

Sahil Suneja

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Expertise and Current Interests: Virtualization, Cloud Computing, Systems Security, Machine Learning

Education

- **University of Toronto, Canada** **2016**
Ph.D. Candidate in Computer Science CGPA: 3.9/4
Thesis: Developed out-of-band and non-intrusive monitoring solutions for virtual machines (VM) in cloud data centers.
- **Indian Institute of Technology (IIT), Kanpur, India** **2010**
B.Tech - M.Tech Dual Degree in Computer Science and Engineering CGPA: 10/10 (Master's), 9.4/10 (Bachelor's)
Thesis: Developed an application-adaptive pre-emptive prefetching scheme to speed up IO-intensive parallel applications.

Awards and Achievements

- **Patent Plateau Award** for multiple patent submissions by IBM (2018).
- **Open Source Recognition Award** for Agentless System Crawler project by IBM (2016).
- **Doctoral Completion Award** by Department of Computer Science, University of Toronto (2015).
- **Bell Graduate Scholarship** at University of Toronto by Bell Canada (2014).
- State-wide **Ontario Graduate Scholarship** twice by Ministry of Training, Colleges and Universities (2012 and 2015).
- **Wolfond Fellowship** based on academic merit by University of Toronto (2010).
- **General Proficiency Medal** based on academic performance in Computer Science Master's by IIT Kanpur (2010).
- **Certificate of Merit for Academic Excellence** thrice by IIT Kanpur (2005, 2006 and 2008).
- **Ram Rajendra Malhotra Memorial Scholarship** in recognition of academic performance by IIT Kanpur (2005-06).
- Invitation as **Prime Minister's Guest** amongst top 0.01% students country-wide in national high school exam (2002).

Work Experience

- **IBM Research T.J. Watson, NY, USA** **July 2016 onwards**
Research Staff Member, Cloud Monitoring and Analytics
 - Transformed the opensource Agentless System Crawler with a plugin-based extensibility model. The IBM Cloud private product uses the new crawler to gain operational visibility inside containers.
 - Enhanced IBM Vulnerability Advisor product with application-level package vulnerability detection capability, as well as support for Docker CIS compliance validation.
 - Performed market study about security vs. extensibility trade-offs of existing container monitoring tools.
 - Developed an OS-level container-based sandbox to run the Crawler data collection plugins in a 'safe mode', and tested its effectiveness in containing exploits across multiple dimensions.
 - Highlighted kernel-level ext4 filesystem bug vulnerability in Kata containers.
 - Implemented support for Golang applications over Nabla containers without requiring `fs/gs` register-based thread local storage— a requirement for seccomp profile for Nabla.
 - Enabled a 'pure' unikerel style-compliant static import of numpy into python applications for Nabla containers.
 - Compared filesystem handling trade-offs between Docker, Nabla, Firecracker, gVisor and Kata containers.
 - Explored applicability of Machine Learning towards detecting if a container created from an image can be `ssh`-ed into.
 - Submitted patents and published research papers in HotCloud'18, ICWS'18, HotCloud'17, ICDCS'17, Middleware'17.
- **IBM Research T.J. Watson, NY, USA** **Twice: May-Aug 2013 and June-Sept 2012**
Intern, Data Center Management and Analytics
 - Developed two out-of-band VM monitoring solutions using (i) VM introspection, and (ii) VM cloning & code-injection.
 - Developed a new technique to obtain live VM memory handle in KVM/QEMU.
 - Constructed a taxonomy to compare trade-offs between existing and proposed VM introspection methods.
 - Deployed the proposed VM introspection-based solution internally in IBM's research cloud.
 - Performed use-case studies for versatile applicability of the proposed VM cloning technique for application enhancements, debugging and optimization.
 - Extended IBM's Agentless Systems crawler opensource tool to enable live VM crawling.
 - Published patent and research papers in VEE'17, IBM Journal'16, VEE'15, HotCloud'15, and SIGMETRICS'14.

- **Microsoft Research, Bangalore, India**
Intern in Mobility, Networks and Systems Group

May-Aug 2011

- Developed signal-aware YouTube video players for Android and Windows Phones.
- Conceived and implemented an energy-sensitive scheduling algorithm, which uses recent-history based heuristics to schedule data downloads, without requiring cellular network assistance or server-side modifications.
- Performed extensive phone energy usage measurement experiments on Toronto suburban trains.
- Saved upto 22% radio energy during with my signal-aware video player.
- Published patent and research paper in CellNet'13.

- **Microsoft Research, Redmond, USA**
Intern, Networking Research Group

May-July 2008

- Implemented a Layered Service Provider in the Windows Networking Stack for intercepting and scheduling network connections on-the-fly over Wi-Fi, Bluetooth or DSL.
- Devised a uniform identity concept & a discovery protocol enabling peer identification & secure ad-hoc communication.
- Performed indoor experiments to measure throughput vs. distance characteristics with varying obstruction levels for Wi-Fi & Bluetooth.
- Demonstrated enhanced user experience (125s vs 170s transfer speed) and decreased load on the infrastructure (ad-hoc Bluetooth vs. DSL) for cloud services like Microsoft Live Mesh, with the resulting p2p connection manager.

Technical Skills

- *Programming Languages:* C, Python, Perl, Bash
- *Programming Frameworks:* Scikit-learn ML, OpenMP, MPI, CUDA, OpenCL, Matlab
- *Cloud & Virtualization Technology:* VMs (KVM/QEMU, Xen), Containers (Docker), Unikernels/LibOS (Nabla, Rumpun), Lightweight VMs (Kata, Firecracker)

Patents

- Method and Apparatus of Blackbox Containers. With H. Huang, B. Lum, R. Koller, M. Steinder. 2019 [to be filed]
- Safe shell container facilitating inspection of a virtual container. With C. Isci. 2018
- Secure system state extraction software extensibility via plugin sandboxing. With C. Isci, S. Nadgowda. 2018
- Peer-based optimal performance configuration recommendation. With S. Baset, B. Tak, C. Isci. 2017
- Always-on Monitoring in the Cloud. With C. Isci, V. Bala, T. Mummert. 2014.
- Signal-aware data transfer in cellular networks. With V. Navda, R. Ramjee, A. Balashankar (Microsoft Research). 2014.

Blogs

- Go over Nabla: App Safety meets Host Isolation <https://nabla-containers.github.io/2018/10/29/go/>
- The choices we make: Impact of using host filesystem interface for secure containers <https://nabla-containers.github.io/2018/11/28/fs/>
- Sidecar-container-based crawler plugin sandbox pages.github.ibm.com/unikernel/2017/09/25/plugin-sandbox.html
- Mini-posix: Microservices over ukvm <https://pages.github.ibm.com/unikernel/2017/02/21/miniposix.html>
- Containers vs. Unikernels <https://pages.github.ibm.com/unikernel/2016/11/15/background.html>

Research Publications

1. **S. Suneja** and C. Isci. Secure Extensibility for System State Extraction via Plugin Sandboxing. Under review in Usenix ATC 2019.
2. S. Nadgowda, **S. Suneja**, and C. Isci. RECap: Run-Escape Capsule for On-demand Managed Service Delivery in the Cloud. 10th USENIX Workshop on Hot Topics in Cloud Computing (HotCloud). 2018
3. B. Tak, H. Kim, **S. Suneja**, C. Isci, and P. Kudva. Security Analysis of Container Images using Cloud Analytics Framework. The 16th International Conference on Web Services (ICWS). 2018 [Best Paper]
4. **S. Suneja**, R. Koller, C. Isci, E. de Lara, A. Hashemi, A. Bhattacharyya, and C. Amza. Safe Inspection of Live Virtual Machines. 13th ACM SIGPLAN/SIGOPS International Conference on Virtual Execution Environments (VEE). 2017
5. S. Nadgowda, **S. Suneja**, and C. Isci. Paracloud: Bringing Application Insight into Cloud Operations. 9th USENIX Workshop on Hot Topics in Cloud Computing (HotCloud). 2017
6. S. Nadgowda, **S. Suneja**, N. Bila, and C. Isci. Voyager: Complete Container State Migration. The 37th IEEE International Conference on Distributed Computing Systems (ICDCS). 2017

7. S. Baset, **S. Suneja**, N. Bila, O. Tuncer, and C. Isci. Usable Declarative Configuration Specification and Validation for Applications, Systems, and Cloud. Proceedings of the 18th International Middleware Conference (Middleware). 2017
8. F. A. Oliveira, **S. Suneja**, S. Nadgowda, P. Nagpurkar, and C. Isci. OpVis: Extensible, Cross-platform Operational Visibility and Analytics for Cloud. Proceedings of the 18th International Middleware Conference (Middleware). 2017
9. S. Nadgowda, **S. Suneja** and A. Kanso. Comparing Scaling Methods for Linux Containers. The IEEE Third International Workshop on Container Technologies and Container Clouds (WoC). 2017
10. **S. Suneja**, C. Isci, R. Koller, and E. de Lara. Touchless and Always-on Cloud Analytics as a Service. IBM Journal of Research and Development, Volume 60. 2016.
11. R. Koller, C. Isci, **S. Suneja**, and E. de Lara. Unified monitoring and analytics in the cloud. Proceedings of the 7th USENIX Workshop on Hot Topics in Cloud Computing (HotCloud). Santa Clara, CA, USA. 2015.
12. **S. Suneja**, C. Isci, E. de Lara and V. Bala. Exploring VM Introspection: Techniques and Trade-offs. 11th ACM SIGPLAN/SIGOPS International Conference on Virtual Execution Environments (VEE). Istanbul, Turkey. 2015.
13. P. Colp, J. Zhang, J. Gleeson, **S. Suneja**, E. de Lara, H. Raj, S. Saroiu and A. Wolman. Protecting Data on Smartphones and Tablets from Memory Attacks. Proceedings of the 20th International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS). Istanbul, Turkey. 2015.
14. **S. Suneja**, C. Isci, V. Bala, E. de Lara and T. Mummert. Non-intrusive, Out-of-band and Out-of-the-box Systems Monitoring in the Cloud. Proceedings of the ACM International Conference on Measurement and Modeling of Computer Systems (SIGMETRICS). Texas, USA. 2014.
15. J. Zhi, **S. Suneja**, E. de Lara. The Case for System Testing with Swift Hierarchical VM Fork. The 6th USENIX Workshop on Hot Topics in Cloud Computing (HotCloud), Philadelphia, PA, USA. 2014.
16. **S. Suneja**, V. Navda, R. Ramjee, E. de Lara. EnVi: Energy Efficient Video Player for Mobiles. The 2013 ACM Workshop on Cellular Networks: Operations, Challenges, and Future Design (CellNet). Taipei, Taiwan. 2013.
17. **S. Suneja**, E. Baron, E. de Lara, R. Johnson. Accelerating the Cloud with Heterogeneous Computing. 3rd USENIX Workshop on Hot Topics in Cloud Computing (HotCloud). Portland, USA. 2011.

Positions of Responsibility

- **Reviewer / Sub-reviewer** for papers in TPDS'17, ASPLOS'17, IWOC'17, ICS'16, MASCOTS'15, SpringerPlus'15, SIGMETRICS'13, ICS'13, SYSTOR'12.
- **Volunteer** for UBICOMP'14 Program Committee meeting, and as HotCloud'11 session summarizer.
- **System Administrator**: managed user accounts and backups for Systems and Networks Group at UofT. 2013-14
- **Tutor / Teaching Assistant** for courses related to C, Unix, Algorithms and Data Structures. 2009-15
- **Animation Club Coordinator**: presented lectures and workshops on modeling & animation with 3DS-MAX. 2007-08
- **Student Guide**: counseled students with academic and emotional matters; acted as link to Faculty Counselor. 2006-07