



WIMAX : Bridging the broadband divide

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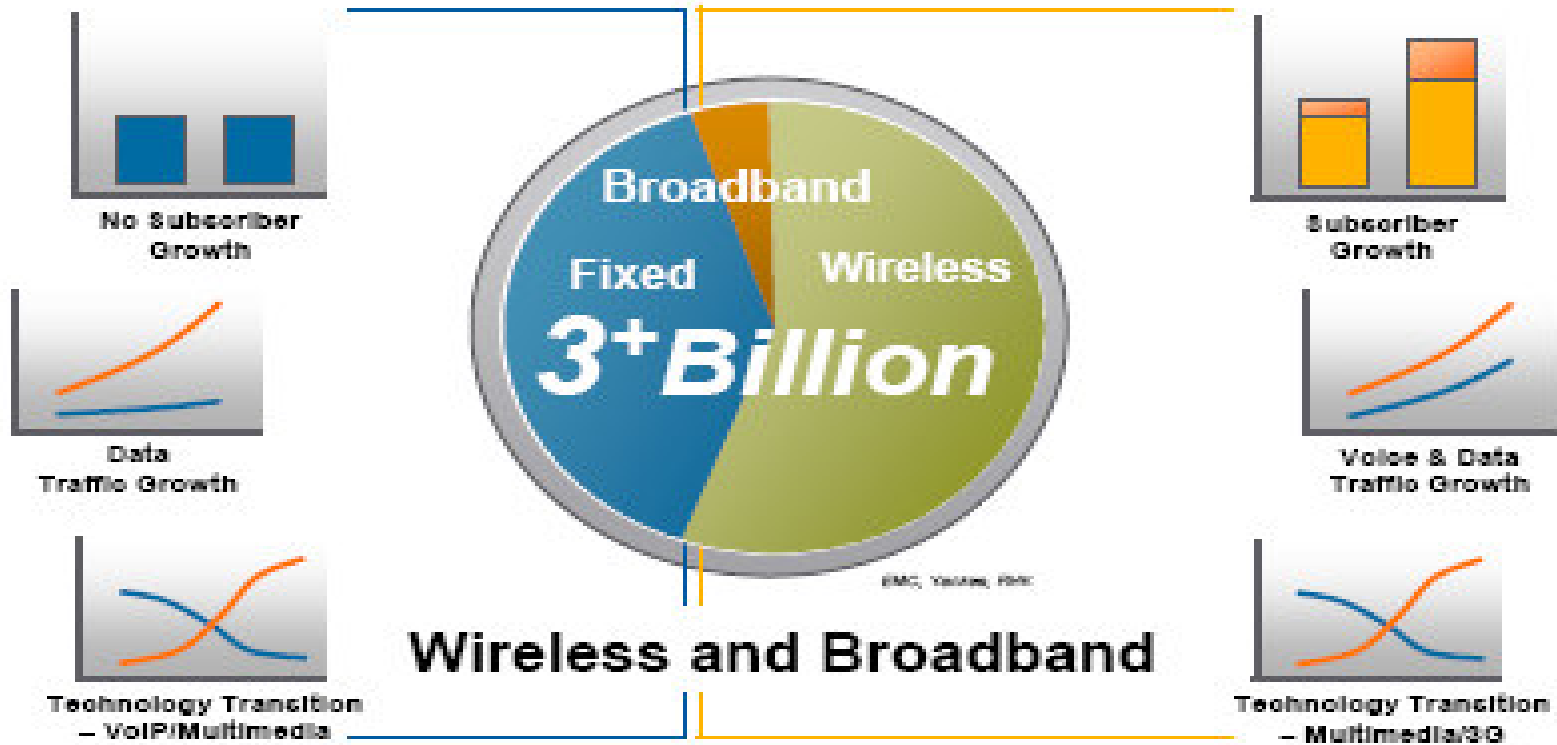
Topics



- What is WIMAX ?
- How can WIMAX accelerate the availability of broadband infrastructure in Greece



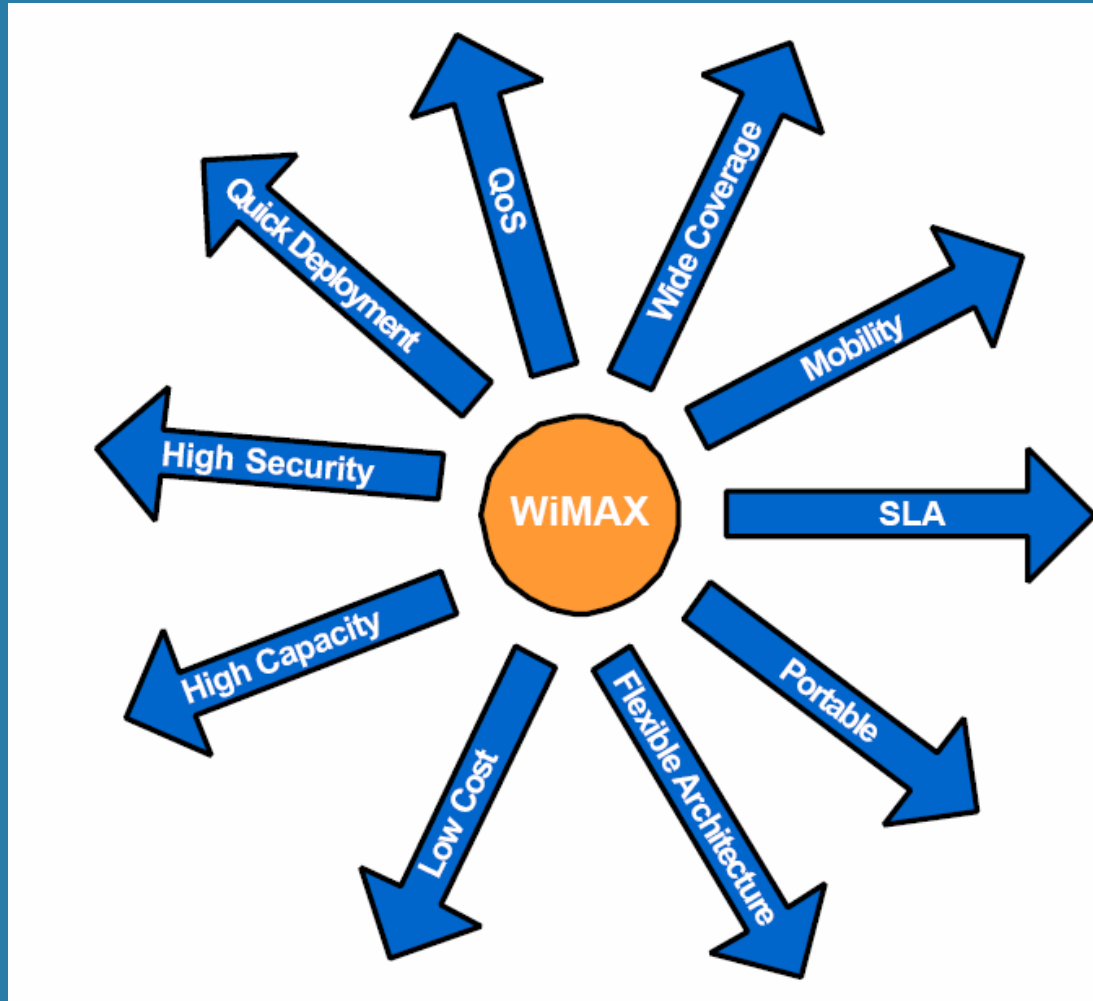
Telecom Market Trends





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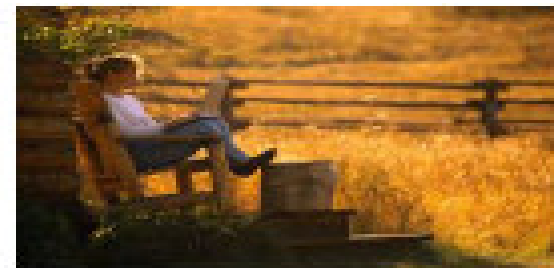
What is WIMAX ?





WiMAX: True Broadband Internet, Everywhere

- > Bandwidth intensive applications and services
- > Highest bit-rate at the lowest cost
- > Most spectrally efficient
- > Enabling the Next Generation of devices



A Fresh start means No Compromise



What is WiMAX

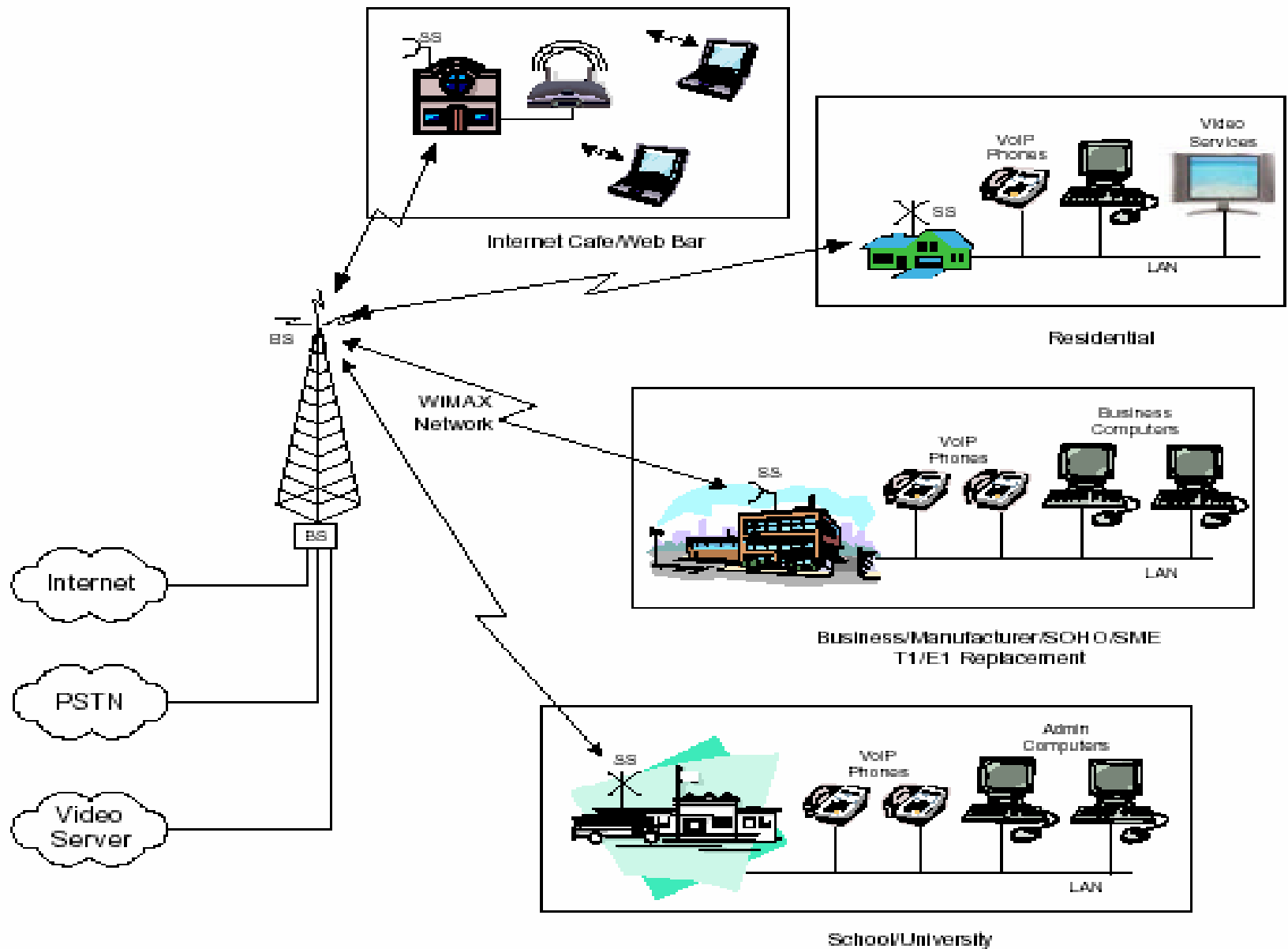
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- **Standard for Broadband Wireless Access**
 - Higher range than WLAN
 - Higher bandwidth than UMTS
 - Usually in licensed spectrum - 2.5GHz, 3.5GHZ
- **802.16d (also known as 802.16-2004)**
 - Fixed only, minimal QoS, lower data rates,
- **802.16e (also known as 802.16-2005)**
 - Mobility, extensive QoS, higher bandwidth
 - Not compatible with 16d
- **CPE**
 - Intel driving solutions



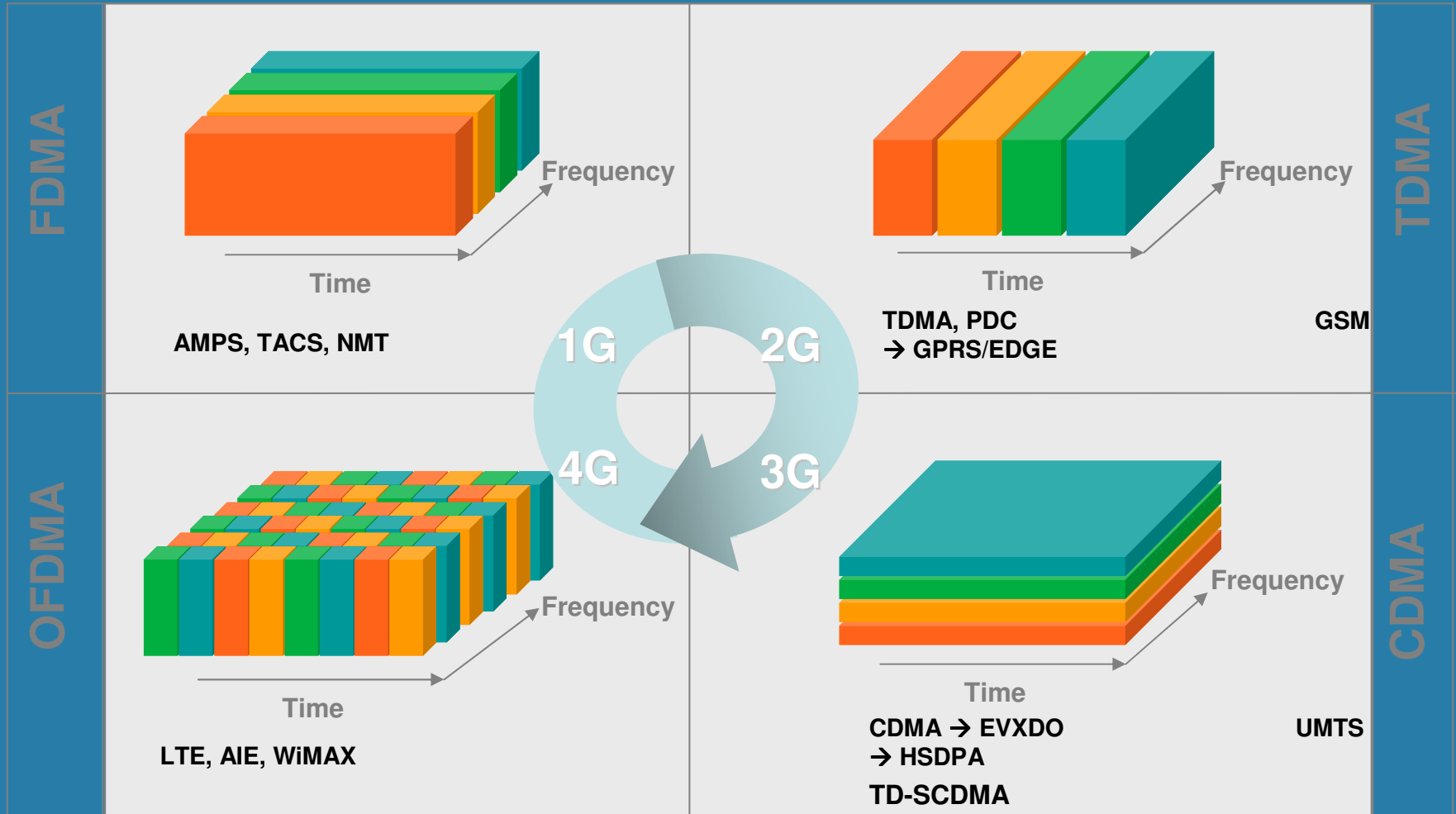
What can it do?

- 25 Mbps per cell rising to 100+Mbps
 - Can support tri, hex and even 8 sector configurations
- Excellent spectral efficiency using OFDMA/MIMO adaptive modulation
- Cell sizes, (1Mbps DL, 256k UL at cell edge)
 - Urban <1km
 - Suburban 1-2km
 - Rural up to 10km
 - Details depend on radio planning, frequency, EIRP, device, etc
- Range of QoS settings support VoIP, streaming video, etc



Radio Access Air Interface Principles

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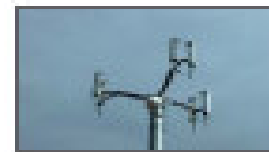
→ User #1 → User #2 → User #3 → User #4

MIMO / OFDMA Makes WiMAX Superior

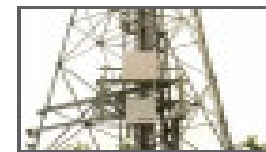


- > True MIMO is faster and cheaper
 - 1/3 the \$/bit of AAS WiMAX
 - 6x the bandwidth of 3G
 - Handles mobility & user #'s
- > MIMO is fundamental in 4G
- > All WiMAX devices will be MIMO enabled

> Nortel is the acknowledged leader in WiMAX MIMO



MIMO Antenna



Adaptive Antenna

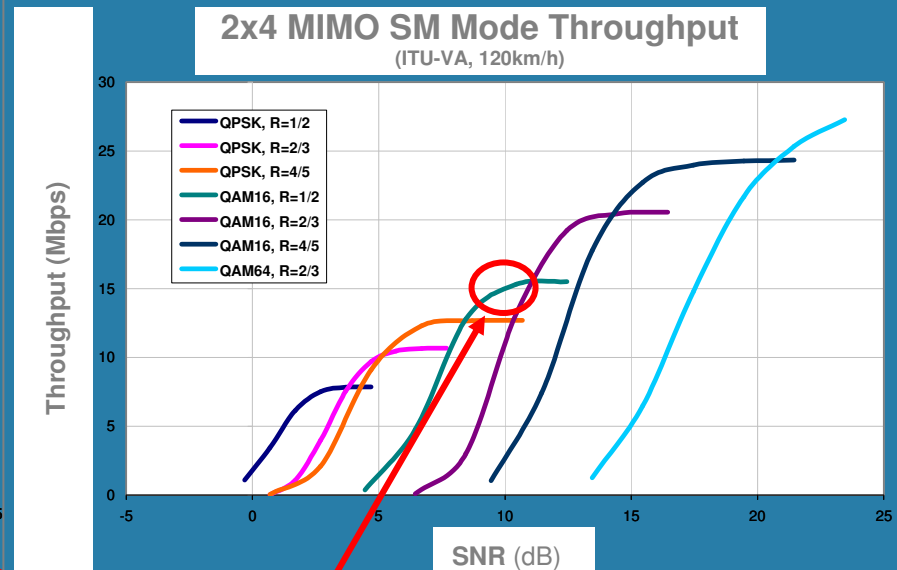
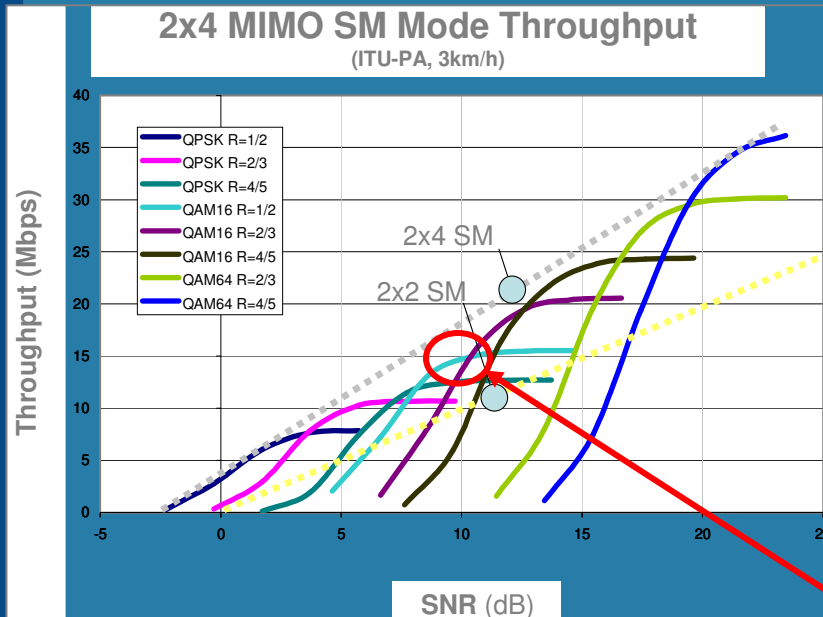


Sprint will not allow Wave 1 devices in its network

MIMO Works Well in a Mobile Apps

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Lab prototype measurement results



Identical throughput at 3 km/h & 120 km/h

MIMO performance is robust in highly mobile applications

WiMAX Mesh Backhaul

- **Flexibility in deployment – deploy BTS's with a mix of fiber and wireless mesh backhaul**
 - Deploy fiber where possible
 - Deploy wireless mesh where spectrum is available
 - Add fiber when mesh becomes congested
- **Reduce number of BTS that require wired broadband backhaul**
 - Reduce OpEx
 - Increase deployment velocity
- **Backhaul redundancy**
 - Provide path diversity



- **BTS with Fiber Connectivity Only**
- **BTS with Fiber and Wireless Mesh Connectivity**
- **BTS with Wireless Mesh Connectivity**

Flexible Backhaul Deployment

Competing technologies

- xDSL
 - Delivers higher bandwidth
 - Limited by distance from exchange, state of cables etc
 - Long contract
 - in Greece still expensive
 - Not available everywhere
 - OTE's dominant position – llu slow
- HSDPA
 - Full mobility with increasing coverage – being deployed now
 - Relatively expensive
 - Low uplink bandwidth
- Microwave
 - Excellent for point to point
 - Hindered by rain etc
 - Must be line of sight and aligned



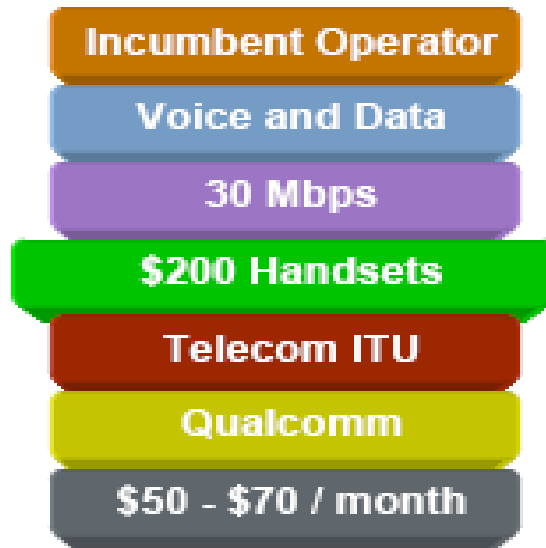
3G vs WIMAX



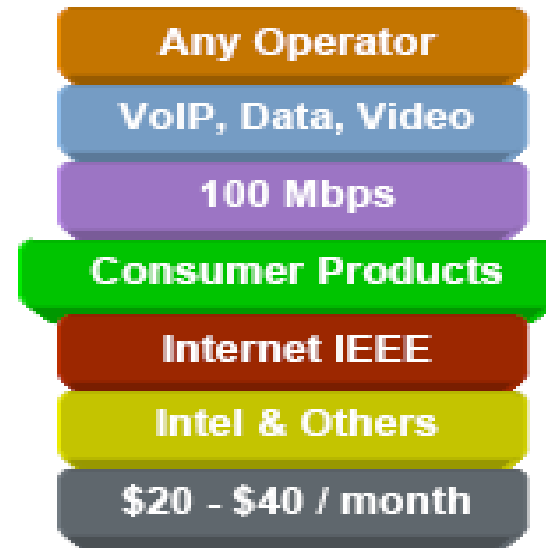
WiMAX: A new paradigm



3G+



WIMAX



WIMAX to Bridge the broadband divide

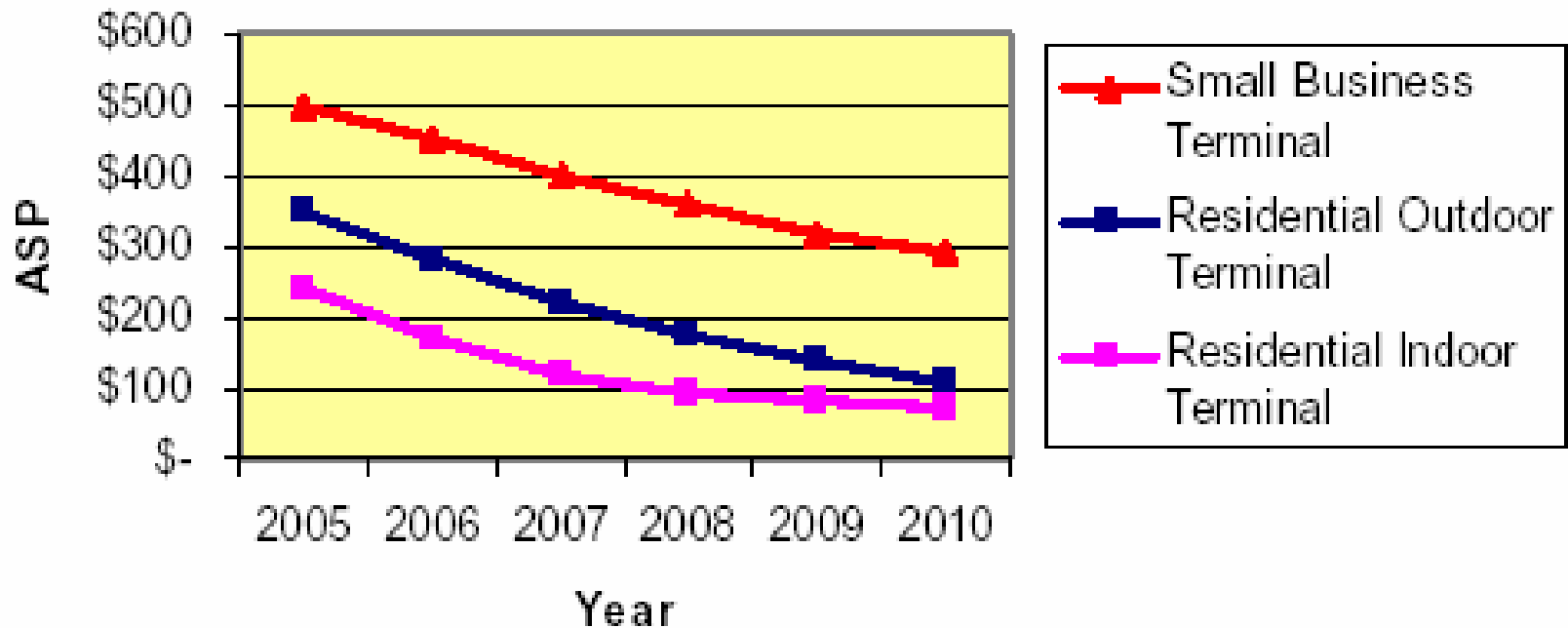
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- Fast deployment – QoS – High bandwidth per BS
- BS prices attractive today, CPE prices falling rapidly
- => Quick return on investment
- Mesh capabilities offer further flexibility
- Ideal for countries like Greece with low fiber/adsl deployment
- Ideal for rural communities – fast deployment – IP capabilities – NOT possible today with narrowband rural implementations

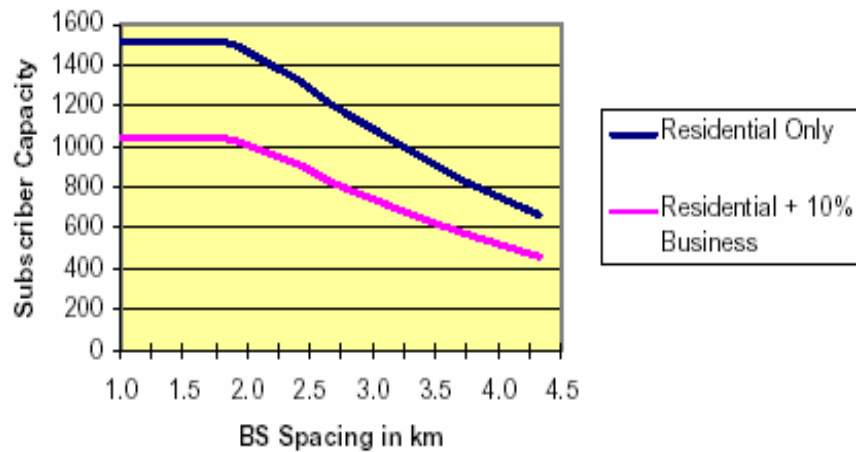
CPE price trends

Estimated WiMAX CPE Prices

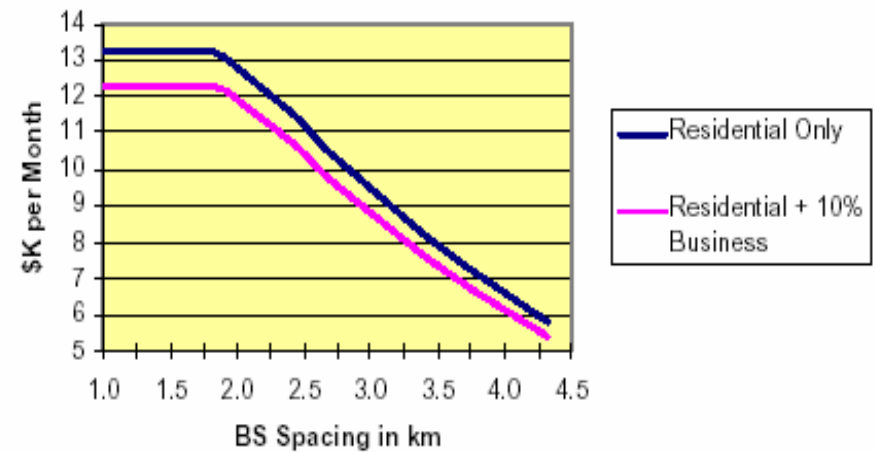




BS Subscriber Capacity



BS Net Revenue Potential

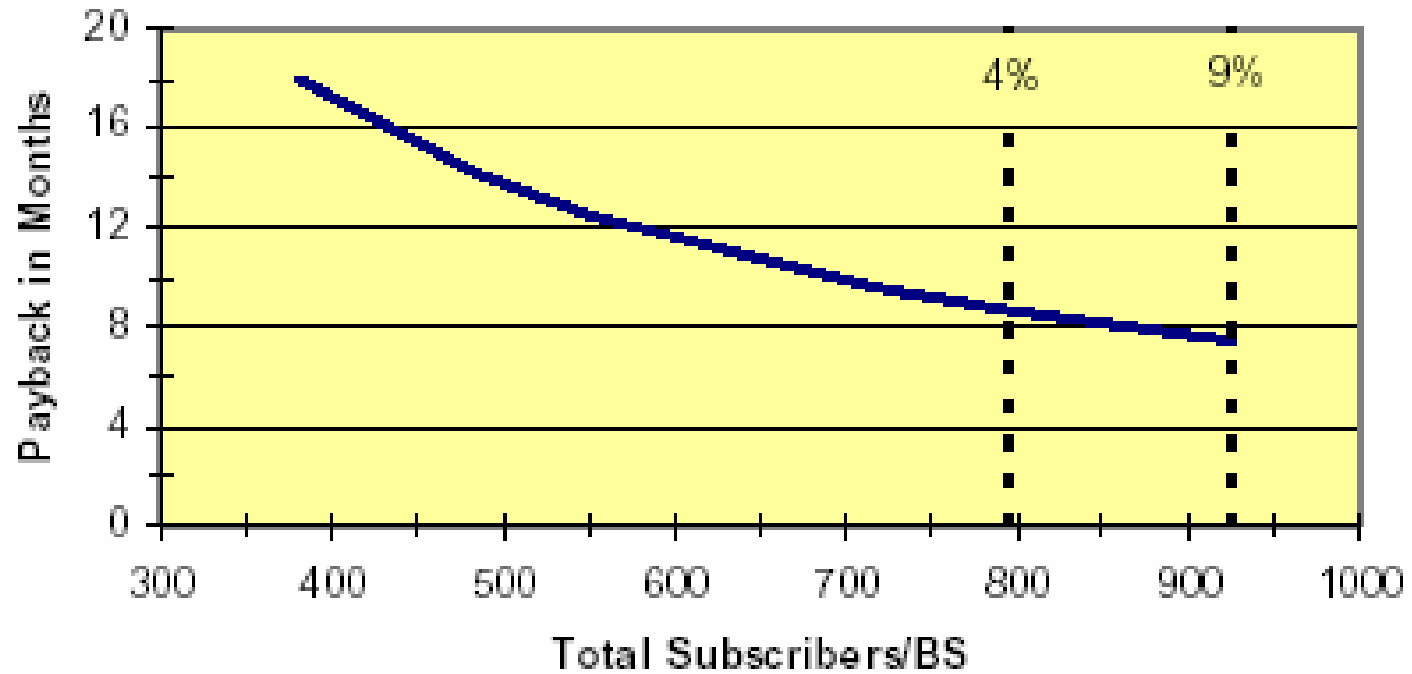


- 4-Channel Base Station
- 3.5 GHz FDD
- 3.5 MHz Channel BW
- 100% Non Line-of-Sight

- 100% Outdoor CPEs
- Uniform Customer Distribution
- Residential ARPU = \$17.50/mo
- Business ARPU = \$77.50/mo



Payback for BS CAPEX





- UNINORTEL is NORTEL in Greece
- UNINORTEL is today supplying equipment and services for the first commercial WIMAX deployment in Greece
- CRAIG WIRELESS
 - aggressive deployment plan.
 - 802.16-2004 being deployed today as I speak
 - 802.1e mobile main focus, should be deploying Spring 2007



Thank you