

## WiMAX Testbed at NYU-Poly

- WiMAX testbed allows local and remote researchers to run experiments over NYU-Poly's GENI WiMAX infrastructure.
- First step: understanding the wide-area performance of the network.

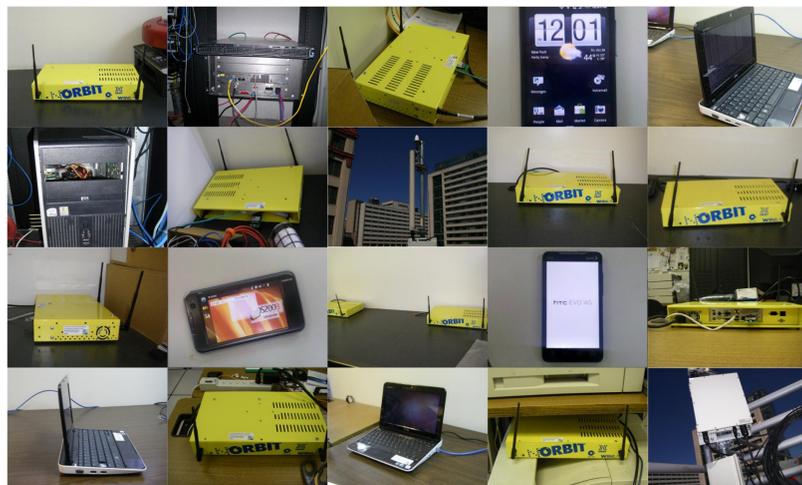


Fig. 1: Wireless Research Testbed at NYU-Poly

## Measuring Wide-Area Throughput

**Problem:** Traditional tools for measuring network throughput are not efficient for taking large quantities of mobile wide-area measurements.

- Typical measurement procedure involves selecting a set of points on a map and taking a measurement at each point.
- Each measurement point takes a long time to collect.

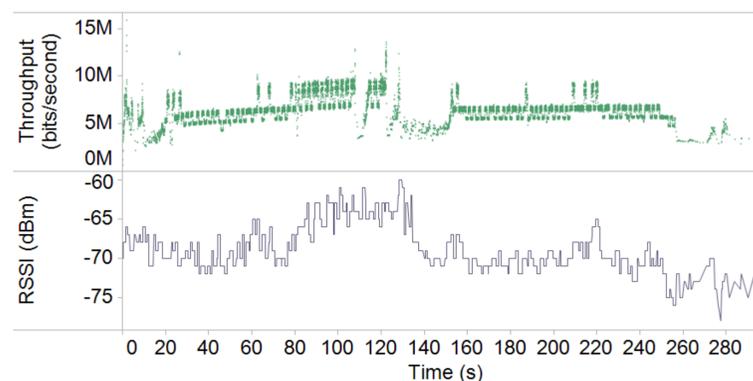


Fig. 2: For an ordinary client-server file transfer (as used by tools such as *iperf*) throughput is not closely correlated with WiMAX signal strength. This kind of communication does not fully utilize network bandwidth, and is not resilient to variations in signal strength, making it unsuitable for this application.

## BitTorrent Measurement Protocol

**Solution:** We developed an OMF/OML application that uses BitTorrent to collect throughput measurements. It records WiMAX signal information, GPS location data, and BitTorrent download and upload rates.

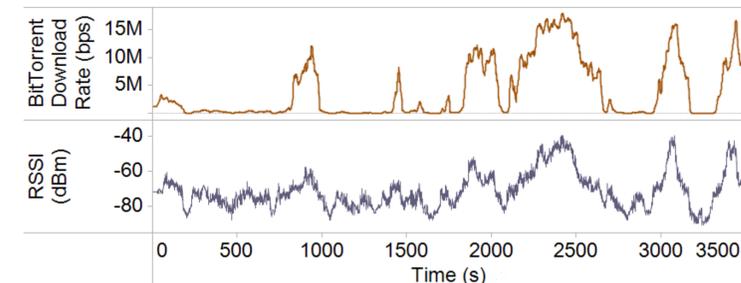


Fig. 3: BitTorrent download rate closely follows WiMAX RSSI as the client moves around the coverage area, and the application adapts quickly to dynamic conditions, making it ideal for this setup.

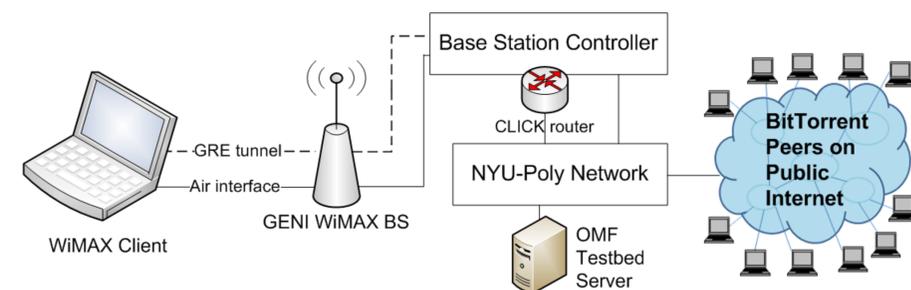


Fig. 4: Configuration for BitTorrent throughput measurement experiment.

## WiMAX Coverage Map

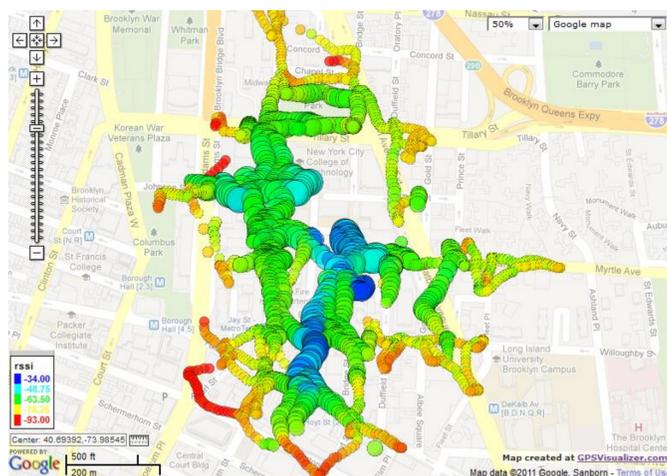


Fig. 5: Wide-area performance of the WiMAX network, with downlink throughput shown by the size of the waypoint and color indicating RSSI in dBm.

## Signal Characteristics in Urban Areas

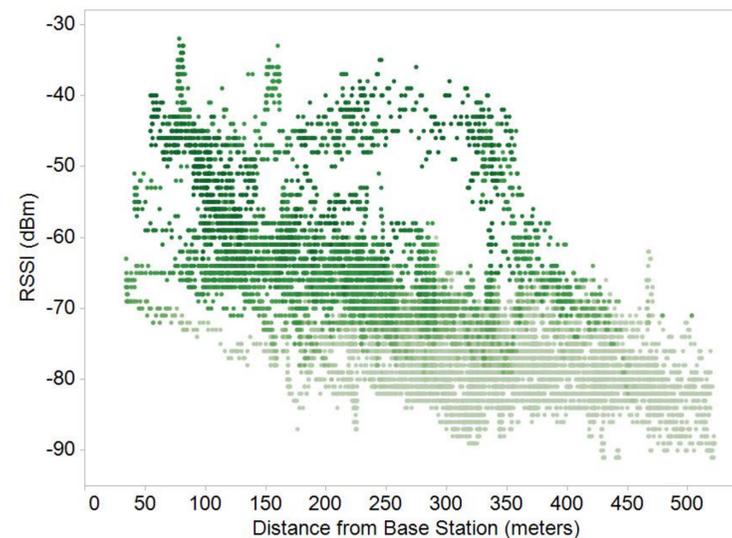


Fig. 6: This experiment showed that in a dense urban area, distance by itself is not a good indicator of WiMAX signal strength or throughput.

## Experiences

- Measurements were efficient to collect (thousands of mobile measurement points in a matter of hours!)
- We gain a better understanding of the characteristics of a WiMAX network in a dense urban environment.
- The measurement points are in a database that is easy to manipulate using standard tools, and can be used as a baseline for further experiments.
- The application may be recycled and the experiment repeated with new network protocols and applications, to measure their effect on network performance.