Chapter 101
Conducting Research in the Cloud

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ABSTRACT

Web 2.0 research is a term for research that uses Web platforms and tools for collaboration, communication, and knowledge generation by researchers who may be geographically dispersed. The new tools allow additional forms of synergistic collaborations between ad-hoc groups of researchers, crowdsourcing of new ideas, and to represent innovative platforms for sharing knowledge more rapidly. In parallel with these new research developments, cloud computing has emerged as a new way to provision and use IT resources to all types of computer users. With cloud computing, computer services are accessed over the Internet in a scalable fashion, and users are abstracted from the actual hardware and software, paying only for resources they use. This chapter discusses how current and future research will make use of cloud computing and how Web 2.0-based research models are transforming how research is conducted globally. It examines these new IT infrastructure models and explores how they can be deployed by organizations and individuals. It then discusses the benefits of cloud computing to the research enterprise and future directions for cloud computing-based research.

INTRODUCTION

Research is a $370 billion industry within the United States, affecting every sector of the economy. Given the large amounts spent on the research enterprise by the government, academia, and industry, there is continuing interest in the tools and infrastructures that can increase its effectiveness and efficiency. Academic research has changed little over the years. It typically involves the individual researcher laboring in isolation or with departmental colleagues to publish research articles and/or seek grant funding (Lee and Bozeman, 2005). The tools used by the majority of academic researchers have essentially stayed the same over the last few decades.

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The major tools used by researchers in business and the social sciences are the word processor, to produce articles; email for the exchange of electronic documents; electronic libraries for citations; and the telephone for discussion with collaborators – all tools that have changed little over the years. This form of research can be labeled Research 1.0 (Anandarajan, 2009).

To be sure, research in the sciences also makes use of specialized hardware for experimentation, but this fact is peripheral for the purposes of this chapter, which focuses exclusively on the technology used for research organization, documentation and communication. Research is therefore still a solitary practice, using basic computing technology and facing built-in limitations.

The limitations of the majority of current research fall into several categories, namely:

- **Limitations of reach:** Collaborations tend to be limited and local, usually with colleagues in the same department or college, due to social and institutional barriers that inhibit introduction to, and familiarity with researchers outside one's institution (Dedhia et al., 2008).
- **Limitations of research management:** E-libraries, telephone and email are the primary approach to today's research management. However, this basic form of research management makes little use of contemporary IT-based tools. Recent tools are providing additional research functionality to generate greater productivity among researchers.
- **Lack of research synergies:** The fact that most research papers are written either by individuals or in "*collaborations of convenience*" with local colleagues limits the synergies that can occur in better matched partnerships (Keraminiyage et al., 2009; Lee and Bozeman, 2005). Collaborations of convenience are those which occur simply because colleagues are in the same department or College and know each other. It stands to reason that more productive collaborations could be found if the pool of potential collaborators is vastly expanded (Suroweicki, 2005).

The Internet and the World Wide Web offer new possibilities to researchers, especially with the advent of Web 2.0 tools. The Internet, of course, enabled communications of increasing sophistication between users across the world, the most popular of which was and is, email.

The first iteration of websites, dubbed Web 1.0, featured unidirectional communication – essentially static information accessed by the website visitors. This was ideal for dissemination of corporate information, sales information, and products and services on offer (Deans, 2008).

Collaboration was possible and expanded somewhat in this era, using such tools as faxes, email, chat, threaded discussions in bulletin boards, online conferencing, and tracking in exchanged word processed documents.

However, Web 2.0 introduced new forms of websites with bi-directional communication, with websites containing mostly user-supplied content. This led directly to social networks, such as the notable Facebook, with over 600 million members, and Twitter, with 190 million members (Ganleya and Lampe, 2009).

In tandem, cloud computing has grown in popularity in the last decade, with large numbers of individuals and organizations making some use of cloud computing applications (Aberdeen Group, 2009). With cloud computing, applications are provisioned remotely across the Internet on a matrix of servers that are abstracted to the user. In effect, computing resources are provided in a similar way as electricity (Armbrust et al., 2010; Bristow et al., 2010; Brynjolfsson et al., 2010).

The key element in cloud computing is a software layer that abstracts user applications from the user while simultaneously provided the resources the applications need from a pool of resources.