Regulations of IPTV Operators in Taiwan

A Case study of CHT

Der Wei Wang
National Communications Commission

Outline

- Introduction
- MOD Service Regulations
- Competition between MOD and CATV

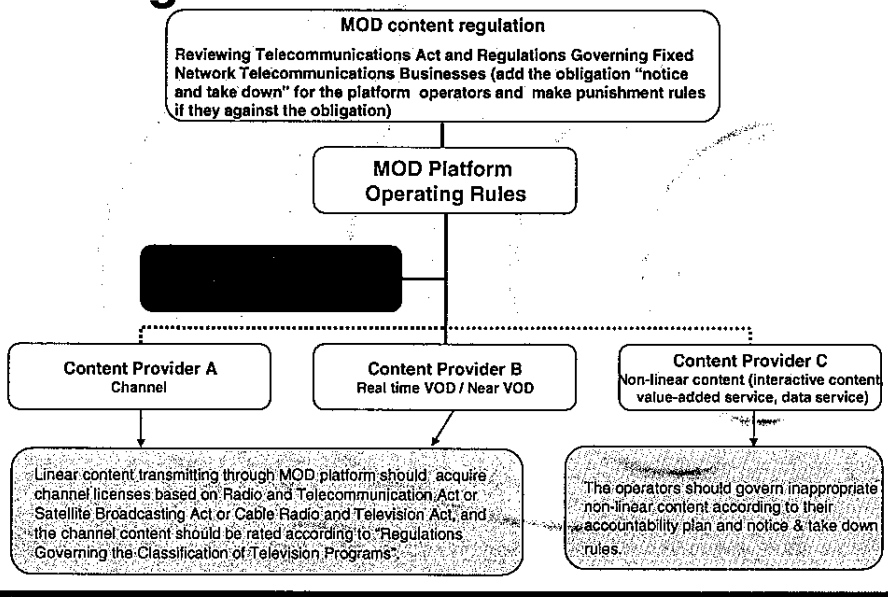
Introduction

- CHT was issued licenses for CATV operation by IPTV technicalities (MOD) in 2004. To operate, government investment was required to withdraw from CHT.
- As it failed to withdraw before the deadline, CHT switched to operate an Telecom's MOD service and provide the leasehold as the platform with content transmission in 2007.

Regulation in CHT MOD Service

- Channel program providers may provide free or pay-for view programs on the MOD platform and pay up to CAD28,500(NTD800,000) to CHT for monthly service charge.
- According to the business contract, viewers of MOD programs pay CAD3 (NTD89) to CHT monthly.
- CHT may operate VOD or other applications services (not including channel programs) on the MOD platform. (ex: games)

Regulation Structure of MOD



Thank You for Your Attention

National Communications Commission

Overview of IPTV in Taiwan

Huang, Tzu-Han

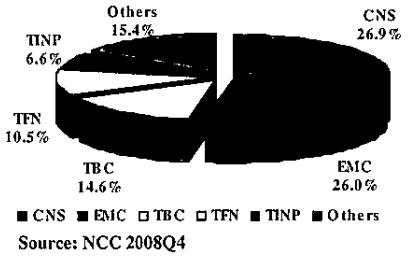
Chunghwa Telecom

Outlines

1. Background and Facts
2. Competition Index
3. Challenges of MOD Business in Taiwan
4. Triple Play Network
5. Briefing MOD Service
6. 2008Olympic Game Event Practice
7. Achievement of MOD Operation
8. Meeting Customer Demand for Convergence
9. Strengthen Strategies Learnt
10. Concluding Remarks

1. Background and Facts

Taiwan		Chunghwa Telecom(CHT)	
Fixed-line Subscribers	13M	Fixed-line Share	97.4%
Mobile Penetration	104%	Mobile Share	37.6%
Broadband Penetration	67%	Broadband Share	88%
Cable TV Penetration (analog/1 package price)	85%	IPTV Penetration	9.5%



Source: NCC 2008Q4

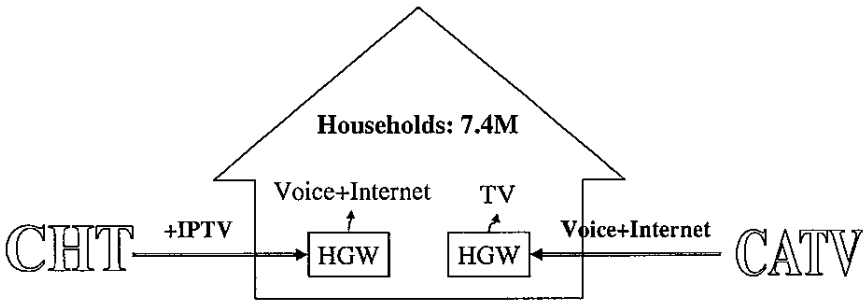
MOD differentiation strategy:

- On Demand
- Interactive
- High Definition

↓

- Better Experience
- Better Quality

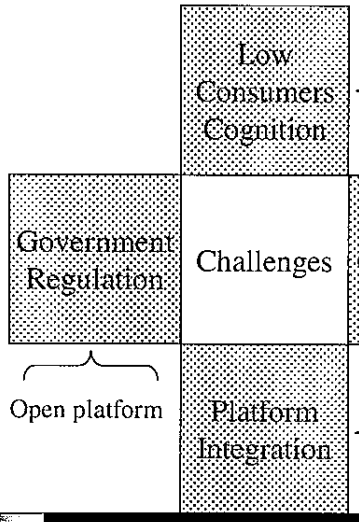
2. Competition Index



Telco and CATV operators are competing not only in voice and data service but also in the next generation TV market, to take leading position in the last mile.

3. Challenges of MOD Business in Taiwan

◆ *Launch Date : March 3,2004*

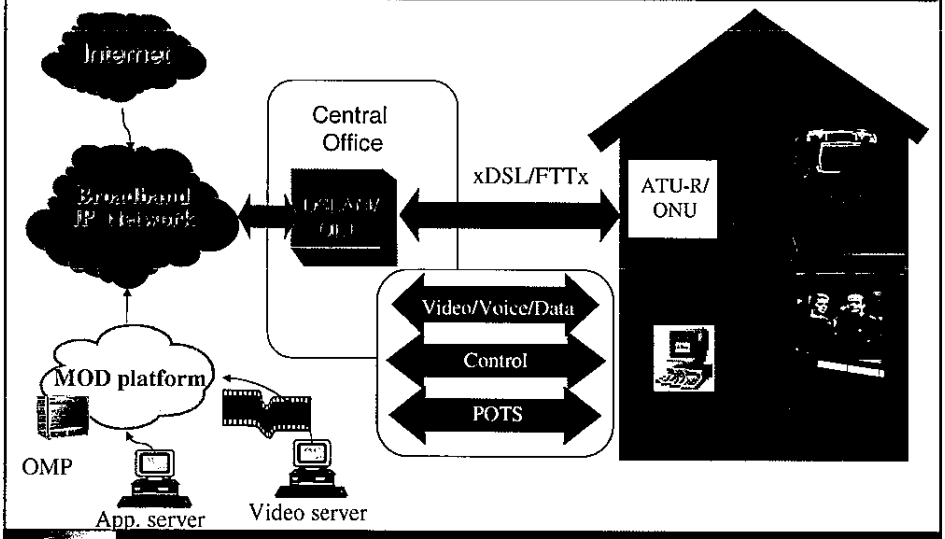


1.Defensive strategy to telco business
2.Complement or replacement of tradition cable

1.CATV high penetration
2.Boycott of MSO

Complicate in system integration:
- Reliable Platform is the foundation
- Platform and network capability

4. Triple Play Network

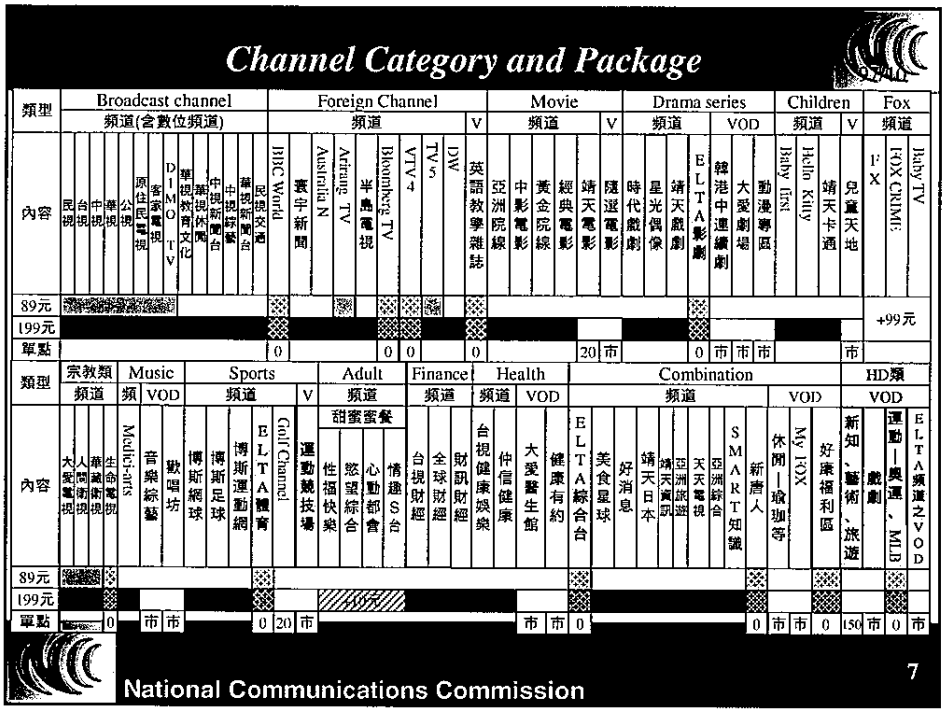


5. Briefing MOD Service

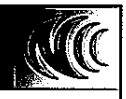
- **TV Channel:**
  - ✧**15 free channels:** free-to air, religion, 3HD channels
  - ✧**63 Pay channels:**
    - **33 domestic** – news, drama, cartoon, stock , travel, …
    - **19 foreign** - BBC, Baby TV, Hello Kitty, FOX family, ...
- **VOD:**
  - ✧**Movie:**
    - per movie and per basket purchas
  - ✧**Series:**
    - per episode and per package purchase
  - ✧**Free VOD:**
    - English learning, New release MV, …
  - ✧**Special:**
    - Kids, My NGC, Leisure, Knowledge, Adult, …

- **Application Service:**
  - ✧**Karaoke on Demand**
    - More than 5,000 Chinese and English son
    - per song with day flat rate and per month
  - ✧**Home Banking**
    - Transfer between accounts
    - Tax and credit card payment
    - Balance checking
- **Interactive service:**
  - ✧**On-line voting**
    - Easy level
    - Expertise level
  - ✧**Game**
  - ✧**Interactive ADs.**

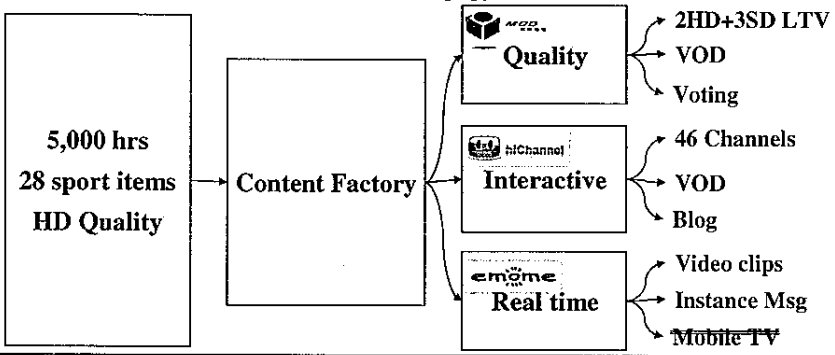
Channel Category and Package



6. 2008 Olympic Game Event Practice

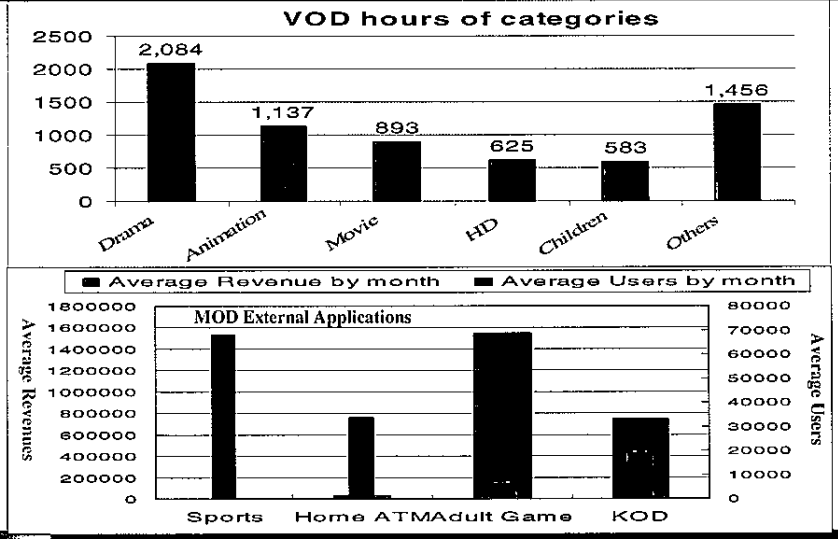


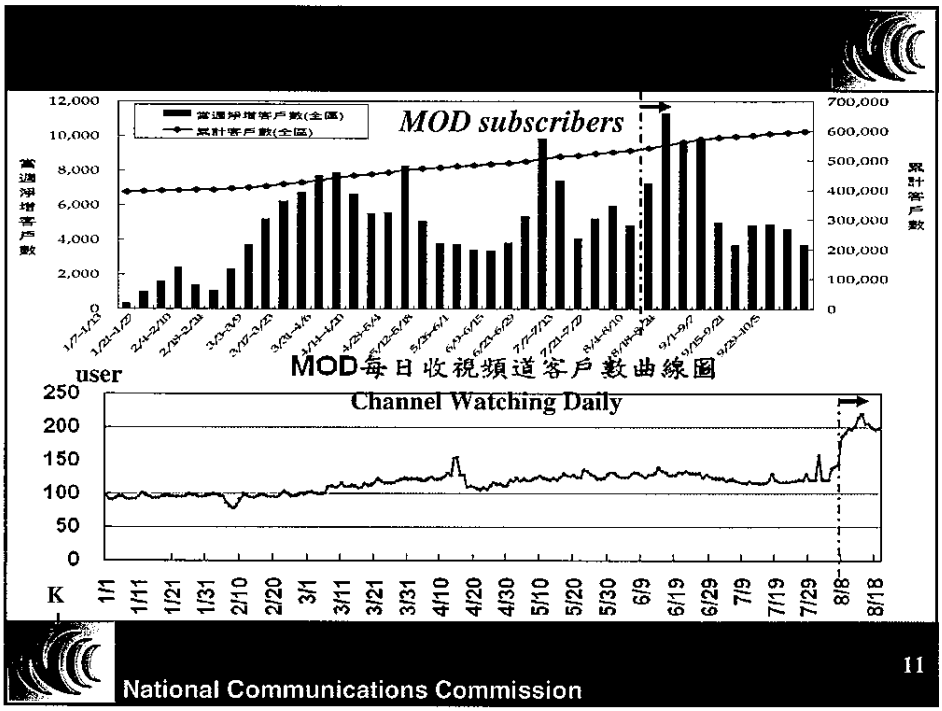
- ✧ New Media includes IPTV, Internet and Mobile
- ✧ Olympic Game Content include:
  - ➢MOD Broadcast hours – HD 504 Hrs、SD 1098 Hrs
  - ➢Hichannel program hours - 3800 Hrs
- ✧ 28 items include baseball, swimming, gymnastics, table tennis…

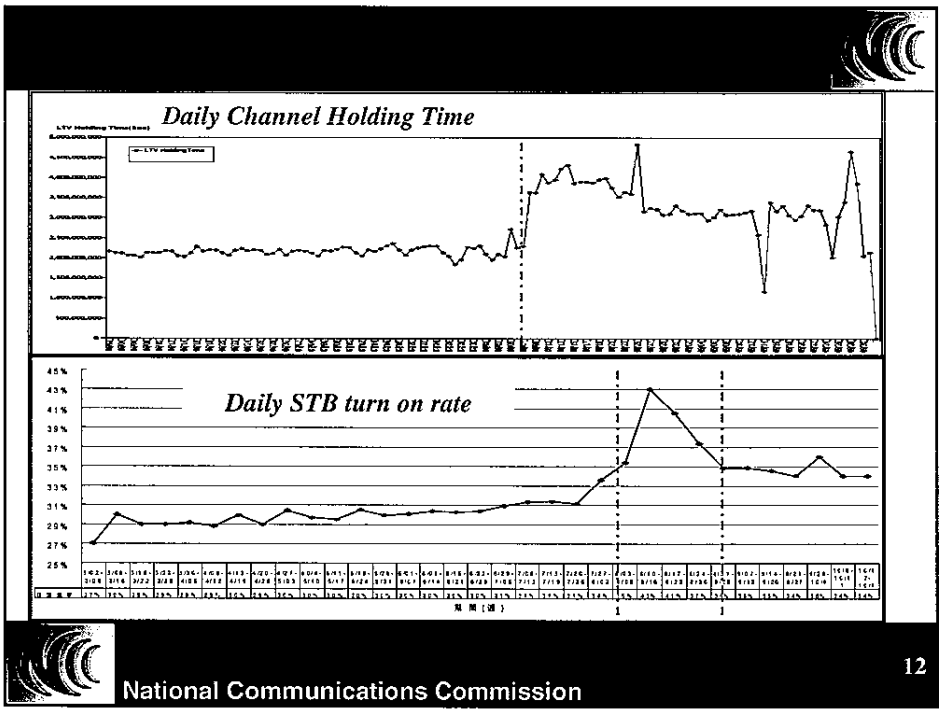


Consumers Cognition Enhanced via Event

7. Achievement of MOD Operation

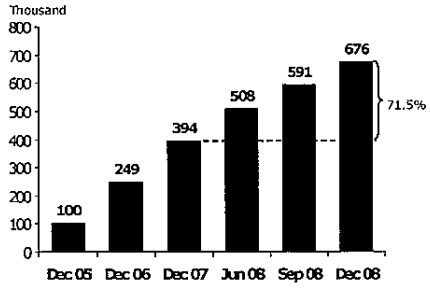



MOD subscribers
MOD每日收視頻道客戶數曲線圖
user
Channel Watching Daily
K
National Communications Commission
11


Daily Channel Holding Time
Daily STB turn on rate
National Communications Commission
12

8. Meeting Customer Demand for Convergence

MOD/IPTV Subscribers



- As of December 2008, subscribers reached 676k, a 71.5% increase since the end of 2007
- Average daily HUT(Household Using Television) of 2008 increased 35% since 2007
- Subs growth of Golden TV package:117,822 ('08) vs. 12,804 ('07)

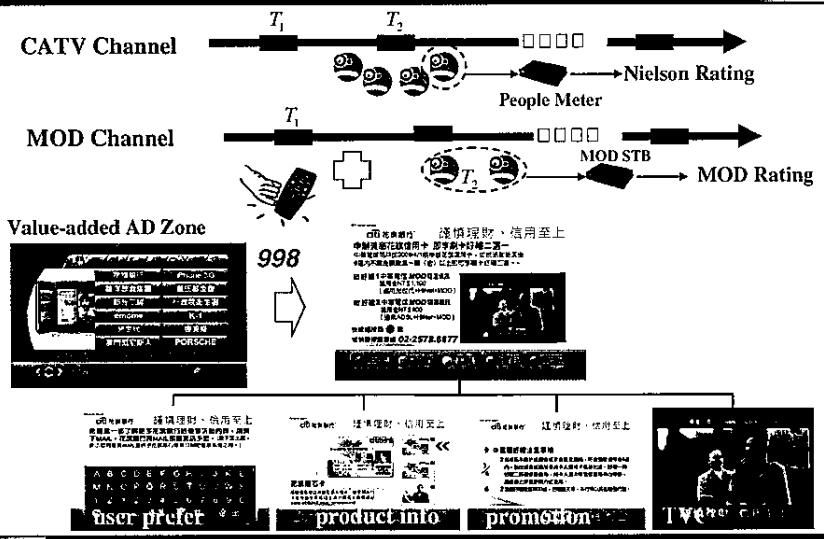
Cross-Platform Solutions

- Conduct cross-platform service operation, marketing and advertising
- Provide integrated bill for multiple services
- Supply debit cards for services
- Improve customer interface to enhance experience and loyalty

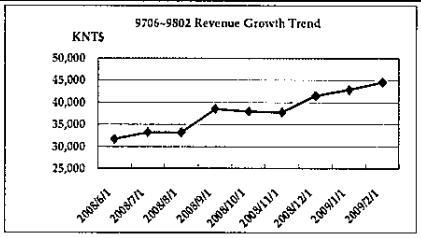
Strengthen Strategies

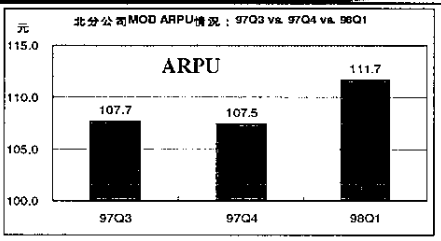
- Content
  - Repackage and introduce premium contents
  - Enhance user interface to increase customer hit rate
- Marketing
  - Segmentation by content category
  - Virus marketing via Internet
  - Community marketing with promotional price
- Interaction
  - Provide interactive advertisement feature to increase the number of reaches
  - Enhance user applications through applying widget-like interface

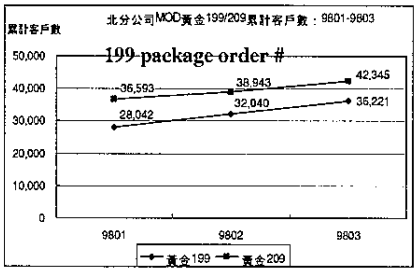
Interactive Advertisement

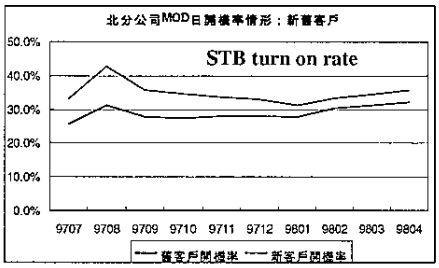


9. Strengthen Strategies Learnt









Touch Community

10. Concluding Remarks

- A reliable platform and infrastructure is the foundation, but the Quality-Content richness is the growth accelerator.
- Improving ARPU and holding time methods:
  - Target marketing strategies on specific customers, provide suitable content to associated subscriber (Touch Ground)
  - Make the user interface more friendly , assist subscribers to familiarize the content and the menu operation
- Bring Taiwan to HD age
- Accelerate the deployment of fiber access
- Expect IPTV penetration of Taiwan can be move forward on the worldwide IPTV rank list soon

Communications Research Centre Canada
An Agency of Industry Canada
Centre de recherches sur les communications Canada
Un organisme d'Industrie Canada

Quality Assessment of HDTV Distribution over IP Networks

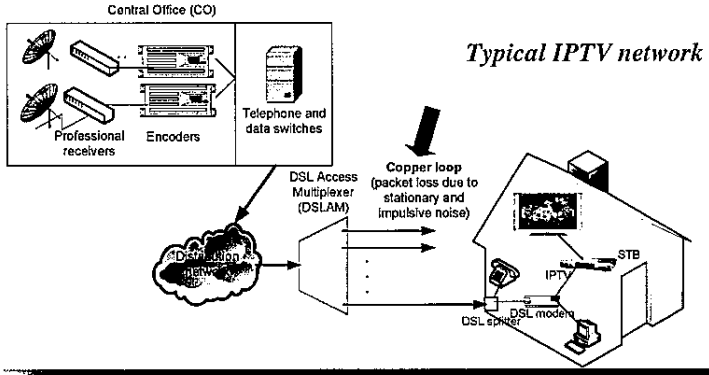
Omneya Issa, Wei Li, Hong Liu,
Filippo Speranza, Ron Renaud
Communications Research Centre Canada

Outline

- Introduction
- Objective
- System design
  - Video material and streaming
  - Impairment scheme
  - Subjective and objective tests
- Results and discussion
- Conclusion

Introduction

- HD content delivery over IP networks is becoming a reality
- Operators' networks are well managed (high priority for IPTV)
- HDTV delivery over best effort last mile access networks remains a challenge.



Typical IPTV network

Objective

Very limited research carried out on HD video quality assessment over IP network

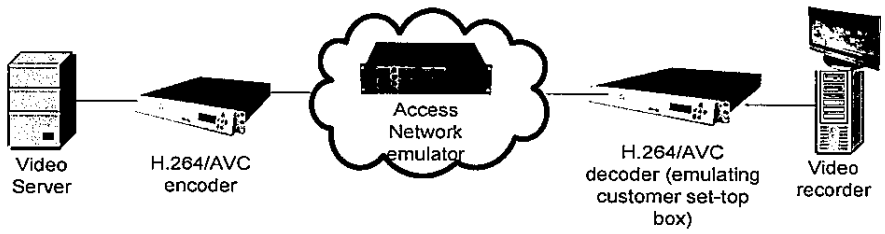
➡ *Assess video quality of H.264/AVC encoded HD material delivered over IPTV access networks.*

➢ Guidelines on:

- ❖ Prediction of user perceived quality in loss-prone environments
- ❖ User tolerance for viewing impaired HD broadcast IPTV

System Design

- A testbed emulating a real IPTV physical channel
- Professional live encoder and decoder
- Decoded video stored for post-analysis
- ANUE emulator introduced network impairments



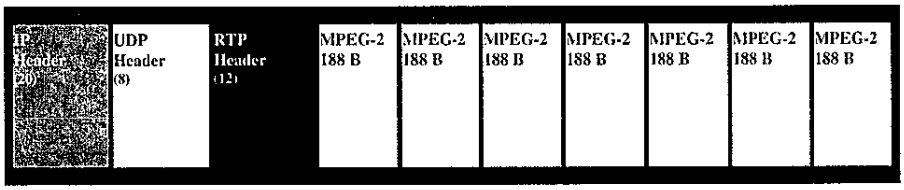
The Testbed

Video Material

- HD 1080i (1920 x 1080 pixels) format
- Two 2-minute sequences
- Twelve 10-second clips per block, covering a wide range of picture complexity
- Encoding: H.264/AVC
  - GOP length of 32 with IBBBP structure
  - Bit rate: 12 Mbps
- Decoder: Professional MPEG-4/AVC decoder, frame repeat for error concealment

Streaming

- MPEG-TS over UDP -> RTP/UDP/IP
  - 7 MPEG-TS packets in one UDP packet
  - 7x188B = 1316B payloads
  - 2-3% overhead



Impairment scheme

- Three types of packet loss on xDSL
  - single packet loss due to stationary noise
  - burst loss because of impulse noise *(most common)*
  - outage caused by link or node failure
- Burst loss
  - Erasure of all packets within burst loss duration
  - Burst length of 8ms + video bit rate (12 Mbps)
    → 10 consecutive lost IP packets
- Five packet loss rates selected
  - 1, 3, 5, 8 and 12 burst loss events/block ←→ packet loss rates ranging from $5x10^{-5}$ up to $1x10^{-3}$

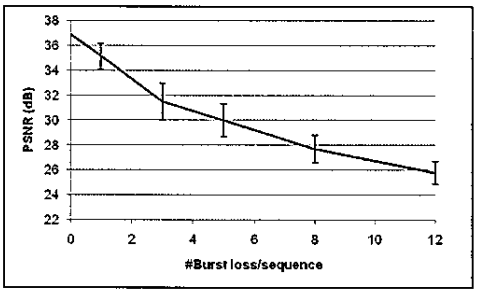
Planning for Subjective Tests

- Same packet loss can result in different quality perception depending on :
  - Picture content
  - Which bits are affected
- Result in :
  - Impairments barely visible 
  - Impairments very visible 

➡ Select "representative" test material based on multiple trials

Target Selection

- One 'representative' sample for each combination of video block and packet loss rate
  - select the sample whose PSNR is closest to the average of 20 repetitions



Average PSNR of 2-minutes sequence for different severity levels

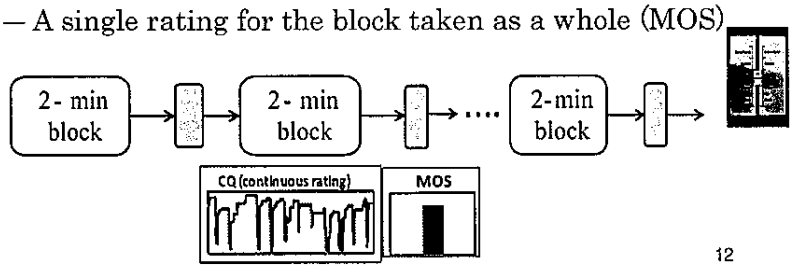
Objective Measurements

- Three full-reference metrics
  - PSNR
  - Structural SIMilarity Index (SSIM)
  - National Telecommunications and Information Administration (NTIA) VQM (General Model)
    - Calibrated to our hardware encoder/decoder

Subjective Measurements

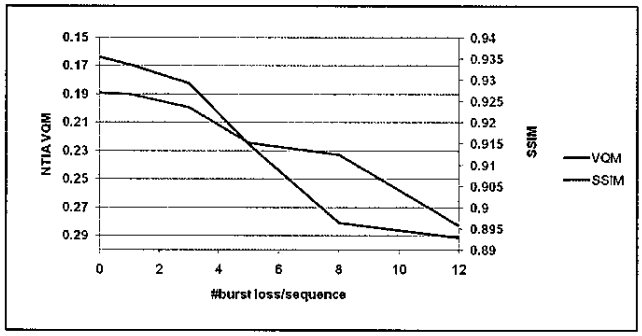
- Source + compressed error-free + 5 impaired
  - 14 x 2-minutes experimental video blocks
  →a total of 28 minutes of viewing material

- Evaluation method
  - Single Stimulus Continuous Quality Evaluation (SSCQE)
  - A single rating for the block taken as a whole (MOS)



Results and discussion

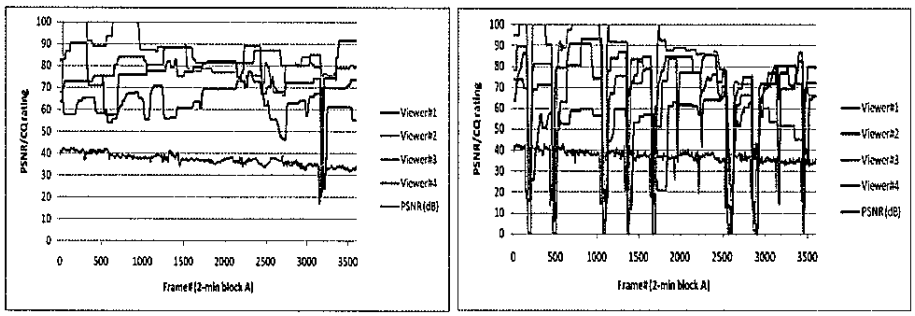
- Objective results



VQM and SSIM data of 2-minutes sequences for different severity levels

Results and discussion

- Subjective results

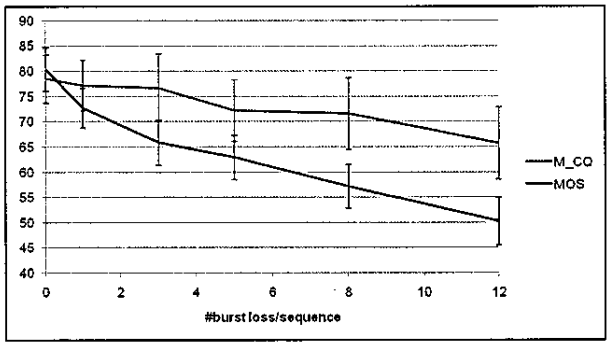


One burst loss *12 loss events*

Continuous ratings (CQ) and PSNR of 4 typical viewers

Results and discussion

- Subjective results across all viewers
  - Average CQ rating over 2-minutes (M_CQ)



Continuous quality and MOS ratings of the subjective tests

Summary

- Assessment of effect of packet loss on HD IPTV distribution
- Subjective and objective measurements
- PSNR tracks well MOS rating of video subject to transmission errors
- Video quality computed from continuous rating does not match the overall opinion of viewers
- Need better pooling method, ex. service acceptability
- Viewer tolerance of visual impairments due to transmission errors could relax the ITU recommendations for HD IPTV ???

Thank you

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Wireless Broadband Access (WBA) Regulatory Policy and Mechanism in Taiwan
2009

Der Wei Wang
National Communications Commission

Outline

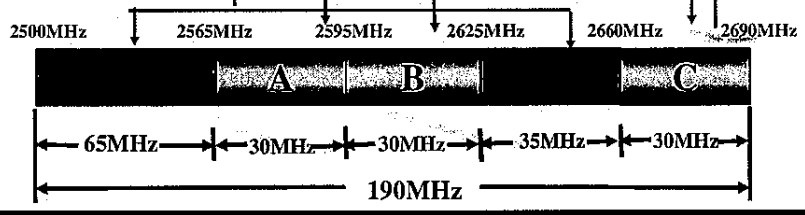
- Introduction
- WBA Spectrum Allocation
- Key items in regulation
  - Licensing framework
  - Licensing procedure
  - Establishment preparation
- Timeline for WBA licensing
- Status of Operation

Introduction

- ◆Major Goals:
  - ➢ Promote the development of wireless businesses
  - ➢ Enable a sound environment for the development of novel communications technologies
  - ➢ Ensure fair competition and the future development of this service
  - ➢ Provide opportunities for prospective operators
- ◆Licensing approach: hybrid of beauty contest & auction
- ◆Licensing principles :
  - ➢ Lower threshold
  - ➢ More operators
  - ➢ Shorter terms

WBA Spectrum Allocation

- ◆ 2.5GHz to 2.69GHz released for mobile WBA
- ◆ Two-phase license issuance
  - Phase one
    - ➢ Spectrum release: 90 MHz
    - ➢ License issuance:6 regional licenses (3each for north and south regions)
  - Phase two
    - ➢ Spectrum release:100MHz left will be released for the future needs



Licensing Framework for WBA

◆Regional Licenses

- Valid period of Licenses
  - ➢ 6 years & can be renewed only once
- Licenses may be merged and converted to a nationwide license
- Each licensee will be assigned a 30-MHz with no guard bands for TDD use
- Each application cannot be granted more than one license

◆Selected License X1 and X2 as the Priority bidding

- Adopted IEEE 802.16e technical standard
- Limited to not a dominant company in the Type I Telecommunications business

◆The requirements for applying for service

- According to Telecommunications Act
  - ➢ the chairman shall have the nationality of the R.O.C.
  - ➢ the total direct shareholding by foreigners <49%
  - ➢ the sum of direct and indirect shareholding by foreigners <60%

Two Stages of Licensing Procedure (1)

◆ First Stage(1/2) : Beauty Contest

- NCC set up the panel to determine the qualification of the applications
  - ➢ 11 panel reviewers – experts in finance, engineering, communication, or industrial economics

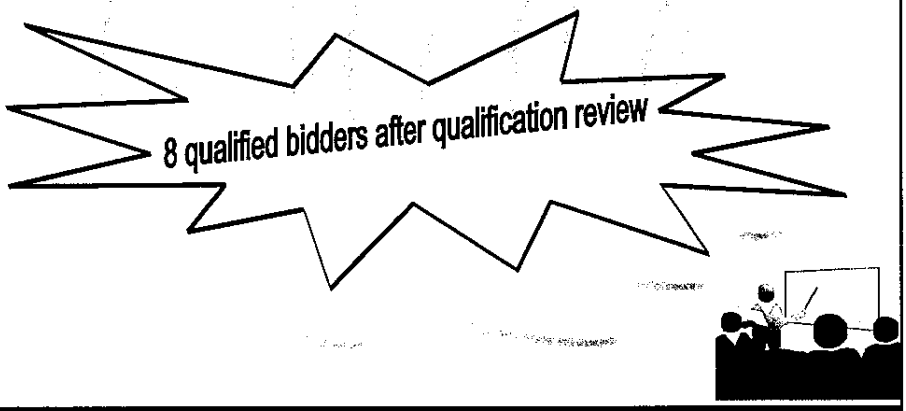
  3 commissioners, 2 government officers, and 6 professors
- Items and the proportion for the review :

  Business planning book : 80 points
  - ➢ Network deployment and technology ability (28 points)
  - ➢ Service and operation planning (23 points)
  - ➢ Financial planning (23 points)
  - ➢ Planning for protection of rights of subscribers (6 points)
  - ➢ Other items (5 points)

  ⇨ Face - to face talk : 20 points
- The applicant which passes the reviewing process (over 75 points) will become qualified bidders.

Two Stages of Licensing Procedure (2)

- First Stage(2/2) : Beauty Contest
  - 13 applicants applied for WBA service

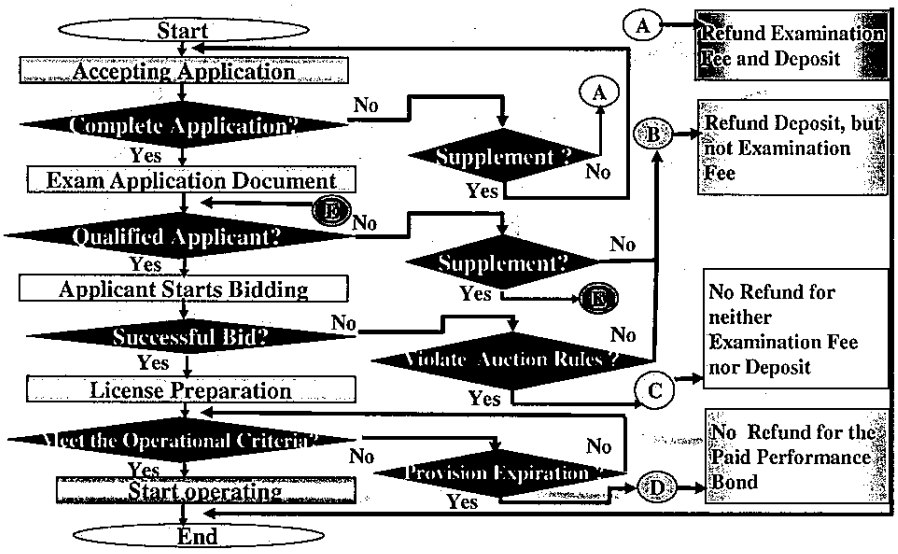


Two Stages of Licensing Procedure (3)

- Second Stage : Auction
  - Limited multi-round bidding
    - Qualified applicants - 10 or more
      Adopt maximum of 10 rounds of bidding
    - Qualified applicants - less than 10
      Adopt single round of bidding
  - Bidding object
    - Refer to a percentage to multiply by the annual revenue of the WBA service as the calculation of charter fee

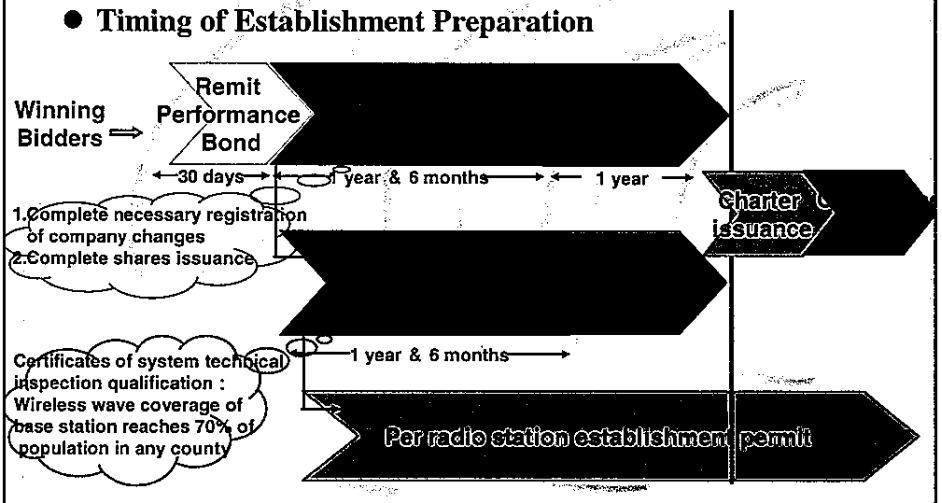
6 winning b[illegible] on July 26, 2007

WBA Licensing Procedural Flow

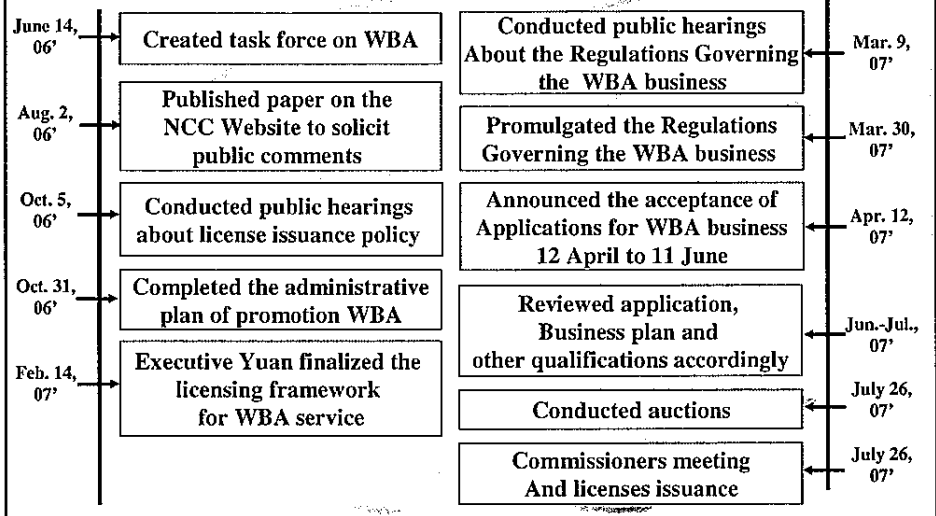


WBA Establishment Preparation

- Timing of Establishment Preparation



Timeline for WBA Licensing



Status of Operation

- NCC announced 6 winning bidders for WiMAX business in Taiwan - July 27th 2007.
- Winning bidders: Tatung InfoComm, First International Telecom, Global Mobile Corporation, VMAX Company, Vee Telecom Multimedia Co., Ltd. And Far EasTone Telecommunications Co., Ltd.
- The winning bidder, Tatung InfoComm began operations in Peng-hu county on April 27, 2009
- Other operators construct their network systems justly and actively.

Thank you for Your Attention!

WiMAX Development in Taiwan

Presented by Mr. Nien-Po Sheng (Roger)
Telecom Technology Center
National Communications Commission

Outlines

- "M-Taiwan" Project
- WiMAX Status in Taiwan
- Challenges/Opportunities

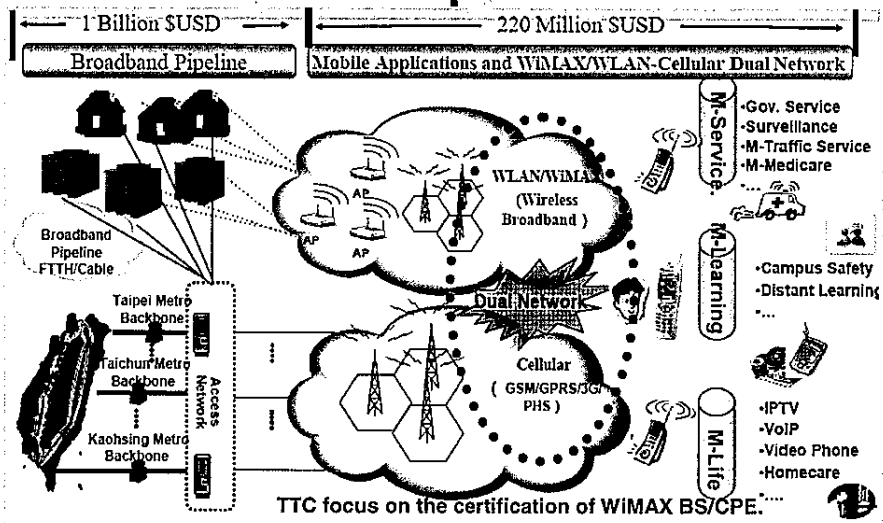
M-Taiwan Project Since 2005

National Communications Commission

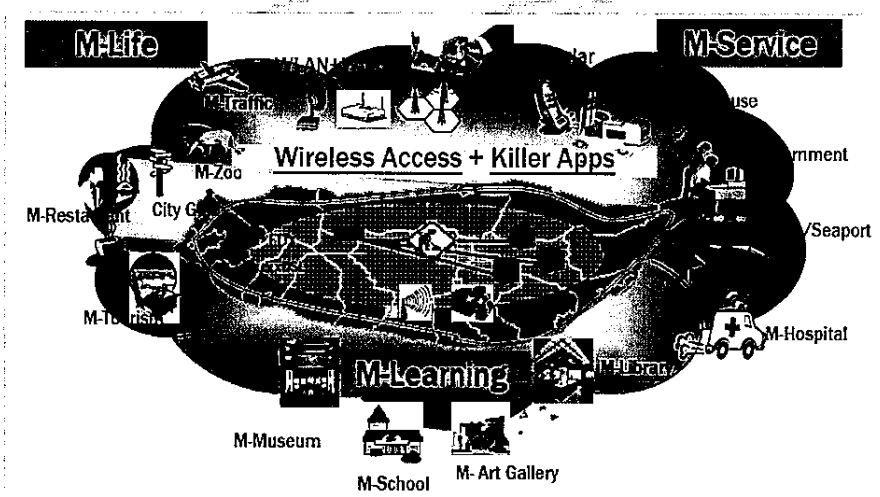
Taiwan WiMAX Blueprint

- The Science & Technology Advisor Group (STAG) of Executive Yuan has developed a WiMAX Blueprint, which states: *"WiMAX Technology will be a focus for the future of Taiwan IT industry and will be a preferred technology option to deliver M-Service, M-Learning and M-Life in " M(obile)-Taiwan Program".*
- The Blueprint provides guidelines for :
  - Technology development Strategy
  - Nationwide R&D projects
  - Spectrum allocation Planning

M-Taiwan: A Program to Realize Taiwan WiMAX Blueprint



M-Taiwan Vision



Vision : Any where, Any time for Any One to Enjoy Broadband/Wireless Services

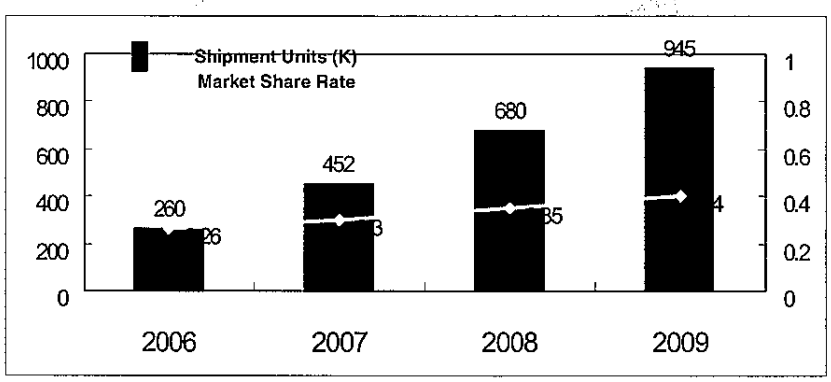
WiMAX Status in Taiwan

National Communications Commission

Taiwan WiMAX Operators Status

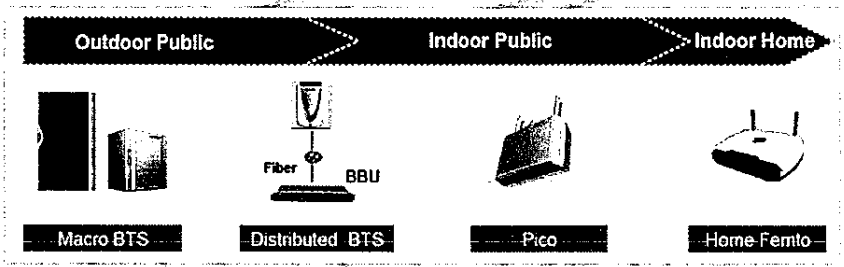
Operator	License Area	Equipment Vendors/ Deployment Strategy
Global Mobile	North	Has selected its vendor of CPE, BS, Core network etc. Starting deployment since Q1 of 2009. Planning to launch service in Q3 of 2009 (BS: NSN; MS: Taiwan vendors)
Vmax	North	Funded by Intel Capital with 11.35M USD. Planning to launch service in Q3 of 2009 in Taipei city and County (BS: Samsung & Alvarion; MS: Taiwan vendors)
FITEL	North	Having M-Taiwan project with 88 Moto BS in Taipei City. Due to financial issue, Fitel suspends its investment. (BS: Moto; MS: Taiwan vendors)
Vee	South	Planning to complete vendor selection in Q2 and launch service in Q4 of 2009 .
Tatung Telecom	South	WiMAX service was launched in Penghu Island in April 2009. Kaohsiung will launch services in July 2009. Don't have enough end users in Penghu island. (BS: Huawei, ALU MS: Taiwan vendors)
Far Easton	South	Having M-Taiwan project with 100 Moto BS in Taichung. Planning to launch service in Q4 of 2009. (BS: Moto; MS: Taiwan vendors)

Taiwan WiMAX CPE Status



~25 WiMAX CPE Vendors in Taiwan

WiMAX Contents Provided in Taiwan



Office building
Shopping Center

Subway Station
Airport

Small Office

Home

Simple bridging between Broadcasting and Internet Connection

Shopping Information Services

Sight Seeing Information Services

Education Services

Challenges

Challenges

- High user fee
  UQ communication: 4,480円(43USD)/month
  Clearwire: 38 USD/month
  Tatung Telecom: 1680NTD(49USD)/month
- Interoperability Issue
  Base Station vs. Mobile station
  Infrastructure/Core network interoperability
- Radio coverage issue
  Lower Power, Higher Center Frequency,...
- Killer applications
  Not clear now!!
- Roaming issue
  Lack of multi-mode CPE...

Q & A

Thank you for your time and attention!

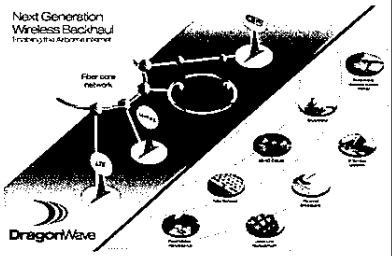
Mr. Nien-Po Sheng (Roger)
Telecom Technology Center
National Communications Commission

DragonWave Overview

DragonWave

DragonWave Fast Facts

- **Headquartered in Ottawa, Canada**
  - Founded in 2000
  - Office in US, UK, France, Germany and Dubai
  - Global Support Team (60% Americas, 40% EMEA)
- **Public Company**
  - Traded in Toronto (TSX)
  - Ticker: DWI
- **Revenue**
  - FY07: $24.2M, FY08: $40.4M
  - Most Recent Results Q3 Fiscal 2009 - $10.7M
- **Capital-efficient scalable business model**
  - Manufacturing outsourced
  - Two Contract Manufacturers – BreconRidge & Plexus



DragonWave

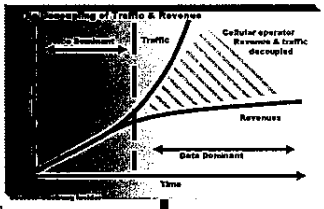
Backhaul Evolution

2G → 3G → 4G

6 Mbit – 8 Mbit

TDM Based - Voice

"Voice Handsets"



30 Mbit – 100 Mbit +

IP Based - Multi Services

"Life Unwired"

Type	NA %	Cost per Mbit
Copper	75%	$$$
Fiber	20%	$$
Microwave	5%	$

→ Cost Leverage for 3G/4G Business Case →

Type	NA %	Cost per Mbit
Copper	0%	$$$
Fiber	30%	$$
Microwave	70%	$

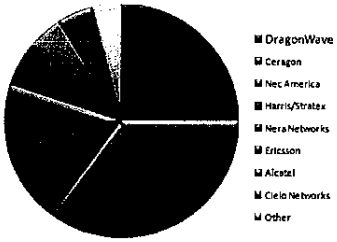
DragonWave

Next Generation Microwave

- IP Based
- High Capacity
- Scalable
- Low latency
- Networkable

US Microwave Deployments (2008 Results)

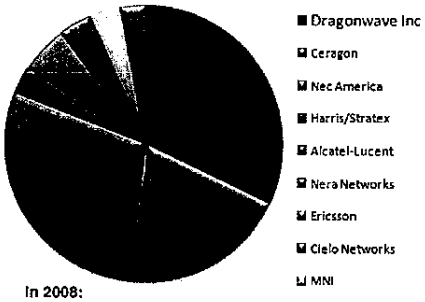
2007 – 11, 18 & 23 GHz US Microwave Deployments



In 2007:

- ✓ DragonWave is **#1** in combined **11, 18 & 23** GHz Links (**25%** market share).
- ✓ DragonWave increases market share position in **18 & 23** GHz to **32%**.
- ✓ DragonWave remains the leader in 24 GHz U/L

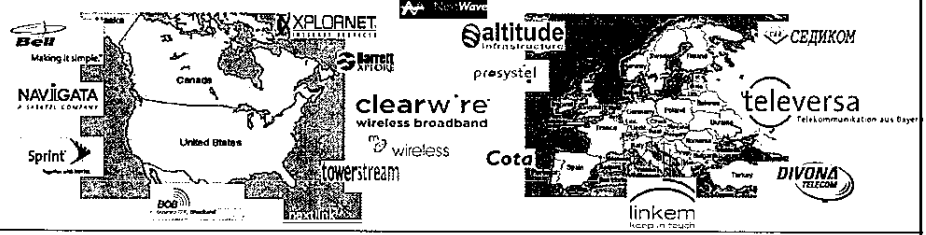
2008 – 6, 11, 18 & 23 GHz US Microwave Deployments

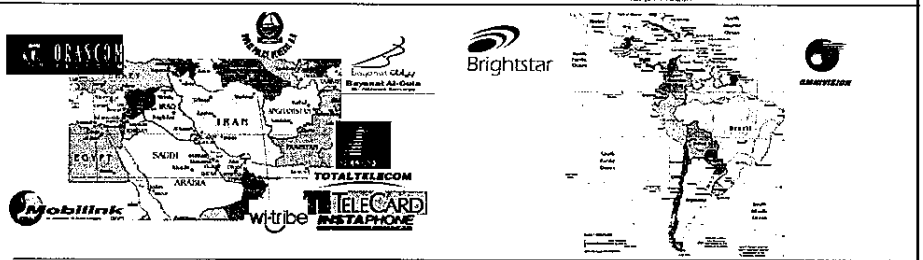


In 2008:

- ✓ DragonWave is **#1** in combined **6, 11, 18 & 23** GHz Links (**32%** market share)*
- ✓ DragonWave increases market share position in **18 & 23** GHz to **46%**.
- ✓ DragonWave remains the leader in 24 GHz U/L

Global Market

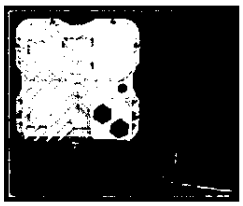


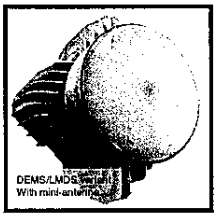


DragonWave

Horizon Compact

- **Horizon Compact**
  - lowest cost solution – Improved Economics
  - Increased Throughput – up to 2 x 400 Mbps
  - "zero" foot print saves valuable shelter space
    - All outdoor means no HVAC demands
    - Ultra low power consumption
  - Multiple Configurations
    - 1:0, 2:0 with LAG, 1+1 HSB, SD &/or FD, ring/mesh
  - Simple, low cost cabling ... uses CAT5E
    - Optical option for extended cable runs
  - Simplified Operation & manageability
    - SNMP V1/2/3, HTTP, SSL, SSH, RADIUS
    - Ultra-high reliability
    - Active RF loopback for 100% link-end fault isolation ... reduces MTTR

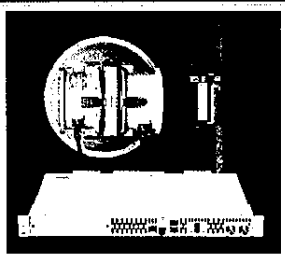


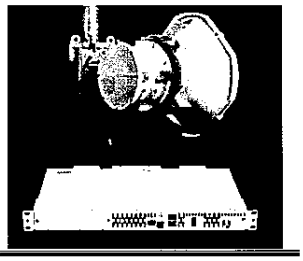


DragonWave

Horizon DUO

- **800 Mbps per IDU**
  - Single or dual radio configurations
  - Up to 1.6 Gbps per link with dual channel operation
- **Reuse of current AirPair radio ODU**
  - Ease of upgrade from AirPair
  - 11GHz - 38GHz Frequency Support
  - Space Reduction (3X Capacity per 1U vs AirPair)
- **Multiple Configurations**
  - 1:0, 2:0 with LAG, 1+1, SD and/or FD, XPIC, ring/mesh
- **Maintains current Horizon Compact feature set**
  - Flex, Low Latency, Mesh, Native Ethernet, GigE, Clip Mount, Adaptive Modulation
  - Rapid Link Shutdown, Jumbo Frames, 802.1p, Flow Control, Weighted Fair Queuing





DragonWave

Service Delivery Unit (SDU) - Features

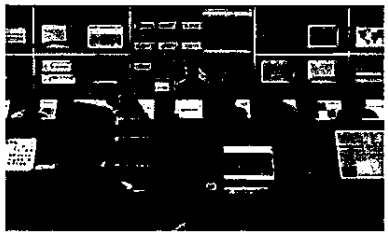
- **Up to 3 per 1RU**
- **6XGigE Interfaces + 16 E1/T1 or STM1/OC3**
  - Configurable between uplink, client and management ports
  - Optical GigE Options
- **Rich feature set**
  - 1+1 Head End Redundancy
  - 802.1ag, 802.3 ah, ITU-T Y.1731
  - 802.1P, RSTP, VLAN, LACP support
- **Multiple Configurations supported**
  - Point to Point (E1/T1 to E1/T1)
  - Aggregation (multiple E1/T1 units to a single STM1/OC3 unit)
  - Dual homing
- **Multiple Timing options**
  - External Clock Input
  - Adaptive clock with Timing over Packet
  - Meets AT&T TR-62411 & G.823 Jitter and Wander
- **Remote Network Management**
  - SNMP V1/V2c/V3, Web GUI, CLI

DragonWave

DragonWave EMS / NMS

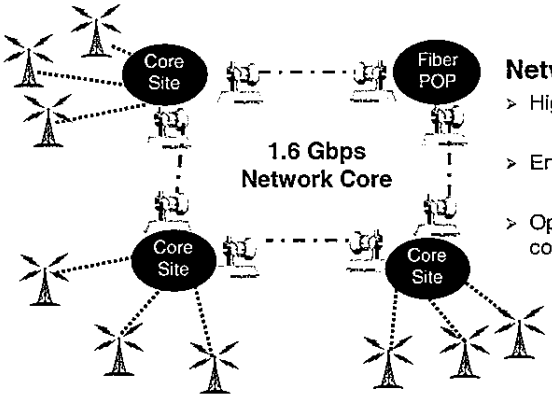
- **DragonWave has chosen a standards-based approach**
  - Uses common industry-standard existing platforms and toolsets
    - Full Graphical User Interface (GUI)
    - Does not require proprietary software
      - Small amount additional training required
      - Operations groups use existing platforms and toolsets
    - Does not require additional hardware (PCs, servers, probes)
    - Integrates into any SNMP management platform

- Integrates into any new or existing management system or network



DragonWave

Horizon Network Applications



Network Fit:

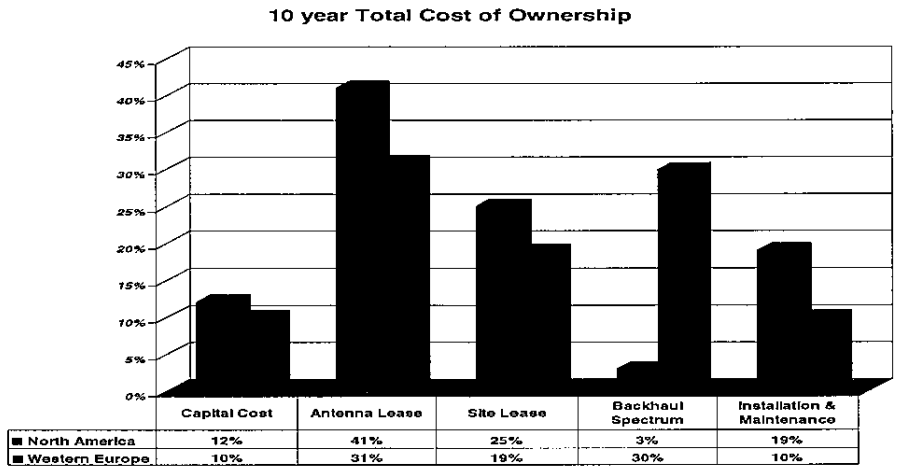
- High-Capacity Duo core rings
  - Up to 1.6 Gbps per link
- End site access via Horizon Compact
  - Up to 400 Mbps
- Optional SDU for sites requiring converged TDM/Ethernet

Horizon Duo Core Link

Horizon Compact Access Link

DragonWave

Backhaul Cost of Ownership

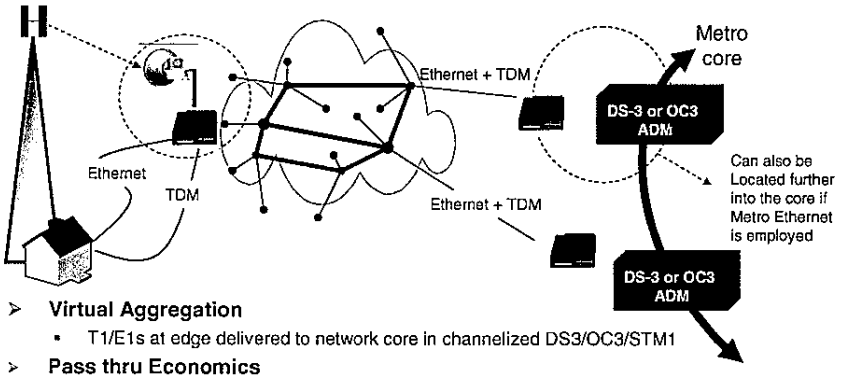


	Capital Cost	Antenna Lease	Site Lease	Backhaul Spectrum	Installation & Maintenance
North America	12%	41%	25%	3%	19%
Western Europe	10%	31%	19%	30%	10%

DragonWave

Converged Mobile Backhaul Network

Wireless Ethernet Backhaul MESH



- **Virtual Aggregation**
  - T1/E1s at edge delivered to network core in channelized DS3/OC3/STM1
- **Pass thru Economics**
  - Only local TDM traffic needs to be handled at any given site
- **Future Proof**
  - Only edge of network changes as traffic mix changes

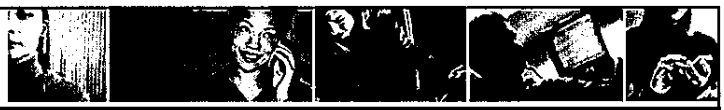
DragonWave

Network Design Example 2

WiMAX Operator

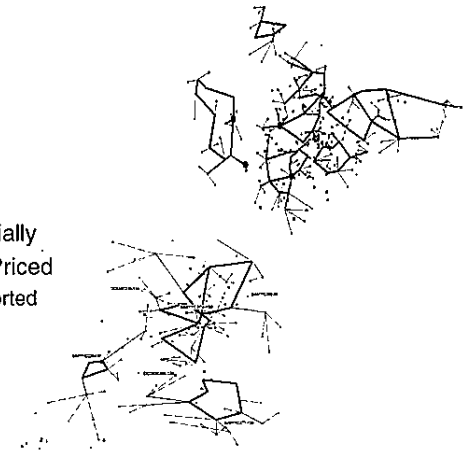
Ring vs Hub and Spoke

DragonWave



Network Study

- **Network Data**
  - 20 Fiber Pop's
  - 400 Target Sites
  - WiMax Deployment:
    - Serving 10Mb per Site Initially
    - Growth to 80Mb per Site Priced
      - Additional growth supported



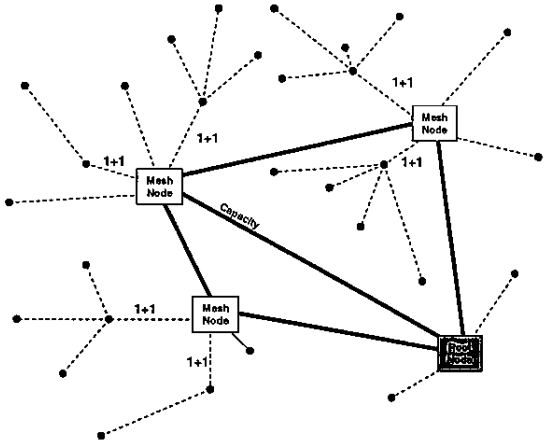
DragonWave

Executive Summary – Network Design

- **WiMAX Backhaul Network –**
  - Designed for 10 Mbps, software scaling to 80 Mbps
  - 91% Site Coverage
    - Sites not covered are low mounting height issues
- **Very Deployable**
  - Ave. Antenna size – 80% are 30 cm; only one 120 cm link
  - Uses only 10 Fiber POPs
    - Any of the 80+ ring sites could be pursued for fiber sites
  - 77% of end sites have 5 or more LoS options
- **Network Performance**
  - Average Delay of 2 ms and 99.995% end to end availability
    - Worst Case delay under failure conditions of 6 ms at 99.99% availability

DragonWave

Mesh/Ring Topology



Comparison to Hub and Spoke

- Fewer links for redundancy
  - Lower cost
- Access to working and protection paths
  - Higher capacity
- Path diversity for availability gain
  - Allows smaller antennas
- 50% higher statistical multiplexing gain
  - Larger community of interest
  - Effective spectral efficiency gain
- Ring splitting for low cost capacity
  - 20% cost vs 50% for 1:N

DragonWave

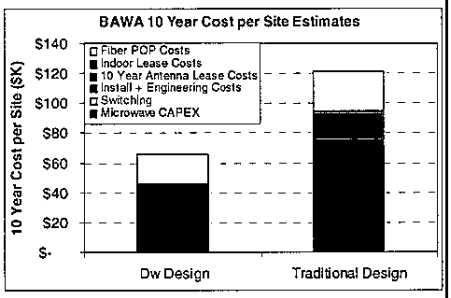
Ring Design Vs. Traditional Hub & Spoke Architecture

	Ring Design	Hub and Spoke
Site Coverage	90%	50%
End Sites/Fiber POP	40	8
Antenna Size Distribution	30 cm – 85% 60 cm – 2% 75 cm – 13%	30 cm – 25% 60 cm – 14% 75 cm – 61%
Max Antennas Per Site	8	12
Alternate Fiber Options Without effecting design	8XFiber POPS (All Ring Nodes)	0

DragonWave

Total 10 Year Savings Estimates

- **Savings from Smaller Antenna Size ~**
  - 50% Antenna Lease savings as 80% of antennas are 1'
- **Indoor Leasing**
  - Equivalent of $10K per site cost savings, assuming $100/month cost at end sites
- **CAPEX**
  - ~25% Savings due to 1+1 reduction and antenna size reduction
- **Fiber POPs**
  - ~25% CAPEX Savings due to Fiber POP reduction

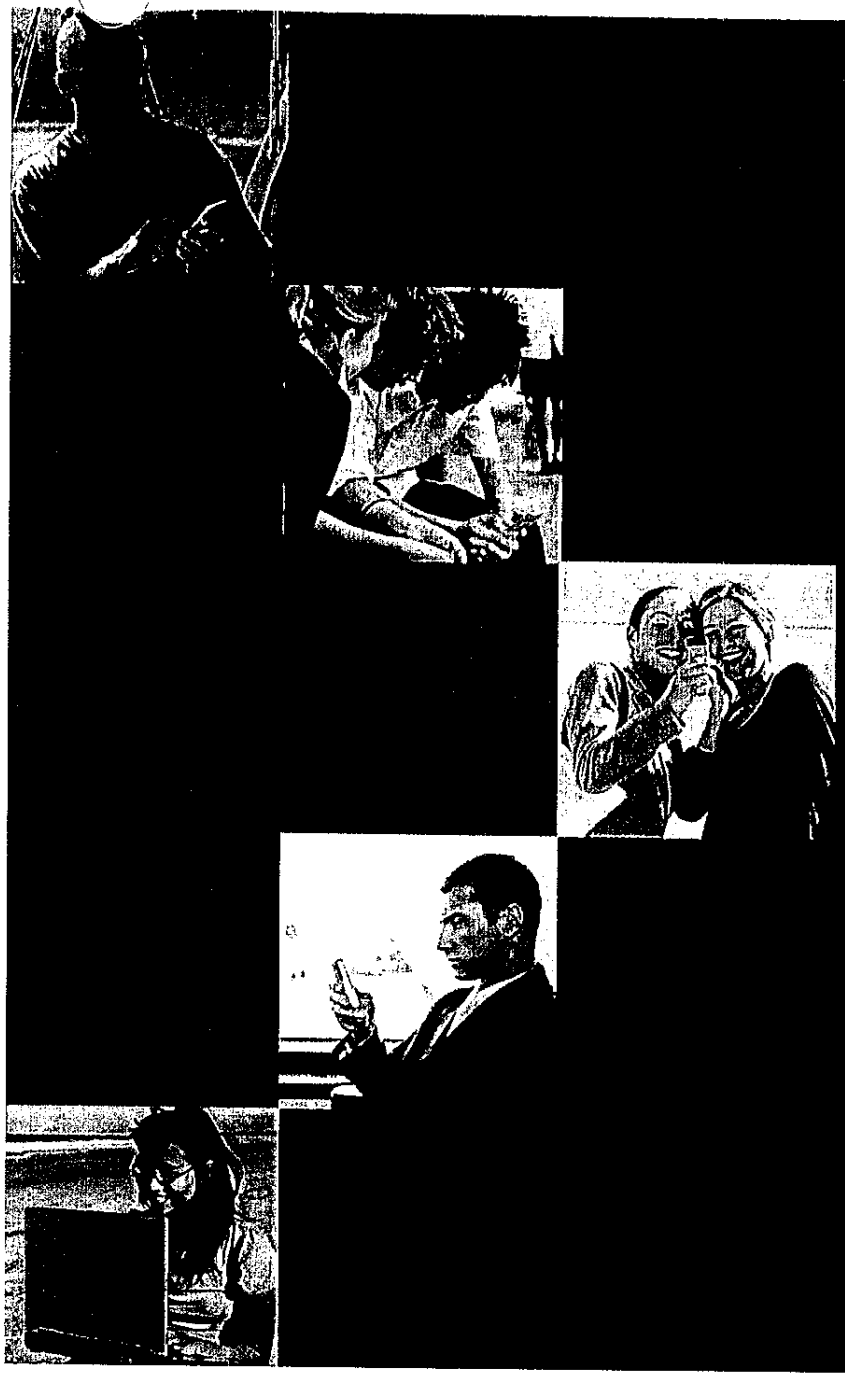


Total Cost Savings per site could be on the order of 50%. This is before including the benefits of BH+BST antenna integration

DragonWave

DragonWave Benefits

- **Highest Carrier-Grade Capacity**
  - 1.6 Gbps on a single link
- **Lowest Cost per bit**
  - Double the Bandwidth with half the hardware
  - Increased Spectral Efficiency
- **Lowest Total Cost of Ownership**
  - All-Outdoor
  - Ring/Mesh Architecture
  - Reduced spectrum costs
- **Converged IP Network transport**
  - Future proof against traffic mix



What Keeps WiMAX Operators Up At Night?

bridgewater SYSTEMS

Gil Riddall
Sr. WiMAX Business Manager

May 13, 2009

Bridgewater at a Glance

- Founded in 1997; Public (TSX: BWC)
- Mobile Personalization Innovator
- #1 in CDMA/EV-DO; #1 in WiMAX
- Market Leader in Service & Policy Control
- Enabling Mobile Data Growth/Transformation
- 150M Subscribers in 100+ Networks Globally
- Profitable and Growing

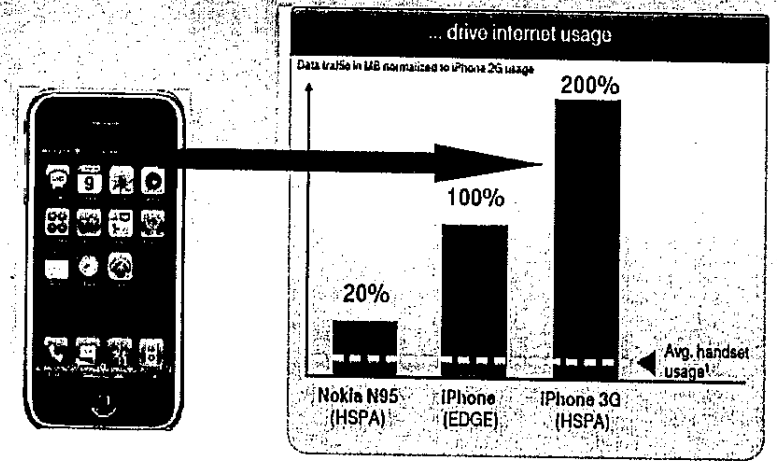
bridgewater SYSTEMS

THE MOBILE PERSONALIZATION COMPANY

The Mobile Data Tsunami

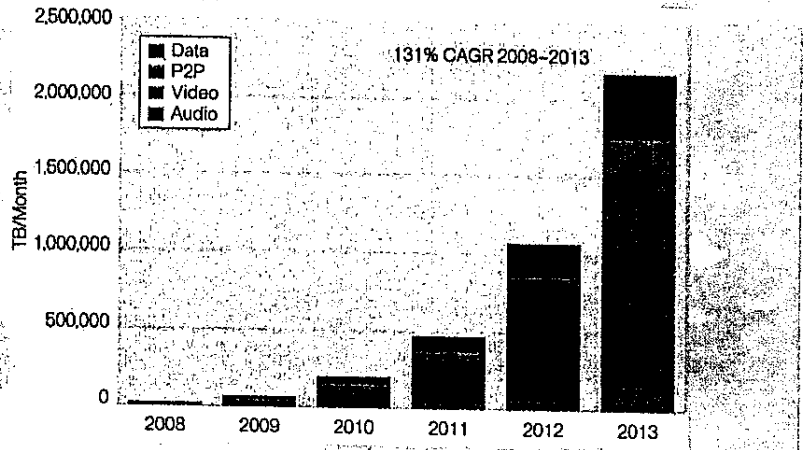
bridgewater SYSTEMS

The iPhone Effect



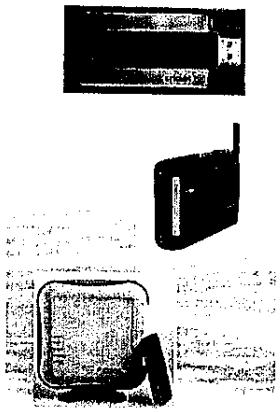
Source: TMobile

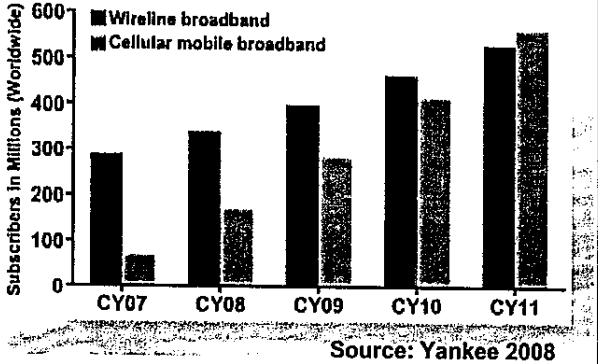
Mobile Data Growth



Source: Cisco 2009

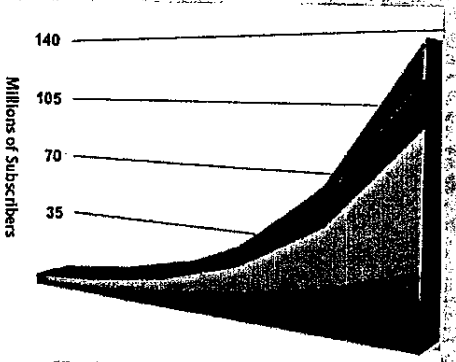
Expanding Mobile Coverage

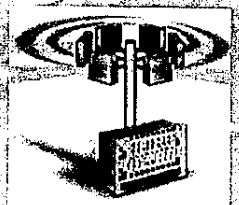




Source: Yankee 2008

WiMAX Subscriber Forecast





Source: WiMAX Forum

WiMAX is a Global Reality

bridgewater SYSTEMS

135

460 network

430 Million

800 Million 2010

clearwire

Sprint

SCARTEL

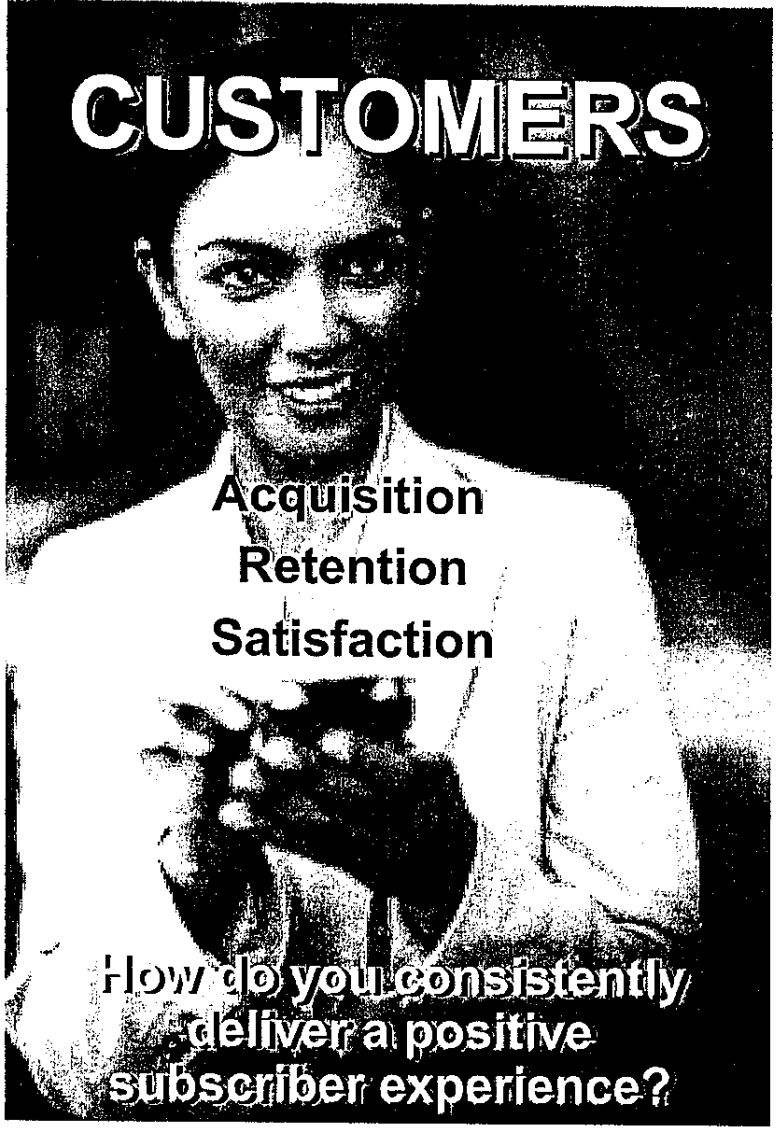
TATUNG

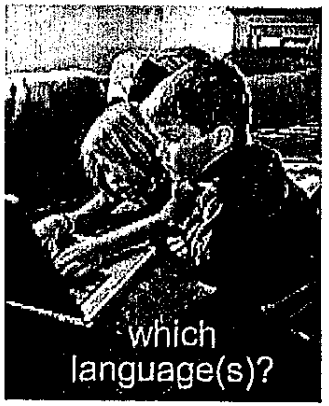
FIRST INTERNATIONAL TELECOM

Accelerating commercial launch is critical –
competition intensifying, multiple broad alternatives available

What keeps service providers awake at night?

bridgewater SYSTEMS

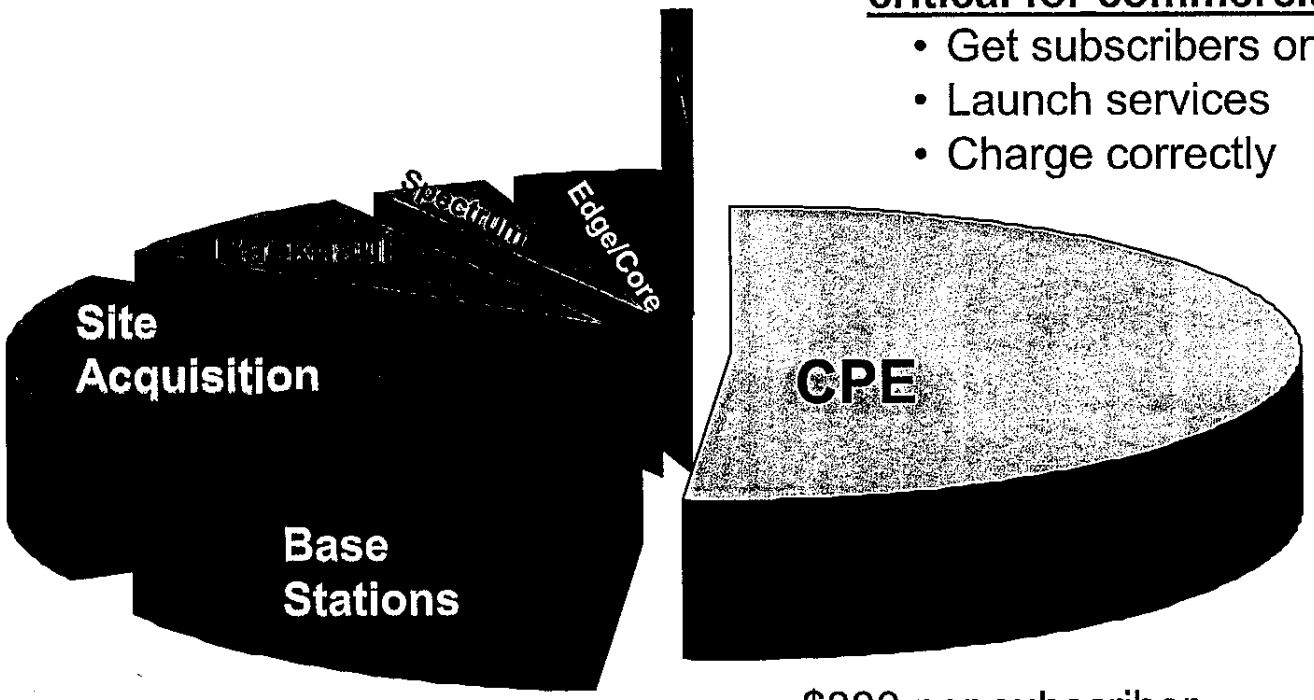




How much do you invest in your subscribers?

bridgewater SYSTEMS

Service Control: 1%



Source: WiMAX Forum, Bridgewater

a small part of total investment, but **critical for commercial launch**:

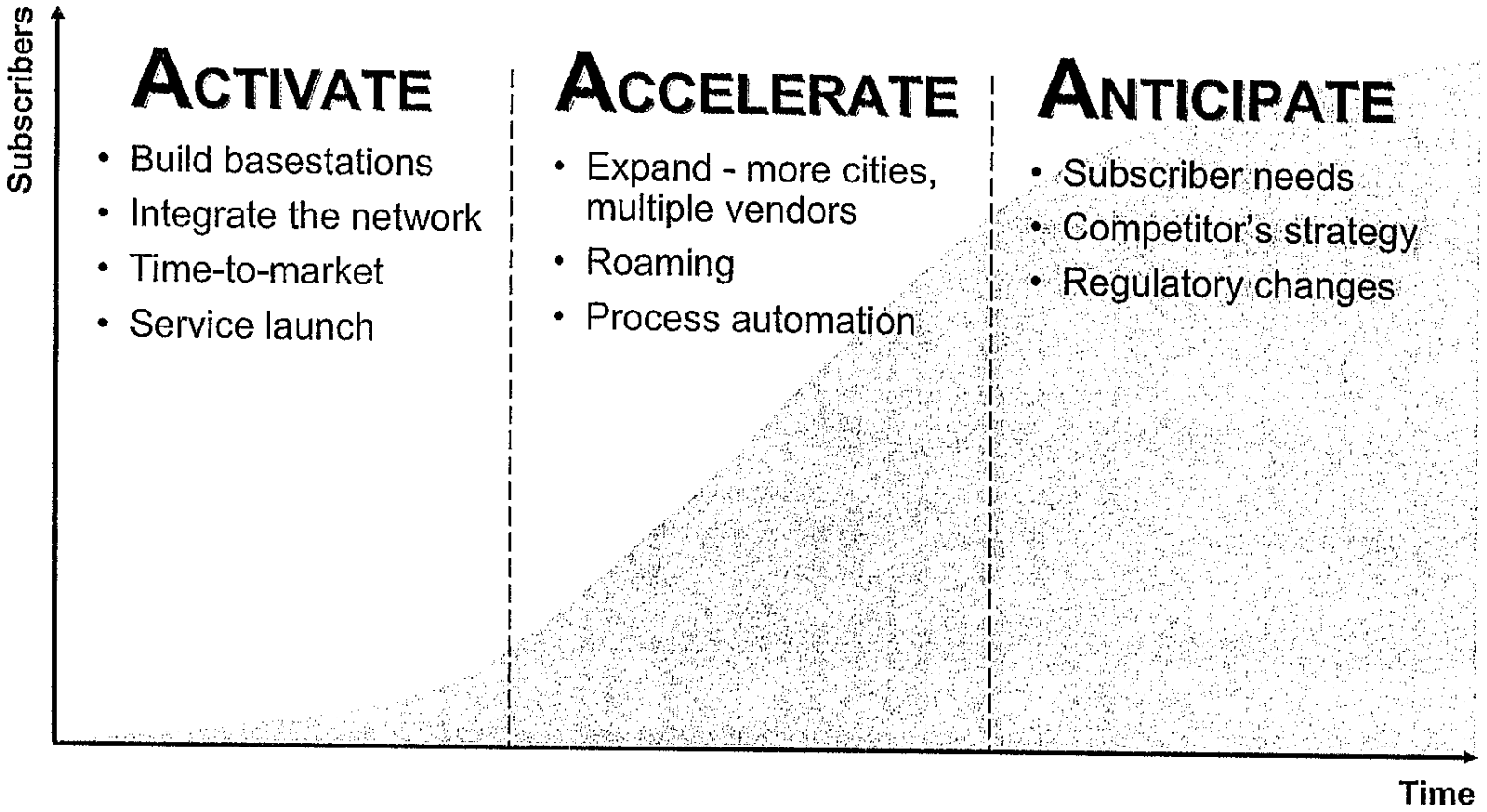
- Get subscribers on net
- Launch services
- Charge correctly

~$330 per subscriber

Making the right investment choices key for business success

Bridgewater's WiMAX experience

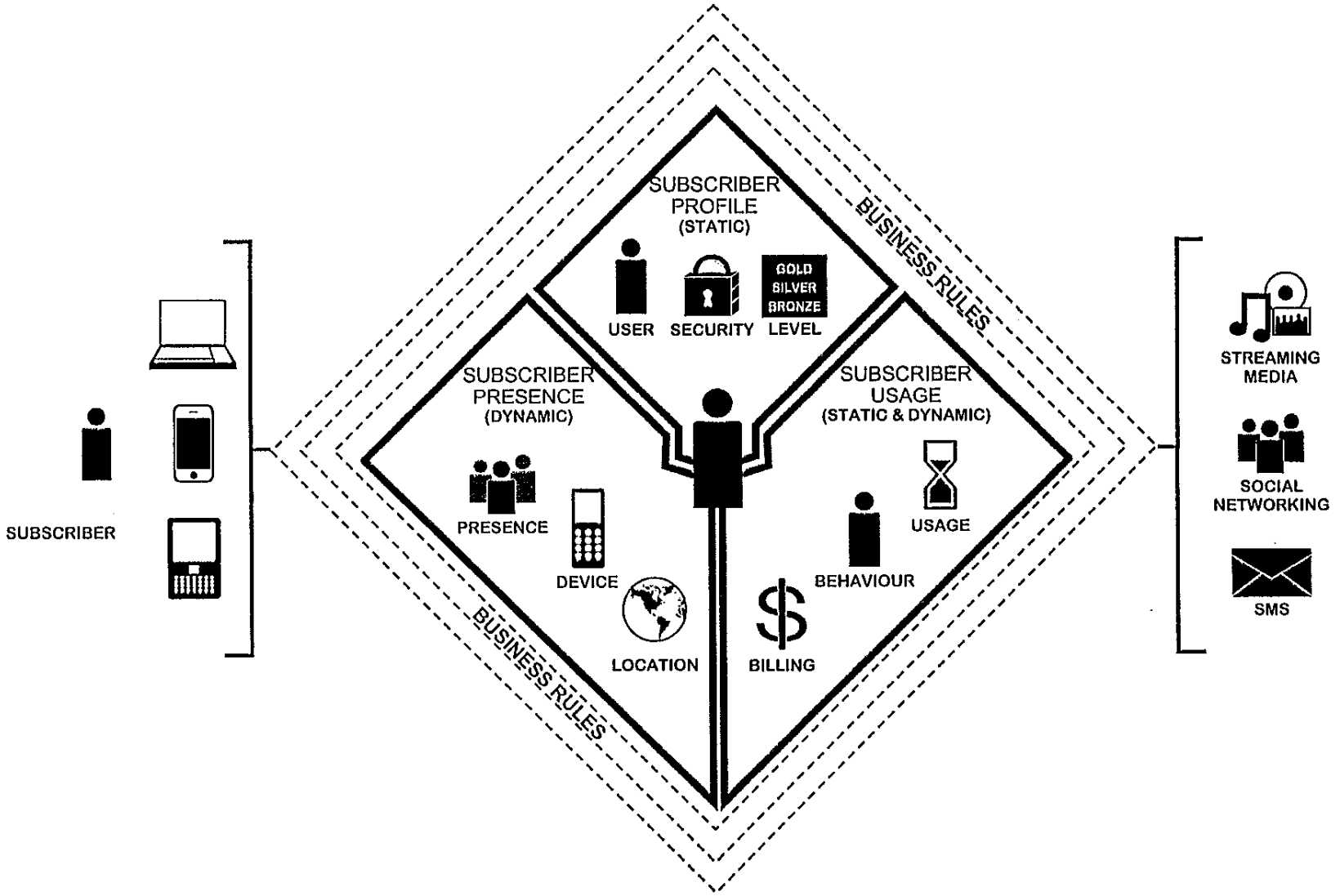
bridgewater SYSTEMS



Challenges evolve throughout the lifecycle

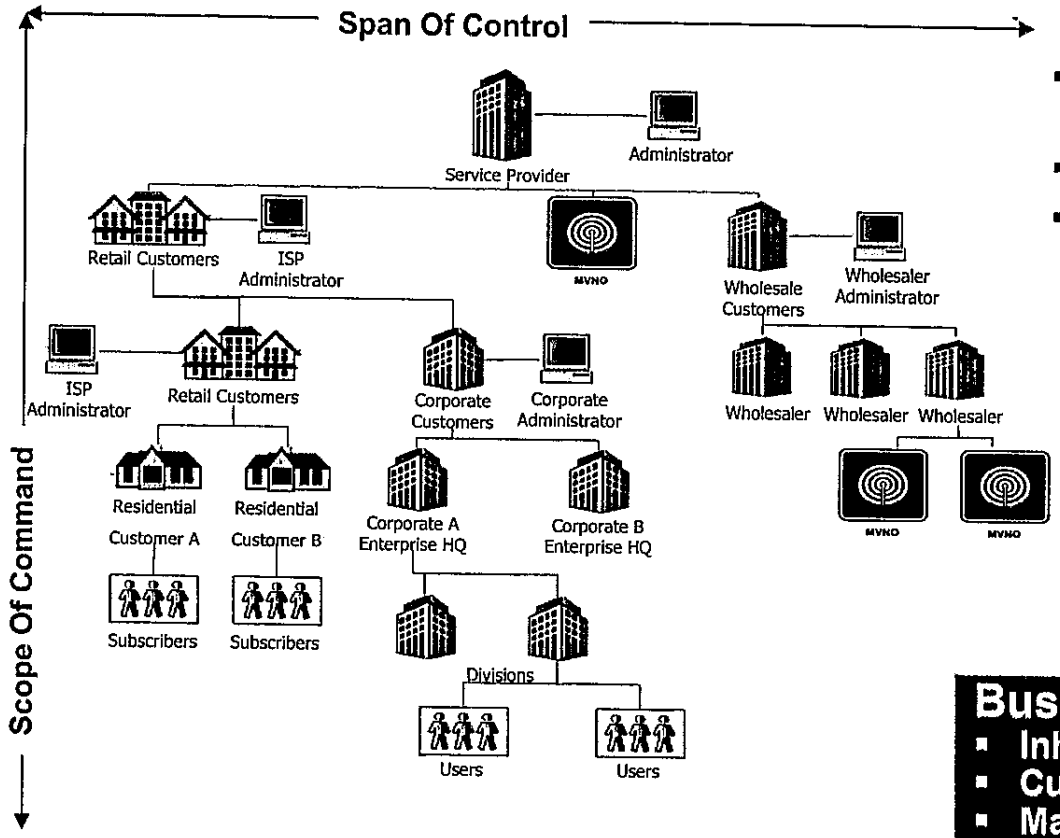
Service Control maximizes subscriber value

bridgewater SYSTEMS



Hierarchical Organization + Flexible Queries: Service Agility and Flexibility

bridgewater SYSTEMS



- Models subscriber groups, service packages, and their relationships
- Flexible Service Bundling
- Hierarchy & Inheritance
  - Groups and security model
  - Self Administration
  - Profiles Inheritance
  - Assigned at any level
  - Override ability

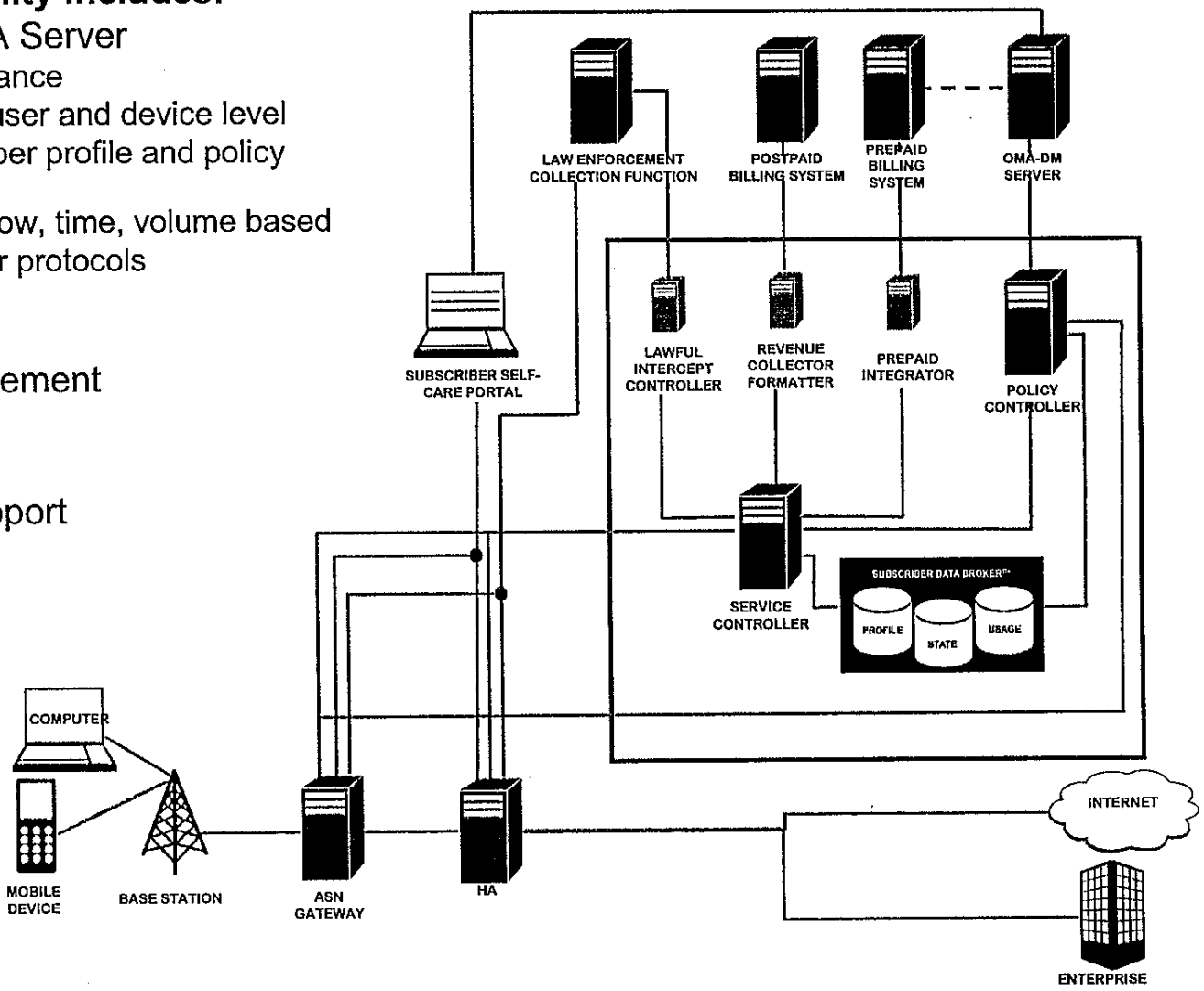
Business Value

- **Inherent agility and flexibility**
- **Customize services for subscriber segments**
- **Manageable and scalable**
- **Self Administration**

WiMAX Network Deployment

bridgewater SYSTEMS

- **WiMAX CSN functionality includes:**
- Service Controller - AAA Server
  - WiMAX Forum compliance
  - Authentication: EAP, user and device level
  - Authorization: subscriber profile and policy based
  - Accounting: service, flow, time, volume based
  - RADIUS and Diameter protocols
  - Mobile IP Support
  - RADIUS Proxy
- Subscriber Data Management
- DHCP server
- Provisioning API's
- Prepaid & Hotlining Support
- Lawful Intercept
- Over-the-Air Activation
- Policy Controller



Example service plans and business models

bridgewater SYSTEMS

Fixed monthly billing

mainstreet BROADBAND	High Speed Internet	serving rural communities

Prepaid and flex plans

XOHM	Home	alternative to DSL, cable
	On-the-Go	mobile broadband
	Pick 2	two devices, one subscriber, a single plan
	Daily On-the-Go	for the casual user

Content and services

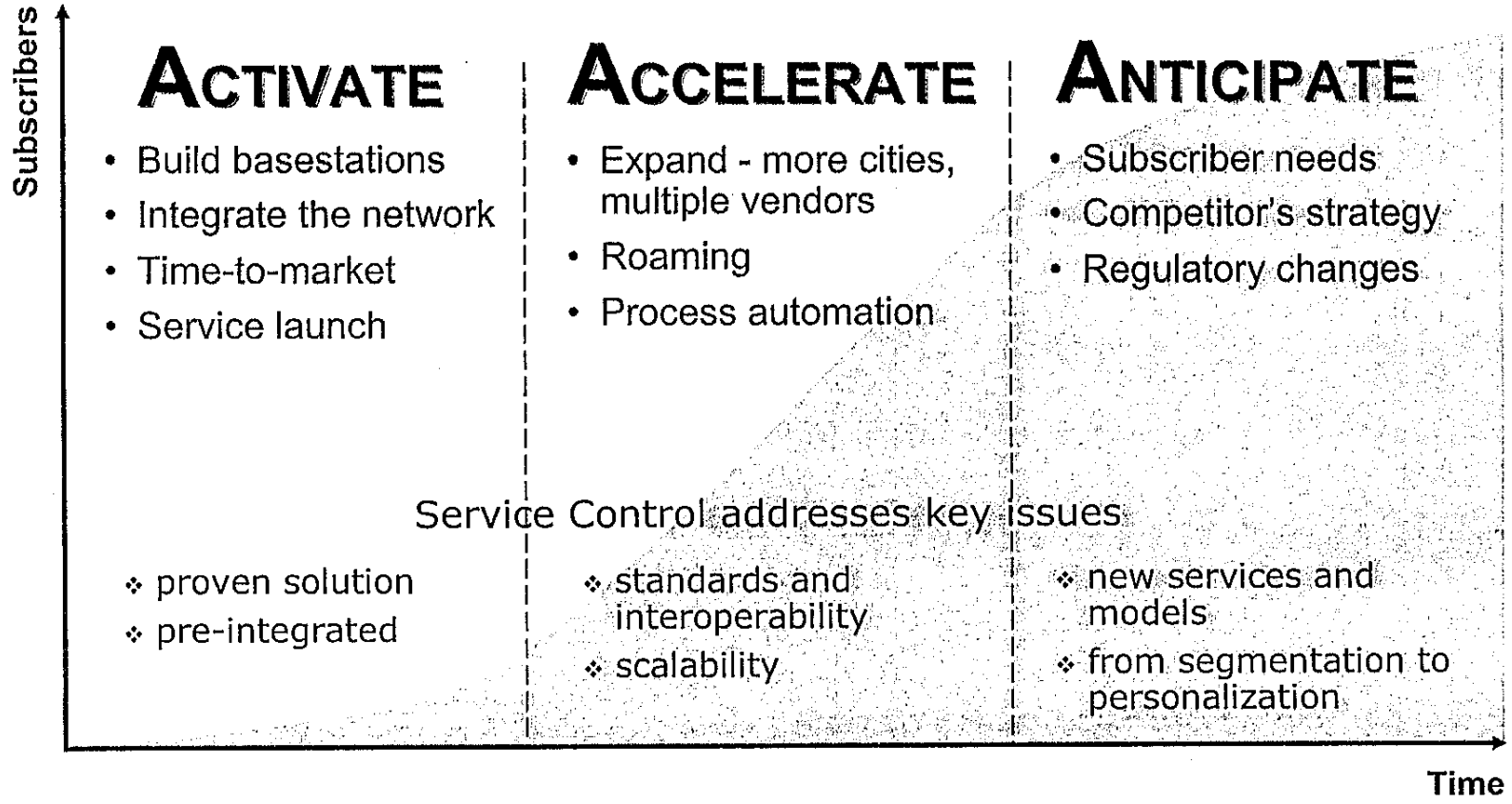
Yota	Yota Max	Internet, Music, TV, Phone, Video
	Yota Mini	Internet, Music
	Yota Day	Internet *for 24 hours*
	device based	Yota Max for HTC 4G handsets

Free
promotion until
May 31, 2009

Combining prepaid, postpaid, profile (subscriber, service, device), and promotions

Service Control throughout the lifecycle

bridgewater SYSTEMS



PLAN AHEAD – downstream issues must be taken into account before service launch.

Mobile Personalization Products for Service Innovation in WiMAX

bridgewater SYSTEMS

Unified subscriber view ■ Personalization ■ Service Innovation

Summary

De-risk your launch

Grow & Expand

Innovate & Personalize

bridgewater SYSTEMS

THE MOBILE PERSONALIZATION COMPANY

Base Station Management

Dr. Ta-sung Lee
National Communications Commission

Outline

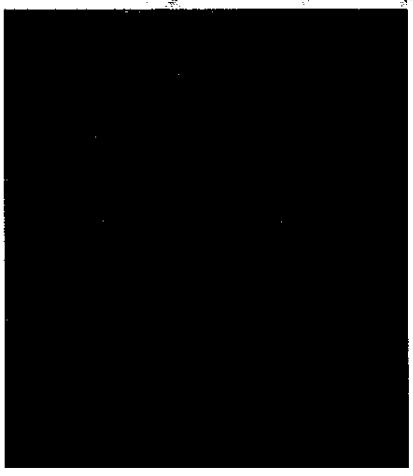
- Current Status in Taiwan
- Regulatory Codes
- Base Station Beautification
- Public Relations

Current Status in Taiwan (1/2)

- **Up to March 2009**
  - **40,720** mobile service licenses and **12,273** base station cites; **17%** of 2G and **12%** of 3G base stations are co-located
- **NIMBY Attitude**
  - The public remains doubtful on the electromagnetic emissions issue; this results in a "not in my back yard (NIMBY)" attitude
- **Base Stations Surroundings**
  - Telecommunications service providers often do not blend stations in with surroundings
- **Result**
  - **1,516** petitions against base stations and **1,112** base stations removed or relocated due to protests in 2008

Current Status in Taiwan (2/2)

Unwelcome Base Stations ----



Outline

- Current Status in Taiwan
- Regulatory Codes
- Base Station Beautification
- Public Relations

Regulatory Codes (1/2)

- New Base Stations
  - On-site inspections - station by station basis
  - Licenses awarded only after qualification
- Co-location Enforcement
  - The number of antennas on one station shall be limited to 12 or less.
- Co-located Base Stations
  - 20% increase year by year
- Service providers are required to beautify base stations

Regulatory Codes (2/2)

- **Out of Campus:** Base stations shall not be constructed on elementary or high school buildings
- **Toll-free Hotline:** A toll-free hotline 0800-873-888 established for people to request electromagnetic readings
- **SAR Value:** According to CNS14959, the standard value of specific absorption rate (SAR) for the electromagnetic emission of cell phones is set to 2.0 W/kg
- **International Standard:** Suggested values for non-ionizing radiation provided by Environmental Protection Administration in Taiwan have been adopted. These are in accordance with values established by "International Commission on Non-Ionizing Radiation Protection, ICNIRP"

Regulation on Power Density

Band\Service	Mobile Service (2G)	3rd Generation Mobile Service (3G)	1900MHz Digital Low-Tier Wireless Telephone Service (PHS)	Wireless Broadband Access (WBA)
800MHz		0.4 mW/cm^2		
900MHz	0.45 mW/cm^2			
1800MHz	0.9 mW/cm^2			
1900MHz			0.95 mW/cm^2	
2000MHz		1.0 mW/cm^2		
2500MHz				1.0 mW/cm^2

Outline

- Current Status in Taiwan
- Regulatory Codes
- Base Station Beautification
- Public Relations

Base Station Beautification (1/3)

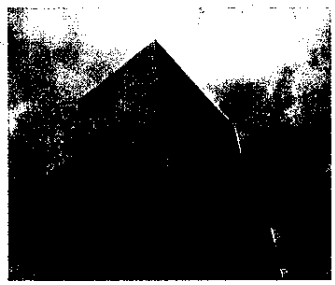
- **Purpose**
  - Minimize impact on the surroundings
- **Methods and Principles**
  - The design, color and material shall match the surroundings in national parks, scenic areas, residential areas or other special locations
  - The antennas and their supports shall be placed in order and preferably be of the same type

Base Station Beautification (2/3)

- **Extension on Roof**

  Antennas and their supports are installed on the top of the roof as an attachment, and enclosed as part of the structure. Meanwhile, the appearance of the original building is taken into account

EX:

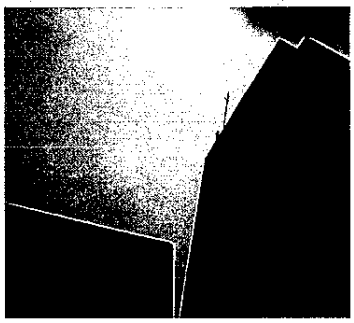


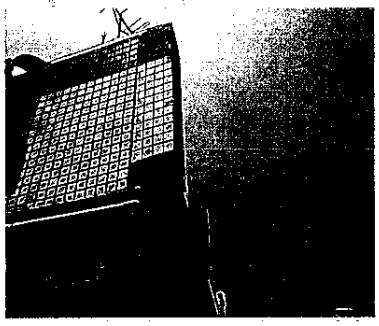
Base Station Beautification (3/3)

- **Attachment to Buildings**

  Antennas and supports are enclosed in a box and are of similar appearance to the building. This entire arrangement makes the installation a part of the building

EX:





Outline

- Current Status in Taiwan
- Regulatory Codes
- Base Station Beautification
- Public Relations

Public Relations (1/2)

- **Purpose**
  - Improve public awareness with a series of programs
  - Avoid confrontations and minimize unnecessary doubt of the public
- **Methods**
  - From 2008, budget has been allocated each year for public relations programs
  - Workshops have been organized in local communities and schools to increase public awareness on the electromagnetic issue
  - A 20-30minutes film was produced by NCC and other agencies of the Executive Yuan (DOH, EPA)
  - A booklet on electromagnetic issues has been published and distributed to the public

Public Relations (2/2)

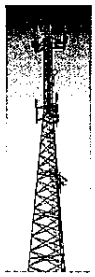
Programs in 2009

- **Forum on Communications Development & Base Station Management**
  - Establish a dialogue with the public and environmental groups. Feedback will be critical to establish effective base station management strategies
- **Workshops on environmental electromagnetic emission management and technologies**
  - Increase public awareness of government policies on non-ionizing radiation
  - Improve non-ionizing radiation monitoring technologies
- **Create incentives to improve base stations**
  - Enable the public to develop better understanding of mobile base stations via public contest
  - Stimulate creative ideas via base station beautification contest

Thank You for Your Attention

Industry Canada Industrie Canada

Antenna and Base Station Installations



Taiwan Information Session

May 2009

Canada

Presentation Overview

- **Industry Canada, Minister's**
  - Responsibility
  - Authority
- **Overview Spectrum Management**
- **Explanation of Current Procedures for the siting and installation of antennas.**

Exclusive Federal Jurisdiction

Radiocommunication

- *Constitution Act, 1982*, reflected 'national' dimension inherent in communications.
- Court decisions have established extensive federal jurisdiction over radiocommunication.
- Provincial, and so municipal, laws may be *ultra vires* – beyond the scope of the enacting body.

2

Minister's Responsibility

- *Department of Industry Act*

  "4. (1) The powers, duties and functions of the Minister extend to and include... (k) telecommunications ... (l) the development and utilization generally of communication undertakings, facilities systems and services for Canada.

  *5. The Minister **shall** ... perform the duties ... assigned by subsection 4(1) in a manner that will ... (g) promote the establishment, development and efficiency of Canadian communications systems and facilities...."*

3

Minister's Authority

- *Radiocommunication Act 5(1)(f):*

  "The Minister may… approve each site on which radio apparatus, including antenna systems, may be located, and approve the erection of all masts, towers and other antenna-supporting structures."

Antennas and antenna towers are critical to the deployment of radio systems.

4

National Independent Canadian Studies

- **December 2004, Professor David Townsend submitted a report to the Department that contained 34 recommendations to improve our antenna siting procedures.** (www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf05353.html)
- **March 2006, Telecom Policy Review Panel released their report of 127 recommendations, two of which dealt with antenna site sharing.** (www.telecomreview.ca)

5

Key Stakeholders in Siting of Antennas

- **Proponents**
- **Land-use Authorities (LUAs)**
- **Citizens**
- **Industry Canada**

6

CPC-2-0-03, Issue 4 Process Overview

- **Proponents must do the following:**

1. Investigate sharing or using existing infrastructure, where feasible, before proposing new antenna supporting structures.
   - February 2008 decision requires all radiocommunication carriers to share antenna towers and sites.
2. Contact the LUA to determine local requirements regarding antenna systems.
3. Undertake LUA and Public Consultation as required, address relevant concerns.
4. Satisfy IC's general and technical requirements.

7

Consultation and Exclusion

- **LUA consultation and Public consultation ensure that the LUA and the public can provide input on the proposal.**
- **However, IC considers some installations to have minimal impact and excludes them from LUA and public consultation.**
- **LUAs are free to establish their own exclusion criteria to exclude more installations (in addition to the ones under IC criteria) as appropriate for their communities.**
- **Excluded structures must still meet the general requirements.**
  - Safety Code 6.
  - Environment.
  - Aeronautical Safety.
  - Interference Protection.

8

Exclusion Criteria

- **Excluded from LUA and public consultations:**
  - Maintenance of existing radio apparatus, including the antenna system, transmission line, mast, tower or other supporting structure.
  - Addition (or modification) of an existing antenna system, the transmission line, antenna supporting structure or other radio apparatus etc. to existing infrastructure, provided the height increase above the existing structure is ≤ 25% of the original height.
  - Maintenance of antenna structure's lighting and painting.
  - Limited duration installations for special events or emergency.
  - New antenna systems, including masts, towers or other supporting antenna structure, with a height < 15 m above ground level (AGL).

Individual circumstances vary and proponents advised to apply exclusion criteria with consideration of local circumstances.

9

Public Consultation

- Public consultation gives the public a direct voice early in the process in influencing proposed installations in their neighbourhoods.
- LUAs are encouraged to establish their own reasonable public consultation process for antenna siting.

10

Where an LUA has Public Consultation Process

- An LUA may exclude installations (in addition to those captured by the IC exclusion criteria in Section 6) from public consultation.
- Public and/or LUA consultation is not required for antenna system proposals excluded by the LUA.
- If an LUA does not have an established and documented public consultation process, proponents are required to follow the IC Default Public Consultation Process.

11

IC Default Public Consultation Process

- **For non-excluded structures, in the absence of LUA public consultation process, proponents are to follow the *IC Default Public Consultation Process*, which has three steps:**
  - Public Notification.
  - Responding to the public.
  - Public reply comments.

12

General and On-going Antenna Complaints

- **Health concerns: Safety Code 6**
- **Not in my backyard**
- **Property value effect**
- **Surprise Factor**
- **Interference**

13

Dealing with Antenna Complaints

- **Professor Townsend's review:**
  - Recommended that property values not be subject of consultation.
  - Opined that the adequacy of Safety Code 6 would be beyond the bounds of consultation.
- **Externalized consultation process**
  - Open and timely process that promotes sharing of information.
  - Antenna proponent to address reasonable and relevant concerns.
  - Interested parties given the opportunity to develop solutions.
  - Public and LUA's local knowledge influence antenna siting.
- **Industry Canada will decide on impasses**
  - May request involved parties provide and share information.
  - May make a final decision or suggest alternate dispute resolution.

14

Industry Canada Industrie Canada

Spectrum Management in Canada

Presentation to:

National Communications Commission of Taiwan

May, 2009

Canada

Importance of Spectrum

- The radio frequency spectrum is an important public and finite resource. The government, as steward, is legislatively mandated under the *Radiocommunication Act* to plan its allocation and use.
- Policy objective: to manage efficiently and effectively in order to generate maximum benefits for Canadians.
- The radio spectrum and telecommunications infrastructure are essential enabling components to all sectors of the Canadian economy and vital to Canadian's social well being.
- The efficient use and continued availability of radio frequency spectrum is critical for growth and innovation in the wireless sector.
- While difficult to estimate, benefits afforded by spectrum usage to the economy are substantial and growing.
  - For example, the value derived by the UK from the use of spectrum is estimated to have risen from 28bn pound in 2002 to around 42bn in 2006 (or approximately 3% of GDP).
- In 2008, the Advanced Wireless Spectrum auction generated some $4.25B in revenue.

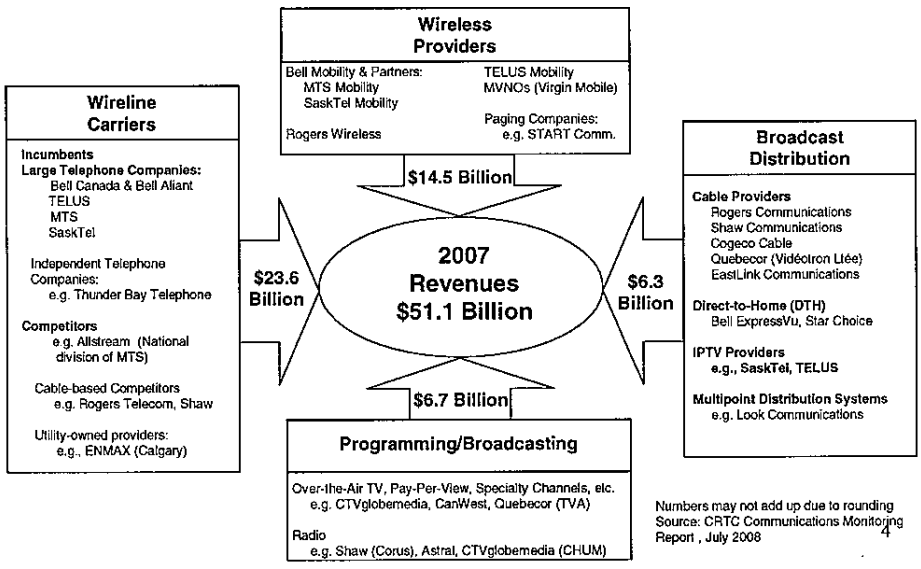
2

Commercial Wireless Sector Overview – Industry Structure

- 3 national mobile networks
- National satellite communications network
- Competitive radio carriers and service providers
- Over-the-air television and radio broadcasting
- 2 Direct-To-Home satellite broadcasting licences
- 4 mobile satellite services
- Fixed wireless

3

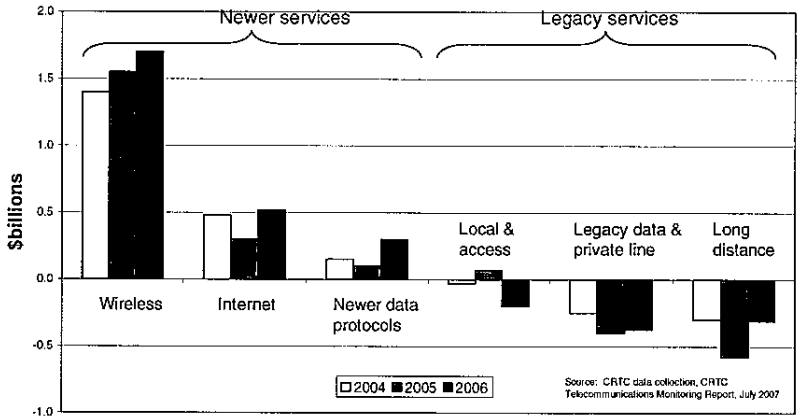
Communications Service Industry Overview



Numbers may not add up due to rounding
Source: CRTC Communications Monitoring Report , July 2008

4

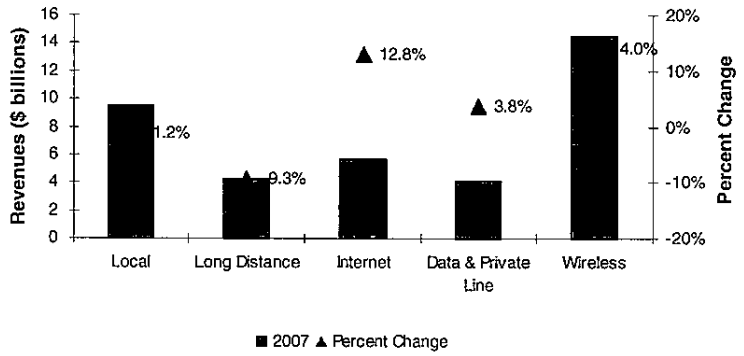
Background – Annual revenue growth by segment



Source of telecom revenue continue to be from *wireless, Internet and newer data protocols (eg IP-VPN, Ethernet).*

5

Annual revenue growth by segment

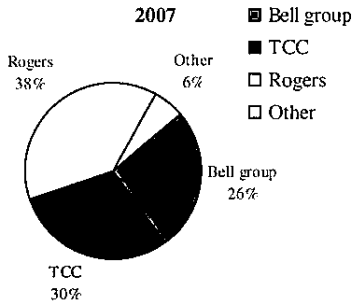


Source: Communications Monitoring Report, CRTC, 2008

Source of telecom revenue continue to grow significantly in the wireless and Internet segments.

6

Commercial Wireless services providers revenue market shares



Telecommunications Revenue Market Share
(Incumbent TSP share of revenues)

- Three large national providers
- Bell & TCC (Telus Communications Company) lost revenue market share to Rogers
- Number of wireless subscribers = 20.3 million in 2007

Source: Communications Monitoring Report, CRTC, 2008

With the recent auction of advanced wireless spectrum (closed July 2008), more competition is anticipated. 282 licenses were conditionally assigned to 15 companies.

7

Spectrum Management: Legislative Framework

Under the *Radiocommunication Act*, the Minister is responsible for all aspects of spectrum management including the orderly development of radiocommunication in Canada.

- This includes: policy, planning, engineering and R&D related to spectrum resources, plus developing standards, issuing licenses, and enforcing the regulations.

	Policy	Regulation
Telecommunications:	Industry Canada	CRTC
Radiocommunications:	Industry Canada	Industry Canada
Broadcasting:	Canadian Heritage	CRTC
Competition:	Minister of Industry	**Investigation** Competition Bureau **Enforcement** Competition Tribunal

8

Program Structure

- National headquarters located in Ottawa
  - Policy, planning, legislation, program direction, standards, procedures, international activities, auctions, fees, database administration
- Thirty four offices distributed across the country deliver the bulk of services to clients
  - Licensing, interference investigations, compliance and enforcement activities
  - 99 fixed spectrum monitoring facilities
  - 47 spectrum surveillance vehicles

9

Spectrum Management Offices across Canada

Headquarters in Ottawa (Ontario)
Five Regional offices
Twenty District offices
Fourteen Branch or Sub offices

10

Pace of change

- The pace of global economic growth in wireless technologies and services has resulted in increasing demand for finite radio frequency spectrum.
- Technological developments are changing the perceived value of spectrum both as a commodity resource and as a generator of innovation, competition and wealth.
- Digital technologies are making available a wide range of wireless devices that generate demand for instant access to communications and the Internet, and freeing up spectrum for other uses (e.g.: shift from analog to digital TV).
- The development and introduction of wireless consumer devices that self-manage interference in a spectrum "commons" area is enabling innovation and competition both in consumer devices and provision of commercial services (e.g.: wi-fi networks and unlicensed spectrum for access to Internet).

The Canadian spectrum management program is under constant pressure to meet the demands of the rapidly changing wireless technology and services.

11

Spectrum Planning

- Development of engineering standards and technical rules for radiocommunication and broadcasting services to:
  - Prevent interference,
  - Protect the public (such as exposure to radio-frequency energy), and
  - Provide the certainty needed to build and invest;
- Negotiation of Canada-U.S. frequency sharing Arrangements:
  - Arrangements permit the interference-free operation of radio equipment near the border;
  - Multiple U.S. agencies (FCC, Department of Commerce, State Department);
- Negotiation changes to international radiocommunication regulations (binding treaty documents) and standards at:
  - World Radio Conferences (WRCs)
    - Next WRC is in 2007;
  - ITU-R and ITU-T (satellite, terrestrial, broadcast, wireline);
  - Inter-American Telecommunication Commission (CITEL);

12

Spectrum Planning (cont'd)

- Develop engineering analysis tools in support of interference investigations;
- Negotiation and implementation of Mutual Recognition Agreements/Arrangements (MRAs);
- Terminal Attachment Program;
- Telecom Chapters of Free Trade Agreements (NAFTA, Canada-Chile Free Trade Agreement (CCFTA));
- Contributes to the security of Canada's cyberspace:
  - Assess impact of new technologies and security requirements on Canadian telecom infrastructure;
- Telecommunications Standards Development;
- Certification, testing, market surveillance and enforcement;

Facilitates a fair marketplace

13

Spectrum Planning (cont'd)

- Develops interference analysis models for:
  - Evaluating complex interference mechanisms among different radio systems,
  - Assessing radiofrequency exposure levels to the public, and
  - Profiling radio frequency congestion levels;
- Designs of spectrum monitoring system:
  - e.g. Integrated Spectrum Observation Centres, Spectrum Explorer and Direction Finding system.

Maximizes spectrum usage

14

Spectrum Policy Framework - Enabling Guidelines

- Market forces should be relied upon to the maximum extent feasible.
- Notwithstanding (a), spectrum should be made available for a range of services that are in the public interest.
- Spectrum should be made available to support Canadian sovereignty, security and public safety needs.
- Regulatory measures, where required, should be minimally intrusive, efficient and effective.
- Regulation should be open, transparent and reasoned, and developed through public consultation, where appropriate.
- Spectrum management practices, including licensing methods, should minimize administrative burden and be responsive to changing technology and market place demands.
- Canada's spectrum resource interests should be actively advanced and defended internationally.

15

Spectrum Policy Framework – Enabling Guidelines

- Spectrum policy and management should support the efficient functioning of markets by:
  - permitting the flexible use of spectrum to the extent possible;
  - harmonizing spectrum use with international allocations and standards, except where Canadian interests warrant a different determination;
  - making spectrum available for use in a timely fashion;
  - facilitating secondary markets for spectrum authorizations;
  - clearly defining the obligations and privileges conveyed in spectrum authorizations;
  - ensuring that appropriate interference protection measures are in place;
  - reallocating spectrum where appropriate, while taking into account the impact on existing services; and
  - applying enforcement that is timely, effective and commensurate with the risks posed by non-compliance

16

Factors influencing the Canadian spectrum management approach

- Ensuring that rules and standards protect users' investments, while supporting and providing maximum flexibility for a wide range of new services and technologies;
- Ensuring spectrum is available for non-commercial use (navigation, science, defense, etc..) ;
- Ensuring that decisions and licensing processes are transparent;
- As spectrum management relies more on market forces, the regulator needs to have surveillance capability to detect and determine the extent of interference problems; and
- The influence of the US use of the radio spectrum that has a huge impact on Canada. Approximately 80% of our population is within interference range of the US.

17

Increasing Reliance on Market Forces

- Canada has taken steps toward more flexible, market oriented, approaches within the constraints of existing legislation:
  - First spectrum auction in 1999 (24/28 GHz fixed)
  - Introduction of flexible use (rather than dedicated) allocations of commercial spectrum
  - More "technology neutral" technical regulations and standards
  - New Spectrum Policy Framework which supports reliance on market forces to the maximum extent feasible and flexible regulation where required
  - Allocation of specific spectrum bands for unlicensed use and/or devices
  - Fully transferable and divisible licences when obtained via auction

18

Licensing Approaches

- Where the demand for spectrum does not exceed the supply, the department uses first-come, first-served licensing to grant access to spectrum.
- Where demand for access to the resource exceeds supply, a competitive licensing process is required
  - auctions are used where reliance on market forces to select licensees is in the public interest.
  - Comparative licensing processes are still used for some satellite licensing processes
- The bulk of spectrum assignments is still done through administrative processes (first come, first served)
- Going forward, most new bands are licensed using spectrum, as opposed to radio licences

19

Licence Fees

- Licences obtained via an administrative process attract licence fees
  - Collect $230M annually – does not include auction revenues
- Fees are not limited to cost recovery
- However, licensing fees seldom reflect market-based value
  - Limited incentive to ensure efficient spectrum use
  - Will be reviewing all fees in the coming years
- All users pay licence fees, including all levels of government, military etc.

20

Conclusion

- Spectrum allocation is a key issue for economic growth and development
- Spectrum allocation means access
- Access means services
- Services mean jobs and growth

21

Thank you

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22


Canada

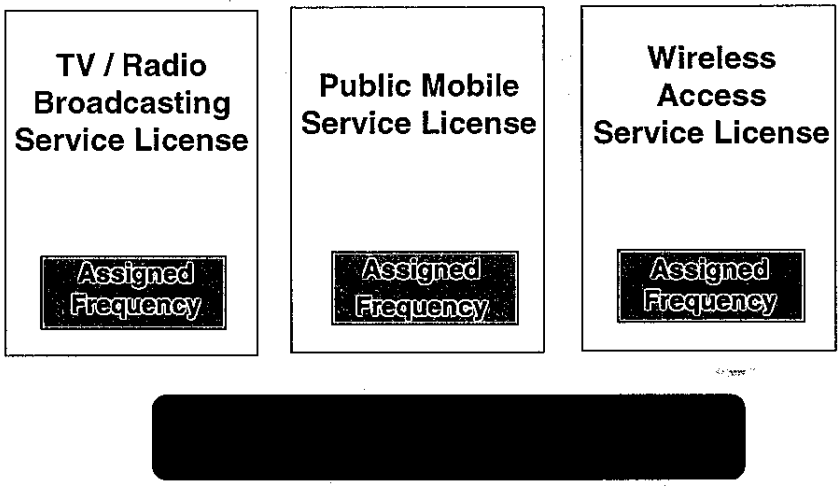
Spectrum Management

Dr. Ta-sung Lee
National Communications Commission

Outline

- Spectrum Allocation for Mobile Services and Short Range Devices
- Spectrum Allocation for PMR
- Information Access
- Forthcoming Plans

Licensing Regime



Authorization Regime of Licensing for Mobile Services

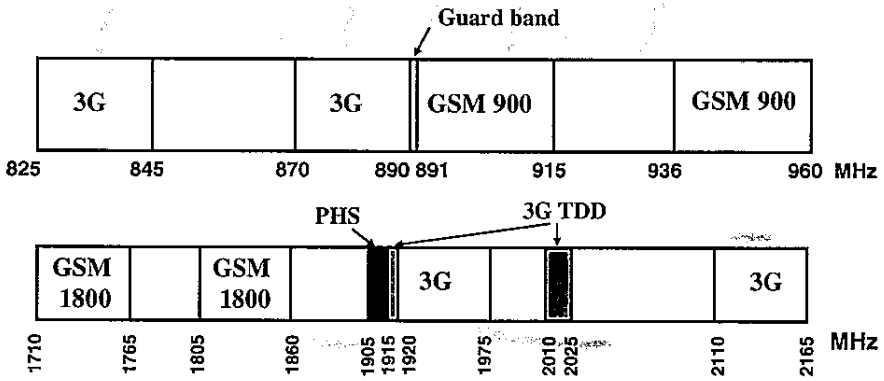
- **Beauty contest**
  - **2G licenses (900 & 1800 MHz)**

Budget Law amended in 1998
Article 94: Unless otherwise provided for by law, grant of quota, frequency, or other limited or fixed amount special licenses shall be conducted by open auction or public invitation to tender.

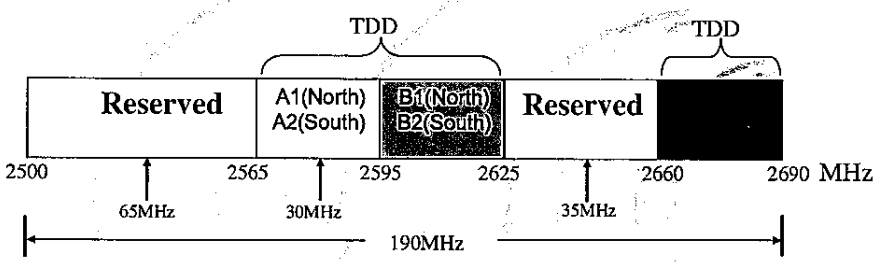
- **Prequalification + Auction**
  - **3G**
  - **1900 MHz low power cordless telephone (PHS)**
  - **Broadband Wireless Access (BWA)**

Spectrum Allocation for Cellular Services

- GSM: 900, 1800
- 1900 MHz low power cordless telephone (PHS)
- 3G



Spectrum Allocation for BWA Service



- Spectrum release in 2 stages
  - 6 licenses awarded in July 2007
  - 100 MHz spectrum reserved

Short Range Devices (SRDs)

- WLAN
  - 2.4 GHz band (2400-2483.5 MHz)
  - 5.25 – 5.35 GHz : for U-NII indoor use
  - 5.47 – 5.725 GHz & 5.725 – 5.825 GHz : for U-NII use
- RFID
  - 922 – 928 MHz: for RFID use
- Vehicle radar systems
  - 76 – 77 GHz

Outline

- Spectrum Allocation for Mobile Services and Short Range Devices
- Spectrum Allocation for PMR
- Information Access
- Forthcoming Plans

Spectrum Allocation for PMR (1/2)

Current Status

- No dedicated spectrum blocks for Private Mobile Radio Service (PMR)

To improve spectrum management

Proposed spectrum blocks

- 3-76 MHz
- 138-174 MHz
- 380-450 MHz & 470-530 MHz

Spectrum Allocation for PMR (2/2)

- Future efforts
  - New licensees will be assigned frequencies within the blocks
  - Existing licensees shall change frequency at renewal of license if it is not in the proposed blocks
  - 450-470 MHz
    - WRC-2007 has identified this band for IMT-Advanced
    - Usage of this band will be subject to future development of worldwide market and technology evolution

Outline

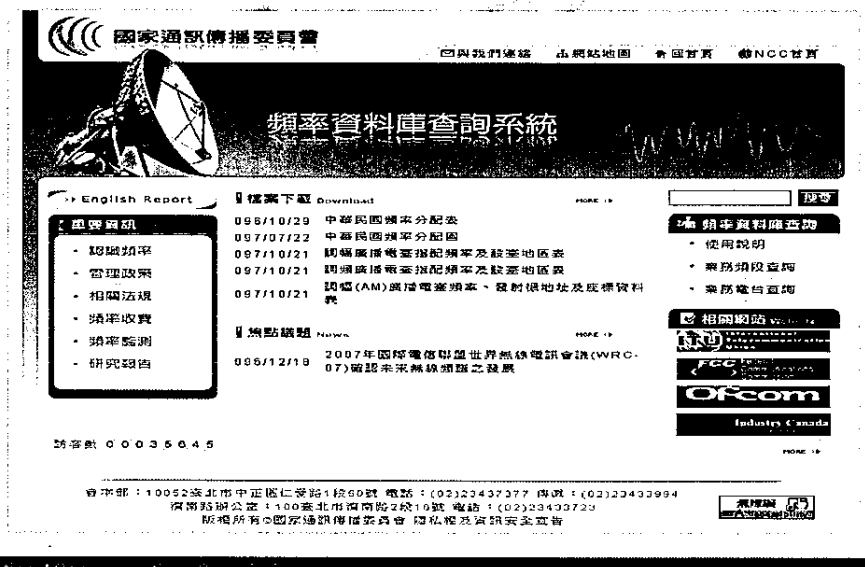
- Spectrum Allocation for Mobile Services and Short Range Devices
- Spectrum Allocation for PMR
- Information Access
- Forthcoming Plans

Information Access (1/3)

- Purpose
  - Disclose information of frequency management
  - Provide guidelines for consumers to choose service providers
- Function
  - Provide information on stations that can provide service where the consumers are located
  - Search for radio stations: by "address", "type of radio station" and "frequency"
    - Address search: by county, city, township and district
  - Free of charge

Information Access (2/3)

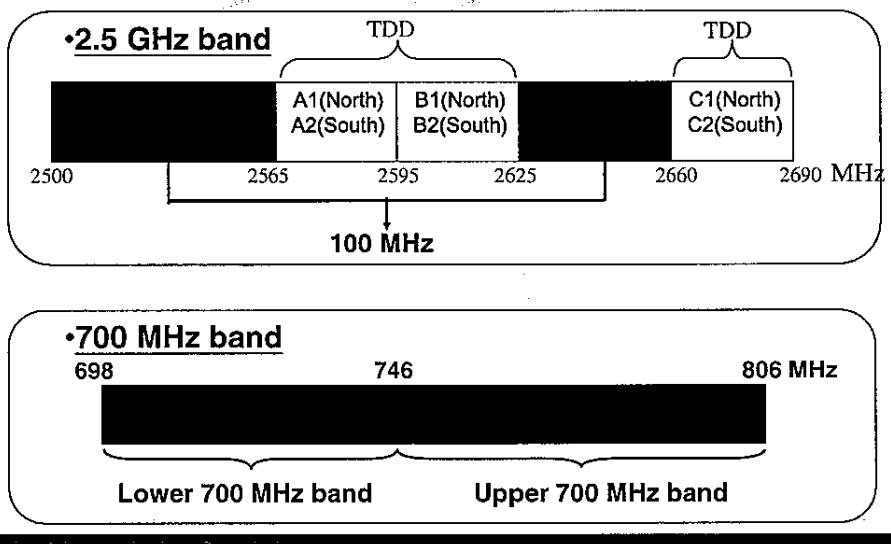
Information Access (3/3)



Outline

- Spectrum Allocation for Mobile Services and Short Range Devices
- Spectrum Allocation for PMR
- Information Access
- Forthcoming Plans

New Spectrum for Mobile Communications



New Spectrum - 700 MHz Band

- Tasks
  - Prepare for spectrum clearance
  - Study spectrum plan and license awarding process adopted by other countries
  - Study propagation model and investigate possible technologies and applications

Thank You for Your Attention

Industry Canada Industrie Canada

Access-Broadband Over Powerline (BPL)

Canada-Taiwan 5th ICT MoU Steering Committee Meeting, May 2009

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Overview

- **What is Access BPL?**
- **Access BPL vendors**
- **ICES-007**
  - **Measurement Methods**
  - **Limits**
  - **Exclusion/Notching Requirements for Bands**
  - **Mitigation Techniques Requirements**
  - **Procedural Requirements**
- **GL-xx**
  - **Exclusion Zones/Protection of Service Contour**
  - **Database**

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What is Access BPL?

- *Access BPL device* means a device that transmits radio frequency signals by conduction over either
  - medium voltage (MV) or
  - low voltage (LV) power lines;

  where medium voltage power line is defined as an overhead or underground power line carrying between 1,000 to 40,000 volts from a power substation to neighborhoods, and where low voltage power line is a power line carrying low voltage, e.g. 240/120 volts from a distribution transformer to a customer's premises.

Note: Power Line Telecommunications (PLT) and Power Line Communications (PLC) are also terms used for this technology

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Access BPL

- Access BPL was two main market applications:
  - Utility applications (e.g. smart grid/intelligent grid implementation)
  - Broadband Access (e.g. internet access to rural areas)

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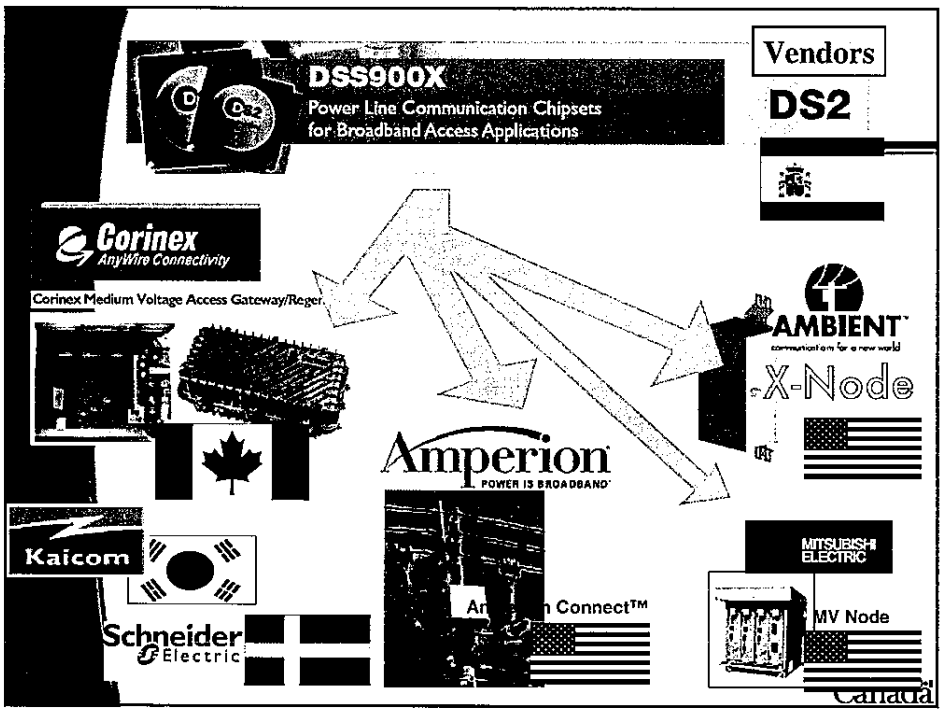
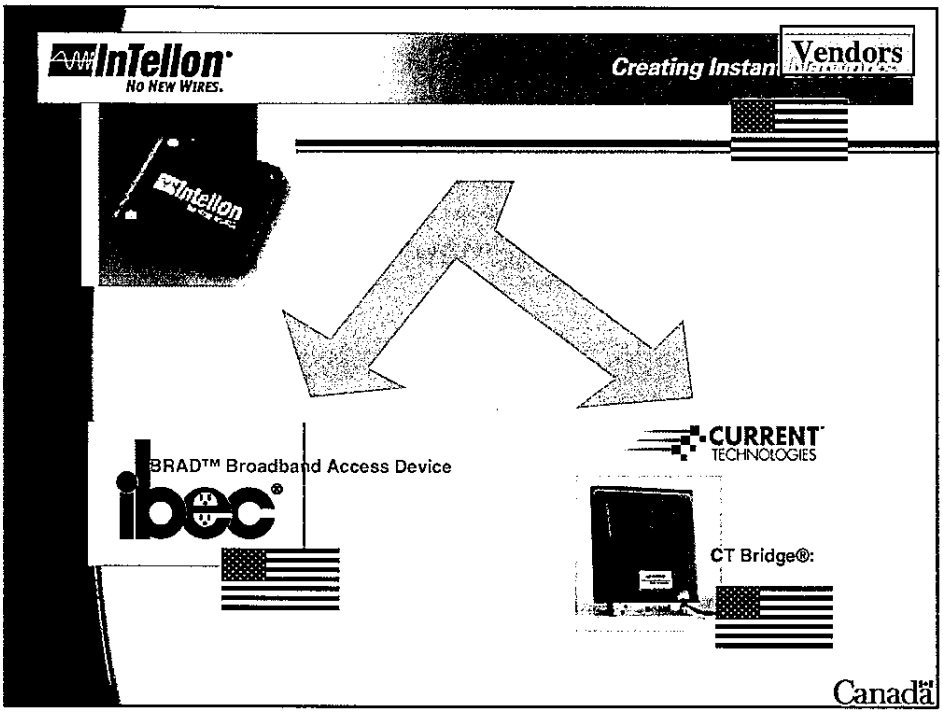

DSS900X
Power Line Communication Chipsets
for Broadband Access Applications
Vendors
DS2
Corinex
AnyWire Connectivity
Corinex Medium Voltage Access Gateway/Reger
AMBIENT
X-Node
Amperion
POWER IS BROADBAND
Kaicom
Schneider
Electric
Connect™
MITSUBISHI
ELECTRIC
MV Node
Canada


InTellon
No New Wires.
Vendors
BRAD™ Broadband Access Device
ibec
CURRENT
TECHNOLOGIES
CT Bridge®:
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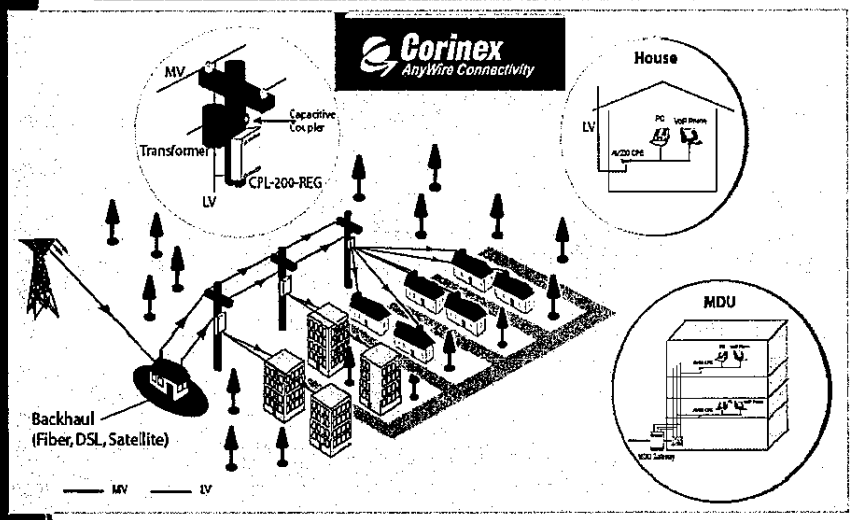
Corinex BPL System



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Summary of Access BPL Regulation Process in Canada

- **July 19, 2005**: Consultation Paper on Broadband over Power Line (BPL) Communication Systems SMSE-005-05
- **Nov 28, 2005**: 137 Comments received – vast majority raised opposition
- **Sept 10, 2008:** Drafts ICES-007 and GL submitted to the RABC
- **Sept, 2008 - Apr, 2009:** RABC Access BPL Working Group

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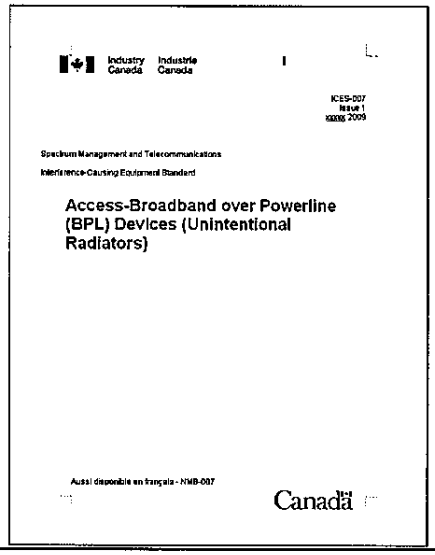
ICES-007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ICES-007
Issue 1
xxxxx 2009

Spectrum Management and Telecommunications

Interference-Causing Equipment Standard

Access-Broadband over Powerline (BPL) Devices (Unintentional Radiators)

Aussi disponible en français - NMB-007

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Technical requirements for Access BPL devices will be covered under an Interference Causing Equipment Standard (ICES-007)

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ICES-007

- Method of Measurement
  - Conducted Emissions Measurement

    Not required; Harmonized with FCC Part 15
  - Radiated Emissions Measurement

    Harmonized with FCC Part 15 requirements for Overhead and Underground Line Installations

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ICES-007

- Radiated Emission Limits

LV power lines at Frequencies Above 30 MHz

Frequency (MHz)	Field Strength (µV/m) at 3 metres
30-88	100
88-216	150
216-960	200
Above 960	500

MV power lines at Frequencies Above 30 MHz

Frequency (MHz)	Field Strength (µV/m) at 10 metres
30-88	90
88-216	150
216-960	210
Above 960	300

LV and MV power lines at Frequencies Below 30 MHz

Frequency (fundamental or spurious)	Field Strength (µV/m)	Magnetic H Field (µA/m)	Measurement Distance (metres)
1.705-30 MHz	30	N/A	30 m

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ICES-007

- Excluded Frequency Bands
  - Aeronautical Bands (no BPL carrier frequencies in these bands)

Frequency Band
2,850 - 3,025 kHz
3,400 -- 3,500 kHz
4,650 – 4,700 kHz
5,450 – 5,680 kHz
6,525 – 6,685 kHz
8,815 – 8,965 kHz
10,005 – 10,100 kHz
11,275 – 11,400 kHz
13,260 – 13,360 kHz
17,900 – 17,970 kHz
21,924 – 22,000 kHz
74.8 – 75.2 MHz

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ICES-007

- Notched Frequency Bands/Frequencies

Amateur Radio Bands

Frequency Band
1.8 – 2.0 MHz
3.5 – 4.0 MHz
7.0 – 7.3 MHz
10.1 – 10.15 MHz
14.0 – 14.350 MHz
18.068 – 18.168 MHz
21.0 – 21.450 MHz
24.890 – 24.990 MHz
28.0 – 29.7 MHz
50.0 – 54.0 MHz

Emergency Communication Frequencies

Frequencies
1711.5 – 1736.5 kHz
1927.5 – 1952.5 kHz
2655 - 2680 kHz
4009 - 4034 kHz

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ICES-007

- Mitigation Techniques
  - Access BPL devices shall incorporate adaptive interference mitigation features to remotely reduce power and adjust operating frequencies, in order to avoid site-specific, local use of the same spectrum by licensed services. These features may include adaptive or "notch" filtering, or complete avoidance of frequencies, or bands of frequencies, locally used by licensed radio operations.
  - When notch filters is used to avoid interference to specific frequency bands, the devices shall be capable of attenuating emissions to a level at least 20 dB below the applicable limits for frequencies below 30 MHz and a level at least 10 dB below the applicable limits for frequencies above 30 MHz.

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ICES-007

- Procedural Requirements
  - A record of the measurement method and results shall be retained by the manufacturer or importer for a period of at least five (5) years and made available for examination on request by the Department.
  - Equipment shall be labeled ICES-007 (Declaration of Conformity)
  - GL-xx document (*Guidelines for the Installation and Operation of Access-Broadband over Powerline (BPL) System) shall be made available either by being part of the user manual of the BPL device or a separate document inside the packaging of the device.*

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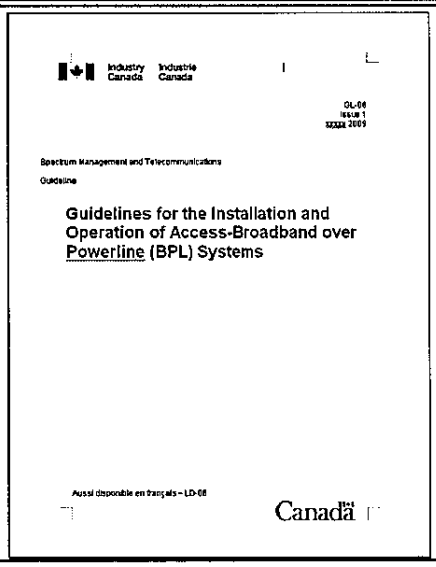
GL-xx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GL-08
ISSUE 1
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Spectrum Management and Telecommunications

Guideline

Guidelines for the Installation and Operation of Access-Broadband over Powerline (BPL) Systems

Aussi disponible en français – LD-08

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Installation and deployment recommendations for Access BPL systems will be covered under a Guideline (GL-xx)

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GL-xx

- Exclusion Zones/Protection of Service Contour
  - Maritime Mobile Services

    To protect maritime mobile services, Access BPL operator should verify if maritime mobile systems operating within the frequencies bands shown in the table are in the geographical area they plan to deploy. If so, BPL systems should not operate within a recommended **1 km** from the maritime mobile system.

Frequency Band
2065 – 2107 kHz
2170 - 2194 kHz
4000 – 4063 kHz
4063 – 4438 kHz
6200 – 6525 kHz
8100 – 8195 kHz
8195 – 8815 kHz
12230 – 13200 kHz
16360 – 17410 kHz
18780 – 18900 kHz
19680 – 19800 kHz
22000 – 22855 kHz
25070 – 25210 kHz
26100 – 26175 kHz

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GL-xx

- Exclusion Zones/Protection of Service Contour (Continue)
  - TV Broadcasting

    To protect broadcasting services, Access BPL operator should verify if television transmitters operating or as allotments within the frequencies bands shown in the table below are in the geographical area they plan to deploy. If so, the Access BPL operator should consult with the broadcaster, and the BPL system should protect the **28 dBμ/V contour** of the broadcasting station.

Broadcasting Bands

Frequency Band
54.0 – 72.0 MHz
76.0 – 80.0 MHz

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GL-xx

- Exclusion Zones/Protection of Service Contour (Continue)

  Access BPL systems may not be installed in the vicinity of locations of existing stations on relevant frequency bands where those stations perform a function that is integral to public safety / distress and related operations. Access-BPL systems must observe a minimum keep-out distance from the transmitting and receiving antenna (specific coordinates) of those public safety / distress and related operations:

  - ❖Coast Guard (1 km)
  - ❖DND (1km and 4 km)
  - ❖Nav Canada (4 km)
  - ❖Radio Astronomy Observatories (29 km and 11 km)
  - ❖CBC HF Broadcasting Tx Sites (1 km)

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GL-xx

- Database
  - Entities operating Access BPL systems should supply to an industry-recognized entity, information on all existing Access BPL systems and all proposed Access BPL systems for inclusion into a publicly available data base.

  - The following information should be posted to the Access BPL database.
  - (1) The name of the Access BPL provider
  - (2) The frequencies of the Access BPL operation
  - (3) The postal codes served by the specific Access BPL operation
  - (4) The manufacturer and type of Access BPL equipment.
  - (5) The contact information, including both phone number and email address of a person at, or associated with, the BPL operator's company, to facilitate the resolution of any interference complaint.
  - (6) The proposed/or actual date of Access BPL operation.

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GL-xx

– A licensed spectrum user experiencing harmful interference that is suspected to be caused by an Access BPL system should inform the local BPL operator's contact person designated in the Access BPL database.

End

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