Curriculum Vitae
Badrinath Ramamurthy

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Hewlett-Packard, ISO
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EDUCATION

PhD., Computer Science, Rensselaer Polytechnic Institute, Troy, NY, USA, 1994.
Thesis Title – "On the Bounded p-Contractibility of Graphs"
MS., Computer Science, Rensselaer Polytechnic Institute, Troy, NY, USA, 1990.
MSc. (Tech) Computer Science, Birla Institute of Technology and Science,
Pilani, India, 1987.

EMPLOYMENT RECORD

Employer	Designation	Duration	Nature of Job
Hewlett-Packard, ISO, Bangalore, India	Technical Architect	7/2003—4/2006	HPC Product Engineering; HPC Filesystems
		5/2006 to date	Work with HPLabs - Semantic Web - Infrastructure automation
IRISA/INRIA, Rennes, France	Visiting Researcher	5/2002—5/2003	Research in Cluster Fault Tolerance
CSE Department Indian Institute of Technology, Kharagpur, India	Visiting Lecturer - Assistant Prof. --- Associate Prof. ---	7/94—12/95 1/96—8/2000 8/2000—6/2003	Teaching, research, and consultancy in Computer Science
RPI, Troy, New York, USA	Instructor, Research Associate, Teaching Assistant	1/89—5/94	Teaching Associate and Research
Consultancy Dev. Center, New Delhi, India	Systems Analyst	7/88—12/88	In Charge of computing facility
National Informatics Center, New Delhi, India	Scientific Officer	7/87—6/88	Network software development

RESEARCH SPECIALIZATION

Areas of research and specialization include High Performance Computing clustered systems, with an emphasis on fault tolerance, checkpoint and recovery schemes; and HPC filesystems. In the recent past, I worked on applications of Semantic Web technologies in enterprise applications. Current work is in the area of automated IT infrastructure provisioning with an attempt to marry some of the HPLabs technologies with HP Enterprise Management Software products and solutions, including cloud-ready infrastructure solutions.

Others areas of expertise include interconnection networks and graph theory.

MAJOR RESEARCH ACCOMPLISHMENTS (Numbers in brackets refer to the publication number as listed in the 'Bibliography' section in this document.)

- Worked on using Semantic Web technologies for enhanced views into data and for annotation[34--37]. The technologies were also presented at the HP-internal conference TechCon-07.
- Worked on using VMs and introducing virtualization awareness into the scheduler for checkpoint-restart[33]. The technologies were also presented at the HP-internal conference TechCon-05 and TechCon-07.
- Responsible for the design and implementation of the checkpoint-restart module for parallel programs on the Kerrighed operating system as described in [23,26,27].
- Studied the impact of various parameters – both system and application parameters on the efficacy of checkpoint-restart schemes and arrived at adaptive methods as described in [19,22,25,28,30,31].
- Implemented Zero-Copy efficient communication schemes for clusters as described [16].
- Studied the "multi-connected loop" architecture for parallel processing and proposed faster shortest path algorithms, routing and queuing schemes. This resulted in my second PhD student's thesis. Relevant publications are [9,11,12,13,14,15,20].
- Studied the "star" interconnection network and proposed methods for efficiently solving problems on this architecture and methods to efficiently use them. This resulted in my first PhD students' thesis. Relevant publications are [7,8,10].
- Studied the difficulty of efficient computation on certain reconfigurable parallel processor architectures and provided practical heuristic solutions. This work was towards my PhD thesis. Relevant publications are [2,3,4,6]

MAJOR PROJECT RESPONSIBILITIES AT HP

Role of an architect/expert consultant on the following HP Prototypes / Products:

- OpenSSI – Prototype for a single system image distributed cluster operating system. 2003-2004 - Individual engineer
- XC – HP's Cluster Computing Software stack Product 2004-2006 – HPC expert
- Semantic Web Research Team – 2006-2008 – Individual researcher
- Independent Research for tunable filesystems for HPC 2008-2009 – Individual researcher/investigator
- Cells – A prototype for an HP Infrastructure as a service. 2009-2011 – Engineer / researcher
- HPCS – Quality Architect and release signoff for storage and compute components of HP's cloud service as seen on www.hpcloud.com Mid 2011 onwards.

ADDITIONAL PROFESSIONAL ACTIVITIES:

- General Co-Chair HiPC '2006 through HiPC '2008 (see www.hipc.org and [E1,E2,E3])
- Program Chair(Applications) ICISTM-10, Workshop Chair – SENOPT'08 at HiPC'08, Workshop Chair – Workshop on Utility, Cloud and Grid Computing at ICDCIT'08
- Invited/Tutorial speaker – IWDC 2005 (Kharagpur, Dec 2005), CIT 2003 (Berhampur, December 2003), IDC HPC User Conference (Bangalore, March 2007), HPC in Observational Astronomy(Pune, Oct 2009)

BIBLIOGRAPHY (Chronologically ordered; Badrinath Ramamurthy abbreviated as R.Badrinath)

1. R. Abburi, R. Badrinath, K. Gildea, and M.S. Krishnamoorthy.
   A Programming Environment for Protocol Development and its Applications.
   In *Proceedings of the International Conference on Computer Integrated Manufacturing*, pages 178-185. IEEE Computer Society Press, 1990.

2. R. Badrinath and M. S. Krishnamoorthy.
   Bounded 2-Contraction of Graphs.
   In *Proceedings of the* 29th *Allerton Conference on Communication, Control and Computing*, pages 498-507, October 1991.

3. R. Badrinath and M. S. Krishnamoorthy.
   On solving Problems for p-Contractible Graphs.
   In *Proceedings of the* 30th *Allerton Conference on Communication, Control and Computing*, pages 565-574, October 1992.

4. R. Badrinath and M. S. Krishnamoorthy.
   Bounded p-Contractability is NP-Complete.
   Technical Report 92-17, Rensselaer Polytechnic Institute, June 1992.

5. R. Badrinath and M. S. Krishnamoorthy.
   Chromatic Polynomials for Reducible and Full 2-Contractible Graphs.
   Congressus Numerantium, 101:187-192, 1994.

6. R. Badrinath and M. S. Krishnamoorthy.
   The Difficulty of Finding Good Embeddings of Program Graphs onto the OPAM
   Architecture.
   In *Proceedings of the International Conference on Massively Parallel Processing using
   Optical Interconnections*, pages 124-132, January 1995.

7. D. K. Saikia, R. Badrinath, and R. K. Sen.
   Embedding Torus on the Star Graph.
   In *Proceddings of the International Conference on High Performance Computing*, pages
   611-616, December 1995.

8. D. K. Saikia, R. Badrinath, and R.K. Sen.
   Congestion-free Dilation-2 Embedding of Full Binary Trees on Star Graphs.
   In *Proceddings of the International Conference on High Performance Computing*, pages
   152-157, December 1996.

9. N. Chalamaiah and R. Badrinath.
   Communication Primitives in Ring-Connected Multicomputers.
   In *Proceddings of the IEEE National Conference on Internet for India*, pages 17-20,
   December 1997.

10. D. K. Saikia, R. Badrinath, and R.K. Sen.
    Embedding Torus on the Star Graph.
    IEEE Transactions on Parallel and Distributed Systems, 9(7):650-663, July 1998.

11. N. Chalamaiah and R. Badrinath.
    Finding Shortest Paths in Multi-Loop Networks.
    Information Processing Letters, 67(3):157-161, August 1998.

12. N. Chalamaiah and R. Badrinath.
    Multiple Token Distributed Loop Local Area Networks: Analysis.
    In *Proceddings of the International Conference on High Performance Computing*, pages
    400-407, December 1998.

13. N. Chalamaiah and R. Badrinath.
    Modelling and Analysis of MCDL Networks.
    In *Proceddings of the International Conference ICCIT-98*, pages 2-6, December 1998.

14. N. Chalamaiah and R. Badrinath.
    Analysis of Multiconnected Loop Topologies for Interconnection Networks.
    In Proceddings of the 21st National Systems Conference, pages 327-332, January 1998.

15. N. Chalamaiah and R. Badrinath.
    A Multi-token Distributed Loop for Local Area Networks.
    In Proceddings of the 21st National Systems Conference, pages 333-338, January 1998.

16. R. Badrinath, S. Gangulay, and A. Singh.
    QMP - a fast protocol for COWs.
    In Proceedings of the International Conference on Parallel and Distributed Computing Systems, pages 437-442, August 2001.

17. R. Badrinath and K. Karnavat.
    Best Effort with Reservation for VoIP through non-RSVP Clouds.
    In Proceedings of the International Conference on Parallel and Distributed Computing Systems, pages 448-456, August 2001.

18. R. Badrinath, N. Mitra, N. Mukherjee, and N. Sinha.
    Performance Modelling of 3G UMTS systems.
    In Proceedings of the International Symposium on The Convergence of Information Technologies and Communications (ITCom 2001), August 2001.

19. H.S. Paul, A. Gupta, and R. Badrinath.
    Evaluation of different classes of checkpoint and recovery protocols with dPSim.
    In Proceedings of the International Conference on Information Technology, pages 315-320, December 2001.

20. N. Chalamaiah and R. Badrinath.
    Deadlock-free Wormhole Routing in Distributed Loop Networks with Virtual Channels.
    In Proceedings of the 7th National Conference on Communications, pages 365-369, January 2001.

21. R. Badrinath, R. Gupta, and N. Srivastava.
    FTOP: A system for fault tolerance on PVM.
    In Proceedings of the International Conference on Parallel and Distributed Computing Systems, pages 520-525, November 2002.

22. H.S. Paul, A. Gupta, and R. Badrinath.
    Hierarchical Coordinated Checkpointing Protocol.
    In Proceedings of the International Conference on Parallel and Distributed Computing Systems, pages 240-245, November 2002.

23. R. Badrinath and C. Morin.
    Common Mechanisms for Supporting Fault Tolerance in DSM and Message Passing Systems.
    Technical Report RR-4613, INRIA, November 2002.

24. P. Panigrahi and R. Badrinath.
    Graceful Labeling of Balanced Stars of Paths.
    In Proceedings of the R C Bose Centenary Symposium on Dicrete Mathematics and Applications, Calcutta, December 2002.

25. H.S. Paul, A. Gupta, and R. Badrinath.
    Performance comparison of checkpoint and recovery protocols.
    In Concurrency and Computation: Practice and Experience,Volume 15(15), pages 1363-1386, 2003.

26. R. Badrinath, C. Morin, and G. Vallée.
    Checkpointing and Recovery of Shared Memory Parallel Applications in a Cluster, In

Proceedings of the DSM03 Workshop/ IEEE CCGRID 2003 Conference, pages 471-478, May 2003.

27. Christine Morin, Renaud Lottiaux, Geoffroy Vallée, Pascal Gallard, Gaël Utard, Ramamurthy Badrinath, Louis Rilling: Kerrighed: A Single System Image Cluster Operating System for High Performance Computing. Euro-Par 2003: 1291-1294

28. Himadri Sekhar Paul, A Gupta, and R Badrinath: A Heterogeneous Checkpoint and Recovery Protocol in Cluster-Based Distributed Systems. In Proceedings of the PDPTA, pages 1224-1230, 2003.

29. A K Turuk, Rajeev Kumar, and R. Badrinath: A Token Based Distributed Algorithm for Medium Access in an Optical Ring Network. In the Proceedings of the International Conference on Distributed Computing (IWDC 2003), LNCS 2918, pages 340-349.

30. Sébastien Monnet, Christine Morin, Ramamurthy Badrinath, A hierarchical checkpointing protocol for parallel applications in cluster federations, in Proceedings of the 18th International IEEE Parallel and Distributed Processing Symposium, pages 211, 2004

31. Sébastien Monnet, Christine Morin, Ramamurthy Badrinath, Hybrid checkpointing for parallel applications in cluster federations. CCGRID 2004: 773-782

32. Ashok K. Turuk, Rajeev Kumar and R. Badrinath. A token-based distributed algorithm for medium access in an optical ring network. Optics Communications, Vol. 23, Issue 1-- 6, pages 199 -- 212, February 2004.

33. R Badrinath, R. Krishnakumar, and R K Palanivel Rajan: Virtualization Aware Job Schedulers for Checkpoint-Restart, In the Proceedings of the International Conference on Parallel and Distributed Systems/ SRMPDS'07, Dec 2007, pages 1-7.

34. Geetha Manjunath, Craig Sayers, Dave Reynolds, Venugopal KS, Swarup Kumar Mohalik, Badrinath R, John Ludd Recker and Malena Mesarina :"Semantic Views for Controlled Access to the Semantic Web", In Workshop on Semantic Web for Collaborative Knowledge Acquisition, SWeCKA'07, 6-12 Jan, 2007

35. Geetha Manjunath, Craig Sayers, Dave Reynolds, KS Venugopal, Swarup Mohalik, R Badrinath; John Recker, Malena Mesarina: Semantic Views for Controlled Access to the Semantic Web, HP Labs Technical Report No. HPL-2008-15, March 2008.

36. Tyler Close, John Recker, Craig Sayers, R Badrinath: Sidebar-- Ad-hoc, Yet Organized, Personal Collaboration, HP Labs Technical Report No. HPL-2008-17, March 2008.

37. Geetha Manjunath, R Badrinath, Craig Sayers and Venugopal K S: Temporal Views over RDF Data, Poster, WWW'08, Beijing, April 2008.

38. Ramamurthy Badrinath: Compute as a Service: Cells as a Service, Contributed section in – Moving To The Cloud: Developing Apps in the New World of Cloud Computing, Elsevier, December 2011.

Conference Proceedings (Editor)

39. Y L Robert, M Parashar, R Badrinath, V K Prasanna, (Eds.) Proceedings of the 13th International Conference on High Performance Computing – HiPC 2006. LNCS 4297, Springer, December 2006.

40. S Aluru, M Parashar, R Badrinath, V K Prasanna, (Eds.) Proceedings of the 14th International Conference on High Performance Computing – HiPC 2007. LNCS 4873, Springer, December 2007.

41. P Sadayappan, M Parashar, R Badrinath, V K Prasanna, (Eds.) Proceedings of the   15th International Conference on High Performance Computing – HiPC 2008. LNCS 5374, Springer, December 2008.

42. DK Panda, R Badrinath, R Govindaraju, V K Prasanna, (Eds.) Proceedings of the 19th International Conference on High Performance Computing – HiPC 2012

HP Internal Publications/Presentations:

43. "Virtualization aware job schedulers for checkpoint-restart", Krishnakumar R, Badrinath Ramamurthy, Palanivel Rajan Kulasekar, Parallel and Distributed System, Seoul, December 2007. Attempt at a practical way to integrate virtualization and schedulers instead of using OS invasive technologies as in the "ZAP" paper above. An earlier version of the work was accepted as a poster for TechCon'07: "Practical Checkpoint-Restart for HPC Clusters".

44. "Semantic Dashboard", Anish Pulikottil Joseph, Venugopal Srinivasmurthy K, and Ramamurthy Badrinath, Poster/Demo and Dragon's Den awardee at HP-TechCon Asia, Kobe, Japan, Nov 2007. The idea in this presentation was later used as the basis of a US Patent indicated below.

45. "Temporal Views over Network Sensor Data", R. Badrinath, Geetha Manjunath, Venugopal K.S., and Craig Sayers, Presented as a full paper at TechCon'07

46. "A Data Aggregation Solution for HPSIM using Semantic Web", Venugopal KS, Geetha Manjunath, R Badrinath, Anita S Kelkar, Siddhesh Jere and Craig Sayers, Presented as a full paper at TechCon'07.   This was particularly exciting as it indicated the benefits of using Semantic Web technologies to mine information from standard HP Management software to enable monitoring and control over aggregated infrastructure. This was also presented to the HPSIM software team.

47. "Zap: Application-Transparent Process Migration", John Janakiraman, Jose Renato Santos, Yoshio Turner, Ramamurthy Badrinath, Gopalakrishna N. Manjunatha, Doug Williams. TechCon'05, April 2005. A very similar idea was later productized by IBM (Meosys).

Patent Award:

48. "Method and system for collecting and distributing user-created content within a data-warehouse based computational system", United States Patent 8,190,555 this is based on applying the semantic web works.

PhD Thesis Advised:

1. "On the Star Graph Topology for Interconnection Networks", by D K Saikia, IIT Kharagpur, June 1997.
2. "A Study of Issues in Multi-Connected Distributed Loop Networks", by N. Chalamaiah, IIT Kharagpur, June 1999.
3. "Compiler Transformations for Improving the performance of Software Transactional Memory Systems", Sandya Mannarswamy, IISc Bangalore, June 2011.

Master Theses Advised (A few, recent):

1. "Theory and evaluation of a Protocol for Checkpointing of parallel Applications in Cluster Federations", Sebastien Monnet, IRISA Rennes, June 2003.
2. "Validating query costing and re-modeling a subset of Relational Operators in a relational database", Suresh LS, Masters Thesis, Birla Institute of Technology and Sciences, Pilani, 2009.
3. "Computation as a Service in Cloud Computing Environment", Abu Bakkar Sarkar, Masters Thesis, Birla Institute of Technology and Sciences, Pilani, 2009.
4. "Storage as a service in cloud computing environment", Abhik Das, Masters Thesis, Birla Institute of Technology and Sciences, Pilani, 2009.