

## **Amy W. Apon, Ph.D.**

Professor and Chair, Division of Computer Science, Clemson University

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### **EDUCATION**

- PhD Computer Science, Vanderbilt University, 1994
- MS Computer Science, University of Missouri-Columbia, 1983
- MA Mathematics, University of Missouri-Columbia, 1981
- BS Ed Mathematics, University of Missouri-Columbia, 1979 (Magna Cum Laude)

### **AREAS OF RESEARCH EXPERTISE**

Cloud computing, applications to Intelligent Transportation and Connected Vehicle, data-enabled science, performance modeling and analysis of parallel and distributed system, networks for high performance computing, impact of high performance computing to research competitiveness, sustainable funding models for research computing, data center design

### **PROFESSIONAL EXPERIENCE**

- 2011-present Chair (with release in 2015), Computer Science Division, Clemson University
- 2011-present Professor, Computer Science, Clemson University
- 1/2016-7/2016 Interim Associate Director for Strategic Initiatives, School of Computing, Clemson
- 1/2015-1/2016 Program Officer, National Science Foundation
- 2008-2011 Director, Arkansas High Performance Computing Center (Founding Director)
- 2004-2008 Director of High Performance Computing, University of Arkansas
- 2007-2011 Professor, Computer Science and Computer Engineering, University of Arkansas
- 2002-2007 Associate Professor, CSCE Department, University of Arkansas
- 1998-2002 Assistant Professor, CSCE Department, University of Arkansas
- 1997-1998 Assistant Professor, Computer Science Department, Vanderbilt University
- 1996-1997 Instructor, Computer Science Department, Vanderbilt University
- 1995-1996 Research Instructor, Biomedical Informatics Department, Vanderbilt University
- 1994-1995 Assistant Professor, Mathematics and Computer Science, Fisk University
- 1990-1994 Ph.D. Fellow, Vanderbilt University, Four-Year Honor's Fellowship
- 1985-1989 Assistant Professor, Computer Science, East Central University, Ada, OK
- 1983-1985 Software Design Engineer, Texas Instruments, Dallas, Texas

## **SIGNIFICANT PROFESSIONAL CONTRIBUTIONS AND AWARDS**

In 2017, Apon received, with Professor Mashrur Chowdhury (Intelligent Transportation Systems), the Collaboration Award from the College of Engineering, Computing, and Applied Sciences at Clemson University. This award recognizes a team of two or more faculty who have demonstrated exemplary and synergistic collaboration in research and/or teaching.

In 2010, Apon received the Distinguished Faculty Achievement Award for Service to the university and the state by the Arkansas Alumni Association, the highest honor given to University of Arkansas faculty members.

In 2009, Apon was awarded the Imhoff Award for Contribution to Research in the College of Engineering at the University of Arkansas, the highest award given in the College of Engineering.

Apon was a Program Officer in the Computer and Network Systems Division of the CISE Directorate of the National Science Foundation from 1/2015 to 1/2016. In this role she managed the proposal submission and review processes for multiple programs, including Computer Systems Research, Exploiting Parallelism and Scalability, Critical Technologies for Big Data, and Smart and Connected Health. She made funding recommendations and interacted with a large community of researchers.

Since 2011, as Professor and Chair of the Computer Science Division in the School of Computing, Dr. Apon has led in multiple successful collaborative proposals to the NSF and partnered in additional proposals that were funded or submitted. The collaborative efforts together have increased the morale and energy of faculty in the Division of Computer Science and collaborative partners and are having a positive effect to their overall research productivity. Research productivity has more than tripled, as measured by count of publications and dollars funded under Apon's leadership.

Two funded Major Research Instrumentation (MRI) projects from the National Science Foundation with PI Apon, NSF 9/1/2012-8/30/2015, \$994K; and NSF 9/1/2017-8/30/2020, partner with professional Ph.D.-level staff in the Clemson Cyberinfrastructure Technology Insertion (CITI) Division and more than twenty faculty across eight departments at Clemson and with two additional universities. The projects have acquired significant expansions to the Clemson Palmetto supercomputing cluster that are a major test platform for several projects in parallel file systems and data-intensive parallel applications.

Apon was the PI on "CI SEEDS – Seeding the Next Generation Cyberinfrastructure Ecosystem" [NSF 4/1/2012-3/31/2015, \$953K, PI Apon]. CI SEEDS is a bridging program to encourage and support students from their bachelor's program into Ph.D. study in areas of data-enabled science. This exemplar program is in its first year, and provides organizational support for recruiting, a summer research experience for undergraduate and beginning graduate students, and an academic year program that matches faculty mentors with new students. The program reached new students and new types of students for Ph.D. study.

Other significant collaborative projects include the NSF-funded project “CI Practitioner” [NSF, 10/1/2012-9/30/2014, \$298K, PI Collier, co-PI Apon] to formalize and develop curricula for CI internships with industrial partners, and an I/UCRC site in the area of decision and visual informatics. Apon led a project that utilizes rigorous econometrics techniques to study the “Effect of Cyberinfrastructure on Universities’ Production Process” [NSF INSPIRE, 8/15/2012-8/14-2015, \$600K, PI Apon], a collaborative project with Economics colleague Dr. Paul Wilson at Clemson.

Prior to coming to Clemson, Apon established the Arkansas High Performance Computing (HPC) Center. The AHPCC was funded by the Arkansas Science and Technology Authority in May 2008. Dr. Apon served as director of high performance computing at the University of Arkansas from 2004-2011. She led the efforts to win multiple grants from NSF that led to the acquisition of supercomputers, including MRI from the National Science Foundation grants in 2004, 2007, and 2010, and the EPSCoR Track-2 grant in 2009. The acquisition of Red Diamond was the first computer in Arkansas ranked on the Top 500 list, in June 2005. These acquisitions created change in the computational community at the University of Arkansas and across the state. The research community grew, top rate publications and research products were produced, and new faculty were attracted to the University as a result of the availability of HPC resources.

Apon led cyberinfrastructure for the state of Arkansas from 2007-2011. Apon initiated and led the effort to bring the high-profile team of experts in high performance computing to the State of Arkansas in October 2007, that included the leaders in the state of all public and private sectors. A consensus plan for cyberinfrastructure was developed during fall, 2008, with participants from the research institutions in the state of Arkansas, and private and public partners. The Arkansas Cyberinfrastructure Task Force Act was passed through her efforts in 2009. Apon was the PI on the state of Arkansas EPSCoR Track-2 project, 2009-2011, in collaboration with ten institutions across the states of West Virginia and Arkansas. The goals of this project, CI TRAIN (<http://www.ci-train.org>), were: 1) grow the cyber workforce through the creation of faculty and staff Cyberinfrastructure Champions that serve as liaisons between researchers and resources and a variety of training and outreach activities, and 2) to provision shared large-scale computational and visualization resources and high-speed network access to participating institutions to support research in a wide spectrum of computational and visualization domains. Apon was the PI on the NSF Academic Research Infrastructure grant, 2009-2011, to the University of Arkansas which dramatically upgraded the data center and campus networking facilities in support of a range of computational science and engineering research areas.

Dr. Apon was the elected Chair of the Coalition for Academic Scientific Computation (CASC, <http://www.casc.org/>) in 2011 and 2012. She served as Vice Chair during 2009-2010. CASC is a national organization with 60-member organizations representing the nation’s most forward-thinking universities and computing centers. CASC is frequently called on to testify before congress and to provide advice at the highest level of funding agencies on strategy and policy for scientific computation. While Vice Chair of CASC, Apon was a co-PI and organizer of the NSF-funded Workshop on Sustainable Funding Models for Research Computing, held at Cornell University, May 2010. This workshop explores critical issues in sustaining the nation’s research infrastructure and provides advice to the National Science Foundation.

Apon was the PI on “Building the Regional Middleware Infrastructure across the Great Plains” to develop a region-wide collaboration environment through the development of middleware services that bridges the geographical boundaries among member institutions. The test bed was completed in 2005 using Shibboleth with about eight participating institutions.

## **TEACHING AND ADVISING**

### **Honor’s or Master’s Thesis or Doctoral Dissertations Directed (serving as major advisor)**

Dr. Apon’s first Ph.D. graduate in 2005 was in the first class of doctoral students admitted to candidacy in the CSCE department at the University of Arkansas. Dr. Apon was instrumental in defining the requirements for the new Ph.D. program in CSCE at Arkansas.

### **Doctoral Degree Advisees Completed**

<b>Degree</b>	<b>Year</b>	<b>Student and Title of Thesis or Dissertation</b>
Ph.D.	May 2005	Pawel Wolinski, “Using Distributed Shared Memory to Store Metadata in a Parallel File System,” Ph.D. Thesis, Computer Science, University of Arkansas
Ph.D.	Dec 2005	Yueyue Zhang, “Array Files for Out-of-Core Computation,” Ph.D. Thesis, Computer Science, University of Arkansas.
Ph.D.	May 2008	Baochuan Lu, “An Integrated Capacity Planning Environment for Enterprise Grids,” Ph.D. Thesis, Computer Engineering, University of Arkansas
Ph.D.	May 2011	Wesley Emeneker, “Modeling Interprocess Shared-Cache Contention on Multicore Architectures with Applications in Virtual Machine CPU Scheduling,” Ph.D. Thesis, Computer Science, University of Arkansas.
Ph.D.	Aug 2011	Hai Nguyen, “File System Simulation: Hierarchical Performance Measurement and Modeling,” Ph.D. Thesis, Computer Science, University of Arkansas.
Ph.D.	Aug 2011	Linh Bao Ngo, “Application of the Empirical Mode Decomposition on the Characterization and Forecasting of the Arrival Data of an Enterprise Cluster,” Ph.D. Thesis, Computer Engineering, University of Arkansas.
Ph.D.	Dec 2011	Seth Warn, “High Performance Geospatial Analysis on Emerging Parallel Architectures,” Ph.D. Thesis, Computer Science, University of Arkansas.
Ph.D.	May 2015	William Clay Moody, Designing, Building, and Modeling Maneuverable Applications in Shared Computing Resources,” Ph.D. Thesis, Computer Science, Clemson University.

Ph.D.	May 2019	Yuheng Du, "Streaming Infrastructure and Natural Language Modeling with Application to Automotive Big Data," Ph.D. Thesis, Computer Science, Clemson University. (Co-advisor Alex Herzog)
Ph.D.	May 2019	Jason Anderson, "Measuring, Characterizing, and Mitigating the Effects of Long-tailed Latency Variation on High Performance Computing Workloads," Ph.D. Thesis, Computer Science, Clemson University.

### Master's Degree Advisees Completed

<u>Degree</u>	<u>Year</u>	<u>Student and Title of Thesis or Dissertation</u>
M.S.	Aug 1998	Parvathi Rajagopal, "Study of Network Cache as a Platform for Parallel Computing," M.S. Thesis, Computer Science, Vanderbilt University
M.S.	Aug 2000	Ann Chen, "On the Optimization of MPI," M.S. Thesis, Computer Science, University of Arkansas
M.S. CSE	May 2001	Baochaun Lu, "The Design of a 3GPP Base Station'," M.S. Project, Computer Systems Engineering, University of Arkansas
M.S. CSCE	May 2001	Chin (David) Chia, "A Smart Web Tool," M.S. Project, CSCE, University of Arkansas
M.S. CSCE	Dec 2001	Prathima Gorjala, "Evaluation of a Parallel File System for Clusters," M.S. Project, CSCE, University of Arkansas
M.S. CSCE	May 2002	William Arensman, "A Study of Cluster and Cluster File Systems as Applied to Digital Map Data Delivery System," M.S. Project, CSCE, University of Arkansas
M.S. CSCE	May 2002	Anila Pillai, "Cluster Computing with LINUX and comparison of NFS and PVFS on GeoStor Data," M.S. Project, CSCE, University of Arkansas
M.S. CSCE	Dec 2002	Prashanth GopalaKrishna, "Parallel File I/O on Cluster for Geographic Information Systems", M.S. project, CSCE, University of Arkansas
M.S. CSCE	May 2003	Mujahed Ibrahim, "Sorting Using MPI on Workstation clusters," M.S. project, CSCE, University of Arkansas

M.S. CSE	Aug 2003	Gregory Amerson, "Design Analysis and Implementation of a Network Messaging Module using VIA," M.S. Thesis, Computer Systems Engineering, University of Arkansas
M.S. CSCE	May 2004	Lance Johnson, "A Three-Node Ring Lock Manager," M.S. project, CSCE, University of Arkansas
M.S. CENG	May 2005	Kurt Landrus, "Using Shibboleth to Control Access to Remote Cluster Resources," M.S. thesis, Computer Engineering, University of Arkansas
M.S. CSCE	Dec 2005	Michael Tinker, "Performance Analysis of the Acxiom Grid Architecture," M.S. project, CSCE, University of Arkansas
M.S. CENG	Dec 2005	Bart Taylor, "Architectural Tradeoffs for Unifying Campus Grid Resources," M.S. Thesis, Computer Engineering, University of Arkansas
M.S. CENG	Aug 2005	Linh Ngo, "Shibbolized Subversion," M.S. Thesis, Computer Engineering, University of Arkansas
M.S. CSCE	Aug 2005	Matt Baker, "Methods for Maintaining Local Cluster Resources for Intercampus and Intracampus Grids," M.S. Thesis, CSCE, University of Arkansas
M.S. CENG	Dec 2008	Hung Bui, "Fairshare Scheduling: A Case Study," M.S. Thesis, Computer Engineering, University of Arkansas
M.S. CSCE	May 2009	James McCartney, "Bouvier Law Term Dictionary for the Twenty-First Century," M.S. project, CSCE, University of Arkansas
M.S.	May 2016	Brandon Posey, "Dynamic HPC Clusters within Amazon Web Services (AWS)," M.S. Thesis, Computer Science, Clemson University
M.S.	Aug 2016	Christopher Gropp, "Analyzing Clustered Latent Dirichlet Allocation," M.S. Thesis, Computer Science, Clemson University

**Undergraduate Honor Students Completed**

<b>Degree</b>	<b>Year</b>	<b>Student and Title of Thesis</b>
B.S.	Dec 1998	Markus Landsberg, "Teaching English to Japanese: A Functional Webspaces", Undergraduate Honor's Thesis, Fulbright College, University of Arkansas

B.S.	May 2000	Julia Lincoln, "An Analysis of Wireless Networking on the University of Arkansas Campus", Undergraduate Honor's Thesis, Fulbright College, University of Arkansas
B.S.	May 2000	Ben McKenzie, "The Design, Analysis, and Implementation of VIA for the PowerPC Architecture", Undergraduate Honor's Thesis, Fulbright College, University of Arkansas
B.S.	May 2002	Brent Shores, "Evaluation of a Real-Time Cluster Architecture", Undergraduate Honor's Thesis, Fulbright College
B.A.	May 2003	Genet Cramlet, "Women in Computing," Undergraduate Honor's Thesis, B.A. Computer Science, minor in Gender Studies, Fulbright College
B.S.	May 2004	Taneem Ibrahim, "Evaluation of Distributed Software Design Architectures", Undergraduate Honor's Thesis, Fulbright College
B.S.	May 2008	Christopher Bryan, "Holistic Characterization of Parallel Programming Models in a Distributed Memory Environment," Undergraduate Honor's Thesis, College of Engineering
B.S.	May 2011	Stanislav Bobovych, "Parallelizing Scale Invariant Feature Transform on a Distributed Memory Cluster," Undergraduate Honor's Thesis, College of Engineering, University of Arkansas

### Students in Progress

Ph.D. CS	Brandon Posey, graduation expected, August 2019.
M.S. CS	Aishwarya Srivastava, graduation expected, May 2019. (thesis option)
Ph.D. CS	Michael Payne, graduation expected May 2020. (full-time with RLEX Group, Atlanta)
Ph.D. CS	Lily Xu, graduation expected, 2020. (full-time employee LexisNexis, Atlanta)
Ph.D. CS	Christopher Gropp, graduation expected, 2020. Co-advisor, Alex Herzog.
Ph.D. CS	Robert Underwood, graduation expected, 2020. Co-advisor, Jon Calhoun.
Ph.D. CS	Farah Alshaniq, graduation expected, 2020, Co-advisor, Ilya Safro.
Ph.D. CS	Annie Walker, graduation expected, 2022, Co-advisor, Alex Herzog.

### Scheduled courses taught (by semester):

Number	Title	Enrollment	Term	Purdue 200 rating	GPA
<i>At the University of Arkansas</i>					
CSCE5313	Advanced Operating Systems	14	S'04	4.8, DL=99, UT=85	3.57

CSCE490	Cluster and Grid Computing	2	F'04	5.0, UT=99	3.0
CSCE590	Cluster and Grid Computing	7	F'04	4.7, DT=86, DL=90	3.29
CSCE4253	Concurrent Computing	13	S'05	4.7, DT=82, DL=85	2.15
CSCE590	Concurrent Computing	7	S'05	5.0, UT=99	3.29
CSCE1113	Programming Foundations I	106	F'05	4.0, CL=63, DL=65	2.54
CSCE1113	Programming Foundations I	33	S'06	4.4, UL=63, CL=73	2.53
CSCE4253	Concurrent Computing	13	S'06	4.0, CL=53, DL=78	2.83
CSCE590	Concurrent Computing	4	S'06	5.0, UT=99	4.0
CSCE1113	Programming Foundations I	148	F'06	4.6, DL=85, CL=75	2.66
CSCE590	Grid Computing	6	F'06	4.8, UT=85, DL=99	4.0
CSCE 590	High Performance Computing	12	S'07	4.9, CT=94, UT=91	3.91
CSCE5313	Advanced Operating Systems	14	F'07	4.7, DL=99, UT=72	3.25
CSCE5013	High Performance Computing	8-9 each semester S'08-S'11, ratings n/a			

*At Clemson University*

CPSC 881	Data-Intensive Computing	17	S'12		
CPSC 3620	Distributed and Cluster Computing	27		Several semesters; faculty evaluation scores are at or above level and discipline mean for all instructor evaluation questions	
CPSC 4440/6440	Cloud Computing Architecture			~40 each semester S'17-present. This new course is supported by Amazon Web Services and provides online access to lab materials.	

Dr. Apon has consistently high teaching ratings. All ratings are well above the departmental average course ratings. Some ratings are highly competitive at the University level.

**Other Evidence of Teaching Effectiveness**

- *Outstanding Undergraduate Research Mentor Award*, University of Arkansas, for mentoring to Genet Cramlet and her publication on “Women in Computing” in the Arkansas Journal of Undergraduate Research, May 2004, (\$1000 to mentor).
- *CSCE Teaching Award* during 2001-2002, 2002-2003, and 2003-2004
- Reid Hall Resident Assistant *Favorite Faculty Member* with recognition in a reception that was held on October 28, 1999.
- Participation in the Supercomputing 2002 Education Program, November 2002, Baltimore, MD. She led the team that was selected in a competitive process and attended with D. Thompson and R. Deaton.
- Outstanding Mentor Award from the University of Arkansas, 2001, 2002, 2003, 2004
- Service on numerous masters and Ph.D. thesis committees.



- Direction of many Independent Studies and served as advisor for numerous Senior Design Projects.
- Mentor to SILO SURF Awardee Brent Shores, B.S. Magna Cum Laude, May 2002 – SILO SURF is a prestigious award for the student and the faculty member
- Mentor to SILO SURF Awardee, Genet Cramlet, B.A., Summa Cum Laude, May 2003
- Mentor to Sturgis Undergraduate Awardee, Taneem Ibrahim, Fall 2003 – a prestigious award for the student and the faculty member
- Mentor to SILO SURF Awardee, Taneem Ibrahim, Magna Cum Laude, May 2004
- Mentor to SILO SURF Awardee, Christopher Brian, Cum Laude, May 2008.
- Mentor to SILO SURF Awardee, Stanislav Bobovych, Summa Cum Laude, May 2011
- Dr. Apon routinely escorts graduate students to national and international conferences.
- Dr. Apon attended the Cohort of Associate Professor Project (CAPP) in Denver, Colorado.
- The course on Grid Computing, Fall 2004, is one of a handful of courses of its type in the world, and is developed with collaborators at many institutions with the support of the National Science Foundation through CCLI A&I grant.
- Apon has collaborated with Barry Wilkinson, UNCC, and Jens Mache, Lewis & Clark College, to improve and develop course modules for grid computing.
- Apon collaborated with Thomas Sterling, LSU, to develop and teach course materials in high performance computing using Access Grid and high-definition video during Spring, 2007-2011. This work was supported by NSF Grant # 0634064, “National Dissemination of HPC Introductory Education through Multimedia,” co-PI with PI Sterling.
- New materials developed on Hadoop and MapReduce for CPSC 3620, Distributed and Cluster Computing, put Clemson at the forefront for undergraduate education in this area. These materials were adopted and extended by the instructor in succeeding semesters.
- *New course in Cloud Computing Architecture is one of a very small handful of similar courses taught across the country and put Clemson on the front edge of education in cloud computing.*

Apon has received numerous emails and other correspondence from students regarding her courses. The email below in 2018 is just one example of this evidence of teaching effectiveness from Keerti Kosana, Calhoun Honors College B.S. CS student and President of ACM-W:

**Sankeerthana Kosana**

Fri, Dec 14, 2:53 PM (18 hours ago) ☆ ↩ ⋮

to Amy ▾

Thanks, Dr. Apon! I'm so glad I took Cloud Computing this semester! I've learned about a lot of new concepts that I found to be very helpful and applicable. Cloud Computing is a growing field with plenty of opportunities, and taking this class has definitely spurred my interest in the subject. There is a long way for me to go, but I'm definitely looking into resources to further my knowledge on Cloud Computing.  
Happy Holidays!

Thanks,  
Keerti Kosana

### **Mentoring in Teaching**

Dr. Apon actively mentored Research Associate Dr. Linh Ngo in the delivery of CPSC 3620, Distributed and Cluster Computing over several semesters. The course was designed by Apon, and Ngo has lectured the course and gradually introduced some of his ideas for exercises and topics. Dr. Ngo's teaching evaluations have been above average in every category related to the quality of the course.

Dr. Apon actively mentored Graduate Teacher of Record Robert Underwood in the delivery of the required undergraduate course in Operating Systems in fall, 2018. The delivery of the course was highly successful. Robert is on his way to be a superb college-level teacher.

## **RESEARCH, PUBLICATION, AND OTHER CREATIVE ACTIVITY**

### **Project Web Sites (PI Apon)**

- [1] Data Intensive Computing Ecosystem (DICE), <https://www.cs.clemson.edu/dice/>
- [2] Arkansas High Performance Computing Center, 2005-2011. <http://hpc.uark.edu>
- [3] CI TRAIN: Cyberinfrastructure for Transformational Scientific Inquiry, 2009-2011. <http://ci-train.org>
- [4] The CI Impact Project: High Performance Computing and Research Productivity in U.S. Universities, 2009-2011. <http://ci-impact.org>
- [5] Cyberinfrastructure Days at the University of Arkansas, May, 2010. <http://hpc.uark.edu/cidays>

### **Books and Book Chapters**

- [1] R. A. Miller, D. A. Giuse, N. B. Giuse, A. Geissbuhler, A. W. Apon, W. W. Stead. "Opportunities for Training in Biomedical Informatics at Vanderbilt University," Yearbook of Medical Informatics, 1996.
- [2] Contributing author to "The CRC Dictionary of Computer Science, Engineering and Technology", Computer System Performance, Measurement, Modeling and Evaluation, CRC Press LLC, May, 2000.
- [3] A. Apon and M. Baker. "Cluster Computing," in Volume 26 (Supplement 5) of the Encyclopedia of Microcomputers, October, 2000.
- [4] M. Baker, A. Apon, R. Buyya, H. Jin, "Cluster Computing and Applications," in the Encyclopedia of Computer Science and Technology, November, 2001.
- [5] D. R. Thompson and A. W. Apon, "Public Networks," in The Internet Encyclopedia. (H. Bidgoli, Ed.), vol 3. Hoboken, NJ: John Wiley & Sons, Dec. 2003.

- [6] A. Apon and J. Mache, editors, *Proceedings of the International Workshop on Grid Computing*, Grid.Edu 2004, Chicago, Illinois, April, 2004.
- [7] D. R. Thompson and A. W. Apon, "Public Network Technologies and Security," in *The Handbook of Information Security* (H. Bidgoli, Ed.). Hoboken, NJ: John Wiley & Sons, 2005.
- [8] O. Ardaiz-Villanueva, M. Bote-Lorenzo, A. Apon and B. Wilkinson, editors, *Proceedings of the Second International Workshop on Collaborative and Learning Applications of Grid Technology and Grid Computing*, CLAG+Grid.Edu 2005, Cardiff, UK, May, 2005.
- [9] Doug L. Hoffman, Amy Apon, Larry Dowdy, Baochuan Lu, Natham Hamm, Linh Ngo, and Hung Bui, "Performance Modeling of Enterprise Grids", book chapter in T. Talley and Yupo Chan, *Data Engineering, International Series in Operations Research & Management Science Volume 132*, 2010, pp 169-2. [http://link.springer.com/chapter/10.1007/978-1-4419-0176-7\\_9](http://link.springer.com/chapter/10.1007/978-1-4419-0176-7_9)
- [10] *The HPC Instructor's Manual*, with co-author Daniel Apon and Linh Ngo, October, 2009.
- [11] C. Stewart, G. Almes, B. Wheeler (editors), G. Almes, A. Apon, G. Brown, H. Hong, D. Lifka, A. Lumsdaine, C. Lynch, M. Pierce, B. Plale, R. Pordes, J. Schopf, C. Stewart, V. Welch, Br. Wheeler, "Cyberinfrastructure Software Sustainability and Reusability: Report from an NSF-funded workshop held 27 & 28 March 2009, Indianapolis, Indiana. May, 2010. <https://www.slashtmp.iu.edu/public/download.php?FILE=milingwal/18308O3LpJI>
- [12] S. Ahalt, A. Apon, D. Lifka, H. Neeman, *Sustainable Funding and Business Models for Academic Cyberinfrastructure Facilities: Report from an NSF-funded workshop*, 3-5 May 2010, Cornell University. November, 2010. <http://www.cac.cornell.edu/~lifka/Downloads/SRCC/NSF-sponsored-Sustainable-Cyberinfrastructure-Report.pdf>
- [13] M. Chowdhury, A. Apon, and K. Dey, Editors. *Data Analytics for Intelligent Transportation Systems, 1<sup>st</sup> Edition*. Elsevier, April, 2017. 344 pages.
- [14] B. Posey, Linh B. Ngo, M. Chowdhury, A. Apon, *Infrastructure for Transportation Cyber-Physical Systems*, Transportation Cyber-Physical Systems. Elsevier, 2018. Pp. 153-171.
- [15] V Gudivada, A Apon, DL Rao. *Database systems for big data storage and retrieval*, Handbook of Research on Big Data Storage and Visualization Techniques, 2018, pp 76-100.

### Articles Published in Professional Journals

- [1] R. S. Wall, A. W. Apon, J. Beal, M. T. Gately, and L. M. Oren. "An Evaluation of Commercial Expert System Building Tools," *Journal of Data & Knowledge Engineering*, vol. 1, 1985, p. 279-304.
- [2] A. W. Apon and L. W. Dowdy. "The Circulating Processor Model of Parallel Systems," *IEEE Transactions on Computers*, 46(5), May, 1997, p. 572-587.

- [3] A. Apon and M. Baker, "Network Technologies," in A Whitepaper on Cluster Computing, *The International Journal of High-Performance Computing Applications*, 15(2), Summer 2001, p. 102-114.
- [4] M. Baker and A. Apon, "Middleware," in A Whitepaper on Cluster Computing, *The International Journal of High-Performance Computing Applications*, 15(2), Summer 2001, p. 136-142.
- [5] A. Apon, J. Mache, R. Buyya, and H. Jin, "Cluster Computing in the Classroom and Integration with Computing Curricula 2001," *IEEE Transactions on Education*, May 2004.
- [6] M. Baker, A. Apon, C. Ferner, and J. Brown, "Emerging Grid Standards," *IEEE Computer*, 38(4), April 2005, p. 43-50.
- [7] A. Apon, G. Monaco, G. Springer, "The Great Plains Network (GPN) Middleware Test Bed," *Journal of Scalable Computing: Practice and Experience*, 7(3), September, 2006, p. 47-60.
- [8] J. Mache, and A. Apon, "Teaching Grid Computing: Topics, Exercises, and Experiences," *IEEE Transactions on Education*, 50(1), February 2007, p. 3-9.
- [9] Amy Apon and Matt Baker, "Teaching Condor Grid Computing to Beginning Programming Students," *IEEE Distributed Systems Online*, 8(4), 2007, art. no. 0704-o4002. (Matt is my master's student.)
- [10] L. Ngo and A. Apon, "Shibboleth as a Tool for Authorized Access Control to the Subversion Repository System," *Journal of Software*, 2(3), Academy Publisher, September 2007, p. 78-86. (Linh is my master's student.)
- [11] A. Apon, S. Ahalt, V. Dantuluri, C. Gurdgiev, M. Limayem, L. Ngo, M. Stealey, "High Performance Computing Instrumentation and Research Productivity in U.S. Universities," *Journal of Information Technology Impact*, Vol. 10, Issue 2, 2010. <http://www.jiti.net/>
- [12] W. Emenecker and A. Apon, "Characterizing the Performance of Cache-Aware Placement of Virtual Machines on a Multi-Core Architecture," *International Journal of Ad Hoc and Ubiquitous Computing (IJAHUC)*, Special Issue on Cloud Computing – Technologies and Services, 2012, June, 2012.
- [13] W. Emenecker and A. Apon, "On Modeling Contention for Shared Caches in Multi-Core Processors with Techniques from Ecology," *Natural Computing*, Volume 12, Issue 3, pp 411-428. September 2013. <http://link.springer.com/article/10.1007/s11047-012-9348-3>
- [14] H. Nguyen and A. Apon, "A component-based end-to-end simulation of the Linux file system," *Journal of Software and Systems Modeling*, Volume 12, Issue 4, pp 745-764, October 2013. <http://link.springer.com/article/10.1007/s10270-012-0253-0>
- [15] Amy Apon, Linh B. Ngo, Michael Payne, and Paul W. Wilson, "Assessing the Effect of High Performance Computing Capabilities on Academic Research Output, *Empirical Economics*, 2015.

- [16] K Lantz, S Khan, LB Ngo, M Chowdhury, S Donaher, A Apon. "Potential of Online Media and Location-based Big Data for Urgan Transit Network in Developing Countries," Transportation Research Record (TRB), Journal of the Transportation Research Board, 2016.
- [17] SM Khan, M Rahman, A Apon, M Chowdhury. *Characteristics of Intelligent Transportation Systems and Its Relationship With Data Analytics*, Data Analytics for Intelligent Transportation Systems, 2017. pp 1-29.
- [18] WC Moody, AW Apon. *Maneuverable Applications: Advancing Distributed Computing*, The Cyber Defense Review 2 (3), 2017, pp 107-126.
- [19] Yuheng Du, Mashrur Chowdhury, Senior Member, IEEE, Mizanur Rahman, Kakan Dey, Amy Apon, Senior Member, IEEE, Andre Luckow, and Linh Ngo. "A Distributed Message Delivery Ingrastructure for Supporting Connected Vehicle Technology Applications" IEEE Transactions on Intelligent Transportation Systems, 2018, 19(3), pp 787-801.

#### **Articles Published in Refereed Conference Proceedings**

- [1] E. Rosti, E. Smirni, T. D. Wagner, A. W. Apon, and L. W. Dowdy. "The KSR1: Experimentation and Modeling of Poststore," ACM Sigmetrics Conference on Measurement and Modeling of Computer Systems, 1993, pp. 74-85.
- [2] T. D. Wagner, E. Smirni, A. W. Apon, M Madhukar, and L. W. Dowdy. "Measuring the Effects of Thread Placement on the Kendall Square KSR1," 8th International Parallel Processing Symposium, 1994.
- [3] C. Childers, A. W. Apon, W. H. Hooper, K. Gordon, and L. W. Dowdy. "The Multigraph Modeling Tool," 7th International Conference on Parallel and Distributed Computing Systems, 1994.
- [4] A. W. Apon. "Challenges of Capacity Planning in a Distributed Environment," Computer Measurement Group Conference on the Performance of Enterprise Computer Systems, 1996.
- [5] A. W. Apon, T. D. Wagner, and L. W. Dowdy. "A Learning Approach to Processor Allocation in Parallel Systems," Eighth International Conference on Information and Knowledge Management CIKM99, November, 1999, p. 531--537.
- [6] A. W. Apon and L. W. Dowdy. "Load Dependent Single Chain Models of Multichain Closed Queueing Networks," Seventh International Conference on Telecommunication Systems, March, 1999.
- [7] P. Rajagopal and A. W. Apon. "Evaluation of RTFC as a Platform for Parallel Computing," Lecture Notes in Computer Science, Proceedings of the Fourteenth IPDPS 1999 Workshops on Parallel and Distributed Processing, 7th Workshop on Parallel and Distributed Real-Time Systems, Springer-Verlag, London, UK, April, 1999, p. 299-308. (Parvathi is my masters's student.)

- [8] A. W. Apon, H. A. Chen, C. F. Fischer, and L. Wilbur. "A Communication Staging Technique for Network Cache Architecture Clusters," in First IEEE International Workshop on Cluster Computing (IWCC'99), IEEE Computer Society (R. Buyya et al., eds.), 1999, p. 55-62.
- [9] H. A. Chen, Y. O. Carrasco, and A. W. Apon. "MPI Collective Operations over IP Multicast," Lecture Notes in Computer Science, Proceedings of the Fifteenth IPDPS 2000 Workshops on Parallel and Distributed Processing, Springer-Verlag, London, UK, May, 2000. pp. 51-60. (Ann is my master's student.)
- [10] A. Apon, R. Buyya, J. Mache, and H. Jin. "Cluster Computing in the Classroom: Topics, Guidelines, and Experiences," The First IEEE/ACM International Symposium on Cluster Computing and the Grid (CCGrid 2001), Brisbane, Australia, May 16-18, 2001, p. 476-483.
- [11] A. Apon, P. Wolinski, and D. Reed. Massive Data Processing on the Acxiom Cluster Testbed. Commercial Applications for High Performance Computing, held as a part of SPIE 2001, Denver, Colorado, August 19-23, 2001, p. 147-158. (Pawel and Dennis are students under my supervision.)
- [12] A. Apon, P. Wolinski, G. Amerson, "Sensitivity of Cluster File System Access to I/O Server Selection," Proceedings of CCGrid 2002, May, 2002, pp. 183-192. (Pawel is a Ph.D. student and Greg is a master's student under my supervision.)
- [13] A. Apon, L. Wilbur, "AmpNet—A highly Available Cluster Interconnection Network", Proceedings of IPDPS 2003, Workshop on Communication Architectures for Clusters, Berlin, Germany, April, 2003, pp. 201-210.
- [14] M. Ibrahim, A. Apon, "Sorting using MPI on workstation clusters," Proceedings of the International Conference on Parallel and Distributed Processing Techniques and Applications, Las Vegas, Nevada, June, 2003, pp. 151-156. (Mujahed is my M.S. student.)
- [15] Y. Zhang, A. Apon, P. Pulay, "File Arrays for Out-of-Core Computations" Proceedings of the International Conference on Parallel and Distributed Processing Techniques and Applications, Las Vegas, Nevada, June, 2003, 7 pages. (Yueyue is my Ph.D. student.)
- [16] A. Apon, J. Mache, Y. Yara, and K. Landrus, "Classroom Exercises for Grid Services," Proceedings of the Linux Cluster Institute International Conference on High Performance Computing, Austin, Texas, May, 2004, 12 pages.
- [17] Johnson, L., and Apon, A. "A Three-Node Ring Lock Manager," International Conference on Parallel and Distributed Processing Techniques and Applications, Las Vegas, Nevada, June, 2004, 4 pages. (Lance is my master's student.)
- [18] Gregory Amerson, and A. Apon, "Implementation and Design Analysis of a Network Messaging Module Using Virtual Interface Architecture," International Conference on Cluster Computing (Cluster 2004), San Diego, September, 2004, 11 pages. (Greg is my master's student.)
- [19] A. Apon, Kurt Landrus, Jens Mache, and Kathryn Huxtable, "Using Shibboleth to Manage Access Control to Remote Cluster Computing Resources," Proceedings of SC2004 - 17th

ACM/ IEEE High-Performance Computing, Networking and Storage Conference, November, 2004.

- [20] A. Apon, Kurt Landrus, "Introduction to Shibboleth," Proceedings of ALAR 2005 Conference on Applied Research in Information Technology, February 18, 2005. (Kurt is my master's student.)
- [21] J. Mache and A. Apon, "Grid Computing in the Undergraduate Classroom: Topics, Exercises and Experiences," Second International Workshop on Collaborative Learning Applications of Grid Technology and Grid Education, Proceedings of the International Conference on Cluster Computing and the Grid, Cardiff, UK, May, 2005.
- [22] B. Lu, M. Tinker, A. Apon, D. Hoffman, and L. Dowdy, "Adaptive Automatic Grid Reconfiguration Using Workload Phase Identification," Proceedings of EScience 2005, December, 2005, 9 pages. (Baochuan is my Ph.D. student and Michael is my master's student.)
- [23] F. Robinson, A. Apon, D. Brewer, L. Dowdy, D. Hoffman, B. Lu, "Initial Starting Point Analysis for K-Means Clustering: A Case Study," Proceedings of ALAR 2006 Conference on Applied Research in Information Technology, March, 2006.
- [24] B. Taylor and A. Apon, "Unifying Campus Grid Resources," PowerPoint presentation at ALAR 2006 Conference on Applied Research in Information Technology, March, 2006. (Bart is my master's student.)
- [25] B. Taylor and A. Apon, "Architectural Tradeoffs for Unifying Campus Grid Resources," Linux Cluster Institute 2006, May, 2006, 26 pages. (Bart is my master's student.)
- [26] Y. Zhang and A. Apon, "Implementation Tradeoffs of the Array Files Library for Out-of-Core Computations," International Conference on Cluster Computing (Cluster 2006), Barcelona, September, 2006, 8 pages. (Yueyue is my Ph.D. student.)
- [27] R. Friedman, C. D. Covington, A. Apon, A. Mantooth, F. Barlow. "Warfighter Security in Commercial Satellite Networks through Signal Path Diversity," American Institute of Aeronautics and Astronautics, September, 2006.
- [28] B. Lu, A. Apon, L. Dowdy, F. Robinson, D. Hoffman, and D. Brewer, "A Case Study on Grid Performance Modeling," International Conference on Parallel and Distributed Computing Systems, November 13, 2006, 9 pages. (Baochuan is my Ph.D. student.)
- [29] H. Shen, A. Apon, C-Z Xu, "LORM: Supporting low-overhead P2P-based range-query and multi-attribute resource management in grids," 13th International Conference on Parallel and Distributed Systems (ICPADS 2007), December 5-7, 2007, Hsinchu, Taiwan. IEEE Computer Society 2007, 1-8.
- [30] L. Ngo and A. Apon, "Using Shibboleth for Authorization and Authentication to the Subversion Version Control System, ALAR Conference on Applied Research in Computer Science, March 9, 2007, Fayetteville, Arkansas (not copyrighted).

- [31] L. Ngo and A. Apon, "Using Shibboleth for Authorization and Authentication to the Subversion Version Control Repository System," International Conference on Information Technology (ITNG'07), April, 2007, pp. 760-765. (Linh is my master's student.)
- [32] M. Baker and A. Apon, "Methods for Maintaining Local Cluster Resources on the Open Science Grid," ALAR Conference on Applied Research in Computer Science, March 9, 2007, Fayetteville, Arkansas. (Matt is my master's student.)
- [33] W. Emenecker and A. Apon, "HPC Virtual Machine Resource Management," Mardi Gras Conference 2008, Baton Rouge, Louisiana, March, 2008. (Wesley is my Ph.D. student.)
- [34] B. Lu, L. Ngo, H. Bui, A. Apon, N. Hamm, L. Dowdy, D. Hoffman, and D. Brewer, "Capacity Planning of Supercomputing Resources in an Academic Environment: A Case Study," Linux Cluster Institute (LCI) International Conference on High Performance Cluster Computing, Champaign-Urbana, Illinois, April, 2008.
- [35] L. Ngo and A. Apon, "Teaching a Course in High Performance Computing for Non-Computing Science and Engineering Students," IT@EDU Conference, Ho Chi Minh City, Vietnam, December, 2008. (Linh is my master's student, Wesley is my Ph.D. student.)
- [36] S. Malladi, H. Bui, A. Apon, J. Cothren, C. Thompson, "Using System Z and Cell/BE to Accelerate an Image Sticking Application," IT@EDU International Conference, Ho Chi Minh City, Vietnam, December, 2008. (Sree Malladi and Hung Bui are master's students under my supervision, with co-advisors Cothren and Thompson.)
- [37] C. Bryan, W. Emenecker, and A. Apon, "A Performance and Productivity Study using MPI, Titanium, and Fortress," HiPC08 Student Symposium, Bangalore, India, December, 2008. (Chris is my undergraduate honor's students, Wesley is my Ph.D. student.)
- [38] B. Lu, L. Ngo, H. Bui, A. Apon, N. Hamm, L. Dowdy, D. Hoffman, and D. Brewer, "Workload Modeling for Performance Management," Computer Measurement Group International Conference '08, Las Vegas, Nevada, December, 2008. (Baochuan Lu is my Ph.D. student.)
- [39] W. Emenecker and A. Apon, "Characterizing Low Level Virtualization Machine Performance in Scientific Applications," Proceedings of ALAR 2009 Conference on Applied Research in Information Technology, February 13, 2009. (Wesley is my Ph.D student.)
- [40] L. Ngo, B. Lu, H. Bui, A. Apon, N. Hamm, L. Dowdy, D. Hoffman, and D. Brewer, "Application of Empirical Mode Decomposition to the Arrival Time Characterization of a Parallel Batch System Using System Logs," MSV '09 International Conference on Modeling, Simulation, and Visualization Methods, Las Vegas, Nevada, July, 2009. (Linh is my Ph.D. student.)
- [41] S. Warn, W. Emenecker, J. Cothren, and A. Apon, "Accelerating SIFT on Parallel Architectures," Cluster 2009," New Orleans, LA, September, 2009.
- [42] H. Bui, L. Ngo, B. Lu, and A. Apon, "Diverse Characterization of a Supercomputing Workload," IT@EDU Conference, Ho Chi Minh City, Vietnam, March, 2010.
- [43] H. Bui, W. Emenecker, A. Apon, D. Hoffman, and L. Dowdy, "Fairshare Scheduling – A Case Study," Linux Cluster Institute (LCI) International Conference on High Performance Cluster Computing, Pittsburgh, PA, March, 2010.



- [44] S. Ahalt, A. Apon, V. Dantuluri, L. Ngo, M. Stealey, "Where are the U.S. Academic Supercomputers?", poster presented at Linux Cluster Institute (LCI) International Conference on High Performance Cluster Computing, Pittsburgh, PA, March, 2010.
- [45] L. Ngo, A. Apon, D. Hoffman, and L. Dowdy, "A Forecasting Capability Study of Empirical Mode Decomposition for the Arrival Time of a Parallel Batch System," International Conference on Information Technology (ITNG'10), April, 2010.
- [46] H. Nguyen, "Performance Analysis of the ext3 File System," Acxiom Laboratory for Applied Research (ALAR) '10, Conway, AR, April, 2010.
- [47] W. Emenecker and A. Apon, "Cache Effects of Virtual Machine Placement on Multicore Processors," International Workshop on Virtualization Technology (IWVT '10), Bradford, UK, June, 2010.
- [48] S. Warn, W. Emenecker, J. Gauch, J. Cothren, A. Apon, "Accelerating Image Feature Comparisons using CUDA on Commodity Hardware," Symposium on Application Acceleration in High Performance Computing, Knoxville, TN, July, 2010.
- [49] S. Bobovych, W. Emenecker, S. Warn, J. Cothren, A. Apon, "Parallelization of the Scale Invariant Feature Transform," poster presentation at the International Conference for High Performance Computing, Networking, Storage, and Analysis, New Orleans, November, 2010. (Stan Bobovych is my Honor's Undergraduate student.)
- [50] H. Nguyen and A. Apon, "Characteristics of Read/Write Operations and Implications for File System Performance Modeling in Linux," International Conference on Performance Engineering, Karlsruhe, Germany, March, 2011.
- [51] S. Warn, A. Apon, J. Cothren, "Accelerating SIFT on hybrid clusters," Proceeding HPDGIS '11, Proceedings of the ACM SIGSPATIAL Second International Workshop on High Performance and Distributed Geographic Information Systems, ACM, New York, NY, USA, ISBN: 978-1-4503-1040-6 doi>10.1145/2070770.2070771.
- [52] L. Ngo, V. Dantuluri, M. Stealey, S. Ahalt, A. Apon "An Architecture for Mining and Visualization of U.S. Higher Educational Data," International Conference on Information Technology (ITNG'12), April, 2012.
- [53] L. Ngo, D. Hoffman, A. Apon, "An An Empirical Study on Forecasting using Decomposed Arrival Data of an Enterprise Computing System," International Conference on Information Technology (ITNG'12), April, 2012. Acceptance rate 36%
- [54] H. Nguyen, D. L. Hoffman, A. Apon, "Parallel File System Measurement and Modeling Using Colored Petri Nets," International Conference on Performance Engineering," Boston, MA, May, 2012. Acceptance rate 28%
- [55] Pengfei Xuan, Kimberly Ferguson, Christin Marshall, John McCann, Linh B. Ngo, Yueli Zheng, and Amy W. Apon, poster publication at eScience, Chicago, October, 2012. (All student co-authors except Ngo, who is a post-doc)

- [56] Amy Apon, Linh Bao Ngo, and Paul W. Wilson, "Efficiency as a Measure of Knowledge Production of Research Universities," The Atlanta Conference on Science of Science and Innovation Policy, September, 2013. 24 pages.
- [57] William Clay Moody, Linh B. Ngo, Edward Duffy, and Amy Apon, "JUMMP: Job Interruptible Maneuverable Map Reduce," Proceedings of the IEEE International Conference on Cluster Computing, September, 2013. 8 pages. Acceptance 39%
- [58] Timothy Barrett, Graham Lenes, Ken Kennedy, Philipp Lix, and Amy Apon, "Automotive Big Data," student poster presentation in IEEE International Conference on Cluster Computing, September, 2013.
- [59] Pengfei Xuan, Yueli Zheng, Sapna Sarupria, and Amy Apon, "SciFlow: A Dataflow-Driven Model Architecture for Scientific Computing using Hadoop," Integrating Large Scale Molecular Dynamics Simulation with Forward Flux Sampling on Hadoop," Workshop on Big Data and Science: Infrastructure and Services, held in conjunction with IEEE BigData 2013, October, 2013. 9 pages. Full paper acceptance rate 22%.
- [60] Michael Payne, Linh Ngo, and Amy Apon, "Academic Research Publishing as a Social Media Paradigm," Proceedings of the IEEE Workshop on Scholarly Big Data, held in conjunction with IEEE BigData 2013. October, 2013. 4 pages.
- [61] Linh Bao Ngo, Michael E. Payne, and Amy Apon. "Teaching HDFS/MapReduce Systems Concept to Graduate." In Proceedings of the NSF/TCPP Workshop on Parallel and Distributed Computing Education. May 2014.
- [62] W.C. Moody; J. Anderson; K.-C. Wang; A. Apon, 'Reconfigurable Network Testbed for Evaluation of Datacenter Topologies', Proceedings of the 6th International Workshop on Data-intensive Distributed Computing (DIDC'14) , June, 2014.
- [63] Jason Anderson, Ken Kennedy, Linh Bao Ngo, Andre Luckow, and Amy Apon. "Synthetic Data Generation for the Internet of Things." Proceedings of the IEEE International Conference on Big Data. 2014, October, 2014.
- [64] Michael E. Payne, Linh Bao Ngo, Flavio Villanustre, and Amy Apon. "Managing the Academic Data Lifecycle: A Case Study of HPCC." Proceedings of the IEEE Workshop of Scholarly Big Data, held in conjunction with IEEE BigData. October, 2014.
- [65] W.C. Moody; Hongxin Hu; A. Apon, 'Defensive Maneuver Cyber Platform Modeling with Stochastic Petri Nets', Proceedings of the IEEE International Conference on Collaborative Computing: Networking, Applications and Worksharing (Collaboratecom), October, 2014.
- [66] A. Apon. "Experimentation as a Tool for the Performance Evaluation of Big Data Systems." Proceedings of the 1st Workshop on Performance Analysis of Big Data Systems, 2015.
- [67] K Lantz, S Khan, LB Ngo, M Chowdhury, S Donaher, A Apon. "Potential of Online Media and Location-based Big Data for Urgan Transit Network in Developing Countries," Proceedings of the Transportation Research Board 94th Annual Meeting, January, 2015.

- [68] Linh Bao Ngo, Michael E. Payne, Flavio Villanustre, and Amy Apon. "Dynamic Provisioning of Data Intensive Computing Middleware Framework." Proceedings of the Workshop on the Science of Cyberinfrastructure: Research, Experience, Applications, and Models, held in conjunction with High Performance Distributed Computing, Portland, OR. June, 2015
- [69] A Luckow, K Kennedy, F Manhardt, E Djerekarov, B Vorster, A Apon. "Automotive big data: Applications, workloads and infrastructures." Proceedings of the IEEE International Conference on Big Data (Big Data), 2015, p. 1201-1210.
- [70] J. Anderson, U. Agarwal, H. Li, H. Hu, C. Lowery, A. Apon. "Performance Considerations of Network Functions Virtualization using Containers." Proceedings of the 2016 IEEE International Conference on Computing, Networking and Communications (ICNC'16), Hawaii, January, 2016.
- [71] C. Gropp, A. Herzog, I. Safro, P.W. Wilson, A. Apon. "Scalable Dynamic Topic Modeling with Cluster Latent Dirichlet Allocation (CLDA)," arXiv preprint arXiv:1610.07703. 2016.
- [72] J. Anderson, C. Gropp, L. Ngo, and A. Apon. "Random Access in Nondelimited Variable-length Record Collections for Parallel Reading with Hadoop," 2<sup>nd</sup> IFIP/IEEE International Workshop on Analytics for Networks and Services, May, 2017.
- [73] B. Posey, C. Gropp, A. Herzog, A. Apon, *Automated Cluster Provisioning And Workflow Management for Parallel Scientific Applications in the Cloud*, MTAGS'17, in conjunction with SC17, November, 2017.
- [74] Y Du, A Herzog, A Luckow, R Nerella, C Gropp, A Apon. Representativeness of latent dirichlet allocation topics estimated from data samples with application to common crawl, Big Data (Big Data), 2017 IEEE International Conference on, 1418-1427
- [75] L Xu, E Muharemagic, A Apon. *ECL-watch: A big data application performance tuning tool in the HPC systems platform*, Big Data (Big Data), 2017 IEEE International Conference on, 2941-2950.
- [76] R Underwood, J Anderson, A Apon. *Measuring Network Latency Variation Impacts to High Performance Computing Application Performance*. Proceedings of the 2018 ACM/SPEC International Conference on Performance Engineering, April, 2018. pp 68-79.
- [77] B Posey, C Gropp, B Wilson, B McGeachie, S Padhi, A Herzog, A Apon. *Addressing the Challenges of Executing a Massive Computational Cluster in the Cloud*, 18th IEEE/ACM International Symposium on Cluster, Cloud and Grid (CCGrid). May, 2018. pp 253-262.
- [78] D Nguyen, A Luckow, E Duffy, K Kennedy, A Apon. *Evaluation of Highly Available Cloud Streaming Systems for Performance and Price*, 18th IEEE/ACM International Symposium on Cluster, Cloud and Grid (CCGrid). May, 2018, pp 360-363.
- [79] Aishwarya Srivastava, Dung Nguyen, Siddhant Aggarwal, Andre Luckow, Edward Duffy, Ken Kennedy, Marcin Ziolkowski, and Amy Apon. *Performance and Memory Trade-offs of Deep Learning Object Detection in Fast Streaming High-Definition Images*, Big Data (Big Data), 2018 IEEE International Conference on, December, 2018.

## Government Technical Reports

- [1] E. Rosti, E. Smirni, T. D. Wagner, A. W. Apon, and L. W. Dowdy. "The KSR1: Experimentation and Modeling of Poststore," ORNL/TM-12287, April 15, 1993, 37 pages.
- [2] T. D. Wagner, E. Smirni, A. W. Apon, M Madhukar, and L. W. Dowdy. "Measuring the Effects of Thread Placement on the Kendall Square KSR1," ORNL/TM-12462, September 7, 1993, 31 pages.
- [3] A. Apon, Final Report for NSF Grant 9617384, "Application and Evaluation of a Low-Cost Parallel Processing Platform", June 29, 1999.
- [4] A. Apon, Final Report for NSF Grant 9996143, "A Parallel Message Passing Platform for Atomic Structures Calculations", October 30, 2001.
- [5] A. Apon, Status report to NSF for Accurate Calculation of Electron Correlation Energies in Large Molecules using Low-cost Parallel Hardware (co-PI), January, 2004.
- [6] A. Apon, G. Monaco, G. Springer, K. Huxtable. "Building the Great Plains Network Middleware Testbed," Case Study and Final Report to Educause/NSF, January, 2006.
- [7] A. Apon, Yearly and Final reports for NSF Grant 0410966, "Collaborative Project: Adaptation of Globus Toolkit 3 Tutorials for Undergraduate Computer Science Students," (PI), July, 2006 and July, 2007.
- [8] A. Apon, Yearly and Final reports for NSF Grant 0421099, "MRI: Acquisition of a Computing Cluster for High-End Applications in Science and Engineering (CHASE)," (PI), August, 2005, August, 2006, August, 2007, and October, 2008.
- [9] A. Apon, Yearly reports for NSF Grant 0722625, "MRI: Acquisition of a Supercomputing Cluster for Computational and Data-Intensive Applications in Science and Engineering," (PI), 2008-2011.
- [10] A. Apon, Quarterly report for "The Cyberinfrastructure Center of Arkansas," grant from the Arkansas Science and Technology Authority (PI), each quarter during 2008-2010.
- [11] Final report for NSF MRI #0722625, , "MRI: Acquisition of a Supercomputing Cluster for Computational and Data-Intensive Applications in Science and Engineering," PI Apon, November, 2011.
- [12] Yearly reports for ongoing NSF grants, 2011-present

## Other Formal Reports and Publications

- [1] A. Apon., "The Acxiom Cluster Testbed," Final Report to the Arkansas Science and Technology Authority, August, 2002.

- [2] Advisor to B. Shores, "Analysis of a Real-Time Software Architecture for Low-Cost Linux Clusters," Final Report to SURF/SILO, May, 2002.
- [3] A. Apon, "Phase I Software Development of the Virtual Satellite," Project Status Report to the Virtual Satellite Corporation, December 20, 2002.
- [4] Advisor to P. Gopalakrishna, Master's Thesis on Parallel File I/O on Cluster for Geographic Information Systems, submitted as a project report to PCI Geomatica, December, 2002.
- [5] G. Amerson, J. Maxwell, D. Reed, and A. Apon, "Evaluation of the InfinSwitch InfiniBand Cluster Interconnect," Project Report to InfinSwitch Corporation, December 18, 2002.
- [6] Thompson, D., Apon, A., Yara, Y., Mache, J., and Deaton, R., "Training a Grid Workforce", poster presented at The Oklahoma Supercomputing Symposium, September, 2003.
- [7] Michael Tinker, Linh Ngo, A. Apon, Bill Johnston, and Snow Winters, "Exploiting the Grid: Distributed Rendering," poster presented at The Oklahoma Supercomputing Symposium, October, 2004.
- [8] A. Apon, "The Adaptive Acxiom Grid," Presentation and report to Acxiom Corporation, August, 2004.
- [9] A. Apon, "Requirements and Development of an Acxiom Modeling Environment Based on Single and Multi-Class Queuing Network Models," (PI), Final Report to Acxiom Corporation, June 30, 2006.
- [10] Advisor to Hai Nguyen, "Grid Data Service Simulator," ALAR Conference on Applied Research in Computer Science, March 9, 2007, Fayetteville, Arkansas.
- [11] Advisor to Reid Phillips and Matt Baker, "Application Packaging and Checkpointing on the Grid with VMWare," ALAR Conference on Applied Research in Computer Science, March 9, 2007, Fayetteville, Arkansas.
- [12] Workshop Participant and Contributor, "Curricula for Undergraduate and Masters Level Courses in E-Science," Report from the ICEAGE (International Collaboration to Extend and Advance Grid Education) Curricula Development Workshop, Brussels, February 14-15, 2008, with Malcohm Atkinson (Chair) and others.
- [13] Workshop Participant and Contributor, Final Report of the Workshop on Instrumentation Needs of Computer and Information Science and Engineering (INCISE) Research, Snowbird, Utah, July 12-13, 2008, with PI Jose Fortes and others.
- [14] Workshop Participant and Contributor, "Developing a Coherent Cyberinfrastructure from Local Campus to National Facilities: Challenges and Strategies," Report from the EDUCAUSE Campus Cyberinfrastructure Working Group and Coalition for Academic Scientific Computation, July, 2008, with Patrick Dreher (Chair) and others.
- [15] Supervisor to Jeff Pummill, panelist and presentor, "Teragrid Campus Champions Panel Presentation," SC 08 International Conference for High Performance Computing, Networking, Storage, and Analysis, Austin, TX, November, 2008.

- [16] J. Pummill, D. Brunson, A. Apon, "Community Funding Models for Computational Resources," position paper in the NSF-funded Workshop on Sustainable Research Computing Centers, Ithaca, NY, May, 2010.
- [17] A. Apon, Panel Member in SC13 Birds of a Feather panel on Benefits-Cost Ratio of High Performance Computing, November, 2013, Denver, Colorado.

### **Invited Articles and Presentations**

- [1] "Applications of Generalized Stochastic Petri Nets to the Performance Evaluation of Multiprocessor Systems," Formal Modeling of Complex Systems Seminar, Vanderbilt University, February 24, 1995.
- [2] "The Circulating Processor Model of Parallel Systems," Real-Time and Distributed Systems Group Seminar, Carleton University, May 23, 1995.
- [3] "Cluster Computing Research at Vanderbilt," University of Tennessee Space Institute, September 11, 1997.
- [4] Dr. Apon developed a series of PowerPoint tutorials on concurrent and cluster computing and presented these in a seminar series to employees of Axiom Corporation during the 1999-2000 academic year.
- [5] "Cluster Computing Research at the University of Arkansas", Axiom technical symposium, Spring, 2000.
- [6] D. Andrews, A. Apon, and L. Welch. "Message Passing Architectures for Stochastic and Dynamic Distributed Real Time Systems," 20th IEEE International Performance, Computing, and Communications Conference (IPCCC 2001), Phoenix, Arizona, April 4-6, 2001, p. 367-372.
- [7] A. Apon, "Introduction to Shibboleth," Oklahoma Supercomputing Symposium, Norman, Oklahoma, October 6, 2004.
- [8] A. Apon, "Supercomputing at the University of Arkansas," Oklahoma Supercomputing Symposium, Norman, Oklahoma, October, 2005.
- [9] A. Apon, "High Performance and Grid A. Apon, B. Lu, L. Ngo, H. Bui, N. Hamm, L. Dowdy, D. Hoffman, D. Brewer, "Project Presentation on Enhanced Grid Modeling," presentation at the ALAR Conference on Applied Research in Computer Science, March 9, 2007, Fayetteville, Arkansas.
- [10] Supercomputing at the University of Arkansas," CCT Talk Series, Louisiana State University, August 11, 2006.
- [11] A. Apon, B. Lu, L. Ngo, H. Bui, N. Hamm, L. Dowdy, D. Hoffman, D. Brewer, "Project Presentation on Enhanced Grid Modeling," presentation at the ALAR Conference on Applied Research in Computer Science, March 9, 2007, Fayetteville, Arkansas.
- [12] Apon has led several training and information session meeting to users of the Red Diamond supercomputer at the University of Arkansas from 2005 to the present.

- [13] Presentation of the Final Report of the Arkansas High Performance Computing External Advisory Committee to Governor Beebe and his staff, January 9, 2008.
- [14] Presentation of the Final Report of the Arkansas High Performance Computing External Advisory Committee to the Governor's Broadband Advisory Council, February, 2008.
- [15] Presentation of the Final Report of the Arkansas High Performance Computing External Advisory Committee to the Arkansas Joint Legislative Committee on Science and Technology, February, 2008.
- [16] Multiple presentations of the Final Report of the Arkansas High Performance Computing External Advisory Committee to administration at the University of Arkansas, including deans, and Chancellor Gearhart, spring, 2008.
- [17] Panel member and presentation, "Teaching Grid Computing to Undergraduate Computer Science Students," SIGCSE 2008 International Conference on Computer Science Education, Portland, Oregon, March 13, 2008.
- [18] Presentation to the University of Arkansas student ACM organization on "High Performance Computing at the University of Arkansas," April 1, 2008.
- [19] Presentation of "Arkansas Cyberinfrastructure" to the Arkansas Users of Technology and Information Systems (AUTIS) Annual Meeting, June, 2008.
- [20] Presentation of "Arkansas Cyberinfrastructure" to faculty and students at Arkansas State University, Jonesboro, Arkansas, October 22, 2008.
- [18] Presentation of "Arkansas Cyberinfrastructure" as an Industry Presentation with QLogic, International Conference for High Performance Computing, Networking, Storage, and Analysis, Austin, TX, November, 2008.
- [21] Presentation of "Arkansas Cyberinfrastructure" to faculty and students at the University of Arkansas for Medical Sciences, Little Rock, Arkansas, December, 2008.
- [22] Presentation of "Arkansas Cyberinfrastructure" to the Arkansas Research and Education Optical Network (ARE-ON) Steering Committee, Little Rock, December, 2008.
- [23] Presentation of "Arkansas Cyberinfrastructure" at the Great Plains Network Cyberinfrastructure Summit, Kansas City, Missouri, December, 2008.
- [24] Presentation of "Arkansas Cyberinfrastructure" at the ALAR Conference, Conway, Arkansas, March, 2009.
- [25] Presentation of "The Arkansas Cyberinfrastructure Strategic Plan" at the Great Plains Network Annual Meeting, Kansas City, Missouri, May, 2009.
- [26] Presentation of "CI-TRAIN EPSCoR Track-2 Project" at the 2009 Arkansas NSF EPSCoR Annual Conference, Little Rock, Arkansas, October 2, 2009.
- [27] Presentation of "Writing a Supercomputer Proposal for the National Science Foundation's Major Research Instrumentation Solicitation" at the Oklahoma Supercomputing Symposium, Norman, Oklahoma, October 7, 2009.

- [28] Presentation of “High Performance Computing Using the Star of Arkansas” at University of Arkansas at Fort Smith, October 22, 2009.
- [29] Presentation of “Cyberinfrastructure and Arkansas” at the ARE-ON Steering Committee meeting, Fort Smith, Arkansas, October 26, 2009.
- [30] Presentation of “Infrastructure for High Performance Computing” to the National Academies Regional Meeting, Little Rock, Arkansas, March 9, 2010.
- [31] Presentation of “High Performance Computing at the University of Arkansas” to the Arkansas Academy of Computing, Fayetteville, Arkansas, April 10, 2010.
- [32] Presentation of “High Performance Computing Instrumentation and Impact to Academic Research Competitiveness,” South Carolina and Tennessee EPSCoR Track-2 Workshop, September, 2010. <http://www.scepscor.org/EPSCoR/Track2Workshop/>
- [33] Presentation to the NSF-funded workshop on Input to the HPC Community Workshop on Broader Engagement and Workforce Development, December, 2010.
- [34] Presentation to the Great Plains Network Consortium Professional Series, “Workforce Development Programs at Clemson University in Data-Enabled Science,” September, 2012.

#### **Other Articles**

- [1] Advisor to Allen MacKenzie, “A Comparison of Network Measurement Tools,” Technical Report, Vanderbilt University, 1997.
- [2] K. Gordon, A. Apon, B. Hooper, and L. Dowdy, “An Introduction and Analysis of RTFC Rostering,” Technical Report, Vanderbilt University, June, 1998.
- [3] Advisor to Julia Lincoln, “An Analysis of Wireless Networking on the University of Arkansas Campus,” The University of Arkansas Journal of Undergraduate Research, Summer, 2000.
- [4] Advisor to Ben McKenzie, “The Design, Analysis, and Implementation of VIA for the PowerPC Architecture,” The University of Arkansas Journal of Undergraduate Research, Summer, 2000.
- [5] Advisor to Genet Cramlet, “Women in Computing: An Exploration of Current Status and Future Trends,” The University of Arkansas Journal of Undergraduate Research, Summer, 2004.
- [6] Advisor to Taneem Ibrahim, “A Comparative Evaluation of Java RMI and .NET,” The University of Arkansas Journal of Undergraduate Research, Summer, 2004.
- [7] Primary Interviewee in “Case Study: University of Arkansas Graduates to Quad-Core Processors,” Intel Communities Case Study, August 4, 2008. <http://communities.intel.com/docs/DOC-1807;jsessionid=896407D3FA6B042E37E31B85C831178B>
- [8] Advisor to James McCartney and Stephen Sheppard, “Bouvier Law Term Dictionary for the Twenty-First Century,” ICOMP09, Las Vegas, NV, 2009.



- [9] Supervisor to David Chaffin, "View of Campus Bridging," white paper for the NSF Workshop on Campus Bridging, Denver, Colorado, August, 2010.
- [10] K. Emeneker and A. Apon, "Planning a Cyberinfrastructure Days Event," <https://wiki.internet2.edu/confluence/download/attachments/4588469/UArk+-+Planning+a+CI+Days.pdf>

## **SUPPORT FOR RESEARCH AND SPONSORED PROGRAMS**

### **External Research Grants Funded**

Title: Graduate Student Travel Award to attend Performance '93  
Sponsor: National Science Foundation  
Investigator: Amy Apon  
Start date: October 1993  
End date: October,1993  
Amount: \$800

Title: Performance Measurement and Modeling of Parallel Computer Systems  
Sponsor: National Science Foundation  
Investigator: Amy Apon  
Start date: October, 994  
End date: September,1996  
Amount: \$17,364

Title: Alternative Operating Systems Support Techniques for Parallel Processing Systems.  
Sponsor: Ballistic Missile Defense Organization  
Investigator: Amy Apon  
Start Date: September 1995  
End Date: October 1998  
Amount: \$223,994

Title: CISE Research Instrumentation: Application and Evaluation of a Low Cost Parallel Processing Platform.  
Sponsor: National Science Foundation  
Investigators: Amy Apon (PI), Douglas Fisher (co-PI), David R. Pickens (co-PI)  
Start Date: January 1997  
End Date: March 1999  
Amount: \$45,119

Title: CISE Research Instrumentation: Application and Evaluation of a Low Cost Parallel Processing Platform.  
Sponsor: Vanderbilt University Department of Radiology  
Investigators: Amy Apon (PI), Douglas Fisher (co-PI), David R. Pickens (co-PI)  
Start Date: January 1997  
End Date: March 1999  
Amount: \$7,500

Title: CISE Research Instrumentation: Application and Evaluation of a Low Cost Parallel Processing Platform.  
Sponsor: Vanderbilt University Department of Computer Science  
Investigators: Amy Apon (PI), Douglas Fisher (co-PI), David R. Pickens (co-PI)  
Start Date: January 1997  
End Date: March 1999  
Amount: \$7,500

Title: Research Experiences for Undergraduates supplement to CISE Research Instrumentation: Application and Evaluation of a Low Cost Parallel Processing Platform.  
Sponsor: National Science Foundation  
Investigators: Amy Apon (PI)  
Start Date: January 1997  
End Date: March 1999  
Amount: \$10,000

Title: A Parallel Message-Passing Platform for Atomic Structure Calculations  
Sponsor: National Science Foundation Grant ESS#9996143  
Investigators: Amy Apon (PI), C. Fischer (co-PI), L. Dowdy (co-PI)  
Start Date: September 1999  
End Date: August 2001  
Amount: \$75,000

Title: Graduate student supplement to A Parallel Message-Passing Platform for Atomic Structure Calculations  
Sponsor: National Science Foundation Grant ESS#9996143  
Investigators: Amy Apon (PI)  
Start Date: September 1999  
End Date: August 2001  
Amount: \$14,485

Title: Research Experiences for Undergraduates supplement to A Parallel Message-Passing Platform for Atomic Structure Calculations  
Sponsor: National Science Foundation Grant ESS#9996143  
Investigators: Amy Apon (PI)  
Start Date: September, 1999  
End Date: August 2001  
Amount: \$10,000

Title: Graduate student supplement to A Parallel Message-Passing Platform for Atomic Structure Calculations  
Sponsor: National Science Foundation Grant ESS#9996143  
Investigators: Amy Apon (PI)

Start Date: September 1999  
End Date: August 2001  
Amount: \$14,485

Title: Design, Implementation, and Evaluation of MPI and MPI Supporting Functions for NetCache™  
Sponsor: Belobox Networks  
Investigator: Amy Apon (PI)  
Start Date: July 1999  
End Date: August 2000  
Amount: \$22,802

Title: Design and Implementation of the Eastel 3GPP Base Station  
Sponsor: ITI Communications, Inc.  
Investigator: Amy Apon (PI)  
Start Date: January 2001  
End Date: July 2001  
Amount: \$49,513

Title: The Acxiom Cluster Testbed  
Sponsor: Acxiom Corporation  
Investigator: Amy Apon (PI)  
Start Date: January 2001  
End Date: December 2001  
Amount: \$48,300

Title: The Acxiom Cluster Testbed  
Sponsor: Arkansas Science and Technology Authority  
Investigator: Amy Apon (PI)  
Start Date: January 2001  
End Date: December 2001  
Amount: \$45,000

Title: Analysis of a Real-Time Software Architecture for Low-Cost Linux Clusters  
Sponsor: SILO/SURF  
Investigators: Amy Apon  
Start date: January 1, 2002  
End date: May 30, 2002  
Amount: \$3,800

Title: Women in Computing  
Sponsor: SILO/SURF  
Investigators: Amy Apon  
Start date: December 2002

End date: October 2003  
Amount: \$3800

Title: A Comparison of Java and .NET  
Sponsor: SILO/SURF  
Investigators: Amy Apon  
Start date: December 2003  
End date: October 2004  
Amount: \$2400

Title: Accurate Calculation of Electron Correlation Energies in Large Molecules using Low-cost Parallel Hardware  
Sponsor: ITR Solicitation, National Science Foundation  
Investigators: Peter Pulay (PI) (50%) Amy Apon (co-PI) (50%)  
Start date: September 2002  
End date: August 2005  
Amount: \$488,000

Title: Acxiom Problems 1&2  
Sponsor: Acxiom Corporation  
Investigators: Dale Thompson (PI)  
Craig Thompson (co-PI)  
Amy Apon (co-PI)  
Start date: May 16, 2004  
End date: May 15, 2005  
Amount: \$193,000 (estimated)

Title: Acxiom Problem 5  
Sponsor: Acxiom Corporation  
Investigators: Amy Apon (PI)  
Start date: May 16, 2004  
End date: May 15, 2005  
Amount: \$50,000

Title: Collaborative Proposal: CCLI A&I: Adaptation of Globus Toolkit 3 Materials for Undergraduate Computer Science Students  
Sponsor: NSF  
Investigators: Amy Apon (PI, 50%)  
Jens Mache (co-PI 50%), Lewis & Clark College  
Start date: July 1, 2004  
End date: June 30, 2006  
Amount: \$99,000 (Arkansas share approximately \$58,000)

Title: Supplement to Collaborative Proposal: CCLI A&I: Adaptation of Globus Toolkit 3 Materials for Undergraduate Computer Science Students  
Sponsor: NSF  
Investigators: Amy Apon  
Start date: July 1, 2004  
End date: June 30, 2006  
Amount: \$13,600

Title: Extending the Reach: Building the Middleware Infrastructure Across the Great Plains  
Sponsor: Educause/Internet2/NSF  
Investigators: Amy Apon (PI)  
David Merrifield (co-PI), and eight others from the Great Plains Network (GPN) Consortium  
Start date: June 1, 2004  
End date: May 31, 2005 (Phase I), May 31, 2006 (Phase II)  
Amount: \$75,000 from Educause  
\$35,000 committed from MidNet  
\$7,000 cost sharing from the University of Arkansas  
Cost sharing of over \$100,000 (estimated) from numerous resources in the GPN Consortium

Title: Supplement Building the Middleware Infrastructure Across the Great Plains  
Sponsor: Educause/Internet2/NSF  
Investigators: Amy Apon (PI)  
David Merrifield (co-PI), and eight others from the Great Plains Network (GPN) Consortium  
Start date: June 1, 2004  
End date: September 30, 2005 (Phase I)  
Amount: \$8,000 from Educause

Title: National Dissemination of HPC Introductory Education through Multimedia  
Sponsor: NSF  
Investigators: Thomas Sterling (PI)  
Am Apon (co-PI)  
John Sterling (co-PI)  
Start date: July 1, 2007  
End date: June 30, 2009  
Amount: \$249,873, Subcontract to the University of Arkansas approximately \$40,000

Title: MRI: Cluster for High-End Applications in Science and Engineering  
Sponsor: NSF  
Investigators: Amy Apon (PI)  
Peter Pulay (co-PI)

Laurent Bellaiche (co-PI)  
Russell Deaton (co-PI)  
Huaxiang Fu (co-PI)  
Paneer Selvam (co-PI)  
Start date: August 1, 2004  
End date: July 31, 2008  
Amount: \$213,334  
\$213,334 hardware cost sharing and other additional funding from the University of Arkansas

Title: Requirements and Development of an Acxiom Modeling Environment Based on Single and Multi-class Queuing Network Models  
Sponsor: Acxiom Corporation  
Investigators: Amy Apon (PI), and Larry Dowdy  
Start date: May 16, 2005  
End date: September 30, 2006  
Amount: \$118,740

Title: Hierarchical Modeling of the Acxiom Grid  
Sponsor: Acxiom Corporation  
Investigators: Amy Apon (PI), and Larry Dowdy  
Start date: May 16, 2006  
End date: May 15, 2007  
Amount: \$130,008

Title: Hierarchical Modeling of the Acxiom Grid  
Sponsor: Acxiom Corporation  
Investigators: Amy Apon (PI), and Larry Dowdy  
Start date: May 16, 2007  
End date: May 15, 2008  
Amount: \$65,004

Title: A User Forum for Platform LSF HPC  
Sponsor: Platform Computing  
Investigators: Amy Apon (PI)  
Start date: October 1, 2006  
End date: August 14, 2008  
Amount: \$14,838

Title: Supplement to MRI: Cluster for High-End Applications in Science and Engineering  
Sponsor: NSF  
Investigators: Amy Apon (PI)  
Start date: August 1, 2004  
End date: July 31, 2008

Amount: \$20,000 in support of the Arkansas Cyberinfrastructure Initiative External Advisory Committee  
\$26,000 additional funding from the University of Arkansas, Fayetteville, UALR, and ASTA (approximate)

Title: MRI: Acquisition of a Supercomputing Cluster for Computational and Data-Intensive Applications in Science and Engineering

Sponsor: NSF

Investigators: Amy Apon (PI)  
Peter Pulay (co-PI)  
Laurent Bellaiche (co-PI)  
Huaxiang Fu (co-PI)  
Paneer Selvam (co-PI)  
Craig Thompson (co-PI)

Start date: August 1, 2007

End date: July 31, 2010

Amount: \$803,306  
\$100,000 hardware cost sharing and *much* additional funding from the University of Arkansas in support of personnel and infrastructure

Title: Impact of Cell B.E. on Systems Z Compute Intensive Workloads

Sponsor: IBM Research Award

Investigators: Craig Thompson (PI)  
Amy Apon (co-PI)  
David Douglas (co-PI)

Start date: January 1, 2008

End date: December 31, 2008

Amount: \$32,000 (estimated)

Title: Cyberinfrastructure Center of Arkansas

Sponsor: Arkansas Science and Technology Authority

Investigators: Amy Apon (PI)

Start date: May 15, 2008

End date: May 14, 2010

Amount: \$250,000

Title: Cyberinfrastructure for Transformative Scientific Inquiry (CI-TRAIN)

Sponsor: National Science Foundation

Investigators: Amy Apon (PI)  
Laurent Bellaiche (co-PI)  
Doug Spearot (co-PI)  
Fred Limp (co-PI)  
Srini Ramaswamy (co-PI)

Start date: September 1, 2009



End date: August 31, 2012  
Amount: \$3,370,951

Title: Demonstrating the Impact of High Performance Computing to Academic Competitiveness

Sponsor: National Science Foundation

Investigators: Amy Apon (PI)  
Stanley Ahalt (co-PI)

Start date: September 15, 2009

End date: February 28, 2012

Amount: \$299,351

Title: Exploring Parallelization of Nearest Neighbor Search and Clustering in High-Dimensional Space in Emerging Parallel Architectures with Applications in Computer Vision

Sponsor: National Science Foundation

Investigators: Amy Apon (PI)  
Jackson Cothren (co-PI)

Start date: October 1, 2009

End date: September 30, 2011

Amount: \$99,736

Title: CASC 20<sup>th</sup> Anniversary Symposium: Changing Science and Engineering – the Impact of HPC

Sponsor: National Science Foundation

Investigators: Amy Apon (PI)  
Stanley Ahalt (co-PI)

Start date: October 1, 2009

End date: September 30, 2010

Amount: \$25,000

Title: NSF Workshop on High Performance Computing Center Sustainability

Sponsor: National Science Foundation

Investigators: Stanley Ahalt (PI)  
Amy Apon (co-PI)  
David Lifka (co-PI)  
Henry Neeman (co-PI)

Start date: October 1, 2009

End date: September 30, 2010

Amount: \$49,613

Title: Cyberinfrastructure for Arkansas

Sponsor: Arkansas Science and Technology Authority

Investigators: Amy Apon (PI)

Start date: January 15, 2010  
End date: January 14, 2012  
Amount: \$668,008

Title: MRI-R2: Acquisition of an Integrated Instrument for Computational Research and Education

Sponsor: NSF

Investigators: Amy Apon (PI)  
Douglas Spearot (co-PI)  
Jackson Cothren (co-PI)  
Magda El Shanawee (co-PI)  
Peter Pulay (co-PI)

Start date: May 2010  
End date: April 2013  
Amount: \$900,000

Title: ARI-R2: Upgrading to a Sustainable Infrastructure for Research Computing

Sponsor: NSF

Investigators: Amy Apon (PI)  
Robert Zimmerman (co-PI)  
Michael Abbiatti (co-PI)

Start date: September 2010  
End date: August 2013  
Amount: \$1,701,988

Title: Demonstration Project: Arkansas Minority Cyberinfrastructure Training, Education Consortium (AMC-TEC)

Sponsor: NSF

Investigators: Jessie Walker (PI)  
Amy Apon (co-PI)  
Michael Abbiatti (co-PI)  
Mansour Mortazavi (co-PI)

Start date: September 2010  
End date: August 2012  
Amount: \$231,743

Title: CI SEEDS: Seeding the Next Generation Cyberinfrastructure Ecosystem

Sponsor: NSF

Investigators: Amy Apon (PI)  
David Jacobs (co-PI)  
Jill Gemmill (co-PI)

Start date: April 1, 2012  
End date: March 31, 2015  
Amount: \$953,979

Title: MRI: Acquisition of High Performance Computing Instrument for Collaborative Data-Enabled Science  
 Sponsor: NSF  
 Investigators: Amy Apon (PI)  
 Walt Ligon (co-PI)  
 Jill Gemmill (co-PI)  
 Steve Stuart (co-PI)  
 Melissa Smith (co-PI)  
 Start date: September 1, 2012  
 End date: August 31, 2015  
 Amount: \$1,005,000 (approximate)

Title: INSPIRE: Evaluating the Effect of Cyberinfrastructure on Universities' Production Process  
 Sponsor: NSF  
 Investigators: Amy Apon (PI)  
 Paul Wilson (co-PI)  
 Linh Ngo (co-PI)  
 Start date: August 15, 2012  
 End date: August 14, 2015  
 Amount: \$600,000

Title: EAGER: Developing a Framework for a Cyberinfrastructure General Practitioner Program  
 Sponsor: NSF  
 Investigators: Galen Collier (PI)  
 Amy Apon (co-PI)  
 James Pepin (co-PI)  
 James von Oehsen (co-PI)  
 Start date: October 1, 2012  
 End date: September 30, 2014  
 Amount: \$298,870

Title: Cloud Computing Architectures and Applications, Big Data Analytics (multiple gifts)  
 Sponsor: BMW Group  
 Investigators: Amy Apon (PI)  
 Start date: January 2012 to present  
 Amount: \$400,000 (estimated)

Title: Big Data Analytics (multiple gifts)  
 Sponsor: LexisNexis and HPC Systems  
 Investigators: Amy Apon (PI)  
 Start date: January 2013 to present

Amount: \$260,000 (estimated)  
Title: EAGER: Characterization, Prediction, and Management of Latency Variation in Virtualized HPC and Warehouse Scale System  
Sponsor: NSF  
Investigators: Amy Apon (PI)  
Start date: August 1, 2016  
End date: September 30, 2014  
Amount: \$308,000

Title: II NEW: Infrastructure to Support Research in Network-Aware Data-Intensive Computing  
Sponsor: NSF  
Investigators: Amy Apon (PI)  
Lavanya Ramakrishna (coPI)  
James Pepin (coPI)  
Kuang-Ching Wang (coPI)  
Start date: September 1, 2014  
End date: July 31, 2018 (estimated)  
Amount: \$668,357

Title: MRI: Acquisition of High Performance Computing Instrument for Collaborative Data-Enabled Science  
Sponsor: NSF  
Investigators: Amy Apon (PI)  
Mashrur Chowdhury (co-PI)  
Jill Gemmill (co-PI)  
Dvora Perahia (co-PI)  
James Wang (co-PI)  
Start date: September 1, 2017  
End date: August 31, 2020  
Amount: \$994K (approximate)

### **Research Equipment and Software**

Description: Grant of 8-way symmetric multiprocessor and a 4-way symmetric multiprocessor computers  
Sponsor: Acxiom Corporation  
Investigator: Amy Apon (PI)  
Date Received: November 1999  
Value: Estimated at \$500,000 in 1992

Description: Consignment of Real-Time Fiber Communications (RTFC) hardware and supporting AmpDC middleware.  
Sponsor: Belobox Networks  
Investigator: Amy Apon (PI)  
Start Date: July 1997  
End Date: June 2000  
Value: \$100,000

Description: Parallel I/O on Cluster for Geographic Information Systems  
Sponsor: PCI Geomatica  
Investigators: Amy Apon  
Start date: February 2002  
End date: December 2002  
Amount: Software licensing, approximately \$6,000

Description: Evaluation of InfiniSwitch InfiniBand Cluster Interconnect  
Sponsor: InfiniSwitch  
Investigators: Amy Apon  
Start date: August 2002  
End date: September 2005  
Amount: InfiniSwitch hardware, approximately \$15,000

Description: Evaluation of Apple G5 computer  
Sponsor: Apple Computer  
Investigators: Amy Apon  
Start date: December 2003  
End date: December,2006  
Amount: Apple G5 Computer, approximately \$4,000

Description: Metadata Design and Array File Implementation over the AmpNet Cluster Interconnect  
Sponsor: Belobox Networks, Irvine, California  
Investigators: Amy Apon  
Start date: August 2003  
End date: September 2007  
Amount: AmpNet hardware and supporting software, approximately \$25,000

Description: Cluster for High-End Applications in Science and Engineering  
Sponsor: Dell Computer Corporation  
Investigators: Amy Apon (PI)  
Start date: December 2004  
Amount: \$505,000 equipment match

Description: Building a Grid Computing Infrastructure in the Great Plains Region

Sponsor: Sun Microsystems  
Investigators: Greg Monaco, Gordon Springer, David Swanson, Amy Apon  
Start Date: January 2006  
End Date: December 2008  
Amount: Sun cluster hardware, approximately \$65,000

Description: Dell Educational Grant  
Sponsor: Dell Corporation  
Investigators: Amy Apon  
Start Date: October 2007  
Amount: Dell dual quad-core server, approximately \$18,000

Description: Sun Academic Excellence Grant  
Sponsor: Sun Microsystems  
Investigators: Amy Apon  
Start Date: January 2008  
Amount: Sun quad dual-core server, approximately \$20,000

Description: Cluster for Computational and Date-Intensive Applications in Science and Engineering  
Sponsor: Dell Computer Corporation  
Investigators: Amy Apon (PI)  
Start date: January 2008  
Amount: \$600,000 equipment match

### **Research support and grants from the University**

Title: New faculty startup funds  
Sponsor: Graduate School, University of Arkansas  
Date: August 1998  
Value: \$48,000

Title: Graduate student supplement to A Parallel Message-Passing Platform for Atomic Structure Calculations  
Sponsor: Graduate School, University of Arkansas  
Investigators: Amy Apon (PI)  
Start Date: September 1999  
End Date: August 2001  
Amount: \$12,273

Title: Design, Implementation, and Evaluation of MPI and MPI Supporting Functions for NetCache™  
Sponsor: Fulbright College  
Investigator: Amy Apon (PI)

Start Date: July, 1999  
End Date: August, 2000  
Amount: \$24,305 (matching salary amount in kind)  
Title: Cluster Computing in the Classroom, Topics, Guidelines, and Experiences  
Sponsor: CSCE Department  
Investigators: Amy Apon (PI)  
Start Date: May 2001  
End Date: May 2001  
Amount: \$1500, for airfare to present the paper at the Cluster.Edu conference

Title: Oklahoma Supercomputing Symposium  
Sponsor: CSCE Department  
Investigator: Amy Apon (PI)  
Amount: \$200 (estimated) to attend workshop, present poster, and escort 8 graduate students

Title: Supercomputing, 2003  
Sponsor: CSCE Department  
Investigator: Amy Apon (PI)  
Amount: \$800 to attend Supercomputing for collaboration talks

Title: International Workshop on Grid Education, 2005  
Sponsor: CSCE Department  
Investigator: Amy Apon (PI)  
Amount: \$1500 (estimated) to attend and Co-Chair Grid.Edu workshop

Title: Platform LSF Scheduling Software  
Sponsor: Computing Services/AREON  
Investigator: Amy Apon (PI)  
Dates: May 2006  
Amount: \$46,000 (estimated) to purchase LSF scheduler for Red Diamond

Title: Support for High Performance Computing  
Sponsor: Graduate School  
Investigator: Amy Apon (PI)  
Dates: November 2005-June 30, 2006  
Amount: \$60,000 (estimated) for salaries, stipend, tuition, for HPC administration

Title: Support for High Performance Computing  
Sponsor: Computing Services  
Investigator: Amy Apon (PI)  
Dates: May, 2005-June 30, 2006  
Amount: \$22,000 (estimated) for salaries and stipend for graduate assistant

Title: Support for High Performance Computing  
Sponsor: Graduate School  
Investigator: Amy Apon (PI)  
Dates: July 1, 2006-June 30, 2007  
Amount: \$115,000 (estimated) for salaries, tuition, for HPC administration  
Title: Support for High Performance Computing  
Sponsor: UA Information Technology  
Investigator: Amy Apon (PI)  
Dates: July 1-June 30, 2007  
Amount: \$60,000 (estimated) for salaries, stipend for graduate assistant

Title: Support for High Performance Computing  
Sponsor: Graduate School  
Investigator: Amy Apon (PI)  
Dates: July 1, 2007-June 30, 2008  
Amount: \$99,925 (estimated) for salaries, tuition, for HPC administration

Title: Hardware Match for High Performance Computing  
Sponsor: Graduate School  
Investigator: Amy Apon (PI)  
Dates: July 1, 2007-June 30, 2008  
Amount: \$100,000 hardware match for High Performance Computing

Title: Support for High Performance Computing  
Sponsor: UA Information Technology  
Investigator: Amy Apon (PI)  
Dates: July 1, 2007-June 30, 2008  
Amount: \$178,122 (estimated) for salaries, licenses, warranties, and other items for HPC

Title: Travel Support for Grid Curricula Workshop, Brussels, Belgium  
Sponsor: Department of Computer Science and Computer Engineering  
Investigator: Amy Apon (PI)  
Dates: February 12, 2008-February 16, 2008  
Amount: \$2,000

Title: Cyberinfrastructure Center of Arkansas  
Sponsor: Arkansas Science and Technology Authority  
Investigators: Amy Apon (PI)  
Start date: May 15, 2008  
End date: Continuing  
Amount: Matching funding from the Office of the Vice Provost for Research, University of Arkansas, in support of staff the Arkansas HPC Center



## Summary of Research Support

- Total funding from all external sources as PI is more than \$15M
- Total funding from all external sources as PI or coPI is more than \$20M
- Responsible for managing additional funding from multiple gift or internal sources in range of \$250,000 each year since 2006.

## SERVICE

### Service performed at the state, university, college, or departmental levels.

At East Central University:

- Department equipment committee
- Campus equipment committee
- Faculty search committee

At Fisk University:

- Developed, installed, and maintained the Fisk home pages (among the first web pages ever published), December 1994.
- Faculty mentor for the student ACM chapter.

At Vanderbilt University: CSAB/ABET accreditation committee

At the University of Arkansas:

- Undergraduate Curriculum Committee (chair 1998-2002, member 2003-2008). As Chair of the Undergraduate Curriculum Committee from 1998-2002, Apon, as Assistant Professor, led the merging of the Computer Science curriculum in the College of Arts and Sciences and the Computer Systems Engineering curriculum in the College of Engineering during a time of significant departmental change as the two departments were merged into the single Computer Science and Computer Engineering Department in the College of Engineering.
- M.S. Comprehensive Examiner (1998-2001)
- Ph.D. Qualifying Examiner, most semesters
- Head Search Committee (on two separate committees)
- Faculty Search Committee (on multiple years)
- Tech Fee University-level committee (2002-2007)
- Scholarship Committee, Engineering College-level committee (2004-2005)

- Director of High Performance Computing, 2004-2011. This position has been partially compensated by the University and represents a commitment of 10-20 hours each week preparing budgets, managing 3 FTE full-time staff, responding to user requests, setting policy for HPC usage, designing hardware and software architectural solutions, representing the University externally to vendors and to the national HPC community, and other Director tasks.

For the State of Arkansas:

- Director, Arkansas Cyberinfrastructure Initiative, 2008-present

At Clemson University

- University Faculty Liaison, Watt Family Innovation Center Project
- Member, Tycho Howe Endowed Chair Search Committee, 2011-2012
- SOC Graduate Recruiting Committee, 2011-2013 (Chair), 2013-2014 (member)s
- *Ex officio* member of the CS Faculty Search Committee, 2011-present
- Chair, Hash Endowed Chair Search Committee, 2013-2014
- Chair, University Conflict of Interest Committee, 2017-2018.

## Professional Service

Chair, Coalition for Academic Scientific Computation, 2011-2012, Vice Chair 2009-2010.

Member of the TeraGrid Science Advisory Board, 2010.

Membership in Professional Organizations

Senior Member of IEEE, IEEE Computer Society

Senior Member of Association for Computing Machinery

Service as Reviewer/Panelist/Conference Activities in the Professional Community:

- Participant in the AAAS seminar to advise the National Science Foundation, NSF review panelist for ITR, 2000.
- Publicity Chair for the Eighth International Workshop on Parallel and Distributed Real-Time Systems (WPDRTS 2000).
- Session Chair for the Seventh International Workshop on Parallel and Distributed Real-Time Systems (WPDRTS 1999).
- Session Chair for the Eighth International Conference on Information and Knowledge Management (CIKM 99)
- Review Panelist for the ITR Solicitation for the National Science Foundation, March 2000.
- Session Chair for the Eighth International Workshop on Parallel and Distributed Real-Time Systems (WPDRTS 2000).
- Program Committee Member for HPCN2000, The University of Amsterdam, The Netherlands, May 2000

- Program Committee Member for WCNC2000, Chicago, Illinois, September 2000.
- Program Committee Member for CMG2000 Research Track, The Computer Measurement Group, Inc. 26th Annual Conference Orlando, FL, December 10-15, 2000.
- Executive Committee member (Publicity Chair) for IEEE Task Force on Cluster Computing
- Publicity Chair for the Eighth International Workshop on Parallel and Distributed Real-Time Systems (WPDRTS 2000).
- Program Committee Member for EuroPar2001.
- Program Committee Member for Cluster 2001.
- Publicity Chair for the Ninth International Workshop on Parallel and Distributed Real-Time Systems (WPDRTS 2001).
- Session Chair for the Conference on Commercial Applications for High-Performance Computing
- Publicity Chair for the Tenth International Workshop on Parallel and Distributed Real-Time Systems (WPDRTS 2002).
- Program committee, Cluster 2002, responsible for reviewing several papers.
- Reviewer for IEEE Transactions on Computers, reviewed DPR, LPR: Proactive Resource Allocation Algorithms for Asynchronous Real-Time Systems"
- Reviewer for Special Issue of the Wiley Journal Computation and Concurrency
- Reviewer for IPDPS 2003
- Reviewer for International Journal of Computer Applications
- Reviewer for the Special Issue of Supercomputing Journal on Infrastructures and Applications for Cluster and Grid Computing Environments
- Reviewer for International Workshop on Communication Architectures for Clusters, 2003
- Reviewer for IEEE Transactions on Education
- Reviewer for the Handbook of Information Security
- Co-Chair and primary organization of First International Workshop on Grid Education, Grid.edu 2004
- Program Committee member and reviewer for Cluster 2004
- Program Committee member and Reviewer for Grid 2004
- Session Chair for Cluster 2004
- Program Committee member for ISPA 2004
- Co-Chair for Second International Workshop on Collaborative and Learning Applications of Grid Technology and Grid Education, CLAG + Grid.edu 2005
- Program Committee member for Cluster 2005
- NSF MRI Panel member, 2005
- NSF CRI Reviewer, 2005
- Program Committee member for ISPA 2005
- Reviewer, International Journal of Computer Applications, 2006
- Program Committee member for ICAS 2006

- Program Committee member for ICNS 2006
- Program Committee member for Cluster 2006
- Program Committee member for SC Posters, 2006
- NSF MRI Panel member, 2006
- Program Committee for Cluster 2007, LCI 2007, GADA 2007, ICPADS 2007
- Program Committee for GADA 2008, Supercomputing 2008, LCI 2008
- NSF Panel member, two panels, 2008
- Program Committee for Cloud 09, ALAR 09
- Reviewer for the Nebraska Research Initiative, 2007, 2008
- Program Committee for LCI 2008, Cluster 2009, ICPP 2009
- NSF Panel member, multiple occasions each year
- Poster Chair for LCI 2009
- Poster Committee member for SC10
- Reviewer for Journal of Parallel and Distributed Computing
- Tutorials Committee member for SC11
- Technical Program Committee member for Cluster '11, '12, '13.
- Technical Program Committee member for SC'12.
- Panels Chair, Cluster '13
- Technical Program Committee member for IPDPS, multiple years.
- Co-Chair, SCALE Challenge, held in conjunction with CCGrid, 2018.
- Member of the Editorial Board, Journal of Big Data, Elsevier, 2016-present
- Member of Steering Committee, Cyber Defense Journal, 2017-2020.
- Chair, External Advisory Committee, Extending Cloud Access to enable Science, funded by the National Science Foundation. 2018-2020.

### **Other kinds of professional service**

Expert Witness for Block Financial Corporation vs. Yodlee on patent issues in middleware issues, 2003.

Professional Consulting:

- Acxiom Corporation
- Virtual Satellite Corporation
- ITI Communications, Inc.