
  - Car Electronics
  - Information Appliance, etc.
- **Network-based Computing**
- **Client-server Computing**
- **Multi-media**
  - text,audio,video,white board, graphics,virtual reality,etc.
- **Integrated Networks**
  - PSTN
  - CATV
  - Broadcasting
  - Wireless
  - LAN,WAN,MAN
  - Internet/Intranet/WWW
  - Next Generation Internet(NGI) ,etc.

- **Network Technology will be Connecting Everywhere Globally**

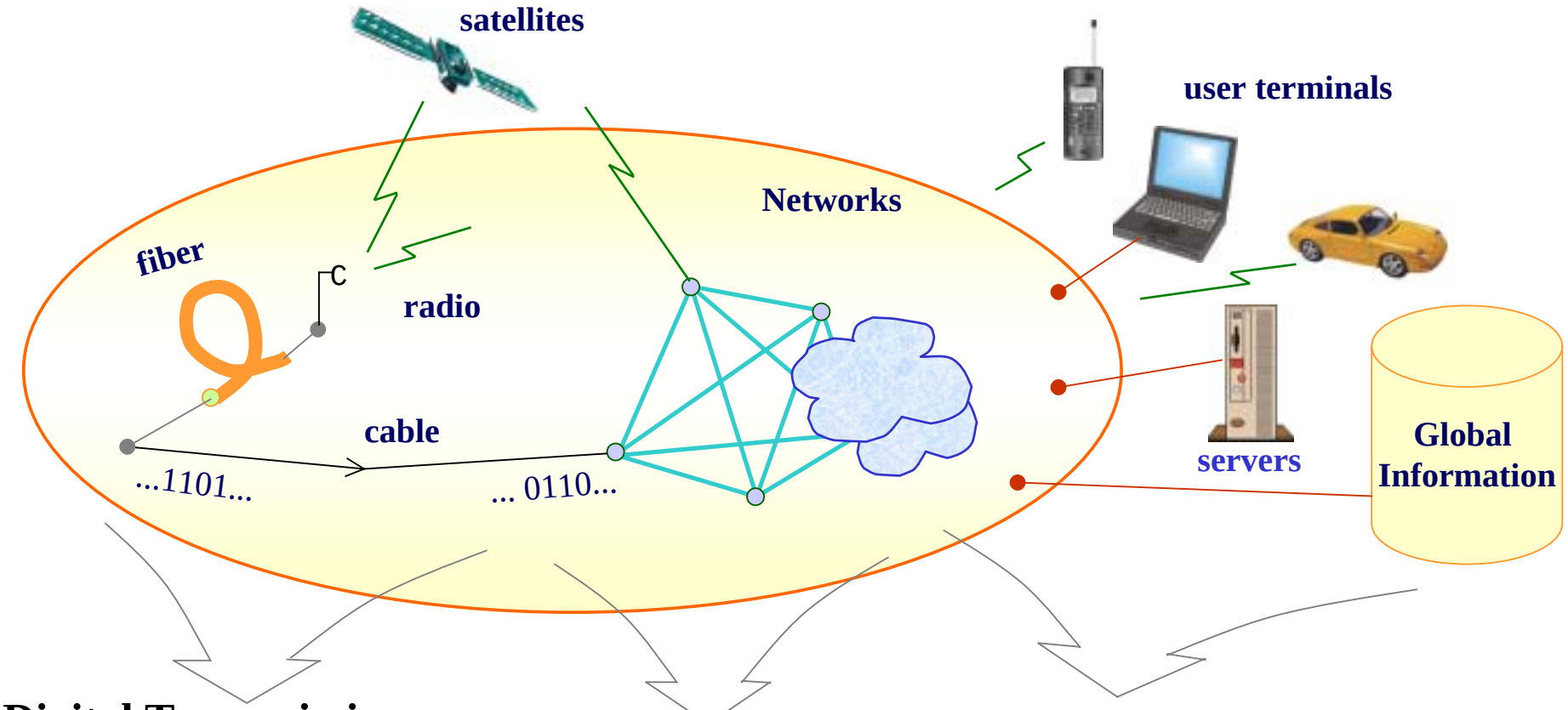
- **Huge Volume of Information Disseminated across the Globe in Microseconds**

Integrated Global Knowledge and Information System in Future Network Era



- **Multi-media, Multi-lingual, Multi-functionalities**
- **Cross-cultures, Cross-domains, Cross-regions**
- **Integrating All Knowledge Systems and Information-related Activities Globally**
- **All Knowledge and Information/Services Represented in Form of Multi-media Signals Including a Wide Variety of Languages**

World of Digital Communications and Computing



- **Digital Transmission**
  - point-to-point
  - physical layer of data (0's and 1's) transmission
  - wired/wireless, fibers, radio, satellite,...

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- **Networking**
  - architectures and protocols
  - switching, ATM
  - broadband access

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- **Multi-media Signal Processing**
  - digital representation of multi-media knowledge and information
  - audio/visual user interface

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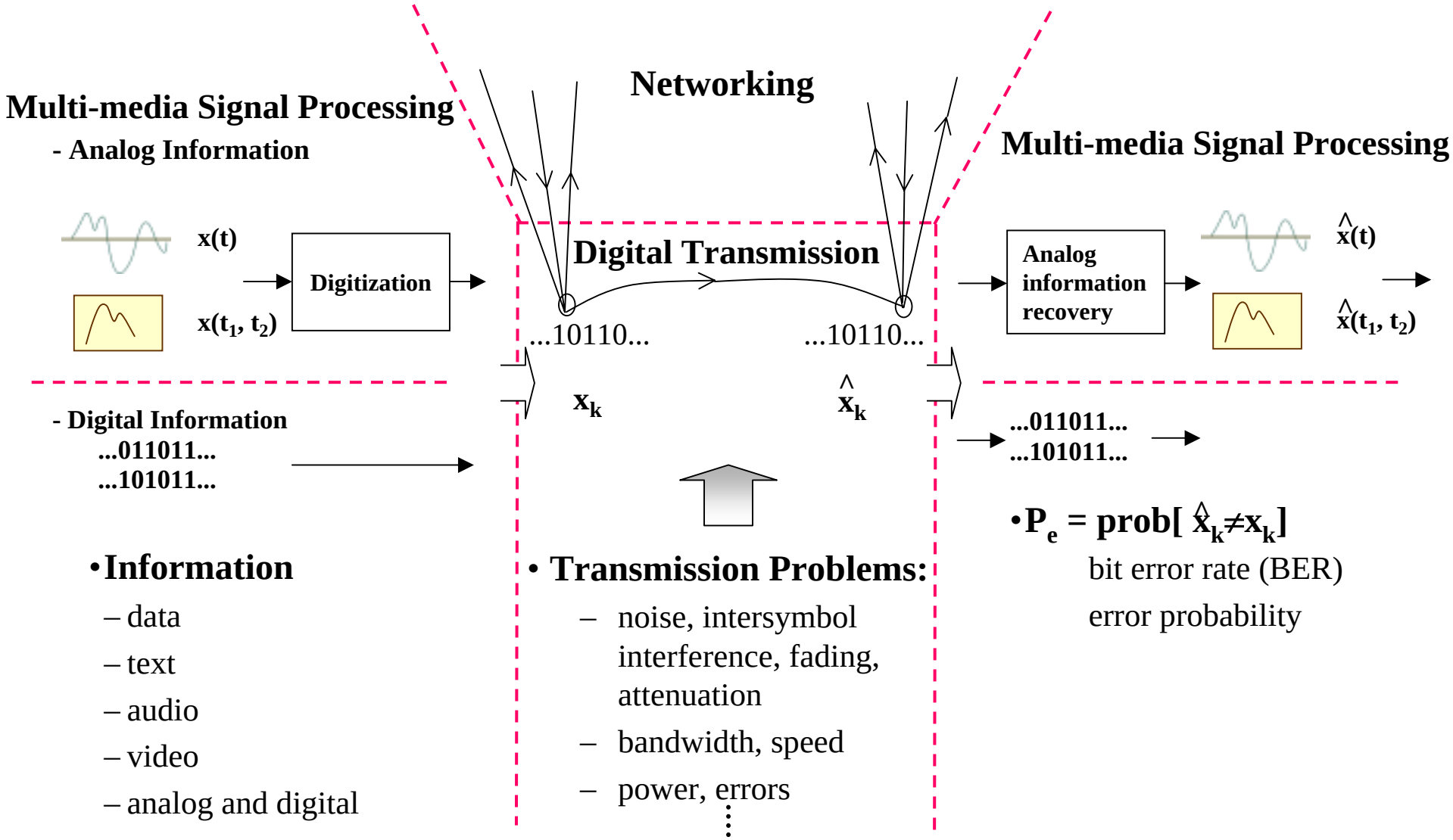
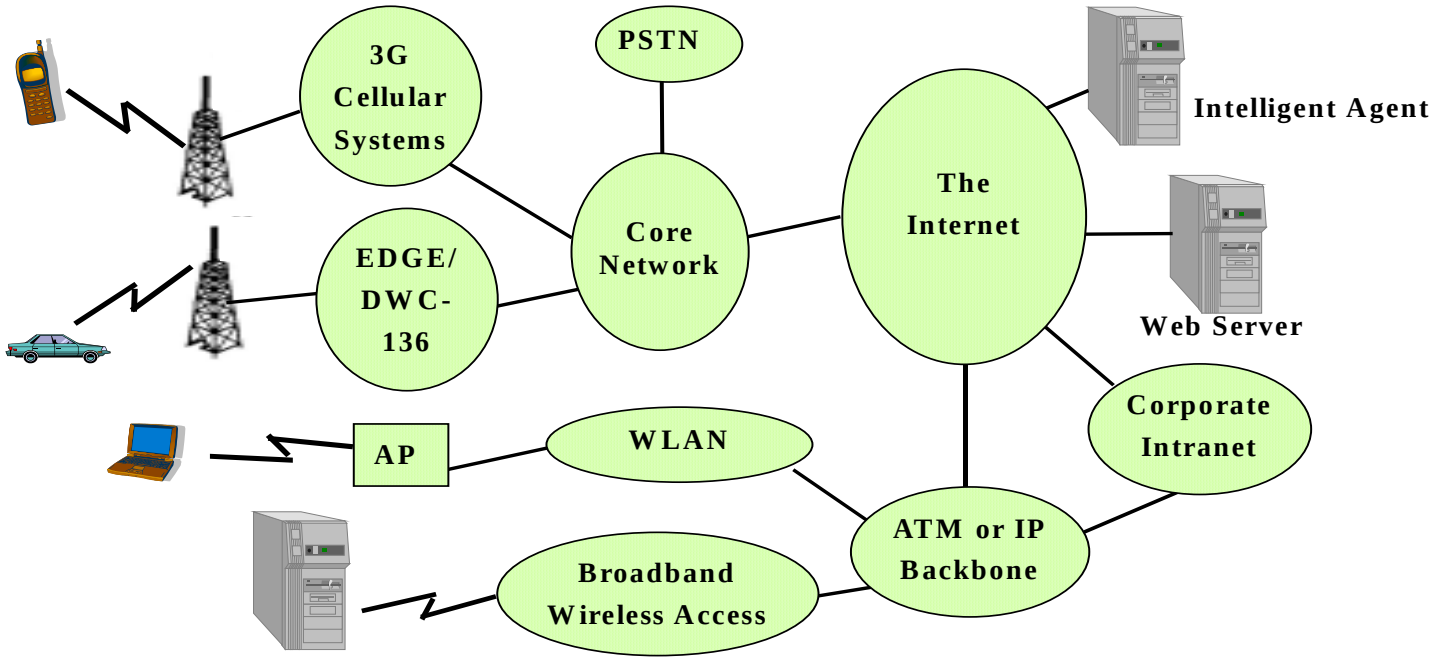
Digital Transmission, Multi-media Signal Processing and Networking



Wireless Access of Global Multi-media Information



- **Anytime, from Any Where**
- **As Handset Size Shrinks While Required Functionalities Grows Continuously, Multi-media User Interface will be the Key**
- **Examples**
  - virtual reality
  - voice retrieval,voice browser, voice portal
  - spoken dialogue based access to intelligent agents

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0. Introduction- The World of Digital Communications and Computing

1. Fundamentals

Fourier analysis and stochastic modeling of signals and noise, Sampling Theorem and PCM, basic concepts in digital communications, etc.

2. Digitization and Compression of Speech, Audio and Video Signals

quantization and signal compression, linear predictive coding (LPC), code-excited linear prediction (CELP), perceptual coding, etc.

3. Digital Transmission – Baseband, Modulation and Systems

error rate and noise, speed and bandwidth, channel problems, vector space theory, modulation techniques, spread-spectrum and CDMA, wireless communications, optical fiber communications and WDM, etc.

4. Speech Access of Networks

speech signal modeling and recognition, text-to-speech synthesis, spoken dialogue systems, human-network speech interface, etc.

5. Conclusion: Looking towards the Future

- 適合年級：三、四（資工系）、研（資研所）
- 課程目的：提供資工系所同學進入此一充滿機會與挑戰的新領域所需的基本知識，熟習數位通訊所用的語言、工具及分析方法，尤其著重目前資工系所較少課程涵蓋的部份。
- 教科書：無。
- 主要參考書：

1. Simon Haykin, “Communication Systems”, 4-th Edition, 2000, John Wiley and Sons, 歐亞
2. Oppenheim & Willsky, “Signals and Systems”, 2nd Edition, 1997, Prentice Hall, 新月
3. Gold and Morgan, “Speech and Audio Signal Processing”, 2000, John Wiley and Sons, 松瑞
4. Theodore S. Rappaport, “Wireless Communications”, 1996, Prentice Hall, 新月
5. Becchetti and Prina Ricotti, “Speech Recognition – theory and C++ implementation”, 1999, John Wiley and Sons, 民全
6. Gerd Keiser, “Optical Fiber Communications”, 3rd Edition, 2000, McGraw-Hill

- 教材

available on web before the day of class (http://speech.ee.ntu.edu.tw)

- 成績評量方式

Midterm	35%
Computer Problems	30%
Final Report	35%