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Guest editorial

The Global Internet

Until a few years ago, most of the world knew only little or nothing about the Internet. It was a relatively small network used largely by the scientific community for sharing resources on computers and for interacting with research colleagues. Ever since, the Internet has grown dramatically and has revolutionized our society and our economy. It has changed the way people communicate with each other and the way business is conducted. The Internet has created a global environment that is drawing people from all over the world closer together—it has evolved into a Global Internet.

The global nature of the Internet poses significant technical challenges at all levels. These challenges have been at the focus of a very successful symposium series—the IEEE Global Internet Symposium, the flagship workshop of the IEEE's Internet Technical Committee. These symposia provide a forum for researchers and practitioners to present and discuss advances in Internet-related technologies with a special focus on experimental systems and on emerging Internet technologies. The 2002 Global Internet Symposium, chaired by Markus Hofmann and Robin Kravets and held during November 17–21 in Taipei, Taiwan in conjunction with IEEE Globecom 2002, was the seventh in a series of successful symposia. After an extensive reviewing process from a program committee made of well-respected networking experts, 28 outstanding papers were accepted out of a record 141 submissions. Despite the distant location, IEEE Global Internet 2002 had excellent attendance and participation in all of the sessions. The papers and presentations addressed a wide range of challenging topics and generated interesting discussions, which is the earmark of a successful workshop.

Looking back at the 2002 Global Internet Symposium, we would like to bring a taste of the depth and quality of the symposia to the networking community. Given Global Internet's focus on experimental and speculative work, papers are typically submitted in short form. From the group of 28 accepted papers, we have chosen five papers and asked the authors to provide an updated, full-length article incorporating latest findings and results. The papers were chosen both on merit and on their ability to capture important issues in Internet research. These articles touch on many of the most important topics in current Internet research, focusing on peer-to-peer communication, content distribution, distributed services, BGP routing and multicast address allocation.

While peer-to-peer networking has the potential to support communication between users in dynamic groups, the challenge lies in finding the peers with which to communicate. S. Banerjee, C. Kommareddy and B. Bhattacharjee tackle this problem in "Efficient Peer Location on the Internet" by providing a hierarchical solution that scales to large groups. Their peer-location scheme, called "Tiers", can be implemented at the application layer, supporting simple deployment without infrastructure support.

In "Coarse-Grain Replica Management Strategies for Dynamic Replication of Web Contents", N. Fujita, Y. Ishikawa, A. Iwata and R. Izmailov address the problem of scalable Web content distribution by partitioning objects into groups based on how frequently they are accessed. While

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per-object management provides the best load-balancing, per-group management achieves comparable results while reducing download time and server load. The challenge to such a group-based approach is to dynamically determine the granularity of the groups.

Similar to Web content, the placement of services impacts user satisfaction and network performance. In "Representing the Internet as a Succinct Forest", J. Gast and P. Barford present an effective scheme for the placement of resources at the autonomous system (AS) level by representing the Internet as a forest of ASs. Starting with the AS-level topology from BGP routing tables, they improve the topology using routes obtained from running traceroute. This enhancement identifies links that may be hidden in the routing tables and corrects the relationships between ASs in the network.

The success of the Internet is entwined in the effectiveness of the routers, which is impacted by the size of the routing tables. In "On Characterizing BGP Routing Table Growth", T. Bu, L. Gao and D. Towsley investigate the factors that contribute to routing table size. By evaluating real routing tables, they identify four factors: mutlihoming, load balancing, poor address aggregation and address fragmentation. While address fragmentation is by far the worst offender, both multihoming and load balancing introduce longer prefixes into the routing table.

The final paper investigates the problem of multicast address allocation, where unique addresses need to be assigned from a globally shared address space. D. Zappala, V. Lo and C. Gauthier-Dickey attack this problem in "The Multicast Address Allocation Problem: Theory and Practice" by applying techniques from processor allocation in hyper-cubes. While non-contiguous address masks can achieve more efficient allocation, the authors show that this improvement is not realized due to the fragmentation of the address space.

We hope the reader finds the selection of papers as interesting as we did. They address a diversity of problems that are highly relevant to building and maintaining a scalable, reliable global Internet.

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