

# Chapter IV

## Extensible Digital Library Service Platform

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### ABSTRACT

*In this chapter, we describe X-system, a general digital library platform which is capable of handling large-scale digital contents with flexible, extensible management features. The development of X-system achieves several important goals of modern digital library systems, including a fully functional system, neutral and portable architecture, stackable modules, data exchange, and universal access. The model and architecture are discussed in this chapter. Moreover, several extension case studies of X-system are demonstrated to show the extensibility of our system. In addition, to act as a basic digital archive/library system, the X-system has been adopted as various different usages, including e-learning platform, knowledge management platform, and library circulation system.*

### INTRODUCTION

Advances in computer network and storage technologies have inspired the design of digital libraries in recent years. The emergence of digital libraries has introduced a number of important issues (Chen, Chen, Chen, & Hsiang, 2002; Chen,

Chen, & Chen, 2001; Dempsey & Heery, 1997). One issue that has not attracted much attention but is essential to digital library development is the flexible design of digital library systems. After the construction of a digital library, it is natural for the digital library to push the content circulation and application as much as possible

in order to show its maximum effect. Based on this point of view, it is important to design a suitable architecture to support flexible contents management and fast service development. For the flexible contents management aspect, it is known that if a closed data storage system is adopted, the circulation of digital library contents decreases. So the data model and storage with high portability is necessary for easy data access and manipulation. For the fast service development aspect, it is more competitive for a system architecture with stackable service features to develop digital library services according to different information needs. If a digital library system meets the requirements of both flexible contents management and fast service development, it is more likely to create many kinds of information service based on it. The evolving trend of digital library technologies contains several issues: (1) from closed system to open system; (2) from table-based schema to extensible markup language (XML)-based data model; (3) from modular or object-oriented design to component-based design; and (4) from single purpose (digital archive) only to multipurpose scenario. In this chapter, we introduce X-system (Yeh & Chen, 2003), a general digital library platform which is capable of handling large-scale digital contents with flexible, extensible management features.

## **DESIGN ISSUES OF DIGITAL LIBRARY SYSTEMS**

As mentioned earlier, the most important features of a modern digital library system are flexibility and generality. Since 2003, the year of X-system's announcement, several extensions and applications have been developed and deployed. The aim of our research is to create a powerful digital library system which meets the following important design issues:

1. **Fully functional digital library system:** The design of X-system aims at handling multiple metadata formats which meet the needs of various digital content applications. For example, digital archive systems, knowledge management systems, and e-learning systems all require various kinds of metadata coexisting in a repository system. So the ability of handling various metadata formats becomes a fundamental requirement of digital library systems. This is also one of the basic features of function design in X-system.
2. **Platform neutral, fully portable system architecture:** The development of X-system is totally based on platform-independent technologies, including Java programming language, Java application servers, XML data presentation, XSL/XPath (Clark & DeRose, 1999) data transformation, and so on. Also we use a Java-based, native XML database server as the metadata storage, which means the whole system is fully portable. Currently the X-system has many deployment experiences, including Windows-based systems, Linux-based systems, and Solaris-based systems. Any platform which supports Java virtual machine will run our system.
3. **Stackable information service modules:** In addition to the modular and object-oriented design concepts, the X-system introduces the layered function design concept, which makes system services stackable. Any newly extended service (we call them "upper-layer services") may use basic services ("lower-layer services") provided by the base system, and the extended services will also be used by future extended services. The layered architecture makes X-system more extensible than many current digital library systems, and there will be several extension

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