DOCUMENT MANAGEMENT AND ELECTRONIC SIGNATURE IN AN ONLINE CONTRACT SERVICE

Thomas Kwok and Thao Nguyen

IBM Research Division, Thomas J. Watson Research Center. 19 Skyline Drive, Hawthorne, NY 10532, USA

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Abstract: In this paper, we present a Web-hosted contract service application that enables small and medium-size businesses to execute and manage contracts entirely online, such as the merging several documents to form an electronic contract and the superimposing of users' signing information as a watermark in a signed contract, eliminating the need to work with paper documents. This application has found to improve substantially the efficiency, and at the same time eliminates the potential for human error and security breaches in the performance of electronic contract management and processing tasks.

1 INTRODUCTION

Today, contracts are created, executed and managed via paper-based and manual processes in most enterprises. However, managing contracts manually can be inefficient and cumbersome because there is no standardized processes to follow or enforce. This approach may also lead to errors or faults with potential risk and liability. Automation of the contract lifecycle presents a substantial value creation opportunity for the enterprise. This value stems from improved productivity and security, effectively aggregated contract information, accelerated contract lifecycle processes, reduced contractual errors and risk, enabled revenue forecast and profit optimization, as well as better compliance enforcement (McGovern, 1986). With the advent of Internet technology and electronic commerce, there are growing research activities and implementation efforts on establishing and standardizing an electronic contract management and process system. Currently, the International Association of Contract and Commercial Managers have listed over twenty commercial available software products for electronic contract management (IACCM, 2006). Most of the research activities reported is focus on electronic contract creation or representation language (Tan, 2002), management (Milosevic, 2004), negotiation and collaboration (Perrin, 2004), execution (Iwaihara, 2004), fulfillment (Xu, 2003), performance (Daskalopulu, 2002) and data mining

(Castellanos, 2004). Nearly all of electronic document management and process systems can automatically execute a few document processes at the same time according to the predefined document flows or workflows. However, there is no study or product focus on a Web-based electronic contract management and process application that can execute document processes automatically according to a set of predefined tasks all at once without human intervention, such as converting document formats, merging several documents in one document, and renumbering page numbers, as well as adding signature information as watermark on the signed contract document, in a secure environment. In this paper, we address the need of these functions, such as security issues, for a Web-hosted online contract service application. We also describe novel techniques used to implement these functions.

2 THE FRAMEWORK

An architectural framework for a document management and electronic signature subsystem in a Web-hosted online contract service application is shown in Figure 1. The system comprises an application server with a local or remote common database, at least one Web-based administrator module and many Web-based individual user modules, a task execution engine and a set of predefined task modules, a signature and document

profile module, an encryption engine and a signing information watermark engine. All communications, interactions and connections among administrator and user modules, the application server, and the remote common database go through one or more secure wired or wireless networks. As a result, the Web-hosted online contract service application can enable authorized users to carry out different document processes and sign contracts in real-time using a Web browser without additional hardware and software installation.
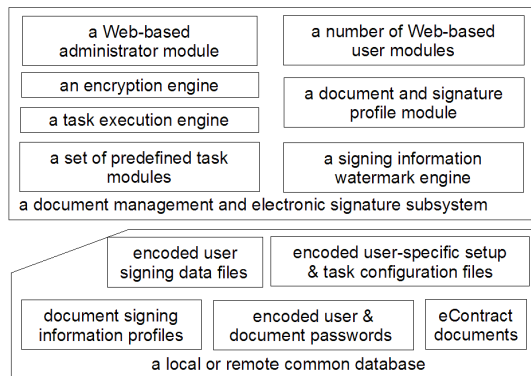

Figure 1: An architectural framework of a document management and electronic signature subsystem.

3 ADMINISTRATION MODULE

As described in Figure 2, an administrator uses the administrator module to generate setup files for his or her users. A setup file allows a particular user in his or her user module to perform certain predefined tasks on electronic contract documents. The allowable predefined tasks that the user can perform must be in accordance with his or her predefined roles and security level in the system. This user-specific setup file can also apply to a group of users with similar roles, positions or security levels in the system. Thus, different users or different groups of users of different roles, positions or security levels can perform different management and process tasks on different types of electronic contract documents using this system. First, an administrator selects all the electronic contract and document types designated for or assigned to a particular user to manage and process. The administrator also selects different company policies based on the user's roles, position and security level in the system, as well as the selected electronic contract and document types. The setup file generator then builds a set of document management and process rules and a set of security rules based on the selected company

policies. According to this set of security rules, the administrator sets a number of passwords with different privileges for accessing each electronic contract document type selected. The administrator also sets allowable predefined tasks and their associated steps as well as security settings for the required document types for each task with respect to the set of management, process and security rules generated. Finally, the setup file generator combines all these task and security parameters and information to construct a user-specific setup file. Once a setup file has been generated, it is immediately and automatically encoded with the encryption engine. Then, the administrator sends out an e-mail to the user to inform him or her that his or her encoded setup file is ready for access or download.
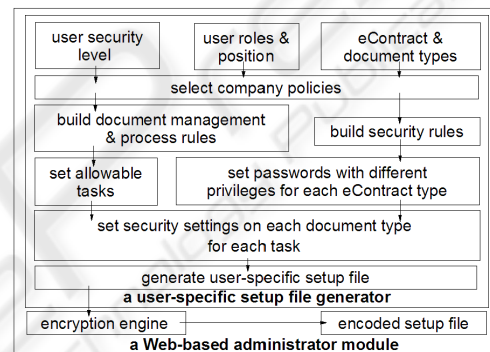

Figure 2: A block diagram showing the flow steps of a Web-based administrator module.

4 USER MODULE

Figure 3 is a block diagram showing the flow steps of a user module. The user selects and configures a set of necessary predefined tasks and their associated steps required him or her to carry out on this particular electronic contract based on the setup file. Once the appropriate, necessary and allowable tasks and their associated steps have been selected, the user selects all the required electronic contract documents for each necessary task and its associate steps. According to the setup file, the user also selects and configures a set of allowable security rules. With these security rules as guidelines, the user selects allowable security settings for each document under each task and its associated steps. Then, the user sets passwords with different privileges for each electronic contract document corresponding to its selected security settings. The task execution engine will use these passwords to remove or add security on electronic contract

documents during the task execution. Finally, the configure file generator constructs a task configuration file from all selected task, security and document related parameters.
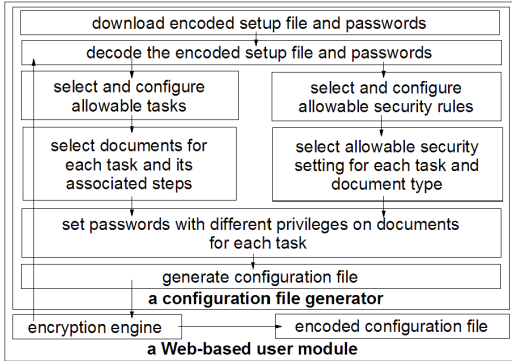

Figure 3: A block diagram showing the flow steps of a Web-based user module.

5 SIGNING WATERMARK

This system have merged all related documents of an electronic contract into one PDF document such that all parties involved only need to review, approve and sign a single electronic contract PDF document. Then, the document and signature profile module automatically reads and parses the type, format and orientation of the contract document. It also reads and parses the number of signature blocks. For each signature block, the module reads and parses the signature block type and the number of signing data fields. For each signing data field, the module reads and parses the signing data type, the page number and page location of this signing data field. Then, a document signing information profile is generated based on this document and signature information.

When a user signs an electronic contract on-line by clicking the "I agree", "I accept", "Sign", or any similar buttons representing acceptance, the system captures or gathered most of the required signing information from the signer's computer using the URL get or post method through the Internet or other on-line electronic processes. The system also retrieves the rest of the required signing information from his or her records stored in the system's database. The signing information comprises at least the signer's name, the signer's company, and the date or timestamp of the signing. Once a signing data file has been generated, an encryption engine immediately and automatically encodes it.

Whenever an incoming electronic contract requests the superimposing of the electronic signing information on its electronic contract PDF document, the signing information watermark engine implicitly calls the encryption engine to decode the encoded signing data file in order to parse and insert signing data entries into a temporary signing image template according to the document signing information profile. In addition, the engine adjusts the page location of this signing data entry in the template according to the page position of its corresponding signing data field in the document signing information profile. By doing that, the temporary signing image template with all the signing information can be superimposed on the incoming electronic contract PDF document in a manner similar to adding a watermark (Kwok, 2005). Finally, secure protections from alternations or modifications are added on the signed electronic contract PDF document with the signing information watermark to ensure that its contents and signing data entries cannot be altered or modified.
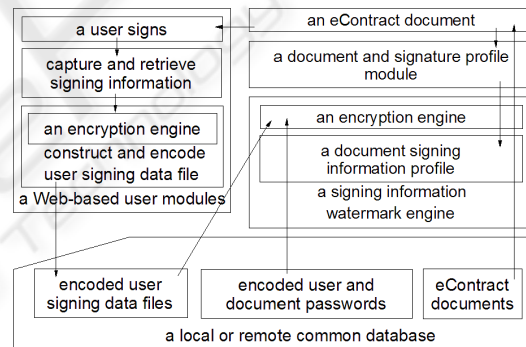

Figure 4: A schematic diagram illustrating the superimposing of user signing data as a watermark.

6 TASK EXECUTION ENIGNE

As illustrated in Figure 5, the task execution engine starts to retrieve a particular encoded user-specific setup file from the local or remote common database. It calls the encryption engine implicitly and automatically to decode the encoded security parameters in the encoded setup file. Once, the security parameters have been properly decoded, it proceeds to retrieve and decode the encoded passwords with different privileges for each electronic contract document type from the database. Similarly, the task executing engine also retrieves and decodes a particular encoded user-specific task configuration file corresponding to the management

and process of a particular electronic contract designed for or assigned to the user. Once, the task and document parameters have been properly decoded, the engine attempts to retrieve all the required documents for processing from the database. Then the task execution engine proceeds to create a temporary empty document. The task execution engine calls a set of predefined task modules implicitly and automatically to retrieve all the necessary predefined tasks and their allowable steps, as well as execution instructions for each predefined task and its associated steps. The task execution engine carries out all the execution instructions on the required documents for each necessary task. Once all the necessary tasks have been executed, the task execution engine restores the security settings as necessary for all documents. Finally, the task execution engine adds security settings with password on the resulting temporary document according to the parsed security parameters from the setup file.
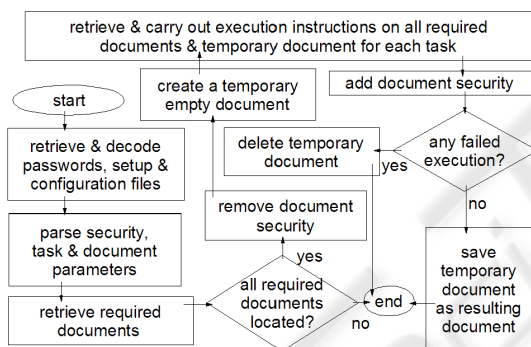

Figure 5: A flow diagram illustrating the algorithm of a task execution engine.

7 CONCLUSIONS

This document management and electronic signature subsystem enables a user to manage and process electronic contract documents with predefined tasks and their associated steps in an automated and secure environment. This system also provides an automated and efficient way for a user to superimpose the electronic signing information as a watermark on a signed electronic contract PDF document in a secure environment. This Web-hosted online contract service application has enable small and medium-size businesses to execute and manage contracts entirely online, eliminating the need to work with paper documents. Some of the features and functions of this document management and

electronic signature system have been implemented in the Web-hosted online contract service application used in IBM. It has found to reduce the time it takes to complete contracts from days to minutes, driving down processing costs and increasing productivity with anytime, anywhere access to contracts.

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