Web Engineering: A New Discipline for Development of Web-Based Systems

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Abstract. In most cases, development of Web-based systems has been ad hoc, lacking systematic approach, and quality control and assurance procedures. Hence, there is now legitimate and growing concern about the manner in which Web-based systems are developed and their quality and integrity. Web Engineering, an emerging new discipline, advocates a process and a systematic approach to development of high quality Web-based systems. It *promotes the* establishment and use of sound scientific, engineering and management principles, and disciplined and systematic approaches to development, deployment and maintenance of Web-based systems. This paper gives an introductory overview on Web Engineering. It presents the principles and roles of Web Engineering, assesses the similarities and differences between development of traditional software and Web-based systems, and identifies key Web engineering activities. It also highlights the prospects of Web engineering and the areas that need further study.

Keywords: Web engineering, Web-based systems development, Web crisis, Web design, Web development, Web lifecycle

1   Introduction

The growth of the Internet, Intranets, Extranets, and the World Wide Web has had significant impact on business, commerce, industry, banking and finance, education, government and entertainment sectors, and our personal and working lives. Many legacy information and database systems are being migrated to Internet and Web environments. Electronic commerce through the Internet is rapidly growing, cutting across national boundaries. A wide range of new, complex distributed applications is emerging in the Web environment because of the popularity and ubiquity of the Web itself and the nature of its features: it provides an information representation that supports interlinking of all kinds of content, easy access for end-users, and easy content creation using widely available tools.

   In most cases, however, the development approach used for Web-based systems has been ad hoc, and many Web-based systems have been kept running through a continual stream of patches. Overall, Web-based systems development has lacked rigour, systematic approach, and quality control and assurance. As the complexity

and sophistication of Web-based applications grow, there is now legitimate and growing concern about the manner in which they are created and their quality and integrity.

In the absence of disciplined process for developing Web-based systems, we may face serious problems in successful development, deployment, operation and 'maintenance' of these systems. Poorly developed Web-based applications that are escalating now have a high probability of failure. Worse, as Web-based systems grow more complex, a failure in one system or function can and will propagate broad-based problems across many systems and/or functions. When this happens, confidence in the Web may be shaken irreparably, which may cause a Web crisis [1]. The potential Web crisis could be more serious and widespread than the software crisis, which the software developers have been facing [2].

In order to avoid a possible Web crisis and achieve greater success in development and applications of complex Web-based systems, there is a pressing need for disciplined approaches and new methods and tools for development, deployment and evaluation of Web-based systems. Such approaches and techniques must take into account: 1) the unique features of the Web, 2) operational environments of Web-based systems, 3) scenarios and multiplicity of user profiles, and 4) diverse type (and skills and knowledge) of the people involved in building Web-based systems. These pose additional challenges to Web-based application development.

Motivated by the concern among some Web-based systems developers (including the authors) about the chaotic way in which most Web-based systems are developed, a few new initiatives were undertaken to address the problems of Web-based systems development and bring the potential chaos under control, and to facilitate successful Web-based systems development [3-7].   These initiatives have promoted Web engineering as a discipline.

Web Engineering is concerned with establishment and use of sound scientific, engineering and management principles and disciplined and systematic approaches to the successful development, deployment and maintenance of high quality Web-based systems and applications.

It incorporates some of the well-known and successful traditional software 'engineering' principles and practices, adopting them to more open and flexible nature of the Web, and the type of Web application. It also takes into consideration other elements that are specific to the Web environment.

We organised the first workshop on Web Engineering in 1998 [3] in conjunction the World Wide Web Conference (WWW7) in Brisbane, Australia, to address the state of Web-based systems development and to promote Web engineering approaches. Building on the success and outcome of the first workshop [3], two more workshops on Web engineering were organised in 1999 [5, 6] to review practices in Web-based systems development and the progress in this area, and to pave directions for further study. The *IEEE Software* magazine [4] presented an interesting roundtable discussion on "Can Internet-Based Applications be Engineered?" Also a few Web engineering related articles [7-14] were published. These invoked a growing interest in Web Engineering - a new discipline and approach for successful Web-based systems development.

This paper gives an introductory overview on Web Engineering in order to promote this new discipline among Web-based systems developers, researchers, academics and students.