

Ramesh R. Rao

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Ramesh Rao has been a faculty member at UC San Diego since 1984. Prior to becoming the director of Qualcomm Institute, Dr. Rao was the director of the Center for Wireless Communications (CWC) at UCSD. Dr. Rao is involved on a day-to-day basis with a wide variety of research initiatives at Qualcomm Institute. He leads several major interdisciplinary and collaborative projects and has been a PI on dozens of federal-, state-, foundation- and industry-funded grants.

1. Professional Roles, Activities, and Awards (as of: July 15, 2015)

- Fellow of the Institute of Electrical and Electronics Engineers (IEEE) for leadership in wireless communications
- Senior Fellow of the California Council on Science and Technology (CCST)
- Qualcomm Endowed Chair in Telecommunications and Information Technology
- Professional Gordon Engineering Leadership Award 2010, Gordon Engineering Leadership Center, UCSD
- Member, UC San Diego Health System Advisory Board
- Member of the Board of Advisors, CommNexus San Diego: A Network of Communications Companies
- Member, Rady Children's Hospital and Health Center Board of Trustees' Information Technology Task Force
- Member, Weqaya Advisory Task Force, Health Authority – Abu Dhabi (HAAD), United Arab Emirates
- Member, Young Scholar Award Selection Committee, Marconi Society
- Member of the Board of Directors, Academy of Neuroscience for Architecture
- Investigator, Health Data Exploration Project, Robert Wood Johnson Foundation
- Member, Clarke Center's Internal Advisory Board
- Member, Advisory Board, Center for Global Justice
- Member, Steering Committee of Cross-Campus Healthy Aging Initiative
- Member, UCSD CREATE STEM Success Initiative Internal Advisory Board
- IEEE Communications Society, Member, Organizing Committee of GLOBECOM 2015
- IEEE Communications Society, Chair, Technical Program Committee of GLOBECOM 2015
- Member of the Board of Governors IEEE Information Theory Society, 1997-1999 and 2000-2002
- Secretary, Technical Activities Council and Technical Committees Board, IEEE Communications Society, 1990-1991
- Publications Editor, IEEE Transactions on Information Theory, 1999-2001

- Editor for Packet Multiple Access, IEEE Transactions on Communications, 1997-2000
- Guest Editor, Special Issue on Multimedia Network Radios, IEEE Journal of Selected Areas in Communications, 1998
- Member, Editorial Board, IEEE Networks, 1997-1999
- Chair, the National Research Council's Committee on Using Information Technology to Enhance Disaster Management, the findings were published by the NRC in 2007: "Improving Disaster Management: The Role of IT in Mitigation, Preparedness, Response and Recovery."
- Organized "The New Role of Science and Engineering in Risk Reduction," NSF Workshop, La Jolla, CA, February, 2003
- Testified before House Armed Services Committee on Calit2 research related to Homeland Security, February 2002
- Member, Education Task Force of The San Diego Foundation Regional Vision Council
- *Best Paper Award*
P. Zhou, B.S. Manoj and R. Rao, "On Optimizing Non-Asymptotic Throughput of Wireless Mesh Networks," Proceedings of the 5th IEEE Consumer Communications and Networking Conference (CCNC 2008), Las Vegas, NV, January 10-12, 2008, pp. 343-347.
- *Best Demonstration Award*
Douglas Palmer, Rajesh Gupta, and Ramesh Rao, "Calit2 Sensor Nodes and their use for data integration in WIISARD," Fourth International Symposium on Information Processing in Sensor Networks (ISPN) 2005
- Distinguished Alumni Award 2012, A. James Clark School of Engineering (ECE), University of Maryland
- Distinguished Alumnus Award 2008, National Institute of Technology (NITT), Tiruchirappalli
- National Merit Scholarship, Govt. of India, 1967

2. Recent Research Grants (as of: July 15, 2015)

| Title | Role, Granting Agency, Total award, Time period |
|---|--|
| Center of Excellence Telecom Applications (CETA) at the University of California, San Diego (UCSD) and The King Abdulaziz City for Science and Technology (KACST) | PI, The King Abdulaziz City for Science and Technology (KACST) \$1,983,980; November 2014 – November 2016 |
| Future Approaches to Sharing the Wireless Spectrum | PI, National Security Research Institute \$45,454; April 2015 – October 2015 |
| Research on Security Considerations for IoT Devices | PI, National Science Foundation (NSF) \$22,500; April 2015 – March 2016 |

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| Innovation Initiatives at Calit2 San Diego | PI, Qualcomm Charitable Foundation \$1,700,000; October 2013 – September 2015 |
| Wireless Broadband Technology Demonstrator | PI, Maxentric Technologies LLC \$236,314.67; September 2013 – November 2015 |
| Creation of a Research Program of the California Institute for Telecommunications and Information Technology (Calit2) at the UC San Diego in collaboration with Saudi Arabia's King Abdulaziz City for Science and Technology (KACST) | PI, King Abdulaziz City for Science & Technology (KACST) \$3,469,803; March 2010-March 2013 |
| Cognitive Protocol Stack Design | PI, Army Research Office (ARO) \$360,000; October 2011 – September 2014 |
| WIISARD SAGE: Self-Scaling Systems for Mass Casualty Management | Co-PI, National Institute of Health (NIH) \$1,565,855; September 2009 – September 2012 |
| DURIP: CogMeshNet: A Cognitive Mesh Networking Testbed | PI, Army Research Office (ARO) \$149,945; August 2011 – August 2012 |
| Opportunistic Communications and Cognitive Cross-layer Protocol Stack Design | PI, Army Research Office (ARO) \$307,414; September 2009 - August 2011 |
| CWC/Cognitive Networks | Co-PI, UC Discovery \$353,600; November 2009-October 2011 |
| iDASH: Integrating Data for Analysis, Anonymization, and Sharing | Co-PI, NIH - National Institute of Heart, Lung & Blood Institute \$18,654,233; September 2009 - August 2011 |
| SBIR Phase II: 60 GHZ Wide Band, Local Radio (WBLR) | PI, MaXentric Technologies – Navy \$120,000; April 2010 – April 2011 |
| Communication, Command and Control, and Sensor Concepts for Network Centric Operations | PI, SPAWAR \$15,000,000; October 2003-January 2011 <i>This SPAWAR grant has led to 51 UCSD professor-led contracts.</i> |

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| Collaborative Research: Responding to the Unexpected (RESCUE) | PI, National Science Foundation (NSF) \$3,541,999 (UCSD), \$12.5M total; October 2003-Sept 2008/2009 |
| ResponSphere: An IT Infrastructure for Responding to the Unexpected | Co-PI, NSF \$900,795 (UCSD); \$1,801,590 total; September 2004-August 2009 |
| Therapeutic Window for Acute Stroke Therapy | Co-PI, National Institute of Health (NIH)/NINDS \$ 6,131,542; July 2003-June 2008 |
| Wireless Internet Information System for Medical Response in Disasters | Co-PI, NIH \$4,065,027; October 2003-September 2006 |
| Proximity Driven Mobile Malware | PI, University of Bath \$8,339.35; July 2007-June 2008 |
| SGER: The CogNet (Cognitive Complete Knowledge Network) System | PI, NSF \$100,000; October 2006-September 2007 |
| NRT: Scalable Testbed for Next Generation Mobile Wireless Networking Technologies | Co-PI, NSF \$390,000 (UCSD); \$5,558,716 total; October 2003-Sept. 2007 |
| Adaptive Systems | PI, UC Discovery/ Ericsson \$2,520,197; July 2002-June 2006 |
| Region-Based Image Compression Subject to Energy and Bandwidth Constraints | Co-PI, Office of Naval Research (ONR) \$ 592,147; January 2003-December 2005 |
| BioNet System Design and Development Support | PI, SPAWAR \$1,166,220; September 2004-September 2005 |
| “Smart” Sensor Networks for Visual Context Capture and Interactivity | Co-PI, UC Discovery/ Ericsson/Hewlett-Packard \$441,126; August 2003-August 2005 |
| Application and Network-Aware Multi-Layer Adaptation of Wireless Protocols and Architectures | Co-PI, UC Discovery/ Nokia/ Ericsson/ Intersil Corporation/ST Microelectronics \$301,647; August 2003-August 2005 |

3. Other Activities (as of: July 15, 2015)

- Panel, "Wellness and quantified self," M3 Mobility Exchange Conference 2012, San Diego, CA, November 11-13, 2012
<http://www.m6mobilityxchange.com/conference-seminar-agenda/>
- Panel, "Innovative Methods and Devices for Personal Health," TiE South Coast Event, San Diego, CA, April 23, 2013
- Interview, "Get Buzzed When You're Blissed Out", KPBS, June 6, 2013
<http://www.kpbs.org/news/2013/jun/06/get-buzzed-when-youre-blissed-out/>
- Expert Advisor, "Blue Ribbon Panel," Alliance Healthcare Foundation's Innovation Initiative, San Diego, CA, July 16, 2013
- Panel, "STEM Group," Balboa Park Centennial Forum 2013, San Diego, CA, July 30, 2013
- Interview, "Quantifying Bliss," Atlantic Meets the Pacific 2013, San Diego, CA, October 2-4, 2013
<https://www.youtube.com/watch?v=SRDu12UHHVE> 10/10/2013
- Interview, "UCSD wants to make a robot for you," UT San Diego, October 31, 2013
<http://www.utsandiego.com/news/2013/oct/31/robot-ucsd-qualcomm/>
- Interview, "Robotics with Ramesh Rao," The Roger Hedgecock TV Show, November 15, 2013
<http://www.utsandiego.com/video/play/63388/>
- Plenary Panel, "Innovation and Opportunities to Leverage Emerging Technologies," MILCOM 2013, San Diego, CA, November 18-20, 2013
http://www.milcom.org/2013/plenary_panels.htm
- Presentation, "Ubiquitous Sensing for Somatic Studies," UC Riverside Colloquium, Riverside, CA, April 14, 2014
<http://www.ece.ucr.edu/news-events/article.php?EID=177&Article=Ubiquitous-Sensing-for-Somatic-Studies-Presented-by%3A-Dr.-Ramesh-Rao>
- Panel, "Future of Robotics," UCSD EPSE/LAMP Edge 2014, San Diego, CA April 17, 2014
<http://www.epselamp.org/2014/05/edge-trends-recap-the-future-of-robotics/>
- Panel, "How to leverage industry to "regain" RDT&E lost to long term budgetary constraints," AFCEA C4ISR Symposium 2014, San Diego, CA, April 22-24, 2014
- Panel, "Voice of the Patient," WLSA Convergence Summit 2014, San Diego, CA, May 14-16, 2014
<http://wirelesslifesciences.org/videos/wlsa-convergence-summit-2014-voices-of-patients/>
- Presentation, "Listening to the dancing heart," INK 2014, Mumbai, India, October 31-November 2, 2014
<http://www.inktalks.com/discover/729/ramesh-rao-listening-to-the-dancing-heart>
- Presentation, "The Sunny Side of Spectrum Sharing: The San Diego Model City Alliance," FCC and NTIA Model City Program Workshop, Washington DC, April 15-16, 2015
<https://www.fcc.gov/events/fcc-and-ntia-announce-workshop-model-city-program>

4. Publications (as of: July 15, 2015)

Journals, Books, and Book Chapters

69. M. Danieleto, G. Quer, R. Rao, and M. Zorzi "CARMEN: A Cognitive Networking Testbed on Android OS Devices," *IEEE Communications Magazine*, Vol. 52, Issue 9 (12 September 2014), pp. 98-107

68. M. Danielelto, G. Quer, R. Rao, and M. Zorzi "Traffic Sensing and Characterization in Multi-Channel Wireless Networks for Cognitive Networking," *Computer Networks*, Vol. 56, Issue 7 (3 May 2012), pp. 1968-1982
67. S. Xu, K.S. Kwak, and R. Rao, "Interference-Aware Radio Resource Allocation in D2D Underlaying LTE-Advanced Networks," *Korean Society for Internet Information Transactions on Internet and Information Systems (TIIS)*, Vol. 8, No. 8 (August 2014), pp. 2626-26466
66. C.K. Verma, B.R. Tamma, B. S. Manoj, and R. Rao, "A Realistic Small-World Model for Wireless Mesh Networks," *IEEE Communications Letters*, Vol. 15, No. 4, April 2011, pp. 455-457. DOI: 10.1109/LCOMM.2011.020111.100266
65. B. R. Tamma, A. Badamb, C. Siva Ram Murthy, and R. R. Rao, "K-Tree: A multiple tree video multicast protocol for Ad hoc wireless networks," *Computer Networks*, Vol. 54, Issue 11 (2 August 2010), pp. 1864-1884. DOI: 10.1016/j.comnet.2010.02.013
64. P. Zhou, X. Wang, B. S. Manoj, and R. Rao, "On Optimizing Gateway Placement for Throughput in Wireless Mesh Networks," *EURASIP Journal on Wireless Communications and Networking*, Vol. 2010 (2010), 12 pp. DOI: 10.1155/2010/368423
63. T. DeFanti, G. Dawe, D. Sandin, J. Schulze, P. Otto, J. Girado, F. Kuester, L. Smarr, and R. Rao, "The StarCAVE, a third-generation CAVE and virtual reality OptIPortal," *Future Generation Computer Systems*, Vol. 25, Issue 2 (February 2009), pp. 169-178. DOI: 10.1016/j.future.2008.07.015
62. B.S. Manoj, R.R. Rao, and M. Zorzi, "CogNet: a cognitive complete knowledge network system," *IEEE Wireless Communications*, Vol. 15, Issue 6 (January 19, 2009), pp. 81-88. DOI: 10.1109/MWC.2008.4749751
61. B.C. Meyer, R. Raman, T. Hemmen, R. Obler, J.A. Zivin, R. Rao, R.G. Thomas, P.D. Lyden, "Efficacy of site-independent telemedicine in the STRokE DOC trial: a randomised, blinded prospective study," *Lancet Neurology*, Vol. 7, Issue 9 (September 2008), pp. 787-795. DOI: 10.1016/S1474-4422(08)70171-6
60. P. Zhou, X. Wang, and R. Rao, "Asymptotic Capacity of Infrastructure Wireless Mesh Networks," *IEEE Transactions on Mobile Computing*, Vol. 7, Issue 8 (August 2008), pp.1011-1024. DOI: 10.1109/TMC.2007.70778
59. B.S. Manoj, P. Zhou, and R.R. Rao, "Dynamic adaptation of CSMA/CA MAC protocol for wide area wireless mesh networks," *Elsevier Computer Communications*, Vol. 31, Issue 8 (May 25, 2008), pp. 1627-1637. DOI: 10.1016/j.comcom.2008.01.048
58. M. Rossi, M. Zorzi, and R.R. Rao, "Statistically assisted routing algorithms (SARA) for hop count based forwarding in wireless sensor," *Wireless Networks*, Vol. 14, Number 1 (February 2008), pp. 55-70. DOI: 10.1007/s11276-006-7791-8

57. R.B. Dilmaghani and R.R. Rao, "Hybrid Wireless Mesh Network with Application to Emergency Scenarios," *Journal of Software*, 2008, Vol. 3, No. 2 (February 2008), pp. 52-60. DOI: 10.4304/jsw.3.2.52-60
56. B.C. Meyer, R. Raman, R. Rao, R.D. Fellman, J. Beer, J. Werner, J.A. Zivin, and P.D. Lyden, "The STRokE DOC trial technique: 'video clip, drip, and/or ship'," *International Journal of Stroke*, Vol. 2 (November 2007), pp. 281-287. DOI:10.1111/j.1747-4949.2007.00153.x
55. B.S. Manoj, R.R. Rao, and M. Zorzi, "Architectures, Protocols, and Analytical Approaches for Next Generation Cognitive Networking," in *Cognitive Wireless Networks: Concepts, Methodologies and Visions Inspiring the Age of Enlightenment of Wireless Communications*. F.H.P. Fitzek and M. Katz, Eds. Dordrecht, The Netherlands: Springer, 2007, pp. 271-284.
54. R.R. Rao, J. Eisenberg, and T. Schmitt (Eds.), *Improving Disaster Management: The Role of IT in Mitigation, Preparedness, Response, and Recovery*, Committee on Using Information Technology to Enhance Disaster Management, National Research Council, Washington, DC: National Academies Press, 2007, 177 pp.
53. M. Zorzi and R.R. Rao, Reply to "Comments on 'Capture and Retransmission Control in Mobile Radio'," *IEEE Journal on Selected Areas in Communications*, Vol. 24, No. 12 (2006), pp. 2341-2342. DOI: 10.1109/JSAC.2006.887340
52. P. Nuggehalli, V. Srinivasan, C. Chiasserini, and R.R. Rao, "Efficient cache placement in multi-hop wireless networks," *IEEE / ACM Transactions on Networking*, Vol. 14, No. 5 (October 2006), pp. 1045-1055. DOI: 10.1109/TNET.2006.882863
51. K. Wang, C.F. Chiasserini, J.G. Proakis, and R.R. Rao, "Joint Scheduling And Power Control Supporting Multicasting In Wireless Ad Hoc Networks," *Ad Hoc Networks*, Volume 4, Issue 4 (July 2006), pp. 532-546. DOI: 10.1016/j.adhoc.2005.06.001
50. P.B. Gibbons, T.F. Abdelzaher, J. Aspnes, R. Rao (Eds.), *Distributed Computing in Sensor Systems*, Proceedings of the Second IEEE International Conference (DCOSS 2006), San Francisco, CA, USA, June 18-20, 2006, (Lecture Notes in Computer Science 4026 Springer 2006), 563 pp.
49. K. Chebrolu and R. Rao, "Bandwidth Aggregation for Real-Time Applications in Heterogeneous Wireless Networks," *IEEE Transactions On Mobile Computing*, Vol. 5, No. 4 (April 2006), pp. 388-403. DOI: 10.1109/TMC.2006.1599407
48. P. Nuggehalli, V. Srinivasan, and R.R. Rao, "Energy efficient transmission scheduling for delay constrained wireless networks," *IEEE Transactions On Wireless Communications*, Vol. 5, No. 3 (2006), pp. 531-539. DOI: 10.1109/TWC.2006.1611083
47. B.S. Manoj and R.R. Rao, "Load Balancing in Wireless Mesh Networks," in *Wireless Mesh Networks: Architectures, Protocols, and Standards*. Y.S. Zhang, et al., Eds., Florida: CRC Press, 2006, pp. 263-296.

46. B.S. Manoj and R.R. Rao, "Wireless Mesh Networks: Issues and Solutions," in *Wireless Mesh Networks: Architectures, Protocols, and Standards*. Y.S. Zhang, et al., Eds., Florida: CRC Press, 2006, pp. 3-48.
45. K. Chebrolu, B. Raman, and R.R. Rao, "A Network Layer Approach to Enable TCP over Multiple Interfaces," *ACM / Kluwer Journal of Wireless Networks*, Vol. 11 (2005), pp.637-650. DOI: 10.1007/s11276-005-3518-5
44. B.C. Meyer, P.D. Lyden, L. Al-Khoury, Y. Cheng, R. Raman, R. Fellman, J. Beer, R. Rao, and J.A. Zivin, "Prospective Reliability of the STRokE DOC Wireless / Site Independent Telemedicine System," *Neurology* 2005, no. 64 (March 2005), pp. 1058-1060.
43. V. Srinivasan, P. Nuggehalli, C.F. Chiasserini, and R. R. Rao, "An Analytical Approach to the Study of Cooperation in Wireless Ad Hoc Networks," *IEEE Transactions on Wireless Communications*, Vol. 4, No. 2 (March 2005), pp.722. DOI:10.1109/TWC.2004.842950
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35. M. Kim, C. G. Kang, and R. R. Rao, "Group-wise Transmission Rate Scheduling Scheme for Integrated Voice/Data Service in Burst-Switching DS/CDMA System," *IEICE Trans. Fundamentals*, Vol. E85-B, No. 8 (March 2002), pp. 1618.

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33. C. F. Chiasserini and R. R. Rao, "Energy Efficient Battery Management," *IEEE JSAC Wireless Series*, Vol. 19, No. 7 (July 2001), pp. 1235 -1245. DOI:10.1109/49.932692
32. C. F. Chiasserini and R. R. Rao, "Improving Battery Performance by using Traffic Shaping Techniques," *IEEE JSAC Wireless Series*, Vol. 19, No. 7 (July 2001), pp. 1385-1394. DOI: 10.1109/49.932705
31. M. Zorzi and R. R. Rao, "Energy Efficiency of TCP in a local wireless environment," *Mobile Networks and Applications (special issue on Energy Efficient Protocols)*, Vol. 6 (June 2001), pp. 265-278. DOI: 10.1023/A:1011482901234
30. C. F. Chiasserini and R. R. Rao, "Stochastic Battery Discharge in Portable Communication Devices," *IEEE Aerospace and Electronic Systems Magazine*, Vol. 15, No. 8 (August 2000), pp. 41-45. DOI: 10.1109/BCAA.2000.838358
29. M. Zorzi, A. Chockalingam, and R. R. Rao, "Throughput Analysis of TCP on Channels with Memory," *IEEE Journal on Selected Areas of Communication*, Vol. 18 (July 2000), pp. 1289-1300. DOI: 10.1109/49.857929
28. M. Zorzi and R. R. Rao, "Perspectives on the Impact of Error Statistics on Protocols for Wireless Networks," *IEEE Personal Communications*, Vol. 6 (October 1999), pp. 32-40. DOI: 10.1109/98.799618
27. M. Zorzi and R. R. Rao, "Latency probability of a retransmission scheme for error control on a two-state Markov channel," *IEEE Transactions on Communications*, Vol. 47, No. 10 (October 1999), pp. 1537-1548. DOI: 10.1109/26.795822
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25. E. Ayanoglu, V. Bahl, R. S. Cheng, R. R. Rao, and M. Zorzi, "Multimedia Network Radios (guest editorial)," *IEEE Journal on Selected Areas in Communications*, Vol. SAC-17 (May 1999), pp. 753-755.
24. A. M. Chen and R. R. Rao, "Wireless Channel Models- Coping with Complexity," *Wireless Multimedia Network Technologies*, Kluwer Academic Publishers, pp. 271-288, 1999. DOI: 10.1007/0-306-47330-5_15
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22. A. Chockalingam, P. Dietrich, L. B. Milstein, and R. R. Rao, "Performance of Closed-Loop Power Control in DS-CDMA Cellular Systems," *IEEE Transactions on Vehicular Technology*, Vol. 47, No. 3 (August 1998) pp. 774-789. DOI: 10.1109/25.704833

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7. M. Zorzi and R. R. Rao, "Capture and Retransmission Control in Mobile Radio," Journal of Selected Areas in Communications, Vol. 12, No. 8 (October 1994) pp. 1189-1198. DOI: 10.1109/49.329345
6. A. B. Behroozi-Toosi and R. R. Rao, "Delay Upper Bounds for a Finite User Random Access System with Bursty Arrivals," IEEE Transactions on Communications. Vol. 40, No. 3 (March 1992), pp.591-596. DOI: 10.1109/26.135729
5. R. R. Rao, "Computer Communications - A First Course -- J. Walrand," Book Review IEEE Transactions on Information Theory Vol. 38, No. 5 (January 1992), pp.214-216.
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