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F15

DB2 for Z/OS DBA : Break the
barrier, have fun with DB2, PHP
and the Web !

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Euroclear

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Platform: DB2 UDB for Linux, Unix, Windows

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This presentation talks about Web development with DB2 and PHP, although the development platform is DB2 for LUW, the contents is valid for DB2 on every platform.

Agenda

- Web database application development : a quick tour
- Presentation of PHP
- Setting up the environment
- Start programming with PHP and DB2
- Run the application and have fun with DB2 administration

Web database application development : A quick tour

- Dynamic vs. Static Web page
- Web database application :
 - ✓ Database : DB2 Family, Oracle, SQL Server, others
 - ✓ Programs : Java, Microsoft, Open source

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Static Web page : No interaction with the user, everybody sees the same web page

Dynamic : Interaction, different users might see different web pages, to create a dynamic page we must use another language in addition with HTML

The database is useless unless you can move data in and out

Some scripting language are used in dynamic web pages , such as Javascript (nothing to do with Java) , but they don't have the capabilities to interact with a database

Web database application development : A quick tour

- Relational databases :
 - ✓ The 3 majors : DB2, Oracle, SQL Server
 - Conventional editions
 - Free license edition available on Windows and Linux : XXX Express
 - ✓ Free/ Open source database : Apache Derby (IBM Cloudscape), MySQL, PostgreSQL (backed by Sun Microsystems) ...

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Apache Derby is a Java based RDBMS

Why IBM is open sourcing Cloudscape as Derby :

<http://www-128.ibm.com/developerworks/db2/library/techarticle/dm-0410prial/>

“By open sourcing Cloudscape, IBM hopes to accelerate development of Java-based applications and drive more innovation around Linux and Java. So expanding this market expands the market for high-value IBM middleware, hardware, and services. We think it will especially create new business opportunities in areas such as embedded database applications, small business solutions, and Java and Web-based applications. “

Web database application development : A quick tour

- Development communities
 1. Java Platform, Enterprise Edition (formerly known as J2EE)
 - ✓ Access to database with SQL based API : JDBC (Dynamic SQL interface), SQLJ (Embedded SQL in Java language)
 - ✓ Access to database with non SQL base API : Java beans (wrapped stored procedures) and Web services
 - ✓ Dynamic Web documents (HTML, XML ..) : JSP (JavaServer Pages)
 - ✓ Application server : IBM Websphere, Oracle Application Server, BEA WebLogic

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JDBC provides classes and interfaces that make easy to connect to a database and to retrieve data. This means that you don't have to know anything about connecting to a database , you just have to know how to call the various methods defined by the JDBC interface

SQLJ much fewer code than JDBC (average ratio of 1:7)

With SQLJ the data retrieval is still done through a JDBC connection, the main difference is that the SQL is statically coded in the application

Web database application development : A quick tour

SQLJ vs. JDBC

| SQLJ syntax: | Retrieve a single row with SQLJ vs. JDBC |
|---|--|
| <pre>#sql [conCtx] { SELECT job INTO :job FROM staff WHERE name = :name };</pre> | |
| JDBC syntax: | |
| <pre>PreparedStatement pstmt = con.prepareStatement("SELECT job FROM staff WHERE name = ? FETCH FIRST 1 ROW ONLY"); ResultSet rs = pstmt.executeQuery(); if (rs.next()) job = rs.getString(1); else job = null; pstmt.close();</pre> | |
| SQLJ syntax: | Insert a single row with SQLJ vs. JDBC |
| <pre>#sql [conCtx] { INSERT INTO sales VALUES (:date, :salesperson, :region, :sales) };</pre> | |
| JDBC syntax: | |
| <pre>PreparedStatement pstmt = con.prepareStatement("INSERT INTO sales VALUES (?, ?, ?, ?)"); // set input parameter pstmt.setObject(1, date); pstmt.setString(2, salesperson); pstmt.setString(3, region); pstmt.setInt(4, sales); pstmt.executeUpdate(); pstmt.close();</pre> | |

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Web database application development : A quick tour

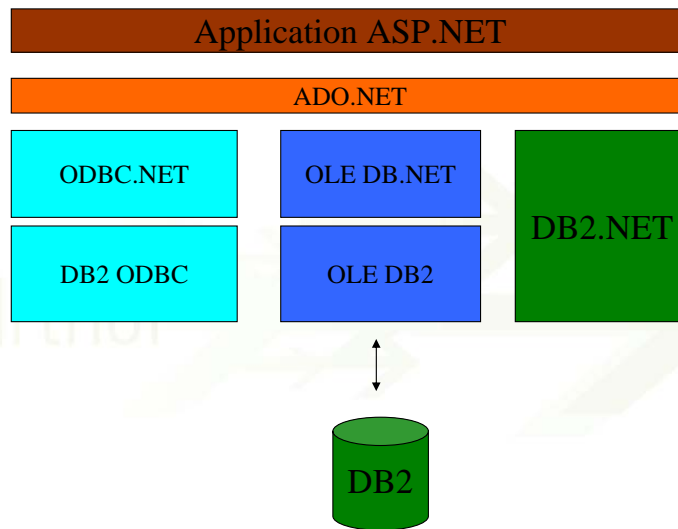
- Developer communities
 - 2. Microsoft .NET : Windows only
 - various technologies built on .NET Framework
 - ✓ .NET Framework : part of Windows OS
 - Common Language Runtime (CLR)
 - Class libraries
 - .NET compliant languages
 - ✓ Access to database with SQL based API : ADO.NET (ActiveX Data Objects)
 - ✓ Access to data with non SQL base API : Web services
 - ✓ Programming language : #C, Visual Basic.NET
 - ✓ Dynamic Web pages : ASP.NET (Active Server Pages)

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.NET is a brand that applies to various technologies, the development Access to data with non SQL base API : Web services

CLR is like JVM to Java (Java Virtual Machine)

ADO is another data access application interface that Microsoft provide (like ODBC and OLE DB) : it combines the best features if its predecessors



Previous versions of DB2 are shipped with the DB2 ODBC/CLI driver and the IBM OLE DB provider for DB2. In DB2 8.2 these 2 drivers are updated to also work with the Microsoft ODBC .NET and OLE DB .NET data providers. With the enhanced drivers .NET application can access DB2 through the use of ODBC and OLE DB

Web database application development : A quick tour

- Developer communities
 3. Open source/Free software, the LAMP architecture :
 - ✓ Linux
 - ✓ Apache
 - ✓ MySQL, but why not DB2 ?
 - ✓ Perl, PHP or Python

Why open source software ?

Presentation of PHP



- *HyperText Preprocessor* (formerly *Personal Home Page* by Rasmus Lerdorf)
- One of the most popular Web application development languages used today
 - ✓ Free and Exceptionally easy to learn and to use
 - ✓ Designed to interact with databases
 - ✓ Easy to develop (large PHP community), easy to deploy
 - ✓ Secure and robust
 - ✓ Used for over of 40% of Web scripting applications
(05/2006 : 20.5 millions domains, 1.2 million IP Addresses, source <http://www.php.net/usage.php>) **Pepsi**

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PHP is a server side scripting language(embedded in HTML code), meaning that it runs on the Web server when a page is requested via HTTP, rather than on the Web Browser.

Write/update and view the result immediately

Ease of setting up a PHP environment

PHP was developed from the ground up to be a Web platform

Open source = free for corporate use - large community available for support

Secure and Robust = The user does not see the PHP code

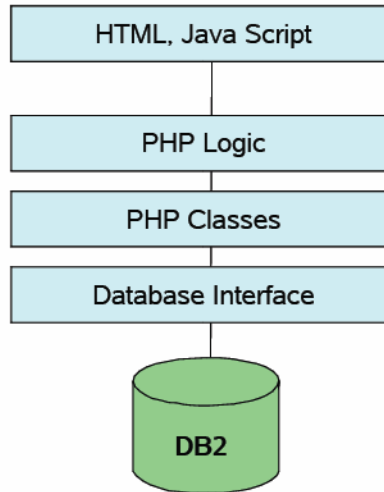
Presentation of PHP

- Typical use :
 - ✓ Blogs
 - ✓ Wikis
 - ✓ Discussion forums
 - ✓ Lightweight content management systems

Wiki is a piece of server software that allows users to freely create and edit Web page content using any Web browser

Presentation of PHP

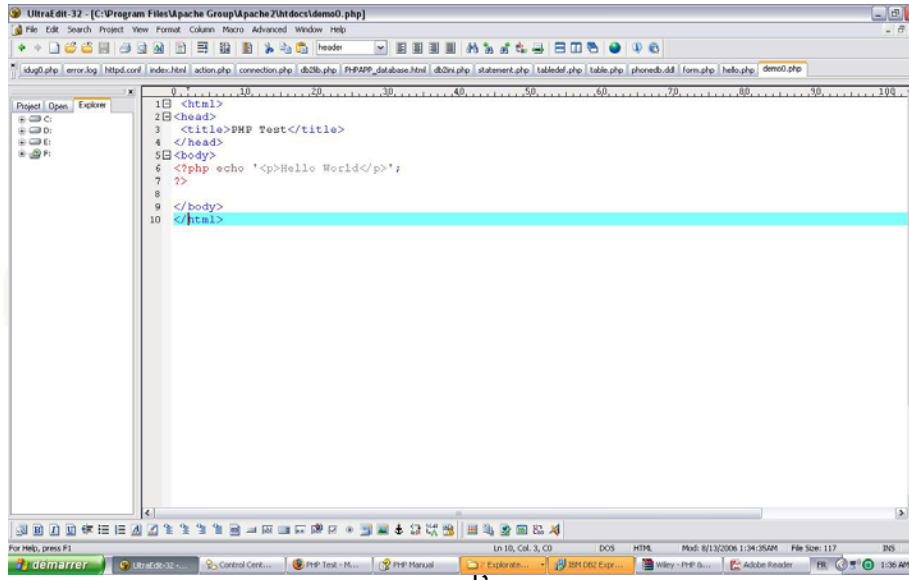
- N-tier architecture



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Diagram to insert

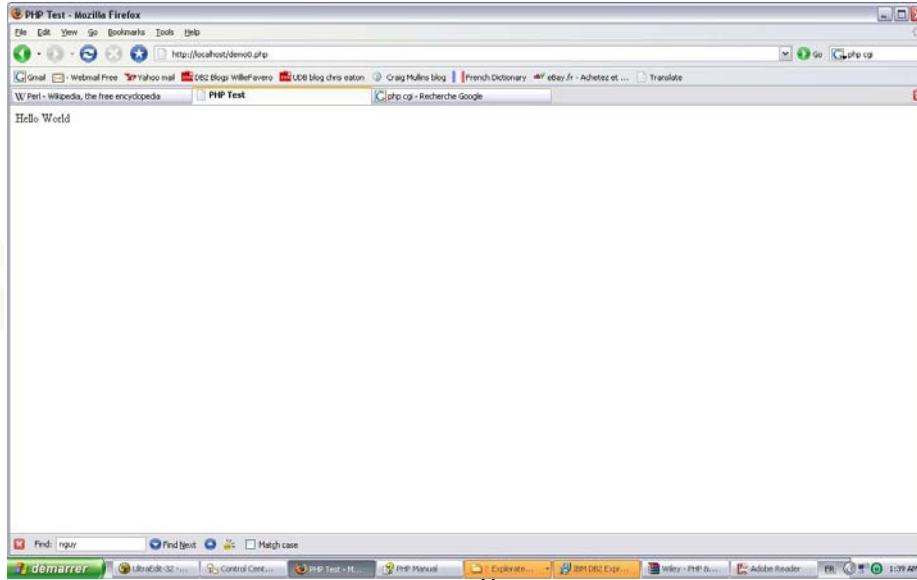
How does it work ?



```
1 <html>
2 <head>
3 <title>PHP Test</title>
4 </head>
5 <body>
6 <?php echo '<p>Hello World</p>';
7 ?>
8 </body>
9
10 </html>
```

The screenshot shows the UltraEdit 32 interface with a PHP script open. The script is a simple HTML document with a title 'PHP Test' and a body containing a PHP echo statement that outputs 'Hello World'. The file is named 'demo0.php' and is located in the directory 'C:\Program Files\Apache Group\Apache2\htdocs\'. The status bar at the bottom indicates the current line is 10, column 3, and the file size is 117 bytes.

Web browser view



Page source view

```
view-source: - Source of: http://localhost/demo0.php - Mozilla Firefox  
File Edit View Help  
<html>  
<head>  
<title>PHP Test</title>  
</head>  
<body>  
<p>Hello World</p>  
</body>  
</html>
```



Presentation of PHP

- Language elements

```
<html>
  <head>
    <title>Example</title>
  </head>
  <body>

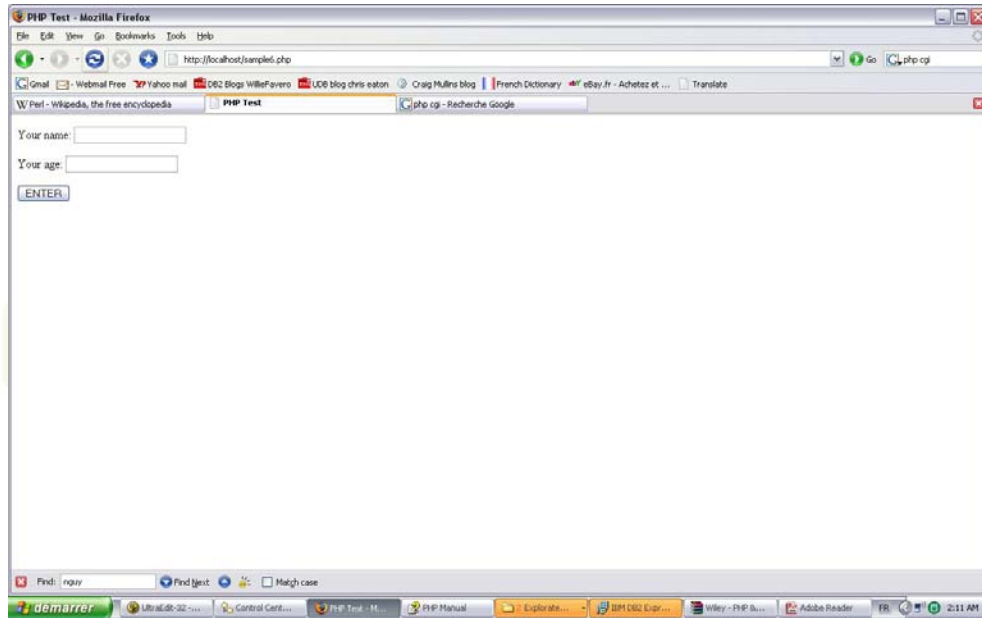
    <?php
      echo "Hi, I'm a PHP script!";
    ?>

  </body>
</html>
```


Presentation of PHP

- Forms : POST, GET

```
<form action="action.php" method="post">  
<p>Your name: <input type="text" name="name" /></p>  
<p>Your age: <input type="text" name="age" /></p>  
<p><input type="submit" value = "ENTER"/></p>  
</form>
```



Presentation of PHP

- PHP forms

```
Hi <?php echo $_POST['name']; ?>.  
You are <?php echo $_POST['age']; ?> years old.
```

- Result in the Web browser

```
Hi Joe. You are 22 years old.
```

Presentation of PHP

- Database extensions (PECL), all these extensions use the underlying call level interface (CLI) driver
 - ✓ Ibm_db2
 - ✓ PHP Data objects
 - ✓ Unified ODBC driver

Presentation of PHP

- **ibm_db2**
 - ✓ An optimized DB2 UDB driver
 - ✓ Developed and contributed under open source license by IBM
 - ✓ Integrated Development Environment : IBM Zendcore

Presentation of PHP

- PDO_ODBC : **P**HP **D**atabase **O**bjects
 - Fast, light, language C standardized data access interface for PHP
 - Unified access for all databases
 - Just released with PHP 5
 - The future of PHP database programming

Presentation of PHP

- Unified ODBC
 - ✓ Built in to PHP Core, the oldest database driver
 - ✓ No DB2 specific optimizations
 - ✓ Not recommended

Presentation of PHP

- PHP application development with DB2 (using ibm_db2)
 - ✓ Host variables
 - ✓ Connection
 - ✓ Process result sets
 - ✓ XML support
 - ✓ Large objects
 - ✓ SP

Connection

```
// cataloged connection
$database = 'SAMPLE';
$user = 'db2inst1';
$password = 'ibmdb2';
$conn = db2_connect($database, $user, $password);

// uncataloged connection
$database = 'SAMPLE';
$user = 'db2inst1';
$password = 'ibmdb2';
$hostname = 'localhost';
$port = 50000;

$conn_string = "DRIVER={IBM DB2 ODBC DRIVER};DATABASE=$database;" .
  "HOSTNAME=$hostname;PORT=$port;PROTOCOL=TCPIP;UID=$user;PWD=$password;";
$conn = db2_connect($conn_string, '', '');
$rc = db2_close($conn);
```

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Maybe a development on different DB2 components : DB2 client , DB2 connect

DB2 Connect as DRDA requester : to be verified

Process result sets

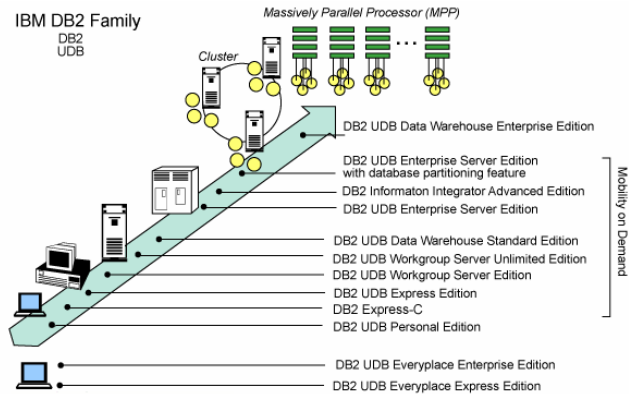
```
$sql = "SELECT id, name, breed, weight FROM animals ORDER BY
      breed";
$stmt = db2_prepare($conn, $sql);
$result = db2_execute($stmt);
while ($row = db2_fetch_assoc($stmt)) {
    printf ("%5d %-16s %-32s %10s\n",
           $row['ID'], $row['NAME'], $row['BREED'],
           $row['WEIGHT']);
}
-----
0      Pook                cat                3.20
5      Rickety Ride       goat              9.70
2      Smarty             horse            350.00
```

Setting up the environment

- The components, in order of installation :
 - Database
 - Web server
 - PHP (integrated in Zend Core for IBM)

Setting up the environment

- Database : DB2 Family



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DB2 connect and DB2 client purpose

Quick comparison with other RDBMS : the features that make the difference

...

Setting up the environment

- Database : DB2 Express –C
 - ✓ Designed for partners in the development communities
 - ✓ Exactly the same functionalities as DB2 Express except restriction on number of CPU and some production features
 - No HADR
 - No use with DB2 connect
 - Support uniquely on forum

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Why free database ?

Setting up the environment

- The Web Server : Apache
 - ✓ Free license
 - ✓ Widely used (65% of websites)
 - ✓ PHP is 70% used on Apache Unix servers

Setting up the environment

- PHP package with Zend Core for IBM
 - ✓ Instant PHP set up
 - ✓ Easy PHP customization (web based GUI)
 - ✓ “Peace of mind in Production”
 - ✓ Bundles all required DB2 UDB, Cloudscape libraries. Immediate database access
 - ✓ Supports popular Web servers/clients and OS
 - ✓ Integrated with Zend Studio, the commercial PHP IDE
 - ✓ Large number of samples provided

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IBM strategy / deal/partnership with Zend technologies

PHP was originally created by Rasmus Lersdorf in the mid 90s, and reimplemented in C by students who formed Zend Technologies, Inc.

The screenshot shows the 'Zend Core for IBM' configuration interface in Microsoft Internet Explorer. The browser's address bar shows the URL: `http://localhost/ZendCore/index.php?view=configuration`. The page title is 'Zend Core for IBM' and the navigation menu includes 'Control Center', 'Configuration', and 'Documentation'. The 'Configuration' section is active, and the 'Language Options' sub-section is expanded. Below this, a table lists various PHP configuration options with their current values and radio buttons to toggle them.

| Name | Value |
|---|---|
| <code>allow_call_time_pass_reference</code> <i>Enable the ability to force arguments to be passed by reference at function</i> | <input type="radio"/> On <input checked="" type="radio"/> Off |
| <code>asp_tags</code> <i>Enables the use of ASP-like tags in addition to the usual <?php ?></i> | <input type="radio"/> On <input checked="" type="radio"/> Off |
| <code>expose_php</code> <i>Decides whether PHP may expose the fact that it is installed on the server</i> | <input checked="" type="radio"/> On <input type="radio"/> Off |
| <code>implicit_flush</code> <i>Implicit (automatic) flush</i> | <input type="radio"/> On <input checked="" type="radio"/> Off |

Setting up the environment

- DB2 connectivity with the `ibm_db2` extension :
 - ✓ Cataloged / uncataloged connection
 - ✓ Requisites :
 - Access to DB2 LUW : needs only a DB2 client on the server that hosts PHP
 - Access to DB2 for Z/OS or iSeries : needs also DB2 Connect as DRDA requester

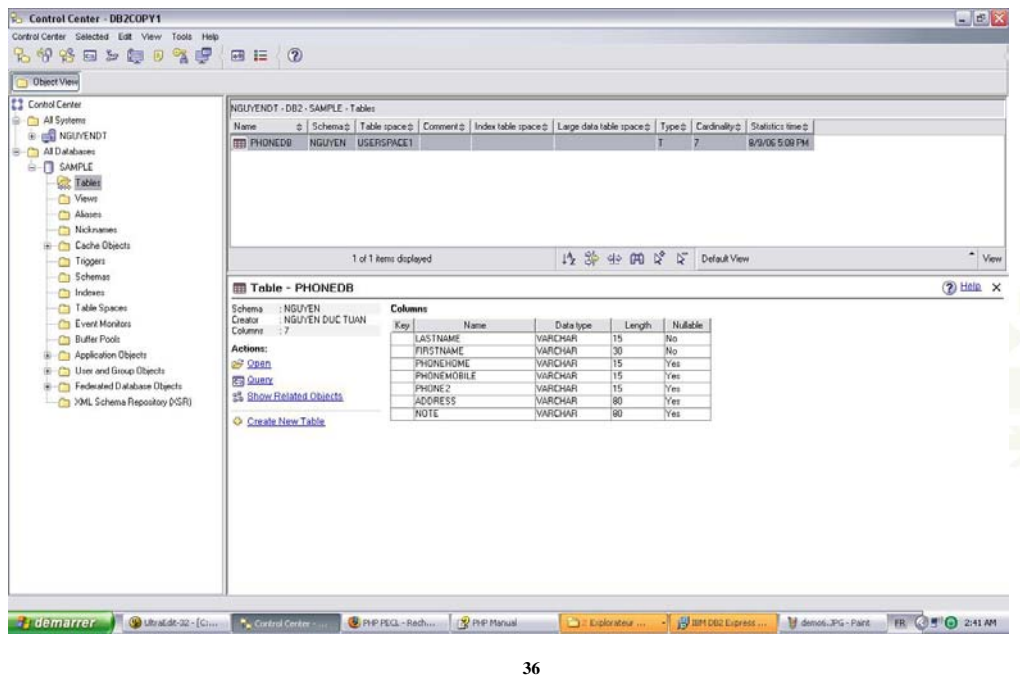
Start programming with PHP and DB2

- Our sample application : the telephone directory
 1. Design / Generate HTML pages with :
 1. HTML editors : Dreamweaver ..
 2. Self coding
 3. Template HTML pages

Start programming with PHP and DB2

- Our sample application : the telephone directory
 2. Creating the DB2 objects (tables , index ..)

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Start programming with PHP and DB2

- Our sample application : the telephone directory
 - Going from an existing sample
 - Change the code to address my needs
 - Immediately check the result

Start programming with PHP and DB2

- Testing : radically simple, immediate
- *Root_document* in the web server configuration file (conf.ini) must points to your PHP source directory
- Be careful to case sensitivity !!

```
select name,weight from animals;
$row=db2_fetch_assoc(...);
➤ $row[ 'NAME' ] exists
➤ $row[ 'name' ] does not exist
```
- As on Mainframe, check the log files ! In case of error what you often get is just a white screen on your browser !!!
- If errors with `db2_prepare()` or `db2_exec()` and you cannot display the error message using `db2_stmt_errormsg()` then check the connection handle

Performance consideration

- Use `db2_prepare()` instead of `db2_exec` for performance and security
- PHP scripts are compiled every time unless the scripts are cached using a PHP caching products
- Activate Output Buffering (Apache)
- Use `ibm_db2` if you plan to use SP, LOBs and you want best performance
- Avoid scrollable cursors
- The first connection to a database can take time as DB2 allocate resources , you can accelerate this using the command `ACTIVATE DATABASE dbname`

Run the application and have fun with DB2 administration

- Live demo of the application
- Easy DB2 administration with the Control Center

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Glossary

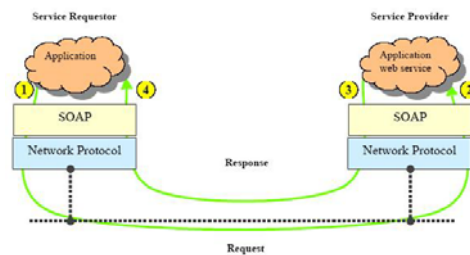
- **IDE** : Integrated Development environment
- **JDBC** : Java DB Connectivity
- **ODBC** : Open DB Connectivity (Microsoft data driver)
- **OLE DB** : Object Linking and Embedding DB (Microsoft data driver)
- **OSS** : Open Source Software
- **Wiki** : a piece of server software that allows users to freely create and edit Web page content using any Web browser (wiki wiki is an Hawaiian word for "fast")
- **Application server** : this term often refers to a J2EE application server : JBoss (Redhat) , Websphere (IBM) , Oracle 10g, WebLogic(BEA) - The programming language used is Java. The web modules are JSPs and business logic is built into Enterprise JavaBeans (EJB)
- **JSP** : Java Server Pages, is a Java technology that allows developers to dynamically generate web documents (HTML..). JSP are compiled into Java servlets
- **EJB** : Enterprise JavaBeans, "Reusable software components that can be manipulated visually in a builder tool " (Specification by Sun Microsystems). EJB is a server side component that encapsulates the business logic of an application.

Glossary (cont.)

- **SOA and Web services**

- **SOA** : Service Oriented Architecture, SOA is an IT architectural style that supports integrating your business as linked services that can be accessed when needed over the network : these services can assembled themselves when they are needed into on-demand applications. Typically, SOA achieves this goal by creating a message based system. Web services are the most common technology standards used to implemented SOA.

- **Web services** : The World Wide Web is more and more used for application to application communication. Web services are web based applications that use open, XML-based standards and transports protocols (SOAP) to exchange data with clients



References

- www.ibm.com/db2
- www.php.net
- www.wikipedia.org

Session F15
DB2 for Z/OS DBA :
Break the barrier, have
fun with DB2, PHP and
the Web !

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