

<b>Documents Available in PDF Format:</b> <ul style="list-style-type: none"> <li>• ULN workshop announcement</li> <li>• Questions for ULN considerations</li> <li>• Some responses and more questions</li> </ul> Link to abstracts of overview talks	<b>Modeling and Simulation of Ultra-Large Networks: Challenges and New Research Directions</b>  NSF-Sponsored Workshop (by Invitation-Only) Nov. 19-20, 2001, Tucson, AZ, USA
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**Organized by:**

- The Arizona Center for Integrative Modeling and Simulation (<http://www.acims.arizona.edu>)
- The Society for Modeling and Simulation International (<http://www.scs.org>)

**Sponsored by:**

- The National Science Foundation Advanced Networking Infrastructure Research Program (NSF/ANIR)

**Purpose:**

To bring together for a short, but intense, period some of the world's leading researchers in the networking area to meet with counterparts with expertise in modeling and simulation of networks and of systems more generally.

**Activities:**

Invited participants will be tasked with elucidating the unknowns of ultra-large networks and with new directions of research that can address these unknowns. The results are expected to be a set of specific finding of gaps in our knowledge of the behavior of ultra-large networks and how to deal with their design, management, and control. Participants will assess whether current approaches can be evolved to deal with the large increases in scale or whether different, revolutionary paradigms are required. They will address the need for new techniques and approaches for building models of ultra-large networks and developing simulation environments for studying their behaviors. Suggestions for borrowing points of view form other areas such as complex adaptive systems and from basic theory of modeling and simulation will be encouraged. The workshop Invitee will be grouped into three teams each consisting of 10 members each: Networks, Network Simulation, and Modeling and Simulation. A substantial period of time will be allocated for a facilitated activity using GroupSystems software for anonymous interactive review of recommendations. The scheduled activities are shown below.

<b>First Day (Monday, Nov. 19, 01)*</b>		<b>Location</b>
07:00 – 7:45 am	Breakfast	Sheraton Hotel
8:00 – 12:00 am	Introduction, Three Presentations (one per focus group leader)	Sheraton Hotel
12:00 – 1:15 pm	Lunch	Sheraton Hotel
01:30 – 5:30 pm	Three Parallel Breakout Sessions	Sheraton Hotel
06:30 – 8:30 pm	Informal Discussions and Dinner	Sheraton Hotel
<b>Second Day (Tuesday, Nov. 20, 01)</b>		
07:00 – 7:45 am	Breakfast	Sheraton Hotel
08:15 – 11:45 am	GroupSystems-facilitated Anonymous Review of First Day's findings	University of Arizona
12:15 – 1:30 pm	Lunch	Sheraton Hotel
01:30 – 4:30 pm	Plenary Discussion, Summary of Finding and Recommendation, and Wrap-up	Sheraton Hotel
06:00 – 8:00 pm	Dinner	Pinnacle Peak

**\* Evening Reception will be held on Sunday Nov. 18, 6:00 – 8:00 pm**

**Outcome:**

The results of the workshop will be compiled into a proceeding that will provide a useable and significant guide for new NSF funding initiatives for future network infrastructure research.

**List of Participants and Observers:**

<b>Participants</b>	<b>Organization</b>	<b>Website</b>
Agarwal, S.	Lucent Technologies	<a href="#">Link</a>
Bagrodia, R.	University of California Los Angeles	<a href="#">Link</a>
Claffy, K.	San Diego Super Computing Center, UCSD	<a href="#">Link</a>
Colbourn, C.	Arizona State University	<a href="#">Link</a>
Floyd, S.	Lawrence Berkeley Nat'l Lab/ACIRI/UCB	<a href="#">Link</a>
Fujimoto, R.	Georgia Tech	<a href="#">Link</a>
Gelenbe, E.	Univ. of Central Florida	<a href="#">Link</a>
Gill, V.	MFNX	<a href="#">Link</a>
Ghosh, S.	Stevens Institute of Technology	<a href="#">Link</a>
Hall, S.	Lockheed Martin	<a href="#">Link</a>
Hariri, S.	University of Arizona	<a href="#">Link</a>
Hui, J.	Arizona State University	<a href="#">Link</a>
Kim, T.G.	Korea Advanced Institute of Science & Technology	<a href="#">Link</a>
Martinez, R.	University of Arizona	<a href="#">Link</a>
Ng, H.	Naval Research Laboratory	<a href="#">Link</a>
Meyer, D.	Sprint	<a href="#">Link</a>
Nicol, D.	Dartmouth College	<a href="#">Link</a>
Orman, H.	Nortel	<a href="#">Link</a>
Pink, S.	University of Arizona	<a href="#">Link</a>
Raghavendra, C.	University of Southern California	<a href="#">Link</a>
Reily, G.	Georgia Tech	<a href="#">Link</a>
Sanders, W.	University of Illinois, Urbana Champaign	<a href="#">Link</a>
Sarjoughian, H.	Arizona State University	<a href="#">Link</a>
Wainer, G.	University of	<a href="#">Link</a>
Wilsey, P.	University of Cincinnati	<a href="#">Link</a>
Woodcock, B.	Zocal	<a href="#">Link</a>
Zeigler, B.	University of Arizona	<a href="#">Link</a>
Znati, T.	NSF/University of Pittsburgh	<a href="#">Link</a>
Cam, H.	Arizona State University	<a href="#">Link</a>
Gupta, S.	Arizona State University	<a href="#">Link</a>
Krunz, M.	University of Arizona	<a href="#">Link</a>
Louri, A.	University of Arizona	<a href="#">Link</a>
Reisslein, M.	Arizona State University	<a href="#">Link</a>
Rozenblit, J.	University of Arizona	<a href="#">Link</a>
Sen, A.	Arizona State University	<a href="#">Link</a>
Xue, G.	Arizona State University	<a href="#">Link</a>

**Prelude to the Workshop:**

The Internet is increasing in connectivity, expected to reach 1 billion nodes in 2005, and node capability (gigahertz playstations are imminent) providing a highly interconnected and computationally powerful medium. Such a globally and ubiquitously dispersed network will provide a new frontier for new kinds of educational, commerce and entertainment activities. However, there are many issues that arise in the

emergence of such a large, highly decentralized, collection of interacting parts. The increased connectivity and capability creates new complexity and dynamics that we are only on the verge of appreciating. Moreover, increased connectivity by itself does not assure improved business customer relationships, more fruitful scientific collaboration, and a safe yet adventurous environment for children. Indeed, there is ever more potential for information and processing overload and malicious security attacks that shut down the entire system. The question is then as the world scales up in inter-connectivity, how to assure that our current quality of life is actually improved, or at least maintained, and not diminished. Recent tragic events have shown how technology and scale are not necessarily good in themselves. Technology can be horribly abused and the vulnerability of systems may increase drastically with scale. Thus this workshop is more timely and urgent now than when it was first proposed. Its products are expected to be of extreme importance to the nation and the world.

Techniques that work for small networks fail markedly when the size, complexity, and interdependence of network nodes increases by one million fold. The impacts of scaling up need to be examined from several points of view such as security, openness, resource sharing, flexibility, adaptivity, and fault-tolerance. New theories, paradigms and techniques need to be developed to address these issues. Moreover, computer-based modeling and simulation (M&S) methodology is required to enable these developments since the scale is well beyond what analytical tools alone can handle. Moreover, there is limited ability to do controlled experiments on the "always on" Internet. Thus, the time has come to develop M&S-based approaches for understanding the behaviors of very large inter-connected networks with very few loci of control and many interacting and varied sources of input and services demand.

### **Workshop/Hotel Location**

Hotel and Workshop Location: Sheraton Hotel, 5151 East Grant Road, Tucson, Arizona. Ph: 520-323-6262. For further information visit <http://tucson.hotelguide.net/data/h100066.htm>. The anonymous GroupSystems-facilitated activity will be conducted at the University of Arizona, [www.arizona.edu](http://www.arizona.edu).

### **Reception Location**

From Sheraton Hotel: Take Grant Road (heading East, take a left as you leave the hotel) to where it meets Tanque Verde, taking a left (continuing straight is Kolb). Continue on Tanque Verde (east) to Sabino Canyon Rd. (second light) and turn left (heading north); The Sahuaro Girl Scout "Hacienda" program facility is located approx. 1.5 miles ahead on the left side of road at 3101 N. Sabino Canyon road (tel# 520-319-3181). There is a left turn break in the center median right at the entrance. Balloons or ACIMS sign will mark the entrance. Follow the dirt road around until reaching the parking lot by the pool.

### **Financial Support:**

For the invited speakers, the grant allows us to reimburse up to \$400 for travel expenses, plus cover hotel accommodations (at the workshop venue). If travel expenses exceeds \$400 please contact Steve Branch directly and we will make arrangements to purchase the ticket for you. Meals for the two-day event will be provided separately by the workshop.

### **Other Cooperating Organizations:**

- University of Arizona, College of Engineering & Mines and Dept. of Electrical & Computer Engineering
- Arizona State University, College of Engineering & Applied Sciences and Dept. of Computer Science & Engineering
- Center for Advanced Telesystematics, University of Arizona.

### **More Information**

For more information regarding travel arrangements and accommodations, please contact

Mr. Steve Branch  
Executive Director  
Society of Modeling & Simulation International  
P.O. Box 17900-7900  
San Diego, CA 92177  
sbranch@scs.org  
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For further technical information in regard to the workshop and ACIMS Open House (see below) activities please contact:

- Bernard Zeigler, Electrical & Computer Engr. Dept. Univ. of Arizona, [zeigler@ece.arizona.edu](mailto:zeigler@ece.arizona.edu), 520-621-2108.
- Hessam Sarjoughian, Computer Science & Engr. Dept., Arizona State Univ., [sarjoughian@asu.edu](mailto:sarjoughian@asu.edu), 480-965-3983

### **Arizona Center for Integrative Modeling and Simulation**

On Nov. 18, 2001, there will be the first organizational meeting of the new Arizona Center for Integrative Modeling and Simulation. For more information, please visit [www.acims.arizona.edu/EVENTS/ACIMSOpenHouse2001.html](http://www.acims.arizona.edu/EVENTS/ACIMSOpenHouse2001.html).