

# 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: 3.92/4.0)

- 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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|------|---|------------------|
| 2019 | <b>2019 Milton Mohr Fellowship</b> , College of Engineering, University of Nebraska-Lincoln.                            | Nebraska, USA    |
| 2019 | <b>Outstanding Graduate Student Research Award (2018 - 2019)</b> , Dept. of CSE, University of Nebraska-Lincoln.        | Nebraska, USA    |
| 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. Available at <https://doi.org/10.1109/ANTS.2018.8710165>
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. Available at <https://doi.org/10.1109/ANTS.2018.8710071>
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. Available at <https://doi.org/10.1109/ANTS.2018.8710068>
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, Saphthagiri 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

## INVITED SEMINARS (CONT...)

5-6 Aug 2011	<b>Computer Network Simulation</b> , Dept. of MCA, Cambridge Institute of Technology	<i>Bangalore, INDIA</i>
17-19 Mar, 2011	<b>Network Simulation: Principles &amp; Practice</b> , Dept. of ECE, BMS College of Engineering	<i>Bangalore, INDIA</i>
14-16 Mar 2011	<b>RF &amp; Wireless System Design</b> , IEEE Student Branch, Sambhram Institute of Technology	<i>Bangalore, INDIA</i>
5-8 Oct, 2010	<b>RF &amp; Wireless System Design</b> , IEEE Student Branch, Sambhram Institute of Technology	<i>Bangalore, INDIA</i>
9-10 Aug 2010	<b>Network Simulation using NS2</b> , Dept. of ISE, PES Institute of Technology	<i>Bangalore, INDIA</i>