Debopam Bhattacherjee

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RESEARCH INTERESTS

Low-Earth orbit (LEO) satellite networks, Internet architecture, low-latency networks & applications, transport & congestion control, and network measurement.

KEY HIGHLIGHTS

- Known for trend-setting research on designing broadband low-Earth orbit satellite networks. A paper on identifying LEO networking research opportunity at ACM HotNets '18 led to a flurry of follow-up papers in top conferences. *Hypatia* (which was chosen as the best paper at ACM's Internet Measurement Conference, the flagship network measurements venue) serves as a foundational building block for LEO satellite networking research.
- Authored the most cited ACM CoNEXT paper since 2019. This work on LEO network topology design also received IRTF's Applied Networking Research Prize in 2020 (4 awardees across the globe in 2020).
- Broad interdisciplinary network of collaborators across industry and academia. In random order: Duke University, UC Irvine, VMware Research, UIUC, Akamai, Harvard, UCSC, VU Amsterdam, Yale, Emerald Technologies, Max Plank Institute, Google, Oracle Labs, Azure Space, IIIT Delhi, IIT Kanpur, ETH Zürich, Linköping University, Aalto University, Airbus, OneWeb, Univ. of Surrey, Telefonica.
- Community contributions: Started co-organizing the popular LEOCONN (LEO satellite communications) series of events right from my graduate school days. Co-organized LEOCONN '21, LEOCONN '22, IETF-111 side-meeting on SATCOM. Currently co-organizing a Webinar series, LEOCONN WS, which hosts tech-talks from eminent industry players and academic institutions.
- Ph.D. from a top CS school – ETH Zürich CS department ranks (global) #7 on CSRankings (2013 - 2023), #9 on QS World University Rankings (2023), and #4 on Times Higher Education World University Rankings (2023). 7 papers in top networking conferences and workshops during Ph.D.; multiple awards.
- Significant teaching and mentoring experience: 6 different courses, 11 semesters of teaching. 7 bachelor theses, 9 master theses, and 2 internship supervision. Currently mentoring 1 intern and 2 pre-doctoral research fellows at Microsoft Research. Supervised students are well-placed in industry/academia.
- 5 years (2009-14) of rich pre-doctoral industry experience as a Technology Consultant in two of the big four consulting firms. In-depth hands-on experience with Python, J2EE, BPM, Node.js, shell scripts, DBMS, ESB, Web services, RESTful APIs, etc.

EDUCATION

Ph.D. Computer Science (Networked Systems)
ETH Zürich, Switzerland, 2021
Thesis title: Towards Performant Networking from Low-Earth Orbit
Committee: Ankit Singla (Staff Software Engineer, Google; ex Asst. Prof. ETH Zürich),
Adrian Perrig (ETH Zürich),
Ranveer Chandra (Managing Director, Research for Industry, Networking Research, Microsoft)

M.S. Security and Mobile Computing (NordSecMob)
KTH Royal Institute of Technology, Sweden + **Aalto University**, Finland, 2016
Thesis title: Stepping Stone Detection for Tracing Attack Sources in Software-Defined Networks
Committee: Tuomas Aura (Aalto University),
Markus Hidell (KTH Royal Institute of Technology),
Andrei Gurtov (Linköping University)

B.E. Computer Science & Engineering
Jadavpur University, India, 2009

EMPLOYMENT

11/2021 – **Microsoft Research Lab**, India
Position: **Senior Researcher**
Projects: 1. Network Brain: Holistic optimization of large-scale networked services.
2. LEOScope: A large-scale testbed for LEO satellite broadband providers.
3. Transport optimization over LEO satellite networks.
4. Mining social media for passive network measurements.
5. End-host transport toward leveraging heterogeneous network channels.
6. LEO satellite network design.
Tech stack: Python, Azure Cognitive Services, Storage APIs, Bing API, etc.

10/2016 – 09/2021 Systems Group, Department of Computer Science, **ETH Zürich**, Switzerland
Position: **Ph.D. Candidate**, Network Design Lab
Ph.D. supervisor: Ankit Singla
Long-term collaborators: Brighten Godfrey, Bruce Maggs,
Balakrishnan Chandrasekaran, Gregory Laughlin,
Sangeetha Abdu Jyothi.
Projects: 1. LEO satellite network design, simulation, and performance optimization.
2. Speed-of-light terrestrial ISP design leveraging fiber and point-to-point radio.
3. Low-latency Web content delivery using distributed cloud-based reverse proxies.
Tech stack: Python, Gurobi, shell scripts, Java.

06/2019 – 08/2019 **Max Planck Institute** for Informatics, Saarbrücken, Germany
Position: **Research Fellow** at Internet Architecture group
Supervisor: Anja Feldmann, Balakrishnan Chandrasekaran
Project: ISP-level traffic simulations toward designing a credit-based flow control.
Tech stack: Java.

06/2015 – 07/2016 Computer Science and Engineering Dept., **Aalto University**, Finland
Position: **Research/Teaching Assistant**
Supervisor: Tuomas Aura, Andrei Gurtov
Projects: 1. A cloud-based solution to configure home and small office routers.
2. Stepping stone detection for tracing attack sources in Software-Defined Networks.
Tech stack: Python, Java, Shell Scripts.

08/2009 – 08/2014 **PwC** & **Deloitte**, India
Position: **Senior Technology Consultant**, Technology Consultant
Domains: Insurance, eGovernance, Business Process Automation.
Tech stack: Python, Java/J2EE, BPM, Node.js, shell scripts, DBMS, ESB, Web services, RESTful APIs, etc.

PUBLICATIONS

Refereed Publications

2023 *Don't Forget the User: It's Time to Rethink Network Measurements* [ACM HotNets] A. Taneja, R. Bothra, D. Bhattacherjee, R. Gandhi, V. N. Padmanabhan, R. Bhagwan, N. Natarajan, S. Guha, R. Cutler

2023 *Boosting Application Performance using Heterogeneous Virtual Channels: Challenges and Opportunities* [ACM HotNets] T. Touseef, W. Sentosa, M. K. Vaddiraju, D. Bhattacherjee, B. Chandrasekaran, B. Godfrey, S. Tiwari

2023 *Exploring Low-Earth Orbit Network Design* [ACM MobiCom LEO-NET] S. Basak, A. Pal, D. Bhattacherjee

2022 *cISP: A Speed-of-Light Internet Service Provider* [USENIX NSDI] D. Bhattacherjee, W. Aqeel, S. A. Jyothi, I. N. Bozkurt, W. Sentosa, M. Tirmazi, A. Aguirre, B. Chandrasekaran, P. B. Godfrey, G. P. Laughlin, B. M. Maggs, A. Singla

2020 *In-orbit computing: an outlandish thought experiment?* [ACM HotNets] D. Bhattacherjee, S. Kassing, M. Licciardello, A. Singla

2020 *"Internet from Space" without Inter-satellite Links?* [ACM HotNets] Y. Hauri, D. Bhattacherjee, M. Grossmann, A. Singla

2020 *Exploring the "Internet from space" with Hypatia* [ACM IMC] S. Kassing, D. Bhattacherjee, A. B. Águas, J. E. Saethre, A. Singla [**Best Paper Award**]

2020 *A bird's eye view of the world's fastest networks* [ACM IMC] D. Bhattacherjee, W. Aqeel, G. Laughlin, B. M. Maggs, A. Singla

2020 *Untangling Header Bidding Lore* [PAM] W. Aqeel, D. Bhattacherjee, B. Chandrasekaran, P. B. Godfrey, G. Laughlin, B. Maggs, A. Singla [**Best Dataset Award**]

2019 *Network topology design at 27,000 km/hour* [ACM CoNEXT] D. Bhattacherjee, A. Singla [**IRTF Applied Networking Research Prize 2020**]

2019 *Watch your step! Detecting stepping stones in programmable networks* [IEEE ICC] D. Bhattacherjee, A. Gurtov, T. Aura

2018 *Gearing up for the 21st century space race* [ACM HotNets] D. Bhattacherjee, W. Aqeel, I. N. Bozkurt, A. Aguirre, B. Chandrasekaran, P Godfrey, G. Laughlin, B. Maggs, A. Singla

2017 *A Cloud-based Content Gathering Network* [USENIX HotCloud] D. Bhattacherjee, M. Tirmazi, A. Singla

Preprints

2023 *T3P: Demystifying Low-Earth Orbit Satellite Broadband* [arXiv:2310.11835] S. Tiwari, S. Bhushan, A. Taneja, M. Kassem, C. Luo, C. Zhou, Z. He, A. Raman, N. Sastry, L. Qiu, D. Bhattacherjee

2023 *On viewing SpaceX Starlink through the Social Media Lens* [arXiv:2307.13441] A. Taneja, D. Bhattacherjee, S. Guha, V. N. Padmanabhan

2019 *Measuring and exploiting the cloud consolidation of the Web* [arXiv:1906.04753] D. Bhattacherjee, M. Tirmazi, A. Singla

2018 *Dissecting Latency in the Internet's Fiber Infrastructure* [arXiv:1811.10737] I. N. Bozkurt, W. Aqeel, D. Bhattacherjee, B. Chandrasekaran, P. B. Godfrey, G. Laughlin, B. M. Maggs, A. Singla

AWARDS AND HONORS

2020 Best Paper Award at ACM IMC, *Exploring the "Internet from space" with Hypatia*.
2020 Best Dataset Award at PAM, *Untangling Header Bidding Lore*.
2020 IETF/IRTF Applied Networking Research Prize.
2019 Selected for Ph.D. Workshop, Microsoft Research, Cambridge.
2014 Awarded NordSecMob (Erasmus Mundus Master's program) Consortium Scholarship.
2005 Ranked 60/70,000 in West Bengal Joint Entrance Examination (WBJEE).
2003 Awarded National Merit Scholarship by Government of India [2003 – 2009].

Recent Achievements

2023 Microsoft Global Hackathon Executive Challenge 2023 Honorable Mention [badge]
2023 S. Basak (IIT Kanpur, collaborator) received the Prime Minister's Research Fellowship (PMRF, India) for pursuing our satellite network research agenda.

SELECTED MEDIA COVERAGE

04/2022 Wireless Microwave Internet could mean the end of lag SYFY Wire.
12/2019 Laser-Linked Satellites Could Deliver 'Internet from Space' NextGov.
12/2019 A new network design for the "internet from space" TechXplore.
08/2017 A cloud-based content gathering network The morning paper.

TALKS

2023 *Demystifying LEO Satellite Broadband* [VU Amsterdam – India Science Seminar]
2023 *Moving Toward the 'New' Space* [International Conference on Space, Bangalore]
2023 *Low-Earth Orbit Broadband Opportunities and Challenges* [APNIC-55]
2022 *Towards measuring Low-Earth Orbit network performance* [LEOCONN & U. Surrey]
2021 *Towards Performant Networking from Low-Earth Orbit* [AINTEC, U Cambridge]
2021 *On improving low-Earth orbit satellite network performance* [LEOCONN, Microsoft Research, Juniper Networks]
2020 *In-orbit computing: an outlandish thought experiment?* [ACM HotNets]
2020 *"Internet from Space" without Inter-satellite Links?* [ACM HotNets]
2020 *Exploring the "Internet from space" with Hypatia* [ACM IMC]
2020 *A bird's eye view of the world's fastest networks* [ACM IMC]
2019 *Network topology design at 27,000 km/hour* [ACM CoNEXT, APNIC-50, IETF-109]
2018 *Gearing up for the 21st century space race* [ACM HotNets]
2018 *Speeding up the Internet* [ETH Zürich Systems Group Retreat]
2017 *A Cloud-based Content Gathering Network* [USENIX HotCloud]
2016 *Detection of Stepping Stones in Software Defined Networks* [Invited talk at ETH Zürich]

TEACHING

Spring 2019 - 2021 *Future Internet* [Graduate], ETH Zürich
Spring 2019 - 2021 *Computer Networks* [Undergraduate], ETH Zürich
Spring 2017 - 2018 *Advanced Computer Networks* [Graduate], ETH Zürich

Autumn 2016 *Big Data* [Graduate], ETH Zürich
Autumn 2015 *Network Security* [Graduate], Aalto University
Autumn 2015 *Information Security* [Graduate], Aalto University

SUPERVISION

Internship/ Research Fellowship (RF)

2023 *End-to-end transport over LEO satellite networks*, S. Bhushan (RF), MSR - India
2023 *Enabling LEO network experiments at scale*, S. Tiwari (RF), MSR - India
2023 *Enabling LEO network experiments at scale*, A. Taneja, MSR - India
2022 *Mining social media to quantify network performance and user perception*, A. Taneja, MSR - India
2022 *Detecting wind and solar parks with multi-modal data*, P. Singh, MSR - India

Master's Thesis

2021 *BBR congestion control in LEO satellite networks*, C. Ettlin, ETH Zürich
2021 *Routing over dynamic Low Earth Orbit satellite networks*, D. B. Irani, ETH Zürich
2021 *Analyzing the Impact of GEO Arc Avoidance on LEO Constellation Performance*, F. Zafar, ETH Zürich
2020 *Routing for a satellite mega-constellation*, M. Grossmann, ETH Zürich
2020 *Simulating LEO satellite networks*, B. A. André, ETH Zürich
2019 *Fast Web Browsing Over The Tor Network*, A. Isac, ETH Zürich
2019 *Web browsing with privacy-enhanced MITM*, T. Krebs, ETH Zürich
2018 *Assessing unfairness in the Internet/Web ecosystem*, O. Butz, ETH Zürich
2018 *Turning Web page delivery upside down*, J. Purtschert, ETH Zürich

Bachelor's Thesis

2021 *Sun synchronous low Earth orbit satellite constellation design*, P. Eigensatz, ETH Zürich
2020 *Internet from space without inter-satellite laser?*, H. Yannick, ETH Zürich
2019 *Simulations of Satellite-based low-latency Internet*, J. E. Saethre, ETH Zürich
2019 *Performance of fetching web pages on mobile devices*, A. Köpe, ETH Zürich
2019 *Customizing QUIC/HTTP2 for Web servers*, A. Benelli, ETH Zürich
2018 *Optimizing a Smart Proxy*, J. Gallmann, ETH Zürich
2018 *Customizing QUIC for Web servers*, C. Neukom, ETH Zürich

COMMUNITY SERVICE

2024 ACM CoNEXT '24 *TPC Member*
2024 ACM MobiCom '24 *Publicity Co-Chair*
2023 The Networking Channel (Panel discussion on LEO networks) *Co-organizer*
2023 LEO-NET (MobiCom '23) *Advisory Board Member, TPC Member*
2023 LEOCONN WS (Webinar Series on LEO satellite networks) *Co-organizer*
2022 LEOCONN '22 (1-day tutorial on satellite-based networking) *Co-organizer*
2021 LEOCONN '21 (Webinar on satellite-based networking) *Co-organizer*
2021 IETF-111 side-meeting on SATCOM activities *Co-organizer*

Referee names will be shared as needed.