Report on MDM 2003:
The 4th International Conference on Mobile Data Management

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The 4th International Conference on Mobile Data Management (MDM 2003 for short) took place between the 21st and 24th of January 2003 at the Monash University Caulfield Campus in Melbourne, Australia. This conference was the third in the Mobile Data Management series, MDM 2001 having taken place in Hong Kong and MDM 2002 in Singapore. MDM 2004 focused on the challenges and opportunities for the management of data in mobile as well as in pervasive and wearable computing.

1 Conference Overview

Each of the three keynote talks highlighted a major issue in *sensor networks*, *ubiquitous commerce* and *next generation communication services*. These issues were discussed together in the panel of the conference that debated the question: "*Is Ubiquitous Computing the technology of the future or just hype?*"

A record number of 87 research papers were submitted to the conference from 23 countries and were subject to a rigorous review procedure. Twenty one full papers and fifteen short papers from both academia and industry were selected for publication in the proceedings published by Springer Verlag [1]. Three regular papers were nominated for the best paper award. Each of these papers addresses one of the important issues of energy in sensor networks, visualization on small displays and tracking of mobile devices.

Reflecting the wide spectrum of topics, the presentations of the selected papers were organized in nine sessions:

- *Storage Management*
- *Location Tracking*
- *Location Management*
- *Information Management*
- *Location Aware Services*
- *Query Processing*
- *Context Aware Services*
- *Context Aware Information Services*
- *Resource Discovery*

The research program was complemented by three tutorials and an industrial track. The industrial track consisted of six selected papers that provided an insight into the industrial experience in offering mobile data services. The details of the industrial track as well as keynote and panel presentations are available from the MDM 2003 Web site [2].

2 Paper Awards

The best paper award for the conference was given to Abhishek Ghose, Jens Grossklags, and John Chuang from the University of California at Berkeley, USA, for their paper entitled "*Resilient Data-Centric Storage in Wireless Ad-Hoc Sensor Networks*." This paper addresses power constraints in wireless sensor networks and proposes Resilient Data-Centric Storage (R-DCS) as a method to prolong the overall lifetime of the network by replicating data at strategic locations in the sensor network. Through analytical results and simulations, it is shown that this scheme leads to significant energy savings in reasonably large-sized networks

and scales well with increasing node-density and query rate. It is also shown that R-DCS realizes graceful performance degradation in the presence of clustered as well as isolated node failures, hence making the sensor network data robust.

The two runner-up papers were: (1) "*Document Visualization on Small Displays*" by Dik Lee, Hoi Ka Kit, and Jianliang Xu from Hong Kong University of Science and Technology, China, and (2) "*Adaptive Location Management in Mobile Environments*" by Ratul Majumdar, Krithi Ramamritham from Indian Institute of Technology, India and Ming Xiong from Lucent Bell Labs, USA.

The first runner-up paper addresses the important problem of screen size limitations on mobile devices, e.g., PDAs, and proposes a document segmentation and presentation scheme. The scheme automatically divides a web document into a number of logical segments based on the screen size and the structure and content of the document. Additional information such as overviews and summaries is also extracted to facilitate navigation. The scheme presents the segments and structural information of a web document to make full use of the screen for information finding.

The second runner-up paper on location tracking proposes an adaptive location management algorithm where a mobile device (MC) dynamically determines whether or not to update its location when it moves to a new location area. By predicting its duration within a location area, MC avoids unnecessary, costly location updates, relying on paging for tracking. Experimental results show that the proposed adaptive location management algorithm considerably reduces the location management cost. The efficiency of the proposed algorithm was also tested with SUMATRA (Stanford University Mobile Activity TRAces), which has been validated against real data on call and mobility traces.

The two runner-up papers received Certificates of Honorary Mention. Both Abhishek and Jens, authors of the best paper, attended the conference and both received the prize for the best paper - VIP tickets to Australian Tennis Open men's semifinals - and, perhaps, contributed to Andrea Agassi's victory in semifinals and eventually his Grand Slam success ☺

3 Conference Calendar/Events

Day 1:

The first day of the conference was devoted to tutorials –

- *Data Management in Mobile Computing* by Sanjay Kumar Madria of University of Missouri-Rolla
- *Mobile Services Development: Adaptation and Contextualisation* by Johan Hjelm of Senior Specialist, Ericsson Research
- *Moving Objects Databases* by Ouri Wolfson of University of Illinois at Chicago.

There was an excellent barbecue in the evening on the Monash University lawn which enabled people to mix and get to know each other.

Day 2:

The main conference opened with a keynote presentation entitled *"Data, data everywhere: Avoiding petabyte on your face"* given by Badri Nath from Rutgers University. Badri focused on the increasingly important topic of sensor networks and the way they will govern our interactions with our physical surroundings. Despite recent advances in sensor networks, Badri convincingly argued that key issues still remain because of the potentially vast amounts of data which will be generated by sensors in all consumer devices, cars, on the body for medical purposes, environmental sensor networks etc. This information overload will seriously challenge current database technology, requiring in-network aggregation and filtering of data. Badri also discussed the importance of approximate queries, estimation of results and consequently the need of dealing with errors in the data.

The keynote was followed by a session on Storage Management with papers on storing and accessing user context, and cache management for ad-hoc and multi-mobile cell networks.

The afternoon session was devoted to Location Tracking with papers on querying trajectories and spatiotemporal indexing of mobile objects, followed by a session of short papers on Location

Management for moving objects as well as for mobile agents. Buses took us to the conference Dinner at the Melbourne Zoo.

Day 3:

In spite of sumptuous wining and dining of the previous night, the first session on the third day on Information Management was well attended. Papers were presented on read-only transactions, constructing publish-subscribe trees and managing personal workflows. It was followed by a session on Location Aware Service covering support for smart spaces, finding time dependent shortest paths, searching for nearest neighbors and adaptive location management.

The second keynote was given by Anatole Gershman who is the Director of Research of the Accenture Technology Labs, USA. At the beginning of his lively talk, Anatole contrasted the rapid progress in the development of the infrastructure for ubiquitous and mobile computing to the largely ill define applications that will be built on this new infrastructure. Anatole then argued that the killer application of the future will be the *Ubiquitous Commerce* and it will result from three primary capabilities of ubiquitous devices: (1) to provide a service channel for remote service providers through an "always on" connection, (2) to inform these services about the local context of the user through an array of sensors, and (3) to enable these services to affect things in the user environment through actuators and local communication links. Anatole's message was made clear through a number of videos on example future commercial applications of ubiquitous computing. These included shopping advisers which can alert you to clothes which match your wardrobe and tastes, personal health services such as an intelligent medicine cabinet which can make sure you take the right medication and many other applications which will help in daily life.

The keynote was followed by a panel session chaired by Morris Sloman (Imperial College London, UK) with panelists Anatole Gershman (Accenture Technology Labs, USA), Ravi Jain (NTT DoCoMo USA Labs) and Bruno Von Niman (Ericsson, Sweden) discussing whether *Ubiquitous Computing is really the technology for the future or just hype.* The panel followed on Anatole Gershmann's keynote speech, in which he repeatedly raised the issue that in future commercial systems the customers may not be human, but agents making decisions to purchase on ones behalf. Ravi Jain first tried to indicate where Pervasive Computing was on the Gartner Hype Cycle, and argued that powering ubiquitous devices is one of the major unsolved problems. At the end, Ravi expressed the view that on the whole the social problems, such as invasion of privacy, will be harder to solve than the technical ones. Bruno Von Niman focused on user interaction issues and noted that new interaction paradigms are needed to deal with the convergence of telephony, data communication, mobility and the Internet - seamless interoperable services is a key requirement of pervasive systems. The final conclusion of the panel was that hype is due to the excitement of the challenges and prospects of ubiquitous computing and universal access.

The final session of the day consisted of short papers on Storage Management and Query Processing in parallel with a session of industrial presentations.

Day 4:

The morning of the last day of the conference was devoted to Context Aware Service with some short papers followed by papers on policy-based binding to information resources, constructing environment aware mobile applications, experiences with CC/PP and document visualization on small displays.

Ravi Jain who is a Vice President and Project Manager in the Autonomous Communications Lab, NTT DoCoMo USA Labs, San Jose, CA, gave the third keynote talk entitled *"4G Services, Architectures and Networks: Speculation and Challenges."* Ravi's talk was built around three questions: "Who needs 4G?", "What's wrong with 3G?", and "What is 4G anyway?" Basically, Ravi talked about the domination of mobile devices in future communication services, while distinguishing the current two contradictory trends toward integration of functionality, that is, of PDA/phones and of specialized embedded devices. He further

discussed the characteristics (challenges) likely to emerge for 4G wireless services which will increase data rates, more programmability, personalization and location-based services. Finally, Ravi offered the pragmatic observation that the service providers will have to cater for increased numbers of subscribers although they should expect lower revenues from each subscriber.

The final session on Resource Discovery included papers on autonomous services for smart mobile devices, global location services and a spatial discovery service.

4   Conclusions

MDM 2003 was very successful. Selected paper from MDM 2003 will be published in a special issue of IEEE Magazine "*DS-online*" [4] in the IEEE magazine-style form. This special issue on "*Mobile Data Management: achievements and opportunities*" will appear in October, November and December 2003 issues.

The next MDM, the 5th one in the series will take place at the University of California, Berkeley, 19-22 January 2004, see [3] for details.

5   Acknowledgments

MDM 2003 would not have been successful without the contributions of all the members of the organizing committee and the members of the technical program committee. MDM 2003 was co-sponsored by Monash University's School of Computer Science and Software Engineering, Centre for Distributed Systems and Software Engineering, and Faculty of Information Technology, in cooperation with ACM SIGMOD, ACM SIGMOBILE, and Australian Computer Society (ACS). It also received support from Sun Microsystems, Motorola Inc., CRC for Distributed Systems Technology Centre Pty Ltd, Accenture Technology Labs, NTT DoCoMo USA Labs and Microsoft Research.

References

[1] M. Chen, P. K. Chrysanthis, M. Sloman, and A Zaslavsky (Eds). *Mobile Data Management: 4th International Conference MDM2003 Proceedings, Melbourne, Australia*, Springer, LNCS 2574, 2003.

[2] MDM2003: www.csse.monash.edu.au/projects/ MobileComponents/mdm2003/

[3] MDM2004: www.cs.duke.edu/mdm2004/

[4] DS-Online: http://dsonline.computer.org/