

WiMax

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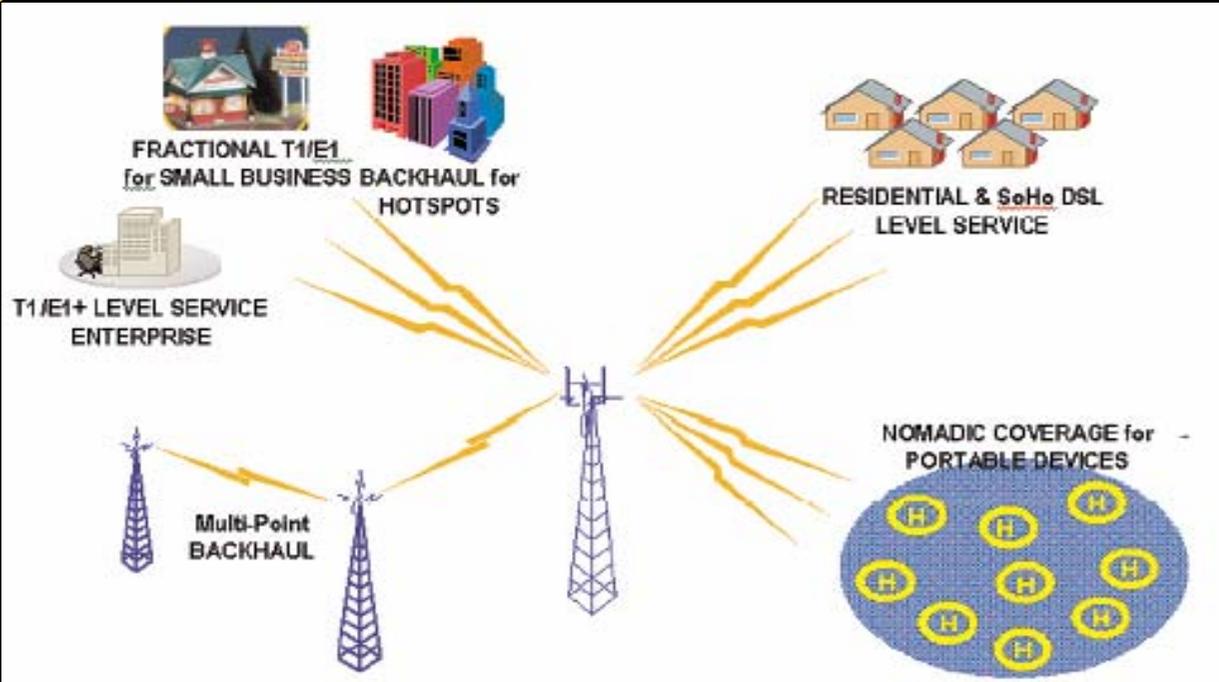
South Dakota Public Utilities Commission
Technology on the Horizon
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WiMAX – The Current Vision

- WiMax is a selection by the WiMax Forum of a subset of the 802.16 Wireless Metropolitan Area Networking Standards together with specifications of interoperability tests and a certification program intended to yield WiMax Certified Product for wireless broadband access for three markets:
 - Fixed Access (2005) last mile access (focused primarily outside not US/Western Europe except as a DSL fill-in)
 - Portable (2006) Metrozone networks with portable and fixed access: end user devices just like WiFi
 - Mobile (2007) vehicular handover, speed, full mobility

FOR PURPOSES OF THIS TALK WIMAX MEANS A WIMAX CERTIFIED PRODUCT INTEROPERABLE WITH OTHER WIMAX PRODUCT. THERE ARE WORKING “PRE-WIMAX” PRODUCTS THAT COULD BE DEPLOYED TODAY.

The 802.16x standard known also as WiMAX provides a vision for wireless broadband backhaul, as well as fixed and mobile access



Access

Broadband access with a range of up to 50km with LOS*, <10km NLOS* and maximum of 134 Mbps per channel**. 802.16-2004 is wireless alternative to e.g. cable, fiber and DSL for the last mile access for residential, SOHO customers as well as enterprises. 802.16e is a mobile version of the WiMAX wireless broadband standard (**Caveat emptor: reality likely to be far less in distance and speed**)

Backhaul

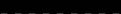
WiMAX can also provide wireless backhaul for e.g. WLAN (802.11x/ Wi-Fi) access points (hotspots)

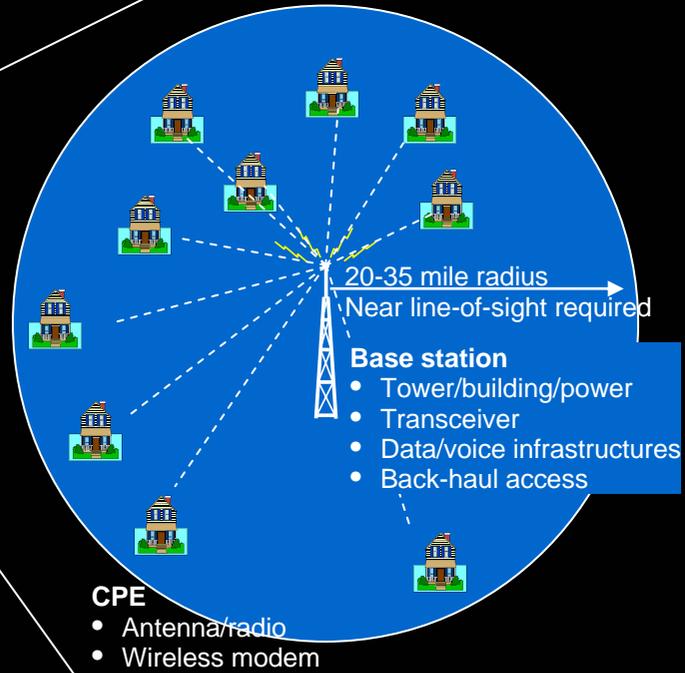
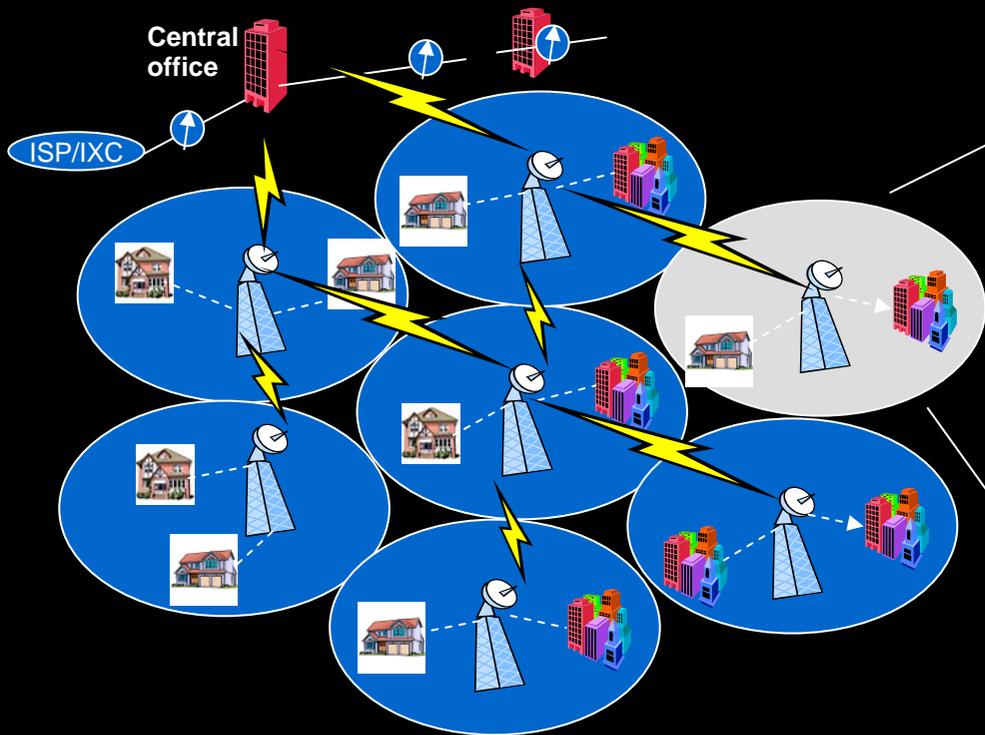
* LOS = Line Of Sight, NLOS = No Line Of Sight

** Dependent on sub specification e.g. 802.16, 802.16a, 801.16e (further details in appendix), as well as current conditions and vicinity of base- station and LOS/NLOS

Source: WiMax Forum, Nordic Wireless Watch

WiMAX - NETWORK ARCHITECTURE

-  Fiber
-  Point-to-point wireless (e.g., /802.16)
-  Point-to-multipoint wireless (e.g., 802.16a)



Node = Smaller cell
(as small as 0.2 miles)

WiMax TECHNICAL DATA

Best-case, claimed performance characteristics – best case for one parameter may exclude best case for other parameters

WiMax (a subset of IEEE80216 - 2004)				
Title	Line of Sight	NLOS/Nomadic	Fully Mobile	Service Features
Vehicular mobility	Fixed	Portable	20 to 100+ km/h	<ul style="list-style-type: none"> • Cellular topology • Support for multiple services with QoS (IPv4, IPv6, ATM, Ethernet, etc.) • Bandwidth on demand • Support for multiple frequency allocations • Point-to-multipoint topology, with mesh extensions • Support for adaptive antennas and space time coding
Spectrum	10-66 GHz	2-11GHz, lic. and unlicensed	2-6 GHz licensed bands	
Channelization	20, 25 and 28 MHz	1.25-20MHz	1.25-20 Mhz ability to subchannelize in the UL	
Mobility features	None	Portable	Local/regional mobility, handover and roaming support	
Spectral efficiency	2 bps/Hz	2 bps/Hz	2 bps/Hz	
Peak data rate DL*	32-134 Mbps	70 Mbps at 20 MHz	70 Mbps at 14 MHz claimed	
Line of sight	LOS required	LOS not required, but will impact performance	-	
Range	<50km, but typically 2-5km	<50km, but typically .5 – 10 Kmb	.5-5 km	

* Actual date rate will be far less that peak, data rate decreases as range increas

Source: Wimax, Ovum, McKinsey team analysis

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WiMAX is a forum promoting and supporting the 802.16 standard, in a similar way as Wi-Fi-forum promotes 802.11x



Purpose

The purpose of WiMAX is to promote deployment of broadband wireless access networks by using a global standard and certifying interoperability of products and technologies

Principles

WiMAX comprises of industry leaders who are committed to the open interoperability of all products used for broadband wireless access

- Support IEEE 802.16 standard
- Propose and promote access profiles for the IEEE 802.16 standard
- Certify interoperability levels both in network and the cell
- Achieve global acceptance
- Promote use of broadband wireless access overall

Note: WiMAX is trying to serve the same purpose for 802.16 as WiFi forum has done for 802.11b, making it a success

Source: WiMAX

Several significant industry players are members of WiMAX. Caveat: Forum success may not imply commercial success.

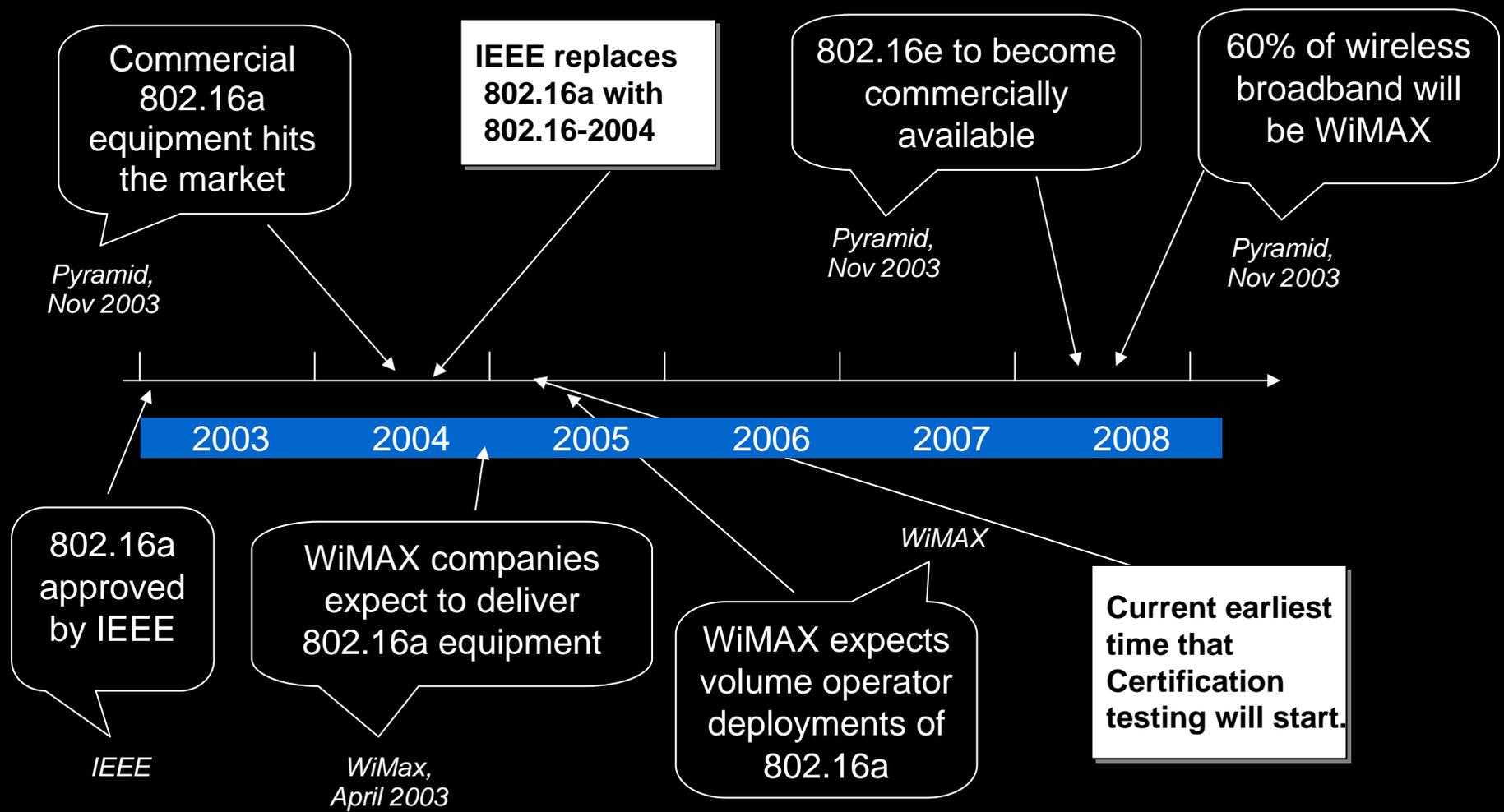
WiMAX Members (Mar 2004)

- Advantech
- Airspan
- Alvarion
- Analog Devices
- Andrew Corporation
- Aperto Networks
- Arris
- AT&T
- Atheros
- Axxcelera BW
- Bandai Wirless
- Beamreach networks
- China Motion Telecom
- Compliance Certification Services
- Comtech AHA
- Covad
- CTS Communications Components
- Cushcraft Corporation
- Daintree Networks
- Distributel
- Elcotez
- Engim
- Ensemble Communications
- Filtronic
- First Avenue Networks
- Fujitsu Microelectronics America, Inc.
- Inphi Corporation
- Gradiente Eletronica S.A.
- Inphi
- Intel
- Intracom
- K&L microwave
- Karlnet
- L3 Primewave
- LCC
- Micom labs
- MTI
- M-Web
- NEWS IQ
- NextWave telecom
- NextNet Wireless
- Nozema
- OFDM Forum
- Orthogon Systems
- Powerwave Technologies
- Pronto Networks
- Proxim
- PCCW
- PicoShip
- Radwin
- Redline Communications
- Remec
- RF Integration
- RF Magic
- SGS
- Siemens Mobile
- SI Wave
- SI Works
- SR Telecom
- Stratex Networks
- Towerstream
- TurboConcept
- Unwired Australia
- Vcom
- Vyvo
- Wavesat Wireless
- WiLan
- Winova Wireless
- ZTE Corporation



TIMEFRAMES TO LARGE SCALE ADOPTION MAY BE SIGNIFICANT PROJECTED ANALYSTS TIME LINES HAVE ALREADY SLIPPED 1 YEAR.

Comparison with WiFi times frames would imply a slower schedule.



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Source: Pyramid Research, Wimax, Computer world, team analysis.

SIGNIFICANT ADOPTION BARRIERS REMAIN FOR WIMAX

Intellectual Property

- Intel and the WiMax forum are portraying WiMax as the open standard, yet many of the companies contributing to WiMax may have patents over some of the details of the specs. IPR claims may only surface as the technology is deployed (as is currently happening with WiFi). Qualcomm claims to have IPR in WiMax. Arraycomm, Flarion, WiLan and other may make similar claims.

Spectrum

- WiMax is currently being targeted at 2.5 (MMDS) in the Americas, 3.4-3.6 in ROW, and 2.4 and 5.8 for unlicensed.
 - MMDS (2.5) spectrum in the U.S. is encumbered and major "refarming" of the spectrum is needed (FCC proceeding under way). However the cellular industry is likely to delay this process. Building penetration an issue.
 - 3.4-3.6 Ghz severely significantly constrains range (1.6 to 2X equipment needed compared to 2.5). Building penetration very problematical.
 - Power limitations in unlicensed spec means range likely to more limited than 3.4

Timelines

- The original WiMax schedules have slipped. Continued slippage will not only affect credibility but also mean that more and potential markets (e.g. Internet access to homes, nomadic PC users) will be captured. Many experts believe fully mobile WiMax (802.16) may be 5 years out.

SIGNIFICANT ADOPTION BARRIERS REMAIN FOR WIMAX (con.)

Technical Credibility

- Early testing by service providers and paper analysis indicates link/sector capacity in "real world" may be well under promises by a factor of 3 to 10 with NLOS with good speed and building penetration at << 1 km at 3.5 Ghz, driving the needs for many cell sites and high backhaul costs.
- WiMax was originally conceived as a point-to-point technology. There are many cellular systems problems such as noise interference from non-synchronzied neighboring systems that effect the economics. Many technical experts are claiming WiMax with full mobility may well be 5 years away.

Standards Process

- Compromises may limit performance – standards driven technologies usually provide less performance than a proprietary solution given the compromises necessary to accommodate all the participants.
- Likelihood of delay – The WiMax Forum selects particular instantiations of the 802.16 IEEE standards. While Intel may have the clout to force decisions in the WiMax Forum, they do not have the same ability in IEEE which has to abide by the IEEE processes. Since all of the 802.16 standards have not been set and in particular the 802.16(e) standards for mobility, there is substantive opportunity for delay by companies who may be disadvantaged by particular directions.

Coverage

- Early test show hype far out in front of reality. 3-5 X difference between extreme claims and reality. Factor of 2-3.5 between LOS and NLOS. Realistic NLOS 3.5 Ghz outdoor performance today may be only 1 Km and for indoor less than .5 Kilometer. Much work to be done.

WIMAX FORUM DRIVEN BY INTEL IS AGGRESSIVELY WORKING TO MAKE WIMAX THE WIDE AREA NETWORKING COMPLEMENT TO WIFI



Will WiMax be the Wide Area equivalent of WiFi or a niche technology in a crowded market??????

*For technologies that make it in the market,
engineers are always overly optimistic on
how successful they will be w/in 2 years
and
always underestimate the impact of their
technologies over a decade!!!*

Thanks !