An Examination of Alternative Methods for Building Websites and Their Comparison

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Abstract. Virtually every facet of people's professional and personal lives has been touched by the expansion of the Internet and the World Wide Web. Unfortunately, security is often overlooked throughout the development cycle of online apps in today's fast-paced environment. The majority of online apps are also susceptible to assaults since they are created employing less skilled developers and conventional software development processes. Web applications vary from conventional development in many ways, and this article compares and contrasts those ways while also discussing the unique characteristics of web development.

Keywords: Development of secure online applications, web engineering, and approaches for web development

1. Introduction

Business, commerce, industry, banking and finance, education, government, and the entertainment industries, as well as our personal and professional lives, have all been profoundly affected by the expansion of the Internet and the World Wide Web. The Internet and web-based settings have become the new homes for many private database and legacy systems.

The connected world's application security is in a sorry condition due to the competition-era mad rush to get apps onto websites, clouds, and mobile devices. Companies of all sizes hastily released new apps to the public without giving any consideration to how stable or long-lasting they would be [1]. At the application development level, security is usually not given any consideration. Assuming the program is functional, the logic runs, firewalls and other external perimeters might provide some protection, but not enough. We still haven't solved the fundamental issue with online applications—secure web development and security testing—so security breaches keep happening. Patches have been an ongoing process for keeping web-based applications operational [2]. There is a considerable risk of failure for the many poorly constructed web-based apps that are already proliferating.

In addition, software companies are relentlessly pursuing web-based system development without significantly altering their development teams or methodology. Development on the web is neither rigorous, methodical, or assured of high quality. Such projects are often delegated or outsourced to small teams of young, highly competent engineers by software companies [3]. One way to characterize the process of creating software is via the Software Development Life Cycle (SDLC), which may be either descriptive or prescriptive [4]. Furthermore, web-based development is the methodical procedure that lays out the steps to take while creating a website or online application. Put simply, web engineering is the use of methodical,

methods for the systematic and measurable creation, execution, and upkeep of web-based applications [2, 5]. Undoubtedly, web development falls under the umbrella of software development. However, it remains distinct from conventional software development and need a distinct paradigm for its development process. We risk encountering significant challenges in the development, implementation, operation, and maintenance of Web-based systems if we do not adhere to a disciplined approach [2]. In 1998, researchers at Australia's University of Western Sydney saw the need for a more methodical approach to online development and founded the new field of online engineering [2, 6, 7]. A whopping 86% of the websites

that WhiteHat Security examined had a critical vulnerability, according to its research on website security [9]. As the number of vulnerabilities grows, so does the frequency with which attackers take advantage of them [8]. The results show that online security is still a problem and that current methods for developing safe web applications are insecure. A new web process model is needed to address this.

In addition to comparing the current models, this study also addresses the security issues with them. The paper is structured as follows:The evolution and distinctive characteristics of web apps are detailed in Section II. The third section contrasts the various online process models. The article is concluded and future work is described in the last part.

2. Web Applications' Features

Web application is a client/server application that uses a web browser as its client program, and performs an interactive service by connecting with different servers over the Internet. It presents dynamically tailored content based on request parameters, tracked user behaviours, and security considerations [10]. Some special features of web Applications are given in brief below:

a) Complex, Dynamic and Distributed Architecture: Most web applications are characterized by a dynamic architecture which might change and evolve during run-

time. Therefore, a specification method for Web applications should support modelling logical distributed elements, their bindings to physical elements, and algorithms for detecting system architecture during run-time [11].

b) World wide access for heterogeneously skilled users:Web applications can be universally accessed by usersof different skill levels.

c) Variety of Information resources: Web applications must be capable of handling complex, hierarchical data as well as structured or unstructured data which may be stored in different systems and distributed over multiple sites.

d) Security and Privacy Support: Though web applications can be accessed universally but still they should deal with private data using privacy and security management [2]. Security means dealing with Confidentiality, Authentication, Access control, Integrity, and Non- Repudiation.

e) Real Time information: Web applications should provide real time or nearly real time information. Moreover, some Web applications should run continuously, forcing the developer to be able to add new constructs and functionality without disturbing the working version.

f) Dynamic Support: Dynamic behaviour of applications allow to access data, manipulate it, ask the server for code, verify different types of constraints, and produce results for the users or updates for the server.

g) Scalable: Web application must support unlimited users.

Though Web application development involves some programming and development, and adopts some of the principles of the software development, but it is also different from traditional software development. Most Web-based systems need to be developed within a short time, making it difficult to apply the same level of formal planning and testing as used in software development. Moreover, It has additional requirements for Navigational, Multimedia, Usability, Security etc. Also, the web platform is a complex ecosystem composed of large number of components and technologies. There is rareperson who is master of all these, so the web development is like "Jack of all trades".

3. Comparison of different Webdevelopment Models

As the web engineering has become an established branch of software engineering, since then, there has been substantial activity within web engineering research community and multitude of web approaches are proposed. The evolution of web engineering relatedresearch is analyzed in various comparative studies

and surveys [12]. There are large number of proposed models for web like HDM, EORM, RMM, MacWeb, OOHDM (Object Oriented Hypermedia Design Method), SOHDM (Scenario-based Hypermedia Design Method), UWE (Unified Modelling Language based Web Engineering), WebML (Web Modelling Language), UWA (Ubiquitous Web Application), W2000, WSDM (web site Design Method), WUML (Web Unified Modelling Language), OOH (object Oriented Hypermedia), WebSA (Web Software Architecture), WebRE (Web Requirements Engineering Meta model), FLiP (FuseBox Life Cycle Process), FDD (Feature Driven Development), FDMSWAP (Formal Development Methodology for secure Applications), WISDM (Web Information system Development Methodology), and WES (Web engineering Security). This leads to obvious questions that why there are so many approaches? Is there no standard? Why still large no. of insecure web applications is developed? Why they do not get completed on time? Actually, each approach focuses on some specific aspects and proposes suitable models, techniques and vocabularies. Althoughsome of these approaches, such as HDM, EORM, RMM, Mac Web are based on E-R Modelling and are irrelevant according to underlying concepts and principles of Web development community, So these are not used. Table I shows the specific purpose of these proposed models. OOHDM has had valuable contribution to web engineering research and many of its ideas have become accepted [17].

Table I: Proposed Web development models

Existing Models	Focus	Phases
OOHDM [13]	Design of hypermedia	Requirement, Conceptual Design, Navigational Design, Abstract Interface Design, Implementation
SOHDM [14]	Integrating enterprise databaseswith distributed hypermedia systems	domain analysis, object modelling; view design; navigation design;implementation design; and construction
UWE [15]	Visual Modelling with Systematic Design throughout SDLC	SDLC
Web ML [16]	Design and Implementation of Data intensive web applications	Design and Implementation
UWA [18]	User centred conceptual application	Requirement Analysis, specification and Design
W2000 [19]	Notation for modelling complex applications	Navigational & Functional Requirements Modelling, Hypermedia Design, Service Design
WSDM [22]	User centred Design	User Modelling, conceptual Design, Implementation Design and Implementation
WUML[20]	Methodological Support forubiquitous web application development	N/A
WebSA [12]	Architectural and Transformational Models to specify web site	Design Phase

As clear from the table II, most of the existing web methodologies are focused on the hypermedia, design, look and feel of the web applications. Few methodologies like UWE, WebML, UWA are relying on UML modelling techniques and they define the actors (users) and use cases (requirements). Of all their requirements, their functional requirements on the system are the most revealing. And the current trend is moving focus towards of the security. Methodologies like XP, SCRUM and FDD are Agilesoftware

WebRE[12]	Models Web systems behaviours Requirements	Node, Page, Content Modelling
FLiP/Fusebox [21]	Encourage inexpensive Design changes	Personas & Goals, wireframe, Front end development, applicationarchitecting, fuse coding, Unit testing, Application Integration, Deployment
XP [3]	Software quality, iterative Short development cycles	Iterative planning, Designing, coding, testing
SCRUM [23]	Functional Requirements fulfilment on time	Planning & High Level Design, Iterative develop, Wrap, Review, Adjust and Release
FDD[22]	Functional Requirements	Develop overall model, Develop featured list, iterative plan, design, build by feature
FDMSWAP[24]	Security & light weight user of formal methods	Requirements, Threat Modelling, Abstract Formal models of security properties, system development, verification of secure models of the system, model checking and Validation of secure models of the system
WISDM[25]	modification of multiview aspects locally and uniquely	Organizational & informational analysis, Work & Technical Design, Implementation
WES[8]	security	Application Security Requirements and Risk Assessment, Security Deign/Coding, Controlled Environment Implementation, Testing, Implementation in Production

development methodologies but they are commonly used in organizations for the web development,so they are also considered. Moreover Agile methodologies are different from traditional development methodologies like waterfall, Iterative etc. because they involve the user involvement. Agile methodologies are similar but still they have few differences mentioned in table II.

Table II: Comparing Agile Methodologies

Agile Methodologies	Documentation Degree	End User involvement	Team Meetings	Size of Project	Iteration time period
XP [3]	Low	Active Involvement	Informal & daily	Small	1 to 6 weeks
SCRUM [23]	Low	Only Product Owners involved	Informal & daily	Any	2 to 4 weeks
FDD [22]	High	Through reports	Formal & document shared	Any	2 days to 2 weeks

None of these methodologies are considering Security as the functional requirement and end users do not have the knowledge about lack of security and their consequences. As a result of which web applications are still developed with vulnerabilities. A development method for web applications should combine traditional techniques and principles of software, security engineering with unique/special aspects of web. FDMSWAP, WES considers security as main requirement during development life cycle, but these methodologies are yet to be implemented in the real world.

IV. Conclusion and Future Work

In this paper, we have first described the special features of web application that make them different from traditional development. To better understand their differences we have discussed web architecture and the technology changes occurred in their development. As the modern web sites lack security, so security issues and theirdevelopment principles are discussed. Implementing security principles in development phases can eliminate vulnerabilities and it is seen that there is lack ofimplementing security in web development methodologies. Methodologies like FDMSWAP and WES provide a roadmap for web application development thatwill help guide organizations to a more secure system. In future, these security methodologies can be validated and new validated web development methodologies can be proposed that will consider web,,s special features in the phases of development cycle.

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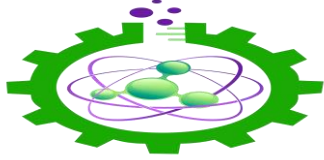
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