

Questions for ULN consideration (First Draft)

The following questions are a first crack at the kinds of questions that might need to be answered by modeling and simulation of ultra-large networks. For M&S methodology, they are domain questions; The workshop will address the general issue of the adequacy of existing models, simulations, and methodologies for representing, simulating, and evaluating ULNs. Some questions raised for M&S methodology appear at the end. First we have domain questions:

Network Questions

1. Can IP, ATM or combinations of current protocols scale to the one billion-node Internet? Current routing algorithms incorporate hop-by-hop routing mechanism that makes QoS difficult. What are the requisite properties of new algorithms? How can they be tested before fielding?

Streamlining the Internet-fiber connection, *Dixit, S.; Yinghua Ye*
IEEE Spectrum, Volume: 38 Issue: 4 , April 2001 Page(s): 52 –57

IP Switching for Scalable IP Services *Hassan M. ahmad, Ross Callon, Andrew G. Malis, John Moy*
Proceedings of the IEEE, VOL. 85, NO. 12, December 1997

An Approach to Routing Elastic Flows, *Sara Oueslati, Eliane Oubagha.*,
In ITC16 Volume 3b, June 1999.

A Comparative Study of Routing Algorithms for Elastic Flows in a MultiServe Network, *Sara Ouslati, Eliane Oubagha.* France Telecom R&D, March 2000.

2. The “last mile” is a major issue in performance and ability to bridge the digital divide. What kinds of models are needed to address this issue?

Bring home the Internet, *Dutta-Roy, A.*
IEEE Spectrum, Volume: 36 Issue: 3 , March 1999, Page(s): 32 –38

Managing the last mile [access network] *Bernstein, L.; Yuhas, C.M.*
IEEE Communications Magazine, Volume: 35 Issue: 10, Oct. 1997, Page(s): 72 –76

Paving the information superhighway's last mile *Lawton, G.*
Computer, Volume: 31 Issue: 4, April 1998, Page(s): 10 -12, 14

3. We seem headed toward a ubiquitous Internet characterized as a massively distributed network with powerful local servers forming the master-slave relations. Will this one-level hierarchy be capable of performance and other demands? Is more centralize/hierarchical control over the Internet required?

Master/slave computing on the Grid, *Shao, G.; Berman, F.; Wolski, R.*
Heterogeneous Computing Workshop, 2000. (HCW 2000) Proceedings. 9th, 2000, Page(s): 3 –16

Architectures, features, and implementation of high-speed transport protocols
La Porta, T.F.; Schwartz, M. IEEE Network , Volume: 5 Issue: 3 , May 1991, Page(s): 14 -22

4. Can/should efficient algorithms be designed/implemented that load-balance across geographical servers? Can/should header size be increased as allowed by future channel capacity increases?

A dynamic load balancing algorithm based on distributed database system
Yucai Feng; Dong Li; Hengshan Wu; Yi Zhang High Performance Computing in the Asia-Pacific Region,

2000. Proceedings. The Fourth International Conference/Exhibition on , Volume: 2 , 2000 Page(s): 949 - 952 vol.2

Issues of the state information for location and information policies in distributed load balancing algorithm *Gil-Haeng Lee* EUROMICRO Conference, 1999. Proceedings. 25th , Volume: 1 , 1999 ,Page(s): 67 -70 vol.1

Load balancing in a heterogeneous computing environment *Gopalt, S.; Vajapeyam, U.* System Sciences, 1998., Proceedings of the Thirty-First Hawaii International Conference on , Volume: 7 , 1998 , Page(s): 796 -804 vol.7

5.Can the current TCP/IP protocol suite solve the problem of pervasive networking (everything on the internet)? Do we need new architectures that specify new packet designs and the underlying infrastructure?

Building networks on the fly [cellular radio], *Pascoe, R.*
IEEE Spectrum, Volume: 38 Issue: 3 , March 2001 ,Page(s): 61 –65

Architectures, features, and implementation of high speed transport protocols, *La Porta, T.F.; Schwartz, M.* Global Telecommunications Conference, 1991. GLOBECOM '91.'Countdown to the New Millennium., Featuring a Mini-Theme on: Personal Communications Services , 1991 Page(s): 1717 -1721 vol.3

6.What technologies might push us into next generation of networks? Optical computing and networking, wireless, ...

7. Are there fundamental problems that must be solved to limit/manage information growth - an analogy is energy resources where there exists abundant amount of it, but not practical to harvest it.

Modeling and Simulation Questions Raised by Network Questions

M&S methodology per se must address questions of the form:

- Can feasible models be developed to address domain questions such as those above?
- Will there be enough scale and heterogeneity in the models to obtain realistic answers?
- Can/should complexity controlling approaches such as hierarchical construction be employed?
- Can/should families of multi-resolution models be developed -- can models address performance, reliability and security together? Are new models needed for security aspects? Can mutually consistent models be constructed?
- Is there a need for framework/strategy to view ULN from its most basic elements to its whole?
- Are there theories in other areas (e.g., chaos) that might shed light on how to structure/design ULN?

A reference that provides a general introduction to current network simulation without much depth is:
Simulating networks *Kaplan, G.*, IEEE Spectrum, Volume: 38 Issue: 1, Jan. 2001, Page(s): 74 -76