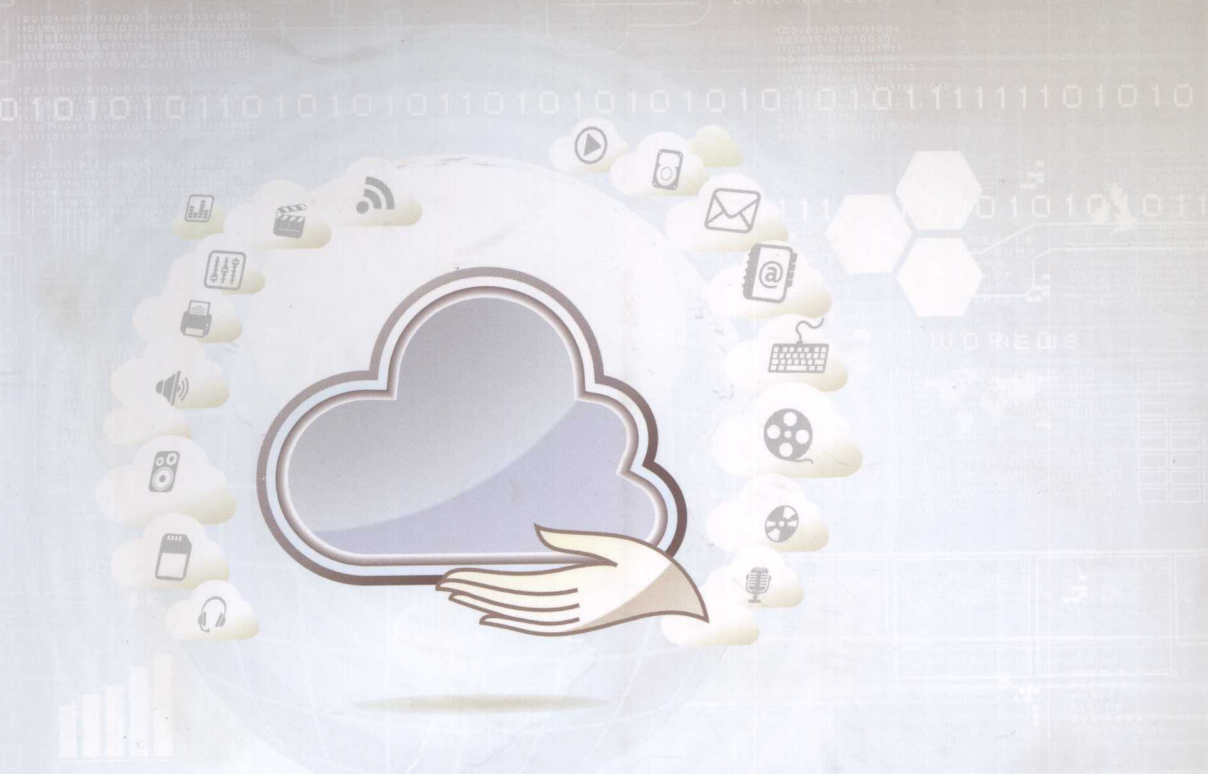

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电子文件管理的实现机理

The Realization Mechanism of Electronic Records Management in Cloud Computing Environment

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序

“走前人没有走过的路”，这是一句我们熟悉的话，也是一个真正知易行难的道理，做事如此，做学问亦是。这样的路上有很多不确定性，包括意想不到的风险和无人领略的风光，走下去可能会磕磕绊绊，又或是天地一新。攻读博士学位、做学问、做事业应该有这种勇气，这种精神，哪怕迷路摔倒，也算是不枉走这一遭。

薛四新是个不大“安分”且执著的人，她喜欢不断挑战自己，踩踏新路。未曾谋面时就知她学技术出身，活跃在档案信息化领域，做项目，写文章出书，研发档案管理系统，技术和管理的结合使她成果不断，她领衔研发的高校人事档案管理和通用档案管理系统还很有些特色和影响。忽一天收她邮件要报考博士研究生，并不知已有研究馆员能力的她为什么还要给自己的生活如此加码。交流后得知，她想把关注点转向电子文件管理，用几年时间系统学习，夯实功底。

四新在职攻读博士学位，双重压力可想而知。她起早摸黑搭上周末兼顾两头，修了不少课，读了不少书，还乐此不疲地参与、张罗了几个研究项目，努力把理论和实践结合起来。其中最值得一提的是，她主持筹建了全国唯一具有国家级资质的电子文件系统测试中心，这对规范我国电子文件管理系统功能非常重要。此前中国没人知道这事该怎么做，从哪儿做起，怎样才能完成对管理系统与国家标准规定的数百条功能需求的符合性测试。四新带着几个年轻人啃了不少中外资料，经历了许多艰辛困难，曲曲直直走了很长的路，终于获得国家认监委认证通过。在这个过程中，对系统研发技术和电子文件管理的双重理解给了她很大助力，不达目的不罢休的倔强更是她坚定前行的支撑。她的团队和国家标准研制团队以及系统研发人员深度切磋，对电子文件管理系统功能需求及实现

方式理解得越来越深，越来越丰富。

四新若以系统测试为题做博士学位论文，应该轻车熟路一些，但她又一次给自己下了战书，选择“云计算环境下电子文件管理的实现机理”为题。她认为云计算引领的技术环境变迁是电子文件管理无法回避的新挑战，也必将变革电子文件管理的取向，为其带来很多新机遇，非常值得研究。但是，在专业圈内对云技术应用可行性还说不清楚，全世界也还没有成熟做法，以此为题做学位论文肯定是有风险的，这于我也是挑战。一位很有经验的博士生导师说得对，导师经常要跟着学生跑，因为每个学生的选题不同，总会跳出你的知识范围。对于云计算，那时我只知道一点概念，对如何应用于电子文件管理充满未知和疑惑。从开题到写作，我和四新一起学习一起讨论，逐渐随着她进入了这片云世界。

这本书的主要特点和贡献在于前沿技术与专业需求的对接。现在云计算平台管理专家已不为稀，但他们极少知晓电子文件管理的特点和要求，无法在这个平台上设计规划电子文件管理工作，而文件管理机构和专家又不甚了解云计算技术及其实施方法，平台和应用之间的隔膜阻碍了二者的结合。如贝弗里奇所言，“独创常常在于发现两个或两人以上研究对象或设想之间的联系或相似之点”，四新以其较强的技术背景和专业理解，尝试着打破这层隔膜，寻找二者之间的联系，比较系统地探讨了云计算环境中电子文件管理的变革，勾画出云计算平台上电子文件管理的新图景。

薛四新写这本书的思维逻辑是：电子文件管理实践需要管理与技术的高度融合；管理与技术的融合程度依赖于系统实现方法的科学性；系统实现方法论的建立需要明确管理活动的基本原理。于是，她从分析原理入手，寻找科学可行的方法，支持管理与技术的融合，从而有了从对象、工具和运作的三层视角，探讨如何借助于云计算的存储能力、技术架构和运营模式，改造和完善电子文件管理的研究框架，目标是达到对电子文件在云计算环境下的可视、可控、可用和可存，使管理活动更加低成本、高效率，促进电子文件管理国家战略与云计算并肩落地实施。

与很多学位论文专注于概念与原则推演不同，本书直言其技术实现的微观视角，直触对象的模型构建、系统的技术框架、功能实现的原理方法等“硬问题”，力求研究结论可操作、可实现、有效果。在对象层，她设计了构建“凭证件”和“信

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息件”双层模型的技术方法，为电子文件管理系统的信息建模提供了方法论支持，以期满足电子文件有效利用与长期保存的双重要求。在工具层，她从电子文件管理的业务连续性出发，以协同管理理论为支撑，提出改变现有文件、档案管理系统的构建逻辑，在云计算平台上用基于组件的功能装配和应需定制的服务模式对文件形成、维护、持续保存和知识化利用等功能实行一体化系统部署的构想，把全程管理、集成管理等理念变成可实现的技术架构。在运作层，她从优化电子文件管理空间布局的视域扩展了云环境中 IT 技术的共享格局，基于云计算的 IT 集约化服务能力，设计了以云电子文件服务中心，实行专业化技术支持、虚拟化管理、低成本运作、集约化运营的服务机制，探索全国或区域性电子文件管理组织的变革之道。

书中的一系列开创性构想让我感到了“云”的高远与广阔，云计算技术改变电子文件管理的巨大空间。如果这些设想全部或部分得以实现，未来的文件、档案管理与传统格局、现实格局都将不可同日而语。这就是探路的价值，超越的意义。赫胥黎说，“大凡实际接触过科学研究的人都知道，不肯超越事实的人很少会有成就”，超越事实就是不循旧轨，拓荒开路，如此做研究需要勇气、志气和担当，也需要眼光、积淀和功力。这样的超越令人欣喜和期待。

冯惠玲

2013 年 9 月 9 日

前　言

学科理论的推陈出新，信息技术的更新换代，国家战略的与时俱进，都给电子文件管理的业务实践提供了方法论的支持。方法论作为人类认识世界和改造世界的一般方法、规则与程序，具有规律性、指导性和可复制性，它的研究需要将技术、管理、业务和时代背景紧密结合，才能用于指导实践。

当今社会，云计算引领信息与通信技术发展新态势、构筑网络信息环境新生态，带来了新一轮的变革、进化与发展的良好时机。本书将电子文件及其管理问题置于云计算生态环境中，从当前电子文件管理实际工作中存在的三大难题入手，即信息系统中电子文件对象鉴识艰难、电子文件管理系统质量不高、电子文件管理运作机制缺失，以电子文件管理学的基础理论、大管理学的权变管理思想、经济管理学的优势聚集学说和协同管理信息系统的柔性构建方法为理论支撑，以云生态环境的新技术、新架构、新模式为技术支撑，综合运用文献综述、实际调查、比较分析、辩证推理、归纳总结和实证研究等方法，分析云计算带给电子文件管理的新思维、新取向、新原理和新方法，研究云生态环境中电子文件对象模型的构造原理、电子文件管理系统的实现机理、电子文件管理模式的运行机制，为在云计算环境下全面实现电子文件的科学管理提供思路、方法和机制。

一、研究内容

（一）云计算对电子文件管理的影响。从云计算产生的背景与发展趋势出发，分析云计算构筑的生态环境特点及其带给电子文件管理的新机遇和新变化，提出在云生态系统中电子文件管理研究的新取向，确定本书研究的内容和重点，即电子文件对象的模型构建、电子文件系统的柔性构建和电子文件管理的运作机制三个层面的原理和方法。

（二）基于云存储的电子文件对象模型的构建原理。分析采用云存储支撑电子文件对象层统一信息建模的特点和优势，针对电子文件长期保存和有效利用的管理双诉求，提出电子文件信息构建的“双层模型”，分析其理论基础、支撑技术、实现原理和构建动因，研究双层模型之间的相互关系、工作原理和同步机制，并对双层模型中“凭证件”的信息构建方法进行深层次的分析和研究，提出具有凭证性保障功能的电子文件身份证的概念、研究其组成要素、构造原理、封装方法，分析其凭证性保障的工作原理和方法。

（三）基于云平台的电子文件系统的实现机理。梳理现有的电子文件管理系统及其发展的趋向，分析了云计算构筑的技术平台在服务型技术架构和优质技术聚合方面给信息管理系统带来的变革和影响，提出了云计算环境下建设电子文件管理服务平台的设想和平台，即服务的电子文件管理系统的实现方法；研究了电子文件管理服务平台的体系结构和构建原理；并在进一步分析电子文件系统建设的理论依据基础上，对电子文件管理服务平台的系统功能的分析方法、功能实现的柔性原理和系统部署的集成方法进行研究。

（四）基于云服务的电子文件管理的运作机制。从云计算的 IT 资源集约化建设、专业化管理和社会化服务等管理模式出发，研究云生态环境下电子文件管理的变化与特点，针对电子文件国家资源分层集中管理的趋同特点，提出建立云电子文件服务中心，并以管理学的权变管理思想，经济学的优势聚集学说、网络环境的虚拟组织理论为依据，分析在电子文件国家资源观念的指导下，建立云电子文件服务中心的依据、条件和动因，进而提出云电子文件服务中心的目标和功能，最后从组织形态、责任主体、管理模式和运作机制等方面研究了云电子文件服务中心的管理运作机制。

（五）案例分析和实证研究。以无纸化营业厅办公系统和区域型数字档案馆为应用案例，分析本书提出的电子文件双层模型、电子文件管理服务系统和电子文件管理服务中心在实际工作中的应用效果，验证本书提出的观点、原理、方法和机制的可行性和有效性。

二、研究特点

（一）变化导向的思维逻辑。云计算技术引领 ICT 领域发展的新趋向，电子文件管理国家战略指引电子文件管理的新行动，如何在新一轮变革的初期，洞

察变化的动向，并思考随之而来的新问题，研究具有理论发展和实践推动价值的新理论、新方法，是本书选题和研究的思维路径。

（二）技术实现的微观层级。从系统中电子文件对象的信息模型构建之微观层面出发，在审视现有系统中文件形成过程的信息获取、信息组织、信息存储与信息呈现等原理的基础上，结合电子文件的档案化管理要求（非结构化证据留存和持续价值保存）和信息化多元利用要求（结构化与半结构化的数据库应用模式和在线智能化分析）以及云计算环境下的可线性扩展存储空间之优势，提出云计算环境下电子文件“双层模型”的构建思路，分析其实现原理。

（三）学科融合的发展视角。电子文件的出现本身就是跨学科知识应用的结果，电子文件研究只从管理学角度研究是很难对实践工作产生有效的指导作用。本书从信息科学领域提出的用于解决海量数据存储与管理的云计算这一发展的新概念出发，研究云计算环境下电子文件管理的技术，以及技术发展对管理理论和方法提出的改进、变革的进化要求，旨在探讨新一轮信息技术支撑下电子文件管理实现的基本原理和运作模式。

三、创新与贡献

（一）提出构建电子文件“双层模型”的实现方法，满足电子文件利用与保存的管理双诉求，解决业务系统中电子文件形成后难以鉴识和获取的难题。本书提出在云存储技术支撑下可以考虑建立电子文件“双层模型”并实施同步管理，认为在电子文件形成之初就应构建“凭证件”和“信息件”，采用“双件套”并行存储方法解决实践工作中电子文件利用与保存的对立甚至是矛盾之问题；“信息件”用于文件生命周期的全程信息化乃至知识化利用，“凭证件”用于证据留存、历史参考以及长期保存，两者在电子文件全程管理各个重要节点保持元数据、内容和过程信息处理等方面的同步和一致；“凭证件”的全生命周期管理和维护从根本上解决了电子文件难以甚至无法从复杂技术环境下运行的业务系统中捕获和鉴定电子文件的难题。

（二）提出建设电子文件管理服务平台和功能系统，实现统一技术架构的电子文件管理的功能系统，解决因电子文件管理系统的异构性和孤岛式建设而造成的电子文件低质量管理的问题。本书通过研究云计算环境下的电子文件管理通用平台的体系结构、技术框架和构建原理，分析面向不同行业、不同管理阶段

的、基于平台即服务的电子文件管理系统的实施方法，提出适应当前社会分工的电子文件管理功能系统一体化集成构建和实现方式。这对于云生态环境下电子文件管理系统的工程实现具有重要的指导作用和参考价值。

（三）提出构建电子文件管理服务中心，促进电子文件管理运作机制的创新与变革，解决电子文件管理实践工作中因难以应对专业强、变革快的信息技术而引发的安全风险和技术保护等问题。云计算的 IT 集约化服务运营模式为电子文件管理的扁平、集中和低成本运行提供了技术支持和运营模式，现有社会分工体制和文件管理格局大大增加电子文件的管理成本，阻碍电子文件科学管理方法的实施和运用，本书提出的服务型电子文件中心的建设将充分利用云计算的这一专业运营及其管理模式，为实现电子文件的专业化、精细化和集约化管理提供了可持续发展的思路、方法和路径。

四、研究展望

本书的研究力图通过技术、管理、业务和运作等多个层面的深度融合、相互渗透与集成的角度，研究解决电子文件管理的方法论问题，这是对当前电子文件管理局限于制度规范、管理要求和系统功能描述等宏观与中观层面研究的一种深化，这一研究对于电子文件管理学科研究内容的拓展、软件工程的开展和管理实践的操作等都具有一定的促进作用和参考价值。未来作者将在此基础上，对电子文件管理实现方法的系统化研究和双层模型在多种格式文件对象模型的构建方面加大研究的力度，为云计算环境下电子文件管理的实现提供科学的、可操作的思路、方法和机制。

薛四新于清华园

2013 年 8 月 28 日

Abstract

The innovation of discipline theory, upgrading of information technology and development of the national strategy have provided support in methodology for the business practice of electronic records management. The practice has proved that the universal problem of electronic records management could be solved only by integration of technology, management, business and system.

In today's society, cloud computing leads the development and evolution of ICT to a new situation. It constructs a new ecological information environment and brings a new opportunity for reform, evolution and development to the ICT field. This paper puts the electronic records management into the cloud computing ecological background, and starts from three major problems existing in the actual work of the current electronic records management system, namely how to appraise electronic records in computing system, how to implement electronic records management system and how to make electronic records management mechanism operating smoothly. Based on the basic theory of electronic management, theory of contingency management and the advantages aggregation theory of economic management, this paper propose the research perspective of new features and changes of cloud ecological environment. Besides, lots of research method, such as literature review, investigation, comparative analysis, dialectical reasoning, summarization and empirical research method are used synthetically in this paper. What's more, this paper analyzes the new thinking styles, new

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orientation, new theory and new method, studies the system of electronic records ontology model structure principle, electronic records management system realization mechanism and electronic records management in cloud computing environment.

Ⅰ. The main research content of this book includes the following five respects

(ⅰ) The influence that cloud computing brings to the electronic records management

This paper starts from the background and development trends of cloud computing, analyzes the new opportunities and changes that the ecological features of cloud computing brings to the electronic records management, puts forward the new orientation of the electronic records management research in the cloud ecological system, and determines the contents and focus of this paper, namely electronic records object model building, electronic records system's flexible construction and electronic records management operation mechanism, these three levels of the principle.

(ⅱ) Electronic records object model construction principle based on cloud storage

This book analyzes the features and advantages of electronic records object layer unified object modeling supported by cloud storage, puts forward the electronic records object construction of double-layer information model, analyzes the theory, supporting technology, principle and construction motivation, and studies the relationship, working principles and synchronous mechanism between the double-layer model. Besides, the paper makes a deep analysis and research of the information architecture method of the pieces of evidence of the double-layer model construction. It also proposes the concept of the certification of the electronic records ID card studies the elements, the fundamentals of the structure, the encapsulation principle, and its working principle of certification and security.

(ⅲ) Electronic records system implementation mechanism based on cloud service model

Combing existing electronic records management systems and their development trends, this paper analyzes the aspects of change and impact brought by the technology platform built by cloud computing in terms of service-oriented architecture and high-quality technology polymerization, puts forward the idea of a new electronic records management system to explore theoretical basis for its implementation, and then from the electronic records management, business continuity management object through consistency and certificate management process supportability three angles affecting the electronic records lifecycle management, makes a depth analysis of the technical architecture of the electronic management system in the cloud computing environment, the key technology and flexible construction principle proposed integrated lateral one and the vertical integration of electronic records management system building ideas.

(ⅳ) Electronic records system management operation mechanism based on cloud service model

This book focuses on the new model that cloud computing formats in IT management field and organizational changes in IT applications and deployment characteristics, analyzes the basic characteristics of the electronic records management practice in the ecological environment in the cloud, puts forward electronic records management form of virtual organizations and its operating mechanism, and takes the regional digital archives building in Beijing as an example to explore the operating mechanism that traditional entity archives in developing electronic archives management in the cloud management mode.

(ⅴ) Case study and Empirical research

Taking paperless office system of digital archives system of Beijing as a practical application case, this paper analyzes the proposed electronic records information model of double-layer construction, flexible electronic records

system construction and operation of the electronic records service mechanism feasibility and the actual effects in practice. This paper aims at verifying the feasibility and effectiveness of its views and achievements, analyzing the problems that may arise, and follow-up studies to expand.

Ⅱ. The research characteristics of this book

(ⅰ) The logical thinking of change-oriented

Cloud computing leads the new pattern of development trend of ICT field, the national strategic principle for electronic records management guide the new action in electronic records management practice, how to seize the opportunity in the early phase of change, reflect on the new issues needed to be studied, and how to explore the new content which has both theoretical and practical value, these are the thinking paths of this paper.

(ⅱ) The micro level of technical realization

The research starts from the forming mechanism and model construction of electronic records object in system, examines the existing system records in the formation process of information acquisition, information organization, information storage, and information presentation on the basis of the principle from the formation mechanism of the electronic records system and model building, combined with electronic records archive management requirements and Information diverse use requirements and cloud computing environments of unlimited storage space superiority, puts forwards the establishment and construction principle of a double-layer model of electronic records in the cloud computing environment.

(ⅲ) The development perspective of Multidisciplinary integration

The emergence of the electronic records itself is the result of interdisciplinary knowledge application, if the electronic records research only focus on management perspective study, it is difficult to achieve the desired results of practical guidance. This paper focuses on cloud computing, which is put forward in the information science field and used to solve massive data

storage and management, studies the technical realization of electronic records management in the cloud computing environment, as well as the requirements of the improvement of the technical development of management theory and methods, aims at exploring the electronic records management best practice mode in technical support.

Ⅲ. The innovations and contribution of this book include the following three respects

(ⅰ) This book first put forward the "double-layer model" to meet the double requirements of utilization and preservation of electronic records management and solve the problem of electronic records difficult to be identified and captured from the Heterogeneous information system. The paper puts forward that "double-layer" information model of electronic records can be designed and be managed synchronistically in the cloud ecosystem. It is an achievable utility model that the front point of the electronic records management control and full management thought could be realized in the support of cloud storage technical. In view of the two goals of electronic records management evidence retained and information use, as well as structured, semi-structured and unstructured mass of information storage capacity provided by cloud computing, it is put forward that the beginning of the formation of the electronic records can be considered to build the double-layer information model, called the "pieces of evidence" and "pieces of information" separately. The later can be used in the information even more educated in the lifecycle of records, and the former can be used for evidence, for historical reference, as well as for the long-term preservation.

(ⅱ) Puts forward the electronic records management platform and analysies the constructing methodology of functional electronic records system based on PaaS. It can help to solve the low quality problem of electronic records management resulted form the Heterogeneous information system. Technical architecture of cloud computing platform will support the functions

of electronic records management system penetration into the formation handling, archiving and utilization, long-term preservation and maintenance of all stages and at all levels, based on a distributed records system and its support management platform which will be the cornerstone of the electronic records management business system deployment, and horizontal integration system deployment process certificate secure electronic records object-oriented methods and archive-oriented back-end management of the vertically integrated centralized management system based on deployment.

(ⅲ) Puts forward to build a service-oriented center of electronic records to promote the innovation of the operating mechanism of electronic files' management. It can help to improve the electronic records management work in practice because it is difficult to deal with the professional, evolution, transformation of information technology and security caused by risks and technical protection problems. The IT intensive services' operation model of cloud computing provides a flat and intensive technological environment and management model for electronic records. The existing social system of labor and the pattern of records management increase the cost of electronic records management. The system and pattern also hinder the implementation and application of electronic records scientific management methods. In the cloud computing environment, it realizes the service mechanism of electronic records management operation. It is thought that the organizational system of electronic records management should be flat and intensive instead of level centralized. In order to ensure the sustainable development of electronic records management, the operation and maintenance of electronic records management system should change the path of self-sufficiency and toward to the professional service.

(ⅳ) The expansion and extension of electronic records management disciplines study scope are studied and should be caused for concern. This paper starts from the model's construction of records object. Then it expands to

architectural approach of electronic records system, the management of the system's related supporting resources and the conversion of the mangers' roles and so on. This paper puts forward new thoughts and methods on these aspects. It is generally agreed that cloud computing is a new kind, innovative technology structure and business model in the Information Technology field. However, cloud computing is defined in this paper, as a new wide kind of integrated management mode of IT assets (including hardware and software infrastructure, information resources and ICT talent). It achieves broad support for social functional activities by supporting all the network communications facilities, hardware and software infrastructure, storage devices, application software, and business process in business activities and overall management of the records information in system. This mode will change the entire ICT ecological environment, even trigger the structure changes of the social functions and the reallocation of tasks. This phenomenon will lead to the transformation of the study in the field of records management and the expansion of the study scope.

Ⅳ. The study limitations of this paper are shown in three aspects

(Ⅰ) From the respect of technology realization, this paper does not use a complete IT modeling method. It learns from an ERMS system in IT Company as much as possible, and provides recordsary evidence based on the proven and promotion mechanism, so it still needs the market acceptance.

(Ⅱ) In terms of research content, as the field of electronic records management is widely, the paper mainly chooses three critical tasks to study, it is difficult to cover everything, and cannot provide the ideas and methods of electronic records management in cloud computing environment.

(Ⅲ) In terms of the records types, this paper takes format/ page electronic records (Page-oriented), namely semi-structured electronic records for case to build "two-piece" information model, information building of audio and video files has not been involved.

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