

# Deepak Nadig

IEEE WCP® · PH.D. STUDENT, DEPT. OF CSE, UNIVERSITY OF NEBRASKA-LINCOLN

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## Education

### UNIVERSITY OF NEBRASKA-LINCOLN

4TH YEAR PH.D STUDENT IN COMPUTER ENGINEERING (GPA: 3.67/4.0)

- Research Focus: **Cybersecurity, SDN and NFV**. Adviser: **DR. BYRAV RAMAMURTHY**

Nebraska, USA

Aug. 2015 - PRESENT

### VISVESVARAYA TECHNOLOGICAL UNIVERSITY (R.V. College of Engineering)

M.TECH. IN DIGITAL COMMUNICATION ENGINEERING (FIRST CLASS WITH DISTINCTION)

- Thesis: "Design & Deployment of DTN Architectures/Protocols for Interplanetary Communication Systems", Adviser: Dr. A.G Ananth

Karnataka, INDIA

2005 - 2007

### VISVESVARAYA TECHNOLOGICAL UNIVERSITY (Kalpataru Institute of Technology)

B.E. IN ELECTRONICS AND COMMUNICATION ENGINEERING (FIRST CLASS)

Karnataka, INDIA

2000 - 2004

## Research Interests

SDN & NFV; Cybersecurity; Service Composition/Chaining; Machine/Deep Learning for Networks.

## Experience

### University of Nebraska-Lincoln, USA

RESEARCH ASSISTANT, DEPT. OF COMPUTER SCIENCE & ENGINEERING

- Currently working on NSF-Funded Project on *Innovating Network Cyberinfrastructure through Openflow and Content Centric Networking in Nebraska*

Lincoln, NE, USA

Jan 2016 - Present

### Argonne National Laboratory, USA

RESEARCH AIDE, MATHEMATICS AND COMPUTER SCIENCE

- Worked on evaluating various high-performance data transfers tools such as GridFTP, XDD, FDT and mdtmFTP for WAN data movement.

Lemont, IL, USA

May 2017 - Aug 2017

### University of Nebraska-Lincoln, USA

GRADUATE TEACHING ASSISTANT, DEPT. OF COMPUTER SCIENCE & ENGINEERING

- Involved in the assessment process; provided effective, timely, & appropriate feedback to students to support their learning.

Lincoln, NE, USA

Aug 2015 - Dec 2015

### SOLUTT Corporation

DIRECTOR, TECHNOLOGY & RESEARCH

- Instrumental in heading Networking/Wireless Operations at SOLUTT.
- Worked on multiple projects focusing on PHY/MAC layer Design, LTE, LTE-A, cdma2000, and IEEE 802.11 Multigigabit technologies.
- Experience in evaluating Antenna/RF Systems, Channel Models (incl. WINNER, SCM, 802.11Tgn) and Traffic Engineering.
- Actively engaged in the design, development and delivery of advanced training programs, workshops and seminars. Trained over 600 Engineers in network design, LTE & LTE-A, UMTS, IEEE 802.11 & 16, and cdma2000 1x/EVDO.
- Established learning management frameworks and e-learning platforms for delivering online content, deploying secure real-time assessments, feedback and analytics to create the SOLUTT Virtual Learning Environment.

Bangalore, INDIA

Jan 2010 - Aug 2015

### Cambridge Institute of Technology

VISITING FACULTY

- Taught Graduate Courses in Computer Science. Initiated a Project on Development of Opportunistic Grids for HPC.

Bangalore, INDIA.

Aug - Dec 2011

### B.M.S. Institute of Technology

FACULTY OF ENGINEERING

- Taught Undergraduate Courses in Communication Engineering.
- Actively involved with FOSS/LUG to promote Open Source Software for Solving Engineering Problems.

Bangalore, INDIA.

Jan - Dec 2009

### R.V. College of Engineering

FACULTY OF ENGINEERING

- Taught Graduate & Undergraduate Courses in Telecommunications Engineering.

Bangalore, INDIA.

Aug 2007 - Jun 2008

## Indian Space Research Organization (ISRO), Satellite Center (ISAC)

Bangalore, INDIA.

RESEARCH INTERN

Aug 2006 - Jun 2007

- Worked on Design/Development of Architectures, Protocols & Testbeds for Interplanetary Communication Systems at the Digital Systems Group of Telecommand Division.

## R.V. College of Engineering

Bangalore, INDIA.

RESEARCH ASSOCIATE (DEPT. OF ELECTRONICS & COMMUNICATION ENGINEERING)

May - Jul 2006

- Worked on Simulink Modeling and Simulation of a High Performance Fighter Aircraft.

## Professional Certification

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### IEEE WCP®

IEEE ComSoc, USA

IEEE CERTIFIED WIRELESS COMMUNICATIONS PROFESSIONAL

May 2014 - PRESENT

- Demonstrated expertise in Network & Service Architectures; Wireless Technologies; RF & Antenna Engineering; Standards, Policies & Regulations.

## Honors & Awards

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|------|---|------------------|
| 2017 | <b>Best Paper Award</b> , Received the best paper award at the <i>IEEE ANTS 2017</i> Conference (Acceptance rate: 30%). | Odisha, INDIA    |
| 2016 | <b>Graduate Research Assistantship</b> , Jan 2016 to present, Dept. of CSE, University of Nebraska-Lincoln.             | Nebraska, USA    |
| 2016 | <b>GENI/GEC24 Travel Grant Recipient</b> , Mar 8,9 2016, Arizona State University, Tempe.                               | Arizona, USA     |
| 2015 | <b>Graduate Teaching Assistantship</b> , Aug - Dec 2015, Dept. of CSE, University of Nebraska-Lincoln.                  | Nebraska, USA    |
| 2007 | <b>Certificate of Merit</b> , Ranked 1/18 in the Master's Program, R.V College of Engineering.                          | Bangalore, INDIA |
| 2007 | <b>Excellence Certificate</b> , For work done as a Research Intern at Indian Space Research Organization.               | Bangalore, INDIA |
| 2005 | <b>Best Student Paper Award</b> , Emerging Trends in Wireless Networks, 14th Annual Symposium, IEEE Bangalore Section.  | Bangalore, INDIA |
| 2003 | <b>Best Student Paper Award</b> , KSHITIJ' 2003 – National Symposium, IEEE Student Branch, BEC.                         | Karnataka, INDIA |
| 2003 | <b>Best Student Paper Award</b> , SYRITZ" – A National Level Symposium, NICE.   | TamilNadu, INDIA |
| 2003 | <b>Best Student Paper Award</b> , ISTE Student Chapter – A State Level Symposium, KIT.                                  | Karnataka, INDIA |

## Publications

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### CONFERENCE PROCEEDINGS

1. **D. Nadig** et al., "APRIL: An Application-Aware, Predictive and Intelligent Load Balancing Solution for Data-Intensive Science", To appear in **2019 IEEE INFOCOM Proceedings**, Apr 2019, Paris, France.
2. **D.Nadig** and B. Ramamurthy, "Securing Large-scale Data Transfers in Campus Networks: Experiences, Issues, and Challenges", ACM SDN-NFV Security 2019, Mar 2019, Richardson, Texas, USA. [**Invited Paper**] Available at <https://doi.org/10.1145/3309194.3309444>
3. **D. Nadig** et al., "Large Data Transfer Predictability and Forecasting using Application-Aware SDN", 2018 IEEE International Conference on Advanced Networks and Telecommunications Systems (ANTS) (IEEE ANTS 2018), Dec 2018, India.
4. **D. Nadig** et al., "Comparative Performance Evaluation of High-performance Data Transfer Tools", 2018 IEEE International Conference on Advanced Networks and Telecommunications Systems (ANTS) (IEEE ANTS 2018), Dec 2018, India.
5. M. Alhowaidi, **D. Nadig** et al., "Multipath Forwarding Strategies and SDN Control for Named Data Networking", 2018 IEEE International Conference on Advanced Networks and Telecommunications Systems (ANTS) (IEEE ANTS 2018), Dec 2018, India.
6. **D. Nadig** et al., "Optimized Service Chain Mapping and reduced flow processing with Application-Awareness", 2018 4th IEEE Conference on Network Softwarization and Workshops (**NetSoft**), Montreal, QC, 2018, pp. 303-307. Available at <https://doi.org/10.1109/NETSOFT.2018.8459912>
7. **D.Nadig** and B. Ramamurthy, "Identifying Anomalies in GridFTP transfers for Data-Intensive Science through Application-Awareness", ACM SDN-NFV Security 2018, Mar 2018, Tempe, Arizona, USA. [**Invited Paper**] Available at <https://doi.org/10.1145/3180465.3180469>
8. **D. Nadig** et al., "Differentiated Network Services for Data-intensive Science using Application-aware SDN", IEEE ANTS 2017, Dec 2017, India. Available at <https://doi.org/10.1109/ANTS.2017.8384105>
9. **D.Nadig** and B. Ramamurthy, "ScienceSDS: A Novel Software Defined Security Framework for Large-scale Data-intensive Science", ACM SDN-NFV Security 2017, Scottsdale, Arizona, USA. [**Invited Paper**] Available at <https://doi.org/10.1145/3040992.3040999>.
10. **D.Nadig** et al., "SNAG: SDN-managed Network Architecture for GridFTP Transfers", Proceedings of the Third Workshop on Innovating the Network for Data-Intensive Science, INDIS '16, Nov 2016. Available at <https://doi.org/10.6084/m9.figshare.5195641>.
11. **D.Nadig** et al., "On the MAC Layer Jamming Techniques for IEEE 802.11e based Wireless Ad-hoc Networks", Proceedings of the International Conference on Computer Modeling and Simulation (ICCMS 2011), Mumbai, INDIA Jan 7 – 9th, 2011.

12. **D.Nadig** et al., “Performance Analysis and Evaluation of Delay-Tolerant Network Bundling Protocol on a Scalable Virtual Network Test Platform”, Proceedings of the IET International Conference on Wireless, Mobile and Multimedia Networks, Jan 2008. Available at <https://doi.org/10.1049/cp:20080143>
13. **D.Nadig** et al., “On the Characterization, Evaluation and Analysis of Performance of Delay-Tolerant Networks”, Proceedings of the International Conference on Embedded Systems, Mobile Communication and Computing (ICEMC2), Aug 2007.

## POSTER PRESENTATIONS

1. “Securing Data Intensive Science Projects Through Intelligent Networks”, 2017 Midwest Big Data Hub (MBDH) All-Hands Meeting, Omaha, USA, Oct 2-3, 2017.

## MASTER’S THESIS

1. “Design and Deployment of DTN Architectures and Protocols for Interplanetary Communication Systems”, Master’s Thesis, RV College of Engineering, Visveswaraya Technological University, Jul 2007.

## TECHNICAL REPORTS

1. “A Study of Jamming in IEEE 802.11e Networks”, Technical Report, Dept. of Electrical Computer Engineering, North Carolina State University, Raleigh, USA, Dec 2008
2. “Simulation and Analysis of Intersystem Handovers in Mobile WiMax Networks”, Technical Report, Dept. of Electrical Computer Engineering, North Carolina State University, Raleigh, USA, Dec 2008

## Skills

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<b>Languages</b>	Python, Java
<b>Stacks</b>	OpenStack, OPNFV, OSGi, Elastic, InfluxDB/Grafana
<b>Software-Defined Networks</b>	OpenFlow, ONOS, Open vSwitch, P4
<b>Emulation/Simulation</b>	Mininet, LXC, ns3, OPNET, Matlab/Simulink
<b>Network Testbeds</b>	DETERLab, GENI, CloudLab, ChameleonCloud
<b>SCM/DevOps</b>	Git, Mercurial, Vagrant, Docker, Kubernetes
<b>Machine Learning</b>	scikit-learn, TensorFlow, Keras
<b>Agile Methodologies</b>	Scrum, Kanban
<b>Other</b>	Wireshark, IPTables, VTun, $\LaTeX$

## Professional Associations

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- IEEE, IEEE ComSoc & IEEE SDN Community, MEMBER (2011 - PRESENT)
- IEEE Bangalore Section, Member of IEEE GOLD SIG EXE-COM Professional Activities Group (2011 - 2014)

## Recent Projects

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- **Intelligent Optical Networks using Virtualization and Software-Defined Control (Ongoing)**  
 Funding Agency: **National Science Foundation (NSF), CNS Program.**  
 Platforms: **Python/Java, ONOS, OpenStack, CORD, Elastic Stack.** Working on developing a unified network architecture for a software defined optical network (SDON) that features end-to-end service provisioning, expediting data transfers over multiple domains that use heterogeneous transport. The project will explore strategies for dynamic resource allocation and bandwidth-on-demand (BoD) in multi-layer SDN/Optical networks.
- **Innovating Network Cyberinfrastructure through Openflow and Content Centric Networking (Completed)**  
 Funding Agency: **National Science Foundation (NSF), CC\*DNI Program.**  
 Platforms: **Python/Java, ONOS, OpenStack, OPNFV, Elastic, GENI, Bro IDS.** Working on deploying an SDN/NFV production network to manage resources and to provide scalable network security by using an OpenFlow policy-based framework. Also working on an SDN-enabled control architecture for Named-Data Networking (NDN) for efficiently handling high-priority, high-volume data transfers from the compact muon solenoid (CMS) experiment.
- **Software Defined Security and Service Composition through Service Function Chaining**  
 Platforms: **OpenStack, ONOS, Open vSwitch.** Integrated SDN with a service function chaining (SFC) infrastructure that provides virtual network functions (VNFs) for secure handling and monitoring of incoming traffic.
- **Protocol Independent Forwarding in Software Defined Networks**  
 Platforms: **P4, Open vSwitch, GENI.** Developed a protocol independent packet processor using P4 to evaluate available switching targets, parsers and flow control behaviors.

- **Multi-layer SDN Control of Packet/Optical Networks**

Platforms: **ONOS, LINC-OE**. Used **LINC-OE** to create optical topologies to study flow configuration behavior in optical WDM networks with ROADMs and packet IP switches. Demonstrated a converged packet/optical architecture to study optical link failure recovery.

## Professional Activities

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### SERVICE

2019	<b>Reviewer</b> , IEEE Journal on Selected Areas in Communications (IEEE JSAC)	IEEE, USA
2018-2019	<b>Committee Member</b> , Cybersecurity Faculty Search Committee, Dept. of Computer Science & Engineering, University of Nebraska-Lincoln.	Nebraska, USA
2018-2019	<b>Vice President</b> , Computer Science & Engineering Graduate Student Association, University of Nebraska-Lincoln.	Nebraska, USA
July 2018	<b>Judge</b> , McNair Summer Research Colloquium, University of Nebraska-Lincoln.	Nebraska, USA
2017	<b>Reviewer</b> , 2017 IEEE International Symposium on Local and Metropolitan Area Networks (LANMAN).	IEEE, Japan
2016	<b>Reviewer</b> , IEEE INFOCOM 2017.	IEEE, USA
2016	<b>Reviewer</b> , 37th IEEE Sarnoff Symposium, 2016.	IEEE, USA
2015	<b>Board of Studies Member</b> , 8th Meeting of the Board of Studies (BOS) in Electronics and Communication Engineering, SJ College of Engineering.	Mysore, INDIA
2011	<b>Reviewer</b> , 2011 3rd International Conference on Computer Technology and Development	Chengdu, CHINA
2011	<b>Reviewer</b> , 2011 3rd International Symposia in Advance Computing (ISAC 2011)	Lucknow, INDIA
2007	<b>Committee Member</b> , Entrepreneurship Development Cell (EDC), RV College of Engineering	Bangalore, INDIA

### INVITED TALKS

8 May 2015	<b>Keynote Address, Convocation &amp; Student Forum, VISHIST-15</b> , Sambhram Inst. of Technology	Bangalore, INDIA
28 Mar 2015	<b>Network Simulation and Modeling</b> , Dept. of ECE, SJ College of Engineering	Mysore, INDIA
28 Oct 2015	<b>Tools for Data Science and Analysis</b> , Dept. of Computer Applications, PES Institute of Technology	Bangalore, INDIA
17 Oct 2014	<b>SDN: Trends in Programmable Networks</b> , Dept. of ECE, Sapthagiri College of Engineering	Bangalore, INDIA
27 Jan - 1 Feb, 2014	<b>Antennas for Next-Generation Network Mobile Radios</b> , Antenna Technologies, Faculty Development Program, TEQIP II, Dept. of ECE, BMS College of Engineering	Bangalore, INDIA
17 Aug 2013	<b>Simulation of Computer Networks and Systems</b> , Dept. of MCA, CMR Institute of Technology	Bangalore, INDIA
19 Jul 2013	<b>Next Generation Networks: Simulation &amp; Modeling Perspectives</b> , Seminar on Understanding Wireless Communication Technologies: 3G, 4G/LTE, WiMAX; Dept. of ISE, PES Inst. of Technology	Bangalore, INDIA
27-28 Apr 2012	<b>LATEX for Mathematical Publishing</b> , Faculty of Mathematics and Statistics, Christ University	Bangalore, INDIA
12 Apr 2012	<b>The Future is Open: OSS in Technology</b> , KRITANSH Forum, Dept. of MCA, Cambridge Institute	Bangalore, INDIA
22 Oct 2011	<b>Wireless Network Architectures: Evolution &amp; Directions</b> , Dept. of ECE, BMS Inst. of Technology	Bangalore, INDIA
01 Oct 2011	<b>Wireless Communication Engineering Technologies</b> , IEEE Student Branch, Dr. Ambedkar Inst.	Bangalore, INDIA
23 Dec 2010	<b>Mathematical Modeling of Large Scale Random Networks</b> , National Conference on Recent Trends in Network Security & Cryptography, Dept. of MCA, PES Institute of Technology	Bangalore, INDIA

### INVITED SEMINARS

2-4 Jul 2015	<b>Workshop on ns3 Network Simulator</b> , Dept. of Computer Applications, RV College of Engineering	Bangalore, INDIA
1-5 Jun 2015	<b>Workshop on Network Simulation using ns3</b> , Dept. of CSE, Nitte Meenakshi Institute of Tech	Bangalore, INDIA
15 Feb 2015	<b>Workshop on Next-Generation Network Simulation using ns3</b> , Amrita Vishwa Vidyapeetham	Bangalore, INDIA
6-7 Feb 2015	<b>Workshop on ns3 and Computer Networks</b> , Dept. of ECE, Sri Venkateshwara College of Engg.	Bangalore, INDIA
1-4 Dec 2014	<b>Faculty Development Programme on ns3</b> , Dept. of ECE, Sri Venkateshwara College of Engg.	Bangalore, INDIA
28 Oct 2014	<b>Workshop on Tools for Data Science and Analysis</b> , Dept. of MCA, PES Institute of Technology	Bangalore, INDIA
26-27 Sep 2014	<b>Workshop on Computer Network Laboratory</b> , Dept. of MCA, Bangalore Institute of Technology	Bangalore, INDIA
2-3 Aug 2014	<b>National Workshop on NS3 Simulation</b> , Dept. of CSE, Amrita School of Engg, Amrita University	Bangalore, INDIA
27-28 Jun 2014	<b>Workshop on Network Simulation</b> , Dept. of MCA, CMR Institute of Technology	Bangalore, INDIA
12-13 Nov 2013	<b>NGN Simulation Tools &amp; Frameworks</b> , TEQIP Phase II, Dept. of ISE, Dr. Ambedkar Inst. of Tech.	Bangalore, INDIA
31 Jul 2012	<b>Network Simulations &amp; Modeling using ns2</b> , Dept. of CSE, C Byregowda Institute of Technology	Kolar, INDIA
5-6 Aug 2011	<b>Computer Network Simulation</b> , Dept. of MCA, Cambridge Institute of Technology	Bangalore, INDIA
17-19 Mar, 2011	<b>Network Simulation: Principles &amp; Practice</b> , Dept. of ECE, BMS College of Engineering	Bangalore, INDIA
14-16 Mar 2011	<b>RF &amp; Wireless System Design</b> , IEEE Student Branch, Sambhram Institute of Technology	Bangalore, INDIA
5-8 Oct, 2010	<b>RF &amp; Wireless System Design</b> , IEEE Student Branch, Sambhram Institute of Technology	Bangalore, INDIA
9-10 Aug 2010	<b>Network Simulation using NS2</b> , Dept. of ISE, PES Institute of Technology	Bangalore, INDIA