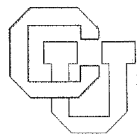


Harvest: A Scalable, Customizable Discovery and Access System

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Abstract

Rapid growth in data volume, user base, and data diversity render Internet-accessible information increasingly difficult to use effectively. In this paper we introduce *Harvest*, a system that provides a set of customizable tools for gathering information from diverse repositories, building topic-specific content indexes, flexibly searching the indexes, widely replicating them, and caching objects as they are retrieved across the Internet. The system interoperates with Mosaic and with HTTP, FTP, and Gopher information resources. We discuss the design and implementation of each subsystem, and provide measurements indicating that Harvest can reduce server load, network traffic, and index space requirements significantly compared with previous indexing systems. We also discuss a half dozen indexes we have built using Harvest, underscoring both the customizability and scalability of the system.

1 Introduction

Over the past few years a progression of Internet publishing tools have appeared. Until 1992, FTP [43] and NetNews [39] were the principal publishing tools. Around 1992, Gopher [38] and WAIS [31] gained popularity because they simplified network interactions and provided better ways to navigate through information. With the introduction of Mosaic [2] in 1993, publishing information on the World Wide Web [3] gained widespread use, because of Mosaic's attractive graphical interface and ease of use for accessing multimedia data reachable via WWW links.

While Internet publishing has become easy and popular, making *effective use* of Internet-accessible information has become more difficult. As the volume of Internet accessible information grows, it is increasingly difficult to locate relevant information. Moreover, current information systems experience serious server and network bottlenecks as a rapidly growing user populace attempts to access networked information. Finally, current systems primarily support text and graphics intended for end user viewing; they provide little support for more structured, complex data. For a more detailed discussion of these problems, the reader is referred to [10].

In this paper we introduce a system that addresses these problems using a variety of techniques. We call the system *Harvest*, to connote its focus on reaping the growing crop of Internet information. Harvest supports resource discovery through topic-specific content indexing made possible by a very efficient distributed information gathering architecture. It resolves bottlenecks through topology-adaptive index replication and object caching. Finally, Harvest supports structured data through a combination of structure-preserving indexes, flexible search engines, and data type-specific manipulation and integration mechanisms. Because it is highly customizable, Harvest can be used in many different situations.

The remainder of the paper is organized as follows. In Section 2 we discuss related work. In Section 3 we present the Harvest system, including a variety of performance measurements. In Section 4 we offer several demonstrations of Harvest, including WWW pointers where readers can try these demonstrations. In Section 5 we discuss work in progress, and in Section 6 we summarize Harvest's contributions to the state of resource discovery.

2 Related Work

While impossible to discuss all related work, we touch on some of the better-known efforts here.

Resource Discovery

Because of the difficulty of keeping a large information space organized, the labor intensity of traversing large information systems, and the subjective nature of organization, many resource discovery systems create indexes of network-accessible information.

Many of the early indexing tools fall into one of two categories: file/menu name indexes of widely distributed information (such as Archie [18], Veronica [19], or WWW [37]); and full content indexes of individual sites (such as Gifford's Semantic File System [21], WAIS [31], and local Gopher [38] indexes). Name-only indexes are very space efficient, but support limited queries. For example, it is only possible to query Archie for "graphics packages" whose file names happen to reflect their contents. Moreover, global flat indexes are less useful as the information space grows (causing queries to match too much information). In contrast to full content indexes that support

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