

# Internet in Chinese Taipei and rapidly deployable alternatives for rural areas

Chiou Wen-Yuh  
Senior Engineer  
Chunghwa Telecom  
Mobile Business Group  
Chinese Taipei  
19/Sep/2004



# Brief introduction of environment

## ❑ Population & GDP

- 23M.
- 13,156 USD (2003).

## ❑ Characteristic of geography

- Precipitous Mountains cross country from north to south.
- off-shore islands.
- Difficult to deploy & maintain telecom infrastructures .

## ❑ Education level

- High school:33.64%.
- College & University:29.46%.

## ❑ Telecom penetration

- Mobile: 112%.
- Internet: 37%.



# Status quo of Chunghwa Telecom (CHT)

## □ CHT is the largest mobile, fixed & ISP operator in Chinese Taipei.

- Capital: 2.82 billion USD
- Revenue: 5.5 billion USD in 2003
- 29,016 employees as of Mar.2004
- Experienced in Cellular Operation
  - 8.2M GSM Subscribers in 2004.
    - GSM 900/1800→GPRS→3G(WCDMA)
- Experienced in Fixed line operation
  - 17.3M Fixed line subscribers in 2004.
- Experienced in ISP operation
  - Internet : HiNet.
  - 5.8M Subscribers (ADSL 3.08M).
  - Mobile Internet : emome.
    - 250,000 GPRS Subscribers.
    - 1.5M emome members.



# Preface of Internet

- ❑ In 1992, TAnet(Taiwan Academic Network) Begins to Connect to Internet for Academic Purpose.
- ❑ In Apr., 1995, Commercial Internet Services HiNet (CHT) was launched, now is the largest ISP with a 62% market share.
- ❑ There are about 120 Registered ISPs totally by June, 2004.
- ❑ Total Internet user comes to 8.9 million by Mar., 2004.
- ❑ Number of broadband users reaches 3.08 million (ADSL + Cable) by Mar., 2004, ranked World #3 in terms of population ratio.



# How and what we did for Internet

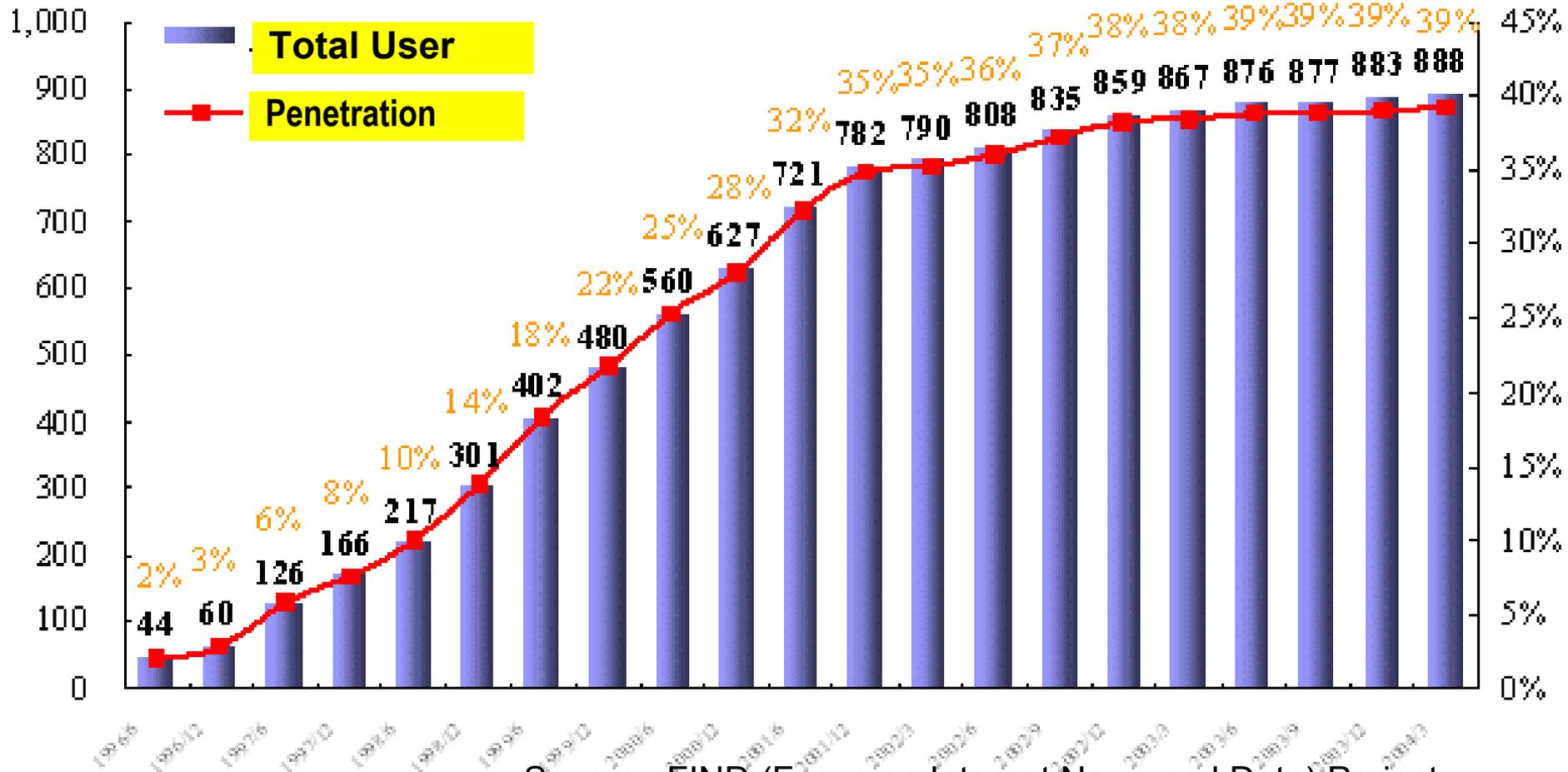
## □ NII (National Information Infrastructure) Project(1994-1996)

- Combined government, PC industries, scholarship together to popularize Internet in Chinese Taipei.
  - To make Chinese Taipei as the Asia-Pacific Telecom center.
  - To push our information industries as world rank # 5.
  - To build up a whole-island wide broadband backbone systems.
- From schools to enterprise to families
  - TANet is Free to students.
    - Universities the first, then high-schools & middle/primary schools gradually.
  - Extend to neighborhood outside campus (2km <) very soon using ISDN/ADSL Technologies.
  - Frame Relay as the main access way for enterprise that time.
  - PC become a necessary appliance to a family in 1995.



# Internet users

Unit: 10,000



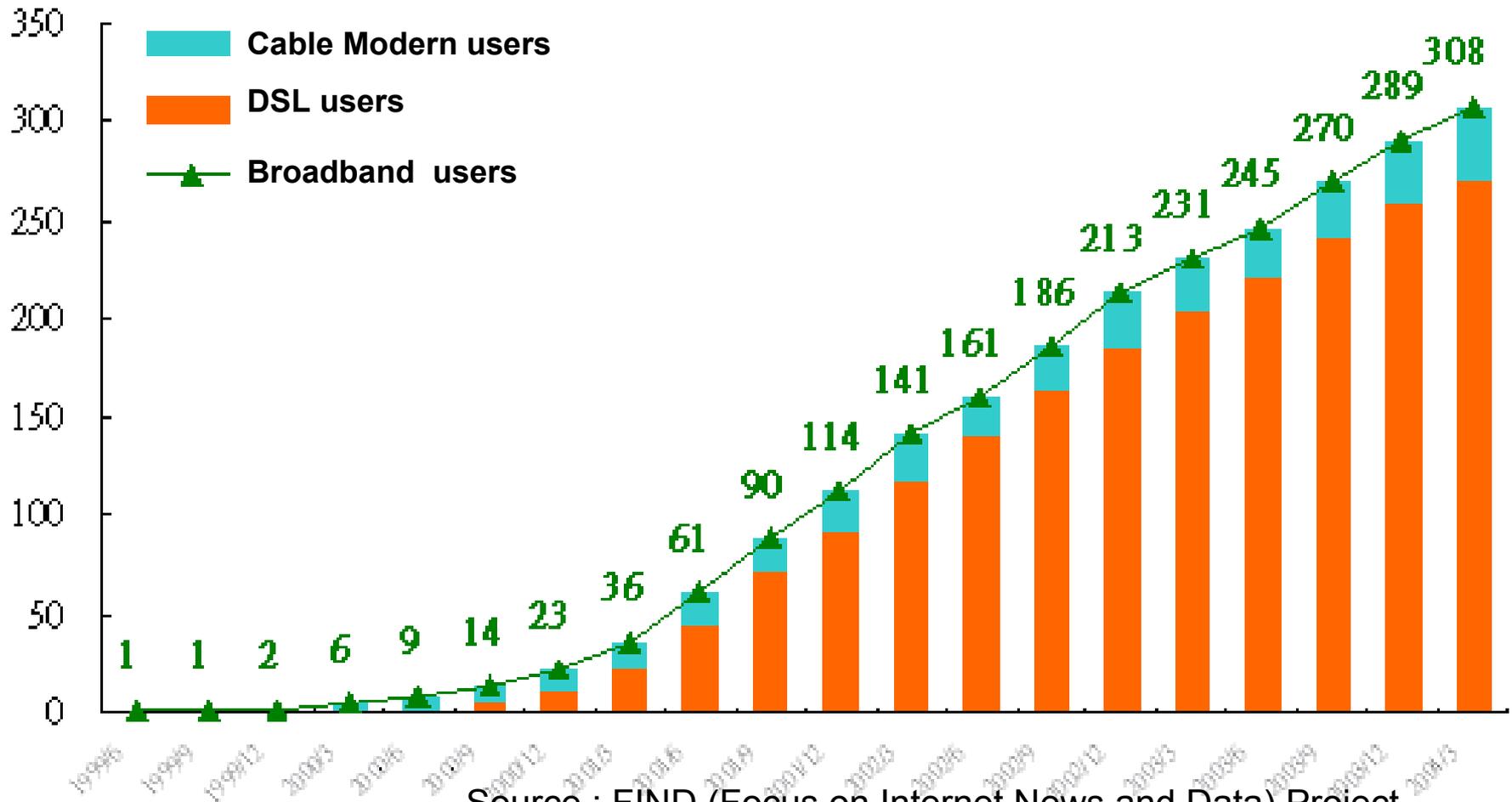
Source : FIND (Focus on Internet News and Data) Project  
Institute for Information Industry

Date: 2004/3/31



# Broadband Internet Users

Unit : 10,000



Source : FIND (Focus on Internet News and Data) Project  
Institute for Information Industry

Date : 2004/3/31



# Access Type & Speed

## □ ADSL

- 256K/64K, 1M/64K, 2M/256K, 8M/640K

□ FTTB 1.5M ~ 100M

□ WLAN 11Mbps (802.11b)

□ Leased Line 64K ~ 45Mbps

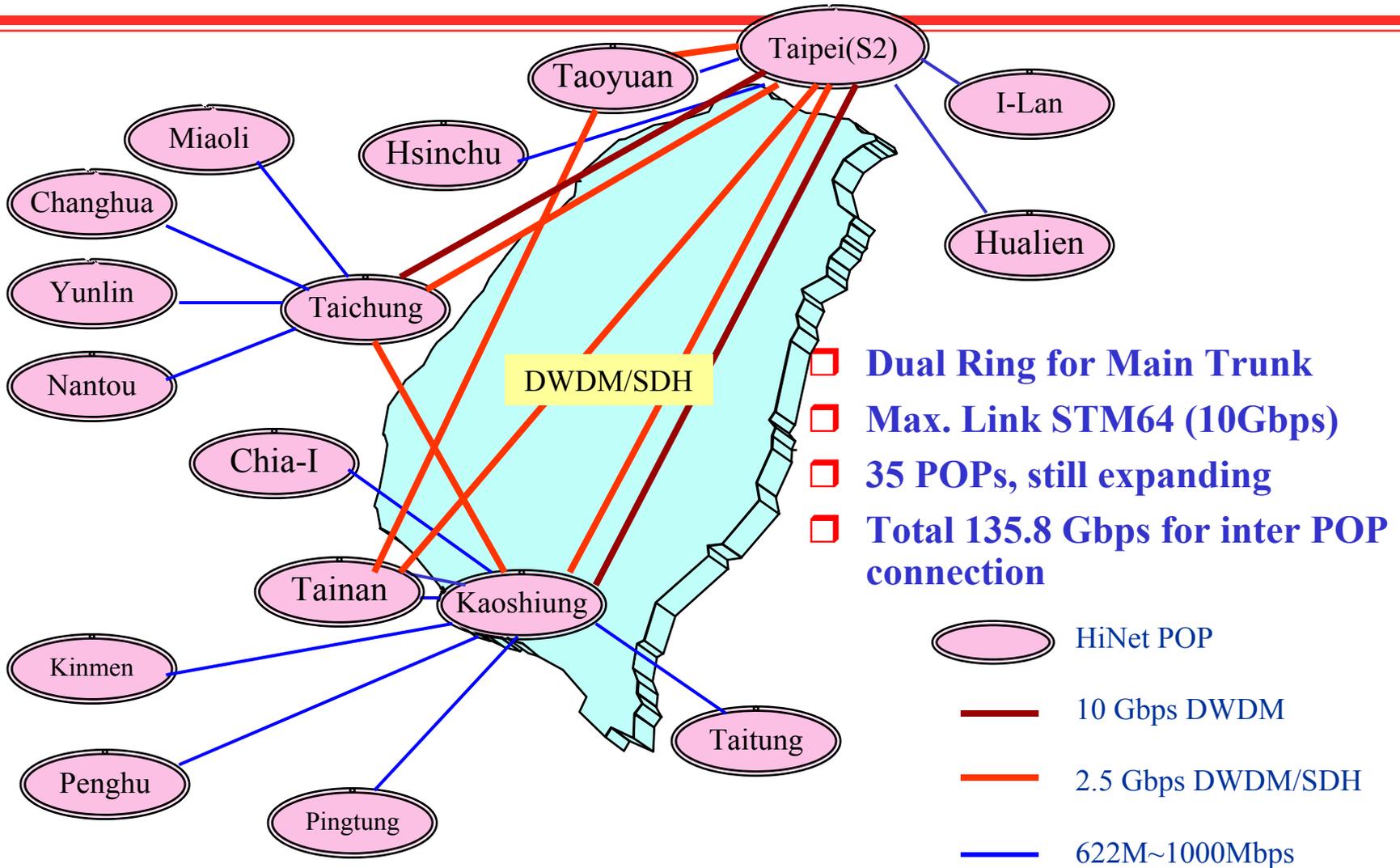
□ PSTN 56Kbps

□ ISDN 64K ~ 128Kbps

□ Frame Relay 64K ~ 1,544Kbps



# HiNet Backbone



# Content in HiNet

<b>Information</b>	News, Weather, Fate, Yellow Pages, Travel, Tourism
<b>Entertainment</b>	Game, VOD, Music, Radio, Ring tone Message, Picture Message
<b>Community</b>	Community, Chat Room, Forum, Club
<b>Commerce</b>	Shopping, Ticket Booking , Auction
<b>Learning</b>	Language Learning, Job Training, Technology Training
<b>Tools</b>	Download, Anti-Virus, DN Registration, Land Service



# Future Key Goals

- ❑ Keep promoting broadband network access.
  - ADSL, Fiber, WLAN
  - Higher BW
- ❑ Converge Networks to reduce cost & better quality.
- ❑ Enrich broadband content through cooperation.
- ❑ Provide triple play on broadband network.
- ❑ Focus QoS & personalization.
- ❑ Exploit International Expansion Opportunities.



# M-Taiwan Program

- ❑ Take advantage of Chinese Taipei No.1 PC & WLAN products and mobile phone penetration, Executive Yuan decided to propose 「M-Taiwan Program」 in 2003:
  - 3G/WLAN dual-mode EAP-SIM integration.
  - Set up 6,000km optical-fiber broadband backbones, and to execute the integrated beyond 3<sup>rd</sup> Generation Program.
  - choice 8 demonstration sites to deploy WLAN network.
- ❑ Goals of 「M-Taiwan Program」 :
  - To promote the penetration of mobile internet to 5th in the world rank.
  - To create telecom industry to become the next industry with trillion dollar revenue.
  - To balance the inter-regional developments between cities and rural area.



# Vision of M-Taiwan Program

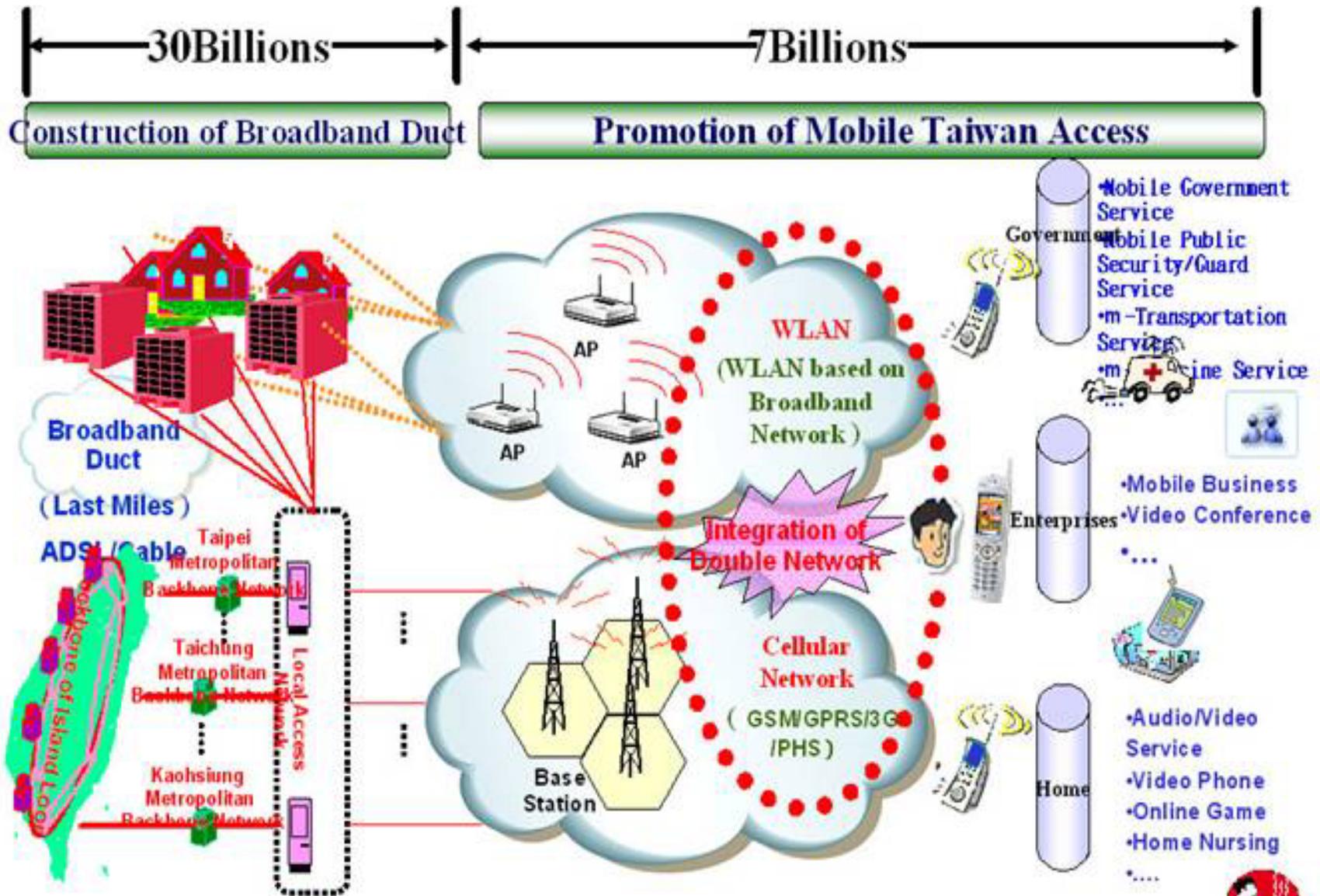
## □ e-Nation to M-Nation & M-life

- Civil can share wireless Internet services with a 1/3 usages fee compare to current charges.
- Multiple digital applications & services through wireless broadband Infrastructure anytime ,anywhere.

*Mobile Taiwan! Unlimited/wireless applications Towards a New Vision!!*



# 3G/WLAN Dual-mode mobile Internet



# ABIEN Program for broadband Internet

- Proposed By DGT (The Directorate of General Telecommunications) of Chinese Taipei.
  - To promote Chinese Taipei as world No.1 nation in terms of Fiber broadband penetration by 2007.
    - 2M FTTH users with 100M bandwidth (for MOD、HD etc..) .
    - 1.7M WLAN/3G users with a 20M downloading speed.
    - Unleash Rules to promote digital contents .
    - IPv6.
  
- CHT will play an important role to support ABIEN Program.
  - 1.2 billion USD to promote 2.M FTTH users by 2010.



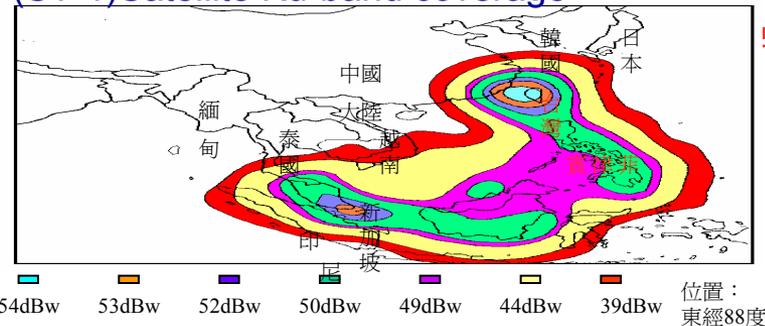
# Experiences of Internet installation for rural areas

- ❑ To balance the development of both rural and urban areas, the government has a fund to help subsidize of carriers for communications deployment in islands, mountainous areas and isolated locations.
- ❑ As a government owned corporation, CHT has the responsibility to support and service the populous in rural areas. The usage of licensed microwave has been reduced and most of them have been replaced with optical fiber and spread spectrum microwave solutions.
  - In mountainous areas such as Miao-Li, in order to meet rapid deployment goals and ease of maintenance, CHT uses a combination of the ST-1 satellite Ku band ipSTAR broadband services with WLAN. This allows for cost effective Internet services for the native population.
  - For the islands, CHT uses sea cables and satellite/microwave for redundant purposes.
  - In conjunction with the M-Taiwan project, we have deployed 802.11b WLAN and ADSL access in some demonstration hotspots. We have provided access for some scenic areas, train stations and government offices, all enabled with WiFi.



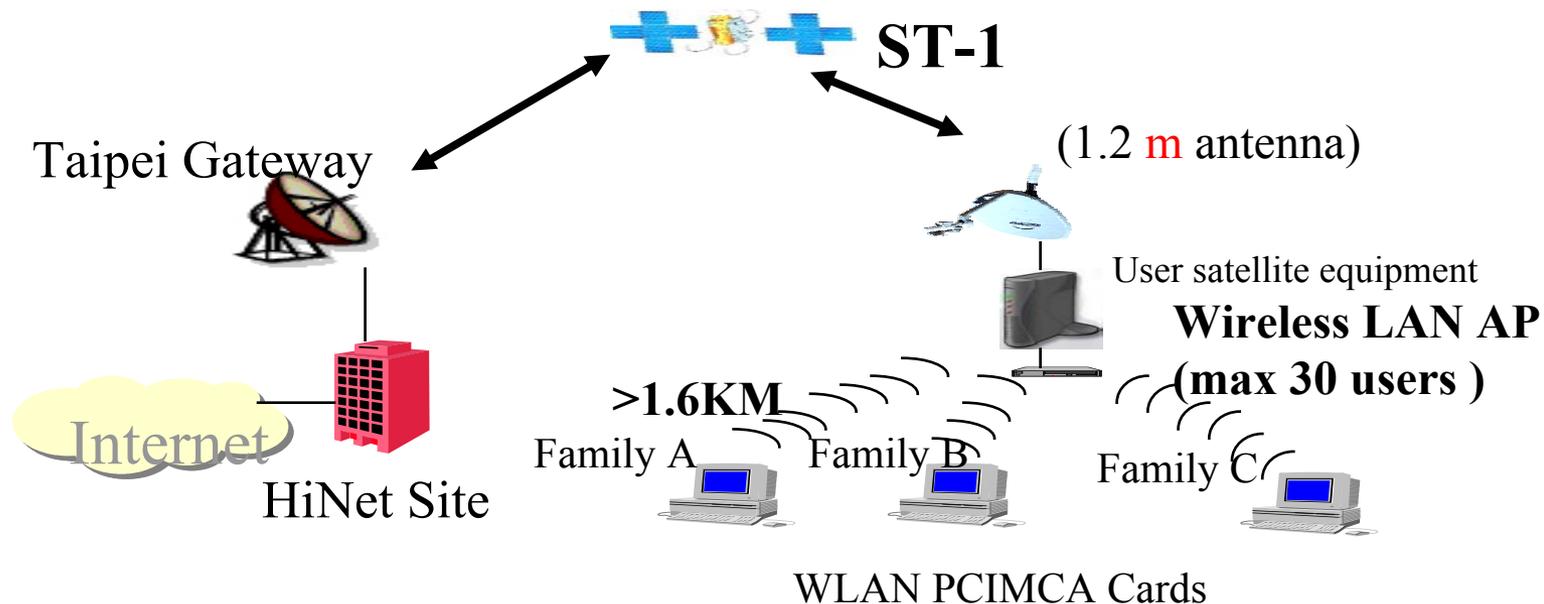
# Real cases in rural area(一)

(ST-1) Satellite KU-band coverage



## Mountain Areas

- Miao-Li county( mountains & hills)
- Satellite (ipSTAR) + WLAN(802.11b/g)
  - ipSTAR( Frequency/Bandwidth sharing) reduces users monthly/packet free.
- WLAN extend coverage to let every family can access Internet at home.

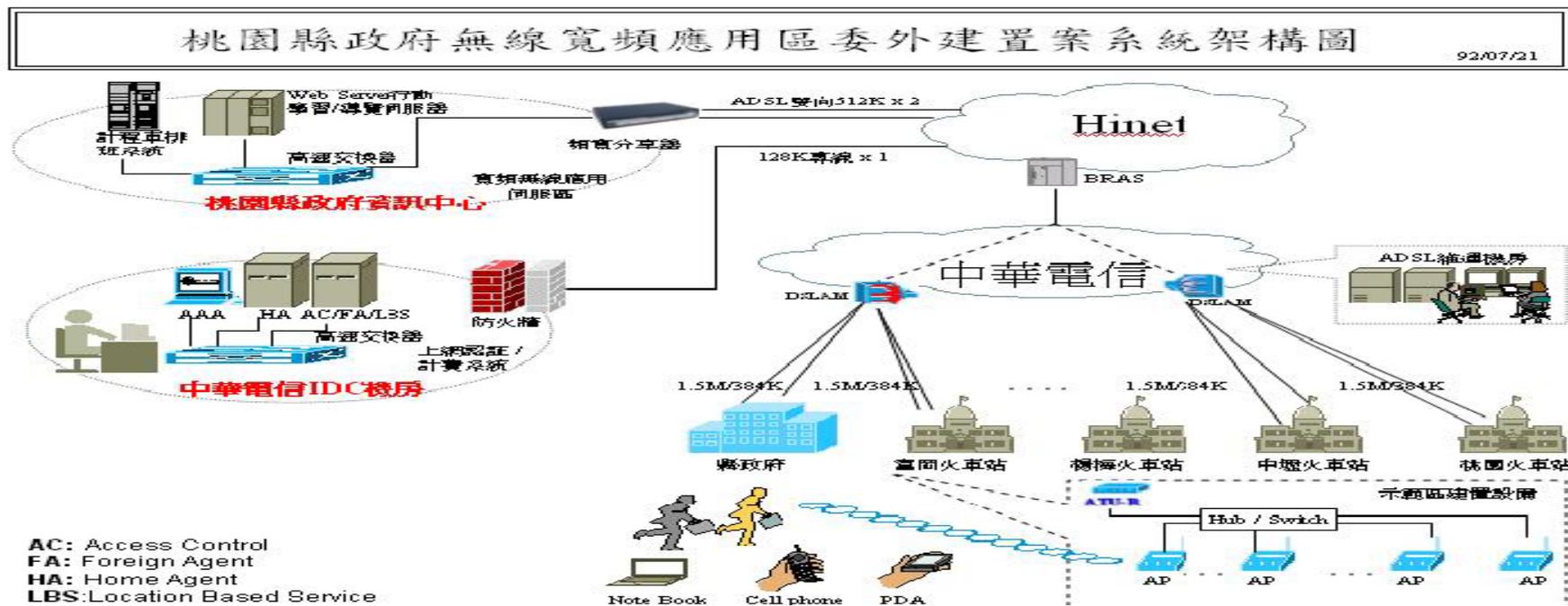


# Real cases in rural areas(二)

## Plains

- Rail-Road WLAN Internet.
- Vast, few people (along rail-road area).

● 802.11b + ADSL/2.5G/3G.



# Key factors to choose alternatives in rural areas

---

## Rapid deployment

- shortening the time to deploy and providing enough bandwidth immediately.

## Less expense in installation/recurrent cost

## Freedom from terrain difficulties

## Freedom from interference

## Mobility

## No rights-of-way issues

## Increased security

## License free



# Categories of Internet alternatives

## ❑ Backhaul

- Optical Fiber
- Microwave (Licensed)
- Satellite
  - ipSTAR (bandwidth sharing) as Backhaul
- WLAN (outdoor 802.11 a/g) / WiMax(802.16d/e)

## ❑ Last mile

- Microwave (Spread Spectrum)
- FSO (Free Space Optical)
- WLAN(802.11b/g)
  - 802.1x (nice to have)
    - EAP-SIM Authentication
      - » Security
      - » Future applications such as dual-mode integration & transaction

# Satellite ipSTAR cross-islands alternative

- ❑ Satellite (VSAT) creates a communications infrastructure in places where it is too difficult or too costly to use traditional means.
- ❑ The best means to deploy telecom infrastructure in mountain & off-shore islands.
- ❑ ipSTAR (bandwidth sharing) as Backhaul provide a chipper way to popularize Internet in mountain area in Chinese Taipei.

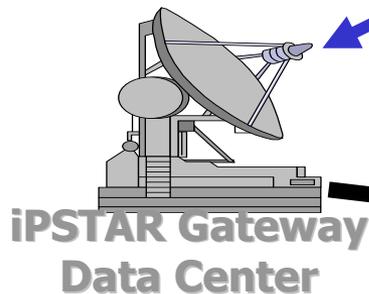
## Forward Link

- User bit rate: up to 8 Mbps per Terminal

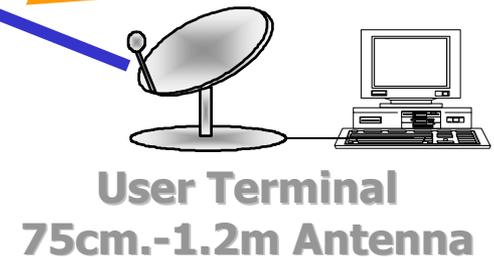


## Return Link

- User bit rate: 128 kbps up to 2.5 Mbps per Terminal



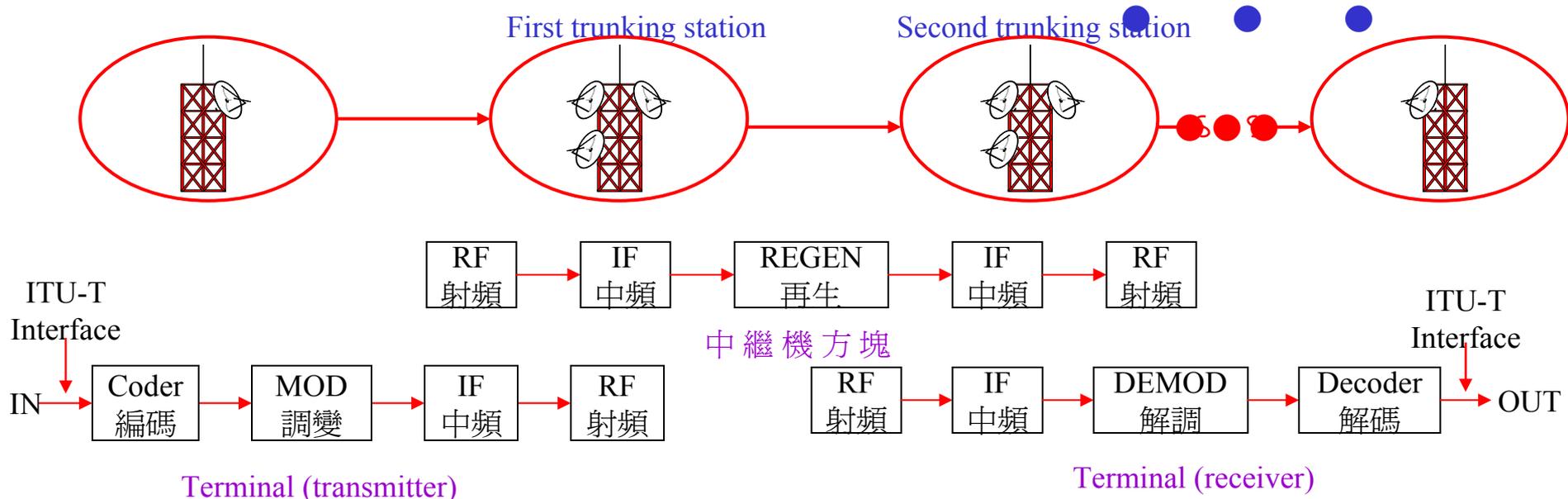
- Video Conference
  - VoIP
  - Intranet · Extranet
- National &  
International  
Networks**



# Microwave transmission

## ☐ Microwave

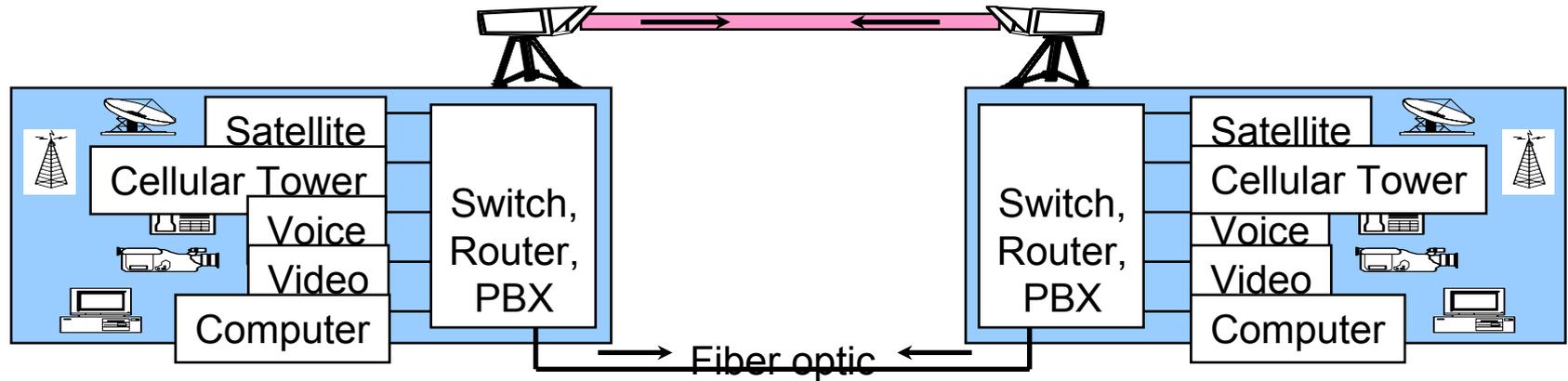
- 4/6GHz, 20 ~50 km per hop
- As a backhaul/backup alternative used in urban/rural /mountain area
- LOS (Line Of Sight)
- Sensitive to interference



# Free Space Optical (FSO)

## □ Near infrared lasers

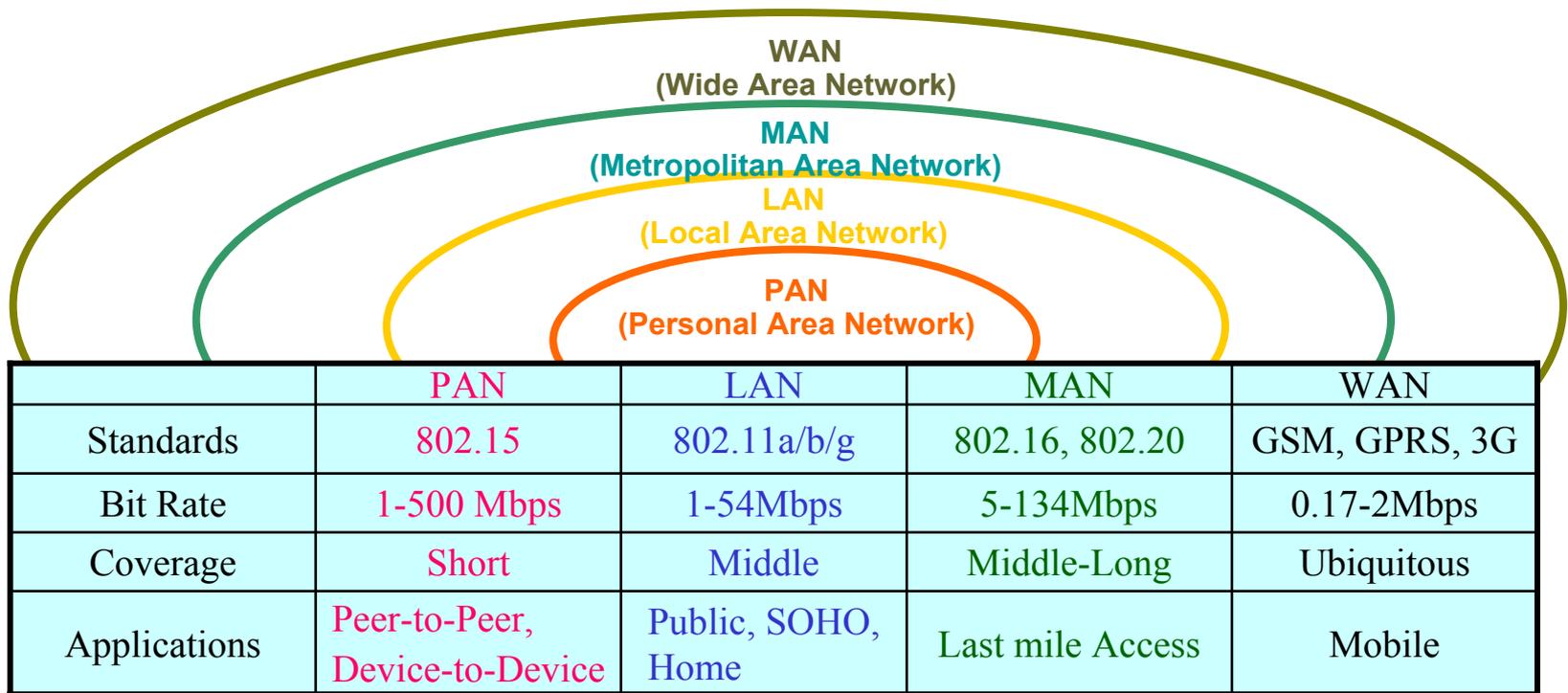
- Point to point system as fiber optical backup pass geography barrier
- No licensing required
- High bandwidth (10 Mb/s or higher)
- Shorter ranges (< 3 km, 2 miles)



- (a) extending fiber optic networks past geographical barriers  
(b) speed up fiber extensions or act as a cost-effective back-up

# Public Wireless Local Area Network (WLAN)

- ❑ Wi-Fi & WiMax are the most powerful technologies for public Internet in 2004.
- ❑ Wi-Fi & WiMax together comes a WMAN & WWAM wireless Internet world.
- ❑ Provide a 11-70Mbps transmission speed that can fully replace current fiber cables and DSL(64k-6Mbps).
- ❑ Most cost-effective & rapidly deployment.
- ❑ Popular & popular because of Centrino NB/PDA.



# Wi-Fi & WiMax

	802.11	802.16	802.16a/d	802.16e	802.20
Status of Standard	Complete	2001/12/06	2004 /Q4	Est. 2005	Est. '05-06
Target App.	WLAN	WMAN	WMAN	WMAN	WWAN
Range	Up to 300 ft. for indoor LAN	Average Cell Radius 1-3 mi	Average Cell Radius 4-6 mi	Average Cell Radius 1-3 mi	
Channel Conditions	LOS when outdoors	LOS	NLOS	NLOS	NLOS
Spectrum	Unlicensed	10-66 GHz Licensed	2-11 GHz	2-6 GHz	<3.5 GHz Licensed
Mobility Support	Portable – Local Roaming	Fixed	Fixed	Regional Roaming	Vehicular Mobility – Global Roaming
Channelization	20 MHz	Scalable 1.5-20 MHz	Scalable 1.5-20 MHz	Scalable 1.5-5 MHz	1.25 or 5 MHz
Spectral Efficiency	< 2.7 bps/Hz	< 4.8 bps/Hz	< 3.75 bps/Hz	< 3 bps/Hz	< 1.25 bps/Hz
Bit Rate	54 Mbps (20 MHz BW)	< 96Mbps (20 MHz BW)	< 75 Mbps (20 MHz BW)	15 Mbps (5 MHz BW)	< 6 Mbps (5 MHz BW)

# Analysis of alternatives

50km<

Items	VSAT	Microwave	WLAN/ WiMax	Fiber	FSO	comments
Rapid deployed	fast	fast	fastest	slow	fast	
Terrain restrict	Non.	Mountains Cross islands	Mountains Vast plains	Plains mountains	Vast plains	
Interference	rain	rain		free	Fog, rain	
mobility	No.	No.	yes	No.	No.	
Distance	No limitation	2-50km	12-50km (outdoor)	50km	2km	
Spectrum	12-14G Ku band	5.8G	2.4/5G	1310nm 1550nm	700-900nm 1400-1600nm	
Bid Rate	128Kbps	45Mbps	20/134Mbps	10Gbps>	10-155Mbps	
Cost	80,000+ (4,000/month)	60,000	10,000	240,000	20,000	USD



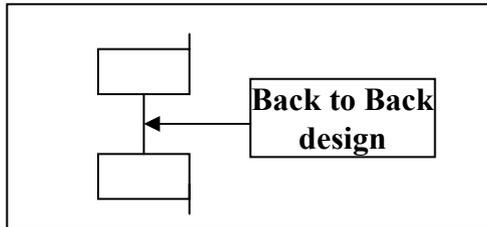
# Conclusion of alternatives comparisons

- ❑ WLAN may be the best solution for rural areas. Some proprietary but standard-comply 802.11 products can cover near 30km.
  - Satellite VSAT
    - Cost effective to installation, but long term transponder leasing is cost-prohibitive.
  - Microwave
    - Rapid deployment and cost-effective when used for backhaul, but less availability in last-mile Internet use compare to WLAN.
    - Microwave + WLAN is the best way to popularize Internet in mountain areas.
  - FSO
    - Fog attenuation is fatal , not suitable for rainy & misty areas.
  - Fiber
    - Cost prohibitive.
    - Installation is time consuming.

# A 250km<sup>2</sup> area of PWLAN design

## □ Conditions:

- Terrain: vast, plains

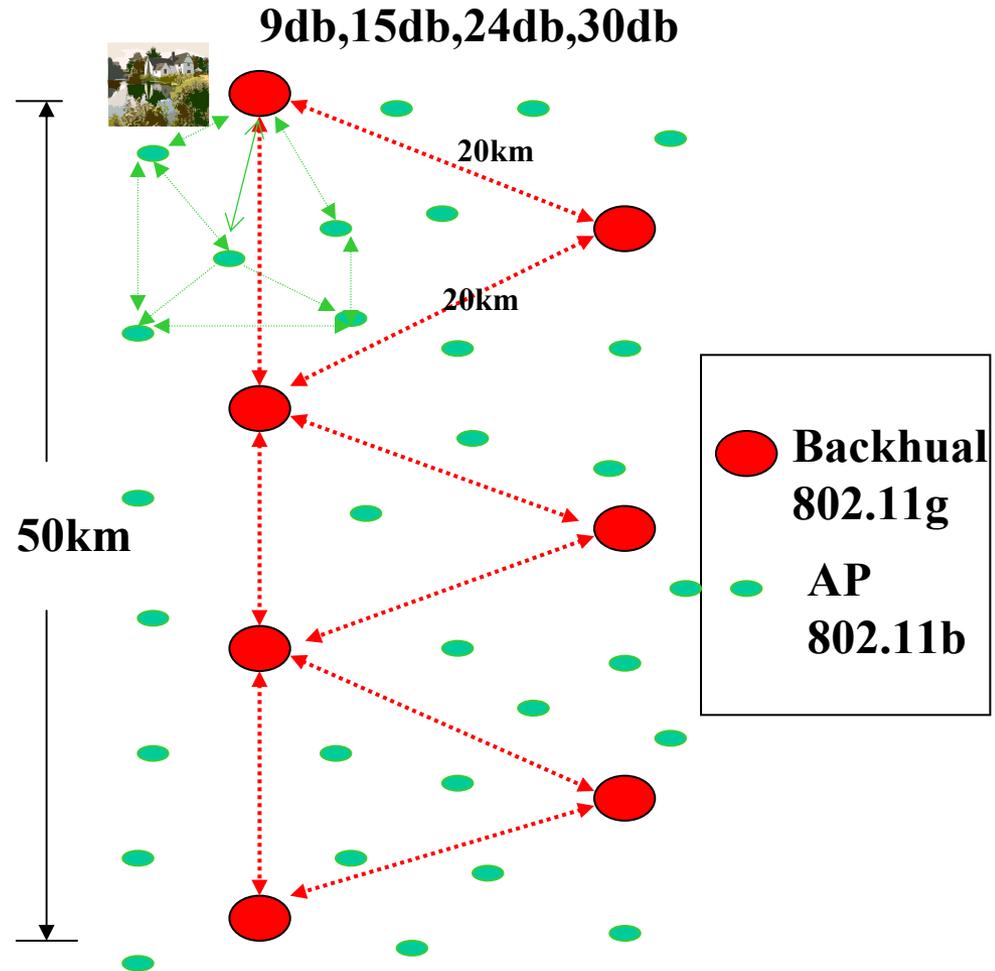


## □ System design:

- Switching Control
- Bridge Control
  - Load Balancing
  - Repeating
  - Wireless Routing

## □ Strongly recommend that Government allocate a licensed spectrum for Backhual use.

- Avoid from interference.



# Conclusions

- ❑ The most cost-effective alternative is Wi-Fi , especially in areas of vast and scattered population patterns.
- ❑ In mountainous areas, due to ease of installation, a combination of Microwave and 802.11b WLAN is an optional solution.
- ❑ If funding is adequate, the optical fiber network is the best solution.
- ❑ For islands or places where there is a repeated pattern of natural disaster (such as land slides and typhoons), Wireless solution (such as microwave or WLAN) is still the best option.
- ❑ The persistency of government with the assistance of carrier policies is the main driving forces for a nation to promote high Internet penetration.
  - No matter which country you are from, starting Internet access from the schools is the best way to go.
  - Gaming & chatting are always the most attractive applications for youths.





# Thank You!

Chiou Wen-Yuh  
Senior Engineer  
Mobile Business Group  
Chunghwa Telecom(TAIWAN)  
e-mail: [chiouwy@cht.com.tw](mailto:chiouwy@cht.com.tw)  
Tel: +886 23316-6205  
Mobile: + 886 937400416

