



# WiMAX 101

April 23, 2009



- Introduction to WiMAX
- WiMAX technology
- Providers' value proposition
- How WiMAX compares
- Consumer advantage

# What is WiMAX?

*WiMAX is "a standards-based technology for the delivery of last mile wireless broadband access as an alternative to cable and DSL"*

## WiMAX

- Worldwide Interoperability for Microwave Access
- Goal: Mobilizing the Internet

## IEEE 802.16 standard

- Open systems architecture, standards and interoperability
- Drives down costs
- WiMAX Forum formed in June 2001

## Licensed Spectrum

- 2.5 and 2.3 Ghz range current **US certified profiles**
- Greater Quality of Service and Security

## Funding

- Intel, Motorola, Sprint, Clearwire, **Comcast**, Google
- Over **\$8B** in development funding

*The way WiMAX works differentiates it and makes it a viable broadband option*

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- Operates over licensed spectrum for secure service, **low latency** and low interference
- Reaches 2-3 miles indoor and 5-7 miles outdoor
- Makes entire town a “hot spot”
- Provides emerging mobility

# WiMAX operational advantages

## CapEx

- Open standard
- Economies of scale
- Converged services

## OpEx

- Flat IP network
- Efficient backhaul
- Low cost installation



## Customer Acquisition

- WiFi-like distribution
- Intel platform branding
- Applications & mobility

## OFDM Performance

- Latency
- Spectral efficiency
- Advanced antenna support

*WiMAX requires low capital and operational expenditures to make it a “disruptive” technology in the US and around the world*

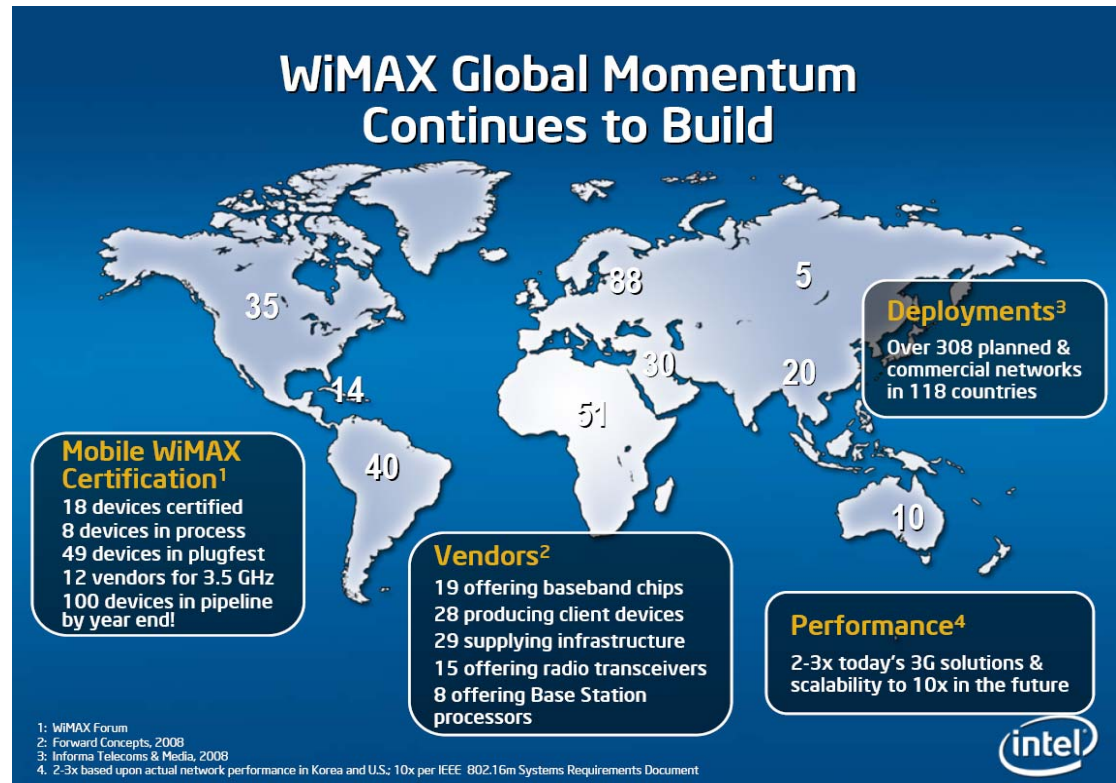
*Since 2007, WiMAX adoption in the US has grown as momentum builds globally*

## United States

- First WiMAX retail deployment- May, 2007 in Rexburg, Idaho
- **First 16e mobile deployment – Jackson Hole, WY June 2008**
- Clearwire predicts it will serve over 120 million Americans in coming years

## Globally

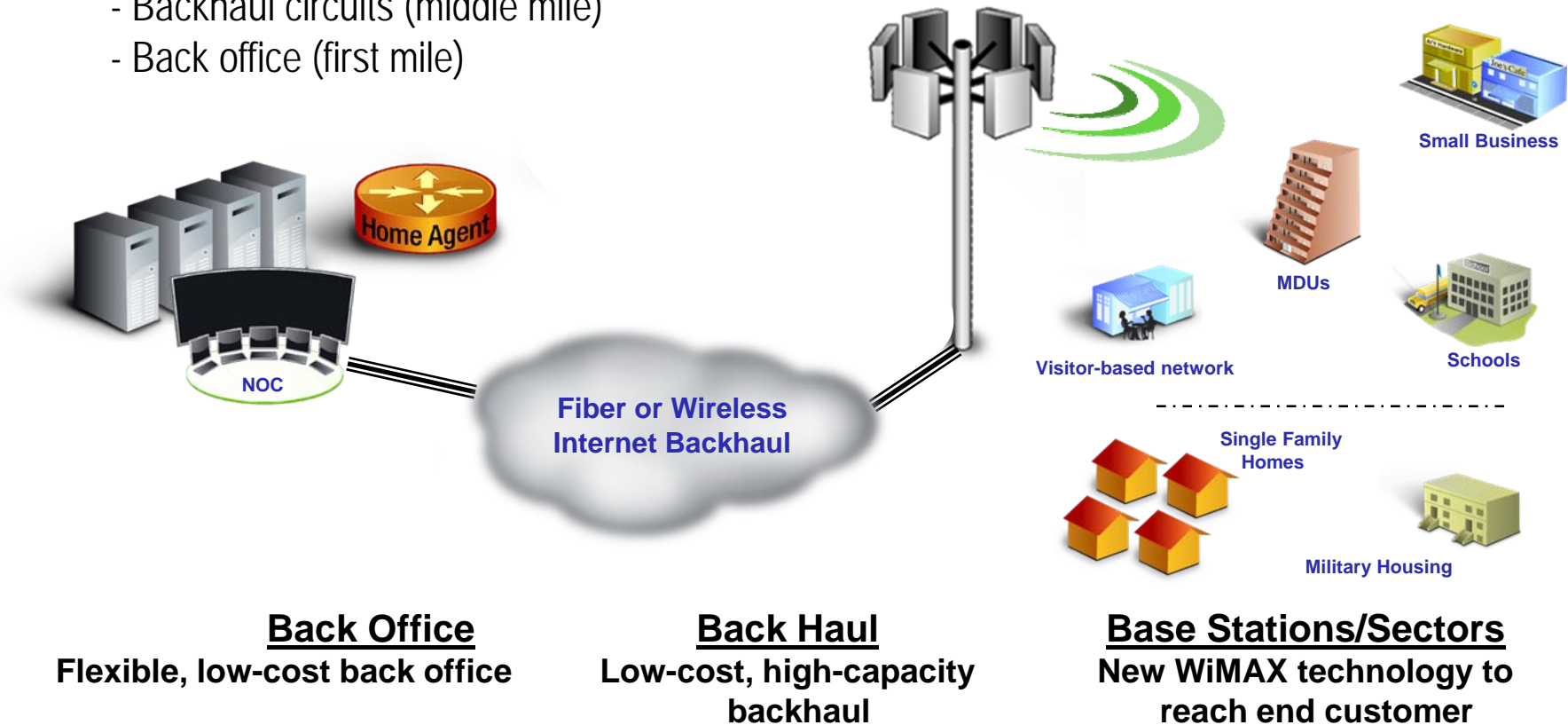
- 308 commercial networks planned or deployed
- Hundreds of devices under development
- Over 100mm users by 2012
- Service revenues of \$24bb by 2012



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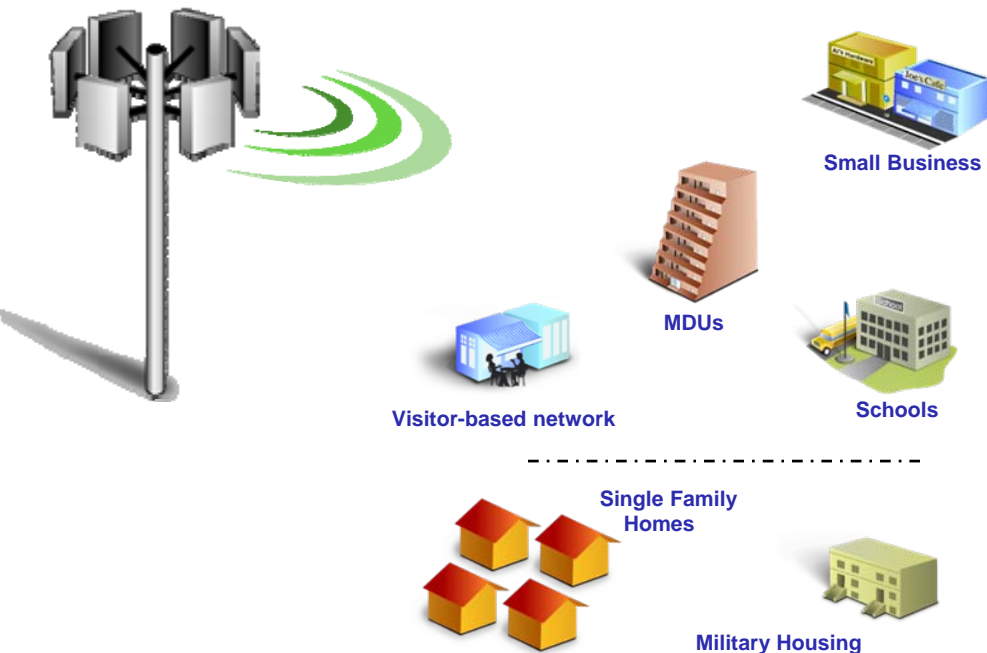
# Technology basics

- WiMAX operators using licensed spectrum deploy and manage:
  - Base stations/sectors (last mile)
  - Backhaul circuits (middle mile)
  - Back office (first mile)



# Last mile advantages of WiMAX

*Known as a “last mile solution”, WiMAX deployments can provide service directly to a large area with a single base station*



**Last Mile**  
New WiMAX technology to reach end customer

- Next generation wireless broadband
- Ranges of several kilometers
- Point-to-multipoint, LoS and NLoS

# Radio network technology features

## Modulation

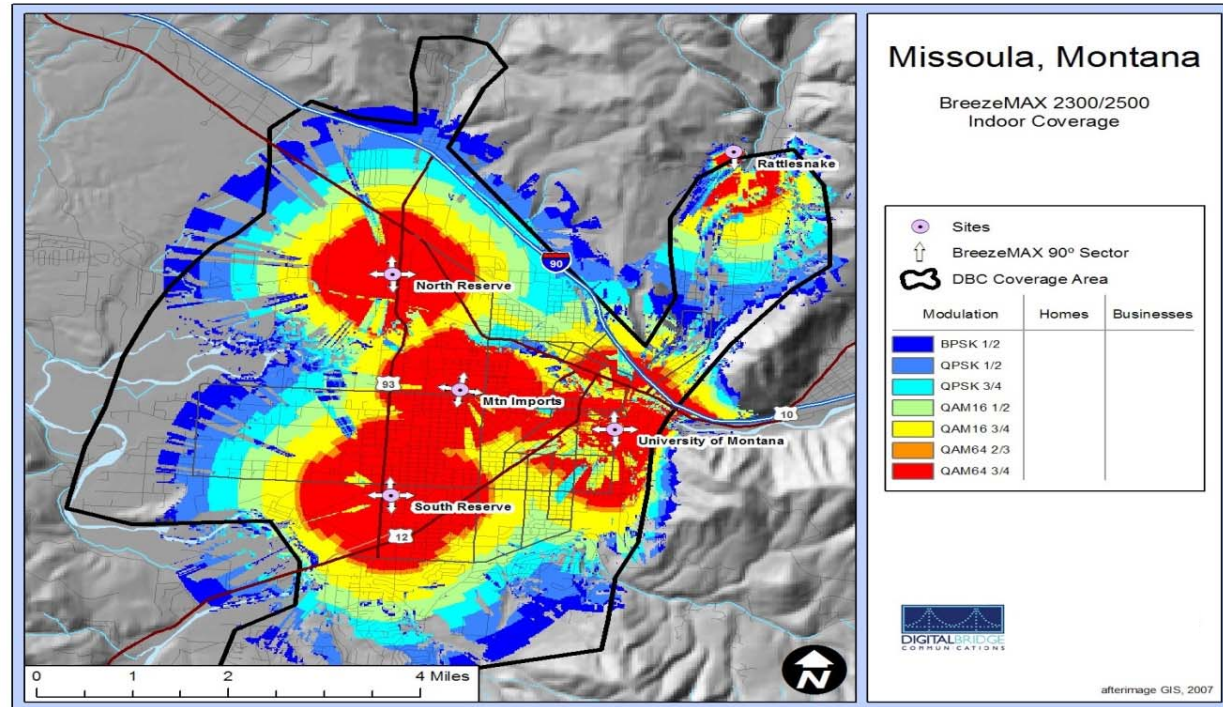
Single Carrier, 256 OFDM,  
2048 OFDMA - BPSK, QPSK,  
16-QAM, 64-QAM, 256-QAM

## Antenna system support

Diversity, MIMO, SDMA

## Duplexing

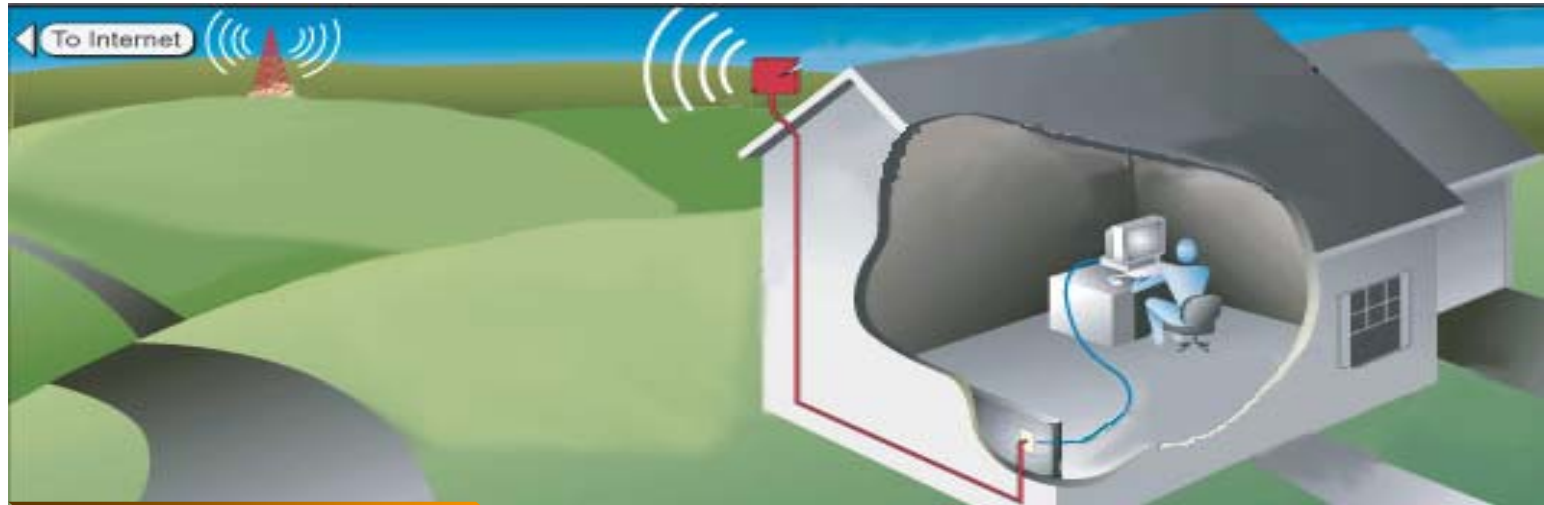
FDD, H-FDD, TDD



*The flexibility of WiMAX technology along with recent advances in end-user devices have made reaching the consumer even easier*

# Looking back: WiMAX advancements

*Pre-WiMAX deployments were “wireless to the rooftop” and required a truck roll for every customer*



**2005**

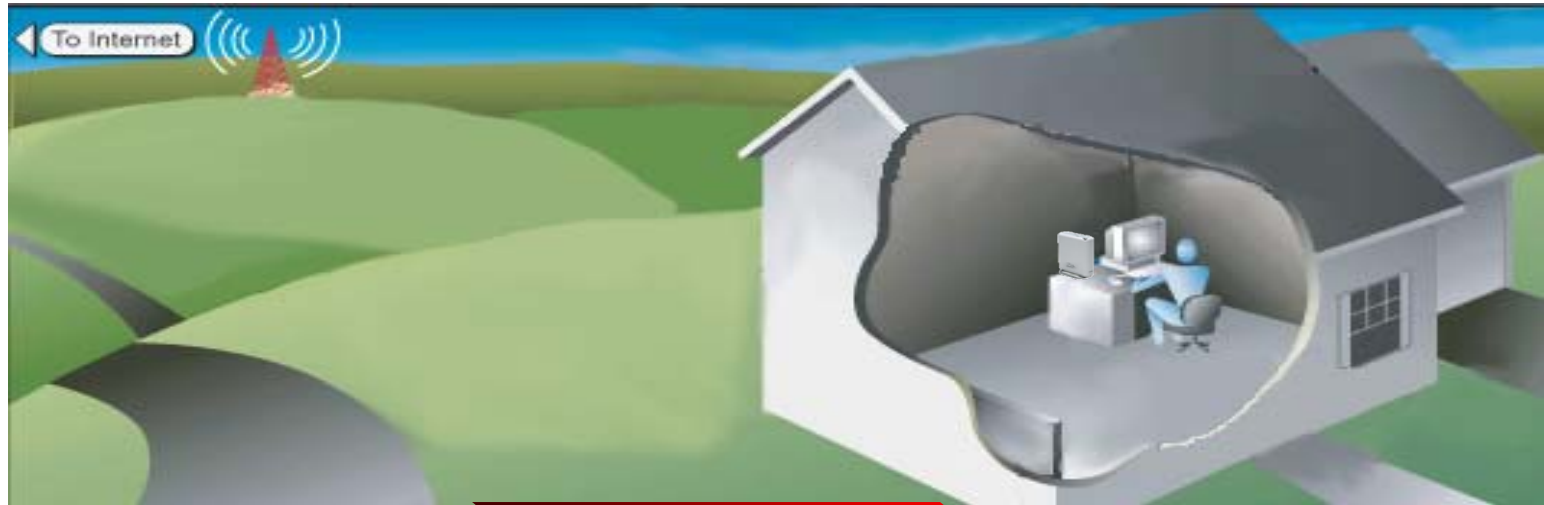
**\$650 - Average customer installation**

## **2005 Trials**

- Unlicensed spectrum
- Pre-WiMAX CPE and base stations
- High CAPEX and OPEX costs

## 2007: Moving towards portability

*In 2007, a new “ecosystem of advantages” was created with the availability of WiMAX CPE*



**2007**

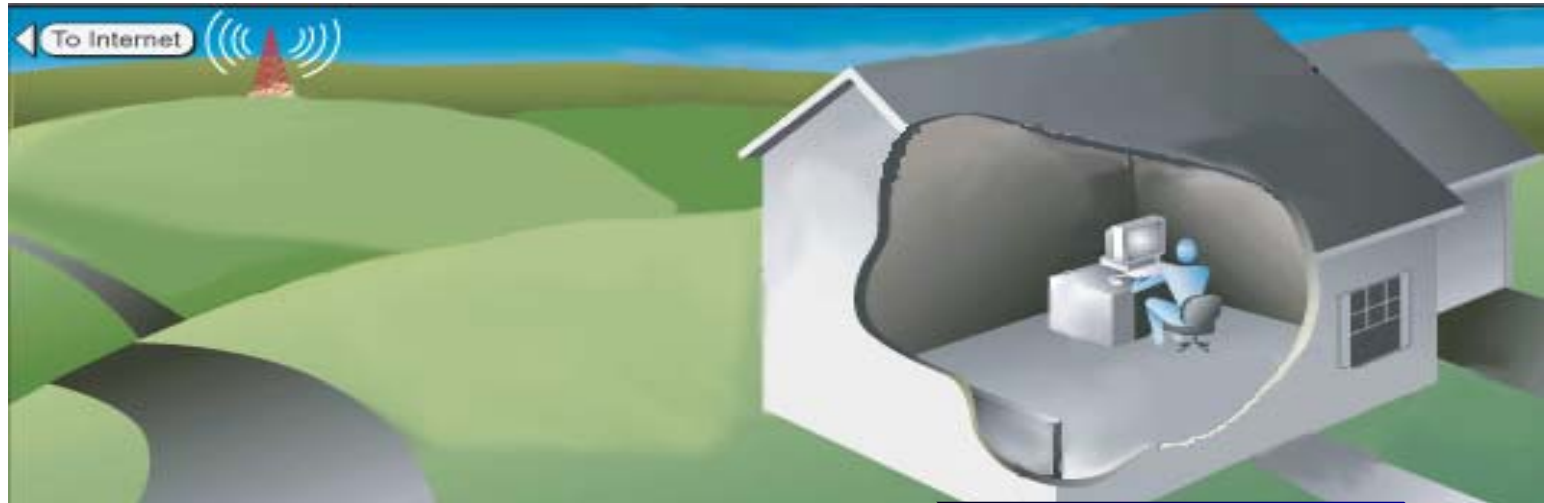
**\$260 customer installation (indoor CPE)**

### **Key Differentiators:**

- 2-3 mile NLOS (5-7 mile LOS)
- Up to 70%+ self install
- Standardized CPE
- VoIP capable

## 2009: WiMAX inside

*Now, mobile WiMAX has arrived with chips embedded in laptops, desktops and handhelds, creating a “Centrino™-like” adoption curve*



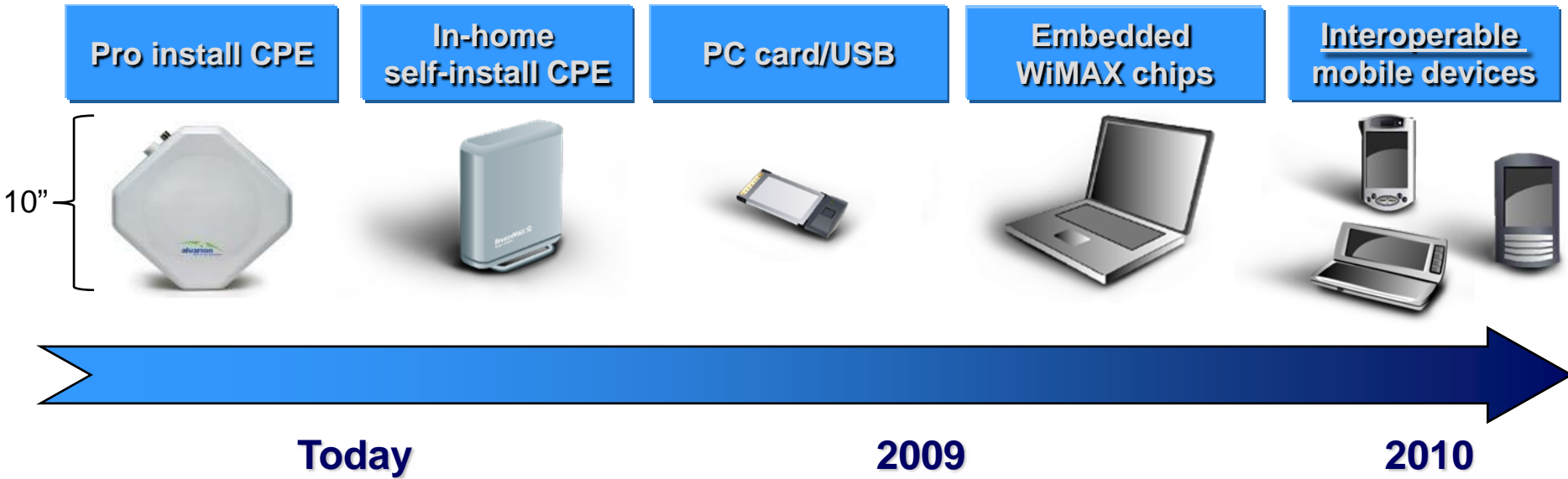
### **Future Potential:**

- Laptops shipped with WiMAX embedded
- Nomadic roaming capable
- Portable broadband “pocket modem”
- Service convergence

**2009**

**“WiMAX Inside”**

# "WiMAX is here, now." -Intel Corporation\*



**WiMAX emerging mobility is changing broadband like the cellular networks changed voice communication...**

*\*March 2008 Investor Meeting*

....only to an exponentially greater degree.

Whereas cellular networks enabled use of the cell phone, WiMAX enables an explosion of consumer devices

**Consumer Electronics**

**Embedded Port. Devices**

**Handsets**

**Embedded PC Devices**

**Ext. Attached PC Cards**

**Modems**



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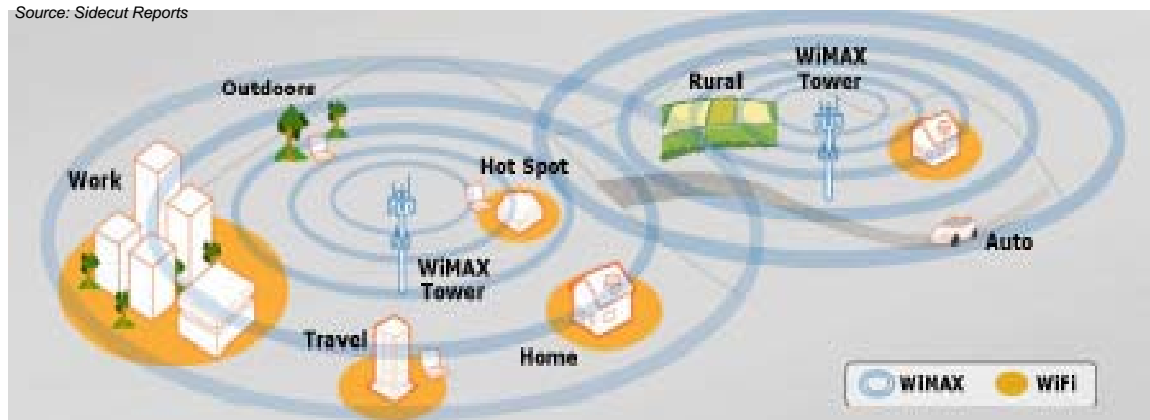
*WiMAX service providers benefit from the technology's high speeds, licensed spectrum, and efficiencies*

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- Carrier-grade quality of service
- Broad coverage areas (90+ sq. miles per base station)
- Low predictable latency with low interference issues
- Capital-efficient (<10% of cable/telco network cost per HH)
- Leverages licensed spectrum and all-IP network infrastructure
- High bandwidth services: T1/DS1, VOD, streaming

# Covering an entire community

*Using radio network planning, providers design and deploy a low-capital cost, flexible network that can cover an entire town or community – without having to lay cable to each end user*



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# WiMAX overshadows other options

*WiMAX has clear advantages over WiFi, 3G and 4G cellular, Cable, and DSL*

Consumer value proposition	4G WiMAX	Wi-Fi hotspots	3G cellular	4G cellular	Cable wireline	DSL wireline
True broadband Internet experience similar to PC at home or office (i.e., at least 2Mbps <i>per user connection</i> )...	2-4Mbps per user connection ✓	Varies—shared connection	600kbps-1.4Mbps per user connection	2+Mbps per user connection	2-5Mbps shared	1-3Mbps per line
..wherever, whenever they want it...	Home or on-the-go connection to you and your life ✓	Limited reach (300 feet)	Home or on-the-go	Home or on-the-go	Home only	Home only
...on whatever device they choose...	Any IP device with a WiMAX chip ✓	Any device with a Wi-Fi chip	Cell phone/PC card	?	PC	PC
...that is reliable...	Flat, all-IP, and over licensed spectrum ✓	Unlicensed = interference	Voice-centric, non-IP network	Voice-centric until networks are upgraded	Shared connection	Distance and plant limitations
...simple to install and use...	Self-install ✓	Self-install	Self-install	?	Technician install	Some self-install, but provisioning required
...affordable...	\$30-\$40 per month per user connection ✓	\$10 per day per user connection	\$50-\$70 per month per user connection	?	\$40-\$60 per month	\$25-\$40 per month
...and available now!	NOW ✓	NOW	NOW	4+ years away	NOW	NOW

*WiMAX and LTE are similar technologies that both threatened traditional, wired broadband services – the biggest difference is that WiMAX is a reality*

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- WiMAX has a 2-3 year head start on LTE
  - 5-10 years in rural areas
- WiMAX and LTE will provide similar speeds
- WiMAX is based on a IEEE standard (802.16)
  - Open standard
  - Less expensive equipment
  - Lower network costs – translates to better efficiency

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# WiMAX is a different way to get online

*WiMAX offers a differentiated value proposition, especially in underserved communities*



## From the Tower

**It's Secure.** Licensed spectrum built on the 802.16 d/e standards

## To the Town

**It's Fast.** High power signal brings high speed

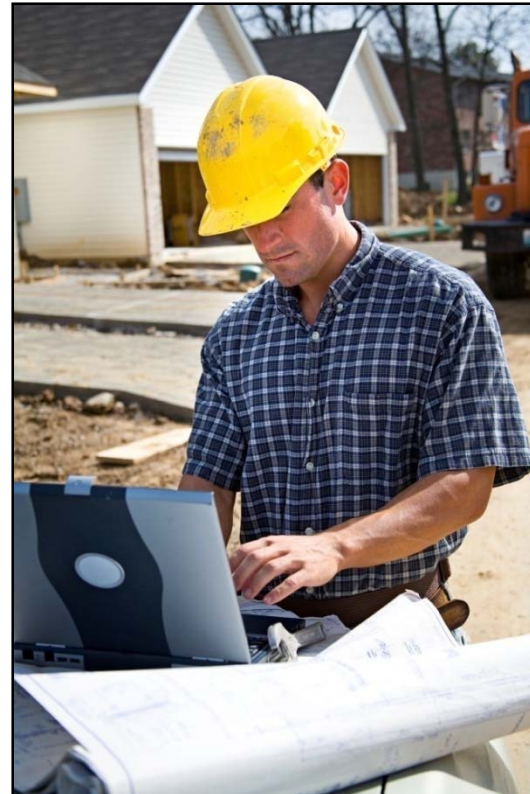
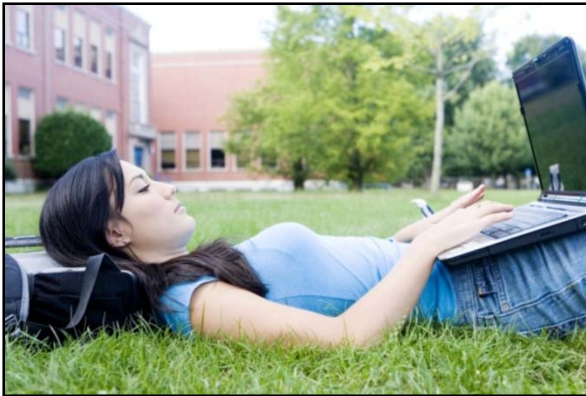
## To You

**It's Easy.** Simplest technology – online in seconds

**And...it goes anywhere.**

## Internet on the go

*Quality, affordable Internet service: WiMAX is Internet that you can take with you*



At school...

At home...

Or at  
work...where  
ever that may  
be.

# The WiMAX consumer advantage

- **Instant availability:** set up today
- **Tremendous value:** for little more than dial-up, get true high speed
- **Competes effectively with DSL, cable, WiFi, dial-up, and satellite:**
  - DSL service degrades the further you are from the telephone central office
  - Cable is limited to specific areas of town and takes time to hook-up
  - Unlicensed WiFi can't match WiMAX speed, reliability, and security
  - Dial-up can't come near WiMAX speed
- **Take it with you:** Mobility is the next step in Internet service
- **New Services:**
  - Mobility complement to landline services (home and away)
  - T1/DS1 replacement vs. RBOC
  - Meter reading, home security, and other services



- Overall very rapid adoption, with strong penetration in all markets
- Excellent community support
- Early adopter profile is diverse
  - Migration from dial-up
  - Students
  - Professionals
  - Mobile workforce
  - Additional market segments for your business!
- Additional VOIP and mobility services coming quickly



BRIDGEMAXX self-install modem  
(about the size of a book)



BRIDGEMAXX pro-install modem

## Conclusion: Why WiMAX succeeds

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- **Capital Efficiency** – Network cost per household served is \$40-\$60 per HH versus DSL/cable at \$800-\$1200
- **Demand-driven deployment** – Networks built where there is pre-identified demand and density versus along rights-of-way
- **All-IP, scalable infrastructure** – Open ecosystem permits profitable additions to ARPU
- **Penetration Rates** – Some markets approaching 20% penetration in less 6 months
- **Competitive differentiation** – Service differentiates on portability and simplicity of install/activation
- **Redefinition of the customer experience** – “Broadband-in-a-box” allows customers to control the installation and activation experience, particularly important for visitors (roaming and non-roaming)

# Questions?

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- Thank you to DigitalBridge for this comprehensive overview of WiMAX!
- Join NRTC on April 29 at 11 am EDT for an overview of Broadband Stimulus plans and WiMAX/Satellite opportunities for your service area!