

Preface

IBM's Centre for Advanced Studies (CAS) represents an innovative and successful model, launched in 1990, for the creation of new software technology and its rapid transfer into products. CAS brings together software researchers and developers from universities and industry, with major funding from government, under a model that extends and improves upon the concept of an applied research center. The Centre has its headquarters at the IBM Software Solutions Division's Toronto Laboratory in North York, Ontario, Canada. An earlier issue of the *Journal* (Volume 33, Number 3, 1994), presented the original CAS model, its use up to 1994, and the ongoing work and results of a number of projects sponsored by the Centre at the time.

This issue brings us up to date on the evolution of the model, the lessons learned since 1994, and a sample of the current projects. An introductory essay describes the concepts and operation of CAS, and their evolution since 1990. There are five papers drawn from current projects. We are indebted to S. G. Perelgut of the Centre for his considerable efforts in the formation, coordination, and development of this issue.

Perelgut et al. review the history of CAS and compare its initial principles, initiatives, and operation with those of the present. The first CAS director, J. Slonim, and the current director, G. Silberman, have provided leadership and direction for the Centre, while the interval between their tenures proved to be an opportunity to reflect on and reexamine the fundamental purpose of CAS. The goals of the Centre and its value to IBM have been validated. The basic principles have not changed, but CAS has evolved. Increased interdependence and trust between university and industry participants have fostered changes that enhance the value of the Centre to both groups. The authors conclude that CAS will continue to be an important component of the Toronto Laboratory.

An important area of research sponsored by CAS, in conjunction with the Canadian Institute for Telecom-

munications Research, is the technology needed for distributed multimedia applications. These applications have been made possible by workstations with audio and video capabilities, server machines with high-capacity storage devices, and broadband networks with guaranteed quality of service. Wong et al. discuss a major research project on broadband services, involving a multidisciplinary team from eight institutions across Canada. This team has created a prototype to demonstrate various components of their research, using multimedia news as the application. This prototype was demonstrated in 1996 at CASCON (the annual conference of CAS sponsors and participants) and illustrates the various facets of their multimedia architecture. The authors explain the project organization, describe the prototype, and present their research results so far.

Another area of research supported by the Centre is the management of distributed systems and distributed applications. Bauer et al. report on the services developed in support of their conceptual framework, MANDAS (Management of Distributed Applications and Systems). MANDAS was described by Bauer and others in the earlier CAS issue of the *Journal*. Here the authors discuss the lessons learned, both from the earlier work and during the development of the prototype management system. The prototype implements services for data management, configuration, monitoring, and control. One of the management applications included in the prototype and described in this paper is POET (Partial Order Event Tracer), the result of a CAS project on event visualization. The work described here exemplifies the interrelations among the Centre's projects: MANDAS itself evolved from an earlier CAS project called CORDS (Consortium for Research on Reliable Distributed Systems).

Networks of workstations are involved in another aspect of CAS research, that of parallel computing. Such networks can be used, rather than multiprocessors, for a large class of parallel applications that can tolerate the higher latency and lower bandwidth of networks. Although most parallel computing today is

based on a message-passing model, it is easier to develop parallel programs using a shared-memory model. Parsons, Brorsson, and Sevcik report on their model for predicting the performance of distributed virtual shared-memory applications. The model shows that software delays limit performance to a greater extent than hardware delays with current technology, and predicts that hardware delays will become increasingly significant as processor speeds increase.

The subject of the research done by Seaman and Basili is human effort. In this paper the authors report on an empirical study of organizations. During the study they investigated the amount of effort expended by software developers in communicating with one another and how that effort was affected by organizational factors. Qualitative methods were used to collect data that were then analyzed using quantitative methods. The goal of the study was the generation of new theory, and the results are presented as hypotheses. Two of the organizational factors that appear to increase effort are participants' lack of familiarity with one another's work and participants' locations that are physically distant.

Legacy software systems are valuable company assets, typically complex and difficult to change. Migrating such systems to modern platforms is a significant challenge. Research on an environment to support that migration is the subject of the paper by Finnigan et al. The authors describe this environment from the perspective of three different roles: the builder, the librarian, and the patron. The metaphor of a "software bookshelf" captures the intent of this project: to collect and present in a coherent form different kinds of relevant information about a legacy system for re-engineering and migration purposes. Requirements for the bookshelf, a generic Web-based architecture, and a prototype implementation are described in the paper.

The next issue of the *Journal* will be a special issue on applied research and prototypes for advanced applications on the Internet for such significant purposes as commerce, education, data mining, and security.

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Editor