A Report on Web-Based Decision Support Systems

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Introduction

The primary challenge of Decision Support Systems (DSS) is to improve the quality of decision-making and the performance of decision makers. To facilitate the successful implementation of DSS, three components must be integrated. These include a data component (database, transaction processing system or data warehouse); modeling software to manipulate the data (On-line Analytical Processing [OLAP], statistics-based or simulation-based); and a friendly user interface. While refinements continue in the development of each of these components, traditional DSS has suffered significantly from localized, non-standard user environments. Web-Based DSS has gone a long way towards solving many of these user-interactivity problems and has opened up DSS capabilities to a broader constituency.

Universal availability and user-friendliness has made the World Wide Web (WWW) the preferred platform for the delivery of Decision Support Systems. D.J. Power defines Web-Based DSS as “a computerized system that delivers decision support information or decision support tools to a manager or business analyst using a ‘thin-client’ Web browser like Netscape Navigator or Internet Explorer.”

Web Interface and Distributed Access

The most noticeable contribution of Web-Based DSS to the arena of decision support is the broadly accepted and familiar Web page interface. By definition, the contemporary Web environment is an extremely friendly Graphical User Interface (GUI). Facilitated on the client-side by Web browser software, it consists of a number of simple input/output elements and controls that are easily augmented with multimedia and charting capabilities. The Web interface is rooted on widely accepted standards and protocols and provides transparent access to remotely located resources such as data and application software tools.
In addition to the highly interactive and comfortable interface intrinsic to the Web, the Internet and Web technology offer a level of distributed access to DSS capabilities that are of great significance. Based on universal communications protocols and a globally distributed telecommunications infrastructure, the Web can offer immediate access to tools and data that are both distance and platform independent. While many traditional DSS implementations were restricted by proprietary, cumbersome and localized client/server systems, Web-Based DSS take advantage of simple, wide-spread Web technologies to distribute the decision making process among a diverse group of geographically dispersed end-users. This geographical freedom allows DSS to be implemented across the plant or across the planet. DSS can easily be integrated into existing Web domains such as corporate intranets, the global Internet and enterprise-wide extranets. The promise of Web-Based DSS is an information management tool that can support decision makers along the entire value chain, including suppliers, corporate managers and customers.

**Enabling Technologies**

A number of enabling technologies have evolved in just the last ten years that facilitate the distribution of DSS services over the Web. Among these is the Transmission Control Protocol/Internet Protocol (TCP/IP) suite of Internet standards. This suite of protocols, including Hypertext Transport Protocol (HTTP), which defines how Web documents are formatted, outlines the basic rules of all Internet communication. Modern programming languages such as Hypertext Markup Language (HTML), Extensible Markup Language (XML), Java, and Common Gateway Interface (CGI) are serving as DSS integrated tools used in the construction of DSS modeling applications and interfaces. These interfaces may serve simply as a front-end for client/server DSS applications - such as linking transaction processing systems (TPS) or data
warehouses to server-based modeling tools. Conversely, they may exist as stand-alone Web-based DSS applications in the form of Java applets that accept user-provided data and process financial or statistic models.

**Historical Perspective**

Although the conceptual ideas behind DSS may be traced as far back as the 1960s, only now is business beginning to realize the promise and potential of DSS. Mainframe-based DSS applications were the norm until the 1990s, when client/server DSS platforms and data warehouses were beginning to be integrated. Better communications infrastructures and the emergence of intranets pushed developments further throughout the later part of the 1990s. As mentioned previously, Web enabling technologies such as HTTP, HTML, and browser applications were developed in the early 1990s. While widespread use of the WWW was a reality by 1996, Web-Based DSS didn’t begin its growth surge until 1999. This exponential growth was quickly followed in 2000 by the introduction of DSS supporting Application Service Providers (ASPs) and Communications Driven DSS. The latter of these facilitating the decision support process among many decision makers without restrictions for time and location. At present, the notion, as stated by D.J. Power, of “Web as computer” is increasingly becoming a reality. Utilizing Java-enabled Web browser software, DSS can be distributed as a thin-client service without regard to platform or geography.

**DSS Capabilities Deliverable over Web**

Web-based DSS can deliver a multitude of decision support platforms. Among these are Data-Driven DSS, Model-Driven DSS, Optimization DSS, Communication-Driven DSS and Knowledge-Driven DSS. The two most common of these are Data-Driven and Model-Driven. Data-Driven DSS refer to a DSS system that allows for access to and manipulation of data.
Data-Driven DSS gives end-users the ability to “organize, retrieve and synthesize” mass quantities of pertinent data through the use of retrieval tools, OLAP technologies, and data mining. In other words, these methods allow the user to convert large volumes of relevant data from many disparate sources into useful information. This information can, in turn, be presented in relatively simple, easily understandable formats.

Model-Driven DSS, or Model-Oriented DSS, typically operates off of a limited database. Its primary function is to processes user-supplied data in a user-manipulated statistical, financial, optimization or simulation model. Model-Driven DSS gives users the opportunity to access and manipulate any number of complex models (i.e. statistical expression or a compilation of rules or parameters) that could be used to analyze a particular situation. With a Model-Driven DSS, the user either enters or retrieves appropriate data and then applies a user-defined model for analysis. These models may then provide results based on simulation or “what if” analysis.

**Web-Enabled DSS for Customer and Casual Users**

Stakeholders making use of Web-Based DSS include upper and mid-level management, suppliers and customers. One of the most significant advancements of Web-Based DSS, in contrast to traditional DSS implementations, is the ability of ordinary customers and “casual users” to make use of information generated by these tools. This has led to a new classification of decision support tools known as Customer Decision-Support Systems (CDSS). Using an increasing number of Web-enabled CDSS systems, customers are empowered with information to aid in the selection of products and services. Some examples of successful CDSS systems include the multitude of financial calculators offered by brokerage and investment firms that are accessible via the Web. Another example, this one coming from the manufacturing arena, includes the General Electric Plastics (GEP) DSS. This Web-Based DSS allows engineers,
looking to purchase polymer materials, the ability to run simulation analysis from their office computers. Using data provided by GEP, any customer could evaluate the behavior of these materials by manipulating a number of thermal variables.

**Benefits and Concerns**

According to John J. Orefice, a top executive with Siemens Health Services, some of the most significant weaknesses of traditional DSS systems include the high cost involved in implementation and maintenance, and a dependence “on expensive IS resources for widespread use.” Web-Based DSS goes a long way in eliminating these concerns. Global access to Internet resources, the well-known and user-friendly browser interface, and the relatively low costs involved in implementation make Web-Based DSS a step closer to the ideal of paperless e-business management. The quick-and-easy learning curve associated with the WWW interface also means that the costs and time associated with user training can be kept significantly low. Reductions in both cost and IT support loads can be realized using Web-Based DSS. This fact is illustrated in a quote from a Bell Canada spokesman in an interview conducted by D.J. Power: “The Web dramatically alters the cost dynamics of delivering applications to users… All users need are a Web browser and a laptop computer. There’s almost no training required, very low client costs and zero infrastructure costs. The intranet acts as a free wide area network.”

As DSS systems increasingly become available via the word wide web, special measures must be taken by the employer of the system to maintain its security. As noted, some of the primary benefits of Web-Based DSS are its widespread availability, the familiarity and ease of use of its WWW user interface, and the minimal equipment required by the user to access the system. These benefits allow virtually anyone with a computer, web access, and an appropriate browser to gain access to decision support tools and information.
This ease of access creates a situation that can enable the dissemination of sensitive information; sensitive information that can negatively impact a business if made available to the wrong people. In this environment, it is of paramount concern that employers of a Web-Based DSS system maintain strong security in the face of external and internal threats.

Security may be maintained through the use of several methods. For example, web servers can provide security through user authentication and class restriction. Also, encrypted transmission of the data can provide further security through the use of Secure Sockets Layer (SSL) and Secure Electronics Transactions (SET).

When preparing to employ a web-based DSS, programs should be critiqued in regards to their security measures. According to Matt Calkins, product manager of DSS Web, "There are three main security items to keep in mind when selecting a Web tool that permits access to crucial data: First, it should be compatible with your existing firewall and encryption layers; second, it should use caching wisely and in a security-conscious manner; and finally, it should manage passwords for optimal safety and convenience."

**Summary and Conclusions**

The Internet and World Wide Web have been a boon to the distribution of decision support tools to a number of diverse end-users. The usability and global access associated with Web-Based DSS has gone a long way in helping business realize the dream of placing information at the finger-tips of those that need it, regardless of location or level of computer skills. This report has sought to outline the usability of the Web and the unique enabling technologies that power the Internet. Examples and descriptions of Web-enabled DSS services such as Data, Model, and Customer Driven DSS were discussed as well. Finally, the benefits and concerns of Web-Based DSS were examined. While security is still a notable concern, the
benefits of web-delivered DSS tools, including reduced cost, universally accepted communications infrastructures and ease of use, have established Web-Based DSS as the preferred platform for the delivery of information to facilitate effective decision-making.
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