The Computer Journal, 46(6), © British Computer Society 2003; all rights reserved

Capsule Reviews

The Capsule Reviews are intended to provide a short succinct review of each paper in the issue, in order to bring the content to a wider readership. This issue's Capsule Reviews were compiled by Fairouz Kamareddine. Professor Kamareddine is an Associate Editor of *The Computer Journal* and is based in the School of Mathematical and Computer Sciences at Heriot-Watt University, Edinburgh, UK.

A cost-based admission control algorithm for digital library Multimedia Systems Storing Heterogeneous Objects. I.-R. CHEN AND N. VERMA

A digital library usually contains mixed types of objects (e.g. video, audio, images and texts). These types of objects are different. For example, video and audio objects are continuous media, whereas image and text objects are discrete media. Continuous media are resource-demanding due to compression. However, discrete media, such as image and text objects, are more widely used and account for more than 70% of the data bytes accessed on the web. Hence, it makes no sense to give resource-demanding video/audio object requests a higher priority over image/text requests. And thus, in a mixed model of objects as above, it is important to effectively service mixed workload objects for multimedia servers for online digital library multimedia services. This is a difficult challenge: we need to guarantee performance of image/text requests and simultaneously satisfy the real-time requirement of video/audio requests.

This paper addresses this challenge and presents and analyses a cost-based admission control algorithm for handling mixed workloads in digital library multimedia systems that provide access services to mixed objects. The algorithm presented is priority-based, and addresses the question of how much resource should be allocated to service video/audio and image/text requests. Priorities are defined in terms of 'rewards' and 'penalties' associated with different objects. The analysis of the proposed algorithm shows that it significantly improves the reward value obtained without sacrificing other performance metrics such as response time.

Development of a conceptual query language: adopting the user-centered methodology. V. OWEI

The concept of end-user computing (EUC) is viewed as the development or use of information systems by the primary users of the systems' output. In the 1980s we witnessed the linking of PCs into networks and this allowed end-user access to corporate data. This led to the convergence of EUC and corporate computing and enhanced the end-user's productivity. This inevitably led corporate users to develop their own tools and applications with no help from information systems professionals. To satisfy the demands of these users, personal computing devices came equipped with database management systems and support for graphical user interface aimed at the end-user. These database management systems improve the efficiency and effectiveness of the users' applications. However, in order to facilitate the users' ability to manipulate the databases, a major aspect of a database management system is its ability to formulate a query for data retrieval. However, until recently, query languages were designed by database experts without consideration for usability. In fact, some very powerful query languages score low on usability. Moreover, existing query languages employed in end-user computing pre-date the web (which is most likely heavily used by the end-user).

This paper joins concerned database researchers who argue for the adoption of a user-centered approach in developing the tools stating that a user-centered approach will ensure the usability of the tools. As a matter of fact, an early study showed that user involvement and participation in the development of information systems lead to more acceptable and usable systems. This paper discusses (and evaluates) the use of a specific user-centered approach in the development of a conceptual query langauge (CQL). The paper reports that the users' participation in the conception of CQL led to an improvement in user performance with CQL and in regard to its perception.

Efficient embeddings into hypercube-like topologies. V. HEUN AND E. MAYR

Hypercubes are a very popular model for parallel computation because of their small number of interprocessor connections. Because of this popularity, hypercubes have been widely used for embedding various graph classes. The problem, however, is that the graphs usually embedded in hypercubes have regular structures (such as pyramids, rings, etc.) and that regular structures are not applicable if the communication structure of a parallel algorithm is irregular. Another important problem is deciding how good the embedding of one particular graph into another is. This is particularly important since the better it is, the more certain we are that the new graph indeed represents the intended initial graph.

This paper presents a general method for embedding irregularly structured graphs into their optimal hypercubes. The general technique presented for this is based on the so-called extended edge bisectors. An extended edge bisector is defined as an edge bisector where a given subset of the vertices is distributed more or less evenly among the two halves of the bisected graph. The paper gives various results related to the bounds of the dilation and node congestion for

the embedding. These bounds naturally depend on different parameters such as the size of the extended edge bisector, etc. Both the applicability of the technique and its potential for generalizations are discussed.

Speed-up of parallel processing of divisible loads on *k*-dimensional meshes and tori. K. LI

This paper deals with the problem of divisible loads and proposes a particular divisible load distribution algorithm while also analysing its parallel time and speed-up.

Typically, divisible loads can be arbitrarily divisible into small load fractions, which are assigned to parallel processors for processing. In doing so, many issues need to be well investigated (e.g. scheduling, distribution and processing) and as expected, such investigations may well be based on the different kinds of systems and networks used. For example, the network topology that determines the speed at which divisible loads are distributed over a network may well have a strong impact on performance.

An important already well-known result in the area includes the Amdahl law which states that if a fraction f of a computation is sequential and cannot be parallelized, the speed-up is bounded from above by $1/f$ no matter how many processors are used. However, the case $f = 0$ (i.e. when the load is divisible), leads to $1/f$ being infinite but this does not imply that unbounded speed can be achieved.

This paper departs from this observation and considers parallel processing of a divisible load on a multicomputer system with N processors connected by a static interconnection network. The paper studies the performance limit of such parallel processing of divisible loads on static interconnection networks. The author shows that indeed, the speed-up of parallel processing of a divisible load can be bounded from above by a quantity which is independent of the network size, and that, as the network size becomes large, the speed-up of processing divisibile loads can largely be improved. This improved speed-up for large networks is due to the increased network connectivity, which yields a faster speed for load distribution.