204222 - Fundamentals of Database Systems

Chapter 14

Web Database Programming Using PHP

Adapted for 204222

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Chapter 14 Outline

- A Simple PHP Example
- Overview of Basic Features of PHP
- Overview of PHP Database Programming

Web Database Programming Using PHP

- Techniques for programming dynamic features into Web
- PHP
  - Open source general-purpose scripting language
  - Interpreters provided free of charge
  - Available on most computer platforms
  - Comes installed with the UNIX operating system

A Simple PHP Example (cont'd.)

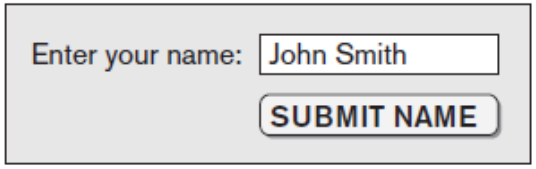
- DBMS
  - **Bottom-tier database server**
- PHP
  - **Middle-tier Web server**
- HTML
  - **Client tier**

(a)

```
    //Program Segment P1:
 0) <?php
 1) // Printing a welcome message if the user submitted their name
    // through the HTML form
 2) if ($_POST['user_name']) {
 3)   print("Welcome,  ") ;
 4)   print($_POST['user_name']);
 5) }
 6) else {
 7)   // Printing the form to enter the user name since no name has
      // been entered yet
 8)   print <<<_HTML_
 9)   <FORM method="post" action="$_SERVER['PHP_SELF']">
10)   Enter your name: <input type="text" name="user_name">
11)   <BR/>
12)   <INPUT type="submit" value="SUBMIT NAME">
13)   </FORM>
14)   _HTML_;
15) }
16) ?>
```

(b)

(c)



(d)

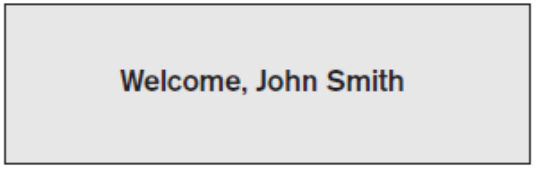


Figure 14.1
(a) PHP program segment for entering a greeting, (b) Initial form displayed by PHP program segment, (c) User enters name *John Smith*, (d) Form prints welcome message for *John Smith*.

A Simple PHP Example (cont'd.)

- Example Figure 14.1(a)
- PHP script stored in:
  - http://www.myserver.com/example/greeting.php
- <?php
  - PHP start tag
- ?>
  - PHP end tag
- Comments: // or /* */

A Simple PHP Example (cont'd.)

- $_POST
  - **Auto-global** predefined PHP variable
  - Array that holds all the values entered through form parameters
- Arrays are dynamic
- **Long text strings**
  - Between opening <<<_HTML_ and closing _HTML_;

A Simple PHP Example (cont'd.)

- PHP **variable names**
  - Start with $ sign
- Overview of Basic Features of PHP
  - Illustrate features of PHP suited for creating dynamic Web pages that contain database access commands

PHP Variables, Data Types, and Programming Constructs

- PHP **variable names**
  - Start with $ symbol
  - Can include characters, letters, and underscore character (_)
- Main ways to express strings and text
  - **Single-quoted strings**
  - **Double-quoted strings**
  - **Here documents**
  - **Single and double quotes**

PHP Variables, Data Types, and Programming Constructs (cont'd.)

- Period (.) symbol
  - String concatenate operator
- Single-quoted strings
  - Literal strings that contain no PHP program variables
- Double-quoted strings and here documents
  - Values from variables need to be interpolated into string

PHP Variables, Data Types, and Programming Constructs (cont'd.)

- Numeric data types
  - Integers and floating points
- Programming language constructs
  - For-loops, while-loops, and conditional if-statements
- Boolean expressions
- Comparison operators
  - == (equal), != (not equal), > (greater than), >= (greater than or equal), < (less than), and <= (less than or equal)

PHP Arrays

- Database query results
  - Two-dimensional arrays
  - First dimension representing rows of a table
  - Second dimension representing columns (attributes) within a row
- Main types of arrays:
  - **Numeric** and **associative**
- Numeric array
  - Associates a numeric index with each element in the array
  - Indexes are integer numbers
    - Start at zero
    - Grow incrementally
- Associative array
  - Provides pairs of (key => value) elements

PHP Arrays (cont'd.)

Figure 14.3
Illustrating basic PHP array processing.

```
 0) $teaching = array('Database' => 'Smith', 'OS' => 'Carrick',
                      'Graphics' => 'Kam');
 1) $teaching['Graphics'] = 'Benson'; $teaching['Data Mining'] = 'Kam';
 2) sort($teaching);
 3) foreach ($teaching as $key => $value) {
 4)   print " $key : $value\n";}
 5) $courses = array('Database', 'OS', 'Graphics', 'Data Mining');
 6) $alt_row_color = array('blue', 'yellow');
 7) for ($i = 0, $num = count($courses); i < $num; $i++) {
 8)   print '<TR bgcolor="' . $alt_row_color[$i % 2] . '">';
 9)   print "<TD>Course $i is</TD><TD>$course[$i]</TD></TR>\n";
10) }
```

PHP Arrays (cont'd.)

- Techniques for looping through arrays in PHP
- Count function
  - Returns current number of elements in array
- Sort function
  - Sorts array based on element values in it
- Functions
  - Define to structure a complex program and to share common sections of code
  - Arguments passed by value
- Examples to illustrate basic PHP functions
  - Figure 14.4
  - Figure 14.5

Figure 14.4
Rewriting program segment P1 as P1′ using functions.

```
    //Program Segment P1':
 0) function display_welcome() {
 1)      print("Welcome,  ") ;
 2)      print($_POST['user_name']);
 3) }
 4)
 5) function display_empty_form(); {
 6) print <<<_HTML_
 7) <FORM method="post" action="$_SERVER['PHP_SELF']">
 8) Enter your name: <INPUT type="text" name="user_name">
 9) <BR/>
10) <INPUT type="submit" value="Submit name">
11) </FORM>
12) _HTML_;
13) }
14) if ($_POST['user_name']) {
15)   display_welcome();
16) }
17) else {
18)   display_empty_form();
19) }
```

PHP Functions (cont'd.)

Figure 14.5
Illustrating a function with arguments and return value.

```
 0) function course_instructor ($course, $teaching_assignments) {
 1)   if (array_key_exists($course, $teaching_assignments)) {
 2)   $instructor = $teaching_assignments[$course];
 3)   RETURN "$instructor is teaching $course";
 4)   }
 5)   else {
 6)   RETURN "there is no $course course";
 7)   }
 8) }
 9) $teaching = array('Database' => 'Smith', 'OS' => 'Carrick',
                      'Graphics' => 'Kam');
10) $teaching['Graphics'] = 'Benson'; $teaching['Data Mining'] = 'Kam';
11) $x = course_instructor('Database', $teaching);
12) print($x);
13) $x = course_instructor('Computer Architecture', $teaching);
14) print($x);
```

PHP Server Variables and Forms

- Built-in entries
  - $_SERVER auto-global built-in array variable
  - Provides useful information about server where the PHP interpreter is running
  - Examples:
    - **$_SERVER['SERVER_NAME']**
    - **$_SERVER['REMOTE_ADDRESS']**
    - **$_SERVER['REMOTE_HOST']**
    - **$_SERVER['PATH_INFO']**
    - **$_SERVER['QUERY_STRING']**
    - **$_SERVER['DOCUMENT_ROOT']**
- $_POST
  - Provides input values submitted by the user through HTML forms specified in <INPUT> tag

Overview of PHP Database Programming

- PEAR DB library
  - Part of PHP Extension and Application Repository (PEAR)
  - Provides functions for database access
- Connecting to a Database
  - Library module DB.php must be loaded
  - DB library functions accessed using `DB::<function_name>`
  - `DB::connect('string')`
    - Function for connecting to a database
    - Format for 'string' is: `<DBMS software>://<user account>:<password>@<database server>`

```
 0)  require 'DB.php';
 1)  $d = DB::connect('oci8://acct1:pass12@www.host.com/db1');
 2)  if (DB::isError($d)) { die("cannot connect – " .  $d->getMessage());}
     ...
 3)  $q = $d->query("CREATE TABLE EMPLOYEE
 4)    (Emp_id INT,
 5)    Name VARCHAR(15),
 6)    Job VARCHAR(10),
 7)    Dno INT)" );
 8)  if (DB::isError($q)) { die("table creation not successful – " .
                          $q->getMessage()); }
       ...
9)   $d->setErrorHandling(PEAR_ERROR_DIE);
     ...
10)  $eid = $d->nextID('EMPLOYEE');
11)  $q = $d->query("INSERT INTO EMPLOYEE VALUES
12)    ($eid, $_POST['emp_name'], $_POST['emp_job'], $_POST['emp_dno'])" );
     ...
13)  $eid = $d->nextID('EMPLOYEE');
14)  $q = $d->query('INSERT INTO EMPLOYEE VALUES (?, ?, ?, ?)',
15)  array($eid, $_POST['emp_name'], $_POST['emp_job'], $_POST['emp_dno']) );
```

Figure 14.6
Connecting to a database, creating a table, and inserting a record.

Connecting to a Database (cont'd.)

- Query function
  - `$d->query` takes an SQL command as its string argument
  - Sends query to database server for execution
- `$d->setErrorHandling(PEAR_ERROR_DIE)`
  - Terminate program and print default error messages if any subsequent errors occur

Collecting Data from Forms and Inserting Records

- Collect information through HTML or other types of Web forms
- Create unique record identifier for each new record inserted into the database
- PHP has a function `$d->nextID` to create a sequence of unique values for a particular table
- **Placeholders**
  - Specified by ? symbol

Retrieval Queries from Database Tables

- `$q`
  - **Query result**
  - `$q->fetchRow()` retrieve next record in query result and control loop
- `$d=>getAll`
  - Holds all the records in a query result in a single variable called `$allresult`

```
 0) require 'DB.php';
 1) $d = DB::connect('oci8://acct1:pass12@www.host.com/dbname');
 2) if (DB::isError($d)) { die("cannot connect – " .  $d->getMessage()); }
 3) $d->setErrorHandling(PEAR_ERROR_DIE);
    ...
 4) $q = $d->query('SELECT Name, Dno FROM EMPLOYEE');
 5) while ($r = $q->fetchRow()) {
 6)   print "employee $r[0] works for department $r[1] \n" ;
 7) }
    ...
 8) $q = $d->query('SELECT Name FROM EMPLOYEE WHERE Job = ? AND Dno = ?',
 9)   array($_POST['emp_job'], $_POST['emp_dno']) );
10) print "employees in dept $_POST['emp_dno'] whose job is
      $_POST['emp_job']: \n"
11) while ($r = $q->fetchRow()) {
12)   print "employee $r[0] \n" ;
13) }
    ...
14) $allresult = $d->getAll('SELECT Name, Job, Dno FROM EMPLOYEE');
15) foreach ($allresult as $r) {
16)   print "employee $r[0] has job $r[1] and works for department $r[2] \n" ;
17) }
    ...
```

Figure 14.7
Illustrating database retrieval queries.

Summary

- PHP scripting language
  - Very popular for Web database programming
- PHP basics for Web programming
- Data types
- Database commands include:
  - Creating tables, inserting new records, and retrieving database records