Advanced issues of operating systems for reliable distributed sensor networks
Aim and scope

Hong, Jiman; Kuo, Tei-Wei; Heo, Junyoung

Published in:
International Journal of Distributed Sensor Networks

Published: 01/03/2012

Document Version:
Final Published version, also known as Publisher's PDF, Publisher's Final version or Version of Record

Published version (DOI):
10.1155/2012/394197

Publication details:
Hong, J., Kuo, T.-W., & Heo, J. (2012). Advanced issues of operating systems for reliable distributed sensor networks: Aim and scope. *International Journal of Distributed Sensor Networks*, *8*(3), Article 394197. https://doi.org/10.1155/2012/394197

Hindawi Publishing Corporation
International Journal of Distributed Sensor Networks
Volume 2012, Article ID 394197, 2 pages
doi:10.1155/2012/394197

Editorial

Advanced Issues of Operating Systems for Reliable Distributed Sensor Networks: Aim and Scope

Jiman Hong,[1] Tei-Wei Kuo,[2] and Junyoung Heo[3]

[1] *School of Computer Science and Engineering, Soongsil University, Seoul 156-743, Republic of Korea*
[2] *Department of Computer Science and Information Engineering, National Taiwan University, Taipei 10617, Taiwan*
[3] *Department of Computer Engineering, Hansung University, Seoul 136-792, Republic of Korea*

Correspondence should be addressed to Junyoung Heo, jyheo@hansung.ac.kr

Received 25 December 2011; Accepted 25 December 2011

The designs of high-reliability operating systems for distributed sensor networks must take into account a wide variety of constraints: fault tolerance, performance, code size, presence of real-time tasks, maintainability, and possibly scalability. This special issue provides a forum for the presentation of high-quality, original research covering all aspects of operating systems to provide high reliability for distributed sensor networks; algorithm, design, analysis, implementation, evaluation, and case studies. Solutions might be proposed at different levels of abstractions, making use of an assortment of tools and methodologies.

Flash memory is a widely used device to store data in distributed sensor nodes. Sensor nodes are highly resource constrained in terms of limited processing speed, runtime memory, persistent storage, communication bandwidth, and finite energy. Therefore, for wireless sensor networks supporting sense, store, merge, and send schemes, an energy-efficient and reliable database-based query optimization technique is highly required with consideration of sensor node constraints. Databases on hard disk drives perform data storage and retrieval using index structures, which are still not practiced for sensor devices. In the first paper, "*Performance evaluation of indices-based query optimization from flash-based data centric sensor devices in wireless sensor networks,*" authors evaluate different indices like B-tree, R-tree, and MR-tree by implementing them on log structured external NAND flash-memory-based advanced file systems for supporting energy-efficient data storage and query optimization from flash-based data centric sensor devices in wireless sensor networks. Experimental results show that PIYAS file system along with B-tree indexing deployed on flash memory MLC gives the significant performance in respect of high query throughput optimization and less resources consumption for wireless sensor devices.

The IEEE 802.15.4 standard provides GTS (Guaranteed Time Slot) mechanism for reliable transmission. GTS mechanism is suitable for transmitting time-sensitive data because it allocates time slots to a specific node. However, the GTS mechanism in the standard can be used only for one-hop communication. In the second paper, "*A novel GTS mechanism for reliable multihop transmission in the IEEE 802.15.4 network,*" authors propose and implement a multihop GTS mechanism for reliable transmission in multihop networks. Simulation results using NS-2 show that low delay and high delivery ratio can be achieved using the proposed mechanism.

Mobility in mobile sensor networks causes frequent route breaks and each routing scheme reacts differently during route breaks. It results in a performance degradation of the energy consumption to reestablish the route. Since routing schemes have various operational characteristics for rerouting, the impact of mobility on routing energy consumption shows significantly different results under varying network dynamics. Therefore, we should consider the mobility impact when analyzing the routing energy consumption in mobile sensor networks. However, most analysis of the routing energy consumption concentrates on the traffic condition and often neglects the mobility impact. The third paper, "*Impact of mobility on routing energy consumption in mobile sensor networks,*" analyzes the mobility impact on the routing energy consumption by deriving the expected energy consumption of reactive, proactive and flooding scheme as a function of both the packet arrival rate and topology change rate. Routing energy consumption for mobile sensor networks is analytically shown to have a strong relationship with sensor mobility and traffic conditions. Authors demonstrate the accuracy of our analysis through simulations. The analysis can be used to decide a routing scheme that will operate most energy-efficiently for a sensor application, taking into account the mobility as well as traffic condition.

In urban vehicular sensor networks, vehicles equipped with onboard sensors monitor some area and the result can be shared to neighbor vehicles to correct their own sensing data. However, due to the frequent change of vehicle topology compared to the wireless sensor network, it is required for a vehicle to discover neighboring vehicles. Therefore, efficient neighbor discovery algorithm should be designed for vehicular sensor networks. In the fourth paper, "*Tree-based neighbor discovery in urban vehicular sensor networks,*" authors propose two efficient tree-based neighbor discovery algorithms in vehicular sensor networks and analyze them. The expected value of neighbor discovery delay has different characteristics depending on neighbor discovery algorithms. An interesting observation of the result is M-binary tree-based neighbor discovery shows better performance than M-ary tree-based neighbor discovery in the parking lot scenario, which is a counterintuitive result.

The fifth paper, "*A fast and reliable hybrid data delivery protocol for large-scale heterogeneous sensor networks,*" proposes a hybrid data delivery method for the large-scale heterogeneous sensor networks, which is a fast and reliable delivery protocol for the aggregated data from the sinks to the GW. This paper develops a new multicriteria-ranking algorithm, which determines multiple forwarders for each hop by ranking neighbor nodes. To rank the nodes, they compute the fitness value using features for each node such as the received signal strength, nodal delay, and hop distance. This paper determines the time of sending among forwarders using the waiting time assignment algorithm. In the experimental section, the proposed method outperforms conventional data delivery protocols in terms of data delivery ratio and end-to-end delay.

Acknowledgments

The guest editors would like to acknowledge the contributions of the many experts who submitted their work, participated in the review process, and provided constructive and helpful comments to the authors to improve the technical content and presentation quality of the papers. They would also like to thank Professor Sundaraja Sitharama Iyengar, the Editor-in-Chief of the Hindawi International Journal of Distributed Sensor Networks, for their support and help in bringing this special issue to press.

Jiman Hong
Tei-Wei Kuo
Junyoung Heo