Uttam Ghosh

CONTACT INFORMATION

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SUMMARY

- Working as an Assistant Professor of Practice in EECS, Vanderbilt University, Nashville, Tennessee.
- Worked as an Instructor at Department of Computer Science, Tennessee State University (TSU) since 11th August, 2017. Taught three undergraduate courses: Discrete Math, Data Communication and Computer Networks and Introduction to Computing. Actively worked for setting up *Smart Computing and Advanced Networking* lab in TSU.
- Worked as Post-doctoral Research Associate at Department of Electrical and Computer Engineering, TSU from 15th August, 2016 to 10th August, 2017. Worked in SDN-enabled smart grid security and taught network security and risk analysis graduate course. Actively worked with Cyber Resilient Energy Delivery Consortium (CREDC).
- Worked as Post-doctoral Teaching Fellow at Department of CIS, Fordham University, Bronx, NY from 14th January to 30th June, 2016. Worked for WINCS lab setup and taught four courses (including two summer courses) related to cyber-security for undergraduate and post-graduate levels.
- Worked as Post-doctoral Research Fellow at ADSC, Illinois at Singapore Pte Ltd, in collaboration with Coordinated Science Laboratory (CSL), UIUC, USA, from 16th March, 2015 to 13th January, 2016. Worked on applicability of SDN in cyber-security especially in Smart Grid.
- Worked as Project Engineer II at Centre for Development of Advance Computing (C-DAC), Bangalore, Govt. of India since 23rd September, 2013 to 13th March, 2015. Worked on Internet of Things, Wireless Sensor Networks, Smart City and ZigBee.
- Designed and developed a Graphical User Interface for Network Simulator (ns-2) for Aakash environment under guidance of Prof. Raja Datta, IIT Kharagpur and Prof. Kannan M Moudgalya, IIT Bombay.
- Highly motivated networking and CPS researcher designed several algorithms related to secure addressing, routing and data transmission in mobile ad hoc networks and fault tolerance of SDN based Smart Grid.
- I have developed a testbed for mobile ad hoc networks and implemented and tested algorithms and compared the results using network simulator (NS).
- I have conducted several short term courses and corporate training courses on Advanced Networking, MANET Testbed (developed in our lab at IIT KGP) demonstration, NS-2, C, C++, Python and JAVA.

OBJECTIVES

To secure a promising position that offers both a challenge and a good opportunity for growth.

RESEARCH INTERESTS

Cyber Physical System Applications and Security, Software Defined Networking (SDN), Distributed & Mobile Computing, Wireless Sensor & Ad Hoc Networks, Internet of Things (IoT) and Content Centric Networking (ICN), Smart Grid, Cloud Computing, Wireless Networks, Protocol Stacks for Wireless/Wired Networks, Indoor Positioning System.

Education

Indian Institute of Technology Kharagpur — Kharagapur, India

Doctorate of Philosophy in E&ECE — January 2010—October 2013

Thesis Title: *Secure Protocols for Mobile Ad Hoc Networks*

Supervisor: *Prof. Raja Datta*

Indian Institute of Technology Kharagpur — Kharagpur, India

Master of Science (by Research) in E&ECE, — 2007—2009

Thesis Title: *Secure Dynamic IP Configuration Schemes for Mobile Ad Hoc Networks*

Supervisor: *Prof. Raja Datta* — CGPA:9.32/10

Govt. College of Engineering and Textile Technology Serampore — West Bengal, India

B.TECH in Information Technology — 2001—2005

Project Title: *Police-Crime Record Management System using JSP* — CGPA:7.72/10

Industrial Training: *Multi-User Conferencing, FTP Server using Java (JDK1.3)*

Place: *Ardent Collaboration, Kolkata, West Bengal, India*

Post Doctoral Experience

Tennessee State University, Nashville, TN

Title: Post-Doctoral Research Associate in Cyber Physical Security

Supervisor: Prof. Sachin Shetty

Work Summary: I was responsible for Applied research in cyber-security and taught a course in postgraduate level.

Fordham University, Bronx, NY

Title: Post-Doctoral Teaching Fellow in Cyber Physical Security

Supervisor: Prof. Mohammad S Obaidat

Work Summary: I was responsible for setting up Wireless Information Network and Cyber Security (WINCS) Laboratory and teaching four courses related to cyber-security for both undergraduate and post-graduate students.

University of Illinois at Urbana-Champaign (UIUC), ADSC Lab, Singapore

Title: Software Defined Networking for Smart Grid Resilience

Supervisors: Prof. Ravishankar K. Iyer and Dr. Rui Tan

Work Summary: Current grid communication networks are based on the standard IP networking paradigm, where the network functionality (e.g., routing) is mostly fixed at the design phase. It does not have the provision to reconfigure the network, utilize bandwidth, detect fault and recover from it dynamically once the network is deployed. Moreover, the functionality of Smart Grid cannot be integrated with IP networking easily. The application of software defined networking (SDN) is considered in smart grids for enhancing system resilience. It can be seen that adopting SDN to enrich functionality and improve QoS of smart grid communication networks by leveraging SDN's run-time configurability. While QoS is an important issue, system resilience, i.e., the ability of a system to recover and maintain critical services despite accidental failures and malicious attacks, is also a key consideration for critical infrastructures like power grids. I have designed algorithms/protocols for SDN in Smart Grid Resilience. I successfully setup a SDN testbed using four HP 2920 switches, RYU/OpenDayLight controller and thirty two Raspberry Pi boards to evaluate QoS in a smart grid.

Professional Achievements

Post Doctoral Fellowship from Tennessee State University (from August 2016 to August 2017).

Postdoctoral Fellowship from Fordham University (from January 2016 to June 2016).

Postdoctoral Fellowship from UIUC, USA from March 2015 to January, 2016.

Best paper award along with coauthor in FCC 2014, New Zealand.

Microsoft Research India, Student Travel Grant to attend WCNC 2012 in Paris, France.

IEEE ComSoc Student Travel Grant to attend WCNC 2012 in Paris, France.

MSRI, Student Travel Grant to attend IPDPS 2012 in Shanghai, China.

Student Travel Grant, from IEEE Kharagpur Section, to attend IPDPS 2012.

Scholarship from Ministry of HRD, Govt. of India (29th Dec 2009 to August 2013).

Scholarship from DIT, Govt. of India (7th Jan to 29th Dec, 2009).

Scholarship from Indian Institute of Technology, Kharagpur (June 2007 to 6th Jan, 2009).

Scholarship from DIT, Govt. of India for 1 year 7 months (June 2005 to Jan 2007).

Scholarship from Govt. College of Engineering & Textile Technology, Serampore for 6 months.

Academic Experience

Course Title	**University**	**Semester**	**Level**	**Role**
Discrete Mathematics	TSU, CS Nashville, USA	Fall 2017	UG	Instructor
Introduction to Computing	TSU, CS Nashville, USA	Fall 2017	UG	Instructor
Data Communication & Computer Networks	TSU, CS Nashville, USA	Fall 2017	UG	Instructor
Network Security & Risk Analysis	TSU, CE Nashville, USA	Spring 2017	PG	Instructor
Secure Cyber Networks	Fordham University CIS, NYC, USA	Spring 2016	UG	Developer Instructor
Cybersecurity Essentials	Fordham University CIS, NYC, USA	Spring 2016	PG	Developer Instructor
Cybersecurity & Applications	Fordham University CIS, NYC, USA	Summer 2016	UG	Developer Instructor
Special Topics in Cybersecurity	Fordham University CIS, NYC, USA	Summer 2016	PG	Instructor
Data Communications & Networking	CDAC Bangalore, India	Spring-Fall 2014	PGD	Coordinator
Advanced Data Structure	IIT Kharagpur, India	Spring-Fall 2010-2013	UG & PG	Teaching Assistant
Advanced Operating Systems	IIT Kharagpur, India	Spring-Fall 2010-2013	PG	Teaching Assistant Assistant
Networking Simulation	IIT Kharagpur, India	Spring-Fall 2010-2013	PG	Lab Assistant Assistant

Practical Experiments:
As a Teaching Assistant I have taken Lab and Practical Experiments on Network Simulation, L-2 and L-3 Experiments, SDN, MANET, WLAN, VoIP, and Socket Programming (using C and Java) of UG and PG Courses of Department of E&ECE, IIT Kharagpur during 2007-2013.
I have taken labs on Network Simulator (NS-2) at (a) CDAC, Bangalore, India (b) Fordham University, NYC, USA and (c) TSU, Nashville, USA.

Student Dissertation Guidance: In the area of mobile ad hoc and sensor ZigBee networks
Post-Graduate (M.Tech): 2 students in IIT Kharagpur and 1 student in CDAC Bangalore.
Under graduate (B.Tech): 3 students in IIT Kharagpur and 3 students in CDAC Bangalore.

Short Term Courses and Training:
Organized short term courses on hands on experiments of networking protocols for the faculties of AICTE approved colleges, officers from Government of India Defense and Army and industries.
Organized short term courses on C, C++ and Java for UG and PG students from IITs and NITs.
Demonstrated an automated testbed of MANET to scientists of DRDO, Government of India.
Conducted a short term course on An Introduction to Network Simulator NS-2 to demonstrate Networking Protocols (e.g., TCP/IP, Distance Vector Routing) at ECIL, Hyderabad, Government of India.

Project Proposal:
Actively participated and written project proposals on Wireless Networking, Smart Cities and Software Defined Networking, and approved by DIT, DRDO, MHRD, Govt. of India.
Written a project proposal to setup WINCS lab at Fordham University, NYC, USA.
Written a project proposal to setup Smart Computing and Advanced Networking lab at TSU, Nashville, USA.

Conference Arrangements:
Organized and actively participated as a Volunteer in prestigious International conferences (ICCCD 2012, NCC 2012, IndoCrypt 2008, IEEE Conferences held in IIT Kharagpur).

Paper Presentation

- IEEE ICDCS, 2017, Atlanta, USA.
- IEEE IPDPS, 2012, Shanghai, China.
- IEEE WCNC, 2012, Paris, France.
- ACM ACWR, 2011, Kerala, India.

Invited Talk

- "Towards a Resilient Smart Grid using Software Defined Networking" IIIT- Bangalore, 2016.
- "A Secure Addressing Scheme for Large-Scale Managed MANETs", ADSC, Singapore, 2015.
- "Software Defined Networking", GARUDA-NKN Meet, IISC Bangalore, 2015.
- "Secure Addressing in Mobile Ad Hoc Networks", NIT, Calicut, Kerala, 2015.
- "Introduction to Wireless LANs", CDAC, Electronics City, Bangalore, 2014.
- "Simulator/Testbed of Communication Networking", Dept. of E&ECE, IIT Kharagpur, 2014.
- "Identity based Schemes for Securing Mobile Ad Hoc Networks", IEEE Kharagpur Section, 2012.

Project Experience

Software Defined Networking:

- Extensively working on SDN Controllers (POX, RYU, ODL, Floodlight) and OpenFlow Switches (OVS and HP OpenFlow Switch) and Emulators (Mininet).
- Extensively working on fault injection, detection and prevention in SDN Controllers.

Cyber Physical Security:

- Implemented a SDN testbed (using RYU and Open Day Light Controller and 5 HP OpenFlow enabled switches) for smart grid networks.

Wireless Sensor Motes:

- Worked with C-Motes (Developed by CDAC) and setup experimental testbed at CDAC Bangalore.
- TinyOS/ Contiki-OS: Worked in developing Integrated Development Environment (IDE) for Code Generator of Wireless Sensor Networks and implementing secure and energy efficient ZigBee protocol stack in Contiki-OS at CDAC Bangalore.

Wireless Ad-hoc Networks Testbed: Developed a mobile ad hoc network testbed.

- Implemented message passing based Intrusion Detection System (IDS) at NERIST, Government of India.
- Implemented secure dynamic host configuration protocols and secure dynamic transmission control protocols for DRDO, DEAL, Dehradun, Government of India.
- Developed two secure dynamic transmission control protocols for mobile ad hoc networks in testbed.

Network User Interface, Programming and Simulation:

- Designed and developed java based GUI for network simulator NS-2.
- Designed and developed java based GUI for configuration of ZigBee protocol stack.
- Very strong in network programming (e.g., C, C++, Java, Python, TCL)
- Socket programming, Linux Kernel programming.
- Very strong in Network Simulators (NS-2 and Mininet) and implemented several protocols and algorithms in network simulator and compared results obtained from simulation and real environment.

Technical Skills

- Simulators/Emulators: Mininet, NS-2/3
- Languages: C, C++, Java and J2EE, Python
- Open-Source Software: SDN Controllers such as RYU, POX, ODL etc.

Journal Publications

[J1] **U. Ghosh** and R. Datta, "A Secure Addressing Scheme for Large-Scale Managed MANETs", in *IEEE Transactions on Network and Service Management*, vol.12, no.3, pp.483-495, Sept. 2015.

[J2] P. Chatterjee, **U. Ghosh**, I. Sengupta and S. K. Ghosh, "A Trust enhanced Secure Clustering Framework for Wireless Ad Hoc Networks", in *Springer Wireless Networks*, Vol:20, Issue:7, October, 2014, pp: 1669-1684, 2014.

[J3] W. Alnumay, P. Chatterjee and **U. Ghosh**, "Energy Aware Secure Routing for Wireless Ad Hoc Networks", in *IETE Journal of Research*, Vol. 60, No. 1, pp-50-59, 2014.

[J4] W. Alnumay and **U. Ghosh**, "Secure Routing and Data Transmission in Mobile Ad Hoc Networks", in *IJCNC*, 2014.

[J5] **U. Ghosh** and R. Datta, "IDSDDIP: A Secure Distributed Dynamic IP Configuration Scheme for Mobile Ad Hoc Networks", in *Wiley International Journal of Network Management*, 2013.

[J6] P. Chatterjee, **U. Ghosh**, I. Sengupta and S. K. Ghosh, "A Novel Approach for Modeling Trust in Cluster based Wireless Ad Hoc Networks", in *IET Networks*, 2013.

[J7] **U. Ghosh** and R. Datta, "SDRP: A Secure and Dynamic Routing Protocol for Mobile Ad Hoc Networks", in *IET Networks*, 2013.

[J8] **U. Ghosh** and R. Datta, "P-TCP: A Prediction based Secure Transmission Control Protocol for Wireless Ad Hoc Networks", in *IETE Journal of Research*, 2012.

[J9] **U. Ghosh** and R. Datta, "A Secure Dynamic IP Configuration Scheme for Mobile Ad Hoc Networks", in *Elsevier Ad Hoc Networks*, Volume 9, Issue 7, pp. 1327-1342, Sept. 2011.

[J10] **U. Ghosh** and R. Datta, "ADIP: an improved authenticated dynamic IP configuration scheme for mobile ad hoc networks", in *International Journal of Ultra Wideband Communications and Systems*, Vol. 1, No. 2, pp. 102-117, 2009.

Conference Proceedings

[C1] **U. Ghosh**, P. Chatterjee, S. Shetty, "A Security Framework for SDN-enabled Smart Power Grids", in *IEEE ICDCS CCNCPS 2017*, Atlanta, USA.

[C2] **U. Ghosh**, P. Chatterjee, D. Tosh, S. Shetty, K. Xiong and C. Kamhoua, "An SDN based Framework for Guaranteeing Security and Performance in Information Centric Cloud Networks", in *IEEE Cloud*, Hawaii, USA, 2017.

[C3] **U. Ghosh**, Z. Wang, X. Dong, R. Tan, Z. Kalbarczyk, D. Yau and R. K. Iyer, " An Empirical Study on Smart Grid Resilience under Software-Defined Networking Controller Failures", in *ACM CPSS 2016*, Xi'an, China.

[C4] S. Kulkarni, **U. Ghosh** and H. Pasupuleti, "Considering security for Zigbee protocol by using Message Authentication Code", in *IEEE INDICON*, 2015, New Delhi, India.

[C5] W. Alnumay, P. Chatterjee, and **U. Ghosh**, "A Trust Aware Secure Framework for Wireless Adhoc networks", in *CTS 2015*, Atlanta, Georgia, USA.

[C6] W. Alnumay and **U. Ghosh**, "SA-TCP: A Secure and Adaptive TCP for Wireless Ad Hoc Networks", in *Springer FCC 2014*, New Zealand, 2014 (Best Paper Award).

[C7] **U. Ghosh** and R. Datta, "A Novel Signature Scheme to Secure Distributed Dynamic Address Configuration Protocol in Mobile Ad Hoc Networks", in *IEEE WCNC 2012*, Paris, France.

[C8] **U. Ghosh** and R. Datta, "An ID based Secure Distributed Dynamic IP Configuration Scheme for Mobile Ad Hoc Networks", in *ICDCN 2012*, Hong Kong, China.

[C9] **U. Ghosh** and R. Datta, "Identity based Secure AODV and TCP for Mobile Ad Hoc Networks", in *ACWR 2011*, Kerala, India, December, 2011.

[C10] **U. Ghosh** and R. Datta, "IDDIP: An ID Based Secure Dynamic IP Configuration Scheme for Mobile Ad Hoc Networks," in *IEEE N2S 2009*, Paris, France.

[C11] **U. Ghosh** and R. Datta, "An Authenticated Dynamic IP Configuration Scheme for Mobile Ad Hoc Networks," in *IEEE WOCN 2009*, Cairo, Egypt.

[C12] **U. Ghosh** and R. Datta, "MMIP: A New Dynamic IP Configuration Scheme with MAC Address Mapping for Mobile Ad hoc networks," in *NCC 2009*, IIT Guwahati, India.

[C13] N. Marchang, **U. Ghosh** and R. Datta, "A Collaborative Approach for Intrusion Detection in Mobile Ad-Hoc Networks", in *AMOC 2007*, Jadavpur University, India.

[C14] **U. Ghosh**, "Identity Based Schemes for Securing Mobile Ad Hoc Networks", in *IEEE IPDPS 2012*, Shanghai, China (PhD Forum).

[C15] W. Alnumay and **U. Ghosh**, "A Network Virtualization Framework for Information Centric Data Center Networks" in *IEEE CCNC 2015*, Las Vegas, USA (Poster).

Book Chapters

[B1] **U. Ghosh**, P. Chatterjee and S. Shetty, "Securing SDN-enabled Smart Power Grids", in *Cyber-Physical Systems for Next Generation Networks*, IGI Global, 2018 (Accepted).

[B2] **U. Ghosh**, P. Chatterjee, S. Shetty, C. Kamhoua, and L. Njilla, "Towards Secure Software-defined Networking Integrated Cyber-Physical systems: Attacks and Countermeasures", in *Springer Versatile Cyber-Security*, 2018 (Accepted).

[B3] **U. Ghosh**, P. Chatterjee, R. Datta, C. Kamhoua, and S. Shetty, "A security overview of Mobile Ad hoc networks", in *Computer and Cyber Security: Principles, Algorithm, Applications and Perspectives*, CRC Press, 2018 (On-going).

Personal Information

- Nationality: Indian
- Date of Birth: 20th December, 1982
- Passport Number: Z3117821
- Languages Known: English, Bengali and Hindi
- Personal Interests: Listening Music, Watching Movies and Playing Cricket (Won several prizes in Cricket, Badminton and Carom at School & UG levels)
- Strengths: Adaptation, Determination and Hard Working

PhD Work Summary

Thesis Title: Secure Protocols for Mobile Ad Hoc Networks

Contributions in the Thesis: The Thesis mainly focuses on the attacks of Network and Transport layers and provides security at bootstrap, network formation, route discovery and maintenance, and end-to-end data transmission with good QoS in MANET.

Comments from Reviewers:

Prof. Pallapa Venkatram, IISC, Bangalore, India: Mr. Ghose has demonstrated by the simulation results under various conditions that the proposed method maintains longer connectivity among the nodes due to maximum lifetime increase. In totality, the results produced are quite encouraging and comparable with the existing works in the field. The review of the literature exhibits his awareness of the contemporary works in the field/ overall thesis quality is good and merits award of PhD degree.

Prof. Mainak Chatterjee, UCF, Florida, USA: I feel that the thesis presents novel contributions that can help secure communications in mobile ad hoc networks. The candidate has shown very good understanding of the existing literature and this thesis enhances the state-of-the-art which I think would help the research community. I find the research by Uttam ghosh original and significant. The proposed algorithms and protocols are novel. Without any reservation I consider the thesis to be worthy for the award of doctoral degree.

MS (by Research) Work Summary

Thesis Title: Secure Dynamic IP Configuration Schemes for Mobile Ad Hoc Networks

Contributions in the Thesis: The Thesis presents three secure distribute dynamic IP (IPv4) address configuration schemes that can handle network partitions, mergers, node arrival and graceful/graceless departure.

B.Tech Work Summary

Project Title: Police-Crime Record Management System using JSP

Contributions in the Project: It helps the police and the informant to detect and prevent the crime.

Informant can search the police station by zone/dist/pin code and launch FIR to the nearest police station. Police-in-charge can accept/reject the FIR and update the FIR and Criminal database. SP can view investigation officer under him and can order them online.

Industrial Training: Multi-User Conferencing and FTP Server using Java (JDK1.3)
Place: Ardent Collaboration, Kolkata

Contributions in the Training: In this training, we implemented a Multi-User Conferencing system, where a number of clients can communicate with each other through a server. Java Swing is used to create GUIs for the users.