Findings of the thesis titled "**Evaluation of Trends in LTE and Transition to Fifth Generation (5G)",** submitted by Garima Shukla to Department of Electronics & Communication Engineering, Faculty of Engineering & Technology, Jamia Millia Islamia for the award of the Degree of Doctor of Philosophy

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This research undertakes analysis of some of the key requirements, challenges and their solutions that will be encountered in deployment of 5G cellular networks. Mathematical analysis of mmWave links, utilizing Poisson Point Process (PPP) based modelling, and incorporating beamforming is undertaken for a typical case of mmWave based adhoc networks with beam misalignments. Probability of successful transmissions in Non-Line of Sight (NLOS) conditions is calculated and shown that it varies with beamwidth and an optimum beamwidth of 30° for misaligned NLOS transmissions is found for the model. The NLOS transmissions are assessed to be useful for sustained transmissions in the beamformed mmWave domain. The mathematical analysis can be extended to other propagation conditions depending on channel conditions, antenna profiles etc.

The simulations of mmWave based networks using IEEE 802.11 ad protocol for mmWave communication at short distances at 60 GHz has been undertaken in ns3 simulator. Key metrics such as throughput and latency are evaluated for various topographies and presented. Evaluation from lowest level of channel model to the TCP layer itself was undertaken by modifying the ns3 simulator for the purpose. The RTT figures of TCP BBR and TCP CUBIC are a limiting factor towards achieving IMT-2020. In case of TCP Vegas, the throughput is a limiting factor in achieving IMT 2020 specifications. However, TCP BBR, performs better in the overall considerations of both throughput and RTT and is a better choice than TCP Vegas and TCP CUBIC in IEEE 802.11ad networks which will be utilized in heterogeneous networks comprising 5G deployment scenarios. The existing solutions for TCP might need a re-ordering and a re-look, in terms of their relevance, to accommodate the new regime.

The mmWave scenario was evaluated in a typical smart city setting using ns-3. At high vehicular speeds degradation in latency was observed. It is seen that both LOS and NLOS conditions are important for proper deployment of mmWave networks in smart cities.

The framework deployed in the study will be useful for upcoming scenario of IEEE 802.11ay networks promising speeds up to 300 Gbps.

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