

Query Previews for Networked Information Systems: A Case Study with NASA Environmental Data

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ABSTRACT

Formulating queries on networked information systems is laden with problems: data diversity, data complexity, network growth, varied user base, and slow network access. This paper proposes a new approach to a network query user interface which consists of two phases: query preview and query refinement. This new approach is based on dynamic queries and tight coupling, guiding users to rapidly and dynamically eliminate undesired items, reduce the data volume to a manageable size, and refine queries locally before submission over a network. A two-phase dynamic query system for NASA's Earth Observing Systems--Data Information Systems (EOSDIS) is presented. The prototype was well received by the team of scientists who evaluated the interface.

Keywords: User interface, direct manipulation, dynamic query, metadata, query preview, query refinement, EOSDIS.

INTRODUCTION

The exploration of networked information resources becomes increasingly difficult as the volume of data grows and as the complexity increases. Congested networks and a varied user population contribute to the problems of information retrieval.

In this paper, we present a case study showing a user interface to support efficient query formulation for networked information systems using dynamic queries and query previews [DPS97]. The case study is based on our work with NASA's environmental data.

Dynamic query user interfaces have been developed at the Human Computer Interaction Lab for several years [Shn94]. Dynamic query user interfaces apply the principles of direct manipulation to query formulation:

- visual representation of the query
- visual representation of the results
- rapid, incremental, and reversible control
- selection by pointing, not typing
- immediate and continuous feedback

Dynamic queries involve the interactive control by a user of visual query parameters that generate a rapid (under 100msec), animated, and visual display of database search results. As users adjust sliders or buttons, results are updated in real time on the display.

The enthusiasm users have for query previews emanates from the sense of control they gain over the database. Empirical results have shown that dynamic queries are effective for novice and expert users to find trends and spot exceptions [Will93].

Early implementations of dynamic queries used relatively small datasets of a few thousand datapoints as they required the data to be stored in memory to guarantee rapid update of the display. We are working on algorithms and data structures that support larger datasets (up to 100,000 datapoints) [Tan96], but slow network performance and limited local memory remains an obstacle when trying to use dynamic queries for very large distributed datasets. Query previews offer a solution to this problem.

QUERY PREVIEWS

Query previews combine browsing and querying. Summary data about the database (such as the number of datasets in pre-defined categories) are used to guide users to reduce the scope of their queries and to focus only on the datasets of interest. The summary data is generally orders of magnitude smaller than the database itself, and can be downloaded from the server quickly to drive a dynamic query interface locally on the user's client machine.

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