ENTERPRISE CONTENT MANAGEMENT IN THE CLOUD

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Abstract

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At present the attention of many organizations concentrates to the Enterprise Content Management system (ECM). Unstructured content grows exponentially, and Enterprise Content Management system helps to capture, store, manage, integrate and deliver all forms of content across the company. Today, decision makers have possibility to move ECM systems to the cloud and take advantages of cloud computing. Cloud solution can provide a crucial competitive advantage. For example, it can reduce fixed IT department cost and ensure faster ECM implementation.
To achieve the maximum level of benefits from implementation of ECM in the cloud it is important to understand all possibilities and actions during the implementation. In this paper, the general model of the ECM implementation in the cloud is proposed and described.
The risk may relate to all aspects of the implementation, such as cost, schedule or quality. This is the reason why the introduced model places emphasize on risk. The aim of the article is to identify risks of the ECM implementation in the cloud and quantify the impact of risk. The article is focused on the Monte Carlo method. Monte Carlo method is a technique that uses random numbers and probability to solve problems. Based on interviews with an IT managers there is created an example of possible scenarios and the risk is evaluated using the Monte Carlo method.

ECM, cloud, risk, Monte Carlo

The term ECM is the abbreviation for Enterprise Content Management. ECM covers many areas such as document management, web content management (including web portal), record management or business process management. Key features of ECM systems are capturing, storing, managing, indexing, preserving and retrieving all forms of content across the company.

Many companies find ECM systems very expensive and difficult to implement. Instead of developing, maintaining and running an ECM system in-house it is possible to access everything through the web, use cloud computing. Assigning tasks related to ECM such as document management, archiving or workflow to a remote location allows organizations to focus their time and resources on business activities. A key benefit is the ability to rent computing services from a third-party provider. Hardware or software resources are consumed as a service and are billed on a subscription basis.

Cloud content management becomes an inevitable solution for many companies. According to new research the Association of Information and Image Management, 46% respondents consider that document and content management applications will be cloud by choice within 3 years (AIIM, 2012).

Almost any change, good or bad, means some risk. It is necessary to identify the risks and quantify them. Cloud ECM projects usually start with enthusiasm to save on costs and increase user productivity. The projects fail very often. The described model and list of risks can help IT manager to avoid the fiasco.

Therefore the aim of this article is to present a development model for Cloud ECM. It is completed by a list of risks. Risks are categorized according phases of the model. To present the results of this paper, the format of a single illustrative case study is chosen. Case study is based on interviews with IT managers.

METHODS AND RESOURCES

The aim of this paper is to design an appropriate Cloud ECM development process. The first step is the literature review and it obtains the necessary knowledge of the concepts. Information from several surveys and studies is used as the start point of the analysis. All the sources used in this article are listed in the bibliography section at the back of the article.

Several authors have presented and evaluated models for implementing software but there is lack of knowledge concerning Cloud ECM development from the perspective of organizations. The presented model is based on the waterfall model. Waterfall model is defined as a model of the software development process in which all phases are substantially carried out in a specified order with no, or minimal iterations (Kadlec, 2004). The general model is adapted to ECM in the Cloud. The result is development model for Cloud ECM including seven phases. The specific risks for an implementation are classified in seven categories according the phases of this model.

For the purpose of this article it is used qualitative research in the form of a single case study. The case study is done for a leasing company. The company has implemented parts of the ECM system – Document Management System and Workflow Management System.

The risk analysis process for this study is intended to conduct sensitivity analysis. Sensitive analysis generally ranks the relative impact of each risk as a percentage of total cost uncertainty.
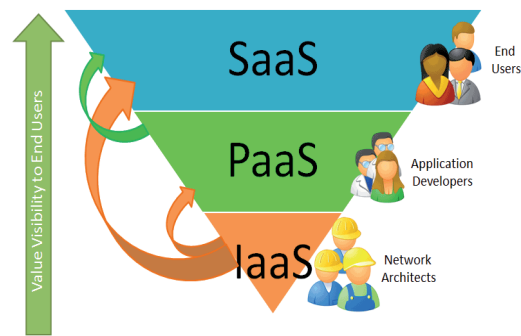
In the first stage initial cost are calculated and all risks are analyzed. Afterwards 13 risks, which have an initial cost risk level moderate or high, are evaluated in detail. Monte Carlo method is used for evaluation and is focused on initial costs. The Monte Carlo techniques are facilitated computationally by a commercially available risk analysis software package Crystal Ball that is an add-in to Microsoft Excel.

The concept of cloud computing and the ECM system is discussed in following chapters.

Cloud Computing

Cloud computing can be defined as a new style of computing which can be dynamically scalable and seen as usual virtualized resources and services over the Internet (Furth, 2010). Cloud services can be categorized to three different services: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS) (Sun, Xiang, 2010).

In case of ECM system we should focus on SaaS model. In the SaaS model, software applications are offered as services on the Internet rather than as software packages to be purchased by individual customers (Nezhad, Stephenson, Singhal, 2009). The layers of cloud computing are in the picture bellow.

1:	*The layers of Cloud Computing Source (Schuller, 2008)*

Organizations today are implementing three primary delivery models for cloud: private, public and hybrid. In private clouds, IT activities or functions are provided "as a service," over an intranet, within the enterprise and behind the firewall of the organization. In public clouds, IT activities or functions are pro-vided "as a service" over the Internet. For hybrid clouds, internal and external service delivery methods are integrated, with activities or functions based on security requirements, criticality architecture and other established policies (IBM, 2010).

Cloud computing benefits

Any company has to think about advantages and disadvantages of cloud computing. The benefits of delivering ECM using cloud computing are discussed in many papers. For example Raihana (2012) describes lower deployment costs, easy and fast deployment and expansion.

Charan, Rao, Srinivas (2011) describe disadvantages. Cloud ECM systems may not align with current business needs and customization is not to be possible in every case. Pieces of data are stored on third party servers. The company has to agree with general upgrades and has to have constant connection to the Internet.

The biggest obstacle that survey respondents gave as inhibiting a move to the cloud is the perceived security risk (61%), followed by a lack of compliance standards (AIIM, 2012).

Enterprise Content Management

Formal definition of the ECM is for example offered by organization AIIM (2011). Enterprise Content Management (ECM) is the strategies, methods and tools used to capture, manage, store, preserve, and deliver content and documents related to organizational processes.

Kunstová (2009) presents that center of the ECM is Document Management System, because DMS system provides a central repository of documents and other types of data to other components within the ECM and other enterprise applications.

The key to a successful ECM system is the ability for users to find easily and quickly information within the repository. An effective metadata-based

ECM system enables users to search the information in a manner that is most logical to them. Metadata can be defined as "structured information about a document, data, or other information content". Examples of metadata are author, title, date of publication, access permissions, and so on.
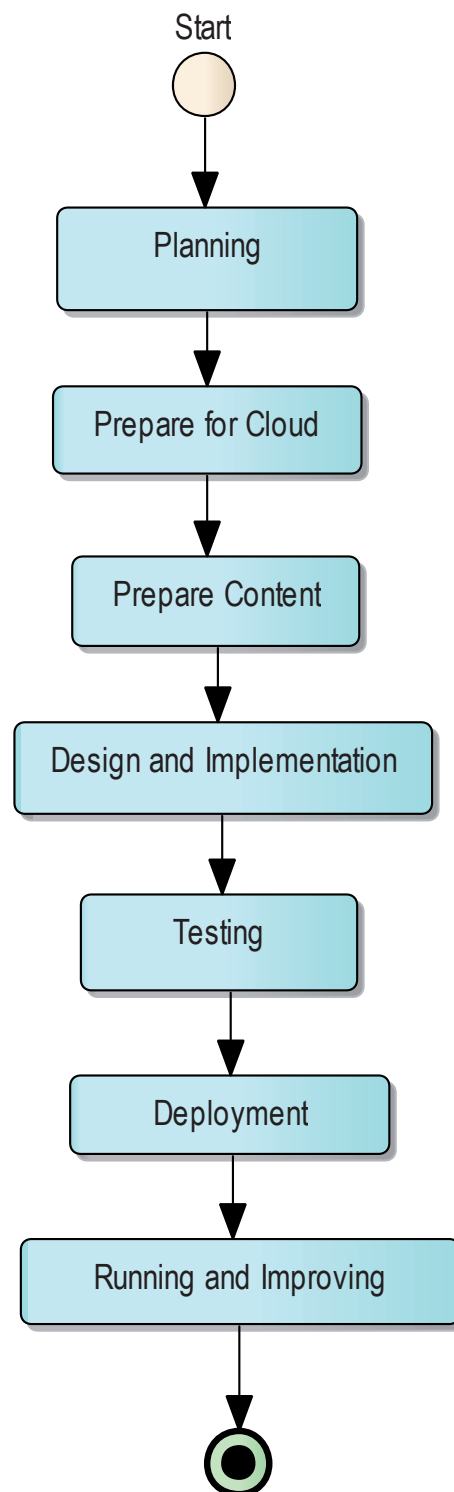
RESULTS

Software life cycle models describe phases of the software cycle and the order in which those phases are executed. There are tons of models, and many companies adopt their own, but all of them have very similar patterns. Each phase produces deliverables required by the next phase in the life cycle (Ragunath, Velmourougan, Davachelvan, Kayalvizhi, Ravimohan, 2010). The Cloud ECM development model is based on the waterfall model of the IBM Partner, Software Development Life Cycle, SDLC (Arcisphere Technologies, 2012). The SDLC model breaks delivering the system down into five phases: Planning, Design and Implementation, Testing, Deployment and Maintenance.

The general model is modified for ECM systems in the Cloud. The Cloud ECM model is divided to the seven generic phases. Two phases are added and the phase Maintenance is renamed. Each phase is described and completed by a list of risks. The model is in the Fig. 2, list of risks is in the Tab. I.

During the first stage Planning, the company's management team sets out detailed business requirements. The managers also determine acceptable levels of business risk and outline components of the budget and timeline. The next step wants the business analysts to determine the feature requirements, the business analysts create customer use cases with detailed scenarios of how the product is intended to be used and what problems the product will solve (Arcisphere Technologies, 2012). A list of vendors is created. At a minimum cloud service providers have to own certifications for ISO 27001 and Statements on Standards for Attestation Engagements (SSAE) No. 16, as this shows the provider is making investments in availability, security and performance levels (Columbus, 2012). Finally the project plan with deadlines for major milestones is created.

The phase Prepare for Cloud is focused on infrastructure. A review of the infrastructure has to be done. The company has to ensure that has enough bandwidth (Internet access) available to run application via the Cloud smoothly and quickly. It is important to reduce potential performance bottlenecks before they impact business operations. It has to be defined access to the back-end data even after the contract has finished. Some vendor form contracts expressly reserve the right to store customer data in any country in which they do business that is why legal condition has to be check.

During the phase Prepare Content the full content audit is made. The audit will list all content and

2: *Cloud ECM Model (Authors)*

indicate whether they are to be migrated, revised or deleted and how. The structure, metadata and content lifecycle have to be defined. It is useful to identify an owner for content that is migrated (The Agimo, 2012).

During the Design and Implementation phase the components of the ECM system are chosen,

the ECM system is designed and configured. If the cloud ECM vendors can provide a cloud platform to customize, then the development team begins code writing for each of the features specified by the business analysts. The contract and subscription agreement should be done before moving to the next phase.

After configuration the testing need to be carried out. The Deployment phase is the stage at which

the product is considered complete and released to customers, all content is migrated and users are trained.

After all the steps are done, the employees can use the Cloud ECM system. Subscription fees based on contract have to be paid. The company does not have to think about maintenance. That is why the phase is renamed as Running and Improving.

I: *Cloud ECM Model Risks (Authors)*

Cat.	Nr.	Risk Event	Authors
Planning			
	1	Development without top management commitment	Keil *et al.*, 1998
	2	Lack of user Involvement	Keil *et al.*, 1998
	3	Unclear business objectives	Chaos, 1995
	4	Unclear, continually changing requirements, no priority	Wallace *et al.*, 2004
	5	User department conflicts	Keil *et al.*, 1998
Prepare for Cloud			
	6	IT processes not evaluated, consolidated	Galonis, 2011
	7	Security	Vohradsky, 2012
	8	Legal problem	Vohradsky, 2012
	9	Poor Backup and Disaster Plan	Vohradsky, 2012
	10	Problem with Internet access, bandwidth	Vohradsky, 2012
Prepare Content			
	11	Content Owners not defined	The Agimo, 2004
	12	Content Audit not conduct	The Agimo, 2004
	13	Unclear or not defined structure, taxonomy, classification	The Agimo, 2004
	14	Process and ECM lifecycle not monitored	Interview
	15	Content Team not defined	Interview
Design and Implementation			
	16	Poor planning and control	Wallace *et al.*, 2004
	17	Incorrect technology, no customization	Vohradsky, 2012
	18	Service Level Agreement not clearly defined	Vohradsky, 2012
	19	Developing wrong user interface	Boehm 1991
Testing			
	20	Lack of cooperation from users	Interview
	21	Wrong Test Cases	Interview
	22	Testers lack specialized skills	Interview
	23	Lack of time for testing	Interview
Deployment			
	24	Lack of training	Basl, Blažíček, 2008
	25	Multiple content repositories and chaos	Interview
	26	Defined Process are not respected	Interview
	27	Change in initial conditions	Keil *et al.*, 1998
	28	Wrong or no migrations strategy	Interview
	29	Developing the wrong software functions	Addision, 2001
Running and Improving			
	30	Help desk processes are not defined	Galonis, 2011
	31	Change desk processes are not defined	Galonis, 2011
	32	Content approver is not defined	The Agimo, 2004
	33	Cloud Vendor has finished	Vohradsky, 2012

The cloud vendor monitors the performance and provides upgrade packages over a certain period.

There are many studies about software risk. Wallace, Keil and Rai (2004) defined 27 software risks which are classified into six dimensions. Keil, Cule, Lyytinen, Schmidt, (1998) tapped the experience of more than 40 software project managers from around the globe to identify a universal set of risk factors. Vohradsky (2012) is focused on Cloud risk.

The list of the Cloud ECM development risks is in the Tab. I. These risks are categorized according generic phases of the Cloud ECM model and are chosen according the literature review and interviews with IT managers.

Case Study

The leasing company has implemented Document Management System and Workflow Management System. The company has 150 employees.

At the beginning initial costs are calculated. It is used a trial cloud ECM version and subscription fees are not included. It is calculated with internal work only. The company has internal employees who conduct analyses, prepare design, configure the system and migrate content. The system customization is not needed. Employees have to collaborate and their time is calculated too. Initial costs are in the Tab. II.

After it a risk register is used for the case study. All the risks (Tab. I) are evaluated – initial cost likelihood, impact and risk levels are set up. The risk level is the resultant of likelihood and impact.
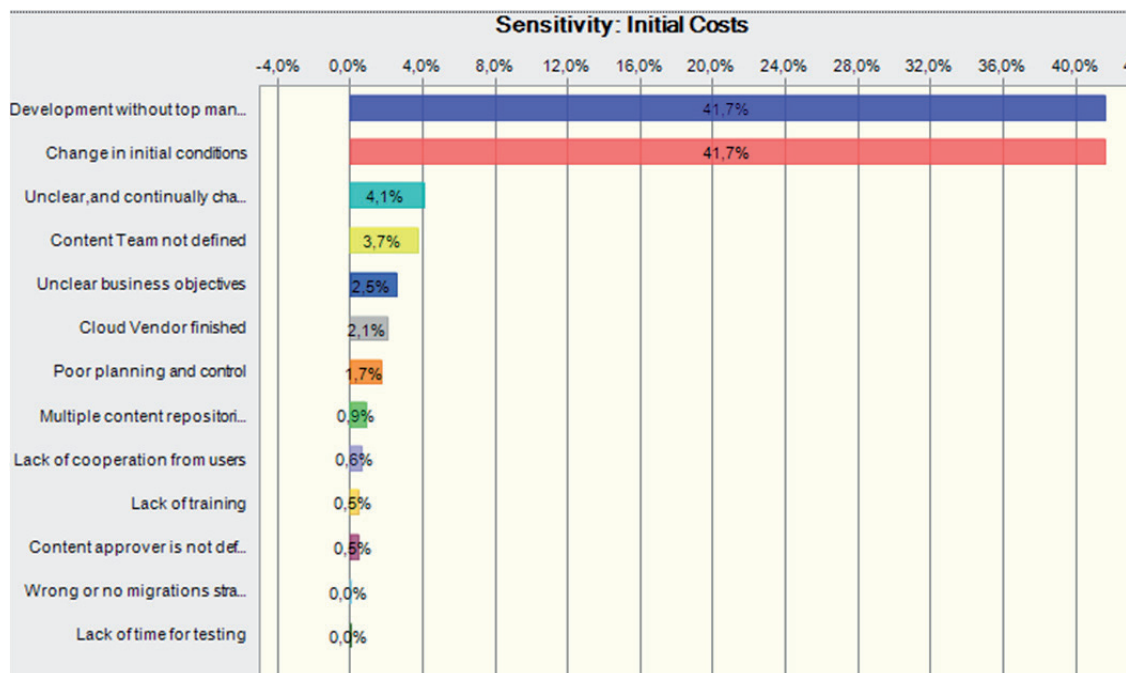
II: *Initial Costs (Authors)*

Phase	Cost [Euro]
Planning	28 800
Prepare Content	8 000
Prepare for Cloud	1 600
Design and Implementation	1 920
Testing	1 920
Deployment	8 800
Running and Improving	0
Sum	**51 040**

The risk analysis studies in detailed 13 risks with the high and moderate impact levels. The low impact level activities are not studied because of the minimal impact of the activities on the initial cost. The summary risk register is shown in Tab. III.

The 13 risks are analyzed using the low, most likely and high estimates for each risk item. The estimation is based on an IT manager estimation and experience and no dynamic effects are included. For regular and practical cases the triangular distribution with the threshold values Pessimistic, Most Likely and Optimistic is useful. Other continuous distributions, for instance rectangular distribution, beta distribution, normal distribution or uniform distribution, could be used in this context too. Many times, risk events have a correlation or relationship to one another. We assume no correlation or relationship in this case.

III: *Risk Register (Authors)*

Cat.	Nr.	Risk Event	Initial Cost		
			Likelihood	Impact	Risk Level
Planning					
	1	Development without top management commitment	Very Unlikely	Crisis	**High**
	3	Unclear business objectives	Unlikely	Critical	Moderate
	4	Unclear, continually changing requirements, no priority	Likely	Critical	**High**
Prepare Content					
	15	Content Team not defined	Unlikely	Critical	Moderate
Design and Implementation					
	16	Poor planning and control	Very Likely	Critical	**High**
Testing					
	20	Lack of cooperation from users	Very Likely	Significant	**High**
	23	Lack of time for testing	Likely	Marginal	Moderate
Deployment					
	24	Lack of training	Likely	Significant	Moderate
	25	Multiple content repositories and chaos	Likely	Significant	Moderate
	27	Change in initial conditions	Unlikely	Crisis	**High**
	28	Wrong or no migrations strategy	Likely	Marginal	Moderate
Running and Improving					
	32	Content approver is not defined	Likely	Marginal	Moderate
	33	Cloud Vendor has finished	Unlikely	Critical	Moderate

3: *Sensitive Chart (Authors)*

Risk factors are entered into the Crystal Ball software to conduct a Monte Carlo simulation. In this example 10000 iterations are used. The cost sensitivity chart is shown in Fig. 3.

The sensitivity chart shows the influence of each risk items on the resulting initial cost. The risk items are ranked according to their importance to the initial cost. As shown in the Initial Cost Sensitivity Chart, the Development without top management and the Change in initial conditions have the most influence on the initial costs.

DISCUSSION

We analyze and survey several information resources. Our objective in this work is to prepare the general model of ECM cloud implementation, describe phases and create a list of risks for each phase.

The strength and weakness of the presented model are discussed. The main strength of this model is that it is focused on ECM in the Cloud and risks are categorized according the phases of the model. For the future, it is suggested that each phase of the model is studied in more detail and that further evidence is provided. The paper is based only on literature and interviews with IT managers. Recommendations for the future research are to create a questionnaire and send it to companies where the ECM system is in place, or is implemented. Questionnaire should determine the greatest risks in ECM Cloud implementation and find out hidden costs of it.

The case study for a leasing company is focused on initial cost, risk and sensitive analysis. A parallel process can also be used to determine the probability of various project schedule duration outcomes and quantify the required cost and schedule contingency (float).

The company should also include the possibility of deployment without cloud. Cost analysis helps decide whether to go ahead with moving a particular application to the cloud or not from a return on investment perspective. Cost should include capital expenditure, operational expenditure, and the overhead costs involved with migration.

SUMMARY

Enterprise Content Management provides a platform for secure management of all structured and unstructured content across the enterprise. Seeing the benefits of "renting" software, corporations are increasingly using content management in the cloud.

Based on the results of a literature study, we proposed a Cloud ECM model with a list of potential risks. All risks from the list have been categorized to the ECM cloud model's phases.

The case study is done for a leasing company and is focused on risk analysis. The Monte Carlo simulation is used.

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