An Evaluation Framework For Disseminating Context Information With Gossiping*

Graham Williamson, Graeme Stevenson, Steve Neely, Simon Dobson, and Paddy Nixon

Systems Research Group
School of Computer Science & Informatics
UCD Dublin, Ireland
graham.williamson@ucd.ie

Abstract. As we gain access to increasing volumes of context data, we face the problem of moving this information from the sensors that produce it to the applications that consume it. Our approach to this problem uses *gossiping*, a probabilistic routing protocol, to disseminate context information throughout the environment. We present on-going work on evaluating the performance of different gossiping protocols for this purpose.

1 Introduction

Pervasive computing systems require a large amount of information to be available in order to support adaptive, context-aware, applications. We face the challenge of delivering information from contributing sensors to all points where it is required by applications. Furthermore, because of the nature of the information and the applications which use it, it must be delivered in a timely manner.

The characteristics of data and applications in these systems allow us to use a non-deterministic mechanism called *gossiping* [1] to underpin the communications. In order to explore the performance of gossiping for disseminating context information, after a brief overview of gossiping, we present ongoing work on an evaluation framework for gossiping protocols.

2 Gossiping in Pervasive Systems

Data from sensors in these systems, in addition to having a limited lifetime, are often frequently repeated. For example, the location of a person will be continuously updated; or the reading from a temperature sensor may be refreshed periodically. The implication of this is that we do *not* need to guarantee complete reliability of message delivery to all nodes: a missed message is likely to be refreshed. Relaxing the reliability constraints allows us to use *gossiping* to support

* This material is based on works supported by Science Foundation Ireland under Grant No. 04/RP1/I544.

communications. We propose that gossiping can provide the desirable properties of scalability, decentralisation, and robustness to change, that are required for pervasive computing systems.

Gossiping is decentralised and uses only simple, local interactions. This produces emergent behaviour which can result in a scalable, resilient network. However, because behaviour is emergent, it can be difficult to evaluate the effectiveness of a specific algorithm, or the effect that can be produced by small tweaks in the same algorithm.

3 The Evaluation Framework

The gossiping evaluation framework is a two-phase approach involving simulation in OMNet++ [2], a discrete event simulator that can model computer networks and communication protocols, and real-world experimentation on Planet Lab [3]. These methods compliment and provide validation against each other, allowing us to come to a consensus on the performance of a particular implementation.

We identify the set of parameters that can affect the performance of a gossiping implementation (such as the frequency of gossips, or the number of nodes gossiped to on each round of the algorithm). The impact of altering each parameter must be assessed in order to gauge performance. Thus, we also identify a set of measurements that we feel can be used to characterise and compare the performance of gossiping algorithms.

The key properties that we will assess initially using our evaluation framework inlcude the:

- **latency** of data propogation through networks of different topologies
- **coverage** of message dissemination with respect to time
- **robustness** of the data propogation under node and link failures
- **scalability** of the system with respect to the number of participating nodes

4 Conclusion

With this evaluation framework we will confirm the suitability of gossiping for the dissemination of context information and we will examine the effect that a number of parameters can have on the performance of gossip style algorithms. The results from these experiments will allow us to tune our implementation and gain an understanding of the issues and trade-offs involved when designing a gossiping protocol.

References

1. Eugster, P.T., Guerraoui, R., Kermarrec, A.M., Massoulie, L.: Epidemic information dissemination in distributed systems. Computer **37**(5) (2004) 60–67
2. Varga, A.: The OMNet++ discrete event simulation system. In: Proceedings of the European Simulation Multiconference (ESM'2001), Prague, Czech Republic (2001)
3. The PlanetLab Homepage. (http://www.planet-lab.org/) Last accessed: July, 2006.