Sareena K P

PhD Student, IIT Madras
Phone: +91 9445329960
email: sareena@cse.iitm.ac.in, sareena.kp@gmail.com

1. Research Interests

Network Security, Distributed Denial-of-Service Attacks, Malware Analysis and Research,

2. Qualifications Overview

- Pursuing Direct PhD in Computer Science and Engineering from Indian Institute of Technology Madras, Chennai, since Jan 2015. The area of research is Network Security and Future Internet Architectures
- 10 years of industry experience in embedded products and system software (firmware and drivers) development
- 3rd rank in B.E. Computer Science and Engineering, Bangalore University, 2004
- Qualified GATE 2014 Computer Science, Gate score: 573, AIR: 2336, Percentile: 98.49
- Core expertise include ARM, 8051, Linux, RTOS platforms, and windows driver development with smart card technology specialization
- Experience in various phases of product development cycle, including requirement specification, design, development, testing, and maintenance
- Expertise in Near field communication (NFC), contactless and contact smart card technology
- Experience in guiding and mentoring freshers and junior team members
- Filed an invention disclosure in HP
- Good experience in working with cross-functional teams (hardware, software, testing, and sales)
- Excellent team player with good interpersonal and communication skills

3. Research Experience

My research interest is in the area of *Network Security*. I am currently working on novel DDoS mitigation strategies, traceback of DDoS attackers, encrypted and unencrypted traffic analysis for malware detection, and cyber security in Industrial Control Systems.

Ongoing Projects

- **Sundew:** Cross-Dimensional Analysis of Malware Behavior, and framework for malware detection.
- Identifying Early Indicators of a Malware Infection
- **Net-Police:** A solution for early mitigation of DDoS Attacks.
- **Jugaad**: A Low-Cost Real-World Testbed for Network Security Oriented Experiments

List of Publications

- *Net-Police: A Network Patrolling Service for Effective Mitigation of Volumetric DDoS Attacks,* Sareena Karapoola, Prasanna Karthik Vairam, Shankar Raman, Kamakoti Veezhinathan, Elsevier Computer Communications, 2020.

- *Towards Identifying Early Indicators of a Malware Compromise*, Sareena K.P, Unnati Parekh, Chester Rebeiro and Kamakoti V., Accepted for publication at 14th ACM Asia Conference on Computer and Communications Security (ASIACCS) 2019.
- *Early Malware Detection using Network Traffic Analysis*, Sareena K.P, Unnati Parekh, Chester Rebeiro and Kamakoti V., at 8Th International Conference on Security Privacy, and Applied Cryptography Engineering (SPACE) 2018.
- *A Secure Framework for Quick and Effective DDoS Mitigation*, Sareena K.P. and Kamakoti V., at PhD Conclave, Asia Security and Privacy Conference, 2017, held at NIT Surat, 29 Jan-1 Feb, 2017.
- *Eradicator: An Integrated Approach for Defense against Cyber Attacks in PLC based Industrial Control Systems*, at Embedded Security Challenge, Cyber Security Awareness Week, 2017, held at IIT Kanpur, 9-11 Nov, 2017. Member of the team that won the First place in the Embedded Security Challenge.

4. Industry Experience (2004-2015)

- Research Associate [Jun'14 to Dec'14] in Network Systems Laboratory, Department of Computer Science, **IIT Madras**.

- 8 years in **Identiv Private Limited (**Formerly known as Identive Technologies (India) Pvt. Ltd. and SCM Microsystems Pvt. Ltd.) [Jan '06 – Jan'14].

  Last held position: *Project Lead- Software*.

- 1.5 years, in **Hewlett Packard,** System Technology Software Division, Bangalore [Aug '04 – Jan '06].
  Position held: *Software Developer*

5. Academic Details

Degree	University/Board	Year	Marks scored (%)	Remarks
MS + PhD	Indian Institute of Technology (IIT), Madras	Ongoing (Since Jan 2015)	CGPA 9.22	Completed the prescribed course work.
BE (Computer Science & Engineering)	Visvesvaraya College of Engineering, Bangalore University, Bangalore	2000-2004	84.56	3rd rank
XII Std CBSE(AISSCE)	National Public School, Bangalore	1998-2000	87.8	Distinction
X Std CBSE(AISSE)	Kendriya Vidyalaya N.A.L, Bangalore	1996-1998	92.8	6th at the national level; 2nd at the regional level; School topper
GATE		2014	Score: 573	Percentile: 98.49 AIR: 2336

6. Technical Expertise

Have extensive experience and thorough knowledge in the following technology domains, tools, and operating systems.

Firmware development

- Router and switch development on QorIQ multi-core communication processors.
- Microcontrollers – ARM Cortex M3 (STM32F family), ARM9 (Atmel), and 8051 (STC2 and STC3)
- Contactless ASICs : PN533, PN512, CLRC663,CLRC632, and MFRC531
- RTOS firmware (Free RTOS) and firmware with Linux OS
- Interfaces and peripherals: SPI, USB, USART, RS485, Keypad, and LCD
- Compilers: Rowley CrossWorks (ARM Cortex M3), Keil, and Atmel AVR compiler

Windows driver development

- Windows Driver Kit (WDK), Kernel and user mode framework (KMDF and UMDF)
- Windows Driver Model (WDM) and Windows Internals
- Tools: Windbg for debugging, troubleshooting, and Hardware Certification Kits (HCK)

Technologies

- Network router/switch development on Freescale QorIQ multi-core communication processors.
- Contactless smart card technology (Proximity - ISO 14443, Vicinity - ISO 15693, low-frequency cards) and Near Field Communication (NFC).
- Contact smart card communication (ISO 7816)
- Physical access control terminals
- Specification for smart card Interface (PCSC, CCID)
- SCSI-3 and FC protocols for storage devices
- Interfaces: USB, USART, and SPI

Languages and operating system

- Build System: Yocto
- RTOS: FreeRTOS
- OS: Windows (Intel x86, IA64, and AMD64 architectures), and Linux
- Languages: C, C++, and Java

7. Project Experience

Indigenous Router/Switch Development

As a part of *'Make in India'* program, the research project at IIT Madras was initiated to build an indigenous low-cost router and switch box using the Freescale QorIQ multi-core communication processors. I have worked on the design and implementation of the router/switch functionalities on the Freescale box.

Firmware with real time OS (FreeRTOS)

For future scalability and performance improvement of the Identive products, initiated and worked independently on a research project on the feasibility and porting of USB smart card reader functional firmware onto FreeRTOS.

- *Responsibilities*: To develop a RTOS software development kit for future product development with support for maximum concurrency among all possible modules; documentation and training.
- *Hardware*: STM32F103RET6TR (ARM Cortex M3 core), contact module, contactless (CLRC663) module, multiple USB interfaces, 3 serial ports.
- Designed the contact and contactless card communication to be asynchronous, resulting in maximum concurrency, among the two modules.
- Achieved concurrent transaction in the multiple USB endpoints.

- Designed the USART module to allow multiple USART reception concurrently.
- Based on the outcome, the management decided to move all upcoming products to RTOS platform and received appreciation from the CTO for this.
- Used the Tracalyzer (FreeRTOS+Trace) for debugging.

Desktop USB smart card contact and contactless readers

Worked on multiple smart card reader development projects (both contact and contactless readers).

- *Responsibilities*: Development of firmware, driver, testing tools/utilities, documentation.
- *Hardware*: Worked on USB readers with the following hardware.
    - SCM STC2 and STC3 microcontroller: 8051 core, USB, and contact smart card interface with contactless ASIC (MFRC531, PN512)
    - STM32F103xx family of microcontrollers: ARM Cortex M3 core (STM32F103RET6TR), contactless ASIC (CLRC632)
    - Atmel microcontroller with PN512 and CLRC632 for contactless
- Worked on the following modules:
    - Hardware abstraction layer in the firmware for contactless NXP ASICS: PN512, PN533, CLRC663, CLRC632, and MFRC531
    - Contact smart card module
    - Contactless technologies and cards: ISO 14443, Mifare, Infineon, ST, G&D, ISO 15693, and NFC
    - USB Enumeration
    - Windows drivers for the readers

Physical access control terminals

This project involved the development of different types of contactless physical access control terminals for the American market. The cards supported are high frequency (13.56 MHz), Low Frequency (125 KHz), iClass cards.

- *Role*: Developer and Project Lead for software team
- *Responsibilities:* Firmware development; leading the team members; project documentation.
- *Hardware*: STM32F103xx family of microcontrollers (ARM Cortex M3), contactless (CLRC632, CLRC663), USB, USART, RS485 interface, wiegand interface to the control panel, and low frequency technology module.

German eHealth application project

This project involved the development of eHealth application firmware for a mobile hand-held, battery operated device (with two smart card slots) for the German e-healthcare market. Functionalities include secure access and storage of the patients' data.

- *Hardware:* 2 smart card slots, LCD, Keypad, memory, ARM9 microcontroller, USB.
- *Responsibility:* Project lead and developer, firmware development, documentation, overview of testing and certification process.
- Received accolades for successfully completing the stringent certification procedure of the Govt. of Germany.

German eHealth terminal project

This project involved the development of standalone smart card terminal for the German Govt. e-health card program, which is one of the largest electronic healthcare projects in the world.

- *Hardware*: Atmel ARM9 AT91RM9200, USB, and Ethernet module, LCD, Keypad, Smart card module

- Linux OS firmware
- *Responsibility*: Application firmware development.

Driver development
Worked on Windows (all versions up to Windows 8) and Linux driver development for smart card readers (Identive).

Windows drivers for HP Smart Array controllers
Worked on the drivers for HP Smart Array Controllers and Fiber Channel (FC) Array Controllers on HP Proliant Servers

- Development, maintenance, and enhancement of drivers (Intel x86, IA64 and AMD64)

Maintenance of Instant Top Tools and Net Server Agents
Top tools are free web based tool to enable remote management of HP devices using a web browser. Net Server agents provide management information to the top tools.

Karnataka e-Governance project on Proliant Essentials
This was a field engagement activity for the Karnataka e-Governance Customer. The requirement was to develop a scripting tool kit to support the following features on remote Proliant Servers (having the Integrated Lights Out remote management card) from a central server, using the Proliant Essentials.

- Power Management (Switch on/off/reset/restart)
- Pre Boot Operations (OS Installation, read/write remote BIOS settings)
- Post Boot Operations (Executing Software Installation, Copying Files, read/write registry settings)

8.

9. Awards and Recognitions

- Star TA Award from Department of CSE, IIT Madras for contributions as a Teaching Assistant.
- Embedded Security Challenge 2017 Winner, First prize at Embedded Security Challenge, Cyber Security Awareness Week, organized by IIT Kanpur, for presenting '*Eradicator: An Integrated Approach for Defense against Cyber Attacks in PLC based Industrial Control Systems*'.
- Embedded Security Challenge 2019 Winner, First prize at Embedded Security Challenge, Cyber Security Awareness Week, organized by IIT Kanpur, for presenting '*Cracking Open the Safe: Subverting Authentication in RFID Systems*'.
- Filed an invention disclosure on efficient power saving mechanism in Proliant servers using remote management [Hewlett Packard]
- First time introduced application of RTOS in smart card reader firmware in Identive Technologies. The finding has received good appreciation from the CTO and the entire Identive team. The management team has decided to develop upcoming products using RTOS platform
- Single handedly developed eHealth application firmware for the German health care market and received the certification from the Govt. of Germany.

10. Academic Achievements

- Secured 3rd rank in B.E Computer Science and Engineering, Bangalore University, 2004.
- Secured 6th rank at the national level in All India Secondary School Examination (X Std-CBSE), 2nd at the regional level and 1st at the school level. Was among the top 0.1

percent of the successful candidates in the subjects English and Mathematics.

- Qualified Karnataka CET 2000, in both Medical (Rank 236) and Engineering (Rank 805) categories.

11. Professional Training Attended/organized

- Represented SCM in *'Cards Asia 2011'* (13-15 April 2011) at Singapore to showcase SCM products and to have interactions with the customers.
- Attended the training on "Linux Internals and Programming Essentials" at the Linux Learning Center, Bangalore.
- Organized various technical and process improvement trainings in Identiv, HP and IIT.

12. References

Prof. Kamakoti. V. Professor, Dept. of Computer Science and Engineering, IIT Madras, Chennai. *email*: *kama@cse.iitm.ac.in* *phone*: +91-44-22574368	Prof. Chester Rebeiro Professor, Dept. of Computer Science and Engineering, IIT Madras, Chennai. *email*: chester*@cse.iitm.ac.in*	Prof. Krishna Sivalingam Professor, Dept. of Computer Science and Engineering, IIT Madras, Chennai. *email*: *krishna.sivalingam@cse.iitm.ac.in phone*: +91-44-22574350

13. Personal Details

1.	Date of birth:	24-07-1982
2.	Nationality:	Indian
3.	Sex:	Female
4.	Languages known:	English, Hindi, Malayalam, Tamil and Kannada
5.	Permanent address:	E801, Purva Swanlake, 1/367 A, Old Mamallapuram Road, Kelambakkam, Kanchipuram, Tamil Nadu 603103