Making 802.11 (Wi-Fi) viable in mobile outdoor urban environments

802.11's inherent weakness is its dependence on the cyclic prefix and its relationship to delay spreads. RMS delay spreads make outdoor radio frequency environments challenging for current "Plain Vanilla" 802.11 receivers that are used in wireless deployments. When a signal is transmitted, it is subject to harsh multipath, or reflections of energy off things like buildings, cars, trees, etc. all of which results in multiple instances of energy arriving at different points in time, like echos. The cyclic prefix and pilot symbols are techniques used conventionally in OFDM to help with channel estimation, that is to help the receiver adjust itself to receive the data transmission coherently. If the delay spread exceeds .8 microseconds – 802.11's cyclic prefix length – the data transmission is incoherent, thus the innate challenge of using 802.11 outdoors. It is worth noting that the .8 microseconds cyclic prefix is the theoretical tolerance, but published numbers quote only a .1 to .5 microseconds delay spread tolerance for "vanilla" 802.11.

One approach to solving these problems may be a new technique called Iterative PHY Receiver Processing developed by Cohda Wireless. This approach is in the early stages of being commercialized and is being demonstrated today using prototype hardware. When a group of OFDM symbols is transmitted, Iterative PHY Receiver Processing sends the symbols through an iterative loop and is able to correct itself based on the results of the prior iteration. Essentially, it's able to improve the accuracy of the transmission as it's being received. The great thing about this technique is that it's impervious to the twin evils of long delay spreads and mobility.

The obvious benefit of this technique is the lack of dependence on conventional OFDM techniques to perform channel estimation in harsh radio environments. By collecting all of the energy pertaining to each OFDM symbol irrespective of radio channel dispersion, the radio accounts for interference that may arise within and between OFDM symbols and is able to track variations in the radio frequency environment as they occur throughout the duration of the packet. As for mobility, it is able to maintain links while at speeds in excess of 200 mph in Non-LOS conditions. Most importantly however, this technology has a low implementation complexity and is interoperable with 802.11 and 802.16e. The good news for consumers, first responders, and Muni Wi-Fi network deployment companies is that we can expect to see this technology commercialized within the next several months. This holds the promise of reducing 802.11 radio device density by potentially two-thirds and could drastically lower the TCO and overhead for municipalities that deploy city-wide wireless networks. With so many future applications and possibilities for Muni Wi-Fi, it's crucial that we do whatever we can to make this standard as viable as possible.