

無線網路多媒體系統

Wireless Multimedia System



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<http://wmlab.csie.ncu.edu.tw/course/wms>

2005 Fall

We provide
無線網路多媒體實驗室
Wireless
Wireless Network & Multimedia Laboratory
Solution

First Week Agenda

- ◆ Course Preview
- ◆ Wireless Multimedia/Mobile Computing / Pervasive Computing
- ◆ Wireless Mobile Communications
- ◆ System Review and Fundamental Problems
- ◆ Next Week



Course Preview



What is Going to Happen in the Course?

Course Contents

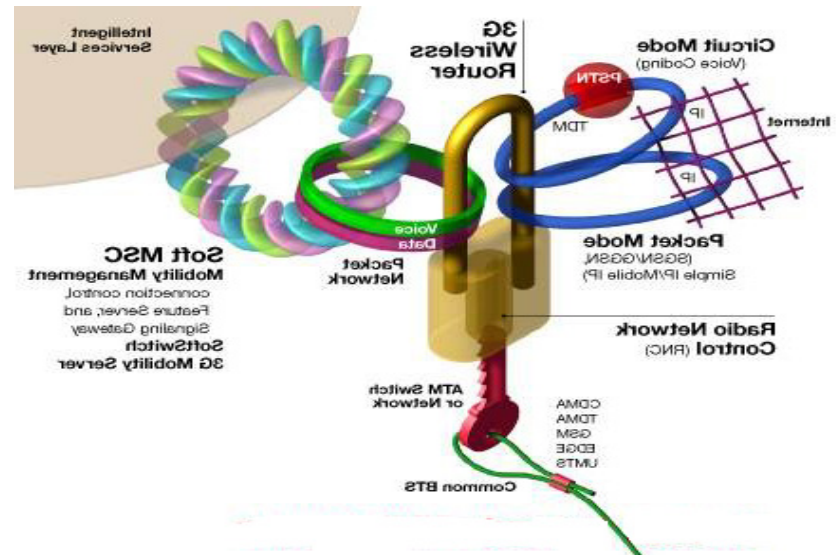
◆ Fundamental Wireless Technology

- Propagation Model
- Wireless Medium Access
- Transport Solutions
- Ad hoc Wireless System
- Cellular System
- Middleware Systems
- Multimedia System

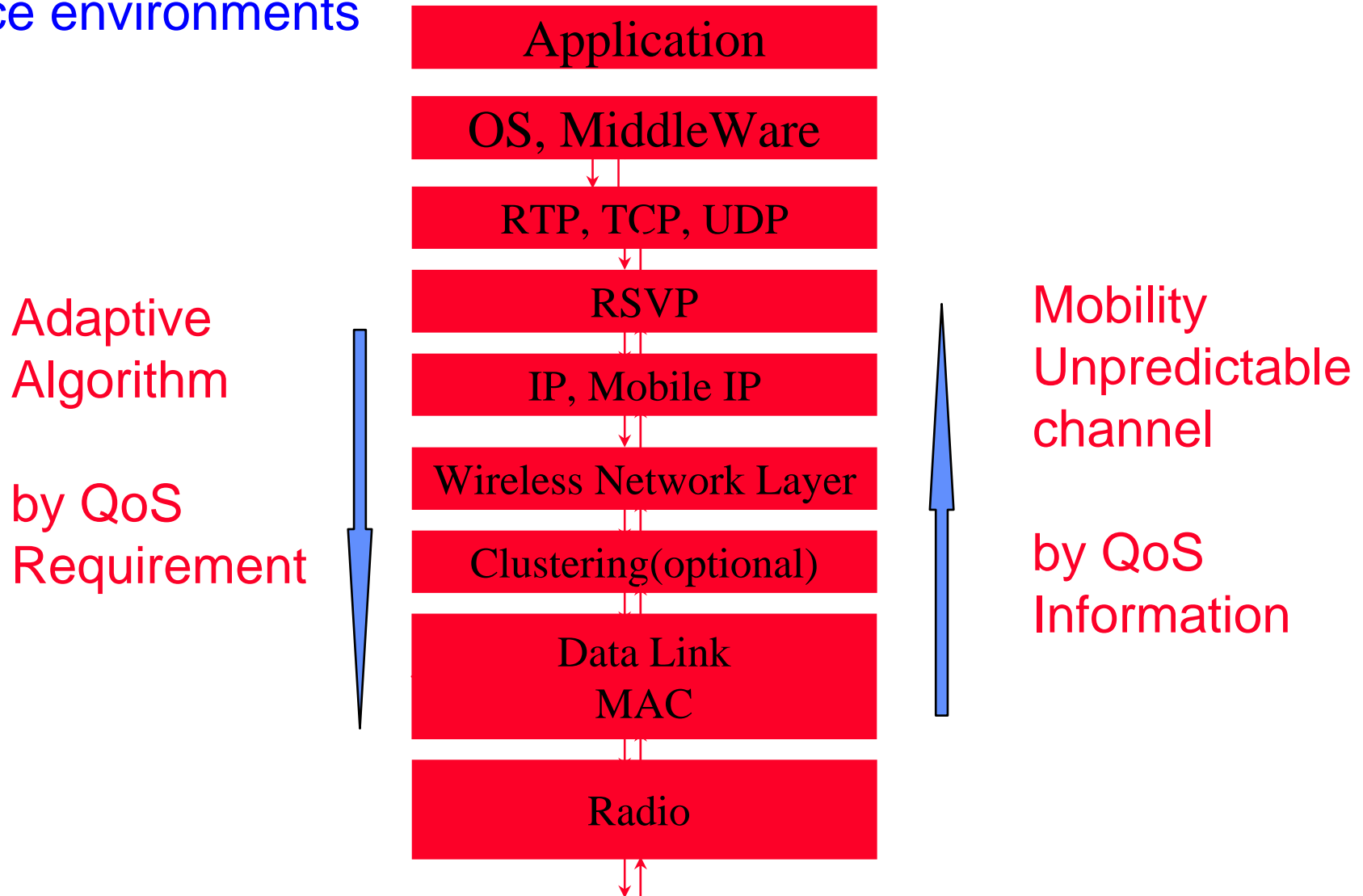


◆ Advanced Wireless Technology

- Multicasting
- Heterogeneous System
- Routing Algorithms
- QoS/ Reliable Transmissions



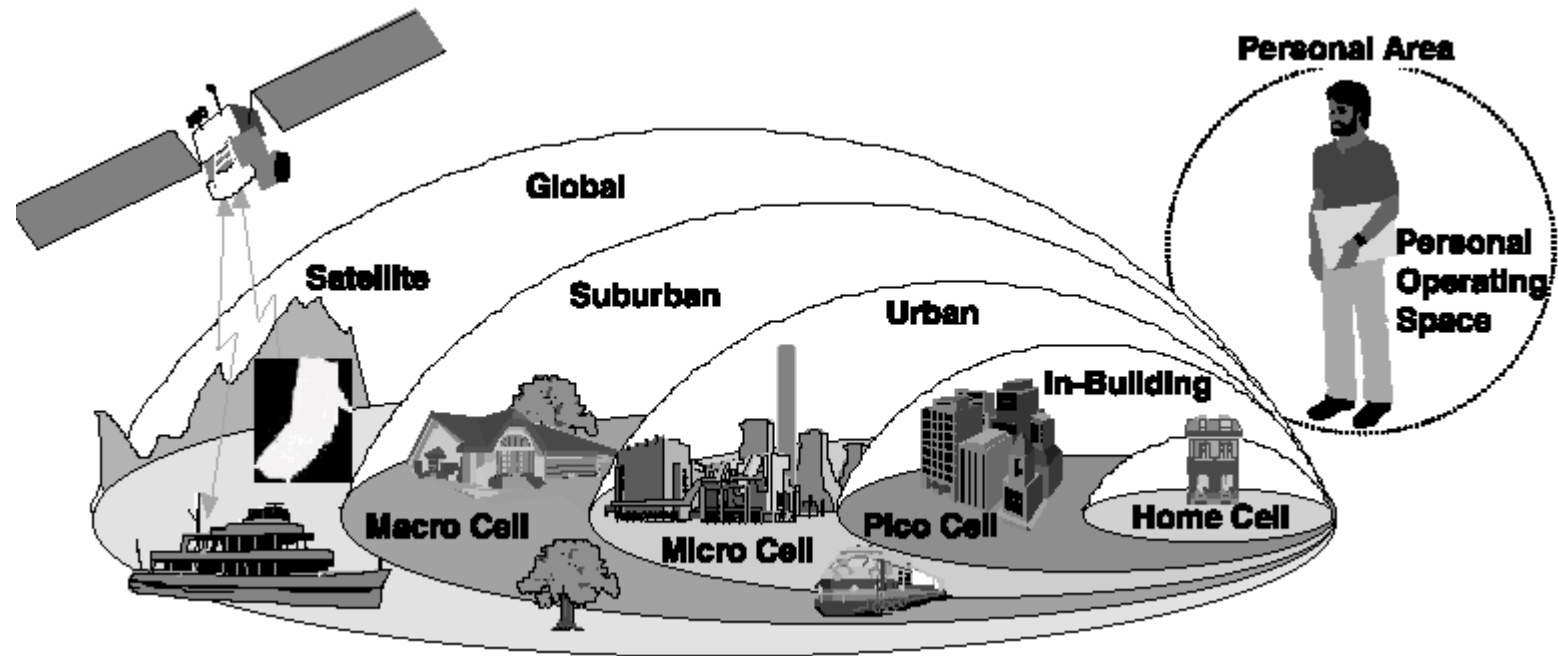
Roaming Across a variety of heterogeneous network and service environments



New Interests

- ◆ Provision of Sufficient Transmission Capacity for Broadband Mobile Multimedia: A Step Toward 4G
- ◆ Future Broadband Radio Access Systems for Integrated Services with Flexible Resource Management
- ◆ QoS Support for an All-IP system Beyond 3G
- ◆ Enhancing IP Service Provision over Heterogeneous Wireless Network
- ◆ Re-configurable Terminals: An Overview of Architectural Solutions

Ubiquitous Services



Adaptive Applications



Video



Audio

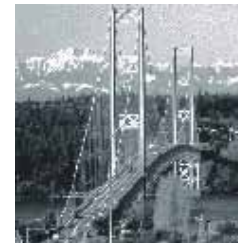


Graph



Text

Varied type
of service



Adaptive
application
coding

High

.....

Quality

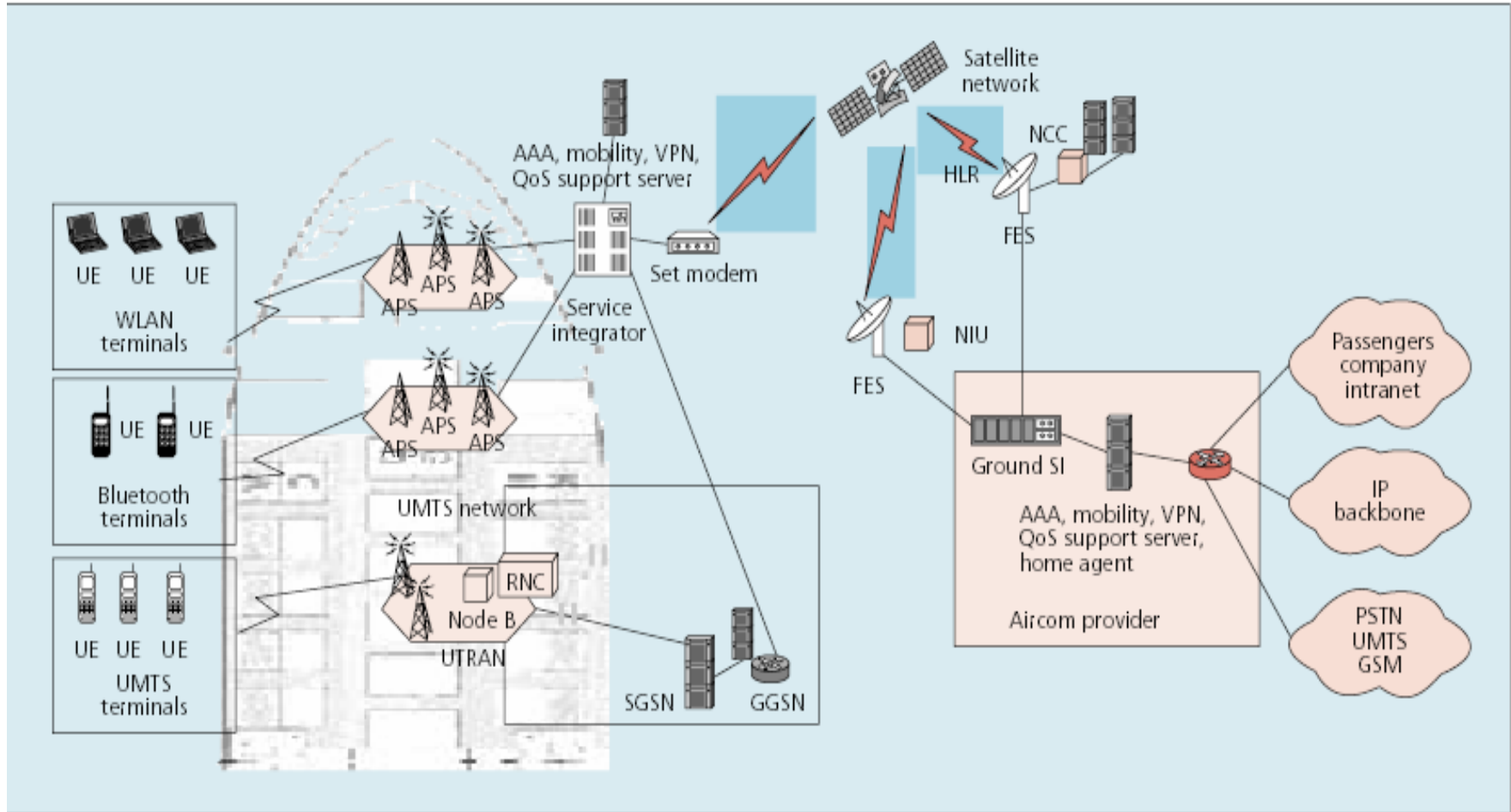
.....

Low

Expectation of the Class

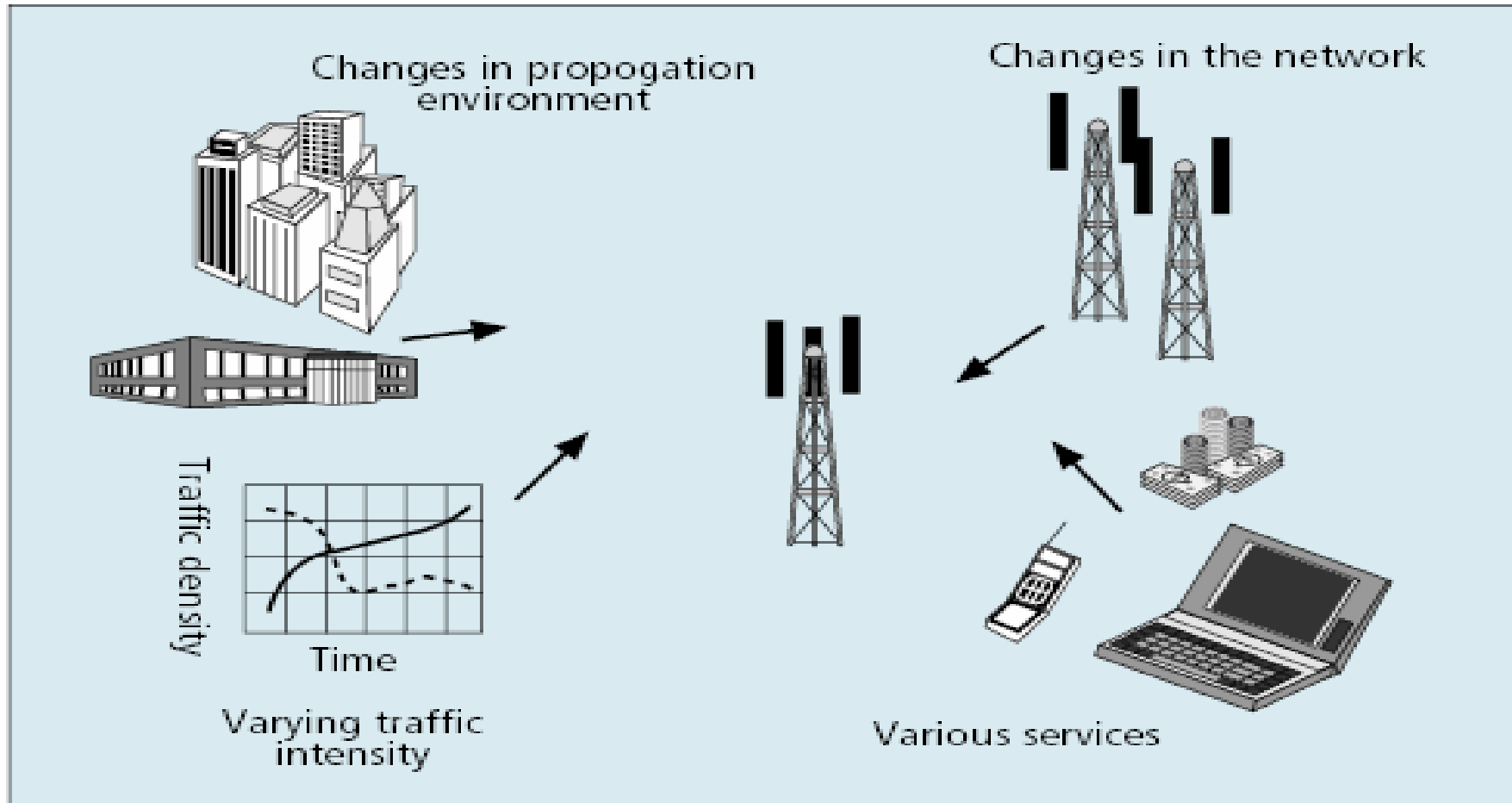
- ◆ Basic Understanding of PCS world
- ◆ Being able to do the wireless research
- ◆ Developing the capability to invent the key wireless applications

Aeronautical Communications



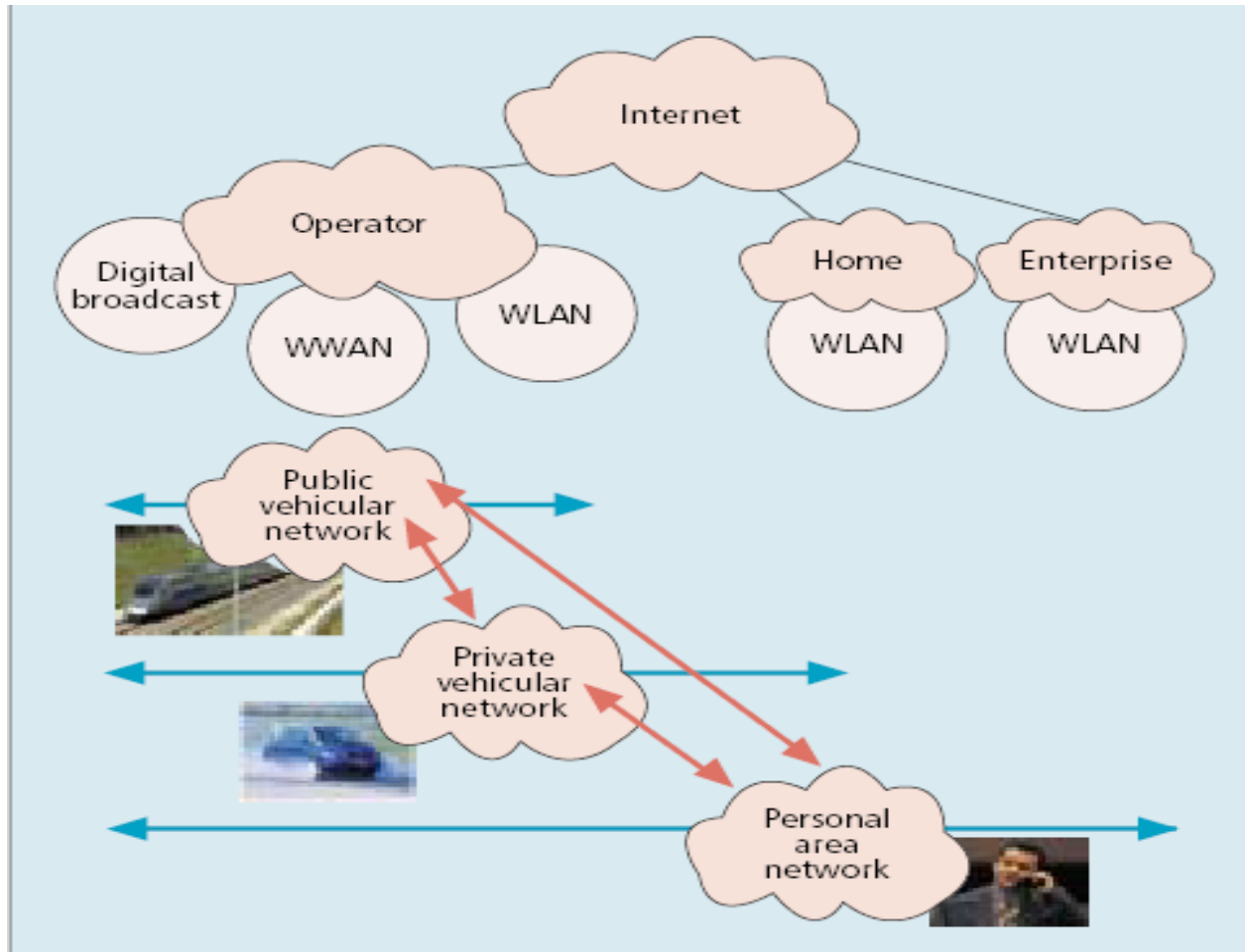
■ Figure 2. Aeronautical communications network architecture.

Situation-Aware Wireless Networks



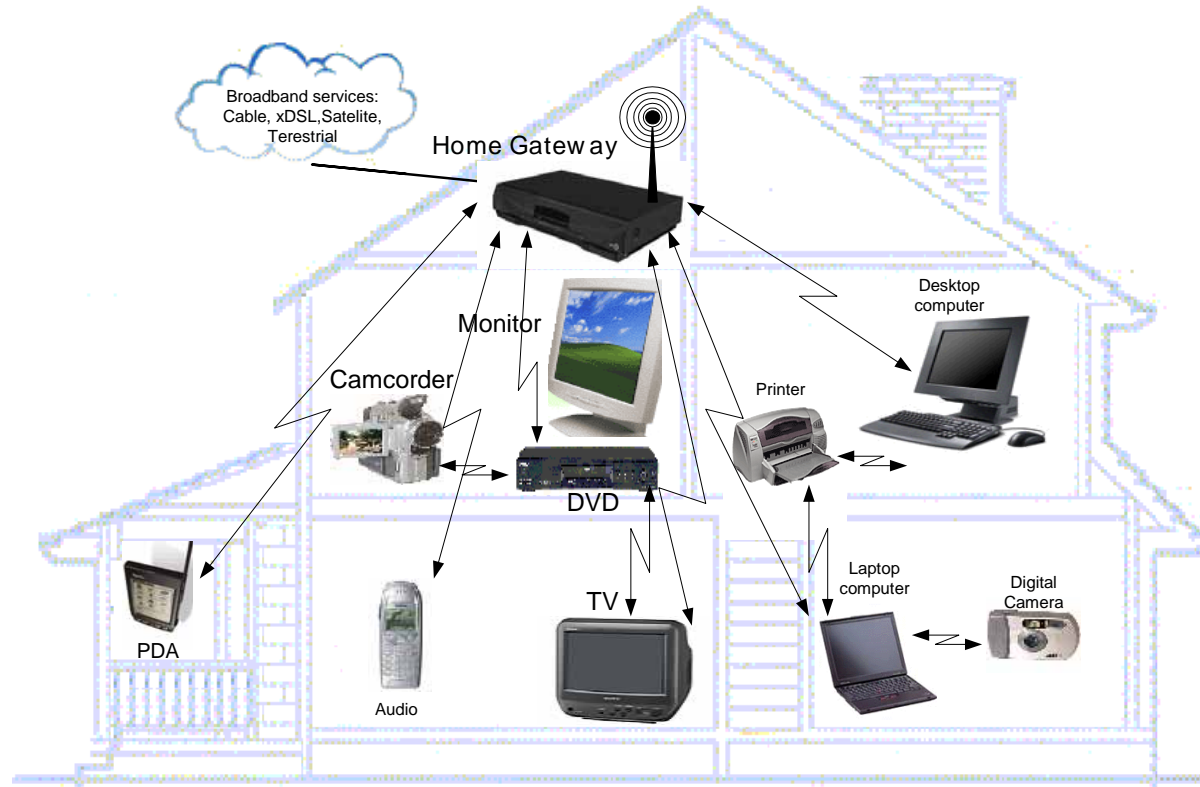
■ Figure 4. *Situation awareness functionality.*

Network Mobility Management



■ Figure 1. A mobile network in a B3G system.

Ultra-Wideband Radio



Course Process

- ◆ Paper reading and your presentations
- ◆ Wireless Multimedia Applications Exercises

Mobile Computing



Mobile phone today = multipurpose terminal for ...



Reading list for This Lecture

◆ Required Reading:

(Cfox95) D. Cox, "Wireless Personal Communications: What is it?," IEEE Personal Communication Magazine, (April 1995) pp.20-35

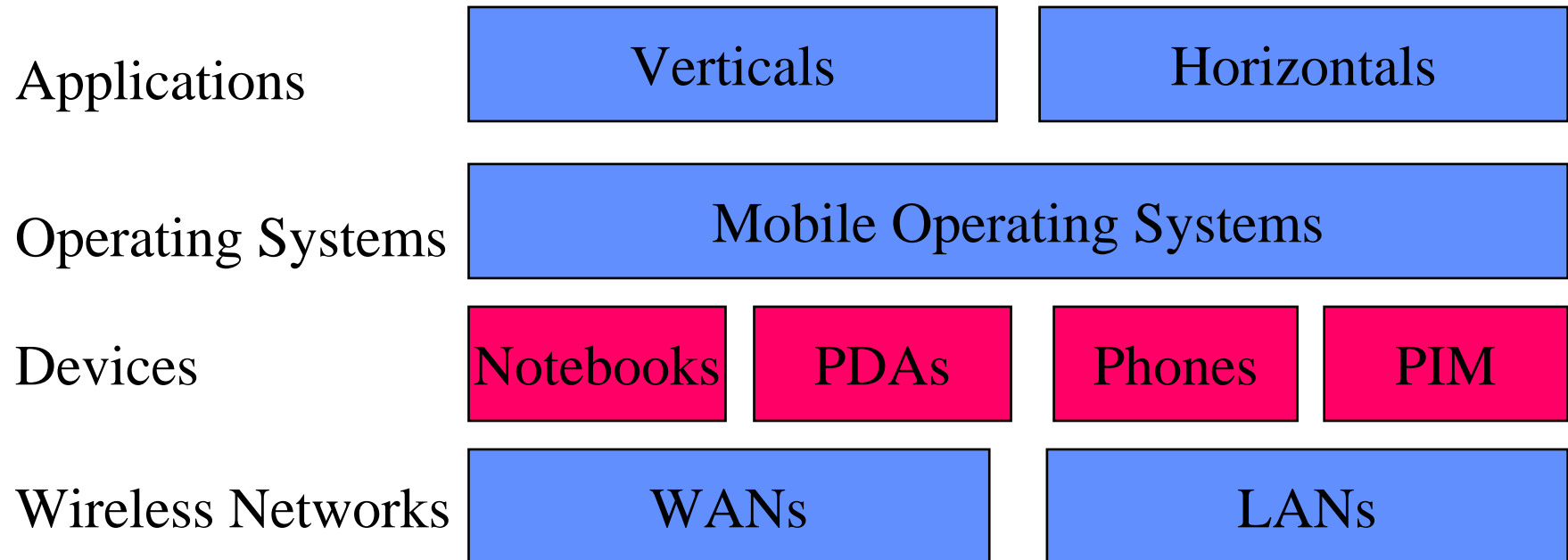
(S.2001) M. Satyanarayanan, "Pervasive Computing: Vision and Challenges", IEEE Personal Communication Magazine, (August 2001), pp.10-17

(Bi2001) Qi Bi, George I. Zysman, and Hank Menkes, "Wireless Mobile Communications at the Start of the 21 Century", IEEE Communication Magazine (January 2001), pp. 110-116

Further Reading

(Bolcskei2001) H. Bolcskei, A. J. Paulraj, K. V. S. Hari, and R. U. Nabar, "Fixed Broadband Wireless Access: State of the Art, Challenges, and Future Directions", IEEE Communication Magazine

Mobile Computing



Mobile Computing

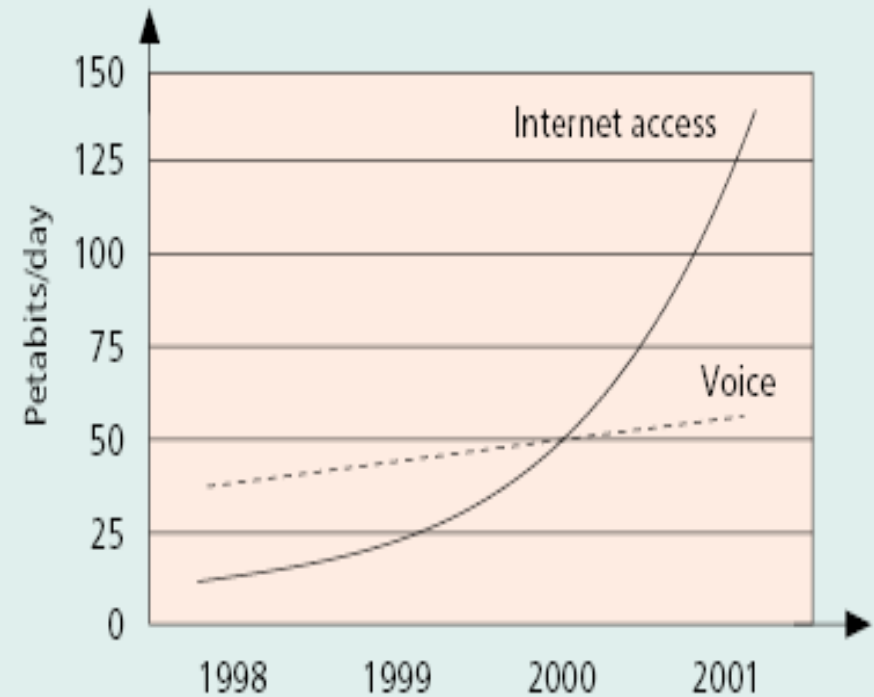
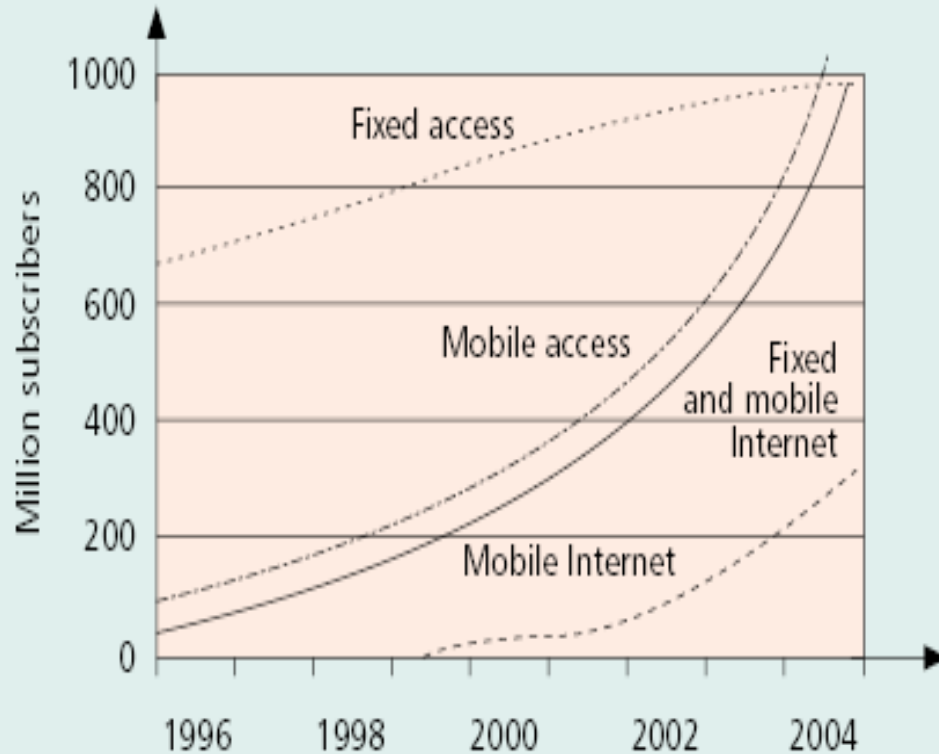
- ◆ information processing in general
 - not just communication or just computing, but both
- ◆ Any medium or combination of medium
 - process not just telephone voice or just data, but multimedia
- ◆ Mobility
 - components of the systems may be
 - ◆ moving, tether-less (wireless), portable
 - uses of the system may be moving

Why should we care ?



- ◆ Reason # 1 : \$\$\$ & jobs
- ◆ Explosive growth of wireless voice, paging, and data services
 - 35-60 percent annual growth in the past decade
 - mobile phones in US will be 42 % of fixed -line phones by 2000
 - 700 million mobile users at the end of 2000
 - One billion expected by 2003
- ◆ Big demand for portable communicators and computers
 - 2 M portable computer in 1988 to 74.1 M units in 1998

Growth in traffic in different access system and voice and data services



Is there a more “academic” reason ?

- ◆ Reason # 2: a next step in the evolution of information system
- ◆ Evolution from personal computing to networked computing to mobile computing
- ◆ Evolution from wired telephony to cordless telephony to mobile cellular telephony
- ◆ At the same time, unification of computing and communication



Mobile Multimedia Systems

- ◆ Ubiquitous information access (everybody else)
 - e.g. wireless computing, mobile computing, nomadic computing
 - information distributed everywhere by “the net”
 - users carry (wireless) terminals to access the information services
 - terminal is the universal service access device
 - terminals adapt to location and services
 - Knowledge-based society
- ◆ Flexible Users Choices
 - In terms of access, service, content
 - Any where, anytime, any terminal equipments
- ◆ Wearable Computing terminal / Mobile Broadband services (MBS)



Pervasive Computing

- ◆ Technology that disappears
 - The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it".
- ◆ Ubiquitous (Invisible) Computing (Xerox PARC)
 - Cheap computers of different scale and types embedded everywhere
 - Potentially 100s of computers per room that disappear into background (e.g. active badge, tabs, pads, live boards..)
 - User centric, not terminal centric
 - Computers swapped and shared among users
- ◆ Effective Use of Smart Spaces
- ◆ Invisibility
- ◆ Localized Scalability
- ◆ Masking Uneven Conditioning

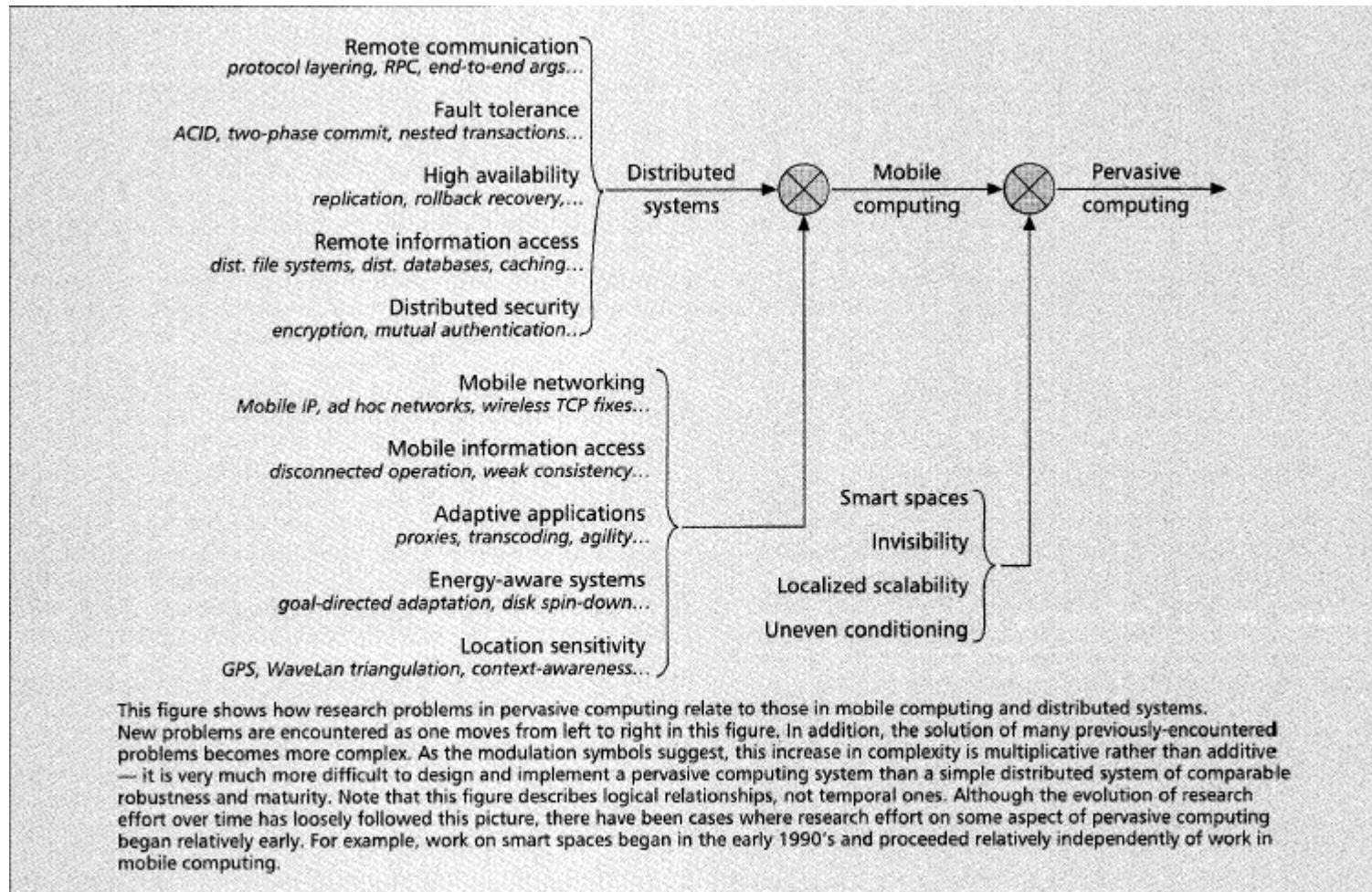


Support for Pervasive Computing

- ◆ User Intent
- ◆ Cyber Foraging
- ◆ Adaptation Strategy
- ◆ High-Level Energy Management
- ◆ Balancing Pro-activity and Transparency
- ◆ Privacy and Trust
- ◆ Impact on Layering

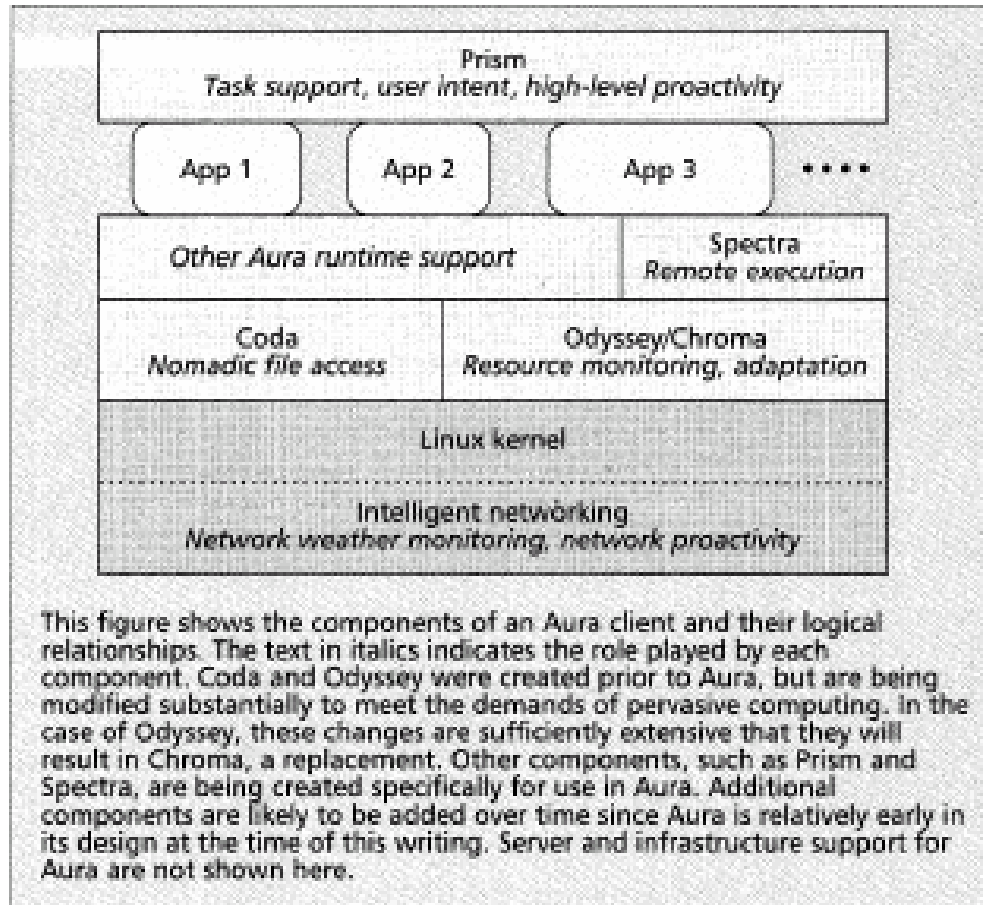


Pervasive Computing



■ Figure 1. Taxonomy of computer systems research problems in pervasive computing.

Aura Client



■ Figure 2. The structure of an Aura client.



Wireless Communications



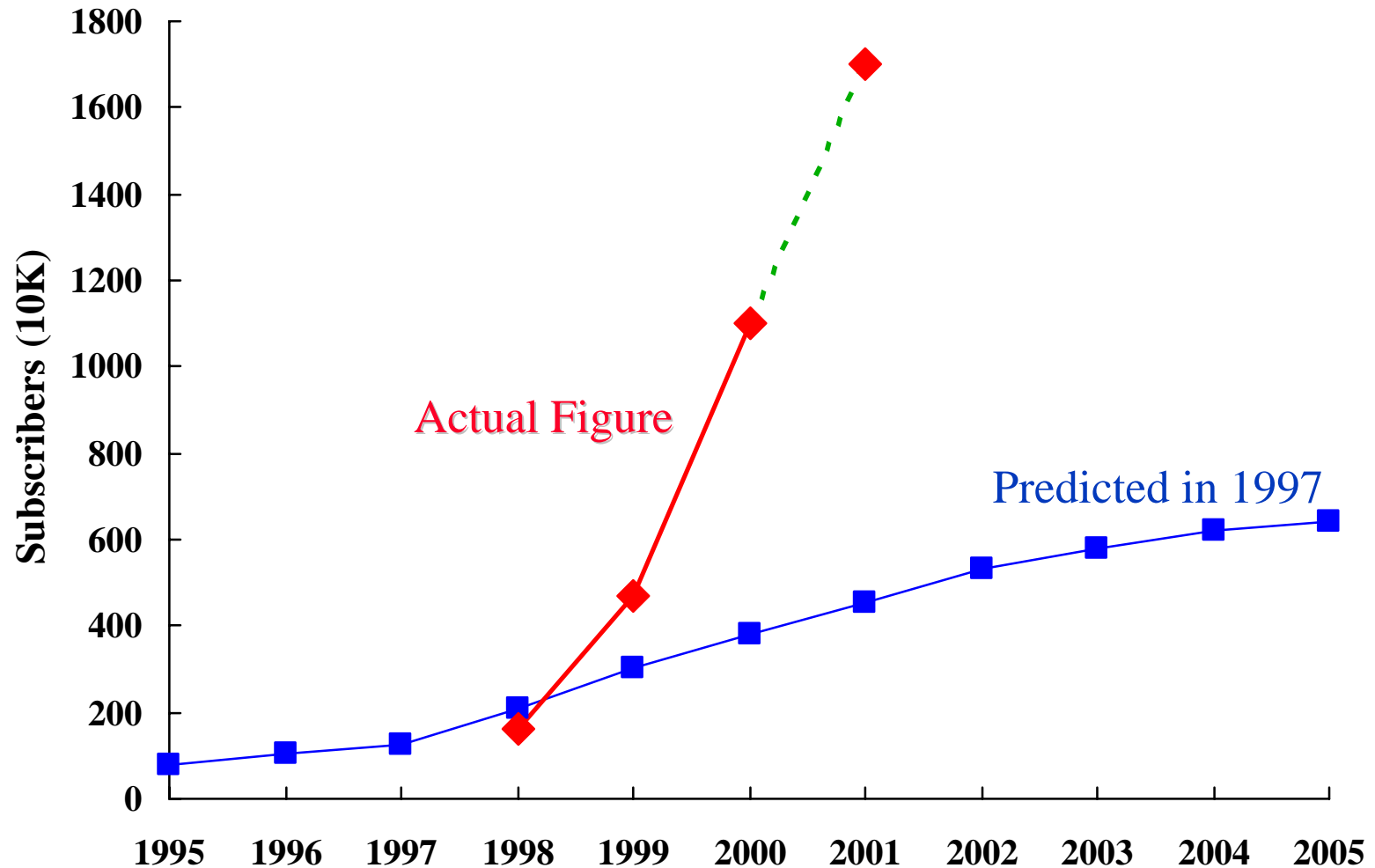
Mobile Communications

Fixed Broadband Wireless Communications

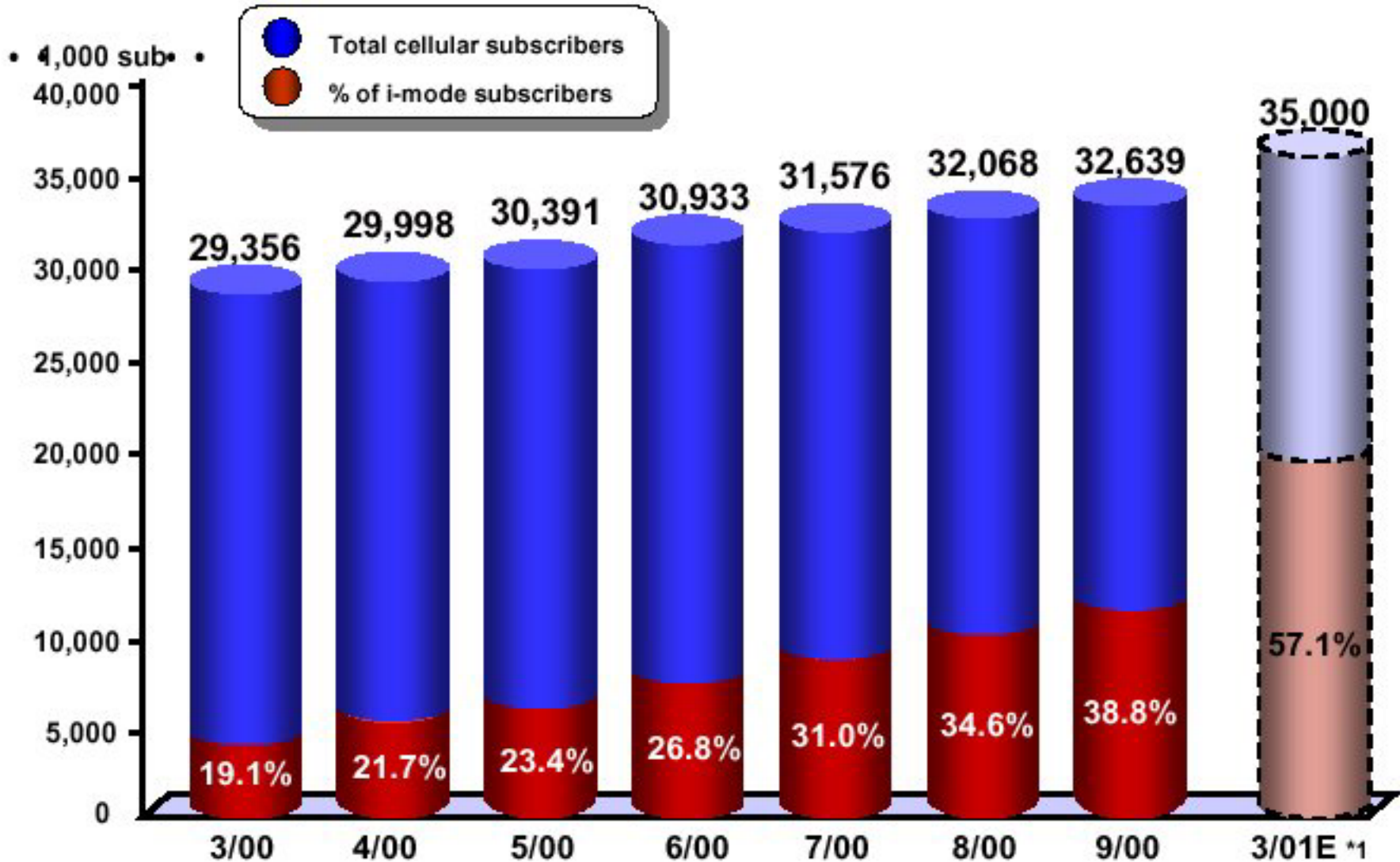
Evolution of Mobile Wireless Systems

- ◆ First Generation : Analog – Voice
 - Analog modulation
 - Cellular phone (AMPS) with manual roaming
 - Cordless phones
 - Packet radio networks
- ◆ Second Generation : Digital - Voice & Data
 - WAP (wireless application protocol)
 - 2.5 G GPRS
 - Wireless data LANs (802.11), MANs (Metricom), WANs (CDPD, ARDIS, RAM)
- ◆ Third Generation: Digital – Multimedia
 - Unified digital wireless access anytime, anywhere
 - Voice, data, images, video, music, sensor etc.
- ◆ 4G~ Life after Third-Generation Mobile Communications

台灣行動電話發展趨勢圖



Cellular Service Subscription



Wireless Personal Communications

- ◆ What is it?
 - Cellular telephone
 - Cordless telephone
 - Paging systems
 - Wide area data networks
 - Local area data networks
- ◆ Many ways to segment PCS
 - Applications
 - Extent of coverage
 - Degree of mobility (speed, area)
 - Circuit switched voice vs. packet-switched data
 - Mode of communication (messaging, two-way real time, paging, agents)
 - User location (indoor vs. outdoor, train, airplane)
- ◆ **Common ingredients in all PCS activity**
 - Desire for mobility in communications
 - Desire to be free from tethers

2000 Market Share

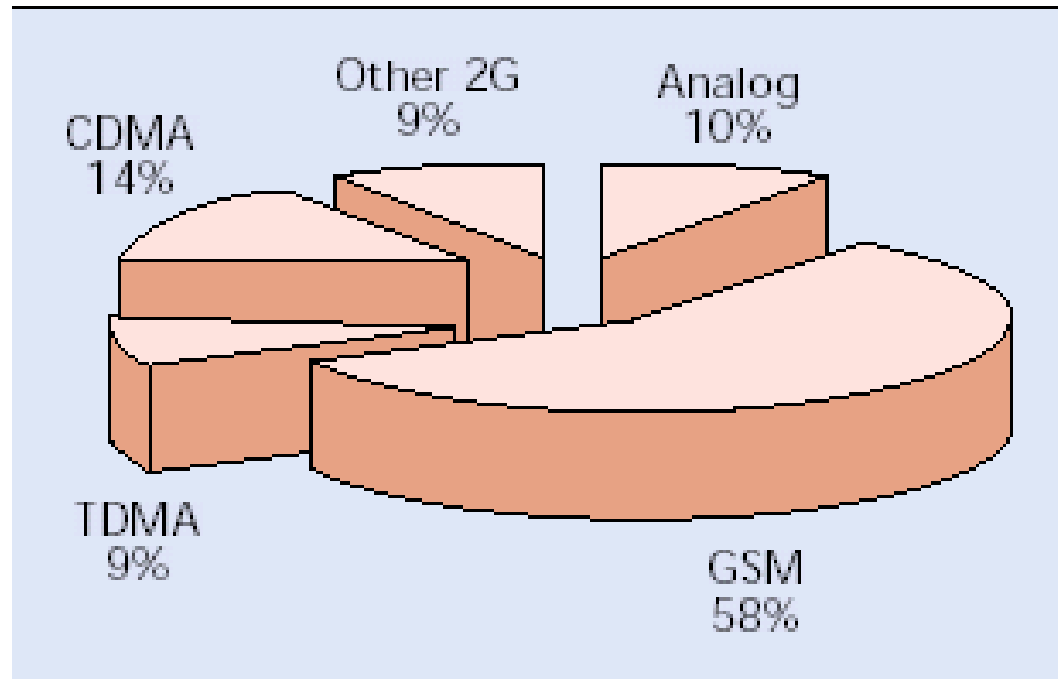


Figure 5. *Estimated market shares of 1G and 2G wireless mobile systems in 2000.*

Mobile Terminal Growth

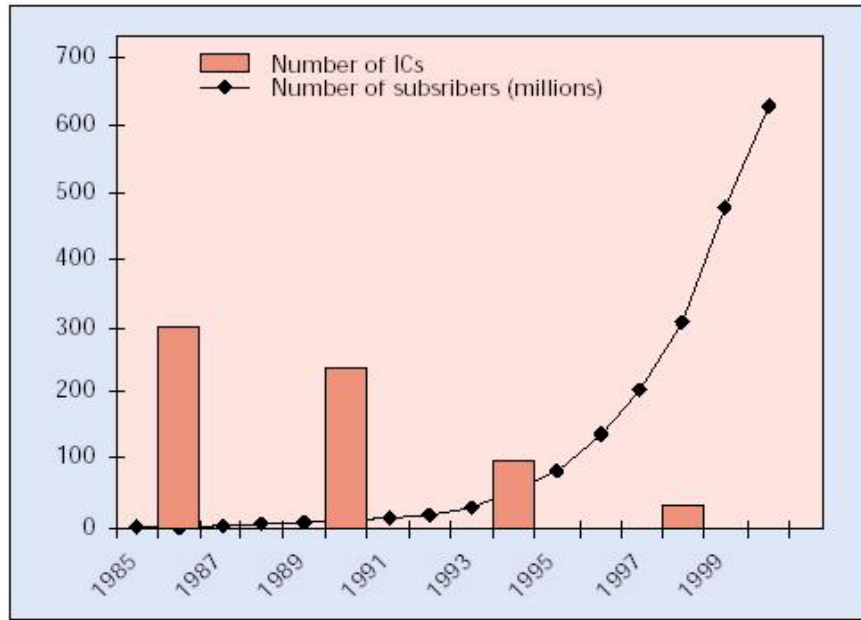


Figure 1. Subscriber growth and IC reduction in mobile terminals.

QUALCOMM

> Easy Migration
from cdmaOne
to 3G



Time to Market



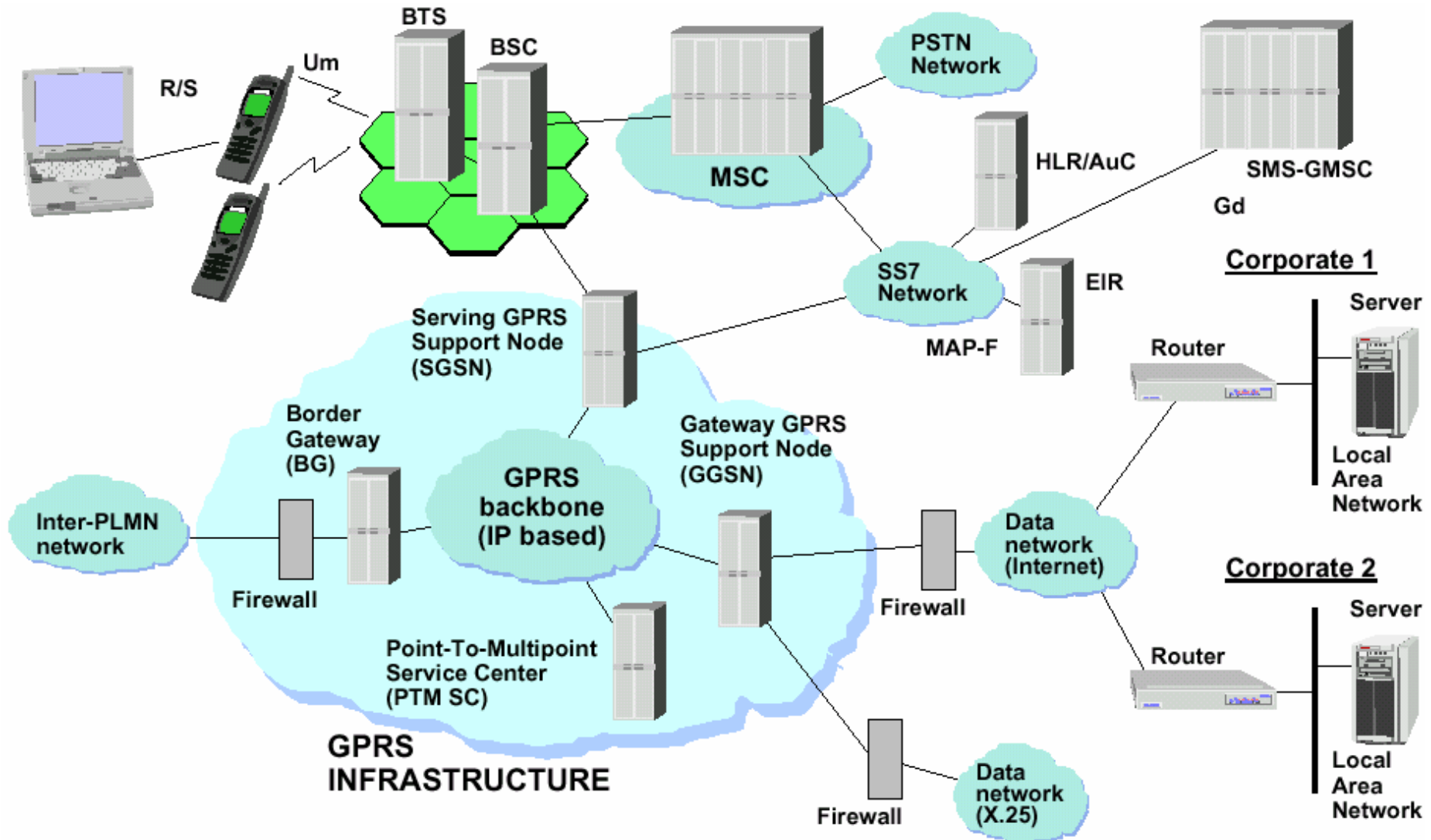
Simple IS-95 to cdma2000 conversion

DEUTSCHE BANK ALEX. BROWN

11.14.00

16

GPRS Architecture



RS Spectrum Allocation

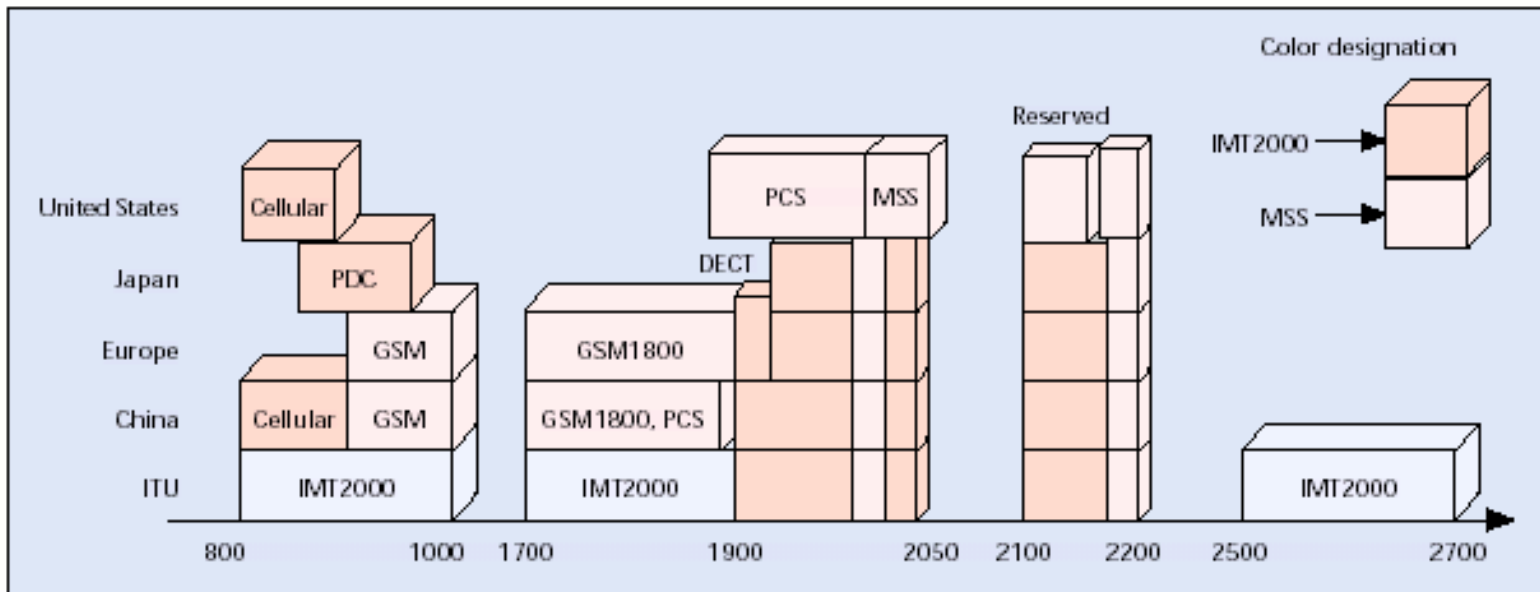
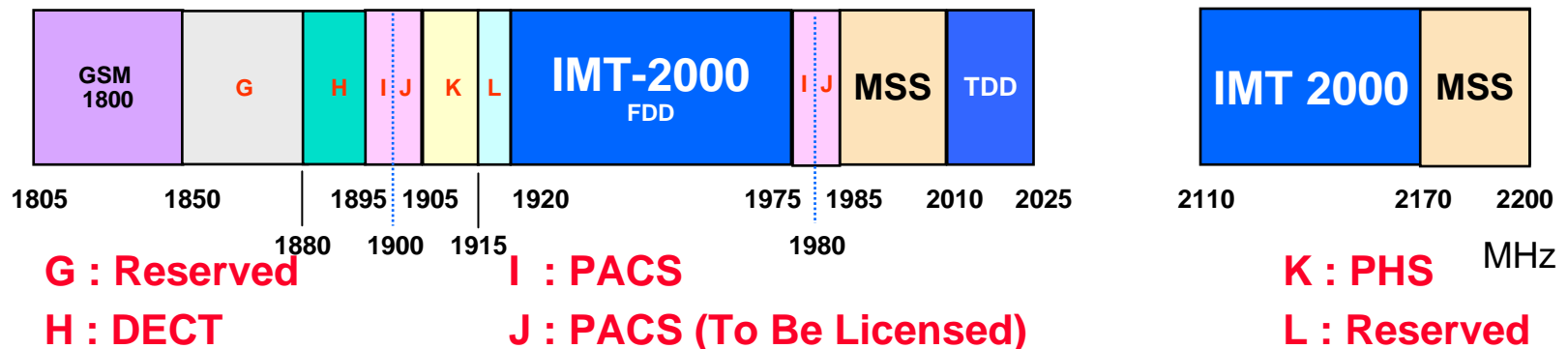
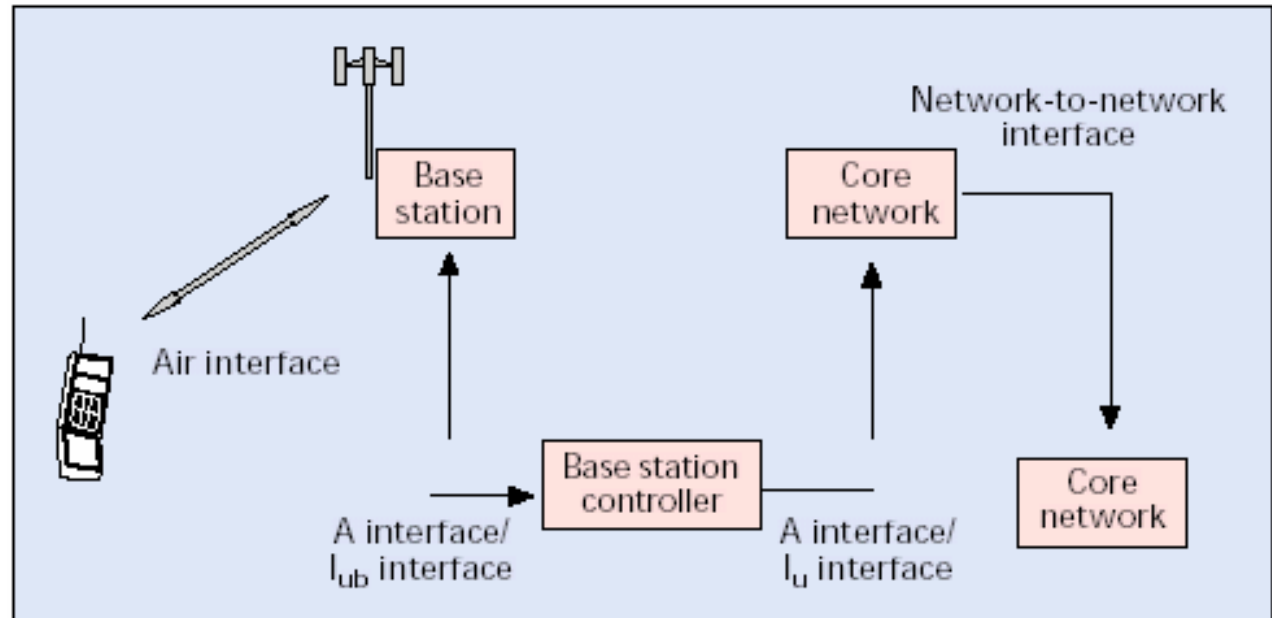


Figure 2. RF spectrum allocation in major regions.

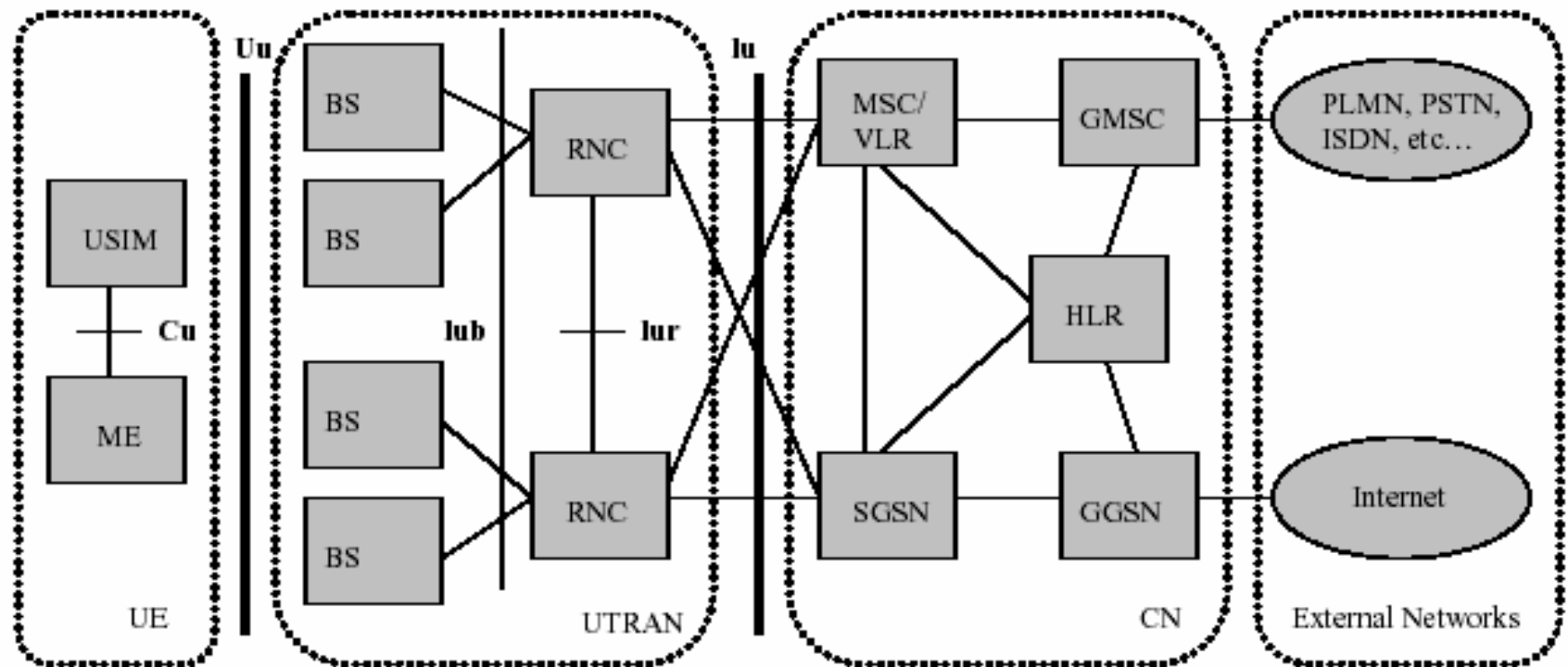


Wireless Mobile Interface



■ Figure 4. Wireless mobile system interface definition.

Elements of UMTS Architecture



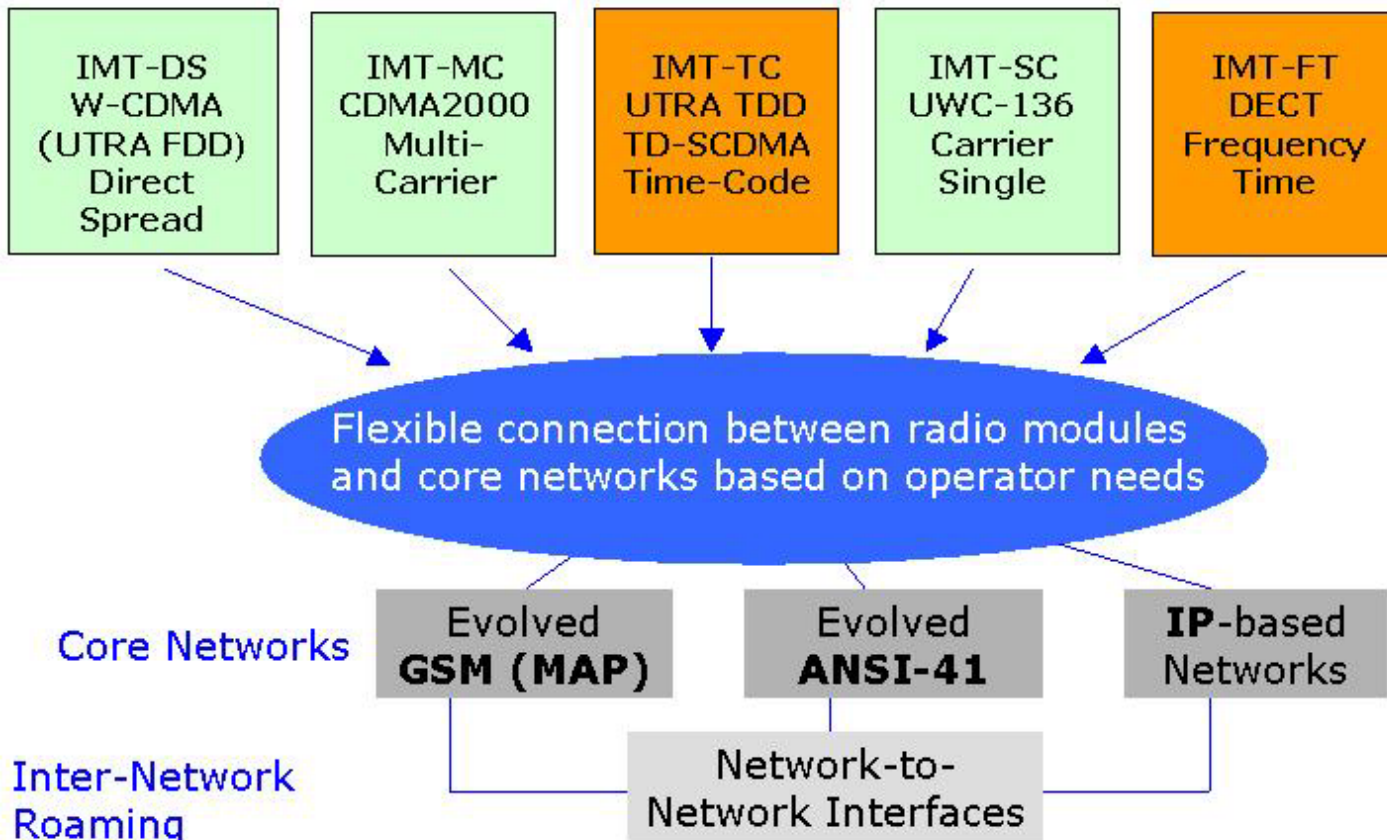
第三代行動電話之技術標準

Modular IMT-2000 Harmonization

Paired spectrum

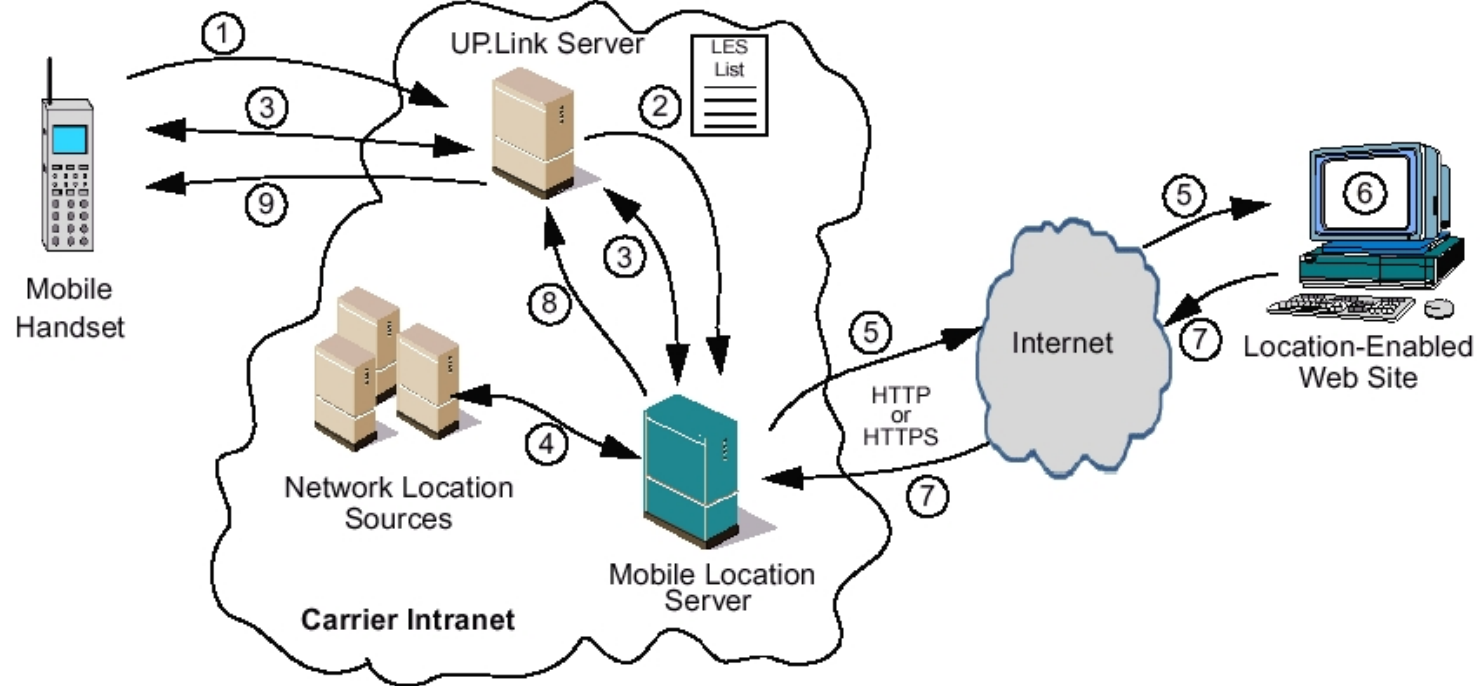
Unpaired spectrum

(Terrestrial Component)

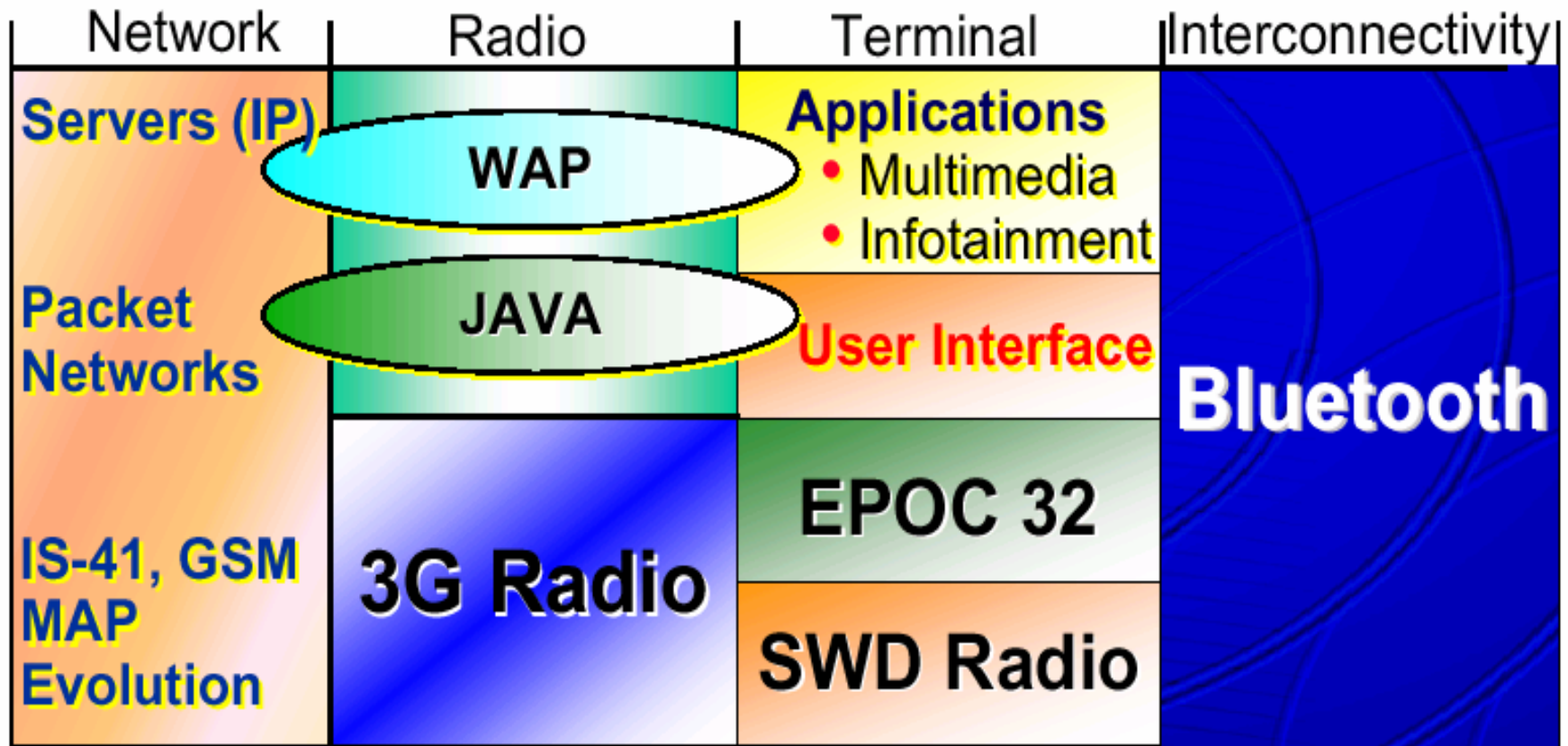


Location-Based Applications

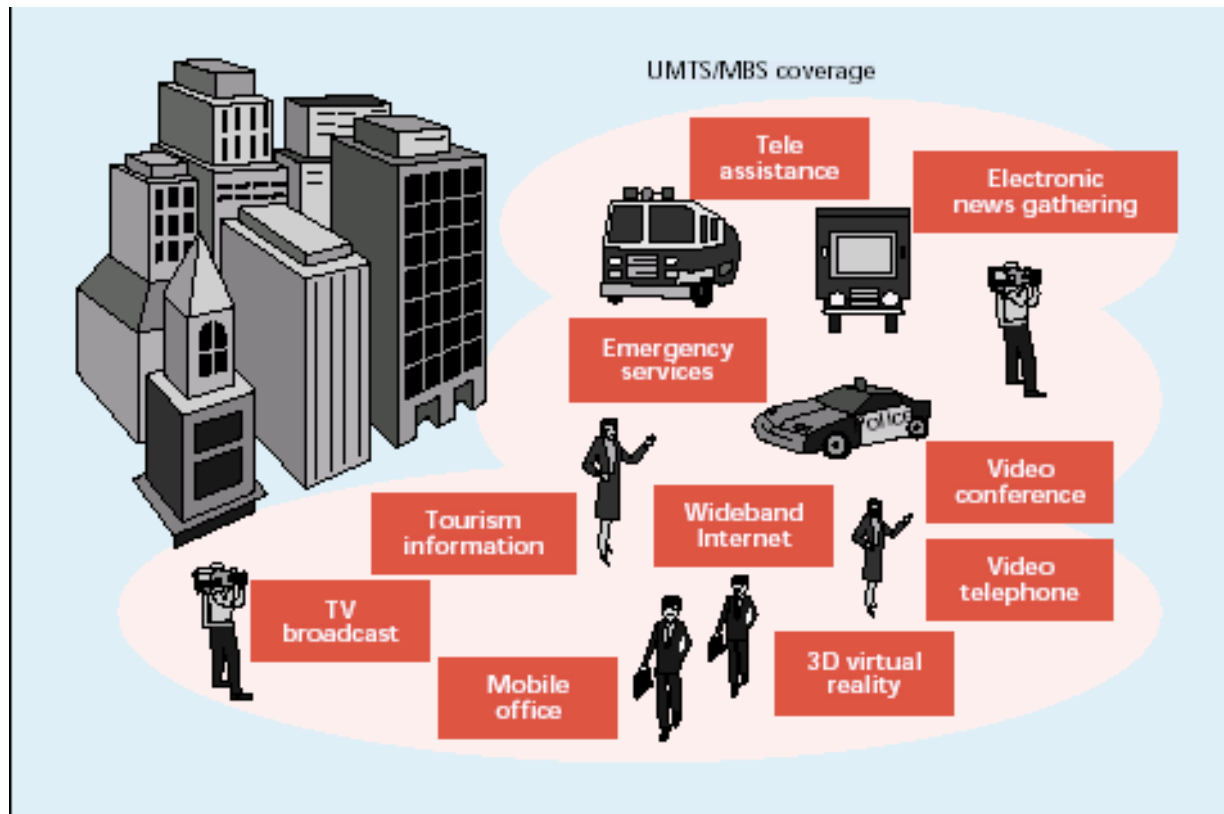
Figure 1. A typical location data transaction



3G-Network integration

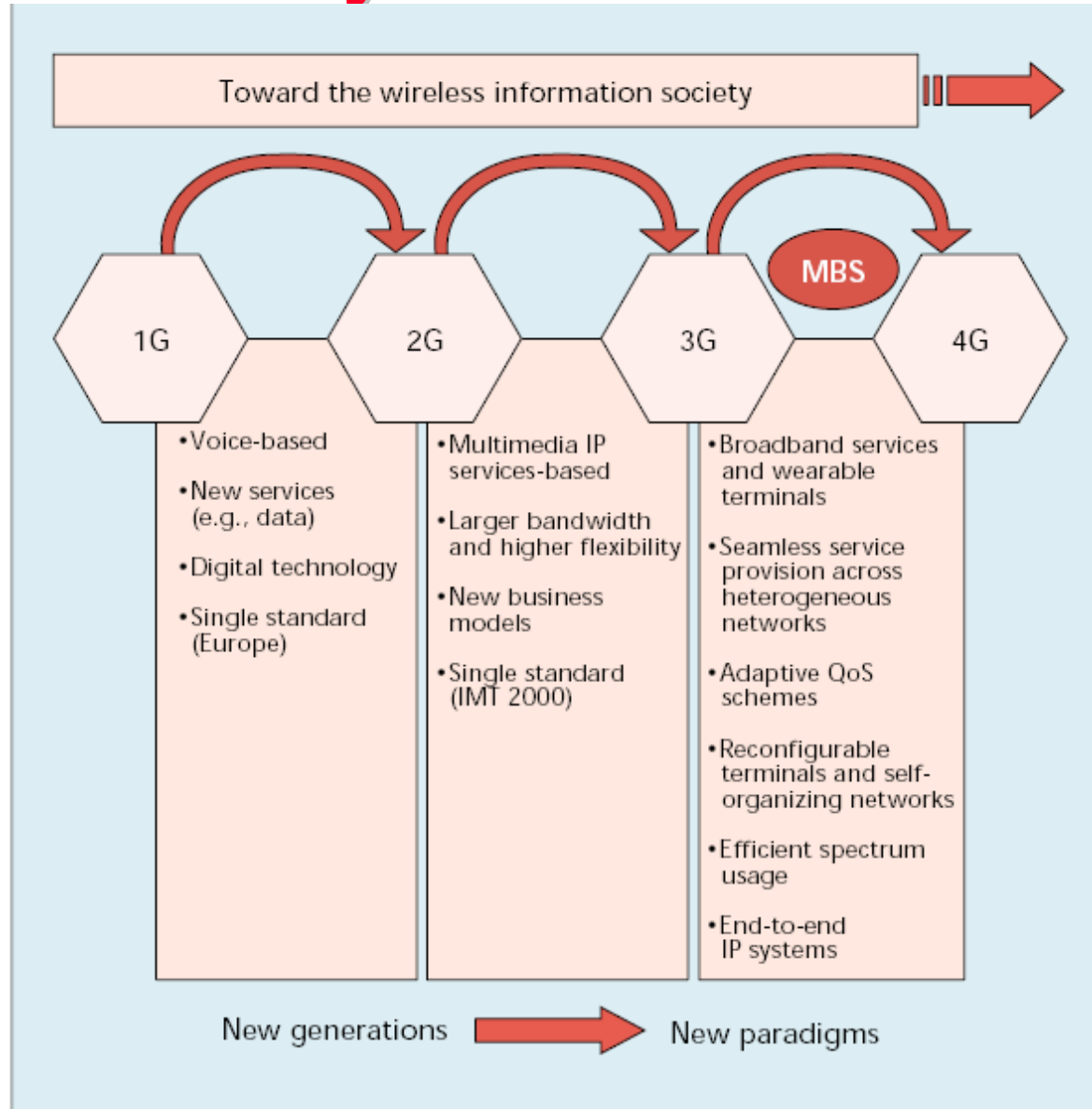


Mobile Broadband System

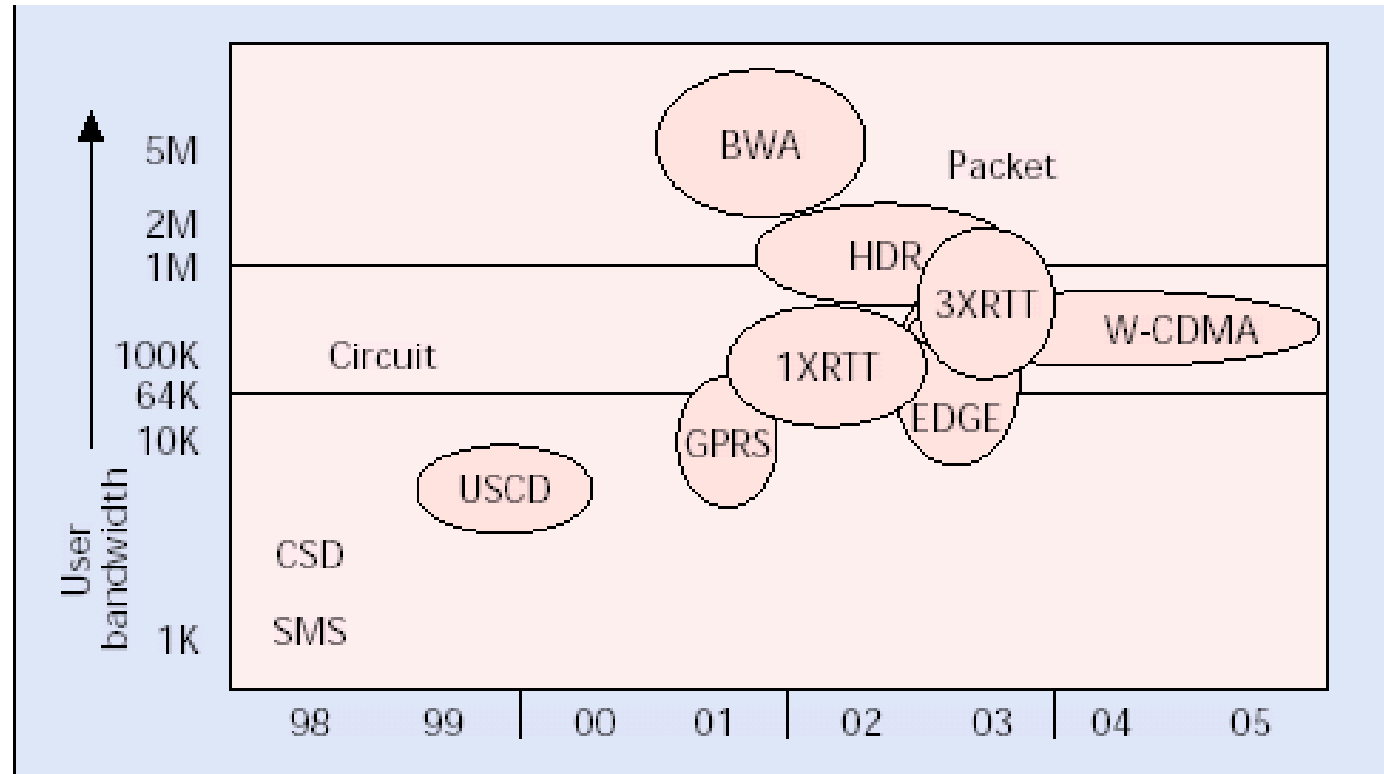


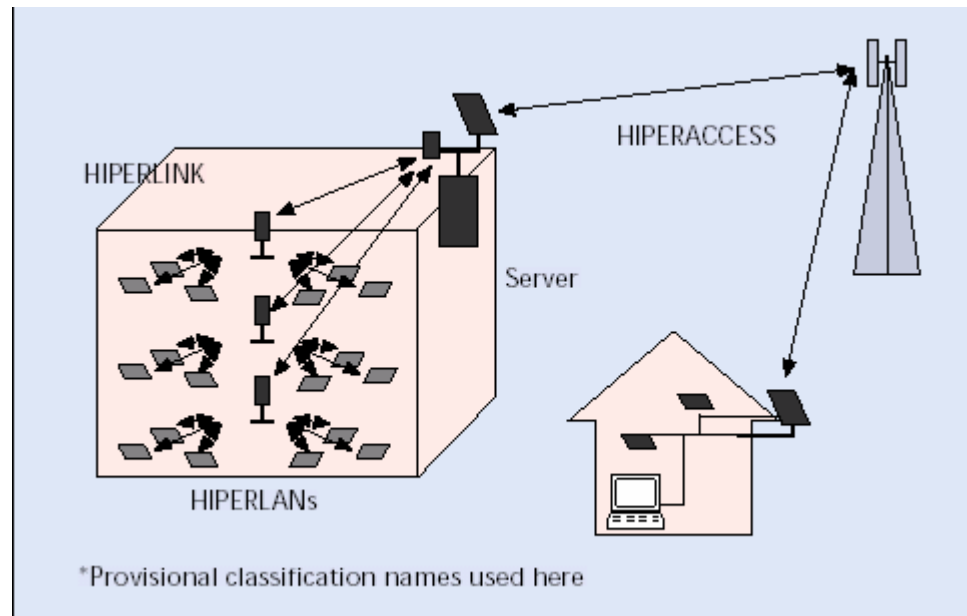
■ Figure 1. MBS and UMTS coverage and applications.

Mobile System Evolution



Wireless & Multimedia ■ Figure 5. Mobile communication systems evolution.





WiMAX Nomadic and Portable



Non Line of Sight
Point to Multi-point

802.16

Line of Sight
BACKHAUL

802.16



802.16e PC
Card



Laptop Connected
Through 802.16

SEEKS BEST
CONNECTION

2 to 3 Kilometers Away

Telco Core
Network or
Private (Fiber)
Network

INTERNET
BACKBONE

Ref: Margaret LaBrecque, "Enabling Deployments through Standards and Certification,"
WiMax, 2003

Wireless & Multimedia Network Laboratory™

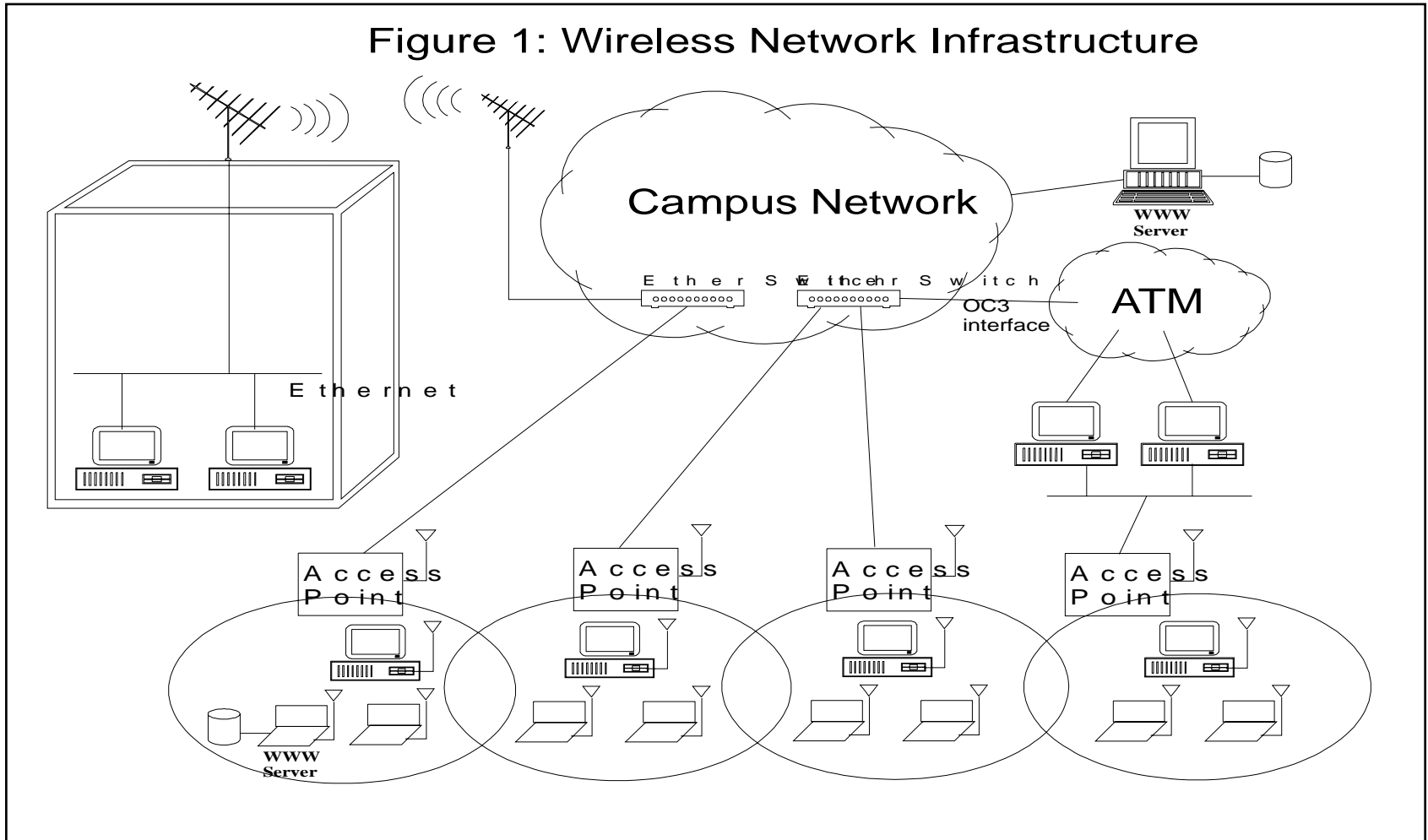


**National Central University
&
Hughes Network Systems
LMDS Demo Briefing**

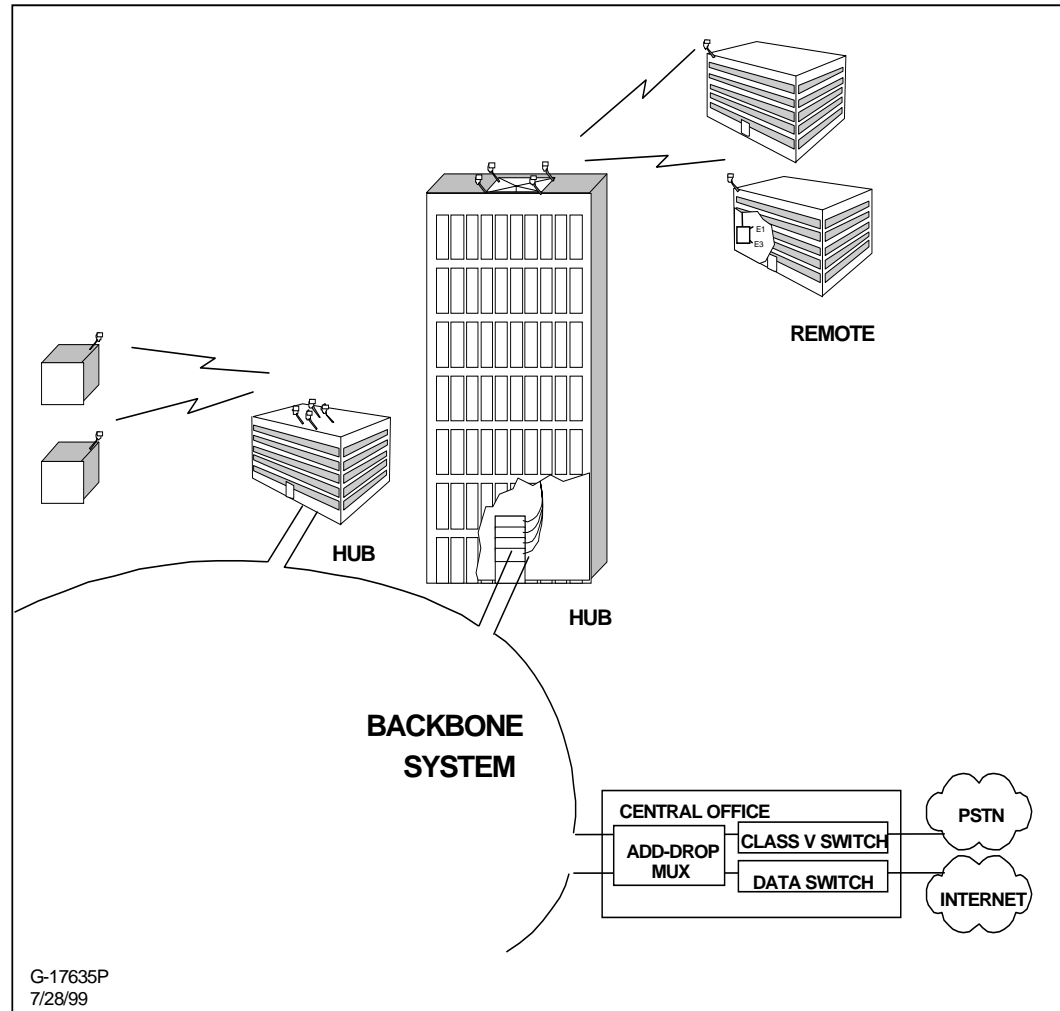
November 1999

Campus Network

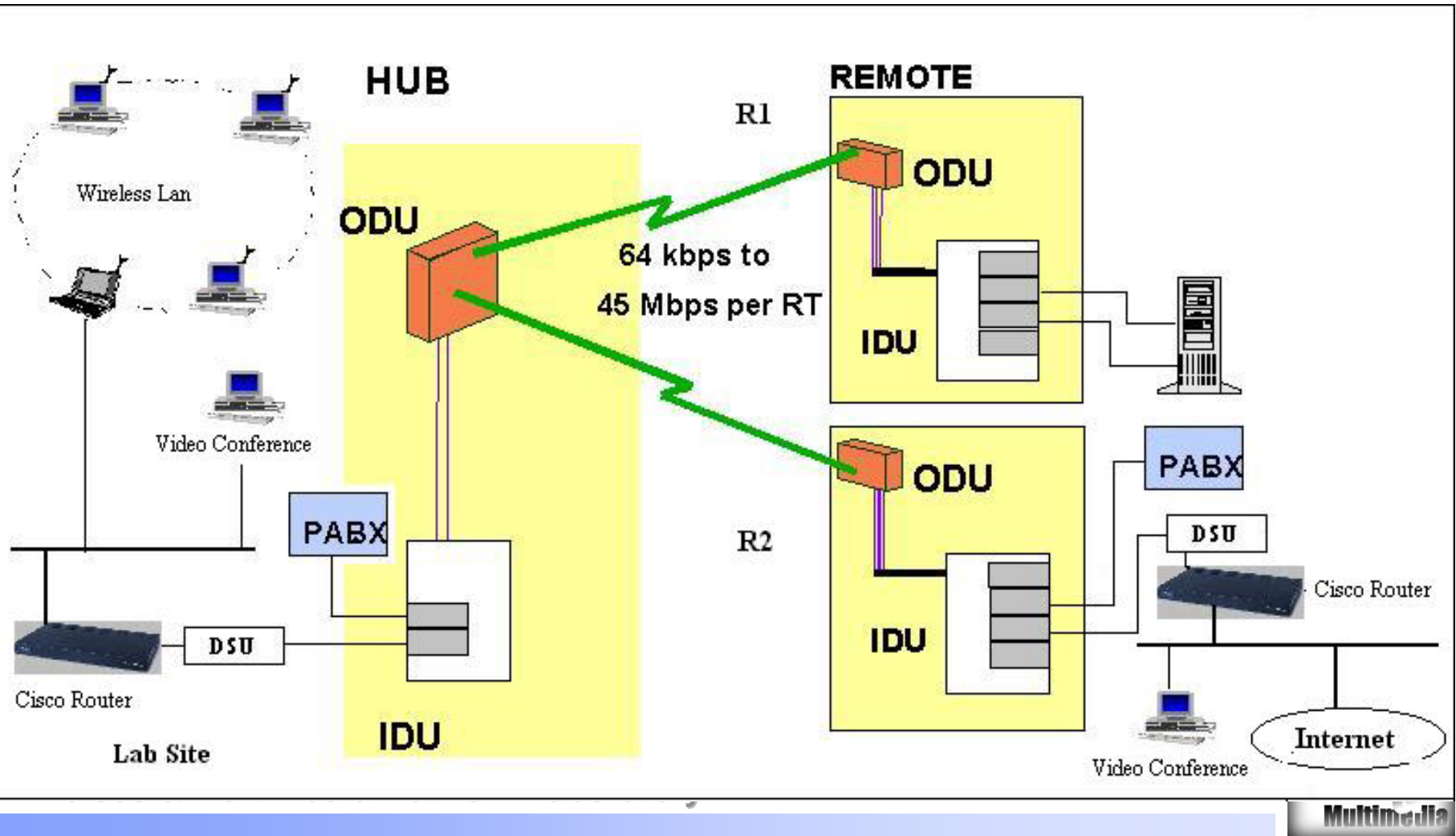
Figure 1: Wireless Network Infrastructure



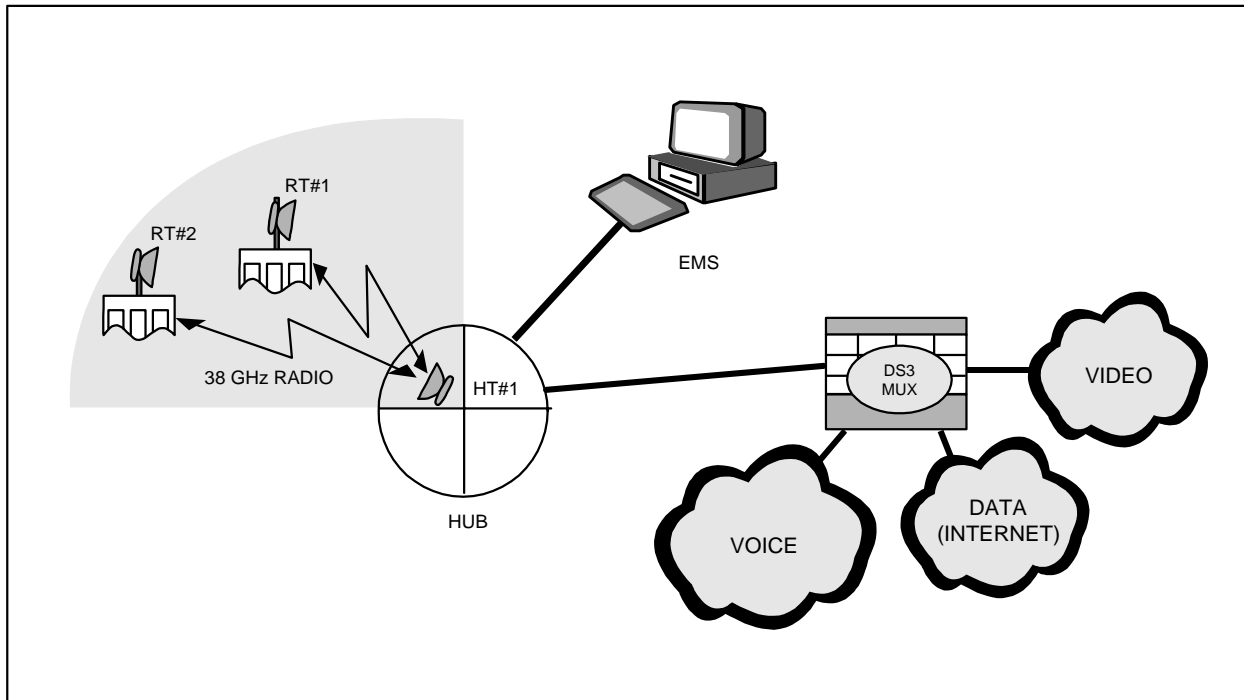
LMDS NCU Test-bench



Architecture of the Demo

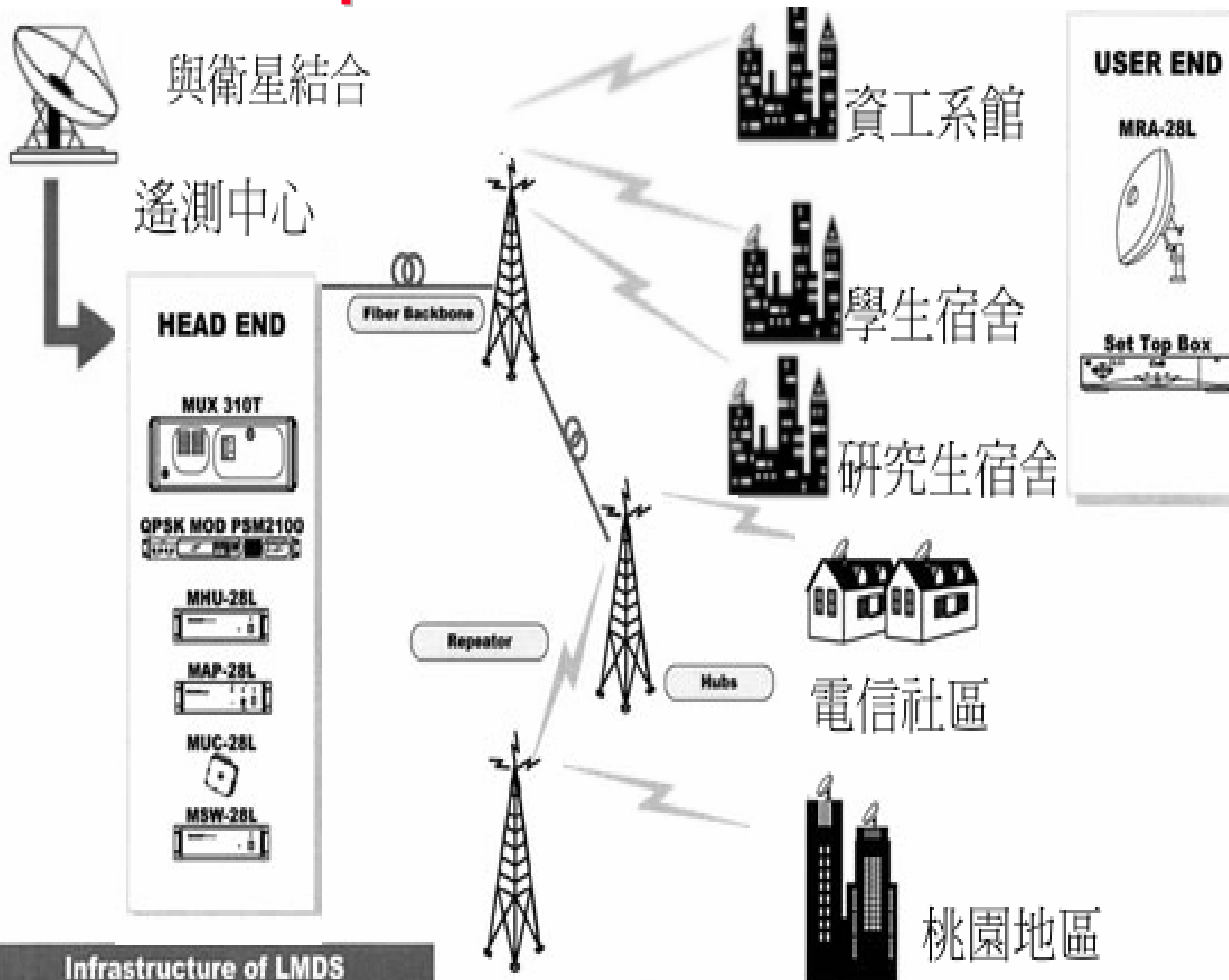


National Central University Demo Layout

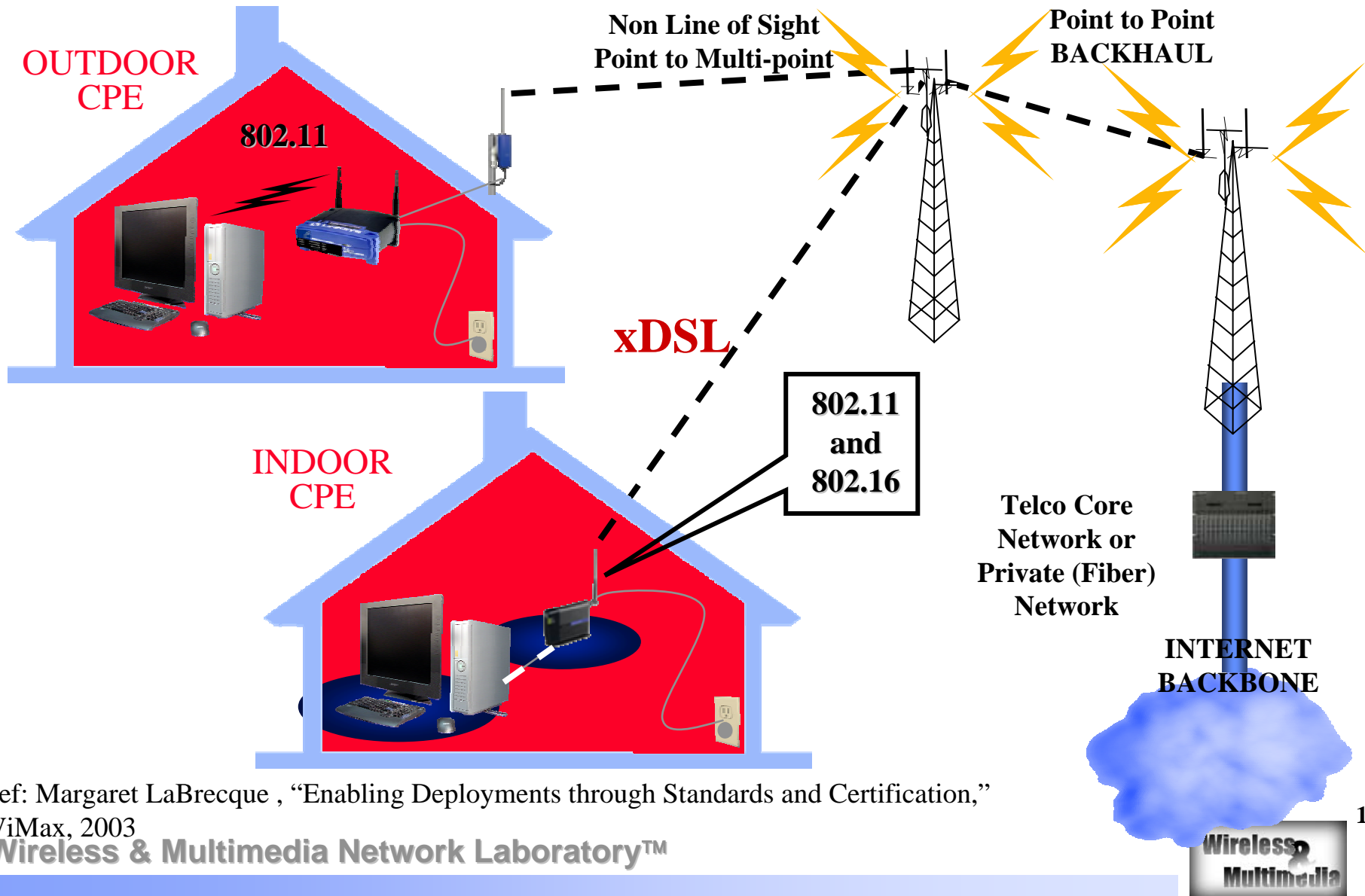


G-17833P 8/19/99

Step.1 LMDS Architecture

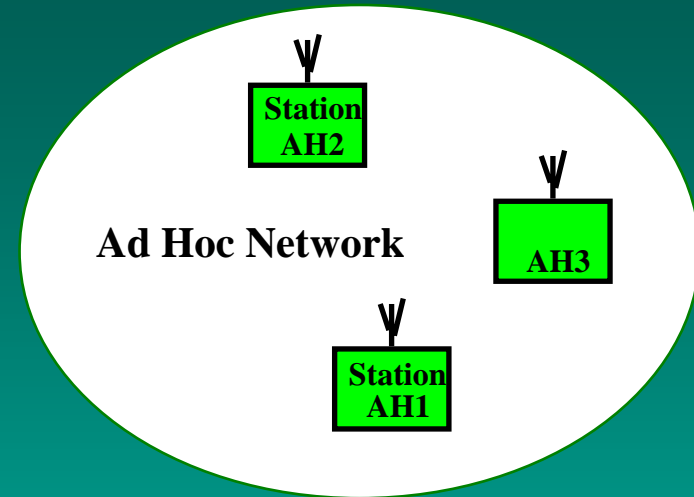


WiMAX Consumer Last Mile



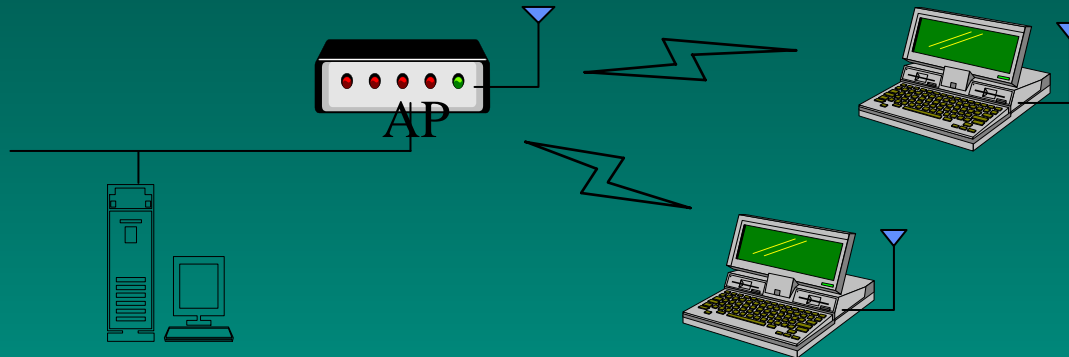
IEEE 802.11 Configurations - Independent

- ◆ Independent
 - one Basic Service Set - BSS
 - Ad Hoc network
 - direct communication
 - limited coverage area

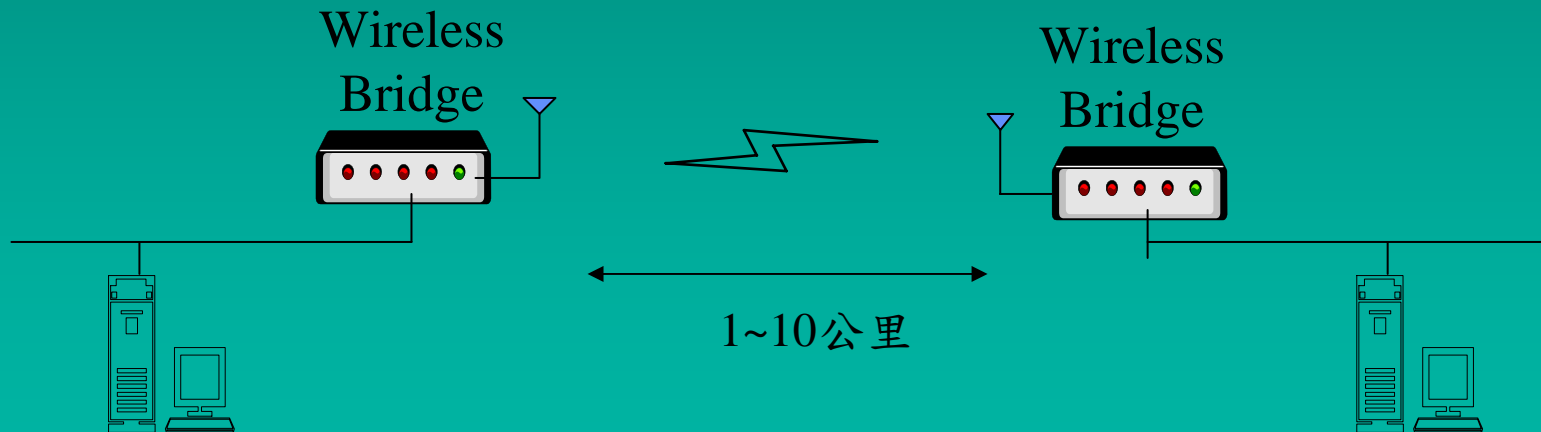


Topology of a Wireless LAN

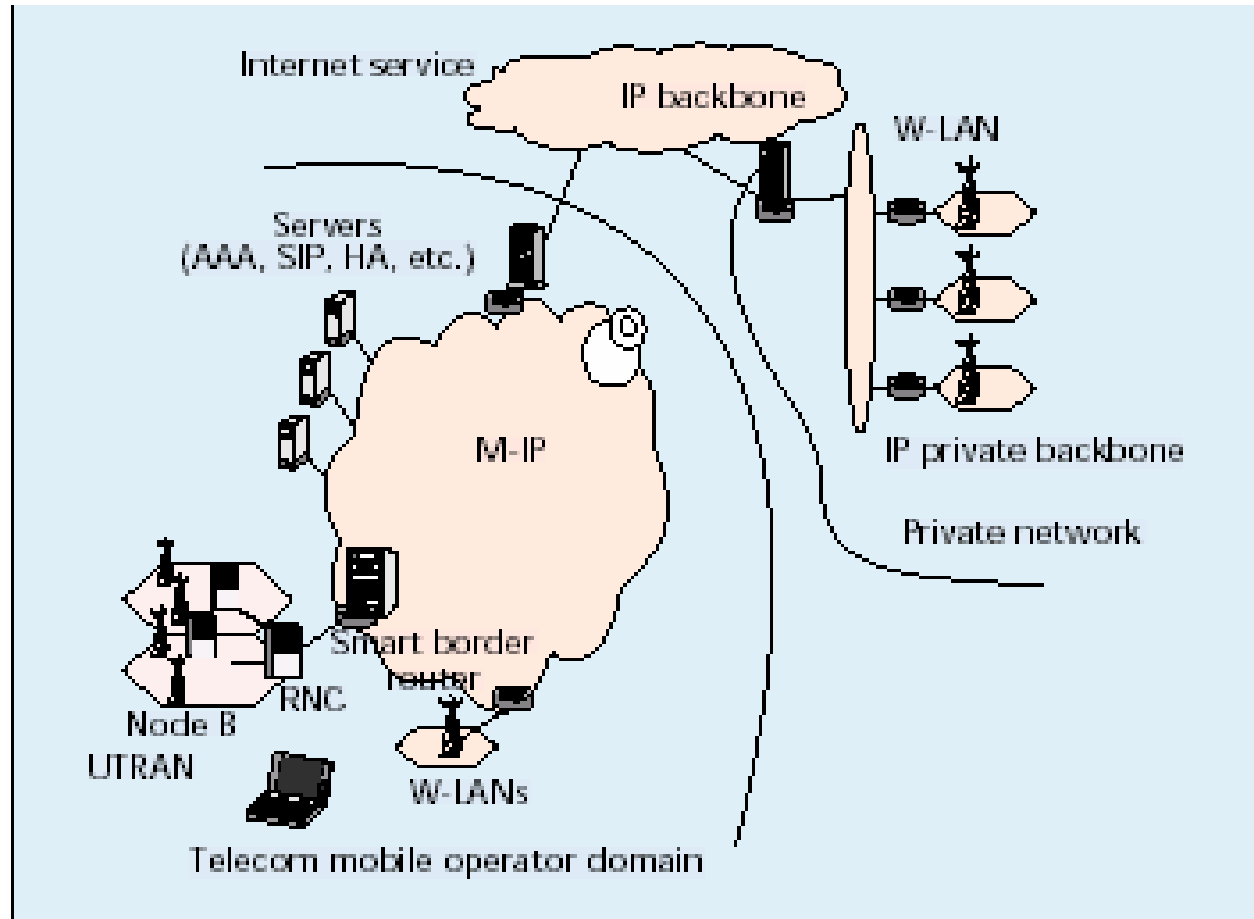
- ◆ 進接(Access)應用: 使用者與網路的连接



- ◆ 中繼(Trunk)或骨幹(Backbone)應用: 網路與網路之間的连接. 例如,大樓與大樓之間的通訊, 或是遠方網路的连接.



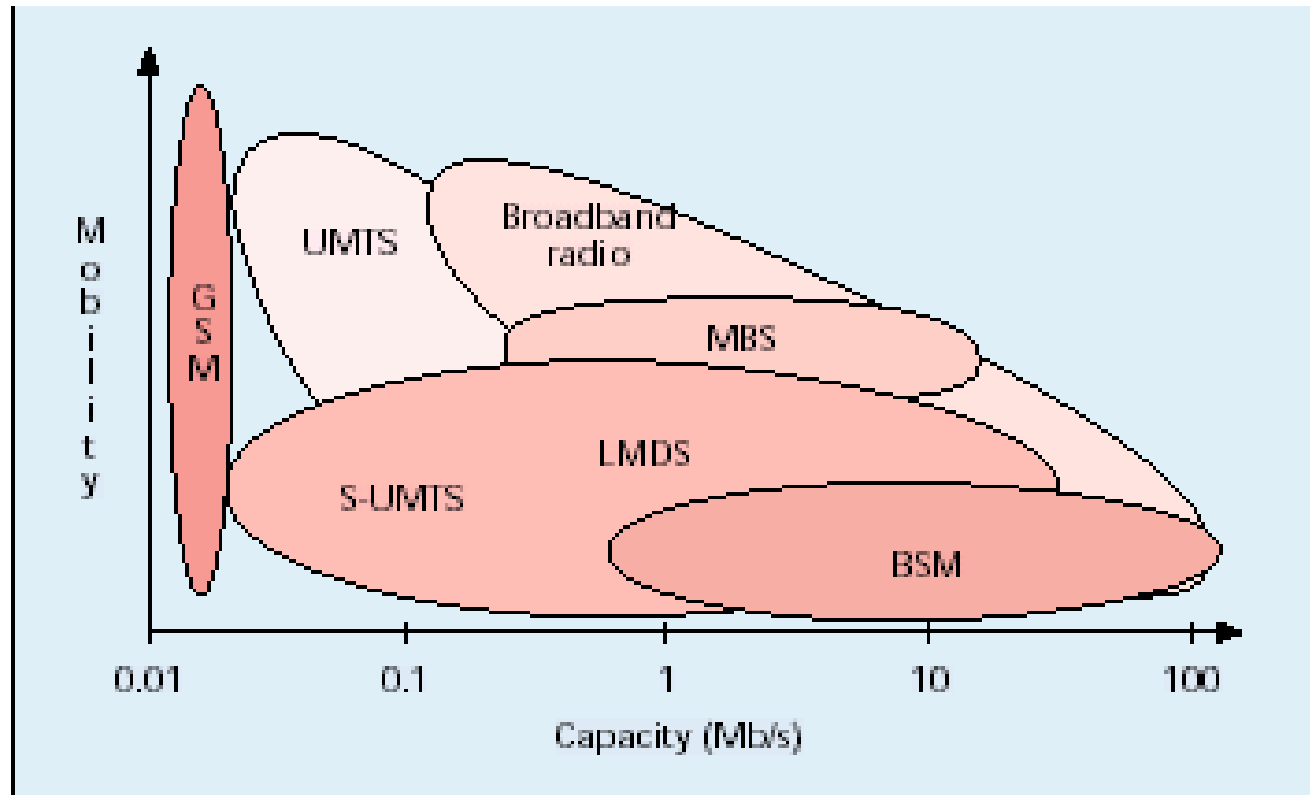
IP integration



WiMedia Solutions – Simple Usage

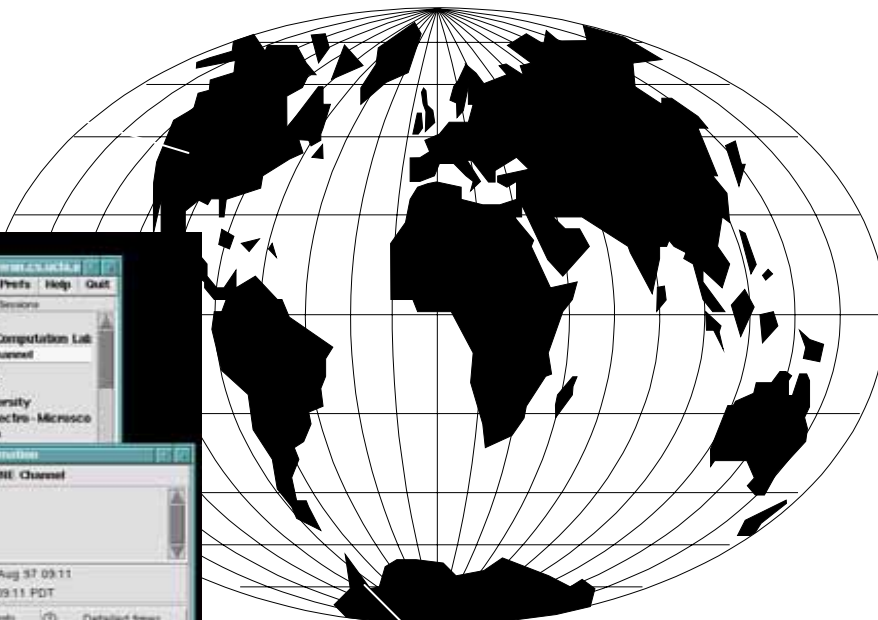
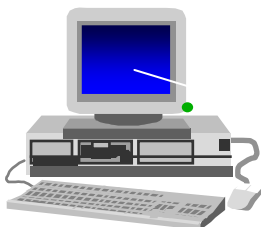
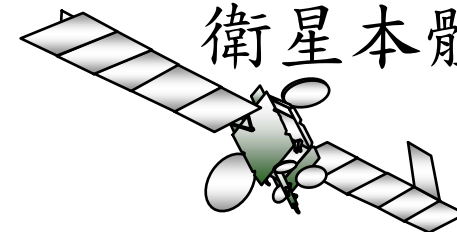


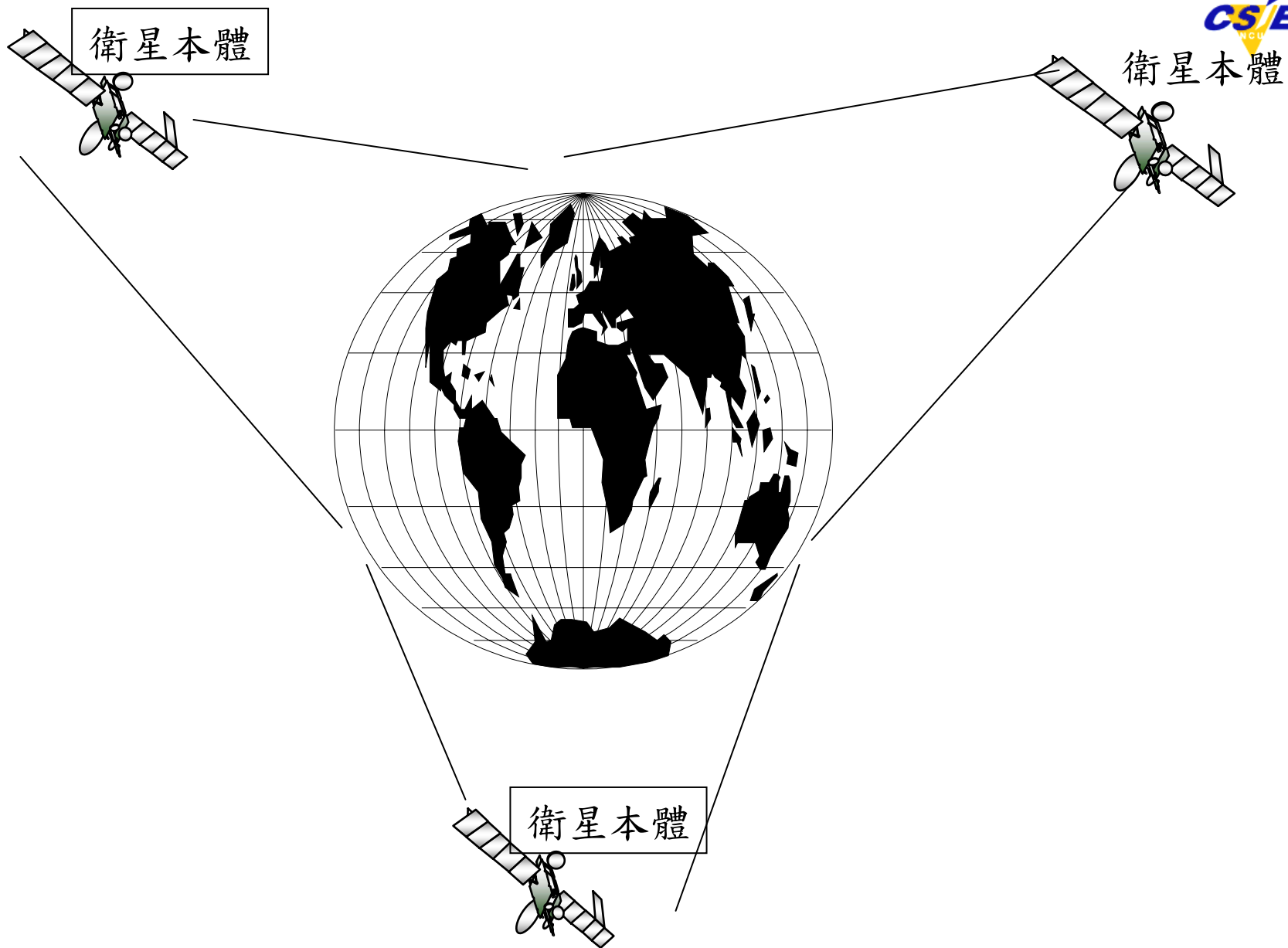
Capacity and Mobility



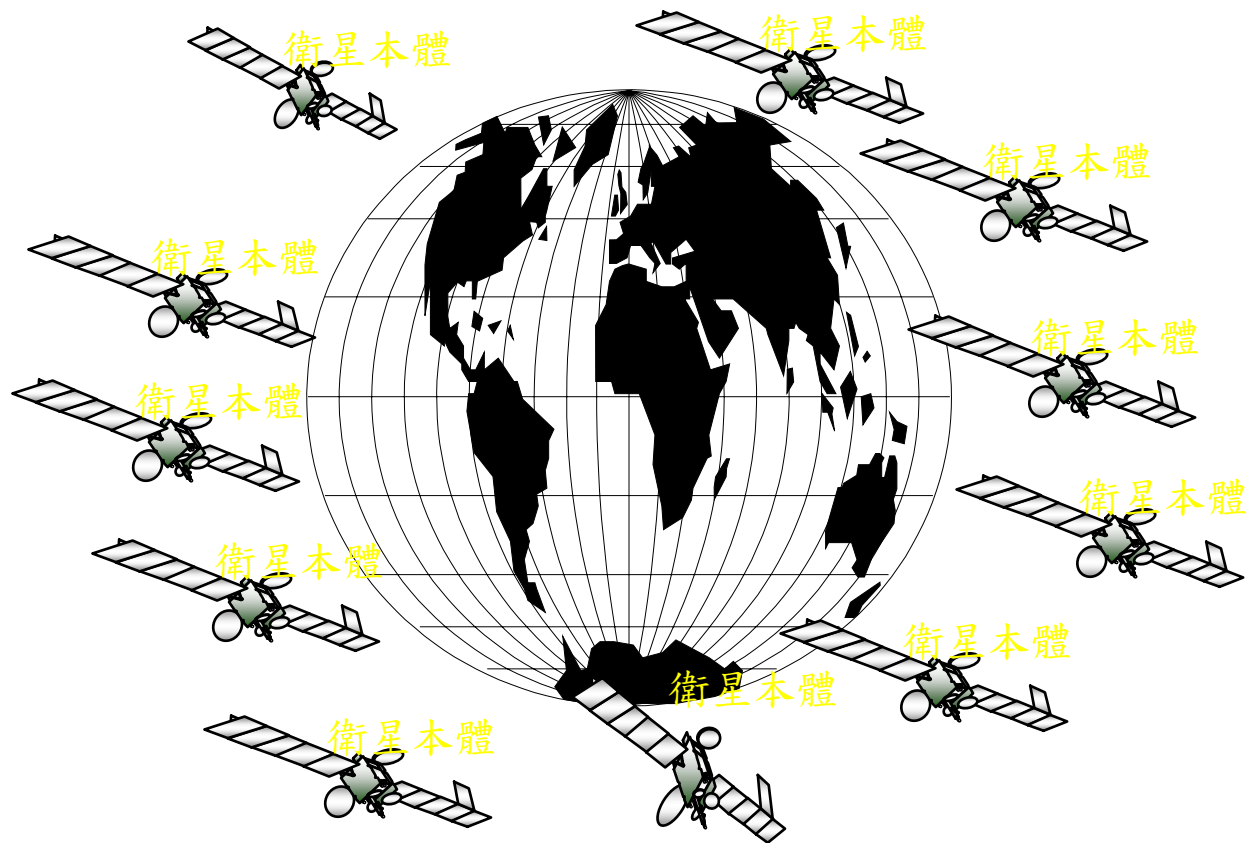
地球村的建立

衛星本體

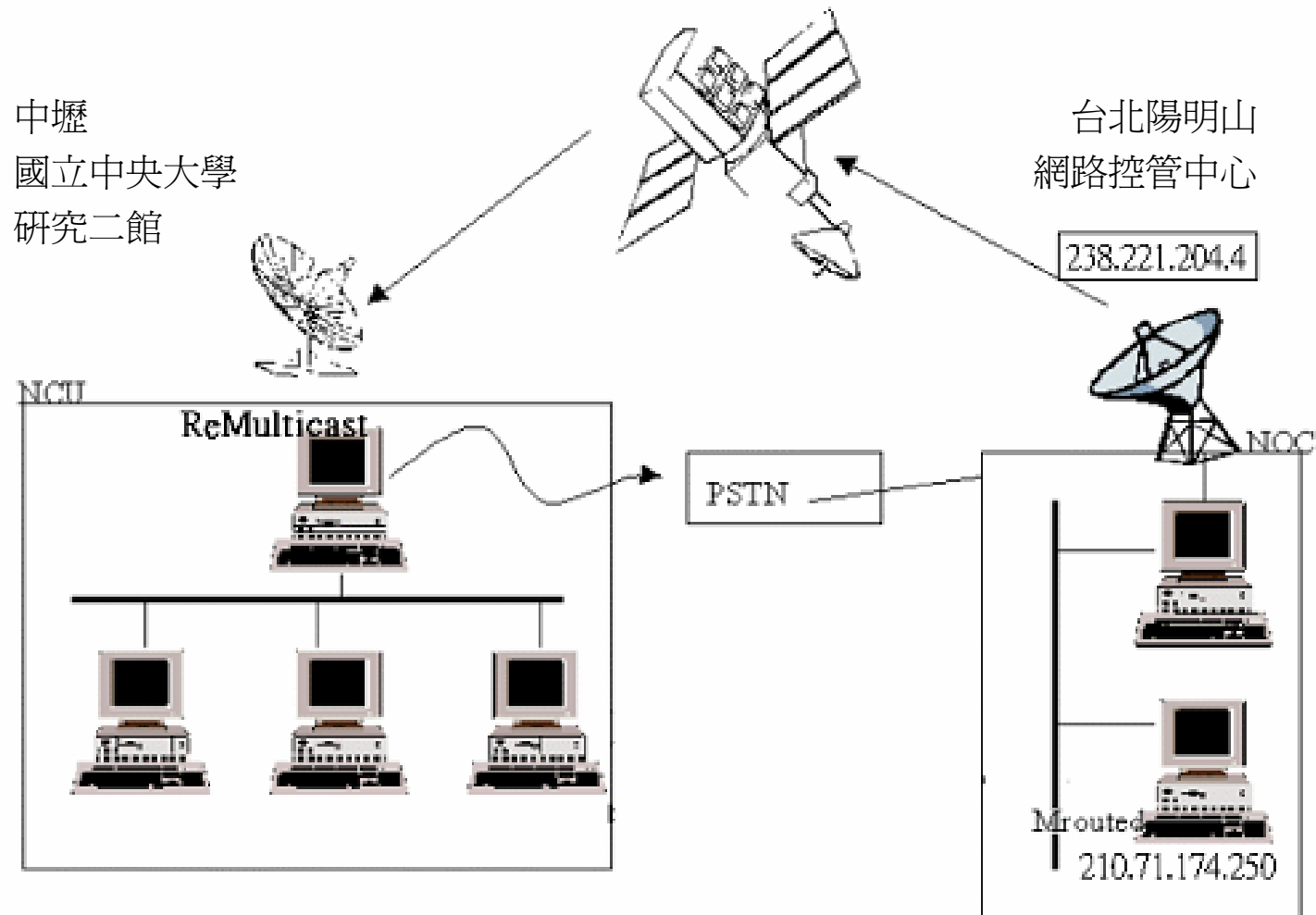




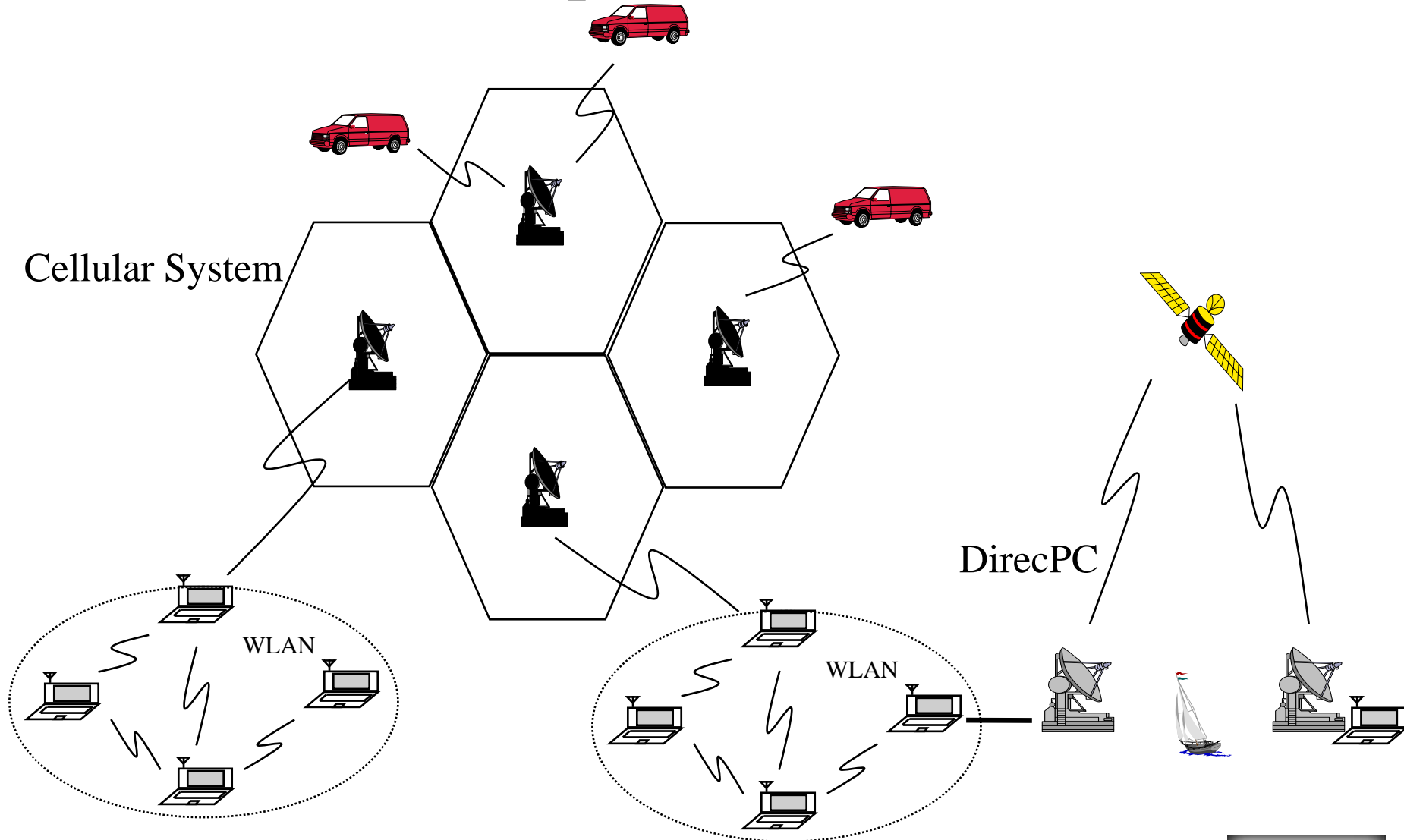
Sky of Satellites



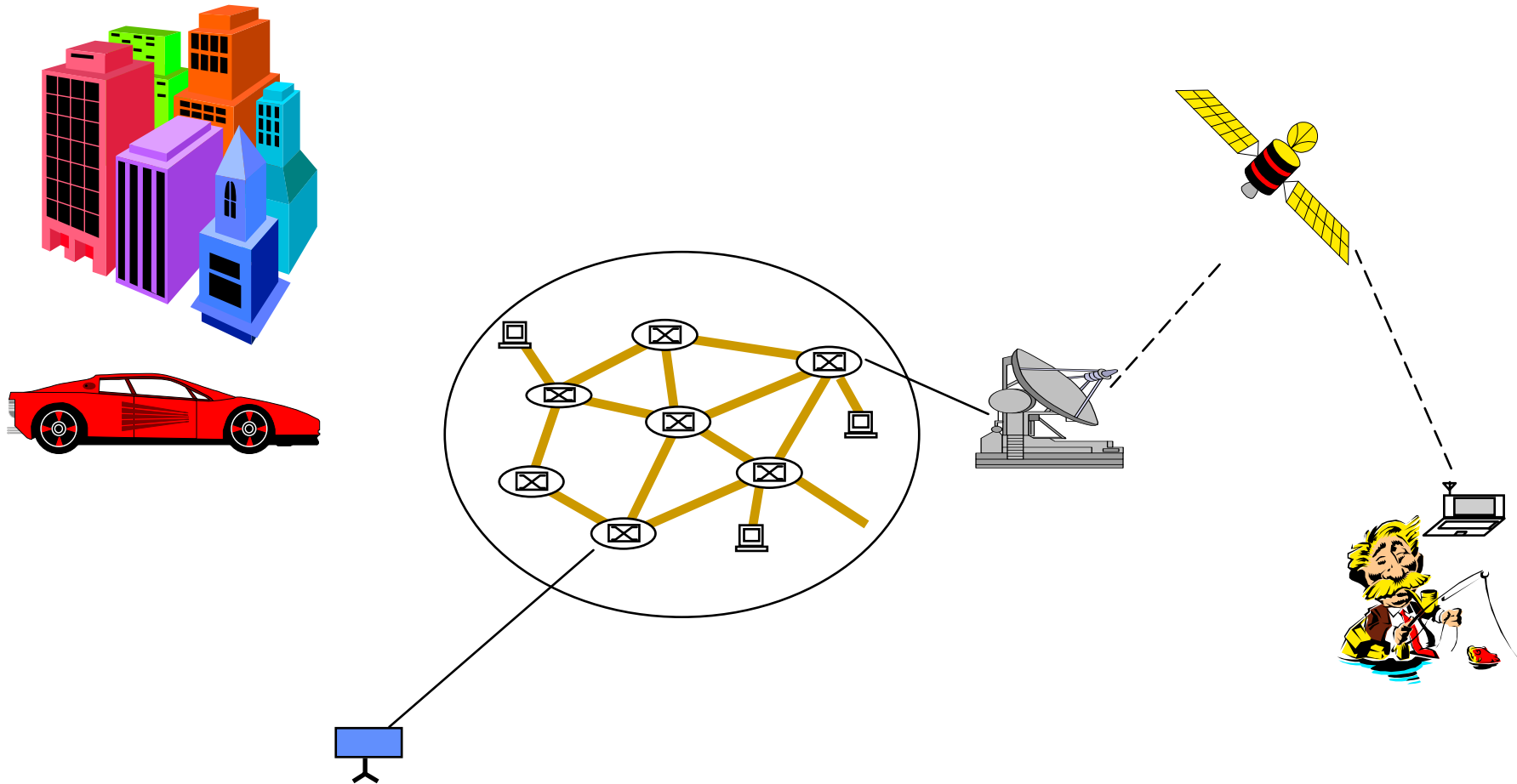
DirecPC Satellite Experiments



Ubiquitous Access



“Anytime Anywhere ” Information System



Fundamental Issues

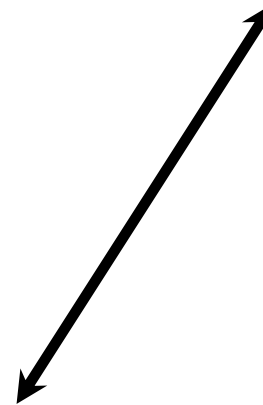
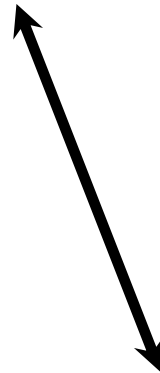


Three System Components

End-Point
Terminal Architecture



Infrastructure
Network architecture

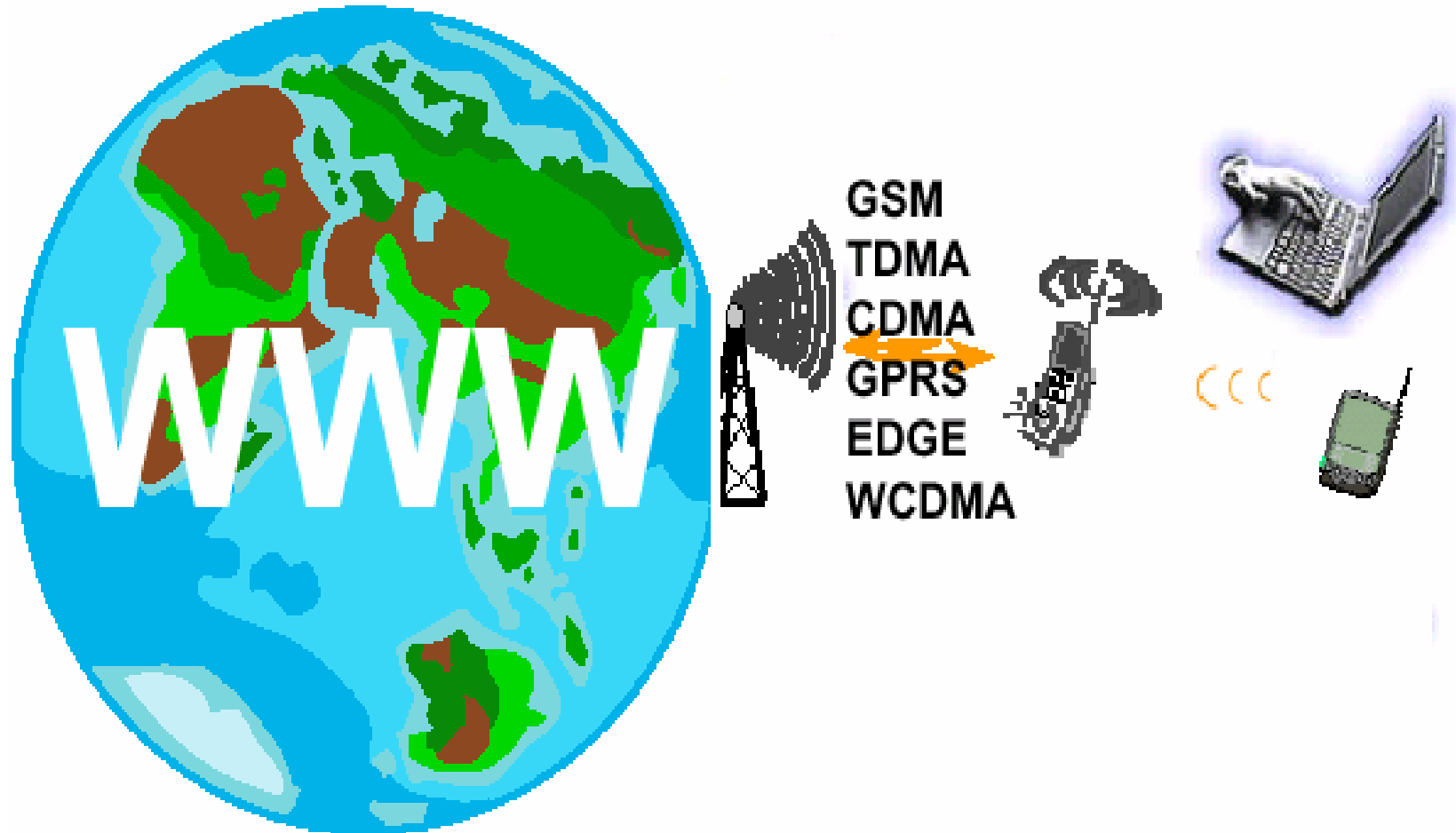


Services
OS & Middleware

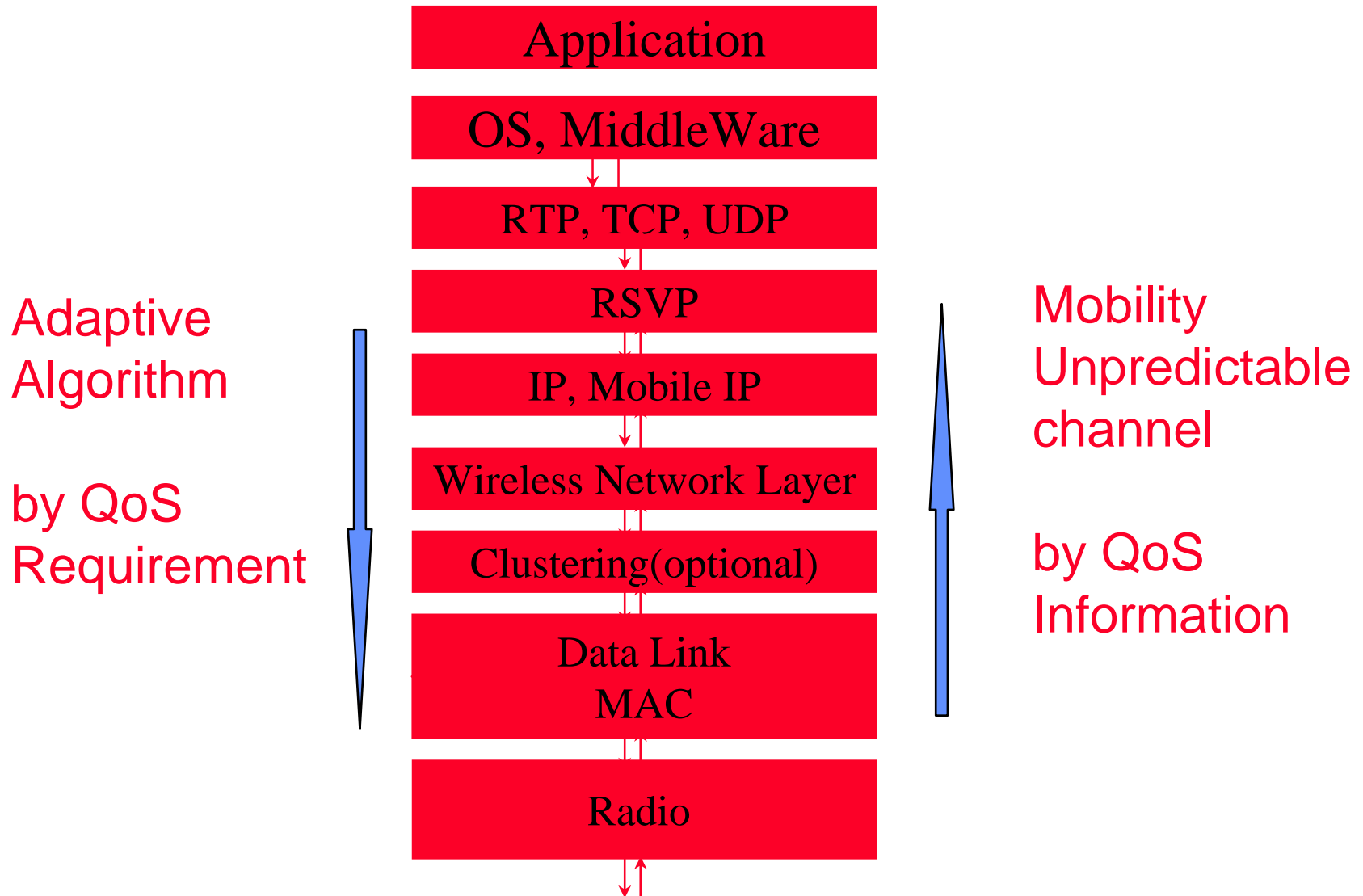
Personal area network



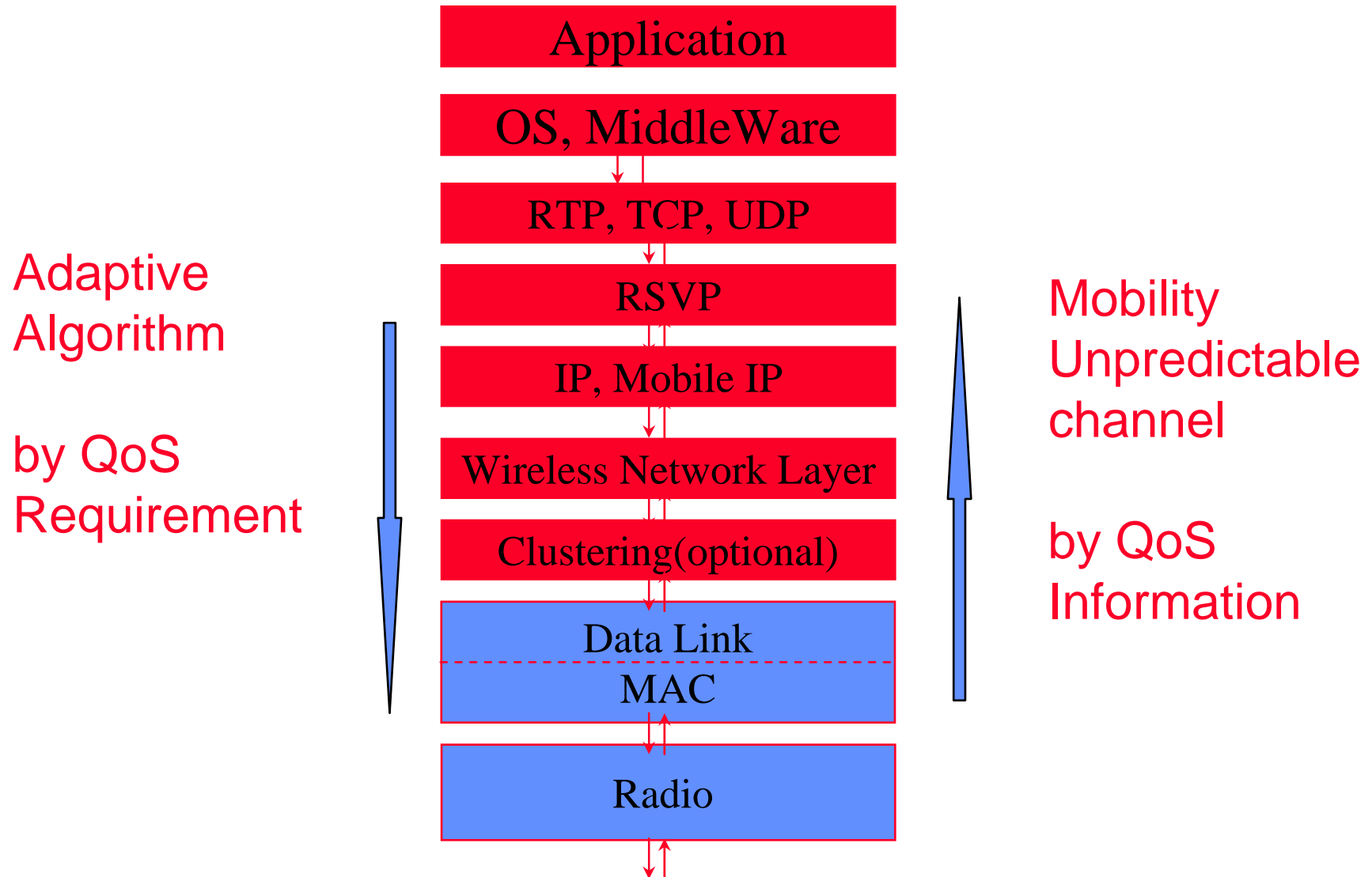
Connect devices to internet on the mobile infrastructure world wide



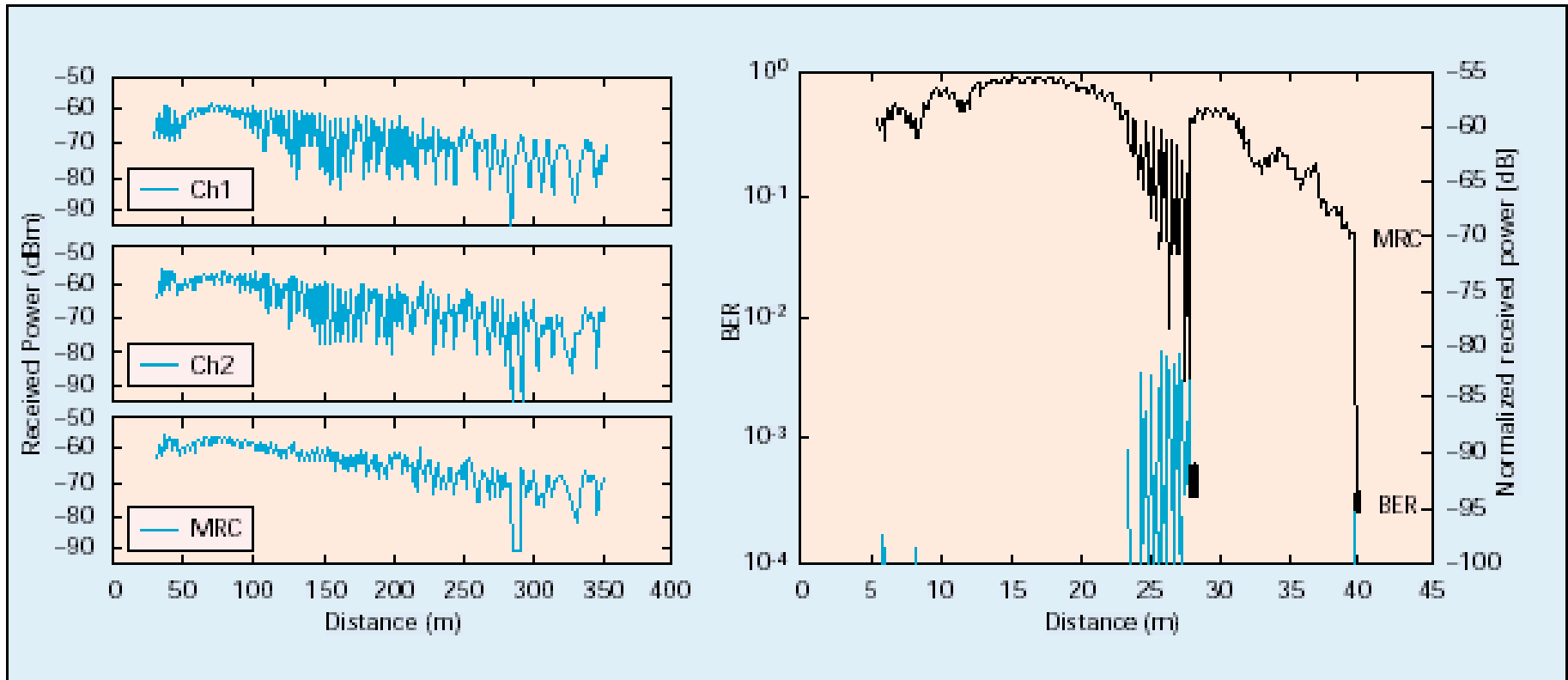
QoS and Multimedia Traffic Support



QoS and Multimedia Traffic Support

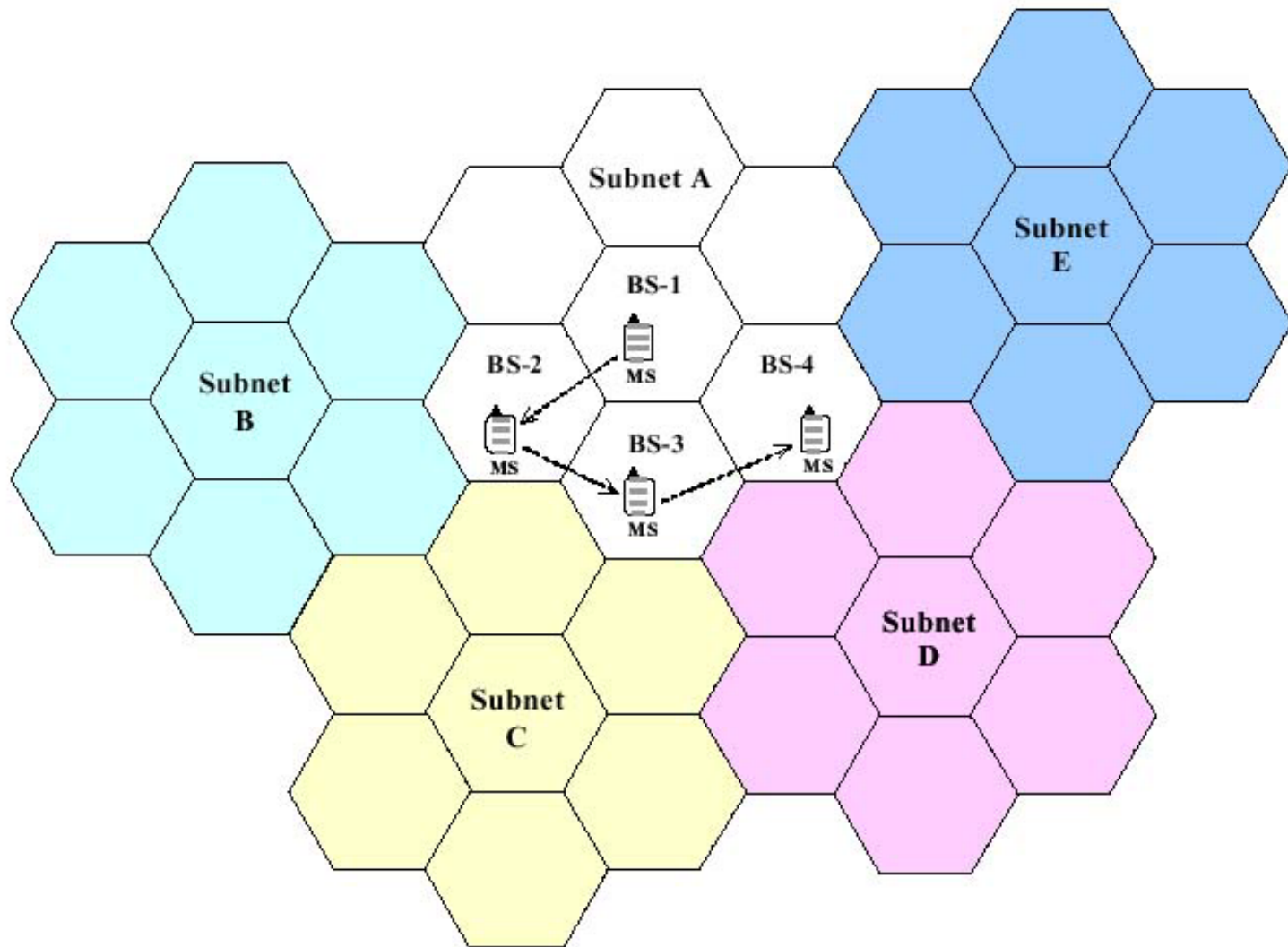


Channel Propagation and Fading



■ Figure 4. Received power as a function of distance: in a street (left), in a pavilion (right); BER and handover (right).

Intra-Domain Handoff

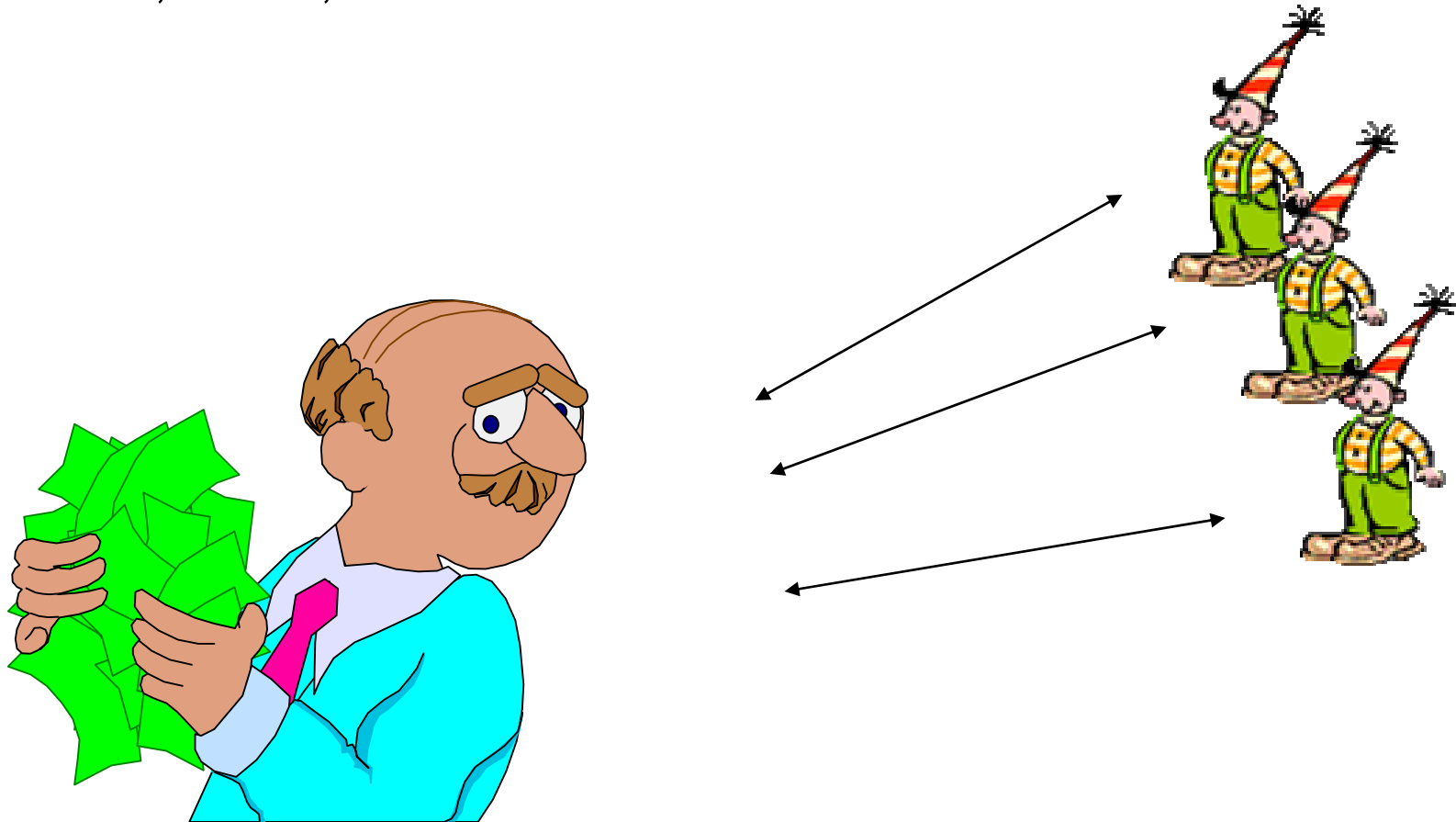


Resource Sharing

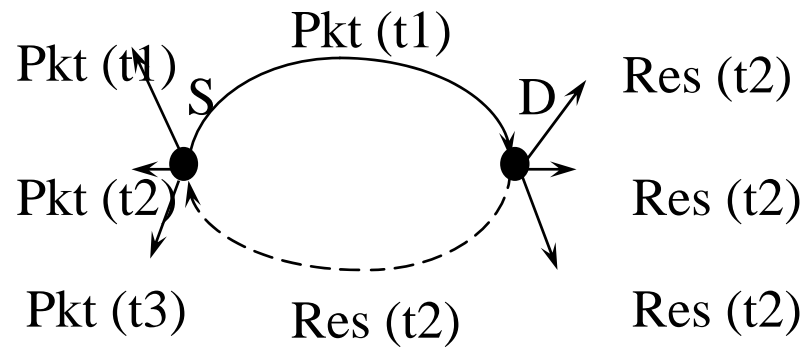
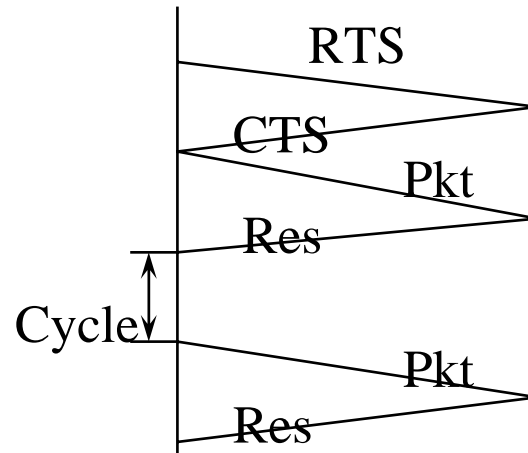
- ◆ Reservation Approaches
 - Centralized Control
 - token (round robin)
- ◆ Collision Approaches
 - fight for resource
 - distributed control

Through A Centralized Control

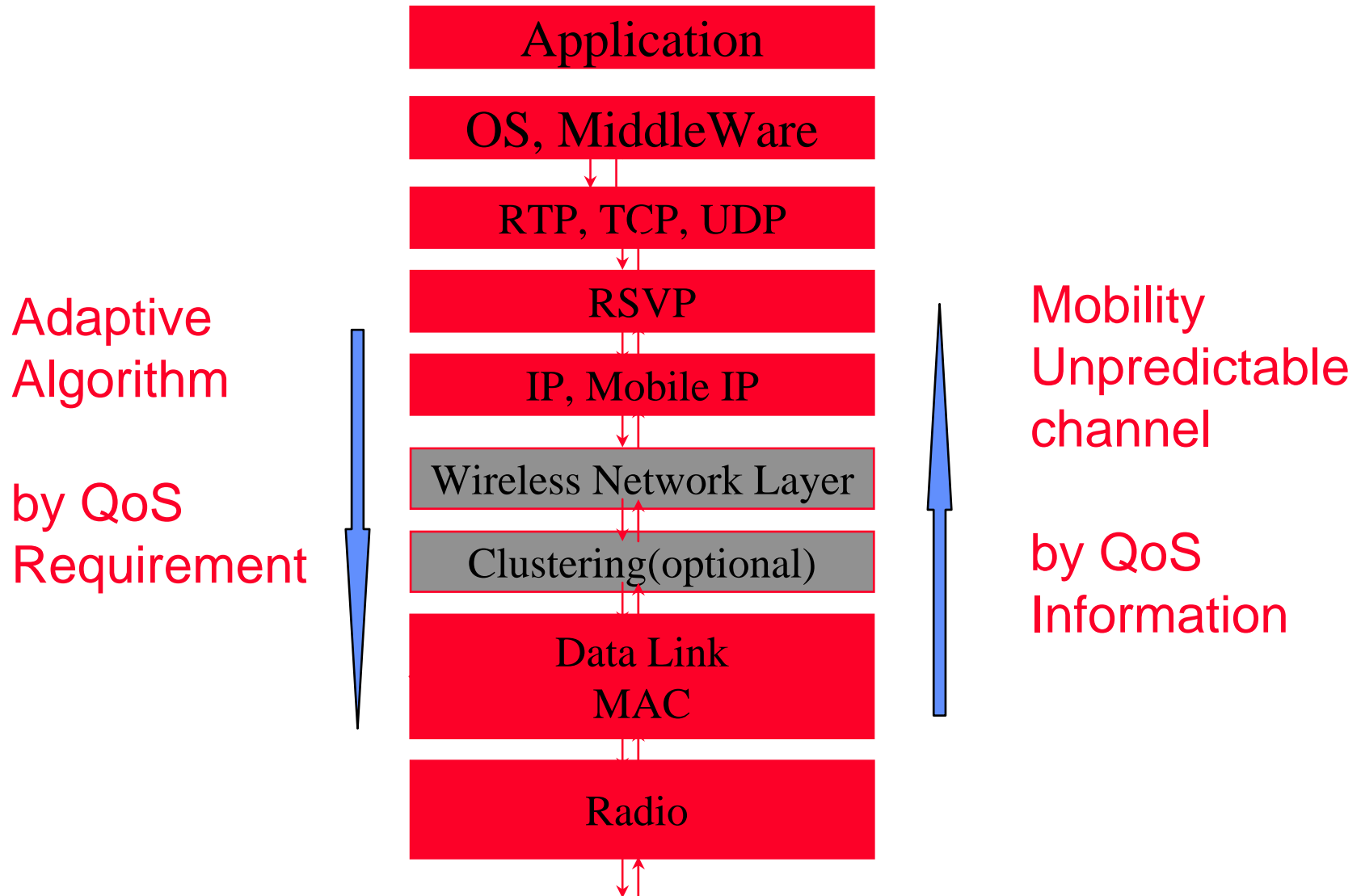
- ◆ TDMA, FDMA, CDMA



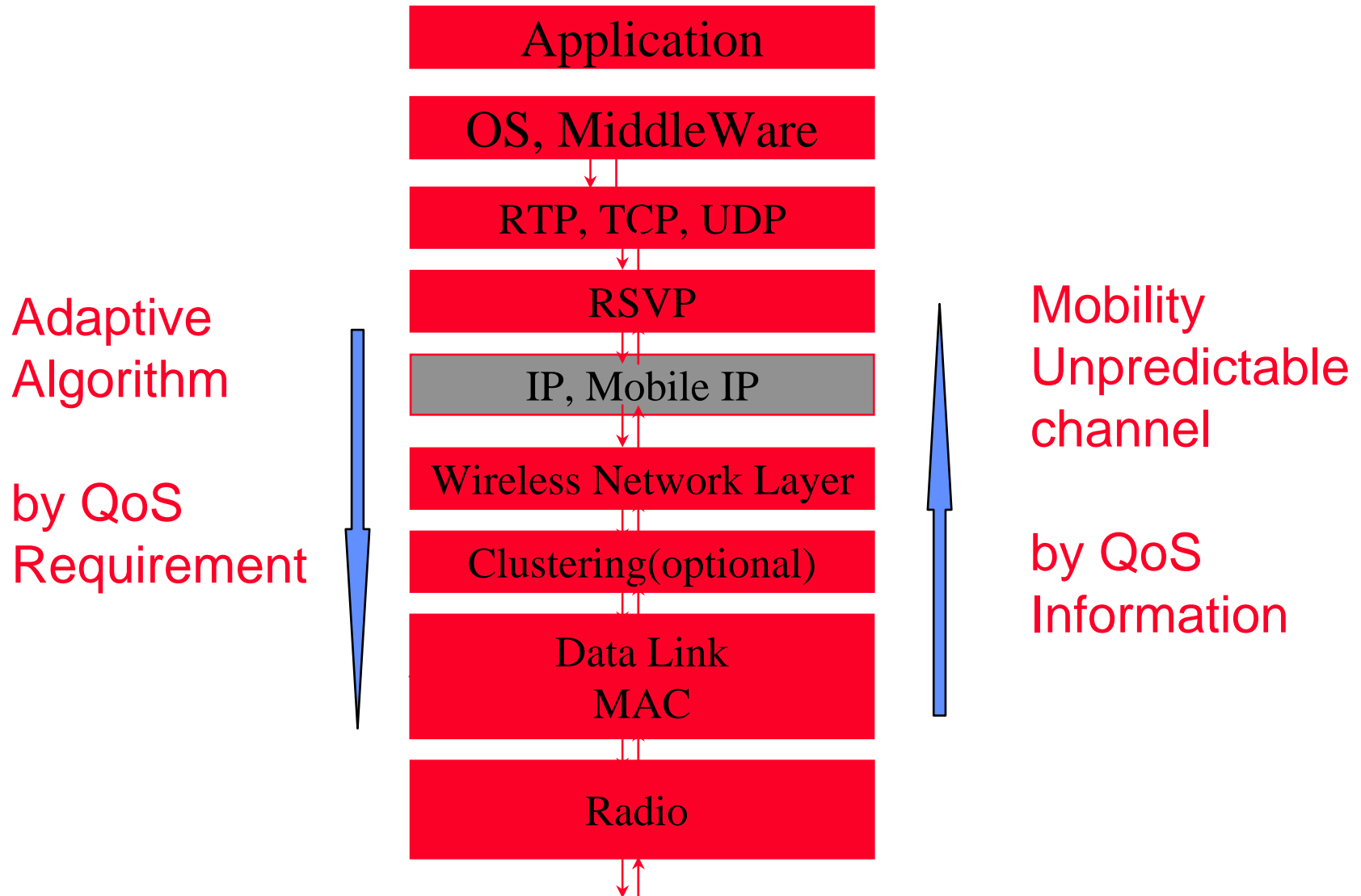
MACA/PR



QoS and Multimedia Traffic Support



QoS and Multimedia Traffic Support

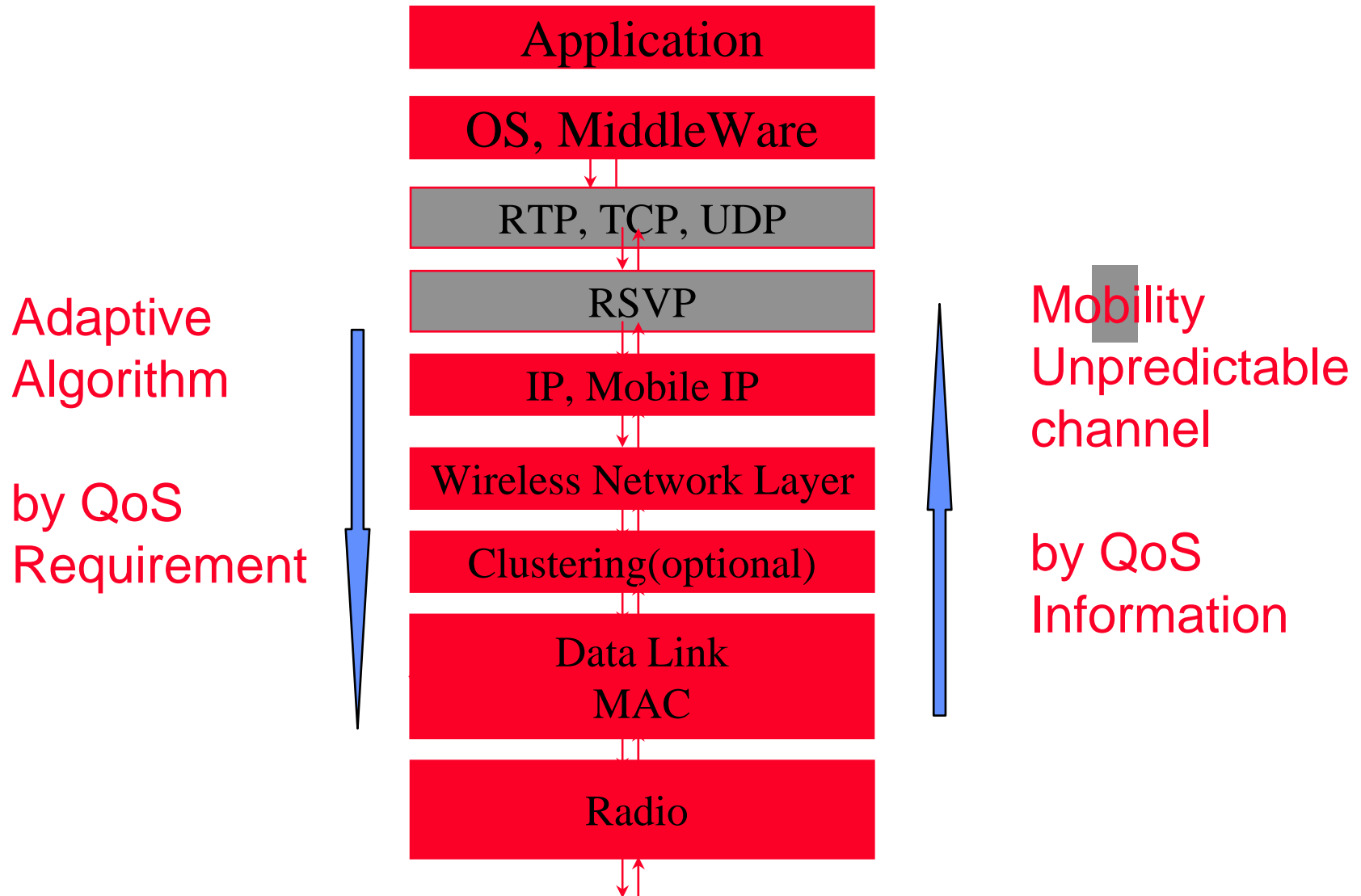


Internetworking, IP, Mobile

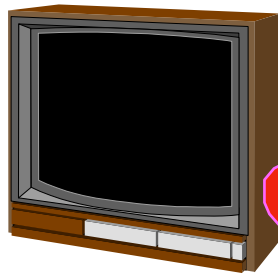
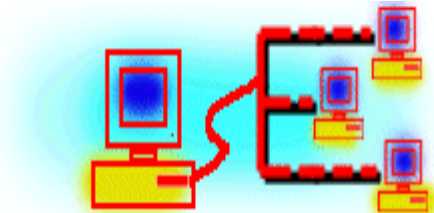
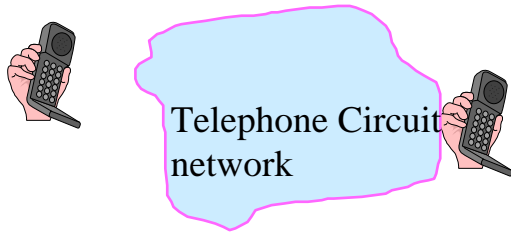
- ◆ Internetworking
 - roaming through different networks
 - supporting IP format
 - supporting IP portability



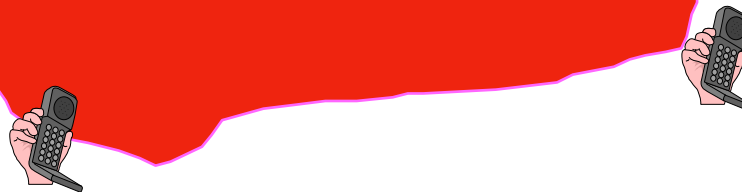
QoS and Multimedia Traffic Support



What problem does Multimedia Bring?



Integrated Service
Packet Network



Emerging technologies:

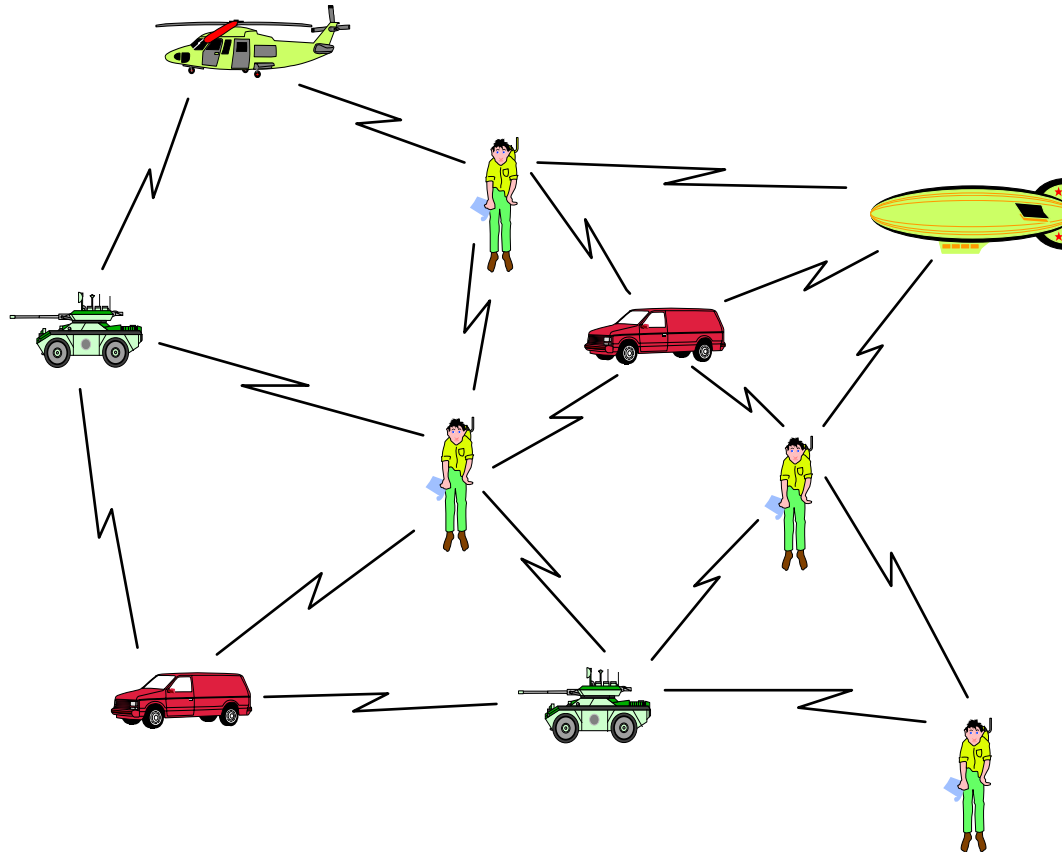
1. "Datagrams" + "Flows" IPv6
2. "Virtual Circuits" (ATM)

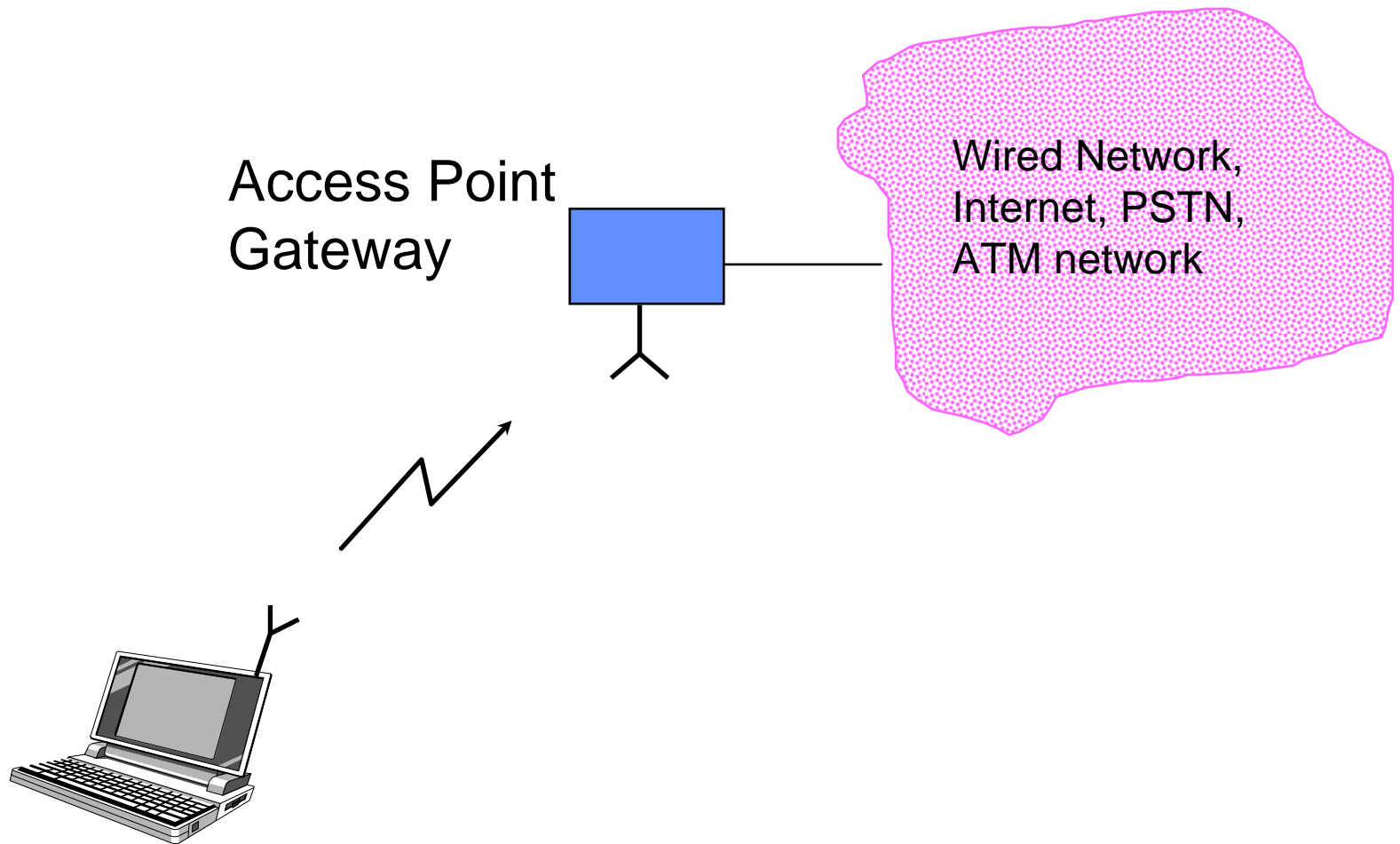
5

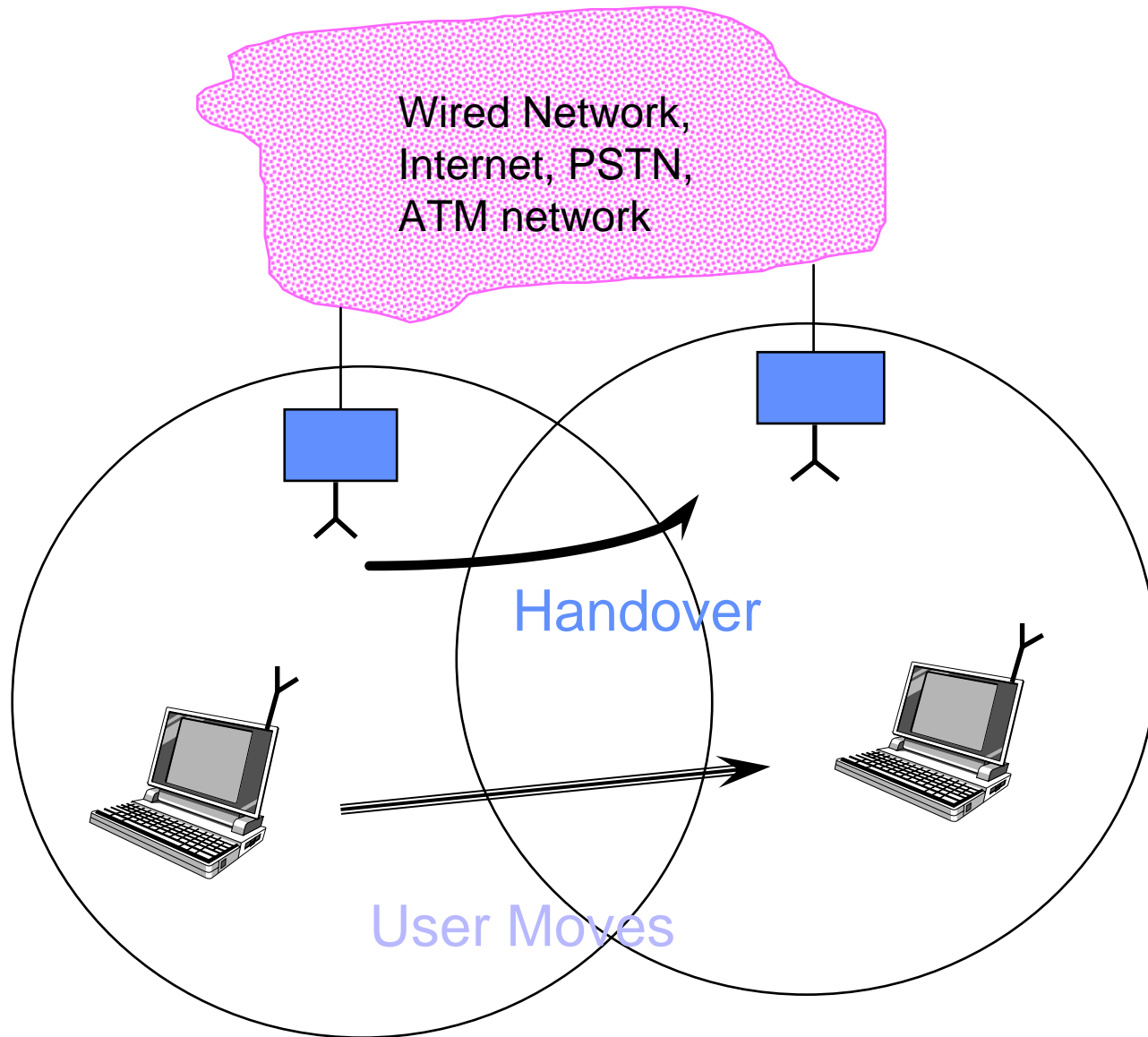
System Configurations

- ◆ Ad hoc ~ Multi-hop
 - Wireless LAN
 - Blue-tooth
 - Packet Radio
 - WAMIS
- ◆ Cellular ~ GSM, WAP, GPRS, 3G
- ◆ Satellite ~ LEO, GEO

Ad Hoc Wireless Network







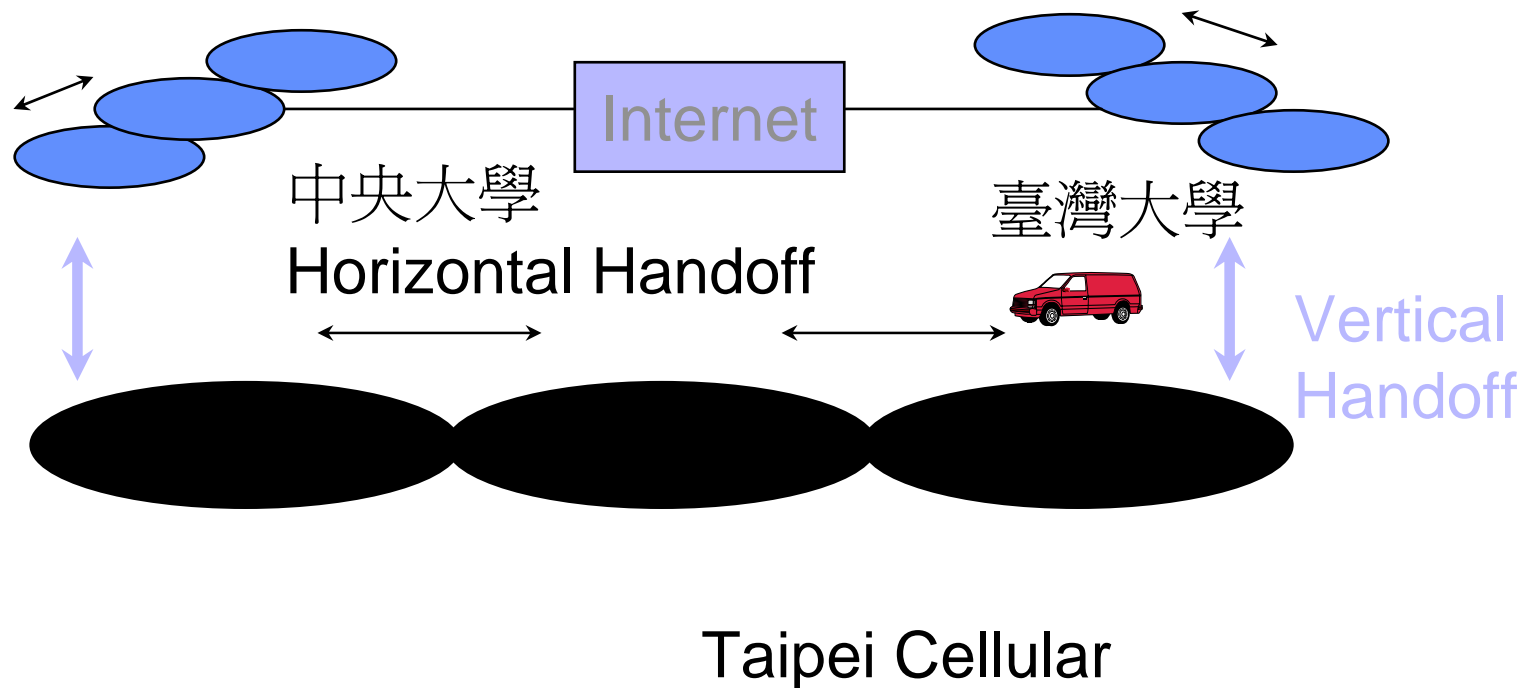
Typical Cellular Call

- ◆ Initialization (find your base-station)
- ◆ Service Request
 - Location Level : Paging
 - Channel Assignments
- ◆ Handoff



Wireless Comm: Heterogeneity & Security

- ◆ Heterogeneous networks



Limited & Variable Bandwidth

- ◆ Low bandwidth compared to wired
- ◆ Highly variable bandwidth
- ◆ High latency

Wireless Communication

- ◆ More difficult than wired communication
- ◆ Dis-connections

Mobility

- ◆ Address migration
- ◆ Location-dependent information
- ◆ Migration locality

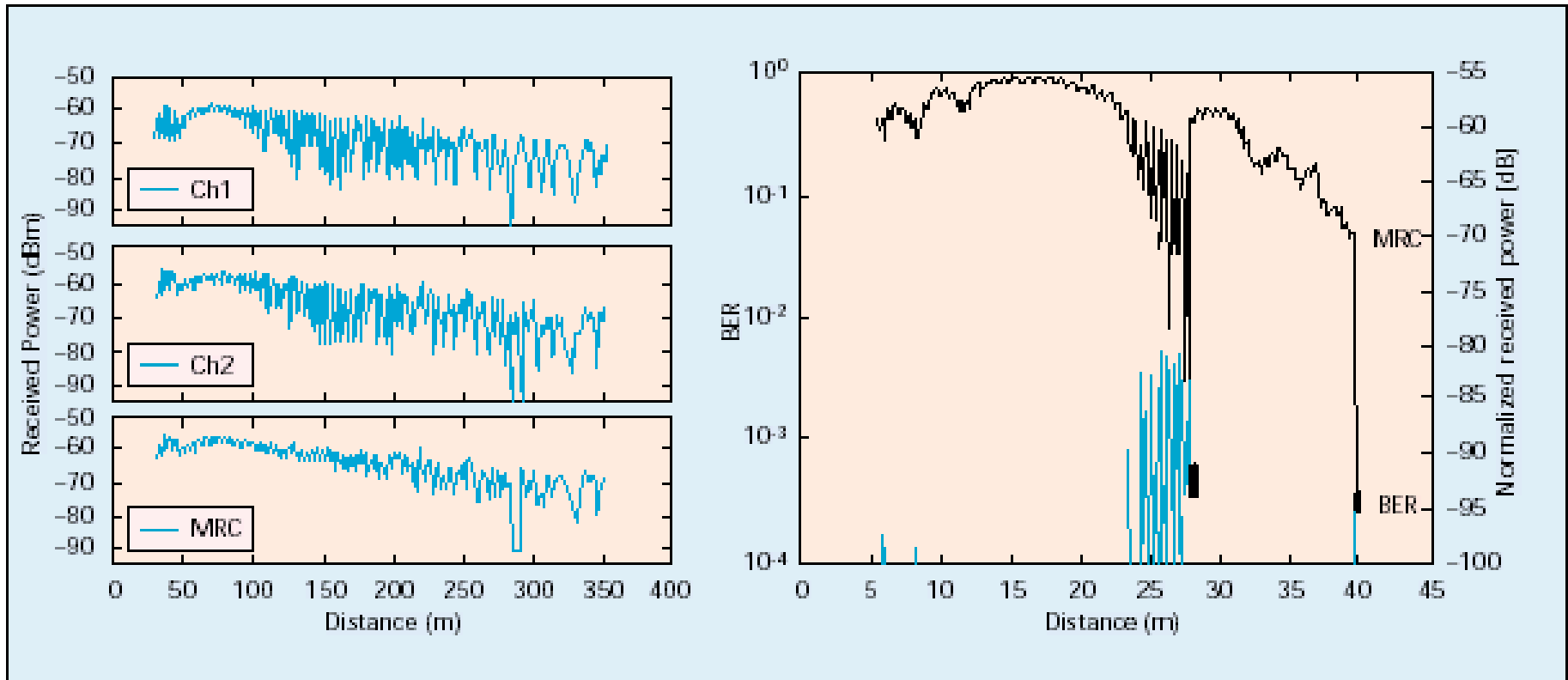
Portability

- ◆ Light weight power
- ◆ Risks to data
- ◆ Small user interface
- ◆ Small storage capacity

Challenges in Mobile Multimedia Infor-System

- ◆ Portable end-points
- ◆ End-to-end Quality of Services
- ◆ Seamless operation under context (location) changes
- ◆ Context-aware operation
- ◆ Secure operation

Channel Propagation and Fading



■ Figure 4. Received power as a function of distance: in a street (left), in a pavilion (right); BER and handover (right).