Gowri Sankar Ramachandran

Employment

2019 - **Senior Research Associate**, *USC Viterbi Center for Cyber-physical Systems and the Intenet-of-Things (CCI) and Autonomous Networks Research Group (ANRG)*, University of Southern California (USC), Los Angeles, USA.

Education

2012–2017 (July) **Ph.D. in Computer Science with a focus on Internet-of-Things**, *imec-DistriNet, KU Leuven*, Leuven, Belgium.
Thesis Title: Cross-layer optimization of dynamic IoT systems

2009–2012 **Master of Science in Intelligent Embedded Systems**, *Malardalen University*, Vasteras, Sweden.

2010–2012 **Master of Science in Intelligent Embedded Systems (An Erasmus Exchange Student)**, *Technical University of Eindhoven (TU/e)*, Eindhoven, The Netherlands.
Thesis Title: Integrating enhanced slot-shifting in μC/OS-II RTOS

2007–2008 **Post Graduate Diploma in Embedded Systems Design**, *NIELIT (formerly known as DOCACC Centre)*, Calicut, Kerala, India.

2002–2007 **Bachelor of Technology in Electronics and Communication Engineering**, *SASTRA University*, Tanjore, Tamilnadu, India.

Experience

2017–2019 (24 months) **Postdoctoral Researcher**, *Center for Cyber-physical Systems and the Intenet-of-Things (CCI), Autonomous Networks Research Group*, University of Southern California (USC), Los Angeles, USA.

2012–2017 (56 months) **Research Associate**, *iMinds-DistriNet, KU Leuven*, Leuven, Belgium.

2012–2012 (4 months) **Research Internship**, *iMinds-DistriNet, KU Leuven*, Leuven, Belgium.

2010–2011 (5 months) **Research Internship**, *System Architecture and Networking (SAN) group, Technical University of Eindhoven*, Eindhoven, The Netherlands.

2008–2008 (6 months) **Assistant Engineer**, *NIELIT (formerly known as DOCACC Centre)*, Calicut, India.

Research Interests

Resource management, data marketplaces, distributed data and payment management systems, edge computing, and systems for Internet-of-Things and Smart Cities, with a focus on problems related to performance, self-adaptation, trust, and scalability. I enjoy working on problems that are motivated by real applications. In particular, I like to engage and work with industrial and government organizations to translate research innovations into practice. My work spans the whole spectrum of building systems, algorithm and middleware development, empirical analysis, testbed deployments, including working with practitioners to apply the research into practice.

Awards

- Received **First Prize** (out of over 400 participants from 4 continents) at GRMDS Challenge, which focused on creating data-driven risk modelling and prediction to study the spread of CoVID-19 in Los Angeles, June, 2020. Our proposed risk-score model was adopted by City of Los Angeles to convey the CoVID-19 spread levels to the community members: `https://www.latimes.com/california/story/2020-07-02/la-unveils-color-coded-system-to-assess-coronavirus-risk`
- Received **Second Prize** (out of over 150 participants) at AutoMobility Los Angeles Hackathon for Building Incentive-driven Eco-friendly Routing Framework, November, 2019.
- Received **Best Student Paper Award** as a co-author at Fifth IEEE International Conference on Multimedia Big Data (BigMM) for *"A Crowd-Based Image Learning Framework Using Edge Computing for Smart City"*, September, 2019.
- Received **Second Prize** at ChainPort's Supply Chain Hackathon at Los Angeles on October 13, 2018.
- Received a **Cash Prize** of 1500 USD at ETHSF (world's largest Ethereum hackathon) at San Francisco on October 7, 2018.
- Received **Best Paper Award** as a co-author at Mobiquitous for *"Selective jamming of LoRaWAN using commodity hardware"*, November-2017.
- Received **Best Paper Award** as a co-author at AFRICATEK (an international conference on emerging technologies for developing countries) for *"Developing the IoT to support the health sector: a case study from Kikwit, DR Congo"*, March-2017.
- Received **Second Prize** (out of over 200 participants) in LoRa Alliance Global IoT Challenge for *"developing and deploying a smart medical fridge for preserving blood and vaccine supplies"*, February-2017.
- Received **Honorary Certificate of Appreciation** from IEEE Communications Society for *"LoRa Congo: low power, long-range monitoring technology for development projects in Congo"*, December-2016.

- Received **Best Paper Award** as the primary author at WICSA/CompArch (a top-tier software engineering conference) for *"Building dynamic and dependable Internet-of-Things applications with Dawn"*, April-2016.
- Received **Erasmus Scholarship** for graduate studies in Technical University of Eindhoven (TU/e), The Netherlands, 2011-2012.

Internet-of-Things Practical Deployment Experiences

- Deploying a smart campus IoT testbed to test and evaluate applications, wireless technologies, and networking protocols to unravel the challenges of next-generation IoT and smart city applications. (ongoing work)
- Deployed a 15-node LoRa (long-range communication) testbed for the design, implementation, and evaluation of TSCH protocol at iMinds-DistriNet, KU Leuven, Belgium, 2017.
- Deployed a LoRa-based smart fridge in Kikwit, DR Congo for preserving critical medical supplies such as blood and vaccine, 2016.
- Deployed a 50-node TSCH-based μPnP testbed at iMinds-DistriNet, KU Leuven, Belgium, 2015.

Didactic experiences

- Supervised more than 25 undergraduate and graduate students on various projects at USC (2017-2019), USA.
- Supervised four master thesis projects at KU Leuven (2012-2016), Belgium.
- Responsible for lab sessions of computer networks course (B-KUL-G0Q43A) for four years (2012-2016) at KU Leuven, Belgium. Approximately 150 students attended the course each year.
- Responsible for conducting exams and evaluation of software architecture for real-time embedded systems (B-KUL-H04L2A) course for three years (2013-2016) at KU Leuven, Belgium. Approximately 30 students attended the course each year.
- Mentored IoT projects of capita selected distributed systems (B-KUL-H04G7A) course for three years (2013-2016) at KU Leuven, Belgium. Approximately 20 students attended the course each year.
- Responsible for lab sessions of computer architecture and software systems (B-KUL-H01P5A) course for two years (2014-2016) at KU Leuven, Belgium. Approximately 60 students attended the course each year.
- Taught embedded systems, real-time operating systems, and C programming courses to graduate students at DOEACC Centre, Calicut, India (2008).

Service

- **Publication Co-Chair**, 20th ACM/IEEE Conference on Information Processing in Sensor Networks (IPSN), 2021.

- **Poster Committee Co-Chair**, 18th ACM Conference on Embedded Networked Sensor Systems (SenSys 2020).
- **Technical Program Committee Co-Chair**, Second International Workshop on Blockchain-enabled Networked Sensor Systems (BlockSys), 2019.
- **Web Chair**, Second International Symposium on Foundations and Applications of Blockchain 2019 (FAB '19).
- **Publication Co-Chair**, CPS-IoT week conferences (IPSN, IoTDI, HSCC, ICCPS, and RTAS) and workshops, 2019.
- **Publication Co-Chair**, ACM Conference on Embedded Networked Sensor Systems (SenSys 2018), ACM International Conference on Systems for Built Environments (BuildSys 2018), and co-located workshops.
- Reviewed articles for ACM SigComm Computer Communication Review, IEEE Transactions on Services Computing, ACM Transactions on Sensor Networks, IEEE/ACM Transactions for Networking, IEEE Internet of Things Journal, IEEE Transactions on Engineering Management, Springer Financial Innovation, ACM Transactions on Spatial Algorithms and Systems, Second IEEE International Conference on Blockchain and Cryptocurrency (ICBC), Third IEEE Conference on Blockchain, Second International Workshop on Distributed Fog Services Design (DFSD 2019), International Workshop on Blockchain for the IoT (BIoT - 2018), and Blockchain-enabled Networked Sensor Systems (BlockSys 2018).
- Co-organized a Blockchain Hackathon at University of Southern California.

Invited Talks

- **Tutorial at World Forum on Internet of Things (WF-IoT) on the topic of Dispersed Computing and IoT Data Marketplaces using Jupiter and I3**, August, 2020.
- **Trinity: A Decentralized Solution for Blockchain-based Supply Chain Applications**, Guest Lecture for Supply Chain Finance (DSO 599) course at University of Southern California, Los Angeles, July, 2020.
- **Developing a Community-driven IoT Data Marketplace for Smart Cities: Is there a Role for Blockchain?**, Webinar organized by BV Raju Institute of Technology, Hyderabad, July, 2020.
- **Developing City-scale IoT Applications using Data Marketplace**, Webinar organized by SRM University, Chennai, May, 2020.
- **Introduction to IoT Network Protocols**, Guest Lecture for Distributed Systems for the Internet of Things (EE 250L) course at University of Southern California, Los Angeles, February, 2020.
- **Protocols and Frameworks for Data Sharing and Data Economy**, University of California, Santa Barbara, November, 2019.

- **Introduction to Distributed Pub-Sub and (De)centralized Data Marketplace**, Columbia University, New York, November, 2019.
- **Introduction to Blockchain Technology and Data Marketplaces**, San Diego Sheriff Department, August, 2019.
- **Decentralized Solutions for Blockchain-based Supply Chain Applications**, Guest Lecture at a course on Blockchain, IoT, and Supply Chain Applications at USC, June, 2019.
- **Wireless Networking for the Internet of Things**, University of California, Santa Barbara, May, 2019.
- **Designing Non-cryptocurrency Blockchain Applications : Technical Overview and Design Questions**, Webinar organized by Paramount Software Solutions, January, 2019.

References

- Prof. Dr. Bhaskar Krishnamachari, Mentor and Supervisor at the University of Southern California, USA. (bkrishna@usc.edu)
- Prof. Dr. Danny Hughes, PhD supervisor at KU Leuven, Belgium. (danny.hughes@cs.kuleuven.be)
- Dr. Sam Michiels, Co-supervisor at KU Leuven, Belgium. (sam.michiels@kuleuven.be)

Publications

2020   Balachandran, Chandrasekar et al. "EDISON: A Blockchain-based Secure and Auditable SDN Orchestration Framework for Multi-domain 5G Networks and Beyond". In: *3rd IEEE Conference on Blockchain*. IEEE Blockchain '20.

Gowri Sankar Ramachandran Jeremy Stout, Joyce Edson and Bhaskar Krishnamachari. "ParkingJSON: An Open Standard Format for Parking Data in Smart Cities". In: *Open Journal of Internet Of Things (OJIOT)* 6.1.

Kiamari, Mehrdad et al. "COVID-19 Risk Estimation Using a Time-Varying SIR-Model". In: *Proceedings of the 1st ACM SIGSPATIAL International Workshop on Modeling and Understanding the Spread of COVID-19*. COVID-19. Seattle, WA, USA: Association for Computing Machinery, 36âĂŞ42. ISBN: 9781450381680. DOI: 10.1145/3423459.3430759. URL: https://doi.org/10.1145/3423459.3430759.

Matos, Everton de et al. "Context information sharing for the Internet of Things: A survey". In: *Computer Networks* 166, p. 106988. ISSN: 1389-1286. DOI: https://doi.org/10.1016/j.comnet.2019.106988. URL: http://www.sciencedirect.com/science/article/pii/S1389128619310400.

Na, Yoonjong et al. "Enhancing the Reliability of IoT Data Marketplaces through Security Validation of IoT Devices". In: *Proceedings of the Second*

International Workshop on IoT Applications and Industry 4.0, Co-located with IEEE DCOSS-2020.

Ramachandran, Gowri Sankar and Bhaskar Krishnamachari. "Real-Time Internet of Things for Smart Environments". In: *Handbook of Real-Time Computing*. Ed. by Yu-Chu Tian and David Charles Levy. Singapore: Springer Singapore, pp. 1–25. ISBN: 978-981-4585-87-3. DOI: 10.1007/978-981-4585-87-3_47-1. URL: https://doi.org/10.1007/978-981-4585-87-3_47-1.

Ramachandran, Gowri Sankar et al. "WhistleBlower: Towards A Decentralized and Open Platform for Spotting Fake News". In: *3rd IEEE Conference on Blockchain*. IEEE Blockchain '20.

Zhao, Xiangchen et al. "Demo Abstract: The Intelligent IoT Integrator Data Marketplace – Version 1". In: *Proceedings of the 5th ACM/IEEE Conference on Internet of Things Design and Implementation (IoTDI)*.

2019   Bakir, Fatih, Ramachandran Gowri Sankar Wolski Rich, and Chandra Krintz. "Devices-as-Services: Rethinking Scalable Service Architectures for the Internet of Things". In: *Proceedings of the 2nd USENIX Workshop on Hot Topics in Edge Computing (HotEdge)*.

Callegaro, Davide et al. "Information Autonomy: Self-Adaptive Information Management for Edge-Assisted Autonomous UAV Systems". In: *Proceedings of the 2019 IEEE Military Communications Conference (MILCOM)*.

Constantinou, Giorgos et al. "A Crowd-Based Image Learning Framework Using Edge Computing for Smart City (**received Best Student Paper Award**)". In: *Fifth IEEE International Conference on Multimedia Big Data (BigMM)*.

Karyakulam Sajan, Kurian, Gowri Sankar Ramachandran, and Bhaskar Krishnamachari. "Enhancing Support for Machine Learning and Edge Computing on an IoT Data Marketplace". In: *1st Workshop on Challenges in Artificial Intelligence and Machine Learning for Internet of Things (AIChallengeIoT) in conjunction with 17th ACM Conference on Embedded Networked Sensor Systems (SenSys 2019)*. AIChallengeIoT '19.

Radhakrishnan, Rahul, Gowri Sankar Ramachandran, and Bhaskar Krishnamachari. "DEMO: SDPP: Streaming Data Payment Protocol for Data Economy". In: *Proceedings of the IEEE International Conference on Blockchain and Cryptocurrency (IEEE ICBC)*.

Ramachandran, Gowri Sankar, Sharon L.G Contreras, and Bhaskar Krishnamachari. "Publish-Pay-Subscribe Protocol for Payment-driven Edge Computing". In: *Proceedings of the 2nd USENIX Workshop on Hot Topics in Edge Computing (HotEdge)*.

Ramachandran, Gowri Sankar et al. "Demo: An Immersive Visualization of Micro-climatic Data using USC AiR". In: *Proceedings of the 17th ACM International Conference on Mobile Systems, Applications, and Services (MobiSys)*.

Ramachandran, Gowri Sankar et al. "Trinity: A Byzantine Fault-Tolerant Distributed Publish-Subscribe System with Immutable Blockchain-based Persistence". In: *Proceedings of the IEEE International Conference on Blockchain and Cryptocurrency (IEEE ICBC)*.

Ramachandran, Gowri Sankar et al. "Video: Micropayments for Trusted Vehicular Services using MOTIVE". In: *Proceedings of the 17th ACM International Conference on Mobile Systems, Applications, and Services (MobiSys)*.

Tran, Jason et al. "An Evaluation of Consensus Latency in Partitioning Networks". In: *Proceedings of the 2019 IEEE Military Communications Conference (MILCOM)*.

Tran, Jason A et al. "SwarmDAG: A Partition Tolerant Distributed Ledger Protocol for Swarm Robotics". In: *Ledger, [S.l.], apr. 2019. ISSN 2379-5980*.

Xu, Ronghua et al. "BlendSM-DDM: BLockchain-ENabled Secure Microservices for Decentralized Data Marketplaces". In: *2nd International Workshop on BLockchain Enabled Sustainable Smart Cities in conjunction with 5th IEEE Annual International Smart Cities Conference*. BLESS '19.

Yang, F. et al. "AsTAR: Sustainable Battery Free Energy Harvesting for Heterogenous Platforms and Dynamic Environments". In: *2019 International Conference on Embedded Wireless Systems and Networks (EWSN)*, pp. 63–70.

2018   Ammar, Mahmoud et al. "slimIoT: Scalable lightweight attestation protocol for the Internet of Things". In: *Proceedings of the IEEE Conference on Dependable and Secure Computing*. DSC '18.

Ramachandran, Gowri Sankar, Rahul Radhakrishnan, and Bhaskar Krishnamachari. "Towards a Decentralized Data Marketplace for Smart Cities". In: *1st International Workshop on BLockchain Enabled Sustainable Smart Cities in conjunction with 4th IEEE Annual International Smart Cities Conference*. BLESS '18.

Weyns, Danny, Gowri Sankar Ramachandran, and Ritesh Kumar Singh. "Self-Managing Internet of Things". In: *Proceedings of the 44th International Conference on Current Trends in Theory and Practice of Computer Science*. SOFSEM '18.

2017   Akkermans, Sven et al. "CerberOS: A Resource-Secure OS for Sharing IoT Devices". In: *Proceedings of the 2017 International Conference on Embedded Wireless Systems and Networks*. EWSN 2017. Uppsala, Sweden: Junction Publishing, pp. 96–107. ISBN: 978-0-9949886-1-4. URL: http://dl.acm.org/citation.cfm?id=3108009.3108023.

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Iftikhar, M. Usman et al. "DeltaIoT: A Self-adaptive Internet of Things Exemplar". In: *Proceedings of the 12th International Symposium on Software Engineering for Adaptive and Self-Managing Systems*. SEAMS '17. Buenos Aires, Argentina: IEEE Press, pp. 76–82. ISBN: 978-1-5386-1550-8. DOI: 10.1109/SEAMS.2017.21. URL: https://doi.org/10.1109/SEAMS.2017.21.

Lawrence, Piers W. et al. "Developing the IoT to Support the Health Sector: A Case Study from Kikwit, DR Congo (**received Best Paper Award**)". In: *Emerging Technologies for Developing Countries: First International EAI Conference, AFRICATEK 2017, Marrakech, Morocco, March 27-28, 2017 Proceedings*. Cham: Springer International Publishing, pp. 45–56. ISBN: 978-3-319-67837-5. DOI: 10.1007/978-3-319-67837-5_5. URL: https://doi.org/10.1007/978-3-319-67837-5_5.

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2016   Ramachandran, Gowri Sankar et al. "Building Dynamic and Dependable Component-Based Internet-of-Things Applications with Dawn (**received Best Paper Award**)". In: *2016 19th International ACM SIGSOFT Symposium on Component-Based Software Engineering (CBSE)*, pp. 97–106. DOI: 10.1109/CBSE.2016.18.

Ramachandran, Gowri Sankar et al. "Hitch Hiker 2.0: a binding model with flexible data aggregation for the Internet-of-Things". In: *Journal of Internet Services and Applications* 7.1, pp. 1–15. ISSN: 1869-0238. DOI: 10.1186/s13174-016-0047-7. URL: http://dx.doi.org/10.1186/s13174-016-0047-7.

2015   Ramachandran, G. S. et al. "Measuring and Modeling the Energy Cost of Reconfiguration in Sensor Networks". In: *IEEE Sensors Journal* 15.6, pp. 3381–3389. ISSN: 1530-437X. DOI: 10.1109/JSEN.2015.2388857.

Ramachandran, Gowri Sankar et al. "Dawn: Dependable Networking Framework for Multimedia-enabled Internet-of-Things". In: *Proceedings of the 13th International Conference on Advances in Mobile Computing and Multimedia*.

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Ramachandran, Gowri Sankar et al. "Hitch Hiker: A Remote Binding Model with Priority Based Data Aggregation for Wireless Sensor Networks". In: *Proceedings of the 18th International ACM SIGSOFT Symposium on Component-Based Software Engineering*. CBSE '15. Montreal, QC, Canada: ACM, pp. 43–48. ISBN: 978-1-4503-3471-6. DOI: 10.1145/2737166.2737179. URL: http://doi.acm.org/10.1145/2737166.2737179.

2013   Hughes, D. et al. "Energy aware software evolution for Wireless Sensor Networks". In: *World of Wireless, Mobile and Multimedia Networks (WoWMoM), 2013 IEEE 14th International Symposium and Workshops on a*, pp. 1–9. DOI: 10.1109/WoWMoM.2013.6583386.

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2012   Heuvel, M. M. H. P. van den et al. "Towards RTOS support for mixed time-triggered and event-triggered task sets". In: *Proceedings of 2012 IEEE 17th International Conference on Emerging Technologies Factory Automation (ETFA 2012)*, pp. 1–4. DOI: 10.1109/ETFA.2012.6489733.

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