

Muhammad Salah ud din, Ph.D.

PERSONAL DATA

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RESEARCH INTERESTS

My research interests span the broader areas of network and distributed systems, Edge computing/Edge AI, IoT, intelligent autonomous vehicular communications, and next-generation communication and networking paradigms (ICN/NDN/SDN). In my work, I conceptualize the network as a large-scale computational fabric and focus on developing efficient and intelligent systems to support distributed edge learning, and in-network computations aiming to optimize network resource utilization and amplify applications' QoS.

PROFILE HIGHLIGHTS

- **Research:** With more than 5.5 years of extensive research experience (4 years as a Ph.D. candidate and 1.5 years as a Research Fellow), I am deeply committed to designing and developing intelligent and reliable distributed networking protocols.
- **Fundings:** During my postdoctoral and Ph.D. research, I actively participated in and co-led the drafting of project proposals, contributing to both national and international initiatives that advanced the research and development goals of the research group.
- **Industry Experience:** I bring a unique combination of expertise in software development, research, and teaching. With over five years of experience in the software industry, I have designed and developed software systems while serving in various roles, including Senior Software Engineer and Software Engineer at leading IT companies. This industry background significantly enhances my research and teaching by enabling me to bridge theoretical knowledge with practical applications. I actively integrate these experiences into my academic work, particularly when advising students in the areas of networks and distributed systems.
- **Publications:** I have several publications in top-tier peer-reviewed journals and conferences, including *IEEE Transactions on Services Computing*, *IEEE Transactions on Network and Service Management*, *IEEE Transactions on Intelligent Transportation Systems*, *IEEE Internet of Things Journal*, *IEEE Sensors*, and *IEEE VTC*, among others.
- **Teaching:** I have actively contributed to teaching at both undergraduate and graduate levels, primarily serving as a co-module leader and Teaching Assistant for several foundational and advanced modules, including *Computer Networks*, *Advanced Topics in Distributed Systems*, and *Wireless Communications*. Notably, I also co-led the *Network Simulations* module, where I contributed to curriculum design, defined final assessments, and shaped learning outcomes.
- **Professional Services:** I have demonstrated both leadership and technical expertise through my roles in various conferences, including serving as a Program Committee member for the 1st International Workshop on Federated Learning for Wireless Edge Artificial Intelligence (FedEdgeAI), TPC Co-Chair for ICGHIT 2024, and Publicity Chair for the IEEE ICC Workshop on Metaverse-based Networking and Computing.
- **Awards & Invited Talks Services:** I have received multiple prestigious awards and have been invited to deliver talks on my areas of expertise at esteemed universities. Further details are provided in relevant sections in the CV.

EDUCATIONAL PROFILE

2019 - 2023	Ph.D. in COMPUTER ENGINEERING, Hongik University , South Korea Advisor: Prof. Dr. Byung Seo Kim Thesis Title: Information-centric communication protocols for efficient data collection and In-network computations Ph.D Dissertation Date: May 30, 2023
2013 - 2016	Master of Science in COMPUTER SCIENCE, COMSATS University Islamabad , Islamabad Campus, Pakistan Thesis Title: Energy efficient data forwarding in underwater wireless sensor networks Advisor: Prof. Dr. Yasir Faheem
2009 - 2013	Bachelor of Engineering in INFORMATION & TECHNOLOGY, University of Engineering and Technology Taxila , Punjab, Pakistan Thesis Title: An android based employee monitoring system and tracking system Advisor: Mr. Muhammad Ahmed Zafar

RESEARCH, TEACHING, AND INDUSTRY EXPERIENCE

- Sep 2024 - Present **Postdoc Research fellow**, EURECOM, France.
Project Title: Distributed Vehicular Knowledge networking
Roles and Responsibilities:
- Engage in developing intelligent distributed knowledge sharing mechanism in vehicular environments.
 - Publishing and Presenting Findings to reputed journals.
 - Supervise Ph.D., and Master's students research projects/theses.
- Sep 2023 - Sep 2024 **Postdoc Research fellow at Broadband Convergence Networks (BCN) Laboratory**, Hongik University, South Korea.
Project Title: Research on Decentralized Microservice-Centric Network (DMCN) frameworks for in-network computations
Roles and Responsibilities:
- Engage in cutting-edge research on distributed microservices centric in-network computations.
 - Publishing and Presenting Findings to reputed journals.
 - Project proposals write-up to secure funding.
 - Supervise and mentor Ph.D., and Master's students research projects/theses.
 - Collaborate with National and International fellow researchers.
- Sep 2019 - Aug 2023 **Ph.D Candidate in Broadband Convergence Network (BCN) Lab**, Hongik University, South Korea.
Roles and Responsibilities:
- Propose and publish novel research articles in high-impact journals and top-tier conferences.
 - Collaborate with team members in BCN Lab and researchers from international labs.
 - Conduct experiments using simulators like ndnSIM, NS3, and OMNET++.
 - Write research proposals at both international and national levels.
 - Develop and maintain intercontinental NDN-based wireless and wired testbeds.
- Oct 2022 - Dec 2022 **Teaching**, Department of Electronics and Computer Engineering, Hongik University, South Korea.
Title of the Unit: Network Simulations
Responsibilities: As a co-module leader I have to
- Deliver lectures.
 - Conduct lab sessions.
 - Design assignments, design final assessments, and grading.
- Feb 2018 - Aug, 2018 **Sr. Software Engineer**, China Mobile (ZONG) Islamabad, Pakistan.
Responsibilities: As a senior Software Engineer specializing in Mobile Apps Development at ZONG, my key responsibilities included:
- Crafting well-structured, efficient, and testable code.
 - Collaborating with team members to establish both functional and non-functional requirements for new software or applications.
 - Offering technical guidance to colleagues.
- Mar 2016 - Jan 2018 **Software Engineer**, FINCON-IT, Islamabad, Pakistan
Responsibilities: At FINCON, as a Software Developer specializing in Healthcare mobile applications, my key duties encompassed:
- Writing well-structured, efficient, and testable code.
 - Overseeing full lifecycle software development.
 - Integrating software components into a fully operational software system.
 - Offering technical guidance to colleagues.
 - Contributing to the development of various software and application products.
- Mar 2013 - Jun 2015 **Software Engineer**, IPLEX, Islamabad, Pakistan
Responsibilities: Worked as a Software Developer, contributing to the design and development of android based entertainment applications.

PUBLICATIONS

Patents:

1. **Muhammad Salah ud din**, Muhammad Atif Ur Rehman, and Byung Seo Kim, “ ZTMC administered distributed Microservices centric in network computing system”, Korean Patent Submission in process.
2. **Muhammad Salah ud din**, Muhammad Atif Ur Rehman, and Byung Seo Kim, “ Communication Method for Microservices-Centric Computing between vehicles in the Information-Centric Vehicle Networks”, Korean Patent Application Number: 10-2024-0028247, Date: 2024-02-27
3. Muhammad Atif Ur Rehman, Sana Fayyaz, **Muhammad Salah ud din**, and Byung Seo Kim, “ Clustered Stationary Vehicles-based Vehicular Networking and Computing System”, Korean Patent Number: 10-2509279, Date: 2023-03-08.

Journal/Conferences (Under Review):

4. **Muhammad Salah ud din**, Muhammad Nadeem Ali, Ghulam Musa Raza, Muhammad Imran, Byung-Seo Kim “ Inter-dependent Microservice Offloading and Semantic-Aware Results Transmission in 6G vehicular Edge Networks ”, IEEE Transactions on Intelligent Transportation System, (Impact Factor: 8.5), **Major revisions**
5. Muhammad Imran, **Muhammad Salah ud din**, Byung-Seo Kim “ RLFS-ICN: Reinforcement Learning driven Forwarding Strategy in Information-Centric Networks”, IEEE Transactions on Network and Service Management, (Impact Factor: 4.7), **Major revisions**

Journal Articles - SCI/SCIE (Published):

6. **Muhammad Salah ud din**, Muhammad Atif Ur Rehman, Byung-Seo Kim “CFEC: An ultra-low latency Microservices Based In-Network Computing Framework for Information-Centric IoVs” in IEEE Transactions on Services Computing, (Impact Factor: 5.5)
7. **Muhammad Salah ud din**, Muhammad Atif Ur Rehman, Muhammad Imran, Byung-Seo Kim “Performance Evaluation of Microservices Centric In-network Computations for Internet of Vehicles” in Elsevier Journal of System Architecture, (Impact Factor: 4.5)
8. **Muhammad Salah ud din**, Muhammad Atif Ur Rehman, Rehmat Ullah; Byung-Seo Kim, “Improving Lifetime of Resource-constrained IoT Devices by Mitigating Redundant Transmissions in Heterogeneous Wireless Multimedia of Things” Digital Communication and Networks, (Impact Factor=7.9)
9. **Muhammad Salah ud din**, Muhammad Atif Ur Rehman, Byung-Seo Kim, “CIDF-WSN: A Collaborative Interest and Data Forwarding Strategy for Named Data Wireless Sensor Networks”, Sensors, (Impact Factor=3.847)
10. **Muhammad Salah ud din**, Muhammad Atif Ur Rehman, Rehmat Ullah and Byung-Seo Kim, “Towards Network Lifetime Enhancement of Resource-Constrained IoT Devices in Heterogeneous Wireless Sensor Networks,” Sensors, vol. 20, no. 15, pp. 1-23, 2020.(Impact Factor=3.847)
11. Muhammad Nadeem Ali, Muhammad Imran, **Muhammad Salah ud din**, Byung-Seo Kim “ Intelligent Forwarding and Computation Node Selection in ICN Mobile Edge Computing”, IEEE Sensors, (Impact Factor: 4.3)
12. Muhammad Atif Ur Rehman, **Muhammad Salah ud din**, Spyridon Mastorakis, Byung-Seo Kim, “FoggyEdge: An Information-Centric Computation Offloading And Management Framework For Edge-Based Vehicular Fog Computing”, IEEE Intelligent Transportation Systems Magazine, (Impact Factor: 5.293)
13. Muhammad Imran, Muhammad Nadeem Ali, **Muhammad Salah ud din**, Muhammad Atif Ur Rehman, Byung-Seo Kim “An Efficient Communication and Computation Resources Sharing in Information-Centric 6G Networks” IEEE Internet of Things, (Impact Factor: 10.0)
14. Sana Fayyaz, Muhammad Atif Ur Rehman, **Muhammad Salah ud din**, Byung-Seo Kim, Ali Kashif Bashir, Md Israfil Biswas, “Information-Centric Mobile Networks: A Survey, Discussion and Future Directions” in IEEE Access, (Impact Factor: 3.476)
15. Ghulam Musa Raza, Ihsan Ullah, **Muhammad Salah ud din**, Byung-Seo Kim “INF-NDN IoT: An Intelligent Naming and Forwarding in Name Data Networking for Internet of Things” in IEEE Access (Impact Factor: 3.4)
16. Muhammad Imran, **Muhammad Salah ud din**, Muhammad Atif Ur Rehman, Byung-Seo Kim, “MIA-NDN: Microservice centric Interest Aggregation in Named Data Networking”, Sensors, (Impact Factor: 3.847)
17. Muhammad Imran, Muhammad Ibrahim, **Muhammad Salah ud din**, Muhammad Atif Ur Rehman, Byung-Seo Kim, “Live virtual machine migration: A survey, research challenges, and future directions” in Computers and Electrical Engineering, (Impact Factor: 4.152)
18. Sana Fayyaz, Muhammad Atif Ur Rehman, **Muhammad Salah ud din**, and Byung-Seo Kim, “Survey on Producer Mobility in Information-Centric Networks” Journal of the Institute of Electronics and Information Engineers, Vol. 58, No. 2, pp.-, Feb. 25, 2021. [ISSN: 2287-5026]

19. **Muhammad Salah ud din**, and Byung-Seo Kim, "Performance Evaluation of SDWNs in Cloud Systems" Inderscience Publishers, Vol. 21, No. 4, pp.-, jan. 2022. [issn = 1466-6642]

Proceedings and Conferences:

20. **Muhammad Salah ud din**, Muhammad Atif Ur Rehman, Muhammad Imran, Byung-Seo Kim, "PVAAS: A Cost-Efficient Computation Offloading Strategy for Information-Centric Vehicular Networks" In proceedings of 10th International Conference on Green and Human Information Technology, Jeju Island, Korea, Jan. 19 - 21, 2022.
21. **Muhammad Salah ud din**, Muhammad Atif Ur Rehman, Muhammad Imran, Byung-Seo Kim, "A.I for Intelligent Information Centric Networking" in IEEE/IEIE ICCE-Asia 2021, November 2021, DEL PINO Resort, Gangwon province, South Korea, November 01 - 03, 2021.
22. Muhammad Atif Ur Rehman, **Muhammad Salah ud din**, Muhammad Imran, Sana Fayyaz, Byung-Seo Kim, " ndnCSIM - A Microservices based Compute Simulator for NDN" in Summer Conference of the Institute of Electronics Engineers of Korea, June 2021, Jeju Island, South Korea, June. 30 - July 02, 2021.
23. **Muhammad Salah ud din**, Muhammad Atif Ur Rehman, Muhammad Imran, Eun-Sung Jung, Byung-Seo Kim, " A Robust Data Forwarding Scheme for NDN based Single Radio Wireless Sensor Networks" in Summer Conference of the Institute of Electronics Engineers of Korea, June 2021, Jeju Island, South Korea, June. 30 - July 02, 2021.
24. Muhammad Atif Ur Rehman, **Muhammad Salah ud din** , Sana Fayyaz, Hyun-Doo Jin, and Byung-Seo Kim, "Integrating Information-Centric Wireless Sensor Network to the Internet: A Softwarized Approach" In proceedings of 9th International Conference on Green and Human Information Technology, Jeju Island, Korea, Jan. 13 - 15, 2021.
25. **Muhammad Salah ud din**, Muhammad Atif Ur Rehman, Sana Fayyaz, Hyun-Doo Jin, and Byung-Seo Kim, "PEN-WSN: Power Efficient Named Data Networking Enabled Cluster based WSN" In proceedings of 9th International Conference on Green and Human Information Technology, Jeju Island, Korea, Jan. 13 - 15, 2021.
26. **Muhammad Salah ud din**, Muhammad Atif Ur Rehman, Rehmat Ullah, Hyundoo Jin, and Byung-Seo Kim, "Energy-Efficient Cluster-head Declaration Mechanism for Wireless Sensor Networks," In proceedings of 8th International Conference on Green and Human Information Technology, Feb. 05 - 07, 2020, Hanoi, Vietnam.

Posters:

27. Muhammad Imran, **Muhammad Salah ud din**, Muhammad Atif Ur Rehman, Young Chul Kim, Byung-Seo Kim, " An Overview of Live VM Migration Techniques in Cloud Data Center" in Summer Conference of the Institute of Electronics Engineers of Korea, June 2021, Jeju Island, South Korea, June. 30 - July 02, 2021.
28. Sana Fayyaz, Muhammad Atif Ur Rehman, **Muhammad Salah ud din**, and Byung-Seo Kim "Seamless Producer Mobility in Named Data Mobile AdHoc Networks" Accepted as poster in Summer Conference of the Institute of Electronics Engineers of Korea, August 2020, Jeju Island, South Korea.
29. **Muhammad Salah ud din**, Muhammad Atif Ur Rehman, Hyun-Doo Jin, Chan-Won Park, and Byung-Seo Kim "Energy Efficient Data Transmission in Cluster Based Heterogenous Wireless Sensor Networks" Accepted as poster in Summer Conference of the Institute of Electronics Engineers of Korea, August 2020, Jeju Island, South Korea.

HONORS & AWARDS

1. [Best Research Of Year Award \(2021-01-01 to 2022-02-28\)](#) Awarded best Research of the Year award for the period 2021-01-01 to 2022-02-28
2. [Hongik Research Frontier Grant \(2021-2022\)](#): Won the Hongik University Research Frintier grant for the year 2021-2022
3. [ACM SIGCOMM Travel Grant\(\\$1500\)](#): Awarded by ACM SIGCOMM for the conference ACM SIGCOMM 2022, Amsterdam, the Netherlands, (Aug. 22-26, 2022)
4. [The Most External Impact Award](#): Participated in NDN Hackathon as a **Team member** and Won "Most External Impact" at the 11th Named Data Networking Hackathon sponsored by NDN Consortium on May 21-23, 2021 at USA - Virtual
5. [The Most Usefull Tool Award](#): Participated in NDN Hackathon as a **Team member** and Won "The Most Usefull Tool Award" at the 9th Named Data Networking Hackathon hosted by NDN Team (University of California, Los Angeles) on September 7-8, 2019 at Gaithersburg, MD, USA. (Sep. 7-8, 2019).
6. [Global Scholarship \(Approx. \\$50,000\)](#): Awarded by Hongik University, Republic of Korea, for a Doctorate Degree in Computer Engineering. (Sep, 2019 - Sep, 2023).

PAPER PRESENTATIONS

1. **Title**: An Optimized Node Synchronization Mechanism for NDN enabled Resource Defficient IoTs
Venue: Summer Conference of the Institute of Electronics Engineers of Korea, Jeju Island, South Korea, June 29th - July 01, 2022.

2. **Title:** PVAAS: A Cost-Efficient Computation Offloading Strategy for Intelligent Information-Centric Vehicles
Venue: 10th International Conference on Green and Human Information Technology, Jan. 19 - 21, 2022 Jeju Island, South Korea.
3. **Title:** A.I for Intelligent Information Centric Networking
Venue: IEEE/IEIE ICCE-Asia 2021, November 2021, DEL PINO Resort, Gangwon province, South Korea
4. **Title:** A Robust Data Forwarding Scheme for NDN based Single Radio Wireless Sensor Networks
Venue: Summer Conference of the Institute of Electronics Engineers of Korea, June 2021, Jeju Island, South Korea
5. **Title:** PEN-WSN: Power Efficient Named Data Networking Enabled Cluster based WSN
Venue: 9th International Conference on Green and Human Information Technology, Jeju Island, Korea.
6. **Title:** A Robust Data Forwarding Scheme for NDN based Single Radio Wireless Sensor Networks
Venue: 2021 Summer Conference of the Institute of Electronics Engineers of Korea, June 30th - July 02, 2021, Jeju Island, South Korea.
7. **Title:** Energy Efficient Data Transmission in Cluster Based Heterogenous Wireless Sensor Networks
Venue: 2020 Summer Conference of the Institute of Electronics Engineers of Korea, Aug 19-21, 2020.

INVITED TALKS

1. **Title:** Towards Efficient communication and Microservices centric in network computations for next-generation autonomous vehicular networks.
Date & Venue: May 13, 2024 Department of AI Convergence Network, Ajou University South Korea.

PROJECTS

Jan 2024- Dec 2025	Research on In-Aerial Network Computing (IANC)-based Federated Learning Framework (Korea-Turkiye Joint Research Program) Sponsor: National Research Foundation of Korea
Mar 2022- Feb 2026	Research on Decentralized Microservice-Centric Network (DMCN) frameworks for in-network computations Sponsor: National Research Foundation of Korea
Sep 2020 - Aug 2027	Brain Korea 21: Research Team for Super-Distributed Autonomous Computing Service Technologies Sponsor: National Research Foundation of Korea
Jun 2020 - Dec 2023	Research on Integrated Field Data-Based Manufacturing Service Infrastructure Sponsor: Ministry of Trade, Industry and Energy
Oct 2020 - Dec 2022	Establishment of Big Data and Control Center open lab for Autonomous Driving Pilot Testing Sponsor: Ministry of Trade, Industry and Energy South Korea

TECHNICAL SKILLS

PROGRAMMING	C/C++, JAVA, C#
SIMULATORS	NS3, ndnSIM, NS2, Castalia (Omnet++)
PROTOCOLS	IEEE 802.11, 802.15.4, Bluetooth, TCP/IP, NDN, REST
TOOLS	Android Studio, Eclipse, Visual Studio, VS Code MATLAB, SQL Server Management Studio
MISC.	Origin, Wireshark, Packet Tracer, MS Office

PROFESSIONAL SERVICES

Conference Chair and Technical Program Committee Member at International Conferences and Workshops

1. Program Committee Member: 1st International Workshop on Federated Learning for Wireless Edge Artificial Intelligence (FedEdgeAI) 20 July - 23 July, 2025, Glasgow, Scotland, UK
2. TPC Co-Chair: 12th International Conference on Green and Human Information Technology Jan 23 - 25, 2024, Vietnam
3. Publicity Chair: IEEE ICC Workshop on Metaverse-based Networking and Computing 2023, Rome Italy

Reviewer International Journals and Conferences:

1. IEEE Transaction on Services Computing
2. IEEE Internet of Things Journal

3. Transactions on Emerging Telecommunications Technologies (Wiley)
4. IEEE Access
5. Springer Journal of Super computing
6. MDPI

REFERENCES

Dr. Byung Seo Kim	Professor, Department of Software Convergence Organization: Hongik University, South Korea Email: jsnbs@hongik.ac.kr
Dr. Rehmat Ullah	Associate Professor in Computing Organization: Newcastle University, UK Email: rehmat.ullah@ncl.ac.uk
Dr. Muhammad Atif ur Rehman	Assistant Professor, Department of Computing & Mathematics Organization: Manchester Metropolitan University, UK Email: m.atif.ur.rehman@mmu.ac.uk