Shivanshu **Singh**

Final Year Undergraduate

Indian Institute of Technology Kanpur

(+91) 8004610134 | shivansh@iitk.ac.in | randombits.xyz | shivnshu | shivnshu

Education

Indian Institute of Technology Kanpur *Kanpur, India*

Bachelor of Technology, Major in Mechanical Engineering *2014-2018 (Expected)*

- Cumulative Performance Index / CGPA: 8.1/10

Work Experience

Auto Scaling of Microservices running on Docker Containers *Pune, India*

Software Intern, AutoDesk (Received Pre-Placement Offer) *May. 2017 - July. 2017*

- Worked on adding the auto-scaling functionality for containers of DC/OS cluster running microservices.
- Built a modular design with two components, one responsible for fetching and arranging metrices and, other for decision making and scaling.
- Used separate AWS lambda functions for components and AWS SNS service for communication between them.
- Maintained designed state variables of micro-services in Redis database and used AWS CloudWatch for periodic invocation of first component.
- Employed a machine learning technique (Stochastic Gradient Descent), in the second component, to make the calculated guess of amount of scaling (up/down) for each micro-service.

Projects

Secure Memory Deduplication and Covert Channel Construction in Linux Kernel *IIT Kanpur*

Course Project, Prof. Debadatta Mishra *Sep. 2017 - Nov. 2017*

- Studied the source code of KSM, a linux kernel(v4.14.4) thread responsible for implementing memory deduplication in linux operating systems.
- Constructed a covert channel for communication between two processes running on same physical machine, separated by VMs.
- Exploited the write-time differences between merged and unmerged pages, caused by COW(copy-on-write) on merged pages, for covert channel construction.
- Designed and developed a synchronized protocol for reliable communication between processes using two mutually known pages content.
- Simulated the information disclosure attack, caused by merging, to detect the content of javascript object typed array in web browser.
- Devised and developed two mitigation techniques, *stochastic false merging* and *stochastic false unmerging*, to introduce significant amount of noise in write time, thus making the covert channel unreliable.

Large Margin Multi-Modal RGBD Object Recognition *IIT Kanpur*

Course Project, Prof. Vinay Namboodiri *Sep. 2017 - Nov. 2017*

- Worked on improving the sematic information in feature vector representation and consequently classification accuracy of images by leveraging the additional depth channel along with color channels based on this paper.
- Developed a generic convolutional neural network (CNN) that takes two modals as input, processes them separately, correlate them using two correlation matrices and output their linear combination.
- Used a cost/loss function consisting of weighted loss in individual modal CNNs and designed loss incurred while calculating the correlational matrices.
- Employed an alternating approach for optimizing the weights assigned to individual modal in loss function and the correlational matrices.
- Demonstrated successfully the increased classification accuracy when compared to accuracies obtained by using only one modality or several modality but not correlating them.

Securing Zoobar Server *IIT Kanpur*

Course Project, Prof. Sandeep Shukla *Jan. 2017 - Apr. 2017*

- Simulated various exploitations in a web application called Zoobar, written in C and serving CGI scripts.
- Employed control hijacking techniques like buffer overflow, integer overflow and format string attacks to exploit the vulnerabilities.
- Performed various browser-based attacks like SQL injection, XSS, CSRF on Zoobar web application.
- Fixed security bugs in web server, implemented privilege separation and server-side sand-boxing.
- Demonstrated the limitations of various mitigation techniques like stack canaries, address space layout randomization (ASLR) etc.

Research Interests

Broadly Interested in Computer Systems, Cyber-Security and Networking

Hackathons

AMR (Advanced Motion Recognition) System

Winner, 24-hours hackathon, Microsoft's Code.Fun.Do *Apr. 2017*

- Designed and developed an android app to make the android device a 3D controller to control a uploaded CAD model.
- Used three.js to load and render the model on the browser exposing the APIs to control its orientation and location on the display.
- Established a real time and reliable communication between the android device and the web browser using websockets.

HashTag

Winner, 24-hours hackathon, Google Developer Group *Nov. 2016*

- Implemented a file management system on the android device using tags that has superior accessibility capabilities as opposed to conventional file management system.
- Used linked list semantic to manage the mapping between files/folders and tags, and stored them into the SQLite database.

Mini Projects

- Implemented various locking mechanisms like spin lock, semaphores, sequencial lock, RCU etc. in linux kernel and compared their efficiency empirically.
- Built chat room for processes, when in kernel mode, using a char device and employing the monolithic nature of linux kernel.
- Studied and presented various proof methods like coinduction, fusion etc. for corecursive programs of functional languages. ppt.
- Conceptualised and designed a responsive website for Cultural Council, IIT Kanpur using CodeIgniter MVC framework, jQuery etc.

Technical Skills

Programming	C, Java, Python, Haskell, bash scripting
Software and utilities	Linux shell utilities, Docker, Vim, Emacs, LaTeX, PyTorch, ROS
Operating Systems	Arch Linux (with i3wm and xmonad), Debian Linux (Ubuntu, Kali)

Relevant Courses

Computer Systems Security (A)	Computer Organization*	Introduction to Programming (A)
Linux Kernel Programming (A)	Principles of Programming Languages (A)	Modern Cryptography*

*A: Top Grade, * ongoing courses*

Miscellaneous

- Write blog about linux, books and programming in general at randombits.xyz.
- Volunteered in CSAW (Cyber Security Awareness Weekend) organised by NYU and IIT Kanpur.