Next Generation on Wireless Research and Standardization on 5G and Beyond

Project code: RD/0121-MEITY01-001

Sub-project: Resource Allocation in Millimeter Wave Networks
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Next Generation on Wireless Research and Standardization on 5G and Beyond

• This research project is part of an ongoing research project on the topic wireless research and standardization on 5G and beyond that is being funded by the Ministry of Electronics and Information Technology (MeitY)

• It is being implemented by a consortium of the Indian Institute of Science, Centre of Excellence in Wireless Technology (CEWiT) at IIT Madras and various IITs including IIT Bombay, IIT Kanpur, IIT Delhi, IIT Madras, IIT Kharagpur and IIT Hyderabad

• The project Investigators from IIT Bombay are Prof. Prasanna Chaporkar (PI), Prof. Abhay Karandikar (Co-PI) and Prof. Gaurav Kasbekar (Co-PI)

• The objectives of this project are described on the next few slides
Project Objectives

• 5G and Beyond Research:
  • Conduct research in areas that are part of 5G and beyond and file the research outputs as patents, publications, etc.
  • Also, a simulation tool will be evolved by enhancing the existing simulator built over the years as and when the standards evolve

• Standardization:
  • All relevant research outcomes will be taken to the Indian standards forum TSDSI and the global standard forums such as 3GPP, ITU and IEEE to incorporate it as Standard Essential Patents (SEPs)

• Building 5G and Beyond Solutions:
  • Based on the expertise and IPs available with the participating institutes, appropriate wireless systems and subsystems will be developed for Indian defense and telecom equipment vendors in India

• Implementation in the 5G testbed
  • Participating institutes will implement the relevant algorithms developed through this project in the 5G testbed funded by DoT to evolve it further, which will help in testing the ideas in a practical environment, which will in turn make it useful in product development

• Capacity Building
  • Participating institutes will help in building hundreds of experts in the area of 5G and beyond technologies in various Industries, Research and Development organizations and academic institutions by conducting training programs and workshops and conferences
Resource Allocation in Millimeter Wave Networks

• The focus of the research group led by Prof. Gaurav Kasbekar is on mmWave networks
• Next, we provide more information about the objectives of this sub-project
• Millimeter Wave (mmWave) communications is one of the key technologies being considered for enabling 5G cellular systems
• A large amount of bandwidth in the mmWave bands is unused, and several applications using these bands have been envisioned, e.g., multi-Gbps communication between base stations (BS) and user equipment (UE) in small cells and hotspots, providing wireless backhaul connectivity to small cells and indoor wireless networks, etc.
• However, the propagation characteristics in the wireless medium in the mmWave bands significantly differ from those in sub-6GHz bands
• For example, the propagation loss in mmWave bands is much higher than that in sub-6GHz bands, due to which beamforming needs to be adopted in mmWave bands, resulting in directional communications
Resource Allocation in Millimeter Wave Networks (contd.)

- Also, since diffraction is weaker, mmWave communications are highly prone to blockages due to obstacles, e.g., walls, humans, trees.
- As a result of the above characteristics, several challenges need to be addressed in order to enable effective communication using mmWave bands.
Resource Allocation in Millimeter Wave Networks (contd.)

• Our objective is to address challenges in resource allocation in mmWave networks, which include the following:
  • Design of algorithms for UE-BS association and handovers among different cells
  • Dynamic allocation of resources including bandwidth, beamwidths and beam directions in different cells to UEs
  • Effectively dealing with blockages due to obstacles
  • Enabling robust communication in the presence of rapidly fluctuating link qualities
  • Achieving a high degree of spatial reuse via effective interference management