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# **Bring RPG/COBOL business logic to the web with the PHP Toolkit**

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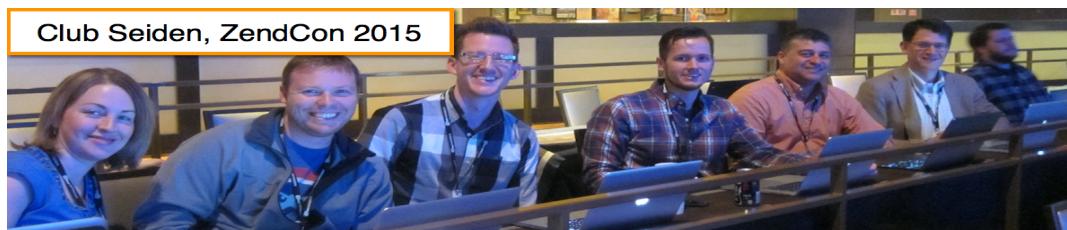
[seidengroup.com](http://seidengroup.com)

# Seiden Group and Club Seiden

Alan is a leader and expert in PHP on IBM i; leader, Zend's PHP Toolkit for IBM i; and “Performance guru of PHP on IBM i”



**Seiden Group** is a team of experts available for mentoring/troubleshooting/project advice/development.



[seidengroup.com](http://seidengroup.com), [alan@seidengroup.com](mailto:alan@seidengroup.com)

# Contact

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# Today's toolkit topics

- **A key component of modernization on IBM i**
- **How the toolkit came to be**
- **Who and how?**
  - Open source on IBM i? Yes!
  - Community project
- **Install/configure/use**
- **Program and command calls**
- **Performance**
- **Tips, troubleshooting, resources**

# Kieta from Hard Rock hotel (ZendCon)



“This system  
is great. I love  
my ‘hot  
keys.’”

# Toolkit connects PHP to the i

# Access traditional ‘i’ resources from PHP

- **Call RPG, COBOL, CL**
  - Including IBM i APIs
  - Most popular use of toolkit
- **Commands**
  - ADDLIB LIB(MYLIB)
  - More command types (details later)
- **Read/write objects that store data**
  - Data areas
  - User spaces
- **Send/receive data queues**
- **Get lists, read data or attributes from these:**
  - Spooled files
  - Job logs
  - Active jobs
  - Objects
  - System values

# Call RPG/COBOL: adapt 5250 logic to the web

The image shows a side-by-side comparison of two interfaces for entering an order. On the left is a green terminal window displaying a menu with options like 'Bill To...', 'Customer', and 'Phone'. A large red arrow points from this terminal to the right-hand web browser window. The web browser displays an 'Order Entry' page with the following details:

**Entered By:** YVONNES  
**Order Date:** 12/15/08  
**Address:** http://i.medranoexpress.com/MedranoExpress/5CE/corder.php?Invoice=...  
**Medrano Express**  
**Dealer | Update Profile | Work with Customers and Invoices**  
**Work with Order 00192913-1**

**Bill-to Customer:** 2223492  
CALDERON RIVERA, MARGARITA  
754 26TH ST  
EAST MOLINE, IL 61244-1864  
USA  
Telephone: 309-292-3297

**Ship-to: FAMILIA**  
CALDERON RIVAS, ELSA MARINA  
BARRIO LAS CRUCITAS  
SANTA CRUZ DE YOJOA,  
CORTES  
HONDURAS  
Telephone: 6549412

**Branch:** 65 Medrano Express - Minneapolis  
**Order Date:** 2008-12-15  
**Order taken by:** YVONNES (Branch-65)  
**Dealer:** GUAMAR-LA GUADALUPANA MARKET  
**Zone:** GUAMAR

**Pickup Date/Comments:** 2009-01-02 ESTA CAJA SE RECOJERA POR FEDEX  
**Shipment Date/Comments:** 2009-01-05

Line#	Item	Item Description	# of Pkgs	Declared Value	Quantity	Unit Price	Customs Fee	Insurance	Extended Amount
1	22"X22"X22"	Box Size: 22 X 22 X 22 Weight: .00 Status: X	1	500.00	1	165.00	.00	15.00	180.00
		Qty Package Content and Description		Value					
		Package 1 of 1	Add/Update content						
		0 ZAPATOS		0.00					
		0 ROFA		0.00					
		0 CAMARA DE VIDEO		0.00					
		0 PAQUES DESECHABLES		0.00					
		Total Content Value		0.00					
		Order Totals:			1				
						1			
							0.00	15.00	180.00

**Buttons:** Print Invoice, Print Labels, Add New Notes

**Order Notes:**

- 2008-12-15 Invoice scheduled for P/U on 12/15/08 by YVONNES.
- 2008-12-15 Package Content entered/updated by YVONNES
- 2008-12-16 Zone changed from LAPAZM To GUAMAR by YALITZAF

**Logon:** SYSTEM SYSTEM SYSTEM

# Screen #1, Order header

Minnesota	Order Entry	Entered By YVONNES
Invoice #. 1000000000000000000-01	Invoice Posted	Order Date 12/15/08
Bill To... 2223492 ( <b>F4=Search</b> )	Ship To FAMILIA	
CALDERON RIVERA, MARGARITA 754 26TH ST	Name... CALDERON RIVAS, ELSA MARINA	
	Addr1.. BARRIO LAS CRUCITAS	
	Addr2..	
	Addr3..	
EAST MOLINE IL 61244-1864	City... SANTA CRUZ DE YOJOA	
Country USA United States	Region. CORTES	
Phone 309-292-3297	Country HONDURAS	
Dealer. GUAMAR LA GUADALUPANA	Phone.. 504-- 654-9412	
Empty Box Delivery Date . 12/15/08	Reference#	
	Delv.Time. ( <b>F4=Search</b> )	
Request Pickup Date . . . . 1/02/09	Pickup Time 0	( <b>F4=Search</b> )
	ESTA CAJA SE RECOJERA POR FEDEX	
Request Ship Date . . . . 1/05/09		
Zone./ Branch ..... GUAMAR / 65		
Enter=Continue <b>F4=Search</b> <b>F12=Previous</b> <b>F20=Override Zone</b> <b>F22=Change Ship-To</b>		

# Screen #2, Order detail

OEORDD	Order Inquiry	Entered By	YVONNES/Minneap
Region	MN Minnesota	Order Date	12/15/08
Bill To	CALDERON RIVERA, MARGARITA	Invoice #	0000000000 -01
Ship To	CALDERON RIVAS, ELSA MARINA	Order Status	Invoice Posted
Country	504 HONDURAS		

Ord Inv				Customs	Delivery	Extended		
Qty	Qty	Item/Desc	Weight	Price	Insure\$	Fee	Charges	Amount
2>Edit	4=Pkg	Content	5=Adjust	Comm	6=Change	Posted	Item	7=Coupon
1	1	22	0	165.00	15.00	.00	.00	180.00
22"X22"X22"								
Coupon								
#/Pkgs								
1	Declared Value...	\$500.00			Invoice Date/By.	12/15/08	YVONNES	
Ln# 001	Inv Seq-01	Comm 30.00			Package Scanned.	1/08/09	YALITZAF	
					Invoice Posted...	1/08/09	YALITZAF	

Bottom

Order Total. 180.00

Invoice 01 Total. 180.00

Enter=Accept F1>New Box F2=Other Charges F7=Summary F24=More Keys

# Screen #3, Content package from detail

## (Option 4 from order header)

Invoice#.	-	1	Package Contents	JESSIE	2/02/10
Line#....	0001	22"X22"X22"	Dist Branch.....	Honduras(50400/516-279-5205)	
Total# of Pkgs....	1	Delivered by.....	FERNANDO ARGUIJ		
Declared Value(Ins)	500	Delivery Date.....	2/01/09		
Insurance Charges..	15.00	Delivery signed by	ELSA MARINA CALDERON		
				Declared	
Pkg#	Package Content/Detail Descriptions			Weight	Customs\$
1=Enter/Edit Content	2=Enter Claim	3=Assign Claim	4=Comment	5=Close Claim	
6=Enter Customs Value					
-	1 -ZAPATOS				
-	-ROPA				
-	-CAMARA DE VIDEO				
-	-PAÑALES DESECHABLES				

Bottom

Enter=Accept F2=Print F12=Previous

# Screen #4, Notes from order detail

F9 key launches this

Date	Notes	Created By
2>Edit	4>Delete	
1/04/09	Label 00192913-01 printed by YVONNES.	SYSTEM
1/04/09	Invoice 00192913-01 printed by YVONNES.	SYSTEM
1/04/09	Dealer changed from LAPAZM to GUAMAR by YVONNES	SYSTEM
12/16/08	Price Overridden from 175.00 to 165.00 by YALITZAF CORRECCION	SYSTEM
12/16/08	Zone changed from LAPAZM To GUAMAR by YALITZAF	SYSTEM
12/15/08	Package Content entered/updated by YVONNES	SYSTEM
12/15/08	Invoice scheduled for P/U on 12/15/08 By YVONNES.	SYSTEM

Add Notes

Bottom

days

Enter=Continue F3=Exit

# Web page combines all 4 “green screens”

Address: http://i.medranoexpress.com/MedranoExpress/i5OE/oeorder.php?Invoice= XXXXXXXXXX Go Links >

**Medrano Express**

bienvenido! LA GUADALUPANA MARKET (GUAMAR) February 2,2010  
Branch: Medrano Express - Minneapolis Phone: 612-721-4547

Dealer | Update Profile | Work with Customers and Invoices

Work with Order 00192913-1

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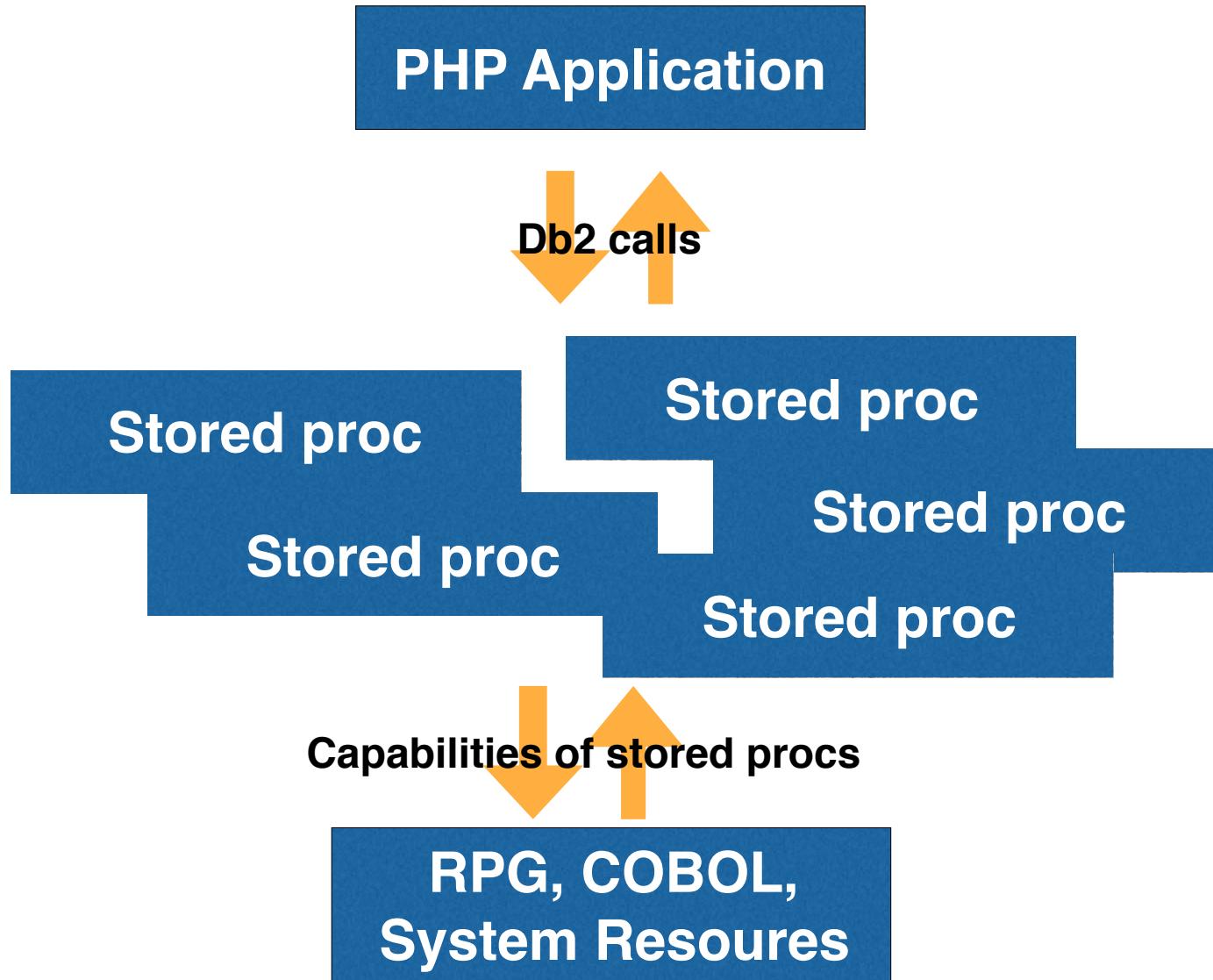
Line#	Item	Item Description	# of Pkgs	Declared Value	Quantity	Unit Price	Customs Fee	Insurance	Extended Amount
1	22"X22"X22" Status: X	Box Size: 22 X 22 X 22 Weight: .00 Qty Package Content and Description Value Package 1 of 1 Add/Update content 0 ZAPATOS 0.00 0 ROPA 0.00 0 CAMARA DE VIDEO 0.00 0 PAcLES DESECHABLES 0.00 Total Content Value 0.00	1	500.00	1	165.00	.00	15.00	180.00
			Order Totals:	1	1	0.00	15.00	180.00	

[Print Invoice](#) [Print Labels](#) [Add New Notes](#)

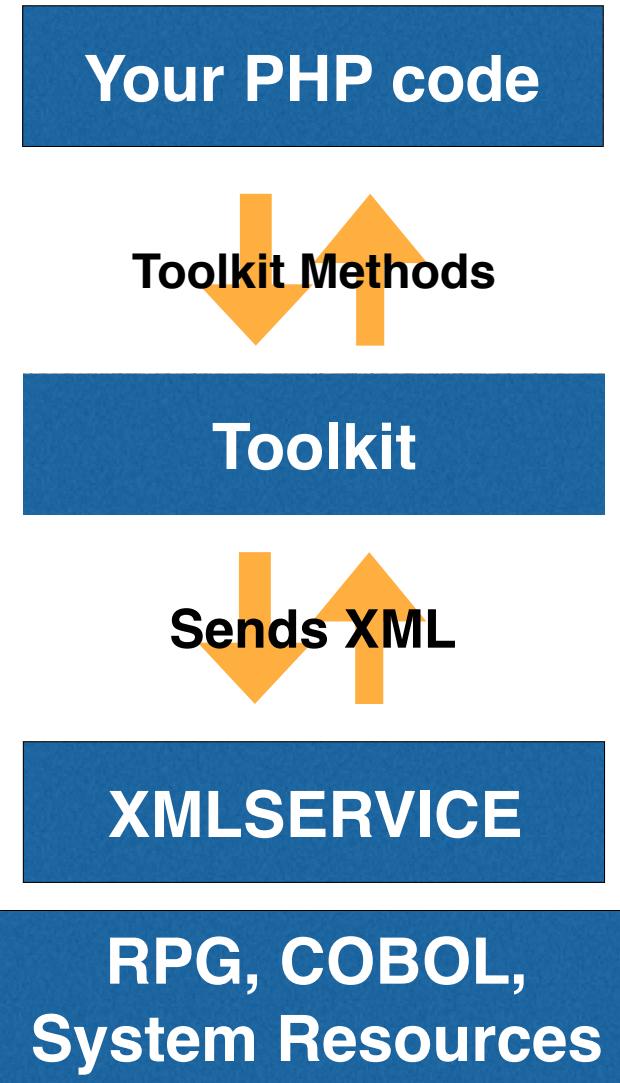
**Order Notes**

2008-12-15 Invoice scheduled for P/U on 12/15/08 By YVONNES. SYSTEM  
2008-12-15 Package Content entered/updated by YVONNES SYSTEM  
2008-12-16 Zone changed from LAPAZM To GUAMAR by YALITZAF SYSTEM

# Traditional stored procedure way to call RPG



# Toolkit architecture (no extra objects)



Also parses data structures  
and more

# XMLSERVICE

# Toolkit's back-end: “XML Service”

- An IBM open source project for IBM i
- Written in RPG
- Like a generic stored procedure
  - Avoid hassle of creating individual stored procedures
  - Works via XML passed to/from it
  - Can handle complex data structures easily
- Tony Cairns, IBM Rochester



# XML Service architecture

- **Cross platform, accessible by all languages**
- **Expects parameters defined in XML**
  - PHP toolkit handles the XML

```
<pgm name='ZZCALL' lib='MYLIB'>
  <parm><data type='1A'>a</data></parm>
  <parm><data type='1A'>b</data></parm>
  <parm><data type='7p4'>11.1111</data></parm>
  <parm><data type='12p2'>222.22</data></parm>
  <parm><ds>
    <data type='1A'>x</data>
    <data type='1A'>y</data>
    <data type='7p4'>66.6666</data>
    <data type='12p2'>77777.77</data>
  </ds>
  </parm>
  <return><data type='10i0'>0</data></return>
</pgm>
```

# Toolkit

# Collaborative

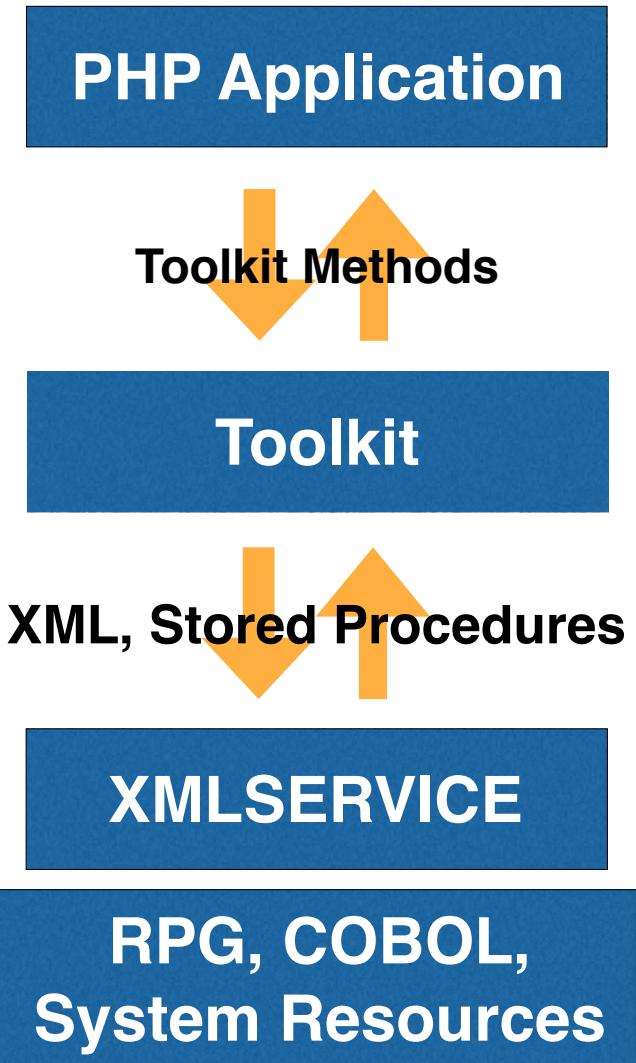
- **Free and Open Source Software (FOSS)**
  - Source code is there—read it, learn, extend, give feedback
  - Open source on IBM i appeals to young developers
- **Community involvement**
  - People are contributing enhancements and fixes (PHP and RPG code). Luca Zovi, Martin Hieden. Tell us your ideas

# Toolkits shipped by Zend (then and now)

- **2006-2011: i5 Toolkit (Easycom)**
  - No longer shipped with Zend Server
  - May still be used if already installed
  - Remains available commercially from Aura company
- **2012+: Open Source Toolkit**
  - Made of pure PHP and RPG, free and open source
  - Functionality similar to i5 Toolkit
  - Includes a Compatibility Wrapper (CW), developed by me, to ease transition to new toolkit

# PHP toolkit talks to XMLSERVICE

- PHP talks to XMLSERVICE through generic stored procedures (installed automatically)
- Any environment that can send/receive XML can use XMLSERVICE
- PHP was the first major “client” to use XMLSERVICE but others are here now (e.g. PowerRuby, Node.js, .NET), strengthening XMLSERVICE as a back-end



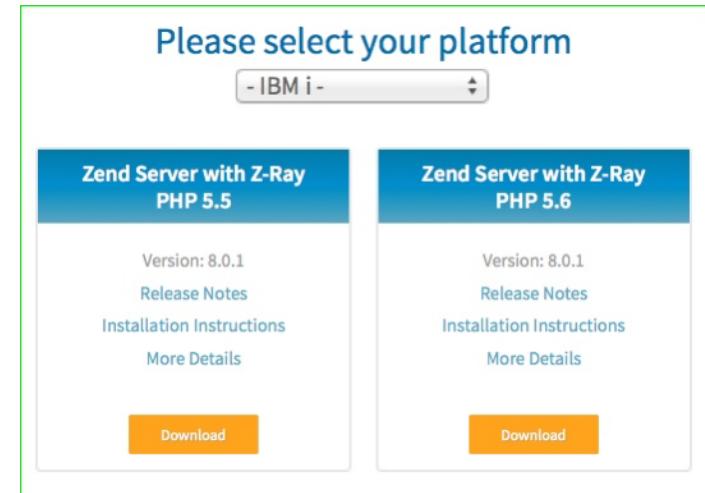
# Install and configure

# Several ways to get toolkit

- **Zend Server**
  - Official, tested release packaged in Zend Server
- **Young i Professionals (YiPs) site**
  - Various levels of testing done
  - Install from source code
- **Github (PHP front-end only)**
- **Details coming up**

# Zend Server for IBM i

- **Download Zend Server 8.x or 9.x**
  - <http://www zend com/en/products/server/downloads-ibmi>
    - Includes latest approved toolkit
- **Editions**
  - <http://www zend com/en/products/server/editions>
  - Basic (free), Professional, Enterprise
  - Same download, different license



# New versions on YiPs

- **Young i Professionals (YiPs) site**

- <http://youngiprofessionals.com/wiki/XMLSERVICE>
- Install from source code
- Two parts: RPG and PHP

## **XMLSERVICE RPG download latest**

[{XMLSERVICE.zip}](#) - RPG library (server)

- [{Installation}](#) - How to install/config/debug?
- [{Changelog}](#) - What's New?
- [{Next Testing}](#) - Unreleased versions?
- Tony Cairns <[adc@us.ibm.com](mailto:adc@us.ibm.com)>  - Author
- [BSD License](#) - business friendly Open Source

## **PHP Toolkit download latest**

- [{PHP Toolkit}](#) - PHP download latest (client)
- Alan Seiden <[alan@alanseiden.com](mailto:alan@alanseiden.com)>  - Author

- **Installation instructions are on the site**

# “Bleeding edge” also on YiPs

- **Test versions of XMLSERVICE**
  - “For brave and helpful only”
  - Rapid releases to resolve issues or add functionality
  - <http://174.79.32.155/wiki/index.php/XMLSERVICE/XMLSERVICETesting>
- **Look under  
“Active test versions”**

**XMLSERVICE Testing**

**XMLSERVICE new enhancements and fix testing**

(click to open) Quick Page Table of Contents

Goto Main Page

**Notification**  
Test versions are for brave and helpful ONLY. This page is explanation of things being worked with XMLSERVICE. You are welcome to download the new version and try it out (main page under testing), but we recommend you try it from the test library XMLSERVICE (crtxml), not production (crtxml2) until the actual release GA. We appreciate any help checking out XMLSERVICE open source project (free programs), our goal is not to be intrusive into your daily activities, but your help testing makes XMLSERVICE better for everyone. If you find an overriding issue or need a critical enhancement please let one of the authors know via email (main page).

Zend usually produces a PTF every quarter new toolkit RPG+PHP wrapper, so XMLSERVICE new main page releases will generally follow a 3 month cycle of testing (March, June, Sept, Dec.).

**Active test versions**

- none

**Older test versions**

- 2012-09-14 -xmlservice-rpg-1.7.2-sg1.zip
- BUG — V5R4 increase PGM OPM limit 32 to 256 parms (Thanks Sandy)
  - Note: V5R4 issue OPM (v5r4=true or <pgm mode='opm' ...)
  - Parm max is essentially unlimited for non-OPM (v5r4=false)

# YiPs installation location

- **Choose XMLSERVICE installation library**

- CRTXML compiles into XMLSERVICE test library
  - If use test library, configure with toolkit.ini's "XMLServiceLib"
- CRTXML2 compiles into ZENDSVR production library
- CRTXML6 compiles into ZENDSVR6 production library
- CRTXML7 compiles into ZENDPHP7 production library

- **Standard directory for PHP toolkit code**

- /usr/local/zendsvr(6)/share/ToolkitApi
- or /usr/local/zendphp7/share/ToolkitApi

# GitHub is latest home to the toolkit

- Front-end PHP part of toolkit is now managed on Github
  - Community can enter issues, submit pull requests, add examples
  - Composer and Packagist...getting close!
  - <https://github.com/zendtech/IbmiToolkit>

The screenshot shows the GitHub repository page for `zendtech/IbmiToolkit`. The page title is "zendtech / IbmiToolkit". Below the title, it says "PHP frontend to XMLSERVICE for IBMi development." with a "Edit" link. The repository statistics are listed: 133 commits, 1 branch, 3 releases, and 2 contributors. A dropdown menu shows the current branch is "master". The commit history is displayed in a table:

IbmiToolkit / +		
Fixed how variable is called.		
	adamculp authored 13 days ago	latest commit b1ad52e10d
	ToolkitApi	Fixed how variable is called.
	ToolkitTests	Update cwtest to standards.
	tests	Added test placeholder.
	vendor	add gitignore files

# Verify installation: run demo scripts

- Deploy the sample scripts:

- [http://files zend com/help/Zend-Server-IBMi/content/i5\\_installing\\_sample\\_scripts\\_ibmi.htm](http://files zend com/help/Zend-Server-IBMi/content/i5_installing_sample_scripts_ibmi.htm)

## New PHP Toolkit Demo Scripts

The new Toolkit technology is based on an open source XML transport developed by IBM and Zend, which allows you to extend PHP code to access IBM i resources. The Toolkit XML service protocol is designed to work with "state full" RPG/CL programs (many open database files and other system resources), so a developer won't have to rewrite any programs just to get on the web.

Clicking on the script name will run the code and clicking on the display code will display the PHP code. The scripts location is /www/zendsvr/htdocs /NewToolkit.

- [Run Display Library \(DSPLBL\) command Display Code](#)
- [Program Call with two parameters Display Code](#)
- [Program Call with Data structure parameters Display Code](#)
- [Service Program call that returns function value Display Code](#)

## Additional code samples

- Work with Spooled File entries [Display Code](#)
- Work with Data Queue (keyed) [Display Code](#)
- Work with User Space [Display Code](#)
- Work with Objects [Display Code](#)
- Work with Jobs [Display Code](#)

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# Program calls

# Calling demo script with result

## Call\_program\_RPG.html

**Calling an RPG program with two parameters**

Code:  (Valid Code is 1 or 2)

**Click “Call program” to pass parameter to PHP and then RPG**

Parameter Name	Parameter Value
CODE	1
DESC	IBM

# RPG program from ZENDSVR samples

File: ZENDSVR/QRPGLESRC

Member: COMMONPGM

```
C      *ENTRY          PLIST
C
C      PARM           CODE      10
C      PARM           NAME      10
*****
C      CODE           IFEQ      '1'
C                  movel      'IBM'     name
C                  ELSE
C      CODE           IFEQ      '2'
C                  movel      'Zend'    name
C                  ELSE
C                  movel      'wrong code' name
C                  ENDIF
C                  ENDIF
C*
C      SETON
C      RETURN          LR
```

# PHP to call it

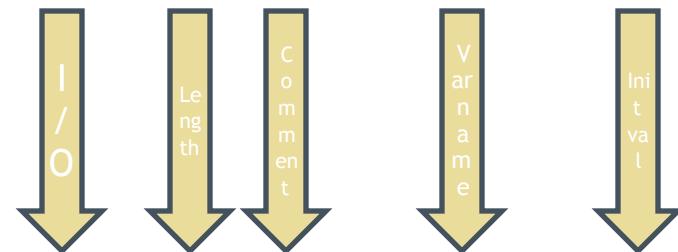
/www/zendsvr/htdocs/Samples/Toolkit/Call\_RPG\_example.php

```
76 //Instantiate the toolkit service object...
77 $ToolkitServiceObj->setToolkitServiceParams(array('InternalKey'=>"/tmp/$user"));
78
79 // Program call...
80 $code = 2; //1 = IBM and 2 = Zend...
81 $desc = ' ';
82
83 $param[] = $ToolkitServiceObj->AddParameterChar('both', 10, 'CODE', 'CODE', $code);
84 $param[] = $ToolkitServiceObj->AddParameterChar('both', 10, 'DESC', 'DESC', $desc);
85
86 $result = $ToolkitServiceObj->PgmCall("COMMONPGM", "ZENDSVR", $param, null, null);
```

# AddParameterChar in detail

```
function AddParameterChar(  
    $io, $size, $comment, $varName = '', $value, $varying, $dimension)
```

AddParameterChar() is defined in ToolkitService.php



Our example:

```
37 $param[] = $ToolkitServiceObj->AddParameterChar('both', 10, 'CODE', 'CODE', $code);  
38 $param[] = $ToolkitServiceObj->AddParameterChar('both', 10, 'DESC', 'DESC', $desc);  
39  
40 $result = $ToolkitServiceObj->PgmCall("COMMONPGM", "ZENDSVR", $param, null, null);  
41  
42 if($result){  
43     showTable( $result['io_param']);  
44 }  
45 else  
46     echo "Execution failed.;"
```

# More parameter types

```
AddParameterChar($io, $size, $comment, $varName, $value, $varying, $dimension)

AddParameterInt16($io, $comment, $varName, $value, $dimension) [5i0 ints]
AddParameterInt32($io, $comment, $varName, $value, $dimension) [10i0 ints]
AddParameterInt64($io, $comment, $varName, $value, $dimension)
AddParameterUInt32($io, $comment, $varName, $value,$dimension)
AddParameterUInt64($io, $comment, $varName, $value, $dimension)

AddParameterFloat($io, $comment, $varName, $value, $dimension)

AddParameterReal($io, $comment, $varName, $value, $dimension)

AddParameterPackDec($io, $length, $scale, $comment, $varName, $value,
$dimension)

AddParameterZoned($io, $length, $scale, $comment, $varName, $value,
$dimension)

AddParameterBin($io, $size, $comment, $varName, $value,$dimension)

AddDataStruct(array $parameters, $name='struct_name', $dim, $by, $isArray,
$labelLen)
```

# Additional program call features

- PCML parameter definitions (optional)
- Complex data structures
- Arrays and output counter fields
- Service programs, procedures, return values
  - Example of call to service program (procedure):

<http://www.seidengroup.com/2012/12/27/service-program-procedures-with-php-toolkit-for-ibm-i/>

# Common question

- “My RPG data structures are complex. Is there a shortcut to creating the PHP parameters?”
- “I am a PHP developer. I don’t understand the RPG data types. My RPG programmer doesn’t know how to explain.”
- The solution is here!

# New RPG-to-PHP parameter mapping tool

- <http://yips.idevcloud.com/Samples/DSpecTool/>
- Creates PHP code based on D Specs
- Open source: <https://bitbucket.org/inext/xmlservice-rpg>
- (NEW: <http://yips.idevcloud.com/Samples/RPGFreeTool/>)

The screenshot shows a web application interface for the D Spec Tool. At the top, there is a navigation bar with two tabs: 'D Spec Tool' (selected, indicated by a green background) and 'Map'. Below the navigation bar, the main content area has a title 'Map RPG to PHP Toolkit'. The content area contains three paragraphs of text:

- This tool helps tedious D Spec mapping.
- Simply cut/paste RPG to generate PHP Toolkit AddParameterXXXX syntax.
- PHP Toolkit generated source appears RPG order, manually re-order PHP statements.

In the bottom right corner of the content area, there is a green button labeled 'Map'.

# Paste the RPG code

## Map RPG To PHP Toolkit

PGM (optional)

LIB (optional)

Input: RPG D Spec cut/paste fixed format 'D' specs (example below)

```
* job info
  D RtvJobInf      PR          ExtPgm( 'QUSRJOBI' )
  D   RcvVar        32766A    options(*varsize)
  D   RcvVarLen     10I 0    CONST
  D   Format         8A       CONST
  D   JobName        26A      CONST
  D   IntJobID       16A      CONST
  D   ErrorCode      32766A   options(*varsize)
```

Generate PHP Stub (verbose)

Generate PHP Stub (ignore "S")

Generate PHP Functions (ignore "S")

Clear Form

# Voila...parameters in PHP

Output: PHP Toolkit (RPG order of appearance, manually re-order PHP statements)

```
// ****
// Procedure: RtvJobInf
// ****
$result = null;
$param = null;
$param[ ] = $tk->AddParameterChar("both",32766,"RcvVar","RcvVar","");
$param[ ] = $tk->AddParameterInt32("both","RcvVarLen","RcvVarLen",0);
$param[ ] = $tk->AddParameterChar("both",8,"Format","Format","");
$param[ ] = $tk->AddParameterChar("both",26,"JobName","JobName","");
$param[ ] = $tk->AddParameterChar("both",16,"IntJobID","IntJobID","");
$param[ ] = $tk->AddParameterChar("both",32766,"ErrorCode","ErrorCode","");
$output = $tk->PgmCall("QUSRJOBI", "", $param, $result, array("func"=>"RTVJOBINF"));
```

- Creates perfect parameters, including any procedure name
- You may have to adjust the order for data structures

# Commands

# Several ways to call commands

```
$conn->CLCommand('my command');  
$conn->CLInteractiveCommand('DSP.... command');  
$conn->CLCommandWithOutput('RTV... command');
```

Details ahead...

# Simple command

```
// CLCommand to add library list entry
$cmdString = 'ADDLIB LIB(ALANLIB)';
$success = $conn->CLCommand($cmdString);
if($success) {
    echo 'Added library';
} else {
    echo 'Error: ' . $conn->getErrorMsg();
}
```

# Interactive command output

```
$cmdString = 'DSPLIBL' ;  
  
// CLInteractiveCommand returns "screen" results  
$liblArray = $conn->CLInteractiveCommand ($cmdString) ;  
  
if($liblArray) {  
    // output full result of DSPLIBL command in an array  
    // <pre> </pre> formats the array  
    echo '<PRE>' . print_r($liblArray, true) . '</PRE>' ;  
}
```

**Results on next slide...**

# Results of DSPLIBL

Array

(

[0] =>	5770SS1 V7R1M0	100423	Library List	3/19/12	8:52:44	Page 1
[1] =>	ASP					
[2] =>	Library	Type	Device	Text Description		
[3] =>	QSYS	SYS		System Library		
[4] =>	QSYS2	SYS		System Library for CPI's		
[5] =>	QHLPSYS	SYS				
[6] =>	QUSR SYS	SYS		System Library for Users		
[7] =>	DBU80	SYS				
[8] =>	QSYS38	SYS				
[9] =>	DC@EPC03	USR		EPC-814 DC@ADKPGM		
[10] =>	ZENDSVR	USR				
[11] =>	QGPL	USR		General Purpose Library		
[12] =>	QTEMP	USR				
[13] =>	* * * * * END OF LISTING * * * * *					

)

# Get info with RTV\* commands

**CLCommandWithOutput()** gets output from RTVJOBA, RTVOBJD,  
RTVUSRPRF...

```
public function getJobAttributes() {  
  
    // Note: specify (?N) for numeric attributes  
    $cmdString = 'RTVJOBA JOB(?) USER(?) NBR(?) CURUSER(?) SYSLIBL(?)  
    CURLIB(?) USRLIBL(?) LANGID(?) CNTRYID(?) CCSID(?N) DFTCCSID(?N)' ;  
  
    // Send command; get output array of key/value pairs  
    $outputArray = $this->CLCommandWithOutput($cmdString) ;  
  
    return $outputArray;  
  
} // (public function getJobAttributes())  
  
$attrs = $conn->getJobAttributes(); // run command  
echo '<pre>' . print_r($attrs, true) . '</pre>'; // print_r() formats arrays
```

Results on next slide...

# Output from RTVJOBA

## Array of job attributes

```
Array (
    [JOB] => QSQSRVR
    [USER] => QUSER
    [NBR] => 240164
    [CURUSER] => QTMHHTTP
    [SYSLIBL] => QSYS          QSYS2      QUSRSYS
    [CURLIB] => *NONE
    [USRLIBL] => QTEMP         QGPL       MYUTIL
    [LANGID] => ENU
    [CNTRYID] => US
    [CCSID] => 37
    [DFTCCSID] => 37
)
```

# More examples

# Array of data structures

- See example here: <http://forums zend com/viewtopic.php?f=113&t=105248>
- Important snippets here:

```
// Subfields for data structure
// Here's a character field array, size 3, that's part of the DS
$ds[] = $conn->AddParameterChar('both', 21, 'Part', 'PTPRT', '')
        ->setParamDimension(3); // three records

// DSCOUNT is a counter field. Value is set by RPG/COBOL program. Value will control the number
// of MULTDS fields that return (see data structure MULTDS below)
$params[] = $conn->AddParameterZoned('both', 5, 0, 'how many MULTDS array elements actually
return', 'DSCOUNT', 6)->setParamLabelCounter('DSCOUNT');

// Multi-occurrence data structure with maximum dimension set to 100 but whose final output count
// will be determined by DSCOUNT. field names arbitrary. Name them whatever you wish
$params[] = $conn->AddDataStruct($ds, 'MULTDS')
            ->setParamDimension(100) // max of 100 records
            ->setParamLabelCounted('DSCOUNT');
```

# Read a data area

```
require_once('iToolkitService.php');

// set up name of data area
$dataAreaObj = new DataArea($ToolkitServiceObj);
$dataAreaObj->setDataAreaName('MYDTAARA', 'MYLIB');

// read it
$value = $dataAreaObj->readDataArea(1, '*ALL'); // offset and length

// output string value from data area
echo $value;
```

# Connecting

# Basic connection

- **Connect with database, user, password**
  - Try \*LOCAL or real database name
    - WRKRDBDIRE shows valid names
  - If leave blank (" , " , " ): connect with default web user
    - QTMHHTTP

```
<?php

// bring in the toolkit
require_once('ToolkitService.php');

// connect to local IBM i
$conn = ToolkitService::getInstance('*LOCAL', 'MYUSER', 'MYPASS');

// specify stateless mode (simple: no internal key needed)
$conn->setOptions(array('stateless'=>true));
```

# Choice of stateless or stateful (private)

- **Easiest way to start: stateless**

- Quicker initial connection, runs toolkit directly in DB2 job (QSQSRVR job)
- No guarantee that you'll get same job from pool
- Share QTEMP between SQL and RPG (runs in DB2 job)
- Specify 'stateless'

```
$conn=>setOptions (array ('stateless'=>true)) ;
```

- **Advanced: stateful/private**

- A new job is started and “reserved” for re-use
- Retains file cursors (READE position), QTEMP, LIBL, open file handles
- Best performance when many program calls
- Specify 'InternalKey' as unique job identifier

```
$conn=>setOptions (array ('InternalKey=>'/tmp/jim123')) ;
```

# Safety first

# Prevent RPG/COBOL errors from hanging

- **“Message waiting” Inquiry messages are to be avoided**
  - It seems “normal” for errors to pop up in a green screen
  - “Record lock,” “Add more records to file?” “Level check”
  - Find them with `DSPMSG MSGQ(QSYSOPR) MSGTYPE(*INQ)`
- **If an RPG/CL does not complete, it won’t return control**
- **Web page will “hang” till it times out or operator ends job**
  - If operator ends job, further requests may go nowhere
- **Three techniques coming up—aside from not allowing faulty programs in production**

# 1. Wrap program in CL having MONMSG

- **Wrap RPG/COBOL call in a CL (control language) program containing a MONMSG statement. Example:**

```
PGM      PARM(&PGMNAME &ERRORFL)
DCL      &PGMNAME *CHAR 10
DCL      &ERRORFL *CHAR 1
/* if any error, end and return error code '1' */
CALL PGM(&PGMNAME)
MONMSG CPF0000 EXEC(GOTO $ERROR)
CHGVAR &ERRORFL '0'
RETURN

$ERROR:
CHGVAR &ERRORFL '1'

ENDPGM
```

## 2. Toolkit timeout technique

```
// give RPG/COBOL 15 seconds to complete before we give up and  
end the program, so that PHP doesn't 'hang'.  
$options = array('stateless' => true,  
                 'customControl' => '*call(15/kill/server)');  
$conn->setOptions(array($options));
```

### 3. Set a global reply via System reply list

- CHGJOB INQMSGRPY(\*SYSRPLYL)
- WRKRPYLE, ADDRPLYLE

Work with System Reply List Entries

Opt	Sequence Number	Message ID	Reply	Compare Value
1	10	CPA0700	D	*NONE
-	20	RPG0000	D	*NONE
-	30	CBE0000	D	*NONE
-	40	PLI0000	D	*NONE
-	60	LBE7200	C	*NONE
-	70	MCH0801	F	*NONE

Add Reply List Entry (ADDRPLYLE)

Type choices, press Enter.

Sequence number . . . . .	15	1-9999
Message identifier . . . . .	CPA0700	Character value, *ANY
Compare data:		
Comparison data . . . . .	*NONE	
Message data start position .	*NONE	1-999, *NONE
Message reply . . . . .	C	

# Resources, events, Q&A

# Resources

- **Alan's toolkit page with links to other resources**
  - <http://alanseiden.com/toolkit>
- **Young i Professionals site**
  - <http://youngiprofessionals.com/wiki/XMLSERVICE>
- **Zend Toolkit Forum**
  - <http://forums zend com/viewforum.php?f=113>
  - “PHP on IBM i”->“Zend Server for IBM i”->“New Toolkit”
- **Zend toolkit manual**
  - [http://files zend com/help/Zend-Server-IBMi/zend-server.htm#php\\_toolkit\\_xml\\_service\\_functions.htm](http://files zend com/help/Zend-Server-IBMi/zend-server.htm#php_toolkit_xml_service_functions.htm)
- **Github site**
  - <https://github.com/zendtech/lbmiToolkit>

# Try the toolkit and get to web/mobile

```
1 PGM PARM(&LOADNBR &MODE &DOCK &DOOR &MSGID &MSGTXT)
2
3 /* Program Variables */
4 DCL VAR(&cEop)      TYPE(*CHAR) LEN(001) VALUE('X')
5 DCL VAR(&cErr)      TYPE(*CHAR) LEN(001) VALUE('E')
6 DCL VAR(&cStrLoad)  TYPE(*CHAR) LEN(008) VALUE('CU85E8RP')
7 DCL VAR(&cStpLoad)  TYPE(*CHAR) LEN(008) VALUE('CU85E9RP')
8 DCL VAR(&LoadNbr)   TYPE(*DEC)  LEN(10 0)
9 DCL VAR(&Dock)      TYPE(*CHAR) LEN(004)
10 DCL VAR(&Door)      TYPE(*CHAR) LEN(002)
11 DCL VA /**
12 DCL VA
13 * Start or stop a particular load by calling a CL.
14 * @param string $id The load id
15 * @param string $type The type: STR for start, STP for stop
16 */
17 /* Global Error
18 */
19 {
20     MONMS
21
22 /*=====
23 /* Main Logic For
24 */
25 /*=====
26
27 /* Start C
28     STRCM
29     MONMS
30
31 /* Call
32     CALLS
33
```

Appointment 0109701 Time: 17:45 - 21:45 Created by: TESTUSER

Appointment SCHED 0 of 374 CPE 0 of 54 MDE 0 of 130 Add Load

Authorization No: 478547 Weight: 8996.38 lbs Load #: 0000007845

Volume: 1416.13 cu/ft 22.127 linear feet Load Type: N/A

Progress: 0% (0 of 374 units loaded)

Seq	Shipment No	Sold-to/Ship-To	Sold-To Nm	Ship-To Nm	Pro No	Bill of lading	Weight	Volume
0000005511	13876/00005	DEPT STORES	DEPT STORES	07947660000037853			121.75	13.26
0000005615	13876/00010	DEPT STORES	DEPT STORES	07947660000037699			156.40	22.31
0000005616	13876/00030	DEPT STORES	DEPT STORES	07947660000037713			577.50	78.97
0000005617	13876/00040	DEPT STORES	DEPT STORES	07947660000037720			244.70	34.21
0000005618	13876/00065	DEPT STORES	DEPT STORES	07947660000037737			1003.05	179.51
0000005619	13876/00080	DEPT STORES	DEPT STORES	07947660000037744			190.75	26.74
0000005621	13876/000875	DEPT STORES	DEPT STORES	07947660000037751			27.80	3.89
0000005622	13076/00000	DEPT STORES	DEPT STORES	07947660000037768			106.00	15.13
0000005623	13876/00000	DEPT STORES	DEPT STORES	07947660000037775			481.35	68.06
0000007714	13876/00020	DEPT STORES	DEPT STORES	07947660000037782			693.00	156.27
0000007715	13876/00010	DEPT STORES	DEPT STORES	07947660000037699			3436.74	582.87
0000007716	13876/00000	DEPT STORES	DEPT STORES	07947660000037799			793.09	130.55
0000007717	13876/00005	DEPT STORES	DEPT STORES	07947660000037768			343.40	42.79
0000007718	13876/00090	DEPT STORES	DEPT STORES	07947660000037775			1659.10	297.13

Notes Print Documents Ok Cancel

When a user presses Start Load, the program calls the CL and starts the logic for moving the shipment into the truck.

# A community resource: get involved

- **Help us enhance the toolkit**
  - Report any issues on the Forum
- **Contribute enhancements, tips, fixes**
  - Write to forum or [alan@alanseiden.com](mailto:alan@alanseiden.com)
- **Why?**
  - Make the toolkit and IBM i platform better for everyone
  - Sharpen your skills; work with great people ☺
  - Working with open source demonstrates commitment to your chosen platform and your career as a whole

---

# **PHP Toolkit for IBM i**

## **technical details**

---

# To check XMLSERVICE version

```
call qp2term  
qsh -c /qsys.lib/zendphp7.lib/xmlver.pgm
```

returns something like:

```
XML Toolkit 1.9.1$
```

Make sure it's at least 1.8.5. Critical bug was fixed in 1.8.0. (If the "xmlver" program not found, your XMLSERVICE is too old!)

For older releases of Zend Server, use library **zendsvr6** or **zendsvr** instead of **zendphp7**.

# How to use persistent DB2 connection

- See “DB2 and PHP Best Practices on IBM i”
  - Persistent DB connection
    - \$conn = ToolkitService::getInstance('\*LOCAL', 'myuser', 'mypw', '', **true**);
    - Fifth param is persistence flag
    - Or re-use an existing DB2 persistent connection
- ```
// connect to db. Make sure i5 naming mode matches between DB2 and toolkit
$namingMode = DB2_I5_NAMING_ON; // ON or OFF
$db = db2_pconnect('DBNAME', 'user', 'pass', array('i5_naming' => $namingMode));

// Connect to Zend API, passing db resource and i5 naming mode instead of dbname/
// user/password.
$conn = ToolkitService::getInstance($db, $namingMode);
```

# Useful settings in toolkit.ini

- Located in /usr/local/zendsvr(6)/share/ToolkitApi
- Useful settings:
  - [system]
    - Debug=true
      - Creates debug.log
    - XMLServiceLib = "ZENDSVR6"
      - Or = "XMLSERVICE"
      - Lets you try new versions safely
    -

# How to check or set CCSID

- **DSPSYSVAL QCCSID**
  - If not 65535, you're probably OK
  - Change with CHGSYSVAL SYSVAL(QCCSID) VALUE(xyz)
- **or in Apache config: /www/zendsvr(6)/conf/httpd.conf**
  - USA settings:
    - DefaultFsCCSID 37
    - CGIJobCCSID 37
  - Different outside of USA. Check list of “Job CCSID”:
    - [http://www-03.ibm.com/systems/i/software/globalization/default\\_list.html](http://www-03.ibm.com/systems/i/software/globalization/default_list.html)
- **Everyone must set a CCSID**
  - This really means YOU.....otherwise toolkit will not work
  - I mean it ☺
- **P.S. Please set your CCSID**

# Connect from “off the box”

# 2-tier = Run PHP on Windows/Linux/Mac

- **A common developer request**
- **Develop on laptop**
  - Connect to XMLSERVICE on IBM i; then deploy PHP code to IBM i with no code changes
- **Or run production PHP on non-i machine, calling IBM i-based RPG, commands, etc.**
- **Never a charge or cost for this 2-tier support**
  - All free and open source

# Alternatives for 2-tier transports

- **DB2 Connect and ODBC**
  - “DB2 Connect” software from IBM (paid software)
    - Advantage: handles SQL queries, too, as if they were local to PC
  - No-charge alternative: ODBC (free with IBM i Access)
- **Other alternatives**
  - CGI/HTTP (no drivers needed)
  - Many more are possible because XML can be sent over any type of connection

# Connect via ODBC

- **First, set up ODBC database config on your PC**
  - Connection name will be used as the db name (\*LOCAL is not allowed)
  - Documentation: <http://publib.boulder.ibm.com/infocenter/iseries/v7r1m0/index.jsp?topic=%2Frzaii%2Frzaiiodbc04.htm>
- **New API style connection**

```
$conn = ToolkitService::getInstance('MYODBCCONN', 'myuser',
    'mypw', 'odbc');
```
- **CW style connection**
  - Specify database name in toolkit.ini

```
[hosts]
myibmi = MYODBCCONN

// PHP to connect via ODBC
$options = array(CW_TRANSPORT_TYPE=>'odbc');
$conn = i5_connect('myibmi', 'myuser', 'mypw', $options);
```

# HTTP transport

- **HTTP/CGI interface, no drivers needed (1.5.0+)**
- **Not enabled by default (secure)**
  - See <http://www.youngprofessionals.com/wiki/XMLSERVICE>
  - “Optional XMLSERVICE REST interface via RPG CGI (xmlcgi.pgm)”
- **Point to it with toolkit.ini**

```
[transport]
; transport type allows configuration of transport from this INI.
transportType = "http" ; ibm_db2 is default. Other choices: "odbc", "http"

; for http transport only
httpTransportUrl = "http://example.com/cgi-bin/xmlcgi.pgm"
; default plug size (expected output size): 4K, 32K, 512K (default), 65K, 512K, 1M, 5M, 10M, 15M
; can also change in code with $conn->setOptions(array('plugSize' => '4K')); or desired size
```

# Performance “do”s and “don’t”s

# Performance “don’t”s

- **Don’t use disconnect() unless it’s the end of the day, logout, etc.**
  - Reconnection in stateful mode is slow
  - Official samples set a bad example here
- **Don’t allow inquiry messages to arise, hanging your job (and maybe more)**
  - See MONMSG and related topics to prevent this
- **Don’t run commands or programs that might return an error to the toolkit**
  - Example: ADDLIBLE can return “already exists” error. Prefer CHGLIBL or other technique
  - Toolkit will fetch joblog for error reporting, which can be slow
  - Not XMLSERVICE’s fault...in future we may allow “fast” (no joblog) mode sometimes for non-critical errors

# Performance “do”s

- **Do use the proper connection option**
  - Stateless: usually simplest and best. No new jobs needed
  - Stateful (InternalKey): requires care in choosing IPC key, and not disconnecting too often
- **Do set plugSize as small as possible for the expected data**
  - \$conn->setOptions(array('plugSize'=>'4K')); // minimum
  - Others are 32K, 512K, 65K, 512K, 1M, 5M, 10M, 15M
- **Do use a persistent db2 connection that you share with the toolkit**
  - See previous slide: “How to use persistent DB2 connection”
- **Do combine multiple command and program calls in a single CL program, then call the CL from the toolkit**
  - Also wrap “RTV\*” commands in CL

# Troubleshooting

# Retrieve error code and message

- **getErrorCode(), getErrorMsg()**
- **These will return a CFP-type code and descriptive message obtained from the joblog**

```
echo 'Problem calling program. Code: '
. $conn->getErrorCode() . '. Text: '
. $conn->getErrorMsg();
```

Problem calling program. Code: RNX1216 Text:  
Error message CPF4103 appeared during OPEN for  
file MNG111FM

# Troubleshooting tips

- **Get latest toolkit version**
  - Start with Zend Server download site
  - or latest XMLSERVICE and PHP wrapper
    - <http://www.youngprofessionals.com/wiki/XMLSERVICE>
  - Test in XMLSERVICE library if unsure
- **Use Z-Ray**
  - View returned XML including joblog if an error occurred
- **Create debug log**
  - In toolkit.ini, set debug=true, then run script again
    - Creates /usr/local/zendsvr6/share/toolkitapi/debug.log
    - debug.log contains all XML send/received, connection info
    - Tip: to split into daily logs, specify:  
`$conn->setOptions(array('debug'=>true, 'debugLogFile' =>' /usr/local/zendsvr6/var/log/toolkit_debug' . date("Ymd") . '.log'));`

# Z-Ray will speed development

- Shows every query and time for each query
- Toolkit extension for Z-Ray shows each program call, input/output, timing
  - Save time otherwise spent hunting in debug logs!

The screenshot shows a web browser window with two main sections. The top section displays a table of parameters:

| Parameter Name | Parameter Value |
|----------------|-----------------|
| CODE           | 1               |
| DESC           | IBM             |

The bottom section shows a toolkit analysis interface for the URL [http://democ8 zend.com:10080/samples/Toolkit/Call\\_RPG\\_example.php](http://democ8 zend.com:10080/samples/Toolkit/Call_RPG_example.php). The interface includes a search bar and a table with the following data:

| Xml In Input          | TimesCalled | Duration Inclusive | Duration Exclusive | Called From File       | Called From Line | XML In Output From .  |
|-----------------------|-------------|--------------------|--------------------|------------------------|------------------|-----------------------|
| <?xml version="1.0... | 1           | 162658             | 5844               | /usr/local/zendsvr6... | 893              | <?xml version="1.0... |
| <?xml version="1.0... | 2           | 21230              | 14408              | /usr/local/zendsvr6... | 893              |                       |

# Interactively debug RPG or COBOL program

1. Add the following line to your PHP script before the program call to be debugged.  
\$toolkitConn should be your toolkit connection object.

```
$toolkitConn->setOptions (array ('customControl'=>'*debug')) ;
```

Run your script. The script will "hang" while it waits on #2 below...(move to green screen 5250 for steps 2-10)

2. A MSGW inquiry message in DSPMSG QSYSOPR will be generated by the toolkit.
3. Note the job information (number, name, user) provided in the MSGW.
4. STRSRVJOB using that job information as parameters.
5. STRDBG with the program and library you wish to debug.
6. Answer the MSGW. Any answer will do--"G" is fine.
7. The RPG program source will appear in debug mode in your terminal, ready to step through, allowing you to inspect variables, etc.
8. When done inspecting and stepping, let the RPG program complete (using function keys indicated on screen).
9. ENDDBG
10. ENDSRVJOB

# Contact and tips

**Alan Seiden**

Seiden Group  
Ho-Ho-Kus, NJ

Free newsletter:  
<http://seidengroup.com/tips>



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