Chapter 7.8
Decision Support–Related Resource Presence and Availability Awareness for DSS in Pervasive Computing Environments

Stephen Russell
George Washington University, USA

Guisseppi Forgionne
University of Maryland, Baltimore County, USA

Victoria Yoon
University of Maryland, Baltimore County, USA

ABSTRACT

Over the last 10 years, pervasive computing environments and mobile networks have become extremely popular. Despite the many end user benefits of pervasive computing, the intrinsic instability and context ambiguities of these environments pose impediments to data-oriented decision support systems. In pervasive computing environments where users, systems, and computing resources are distributed or mobile, the online or "available" state of decision support-related resources may be intermittent or delayed. Awareness or knowledge of these resources' online presence and availability can affect the decision making process. This article discusses issues related to data-driven decision support systems (DSS) in pervasive computing environments (PCE) and demonstrates that a decision maker's awareness of online status and availability can improve decision outcomes. A model for extending DSS resource presence and availability awareness to decision makers is presented and the impact of this knowledge on decision outcomes is evaluated using a management problem simulation.

INTRODUCTION

Technologies such as data mining and business analytics have seen explosive growth over the last 5 years in both research and industry. At the same time, advances in 3rd generation networks and communication have made the promise of pervasive computing environments a reality. With the convergence of pervasive computing environments and business analytics, now more than ever, greater volumes of data are available to decision support systems and subsequently decision-makers. One effect is the increase in data usage for both analysis and justification in decision making. In this context, the data is frequently assumed to be completely accurate and available. Moreover, it is also assumed that a decision support system would be available to assist with filtering, processing, analysis and other decision making tasks.

Despite the advances in technology, the fundamental characteristics of business decision making have not changed. Many business decision opportunities are time limited, and the phases of Simon's (1960) decision-making model still apply to business decision-makers. What has changed is industry's dependence on and related faith in data. There is an implicit belief that data is generally correct and that decision support systems can provide correct deterministic answers to decision problems. The data are used, not only as the basis to derive decision advice, but also to provide supporting justification. As evidence of this change, consider the North American business analytics market. Frost and Sullivan estimate that the enterprise analytics market generated $2.22B in revenue for 2005 and should increase at a Compound Annual Growth Rate (CAGR) of 10.8% from 2006 to 2012, reaching approximately $4.54B in 2012. Business intelligence (BI) is the largest single segment in this market, with $961.4M in revenues, which should reach $1.92B in 2012 at a CAGR of 10.4% (Frost & Sullivan, 2006).

The availability of decision support systems is integrally tied to industry's dependence on data. Gartner estimates that wireless voice and data will continue to displace wireline services, with voice and data services growing at a 6% CAGR - making wireless the fastest-growing segment of the communications services market (Flewelling, 2007). This demand for communication-enabling and data analysis products is clear evidence of businesses' interest and commitment to data-driven decision support and pervasive computing.

While data-oriented decision support and ubiquitous computing capabilities deliver many benefits to decision makers, in real world situations the availability of decision-related resources and support systems is not guaranteed. Moreover, data can be generally considered just one decision-related resource. Other types of computing resources, such as storage or processors must also be considered. What good is data without storage to hold it or a processor to process it? A great deal of research has been conducted to make systems highly available in pervasive computing environments (PCE) through redundant power and communications, data distribution and caching, and dynamic storage solutions. Much of the prior research has sought to address hardware limitations and ensure that computing resources are always available. In practice however, it is difficult, if not impossible, to ensure 100% availability. The telecommunications industry has a concept known as five nines (99.999% up time), which refers to system reliability of a copper-based telephone network. Five nines historically characterized the expected level of service availability that users could expect from a provider's communications network. With the advance of technologies such as digital subscriber lines (DSL), wireless, and packet-based voice communications, users are willing to accept increasingly lower standards of network quality (Lynch, 2002).

This acceptance of ambiguity in network and system availability conflicts with the increasing

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