Sandeep Kumar

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Education

- [2017 -] Doctor of Philosophy in Computer Science
  School of Information and Technology, Indian Institute of Technology, New Delhi, India
  Advisor: Prof. S. R. Sarangi
- [2011 - 2013] Master of Engineering in Computer Science, First Class
  Department of Computer Science and Automation, Indian Institute of Science, Bangalore, India
  Adviser: Prof. K. Gopinath
  Thesis: Modeling Storage Performance in a HPC System
- [2007 - 2011] Bachelor of Technology in Computer Science, First Division
  Guru Gobind Singh Indraprastha Univeristy, New Delhi, India

Research Interest

Security, Distributed and Parallel Systems, Operating Systems, Mobile Systems, IOT, Applied machine Learning.

Current Research Projects

- Optimizing performance of applications in NV-MM
  Modern servers are adopting the large size but high-latency persistent memory of NV-MM to accommodate applications with large memory footprint. However, the performance suffers as the operating system does not take into account the different characteristics of the DRAM and the NV-MM. We are working on improving the performance of such application via the kernel support.
- SecureFS: A Secure File System for Intel SGX
  In this project, we are exploring an efficient and secure file system support for applications running in a secure enclave provided by Intel SGX, which does not support system calls and consequently, the file system in its current form.

  Advisor: Prof. Smruti R. Sarangi
- Security aspects of a Remote Operations System or ROS
  ROS is widely used in autonomous vehicles. In this project, we are exploring the current security challenges for a ROS based system and propose an efficient solution for it.

  Advisor: Prof. Smruti R. Sarangi
- Hardware assisted Control Flow Integrity
  We are looking at ways to ensure the control flow integrity of a binary. Several attacks are mounted on the execution of a binary, which violates confidentiality or integrity or both. A trusted execution environment, which guarantees a secure execution environment, has severe limitations in its current form. We are exploring ways to alleviate these problems.

  Advisor: Prof. Smruti R. Sarangi

Publications

- **Sandeep Kumar**, Diksha Moolchandani, Takatsugu Ono and Smruti Sarangi. F-LaaS: A Control-Flow-Attack Immune License-as-a-Service Model . In IEEE SCC, Milan, Italy, 2019.
  https://ieeexplore.ieee.org/document/8814192
- **Sandeep Kumar**, K. Gopinath, L. Rocchi, P. T. Sukumar, S. Kulkarni and J. Sampath, "Towards a portable human gait analysis & monitoring system," 2018 International Conference on Signals and Systems (ICSigSys), Bali, 2018, pp. 174-180.
  https://ieeexplore.ieee.org/document/8372660/
- **Sandeep Kumar**, S. Padakandla, C. L, P. Parihar, G. K and S. Bhatnagar, "Scalable Performance Tuning of Hadoop MapReduce: A Noisy Gradient Approach," 2017 IEEE 10th International Conference on Cloud Computing (CLOUD), Honolulu, CA, 2017, pp. 375-382.
  https://ieeexplore.ieee.org/document/8030611/
- **Sandeep Kumar**, "Performance modeling of a distributed file-system," 2019 arXiv.
  https://arxiv.org/abs/1908.10036

Work Experience

Jun 2020-	Intel ,Bangalore, India *Research Intern* I will be working with the latest persistent memory technology from Intel.
Sept 2014- July 2017	Indian Institute of Science, Bangalore, India *Research Associate* Worked on auto-tuning of Hadoop Map-reduce using Stochastic algorithms and Human gait analysis. Details in the publication section.
Jul 2013-Jun 2014	Dell R&D, Bangalore, India *Software Development Engineer* Responsible for BIOS configuration and system management tools, *DCC* (Dell Command Configure) and *OMCI* (Open Manage Client Instrumentation) respectively. DCC allows BIOS configuration from the Desktop (Windows and Linux) and OMCI allows remote management application programs to access information about the client computer.

Course Projects

- Toy C Compiler [2018]
  Implemented a Toy C Compiler using Flex Bison and LLVM as part of the Compiler Course Work. It contains LLVM IR code generation and implementation of some basic optimizations.
  Code: https://github.com/sandeep007734/Toy-C-Compiler-using-Flex-Bison-LLVM
- Distributed Computing. [2012]
  Wrote Distributed Programs to solve TSP (Travelling sales man problem), ABP (Alpha Beta pruning search) and MST (Minimum spanning tree) using *rpcgen* in C++ and showed a speed up of factor 9, 6 and 2.5 respectively when the number of servers went up from 1 to 6.
  Advisor: Prof. R.C. Hansdah
  Report: https://goo.gl/BnTpTF
- Communication Network. [2012]
  Studied the algorithm SOFA (Sleep optimal Fair attention), which aims the energy conservation in wireless devices by changing the scheduling policy by simulating it to see the performance.
  Advisor: Prof. Shalabh Bhatnagar
  Report: https://goo.gl/Lh5QQ9
- Game Theory. [2012]
  Studied existing scheme for handling Kidney Exchange Programs and proposed a new scheme **SPAR** for this.
  Advisor: Prof. Y. Narahari
  Report: https://goo.gl/3Mujoh
- Network and Distributed Systems Security. [2012]
  Design and implemented a Secure Email server, using *Diffie Hellman* key exchange algorithm for secure exchange of keys and *DES* algorithm for encrypting the messages using the keys exchanged earlier. *SHA-512* hashing algorithm was used to store password on server side.
  Advisor: Prof. R.C. Hansdah

Scholarships and Grants

2018	A grant to spend one month in Kyushu University Japan for research collaboration.
2017	Visvesvaraya PhD Scheme for Electronics & IT
2011	642 Rank in GATE (Graduate Aptitude Test in Engineering) Exam 2011 (Total Students: 136027)
2004	Scholarship for Scoring above than 80% in secondary school.

Training and Conferences

June, 2020	ISCA, Valencia, Spain (attended remotely due to Covid-19)
Dec, 2019	HiPC, Hyderbad, India
Jul, 2018	Indo-Japan collaboration, Fukuoka, Japan
Jul,2019	IEEE SCC, Milan, Italy
Dec, 2017	HiPC, Jaipur, Rajashtan, India
Jul, 2017	IEEE Cloud, Hawaii, USA
May-Jun 2012	Microsoft Summer School on Distributed Algorithms and System IISc

Selected Talks

- F-LaaS: Flexible licensing as a Service.
  Presented our work, "F-LaaS: A Control-Flow-Attack Immune License-as-a-Service Model", at IEEE SCC.

- SmartCFB: A smart control flow bending attack
  Presented our work on SmartCFB, along with a demo, to dignitaries from DRDO (Defense Research and Development Organization), India.

- CFI: Control flow integrity
  Presented our work on CFI of a binary, emphasizing the importance of maintaining control flow integrity to Japan's Senior Deputy Minister.

- Hadoop performance optimization
  Presented our work on Hadoop performance optimization at IEEE Cloud, Hawaii, USA.

- Using IMU sensors and Android for Human Gait Analysis
  Gave a talk on techniques used for doing Human Gait Analysis using IMU (Inertial Measurement Sensors) and Android smart phone along with some preliminary results at Robert Center for Cyber Physical System, IISc, Bangalore.
  Slides: https://goo.gl/x6XRWw

Teaching experience

- Advanced Distributed Systems [Spring 2020]
- Data structures [Fall 2019]
- Operating System [Spring 2019]
- Introduction to Computer Science [Fall 2018]
- Operating System [Spring 2018]
- Cryptography [Fall 2017]

Interests and Activities

- Reading books. A List of books read so far on Goodreads:https://goo.gl/bEjjJJ
- I occasionally go for Cycling and Trekking Trips. Strava Profile: https://goo.gl/F1ow46

References

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