

Debugging: Past, Present, and Future

Derick Rethans

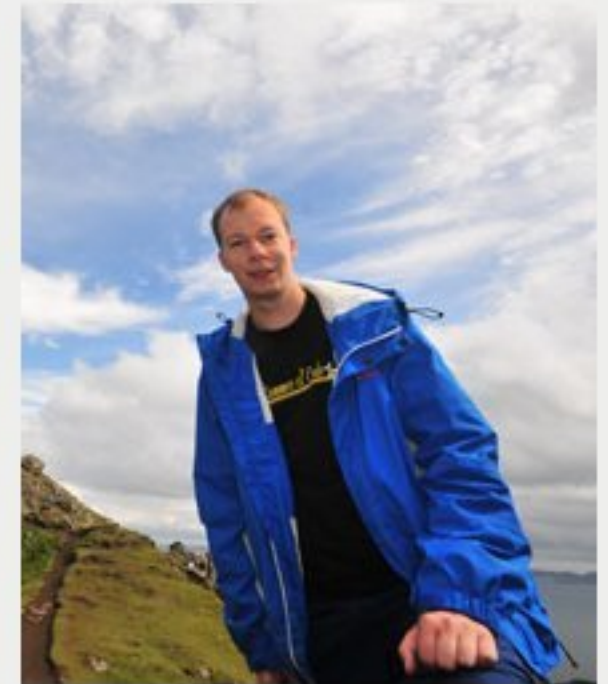
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<http://joind.in/15188>

About Me

Derick Rethans

- I'm Dutch/British living in London
- One of the PHP MongoDB driver maintainers
- Author of the PHP debugger tool Xdebug, PHP's Date/Time/Timezone support, and a bunch of other PHP extensions
- I ♥ maps



Today's agenda

- Past
- Present
- Future

Pretty Printing Variables

Options:

```
<?php
ini_set( 'xdebug.file_link_format', 'xdebug://%f@%l' );
ini_set( 'xdebug.overload_var_dump', 2 );
ini_set( 'xdebug.var_display_max_data', 25 );
ini_set( 'xdebug.var_display_max_depth', 4 );
ini_set( 'xdebug.var_display_max_children', 32 );
?>
```

Turn off in php.ini or .htaccess with:

```
xdebug.overload_var_dump = 0
```

Ladybug

<https://github.com/raulfraile/ladybug.git>

array (3)

/home/httpd/html/test/xdebug/var_dump-ladybug.php : 34

Krumo

<https://github.com/oodle/krumo.git>

▼ ... Array(3) ...

0 => NULL

1 Float => 3.141592654

▶ 2 Array(1) ...

Called from /home/httpd/html/test/xdebug/var_dump-krumo.php, line 30

Krumo version 0.5.0 | <https://github.com/oodle/krumo>

Kint

<https://github.com/raveren/kint.git>

[-] \$a array (3)

NULL

float 3.141592654

[+] array (1)

Called from <ROOT>test/xdebug/var_dump-kint.php line 30

Symfony var-dumper

<https://github.com/symfony/var-dumper.git>

```
array:3 [▼  
  0 => null  
  1 => 3.141592654  
  2 => array:1 [▼  
    "dutch" => Xlocale {▶}  
  ]  
]
```

Scream

- PHP's @ operator hides warnings and errors
- `xdebug.scream=1` makes PHP ignore @



Tracing



Function traces

- Different types: **Textual**, **Parsable** and **HTML**
- Tracing only parts of an application with **xdebug_start_trace()** and **xdebug_stop_trace()**.
- `xdebug.collect_return`:

```
-> explode('/', '/xdebug-phpnw13/11') /home/httpd/pres2/show2.php:121  
=> array (0 => '', 1 => 'xdebug-phpnw13', 2 => '11')
```

- `xdebug.collect_assignments`:

```
-> ezcTemplateVariableCollection->__set($name = 'slideNr', $value = '11') /home/httpd/p  
=> $this->variables['slideNr'] = '11' /home/derick/dev/zetacomponents/trunk/Template
```

Xdebug 2.3: Munging Errors

`xdebug.halt_level:`

```
<?php
ini_set('xdebug.halt_level', E_USER_NOTICE | E_NOTICE);
trigger_error("Testing");
echo "Hi!\n";
?>
```

`xdebug.force_error_reporting &`
`xdebug.force_display_errors:`

- Overrides `error_reporting` or `display_errors`
- Can not be changed with `ini_set()`, only on CLI or in `php.ini`

Live Debugging

- DBGp, common Debugging protocol
- Cross-language: PHP, **HHVM**, Python, Perl...
- Komodo (Linux, Windows, Mac – commercial)
- Netbeans (Java-based – free)
- PHPStorm (Java-based – commercial)
- (and many others: <http://xdebug.org/docs/remote#clients>)

Netbeans

www.derickrethans.nl - NetBeans IDE 6.9.1

File Edit View Navigate Source Refactor Run Debug Team Tools Window Help

Proj... Files Services

Start Page x test.php x index.php x

Search (Ctrl+I)

Source Files

- cache
- html
 - cache
 - content
 - errorhandling
 - files
 - images

index.php - Navigator

```

1  <?php
2  require 'php/config.php';
3  $url = trim( $_SERVER['REQUEST_URI'], '/' );
4  $dopplr = true;
5
6  if ( $_SERVER['SERVER_NAME'] == 'www.derickrethans.nl' )
7  {
8      header( "Location: http://derickrethans.nl/$url" );
9  }
10
11 //check common thingies
12 if ( $url == '' )
13 {
14     $title = "Home";

```

Variables Call Stack Breakpoints Tasks

Name	Type	Value
Superglobals		
api	drBlogApi	
d	ezcDbHandlerSqlite	
transactionNestingLevel	integer	0
transactionErrorFlag	boolean	0
identifierQuoteChars	array	

Filters: [Icons]

netbeans-xdebug running 4 | 1 INS

Komodo

test.php (~dev/php/xdebug-demos/cli-debug) - ActiveState Komodo IDE 6.1 - Debugger

File Edit Code Navigation View Debug Project Tools Help

Start Page test.php x

```
4 private $priv;
5 protected $prot;
6 public $publ;
7
8 function __construct($a)
9 {
10     $this->priv = $a * 2;
11     $this->prot = $a * 2.5;
12     $this->publ = $a * M_PI;
13 }
14
15
16 function foo($a)
17 {
```

Breakpoints Command Output Test Results SCC Output || Debug: test.php

Break at /home/derick/dev/php/xdebug-demos/cli-debug/test.php, line 11.

Name	Type	Value
a	float	2.718281828459
▼ this	TheClass	
priv	float	5.4365636569181
prot	null	
publ	null	

Watch Locals Superglobals

Output Call Stack HTML

Ready | ● __construct | UTF-8 | Ln: 11 Col: 1 | PHP

PHP Storm

The screenshot displays the PhpStorm 7.1 IDE interface. The main editor window shows the file `pres2 - [/home/httpd/pres2] - .../show2.php - PhpStorm 7.1`. The file `show2.php` is open, and the `display` method of the `Presentation` class is selected. The code in the editor is as follows:

```
$tpl = new ezcTemplate();
$tpl->send->node = $xml->documentElement;
$tpl->send->pres = $this;
$tpl->send->pres->forPdf = isset( $_GET['pdf'] );
$tpl->send->slideNr = $slideNr;
$tpl->send->css = $this->css;

echo $tpl->process( 'slide.ezt' );
}
```

Below the editor, the `function renderToRst( $filename )` is defined:

```
function renderToRst( $filename )
{
    $tpl = new ezcTemplate();
    $tpl->send->pres = $this;
    echo $tpl->process( 'rst/presentation.ezt' );
}
```

The `Debugger` window is active, showing the `show2.php:209, Presentation->display()` frame. The `Variables` pane displays the following data:

- `$parts` = {array} [3]
- `$slideNr` = "13"
- `$this` = {Presentation} [6]
- `properties` = {array} [12]
- `slideFiles` = {array} [15]
- `0` = "slides/mongodb/title.xml"
- `1` = "slides/toolbox/me.xml"
- `2` = "slides/xdebug/agenda-ppp.xml"

Xdebug 2.3: New debugging features

- Exception breakpoints wildcard and inheritance
- Constants
- Include error code and exception message in exception breakpoints (needs IDE support)
- Warnings when SELinux is in the way

Activating the Remote Debugger

On the shell:

```
export XDEBUG_CONFIG="idekey=xdebugrocks"
```

Activating the Remote Debugger

With browser extensions:

The **easiest** Xdebug (Firefox):

<https://addons.mozilla.org/en-US/firefox/addon/the-easiest-xdebug/>

Xdebug Helper (Chrome): <https://chrome.google.com/extensions/detail/eadndfjplgieldjbigjakmdgkmoaaaoc>

Xdebug Toggler for Safari: <https://github.com/benmatselby/xdebug-toggler>

vld

Dumps oparray per element:

- main script
- function
- class method
- dead code analysis

Usage:

```
pecl install vld  
php -dextension=vld.so -dvld.active=1 script.php
```

vld paths #1: code

```
<?php
class ExceptionFoo extends Exception {}
class ExceptionBar extends Exception {}
class ExceptionBaz extends Exception {}

function trycatch($action)
{
    echo "Let's do some stuff!\n";
    $f = 5 * pow(3, 7);

    try {
        switch ($action) {
            case 1: throw new ExceptionFoo("test");
            case 2: throw new ExceptionBaz("test");
            case 3: throw new Exception("test");
        }
        echo "Not thrown\n";
    } catch (ExceptionFoo $e) {
        echo "caught\n";
    } catch (ExceptionBar $e) {
        echo "caught\n";
    } catch (ExceptionBaz $e) {
        echo "caught\n";
    }

    echo "And do some more\n";
}

trycatch(1);
```

vld paths #1: output

Function trycatch:

Finding entry points

Branch analysis from position: 0

Jump found. Position 1 = 17, Position 2 = 26

Branch analysis from position: 17

Jump found. Position 1 = -2

Branch analysis from position: 26

Jump found. Position 1 = 29, Position 2 = 38

Branch analysis from position: 29

Jump found. Position 1 = -2

Branch analysis from position: 38

Jump found. Position 1 = 41, Position 2 = 50

Branch analysis from position: 41

Jump found. Position 1 = -2

Branch analysis from position: 50

Jump found. Position 1 = 64

Branch analysis from position: 64

Jump found. Position 1 = -2

Found catch point at position: 53

Branch analysis from position: 53

Jump found. Position 1 = 54, Position 2 = 57

Branch analysis from position: 54

Jump found. Position 1 = 64

Branch analysis from position: 64

Branch analysis from position: 57

Jump found. Position 1 = 58, Position 2 = 61

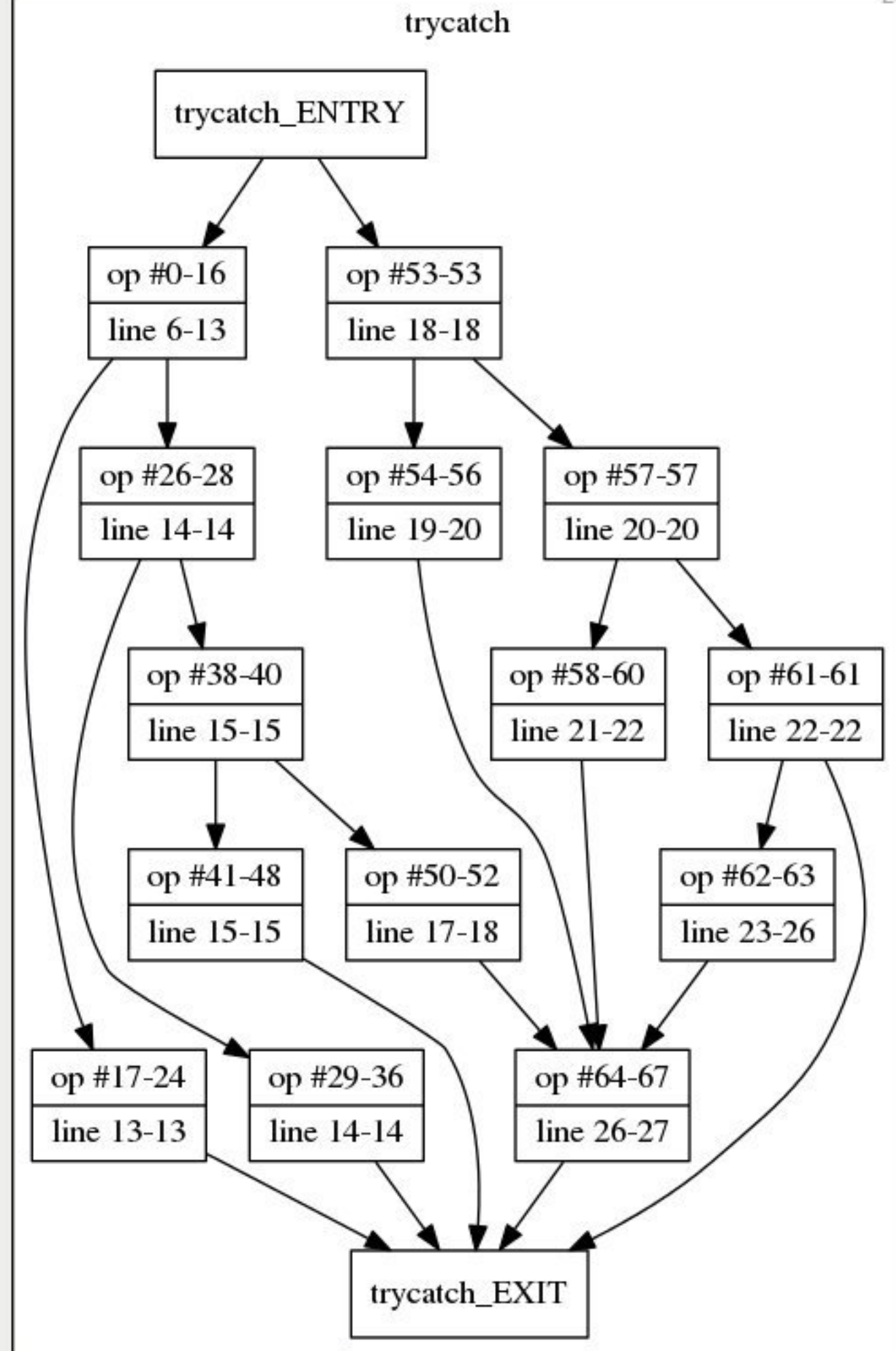
Branch analysis from position: 58

Jump found. Position 1 = 64

```

1 <?php
2 class ExceptionFoo extends Exception
3 class ExceptionBar extends Exception
4 class ExceptionBaz extends Exception
5
6 function trycatch($action)
7 {
8     echo "Let's do some stuff!\n";
9     $f = 5 * pow(3, 7);
10
11     try {
12         switch ($action) {
13             case 1: throw new Exception
14             case 2: throw new Exception
15             case 3: throw new Exception
16         }
17         echo "Not thrown\n";
18     } catch (ExceptionFoo $e) {
19         echo "caught\n";
20     } catch (ExceptionBar $e) {
21         echo "caught\n";
22     } catch (ExceptionBaz $e) {
23         echo "caught\n";
24     }
25
26     echo "And do some more\n";
27 }
28
29 trycatch(1);
30 trycatch(2);
31 try {
32     trycatch(3);
33 } catch (Exception $e) {

```



vld paths #2: code

```
<?php
function loopy($i)
{
    do
    {
        echo $i, ' ';

    } while( $i-- );
    echo "\n";
}

function ifthenelse( $a, $b )
{
    if ($a) {
        echo "A HIT\n";
    }
    if ($b) {
        echo "B HIT\n";
    }
}

loopy(0);
ifthenelse( true, false );
ifthenelse( false, true );
?>
```

vld paths #2: output

Function ifthenelse:

filename: /home/derick/dev/php/derickr-xdebug/tests/bug01034-004.inc

function name: ifthenelse

number of ops: 15

compiled vars: !0 = \$a, !1 = \$b

line	#*	E	I	O	op	fetch	ext	return	operands
12	0	E	>		EXT_NOP				
	1				RECV			!0	
	2				RECV			!1	
14	3				EXT_STMT				
	4		>		JMPZ				!0, ->8
15	5		>		EXT_STMT				
	6				ECHO				'A+HIT%0A'
16	7		>		JMP				->8
17	8		>		EXT_STMT				
	9		>		JMPZ				!1, ->13
18	10		>		EXT_STMT				
	11				ECHO				'B+HIT%0A'
19	12		>		JMP				->13
20	13		>		EXT_STMT				
	14		>		RETURN				null

branch: # 0; line: 12- 14; sop: 0; eop: 4; out1: 5; out2: 8

branch: # 5; line: 15- 16; sop: 5; eop: 7; out1: 8

branch: # 8; line: 17- 17; sop: 8; eop: 9; out1: 10; out2: 13

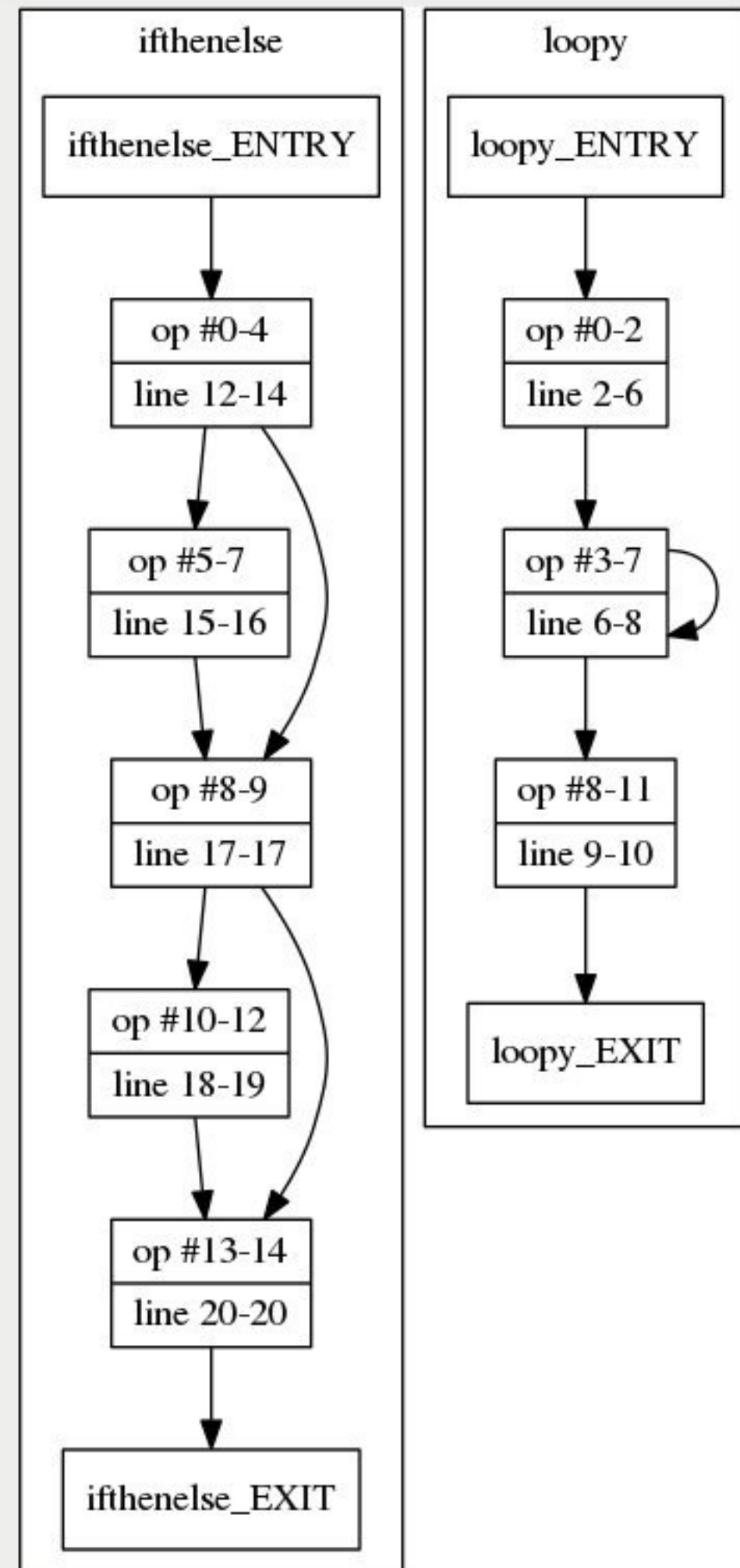
branch: # 10; line: 18- 19; sop: 10; eop: 12; out1: 13

branch: # 13; line: 20- 20; sop: 13; eop: 14; out1: 2

```

1 <?php
2 function loopy($i)
3 {
4     do
5     {
6         echo $i, ' ';
7     } while( $i-- );
8     echo "\n";
9 }
10
11
12 function ifthenelse( $a, $b )
13 {
14     if ($a) {
15         echo "A HIT\n";
16     }
17     if ($b) {
18         echo "B HIT\n";
19     }
20 }
21
22 loopy(0);
23 ifthenelse( true, false );
24 ifthenelse( false, true );
25 ?>

```



Xdebug code coverage

```
<?php
function ifthenelse( $a, $b )
{
    if ( $a ) {
        echo "A HIT\n";
    }
    if ( $b ) {
        echo "B HIT\n";
    }
}
```

```
<?php
require 'vendor/autoload.php';
include 'test.php';

$coverage = new PHP_CodeCoverage;

$coverage->start('coverage1');
ifthenelse( true, false );
$coverage->stop();

$coverage->start('coverage2');
ifthenelse( false, true );
$coverage->stop();

$writer = new PHP_CodeCoverage_Report_HTML;
$writer->process($coverage, '/tmp/code-coverage-report');
```

Xdebug code coverage output

/home/httpd/html/test/xdebug/code-coverage / test.php

Code Coverage									
	Classes and Traits			Functions and Methods				Lines	
Total							CRAP		100.00% 7 / 7
ifthenelse(\$a, \$b)					100.00%	1 / 1	0		100.00% 7 / 7

```

1 <?php
2 function ifthenelse( $a, $b )
3 {
4     if ($a) {
5         echo "A HIT\n";
6     }
7     if ($b) {
8         echo "B HIT\n";
9     }
10 }
11 ?>

```

Legend

Executed

Not Executed

Dead Code

Generated by [PHP_CodeCoverage 3.0-dev](#) using [PHP 5.4.33-dev](#) at Wed Oct 15 18:27:29 BST 2014.

Xdebug branch coverage

```
<?php
include 'dump-branch-coverage.inc';
include 'test.php';

xdebug_start_code_coverage(
    XDEBUG_CC_UNUSED |
    XDEBUG_CC_DEAD_CODE |
    XDEBUG_CC_BRANCH_CHECK // ← new magic sauce
);

ifthenelse( true, false );
ifthenelse( false, true );

xdebug_stop_code_coverage(false);

$c = xdebug_get_code_coverage();
dump_branch_coverage($c);
?>
```

Xdebug branch coverage output

```
A HIT
ifthenelse
- branches
  - 00; OP: 00-04; line: 02-04 HIT; out1: 05 HIT; out2: 08 HIT
  - 05; OP: 05-07; line: 05-06 HIT; out1: 08 HIT
  - 08; OP: 08-09; line: 07-07 HIT; out1: 10 HIT; out2: 13 HIT
  - 10; OP: 10-12; line: 08-09 HIT; out1: 13 HIT
  - 13; OP: 13-14; line: 10-10 HIT; out1: EX X
- paths
  - 0 5 8 10 13: X
  - 0 5 8 13: HIT
  - 0 8 10 13: HIT
  - 0 8 13: X
```

Xdebug branch coverage display

test.php

```

1 <?php
2 function ifthenelse( $a, $b )
3 {
4     if ( $a ) {
5         echo "A HIT\n";
6     }
7     if ( $b ) {
8         echo "B HIT\n";
9     }
10 }
11 ?>

```

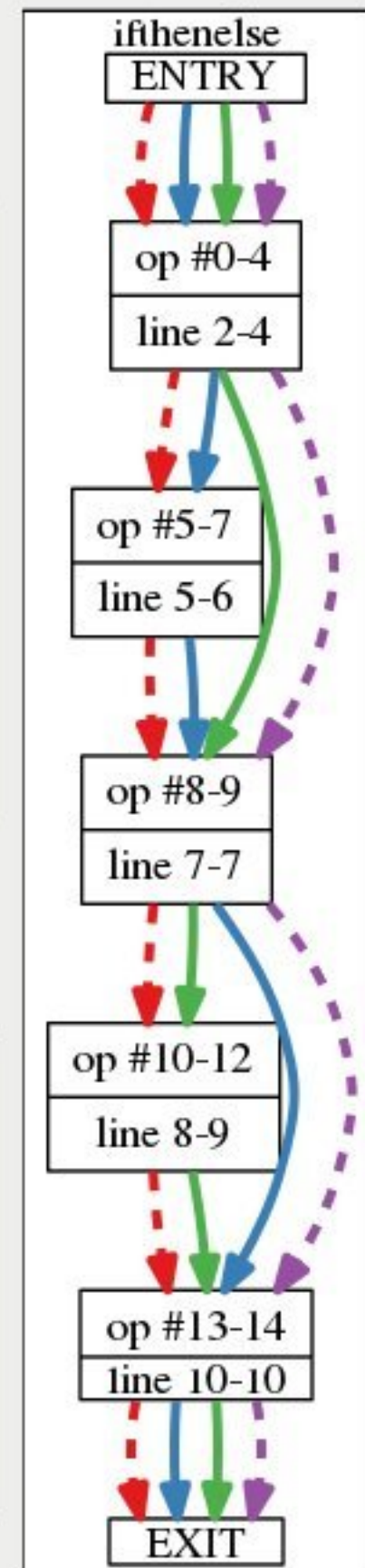
branch.php

```

...
xdebug_start_code_coverage(
    XDEBUG_CC_UNUSED | XDEBUG_CC_DEAD_CODE | XDEBUG_CC_BRANCH_CHECK
);

ifthenelse( true, false );
ifthenelse( false, true );
...

```





Wayback

- It is another tracing module, like the "human readable", "computerized" or "HTML" versions
- `php -dxdebug.auto_trace=1 -dxdebug.trace_format=3`

Wayback: Wrapper

- Program that acts as a DBGp client (just like Xdebug)
- Can read the special format trace files
- Implements extra DBGp commands for: seek, step_back, get_time_range
- Update DBGp spec
- Push IDEs to implement the extra commands

Wayback: Wrapper

- Program that acts as a DBGp client (just like Xdebug)
- Can read the special format trace files
- Implements extra DBGp commands for: seek, step_back, get_time_range
- Update DBGp spec
- Push IDEs to implement the extra commands
- Finish dumper

A few words on PHP 7

- Wayback -> Way in the future
- It compiles now
- About 60% of test cases pass
- It's like rewriting Xdebug ☹

Resources



Slides:

<http://derickrethans.nl/talks/xdebug-dc4d>

Derick Rethans — @derickr — derick@php.net

Feedback: <http://joind.in/15188>

(!) Warning: DOMDocument::load(): Document is empty in /home/httpd/presentations, line: 1 in /home/httpd/pres2/show2.php on line 200

Call Stack

#	Time	Memory	Function	Location
1	0.0013	313776	{main}()	.../show2.php:0
2	0.0092	684528	Presentation->display(\$slideNr = '37')	.../show2.php:142
3	0.0092	685384	load ('/home/httpd/pres2/presentations/')	.../show2.php:200

(!) Warning: DOMDocument::load(): Start tag expected, '<' not found in /home/httpd/presentations, line: 1 in /home/httpd/pres2/show2.php on line 200

Call Stack

#	Time	Memory	Function	Location
1	0.0013	313776	{main}()	.../show2.php:0
2	0.0092	684528	Presentation->display(\$slideNr = '37')	.../show2.php:142
3	0.0092	685384	load ('/home/httpd/pres2/presentations/')	.../show2.php:200

(!) Fatal error: Uncaught exception 'ezcTemplateRuntimeException' with message 'The external (use) variable 'node' is not set in template: /home/httpd/pres2/presentations/templates/default/slide.ezt and called from the application code' in /tmp/template-cache/compiled_templates/xhtmll-updqr0/slide-5eb6f7fc995a21e41e7fdbd1e4869726.php on line 9

(!) ezcTemplateRuntimeException: The external (use) variable 'node' is not set in template: /home/httpd/pres2/presentations/templates/default/slide.ezt and called from the application code in /tmp/template-cache/compiled_templates/xhtmll-updqr0/slide-5eb6f7fc995a21e41e7fdbd1e4869726.php on line 9

Call Stack

#	Time	Memory	Function	Location
1	0.0013	313776	{main}()	.../show2.php:0
2	0.0092	684528	Presentation->display(\$slideNr = '37')	.../show2.php:142
3	0.0115	787648	ezcTemplate->process(\$location = 'slide.ezt', \$config = ???)	.../show2.php:212
4	0.0142	909240	ezcTemplateCompiledCode->execute()	.../template.php:341
5	0.0155	957616	include ('/tmp/template-cache/compiled_templates/xhtmll-updqr0/slide-5eb6f7fc995a21e41e7fdbd1e4869726.php')	.../compiled_code.php:188

(!) Warning: DOMDocument::load(): Document is empty in /home/httpd/presentations, line: 1 in /home/httpd/pres2/show2.php on line 200

Call Stack

#	Time	Memory	Function	Location
1	0.0020	313776	{main}()	.../show2.php:0
2	0.0133	684528	Presentation->display(\$slideNr = '38')	.../show2.php:142
3	0.0134	685384	load ('/home/httpd/pres2/presentations/')	.../show2.php:200

(!) Warning: DOMDocument::load(): Start tag expected, '<' not found in /home/httpd/presentations, line: 1 in /home/httpd/pres2/show2.php on line 200

Call Stack

#	Time	Memory	Function	Location
1	0.0020	313776	{main}()	.../show2.php:0
2	0.0133	684528	Presentation->display(\$slideNr = '38')	.../show2.php:142
3	0.0134	685384	load ('/home/httpd/pres2/presentations/')	.../show2.php:200

(!) Fatal error: Uncaught exception 'ezcTemplateRuntimeException' with message 'The external (use) variable 'node' is not set in template: /home/httpd/pres2/presentations/templates/default/slide.ezt and called from the application code' in /tmp/template-cache/compiled_templates/xhtmll-updqr0/slide-5eb6f7fc995a21e41e7fdbd1e4869726.php on line 9

(!) ezcTemplateRuntimeException: The external (use) variable 'node' is not set in template: /home/httpd/pres2/presentations/templates/default/slide.ezt and called from the application code in /tmp/template-cache/compiled_templates/xhtmll-updqr0/slide-5eb6f7fc995a21e41e7fdbd1e4869726.php on line 9

Call Stack

#	Time	Memory	Function	Location
1	0.0020	313776	{main}()	.../show2.php:0
2	0.0133	684528	Presentation->display(\$slideNr = '38')	.../show2.php:142
3	0.0167	787648	ezcTemplate->process(\$location = 'slide.ezt', \$config = ???)	.../show2.php:212
4	0.0209	909240	ezcTemplateCompiledCode->execute()	.../template.php:341
5	0.0227	957616	include ('/tmp/template-cache/compiled_templates/xhtmll-updqr0/slide-5eb6f7fc995a21e41e7fdbd1e4869726.php')	.../compiled_code.php:188