Beam tracking mechanism for 60 GHz Wireless LAN

Recently, 60 GHz wireless networks have drawn much attention due to availability of huge bandwidth around 60 GHz frequency band which has ability to support very high data rate (i.e., upto 6.7 Gbps). This is also called millimetre wave (mmWave) networking which paves the way for realization of Giga bit WLAN. Supported application could be uncompressed video streaming, sync-n-go file transfer, video games and projection to wireless displays. However, heavy attenuation at 60 GHz frequency band limits the range of transmitted signal up to few meters (1 to 3 meters). Also, presence of obstacles, i.e., walls, furniture, human body shadowing completely blocks the 60 GHz electromagnetic wave.

In order to extend the range of 60 GHz signal, Use of directional antennas have been suggested as the most viable solution. Directional antennas use array of antennas to beamform in a particular direction. The difficulty arises when a user is moving. It is a challenging task to track the movement of a user and thus direct the beam in intended direction. The work is both a mixture of theoretical analysis and implementation work. The work can be approached in multiple ways, and we will guide you through as and when required.

Tasks:

1. Analyse the impact of antenna beamwidth (Rx and Tx both) and mobility of user on outage probability.
2. Study of already available tracking mechanisms in indoor environment and decide upon the feasibility of applying them to 60 GHz networks
3. Propose a novel beam-tracking mechanism for 60 GHz network (which could use both PHY and MAC layers).

Prerequisites:

1. Wireless communication, Ad-hoc networks
2. MATLAB
3. Preliminary knowledge of C/C++ (not mandatory but will be beneficial at the simulation and implementation stage).

Introductory readings:

1. Baykas, et al, "IEEE 802.15.3c: the first IEEE wireless standard for data rates over 1 Gb/s," *Communications Magazine, IEEE* , vol.49, no.7, pp.114,121, July 2011.
2. Junyi Wang, et al "Beam codebook based beamforming protocol for multi-Gbps millimeter-wave WPAN systems," *Selected Areas in Communications, IEEE Journal on* , vol.27, no.8, pp.1390,1399, October 2009.
3. Wireless LAN at 60 GHz, IEEE 802.11ad explained, Agilent Tech, http://cp.literature.agilent.com/litweb/pdf/5990-9697EN.pdf
4. Cordeiro, Carlos, et al "IEEE 802.11 ad: Introduction and performance evaluation of the first multi-gbps wi-fi technology. "*Proceedings of the 2010 ACM international workshop on mmWave communications: from circuits to networks*. ACM, 2010.

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