

North Texas Net-Centric Systems Consortium

This Letter of Intent seeks support for the transformation of an existing industry-university consortium into an NSF Industry-University Collaborative Research Center to include academic, industrial, federal and state institutions and collectively promote and undertake research and workforce development of service-oriented, network-centric systems. In this new paradigm, systems are no longer designed with a fixed set of capabilities but as a set of services that will be dynamically acquired or created, replaced, composed, verified, and validated in real-time in the field without human intervention. These services must always be available, reliable, dependable and fault-tolerant, while maintaining security requirements.

At present the consortium includes the University of North Texas, The University of Texas at Arlington, The University of Texas at Dallas, the Southern Methodist University, Lockheed Martin, Raytheon, and Metalect. Additionally, Boeing, Rockwell-Collins and IBM have expressed an interest in joining the consortium.

The Net-Centric Systems Consortium will be a primary source of collaborative research in design, implementation, and operational support of net-centric software/hardware systems. The consortium will enable coordinated software engineering and systems research and development as well as education and training to meet future technology workforce needs of our nation.

Unlike other Net-Centric consortia that address standards, policies, or market adaptation strategies, the North Texas consortium with an academic focus will develop the research needed for high-quality net-centric systems. Unlike the I/UCRC Software Engineering Research Center (SERC at Ball State University), we will investigate research in both hardware and software formalisms needed for full-fledged Net Centric operations. Unlike the Center for Experimental Research in Computer Systems (CERCS at Georgia Institute of Technology), we focus on theoretical foundations and tools for the design and implementation of Net Centric systems.

Research Focus

The consortium will undertake both basic and applied research needed for net-centric systems. More specifically, the consortium will develop research and associated technologies that lead to robust, fully analyzable net-centric software/hardware systems. This research includes: 1) automated synthesis of net-centric systems that can be verified for functional, performance, and security compliance; 2) continuous monitoring and adaptation to tolerate unexpected events; and 3) development of highly survivable and user-friendly net-centric systems.

Innovative risk assessment analysis techniques will be developed to determine if a system is being designed and implemented at acceptable levels of risk and whether additional effort to further develop the system will be cost-effective. Another research focus of the consortium is models for policy based service integration. Finally, the consortium will provide the diversity needed to independently evaluate competing products and technologies developed by commercial institutions.

Participating Institutions and Faculty

1. The University of North Texas is a comprehensive, Doctoral/Research Extensive public institution, located in the Dallas-Ft. Worth Metropolitan area. With over 32,000 students, UNT is the fourth largest University in Texas. The newly created College of Engineering is already recognized for its innovative degree programs (EE program received \$1M from NSF-EHR, a new Mechanical and Energy Engineering program received planning grant from NSF). The Materials Science and Engineering department received in excess of \$10M in federal funding to acquire state-of-the-art equipment for its nano-technology research. The Department of CSE have been recognized for a long history of producing more Computer and Information Systems doctoral graduates than all other Metropolitan institutions of Higher Education. The department offers BS, MS and PhD degrees in Computer Science and BS and MS degrees in Computer Engineering. In addition to the faculty listed below, other faculty from the College of Engineering will participate in the center activities based on their expertise and project needs.

Krishna Kavi, currently a professor and chair of UNT's Computer Science and Engineering Department conducts research primarily in computer systems architecture, agent-oriented system and formal methods of software engineering. He has authored more than 150 technical publications in these areas. He has received more than \$3M in extramural funding from NSF, State of Texas, Army, NASA and industry to support his research. During 1993-1995, he was a program director at the National Science Foundation

Robert Brazile, currently an associate professor and associate chair of UNT's Computer Science and Engineering spent his first 20 working years in the computer industry at companies such as North American Aviation, Collins Radio, General Electric Computer Division, Mitre, Honeywell Information Systems and GTE. On three separate occasions he was a company officer, or manager, in small startup computer companies. His area of research is metadata and information integration.

Philip Sweany, associate professor in UNT's Computer Science and Engineering Department maintains a research focus in both compiler optimization for architectures exhibiting fine-grained parallelism and application of compiler optimization algorithms to automated synthesis of net-centric systems. He has published more than 30 articles in computer systems and received more than \$1M in external funding.

2. The University of Texas at Dallas (UTD) is a comprehensive public research university that offers an array of interdisciplinary degree programs through seven schools with the goal of providing Texas and the nation the best quality educational and research programs. It emphasizes education and research in engineering, science, technology, and management while maintaining programs of focused excellence in other academic disciplines. UTD is located in the heart of the "Telecom Corridor" with numerous high-technology companies, such as Alcatel, Ericsson, Hewlett-Packard, Lockheed-Martin, MCI, Nortel Networks, Raytheon, Rockwell Collins, Texas Instruments, etc., located within a few miles of the campus. UTD has an enrollment of over 14,000 students and a world-class faculty that includes two Nobel laureates.

Dr. Farokh Bastani's research interests include autonomous decentralized systems, compositional and aspect-oriented software engineering, and AI-based automated programming environments and analysis techniques with applications to network-centric real-time embedded systems, telecommunications and tele-collaborative systems, tele-monitoring and tele-control systems, and large scale swarm systems.

Dr. Joao Cangussu's expertise lies in the area of software process control where he has developed techniques to predict and regulate slippages in the development process through the use of feedback control theory. He has also expertise on testing where he is developing a virtual network testing environment that allows for the easy deployment and (re)configuration of distinct network scenarios.

Dr. Lawrence Chung's main areas of research include requirements engineering and architecting of (systems of) systems, with particular emphasis in such non-functional requirements as interoperability, security and adaptability, in the use of COTS and components, and in model-driven, goal-oriented, and agent-oriented system development.

Dr. Kendra Cooper's research expertise includes COTS component based software engineering methodologies using goal-, aspect-, and object-oriented paradigms for single product and product line development. The early phases of software development are the focus: requirements engineering and software architecture. The research uses interesting combinations of formal methods and empirical studies.

Dr. Jing Dong's main research interest is net-centric software engineering. In particular, he is interested in high-level architecture and design of large-scale net-centric software systems. He has done and is doing research projects on service-oriented architecture, web service, OWL-S, software architecture, design patterns. He is also interested in applying formal engineering methods, such as model checking and theorem proving, in the analysis of net-centric systems.

Dr. Gopal Gupta's primary area of research is computational logic, programming languages, and software engineering, in particular their application to the semantic Web and Web services. Together with Metalex Corporation, his group has developed the Universal Service Description Language, a semantic mark-up for Web services to enable their discovery and composition. His group has also developed computational engines for querying the semantic web as well as for automated service discovery and composition. He is also interested in advanced inference engines for these purposes that run on multicore CPU architectures.

Dr. Dung T. Huynh's research areas include computational complexity theory, automata and formal languages, concurrency theory, communication networks and protocols, parallel computation, program slicing, and software metrics.

Dr. Eric Wong's research focus is on the development of technology to help practitioners produce high quality software at a low cost. In particular, he is doing research in the areas of software testing, maintenance, reliability, metrics, and QoS at the application, as well as architecture/design, level. Dr. Wong has very strong experience in applying his research results to real-life industry projects.

Dr. I-Ling Yen's research interests include high assurance systems engineering and techniques, adaptive systems for coping with changing QoS requirements, software engineering for web service composition and component composition, QoS based web service composition, distributed computing, resource allocation in grid systems, security for data grids, and widely distributed massive data storage systems.

Dr. Kang Zhang's research interests include visual language approaches to software engineering, more specifically, model-driven architecture through graph transformations, and syntactic and semantic specifications of state diagrams. Other interests include model management and integration through meta-modeling; visual programming techniques and automatic generation of visual programming languages; and visual data mining and information visualization.

3. Southern Methodist University, is a private university founded in 1911 and is consistently ranked among the top third of national universities. The faculty and students of the School of Engineering have contributed to several technological innovations. The department of Computer Science and Engineering offers degrees in both computer science and computer engineering. Undergraduate and graduate programs focus on all aspects of computer design as well as software construction and applications.

Jeff Tian is an Associate Professor of Computer Science and Engineering at SMU. His research sponsors and collaborators include NSF, State of Texas, Nortel Networks, IBM, and Lockheed-Martin. His current research focus is risk-based software assessment and quality improvement. He received an NSF CAREER

award in 1998 and numerous other awards and recognitions.

Several other SMU faculty members also have research interests related to net-centric software and systems, including fault tolerance for dependable systems and networks (Suku Nair, Professor), sensor networks and distributed computing (Hesham El-Rewini, Professor and Chair), and embedded system design and testing (Fatih Kocan, Assistant Professor).

4. The University of Texas at Arlington is a comprehensive teaching, research and public service institution located in the heart of the Dallas/Fort Worth Metroplex. UTA, the second largest component of the UT System, offers 90 baccalaureate, 74 masters and 34 doctoral degrees within nine academic units and a graduate school. The Department of Computer Science and Engineering at UTA is in its fourth successful year of a plan called the Top 25 Initiative, which is designed to advance the department to among the top-ranked 25 computer science and engineering university programs in America. In addition to the faculty listed below, other CSE faculty members will participate in the center activities as needed.

David Kung is a full professor in UTA's Department of Computer Science and Engineering. He is also the director of the Software Engineering Program and the Software Engineering Research Center. His research interests include agent-oriented software engineering, object-oriented real time systems modeling and verification, and object-oriented software testing and maintenance, from which a CASE tool called OOTWorks has been developed for industrial use.

Jeff Lei is an assistant professor in UTA's Department of Computer Science and Engineering. He is also a member of the Software Engineering Research Center at UTA. Prior to that, he was a Member of Technical Staff in Fujitsu Network Communications, Inc. for more than three years. He has performed research in the area of analysis, testing, and verification of concurrent and real-time software systems.