

## Chapter 16

# Incremental Cross-Generation Versioning in Decomposable Internet Software Products: Opportunities for Knowledge Management in ISD

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*The most important factor distinguishing firms is the possession of knowledge, and the core differentiating skill is the ability to deploy that knowledge to their competitive advantage (Scott, 1998). Products of the turbulent information industries (Mendelson and Kraemer, 1998), especially those facilitated by the Internet, show the hitherto unseen promise of increasing returns. The flexibility to survive in turbulent technological environments, however, can only be achieved if positive feedback is not suppressed (Hall, 1997). This chapter examines incremental development and maintenance of software products designed to be used, delivered, and maintained through the Internet. Complex software products often go through a process of iterative evolution across several rapidly delivered versions, and the opportunities for knowledge management and application that arise in the midst of their evolution are discussed. We describe how both development and maintenance/upgrading of Internet software must be addressed in ways extending beyond traditional methods used for “traditional” information systems maintenance. Drawing on a diverse theory base, including information economics, emergence theory, and knowledge-based innovation, characteristics of Internet-based software applications are described; linkages between application modularity and decomposability with process knowledge are first explored; feasibility of managing component knowledge and renewing architectural knowledge is discussed; and finally, a conceptual model for managing process knowledge across generations and versions of decomposable applications to support software maintenance and evolution is presented.*

## CHARACTERISTICS OF INTERNET-BASED SOFTWARE APPLICATIONS

Internet software products exhibit several properties of conventional desktop software products—albeit less subtly—as well as several that are unique to this class of software (Iansiti and MacCormack, 1997). Software products delivered for use over public networks such as the Internet possess several characteristics, not all of which are common with their boxed equivalents. Each characteristic is discussed in further detail and summarized in Table 1.

The key characteristic distinguishing Internet-based software applications is their necessarily higher level of interoperability within the existing technological environment. Unlike traditional software products that run on standalone computers and are optimized for a particular, relatively stable operating system, these products depend on a complexly interwoven infrastructure to cooperatively function with other parts of the enterprise. To take a simple case, consider a Web-based site search application. This application might run on a Web server that is based on a particular operating system. This Web server must be accessible through a Web browser that might be running on a different operating system. Interactions occur through a protocol that is determined by an organization other than the one that might have developed the aforementioned components, which in turn depend on the network path provided by a networking service provider. Even though the software product may be located on a specific node on the network, the information system is constituted by the combination of several infrastructural components cooperatively and integratively distributed across the network. Unlike standalone software, changes in any one of these components might lead to loss of interoperability—and consequently operability.

The value of Internet-based software products to the consumer, much like Internet information products, is partially determined by their timeliness of delivery. Timely delivery encompasses two aspects: (1) the delay between a request initiated by the user and actual delivery of the product, and (2) cycle-time needed to deliver demanded functionality. This imposes two parallel constraints reflected in the need for faster development, upgrades, compressed time frames available for delivering new versions, and the need for optimizing over-the-network delivery time that takes available bandwidth into account.

Internet-based software products, like most products in the information industry, are characterized by a fast rate of change (Mendelson and Kraemer, 1998), as underlying technologies evolve rapidly, and often unpredictably (Davenport et al., 1996). Short product lifecycles, in turn, determine time-functional perishability of these products. Having to choose whether to optimize the application for one of multiple competing technological standards (e.g., W<sup>3</sup> Java versus Active Server pages) or to compromisingly ensure interoperability across conflicting standards; timing of commitments; and fundamental reservations about the nature, magnitude, and direction of shifts in consumer needs, create added market uncertainties and process instabilities both during development and during subsequent maintenance (Mullins and Sutherland, 1998; Shapiro and Varian, 1999).

Three broad categories of problems can be assimilated from extant literature: (1) distribution of work, (2) dynamic markets and unstable requirements, and (3) technological dynamism.

*1. Distribution of Work:* Software development teams are increasingly distributed, creating further challenges. As the wave of virtualization hits such engineering-oriented enterprises with full force (Rose, 1998), many aspects of the process that used to be implicit in organizational culture must then be supported and better explicated by enabling technol-

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