

# Akash Trehan

**Github:** <https://github.com/CodeMaxx>

## Internships and Research Projects

- **Improving Fuzzing of Javascript Engines** (May '17 – Present)  
Guide: Prof. Giovanni Vigna and Prof. Christopher Kruegel University of California, Santa Barbara
  - Used instrumentation-guided genetic algorithms in fuzzers to trigger unexpected behaviour in JS Engines
  - Made modifications to American Fuzzy Lop which resulted in **faster block coverage**
  - **Found a bug in Apple Safari's javascript interpreter** - JavaScriptCore
  - Generated environments for automated running of experiments using **kubernetes** and **docker**
- **Isolated Network Infrastructure for Security Experiments** (Dec '16 – May '17)  
Guide: Prof. R.K. Shyamasundar IIT Bombay
  - Set up a network of VMs mimicking an infrastructure with a DNS, Mail, Proxy, Web and Time server
  - Used **vagrant combined with VirtualBox** to ease the process automatic generation of VMs
  - Implemented mini-projects using the infrastructure, to demonstrate **dictionary attacks, stack smashing and Man-in-the-Middle attacks**

## Open Source Contributions

- **OWASP ZeroDay Cyber Research Shellcoder** | Open Web Application Security Project
  - Implemented a new OSX x86 shellcode module using **assembly programming** for penetration testing on OSX. This module was successfully demoed at DEFCON 2016
  - Made various enhancements to the **python** code to improve the user experience
- **SymEngine** | Fastest symbolic manipulation library written in C++
  - Implemented a new Infinity class to handle calculations which could lead to infinitely large values
  - Added new functions for manipulations of symbolic polynomials and trigonometric functions

## Key Development Projects

- **Indexing Schemes for Data Recording Systems** | Guide: Prof. S. Sudarshan (Aug '17 – Nov'17)
  - Hacked **postgres internals** for implementing a new index to support large continuous stream of incoming data and store it in a manner suitable for future access
  - Implemented strategies for **incremental organization of B+ trees** in memory and on disk to support both insertion and queries with reasonable efficiency, and without the delays of periodic batch processing
  - Implemented the **stepped-merge algorithm paper** for merging B+ trees on disk to structure data for faster queries
- **SpamSlam - Spam prevention using Blockchain** | Hack InOut 4.0 Winner (Oct '17 – Oct '17)
  - Used **Gnosis' Ethereum-based APIs** to create mini prediction markets with two participants (email sender and receiver) and outcomes
  - Used Machine Learning techniques to create an approximate oracle for the prediction market
- **Smashing the Stack** | Guide: Prof. R.K. Shyamasundar (Apr '17 – May'17)
  - Demonstrated techniques like **ret2libc attack** and **NOP spray** for exploiting buffer overflows, bypassing Data Execution Prevention (DEP) and Address Space Layout Randomization (ASLR) mitigations
  - Demonstrated **format string exploits** to get arbitrary memory reads and writes

- **Run - Treasure Hunt** | *Yahoo! Japan HackU Winner - IIT Bombay* (Mar '17 – Apr '17)
  - Built a multiplayer treasure hunt Android game supported by a Django server. Players look for and click a picture of an object around them as shown in the clue received on their phones to get the next clue
  - Used histogram equalization and scale invariant feature transform (SIFT) for crude image matching
- **Real-time Chat Application** | *Guide: Prof. Varsha Apte* (Apr '17 – May '17)
  - Built a multithreaded chat server using **Linux socket programming** in C, with LDAP login support
  - Implemented secure salted password hashing with **Argon2i algorithm** for storing passwords in database
  - Built an Android and command line client application with features like friend requests, blocking, last seen and group chat
- **LendIt - Book lending website** | *Hack InOut 3.0 Finalist - NIT Surat* (Aug '16 – Aug'16)
  - Implemented a backend using Django for the Lendit website, which allows user interaction, sending notifications, searching and lending books, maintaining a user profile among other features
  - Got selected among the **top 5** (out of 50) development projects and went through to the final round

## Interests

Reverse Engineering, Software & System Security, Web Security, Network Security, Software Development

## Technical Achievements

- **1<sup>st</sup>** position in **InOut Hackathon Blockchain Track** 2017, Bangalore
- **1<sup>st</sup>** position in **Ubisoft GameJam** 2017, Pune
- **6<sup>th</sup>** position among 1028 teams worldwide in **Seccon CTF** 2017
- **Runner Up** in **Yahoo! Japan HackU** 2017, IIT Bombay
- **2nd Runner Up** in **Microsoft code.fun.do Hackathon** 2016, IIT Bombay
- **2nd Runner Up** in **Kandy Sugar Hackathon** 2016, IIT Bombay
- Audited and **found vulnerabilities** in IIT Bombay TA portal, WnCC internship portal

## Public Speaking and Blogging

- Gave talks on Introduction to cybersecurity, Social Engineering and Introduction to CTFs at IIT Bombay
- Took sessions on Sandbox breakout and Format-string attacks at UC Santa Barbara
- Write blog posts about computer security, programming and write-ups for CTF challenges
- Make youtube videos explaining and demoing various binary exploitation techniques

## Academic Achievements

- **Department Rank 2** in the Computer Science batch
- Secured **All India Rank 24** in **JEE Advanced** out of 150,000 students
- Received IIT Bombay's **Institute Academic Prize** 2015-16
- Awarded the **Kishore Vaigyanik Protsahan Yojana** (KVPY) Fellowship by Govt. of India

## Positions of Responsibility

- **Founder & Manager** | *CSE Cybersecurity Club - IIT Bombay* (Nov '16 – Present)
- **Web Convener** | *Student Technical Activities Body (STAB) - IIT Bombay* (May '16 – May '17)
- **Volunteer** | *Web and Coding Club - IIT Bombay* (May '16 – May '17)

## Programming Skills

C/C++, Python, Bash, x86 assembly, MIPS assembly, SQL, Java, Javascript, Django framework, HTML, CSS, jQuery, SQLite, Docker, kubernetes, Vagrant, OpenGL, L<sup>A</sup>T<sub>E</sub>X, Arduino, Make, MATLAB, Git