References for the Paper

WIPER:
The Integrated Wireless Phone Based
Emergency Response System[*]

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Abstract. We describe a prototype emergency response system. This dynamic data driven application system (DDDAS) uses wireless call data, including call volume, who calls whom, call duration, services in use, and cell phone location information. Since all cell phones (that are powered on) maintain contact with one or more local cell towers, location data about each phone is updated periodically and available throughout the cellular phone network. This permits the cell phones of a city to serve as an ad hoc mobile sensor net, measuring the movement and calling patterns of the population. Social network theory and statistical analysis on normal call activity and call locations establish a baseline. A detection and alert system monitors streaming summary cell phone call data. Abnormal call patterns or population movements trigger a simulation and prediction system. Hypotheses about the anomaly are generated by a rule-based system, each initiating an agent-based simulation. Automated dynamic validation of the simulations against incoming streaming data is used to test each hypothesis. A validated simulation is used to predict the evolution of the anomaly and made available to an emergency response decision support system.

References

[1]   NSF, "Workshop on Dynamic Data Driven Application Systems," www.cise.nsf.gov/dddas, 2000.
[2]   F. Darema, "Dynamic Data Driven Application Systems: A New Paradigm for Application Simulations and Measurements," presented at ICCS'04, Krakow, Poland, 2004.

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[3] C. C. Douglas, "DDDAS: Virtual Proceedings," http://www.dddas.org/virtual_proceedings.html, 2006.

[4] Y. Huang, Xiang, X., Madey, G., Cabaniss, S. E., "Agent-based Scientific Simulation," *IEEE Computing in Science & Engineering*, vol. Jan/Feb, 2005.

[5] B. Mochocki, Madey, G., "H-MAS: A Heterogeneous, Mobile, Ad-hoc Sensor-Network Agent Simulation Environment," in *Spring Simulation Multiconference: Agent-Directed Simulation*. San Diego, 2005.

[6] J. G. Michopoulos, Tsompanopoulou, P., Houstis, E. N., Joshi, A., "Agent-based Simulation of Data-Driven Fire Propagation Dynamics," in *International Conference on Computational Science*. Krakow, Poland: Springer, 2004.

[7] R. Chaturvedi, Filatyev, S. A., Gore, J. P., Mellema, A. A., "Integrating fire, Structure and Agent Models," in *International Conference on Computational Science*. Atlanta: Springer-Verlag, 2005.

[8] RePast, "An Agent Based Modelling Toolkit for Java," http://repast.sourceforge.net/, 2005.

[9] J. R. Vos, "Repast.NET: The Repast Framework Inplemented in the.NET Framework," in *14th Annual NAACSOS Conference*. Notre Dame, 2005.

[10] J. Lee and D. W. S. Wong, *Statistical analysis and modeling of geographic information with ArcView GIS*. Hoboken, N.J.: John Wiley & Sons, Inc., 2005.

[11] R. Najlis, North, M. J., "Repast Vector GIS Integration," in *14th Annual NAACSOS Conference*. Notre Dame, 2005.

[12] OpenMap, "Open Systems Mapping Technology," http://openmap.bbn.com/, 2005.

[13] P. Chew, Chrisochoides, N., Gopalsamy, S., Heber, G., Ingraffea, T., Luke, E., Neto, J., Pingali, K., Shih, A., Soni, B., Stodghill, P., Thompson, D., Vavsis, S., Wawrzynek, P., "Computational Science Simulations based on Web Services," in *International Conference on Computational Science*. Melbourne, Australia: Springer, 2003.

[14] I. Foster, "Service Oriented Science," *Science*, vol. 308, pp. 814-817, 2005.

[15] M. P. Papazoglou, Georgakopoulos, D., "Service Oriented Computing," *Communications of the ACM*, vol. 46, pp. 24-28, 2003.

[16] K. Pingali, Stodgill, P., "O'SOAP - A Web Services Framework for DDDAS Application," in *International Conference on Computational Science*. Krakow, Poland: Springer, 2004.

[17] X. Xiang, Madey, G., "A Semantic Web Services Enabled Web Portal Architecture," in *IEEE International Conference on Web Services (ICWS 2004)*. San Diego, 2004.

[18] G. Gross, "FCC head: Hurricane shows need for redundant telecom," in *InfoWorld, http://www.infoworld.com/article/05/09/22/HNkatrinafcc_1.html?source=NLC-TB2005-09-23, September 22*, 2005.

[19] R. Singel, "U.S. Cell-Phone Tracking Clipped," Wired News, http://www.wired.com/news/print/0,1294,69390,00.html, 2005.

[20] M. Richtel, "Live Tracking of Mobile Phones Propts Court Fights on Privacy," in *The New York Times*, Late - Final ed. New York, December 10, 2005, pp. 1.

[21] M. P. Armstrong, "Geographical Informational Technologies and Their Potentially Erosive Effects on Personal Privacy," *Studies in the Social Sciences*, vol. 27, pp. 19-28, 2002.

[22] M. P. Armstrong, Ruggles, A., "Geographical Information Technologies and Personal Privacy," *Cartographica*, vol. 40, pp. 63-73, 2005.