Olaf O. Storaasli

ORNL Distinguished Research Scientist
Future Technologies Group
Computer Science and Mathematics Division
http://www.ccs.ornl.gov/~olaf

PERSONAL DATA:

Born May 15, 1943 in Philadelphia, Pennsylvania and grew up in Saskatoon, Saskatchewan, Canada and Edinburgh, Scotland. Currently resides with his wife, Barbara in Oak Ridge Tennessee. They have five sons: Olaf, Paul, Brian, Patrick and Colin. Hobbies include traveling, computers, roller blading, ice skating, hiking, stamp collecting, and genealogy. His parents, Dr. Olaf K. and Lila Lee Storaasli, reside in Falcon Heights, Minnesota.

EDUCATION:

'64 B. A. (physics, mathematics and French), Concordia College (Moorhead MN)
'66 M. A. (mathematics; physics). University of South Dakota
'70 Ph. D. (engineering mechanics; mathematics), North Carolina State University
'84-'85 Visiting Scholar (computational mechanics) on NASA Fellowship at NTNU (Norsk Technical University) and Det Norske Veritas, Norway
'89 & '92 NTNU visiting scholar on Royal Norwegian Govt Research Funds

EXPERIENCE:

Internationally-known expert on parallel methods for structural mechanics on high-performance computers having conducted research in this area for over thirty years. Long before parallel computers were commercially available, Dr. Storaasli led a hardware, software and applications team at NASA Langley Research Center to develop one of the first parallel computers, the Finite Element Machine. He has authored over 80 works in computational structural mechanics including static and dynamic structural analysis, eigenvalue and optimization methods, interdisciplinary analysis, data management, and parallel-vector structural analysis methods on supercomputers. He received the prestigious Floyd L. Thompson Fellowship of NASA Langley Research Center for post-doctoral research at the Norwegian University of Science and Technology in Trondheim, Norway, and Det Norske Veritas, Oslo, Norway, during 1984-85. He has been invited to give presentations at the Rockwell International Corporate Meeting (MI), Cray Research (MN), IBM Power Parallel Systems (NY), University of London (UK), NTNU (Norway), Det Norske Veritas (Norway), Chalmers University (Sweden), Linkoping University & SAAB-SCANIA (Sweden), Royal Technical University (Stockholm), Delft University (Netherlands), Brown University (RI), North Carolina State University, The University of Kansas, NAS-NASA Ames (CA), An Executive Seminar on Aerospace Supercomputing (AZ), the University of Wales (UK), the First Intel Supercomputer User's Group (TX), the Intel Supercomputing Industry Summit Meeting (OR), General Electric Corporate R & D Center, (NY), Research Consortium Inc. North America Symposium X (MN), and the U.S. Army High Performance Computing and

Structural Dynamics Workshop (MI) and (MS), the Second Intel Supercomputer User's Group (MO), the University of Minnesota Supercomputing Institute (MN), the U.S. Army High-Performance Computing Center(MS), Old Dominion University (VA), Petaflops Algorithms Workship (VA), Cambridge University (UK), National Center for Supercomputer Applications (IL), HPC User Forum (MI), Oshkosh Airshow (WI), '04 MAPLD Paper and Chair (DC), '03(DC) & '02(MD), HPC User Forum (AZ), OSC RC Talk & Panel(OH), USAF (Eglin) RC Days Talk & Panel Chair(FL), University of Manchester(UK), Oak Ridge National Lab(TN), University of Tennessee (ICL) and University of North Carolina. His recent research has resulted in methods to analyze a 551,720 equation (10,997 bandwidth) refined model of a high speed civil transport transport and a 265,000 equation automobile (3,374 bandwidth) application in less than two minutes on the Cray C-90 and a method to generate and assemble stuctural stiffness matrices on the Intel Delta (Caltech) at speeds 25 times that of one Cray C-90 processor. Dr. Storaasli has recently tailored his static and dynamic equation solvers to operate efficiently on low-cost Pentium computers. Not only do they calculate fast (i. e. a 16,152 equation High-Speed Aircraft analysis now takes 9 seconds on a 300MHz Pentium2 and 2 sec on a Cray C-90), but now permit previously untractable science and engineering calculations (involving millions of complex mechanics or electromagnetics equations) to be solved rapidly on inexpensive computers. Beginning on 2000, he conceived and led a NASA Creativity and Innovation program to explore the promise to use Field-Programmable Gate Arrays (FPGAs) as an alternative to CPUs for scientific and engineering computations. This led to the new NASA $15M 4-yr Reconfigurable Scalable Computer (RSC) for Space Applications

PUBLICATIONS:

Editor of six books, over 80 technical papers and over 100 technical presentations (12 invited overseas lectures) on computational mechanics, high-performance computing algorithm research and lately FPGA-based hypercomputing methods.

SPECIAL HONORS:

NASA Floyd L. Thompson Fellowship 1984-85; 17 Quality Increases ; Outstanding Performance Ratings; 2 Certificates of Recognition; 8 Special Achievement Awards (8): Sustained Superior Performance Award; Superior Accomplishment Awards. Dr. Storaasli is listed in Who's Who in Science and Engineering, Who's Who in the U.S. (South and Southwest), Who's Who in the World, Who's Who in Aviation and Aerospace-U.S. Edition, and Who's Who in Micro-Computers-Notable Individuals of the Micro-Computer Industry. Received 5 NASA-wide and numerous Langley Achievement awards for outstanding work in Computational Structural Mechanics. These awards included significant contributions to the NASA Viking Mars Lander, Space Shuttle and Integrated Programs for Aerospace-Vehicle Design (IPAD) Projects as well as to the development of the Relational Information Management (RIM), since developed into the commercial relational data-base software: R:BASE and a NASA-U.S. Aerospace Industry Exhibit at the Paris Air Show. The citation on the IPAD

Award states: *"For providing national leadership in engineering data-base management research vital to integration of computer-aided design and manufacturing to improve aerospace industry productivity".* In August, 1989, Cray Research (Silicon Graphics) selected the general-purpose matrix equation solution software, PVSolve , developed by Dr. Storaasli and his colleagues, to receive the GigaFLOP Performance Award. PVSolve was used to solve the 54,870 equations (9.2 billion floating point operations) in the Space Shuttle Solid Rocket Booster structural analysis in six seconds elapsed time. Dr Storaasli received The NASA Software of the Year Award for use of his GPS fast matrix solver to speed the GENOA design code. In a worldwide competition, Intel selected Dr. Storaasli to receive a pre-production Intel Pentium Pro (P6) computing system to evaluate performance of structural analysis software.

ORGANIZATIONS:

NASA Langley Supercomputer User's Systems Committee, OpenFPGA.org Steering Committee (founded 2005), MAPLD Technical Committee, Associate Fellow of the American Institute of Aeronautics and Astronautics (member of AIAA CAD/CAM Technical Committee 1981-85), Intel Supercomputer Users Group Executive Board, High-Performance Computing Advisory Board, Virginia Governor's School of Science and Technology Advisory Board & mentor, Caltech Admissions Representative, Pi Mu Epsilon, Alumni Distinguished Service Award (Presented by Waldorf College in 1988), nominated for Distinguished Alumni Award of Concordia College (1998).

CURRENT ASSIGNMENT:

Dr. Storaasli joined the Future Technologies Group in the Computer Science and Mathematics Division in 2005 as a Distinguished Research Scientist.to explore new algorithms and architectures that harness the power of FPGAs for future scientific supercomputing. This includes innovative methods for rapid solution of large systems of matrix equations on supercomputers and FPGAs. Prior to ORNL Dr. Storaasli served as a senior research scientist in the Computational Structures and Materials Branch at NASA's Langley Research Center. His research focused on developing new parallel computational algorithms to solve large systems of matrix equations, harnessing reconfigurable hypercomputers for large-scale analyses (Structures, Electromagnetics and Acoustics), fast eigenvalue analysis and FPGA-based HPC computations (image compression & robotic applications) supporting NASA's NEXTGRADE, HPCCP and Creativity & Innovation Program (sponsored by the Langley Director's Office). Most recently, Drs. Storaasli and Hodson proposed and were selected by NASA HQ Exploration R&T Office for a new $15M 4-year Project entitled Reconfigurable Scalable Computing (RSC) for Space Applications. Dr. Storaasli also taught Parallel Processing Graduate Courses in the Department of Physics, Computer Science and Engineering at Christopher Newport University in which his students use VIVA in addition to traditional MPI. He also taught graduate courses in Computer Science at George Washington University.

Publications of Dr. Olaf Storaasli

Reconfigurable Computing Research References

1. Storaasli, Olaf O., Compute Faster without CPUs: Engineering Applications on NASA's FPGA-based Hypercomputers, presented at Technical Symposium on Reconfigurable Computing with FPGAs, Manchester UK, February 2005.
   Format: PDF (11.7 MB) or (Video (106MB))
2. Amadei, James & Lee, Katy: The Future of Parallel Computing, NASA Langley Research Center, Hampton VA, December 2004
3. Sobieski, Jaroslaw and Storaasli, Olaf O. "Computing at the Speed of Thought," *Aerospace America*, Oct. 2004, pp. 35-38.
4. Storaasli, O., "A New NASA Program:Reconfigurable Scalable Computing, Exploration Systems R & T," Presented at USAF Research Lab RC Days, Eglin AFB, Florida, November 3-4 , 2004.
5. Yoke, J. and Storaasli, O., "Matrix Multiplier Algorithm Development on, and Efficiency Comparisons Between an FPGA and a Traditional x86 Processor," July 8, 2004.
6. A New NASA Program:Reconfigurable Scalable Computing, Exploration Systems R & T," Presented at USAF Research Lab RC Days, Eglin AFB, Florida, November 3-4 , 2004.
7. Storaasli, O. "Engineering Applications on NASA's FPGA-based Hypercomputer", Abstract submitted to the 2004 MAPLD Technical Program, Washington, D.C., September 8-10, 2004.
8. Storaasli, O.. "Engineering Applications on NASA's FPGA-based Hypercomputer", Presentation to the 2004 MAPLD Technical Program, Washington, D.C., September 8-10, 2004.
9. Storaasli, Olaf O. "Scientific Applications on a Reconfigurable, FPGA-based Hypercomputer." Abstract. 2003.
10. Storaasli, Olaf O. "Computing Faster without CPUs: Scientific Applications on a Reconfigurable, FPGA-based Hypercomputer." Presented at 2003 Military and Aerospace Programmable Logic Devices (MAPLD) Conference, Washington D.C., September 11, 2003.
11. Storaasli, Olaf O., Robert C. Singleterry, and Samuel Brown. "Scientific Computations on a NASA Reconfigurable Hypercomputer." Presented at 5th Military and Aerospace Programmable Logic Devices (MAPLD) Conference, Paper in preparation. September 10-12, 2002.
12. Storaasli, Olaf O. et al. "Importance of Ultrafast Computing for NASA Missions" Requested by Langley Senior Scientist, Dennis Bushnell August 6, 2002.
13. Storaasli, Olaf O. "Reconfigurable Computing Technology." Presented at the NASA Space Radiation Shielding Technology Workshop. April 3-5 2002.
14. Singleterry, Robert C., Jaroslav Sobieszczanski-Sobieski, and Samuel Brown. "Field-Programmable Gate Array Computer in Structural Analysis:

an Initial Exploration." 4 3rd American Institute of Aeronautics and Astronautics (AIAA) Structures, Structural Dynamics, and Materials Conference. April 22-25, 2002.

15. Fithian, William, Samuel Brown, and Tyler Reed. "Object Synchronization in VIVA 1.5." Briefing prepared for VIVA users at NASA Marshall, Eglin AFB, Progress Forge, Inc., and Star Bridge Systems, Inc. March 26, 2002.
16. Barr, Kristen, Shaun Foley, and Robert A. Lewis II. "Hypercomputing with the CORDIC Algorithm." August, 2001. Presentation of research conducted under Dr. Olaf O. Storaasli. June-August, 2001.
17. Butler, Patrick. New Horizons Governors School Mentorship Project. May, 2001. Presentation of research conducted under Dr. Olaf O. Storaasli, September 2000 - May 2001.
18. Dandawate, Neha. "Reckless Speeding: The Investigation of the Programming Capabilities of the HAL Hypercomputer." July, 2002. Presentation of research conducted under Dr. Olaf O. Storaasli, June - July, 2002.
19. Dandawate, Neha. "The Investigation of the Programming Capabilities of the HAL-15 Hypercomputer." July, 2002. Paper on research conducted under Dr. Olaf O. Storaasli, June - July, 2002.
20. Fithian, William. "Developing a Matrix Equation Solver for the HAL-15 Hypercomputer." December, 2001. Proposal for research to be conducted under Dr. Olaf O. Storaasli, September 2001 - May 2002.
21. Fithian, William. "Developing a Matrix Equation Solver for the HAL-15." May, 2002. Presentation of research conducted under Dr. Olaf O. Storaasli, September 2001 - May 2002.
22. Fithian, William, Brown, Samuel, Singleterry, Robert and Storaasli, Olaf. "Iterative Matrix Equation Solver for a Reconfigurable FPGA- Based Hypercomputer" Sept. 2002. NASA TM (soon to be released).
23. Foley, Shaun. "Scientific Hypercomputing." August, 2001. Paper describing research conducted under Dr. Olaf O. Storaasli, June - August, 2002.
24. Krishnamurthy, Siddhartha. "Development of an Integration Algorithm for Field Programable Gate Arrays using VIVA," July, 2002. NASA TM on research conducted under Drs. Storaasli & Singleterry. June - Aug 2002.
25. Krishnamurthy, Siddhartha. "Monte Carlo Simulation on Field Programmable Gate Arrays using VIVA," September, 2003. NASA TM on research conducted under Drs. Storaasli & Singleterry.

Formal Refereed Publications: Books

1. Storaasli, O.(Editor): Large-Scale Analysis, Design and Intelligent Synthesis Environments, Elsevier Sciences Ltd. 2000.
2. Storaasli, O. (Editor): Large-Scale Analysis and Design on High-Performance Computers and Workstations, Elsevier Sciences Ltd. 1998.

3. Storaasli, O., and Housner, J. (Editors): Large-Scale Structural Analysis for High-Performance Computers and Workstations, Pergamon Press 1995.
4. Storaasli, O., Housner, J. and Nguyen, D. (Editors): Parallel Computational Methods for Large-Scale Structural Analysis and Design, Pergamon Press 1994.
5. Storaasli, O., and Carmona, E. (Editors): Parallel Methods on Large-Scale Structural Analysis and Physics Applications, Pergamon Press 1991.
6. Noor, A. K.; Storaasli, O. O.; and Fulton, R. E., Storaasli, O., Housner, J. and Nguyen, D.(Editors): Parallel Computational Methods for Large-Scale Structural Analysis and Design, Pergamon Press 1994, A. Noor, Ed., ASME Special Publication H00275, November 1983.

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1. Storaasli, Olaf O.: Large-scale Analysis, Design and Intelligent Synthesis Environments, Advances in Engineering Software, Volume: 31, No.8-9, pp 499-755, September 2000.
2. Watson, Willie R. and Storaasli, Olaf O.: Application of NASA General-Purpose Solver to Large-Scale Computations in Aeroacoustics, Advances in Engineering Software, Volume: 31, No.8-9, pp 555-561, September 2000.
3. Willie R. Watson and Olaf O. Storaasli, Application of NASA General-Purpose Solver to Large-Scale Computations in Aeroacoustics , in Proceedings of Fifth Symposium on the Large-Scale Analysis, Design and ISE, entitled Large-scale Analysis, Design and Intelligent Synthesis Environments, pp 555-561, September 2000.
4. Storaasli, Olaf O.: Large-scale Analysis and Design on High-Performance Computers and Workstations, Advances in Engineering Software including Computing Systems in Engineering Volume: 29, No.3-6, pp 177-492, July. 1998.
5. . Storaasli, O. O.*: a Performance of NASA Equation Solvers on Computational Mechanics Applications, Salt Lake City, Utah, AIAA Paper No. 96-1505, April 15-17, 1996. http://techreports.larc.nasa.gov/ltrs/papers/NASA-aiaa-96-1505/olaf.fm5.html
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7. Storaasli, Olaf O., Housner, Jerrold M. and Nguyen, Duc T.: Parallel Computational Methods for Large-scale Structural Analysis and Design, Int. Journal of Computing Systems in Engineering Volume: 4 No. 4-6, pp 349-542, Dec. 1993.
8. Storaasli, Olaf O., Nguyen, Duc. T. , Baddourah, Majdi. A. and Qin, Jiangning, Computational Mechanics Analysis Tools for Parallel-Vector

Supercomputers , Int. Journal of Computing Systems in Engineering, Vol. 4, No. 4-6, pp. 1-10, Dec. 1993.
9. Storaasli, Olaf O., Nguyen, Duc. T. , Baddourah, Majdi. A. and Qin, Jiangning, Computational Mechanics Analysis Tools for Parallel-Vector Supercomputers: Proceedings of 2nd NASA Symposium entitled: Parallel Computational Methods for Large-Scale Structural Analysis and Design pp. 1-10 Dec 1993.
10. Baddourah, Majdi A., Storaasli, Olaf O. and Bostic, Susan , Linear Static Structural Analysis and Vibration Analysis on High-Performance Computers , International Journal of Computing Systems in Engineering, Vol. 4, No. 4-6, pp. 363-371, Dec. 1993.
11. Baddourah, Majdi A., Storaasli, Olaf O. and Bostic, Susan , Linear Static Structural Analysis and Vibration Analysis on High-Performance Computers: Proceedings of 2nd NASA Symposium entitled: Parallel Computational Methods for Large-Scale Structural Analysis and Design pp. 363-371, Dec 1993.
12. Gupta, Vinney K., Newell, James F., Storaasli, Olaf O., Baddourah, Majdi A. and Bostic, Susan , Space Station Static and Dynamic Analyses Using Parallel Methods, Int. Journal of Computing Systems in Engineering, Vol. 4, No. 4-6, pp. 387-398, Dec. 1993.
13. Gupta, Vinney K., Newell, James F., Storaasli, Olaf O., Baddourah, Majdi A. and Bostic, Susan , Space Station Static and Dynamic Analyses Using Parallel Methods: Proceedings of 2nd NASA Symposium entitled: Parallel Computational Methods for Large-Scale Structural Analysis and Design, pp. 387-398, Dec 1993.
14. Storaasli, Olaf O. and Carmona, Edward A.: Parallel Methods on Large-Scale Structural Analysis and Physics Applications, Computing Systems in Engineering Volume: 2, No.2/3, pp 135-319, Dec. 1991.
15. Nguyen, Duc. T.; Storaasli, Olaf. O.; Carmona, Ed. A.; Al-Nasra, M.; Zhang, Y.; Baddourah, M. A.; and Agarwal, Tarun. K.: Parallel-Vector Computation for Linear Structural Analysis and Nonlinear Unconstrained Optimization Problems, Intl. Journal of Computing Systems in Engineering, Vol. 2, No.2/3, pp. 175-182, December 1991.
16. Nguyen, Duc. T.; Storaasli, Olaf. O.; Carmona, Ed. A.; Al-Nasra, M.; Zhang, Y.; Baddourah, M. A.; and Agarwal, Tarun. K.: Parallel-Vector Computation for Linear Structural Analysis and Nonlinear Unconstrained Optimization Problems, Proceedings of 1st NASA Symposium entitled: Parallel Methods on Large-Scale Structural Analysis and Physics Applications, pp. 175-182, December 1991.
17. Storaasli, Olaf. O.; Nguyen, Duc. T.; and Agarwal, Tarun. K.: Parallel-Vector Solution of Large-Scale Structural Analysis Problems on Supercomputers. AIAA Journal, Vol. 28, No. 7, pp. 1211–1216, July 190.
18. Storaasli, Olaf. O.; Bostic, Susan. W.; Patrick, Merrill. L.; Mahajan, U.; and Ma, S.: Three Parallel Computation Methods For Structural Vibration Analysis. AIAA Journal Guidance, Control, and Dynamics, Vol. 13, No. 3, pp. 555-561, May-June 1990.

19. Darbhamulla, Siva. P.; Razzaq, Zia.; and Storaasli, Olaf. O.: Concurrent Processing in Nonlinear Column Stability: Engineering with Computers. International Journal for Computer-Aided Mechanical and Structural Engineering, Vol. 4, Springer-Verlag, pp. 157-164, New York, 1988.
20. Storaasli, Olaf. O.; Ransom, Jonathan. B.; and Fulton, Robert. E.: Structural Dynamic Analysis on a Parallel Computer: The Finite Element Machine. Computers and Structures, Vol 26 No. 4, pp. 551-559, July 1987.
21. Storaasli, Olaf. O. and Bergan, Paal. G.: Nonlinear Substructuring Method for Concurrent Processing Computers. AIAA Journal, Vol 25, No. 6, pp. 871 –876, June, 1987.
22. Darbhamulla, Siva. P.; Razzaq, Zia.; and Storaasli, Olaf. O.: Concurrent Processing for Nonlinear Analysis of Hollow Rectangular Structural Sections: Engineering with Computers. International Journal for Computer-Aided Mechanical and Structural Engineering, Vol. 2, pp. 209-217, 1987.
23. Blackburn, Charles. L.; Storaasli, Olaf. O.; and Fulton, Robert. E.: The Role and Application of Data Base Management in Integrated Computer-Aided Design. Journal of Aircraft, Vol. 20, No. 8, pp. 717-725, August 1983.
24. Storaasli, Olaf. O. and Foster, Edward. P.: Cost-Effective Use of Minicomputers to Solve Structural Problems. Journal of Aircraft, Vol. 16, No. 11, pp. 775-779, November 1979.
25. Storaasli, Olaf. O.: On the Role of Minicomputers in Structural Design. Computers and Structures, Vol. 7, pp. 117-123, February 1977.

Referenceable Oral Presentations

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1. Storaasli, Olaf O.*, Supercomputers, Clusters & Hypercomputers (Past, Present Future), presented to HPC Users Forum, Dearborn, Michigan, April 12-14, 2004.
2. R. T. Biedron, P. Mehrotra, M. L. Nelson, F. S. Preston, J. J. Rehder, J. L. Rogers, D. H. Rudy, J. Sobieszczanski-Sobieski and O. O. Storaasli, Compute as Fast as the Engineers Can Think!---Ultrafast Computing Team Final Report, presented to SGI-sponsored Conference on Computers for the automotive Industry, March 16, 2001, NASA/TM-1999-209715, September 1999, pp. 1-54.
3. R. T. Biedron, P. Mehrotra, M. L. Nelson, F. S. Preston, J. J. Rehder, J. L. Rogers, D. H. Rudy, J. Sobieszczanski-Sobieski and O. O. Storaasli, Compute as Fast as the Engineers Can Think!---Ultrafast Computing Team Final Report, presented to SGI-sponsored Conference on Computers for the automotive Industry, March 16, 2001, NASA/TM-1999-209715, September 1999, pp. 1-54.

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7. Storaasli, Olaf O., Invited talk entitled: High-Performance Structural Analysis and Equation Solution Algorithms, NSF Workshop on High-Performance Computing, In Workshop Proceedings., University of Nevada- Las Vegas, March 26-28, 1997.
8. Olaf O. Storaasli*, Performance of NASA Equation Solvers on Computational Mechanics Applications , Proceedings of the 34th AIAA/ASME/ASCE/AHS /ASC Structures, Structural Dynamics and Materials Conference Salt Lake City, Utah, AIAA Paper No. 96-1505, April 15-17, 1996.
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11. Gupta, Vinney K., Newell, James F., Storaasli, Olaf O.*, Baddourah, Majdi A. and Bostic, Susan , Space Station Static and Dynamic Analyses Using Parallel Methods: Proceedings of 2nd NASA Symposium entitled: Parallel Computational Methods for Large-Scale Structural Analysis and Design,(also in Int. Journal of Computing Systems in Engineering, Vol. 4, No. 4-6), pp. 387-398, Dec 1993.
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13. Qin*, J.; Agarwal, T.; Storaasli, O.; Nguyen, D;. and Baddourah, M.: ParallelVector Out-of-Core Equation Solver for Computational Mechanics, Proceedings of the 2nd Symposium on Parallel Computational Methods for Structural Analysis and Design, February 24-25, Norfolk, VA, February 1993. (Also in Vol. 4, No. 3, Int'l J. of Computing Systems in Engineering).
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