Mihirraj Dixit
Design, Build, Hack, Repeat

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INNOVATIONS

- **Patents**:

  - **Granted**: MN Dixit, SS Lamba, A Sharma, "Static and dynamic non-deterministic finite automata tree structure application apparatus and method" - [US Patent 11563625](#), 24th Jan, 2023

  - Multiple patent applications published for an original, and state-of-the-art horizontally scalable correlation and policy engine micro-service design which facilitates **closed loop automation** for telecom edge and 5G core components in a multi-cloud environment — [US20230059360A1](#), [US20230022787](#)

  - Patent application filed for data storage system with power saving operations for the 5G RAN closed-loop automation

- **Publications**:

  - S. Iyer, S. Thakur, **Mihirraj Dixit**, R. Katkam, A. Agrawal and F. Kazi, "Blockchain and Anomaly Detection based Monitoring System for Enforcing Wastewater Reuse," 2019 10th International Conference on Computing, Communication and Networking Technologies (ICCCNT), Kanpur, India, 2019, pp. 1-7, doi: [10.1109/ICCCNT45670.2019.8944586](#).

  - S. Iyer, S. Thakur, **Mihirraj Dixit**, A. Agrawal, R. Katkam and F. Kazi, "Blockchain based Distributed Consensus for Byzantine Fault Tolerance in PMU Network," 2019 10th International Conference on Computing, Communication and Networking Technologies (ICCCNT), Kanpur, India, 2019, pp. 1-7, doi: [10.1109/ICCCNT45670.2019.8944881](#).

  - Keni N., Suradkar N., **Dixit M**, Siddavatam I.A., Kazi F. (2019) A Computational Intelligence Approach for Cancer Detection Using Artificial Immune System. In: Verma N., Ghosh A. (eds) Computational Intelligence: Theories, Applications and Future Directions Vol I. Advances in Intelligent Systems & Computing, vol 798. Springer, Singapore, doi: [10.1007/978-981-13-1132-1_36](#)

RESEARCH EXPERIENCE

- **Wireless Communication & Navigation(WiCoN) Team**   RPTU, Kaiserslautern
  Research Assistant - Chair of Prof. Dr.-Ing. Hans D. Schotten   *Feb 2023 - ongoing*
  Key Projects:

  - **6G-ANNA(Access, Network of Networks, Automation & Simplification)**:   *Feb 2023 - ongoing*

    * Project concept: To develop a holistic design for the sixth generation of mobile communications that includes a closed end-to-end architecture, network inter-connectivity with focus on security and resilience.

    * My tasks in present phase typically include designing authentication and encryption mechanisms on physical layer to minimize the current overhead and offer superior alternatives to existing 5G schemes.

- **Smart Service Engineering Team**   DFKI & UdS, Saarbrücken
  Research Assistant - Chair of Prof. Dr. Wolfgang Maaß   *May 2022 - Dec 2022*
  Key Projects:

  - **INTE:GRATE**:   *May 2022 - Dec 2022*

    * Project concept: Researching the mobility data space in Saarland in order to realise the intelligent and sustainable concept of MaaS for the region.

    * My tasks typically included literature review for the system architecture, problem identification and business models, finding use-cases for analysis of mobility data.

- **Centre of Excellence (CoE) in Complex Nonlinear Dynamical Systems(CNDS)**   VJTI, Mumbai
  Research Assistant under Guide: Prof. Faruk Kazi   *Apr 2017 - Jun 2019*
  Key Projects:

  - **Blockchain based monitoring system for enforcing wastewater reuse**:   *Jan 2019 - Jun 2019*

    * Designed and developed a token based system that incentivizes the amount of wastewater reused by industries.

    * Used Hyperledger Fabrics & Composer blockchain framework to store the data securely.

    * **TechStack:** Python - Flask (WSGI), scikit-learn; Hyperledger Fabric, VueJS Web Framework

  - **Blockchain in Smart Grid Infrastructure (Undergraduate Thesis Project)**:   *Jul 2018 - Jan 2019*

* Utilized the immutable ledger in blockchain technology for preventing tampering of data in Load Dispatch Centres.
* Developed a custom voting based consensus algorithm utilizing smart contracts to take correct decision in presence of malicious user in energy efficient systems in a decentralized fashion.
* **TechStack:** Ethereum, Docker, Apache Kafka, Javascript

○ **Ladder Logic Malware Detection using Vulnerability Scanning**: *Dec 2017 - Mar 2018*

* Analysed the Mitsubishi proprietary MELSEC Communication protocol using Deep Packet Inspection.
* Exploited the communication channel between Human Machine Interface(HMI) and Programmable Logic Controller(PLC) using python scripts and analysed system behaviour.
* Created an NodeJS based Intrusion Detection System which monitors the network in realtime, generates alerts and displays the statistical data. Also, developed fuzzer using ladder logic programming.
* **TechStack:** Python(Scapy), Ladder Logic Programming, NodeJS, HTML, CSS, BootStrap

○ **Securing IIoT infrastructure for resilient energy network**: *Jul 2017 - Nov 2017*

* Analysed Industrial Network Protocols/SCADA Protocols like Modbus, DNP3, Profinet, IEEE C37.118, etc.
* Developed custom python scripts to inject false data using Man in the Middle attack between the network.
* Implemented End to End encryption between the Phasor Measurement Unit (PMU) and Phasor Data Concentrator(PDC) to mitigate the vulnerabilities.
* **TechStack:** Python(Scapy, Socket Programming)

○ **Anomaly Detection using Artificial Immune System**: *Apr 2017 - Jun 2017*

* Created a Artificial Immune model using Iterative L2 optimization.
* This model can be further implemented for securing cyber-physical systems.
* **TechStack:** MATLAB, Python

PROFESSIONAL EXPERIENCE

- **Rakuten Mobile Inc (楽天モバイル株式会社) - (RCP Orchestration Team)** Tokyo, Japan
Strategic Planning *Oct 2019 - Oct 2021*
Designing and developing cloud-native applications to support production-grade systems, testing the integrity of the application, carrying out rigorous performance tests to assess the performance metrics and scalability of the application.
Key Projects:

○ **Correlation & Policy Engine (E2EO)**: *Dev Lead & NEDO Researcher, Jun 2020 - Oct 2021*

* Explored, implemented, bench-marked various data processing systems like Apache Spark, Kafka Streams, PNDA, etc.
* Designed and developed **fully cloud-native data stream processing solution from scratch** featuring complex event processing(CEP) and multi hierarchical close-loop feedback correlation which competes with existing bigdata CEP engines like Apache Flink and Siddhi.io.
* Designed and developed a custom data structure that supports permutation as well as ordered pattern matching with data aggregation for flat, topology-based, cross-domain, and multi-layered correlation.
* Utilized event bus system for data partitioning, in-memory database with fast caching along with efficient python, rust(WASM) libraries that compete with C, C++ to create a fault-tolerant, stateless and horizontally scalable system which enables **5k events/sec/core** with preliminary scale tests going to **110,000 events/sec**.
* Designed and latched policy templates onto FastApi ASGI based Policy Manager which stores policies that are utilized by various micro-services comprising of data collection, data analysis, decision & execution entities in the processing system.
* This solution along with hierarchical life-cycle manager enables close loop automation for various cloud-native 5G components to envision **full autonomous network** which can be further extended to non-telecom use cases.
* This production ready system is being utilized currently for 5G Network Slicing and Service Management for 5G vRan healing, scaling & close loop use-cases under NEDO Research Project, Japan.
* **TechStack:** Python - FastAPI(ASGI), orjson; Tech - Apache Kafka, Kubernetes, Redis, MongoDB

○ **Bare Metal as a Service (BMaaS)**: *Software Engineer, Apr 2020 - Jun 2020*

* Developed python and shell scripts for managing bare metal servers which involves provisioning, configuration, and life cycle management of hardware and software components on the server.
* Scripts involved automation of rule-based bare metal server detection, checking required hardware specifications before installing an operating system(OS), Kubernetes cluster, OS hardening.
* **TechStack:** Python - Redfish, Shell scripting, **Cloud Platform** - Kubernetes

- **Configuration Management as a Service(CMaaS) for 4G**:   *Software Engineer*, *Feb 2020 - Apr 2020*
  * Developed python scripts which fetch and correlate between the old configuration data from backed-up zadara object storage and the latest configuration data of the 4G network elements like HSS, HLR, MME, etc.
  * Differences between the configuration data were stored in database and notified to the user via email and user interface. This process was automated using time based scheduler in workflow engine.
  * **TechStack:** Airflow, Zadara, Python scripts

- **Internal Virtual Network Function Manager (IVNFM)**:   *Software Developer*, *Oct 2019 - Mar 2020*
  * Part of core dev team in developing IVNFM for 4G virtualized Radio Access Network(vRAN) that helped the company cutting down the cost of purchasing software from other companies.
  * Developed scripts for Workflow Engine(WFE) to perform lifecycle operations of Network Functions(NF) and Network Services(NS) like restart, reboot, etc. on Openstack VM Clusters. This helped in reducing time required for deploying the 4G vRAN applications from days to around **5 minutes**.
  * Devised and developed multi-tier system to offload the life-cycle manager(LCM) tasks to WFE thereby increasing the overall throughput and performance of the system.
  * Configured and deployed Keycloak as Identity and Access Management(IAM) solution to strengthen IVNFM.
  * Supported testing and production deployment for all components in IVNFM (LCM, WFE, Databases, Security.
  * **TechStack:** Python - Airflow(WFE), Flask(WSGI); **Cloud Platform** - Openstack

Internships

- *Summer Trainee*, PricewaterhouseCoopers (PWC), Mumbai, India   *May 2018 - Jul 2018*
  * Developed Retail Experience Android App for customer having features like quick registration, one tap login, easy checkout.
    TechStack: Xamarin, .Net Framework
  * Developed ticketing tool system that features CRUD operations, status tracking, customized tags.
    TechStack: .Net Framework, MSSQL DB, HTML, CSS, Bootstrap

- *Winter Intern*, Bharat Petroleum Corporation Limited, Mumbai, India   *Dec 2017 - Jan 2018*
  * Risk Assessment and Vulnerability Discovery of BPCL systems and applications.
  * Identified vulnerabilities in the network and explored SIEM (Security Information and Event Management) systems.

Education

- **Universität des Saarlandes**   Saarbrücken, Germany
  Master of Science in Cybersecurity, (Informatics Department) - Sem 4   *Oct 2021-ongoing*
  (Major Affiliations: CISPA, MPI-INF, MPI-SWS, DFKI)

- **Veermata Jijabai Technological Institute (VJTI)**   Mumbai, India
  Bachelor of Technology in Electronics and Telecommunication Engineering   *2015-2019*
  Position of Responsibility:
  - Mentor at VJTI IEEE Council 2017-2018, VJTI, Mumbai
  - Event Manager (Chess) at Enthusia 2016-2017, National Level Sports Festival, VJTI, Mumbai

- **PACE Science Junior College(HSC) - *Intermediate***   Mumbai, India
  Maharashtra State Board of Higher and Secondary Education — Percentage: 91.54%   *Passing: 2015*

- **Balmohan Vidyamandir(SSC) - *Matriculation***   Mumbai, India
  Maharashtra State Board of Higher and Secondary Education — Percentage: 91.27%   *Passing: 2013*

Key Courses Undertaken

Graduate Coursework:
- Security, System Security, Data Networks, Security Testing, Cryptography, Web Security, Digital Currencies & Smart Contracts, IT Forensics, Physical Layer Security, Clock Synchronization & Adversarial Fault Tolerance, Machine Learning Security

Undergraduate Coursework:
- Computer Programming Fundamentals, Data Structures, Telecom Network Management, Numerical Techniques, Statistical Theory, Signal Processing, Computer Communication Networks, Pattern Recognition, Mobile Communication, Embedded Systems

MOOC Courses:

- 5G Specialization, Hardware Security, Cloud Platform Fundamentals, Penetration Testing & Ethical Hacking, Machine Learning, Applied Cryptography, Automata Theory, Blockchain Specialization

SCHOLASTIC ACHIEVEMENTS

- **Hackathons**:
  - **Winner(1st)** amongst 200+ Teams in Global WRC Blockchain Hackathon by World Bank Group, 2019
  - **2nd Runner Up** amongst 300+ Teams in Siemens MakeIT Real Hackathon, 2018
  - **5th Appreciation Prize** of 200 Teams in 3rd Mitsubishi Electric Cup, National Level Automation Competition, 2018

- **Sports Activities**:
  - International FIDE Rated Chess Player with **Rating: 1713**: Won prizes in more than 100+ Tournaments
  - Achieved San QUE, Brown 3rdBelt through GO-JO-RYU of KARATE, from Fudoshin Martial Arts School, Mumbai.

- **Academic**:
  - Passed 日本語 NAT-5Q exam with first class grade, 2020 — Completed JLPT N3 Training, 2021
  - Secured **98.50 percentile** in Joint Entrance Examination Mains (B.Tech) '15 out of 1.4 million candidates conducted by CBSE under Ministry of Education
  - Qualified for Award for Scholarship for Higher Education (SHE) under Innovation in science pursuit for Inspired Research (INSPIRE), 2015
  - Awarded **Special Prize** in Maharashtra Talent Search Examination by Center for Talent Search and Excellence, 2011.
  - Awarded **Certificate of Merit** in Dr. Homi Bhabha Bal Vaidnyanik Competition conducted by Mumbai Teachers' Association held in 2009 & 2011.
  - Awarded **Grade A** in Elementary(2009) & Intermediate(2010) Grade Drawing Examination by Government of Maharashtra.
  - **Silver Medalist** in Maths Pradnya Examination conducted by Maharashtra Ganit Adhyapak Mandal held in 2007 & 2010.
  - Amongst **top 10 ranking** in Maharashtra State Scholarship conducted by Maharashtra State Board Pune held in 2007 & 2010

MISCELLANEOUS

- **FreeCodeCamp Front End Projects**:   *2017*
  - 400 hour program by Freecodecamp to test my understanding of front end framework
  - Projects included: Building a Quote Machine, Javascript Calculator, etc.
  - Tested front-end code in multiple browsers to ensure cross-browser compatibility.
- **Technorion Hexapod Galactic Trooper**:   *Sept 2016 - Nov 2016*
  - A mechanical bot specially built for carrying load on high inclination angles.
- **Haptic Robotic Arm**:   *Nov 2015*
  - Developed Robotic Arm using Haptic Technology

LANGUAGES

English(Native, C2) • Marathi(Native) • Hindi(Native) • Japanese (N4) • German(A1.1)