WiMAX - A Disruptive Technology?

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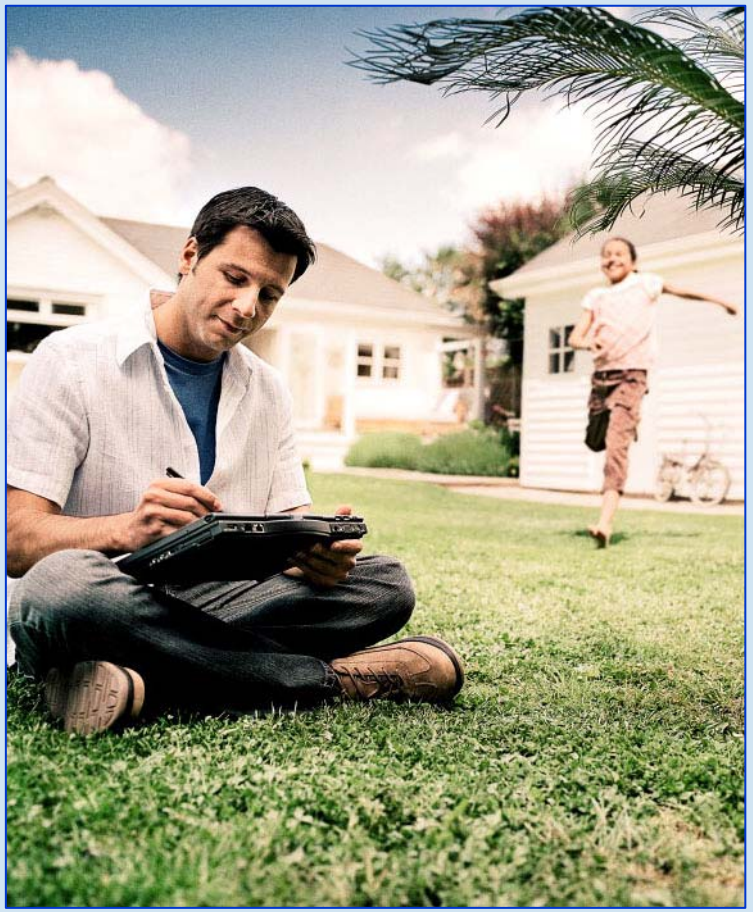

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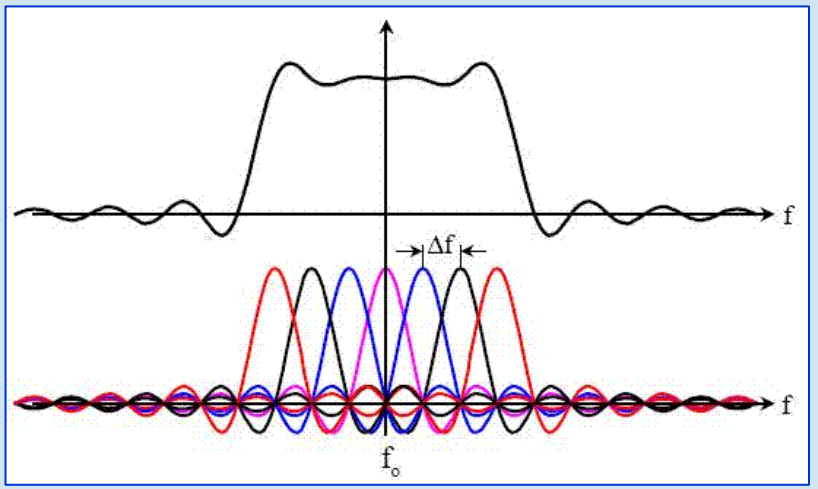
WiMAX, What is It?

- WiMAX term is generally used as common term for collection of radio technologies that are defined by IEEE 802.16 standard, mainly
  - Fixed 802.16-2004
  - Mobile 802.16-2005
- Radio is based on OFDM, OFDMA and SOFDMA, where information is multiplexed at frequency and time domains
- WiMAX Forum standardizes profiles for WiMAX networks and devices



Orthogonal Frequency Division Multiplexing

Definition of Disruption by Wikipedia

- In Scotland, the Disruption of 1843 refers to the divergence from the Church of Scotland of the Free Church of Scotland
- Disruption as a method of execution ... so that the body of the execution victim is pulled apart.
- Information security specialists also may refer to a disaster as a disruption when an event interrupts normal business or technical processes.
- Disruption is also the term for the cancellation of an adoption of a child before it is legally completed.
- Disruption is a method of disabling an explosive device by shooting it with water at high velocity.
- Disruption generally refers to the normal workings of something being interrupted

Clear Direction for Internet Communications

Voice has gone mobile

Internet communication is going mobile

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Drivers for Broadband Radio Technologies

- Broadband technologies improve…
  - Data speeds
  - Latency
  - Spectrum efficiency
  - Cost for providing multi-megabit connectivity
- Broadband deployment requires broadband carriers, hence sufficient spectrum
  - Not a lot available at preferred frequencies that are under 2 GHz

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There Are Plenty Of Technologies For BWA

- WiFi
- HSPA
- LTE
- 1XEvDo
- TD-CDMA
- TD-SCDMA
- iBurst
- Flash-OFDMA
- XMax
- WiBro
- WiMAX 802.16-2004
- WiMAX 802.16-2005
- And more to come, like 802.16 m, 802.20, 802.22...

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Is WiMAX Disruptive from Radio Perspective?

- Disruptive elements:
  - IPR is more evenly spread than with traditional Cellular radios
  - Standardized outside traditional telecoms standardization bodies
  - Frequency and operator licensing has potential to bring new operators and business models
- Non disruptive elements
  - Same OFDM radio is adopted by other radio systems as well: 3G->LTE, 802.11, 820.10...
  - Regulation in licensed and unlicensed bands

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All Modern Radios Have Similar Link Performance. - Differences in Data Rate, System Efficiency and Coverage

- Link performance is similar in eg. HSPA, WiMAX and LTE
  - Shannon limit applies for all radios
- Data rate is a function of bandwidth
  - The broader the bandwidth, the higher the capacity and peak data rate
- System design can bring differences
  - Interference and frequency reuse planning
  - Scheduling
  - Overhead
  - Antenna technologies
- Coverage is a function of frequency and duplexing mode
  - Higher the frequency, smaller the coverage
  - Service continuity and interworking with existing technologies can compensate

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There Are Two Seemingly Conflicting Agendas

- End users want just to get connected with their broadband services
  - Whenever
  - Wherever
  - With good and dependable service
  - With predictable cost
- Service providers want
  - To invest according to growth
  - Scalability
  - Economies of scale and supply side competition
  - To see that their investment pays back
- With plethora of technologies and competing messages…
  - How can the industry fulfill both wishes ?

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Key Ingredients Of Successful Business

- You need only two things:
  - Demand and Supply

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Key Ingredients Of Successful Business

- Demand: some call it killer application
  - We know it's there
  - Demand has downward price elasticity
- Supply
  - Plenty of it like we saw
  - Supply has upward price elasticity
- So how to drive the cost down?

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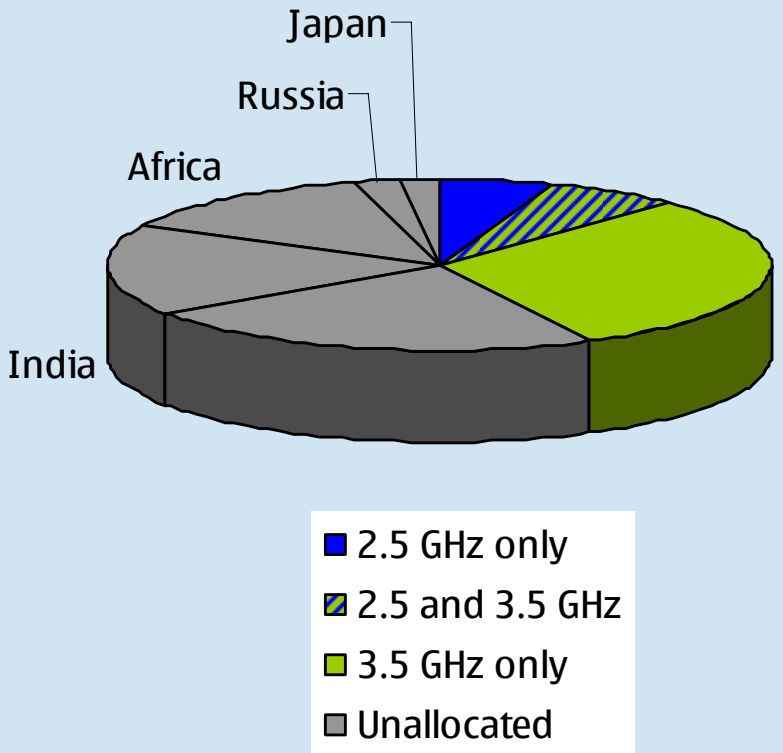
Cost Depends Mostly On Frequency, Targeted Service And Ecosystem

- Frequency
  - Broadband access radios operate mostly in 2Gz and higher bands
  - 3G WCDMA core band around 2GHz
  - WiMAX mainly at 2.5 and 3.5 GHz bands
- Service
  - Broadband access for CPE's, or...
  - Fully mobile service with good indoor coverage
- Ecosystem and volumes
  - Global standards drive volumes
  - GSM is an example of highly successful global standard
  - Can WiMAX achieve same status?

World Population and WiMAX Licenses 3Q06

2.7 B people covered by WiMAX spectrum licenses today



Source: WiMAX Forum license database

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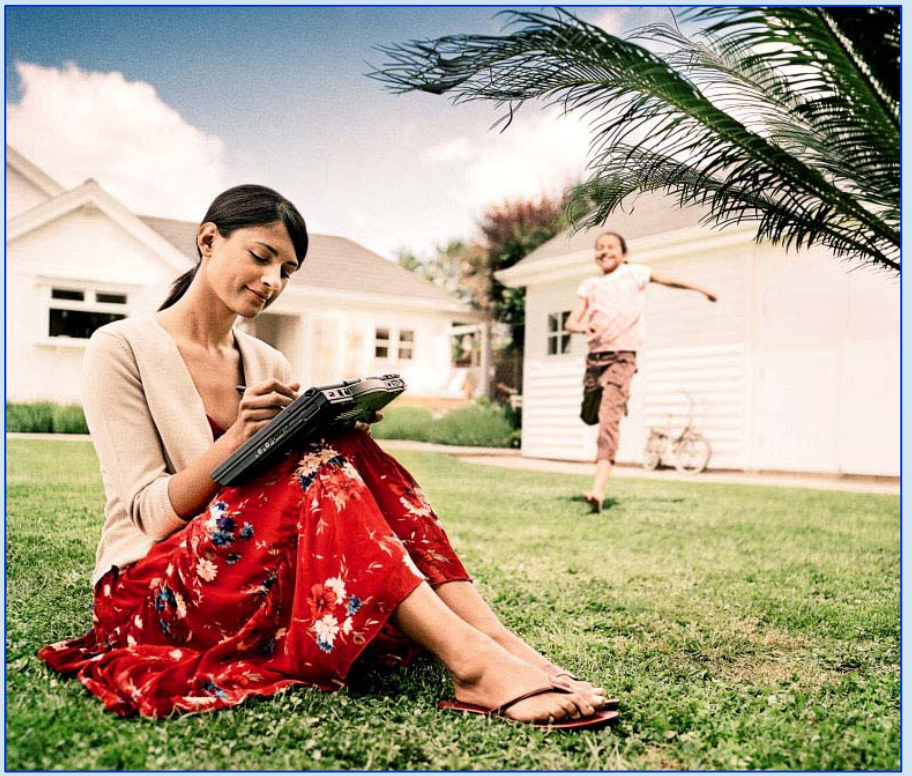
If Radios Are Alike And Frequencies Are Mandated By Authorities, How Can WiMAX Become Broadband For Masses?

- In simple terms,
  - How can WiMAX reach volume?
- Or in other words,
  - Can we stick to standards and not go for fragmentation
- What about the applications that will drive volumes?



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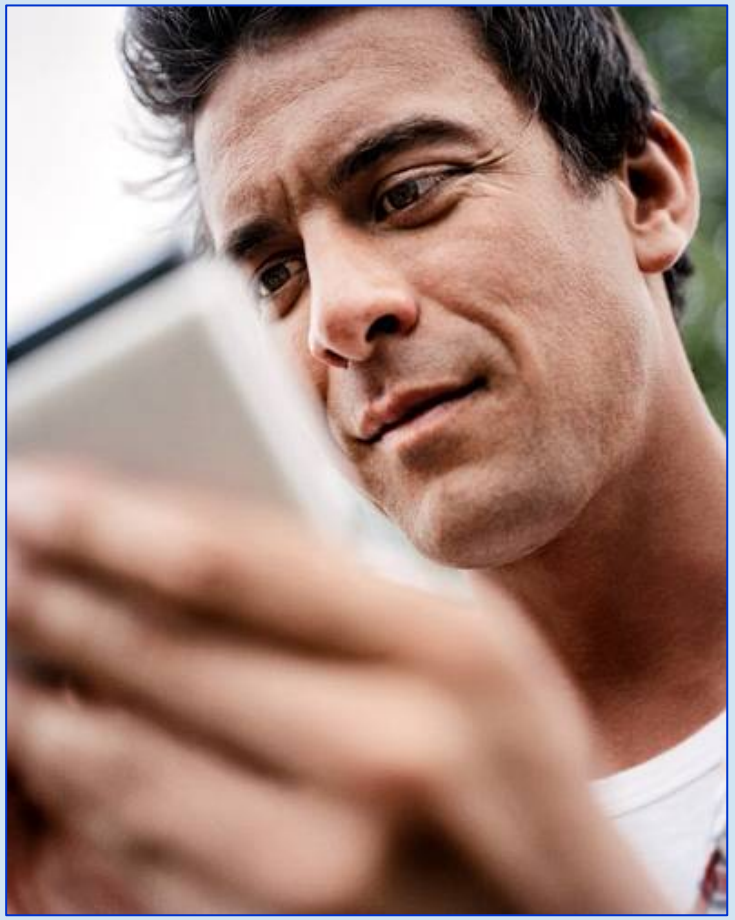
WiMAX Disruption is possible if…

- We keep networks simple
  - As radio is as costly as any other
- We allow innovation for applications
  - Instead of tight standardization
- We have low cost mindset when building networks
  - Instead of traditional telecom mindset
- We let users conect to internet w/o limitation
  - Instead of walled gardens and value capturing mindset
- We use Internet model for services



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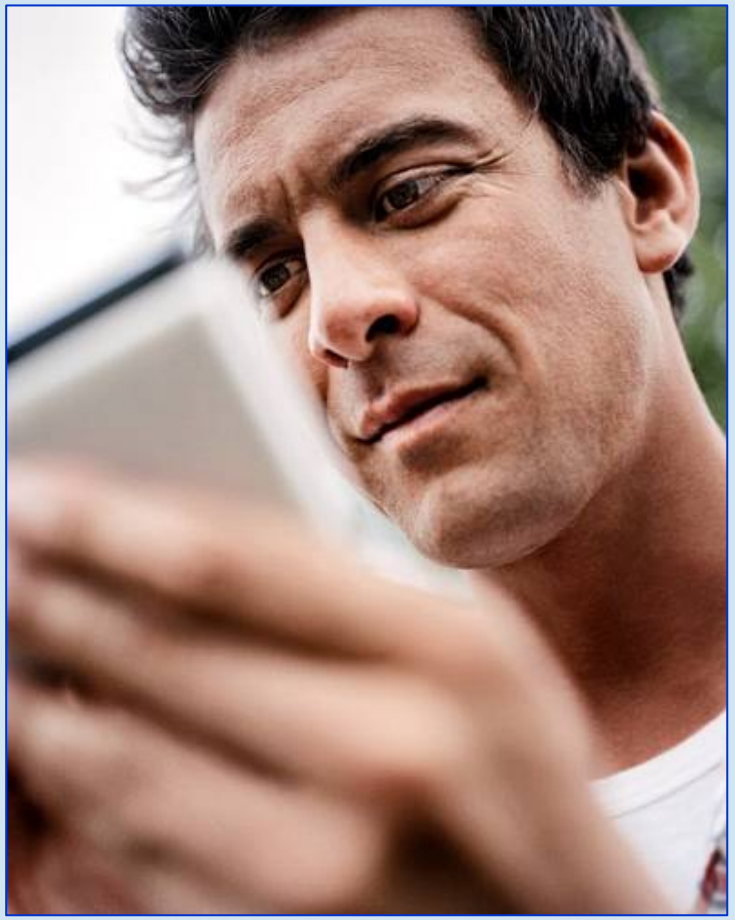
Summary: WiMAX is not Disruptive Radio Technology, but can be Disruptive Ecosystem

- It's not about radio technology
  - It's about ecosystem
- WiMAX is reaching global licensing and acceptance of operators
  - Large volumes are possible if we stick to standards
  - Volumes are deciding the cost
- Make adaptable and simple networks
- Embrace Internet model



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Thank You

