

## Going Paperless – On the Evaluation of Electronic Form Technologies

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**Abstract**—Most organizations rely on the use of forms for their daily business. These forms are more and more replaced by electronic equivalents. This change is usually a significant investment, therefore it is important to understand the requirements and features of available systems. In this paper, we explain some of the common important requirements, and discuss how form technologies can be evaluated by an organization. To illustrate the approach, we describe an exemplary evaluation, based on a project undertaken at the University of Auckland with the aim of making all forms electronic. Our results show that current technologies differ greatly in the requirements that are addressed, and that no single form technology satisfies all the common requirements.

**Keywords**-forms; requirements; technology evaluation

### I. INTRODUCTION

Forms are at the heart of the information infrastructure of many large organization. The degree of efficiency to which a business can operate depends greatly upon how quickly information can be gathered and communicated between different entities, and more often than not, forms are the medium for this process. Paper forms are still in widespread use, but have many disadvantages, including the following:

- The need to repeatedly fill in the same information for each form, e.g. contact details.
- The possibility of fields being incorrectly or incompletely filled out, even if validation would be trivial.
- The difficulty to manage a form catalogue of all forms with all their available versions, due to the distribution of information that exists in large organizations.
- The need for manual staff interaction even for simple tasks.

By contrast, electronic forms have many advantages, such as the possibility to transfer, store, complete, search and manage them more efficiently. As a result, many organizations are trying to move away from paper forms, to electronic form technologies.

Electronic form transfer is an old vision of the computer age, and many partial successes have been achieved in specific areas such as early e-commerce [1] and consumer terminals [2]. Electronic form transfer is an important enabling technology for modern business process management [3]. HTML forms as the predominant online form-based interaction standard have long been recognized as being restrictive in several regards, and alternative technologies have been

proposed and even standardized [4]. However, in practice organizations might have to deal with a considerable number of largely equivalent, but incompatible technologies [5].

With electronic forms being such an important concern, IT service managers need to be able to answer the following questions: i) in how far do their existing resources satisfy the requirements for electronic forms? ii) If the existing resources are insufficient, which of the many form technologies on the market should a service manager invest in? Before answering these questions, the requirements and suitable measures need to be understood. IT service management recognizes the importance of organizational requirements, from both a business and a customer perspective, and the importance of measuring their fulfillment [6].

In an attempt to take the leap away from paper forms at the University of Auckland, an electronic forms working group was established by the IT Services division. To make sure that all important requirements were identified, members from different parts of the university were invited, including management, technical support and academia. This paper describes some of the results of this working group, focusing on results that can help other organizations and researchers to understand the requirements and challenges of form technology evaluation. A more comprehensive overview of the results can be found in [7].

Section II discusses important requirements for electronic form technologies. Section III gives an exemplary evaluation of three popular form technologies. Section IV discusses our exemplary evaluation, coming to conclusions about the state of the art of electronic forms in general. Section V concludes the paper.

### II. REQUIREMENTS

In the following we describe important requirements of form technology. These requirements are a product of the electronic forms working group at the University of Auckland, and are hence specific to the university. However, the university shares many of its requirements with other organizations, as will be explained in the following. A more detailed description of the criteria used to evaluate in how far a particular technology satisfies a requirement can be found in [7].

### *A. Authentication and Authorization*

Authentication is an important feature in an electronic form system. It is necessary to restrict access to forms, for example restricting staff forms to staff members only, or to hide internal forms from non-members. This helps prevent malicious or disruptive behavior by restricting access from those who may have a desire to cause annoyance or harm. It also serves to provide a base for the next requirement, pre-population based on identity, which means that known information about a user is leveraged to fill in some form fields automatically. Without user authentication, there is no identity that can be used to pre-populate a form.

### *B. Pre-Population of Forms based on Identity*

A form system should pre-populate forms with known information, so that a user does not have to enter such information over and over again. This is typically possible for personal information such as identity numbers, contact details, affiliation, etc. Following on from the previous requirement, pre-population based on identity requires a degree of authentication to work. It makes filling out forms faster, as well as reducing errors [8].

### *C. Basic Validation*

Form validation is an important feature for ensuring clerical accuracy, e.g. making sure the user puts their phone number, name etc. into the right fields. It also helps to prevent low level abuse of the systems, e.g. adding completely incorrect details or avoiding required information.

### *D. Validation Employing Data Integration*

More powerful validation is possible if the form system is integrated with external data sources, similar to pre-population. This additional data can be used to validate the values entered in a form, e.g. checking whether the requested number of annual leave days is still available for a user. It can also be used to only offer valid options in the first place, taking into consideration the user's previous choices and other constraints. Removing infeasible options contributes to the ease of use in a form system, and reduces errors.

### *E. Branding*

For most organizations, branding is very important for PR reasons. Forms need to provide a standard look-and-feel that reflects the identity of the organization. This also helps to present a standardised interface to the user, making their experience generally easier. For example, the University of Auckland has a very detailed style guide for its websites, detailing formatting, fonts, spacing, colors and more. However, the paper forms present at the university do not conform to such a style guide, as each department generally manages their own forms. Consistent branding is easier to achieve in an organization when using an electronic form technology. The ability to standardise and enforce a uniform form layout and style is a key feature of electronic forms.

### *F. Email Routing*

Email is still the most popular message exchange technology in most organizations. The ability to automatically forward form data in machine-consumable emails after form submission is a feature required both for internal automation within the technology, and for integration with a business process. Email stands out as a technology that is both simple and widely supported, therefore it is warranted having this as a separate requirement.

### *G. Business Process Integration*

This requirement is similar to the previous one, but more general. A system should be able to send an event once a form has been successfully populated, and link this event to a workflow or business process. The system should also allow workflows to follow up a non-response by a user. Finally, the form system should be able to store the resulting data in a database. All form technologies have some method of storing the data after a user enters it, but there are differences in the supported data storage methods and flexibility.

### *H. Usability and Accessibility*

A forms technology should be configurable to offer good usability and accessibility to its users. Usability has to be considered on both ends, i.e. the user filling in the form and any other person processing the submitted form data. This requirement needs to be evaluated on a case by case basis, as different form technologies implement features relevant for usability in different ways. Generally, the end products are very similar – standard web forms.

### *I. Digital Signatures and Auditability*

For applications where security is a concern it is necessary to have support for digital signing of forms. This is analogous to handwritten signatures on paper forms, but allows forms to be easily auditable as digital signatures can be verified automatically. A digital signature needs to be forwarded and processed with all the other form data, and can then be used to make sure the data on the form was submitted by the right person and not changed afterwards. Another aspect of auditability is tracing, i.e. the ability to follow the progress of a form through a workflow.

### *J. Mobile Devices*

With the growing popularity of smart phones, a forms system should be able to generate forms that can be used on mobile devices. Being able to fill in a form instantly on a mobile device, rather than having to resort to a paper form for lack of a normal computer helps to replace all the paper forms in an organization. If web forms are used appropriately, filling out forms on mobile devices is usually possible.

### K. Development Speed

The creation, deployment and maintenance of forms should be a quick process. This requirement is stated from a form creator's point of view. Satisfaction of this requirement can be evaluated analytically and experimentally, using a typical organization form. For each technology, given a form developer who is proficient in the technology, the form is created, changed according to a given specification, and deployed. The time for this is measured, and it is verified analytically that the time is representative of a technology's development speed.

### L. Ease of Creation

The creation, deployment and maintenance of forms should be easy. This is different from the previous requirement because previously we considered a user who is already proficient. This requirement looks at how easily non-proficient users can deal with a system, regardless of the speed with which tasks can be completed. Ease of use is one of the most important criteria for technology evaluation, and is one of the most important factors to affect the success of the technology in an organization. Even if an organization has a team of developers who are proficient with a technology, such teams are subject to change, and new team members will benefit if this requirement is satisfied.

### M. Required Training

A system should not require a disproportionately large amount of training for form creators. To assess this, we estimated the type and amount of training required for a non-proficient user to be able to create simple, basic form. This requirement and the requirements "Development Speed" and "Ease of Creation" evaluate the usability of a technology from the perspective of form developers. Generally, the technologies with rich functionality are hard to learn and use, and vice versa.

### N. Multi-Channel CRM Integration

In many organizations, forms serve as an interface to people outside of the organization. Such people often do not have the organizational knowledge required to understand the exact meaning of a form, and hence require some kind of support. There are systems for such support, customer relationship management (CRM) systems. CRM is an important concern of modern enterprises, and good CRM functionality is important to ensure a good quality of customer service. As a result, a form technology should be easily usable in the context of an end-user support environment, so that it can be integrated with some form of customer support. A technology with a high score for this requirement should be able to trace changes on a form, and easily show all other CRM information related to it.

### O. Questionnaire Style Surveys

A form system should support the creation and delivery of surveys, with randomised questions, multi-choice questions, and survey reporting. Nowadays, a survey is a common information collection tool in business operations. It is an efficient way to get relatively accurate feedback about a product or a service. However, the survey distribution and the survey result analysis and reporting often cost a lot of time and money.

### P. Deliverability

A forms system should be able to deliver forms using multiple channels (e.g. web, email). It should also be able to generate reports about form response rates. Multi-channel access ensures that users can access a form more easily, choosing the channel most convenient for them. This in turn accelerates the business operation cycle. Web browser compatibility is also part of this requirement, since a technology that cannot support all the common web browsers affects the delivery over the important web channel negatively.

## III. SAMPLE EVALUATION

In order to illustrate our evaluation approach, which is based on the requirements and assessment criteria outlined in the previous section, we performed an exemplary evaluation of 6 popular form technologies. Only three of the evaluations are presented here; more information can be found in [7]. Note that the intention of this evaluation is not to advocate any particular form technology. The form technologies are constantly changing and the requirements of different organizations vary, so organizations need to perform their own evaluations. Our approach serves as a guideline as to how this can be done.

A score in the range 0-5 is given for each of the aforementioned requirements. 0 is the lowest score and means the assessed technology is not able to provide any functionality related to the requirement. The highest score 5 means that the technology can fulfill the requirement easily.

### A. MS SharePoint 2010

SharePoint is an enterprise collaboration platform for the Web [9]. It consists of a collection of products and software elements that include web browser based collaboration functions, process management modules, search modules, and a document-management platform. Most of the integrated capabilities can be performed in a web based environment. SharePoint specifically focuses on document-centric workflows, i.e. the procedures that a particular document (including forms) goes through in its lifecycle.

Sharepoint illustrates two common problems of form technologies. First, there are several ways of implementing forms. Three different tools are offered – InfoPath, web parts, and simple web pages – each with their own features and limitations. This does not only complicate the evaluation

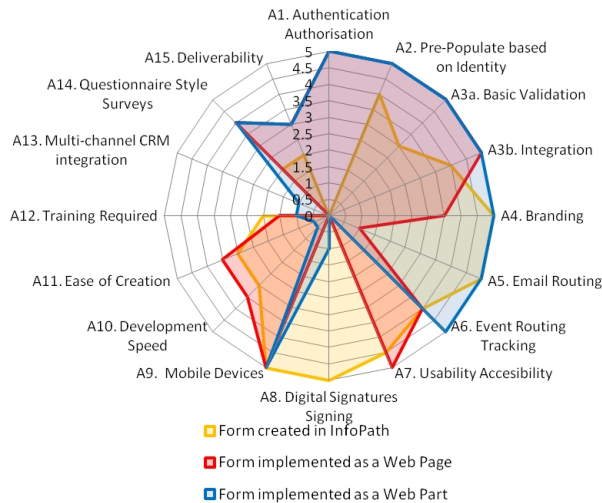


Figure 1. Evaluation results for different types of SharePoint forms.

process, but may also add complexity to the use of such a system. Secondly, if a form technology depends on many other products, there is the risk of vendor lock-in. That is, an organization may be drawn into a larger investment from the same vendor, and then depend on that vendor in the future for system maintenance. In the case of SharePoint, the system depends on technologies such as .NET, MS Office and the Windows OS. Exemplary Sharepoint evaluation scores are shown in the spider diagram in Figure 1.

### B. Jahia

Jahia is a web content management system (CMS). As an example, it shows the overlapping requirements of form technologies and CMS, which are both important enterprise applications. Having enterprise applications with overlapping but not identical requirements is a problem because it leads to redundancy, unnecessary complexity and additional maintenance cost.

Internally, Jahia can be thought of as a set of web pages that can be edited from within any web browser. Each web page is based on a template defining how information is presented on the page. As a CMS, Jahia is very good at satisfying the branding requirement, which is also an important requirement for CMS applications. However, the focus as a CMS means that it does not satisfy all the technical requirements, e.g. it cannot easily be integrated with a CRM application. For more advanced applications, time-consuming customization is necessary.

Exemplary evaluation results are shown in Figure 2. Jahia offers two different options to implement forms, and their individual evaluation results are shown as lines of different colors. Similar to Sharepoint, it becomes clear that such technological diversity makes it harder for decision makes to

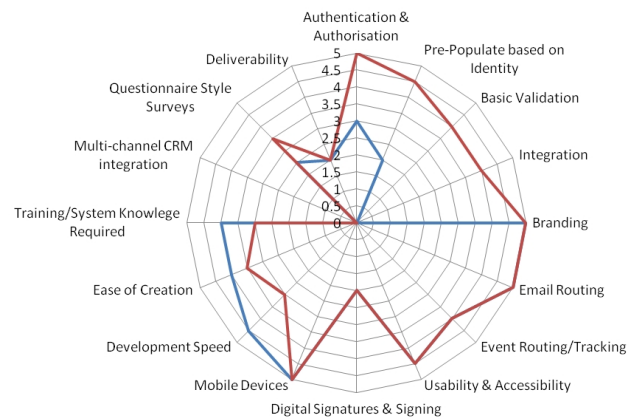


Figure 2. Evaluation results for Jahia forms (red) and templates (blue).

choose a technology: there is no single form implementation option that is superior with regards to all the requirements.

### C. Adobe Acrobat

Adobe Acrobat is a family of computer programs designed to view, create, manipulate and manage files in Adobe's Portable Document Format (PDF). Acrobat Reader is a freeware PDF file viewer that can open and view PDF files. Acrobat Professional offers many additional functions, and comes with LiveCycle Designer, which is a professional form designer tool.

Acrobat is an example of another type of technology that has overlapping requirements with forms: document technology. On the one hand, all forms are documents. On the other hand, document technologies typically have a focus on static content rather than content that can be manipulated, as in form fields.

As a result, Adobe Acrobat fulfils only some of the given requirements and misses out completely on others. For example, authentication and authorization functionality is almost non-existent. Subsequently, dependant functions such as identity based pre-population do not work as well, and there is hardly any support for automating business processes.

However, Adobe Acrobat also illustrates the strengths of document technology. Generally, PDF forms are easy to use by customers. Adobe forms contain the best function for digital signatures among all the evaluated form systems. The development speed and ease of creation of forms is fast and relatively simple.

Even if not widely adopted, Adobe forms are widely used among the university departments, especially when it comes to one-off or administration forms or forms that require digital signatures. The reason is that document technology such as PDF has become mainstream, and is therefore an obvious simple ad hoc solution. However, if forms require processing or extensive management, a more powerful systems needs to

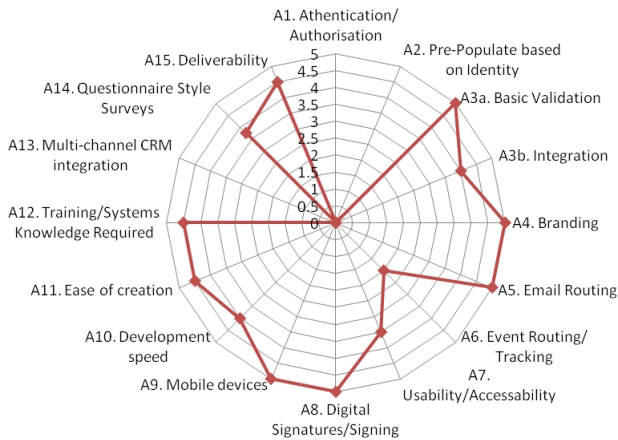


Figure 3. Evaluation results for Adobe Acrobat forms.

be used. Exemplary evaluation results are shown in Figure 3.

#### IV. DISCUSSION

Interestingly, there is no single technology that satisfies all the requirements. For example, digital signing or auditing seems to be hardly supported by form systems at the moment. However, many technologies contain much more business functions apart from those for electronic forms. This shows that most business software nowadays intends to cover a large range of business activity needs, and hence address a larger market.

The more specialized areas of enterprise software have become blurred, which has two consequences. First, many businesses spend large amounts of money to buy software, but only use part of their functionality. Secondly, in order to utilize software, most businesses have to adapt the software and/or themselves. Most large organizations, such as the University of Auckland, are using several systems that provide electronic forms. Replacing all these systems with one incurs software and training costs.

The integration of different enterprise systems remains an important issue, particularly when it comes to cross-cutting technologies such as those for forms. Standardization efforts would help to mitigate these issues, e.g. an industry standard for the exchange and processing of electronic forms.

Our exemplary evaluation highlighted some of the problems of form technologies. First, the power to customize and integrate a system comes at the cost of additional complexity. As with most complex systems, implementing desirable functionalities using complex enterprise platforms is a time-consuming task and requires a high level of IT skills. Simpler systems are generally easier to use, but are more limited in their functionality. Second, as a crosscutting concern, form technology can be found in many applications, such as CMS, document applications, BPM and CRM. However, these applications do not have forms as their sole

focus. Hence, it is hard to find a system that satisfies all the important requirements of form technology.

#### V. CONCLUSIONS

Forms are one of the most common media in business activities. There are a number of common requirements for electronic forms, which were discussed in Section II. The importance of individual requirements varies between organizations, and particularly smaller organizations may have fewer requirements. Our results show that it is hard to find a form technology that fulfills all common requirements, that there is a tension between ease of use and power, and that there are many applications that satisfy some of the requirements while having a different overall focus. This means it may still be better for large organizations to use more than one technology for electronic forms.

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