

APPROACHES to FREQUENCY MANAGEMENT

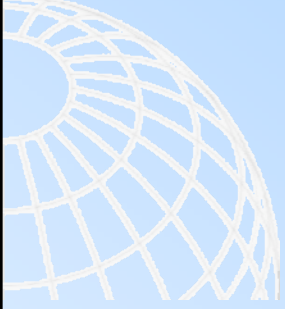
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Telecommunications Management Group, Inc.

Presented at the
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in an Era of Convergence*

June 28-29, 2006
New Delhi, India

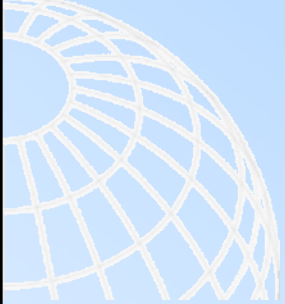


Telecommunications Management Group, Inc.



OVERVIEW

- How the spectrum has traditionally been managed
- Discuss licensing international best practices
- Move toward the “triple play” – voice, data, multi-media
- Impact of convergence on how we manage the spectrum resource




How the Spectrum Has Traditionally Been Used

- Countries and their respective regulators manage the spectrum resource related to:
 - Public (government) and private use, minimizing interference, and addressing health and safety issues
 - Designating bands by use is efficient
- Within their own borders, countries are free to manage their use of spectrum in any way they wish subject to not creating interference to their neighbors who are using spectrum in accord with the ITU Table of Frequency Allocations


Countries Exhibiting Key Spectrum Flexibility Actions

	United States	United Kingdom	Australia	India	Singapore
Secondary markets/spectrum trading	√	√	√		√
Licence-exempt spectrum	√	√	√	√	√
Evaluation of spectrum usage and management	√	√	√	√	
Vacate government spectrum	√	√		√	



Techniques for Licensing Spectrum - International best practices

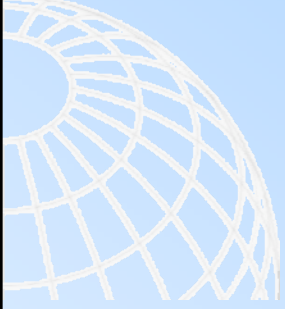
- Spectrum fees often provide substantial funding to regulatory authorities
 - Few examples of recent spectrum assignments without payment: China and India
- Most countries use fixed prices or auctions to price spectrum licenses
 - Fixed price examples: Brazil, France, Germany, Indonesia, Malaysia, United Kingdom, United States
 - Auction examples: Australia, Brazil, France, Germany, New Zealand, United Kingdom, United States
- Most countries set minimum conditions for participation in spectrum tenders
 - Can include proof of financial stability, business plan, and adherence to spectrum caps



Techniques for Licensing Spectrum - International best practices

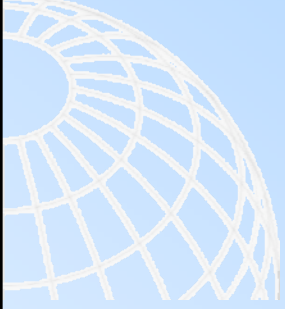
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Spectrum Subscriber Criteria – Only Used in India



India Subscriber Criteria for Cellular Spectrum

- Focuses on voice services and technologies being used
- Acknowledges spectrum efficiency due to differing technologies
- Current practice leads to unequal spectrum blocs that over time will result in a regulatory-induced distortion of the marketplace
 - As operators move toward more common-based technologies (i.e., adoption of WCDMA or CDMA2000) those operators currently employing more spectrum-efficient technologies and having less spectrum as a result will be at a disadvantage compared to those operators currently using less efficient technologies
- Authorizing limited amounts of spectrum may be valid when licensing spectrum to a new application
- This approach is not effective means of managing a market that is mature, proven, and evolving toward a variety of enhanced high speed data applications.



India Subscriber Criteria for Cellular Spectrum

Current Regulatory Issues – Spectrum Subscriber Criteria

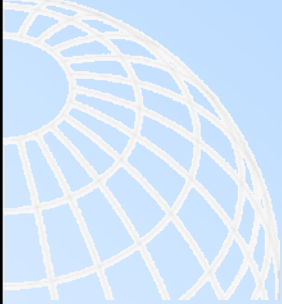
- Not technology neutral and spectrum allocation to both CDMA & GSM operators is not equal.
- Sufficient amount of spectrum is not initially provided.
- Criteria of “twice” the number of subscribers for the same amount of spectrum – the new amended policy of DoT for spectrum allocation is unbalanced
 - Biased toward GSM services
 - “Punishes” the more spectrum-efficient technology
 - Does not take into consideration gains from new developments in GSM, including WCDMA evolution.
 - Goes against recommendations of technology neutral spectrum allocation.

"2G" Mobile Spectrum Auction Results

Country	Year	Total MHz licensed	Total winning bids (US\$ millions)	Price/MHz (US\$ millions)	Population (millions)	Population per MHz (millions)	Price per MHz per pop (US\$ million)
Australia (800 & 1800 MHz)	1998	190	217.3	1.1	18.7	0.1	Less than 0.01
Australia (1800 MHz)	2000	60	812.6	13.5	19.1	0.3	Less than 0.01
Brazil (1800 MHz)	2001	30-60 (per region)*	1,425.7	23.8	175	2.9	0.14
Canada (1900 MHz)	2001	70	992.1	14.2	30.0	0.4	0.47
Germany (1800 MHz)	1999	20.8	228.0	11.0	82.1	3.9	0.13
United States (1900 MHz, A&B)	1994-1995	60	7,019.4	117.0	260.3	4.3	0.45
United States (1900 MHz, C)	1995-1996	30	10,071.7	335.7	262.8	8.8	1.28
United States (1900 MHz, D, E & F)	1996-1997	30	2,517.4	83.9	265.2	8.8	0.32

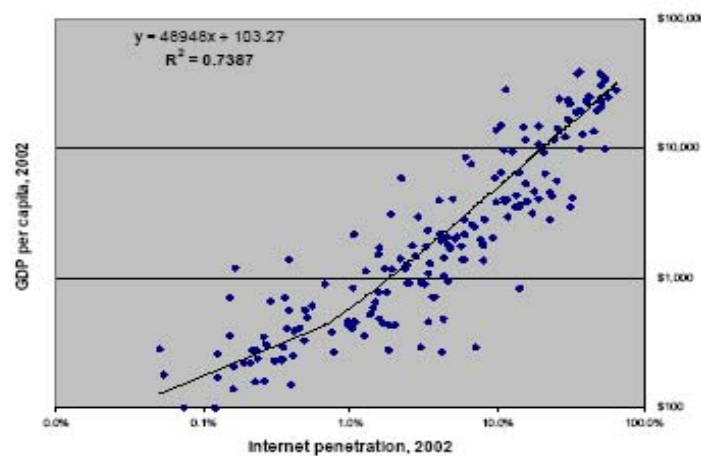
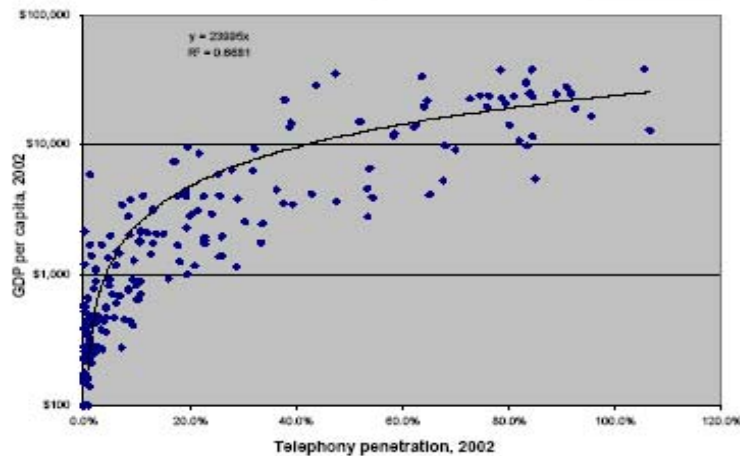
*Amount of spectrum varied by region [General Approaches to Frequency Management](#)





The Move Toward Mobile Data

The Value of Improving Connectivity: *It's not just about Voice... It's about Voice and Data*

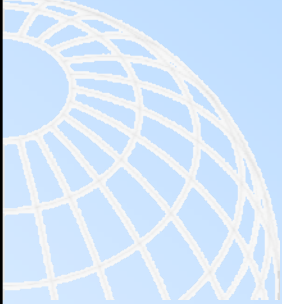


*For each 1% increase in **Mobile penetration**,
GDP per capita goes up by **US\$240***

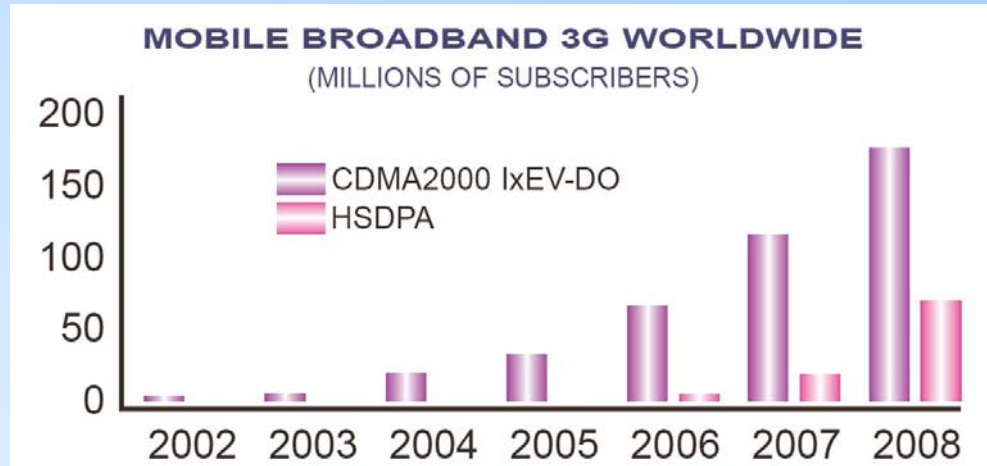
*For each 1% increase in **Internet penetration**,
GDP per capita goes up by **US\$593***

**Although mobile voice communications is bridging the digital divide,
Internet connectivity is equally important for economic & social development
Mobile connectivity is more valuable than fixed or portable connectivity!**

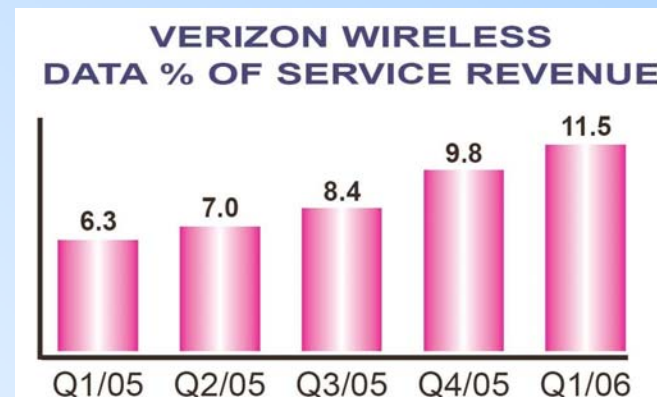
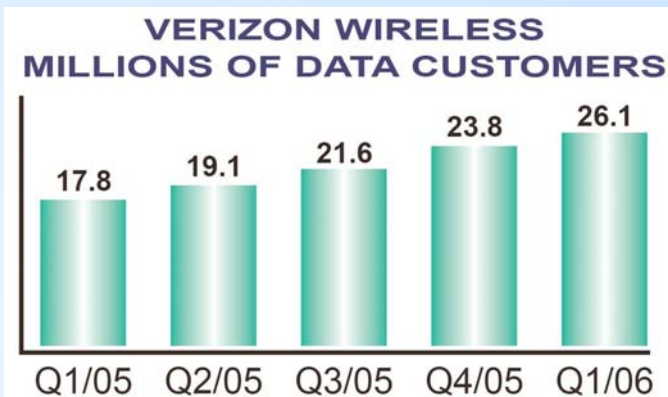
Source: Michael Minges, TMG Telecom, and ITU World Telecommunications Database Statistics, 2003.



The Move Toward Mobile Data



Source: CDMA Development Group, "CDMA Tracks and Newsworthy Facts," May 2006; Strategy Analytics.



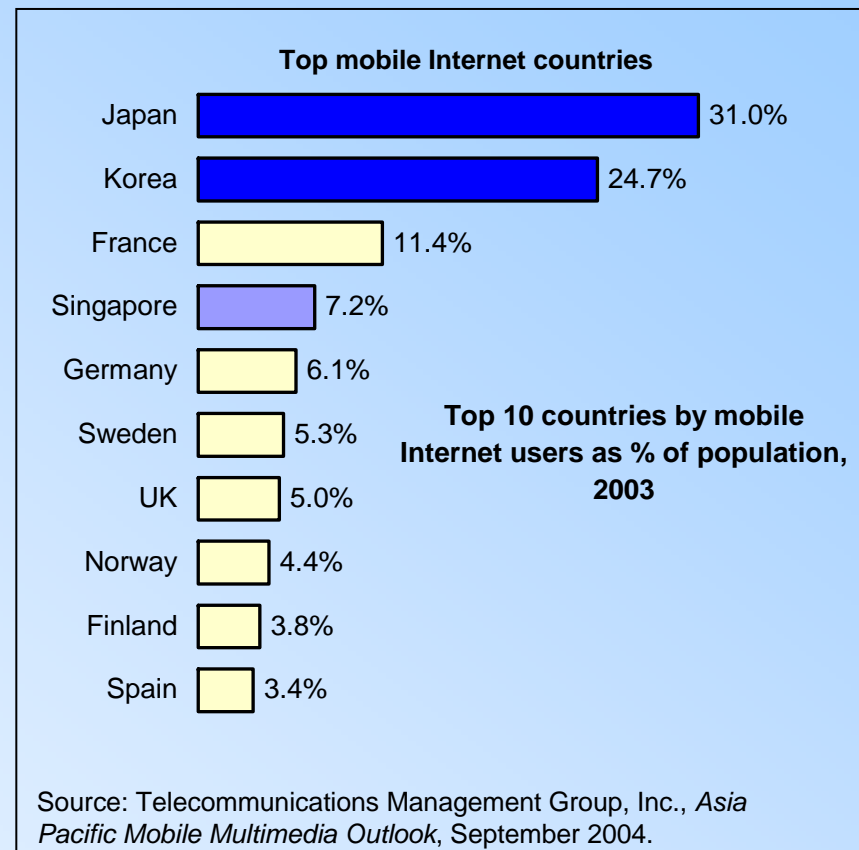
Source: CDMA Development Group, "CDMA Tracks and Newsworthy Facts," May 2006; Verizon Wireless 1Q 2006 results.

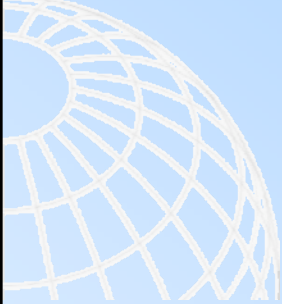
Asia-Pacific Mobile Data Usage

- As of 2003, three Asia-Pacific countries ranked among the top mobile Internet* countries
 - Japan
 - South Korea
 - Singapore

* Mobile Internet users: Reported users of mobile Internet services, including web browsing, e-mail, downloads, m-commerce and multimedia messaging, but excluding text messaging.

Source: Telecommunications Management Group, Inc., *Asia Pacific Mobile Multimedia Outlook*, September 2004

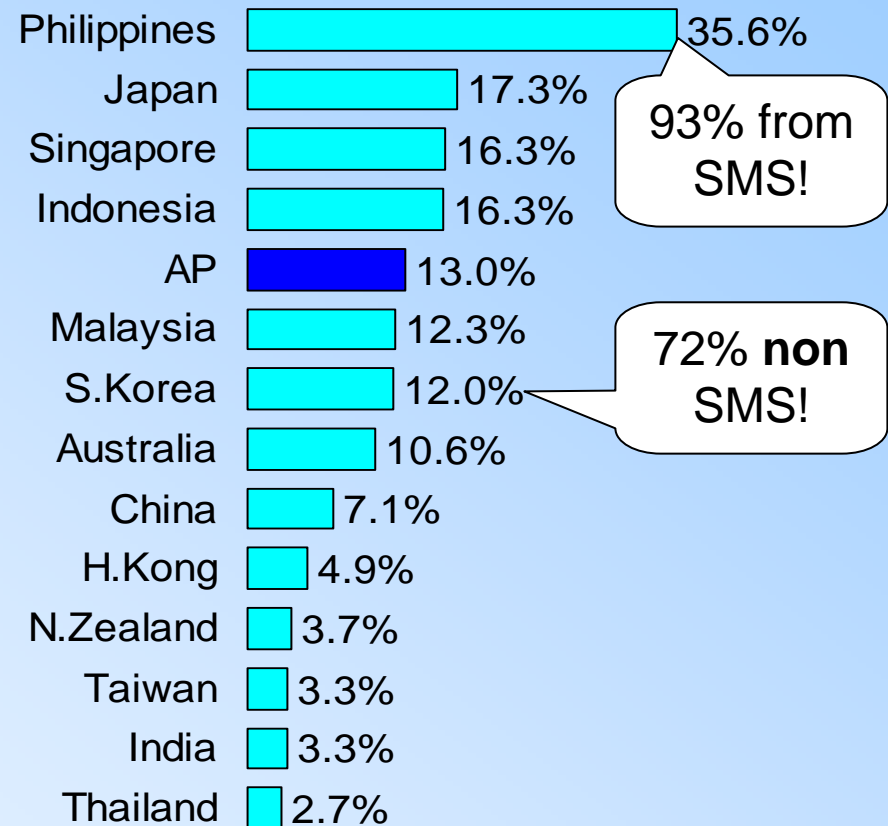




Asia-Pacific Mobile Data Revenue

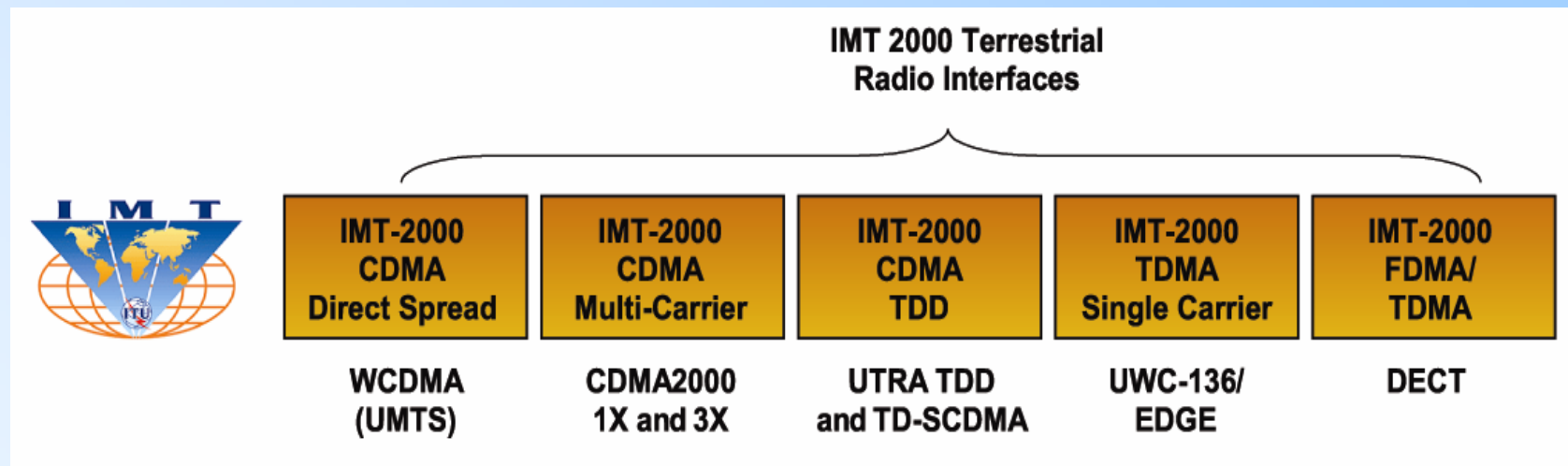
Mobile data revenue as % of total mobile revenue, 2003

- 2003 regional mobile data revenue: US\$21 billion
 - 13% of total mobile revenue
- Each operator has a different mix of mobile data services that generate its revenue. For example:
 - SMART (Philippines): 93% of 2003 mobile data revenue generated by text messaging
 - KTF (South Korea): 28% of 2003 mobile data revenue generated by text messaging

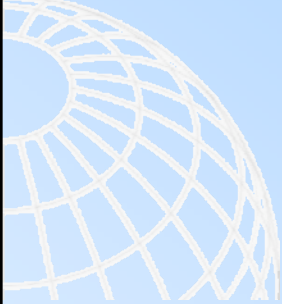


IMT-2000 (3G)

- Five technologies approved by the ITU:



- IMT-2000 supports all IP networks
- Current plans call for up to 72 Mb/s throughput



Identified 3G Bands

806-960 MHz

1710-1885 MHz

1885-2025 MHz

2110-2200 MHz

2500-2690 MHz

IMT-2000 technologies can be deployed in all frequency bands allocated to the mobile service

Ref: World Radio Conference – 2000 (WRC-2000) Istanbul, June 5, 2000:

Footnote S5.388 is associated with Resolutions 212 and 223 (the 1.9 and 2.1 bands)

Footnote S5.384A is associated with Resolution 223 (the 1.7 and 2.5 bands)

Footnote S5.317A is associated with Resolution 224 (the 800/900 bands)



IMT.Advanced Candidate Bands

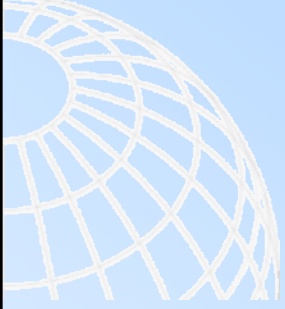
- 410-430 MHz
- 450-470 MHz
- 470-960 MHz
- 1710-2025 MHz
- 2110-2200 MHz
- 2300-2400 MHz
- 2500-2690 MHz
- 2700-2900 MHz
- 3400-4200 MHz
- 4400-4900 MHz

Includes frequencies already identified for IMT-2000
Assumes IMT-2000 bands will be used for IMT.Advanced
Focus on bands below 806 MHz and above 2700 MHz

3G Licensing Trends - Asia

Country	Population	Award Date	Bid/Award Type	Licences Available	Licences Awarded	Cost of Licences	Lic. Cost Per Pop	Licence Obligations	Licence Duration	Transferable	Notes
Japan	126.8M	June/00	Direct Award	3	3	\$0.00	\$0.00		not defined	restricted	WCDMA and CDMA2000
New Zealand	3.9M	July/00	Auction	4	4	\$10.3 - \$16.7M	\$3.29		20 years	yes	avg licence - \$12.8M
South Korea	47.9M	December/00	Beauty Contest plus Fixed Fee	3	2	\$1.1B	\$22.96	R&D contributions	15 years	restricted	WCDMA & CDMA2000
Australia	19.4M	March/01	Auction	6	6	\$4.6M - \$96.4M	\$3.02	commercial launch October 2002	15 years	restricted	2 national, 4 regional licences
Singapore	4.3M	April/01	Beauty Contest plus Fixed Fee	3	3	\$50M	\$11.63		20 years		
Hong Kong	7.2M	September/01	Direct Award	4	4	revenue sharing - variable	variable	make 30% of network available to other carriers	15 years	restricted	originally planned as auction; insufficient bidders
Taiwan	22.4M	February/02	Auction	5	5	\$220M - \$302M	\$12.48	50% coverage within 3 years	16 years	restricted	one CDMA2000 and four WCDMA licences
Malaysia	22.2M	July/02	Beauty Contest	3	2	\$13.2M	\$0.59		15 years		WCDMA
Philippines	89.5M	February/06	Beauty Contest	4	3	\$5.6M	\$0.06	80% coverage in 5 years			Technology neutral

Price per pop calculated using total country population and average license fee in instances where there is a range of fees



3G License Status in Asia

- The market is almost evenly split between beauty contests and auctions
- Average license term is 15 years
- Most licenses transferable with restrictions
- Limited coverage and service launch obligations
- In South Korea and Malaysia, not all licenses initially awarded due to bidders' inability to meet qualification criteria



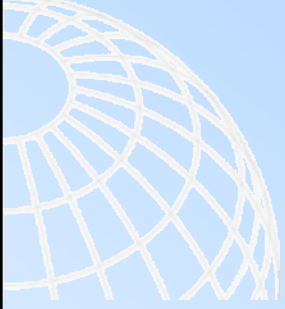
3G License Status in Asia

- Allowing in-band migration has immediate 3G benefits for consumers and businesses
 - ITU has extensively studied migration from 2G to 3G and recognizes the importance of in-band migration
- Licensing of new bands is a lengthy process – often commencing with the regulator seeking public comment on an approach to implementation, technical criteria and application process
- Public comment is key to developing sound implementation policies
- Establishing reasonable conditions for eligibility is crucial



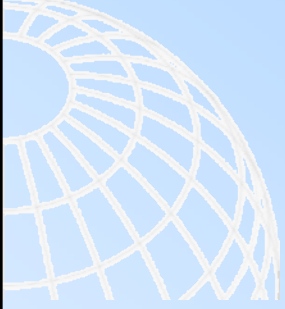
Convergence Impact on Spectrum Management

- New and emerging technologies and the increase in demand for spectrum-dependent wireless services will lead to spectrum management challenges for the regulator and user alike.
- There is general agreement that the regulatory framework in many Administrations will have to change to accommodate the flexibility that modern technology allows in the provision of telecommunications goods and services.
- The challenges lay in the identification of the changes that should be made, how they should be phased in, and how they should be implemented



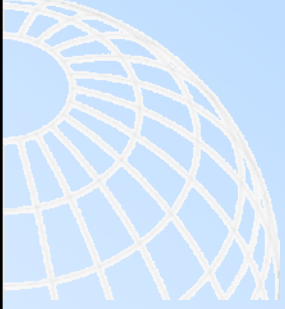
Next Steps for India

- Define a clear roadmap for access to spectrum needed to support current and next generation services on a technology neutral basis – Develop a plan, make it public
- Adapt and modify the telecommunications regulatory framework to accommodate the flexibility that modern technology allows
- Incorporate the capabilities that technological change permits into the management of the radio spectrum
- Enable the introduction of new and different services over existing infrastructure allowing in-band migration
- Enable deployment of broadband wireless access without identifying the technologies that must be employed



One Final Comment...

“Convergence has its own logic and government policy must be mindful of ground realities. No policy can be effective if it is not in step with market and technological realities,” he said.



One Final Comment...

The “he” here is Prime Minister Manmohan Singh, quoted in the March 21, 2006 online edition of The Tribune

Thank You

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