Testing WiMAX performance in the Clear network in Portland

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On the day of the Clear launch in Portland, I had the opportunity to test the network with a laptop. My tests were clearly not systematic or very detailed, but I decided to share the results as they may be of interest to those who have not yet been able to test commercial WiMAX networks.

The performance of the Clear network was consistently good, with throughput typically over 3 mbps in the downlink and between 350 and 400 kbps in the uplink. Internet browsing was fast, so I decided to spend most time checking video applications (YouTube, New York Times, and even a full screen movie from Hulu) and video-conferencing with Skype. All worked reliably well in areas with good coverage. The major limitation of the network were a few areas without sufficient coverage—which I visited twice during the day—, but this is to be expected in a new network still being optimized.

The connection manager was very simple to configure and use (Figure 1). On the downside, it did not provide detailed information on network availability, so when the laptop could not establish a connection, no explanation was given as to what the cause was. However, the connection manager was sufficiently straightforward to use and within seconds of switching the laptop on, I was connected. This is probably the most important feature to subscribers. Establishing or re-establishing the connection was fast, and the connection manager client has an option to allow the laptop to automatically connect to Clear when coverage is available.

As the stationary throughput was quite good and consistent where I checked it, I decided to test in more detail the performance of the network in indoor locations and in a mobility scenario—environments where all wireless networks face a challenge. The results of the tests are available on Google maps (see links at the end).

Figure 1. Laptop client, detail information panel

Indoor locations

For the indoor locations, I picked a garage building (Figure 2, Figure 3), where I could freely go where I wanted; a big bookstore (Powell's Books, Figure 4); a hotel; a restaurant; and the public library. Clear stated objective is to provide first-wall coverage—you need to be close to the outside perimeter of the building to expect a good connection (this is also the case for 3G networks). This was consistently the case. Furthermore, the throughput was usually good even in deep-indoor locations, even though there was some degradation in performance or in some cases lack of coverage.

At the parking garage, I tested throughput at multiple floors and locations within each floor (Figure 5). As expected, the highest throughput was on the rooftop and near the outside walls. Throughput at deep-indoor locations was tested right behind thick cement walls, at multiple locations.

Figure 2. Indoor location at parking garage

Figure 3. Top floor in parking garage

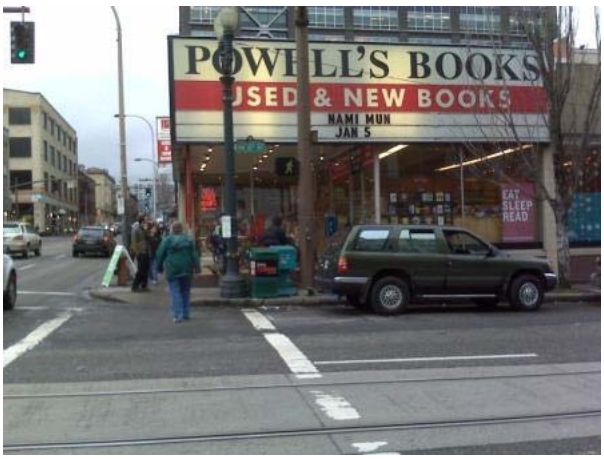

Figure 4. Powell's Books

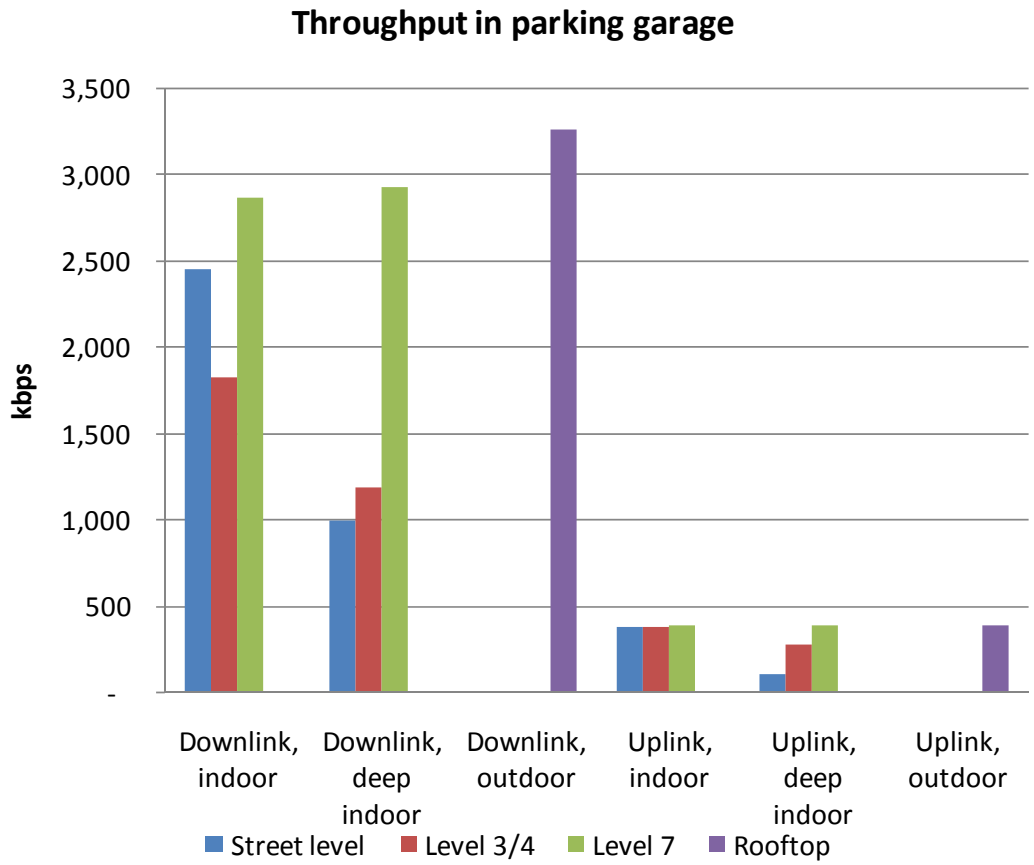

Figure 5. Throughput in parking garage

Indoor coverage at the RiverPlace Hotel and at Powell's Books was very good. I actually tested more locations than reported on the map, but found very similar throughput levels across the buildings. In the public library, I had to find a remote location where I could make a phone call without disturbing library patrons, and that was in an area where cellular voice connectivity was available, but WiMAX coverage was not. It was in the most central part of the building by the elevator. The library Wi-Fi network also had some trouble covering this spot–the downlink speed was only about 600 kbps.

As I got for dinner to Ken's Artisan Pizza, coverage was not sufficient to establish a connection (although the laptop could detect the presence of the Clear network). Too bad, but at least I was able to enjoy one of the best pizzas (Figure 6) in the US without being distracted by work!

Figure 6. Reward at the end of the day

Mobile locations

Most of the tests in a mobile environment were done from the streetcar in downtown Portland (Figure 7) and from buses. Portland is blessed with one of the best public transportation systems in the US, so the plan worked out pretty well.

Figure 7. Portland streetcar

Testing from the streetcar allowed me to check coverage along a well-defined path. The throughput in the streetcar or buses was somewhat lower than that at the same location outdoors. This is to be expected as the train car reduces the strength of the signal. As a result, the tests within the streetcar should not be taken to represent the network performance in a stationary, outdoor environment. Tests in the streetcar, buses as well as indoor locations are relevant however because most users will access the networks from indoor or mobile locations rather than from outdoor locations, especially with laptops.

The median throughput in the downlink was 3031 kbps, in the uplink 382 kbps. The maximum throughput recorded was 5034 kbps in the downlink and 425 kbps in the uplink. In the area between NW 18th Ave and NW 23rd Ave, the coverage was not sufficiently strong to keep the connection. Throughout the rest of the streetcar route, however, the coverage was reliable and handoffs worked well—the connection was maintained throughout the route.

Putting things in perspective

How does the Clear service compare to alternative wireless data services available in the US? Table 1shows what operators advertise on their websites, but there is considerable variability in performance, depending on location and, increasingly, on traffic on the network.

	Downlink	Uplink
Clear	Up to 6 mbps	Up to 1 mbps
Verizon/EV-DO	0.6-1.4 mbps	0.5-0.8 mbps
AT&T/HSPA	0.7-1.7 mbps	0.5-1.2 mbps
Sprint/EV-DO	0.6-1.4 mbps	0.35-0.5 mbps
T-Mobile/HSPA	0.6 average, 1mbps peak	NA

Table 1. Downlink and uplink data rates for WiMAX and 3G in the US. Source: Operators' websites.

Some 3G networks have started to experience congestion at some locations. As the wireless link is shared among all the subscribers connected to same sector in a base station, network performance degrades as the number of subscribers grows. This was not a concern for the Portland network, as it is not yet running at capacity.

While it is difficult to generalize and at each specific location any given network may outperform the others, the performance that I saw on the Clear network was consistently and significantly above what I observed for 3G networks in the US in previous informal tests. The improved performance is in line with the industry expectations and it is enabled by the use of wider

channels and more advanced modulation techniques.

Methodology

Date: January 5th and 6th, 2009.

Laptop used: Lenovo X301, Intel Core Duo CPU U9400 1.4GHz, 4GB Ram.

Speed test: FrontierNet Network Speed Test

Location: Tested locations are shown on the Google map listed in links. When using public transportation, the tests were mostly done while the streetcar or bus was moving and it is therefore difficult to pinpoint the location precisely. I recorded the closest streetcar/bus station was to the tested location, but the tests were done either immediately before (more often) or after the stop. For tests at indoor locations, the Goggle map includes data from multiple locations, as described in the map placemark.

Links

Google map with location tests and throughput: maps.google.com/maps/ms?ie=UTF8&hl=en&msa=0&ll=45.523067,-122.680914&spn=0.004826,0.011984&z=17&msid=106616955607510956463.0004601b735d8621863a3

Marc Walli has published additional data points on Portland's Clear coverage at: http://maps.google.com/maps/ms?ie=UTF8&hl=en&msa=0&msid=111421543144149182907.00045dce7559dccdcc506&z=12

Tri-County Metropolitan Transportation District of Oregon (TriMet): www.trimet.org to see the route followed by the street car

Ken's Artisan Pizza: www.kensartisan.com

FrontierNet Network Speed Test:
http://speedtest.frontiernet.net/
http://elkgrove.speedtest.frontiernet.net/

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