

# Unleashing the potential of mobile 2.0 technologies through efficient spectrum management

Conditions for Mobile 2.0

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**Why worry about spectrum?**

# A public resource that is key to connecting the masses

- Spectrum key to getting the BOP (or even the middle class) connected
  - The right spectrum, at the right time, at the right price
- A public resource and not private
  - But once allocated, often creates “private” rights
- Once allocated, can be used strategically to
  - hold on to unused spectrum (hoard)
  - acquire fresh spectrum with an eye on future commercial value
  - restrict entry into markets

# Challenge: design allocation mechanisms that balance market realities with public interest

- Goals of allocating spectrum:
  - Encourage competition (more connections, lower prices, higher quality, higher choice)
  - Encourage technology choice and innovation
  - Optimize revenue for the government
- While making sure allocation process minimizes incentives (by spectrum holders) to
  - Hoard
  - Restrict entry by others

# Challenge: Balancing the supply and demand for spectrum

- Reduce artificial shortage by
  - Releasing sufficient spectrum at the right time
  - Releasing the right type of spectrum at the right time
- Easier said than done
  - “Best” spectrum for a particular purpose changes over time (technology changes)
  - Owners reluctant to give up spectrum for more economically optimal use
  - Jurisdiction over spectrum allocated by other institutions for other uses (e.g. broadcast vs. telecom spectrum; spectrum granted to the military)

# **Ways of allocating spectrum**

# **Broadly, 3 ways of allocating. All can create private rights once allocated**

- Administrative approach
  - Government officials decide criteria (e.g. first come, first served; “deserving parties”; any license holder; etc.)
  - Can raise funds, but often that is secondary purpose
- Market based approach
  - The market (users of spectrum) decides how much to pay for spectrum
- Commons based approach
  - Often driven by advances in technology that enables sharing

# Administrative allocation

- Based on criteria defined by government
- Pros: may encourage services in underserved (e.g. poor/rural areas) by enabling government to allocate spectrum free (or cheaply) in such areas
  - Achieve social objectives
- Cons: Difficult to implement in the absence of good governance or lack of technical expertise
  - Technology specificity
  - Corruption
- Must be: time limited

# Market based allocation

- Best through auctions
  - other fee paying structures/mechanisms possible
- Pros: Allows market to determine optimal value for spectrum
  - Efficiency of capital allocation
- Cons: many, through bad design
  - Attract insufficient bidders
  - Without secondary trading, incentives to overbid (“now or never”)
  - Collusion
- Optimal:
  - auctions, with permission for secondary trading, and few(er) restrictions on usage
  - should not create “perpetual rights”

# Commons based approach

- Dominant model: spectrum that is unallocated to any one, but shareable by all who meet technical standard (WiFi)
- Key is agreements and standards (e.g. power levels)
- Coexistence : dominant, proven(WiFi, cordless phones)
  - One device doesn't have to communicate to the other
- Cooperation based
  - Devices communicate with each other, using common protocol
  - Can form network of devices; lead to cooperative gain (more devices added → mean distance between devices decreases → devices can transmit at lower power → conserve spectrum)
  - Unproven commercially; security/selfishness issues (when devices carry each other's traffic)

# Commons based approach....contd.

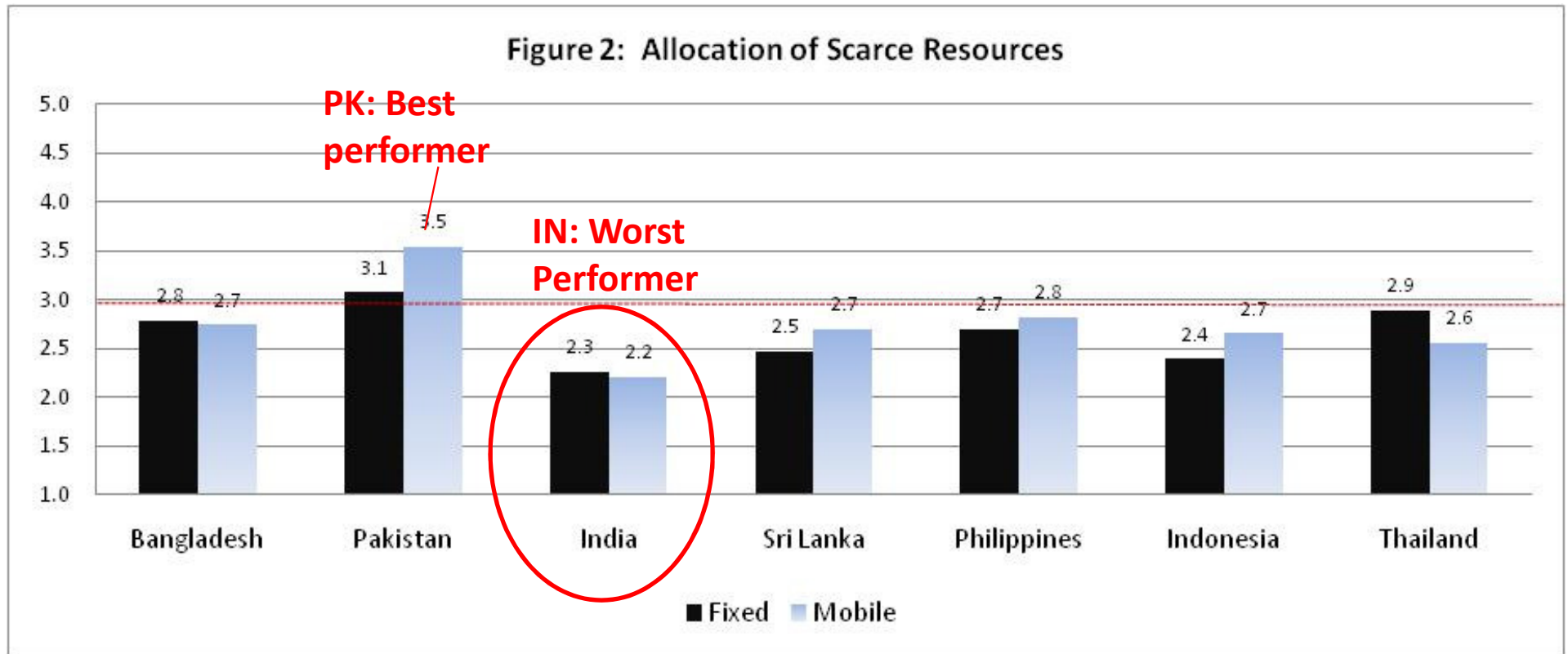
- Can result in higher spectral efficiency
  - Use spectrum that is idle when license holder is not transmitting
- Can result in cheaper spectrum (or free)
  - But doesn't have to be free
- Doesn't have to be "unlicensed": can be commons created by license holder
  - Shared by a small number of (fee paying) licensees OR
  - Primary licensee (fee paying) who allows sharing to one or more secondary non-licensed/licensed players
- Sharing can be opportunistic and have varying prices
  - when primary holder isn't using.
  - Can charge varying fees from secondary (peak/off-peak)
- Best for "new" spectrum/services, to avoid legacy issues
  - How to deal with others who have paid?

**Trying to get it right: country  
examples**

# TRE: Perception measure. Ask stakeholders to evaluate Regulatory & Policy Environment

- Very short survey
- 3 categories of respondents:
  - Category 1: those directly involved in the sector such as operators, equipment vendors
  - Category 2: those indirectly impacted by the sector or those studying/observing the sector with broader interest such as consultants and lawyers
  - Category 3: those who represent the broader public interest such as media personnel, other government officials, retired regulators, civil society organizations
- Along a scale of 1 to 5
  - 5 = highly effective; 3 being midpoint
- Question asked for multiple dimensions
  - Market entry, tariff regulation, allocation of scarce resources, regulation of anti-competitive practices, QoS regulation, Interconnection, USO

# India's bungles in 2G/3G made it the worst performer in 2008; Pakistan is best performer – through fast response?



# India: purely administrative allocation of 2G spectrum

- Amount of spectrum linked to subscriber numbers, not usage (previously)
  - Hoarding, misreporting
  - Lack of incentive to optimize for higher value (VAS) services, incentives to just add voice customers
- No policy for allocating beyond initial ~10MHz
- No mechanism for putting under-utilized spectrum to better use
- No more spectrum in 900MHz to allocate
- Fragmented ownership of spectrum
- MoD yet to clear about 20 MHz needed for growth of 2/2.5G services

# India: Long delays in 3G allocations.

- 27<sup>th</sup> Sep 2006 - TRAI issues recommendations on allocation and pricing of 3G and BWA
- 12<sup>th</sup> Nov 2007 – issues guidelines on BWA (2.3-2.4 GHz, 2.5-2.69 GHz and 3.3-3.4 GHz)
  - But availability not known publically (vacated, re-farmed from incumbents)
- Reservation Price – back and forth between DoT, MoF
- Auctions postponed multiple times
  - Jan 16 2009, Jan 30 2009, Dec 07 2009
- Finally, auctions taking place now as we speak
- Objective – revenue maximization
- Disincentive for new players (only 3G spectrum mentioned; can they get 2G spectrum also, later? )

# USA: Clearing 700 MHz through digital broadcast migration, and auctioning for wireless broadband

- US Congress mandated broadcasters to vacate airwaves in the 700 MHz band by June 2009
  - Part of long anticipated switch to digital TV
  - UK already did similar in 2007
- 700 MHz of great interest for **wireless broadband**
  - Signal penetrate walls, travel far, carry lots of data etc.
  - Better than WiFi (2.4/5 GHz currently). Cheaper<sup>1</sup> etc.
- Auctions held early 2008
  - Prior to auction, Google petitioned for new access conditions that winner would be bound by.

1 - One 700-megahertz transmitter costing \$150,000 can cover an area of over 1,000 square miles. To do the same using the mobile-phone carriers' existing 1,900-megahertz equipment requires four cellular towers, and no less than nine for 2,400-megahertz transmitters. (Source?)

# What Google wanted from winner of 700 MHz C block spectrum (in return for bidding USD 4.6 billion in auction)

- 1 - Open applications
  - Wireless service providers shall not block or inhibit end-user download and utilize applications (“no blocking”)
- 2 - Open devices
  - wireless service providers shall not lock individual handsets to a specific wireless network (“no locking”)
- 3 - Open Services
  - Licensee should provide wholesale services to requesting resellers (third party) based on reasonable, non-discriminatory commercial terms
- 4 - Open Networks
  - Facilities based ISPs required to interconnect their own network facilities with the last-mile towers of the wireless providers
  - LECs having to allow ISPs to interconnect with last mile network

FCC Agrees to these 2. Verizon wins auction. Compliance unclear

But refuses to adopt these two 2 requirements

# Open Services and Open Network requirements: an opportunity missed

- Currently: Telco operators can provide preferred content, often accessible through menu/icons
  - E.g. iMode's iMenu (3000 iMenu partner sites approved by DoCoMo), iPhone's AppStore
- Preferred content = easy billing
  - billed directly via operator onto monthly bill
- Not being on preferred list = barriers to users
  - user has to enter URL; separate entry of credit card info/monitoring
  - If not on list, can even be blocked (e.g. iMode Japan previously did)
- Operator can also choke bandwidth to users and disable features
  - E.g. VOIP disallowed on many networks (Verizon sells phones w/ WiFi Disabled)
- *“incumbent wireless carriers . . . routinely choke bandwidth to users, cripple features, and control the user experience”* in order to protect their wireline broadband offerings (e.g. DSL)

## Gives negotiating power to operator

- Preferred content + ability to choke → operator can negotiate with content provider (application provider) for revenue share
- Can even block access to certain content
- But more often, able to discriminate content
- **FCC got the auction design right (...and raised USD 19 Billion + revenues). But not the rules about operator behavior (e.g. sharing) once spectrum was granted**
- Incremental cost to operator
  - Content mostly promoted by provider/aggregator

# USA: Tapping into cutting edge technology and enabling new models of sharing/commons

- Driven by Cognitive Radio/Software Defined Radio
  - Frequency (transmission/detection) done by software, not hardware (current/previous generation)
  - Sniff/sense available spectrum. If band free, adjust to that frequency. Transmit.
  - Can be in the terminal device (mobile phone/computer) or in the network elements (BTS/BSC etc)

## Becoming commercial reality.

- Commercial use: Venu Bose proving concept by installing with small regional telcos in USA.
    - 2G→3G →next (LTE?) all possible through software upload
    - No hardware replacements required to upgrade
  - Non-commercial use (so far)
    - to use
- If you don't believe it, think 15 years ago about WiFi.  
And wait for China and India to adopt/produce cheap devices**
- 2: Geographically specific database Google is building  
(device turns on, connects to DB, updates, uses free band)

# Conclusions

- Move from administrative criteria → market driven approach
  - Allow market to discover optimal # of operators. Allow mergers, transfers and sharing of spectrum
- De-couple licenses from start-up spectrum
- Do away with escalating spectrum charges
- Better harmonization with ITU allocated bands
- Long term plans for government use of spectrum
- Long term review with goal of finding optimal mix of licensed and unlicensed bands

# Thank You

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