Ayush **Bansal**

Founder, Hacker, Musician, Geek

Wired in · Bangalore, Karnataka · Kota, Rajasthan

(+91) 94625-45882 | ayushb268@gmail.com | ayushb.org | ayush268 | ayush268 | AyushBansal26

Education

Indian Institute of Technology Kanpur

Kanpur, India

Bachelor of Technology, Major in Computer Science and Engineering — *2016 - 2020*

- Cumulative Performance Index / CGPA: 9.0/10.0.

Work Experience

Research & Freelance: Venture Capital & Startups

Remote

Advisor & Consultant — *Jan 2023 - Present*

- Work as a **deeptech expert** for **evaluating potential deals** for institutional and micro VC funds.
- Advise young startups and various portfolio companies on **product planning, technical architecture and hiring**.
- In-depth **research on eBPF** along with **Prof. Tej Chajed** and **Prof. Michael Swift** from **University of Wisconsin-Madison**.

NimbleEdge

Bangalore, India

Co-Founder and Chief Technology Officer — *Mar 2021 - Feb 2024*

- **NimbleEdge is revolutionising the way world computes**, migrating compute from the cloud to the edge (or user) devices, i.e. capturing free real estate. We take care of complex things like the diversity of computing power, OS or communication mediums.
- Raised a **pre-seed round of $3.3 Million** from **Neotribe Ventures** (based out of Silicon Valley) & **Sistema Asia Capital** as institutional investors.
- **Built the entire Technology** (Systems, Development and DevOps), **Content, Marketing** and **Human Resources team** from scratch.
- Brought in **OYO, Dream11 & Glance (Inmobi) as clients** for the company, each having **scale of more than 100 Million Monthly Active Users**.
- Built the **NimbleNet (Peer-to-Peer communication SDK)**, our main product to be completely agnostic of any operating system & architecture.
- Built the entire Infrastructure for our **Aggregating Service** (Cloud Service) to be able to handle **scale of 100s of Millions of devices**.
- Completed the Paid Pilot with OYO via A/B testing over 100 Thousand devices with incredible results in CTR improvement & cloud cost reduction.
- Technologies focussed: C/C++, Golang, Scala, Distributed Edge Computing, Homomorphic Encryption, Peer-to-Peer Communication Protocols.
- Our clients are able to unlock the power of **Hyper-personalization - Billion models for Billion users** and access to untapped data with unlimited revenue potential. All this while **saving enormous cloud costs, improving performance and enhancing end user privacy**.

Tower Research Capital

Gurgaon, India

Low Latency Software Developer — *Aug 2020 - Mar 2021*

- Write efficient and maintainable automated software in C++ allowing us to ensure our correct position in the market.
- Develop cutting-edge software in C++ and Python which allow trading teams to run strategies smoothly.
- **Maintained the entire Trade Reconciliation System** along with a team of 2 people for all the markets that Tower Research Capital trades on.
- **Expanded the Tower's Trading & Reconciliation System** to allow trading **on Taiwan Futures & Crypto Exchanges like FTX, Huobi**.
- **Developed low latency Simulation Software** in C++ and Python running within containerized environment for **testing out trading strategies and platform**. Simulated the trading with custom exchanges developed in-house using historical market data.

InterviewVector

Gurgaon, India

Co-Founder and Chief Technology Officer — *June 2020 - Aug 2020*

- InterviewVector **created Interview as a Service (IaaS) category** helping companies in hiring for Technical roles across teams.
- We believe Engineers' precious time is better spent churning out the next big feature, not on taking interviews to weed out the unfit candidates.
- Signed **more than 10 clients** including emerging unicorns **like BharatPe & MindTickle in first 3 months**.
- **Bootstrapped** the business to an **ARR of $170,000 in just 4 months**.

Eightfold.ai

Noida, India

Software Developer Intern — *Apr 2020 - June 2020*

- Configured and deployed the **complete Alert Management System for the production & development environment**.
- **Re-designed the complete product model** to facilitate and **setup Behavior Driven Development style of testing** using Selenium Framework.
- Reduced the **time taken to run the complete test suite from 62 minutes to less than 10 minutes (84%)**.

Core Engineering, Tower Research Capital

Gurgaon, India

Software Developer Intern — *May 2019 - July 2019*

- Containerized and automated Trade Reconciliation setup to run as microservices on bare metal Kubernetes.
- Developed low latency software in C++ to facilitate integration and regression testing of Trade Reconciliation setup by inducing "deterministic mutations" on the network stream to simulate diverse un-reconciliation or trading-platform failure scenarios.
- Received a Pre-Placement Offer even though there was no vacant position, out of ~35 interns.

Google Summer of Code

OpenPrinting, The Linux Foundation — *May 2018 - August 2018*

- Worked on the Common Print Dialog Project, developing backend connecting and serving all available printers to the Common backend.
- The Dialog allowed access to the available printing queues such as "CUPS", "Google Cloud Print" and more via "Dbus" on the network/system.

New York Office, IIT Kanpur

Kanpur, India

Infrastructure Management & Full Stack Developer, Supervisor Prof. Manindra Agrawal — *May 2017 - Mar 2020*

- Worked on a scalable microservice based web application with an extensive technology stack.
- Developed and deployed the data sharing functionality (using Kafka, Redis, Scala and Go).
- Deployed microservices utilizing Docker, Coreos Container Linux, ConcourseCI, JenkinsCI, and have maintained the cluster on Kubernetes.
- Configured and deployed complete Persistent Volume Storage System, ConcourseCI and pipelines for diverse microservices.
- Developed and deployed LeaderBoard, an Automated Ranking and Scoring System using Ruby on Rails.
- Technologies used: Kubernetes, Docker, Kafka, JenkinsCI, Ruby on Rails, Nginx, Coreos Applications, Rook with Cephfs, Glusterfs.

Projects

Invoker: Towards policy-based eBPF Verification

University of Wisconsin-Madison

Under Prof. Tej Chajed and Prof. Michael Swift — *Sept 2023 - Present*

- Our first goal is to create a verified model of the Linux's eBPF verifier, as there doesn't exist one today and it is one of the core requirements.
- Making eBPF more programmable by making the verification policy based, thus yielding a much more secure and robust eBPF verifier.
- Github repository - ayush268/Invoker

EnvisEdge: Envision Edge on the Cloud

NimbleEdge Open Source — *July 2021 - July 2022*

- EnvisEdge allows users to simulate an edge computing environment to test their ideas and models before putting them in place on the edge.
- A user can setup an environment of their choice with any arbitrary hardware constraints such as RAM, CPU and more.
- Simulate devices on the scale of 100s of millions, testing algorithms & models on a large scale, something which only Big Techs could do.
- Focussed technologies and areas: Scala (with Akka), Golang, Python, Distributed Edge Computing, Federated Learning.

Typed PRNGs: Random Numbers with custom randomness

IIT Kanpur

Under Prof. Satyadev Nandakumar and Prof. Pramod Subramanyan — *Jan 2020 - June 2020*

- Random Data generation should consider that the user can request high-quality random data or a significant amount of pseudorandom data. In other words, a random number generator can produce data of varying levels of randomness according to the user's needs.
- Linux's getrandom() faces the problem of blocking when there isn't enough entropy available to produce high-quality random numbers.
- We tested the properties of injectivity over the mixing function (core of Linux PRNG) which takes entropy stores and bytes of data as input and mixes in output block/non-blocking pools, we got some interesting results in that.
- Published the report on Arxiv - Analysis of Linux-PRNG (Pseudo Random Number Generator)

Modern Cryptology: understanding, breaking and making Cryptographic Ciphers

IIT Kanpur

Under Prof. Manindra Agrawal — *Jan 2020 - Apr 2020*

- Developed multiple techniques for identifying & breaking commonly used ciphers like Substitution, Vigenere, Permutation-Substitution, etc.
- Developed technique and program for **breaking multi-round DES Cipher and AES Cipher**.
- Developed the program for identifying **RSA Encryption with small exponent** and breaking it using **Coppersmith's Attack**.
- Dove into depth of KECCAK hash function to identify vulnerability and breaking a weaker version of it.
- Github repository - ayush268/Crypto_Game

InHs: An interpreter in Haskell

IIT Kanpur

Under Prof. Satyadev Nandakumar — *Sept 2019 - Nov 2019*

- Developed an **interpreter from scratch in Haskell** interpreting a simple kernel language such as **Oz**.
- InHs supported all the basic features of a declarative sequential and concurrent language such as application of non-suspendable and suspendable statements, unification of variables and values, maintenance of a single assignment store and a semantic multi-stack.
- InHs also extends the functionality of basic kernel languages to include features such as Lazy and concurrent executions via trigger store and Non-determinism using Wait Statement, IsDetermined Statement and Message passing model via mutable store.
- Github repository - ayush268/InHs

Certification: Issuing tamper-proof certificates

IIT Kanpur

Under Prof. Sandeep Shukla — *Apr 2019*

- A **Blockchain based service issuing certificates** which once issued cannot be altered by anyone, accomplished by making the hash of the certificate as part of the public **Ethereum** blockchain rendering it easily accessible and verifiable by anyone in the world.
- The service **works on a multi-level hierarchical system** in which the instructor/manager can issue certificates for the students/employees and once issued, no one can alter them and anyone in the world can verify the certificates, thus having a wide array of applications.
- Focussed technologies and areas: Solidity, Ruby on Rails, Ethereum Blockchain, Security.
- Github repository - ayush268/certification

PyGo: A compiler for Golang in Python

IIT Kanpur

Under Prof. Amey Karkare — *Feb 2019 - Apr 2019*

- Developed a **compiler from scratch in Python** with **source language as Golang** and **target as x86_32**.
- PyGo supported all the basic features of Golang along with the advanced features such as optimizations, efficient register allocation, short circuiting, type checking and inference.
- Github repository - hritwik567/PyGo

pROP: Programmable Return Oriented Programming

IIT Kanpur

Undergraduate Project, Prof. Debadatta Mishra — *Jan 2019 - Apr 2019*

- Worked with **x86_64 binaries to invoke any particular syscall** by performing static analysis & using concepts of Return Oriented Programming.
- Developed a **tool (pROP) for building a ROP chain from ROP gadgets** to exploit the 64-bit binaries by invoking a particular syscall.
- Focussed technologies and areas: C/C++, Python, Systems Security - Overflows & Exploits, Computer Architecture, Operating Systems.
- Published the report on Arxiv - A practical analysis of ROP attacks

GemOS: Building a simple OS (in C) for 64-bit systems

IIT Kanpur

Under Prof. Debadatta Mishra — *July 2018 - Oct 2018*

- Developed the **paging structures** for an execution context as per 64-bit virtual address layout, completing the **virtual memory management**.
- Implemented the essential **system calls** like write, expand, sleep, clone, etc. and **exception handlers** like page fault, etc.
- Implemented and enabled the support for **lazy memory allocation** along with functionalities like **copy-on-write for memory pages**.
- Developed **Signal Handler** and implemented the common signals like SIGSEGV, SIGFPE, SIGALRM, along with a system timer (for alarms).
- Developed a **Round-Robin Scheduler** along with the functionality of setup and cleanup of stack while switching processes.

Rode0day: Integrating bug synthesis into a bug finding competition

IIT Kanpur

Under Prof. Brendan Dolan-Gavitt (NYU) and Prof. Subhajit Roy — *June 2018 - Dec 2018*

- Worked on a **Bug Injection Tool Apocalypse** used to inject bugs in C code which are difficult to locate by automated security verification tools.
- Implemented techniques for crashing the buggy C programs from Apocalypse and disguise the bugs rendering them hard to locate.
- Injected **bugs in grep code** based on the implemented techniques and **found 50% success rate** in bug finding competition Rode0day.
- Focussed technologies and areas: C/C++, Security, Formal Methods - Software Verification, Symbolic Execution and Fuzzing.
- Link to competition results - Rode0day-18.10

InVaSion: Input Validation with Symbolic Execution

IIT Kanpur

Research Project, Prof. Subhajit Roy *May 2018 - Nov 2018*

- Worked on **forking-based symbolic execution engines to tackle the problem of Path Explosion** with goal of increasing code and branch coverage for programs requiring formatted inputs such image readers or video players.
- Formulated a framework to represent the formatted input as a FSA, an input specification language (ISL) to be used by a software.
- Developed a **tool in Ruby to parse and compile the ISL, and appending this ISL to the input program**, generating a set of logical constraints on execution by symbolic execution engine, with the goal of guiding symbolic execution tool to produce better inputs.
- **Improved branch coverage by greater than 150%** on programs in Siemens Test Suite, MiBench and Tiff library which require formatted input.
- Focussed technologies and areas: C/C++, Ruby, Compilers, Formal Methods - Software Verification, Symbolic Execution and Fuzzing.
- Published the research paper on Arxiv - Input Validation with Symbolic Execution

Crypto: Capture the Flag Contest

IIT Kanpur

Programming Club *Oct 2018*

- **Organised and prepared problems** for the Capture the Flag Contest as part of the annual **Crypto Competition** for the entire campus.
- Topics Covered: Overflows, Formal Methods, Template Injections, SQL Injections, Networks, Cryptography.
- Github repository - pclubiitk/crypto-18

Linux From Scratch: Compiled Linux System from Source and Built a Package Manager

IIT Kanpur

Association of Computing Activities *Feb 2017 - Apr 2017*

- Created a **Customized Linux based operating system** by compiling all packages from scratch using the host machine's kernel.
- Built a **Package Manager in python** which fetched the dependencies of packages and created a dependency list based on packages installed.
- Blog post with details - ayushb.org/posts/linux-from-scratch/

Positions of Responsibility

Teaching Assistant Department of Computer Science and Engineering, IIT Kanpur *July 2019 - July 2020*

- **Tutored multiple groups of 40 students** in basics of C programming, for the course "Introduction to Programming".
- **Designed and graded assignments, quizzes and exams** for the course **of ~1000 students**.

System Administrator IIT Kanpur *Mar 2018 - July 2020*

- **Administered a cloud in IIT Kanpur**, deploying and managing services **for the campus community**.
- Maintained the **Arch Linux, Gentoo and other mirrors** hosted by IIT Kanpur for the rest of the world.

Coordinator Programming Club, IIT Kanpur *Mar 2018 - Feb 2019*

- **Organized, and set problems** for various **capture the flag** and **programming contests** on campus.
- Conducted lecture series and workshops on programming topics.
- **Organized the Summer Camp & the Winter Camp**, & **mentored over 50 students** in various topics who completed projects in distinct fields.
- **Mentored 12 students in building IoT applications** using Amazon Echo/Alexa and Google Home as a Semester Project.

Honors & Awards

2020	**Academic Excellence Award**, Exceptional Academic Performance, for 3 consecutive years.	*CSE, IITK*
2019	**Exceptional Course Tutor**, Academic Year 2019-2020, rated exceptionally good by the students.	*IITK*
2016	**All India Rank 187**, Joint Entrance Exam Advanced, 200,000 candidates	*India*
2016	**All India Rank 571**, Joint Entrance Exam Mains, 1.5 million candidates	*India*
2016	**All India Rank 52**, KVPY Scholarship, Indian Institute of Science and Government of India	*Bangalore, India*
2015	**Merit Certificate, National Top 1%**, Indian National Chemistry Olympiad	*India*
2015	**Merit Certificate, National Top 1%**, Indian National Astronomy Olympiad	*India*

Relevant Coursework

(A∗) Abstract Algebra	Discrete Mathematics	Theory of Computation
(A∗) Programming Tools and Techniques	Data Structures and Algorithms	Computer Organization
(A∗) Principles of Programming Languages	Algorithms II	Operating Systems
Computer Networks	Systems Security	Compiler Design
Probability and Statistics	Advanced Statistical Methods	Introduction to Machine Learning
Blockchain Technology & Application	Modern Cryptology	Designing Verifiably Secure Systems

A∗: Grade for Exceptional Performance

Skills

Languages C/C++, Python, Golang, Scala, Javascript/TypeScript, Haskell, Ruby, Java, Oz, Perl

Web Akka with Scala, Gin with Golang, Node.js, React, Flask, Ruby on Rails, Django

Utilities Linux shell utilities, Git, Docker, eBPF, Ansible, AWS, Azure, Kafka, Kubernetes, GDB, Postgres, MySQL, MongoDB, LaTeX, Jenkins, Vim

Miscellaneous

- Nerdy Hobbies: Exploring various Programming Languages and Tools, Participating in (and Organising) Capture the Flag contests.
- Open Source: Huge supporter & explorer of open source tools and am usually on the lookout for interesting projects to contribute to.
- Reading: I read a lot of books, both fiction and non-fiction. Books stores are one of my natural habitats.
- Musician: I can play 7 musical instruments, also perform in open mics, events and streets. Music always brings me calm.
- Painting: I specially do acrylic painting, mostly abstract about my thoughts and nature.
- Cooking & Baking: I have many signature recipes, one is my famous Cookies & Cream Cheesecake. Another activity which brings me calm.
- Exploration: Always on the lookout for new experiences in life - food, places, games, shows, anything.