Call for Papers

Workshop title: Next-Generation Networking: Exploring the Convergence of Metaverse and 6G

Name(s) of workshop organizer(s):

1. Prof. (Dr.) Neeraj Kumar (Nehra), Dean, Digital Content Transformation (DCT), Thapar Institute of Engineering and Technology, Patiala (Punjab), India
2. Dr. Kamal Kumar, Assistant Professor, National Institute of Technology, Uttarakhand, India
3. Dr. Keshav Sood, Lecturer in Cyber Security, Deakin University, Melbourne, Australia
4. Dr. Sachin Sharma, Manager (Systems), State Bank of India, Panchkula, India

A brief biography of the organizer(s):

1. Prof. (Dr.) Neeraj Kumar (Nehra), Dean, Digital Content Transformation (DCT), Thapar Institute of Engineering and Technology, Patiala (Punjab), India

Prof. (Dr.) Neeraj Kumar (Nehra) is a Senior Member of IEEE and holds the position of Dean, Digital Content Transformation (DCT) at Thapar Institute of Engineering and Technology, Patiala, India. He serves as a Professor in the Department of Computer Science and Engineering. With expertise in areas like VANET, CPS, IoT, Cloud computing, and Cryptography, Dr. Neeraj has authored 150+ research papers in esteemed journals and conferences. He is a mentor to numerous Ph.D. and M.E./M.Tech. scholars and actively collaborates with leading institutions worldwide.

2. Dr. Kamal Kumar, Assistant Professor, National Institute of Technology, Uttarakhand, India

Dr. Kamal Kumar is an accomplished academic with a Ph.D. from Thapar University, India, and M. Tech. and B. Tech. degrees from Kurukshetra University. He currently serves as the Assistant Professor and Head of the Department of Computer Science and Engineering at the National Institute of Technology, Uttarakhand. With 22+ years of experience, he has supervised 4 Ph.D. and 31 M. Tech. scholars and published 15 SCI, 7 SCOPUS papers along with 32 conferences contributions. Dr. Kamal has chaired and organized numerous conferences, workshops, and technical sessions, showcasing his expertise in the field.

3. Dr. Keshav Sood, Lecturer in Cyber Security, Deakin University, Melbourne, Australia

Dr. Keshav Sood is a dedicated researcher with a distinguished academic background. He holds a Ph.D. in Information Technology from Deakin University, Melbourne, and has completed his B.Tech. and M.Tech. degrees with honors in Electronic and Communication Engineering and Optical Fiber Engineering, respectively. Currently, he serves as a Lecturer at Deakin University, Melbourne, where he contributes to cutting-edge research in areas such as Software-defined Networks, Internet of Things, Quality of Service, next-generation networking, and Cyber Security. Prior to this, he worked as a Research Fellow at the Advanced Cyber Security Engineering Research Centre (ACSRC) at The University of Newcastle, NSW, Australia, and also gained valuable experience at the Terminal Ballistic Research Laboratory (TBRL) in Chandigarh, India.

4. Dr. Sachin Sharma, Manager (Systems), State Bank of India, Panchkula, India

With over 15 years of extensive industry experience in Fortune 500 organizations such as International Business Machines (IBM), Tata Consultancy Services (TCS), and State Bank of India (SBI), Dr. Sachin Sharma brings a wealth of expertise to the table. His diverse background spans sectors such as Telecommunication Technology, Retail, BFSI, and various IT domains. In 2020, Dr. Sharma earned a Ph.D. from Maharishi Markandeshwar University Mullana, demonstrating his commitment to advancing knowledge. His exceptional research contributions secured the prestigious Research Fellowship in Banking Technology for 2021-22, a collaboration between IIBF and IDRBT. Dr. Sharma's research interests encompass cutting-edge domains like Data Analytics, Information Security, Networking, and Biometrics. Additionally, he holds renowned international certifications, including Project Management Professional (PMP), TOGAF 9 Enterprise Architecture Certificate, and Oracle Certified Professional (OCP) DBA, further enhancing his global industry recognition.

This workshop "NEXT-GENERATION NETWORKING: EXPLORING THE CONVERGENCE OF METAVERSE AND 6G" will aim to cover key drivers, use cases, research requirements, challenges and open issues for 6G from researchers across the globe. Company representatives, academic researchers, decision-makers, and other builders and members of communication society will be invited to contribute. This workshop is seeking conceptual, empirical, and technical papers that would eventually offer novelty to following topics, but is not limited to them:

- New Requirements, KPIs and Opportunities for 6G
- 6G Use Cases and New Device Forms
- PHY Technologies for 6G Wireless Networks
- Massive MIMO and Smart Beam for 6G Wireless
- Tbit/s Communications and Millimeter-Wave/THz Links
- Terahertz Communication Beyond 100 GHz
- Challenges in transport layer for Tbit/s Communication
- Cloud Nativeness for 6G Wireless Networks
- Pervasive AI and Trust for 6G Mobile Communication Networks
- Machine type communications in 6G
- Edge clouds for all user-specific computation and intelligence
- 6G Metrics for Data Privacy and Security
- Open-source platforms – a dream or a must to make the next generation hardware and software solutions happen
- Quantum Computing and 6G Wireless

Scope 1: New Requirements, KPIs and Opportunities for 6G

Only for reviewers of this proposal: Under this we will invite authors to cover Functional, performance and ergonomic requirements and KPIs for next generation systems, novel opportunities for next generation networks, and devices for interaction between people/smartphones/XR devices. With the introduction of XR devices the KPI will gradually evolve from Quality of Service (QoS) to Quality of Experience (QoE).

Scope 2: 6G Use Cases and New Device Forms

Only for reviewers of this proposal: Under this we will invite authors to discuss several potential 6G use cases and attempt to provide estimates on requirements to guide design. In addition to the devices used in 5G, new device forms that might be penetrated into 6G wireless networks will also be discussed.

Scope 3: PHY Technologies for 6G Wireless Networks

Only for reviewers of this proposal: Under this we will invite authors to discuss 6G PHY technologies including channel coding, modulation, detection and decoding with high rates, low latency, high reliability and large bandwidths.

Scope 4: Massive MIMO and Smart Beam for 6G Wireless

Only for reviewers of this proposal: Under this we will invite authors to discuss massive MIMO and smart beam steering with active antenna arrays merged with lens antennas for communications and sensing beyond 10 m at frequencies well above 100 GHz

Scope 5: Tbit/s Communications and Millimeter-Wave/THz Links

Only for reviewers of this proposal: Under this we will invite authors to discuss the potential challenges of decoding Tbit/s communications (speed) design and mm-wave/THz links, systems and transceivers, and the possible solutions including but not limited to physical layer distance-aware design, ultra-massive MIMO communications, reflect arrays, and intelligent surfaces.

Scope 6: Terahertz Communication Beyond 100 GHz

Only for reviewers of this proposal: Under this we will invite authors to discuss the technologies for extended spectrum towards THz/beyond 100 GHz that enables merging communications and new applications, such as 3D imaging and sensing for commercial 6G use

Scope 7: Challenges in transport layer for Tbit/s Communication

Only for reviewers of this proposal: Under this we will invite authors to discuss the challenges in the transport layer for reaching 1Tbit/s. Transmission Control Protocol (TCP) remains the leading transport layer protocol for reliable end-to-end communication. All existing communication systems, including Mobile Network Operators (MNO), have adopted TCP/IP protocol suite for their networking and internetworking purposes. Even though network providers have reduced their infrastructure latencies considerably, they can't provide guarantee of QoS service in the transport layer. The current TCP/IP protocol maintains fairness among the flows and doesn't classify normal flow and prioritized flow. Moreover, it always interprets the packet loss as congestion loss. The current design of TCP is not adapted well to cope with the changes in lower layers, communication paths, and multi-path diversity.

Scope 8: Cloud Nativeness for 6G Wireless Networks

Only for reviewers of this proposal: Under this we will invite authors to discuss the leverage of new computing and software technologies for Virtualization and Cloudification enhancements and improvements to support maximum flexibility of networks at a low cost for both non-critical and critical 6G communications

Scope 9: Pervasive AI and Trust for 6G Mobile Communication Networks

Only for reviewers of this proposal: Under this we will invite authors to discuss how artificial intelligence (AI), machine learning (ML) and block chains would transform the platform-based ecosystems, business models, use cases and services in future 6G systems.

Scope 10: Machine type communications in 6G

Only for reviewers of this proposal: Driven by impetus of providing wireless solutions to vertical industries and involving massive Internet of Things devices in critical infrastructures, machine type communications (also known as machine to machine communications) is foreseen to be of paramount importance in 6G deployment. Under this we will invite authors to discuss the challenges and key enablers for machine-to-machine communications in 6G and the potential solutions for enabling mission critical and massive connectivity aspects in 6G.

Scope 11: Edge clouds for all user-specific computation and intelligence

Only for reviewers of this proposal: Optimisation in wireless networks are required to cater to sub-ms latency and computing intensive applications like URLLC and AR/VR. Next generation wireless networks starting from 5G exploited radio spectrum resources to expand the capacity at radio side but without the optimisation in the backhaul edge network to compliment with radio spectrum improvements, we may not achieve required performance. To improve the energy efficiency in the IoT user devices and to provide faster response at sub-ms ranges, part of computing is offloaded to perform in the edge of networks. Similarly, Edge enabled intelligent AR/VR applications may perform context-sensitive high-intensive computations closer to the user terminal to provide high quality of immersion, sub-ms latency and uniform quality of experience to the users. Apart from the cases here, edge cloud computing supports volumetric data transfer applications, predictive data analysis and machine learning for edge enabled AI/ML applications and many more. Considering all the requirements for the edge network, we will invite authors to cover cloud native edge data networks which optimizes the network bandwidth and takes the challenge of providing the sub-ms rate responses. Furthermore, emphasis will be given on discussing future ready edge network solutions that point out a huge opportunity for supporting a wide array of 6G applications which demand fast, efficient and intelligent edge networks.

Scope 12: 6G Metrics for Data Privacy and Security

Only for reviewers of this proposal: Under this we will invite authors to discuss the potential metrics for data privacy and security in 6G wireless networks. In particular, a spectrum of emerging technologies like blockchain and how they can become the enablers for ensuring 6G privacy and security will be explored. New network architecture for 6G privacy and security will be discussed as well.

Scope 13: Open-source platforms – a dream or a must to make the next generation hardware and software solutions happen

Only for reviewers of this proposal: With evolvement of network operating systems, Software Defined Network, virtualisation and orchestration & automation into the networks, we are moving into an era where many projects in mobile networks (both on radio and core networks) are driven by Open Source which are expected to make the next generation network faster and reliable. Introduction of Open Source in Networks is going to have a radical impact in terms of more innovation and faster growth. It is the development of the Open Source projects and

growing open source community that there is lowering of cost and faster market access to network products and technologies.

Scope 14: Quantum Computing and 6G Wireless

Only for reviewers of this proposal: Quantum Computing deals with the design of circuits that use qubits, quantum gates, operators and entanglement in order to solve a class of problems that would, in a classical setup, have an exponential complexity. Quantum computing algorithms generally involve the ability to try all possible inputs to a problem by creating a special composite input. Provided we know how to process and read the desired result, it leads to a significantly huge speedup sometimes taking an exponentially complex problem to a problem with polynomial or even constant complexity! In the perspective of 6G wireless communications, the application would be in finding optimal paths and resource allocations using quantum search algorithms. This would help in meeting the stringent requirements 6G has on the number of connected devices and ultra-low latency. While practical quantum computers, from a commercial perspective, are still far from reality, the theory and techniques on the other hand are well developed. Recent advances in Google and IBM, for instance, have pushed the boundaries of quantum computing far beyond what was expected, and it is likely to progress at an astounding pace.