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Abstract

Outsourced Human Resource (HR), especially payroll, services have been placed for a while. Previously, outsourced payroll providers have provided their services to their clients via conventional modes of communication, such as telephones, facsimile, and courier services. In recent years, with the advent of the Internet and the emergence of web-based electronic commerce between enterprises, there has been a rise in the adoption of web-based technology and information systems by payroll providers, thereby enabling them to interact with their clients through this medium. This development necessitates the use of web-based user interfaces as workspaces between the payroll providers and their clients, and thus, raises certain concerns that determine the effectiveness of web-based payroll processing. These concerns, related to the use of web interfaces, form the basis of the patterns discussed in this paper.

Introduction

Companies have outsourced Human Resource (HR), especially payroll, operations to providers of services; mainly to save the time and effort they have to devote in order to carry these out, themselves. Most of these companies are usually small and medium scale enterprises (SMEs), which have inadequate resources to undertake payroll operations in-house. Payroll service providers (Payroll) undertake not only the basic HR task of paying personnel of clients, but they also deal with more complex issues like taxation, superannuation, client tax write-offs, and audit trails. The latter are burdensome for SMEs who would rather devote resources to their core business functions.

When a client enters into a contract with a payroll company, it provides the latter with a list of its personnel along with all relevant details about pay rates and compensation. Payroll companies create a profile for the client and subsequently, a database of its personnel. With every pay cycle, the client informs the payroll company to start the process of paying personnel. This includes details, such as hours worked, leave of absence, and advances for vacations, bonuses and increments. The payroll company then carries out the tasks of remuneration, which includes the pursuing of taxation, financial, and legal issues involved. Once the process is over for the cycle, the payroll company sends paychecks to the respective employees, and a remuneration report to the client. Prior to the advent of the Internet and its applications in the realm of SMEs¹, most cyclical transactions between clients and payroll companies took place through conventional modes of communication, such as telephones, faxes, and documents being dispatched through courier services. Owing to the confidential nature of payroll operations, the client-payroll contract always included a contact person from each organization. One of them was a person in the client firm who was authorized to initiate the payroll process at the end of each pay cycle, and have access to the personnel database. Usually, this person was either the owner of the firm or a manager who undertook the financial tasks. At the other end, a payroll manager was assigned to each client. Over time, the client contact would establish a working relationship with the client contact, to a point where “recognizing each other’s voice over the phone” was deemed to fulfill the requirement for authorization.

Thus, outsourcing payroll processing has been common for decades, but now, payroll companies are offering Web-based versions of their services for SMEs, with the aim of minimizing the need for the dual flow of “paper-based” document, and the triggering of each transaction over the phone. At the outset of a contract between the two parties, authorization to the database is implemented by means of “log-ins” and “passwords” via a web-based interface. The creation of the personnel database, and data-entry tasks are shifted to the client, who is supposed to carry these out through the web. The aim here is to reduce the time spent by the payroll managers in entering the data themselves, which in turn, translates as cost savings to the clients in the form of reduced fees. At the same time, clients expect (and rightfully so) the quality of services to be at least at the same level as was rendered via the previous “manually-inclined” system. This necessitates the incorporation of certain core requirements into the applications.

Payroll applications deal with highly confidential issues related to the remuneration of personnel. Thus, a web-based application is required to ensure security of data. Security features are embedded into the applications in the form of access restrictions, whereby only an authorized person in the client firm is granted access to personnel data. At the same time, the system should provide paychecks (both online and in the form of slips) to client personnel, remuneration reports and other on-demand deliverables to the client contact. It also interacts with banking applications to divert funds as pay into the bank accounts of client personnel, with insurance funds, auditors, concerned legal/government agencies, etc.

This paper describes a few patterns pertaining to web-based interfaces between the clients and the payroll company. Application interfaces are concerned with gathering data inputs from users, and generating query results and reports. Therefore, the first six patterns deal with important issues surrounding the entry of data and its validation into the web-based information system. The

¹ Electronic Data Interchange (EDI) has always existed as a medium for online transactions between enterprises, but its use has largely been confined to large organizations, owing to cost and infrastructure issues.

patterns, *The Web Coordinator* and *The Personal Query*, deal with the timely generation of timely remuneration reports, and query results, respectively, on the web.

Data Entry & Validation

Any application, regardless of whether it is web-enabled or not, incorporates features that govern data entry and validation. However, web applications are also meant to complement ease-of-use and support online work in remote locations, or in virtual teams. Hence, users should be provided with online support while undertaking data entry. Validation mechanisms should be inserted at the interface as well as the servers, to prevent the violation of business and data integrity rules. These aspects are illustrated in Figure 1, where each aspect of data entry and validation consists of one or more high-level patterns, which are discussed in the following paragraphs.

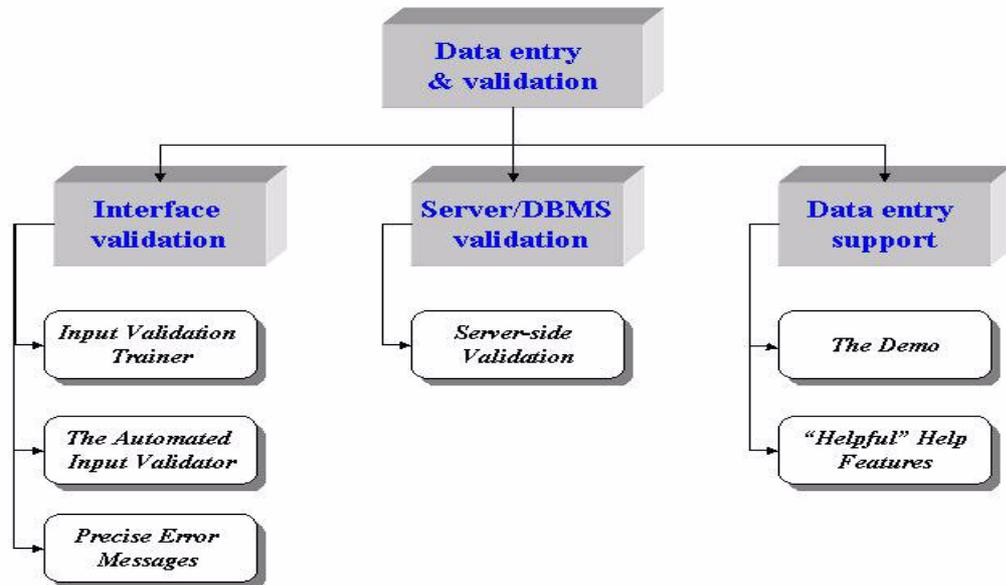


Figure 1 Data Entry & Validation patterns

The Input Validation Trainer

Problem

How to ensure clients' familiarity with the data integrity rules of the particular web application?

Context

With web interfaces, the task of entering personnel records and pay data into the database is shifted to the clients. The interface is presented as a data entry form, which requires the clients to fill out the appropriate fields. However, this means that clients need to be directed in such a way that the rules of data integrity are taken into account while entering personnel records. Thus, data integrity rules need to be imparted directly to clients or embedded into the application. Although clients may be familiar with the usage of computerized systems and even web-based applications, the application, provided by the payroll outsourcer, might be completely new to them. In view of this, they need to be made familiar with the workings of the applications and especially, the prevalent data integrity rules.

Forces

1. Clients may not be familiar with the data integrity rules of the application.
2. An application that flashes data-entry errors "a few times too many" each time clients, largely unfamiliar with the application, enter records may cause frustration, and consequent abandonment of the web-based solution.
3. The data entered by clients through the web application is directed to the database held by the payroll legacy system. In view of this, redundant or inaccurate data entered by clients may result in poor data management by the payroll company.
4. The imposition of data integrity rules as constraints without training might be viewed as "complex" restrictions on their usage of the application. This aversion could discourage from using the application

Solution

Training in data-entry rules

The adoption of the web application by the clients could be facilitated by training client contacts (or other authorized members). The importance of ensuring the integrity of data and the steps taken to ensure this should be incorporated into the training. An example of this is a situation where payroll trainers, during a demonstration of the application at the client site, depict different scenarios of faulty data-entry and its consequences, and then show how data should be entered properly

Consequences

1. Training and effective demonstration of the solution will ensure that clients gain an understanding of data integrity rules and its enforcement during data-entry.
2. Training clients involves the dedication of payroll managers in designing relevant materials and conducting training sessions. Thus, this undoubtedly involves the commitment of the payroll company's resources.

Known Uses

The adoption of new applications in work settings is often accompanied by the provision of training to users. In the domain of outsourced web-based payroll services, this is an essential obligation on part of the payroll provider, and is included in the contractual agreements with clients. Training is offered on most of the features of the application, but the issue of data entry and validation is crucial, and applies to all information systems, whether web or non-web, intra-organizational or inter-organizational. Even though the application of this pattern may be implicit in the adoption of new applications, most IT departments and trainers will state reasons behind the provision of and its outcome, as described in the context and forces, and consequences, respectively.

The Automated Input Validator

Problem

How to ensure the integrity of data entered by clients into the database through the web interface?

Context

Even though training provided by the payroll outsourcer will familiarize client users with the various features of the web application, it may not sufficiently ensure data integrity on its own, due to various reasons, which are described in the forces. Furthermore, many of the forces related to the previous pattern, The Input Validation Trainer, are also relevant in this context.

Forces

1. Clients may not be familiar with the data integrity rules of the application.
2. Payroll staff may not be present while clients are entering data. In such situations, complex data-entry procedures may force clients to consult the on-line Help of the application, which they may be averse to.
3. Clients may receive training in proper data-entry, but still enter records in violation of data integrity rules. Moreover, client contacts and administration staff may attend training sessions, but the actual data-entry task might be assigned to someone employed as a casual/temporary staff. Thus, training may not guarantee that clients follow the rules.

4. The data entered by clients through the web application is directed to the database held by the payroll legacy system. In view of this, redundant or inaccurate data entered by clients may result in poor data management by the payroll company.

Solution

Embedding data integrity rules into the application

Data integrity rules could be enforced as non-functional requirements or constraints into the applications. For example, each time a client enters an employee record incorrectly or more than once, there should be a mechanism that prevents the submission of the data into the system. The constraints should prevent the record being saved until the error is corrected. A related pattern is Unambiguous Format [Welie00].

Consequences

1. Embedding data integrity rules into the application will further enforce integrity by preventing data inaccuracy and redundancy.
2. The embedding of data integrity rules into the application requires significant development hours spent by the company's IT staff.

Known Uses

Most data processing systems, both web and non-web, have business and data integrity rules embedded into them. Examples of such patterns at work can be found in many of the internet banking and web-based flight reservation applications, where incorrect entry into certain fields, such as those for bank account number, credit card information, city and postcode, and dates, prevent the submission of an online form into the system. Integrity rules pertaining to the fields mentioned are usually embedded either into the interface or reside at the web server. For example, these rules will not allow the incorrect number of digits for the bank account number or a mismatch between city and postcode from being sent into the database. Similar types of measures are also undertaken in non-web applications.

The Demo

Problem

How to re-experience the training program?

Context

Clients may not remember the various features of the web application that were introduced in the training program. Besides, the actual task of keying in data might be delegated to members of client organization, who may not have received the training.

Forces

1. Organizing another training session will require commitment of resources of both the client and the payroll company.
2. It may not be possible, nor desirable, to provide training to the client each time new personnel are delegated data entry tasks.

Solution

Inclusion of a demo program

The introduction of web-based services could be accompanied by a multimedia demonstration program (on CD-ROM or included in the payroll company website), which will take the client through a step-by-step tour of the application, with particular emphasis on data integrity and proper data-entry. Thus, clients could refer to this program when they are confronted with errors and are unable to contact payroll managers at the time. For related patterns, Wizard [Weile00] and Archive Scenarios [Coram96] could be referred to.

Consequences

1. A demo program can facilitate the clients' usage of the application. This is especially relevant in a scenario where the task of data-entry, within the client firm, has been delegated to someone who has not received training, e.g. a temporary or newly recruited administration staff.
2. From the viewpoint of the payroll company, however, this may also involve development costs, especially when the demo needs to be upgraded with every new version, or even features, of the application.

Known Uses

1. Demo programs provided with Internet set-up kits, and pre-paid Internet Services, take the user through the installation of necessary tools and dial-up connections in a step-wise manner.
2. Microsoft Office wizards, where the steps in building spreadsheets, presentation, and database tables, forms, and reports, are demonstrated to users. Microsoft products are sold to the general public, who may not be IT professionals. Thus, this pattern is relevant here.
3. Online demonstrations of internet banking procedures, where simulations instruct and guide the customers in the usage of web-based banking facilities. Banks provide internet services to both retail (B2C) and institutional customers (B2B), who are widely dispersed (due to which training is impossible) may not be entirely IT proficient.

Precise Errors

Problem

How to effectively inform client users of erroneous data entry?

Context

This is a follow –up to the Automated Validator pattern, whereby the embedded data integrity rules reject incorrect data entry.

Forces

1. Clients need to be informed of the errors.
2. Web applications should minimize the need for clients to consult the payroll company with regards to routine usage via conventional modes of communication.
3. Vague error messages or error statements that are not specific enough could cause confusion and subsequent frustration with the usage of the application.

Solution

Precise error messages

Error messages should clearly indicate which fields on a web form were entered incorrectly. A variation of this pattern is Warning and Shield [Welie00].

Consequences

1. Precise error messages inform users not only of the incorrectness of the data entered, but also which fields were entered incorrectly.
2. Even though the client user is informed of the fields entered incorrectly, no (online) suggestions, to rectify the errors, are provided. This forms the basis of the next pattern, *“Helpful” Help Features*.

Known Uses

Warning messages generated by well-designed applications, both web and non-web. In web-based business-to-consumer electronic applications, the incorrect entry of credit card information is “greeted” with an error message specifically pointing out the fact. Another example is the error message stating that “end date must be later than start date” when a customer checks his/her transaction history while using internet banking services.

“Helpful” Help Features

Problem

How to provide online assistance to the client user in the rectification of data entry errors?

Context

We are now looking at a situation, which could be considered as the resulting context after the patterns, discussed above, are applied. Clients have received training on the importance of maintaining data integrity and the relevant steps involved. Furthermore, data integrity rules have been embedded in the web applications through which clients enter and process data. It is beyond doubt that data entry is an on-going task. The records of new employees have to be entered, resignations accounted for, salary and pay rates updated, timesheets and leave applications entered etc. Thus, the web interface is a workspace to be frequently used by clients, which cannot always be supervised on-site by payroll managers. Data entered incorrectly will be rejected by the embedded rules by means of error pop-up messages. At the same time, clients, especially those with non-IT (Information Technology) backgrounds, may not remember what they learnt in the training, and thus, commit the mistakes. This is why certain features to guide them, need to be inserted into the application in order to minimize the frustration that might prevail.

Forces

1. Assistance for error rectification should be provided online, not gathered by means of phone calls or email, as these defeat the aims of adopting web-based information systems.
2. Small and medium-sized clients, who are not involved in IT nor have in-house IT staff, may not be entirely comfortable with an application’s Help feature which provides very general hints, or calls for time-consuming navigation through the Help index.

Solution

“Helpful” application Help features

Each time an error message appears to indicate that certain fields were filled incorrectly, clients will consult the Help facility of the application. The error message should provide a direct link to the relevant part of the Help file where it is explained exactly why the data was incorrect as well as examples of the proper format. A variation of this pattern is Continuous Filter [Weile00]. Another such pattern that could be applied to build Help facilities is Element Identification [Coram96].

Consequences

1. An excellent Help facility will undoubtedly support clients. A feature, which explicitly states why the format of the data entered was incorrect, along with examples of the correct format, will definitely be of great “help”.
2. On the other hand, the development of such a feature may not be a simple task. The extent of the user-friendliness of the Help facility needs to be ascertained. Questions like “how do we know that this is user-friendly enough?” or “are the tips and hints precisely

to the point” need to be answered. Such issues are usually dealt with during the process of requirements elicitation. However, it may not be all that feasible to tailor the Help facility as per the requirements of each client.

Known Uses

Help systems (Windows Media Player, Visio 2000), where an error message provides a link to corresponding Help and trouble shooting information.

Server-side validation

Problem

How to ensure that certain violations of data integrity, not identified and alarmed by embedded rules, are dealt with prior to the ultimate flow of the data into the payroll company’s database?

Context

Certain data, particularly those pertaining to non-key fields, may be entered more than once. For example, the client may enter the same bank account number for two of its employees by mistake. Since it is possible for two employees, such as a couple, to have a joint account, the data integrity rules may not be able to spot this error, which is indeed a serious one.

Forces

1. It is not possible to impose data integrity rules on every field on the form.
2. As discussed in the forces of the previous patterns, data integrity rules may not be considered while entering data, unless the application generates error messages.

Solution

Once the data has been entered and the “Send” or “Submit” button clicked, the data should make its way into the web server, instead of into the main databases. Upon the receipt of the data, the web server should generate a web page on the client’s screen with a list of the records (resembling a web report) that had just been entered. This will enable the client to double-check on any errors that were not identified by the embedded rules. Once the process of double-checking is complete, the “OK” button is pressed, which finally moves the data to the respective databases. The process is illustrated with the use cases in Figure 2. Related patterns include Echo Back and Deferred Validation [Cunningham94].

Consequences

1. The data that finally flows into the databases are accurate, and not redundant.
2. The setting up and management of the web server may demand resources from the payroll company.

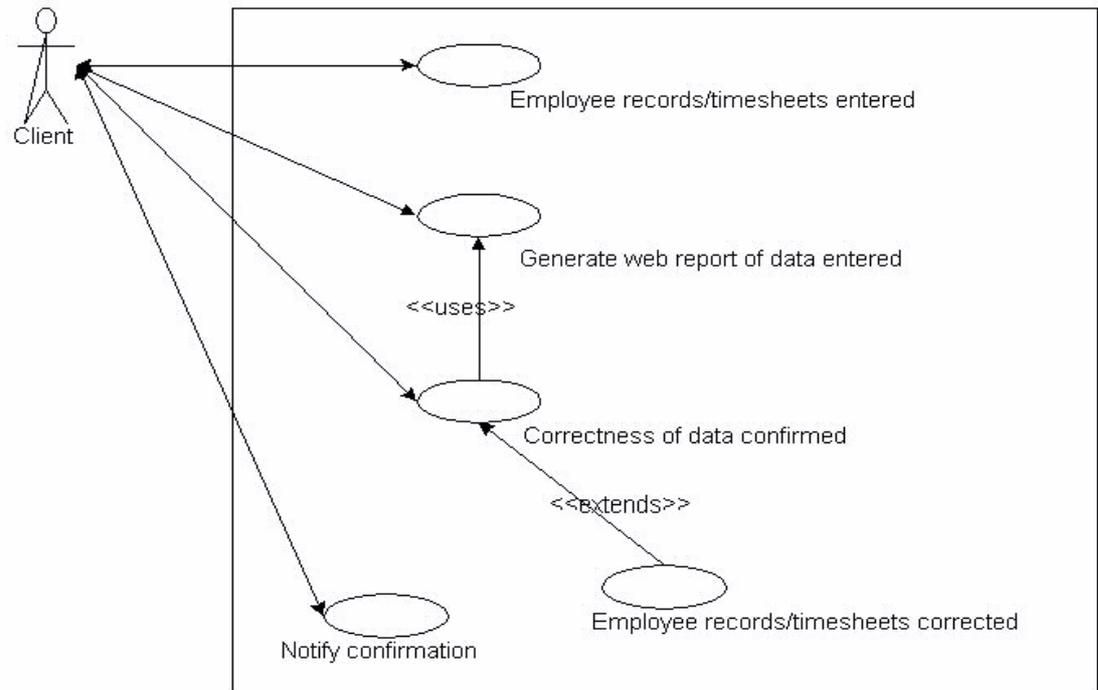


Figure 2. Confirmation of the correctness of employee records/timesheets entered

Known Uses

Web-based information systems in any domain, such as in order processing and fulfillment, where customers place order through a web-based order entry form, and receive deliverables in the form of order confirmation, order approvals, and invoices.

Web Management

Web-based information systems require the performance of a vital function, which is web management. This undertaking consists of a number of tasks, such as web administration, and security. In this paper, a high-level pattern related to the administration has been identified and described as *The Web Coordinator*.

The Web Coordinator

Problem

How to ensure that the web-based information system is functioning optimally at all times, especially during the due dates for timesheets and remuneration reports?

Context

Just prior to the pay date, clients need to fill up web-based timesheets for each of their employees, and send these over through the web. At the end of the pay cycle, the pay for client employees are calculated, and their bank accounts credited. Once the process is complete, a remuneration report (containing a detailed list of employees, their gross and net pay, and various deductions, along with the dates for the pay period) is generated. Prior to the adoption of web-based information systems, paper-based copies of these timesheets were sent to the payroll company through courier services, and preliminary copies of the reports were dispatched to the former by fax. But with a web application, both the inputs and the deliverables, namely the templates of the timesheets and the reports, respectively, can be published on the web, which enables clients to login into the systems, view the report(s), and print them (if they wanted to). The critical factor here is that, with payroll services, the template for the timesheets should appear before the due date, and the reports generated for clients as per deadline. For example, some payroll companies require timesheets to be completed and submitted a few days prior to the pay date, and dispatch reports within 24 hours following the completion of the process of paying personnel. In a non-computerized system, payroll staff simply sent the documents by fax. However, with a web-based information system, clients expect the reports even earlier. The web-based information system is a medium through which transactions between the payroll staff and the clients take place. It reflects, ideally, the business processes that involve the two parties.

Forces

1. A web-based reporting system will call for the participation of not only payroll staff (as it was with faxes), but also that of IT personnel.
2. At the center of the web-based information system is the web server, which could be down due to sudden malfunctions.
3. Payroll and HR service providers usually tend to be sizable organizations, in which a lack of frequent communication between the payroll and IT personnel might exist. There might even exist a certain degree of conflict between the IT staff and their colleagues from the departments they support [Pouloudi96].
4. The payroll IT personnel are primarily responsible for the management of the payroll company's legacy system, and may not possess an understanding of the various issues prevailing in the payroll staff-client interface.

Solution

The need for web-coordination

To effectively manage the web-based information system, a team of web coordinators needs to be established. The members of the team could be drawn from various areas within the payroll company, but definitely from the marketing (consists of staff who deal with clients directly) and IT departments. Furthermore, the team should comprise of members with different sets of skills ranging from marketing, IT management, and web site administration. This pattern could be derived from Cockburn's "Subsystem by Skill" [Cockburn95] and Coplien's "Organization follows Architecture" [Coplien95]. Other related patterns include Unity of Purpose and Diversity of Membership [Harrison96]. A few members of the team should be delegated the core task of the *web-coordinator*, while the others are required to support this role. The web-coordinator works in closely with the marketing and IT departments to ensure that the timesheet templates are made available prior to the concerned due date, and reports are published on the web for the clients' viewing within a certain date and time. If the web server is down or any aspect of the web application or the payroll legacy system is malfunctioning, it is the responsibility of the web-coordinator to convey this to the payroll operators, so that the latter could initiate contingency actions. Meanwhile, messages, explaining the problem, should be flashed once the main web page is accessed, or sent by email to both the payroll operators and the clients about the problem.

Moreover, as the team consists of members from the core departments providing the service, the state of affairs is expected to be higher in transparency throughout the organization. The tasks of the web coordinator are further explained by the use cases in figures 2 and 3, each of which illustrates a scenario: overseeing the availability of timesheet templates on the web as per schedule, and checking whether all the timesheets have reached the web server after being filled in by clients.

The scenarios of web coordination

1. Oversee the availability of timesheet templates on the web as per schedule (Figure 3)

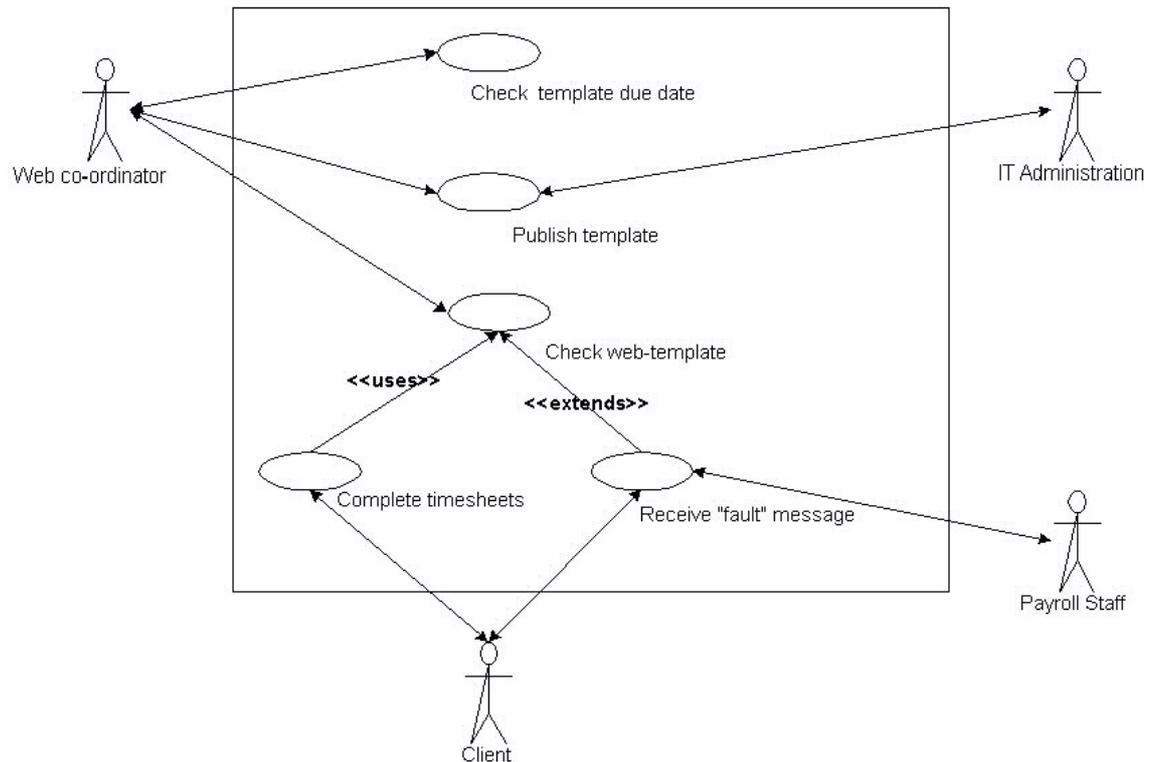


Figure 3. Ensuring timesheet templates appear on the web as per schedule

- **Check template due date:** The web coordinator checks the due date for templates to appear for the respective clients. The due date is set a few days prior to the date the documents need to be filled in and submitted via the web.
- **Publish template:** Upon reaching the due date, the web coordinator, in conjunction with the IT staff, ensure the timesheet template is available on the web (the template is basically a form that needs to be made available to the clients once they log into the website to enter pay data).
- **Check web template:** This involves making sure that the template is functional throughout the period of pay data-entry. However, if problems occur due to system failures, a “fault” message, stating the nature of the problem, is transmitted to both clients and payroll staff. This could be done by flashing the message on the respective workspaces (interfaces), by email, or by other conventional modes of communication.

2. Checking whether all the timesheets have reached the web server (Figure 4)

- **Check submissions:** Clients complete filling in timesheet forms with data, and then send it to the web server. Thus, one of the prime tasks of the web coordinator is to check whether all the timesheets (expected) arrive at the server in the right order. If the timesheets submitted by a particular client is less than the number expected, a message is transmitted to the client stating the fact.
- **Submissions complete:** On the other hand, if all the timesheets have been submitted, the web coordinator informs the payroll staff and the IT administration to begin the payroll process for the client.

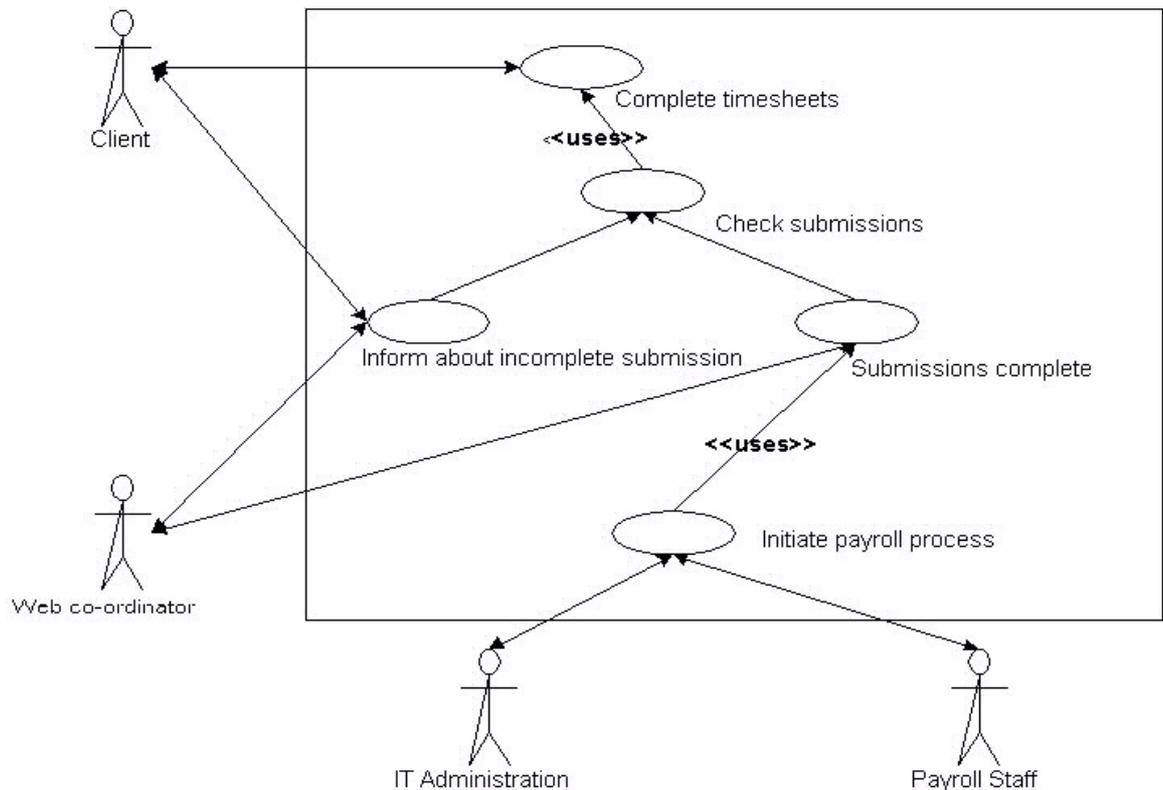


Figure 4. Checking the submission of timesheetsConsequences

1. As shown in figures 2 and 3, the web coordinator ensures that the workspace for both clients and the payroll staff is made available for the payroll process to occur. The concerned parties are informed in case there are problems with the system, so that contingency actions could be implemented. In this way, the provision of optimum web services is possible.
2. Moreover, the web coordination team, due to its proposed composition, acts as a liaison between the marketing and IT staff in the payroll company. This could be instrumental in minimizing the points of dissonance, and possibly improve communication between the concerned departments.

Known Uses

1. This pattern was generated on the basis of experiences gained from research on outsourced web-based payroll systems. Thus, it is applied in such systems.
2. This pattern is adapted and applied in scholarships and stipends payments systems in educational institutions. The processes here are quite similar to those of payroll.
3. Web coordinator finds similar application in both Business-to-Consumer (B2C) and Business-to-Business (B2B) electronic commerce systems. Basically, this pattern can be found in all web-based workflow applications.

Online Processes

Online processes include both workflows and ad-hoc queries and look-ups. Applications, ideally, should be able to accommodate major work routines as well as respond to user queries online. The next pattern, *The Personal Query*, is a description of a generic online query done via a web medium.

The Personal Query

Problem

What about services requested by the clients' individual employees through the web?

Context

Certain clients considering the adoption of web services may include, in their requirements specification, the granting of access to their employees to certain parts of the system for "look ups" of their employment and remuneration records. For example, employees might like to know what hours they had worked during a previous pay cycle, what was the commission paid, or how much was deducted for superannuation.

Forces

1. The web-based payroll system contains extremely sensitive and confidential data, and thus, a high level of security measures are incorporated into the system.
2. Payroll companies usually restrict access to the client contact.

Solution

Employees of clients are granted access to remuneration records once they have supplied the correct username and password to the application through the main web page. Following authentication, the employees are presented with another web page, which provides them with a set of options: they could choose to view a pay report from a previous cycle, or simply, their entire remuneration history with the company they are employed by. The reports are then dynamically generated. The use cases in Figure 5 depict the solution.

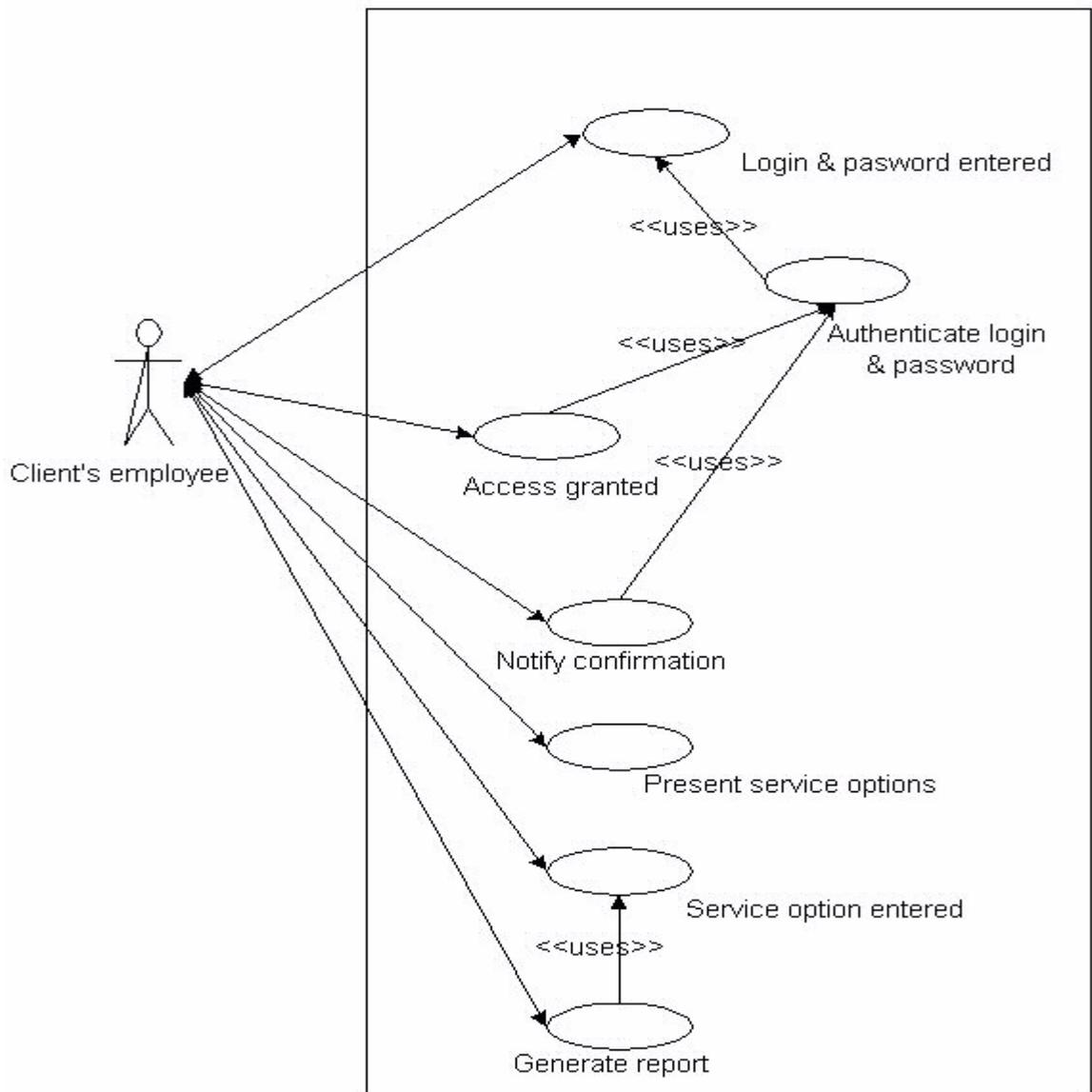


Figure 5. Client employee look-ups

Consequences

1. Client employees are able to view their pay records directly from the web. Thus, payroll staff are freed from having to answer queries on the phone.
2. The inclusion of web queries would also free clients from having to request such services themselves, an important motivating factor behind the adoption of web-based payroll services.
3. The provision of username and passwords for all the employees will increase the work of the web coordinator and other IT staff, who need to manage and account for the greater number of users and their access data.
4. Heavy access to the system by a large number of employees, especially after the pay cycle or at the end of the year, would impose pressure on the web resources. The infrastructure will have to be expanded to accommodate the increase in the traffic.

Known Uses

1. In web-based order processing and fulfillment systems (B2B), this pattern is used in furnishing customers with statistical reports of orders placed or procurements over a given period of time.
2. Web-based Student Employee Payroll System [Thieke00], where students employed on a casual basis by the university, are able to implement queries that enable them to view their pay history.

Summary and Conclusion

This paper has discussed patterns concerned with data input and validation, report generation, and web-based queries in the domain of outsourced web-based payroll systems. As depicted in Figure 6, the patterns fall under the four main aspects of a web-based application, namely data-entry, online processes, deliverables, and web management. The figure shows a general hierarchy of features related to the web-based payroll domain. A feature may consist of two or more sub-features, which are features in themselves. Each atomic feature translates into one or a set of high-level patterns. For example, the Data Entry & Validation features consists of the sub-features of Interface validation, Server/DBMS validation, and Data entry support, each of which relates to a set of patterns, described in the preceding sections of this paper.

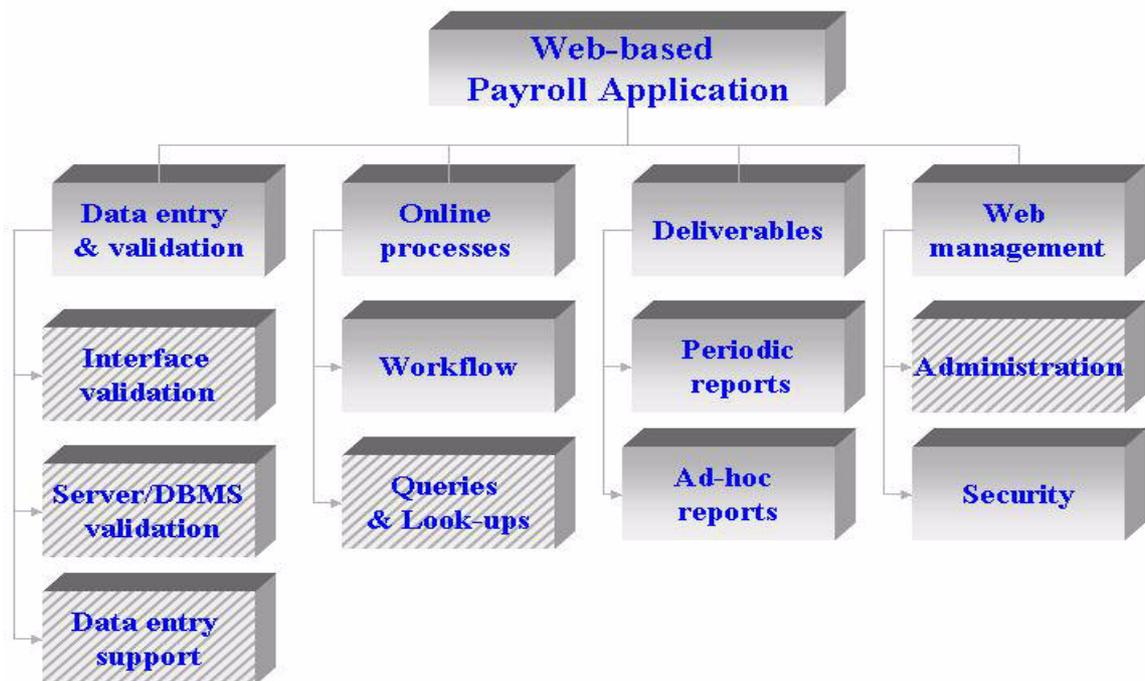


Figure 6 Hierarchy of web application features and interrelationships.

It should be noted that the patterns presented in this paper are by no means exhaustive. This is why the patterns related to the other features, in non-shaded boxes (Figure 6), will be discussed in subsequent papers. Further patterns will be directed at other issues concerning payroll applications, such as security (especially, in view of the need to regulate clients' and their employees' access to the databases), the actual payroll work processes (timesheet submissions, leave entitlements, leave and timesheet approvals/rejections), and the actual production of web-based documents (formal remuneration reports and pay records, and ad-hoc requests).

Future Work

Further patterns will be generated in order to develop a comprehensive pattern language for web-based payroll applications. Not only will some of the features, in non-shaded boxes, in Figure 6, undergo decomposition into more specific sub-features and relevant patterns described, but also lower level patterns will be identified for the features in shaded boxes. Likewise, further patterns could be discovered from the larger context of the outsourced payroll system in general. For example, future works will seek to understand the interfaces of payroll companies with other external parties, such as banks and financial institutions, regulatory bodies, health-care authorities, insurance companies, etc. Figure 7 illustrates a conceptual model of the major payroll processes and the stakeholders² involved. The interfaces with each of these stakeholders, apart from the client, could give rise to a number of patterns, provided the processes are effected via an electronic medium, such as the Internet or the EDI. These details could be discussed in subsequent works, and a complementary set of patterns constructed for this particular domain.

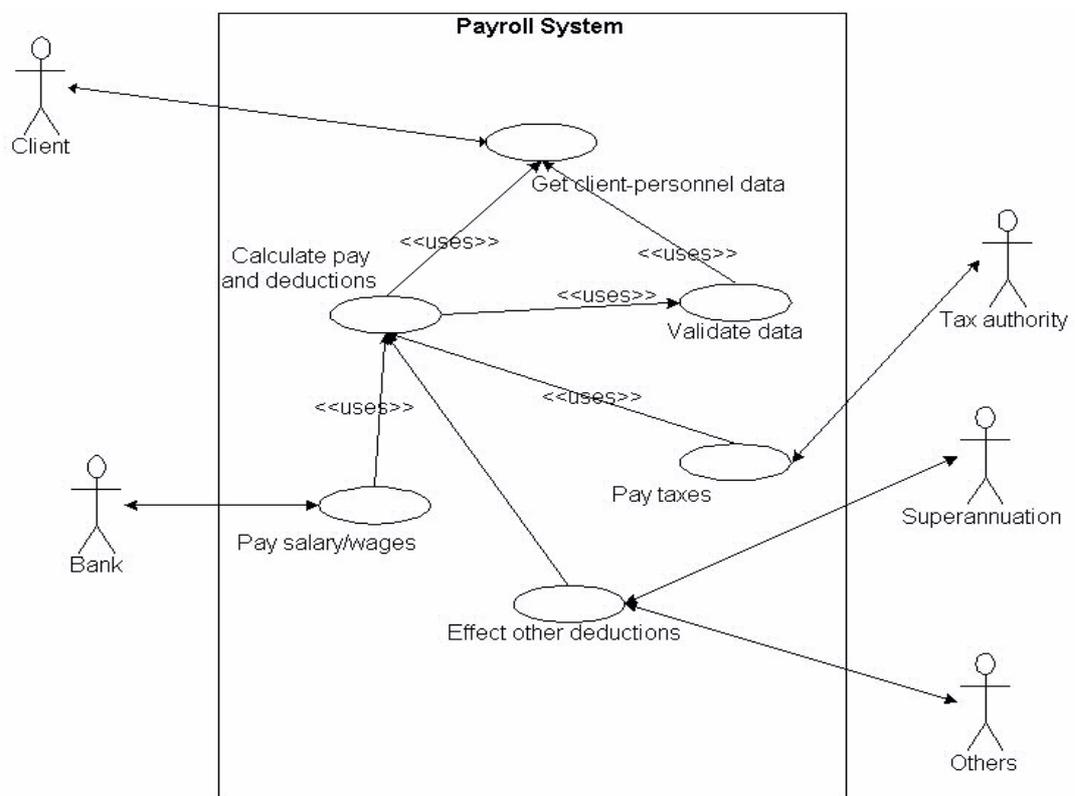


Figure 7. Interfaces with external parties

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² Stakeholders are individuals, groups, or organizations who can affect or is affected by the development and implementation of an information system [Pouloudi97].

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