Distributed Internet-Based E-Commerce Tools

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Abstract: - The Internet has brought an extensive opportunity for different software tools to interact each other more conveniently. The environment of software engineering can offer more and more tools for Internet-based e-commerce. Through the Internet, these tools can effectively serve the transactions for that purpose.

Key-Words:- Software Tools, Distributed Systems, Software Engineering

1 Introduction

Traditionally software tools were more related to a specific environment, like Pact environment [1], Gravity [2], Shamash [3], PCE [4], the Field environment [5], the Forest environment [6], the EAD environment [7], Integrated project-support environment [8], etc. But after more and more enterprises are actively participating in Internet-based e-commerce, the Internet has been widely accepted as a main vast platform for e-commerce. The traditional software tools, which mainly exist on a non-distributed environment, have to be adjusted to serve for Internet-based e-commerce. Thus software tools will need to facilitate e-commerce in a vastly-distributed environment. In recent years, more software tools for Internet-based e-commerce are built on the Web-related environments [9-18] and applications. Actually the Internet has pushed software engineering [19, 20] into a more open-standard and distributed environment. This brings a big challenge to the development of software tools, which contribute to the main evolution of software engineering. Especially in the recent years, the World Wide Web has become an effective platform.

Different software tools, which may serve for a same or similar function, may be created by different vendors. Even same vendors may build different software tools to serve for different purposes over the Web-based applications, especially e-commerce. Because Internet-based e-commerce requires more robust software tools to support, it is essential to understand how these software tools effectively serve for Internet-based e-commerce.

Although Software tools cannot be completely enumerated and the inconsistence among software tools will exist forever, this paper discusses some important software tools for Internet-based e-commerce. Through this, a mechanism can be established to better understand the functions of Internet-based software tools. Especially because the Internet is involving in more and more commercial usage, more and more security tools are definitely needed to secure business transactions over the Internet. This paper will be organised as the follows. Section 2 will discuss the application architecture of software tools. Section 3 will introduce some Web-based tools. Section 4 will illustrate security tools. Section 5 will deal with the issues of software tools
modeling. Section 6 will conclude this paper and also identify the future work.

2 Software Tools Architecture

In order to better understand how the Internet implements tool transactions, we use a traditional way, like the network application architecture, to split functions, which usually are created by tools, between the clients (customers) and servers (sellers/service providers). Thus following architecture can be used to describe how the functions of e-commerce can be achieved by the client/server tool system. Nowadays the multi-tier client-server architecture is widely used by e-commerce systems. The application logic can be categorised according to system requirements. Different application categories can sit on the same tier or different tiers (Fig. 1). If different application categories sit on the same tier, they are parallel. Otherwise they are sequential. Fig. 1(a) shows the parallel relationship of different application categories. Fig. 1(b) shows the sequential relationship of different application categories.

Based on Fig. 1, the traditional two-tier client-server architecture has been expanded into multi-tier client-server architecture by splitting the application logic. If the applications are irrelevant, they can sit on the same tier as Fig. 1(a). But if the applications are relevant to each other, they need to be serialised into different tiers as Fig. 1(b). In order to effectively manage these broadly-distributed software tools,
there will need some standard layers, middleware, to facilitate the diversity of tools. The middleware is used to transparentise the application logic to all the clients. Between the application logic and data sources, the middleware is used to bridge the differences. Thus two additional middleware layers needs to be added to Fig. 1’s architecture. One is between the clients and applications. Another is between the application logic and data sources. This extended architecture is illustrated in Fig. 2.

3 Web-based Tools
Because e-commerce has massively involved the Web usage, tools related to Web development have played a big role in e-commerce. As Fraternali [9] pointed out that existing tools have been grouped into six categories for Web tools: visual editors and site managers; web-enabled hypermedia authoring tools; web-DBPL integrators; web forms editors, report writers, and database publishing wizards; multi-paradigm tools; and model-driven applications generators.

The category of visual editors and site managers is originally designed to alleviate the complexity of writing HTML code and of maintaining the pages of a Web site in the file system. Usually these tools bundle a WYSIWYG (what you see is what you get) editor, which lets the user design sophisticated HTML pages without programming, and a visual site manager, which displays the contents of a Web site and supports functions like page upload, deletion, and renaming and broken link detection and repair in a graphical way, such as Microsoft’s FrontPage, Macromedia’s Dreamweaver, NetObject inc’s Fusion, etc. These tools mainly facilitate the implementation and maintenance of Web sites, and automatically concentrate on content production by generating code from visual page designs. Some tools are able to generate part of the navigation logic by automatically inserting navigation buttons into pages based on their position in the layout of the site. These tools are an excellent solution for small- to medium-sized applications.

The category of Web-enabled hypermedia authoring tools, which is originally constructed for the development of offline hypermedia applications, has been extended to support the generation of applications for the Web. Most of these tools have both Web export facilities and database connectivity. Well-known products include Asymetrix’s Toolbook II, Macromedia’s Director and Authorware, Formula Graphic’s Multimedia, Allen Communication’s Quest, etc.

The category of Web-DBPL (Database Programming Language) integrators is the dynamic production of web pages from information stored in a database by integrating databases and Web technology at the language level. Web-DBPL integrators are tools for the programmers to combine Web and Databases queries together by hand. Well-known tools are Oracle’s PL/SQL Web Toolkit, Sybase’s PowerBuilder Web.PB class library, Borland’s Web interface for Delphi Client Server Suite, etc.

The category of Web form editors, report writers, and database publishing wizards has a large amount of products, which have the common characteristic of leveraging traditional database design concepts and development tools, to rapidly deploy both new and legacy data-intensive applications on the Web. Well-known tools are Microsoft’s Visual InterDev, Visual Basic, Access, Oracle’s Developer, Inprise’s IntraBuilder, Sybase’s PowerBuilder, Apple’s WebObjects, NetDynamic’s Visual Studio, Asymetrix’s SuperCede Database Edition, and Allare’s Cold Fusion Application Wizards, etc. From the software engineering point of view, tools in this category are related to Web development in an Integrated Development Environments (IDEs). These tools can help process management, testing, and maintenance by applying standard software engineering techniques in source and version control, configuration management, and also visual debugging.

The category of multi-paradigm tools integrates solutions from the aforementioned categories into a unified development framework. The most typical configuration is one in which visual HTML editing and site administration are extended with external components, which provide database connectivity, or with enhanced HTML generation capabilities able to produce scripts for pulling content from database, or with full-fledged database publication wizards. Well-known tools in this category are Lotus’s Domino and Domino Designer, Microsoft’s FrontPage of database objects for connecting to external data sources, Elemental’s Drumbeat of Web-database connectivity, NetObject’s Fusion of connection to database, etc.

The category of model-driven Web generators provides the highest level of automation and lifecycle coverage, by applying conceptual modeling and code generation techniques to the development of Web applications. This category has a few commercial
tools, which exhibit different conceptual models and code generation techniques. Well-know tools are Hyperwave’s Software Development Kit, Oracle’s Web Development Suite, etc.

4 Security Software Tools
In addition to previous six categories of Web application tools, e-commerce definitely needs all sorts of security tools to support its business implementation and transactions. Well-known security tools include networking monitoring tools, authentication/password tools, service-filtering tools, tools to scan hosts for known vulnerabilities, Integrity-checking tools, encryption tools, etc. only with these security tools help, e-commerce can be broadly conducted by the convinced producers and customers. The following sub-sections will discuss some important security technologies which impact on the overall security of the Internet.

4.1 IPsec
IPsec [21] stands for Internet Protocol Security protocol. It was originated from IETF (The Internet Engineering Task Force). Several RFCs (Request For Comments) are recorded for IPsec-related development. Some open organisations like FreeBSD (www.freebsd.org), NetBSD (www.netbsd.org), OpenBSD (www.openbsd.org), Frees/Wan (www.freeswam.org), etc, have developed IPsec tools/patches to secure the Internet communications. Actually IPsec provides security services at the IP layer by enabling a system to select the required security protocols, determine the algorithms to use for the services, and put in place any cryptographic keys required to provide the requested services. IPsec can provide security services like access control, connectionless integrity, data origin authentication, rejection of replayed packets, confidentiality, and limited traffic flow confidentiality. Because this security mechanism is implemented at the network layer (IP), any protocols from upper layers, like TCP, ICMP, UDP, POP, SNMP, HTTP, etc., can depend on this security mechanism.

IPsec uses two protocols (AH and ESP) to provide traffic security. AH stands for the Authentication Header which provides connectionless integrity, data origin authentication, and an optional anti-replay service. ESP stands for the Encapsulating Security Payload, which is in charge of implements confidentiality, limited traffic flow confidentiality, connectionless integrity, data origin authentication, and anti-replay service. More and more IPsec-based tools are use in building firewalls, virtual private network, and securing point-to-point communications over the Internet.

4.2 TLS
TLS [22, 23] stands for Transport Layer Security. IETF has published several related RFCs for implementing the security at the transport layer. TLS intends to provide privacy and data integrity between two communications applications. It has two essential parts, record protocol and handshake protocol, which work together to provide secure connections. The record protocol is in charge of encapsulation of requested higher level protocols with symmetric cryptography, like DES, RC4, etc. With the support of the asymmetric cryptography, like RSA, DSS, the handshake protocol is in charge of authenticating and negotiating an encryption algorithm and cryptographic keys between the server and client before the application protocol transmits or receives its first byte of data. Some of organisations, like OpenSSL (www.openssl.org), have developed relevant tools to support TLS.

4.3 Overall Security Protocols from IETF
Because the Internet depends on its protocol stack to establish peer-to-peer connection, it is essential to secure its protocol stack in its five layers (application layer, transport layer, network layer, data link layer, and physical layer). IETF has contributed a lot for the Internet security. As discussed in Schiller and Bellovin [24] for designing the secure protocols, the following have been widely adopted.

- IPSEC: Security at the IP Layer
- TLS: Security at or above the network stream (TCP) layer
- PKIX: Key Management a la X.509 and public key systems
- SMIME and PGP/MIME: Security Messaging
  - SMIME: Secure mail using PKIX keys
  - PGP/MIME: Secure mail using the "PGP" program format
- Although primary application is e-mail, it can be used in other contexts

These protocols have extensively enhanced the security of Internet-based e-commerce from the network layer to the application layer. While the data link layer and the physical layer are not exclusive properties of the Internet, here we do not discuss
their security issues. Many software tools have been built to secure Internet-based communications.

5 Software Tools Modeling
Internet-based e-commerce needs more software tools to support its required software and transactions. In order to better understand how these distributed tools to contribute to Internet-based e-commerce, first we need to know how e-commerce can be done over the Internet. Fig. 3 shows a model of Internet-based e-commerce.

![Fig. 3 model of Internet-based e-commerce](image)

Software tools have to serve for all respective players, customers, vendors, third parties, and the Internet. Fig. 4 shows this service model.

![Fig. 4 service model of software tools](image)

6 Conclusions and future works
This paper extensively discusses software tools for Internet-based e-commerce, especially web-related tools, and Internet-security related software tools. These software tools are essential to Internet-based e-commerce. In the future, more research will be carried out on tool integration for Internet-based e-commerce. Detailed XML-based tool modeling mechanisms will be implemented in the future. The relationship between tools, data and business processes also needs to be investigated further.

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