Guest Editors' Introduction—Mobile Computing: When Mobility Meets Computation

Imrich Chlamtac, *Fellow*, *IEEE*, and Yi-Bing Lin, *Senior Member*, *IEEE*

One of the most challenging and interesting recent trends in the computer and telecommunications industries is the integration of mobile communications and computing. The resulting distributed network, referred to as a mobile computing system, is in more that one way fundamentally different from conventional wired computer networks.

Wireless connectivity enhances the functionality of computing equipment by freeing communication from the location constraints of the wireline infrastructure. By changing this basic characteristic, mobile computing systems operate on a set of assumptions made by traditional computing systems, requiring researchers and users to redefine their model of networked computing.

The successful use of mobile computing faces several challenges, among them:

- The communications link between the mobile host and the base station is unpredictable and varies greatly due to the constantly changing location of the mobile nodes and interference of nonnetwork entities such as buildings.
- The topology of the network changes rapidly due to the movement and resulting connections and disconnections of the mobile nodes.
- The available bandwidth is limited and variable, depending on location. Channel reuse must, therefore, be an integral part of the channel access system in order to provide service to as many potential subscribers as possible.
- The power available to mobile nodes is limited and, as a result, the poser required for transmitting and receiving must be minimized.

These constraints are unique to computer networks designed for mobile nodes and need to be addressed in order to operate mobile computer networks which can handle large numbers of subscribers, each moving at various speeds across cells while requiring different types of service from the network.

This environment creates new challenges to both the mobile telecommunications and computing fields. Consequently, research in the emerging mobile computing field needs to cover a wide area of topics and scenarios.

This special issue consists of eight papers and two brief correspondences which address various aspects of several of the above mentioned topics.

In Ajay V. Bakre and B.R. Badrinath's article, the Indirect TCP (I-TCP) approach is proposed and investigated for mobile computing. The approach isolates mobility and wireless related problems from the traditional computing platform by using mobility support routers as intermediaries, which also provide backward compatibility with fixed network protocols. Throughput comparison with regular (BSD) TCP shows that I-TCP performs significantly better in a wide range related to wireless losses and host mobility.

Michele Zorzi and Ramesh R. Rao's article studies error control and energy consumption for mobile communications. The study indicates that classic ARQ strategies lead to a considerable waste of energy. Based on the investigation, a probing scheme is being proposed for energy saving based on slowing down the transmission rate when the radio channel is impaired.

In a mobile computing environment, the performance of a remote file access protocol, such as NSF, may be poor due to low bandwidth and high error rates of the wireless links. Rohit Dube, Cynthia D. Rais, and Satish K. Tripathi's article proposes two mechanisms to improve NSF performance over wireless links: and aggressive NSF client and link-level retransmissions. Experiments show that compared with the traditional NSF approach, the new scheme improves response time by up to 62%, which brings the performance to within 5% of that obtained in the optimal case.

The paper by Qi Lu and M. Satyanarayanan deals with the issue of providing traditional support for improved data consistency under the resources constraints of mobile clients. The isolation-only transaction (IOT) mechanism of the Coda File System was used to collect the data on resource consumption. The data shows that the resource conservation techniques reduce the demands on CPU and I/O usage, disk space, and RVM space. That is, a severely resource-constrained mobile client can benefit from the improved consistency offered by the IOT mechanism.

Kyungshik Lim and Yann-Hang Lee propose an optimal partitioning scheme to minimize the communication cost in a highway mobile computing environment. In this environment, the radio cells are grouped into clusters. The scheme provides optimal partitioning so that the net cost of the intracluster and the intercluster communications is minimized. The scheme is a dynamic programming algorithm that takes into account the physical topology constraints of the linear arangement of physical cells in highway cellular systems.

- *I. Chlamtac is with the Erik Jonsson School of Engineering and Computer Science, University of Texas at Dallas, P.O. Box 830688, MS EC33, Richardson, TX 83068. E-mail: chlamtac@utdallas.edu.*
- *Y.-B. Lin is with the Department of Computer Science and Information, National Chiao Tung University. E-mail: liny@csie.nctu.edu.tw.*

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Xuefeng Dong and Tan-Hwang Lai propose a mobile call setup and path migration protocol in a cluster of DQDB. The protocol uses a link-state-like routing method for path selection and a source-routing-based scheme for path establishment. In addition, a labeling scheme is used to carry the path information needed by the source routing protocol in a single 53-octet DQDB slot, which results in efficient source routing.

Anthony Joseph, Joshua A. Tauber, and M. Frans Kaashoek describe a software toolkit called "Rover" developed to support the construction of both mobile-transparent and mobile-aware applications. Rover provides a set of programming and communication abstractions that enable the construction of mobile applications with good availability, concurrency, fault tolerance, consistency, and adaptation.

Sridhar Alagar and S. Venkatesan propose three causal ordering algorithms for distributed mobile systems. The first algorithm handles the resource constraints of the mobile hosts for a small-scale system and does not allow graceful host disconnection and connection. The second algorithm eliminates this disadvantage at the cost of inhibiting some messages. The third algorithm integrates the two algorithms to yield good performance for specific environment conditions.

In one of the two brief correspondence contributions, Kin K. Leung proposes the Primary-Writer Protocol which allows mobile user records in a personal communication network to be efficiently distributed in different databases. While this protocol may result in misrouted calls, the performance study indicates that misrouting probability is very small for expected customer behavior while the saving of the signaling traffic is significant.

The brief contribution by B. Gavish and Suresh Sridhar studies priority-oriented control policies for channel assignment in cellular networks. This investigation indicates that for a given set of conditions, the threshold priority policy can be significantly better than other policies.

We would like to express our sincere thanks to all the authors of the 64 submitted papers and the more than 150 reviewers who provided more than 250 reports for this special issue. Also, we would like to thank Jane Liu, the Editor-in-Chief, and Satish Tripathi, the Managing Editor, for their assistance in editing this special issue.

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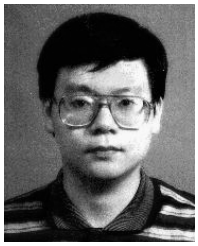
Imrich Chlamtac holds a PhD in computer science from the University of Minnesota (1979), and BSc and MSc degrees in mathematics awarded with Highest Distinction. He is a professor and holds the Distinguished Chair in Telecommunications at the University of Texas at Dallas. He is also a member of the Photonics Center at Boston University and president of BCN Inc., a company dealing with network design, integration, and technology transfer in wireless data and high speed communications jointly with Boston University.

Dr. Chlamtac's research interests include research and implementation aspects of mobile networks and wireless communication systems, optical networks, ATM, and multimedia communication. He has published close to 200 papers in refereed journals and conferences. He is the author of more than 30 invited papers, multiple book chapters, and encyclopedias. In 1981, he coauthored the first textbook on LANs entitled *Local Networks: Motivation, Technology, and Performance.*

Dr. Chamtac serves as the founding Editor-in-chief of the *ACM/URSI/Baltzer Wireless Networks (WINET)* and the *ACM/Baltzer Journal on Special Topics in Mobile Networks and Applications (MONET).* He served on the editorial boards of *IEEE Transactions on Communications, Computer Networks and ISDN systems, High Speed Networks Journal, Telecommunication Systems,* and the *Photonic Network Communications Journal.* He was a guest editor for the *Proceeding of the IEEE,* the *IEEE Journal on Selected Areas in Communications, IEEE Transactions on Computers,* and other journals. He served as the general chair of leading ACM and IEEE conferences and workshops, including ACM Sigcomm, ACM/IEEE Mobicom, and IEEE CCW, and acts as the ACM/IEEE Mobicom Steering Committee chair. Dr. Chlamtac is the chairman of ACM SigMobile, the special interest group on Mobile Computing and Networking.

Dr. Chlamtac is a fellow of the IEEE, a fellow of the ACM, winner of the Society of Computer Simulation award, and ACM best paper award. In the past, he has been an IEEE, Northern Telecom, and BNR distinguished lecturer, and a plenary and keynote speaker at leading conferences. He was a Fulbright Scholar and is an honorary member of the Board of Trustees at the Technical University of Budapest.



Yi-Bing Lin (S'80-M-'96-SM'96) received his BSEE degree from National Cheng Kung University in 1983 and his PhD degree in computer science from the University of Washington in 1990. From 1990 to 1995, he was with the Applied Research Area at Bell Communications Research (Bellcore), Morristown, New Jersey. In 1995, he was appointed a full professor in the Department of Computer Science and Information Engineering at National Chiao Tung University, Taiwan. In 1996, he was appointed deputy director of the Microelectronics and Information Research Center at National Chiao Tung University. His current research interests include design and analysis of personal communications services networks, mobile computing, distributed simulation, and performance modeling.

Dr. Lin is an associate editor of *ACM Transactions on Modeling and Computer Simulation*, a subject area editor of the *Journal of Parallel and Distributed Computing*, an associate editor of the *International Journal in Computer Simulation*, *IEEE Networks*, and *SIMULATION* magazine, an area eidtor of *ACM Mobile Computing and Communication Review*, a columnist for *ACM Simulation Digest*, and a member of the editorial boards of *International Journal of Communications* and *Computer Simulation Modeling and Analysis*. He was the program chair for the Eighth Workshop on Distributed and Parallel Simulation, the general chair for the Ninth Workshop on Distributed and Parallel Simulation, program chair for the Second International Mobile Computing Conference, and the publicity chair of ACM Sigmobile. Dr. Lin is guest editor for the *ACM/Baltzer WINET* special issue on personal communications as well as a guest editor for this special issue of *IEEE Transactions on Computers* on mobile computing. Dr. Lin is a senior member of the IEEE.