Web Search

Interfaces

Web Search Interface

- Web search engines of course need a web-based interface.
- Search page must accept a query string and submit it within an HTML `<form>`.
- Program on the server must process requests and generate HTML text for the top ranked documents with pointers to the original and/or cached web pages.
- Server program must also allow for requests for more relevant documents for a previous query.

Submit Forms

- HTML supports various types of program input in forms, including:
  - Text boxes
  - Menus
  - Check boxes
  - Radio buttons
- When user submits a form, string values for various *parameters* are sent to the server program for processing.
- Server program uses these values to compute an appropriate HTML response page.

Simple Search Submit Form

```
<form action="http://prospero.cs.utexas.edu:8082/servlet/irs.Search" method="POST">
<p> <b> Enter your query: </b>
    <input type="text" name="query" size=40>
<p> <b>Search Database: </b>
   <select name="directory">
   <option selected value="/u/mooney/ir-code/corpora/cs-faculty/"> UT CS Faculty
   <option value="/u/mooney/ir-code/corpora/yahoo-science/"> Yahoo Science
  </select>
<p> <b>Use Relevance Feedback: </b>
<input type="checkbox" name="feedback" value="1">
<br> <br>
<input type="submit" value="Submit Query">
<input type="reset" value="Reset Form">
</form>
```

What’s a Servlet?

- Java’s answer to CGI programming for processing web form requests.
- Program runs on Web server and builds pages on the fly.
- When would you use servlets?
  - Page is based on user-submitted data e.g search engines.
  - Data changes frequently e.g. weather-reports.
  - Page uses information from a databases e.g. on-line stores.
- Requires running a web server that supports servlets.

Basic Servlet Structure

```
import java.io.*;
import javax.servlet.*;
import javax.servlet.http.*;

public class SomeServlet extends HttpServlet {
  // Handle get request
  public void doGet(HttpServletRequest request, HttpServletResponse
     response) throws ServletException, IOException {
    // request – access incoming HTTP headers and HTML form data
    // response - specify the HTTP response line and headers
    // (e.g. specifying the content type, setting cookies).
    PrintWriter out = response.getWriter(); //out - send content to
     browser
  }
}
```

A Simple Servlet

```
import java.io.*;
import javax.servlet.*;
import javax.servlet.http.*;

public class HelloWorld extends HttpServlet {
  public void doGet(HttpServletRequest request,
     HttpServletResponse response) throws ServletException,
     IOException {

      PrintWriter out = response.getWriter();
      out.println("Hello World");
   }
}
```

Generating HTML

```
public class HelloWWW extends HttpServlet {
  public void doGet(HttpServletRequest request, HttpServletResponse
    response) throws ServletException, IOException {

    response.setContentType("text/html");
    PrintWriter out = response.getWriter();
    out.println("<HTML>\n" +
             "<HEAD><TITLE>HelloWWW</TITLE></HEAD>\n" +
             "<BODY>\n" + "<H1>Hello WWW</H1>\n" +
            "</BODY></HTML>");
   }
}
```

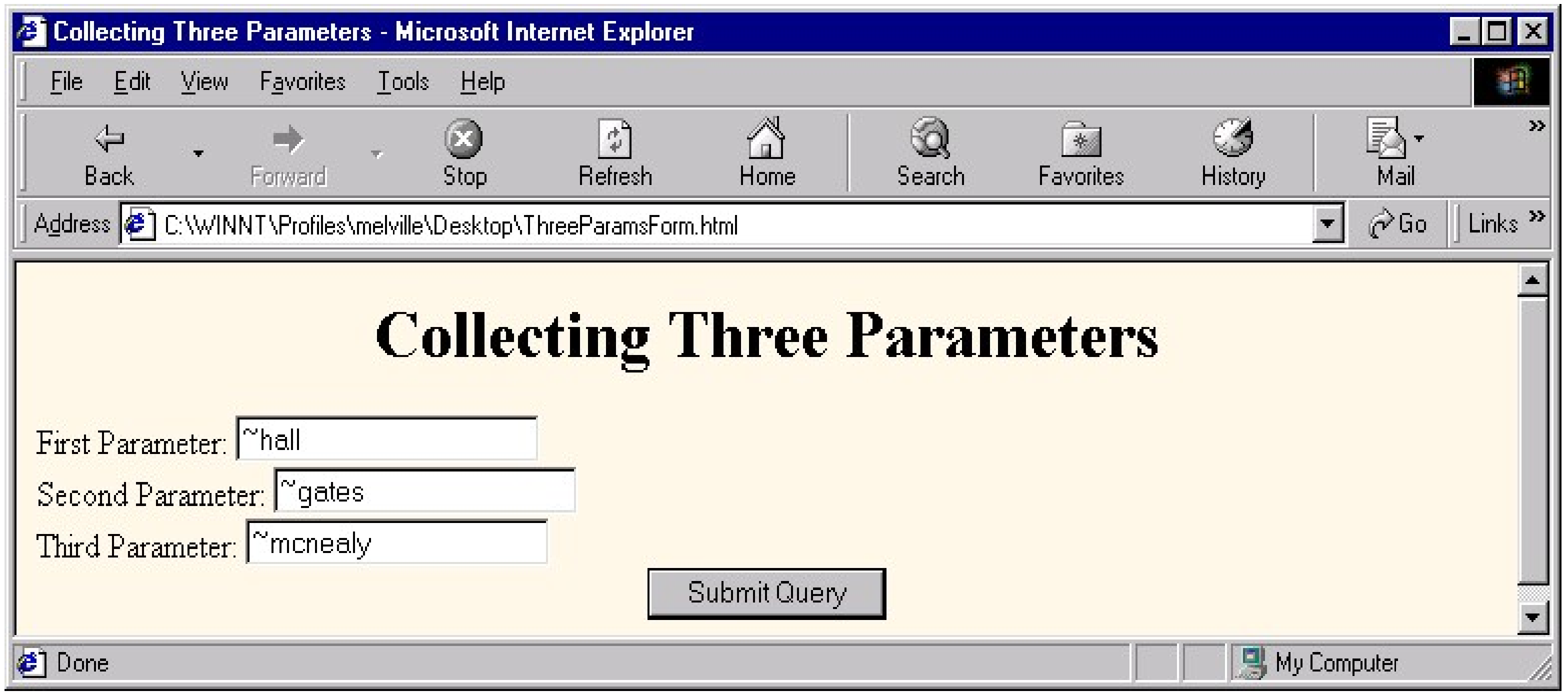
HTML Post Form

```
<FORM ACTION=“/servlet/hall.ThreeParams”
      METHOD=“POST”>
  First Parameter:  <INPUT TYPE="TEXT"
  NAME="param1"><BR>
  Second Parameter: <INPUT TYPE="TEXT"
  NAME="param2"><BR>
  Third Parameter:  <INPUT TYPE="TEXT"
  NAME="param3"><BR>
  <CENTER>
    <INPUT TYPE="SUBMIT">
  </CENTER>
</FORM>
```

Reading Parameters

```
public class ThreeParams extends HttpServlet {
 public void doGet(HttpServletRequest request,
   HttpServletResponse response) throws ServletException,
   IOException {
   response.setContentType("text/html");
   PrintWriter out = response.getWriter();
   out.println(… +"<UL>\n" +
    "<LI>param1: " + request.getParameter("param1") + "\n" +
    "<LI>param2: " + request.getParameter("param2") + "\n" +
    "<LI>param3: " + request.getParameter("param3") + "\n" +
    "</UL>\n" + …);
}
public void doPost(HttpServletRequest request,
   HttpServletResponse response) throws ServletException,
   IOException {
      doGet(request, response);
  }
}
```

Form Example


Collecting Three Parameters - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back
Forward
Stop
Refresh
Home
Search
Favorites
History
Mail
Address
Go
Links
Done
My Computer

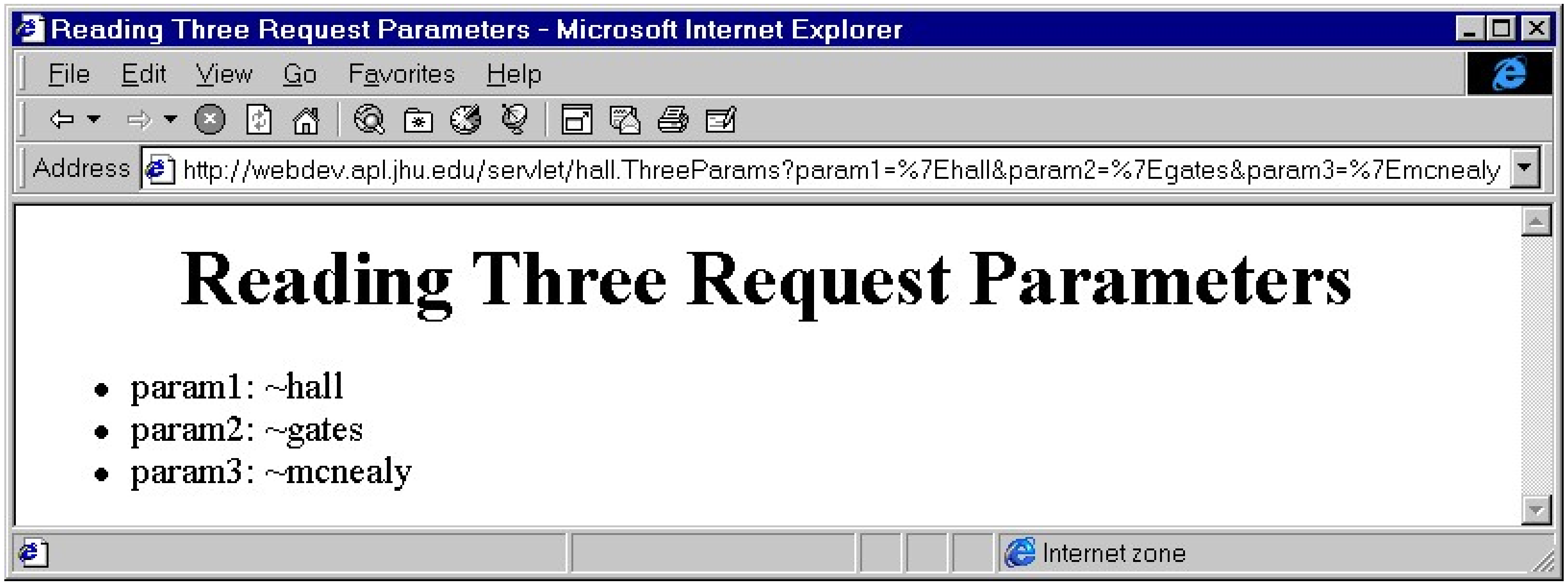
C:\WINNT\Profiles\melville\Desktop\ThreeParamsForm.html

Collecting Three Parameters

First Parameter: ~hall
Second Parameter: ~gates
Third Parameter: ~mcnealy

Submit Query

Servlet Output


Reading Three Request Parameters - Microsoft Internet Explorer
File Edit View Go Favorites Help
Address
Internet zone

http://webdev.apl.jhu.edu/servlet/hall.ThreeParams?param1=%7Ehall&param2=%7Egates&param3=%7Emcnealy

Reading Three Request Parameters

- param1: ~hall
- param2: ~gates
- param3: ~mcnealy

Session Tracking

- Typical scenario – shopping cart in online store.
- Necessary because HTTP is a "stateless" protocol.
- Common solutions: Cookies and URL-rewriting.
- Session Tracking API allows you to:
  - Look up session object associated with current request.
  - Create a new session object when necessary.
  - Look up information associated with a session.
  - Store information in a session.
  - Discard completed or abandoned sessions.

Session Tracking API - I

- Looking up a session object:
  - `HttpSession session = request.getSession(true);`
  - Pass *true* to create a new session if one does not exist.
- Associating information with session:

  -
    ```
    session.setAttribute(“user”,
                         request.getParameter(“name”))
    ```
  - Session attributes can be of any type.
- Looking up session information:
  - `String name = (String) session.getAttribute(“user”)`

Session Tracking API - II

- **`getId`**
  - The unique identifier generated for the session.
- **`isNew`**
  - `true` if the client (browser) has never seen the session.
- **`getCreationTime`**
  - Time in milliseconds since session was made.
- **`getLastAccessedTime`**
  - Time in milliseconds since the session was last sent from client.
- **`getMaxInactiveInterval`**
  - # of seconds session should go without access before being invalidated.
  - Negative value indicates that session should never timeout.

Simple Search Servlet

- Based on directory parameter, creates or selects existing InvertedIndex for the appropriate corpus.
- Processes the query with VSR to get ranked results.
- Writes out HTML ordered list of 10 results starting at the rank of the start parameter.
- Each item includes:
  - Link to the original URL saved by the spider in the top of the document in BASE tag.
  - Name link with page <TITLE> extracted from file.
  - Additional link to local cached file.
- If all retrievals not already shown, creates a submit form for "More Results" starting from the next ranked item.

Simple Search Interface Refinements

- For “More results” requests, stores current ranked list with the user session and displays next set in the list.
- Integrates relevance feedback interaction with “radio buttons” for “NEUTRAL,” “GOOD,” and “BAD” in HTML form.

Other Search Interface Refinements

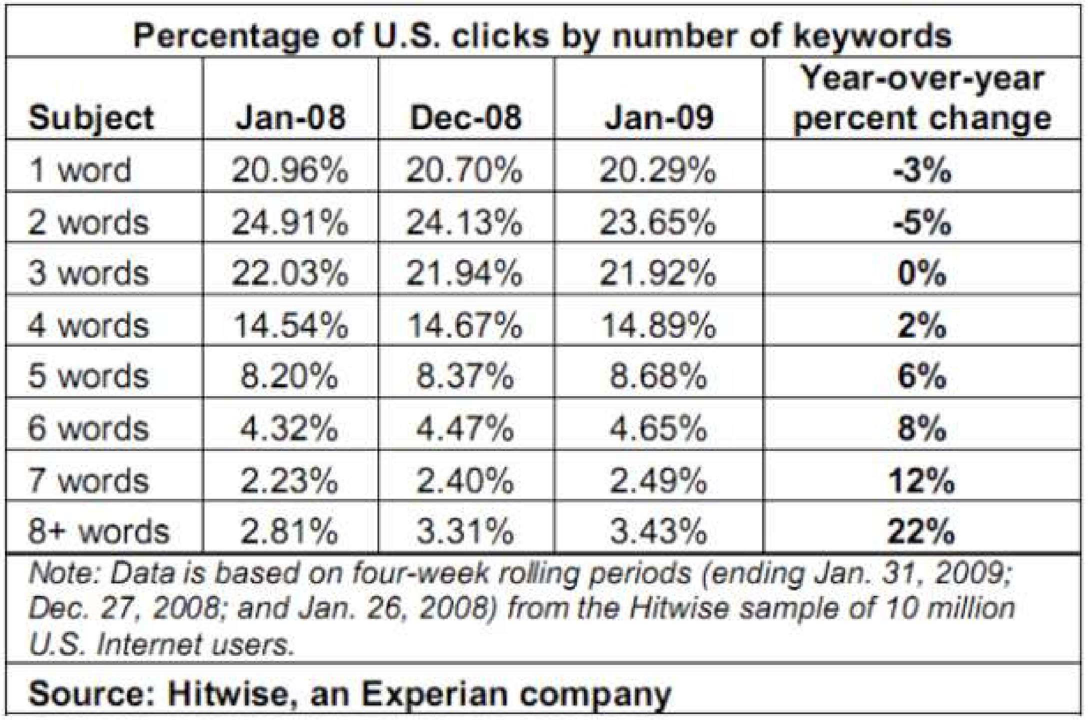
- Highlight search terms in the displayed document.
  - Provided in cached file on Google.
- Allow for “advanced” search:
  - Phrasal search (“..”)
  - Mandatory terms (+)
  - Negated term (-)
  - Language preference
  - Reverse link
  - Date preference
- Machine translation of pages.

Clustering Results

- Group search results into coherent “clusters”:
  - “microwave dish”
    - One group of on food recipes or cookware.
    - Another group on satellite TV reception.
  - “Austin bats”
    - One group on the local flying mammals.
    - One group on the local hockey team.
- Northern Light used to group results into “folders” based on a pre-established categorization of pages (like DMOZ categories).
- Alternative is to dynamically cluster search results into groups of similar documents.

User Query Length

- Users tend to enter short queries.
  - Study in 1998 gave average length of 2.35 words.
- Evidence that queries are getting longer.



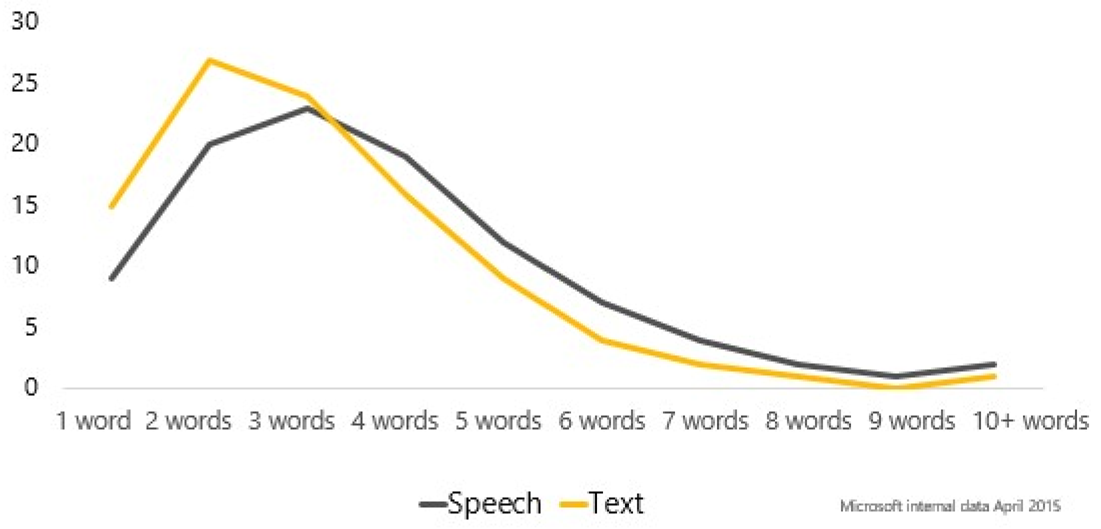
Percentage of U.S. clicks by number of keywords

Subject	Jan-08	Dec-08	Jan-09	Year-over-year percent change
1 word	20.96%	20.70%	20.29%	**-3%**
2 words	24.91%	24.13%	23.65%	**-5%**
3 words	22.03%	21.94%	21.92%	**0%**
4 words	14.54%	14.67%	14.89%	**2%**
5 words	8.20%	8.37%	8.68%	**6%**
6 words	4.32%	4.47%	4.65%	**8%**
7 words	2.23%	2.40%	2.49%	**12%**
8+ words	2.81%	3.31%	3.43%	**22%**

Note: Data is based on four-week rolling periods (ending Jan. 31, 2009; Dec. 27, 2008; and Jan. 26, 2008) from the Hitwise sample of 10 million U.S. Internet users.

Source: Hitwise, an Experian company

Speech Queries are Longer


1 word
2 words
3 words
4 words
5 words
6 words
7 words
8 words
9 words
10+ words
Speech
Text
Microsoft internal data April 2015