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OVERVIEW

Cloud Computing is a specialised form of distributed computing that introduces utilization models for remotely provisioning scalable and measured resources (Erl & Mahmood, 2013). It provides an all-inclusive solution in which computing resources that reside in a cloud environment can be rapidly provisioned to develop and host applications for cloud users to consume. Initiated and backed by the big names in the industry such as Google, IBM and Microsoft, it is an attractive paradigm for commercial enterprises: large and small. Large enterprises can migrate their applications and data to the cloud environments to achieve the benefits of scalability, availability, distributing computing, virtualisation and reduction in capital expenditure; small organisations and start-up ventures can realize benefits by leasing cloud-based ready-made development environments and computing infrastructure on a pay-as-you-go basis; and general public can enjoy the use of cloud application such as email systems and storage space, which are often freely available. In this context, world governments that consist of several ministries, hundreds of departments and the entire population of citizens as the main stakeholders can be likened to a large and complex organisation. These can also benefit from the advantages that the cloud computing paradigm and the related technologies offer.

World governments, federal and local, have already embarked on the road to providing electronic government, also called e-government or Government 1.0, by using the information and communication technologies. Many governments have successfully achieved the highest levels of e-government maturity by providing services such as electronic voting and electronic participation of their citizens. However, with the emergence of cloud computing, Web 2.0, social media and mobile technologies, world governments have better opportunities to move forward to providing much more open and connected governments, ensuring that government services are more responsive and transparent (Mahmood, 2014).

Whereas, electronic government is about harnessing the information revolution to improve the lives of citizens and businesses and to improve the efficiency of the governments (Borras, 2004) and the use of Information and communication technology and new emerging technologies in public administrations combined with organisational change and new skills in order to improve public services and democratic processes and strengthen support to public policies (European Commission, 2003), connected government is another joint step where newer technologies (such as cloud computing, mobile and social media technologies) help to further enhance the interaction between the government and the governed (Mahmood, 2015). This also improves the transparency and openness of government’s functioning – a necessary requirement for a connected government. Using these newer technologies, as Logan (2013) states, a connected government, also referred to as c-government or Government 2.0, truly becomes a government in the hands of the citizens.
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In the more developed world, there are many governments, including the UK, the US, Australia, India, France and Germany, who have developed their own cloud environments, often referred to as Government Clouds, abbreviated as G-Cloud (Raj, 2015). Thus, these governments and their citizens are already reaping the benefits promised by the cloud computing paradigm. Advantages to the governments include: Better business process management; cost and time savings; more accurate and timely information; automation and process improvement, easy maintenance and upgrading of services; and seamless collaboration, vertically and horizontally, with other governmental departments. As discussed by Mahmood (2015), benefits to the citizens include: easy-to-use and on demand access to government e-services; online transactions e.g. payment of bills and filing tax returns; information reliability and ready availability of services around the clock; more accurate and timely information; opportunities for e-participation including e-voting; and citizen oriented decision making by the political leadership. When employing the cloud related technologies, government departments can usefully deploy the following approaches: SOA (service oriented architecture) for the construction of software for distributed computing, e-services and integration of software applications; IaaS (infrastructure-as-a-service) and PaaS (platform-as-a-service) as platforms for scalable software development; SaaS (software-as-a-service) for hosting and deployment of distributed applications and e-services; storage provision within the cloud environment for storage and backup of government and citizens’ personal data; cloud based protocols for privacy, confidentiality and security of data and applications; and Web 2.0, Social Media and mobile technologies to promote citizens’ electronic participation to achieve open and connected government.

In general, use of the Cloud Computing technologies can improve the performance, availability and reliability of government e-services. The virtualised and distributed nature of cloud environments can help governments to develop, maintain and host e-services more effectively. The underlying technologies can also help the citizens to self-provision e-services as and when they require. Web 2.0, Social Media and mobile technologies can further support the citizens to be more involved to ensure that the governments are open, responsive, answerable and more effective.

In this context, this book, Cloud Computing Technologies for Connected Government, considers the various dimensions of the connected government and connected electronic governance; and presents the prevailing situation in the form of status reports, development methodologies, practical examples, best practices, case studies and the latest research. Various chapters in the book discuss the benefits that the cloud computing paradigm promises for large enterprises including governments, and presents frameworks and methodologies for implementing the cloud related technologies to achieve better e-government and connected e-governance. The chapters of the book also present the mechanisms on how the citizens at large can consume services provided by a connected government using modern computing technologies including Web 2.0, social media and mobile networks. The present volume is a collection of 14 chapters authored by 32 academics of international fame and reputed industry practitioners from around the world. Hopefully, the book will serve as a reference text in the subject areas of connected government, connected electronic governance as well as the use of cloud computing and related emerging technologies for the provision of an open and transparent government.

BOOK OBJECTIVE

This book, Cloud Computing Technologies for Connected Government, aims to serve as a reference text, presenting frameworks and methodologies focused on the use of the Cloud Computing paradigm
and cloud related technologies, for the effective provision of connected government. The objective is to understand the use and effectiveness of such technologies and best practices that provide successful strategies towards developing an open and a truly connected government that is responsive to the needs of the general public; and is engaged in full electronic participation of the citizens to affect the political decision making. To this end, the current volume presents reports and discussions on the following:

- Current research and practice with respect to cloud related technologies for c-government
- Cloud related frameworks/strategies for successful implementation of c-government
- Barriers to c-government development because of limitations of cloud technologies
- Best practices, guidelines, recommendations and ideas based on successful case studies.

TARGET AUDIENCE

This volume, Cloud Computing Technologies for Connected Government, is a reference text aimed at several groups of readers, including the following:

- University students, lecturers and researchers interested in the field of Government 2.0, Web 2.0, social media and mobile technologies
- Information systems specialists, technology experts and practitioners in the field of ICT, Web 2.0, social media and e-government
- Decision makers and managers in government departments, public administration and the business sector, responsible for offering e-services using cloud-related technologies
- Project managers and information systems architects tasked with the development of e-services and management of connected government projects.

BOOK ORGANISATION

Cloud Computing Technologies for Connected Government is organised in four sections with a total of 14 chapters, authored by 32 academics and practitioners from around the world, as follows:

- **Section 1: Cloud Computing and Social Media for Connected Government.** There are four contributions in this section. The first chapter discusses cloud computing technologies and their deployment for c-government. The second chapter focuses on government clouds discussing Indian government’s efforts in some detail. The third contribution proposes a framework for the adoption of social media as communication channels for government agencies; and the next submission presents a case for empowering citizens through the use of cloud related technologies.
- **Section 2: Frameworks for Cloud Based Connected Government.** This section also has four chapters. The first of these provides a framework for open and connected governance; whereas the next chapter suggests a framework that utilises ITIL for the migration of e-government services’ provision to the cloud environment. The next contribution presents a cloud-based extensible identity management framework for e-government services. The final chapter in this section discusses the necessary requirements for electronic voting and proposes an architecture for a cloud-based e-voting system.
• **Section 3: Cloud Computing Applications for Connected Government.** This part of the book comprises three chapters. The first contribution explores the state of the art of cloud computing applications in the public sector and discusses implications and specific recommendations; the next chapter discusses such applications specifically for the education sector, considering the National e-Governance Plan initiative by the Indian government. The final submission proposes a layer-based architecture for a Web 2.0 open and collaborative platform for public service advertising.

• **Section 4: Issues and Benefits of Cloud Based Electronic Government.** This final section also consists of three chapters. The first contribution focuses on security and privacy issues and suggests the use of an information security management system to manage cloud-based e-government. The next chapter discusses legal issues surrounding c-government services and presents UK governments’ G-Cloud as a case study. The final contribution of this section, and the last chapter in the book, presents an analysis of costs versus benefits of deploying cloud computing technologies for c-government.

**CHAPTER DESCRIPTIONS**

Detailed abstracts of the book chapters appear in the *Detailed Table of Contents* section. Here, very brief summaries of the chapters’ content are presented.

**Chapter 1** is entitled *Cloud Computing Technologies for Open Connected Government*. Authored by Mahmood, it looks at the cloud computing paradigm and introduces the basic concepts and technology explaining the cloud delivery and deployment models. Then, discussing the concepts of electronic government, it presents the core requirements for the provision of open connected governance. The chapter also illustrates how cloud environment and cloud related technologies can help to improve the efficiency of electronic government to provide a more open, transparent and more efficient connected government.

**Chapter 2** is developed by Raj. Entitled *Significance of Clouds for Connected Governments: The Government Clouds in India*, this contribution presents a case on how the cloud paradigm is shaping up the unique requirements of connected governments. Presenting the significance of the emerging cloud paradigm, the author focuses on how the Government of India is investing in the cloud infrastructures to further promote the much-demanded transparency, accountability, openness, speed and sensitivity in the electronic and connected governance. Benefits of adoption of cloud related technologies are also illustrated.

**Chapter 3** is authored by ALotaibi, Ramachandran, Kor and Hosseinian-Far. Entitled *Adoption of Social Media as Communication Channels in Government Agencies*; it presents an extensive literature review of the use of social media as an effective communication channel between the governmental agencies and the citizens. The chapter proposes a framework taking into account the critical success factors that affect public agencies’ efforts while implementing social media. A list of hypotheses is also presented to validate and evaluate the significance of the factors considered; so that the decision makers are better informed of the inherent concerns and challenges.

**Chapter 4**, entitled *E-Government Initiatives through Cloud Computing: Empowering Citizens* and authored by Anshari and Almunawar, discusses empowerment of citizens in e-government perspective and presents a model for such empowerment to further enhance e-participation in e-government business.
processes using the cloud computing paradigm. The model is derived based on contemporary literature on empowerment and participation through government e-services. It is suggested that Web 2.0 related applications and social media can be effectively used to implement the e-participation of citizens and other stakeholders.

Chapter 5 is entitled A Cloud Based Framework for Connected Governance. Contributed by Mukherjee, Geethapriya and Surianarayanan, this chapter explains the importance of adopting the cloud paradigm for the connected governance and presents its benefits and challenges. As examples, the existing government clouds of Singapore and UK are discussed. The chapter also proposes a framework for connected governance and makes a case on how the cloud deployment and service models can be usefully adopted for connected governance and to enhance the openness, transparency and efficiency of the government e-services.

Chapter 6, entitled A Support Framework for the Migration of E-Government Services to the Cloud, is developed by Cardoso, Moreira and Simoes. Discussing the benefits of the migration of government e-services to the cloud environment, the authors present and recommend a support framework based on the extended ITIL (Information Technology Infrastructure Library) set of best practices. It is suggested that the proposed framework can be usefully deployed to assist in the process of migrating e-government services provision to the Cloud Computing environment. Specific examples of the use of the framework are also provided.

Chapter 7 is developed by Habiba, Anwar and Shibli. Entitled An Extensible Identity Management Framework for Cloud Based E-Government Systems, this contribution elaborates on the need to use the cloud related technologies to enhance the effectiveness and transparency of Identity Management (IdM) functions; and presents a complete working model of an Extensible IdM Framework for Cloud based e-government. A case study illustrating how the Government of Pakistan could use the proposed framework to improve their IdM processes and achieve diverse IdM services as part of their e-government provision.

Chapter 8 is authored by Posea, Ion, Pop, D Popescu and N Popescu. Entitled E-Vote: A Cloud-Based Electronic Voting System for Large Scale Election, this contribution discusses the requirements for an e-voting protocol, using various cryptographic primitives such as symmetric and asymmetric encryption, digital signatures, blind signatures and secret sharing; and proposes a framework for a cryptographic electronic voting scheme. Using the suggested framework, the authors demonstrate the suggested approach to effectively describe architecture of an e-voting system that can support a computationally secure and reliable voting process.

Chapter 9, contributed by Manzoor and entitled Cloud Computing Applications in the Public Sector, explores the state of the art of cloud computing applications in the public sector. The chapter begins with the concepts and technology of cloud computing. Discussing the cloud based governance models for the public sector; it presents examples of applications of cloud technologies in various spheres of public life, taken from other governments including USA, UK, EU, Japan, France, China and Pakistan. The aim is to discover some visible trends; and present implications and suggestions to replicate the recorded successes in other spheres of the public sector.

Chapter 10 is entitled Cloud Computing Applications in Education through E-Governance: An Indian Perspective. The authors, Sivagurunathan and Swasthimathi, focus on the cloud computing applications in the education sector of the public sphere. The chapter provides a model for e-governance in this sector, suggesting that the proposed model can facilitate improved transparency, speedy information dissemination, better administrative efficiency, enhanced quality of educational output in all aspects of the provision of education. Examples are given and practical recommendations are made.
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Chapter 11 is contributed by Pop, Echeverria, Petcu, and Conesa. Entitled Enabling Open and Collaborative Public Service Advertising through Cloud Technologies, this contribution has a focus on public service advertising. Looking at the design of next generation cloud-enabled advertising, a layer-based architecture of a Web 2.0 open and collaborative platform for public service advertising is proposed and validated using case studies from European countries. The enabling technologies are identified and a toolkit to help IT administrators and the deployment of such a system on hybrid cloud environments are also presented.

Chapter 12 is entitled Security and Privacy Issues in Cloud-Based E-Government. Developed by Susanto and Almunawar, it provides a discussion on security of cloud environments, one of the main concerns that the cloud consumers have. The chapter aims to discuss, first, how cloud computing can be deployed for e-government implementation to improve its efficiency; and then how this can be effectively achieved without compromising information security and privacy/confidentiality of data stored in the cloud environment. The chapter looks into the information security management systems (ISMS) and provides implementable recommendations.

Chapter 13, contributed by Kiran, is entitled Legal Issues Surrounding Connected Government Services: A Closer Look at G-Clouds. Here, the focus is on the mandatory legal requirements and the legal issues surrounding the deployment of e-services provided by the governments. Extensive literature review is presented and various relevant frameworks are discussed, in addition to the legal requirements and understanding of SLAs. The contribution uses the UK government’s G-Cloud as case study and example to illustrate the inherent concerns. A discussion on monitoring, management and resolution of the legal risks is also presented.

Chapter 14 is contributed by Chen and Almunawar. Entitled Cost Benefits of Cloud Computing for Connected Government, the chapter provides a detailed look at the benefits and limitation of the cloud computing paradigm; and presents an analysis of costs involved vs the benefits received by those who use cloud based technologies and services. NPV and TCO for cloud deployment are briefly discussed; ROI and hidden costs are discussed in detail; examples are also provided. The best practices are highlighted and a strategy for migration to the cloud is also given. The chapter is concluded with practical recommendations.

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REFERENCES


