Three speakers at the Second Workshop on Network Management and Control nostalgically remembered the INTEROP Conference at which SNMP was able to interface even to CD players and toasters. We agreed this was indeed a major step forward in standards, but wondered if anyone noticed whether the toast was burned, let alone, would want to eat it.

The assurance of the correct operation of practical systems under difficult environments emerged as the dominant theme of the workshop with growth, interoperability, performance and scalability as the primary sub-themes.

Perhaps this thrust is unsurprising since about half the 100 or so attendees were from industry, with a strong contingency of users. This mix of industry and academia resulted partly because the Workshop was jointly sponsored by Polytechnic University and its Center for Advanced Technology in Telecommunications, and the NYNEX corporation with support by the IEEE Communications Society and its Committee on Network Operations and Management. Indeed the Technical program co-chairs, Shivendra Panwar of Polytechnic and Walter Johnston of NYNEX, took as their assignment the coverage of real problems and opportunities in industry.

Never-the-less I take it as a real indication of progress in the field that the community is beginning to take for granted the availability of standards and even the ability to detect physical, link and network level faults and is now expecting diagnostics at higher levels as well as system wide solutions.

Joseph Kubat, Vice President for Development of New York Stock Exchange Floor Trading Systems at the Securities Industry Automation Cor-

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2 Workshop Chairman.
poration and Gerard Weis, President of Advantis, which provides computerized information services over communication networks, represent two organizations whose business is delivering on line real time services. Both recognized that life is what happens after you make other plans. They expressed their critical need for early detection of anomalies and faults. In the case of SIAC, their primary need was to rapidly take the faulty system off line for diagnosis and switch to a back up, with the briefest restoration time. "I don't want an engineer applying a datascope to an on-line system." For Advantis, the need is to be able to effectively solve customers' problems without involving them in excessive dialogue. The customer does not appreciate three different people calling him to re-solicit the details of his complaint. Both acknowledged the efficacy of protocols, standards and network management platforms but were more concerned with performance and fault monitoring and higher layer protocols, even applications; to solve these problems they had to write a great deal of software themselves.

The criticality of software was highlighted by Larry Bernstein, Chief Technical Officer of Operation Systems at AT&T Bell Laboratories. Many network management functions at the physical, link and even network layer are built into hardware. However, most systems and management functions are in software, difficult to build, test and diagnose. From the point of view of the producers of major telecommunications switching software a key to effective systems is "stable software" which can be installed, grown and used reliably. The key is simple code structures and reusable modules. However, to the extent that users might write their own software we are placing the burden on operations less able to effectively deal with these issues, a long way from Bernstein's ideal. Of course the problems will become even tougher. Vinton Cerf, President of the Internet Society, and Vice President for the Corporation for National Research Initiatives and Richard Mandelbaum, Director of the Center for Advanced Technology in Telecommunications at Polytechnic University highlighted the example of the Internet as a highly utilized system that is growing wildly in number of users. By December of 1993 there are 2,000,000 hosts on the system. If the present rate of growth were to continue, by the year 2010 the number of hosts would exceed the number of humans on the globe. There will be escalating problems in management, performance, faults, security, intrusion.

Anna Melamed, Senior Vice President at Technology Solutions Company does works with a number of financial houses. Her view is that users have to solve many problems they would rather have provided by vendors. They have to develop their own systems for the navigation and distribution of alarms, and their own automated knowledge bases for configuration control. A key problem she faces is the lack of scalability of solutions. As systems grow in size and complexity, vendor provided solutions lose their effectiveness, the customer becomes its own integrator.