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## Research: Projects - MSHN

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# NAVAL POSTGRADUATE SCHOOL

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### Research: Projects - MSHN

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### The Management System for Heterogeneous Networks

The Management System for Heterogeneous Networks (MSHN) project is part of the DARPA/ITO Quorum program. Quorum's goal is to develop technologies to allow mission-critical defense applications to achieve survivable, predictable, and controllable quality of service on a globally managed pool of distributed resources.

The goal of the MSHN Project is to explore the application of adaptive and heuristic matching and scheduling techniques, and modern distributed security methods, to a distributed heterogeneous resource management system (RMS) which allows system resources to be accessed by both MSHN-controlled and external applications. To validate our research and engineering assumptions, a prototype version of MSHN has been developed and demonstrated.

A complete description of the MSHN technical program is found in the research papers. The [Final Report](#) provides both a high-level overview of the MSHN technical program and a reference guide to the research papers.

The MSHN Project began in 1997, under the direction of Dr. Debra Hensgen. In the fall of 1999, Dr. Cynthia Irvine took on oversight for MSHN. The primary project contract concluded on March 31, 2000

### MSHN Publications

"An Overview of the Management System for Heterogeneous Networks (MSHN), 8th Workshop on Heterogeneous Computing Systems (HCW '99)", San Juan, Puerto Rico, Apr. 1999 ([PDF](#))

Kim, J-K, Hensgen, D.A., Kidd, T., Siegel, H.J., St. John, D., Irvine, C. E., Levin, T., Porter, N.W., Prasanna, V.K., and Freund, R.F., "A QoS Performance Measure Framework for Distributed Heterogeneous Networks", Proceedings of the 8th Euromicro Workshop on Parallel and Distributed Processing, Rhodes, Greece, pp. 18-27, January 2000 ([PDF](#))

### MSHN's Client Library

"Passive, Domain-Independent, End-to-End Message Passing Performance Monitoring to Support Adaptive Applications in MSHN", 8th International Symposium on High Performance Distributed Computing (HPDC), Aug. 1999 ([PDF](#))

"Design, Implementation, and Testing of MSHN's Application Resource Monitoring Library" Masters Thesis, Naval Postgraduate School, Monterey, CA, Dec. 1998 ([PDF](#))

Howard Jay Siegel and Shoukat Ali, "Techniques for Mapping Tasks to Machines in Heterogeneous Computing Systems", Euromicro Journal of Systems Architecture, Special Issue on Heterogeneous Distributed and Parallel Architectures: Hardware, Software and Design Tools, Vol.46, No.8, pp. 627-639, June 2000 ([PDF](#))

Shoukat Ali, S., "A Comparative Study of Dynamic Mapping Heuristics for a Class of Independent Tasks onto Heterogeneous Computing Systems", Master's Thesis, School of Electrical and Computer Engineering, Purdue University, 1999 ([PDF](#))

Muthucumaru Maheswaran, Shoukat Ali, Howard Jay Siegel, Debra Hensgen, and Richard F. Freund, "Dynamic Mapping of a Class of Independent Tasks onto Heterogeneous Computing Systems", Journal of Parallel and Distributed Computing, Special Issue on Software Support for Distributed Computing, 1999 ([PDF](#))

Prashanth B. Bhat, C.S. Raghavendra, and Viktor K. Prasanna, "Efficient Collective Communication in Distributed Heterogeneous Systems", The 19th International Conference on Distributed Computing Systems (ICDCS), 1999 ([PDF](#))

Muthucumaru Maheswaran, Tracy D. Braun, and Howard Jay Siegel, "Heterogeneous Distributed Computing, Encyclopedia of Electrical and Electronics Engineering", J. G. Webster, editor, John Wiley & Sons, New York, NY, 1999, Vol. 8, pp. 679-690 ([PDF](#))

Yu-Kwong Kwok, Anthony A. Maciejewski, Howard Jay Siegel, Arif Ghafoor, and Ishfaq Ahmad, "Evaluation of A Semi-Static Approach to Mapping Dynamic Iterative Tasks onto Heterogeneous Computing Systems", 1999 International Symposium on Parallel Architectures, Algorithms, and Networks (I-SPAN '99), pp. 204-209, Fremantle, Australia, June 1999

Taylor Kidd and Debra Hensgen, "Why the Mean is Inadequate for Accurate Scheduling Decisions" Proceedings of the 3rd International Symposium on Parallel Architectures, Algorithms, and Networks (ISPAN'99), Perth, Australia, Jun. 1999.

Alhusaini, A., Prasanna, V., and Raghavendra, C.S., "A Unified Resource Scheduling Framework for Heterogeneous Computing Environments", Proc. 8th IEEE Heterogeneous Computing Workshop, Puerto Rico, April 1999 ([PDF](#))

Tracy D. Braun, Howard Jay Siegel, Noah Beck, Ladislau L. Boloni, Muthucumaru Maheswaran, Albert I. Reuther, James P. Robertson, Mitchell D. Theys, Bin Yao, Debra Hensgen, and Richard F. Freund, "A Comparison Study of Static Mapping Heuristics for a Class of Meta-tasks on Heterogeneous Computing Systems",

Proceedings of the 8th IEEE Workshop on Heterogeneous Computing Systems (HCW '99), San Juan, Puerto Rico, Apr. 1999 ([PDF](#))

Muthucumaru Maheswaran, Shoukat Ali, Howard Jay Siegel, Debra Hensgen, and Richard F. Freund, "Dynamic Matching and Scheduling of a Class of Independent Tasks onto Heterogeneous Computing Systems", Proceedings of the 8th Workshop on Heterogeneous Computing Systems (HCW '99), San Juan, Puerto Rico, Apr. 1999 ([PDF](#))

Min Tan and Howard Jay Siegel, "A Stochastic Model for Heterogeneous Computing and Its Application in Data Relocation Scheme Development", IEEE Transactions on Parallel and Distributed Systems, Vol. 9, No. 11, Nov. 1998, pp. 1088-1101 ([PDF](#))

Tracy D. Braun, Muthucumaru Maheswaran, Howard Jay Siegel, Noah Beck, Ladislau Boloni, Albert I. Reuther, James P. Robertson, Mitchell D. Theys, and Bin Yao, "A Taxonomy for Describing Matching and Scheduling Heuristics for Mixed-Machine Heterogeneous Computing Systems, Workshop on Advances in Parallel and Distributed Systems", Proceedings of the IEEE Symposium on Reliable Distributed Systems, Oct. 1998, pp. 330-335, West Lafayette, IN, Oct. 1998 ([PDF](#))

Prashanth B. Bhat, Viktor K. Prasanna, and C.S. Raghavendra, "Block-Cyclic Redistribution over Heterogeneous Networks", The 11th International Conference on Parallel and Distributed Computer Systems, Sep. 1998, pp. 242-249 ([PDF](#))

Muthucumaru Maheswaran, Kevin J. Webb, and Howard Jay Siegel, "MCGS: A Modified Conjugate Gradient Squared Algorithm for Nonsymmetric Linear Systems" Appeared as "Reducing the Synchronization Overhead in Parallel Nonsymmetric Krylor Algorithms on MIMD Machines", 1998 International Conference on Parallel Processing (ICPP '98), Minneapolis, MN, Aug. 1998, pp. 405-413 ([PDF](#))

Prashanth B. Bhat, Viktor K. Prasanna, and C.S. Raghavendra, "Adaptive Communication Algorithms for Distributed Heterogeneous Systems", The 7th International Symposium on High Performance Distributed Computing, Aug. 1998, pp. 310-321.

Robert Armstrong, Debra Hensgen, and Taylor Kidd, The Relative Performance of Various Mapping Algorithms is Independent of Sizable Variances in Run-time Predictions, 7th Heterogeneous Computing Workshop (HCW'98), Mar. 1998, pp. 79-87 ([PDF](#))

Muthucumaru Maheswaran and Howard Jay Siegel, "A Dynamic Matching and Scheduling Algorithm for Heterogeneous Computing Systems", 7th Heterogeneous Computing Workshop (HCW '98), Orlando, FL, Mar. 1998, pp. 57-69 ([PDF](#))

Muthucumaru Maheswaran, Tracy Braun, and Howard Jay Siegel, "High-Performance Mixed-Machine Heterogeneous Computing", 6th Euromicro Workshop on Parallel and Distributed Processing, Madrid, Spain, Jan. 1998, pp. 3-9. H. J. ([PDF](#))

Lee Wang, Howard Jay Siegel, Vwani P. Roychowdhury, and Anthony A. Maciejewski, "Task Matching and Scheduling in Heterogeneous Computing Environments Using a Genetic-Algorithm-Based Approach", Journal of Parallel and Distributed Computing, Special Issue on Parallel Evolutionary Computing, Vol. 47, No. 1, Nov. 1997, pp. 8-22 ([PDF](#))

Howard Jay Siegel and Muthucumaru Maheswaran, "Mapping Tasks onto Heterogeneous Computing Systems", IX Simposio Brasileiro de Arquitetura de Computadores - Processamento de Alto Desempenho (SBAC-PAD '97) (IX Brazilian Symposium on Computer Architectures - High Performance Computing), Campos do Jordao, Sao Paulo, Brazil, Oct. 1997, pp. 3-17. H. J. Siegel was an invited tutorial speaker.

Robert Armstrong, "Investigation of Effect of Different Run-time Distributions on Smartnet Performance", Masters Thesis, Naval Postgraduate School, Monterey, CA, Sep. 1997 ([PDF](#))

### Resource and Application Models

Paul Carff, "When is a Simple Model Adequate For Use in Scheduling in MSHN?", Masters Thesis, Naval Postgraduate School, Monterey, CA, Mar. 1999. Debra Hensgen, advisor.

### MSHN's Monitoring

"Re-targeting the Graze Performance Debugging Tool for Java threads and analyzing the Re-targeting to Automatically Parallelized (Fortran) Code", Masters Thesis, Naval Postgraduate School, Monterey, CA, Mar. 2000 ([PDF](#))

Kresho, J.P., "Quality Network Load Information Improves Performance of Adaptive Applications", Masters Thesis, Naval Postgraduate School, Monterey, CA, Sep. 1997 ([PDF](#))

MSHN's Application Emulator

"When is a Simple Model Adequate For Use in Scheduling in MSHN?", Masters Thesis, Naval Postgraduate School, Monterey, CA, Mar. 1999

### Security in MSHN

Irvine, C. E., and Leven, T. E., "Toward Quality of Security Service in A Resource Management System Benefit Function", Proceedings of the 2000 Heterogeneous Computing Workshop, May 2000 ([PDF](#))

"Toward a Taxonomy and Costing Method for Security Services", Proceedings of the 15th Computer Security Applications Conference, Phoenix, AZ, December 1999, pp 183-188 ([PDF](#))

"Quality of Security Service in a Resource Management System Benefit Function", Naval Postgraduate School Technical Report, NPS-CS-99-002, Monterey, CA, November 1999.

"A Note on Mapping User-Oriented Security Policies to Complex Mechanisms and Services", Naval Postgraduate School Technical Report, NPS-CS-99-008, Monterey, CA, 15 June 1999 ([PDF](#))

Levin, T. E., Irvine, C. E., "An Approach to Characterizing Resource Usage and User Preferences in Benefit Functions", NPS-CS-99-005, Naval Postgraduate School, 15 June 1999 ([PDF](#))

"Security for a Virtual Heterogeneous Machine", 14th Computer Security Applications Conference, Scottsdale, AZ, Dec. 1998 ([PDF](#))

"Integrity Architecture and Security Services Demonstration for Management System for Heterogeneous Networks", Masters Thesis, Naval Postgraduate School, Monterey, CA, Sep. 1998.

"Security Analysis for a Management System for Heterogeneous Networks (MSHN)", Masters Thesis, Naval Postgraduate School, Monterey, CA, Sep. 1997.

#### **MSHN's Performance Criteria**

John Kresho, Debra Hensgen, Taylor Kidd, and Geoffry Xie, "Determining the Accuracy Required in Resource Load Prediction to Successfully Support Application Agility", Proceedings of the 2nd IASTED International Conference of European Parallel and Distributed Systems, Jul. 1998, pp. 224-254 ([PDF](#))

#### **Communication Within MSHN**

Alpay Duman, Debra Hensgen, David St. John, and Taylor Kidd, "Are CORBA Services Ready to Support Resource Management Middleware for Heterogeneous Computing?", 8th Workshop on Heterogeneous Computing Systems (HCW '99), San Juan, Puerto Rico, Apr. 1999 ([PDF](#))

Duman, A., "The Use and Run-Time Overhead of CORBA in MSHN Project", Masters Thesis, Naval Postgraduate School, Monterey, CA, Sep. 1998 ([PDF](#))

Matt Schnaidt, Alpay Duman, Ted Lewis, "A Comparison of C++ Sockets and Corba in a Distributed Matrix Application", Naval Postgraduate School, Monterey, CA, Technical report, Jun. 1998 ([PDF](#))

#### **MSHN's Predecessor**

"Scheduling Resources in Multi-User, Heterogeneous, Computing Environments with SmartNet", 7th Heterogeneous Computing Workshop (HCW '98), Orlando, FL, Mar. 1998, pp. 184-199 ([PDF](#))

"System Software Developers Desperately Need Better Simulation Tools", Proceedings of the Western Simulation Multiconference, sponsored by the Computer Simulation Society, Phoenix, AZ, Jan. 1997.

"SmartNet: A Scheduling Framework for Heterogeneous Computing, proceedings of the International symposium on Parallel Architectures, Algorithms, and Networks (I-SPAN'96)", Sponsored by the IEEE computer Society, Beijing, China, Jun. 1996, pp. 514-521 ([PDF](#))

"Adding Rescheduling to and Integrating Condor with SmartNet", Proceedings of the 4th IEEE Workshop on Heterogeneous Computing, Santa Barbara, CA, Apr. 1995, pp. 4-11.

#### **Related Work in Computer Networks**

Geoffrey G. Xie, Debra Hensgen, Taylor Kidd, and John Yarger, "SAAM: An Integrated Network Architecture For Integrated Services", Proceedings of the 6th IEEE/IFIP International Workshop on Quality of Service, Napa, CA, May 1998 ([PDF](#))

#### **Related Work in Heterogeneous Computing**

Tracy D. Braun, Anthony A. Maciejewski, and Howard Jay Siegel, "A Parallel Algorithm for Singular Value Decomposition as Applied to Failure Tolerant Manipulators", Proceedings of the merged 13th International Parallel Processing Symposium and 10th Symposium on Parallel and Distributed Processing (IPPS/SPDP '99), San Juan, Puerto Rico, Apr. 1999 ([PDF](#))

Muthucumar Maheswaran, Kevin J. Webb, and Howard Jay Siegel, "Reducing the Synchronization Overhead in Parallel Nonsymmetric Krylor Algorithms on MIMD Machines", 1998 International Conference on Parallel Processing (ICPP '98), Minneapolis, MN, Aug. 1998, pp. 405-413.

"Mapping Conjugate Gradient Algorithms for Neutron Diffusion Applications onto SIMD, MIMD, and Mixed-Mode Machines", International Journal of Parallel Programming, Vol. 26, No. 2, Apr. 1998, pp. 183-207.

Mark B. Kulaczewski and Howard Jay Siegel, "SIMD and Mixed-Mode Implementations of a Visual Tracking Algorithm", Merged 12th International Parallel Processing Symposium & 9th Symposium on Parallel and Distributed Processing (IPPS/SPDP '98), Orlando, FL, Apr. 1998, pp. 345-349.

James A. Armstrong, Muthucumar Maheswaran, Mitchell D. Theys, Howard Jay Siegel, Mark A. Nichols, and Kenneth H. Casey, "Parallel Image Correlation: Case Study to Examine Trade-Offs in Algorithm-to-Machine Mappings"

The Journal of Supercomputing, Special Issue on High-Performance Computing and Applications in Computer Graphics, Image Processing, and Computer Vision, Vol. 12, No. 1/2, Jan. 1998, pp. 7-35.

#### **MSHN's Software Engineering Experiences**

David St. John, Taylor Kidd, Debra Hensgen, Mantak Shing, Shirley Kidd, "Experiences Using Semi-Formal Methods During Development of Distributed, Research-Oriented, System-Level Software", Naval Postgraduate School, Monterey, CA, Technical Report, May 1999 ([PDF](#))

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