# Abhishek Chakraborty

School of Engineering and Applied Science
Ahmedabad University
#323, GICT Building, Central Campus
Navrangpura, Ahmedabad, Gujarat 380009, India

**Email:** abhishek.chakraborty@ahduni.edu.in
abhishek2003slg@ieee.org
abhishek2003slg@gmail.com
**Web:** https://chakrabortyabhishek.github.io/

## EDUCATION

**PhD** Indian Institute of Space Science and Technology Thiruvananthapuram, [**2012 − 2018**]
**Thesis:** On the evolution of finite sized complex networks
**Advisor:** Professor B. S. Manoj

**ME (Electronics and Communication Engineering).** Birla Institute of Technology Mesra,
[**2010 − 2012**], **Specialization:** Wireless Communication

**BTech (Electronics and Communication Engineering).** Maulana Abul Kalam Azad University of Technology [Formerly West Bengal University of Technology], [**2003 − 2007**]

## ACADEMIC APPOINTMENTS

**Assistant Professor,** [**Sep. 2024 − Present**]
School of Engineering and Applied Science, Ahmedabad University

**Visiting Research Scientist,** [**Jul. 2024 − Present**]
Qualcomm Institute - UC San Diego Division of Calit2, UC San Diego

**Postdoc - Employee,** [**Jul. 2021 − Jun. 2024**]
Qualcomm Institute - UC San Diego Division of Calit2, UC San Diego

**Visiting Research Collaborator,** [**Mar. 2021 − Jun. 2021**]
Systems and Networks Lab, Department of Avionics, Indian Institute of Space Science and Technology Thiruvananthapuram

**Senior Project Officer,** [**Dec. 2020 − Feb. 2021**]
Department of Computer Science and Engineering, Indian Institute of Technology Madras

**Institute Post Doctoral Fellow,** [**Aug. 2018 − Nov. 2020**]
Department of Computer Science and Engineering, Indian Institute of Technology Madras

**Senior Project Fellow,** [**Aug. 2017 − Aug. 2018**]
Department of Avionics, Indian Institute of Space Science and Technology Thiruvananthapuram

## INDUSTRIAL APPOINTMENTS

**Programmer Analyst,** [**Dec. 2007 − Jul. 2009**]
Cognizant, Inc., Kolkata, West Bengal, India

**Intern,** [**Jun. 2006 − Jul. 2006**]
Netaji Subhas Chandra Bose Telecom Training Centre, Kalyani, West Bengal, India

**Intern,** [**Jun. 2005 − Jul. 2005**]
Bharat Sanchar Nigam Limited, Siliguri Zone, West Bengal, India

## Awards & Recognition

◇ Selected as a CBRS Certified Professional Installer by Google through the professional course jointly offered by Coursera and Google, Oct. 2021.

◇ Selected for SERB National Post Doctoral Fellowship (SERB N-PDF) 2018 in Engineering Sciences under SERB, DST, GoI (File Number: PDF/2018/003828).

◇ Recipient of the Institute Post Doctoral Fellowship at Indian Institute of Technology Madras from Aug. 2018 to Nov. 2020.

◇ Recipient of the Springer Best Student Paper Award for the research paper titled "Graph Fourier transform based on directed Laplacian" at the 2016 $11^{th}$ International Conference on Signal Processing and Communications (SPCOM 2016), IISc Bangalore, India, Jun. 2016.

◇ Recipient of the IIST Scholarship (Sponsored by Department of Space, GoI) from Aug. 2012 to Jul. 2017.

◇ Recipient of the Student Travel Grant to attend ACM MobiHoc 2013, Bangalore, India, from Jul. 29, 2013, to Aug. 1, 2013.

◇ Recipient of the MHRD Scholarship (Sponsored by MHRD, GoI) from Jul. 2010 to May 2012.

## Research Interest (In Alphabetical Order)

(i) Algorithms for Complex Networks, (ii) Communication Networks, (iii) Complex Networks, (iv) Design and Deployment of CBRS Networks, (v) Education Networks, (vi) Network Science, (vii) Next-generation Wireless Network Design, (viii) Softwarized 5G Networks, and (ix) Wireless Mesh Networks.

## Sponsored Research Projects

◇ **Role:** *Principal Investigator*; **Title:** Student Interdisciplinary Journey Management System; **Sponsoring Agency:** Ahmedabad University [2025 – 2028, Award #URBSEASI25A2]

◇ **Role:** *Co-Principal Investigator*; **Title:** Deployment of 6G Accelerated Smart Transportation with C-V2X on Ahmedabad-Rajkot Highway (NH47) Corridor; **Industry Collaborator:** TechSture Technologies India Pvt. Ltd.; **Sponsoring Agency:** Telecom Technology Development Fund (TTDF) Scheme (part of the Bharat 6G Vision), with support from the Telecom Centres of Excellence (TCoE) and the Department of Telecommunications (DoT), Ministry of Communication, Government of India [2024 – 2027, Award #TTDF/6G/212]

◇ **Role:** *Postdoctoral Scholar/Researcher*; **Contributions:** Conceptualization, writing original draft, editing, and conducting preliminary analyses; **Title:** Citizen Broadband Radio Service: A *de novo* Incentive Mechanism Design Framework and its Socioeconomic Impacts; **Sponsoring Agency:** National Science Foundation (NSF, USA) [2022 – 2026, Award #2332034 (Supplement to #2232481)]

◇ **Role:** *Postdoctoral Scholar/Researcher*; **Contributions:** Writing a part of the original draft and analyzing the communication reliability of the CBRS spectrum; **Title:** SweepSpace: Enabling Autonomous Fine-Grained Spatial Spectrum Sensing and Sharing; **Sponsoring Agency:** National Science Foundation (NSF, USA) [2022 – 2026, Award #2232481]

## Professional Research Summary

**Postdoc - Employee & Visiting Research Scientist.** Qualcomm Institute, UC San Diego, [**Jul. 2021 – Present**]
**Research Objectives:** Designing *de novo* next-generation wireless networks for newly released citizens broadband radio service spectrum

The cloud-based centralized Spectrum Access System (SAS) administrator in the recently released incumbent-dominated Citizens Broadband Radio Service (CBRS) shared spectrum often obfuscates

the available spectrum information and revokes CBRS communication rights without prior information from the auctioned Primary Access License (PAL) and unlicensed General Authorized Access (GAA) users to protect the incumbents' location details and their movements. As a result, the communication reliability of the non-incumbents (i.e., PAL and GAA) gets affected by the current policy frameworks concerning only aggregate interference mitigation using the environmental sensing capability networks to protect the incumbents, and no existing solutions exist to address the issue.

In this work, we study the communication reliability for non-incumbents and the socioeconomic impacts of the shared spectrum of CBRS. In particular, our research work mainly focuses on the following avenues: (i) Study the communication reliability of the GAA CBRS Devices (CBSDs) near the incumbent-dominated regions, such as San Diego, (ii) introspect SAS administrator's spectrum obfuscation strategy for safeguarding incumbents' location privacy, and (iii) develop SAS-curated CBRS shared spectrum allocation policies to efficiently manage the coexistence of multiple service providers in a crowded service region with multiple PAL licenses and GAA infrastructures.

**Institute Post Doctoral Fellow & Senior Project Officer.** Indian Institute of Technology Madras, **[Aug. 2018 – Feb. 2021]**
**Research Objectives:** Architecture and protocol solutions to enhance the QoS of next-generation networks: A complex network analysis-based approach

We worked towards developing new architecture and protocol solutions to enhance the next-generation networks' quality of service (QoS). Our proposed solutions also satisfied the diverse network-related stringent requirements in the context of upcoming 5G network specifications. In particular, our research works mainly focused on the novel design proposals for the next-generation networks, which include the following: (i) delay-optimized design of industrial machine-to-machine networks, (ii) deployment of a few edge servers at the identified influential base stations to reduce the end-to-end transmission delay in cellular networks, (iii) efficient and reliable deployment of service function chains for latency-critical services, (iv) optimal and reliable allocation of virtual monitoring functions for better monitoring and decision-making purposes, (v) latency-aware and reliable placement of virtual network functions at the 5G edge cloud, and (vi) the orchestration of QoS-aware network slices using multi-connectivity in the 5G edge cloud.

**Senior Project Fellow.** Indian Institute of Space Science and Technology Thiruvananthapuram, **[Aug. 2017 – Aug. 2018]**
**Research Objectives:** Research and development of an integrated enterprise network security system

We worked towards designing a novel distributed integrated enterprise network security system framework, considering different elements of a typical enterprise network system. In particular, a novel API call transition matrix (API-CTM)-based malware detection technique was developed, using complex network analysis, that can efficiently detect malware attacks based on a system's runtime behavior. Recent threats such as polymorphic and metamorphic malware, which are difficult to identify with the existing detection techniques (e.g., signature-based detection), can be efficiently identified with API-CTM. Our proposed complex network analysis-based malware detection technique can find applications in the design of real-time malware detection systems when an enterprise network security system is considered.

## Academic Research Summary

**PhD Thesis.** Indian Institute of Space Science and Technology Thiruvananthapuram, **[Aug. 2012 – May 2018]**
**Title:** On the evolution of finite sized complex networks

Any complex physical system, artificial or natural, consists of entities interacting with other entities in the system. Such complex systems can be modeled as network graphs where the entities are nodes and their interactions are edges of the network graph. Earlier studies reported the possible mechanisms for

the evolution of complex networks where the size of the network is growing, in the context of nodes and edges, with time. However, the characteristics of finite sized complex systems, seen in many real-world networks, have not been studied in depth.

This thesis aimed to study the characteristics behind the evolution of finite sized complex networks, which can be seen in many real-world networks, such as relationships in community networks, transportation networks, computer networks, and wireless sensor networks, to name a few. Here, *finite sized networks* mean that such complex physical systems are not growing in size when the total number of nodes is concerned. One of the key reasons behind many complex network formations is the greedy optimal/near-optimal decision-based optimization of certain network parameters, such as minimizing the average path length. We also applied our observations from finite sized complex networks to design efficient finite sized real-world networks when reducing the end-to-end transmission delay and enhancing the average network flow capacity are concerned.

**ME Thesis.** Birla Institute of Technology Mesra, [**Jun. 2011 − May 2012**]
**Title:** Capacity enhancement in indoor wireless communication systems

This thesis aimed to analytically derive the closed-form expressions of system capacity in the context of single-cell and multiple adjacent-cell wireless indoor environments. The closed-form expressions also considered the optimal power constraints to better evaluate network system capacity. The singular value decomposition-based technique was also incorporated to introduce space as another degree of freedom to improve the system capacity further.

**BTech Project.** Maulana Abul Kalam Azad University of Technology [Formerly West Bengal University of Technology], [**Jan. 2007 − Apr. 2007**]
**Title:** Design and development of code for radiation pattern measurement of microstrip antenna

This project aimed to develop a Matlab-based simulator to visualize the E-plane and H-plane radiation patterns at a given frequency when considering the cavity model of a particular microstrip antenna. The length and width optimizations were also considered while designing the algorithm. Our developed algorithm is an approximation model that compares well with the IE3D-based simulation model.

## PUBLICATIONS (PUBLISHED/ACCEPTED)

⋄ **Book**

B1 B. S. Manoj, **Abhishek Chakraborty**, and Rahul Singh, "Complex Networks: A Networking and Signal Processing Perspective," Prentice Hall PTR, New Jersey, USA, Feb. 2018.

⋄ **Book Chapters**

BC2 Dhruva Anantha Datta, Sarath Babu, **Abhishek Chakraborty**, and B. S. Manoj, "Computing platforms for the Internet of Things," Chapter in the book titled "Encyclopedia of Sustainable Technologies," 2nd Ed., Edited by Martin A. Abraham, vol. 3, pp. 780-799, Oxford: Elsevier, May 2024.

BC1 Priti Singh, **Abhishek Chakraborty**, and B. S. Manoj, "Complex network entropy," Chapter in the book titled "Soft Computing Applications in Sensor Networks," Edited by Sankar K. Pal and Sudip Misra, pp. 243-263, CRC Press (USA), Aug. 2016.

⋄ **Refereed International Journals**

J12 **A. Chakraborty** and R. R. Rao, "On temporal and spatial behaviors of CBRS SAS," *IEEE Transactions on Cognitive Communications and Networking*, vol. 10, no. 5, pp. 1774-1787, Oct. 2024.

J11 Prabhu K. T., **A. Chakraborty**, and C. Siva Ram Murthy, "Resilient and latency-aware orchestration of network slices using multi-connectivity in MEC-enabled 5G networks," *IEEE Transactions on Network and Service Management*, vol. 18, no. 3, pp. 2502-2514, Sep. 2021.

J10 Prabhu K. T., **A. Chakraborty**, A. Mathew, and C. Siva Ram Murthy, "Reliable placement of service function chains and virtual monitoring functions with minimal cost in softwarized 5G networks," *IEEE Transactions on Network and Service Management*, vol. 18, no. 2, pp. 1491-1507, Jun. 2021.

J9 **A. Chakraborty**, S. Babu, and B. S. Manoj, "On achieving capacity-enhanced small-world networks," *Elsevier Physica A: Statistical Mechanics and its Applications*, vol. 556, pp. 124729 (1 – 17), Oct. 2020.

J8 S. Sai Avinash, **A. Chakraborty**, Shaijumon C. S., and B. S. Manoj, "Corporate linkages and financial performance: A complex network analysis of Indian firms," *IEEE Transactions on Computational Social Systems*, vol. 7, no. 2, pp. 339-351, Apr. 2020.

J7 R. Singh, **A. Chakraborty**, and B. S. Manoj, "GFT centrality: A new node importance measure for complex networks," *Elsevier Physica A: Statistical Mechanics and its Applications*, vol. 487, pp. 185-195, Dec. 2017.

J6 P. Singh, **A. Chakraborty**, and B. S. Manoj, "Link influence entropy," *Elsevier Physica A: Statistical Mechanics and its Applications*, vol. 465, pp. 701-713, Jan. 2017.

J5 D. S. Yadav, **A. Chakraborty**, and B. S. Manoj, "A multi-backup path protection scheme for survivability in elastic optical networks," *Elsevier Optical Fiber Technology*, vol. 30, pp. 167-175, Jul. 2016.

J4 **A. Chakraborty**, Vineeth B. S., and B. S. Manoj, "Analytical identification of anchor nodes in a small-world network," *IEEE Communications Letters*, vol. 20, no. 6, pp. 1215-1218, Jun. 2016.

J3 **A. Chakraborty** and B. S. Manoj, "The reason behind the scale-free world," *IEEE Sensors Journal*, vol. 14, no. 11, pp. 4014-4015, Nov. 2014.

J2 N. Gaur, **A. Chakraborty**, and B. S. Manoj, "Delay optimized small-world networks," *IEEE Communications Letters*, vol. 18, no. 11, pp. 1939-1942, Nov. 2014.

J1 S. Das, **A. Chakraborty**, and S. Kumar, "Capacity calculation and sub-optimal power allocation scheme for OFDM-based systems," *Communications and Network*, vol. 4, no. 4, pp. 292-297, Nov. 2012.

◇ **Refereed International Conferences and Workshops**

C18 H. Wang, **A. Chakraborty**, and R. R. Rao, "On forecasting CBRS spectrum availability," Accepted for Publication in *Proc. IEEE MILCOM 2025*, Los Angeles, California, USA, Oct. 2025.

C17 **A. Chakraborty**, Vineeth B. S., B. S. Manoj, and R. R. Rao, "On identifying optimal shortcut edge locations in a linear small-world wireless sensor network," in *Proc. IEEE ICC 2024*, pp. 1-6, Denver, Colorado, USA, Jun. 2024.

C16 **A. Chakraborty** and R. R. Rao, "On reliability of CBRS communications near U.S. Navy installations in San Diego," in *Proc. IEEE MILCOM 2023*, pp. 1-6, Boston, Massachusetts, USA, Nov. 2023.

C15 Prabhu K. T., **A. Chakraborty**, and C. Siva Ram Murthy, "Latency-aware and survivable mapping of VNFs in 5G network edge cloud," in *Proc. DRCN 2021*, pp. 1-8, Milan, Italy, Apr. 2021.

C14 **A. Chakraborty**, B. S. Manoj, and C. Siva Ram Murthy, "An efficient scheme for constructing small-world machine-to-machine networks," in *Proc. IEEE ICC 2020*, pp. 1-6, Dublin, Ireland, Jun. 2020.

C13 V. Mohana Sruthi, **A. Chakraborty**, B. Thanudas, S. Sreelal, and B. S. Manoj, "An efficient malware detection technique using complex network-based approach," in *Proc. NCC 2020*, pp. 1-6, Kharagpur, India, Feb. 2020.

C12 M. Gudiseva, **A. Chakraborty**, and B. S. Manoj, "Social network aware dynamic edge server placement for next-generation cellular networks," in *Proc. COMSNETS 2020*, pp. 499-502, Bengaluru, India, Jan. 2020.

C11 K. V. Niranjan Sai, B. Thanudas, S. Sreelal, **A. Chakraborty**, and B. S. Manoj, "MACA-I: A malware detection technique using memory management API call mining," in *Proc. IEEE TENCON 2019*, pp. 527-532, Kochi, India, Oct. 2019.

C10 **A. Chakraborty**, Vineeth B. S., and B. S. Manoj, "On the evolution of finite-sized complex networks with constrained link addition," in *Proc. IEEE ANTS 2018*, pp. 1-6, Indore, India, Dec. 2018.

C9 V. Mohana Sruthi, B. Thanudas, S. Sreelal, **A. Chakraborty**, and B. S. Manoj, "ACTM: API call transition matrix-based malware detection method," in *Proc. IEEE ANTS 2018*, pp. 1-6, Indore, India, Dec. 2018.

C8 G. Suresh, **A. Chakraborty**, and B. S. Manoj, "Deterministic evolution through indexed leaf node based attachment in complex networks," in *Proc. NCC 2018*, pp. 1-6, Hyderabad, India, Feb. 2018.

C7 R. Singh, **A. Chakraborty**, and B. S. Manoj, "On spectral analysis of node centralities," in *Proc. IEEE ANTS 2016*, pp. 1-5, Bengaluru, India, Nov. 2016.

C6 R. Singh, **A. Chakraborty**, and B. S. Manoj, "Graph Fourier transform based on directed Laplacian," in *Proc. SPCOM 2016*, pp. 1-5, Bengaluru, India, Jun. 2016.

C5 P. Singh, **A. Chakraborty**, and B. S. Manoj, "Conflict graph based community detection," in *Proc. COMSNETS 2016*, pp. 1-7, Bengaluru, India, Jan. 2016.

C4 **A. Chakraborty**, Vineeth B. S., and B. S. Manoj, "Influence of greedy reasoning on network evolution," in *Proc. Indo-US Bilateral Workshop on Large Scale Complex Network Analysis 2015 (LSCNA 2015)*, pp. 81-84, Kolkata, India, Dec. 2015.

C3 **A. Chakraborty** and B. S. Manoj, "An efficient heuristics to realize near-optimal small-world networks," in *Proc. NCC 2015*, pp. 1-5, Mumbai, India, Feb. 2015.

C2 Arun K. P., **A. Chakraborty**, and B. S. Manoj, "Communication overhead of an OpenFlow wireless mesh network," in *Proc. IEEE ANTS 2014*, pp. 1-6, New Delhi, India, Dec. 2014.

C1 N. Gaur, **A. Chakraborty**, and B. S. Manoj, "Load-aware routing for non-persistent small-world wireless mesh networks," in *Proc. NCC 2014*, pp. 1-6, Kanpur, India, Feb. 2014.

## Teaching Experience (20XX, $\text{M}$onsoon, & $\text{W}$inter)

**Assistant Professor, [Sep. 2024 – Present]**
School of Engineering and Applied Science, Ahmedabad University

  ◇ $26_W$: Advances in Complex Networks (ENR513)
  ◇ $25_W$, $26_W$: Technical Communication (ENR500)
  ◇ $26_W$: Foundation Programme Studio: Environment and Climate Change (FDP102)
  ◇ $25_M$: Signals and Systems (EEE203)
  ◇ $25_W$: Social network Analysis (CSE533)

**Teaching Assistant, [Aug. 2012 – Jul. 2017]**
Department of Avionics, Indian Institute of Space Science and Technology Thiruvananthapuram

  ◇ $14_M - 16_M$: Wireless Mesh Networks Course (AV484)
  ◇ $14_M - 16_M$: Digital Communication Laboratory (AV332)
  ◇ $15_W - 17_W$: Computer Networks Laboratory (AV341)

**Teaching Assistant, [Jul. 2011 – May 2012]**
Department of Electronics and Communication Engineering, Birla Institute of Technology Mesra

  ◇ $11_M$: Wireless Communication and Networking Laboratory (EC7102)
  ◇ $12_W$: Digital Electronics Laboratory (EC4102)

## Affiliations, Activities, & Services

⬦ Senior Member, IEEE

⬦ Senior Member, IEEE Communications Society

⬦ Senior Member, ACM

⬦ Chair, IEEE Student Branch at Indian Institute of Space Science and Technology Thiruvananthapuram [**2012–2013**]

⬦ Student Member of the International Conference of Devices and Communication (ICDeCom) at Birla Institute of Technology Mesra [**2011**]

⬦ IEEE Graduate Student Member Volunteer for IEEE RAICS 2013, 2015

⬦ IEEE Graduate Student Member Volunteer for 2016 IEEE Shannon Centennial Workshop on Communications and Information Theory (SCWCIT 2016)

⬦ Graduate Student Member Volunteer for Trivandrum School on Communications, Coding, and Networking 2017

⬦ Reviewer of the following International Journals:

  – IEEE Transactions on Mobile Computing; IEEE Transactions on Communications; IEEE Transactions on Network and Service Management; IEEE Transactions on Network Science and Engineering; IEEE Transactions on Cognitive Communications and Networking; IEEE Internet of Things Journal; IEEE Sensors Journal; IEEE Communications Letters; IEEE Networking Letters; IEEE Signal Processing Letters; Nature Scientific Reports; Elsevier Computer Networks; Elsevier Physics Letters A; Elsevier Physica A: Statistical Mechanics and its Applications; Elsevier Journal of Computational Science; Elsevier Green Technologies and Sustainability; Elsevier Future Generation Computer Systems; Springer Nature: SN Computer Science.

⬦ Reviewer of the following International Conferences:

  – COMSNETS 2026, IEEE GLOBECOM 2025; IEEE PIMRC 2025; IEEE DySPAN 2024, 2025, 2026; CoCoNet 2019, 2020, 2023; IEEE CSI 2022; IEEE INDICON 2022; IEEE WF-IoT 2021; IEEE WCNC 2020; NCC 2020; IEEE GHTC-SAS 2013; IEEE RAICS 2013, 2015, 2018.

## References

References are available upon request.