QoS Multimedia Applications in Satellite Systems

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QoS for Multimedia Applications in Satellite Systems

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Outline of the Class

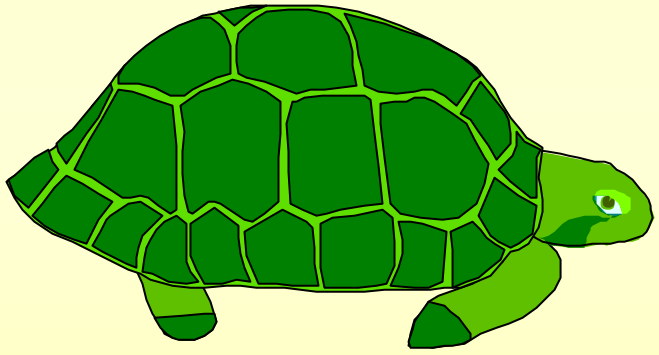
- QoS and Broadband Multimedia Service
- Satellite System
- Satellite Research
- NCU Satellite Research

Mobile phone today = multipurpose terminal for Value Added Service

Academic Research

Broadband Bottleneck?

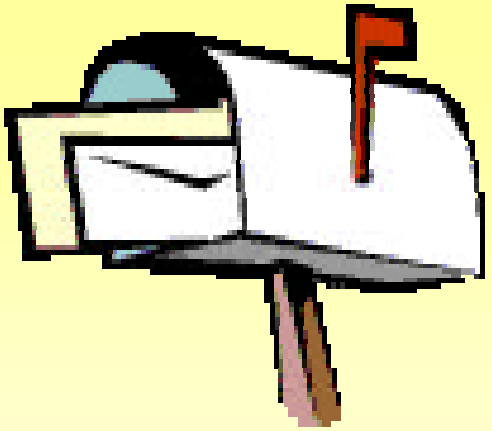
- Last Hop Transmission
  - How does the system provider provide the last hop broadband solution?
- Multi-hop Transmission
  - How does the network server provide the “constant bandwidth” to your end users
  - end to end QoS



Multicasting is a problem?

- Video Conference oriented Service
  - Many to Many
  - One to Many, Video on demand?
  - Synchronization Problem
  - traffic overloading in the internet
    - uni-casting tunneling
    - multihop tunneling

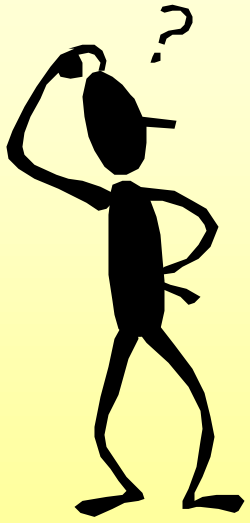
Intelligent Proxy



- Proxy
  - Satellite Receiver worked as the information providers
- Cache/Push
  - NOC work as the information Source to periodically push the data to Satellite receivers

Routing, Asymmetric Transmission

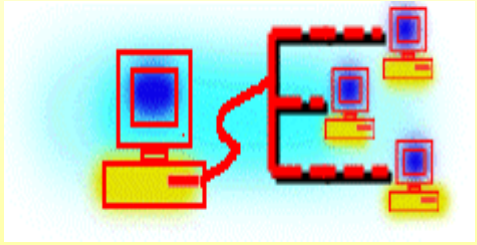
- How to deliver the information to end users according to user specification
- Applications over multi-level connections
  - Asymmetric Transmission
  - Transmission Options
  - Integrated Network



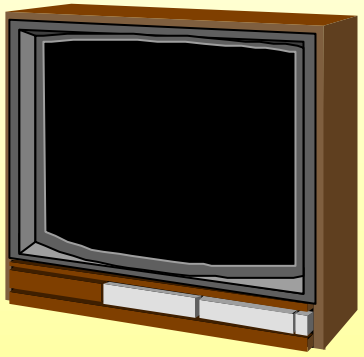
Multimedia Requirements

- ☑不同服務或不同使用者的排程優先權、頻寬分配等等問題
- ☑行事曆的決定

VOICE

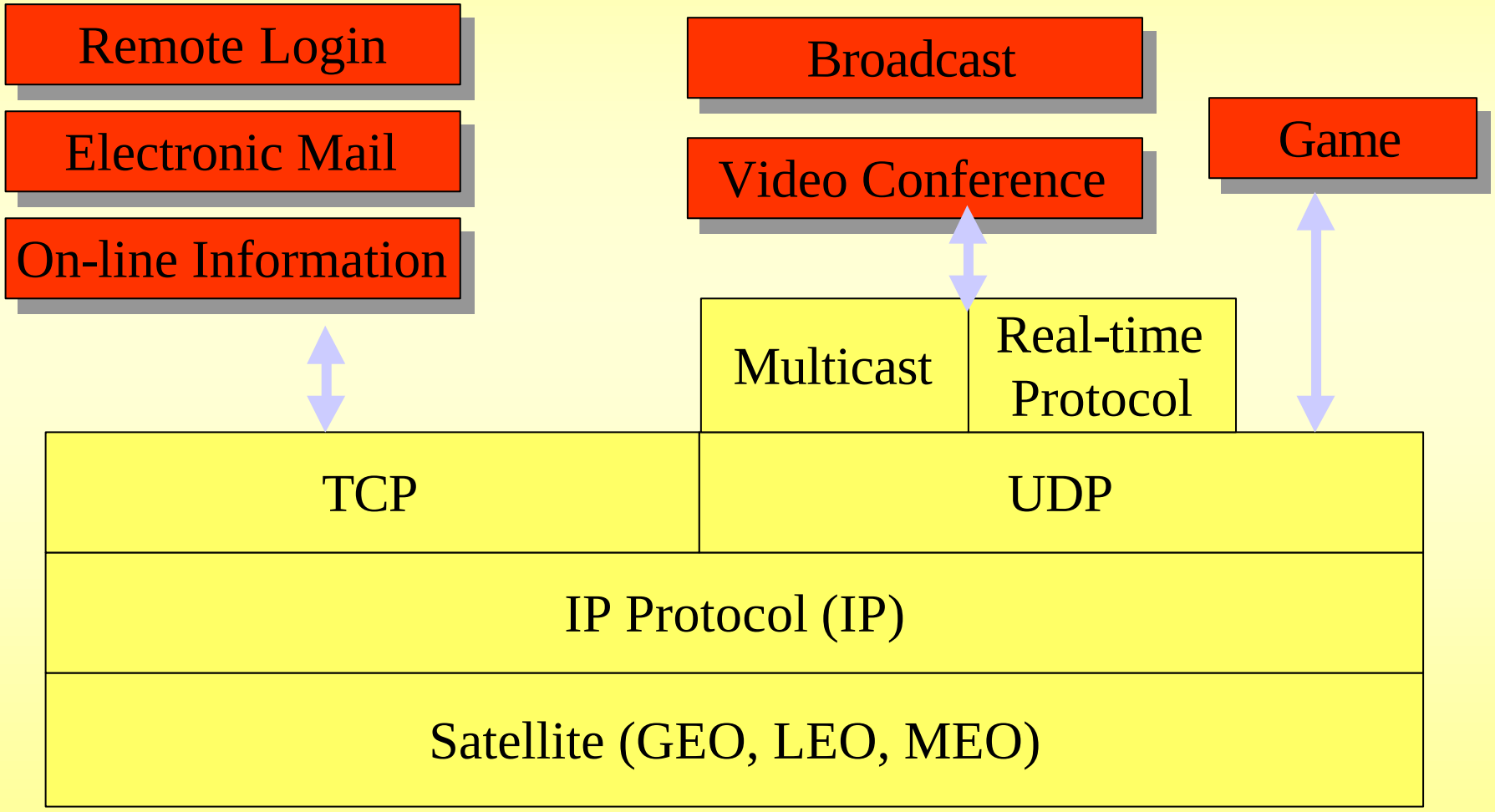


DATA

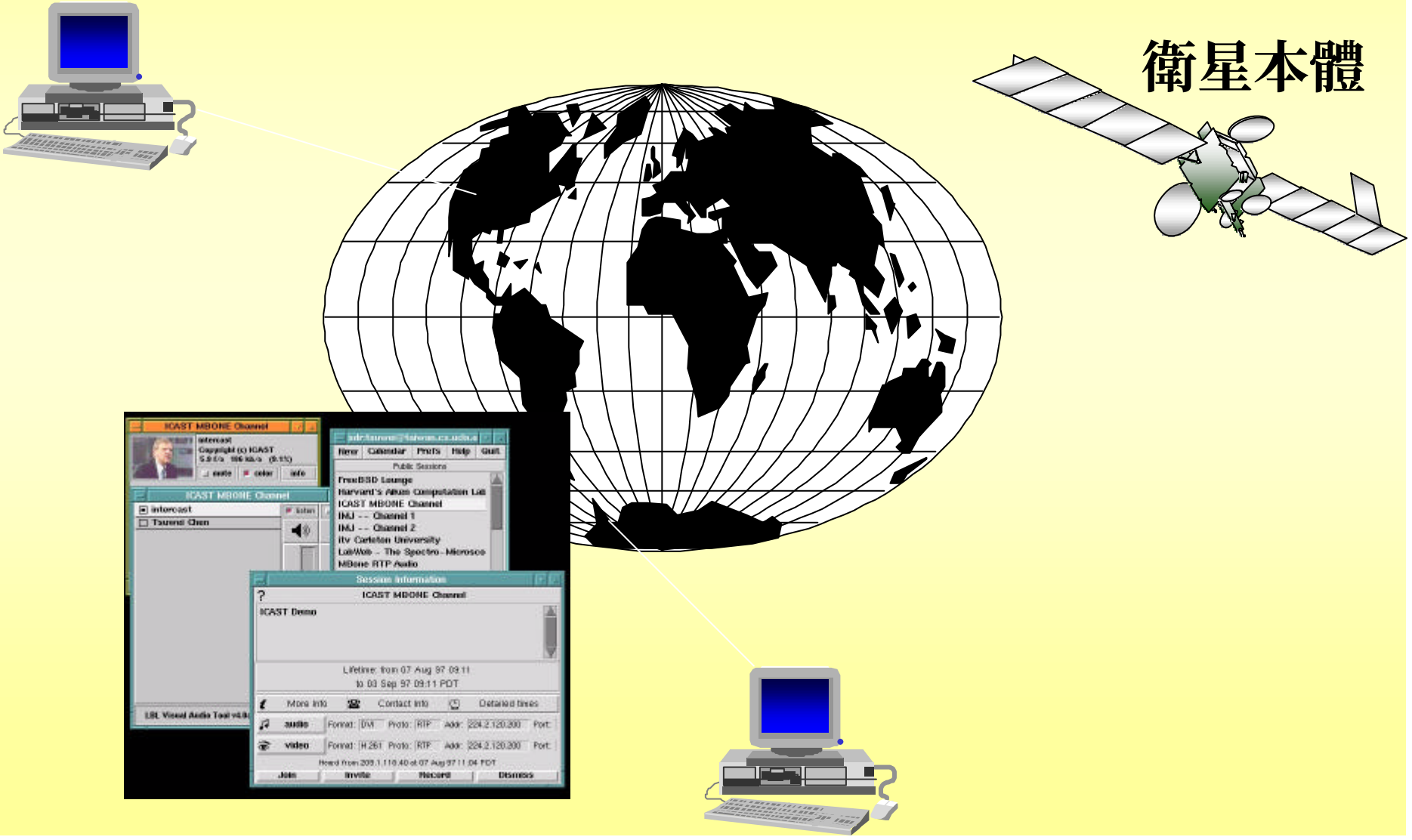


VIDEO

系統架構圖


Remote Login
Electronic Mail
On-line Information
Broadcast
Video Conference
Game
Multicast
Real-time Protocol
TCP
UDP
IP Protocol (IP)
Satellite (GEO, LEO, MEO)

地球村的建立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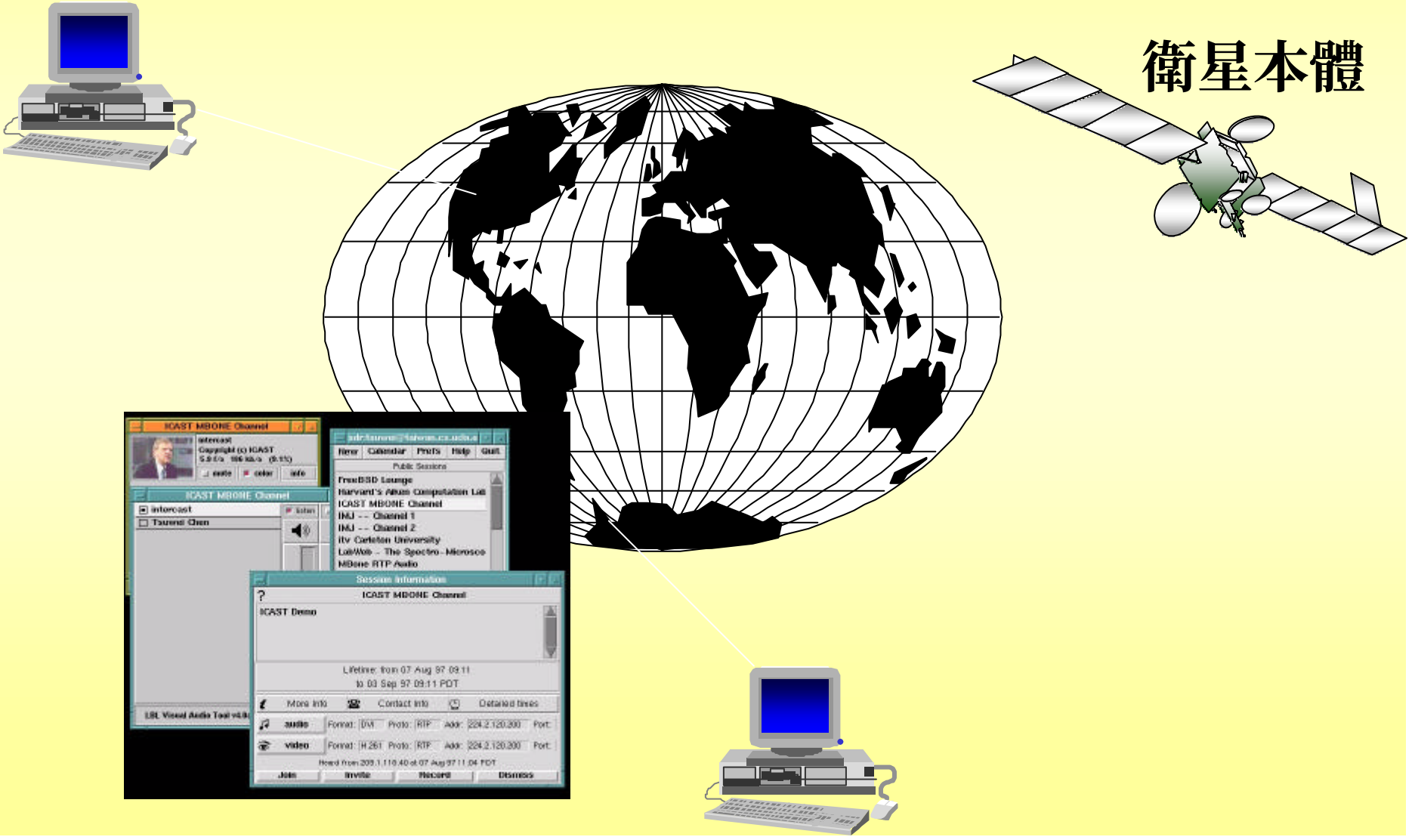
ICAST MBONE Channel
intercast
Tsuenl Chen
Session Information
ICAST MBONE Channel
ICAST Demo
Lifetime: from 07 Aug 97 09:11
to 03 Sep 97 09:11 PDT
More Info
Contact Info
Detailed times
audio
video
Join
Invite
Record
Dismiss

未來趨勢：結合Internet

- **日本：**AI3**計畫**
  WWW Cache+Pre-fetching
- **美國：**ACTS**計畫**
  結合ATM
- **歐州** : EuroSkyWay**計畫**

地球村的建立



無遠弗屆的衛星網際網路技術研究

Internet Growth

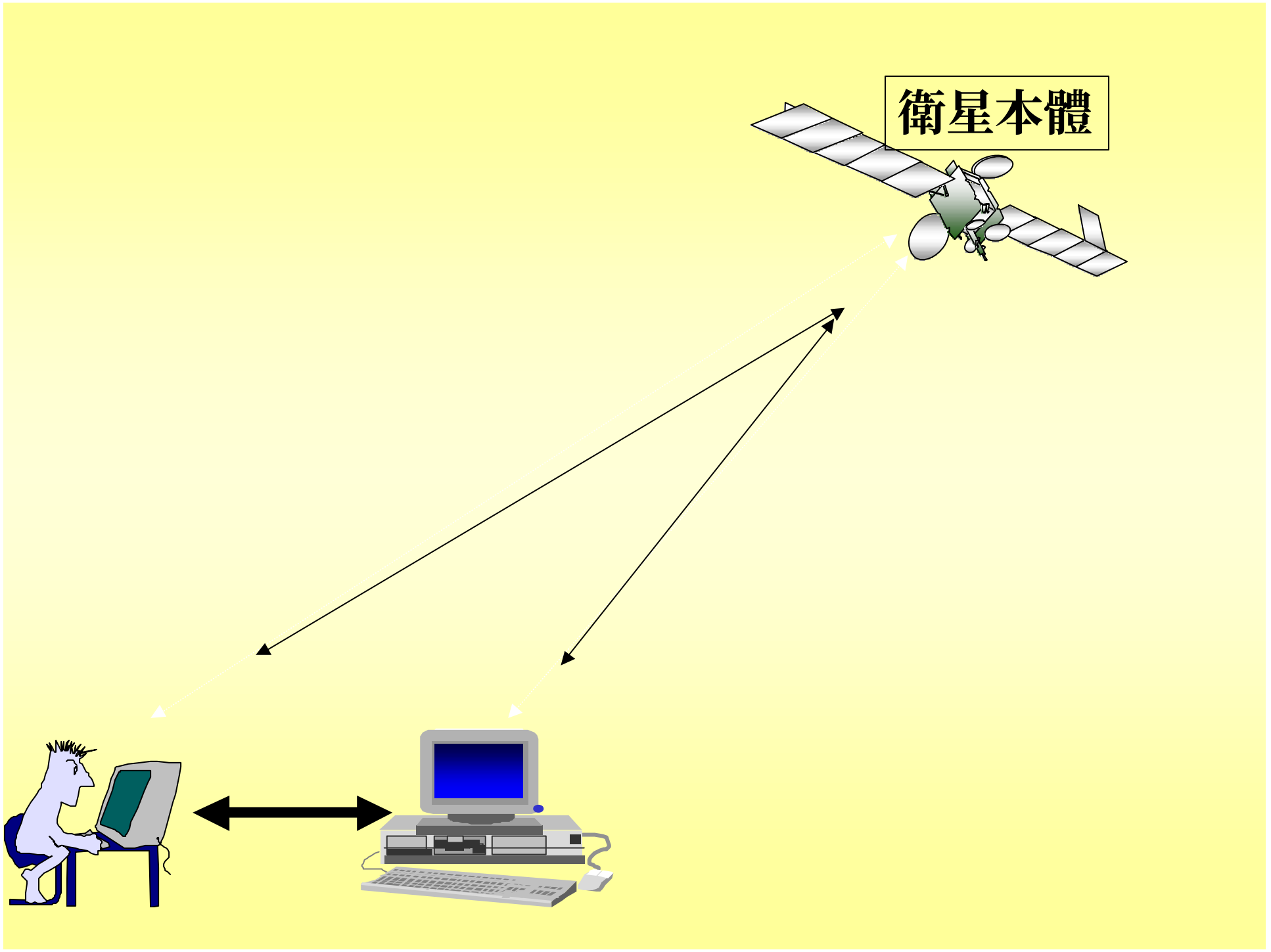
- Internet Usage
  - from research, education , training
  - to product promotion, advertisement, electronic commerce
    - monitoring acid rain, air pollution in south asia

Satellite

- Next Generation Internet
  - high bandwidth application (>45 Mbps)
  - ubiquitous computing with mobile/wireless networks
    - wireless LAN, wireless ATM, wireless metropolitan network, satellite network
    - Satellite offer great potential for multimedia applications with their ability to broadcast and multicast large amounts of data

Merits of Satellite Networks

- High bandwidth
  - Ka-band (20-30 GHz) offer gigabits/s
- Inexpensive
  - no cable cost, cover a large area
- Untethered communication
  - mobile services
- Simple network topology
  - manageable (compared with mesh)
- Broadcast/multicast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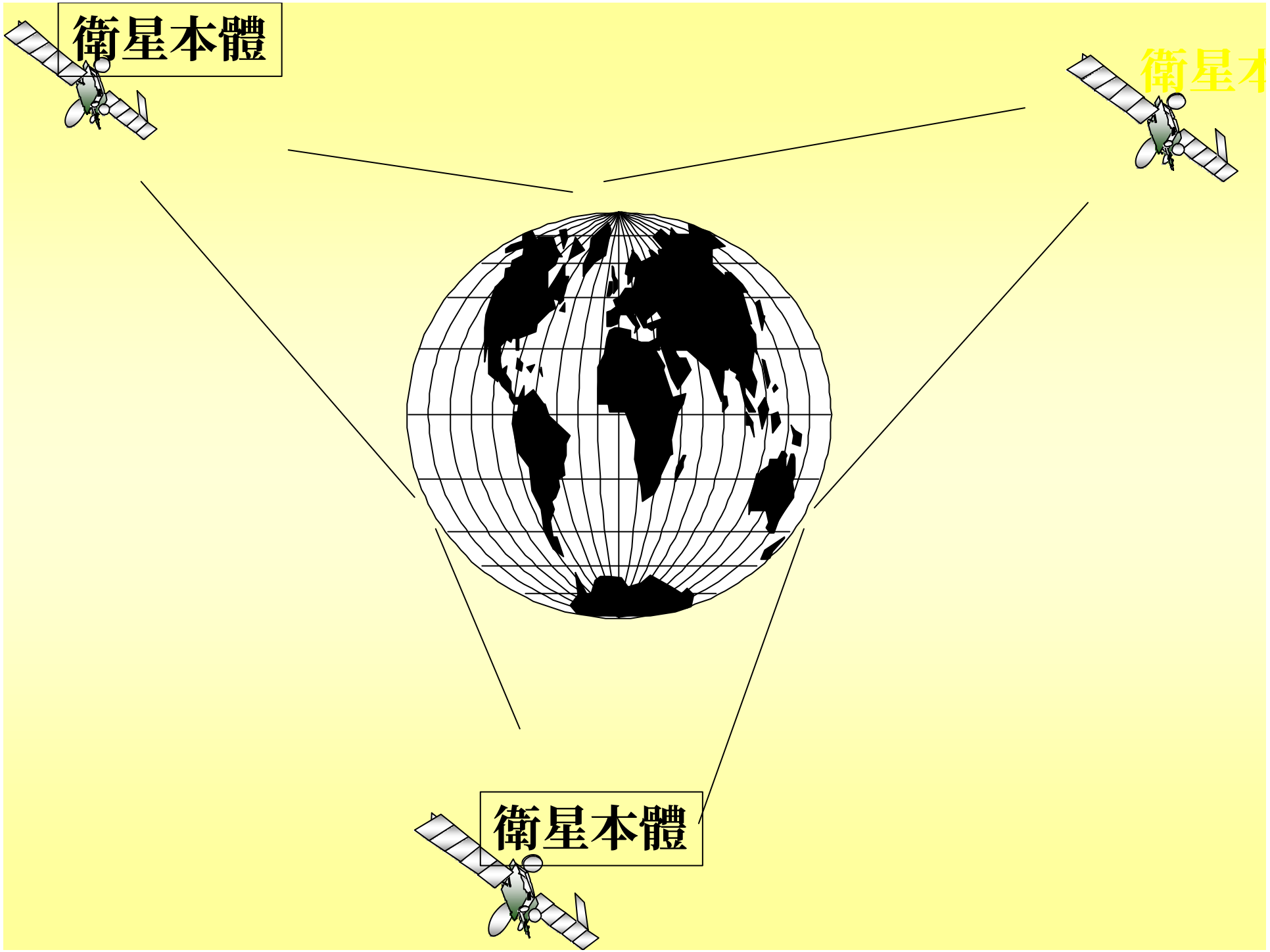
Challenge of Satellite Networks

- Communication Latency
  - GEO
  - 250 ms to 400 ms (framing, queuing, on-board switching)
  - 10 times higher than a point-to-point fiber optics connection
  - bulk data transfer, broadcast type is ok
  - interactive will get hurt
    - TCP requires such interaction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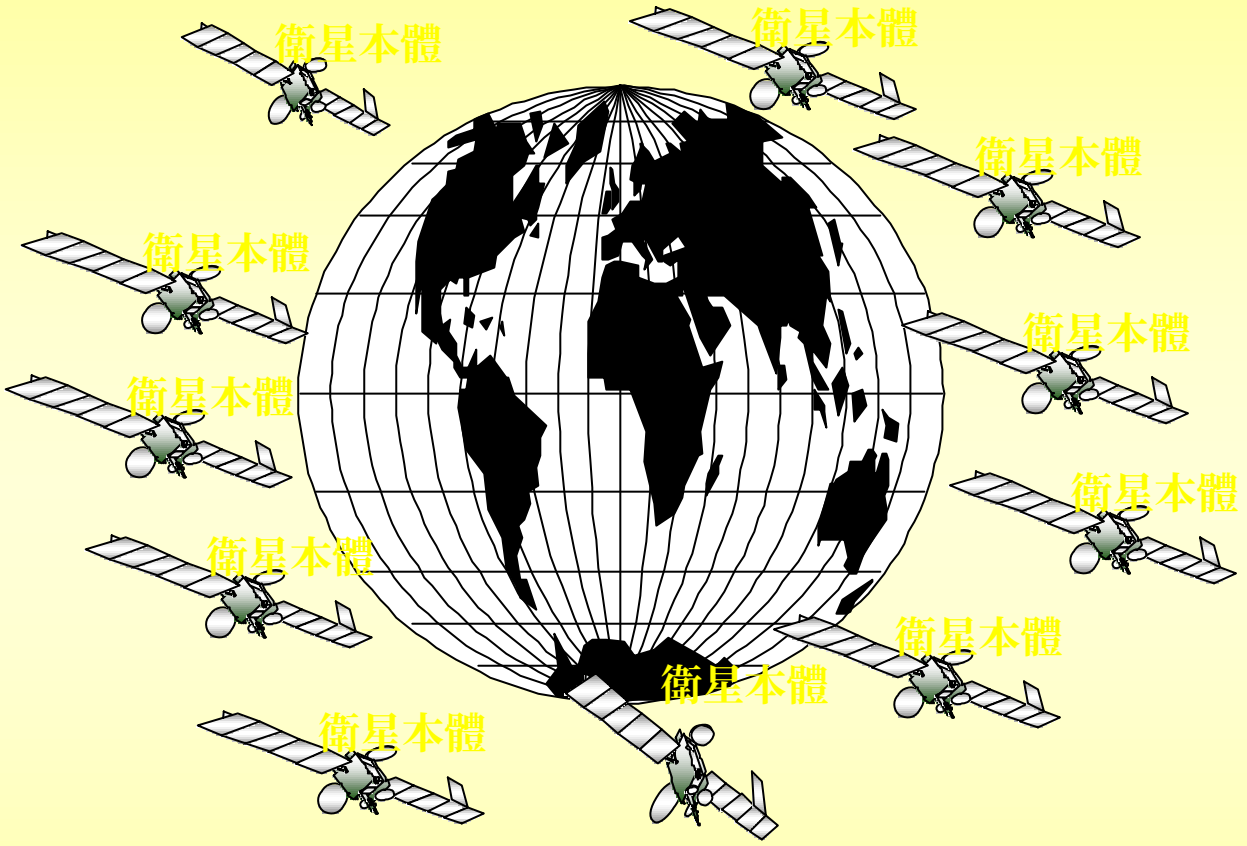
Sky of Satellites



LEO and MEO

- LEO (low earth orbit), MEO (medium earth orbit)
  - twice latency than wired (LEO)
  - introduce complexity due to movement of satellite
  - handoff, tracking and routing need to be done

Applications

- Remote control and login
  - compared with congested and chaotic terrestrial Internet, satellite networks provide slower but more stable (half-second to one second delay)
- Information dissemination and broadcast
  - will be expensive for point to point networks

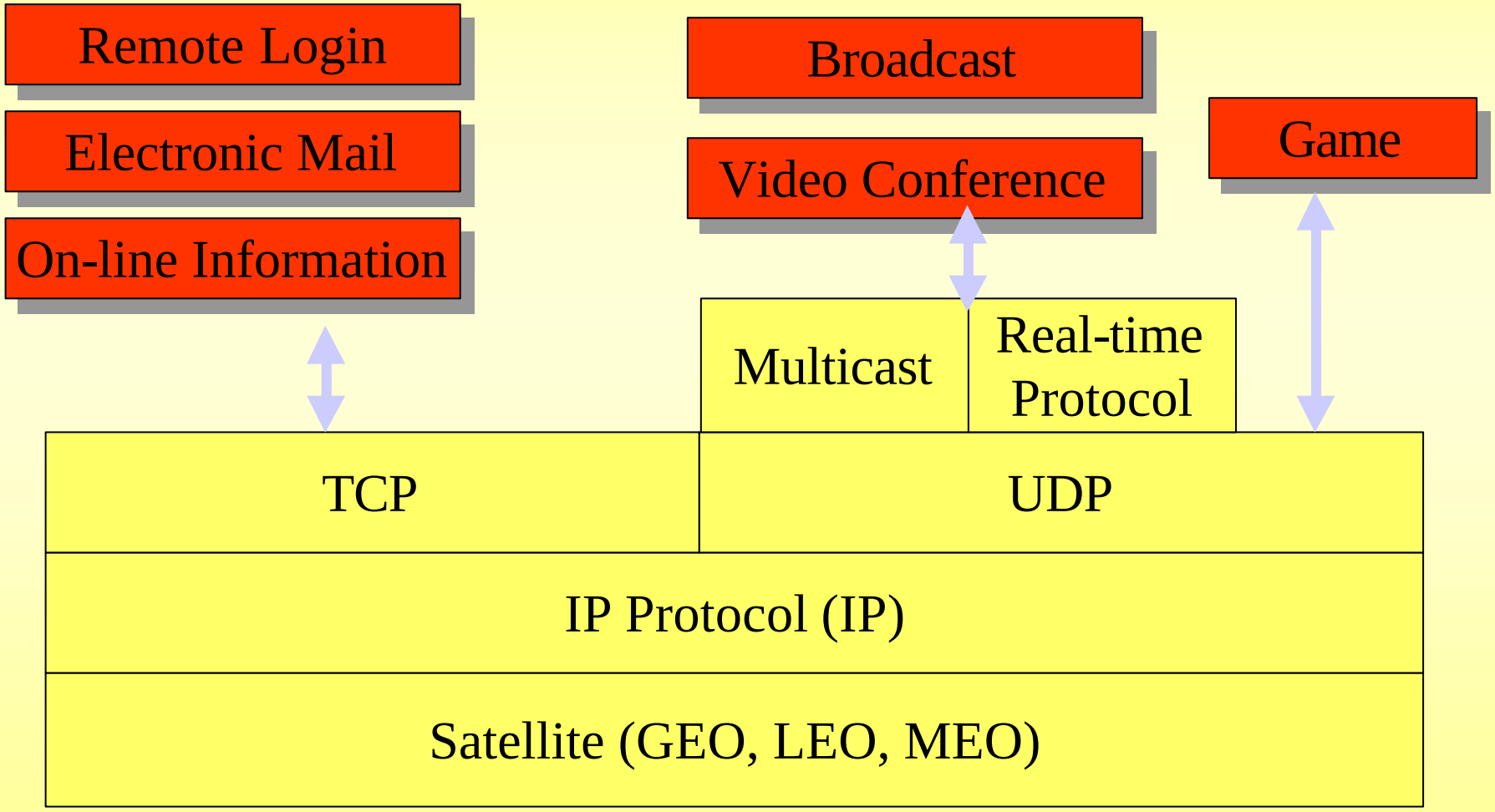
Applications

- Videoconferencing
  - requires no bi-directional synchronous (handshake), on top of UDP
- Electronic mail
  - work fine
- Information retrieved (WWW, FTP)
  - usually on top of TCP
  - requires acknowledge and retransmission

Application

- Interactive Gaming
  - requires instantaneous reaction time
  - chess may be ok
- Different applications vary substantially in demands on bandwidth and responsiveness

系統架構圖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TCP
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IP Protocol (IP)
Satellite (GEO, LEO, MEO)

TCP over long delay networks

- Window Size
- Bandwidth adaptation
- Selective acknowledgement
- Slow Start
- Congestion avoidance
- TCP for transactions

衛星網際網路技術的研究

- USA:
  - NASA support ACTS (Advanced Communication Technology Satellite)
  - NASA support Center for Satellite and Hybrid Communication Networks
    - University of Maryland at College Park
- Asia:
  - AIII (Asian Internet Interconnection Initiatives)

衛星網際網路技術的研究

- Asia:
  - AIII (Asian Internet Interconnection Initiatives)
  - Japan, Asian Multimedia Forum (AMF, 1997)
    - Asymmetrical Satellite Communication System (1998)
  - Japan, Sony Corporation Osaki West Technology

衛星網際網路技術的研究

- Europe
  - EuroSkyWay (Ka Band ATM Solution)
    - On board processing
    - Traffic and Resource Management
    - ATM classes
    - Admission Control

衛星網際網路技術的研究

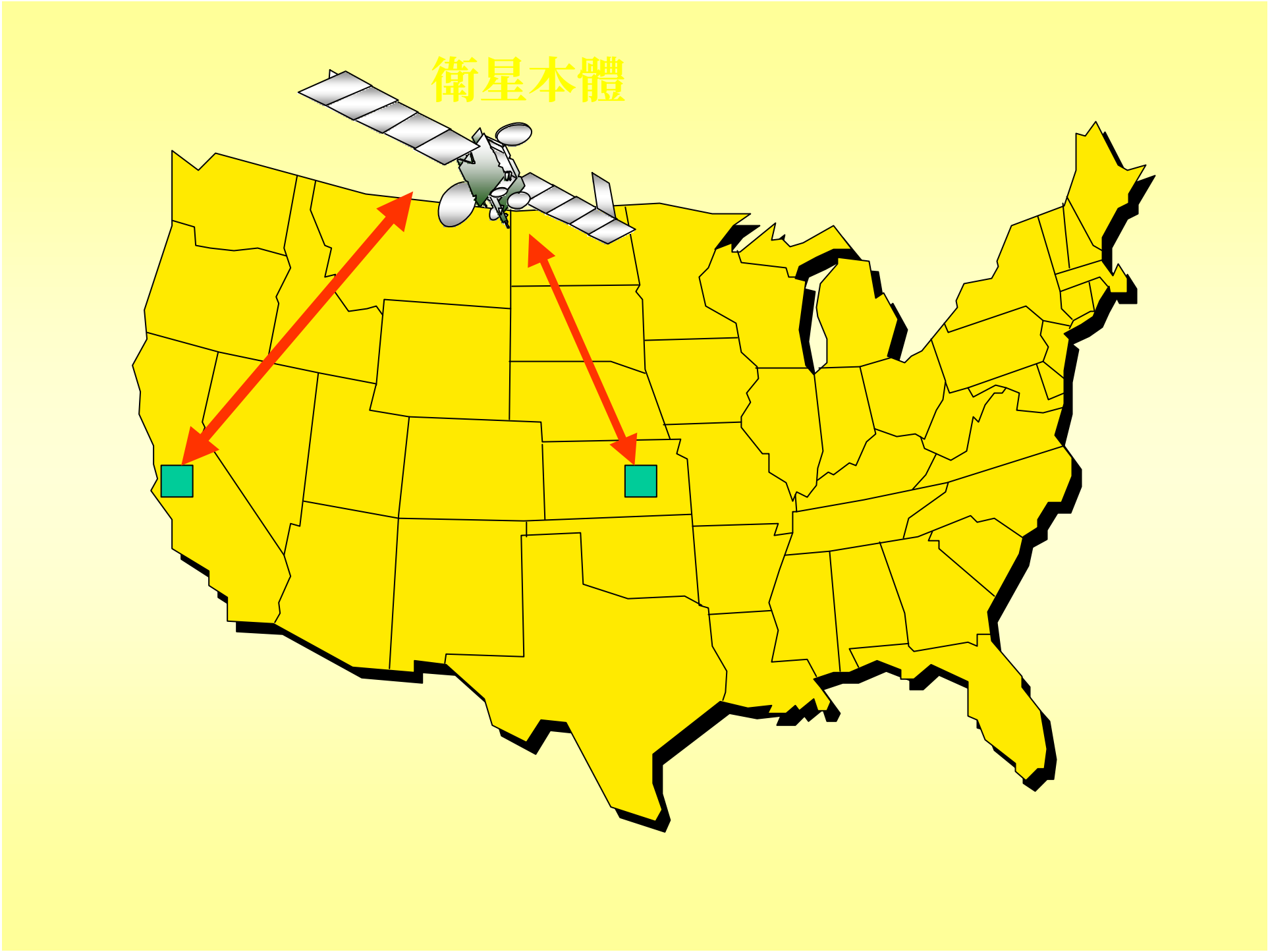
- Taiwan:
  - NCU Wireless Network and Multimedia Lab
    - Intelligent Routing
    - Re-Multicast Server (1999, Direct PC Trial)
    - Reservation Protocol (Spoofing RSVP)
    - Audio Broadcasting

USA

- NASA's Advanced Communications Technology Satellite (ACTS)
  - Provide Ubiquitous Multimedia Service
  - Multicast bone Trial

Hughes Research laboratories

- Geosynchronous earth orbit (GEO) satellite communication networks
  - ubiquitous access to the Internet
  - deliver this promise to end users
    - requires integrating satellite communications into existing transmission links
  - challenges
    - high latency
    - certain TCP based applications need to be changed
    - multicast and networks as a whole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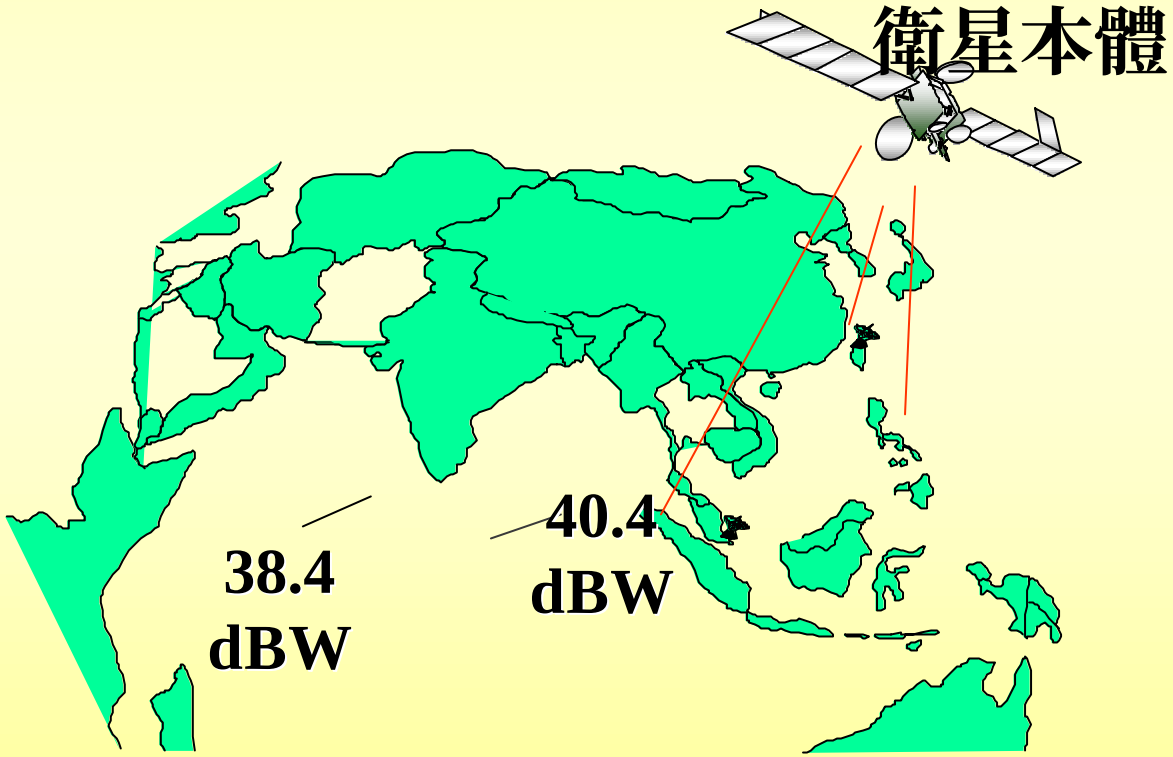
Asia Satellite

- Japan
- Taiwan



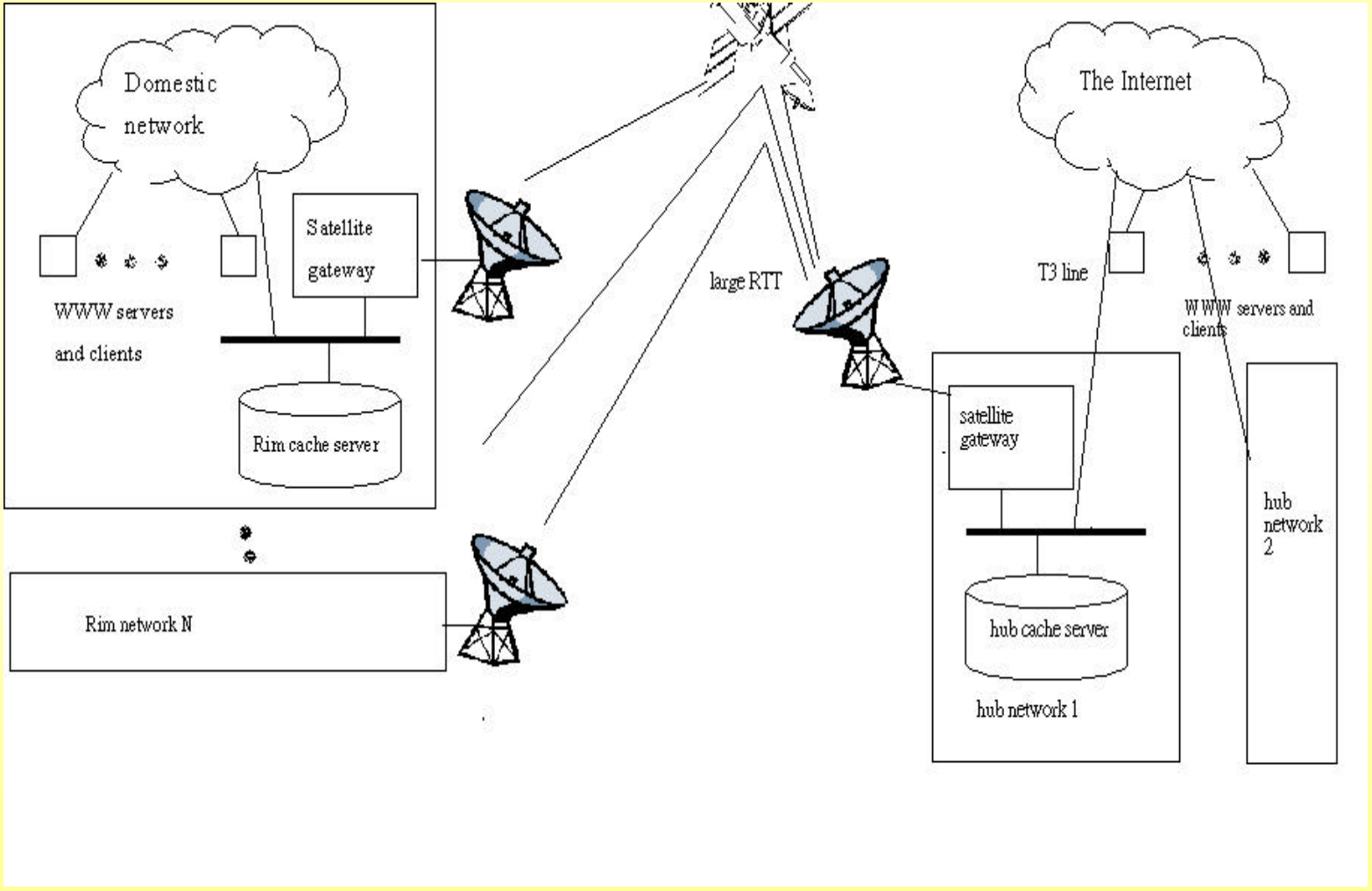
Motivation

- Internal Internet Environment
  - Asia and Pacific area
  - engineering and researcher
- AI3
  - WIDE (Widely Integrated Distribute Environment) project
  - JSA (Japan Satellite System)
  - International Information Infrastructure

Problems

- No good Intra-Asia internetworking
  - most countries and regions in Asia have global Internet, but link to gateways in U.S.
  - growing demands of cooperative works among Asian countries
  - U.S. acts as a hub
  - some developing countries still do not have Global Internet

AI3 **架構圖：**


Domestic network
Satellite gateway
WWW servers and clients
Rim cache server
Rim network N
large RTT
The Internet
T3 line
WWW servers and clients
satellite gateway
hub cache server
hub network 1
hub network 2

Goal of the AIII

- October 1995
  - provide an open Internet Testbed for research and academic community in Asia
- Goal of the AIII
  - Develops an information sharing infrastructure (through VSAT satellite)
  - Develop an efficient Internet topologies, defines recommendations
  - Makes contribution for local development of the internet
  - Efficient transmission technologies for multimedia applications (IP multicast, IPv6)