TRANZEO®
WIRELESS TECHNOLOGIES INC.

Fixed vs Mobile WiMAX

An Apples to Oranges Comparison of Two Wireless Broadband Technologies

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Overview

It is unfortunate that 802.16d fixed WiMAX and 802.16e mobile WiMAX share the same last name. There is virtually no relevant relationship between the two technologies. They are the broadband equivalent of apples and oranges.

802.16d was developed for the sole purpose of linking the "last mile" to the home or enterprise that has long been the gap between broadband Internet "haves" and "have nots". There is no viable competitive technology to fixed WiMAX for providing last mile connectivity other than some proprietary solutions like Motorola's Canopy and variations on WiFi on steroids. 802.16e was developed to compete with existing cellular solutions and to expand mobile voice services by adding high-speed mobile data services. Where the cellular industry started with voice and is adding data service, 802.16e started with data and is attempting to add voice.

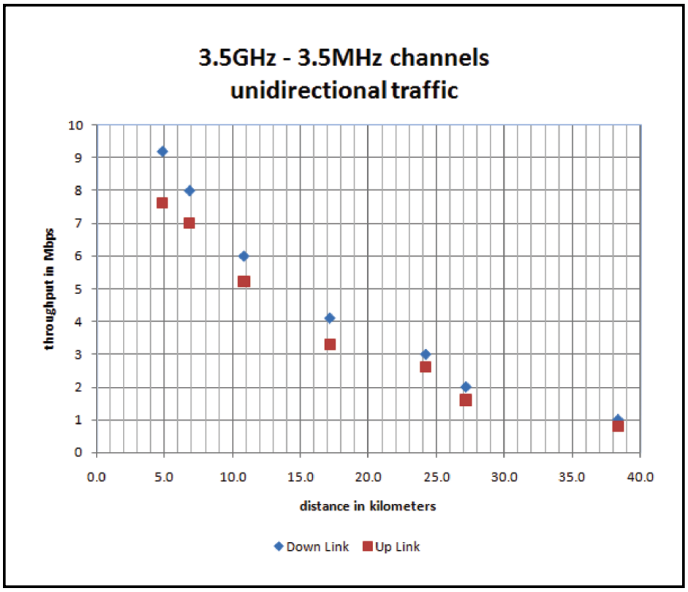
This paper distinguishes the two non-competitive technologies to help service providers decide which technology path to embrace.

Basic System Requirements and Expected Range

802.16d was developed specifically for fixed wireless applications. Because it does not attempt to support mobility, the terminal devices—or Customer Premise Equipment—are not constrained by battery operation or small form factor for handheld operation. This frees up both ends of the link to allow for some symmetry in performance between the CPE and the base station. Typically both the CPE and the base station can support high output power through the radio and antenna combined. The end result is excellent throughput over long distances. It is reasonable to expect a 16d radio operating at 3.5GHz to support broadband services from five to 40 Km (see graph 1).

802.16e was developed specifically for mobility. Therefore the terminal device is constrained by battery life and a small form factor to enable handheld devices. As a result, both ends of the link are not symmetrical. The terminal device requires a great deal of additional signal processing to overcome the limited power and antenna gain of the small form factor device. This processing power is usually leveraged off the terminal device's main processor whether it be a cell phone or a laptop.

The base station also has added complexity. It must have additional signal processing to overcome the limitations of the terminal device and it must support the fast handoff requirements expected of a mobile device. The end result of this asymmetrical connection and the requirement for mobility limits the expected range of a terminal device to the base station to two to three Km.



Graph 1: Example throughput versus distance for a 3.5GHz 802.16d solution

Cost Comparison

An expectation has been set that 16e terminal devices will be less expensive than 16d terminal devices. When comparing similar networks, this is not true. The processing requirements of the 16e terminal are much greater than the 16d device. The "truth" behind the claim that 16e terminal devices can be lower cost than a 16d solution comes from the following assumptions:

1) The volume of 16e devices will be much greater than 16d devices because 16e is going after the much larger mobile market compared to the fixed wireless market. Eventually this may become true but it is not true today. There are very few 16e terminal devices commercially available.
2) The actual 16e terminal component is aided by the host processor of the handset or the laptop. This is true; however the host, either the handheld device or the laptop must be considered as part of the terminal cost.
3) 16e equipment vendors are subsidizing the actual cost of the device to gain market share.
4) Taking into account the range of 16d (five to 40 Km) and 16e (two to three Km) and the price points of the base station, 16d is far more cost effective for fixed wireless applications. By calculating the cost to cover a square Km, a 16e base station can be 12 to 2900 times more expensive than a 16d base station (see table 1).

Area covered by single sector base station with 90 degree antenna

WiMAX Solution		Range (Km)	Area (sq-Km)	Cost ($)	Cost/Area ($/sq-Km)	16e/16d
16d	pico BS	5	20	$1,850	$94	45
	pico BS	40	1257	$1,850	$1	2883
	Macro BS	5	20	$7,000	$357	12
	Macro BS	40	1257	$7,000	$6	762
16e	Macro BS	3	7	$30,000	$4,244	

$1,850 *Tranzeo TR-WMX-35-pBS
$7,000 *Aperto public pricing
$30,000 *Estimated Huawei 16e BS

Table 1: For fixed wireless, the truth is that 16d is by far the lower cost solution for fixed wireless.

Markets

For service providers who are looking for a competitive alternative to T1/E1/DSL, cable, satellite or fiber, 802.16d is a superior choice over 802.16e. There are numerous markets that have exactly these requirements. Business enterprises and campuses in regions that are underserved by traditional telecommunications providers; industrial complexes requiring broadband connectivity across a large geographic region; rural regions of any country that are underserved by traditional telecommunications providers, including many areas of the United States; and developing countries around the world are prime examples of markets that require a fixed broadband communications solution.

Some countries and service providers are building wireless infrastructure in areas that urgently need fixed broadband service and have been convinced 16e provides an economical way to provide these services while paving a roadmap for future mobile services. This roadmap will certainly lead to a higher cost solution for fixed wireless subscribers. Additionally, it will delay the build out of infrastructure to provide basic broadband due to the higher density of base stations required and the present immaturity of the 16e technology and availability of commercial products.

Granted, there are markets that justify a business case for a single wireless solution serving both mobile and fixed wireless customers and in these cases 16e is a viable solution over 16d. In these markets, the question is not 16d versus 16e, but rather 16e versus LTE (Long Term Evolution). It is beyond the scope of this discussion to delve into the merits of 16e and LTE. However, with the continued delay of 16e consumer devices and services, LTE has the opportunity to catch up to 16e and surpass it in market adoption. Many large corporations are taking sides on this debate with the outcome to be determined over the next several years.