CTC CONTACT

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Contel TPC "Image Systems" Seminar Held

The first Technology Policy Committee Seminar for 1990 was held in Westlake Village, California, March 13 and 14. The topic of the seminar was "Image Systems." Forty Contel attendees were treated to two days of technical presentations and demonstrations on future trends, commercial applications, and military applications of image systems technologies.

The meeting began with a brief introduction by **Jack McDonald**, Corporate Executive Vice President, who described image technology as the "frontier of the nineties." According to McDonald, the development of image technology will help networks reach their full potential.

Charles Wohlstetter, Contel's Chairman of the Board, followed with a discussion of the growing importance of international markets and competition for Contel. In addition to intelligent teaming relationships, he stressed the role of technology in maintaining current markets and winning new ones.

The session on future trends began with a presentation by **Professor Patrick Purcell** of the MIT Media Lab. Professor Purcell gave an introduction to the Media Lab describing its philosophy and facilities before giving a quick tour through the laboratory's image-related projects. The laboratory is investigating the increasing overlap among computer science, communications, publishing and broadcasting. Project areas discussed include television of tomorrow, computer graphics and animation, the visible language workshop, movies of the future, spatial imaging and human interfaces.

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Telcos and Cable - What's the Connection?

by Mary Burritt, Manager
Contel Corporate Communications

Interview with Jim Graf,
VP Governmental Affairs for Contel

"Cable/telco cross-ownership" — what does it mean to Contel? We've heard that Congress is debating whether to re-regulate the cable industry or let telephone companies into cable. And we've heard that the cable companies want to protect their lucrative monopolies, while the telcos want to get into cable programming because the revenues would help make fiber-to-the-home economically feasible. But what exactly do telcos, including Contel, want to be allowed to do? Are we involved with cable now? What would Contel do if the cable/telco cross-ownership law were changed tomorrow?

In the following article, **Jim Graf**, Vice President - Governmental Affairs for Contel, explains the issue and its importance to the company.

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Optimization-Based Design, Performance Evaluation, and Management of Communication Networks

By John S. Baras,
Director Systems Research Center, University of Maryland

As communication networks increase in complexity, diversity and services provided, their modeling, design, performance evaluation and management become increasingly more complex. This necessitates the use of groups of experts in addressing these complex problems. More significantly, there is a demand for highly flexible interactive software systems to assist and amplify the abilities of the communication engineers in successfully addressing these tasks.

The technologies involved in addition to communication networks technology include advanced algorithms for network simulation, interactive graphics, object-oriented programming and object-oriented data bases, artificial intelligence and expert systems, advanced optimization algorithms for decision-making and resource allocation.

The ability of communication companies to correctly predict performance of a network at the design or configuration time is rapidly becoming a critical competitive factor; one that influences service pricing, network pricing and the overall success of products. Furthermore, the development and sale of advanced, user-friendly integrated network management tools, will deter-

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CONTEL Technology Center

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mine the winners in this extremely competitive international market. The Systems Research Center (SRC) of the University of Maryland at College Park is addressing several of these key technological problems in an integrated program of research and education. Contel, as one of the sustaining partners of the SRC, has been actively participating in this research effort through collaborative research projects.

Professor John S. Baras (director of the SRC), has been working with CTC researcher, **Doug Whitehead**, Contel ASC engineers **Mike Shakarji** and **Eric Hanlon**, and SRC researcher **Raju Prasannappa**, in developing new methodologies and techniques to address these key questions. The research has been motivated by several concrete problems of direct interest to Contel: the intelligent and integrated management of multimedia and heterogeneous networks, and the development of tools for sizing and estimating the performance of sophisticated new Contel products such as Starcom II.

Optimization-based design, has been one of the major successes of the SRC program, as it provides a systematic framework for control and communication engineers to study and understand the performance tradeoffs at the design stage. Until the current projects with Contel, this powerful methodology had been restricted to the design of control systems and "tuning" of continuous design parameters. In principle this design methodology utilizes advanced optimization methods, coupled with simulators of dynamical systems. Optimization is used to allow for the various performance measures and constraints to interact in a way that reflects the design choices, priorities and other constraints of the design engineer. The methodology is thus capable of handling multi-objective design problems; a reality in the current complex technological systems.

The role of the simulator is to provide estimates of sensitivities in the key design parameters which are being selected. Research at the SRC has demonstrated the power and utility of these ideas in such diverse areas such as the design of controllers for advanced aircraft, chemical plants, electronic circuit design, and robotic manipulators.

Professor Baras's group is attempting to extend, with the help of Contel engineers, these concepts and methodologies into discrete variables, as necessitated by the communication network problems mentioned above. We have met with considerable success in this effort.

One joint project, with CTC engineers, is to develop extensions of exist-

John S. Baras

is a Professor of Electrical Engineering, and has been the Director of the Systems Research Center (SRC), at the University of Maryland, College Park, Md., since its inception in 1985. The SRC was established as one of the National Science Foundation's original Engineering Research Centers, the research focus of the center is the design of real-time automation and information engineering systems. The SRC has five interrelated application thrust areas: intelligent servomechanisms, chemical process systems, manufacturing systems, communication and signal processing systems, and expert systems and parallel architectures.

The SRC has an active Industrial Affiliates Program involving 20 companies, including, **Contel**, Martin Marietta, Westinghouse, Texas Instruments, and Unisys.

Dr. Baras received a B.S. in Electrical Engineering from the National Technical University of Athens, Greece, and a M.S. and Ph.D. in Applied Mathematics from Harvard University. He has also held visiting research scholar positions with Stanford, MIT, Harvard, and the University of California, Berkeley. His main research interests include: stochastic systems, real-time parallel architectures for nonlinear signal processing, expert and symbolic systems for control and communication systems synthesis, distributed parameter systems, and discrete event systems and scheduling. He has recently obtained novel results in speech compression, neural networks and hybrid architecture. Work on the mathematical foundations of vision has also been initiated.

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Figure 1
Architecture for network design, performance evaluation and management workstation.

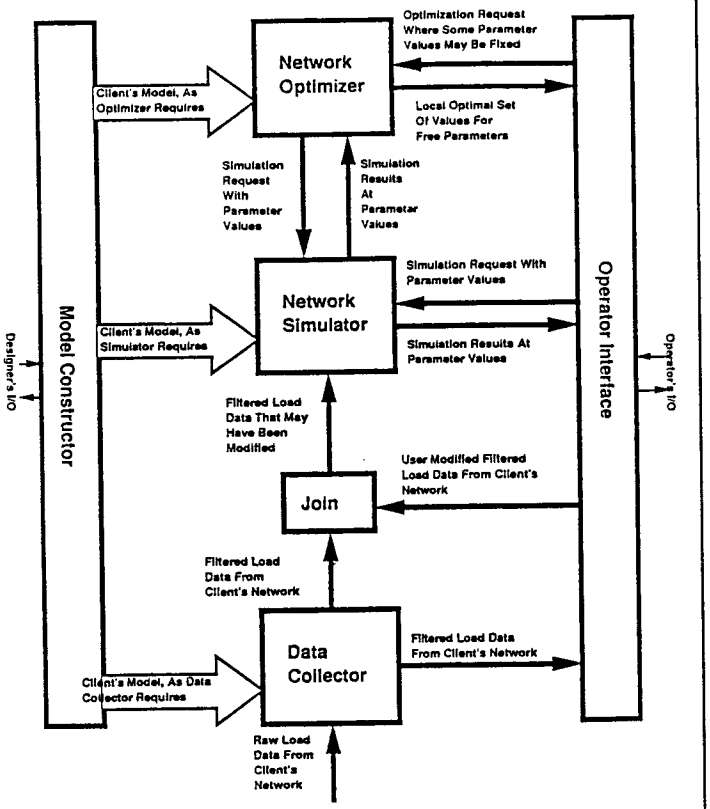
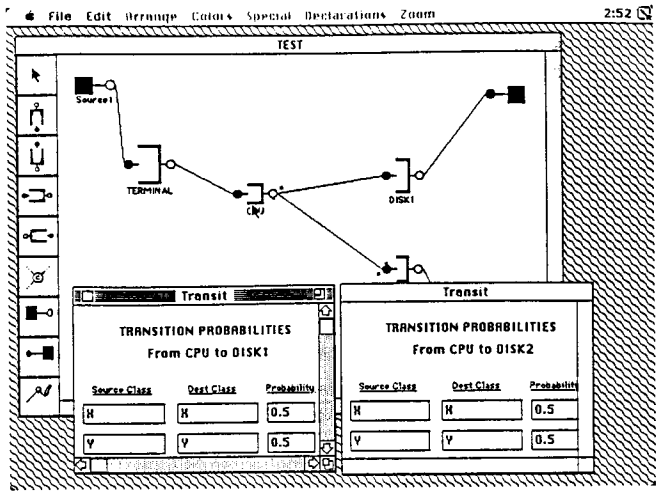


Figure 2
Typical screen from QGRAPH developed at the SRC



ing network management packages with a set of design, analysis, and modeling tools capable of handling sophisticated network products such as Starcom II. This project originated by a request from the marketing department of Contel ASC to develop an interactive decision-aid to accurately estimate throughput, time response and cost in VSAT networks. The researchers from SRC and CTC, have been interacting closely with ASC engineers Eric Hanlon and Mike Shakarji, in defining the problem and testing progress against realistic data.

In addition to the usual VSAT parameters, such as number of VSATs, frame length, basic slot size, packet size, number of ports etc. the decision-aid should be able to handle the sophisticated and flexible protocols provided by the Starcom II product. Flexible protocols are key to better throughput, time response and cost for a VSAT network. To achieve optimal network configuration with respect to throughput, time response and cost currently requires the collaboration of several experts. It is rather unrealistic to expect that such expertise will be readily available within the marketing and engineering personnel of a communications company. The key attractive idea was to produce a tool for Contel that will allow the average operator or marketing engineer to perform as an "expert."

The requirements for the package were briefly as follows:

- Reduce network design turnaround time
- Generate uniform, accurate, network performance solutions
- Assist with maintenance, by minimizing the overhead associated with re-balancing network channel loads
- Assist in configuration management, by providing a tool that will insure that the customer network is performing at optimal levels, and has adequate room for growth
- Be operator-oriented, by hiding needless complexities internally.

The development of such an interactive tool will enable the operator to:

- Balance an existing network to achieve optimal performance
- Anticipate network throughput; design a new network
- Evaluate the design of a network
- Understand the network options available
- Run benchmark tests of performance
- Run hypothetical stress tests
- Be easily trained on all of the above.

Based on these objectives, the architecture (depicted in figure 1 top left) has been developed, by the joint CTC/SRC team. The heart of the software system is the dual module of a network simulator and a network optimizer. When fully developed, this structure will allow the operator to interactively modify the network model and monitor the effects of selecting various network parameters and protocols on such performance measures as throughput, time response and cost. We now have enough understanding of the underlying methodologies to design "environments" for focused applications quite rapidly, utilizing various software modules.

There are various modules in this architecture, described below. The *data collector* collects and analyzes network data to assist in model and simulation validation and performance monitoring. The *model constructor* is an efficient network model generator equipped with an interactive graphics interface. The *network optimizer* will contain various powerful optimization routines for mixed variable optimization problems

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ation rule to permit broader financial or business relationships between telcos and cable companies.

Of all these possibilities, repeal of the cable/telco cross-ownership restriction is the best, because repeal would really establish the incentives for deploying fiber-to-the-home.

Q: What are the most common arguments against lifting the cross-ownership restriction?

A: That telcos would compete unfairly by offering low cable rates subsidized by other services, and that telcos would simply replace cable companies as a monopoly. Both fears are unfounded.

Both the FCC and the state commissions enforce very strict guidelines that would prevent phone companies from cross-subsidizing services. And it is not our intention to replace a cable company. We first have to learn the business, and even work with cable companies as their transporter. Perhaps, in some cases much further down the road, we would compete with them, using our own network.

Q: So what would happen if the cross-ownership restriction were lifted tomorrow?

A: That's a good question. Telephone companies are now beginning a gradual implementation of fiber optics into telephone networks across the country. Telephone companies would look at a community, and based on the local economic factors, decide when they can bring in fiber. And, once the telephone industry starts implementing fiber, the increase in demand for fiber will gradually decrease the expense, making it possible to bring fiber into more communities. We can expect that lifting the restrictions will accelerate this process significantly.

Q: What can employees do?

A: I'm glad you asked, because few issues can be affected more profoundly by employees than this one. Time is now of the essence! We're asking Contel employees to call or write their Senators **today** in support of S. 1068 and their Representatives in support of H. R. 2437. ▲

Federal Systems and the CTC Participate in AFCEA Conference

by Joe Fitzgerald

The Armed Forces Communications and Electronics Association (AFCEA) sponsored a two-day military Government Computing Conference and exhibition at Techworld, in Washington, DC, on January 17 and 18, 1990. In attendance were CTC Software Engineering Laboratory Reuse Project representatives, **Chris Braun,** and **Joe Fitzgerald,** and Federal Systems Sector's Process Enhancement Program (PEP) representatives **Judah Mogilensky, Tara Rumsey** and **Matt Granger.**

Both groups exhibited the latest technologies in software engineering and software reuse. Conference attendees were shown the approaches used by both Federal Systems and the CTC in solving complex problems within these areas. ▲

Participants demonstrate the latest software reuse and process enhancement in AFCEA booth for onlookers.

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including combinatorial optimization algorithms.

An object-oriented graphics environment should be used, which allows the user easy generation of models without the need for learning some cryptic command language. At the SRC we have developed the basic principles for such graphic interfaces, and have developed a prototype: the QGRAPH package. This is a graphic interface for the queueing network simulator QNAP2. QNAP2 was developed by INRIA and SIMULOG in France. With the use of icons and efficient menus, an operator can quickly configure a network model, and then automatically generate QNAP2 code. A typical screen from QGRAPH is shown in figure 2 .

In addition to the above three key modules the "workstation" will include a network design compiler which will translate the data structures into the most favorable ones for use by the network simulator, the data collector and the network optimizer.

The principles described here have been demonstrated by combining QGRAPH, CONSOLE and QNAP2 at the SRC, to illustrate the potential of optimization based methods in network trade off analysis. Following these principles and ideas, the team is developing an interactive environment for VSAT networks and in particular Starcom II, utilizing some public domain software and the design principles developed. More information on the latter is available from Doug Whitehead, CTC.

Future directions of this research will address the following problems:

- The development of efficient aggregation methods so that the network optimizer can avoid repeated calls to the network simulator
- Parallel algorithms for some of the fundamental network management and design functions.

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