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ROSHAN LAL NEUPANE

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Qualifications Profile

Results-driven and skilled Cloud Computing and Cybersecurity research professional with strong background in researching and developing secure cloud-based infrastructure and applications. Possesses detailed knowledge of cloud infrastructure, security protocols at network and application level. Experienced in threat modeling, vulnerability operations/management, risk assessment, and reactive and proactive cyber defense methodologies using AI/ML models.

Technology exposure:

Environments:	Linux, Windows
Tools:	Java, C++, Python, JavaScript, TypeScript, Perl, HTML5, CSS, JSON, XML, Angular, React, Appian, MySQL, AWS, GCP, Github, NoSQL, SOAP, Hadoop, OpenFlow, Shell, LAMP Stack, SDN, REST API, Kubernetes, Docker, Kubeflow, TensorFlow, Jupyter, PyTorch, Kera, Ansible, Jenkins
Cloud Platforms:	Amazon Web Services, Microsoft Azure, Google Cloud Platforms

Educational Background

- **PhD Student in Computer Science (2021 - Current),** University of Missouri, Columbia, MO
- **Master of Science in Computer Science (2015 – 2017),** University of Missouri, Columbia, MO
- **Bachelor of Engineering in Computer Science and Engineering (2010 to 2014),** Visvesvaraya Technological University, Karnataka, India

Experience Highlights

University of Missouri, Columbia, MO (12/2023 – Current)
Cyberinfrastructure Engineer

Technologies: Java, js, Python, Bash, Angular, Express, Springboot, OpenFlow, SDN, AWS, REST, MySQL, Hyperledger, Github, Kubernetes, Docker, Kubeflow, TensorFlow, Jupyter, PyTorch, Kera, Ansible, KubeEdge, Prometheus/Grafana Stack

Notable works include: ....

University of Missouri, Columbia, MO (1/2021 – 12/2023)
Graduate Research Assistant

Technologies: Java, js, Python, Bash, Angular, Express, Springboot, OpenFlow, SDN, AWS, REST, MySQL, Hyperledger, Github, Kubernetes, Docker, Kubeflow, TensorFlow, Jupyter, PyTorch, Kera, Ansible, KubeEdge, Prometheus/Grafana Stack

Notable works include:

- Research in active defense reference architecture that leverages decoy systems to deceive attackers based on the observability of attack with optimized strategy selection based on cost and risk of varying decoy systems provisioned in Enterprise IoT network. Attack detection using Binary Neural Networks (NN) for classifying benign and attack traffic. Multilayered NN for further classifying attacks into specific categories including some of the modern attacks such as Ransomware, Zero-Click. Use of intelligent agents for optimization of attack risk and deployment costs for varying decoy environments

- Performed rigorous research and data analysis to prepare a survey paper (targeting ACM Computing Surveys) that show cases use of AI-driven Intelligent Agents for Active Cyber Defense methods. Explored benefits of adversarial thinking, game theory and defense by pretense ideas for successful cyber defense. Also explored Cyber Threat Intelligence sharing and benefits of collaborative defense against modern attacks

- Research and development of an Insurance Claims Processing application for replacing traditional database architecture, used by National Insurance Crime Bureau (NICB), with Blockchain. Added security in terms of fraud detection using classification

models, etc., security principles in hardening application security against integrity attacks at Infrastructure and Application-levels

- Research and development of a Cyber Threat Intelligence sharing consortium Blockchain called DefenseChain that uses reputation-based detection and mitigation service providers for collaborative defense against cyber threats of varying scale. Use of different machine learning models for detection and active defense methods for defense

- Research and development of a Smart Grid Blockchain (SGChain) architecture for preventing smart grids against loss of availability attacks. Use of Integer Level programming for grid balance maintenance via chaincodes in Hyperledger

- Research and development of Network-based active defense architecture for cloud-based healthcare data processing pipelines via use of Dolus system for traffic quarantine

- Development and maintenance of LMS systems viz., Mizzou Cloud DevOps and Mizzou Cyber Range for teaching Cloud DevOps concepts and Cybersecurity based on Dolus (MS thesis work)

Infosys Limited (12/2019 - 01/2021)
Senior Associate Consultant – Software Developer

Technologies: Java, Appian, BPM, Web services, REST, AD, LDAP

Worked as a Senior Associate Consultant with Infosys using Appian platform to develop applications enhancing user experience and utilizing Business Process Modelling in finance domain. Responsibilities include:

- Security operations for enabling organization wide SSO engaging LDAP and AD integration
- Business process modelling with intuitive experience for customers
- Development of interfaces using SAIL framework
- Cross platform/device integration for telemetry with tools such as Datadog
- Requirement analysis, designing, coding, unit testing, bug fixing and system testing activities
- Utilized SLDC approach / Agile Scrum project methodologies

Innowave Technologies (08/2018 - 12/2019)
Software Engineer / Appian Developer (02/2019 - 12/2019)

Technologies: Appian, Java, React, Web services, Oracle DB, REST, SOAP, XML, Datadog

Worked as an Appian Developer / Software Developer for a telecommunication industry to develop applications enhancing user experience and to prepare business process models to adapt integration and orchestration.

- Developed and deployed custom plugins that include functions, smart services, Java modules, etc., in the Appian
- Business process modelling with intuitive experience for customers
- Developed interfaces using SAIL in Appian
- Developed communication with tools such as Datadog for data analytics
- Configured integration to external systems / APIs for data usage and manipulation to render them using ReactJS
- Used AWS EC2, S3, Lambda, Glue, Redshift etc., for tasks such as deploying servers, performing ETL and usage of EDW
- Implemented business logics and integrations for products following Agile methodology w/ Scrum
- Products: Online Account Management System, Online store, Order Fulfillment

Software Engineer (08/2018 - 02/2019)

Technologies: Java, Oracle DB, MongoDB, Perl, SOAP, REST, GIT, CVS, Shell, Typescript, Node.js

Worked as a computer programmer analyst for a telecommunication industry with wide range of technologies adapted to provide best IT solutions/maintenance. Some of the highlights:

- Developed programming modules in Java to maintain product updates
- Developed a toolkit that enables automated analysis and reconciliation between different network elements to perform cleanup activities against discrepancies
- Developed automation scripts for data validation and reconciliation process

- Developed Rest APIs, Soap web services
- Followed agile methodology – Kanban for project management
- Utilized relational and NoSQL databases such as Oracle DB, MySQL, MongoDB
- Provide technical support for triaging failures in system products

University of Missouri, Columbia, MO (1/2016 – 08/2018)
Graduate Research Assistant, 8/2016 – 12/2017 | **Staff Volunteer,** 12/2017 – 08/2018)

Technologies: Java, C/C++, C#, AWS, GENI cloud, Python, Shell, HTML, CSS, Angular, JSON, PHP, MySQL, TypeScript, JS

Conducted extensive research on cloud computing to ensure up-to-date knowledge and detailed understanding of cyber/cloud security, edge computing, and the IoT. Executed cybersecurity operations to ensure network security, mitigating attacks to prevent LOA, LOI, and LOC. Created solutions utilizing various algorithms through various programming languages, including Java, Python, C++, MATLAB, and R; utilized algorithms for machine learning implementation and data collection processes. Demonstrated expertise with cloud platforms such as AWS and GENI. Programmed SDN and OpenFlow controllers, Hadoop services, OpenStack, and more. Utilized Source Code Management solutions and version control such as Git.

- Developed a novel defense system called "Dolus" to mitigate impacts of targeted attacks such as DDoS, Advanced Persistent Threats (also Advanced Persistent Mining i.e., cryptojacking) against high value/critical services. The system uses ML techniques to detect attacks and apply 'pretense' in a scalable and collaborative manner to deter the attacker based on threat intelligence obtained from attack feature analysis
- Played a key role in the Moving Target Defense in Cloud Platforms project. Utilized GENI cloud to design network topologies and to create attacks on servers and mitigated the attacks to resume cloud services (NaaS). Utilized hping3 and SlowHTTPTest tools for attacks, to name a few. Used shell programming for automation and HTML5, CSS3, Javascript, PHP for web UI development
- Developed tools to enhance research that mostly involved executing C# programs for network systems. Utilized Visual Studio to write automation scripts for DDoS defense mechanisms
- Enabled Software Defined Networking and Software Defined Exchange through different python libraries, focusing on tools such as Frenetic (formerly Pyretic) and Scapy
- Built a full stack web application, Aureate Artifacts, utilizing Angular, HTML5, Java, Javascript, CSS3, PHP, AJAX, JSON, MySQL. Data movements from client to server and vice versa via JSON arrays
- Completed Customer Relation Prediction, a data mining project for upselling and appetency prediction for e-commerce sites for better customer relations. Utilized MATLAB to train and test large sets of data via SVM and Decision Trees
- Utilized Hadoop MapReduce for sorting, analysis of data for an example library and a research-related search engine

Coordinator, Research Experiences for Undergraduates, 5/2017 – 7/2017 and 5/2021 - 7/2021.

Directed REU and Summers@Mizzou "Hacker Tracker" programs, educating Undergraduate researchers and High schoolers. Provided guidance and mentorship for undergraduates regarding research work and issues. Served as a mentor on a two-month program. Directly managed research graduates in achieving research being published in top conferences. Undergraduates successfully published three papers in top conferences under my direct supervision.

Graduate Teaching Assistant, 1/2016 – 5/2017
Technologies: AWS, GENI, DeterLab, CloudLab, C/C++, C#

Utilized cloud computing and advanced algorithm design courses to assist students in completing coursework via AWS, GENI, Deterlab, CloudLab, C/C++ and C#. Established multiple personal clouds in OpenStack from scratch.

- Spearheaded Moving Target Defense, and Defense using Pretense (refer publication) lab assignments, designed to detect and mitigate attacks utilizing the idea of blacklisting/whitelisting, etc.
- Written and analyzed advanced algorithms for sorting, priority-based algorithms, and graph theory.
- Mentored students in understanding data structure fundamentals including stacks, queues, hash tables, binary trees

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CERTIFICATIONS

Appian, 2019**.** Certified Appian designer with ACAD Level 1 credential in Appian.

Sigma SMP training, 2018.

Microsoft Certified Professional (asp.net), 2014.

RELEVANT LINKS

LinkedIn: https://www.linkedin.com/in/roshanln/

Google Scholar: https://scholar.google.com/citations?user=m4GAAnUAAAAJ&hl=en&oi=ao

GitHub: https://github.com/rneupane93

ResearchGate: https://www.researchgate.net/profile/Roshan-Neupane

RESEARCH PUBLICATIONS

1. Mukherjee, B., **Neupane, R. L.**, & Calyam, P. (2017, June). End-to-end IoT security middleware for cloud-fog communication. In 2017 IEEE 4th International Conference on Cyber Security and Cloud Computing (CSCloud) (pp. 151-156). IEEE.
2. Mukherjee, B., Wang, S., Lu, W., **Neupane, R. L.**, Dunn, D., Ren, Y., ... & Calyam, P. (2018). Flexible IoT security middleware for end-to-end cloud–fog communication. Future Generation Computer Systems, 87, 688-703.
3. Debroy, S., Calyam, P., Nguyen, M., **Neupane, R. L.**, Mukherjee, B., Eeralla, A. K., & Salah, K. (2020). Frequency-minimal utility-maximal moving target defense against DDoS in SDN-based systems. IEEE Transactions on Network and Service Management, 17(2), 890-903.
4. **Neupane, R. L.**, Neely, T., Chettri, N., Vassell, M., Zhang, Y., Calyam, P., & Durairajan, R. (2018, January). Dolus: cyber defense using pretense against DDoS attacks in cloud platforms. In Proceedings of the 19th International Conference on Distributed Computing and Networking (pp. 1-10).
5. **Neupane, R. L.**, Neely, T., Calyam, P., Chettri, N., Vassell, M., & Durairajan, R. (2019). Intelligent defense using pretense against targeted attacks in cloud platforms. Future Generation Computer Systems, 93, 609-626.
6. Akashe, V., **Neupane, R. L.**, Alarcon, M. L., Wang, S., & Calyam, P. (2021, July). Network-based active defense for securing cloud-based healthcare data processing pipelines. In 2021 International Conference on Computer Communications and Networks (ICCCN) (pp. 1-9). IEEE.
7. **Neupane, R. L.**, Bhamidipati, N. R., Vakkavanthula, V., Stafford, G., Dahir, M., Bonnah, E., ... & Calyam, P. (2021, December). Claimchain: Secure blockchain platform for handling insurance claims processing. In 2021 IEEE International Conference on Blockchain (Blockchain) (pp. 55-64). IEEE.
8. Purohit, S., **Neupane, R. L.**, Bhamidipati, N. R., Vakkavanthula, V., Wang, S., Rockey, M., & Calyam, P. (2022). Cyber threat intelligence sharing for co-operative defense in multi-domain entities. IEEE Transactions on Dependable and Secure Computing.
9. Wang, S., **Neupane, R. L.**, Pandey, A., Cheng, X., & Calyam, P. (2021, December). Online Learning Platform for Application-Inspired Cloud and DevOps Curriculum. In 2021 IEEE 28th International Conference on High Performance Computing, Data and Analytics Workshop (HiPCW) (pp. 35-42). IEEE.
10. **Neupane, R. L.**, Zobrist, T., Neupane, K., Bedford, S., Prabhudev, S., Haughton, T., ... & Calyam, P. (2023, May). CICADA: Cloud-based Intelligent Classification and Active Defense Approach for IoT Security. In IEEE INFOCOM 2023-IEEE Conference on Computer Communications Workshops (INFOCOM WKSHPS) (pp. 1-6). IEEE.
11. **Neupane, R. L.**, Neupane, K, Esfahani, S. M. S.N., Pan, J., Calyam, P., "Intelligent Active Cyber Defense in Cloud and Edge-based Systems: A Survey". Under Review with ACM Computing Surveys.
12. **Neupane, R. L.**, Bhandari, P., Calyam, P., & Mitra, R. (2023, February). SGChain: Blockchain Platform for Availability Attack Mitigation in Smart Grid Environments. In *2023 International Conference on Computing, Networking and Communications (ICNC)* (pp. 324-330). IEEE.

13. **Neupane, R. L.,** Calyam, P., Wang, S., Neupane, K., Pandey, A., Cheng, X., Gafurov, D., Yeddulapalli, H. S., Glaser, N., Singh, K. P., Gu, Y., Li, S., Srinivas, S., "Online Self-Service Learning Platform for Application-Inspired Cloud DevOps Curriculum". Under Review with IEEE Transactions on Learning Technologies.

14. **Neupane, R. L.**, Bonnah, E., Bhusal, B., Neupane, K., Hoque, K. A., & Calyam, P. (2024). Formal Verification for Blockchain-based Insurance Claims Processing. arXiv preprint arXiv:2402.13169.

15. Neupane, K., Yeddulapalli, H. S., Kambhampati, A., Cheng, X., **Neupane, R. L.**, Kung, E. L., ... & Calyam, P. (2023, December). Automation of News Content Curation and Storytelling for Local Newsrooms. In 2023 IEEE International Conference on High Performance Computing & Communications, Data Science & Systems, Smart City & Dependability in Sensor, Cloud & Big Data Systems & Application (HPCC/DSS/SmartCity/DependSys) (pp. 1051-1060). IEEE.

16. Calyam, P., Kejriwal, M., Rao, P., Cheng, J., Wang, W., Bai, L., ... **Neupane, R. L.**, ... & Taneja, H. (2023, September). Towards a Domain-Agnostic Knowledge Graph-as-a-Service Infrastructure for Active Cyber Defense with Intelligent Agents. In 2023 IEEE Applied Imagery Pattern Recognition Workshop (AIPR) (pp. 1-8). IEEE.