

# Chapter 4

## Information Stewardship in Cloud Computing

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### ABSTRACT

*Cloud computing ecosystems of service providers and consumers will become a significant part of the way information services are provided, allowing more agile coalitions, cost savings and improved service delivery. Existing approaches to information security do not readily extend to this complex multi-party world. The authors argue for a mathematical model-based framework for the analysis and management of information stewardship that makes explicit both the expectations and responsibilities of cloud stakeholders and the design assumptions of systems. Such a framework supports integrated economic, technology, and behavioural analyses, so providing a basis for a better understanding of the interplay between preferences, policies, system design, regulations, and Service Level Agreements. The authors suggest approaches to constructing economic, technology, and behavioural models and discuss the challenges in integrating them.*

### 1. INTRODUCTION

Whether the goal is to reduce costs, increase efficiency, use the latest applications, engage with online experiences, or reduce risk, many consumers, businesses and governments alike want to take advantage of the latest devices, services and

infrastructural capabilities. As our online world becomes more interconnected, all of our lives are increasingly dependent on good stewardship of information systems and the services they support. Cloud computing ecosystems of service providers and consumers—including individuals, charitable and public bodies, SMEs, large enterprises, and governments—will become a significant part of the way these services are provided, allowing

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more agile coalitions, cost savings and improved service delivery. In Section 2 we outline the salient features of cloud computing.

Existing approaches to information security and privacy do not easily extend to this multi-party world and a step change in security attitudes and the way information stewardship is thought about will be essential. In the cloud, it will be harder to establish the risks and obligations, implement appropriate operational responses, and navigate the potentially inconsistent cross-jurisdiction requirements of multiple laws and regulations.

The notion of an information ecosystem is discussed at length in (Nardi & O'Day, 1999). We believe that it is necessary to establish principles for how to assess and manage risk for all the ecosystem: participants, regulators, and policy makers. In particular, we believe it will be necessary to understand how information about perceived attacks can be shared, interpreted, and acted upon in real time by other parties in the ecosystem — that is, principles of *information stewardship*. Without this there is a significant danger of leaving vulnerabilities and opportunities for the rapidly growing cyber-crime threat, and so inhibiting the effective deployment of cloud computing. In Section 3, we propose what we believe to be the key principles.

In order to facilitate such an analytic framework for designing and analyzing cloud services ecosystems and their stewardship régimes, we suggest it will be necessary to develop a rigorous modelling framework which captures, in appropriate forms, the critical components of the ecosystem—be they economic, technological, or user behaviour. We discuss these matters at length in Section 4.

In particular, we suggest that it will be necessary to integrate mathematical and economic models of single-organization systems, as described, for example, in (Collinson & Pym, 2009a; Collinson, Monahan & Pym, 2009; Beaument et al., 2008), in to the multi-party cloud setting, so providing a unified modelling and simulation framework of exposures, responsibilities, threats, defenses,

and incentives of the cloud stakeholders, that will be used to provide management tools for the prediction, communication and mitigation of risk to individuals and decision makers within SMEs, large enterprises, and governments.

## 2. CLOUD COMPUTING AND CLOUD SERVICES

Although many commentators still see cloud computing as more hype than substance, draft working definitions of cloud computing are beginning to emerge. The National Institute of Standards and Technology, Information Technology Laboratory, June 2009 (NIST 2009) propose:

*Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model promotes availability and is composed of five essential characteristics, three delivery models, and four deployment models.*

This characterization of cloud computing provides a useful starting point for a discussion of the challenges of information stewardship. It focuses on the relationship between users and the resources that are managed on behalf of the users to provide services.

The *characteristics* describe how users can gain access to services when they want (*on-demand self-service*), where they want and with whatever device is at hand (*ubiquitous network access*), take advantage of the fact, that because many others are using the same service, resources can be provided cheaply, quickly and in appropriate amounts (*location independent resource pooling*, and *rapid elasticity*), and understand what they have engaged with (*measured service*).

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