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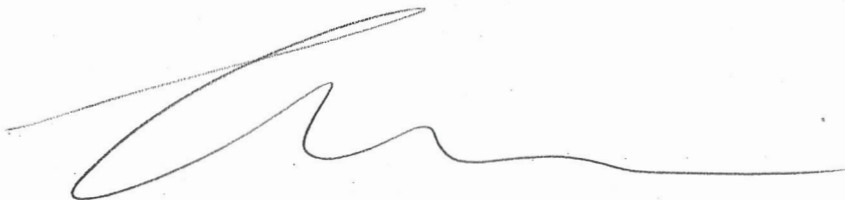
Pei Cao and Chengjie Liu, "Maintaining strong cache consistency in the World Wide Web", *IEEE Transactions on Computers*, vol. 47, no. 4, pp. 445-457, April 1998

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Yours sincerely



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Guest Editor's Introduction

Satish K. Tripathi, *Fellow, IEEE*



THIS special issue presents a selected set of six papers from the 17th IEEE International Conference of Distributed Computing Systems, held in Baltimore during May 1997. These papers were selected based on the reviews for the conference and have gone through major changes as a result of reviews done for the special issue. The papers have also been substantially enhanced to include new results, as well as to make them complete.

The impact of networking is a major component in the performance of distributed systems. The quality of networking support, in many cases, dictates the operational policies of the distributed systems. The networks themselves have a wide variety of characteristics and, in many cases, are heterogeneous. The heterogeneity results in varying performance and, in many cases, the route from a given server to a client may change during the connection. Such changes impact the performance in an adverse way.

In a distributed system, the latency and consistency of the data are important issues. The consistency could be at many different levels. It may be at the cache level or, in some cases, at the object level. Concurrency control and cache consistency are evaluated in some of the papers. The granularity at which the consistency problem is addressed plays a major role in the overall performance of the system. Latency is a prime concern in a distributed system. Distributed systems try to hide latency by introducing concepts of parallelism such as multithreading. The performance of such systems can be enhanced by making sure that work is available for certain threads while others may be stalled for remote requests. Papers selected for this special issue have system measurement components in them.

The paper, "Effect of Connection Rerouting on Application Performance," by Partho Mishra and Mani Srivastava evaluates the performance impact of connection rerouting due to mobility in connection oriented networks. They evaluate the performance effects seen by real-time and non-real-time applications due to virtual circuit (VC) rerouting. The rerouting must be done efficiently in order to minimize the disruptions in the application. The paper examines various rerouting mechanisms with respect to minimizing the impact of handoffs. It is shown that, for data traffic, simple but fast VC rerouting policies with selective acknowledgement are preferable. It turns out that such policies work well for real-time traffic as well.

The paper, "Measuring and Optimizing CORBA Latency and Scalability-Over High-Speed Networks," by Aniruddha S.

Gokhale and Douglas C. Schmidt analyzes the source of latency in conventional CORBA Object Request Broker (ORB) using a high-speed network testbed. Through a series of experiments, the major source of latency and scalability in ORB is quantified. The main sources of latency and scalability arise from intra-ORB function calls, data copying and conversions, inefficient buffering techniques, inefficient server demultiplexing, and lack of proper integration between OS and network features. Fine tuning the general purpose features to specialized cases and avoiding excessive duplications and conversations, in addition to many other simple improvements, can yield a substantial improvement in the performance. The paper also provides a wealth of measurement data.

The paper, "Per-Node Multithreading and Remote Latency," by Kritchalach Thitikamol and Pete Keleher presents experimental results for multithreading (MT) techniques used to hide remote memory and synchronization latencies in Distributed Shared Memory (DSM) Systems. The authors identify the limiting factors to multi-thread speed up. Through a series of measurements for various applications, they show that MT improves the performance of these applications, in some cases more than 20 percent. The implementation of MT, however, is not trivial and may not be transparent to application performance. The paper also presents an analysis of the cases where MT will help, and tips for application developments using MT.

Markos Zaharioudakis and Michael Carey's paper, "Hierarchical, Adaptive Cache Consistency in a Page Server OODBMS," presents experiences from implementing object-level callback locking in the context of the SHORE system. The object-level locking algorithms to enable fine-grained cache consistency were proposed by the authors in an earlier paper. In order to implement the algorithms in a real system, various extensions were made. A number of experiments were performed to quantify the performance gains.

The paper, "Maintaining Strong Cache Consistency in the World-Wide Web," by Chengjie Liu and Pei Cao evaluates various techniques for strong cache consistency in the Web. Currently, the Web caches provide weak consistency, where a stale copy may be returned to the user. In the strong consistency case, stale copy will not be returned to the user. In order to support strong consistency, a cost must be paid in terms of the performance of the system. The paper compares three techniques:

- 1) invalidation—the Web keeps track of all the client sites and sends the changes as they occur;
- 2) polling-every-time—the cache first contacts the server for validation and, then, returns the copy to the user; and

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