Anand Natrajan

Objective

A senior technical position leading a small, deadline-driven development team producing high-quality software products. I enjoy design as well as development focussing on use-case scenarios. I look forward to working in emerging technologies and engaging in multi-disciplinary interaction.

Organisational Fit

I have a strong and proven 13-year track record of working with cutting-edge technology and developing products for small and large companies. I have worked in the entire software cycle from requirements through planning, design, development, maintenance, services and support. Moreover, I have the experience, confidence, demeanour and desire to be in customer-facing situations. I speak well in public and have strong technical writing skills. In addition, I am willing and able to take on leadership roles. I can provide several references attesting to any of these skills on request.

Contact

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Legal Status

Permitted to work in the US with no sponsorship.

Experience & Education

Director of Research & Development
i411 Inc. 02.2005 – present

Senior Software Engineer
Senior Consultant
Avaki Inc. 09.2001 – 01.2005

Principal Architect
EarthMusic Network 02.2000 – present

Research Scientist
University of Virginia 09.1999 – 09.2001

Ph.D. in Distributed Simulations
Master's in Computer Science
University of Virginia 08.1993 – 09.1999

Graduate Engineer
Larsen & Toubro 08.1992 – 08.1993

Bachelor's in Computer Technology
University of Bombay 08.1988 – 08.1992

Strengths & Skills

Technical

- Widely-referenced expert in Distributed Systems – grids, Legion
- Web Services – Apache Axis, SOAP, XML, VB .NET, Perl SOAP::Lite
- Java, J2EE, C/C++, XML/XSLT, JSP, Perl, PHP, scripting, Tcl/Tk
- CGI, JavaScript, servlets, some JSP
- Linux, Solaris, HP-UX, Windows
- Clusters and queuing systems – PBS, LSF, LoadLever, Maui

Communication

- 20+ peer-reviewed papers, technical reports, whitepapers
- Keynote, conference and invited speeches as well as seminar and technical group presentations
- Consulting experience with several Fortune 100 companies

Leadership

- Led design and architecture teams
- Led development efforts
- Led research groups
- Lead author on most publications

Accomplishments & Awards

- Developed first commercial web services API for data grids
- Jointly designed dataflow model for data grids
- Designed and developed first fully-integrated web portal for grids
- Jointly conducted largest biochemical modelling experiment on grids
- Developed first fuzzy search technology widely-used for Hindi film music
- Best paper award

Work Experience

Director of R&D — *i411 Inc.* — Feb. 2005 – present

- i411 Inc. is a self-funded, profitable company located in Herndon, VA. The company designs and deploys Internet Yellow Pages capabilities for its customers. The key benfits of the i411 approach are low cost and very high performance.
- As a director in a small company, I play a very hands-on role in the design and development of i411 products and strategies. I research software components that can cooperate or compete with the company's product. I also participate in grant proposal authorship. I work closely with the engineering and product management team to achieve my goals.
- I was responsible for the ground-up design of v5.0 of DiscoveryEngine, the company flagship product. This product is the best-of-breed in the faceted, fielded, fulltext search engine space, and has been deployed to power a number of customer sites.

Senior Software Engineer — *Avaki Inc.* — Jul. 2003 – Jan. 2005

- Avaki Inc. is a VC-funded company located in Burlington, MA. The company develops data grids which have corporate application in EAI/EII/ETL/BI environments. Data grids provide secure, wide-area access to databases and files.
- As part of the Engineering team, I led the design and development of APIs based on EJB and web services. I also led the design of next-generation data views for complex data transformations and flows. Earlier, I led the product port to HP-UX and Itanium. I also designed stylesheets for large database result-set transformation. I developed a status service and other tools to monitor run-time performance and behaviour. I worked in teams as well as independently, but in both cases, with input from the Services group.
- The development environment was Java/J2EE on Unix/Windows platforms. As part of my responsibilities, I implemented web services using Apache Axis. These web services had to be accessible from a variety of clients, including Axis-based Java clients, SOAP::Lite-based Perl clients, .NET-based VB clients (including clients that were Excel spreadsheets). I ensured that the entire company, ranging from the VPs of Product Management, Services and Marketing, to consultants and documenters were brought up to speed on these technologies.

Senior Consultant — *Avaki Inc.* — Sep. 2001 – Jul. 2003

- I joined Avaki Inc. as part of their Services group. In this capacity, I consulted with several Fortune 100 clients for both compute-grid and data-grid services. My role involved providing technical input to statements of work (SOWs), deploying evaluation and production grids in accordance with the SOWs, and providing post-deployment support. As part of the technical evaluations of our product at customer sites, I tested and wrote utilities, made technical presentations and participated in design discussions with the Engineering team.
- During my tenure, our group had an extraordinarily high success rate with deployments, as judged by criteria agreed upon by the customer and Avaki. Post-engagement feedback from customers frequently mentioned my technical competence, my professionalism and my quickness and thoroughness of response often "beyond the call of duty".

Work Experience (contd.)

Principal Architect — ***EarthMusic Network*** — **Feb. 2000 – present**

- EarthMusic Network is a Hindi film music site located at http://www.earthmusic.net/. The web site provides a unique search engine indispensable to fans of Hindi music. Hindi songs use a Devnagari script which is often transliterated into the Roman script for searching and viewing. The transliteration is not canonical – different people transliterate differently. Moreover, information available on Hindi songs is often scant.
- As technical lead, I designed and developed a fuzzy search engine, called Mantra, for this site. Mantra is a language-independent search engine that can search based on misspellings and mistransliterations. Mantra was incorporated into the general search capability on the site which permitted searching based on singer, film name, year, etc. The web site receives 5500+ hits a day (~ one per 15 seconds), and continues to exist as one of the most popular sites on the web for searching for Hindi music.
- The development environment was Perl and PHP CGI. Advanced information retrieval techniques developed in-house were used in the Mantra search engine. A key feature of the EarthMusic Network environment was innovation – constantly providing better search techniques and result presentation that stayed a step ahead of rival sites.

Research Scientist — ***University of Virginia*** — **Sep. 1999 – Sep. 2001**

- The department of Computer Science at the University of Virginia is located in Charlottesville, VA. In the mid-90s, the highly-ranked Computer Science dept. developed a pioneering technology called metasystems (now called grids) under the direction of Prof. Andrew Grimshaw.
- As part of this research team, called Legion, I led the design of schedulers and scheduling tools for running large jobs on distributed and fault-prone resources. I tested and wrote utilities for running MPI jobs, developed tools for running jobs on various queuing systems, and wrote command-line tools. I also wrote the first web browser for grids, built over Legion. I wrote one of the first graphical viewers for parameter-space studies. I also conducted what was then the largest run of an application on grids; an important proof-of-concept activity for the community that also yielded valuable results to the scientists involved. My duties also involved interacting with users, determining requirements and driving the design of grids based on their feedback.
- Legion was a research environment, but attuned to the needs of several users and collaborators spread across the globe. The development environment was C++, with some Perl/ksh scripting. My focus was on developing quality software in an academic environment and aggressively publishing the results of using this software.

Software Engineer — ***Larson & Toubro*** — **Aug. 1992 – Aug. 1993**

- Larson & Toubro is the largest engineering company in India. Their Information Systems Division, located in a large facility in Bombay, is one of the leaders in software development in India.
- I was part of a team in this division that wrote and tested C++ classes for a CAD package developed by a prominent French client, Matra. I also wrote Xlib routines for displaying the elements in the package. I developed tools for managing classes and automatically generating test cases.
- The development environment was SunOS/Solaris, with some exposure to Motif and Xlib. Development code was C++. In addition to my responsibilities, I developed several scripts to help manage the team's productivity.

Education

Ph.D., Computer Science, August 1999, Univ. of Virginia, Charlottesville, VA.
Topic: Consistency Maintenance in Concurrent Representations

M.C.S., Computer Science, July 1995, Univ. of Virginia, Charlottesville, VA.
Topic: Consistency Management on Distributed Simulations

B.E., Computer Technology, May 1992, Vivekanand Education Society's Inst. of Tech., Univ. of Bombay, Bombay, India.

Development Experience

- Actively involved in investigating and adopting new technologies as needed
- Quick learner, but with long experience in core technologies
- Web Services, SOAP, Apache Axis, SOAP::Lite, .NET
- J2EE, EJBs, JSP, CGI, JavaScript, HTML, XML, XSLT
- Java, C/C++, Perl, PHP, shell programming, Tcl/Tk, some SQL
- log4j, Javadoc, JUnit/NUnit for logging, documentation, testing
- JBoss and Tomcat for application deployment
- Perforce and CVS for source control
- TestTrack for bug tracking
- Ant and make for project development
- Cygwin and IIS for Windows platforms
- Solaris, Linux, HP-UX, Windows and DOS
- Industry expert on compute-grid and data-grid systems
- Parallel and distributed systems, MPI, PVM
- Experienced in information retrieval, modelling and simulation, computer architecture
- Familiar with bioinformatics applications
- Proficient in productivity tools such as MS PowerPoint, MS Excel, MS Visio, Adobe FrameMaker

Teaching Experience

Senior Consultant, *Avaki Compute and Data Grid*, Avaki Inc., Aug. 2001 – Jul. 2003.

Graduate Teaching Assistant, *Undergraduate Introduction to C++ (CS101)*, Dept. of Computer Science, Univ. of Virginia, Spring 1995.

Graduate Teaching Assistant, *Undergraduate Programming Languages (CS455)*, Dept. of Computer Science, Univ. of Virginia, Spring 1994.

Graduate Teaching Assistant, *Graduate Computer Architecture (CS654)*, Dept. of Computer Science, Univ. of Virginia, Fall 1993.

Tutor, *English/History/Civics/Geography*, Grades 8, 9 and 10, Vora Classes, 1991-1992.

Awards and Other Professional Experience

Best Paper, ELECSIM 1995.

Participant, *Global Grid Forum*, Oct. 2000 – Aug. 2001.

Contributor, *Comprehensive Perl Archive Network (CPAN)*.

Project Member, *System for Constructing Neural Networks for Character Recognition*, Vivekanand Education Soc.'s Inst. of Tech., Univ. of Bombay, Bombay, India, 1991-1992.

Project Member, *Graphical User Interface for TEX*, Tata Inst. of Fundamental Research, Bombay, India, 1991-1992.

Interests

Search and Yellow Pages, Grid Computing, Web Services, J2EE, Distributed Systems and Architecture, Modelling and Simulation, Web Architecture

Papers and Publications

Refereed Journal Articles

1. Grimshaw, A. S., Humphrey, M. A., Natrajan, A., *A Philosophical and Technical Comparison of Legion and Globus*, IBM J. of Res. and Devel., Vol. 48, No. 2, pp.233-254, March 2004.
2. Natrajan, A., Crowley, M., Wilkins-Diehr, N., Humphrey, M. A., Fox, A. D., Grimshaw, A. S., Brooks, C. L. III, *Studying Protein Folding on the Grid: Experiences using CHARMM on NPACI Resources under Legion*, Grid Computing Environments 2001, Concurrency and Computation: Practice and Experience, Vol. 16, pp. 385-397, 2004.
3. Lewis, M. J., Ferrari, A. J., Humphrey, M. A., Karpovich, J. F., Morgan, M. M., Natrajan, A., Nguyen-Tuong, A., Wasson, G. S., Grimshaw, A. S., *Support for Extensibility and Site Autonomy in the Legion Grid System Object Model*, J. of Par. and Dist. Computing, Vol. 63, pp. 525-538, 2003.
4. Natrajan, A., Humphrey, M. A., Grimshaw, A. S., *The Legion Support for Advance Parameter-Space Studies on a Grid*, Future Generation Computer Systems, Vol. 18, No. 8, pp. 1033-1052, Elsevier Science, October 2002.
5. Natrajan, A., Nguyen-Tuong, A., Humphrey, M. A., Herrick, M., Clarke, B. P., Grimshaw, A. S., *The Legion Grid Portal*, Grid Computing Environments 2001, Concurrency and Computation: Practice and Experience, Vol. 14, 2001.
6. Reynolds, P. F. Jr., Natrajan, A., Srinivasan, S., *Consistency Maintenance in Multi-Resolution Simulations*, Trans. on Modeling and Computer Simulation (TOMACS), Vol. 7, No. 3, pp. 368-392, July 1997.

Refereed Conference Proceedings

7. Natrajan, A., Crowley, M., Wilkins-Diehr, N., Humphrey, M. A., Fox, A. D., Grimshaw, A. S., Brooks, C. L. III, *Studying Protein Folding on the Grid: Experiences using CHARMM on NPACI Resources under Legion*, 10th High Perf. Dist. Computing (HPDC), August 2001.
8. Natrajan, A., Humphrey, M. A., Grimshaw, A. S., Brooks, C. L. III, *Grids: Harnessing Geographically-Separated Resources in a Multi-Organisational Context*, High Perf. Computing Syst. (HPCS), **Keynote Speech**, June 2001.
9. Natrajan, A., Humphrey, M. A., Grimshaw, A. S., *Capacity and Capability Computing in Legion*, The 2001 Intl. Conf. on Computational Sc. (ICCS), pp. 273-283, May 2001.
10. Natrajan, A., Reynolds, P. F. Jr., *Resolving Concurrent Interactions*, 3rd Intl. Work. on Dist. Interactive Simulation and Real Time Applications (DIS-RT), October 1999.
11. Natrajan, A., Reynolds, P. F. Jr., Srinivasan, S., *A Flexible Approach to Multi-Resolution Modeling*, Par. and Dist. Simulation (PADS), June 1997.
12. Natrajan, A., Nguyen-Tuong, A., *To disaggregate or not to disaggregate, that is not the question*, Electronic Simulation (ELECSIM), May-June 1995, **Best Paper**. Also Univ. of Virginia Dept. of Computer Science Tech. Rep. CS-95-18, June 1995.

Papers and Publications (contd.)

Book Chapters

13. Grimshaw, A. S., Herrick, M., Natrajan, A., *Avaki Data Grid – Secure, Transparent Access to Data*, Grid Technology Publications, eds. Ahmar Abbas, In publication, 2003.
14. Natrajan, A., Grimshaw, A. S., Humphrey, M. A., *Grid Resource Management in Legion*, Grid Resource Management: State of the Art and Future Trends, eds. Jennifer Schopf, Jaroslaw Nabrzyski, Jan Weglarz, Kluwer Publications, pp.145-160, 2003, ISBN 1-4020-7575-8.
15. Grimshaw, A. S., Natrajan, A., Humphrey, M. A., Lewis, M. J., Nguyen-Tuong, A., Karpovich, J. F., Morgan, M. M., Ferrari, A. J., *From Legion to Avaki: The Persistence of Vision*, Grid Computing: Making the Global Infrastructure a Reality, eds. Fran Berman, Anthony J. G. Hey, Geoffrey C. Fox, John Wiley & Sons, pp.265-298, March 2003, ISBN 0-470-85319-0.

Dissertation

16. Natrajan, A., *Consistency Maintenance in Concurrent Representations*, Univ. of Virginia Dept. of Computer Science Diss. CS-2000-01, January 2000.

Unrefereed Publications

17. Natrajan, A., Grimshaw, A. S., Humphrey, M. A., Nguyen-Tuong, A., *Dispelling Seven Myths About Grid Resource Management*, Univ. of Virginia, Dept. of Computer Science, Tech. Rep. CS-2004-33, August 2004.
18. Natrajan, A., Reynolds, P. F. Jr., *Concurrent Representations for Jointly-Executing Models*, Univ. of Virginia, Dept. of Computer Science, Tech. Rep. CS-2001-20, July 2001.
19. Wasson, G. S., Natrajan, A., Gunderson, J. P., Ferrer, G. J., Martin, W. N., Reynolds, P. F. Jr., *Consistency Maintenance in Autonomous Agent Representations*, Univ. of Virginia, Dept. of Computer Science, Tech. Rep. CS-98-06, February 1998.
20. Natrajan, A., Powell, A. L., French, J. C., *Using N-grams to Retrieve Hindi Queries with Transliteration Variations*, Univ. of Virginia, Dept. of Computer Science, Tech. Rep. CS-97-17, July 1997.
21. Natrajan, A., *Authentication Based on Logical Time*, Univ. of Virginia, Dept. of Computer Science, Tech. Rep. CS-97-23, May 1996.

Grant Proposals

22. Reynolds, P. F. Jr., Natrajan, A., *Multi-Resolution Models*, Grant Prop. to US Army SIMTECH, 1998-1999.
23. Reynolds, P. F. Jr., Natrajan, A., *Multi-Resolution Modeling for Fire Support*, Grant Prop. to US Army SIMTECH, 1997-1998.
24. Reynolds, P. F. Jr., Natrajan, A., Srinivasan, S., *Guidelines for Consistency Maintenance*, Grant Prop. to Defense Modeling and Simulation Office (DMSO), 1996-1997.
25. Reynolds, P. F. Jr., Natrajan, A., Srinivasan, S., *Consistency Maintenance using UNIFY*, Grant Prop. to Defense Modeling and Simulation Office (DMSO), 1995-1996. Also Univ. of Virginia Dept. of Computer Science Tech. Rep. CS-95-28, November 1995.

Professional Activities

Speaker

Invited, Grid Perspectives, The Indus Entrepreneurs (TIE), June 2002.

Keynote, High Performance Computing Systems and Applications (HPCS), June 2001.

Invited, University of Maryland, Baltimore County, April 2001.

Committee Member

Program Committee, Journal of Parallel and Distributed Computing (JPDC), 2002.

Program Committee, Distributed Simulations and Real-Time Applications (DS-RT), October 2002, October 2001.

Thesis Committee, Michael P. Walker, A Framework for Scheduling Data-Parallel Applications in Grid Systems, May 2001.

Graduate Student Mentoring Program, University of Virginia, Department of Computer Science, 1994-1998.

Referee

Dist. Computing, 2003.

12th High Perf. Dist. Computing (HPDC), 2003.

J. of Par. and Dist. Computing (JPDC), 2002.

Concurrency and Computation: Practice and Experience (C&C: P&E), 2001.

Intl. Parallel and Distributed Processing Symp. (IPDPS), 2001.

Intl. Conf. on Parallel Processing (ICPP) 2000.

2nd Merged Symp. IPPS/SPDP 1999, 13th Intl. Par. Processing Symp. & 10th Symp. on Parallel and Distributed Processing.

11th, 13th, 14th, 15th Work. on Par. and Dist. Simulation (PADS), 2001, 2000, 1999, 1997.

6th Conf. on Information and Knowledge Management, 1997.

ACM Trans. on Modeling and Computer Simulation (TOMACS), Distributed Simulation, 1996, Parallel Simulation, 1996, Computer Generated Forces, 1997.

Dist. Simulations and Real-Time Applications (DS-RT), 2000, 2001, 2002.

IEEE Trans. on Par. and Dist. Syst. (TPDS), 2000.

IEEE Intl. Conf. on Services Computing (SCC) Grid and Utility Computing Track, 2004.

Miscellaneous

Desk Coordinator, University of Virginia, Department of Computer Science, Dec. 1997 – Aug. 1999.

Social Coordinator, University of Virginia, Department of Computer Science, Jun. 1996 – Nov. 1997.

Student Mentor, University of Virginia, Department of Computer Science, 1994 – 1999.