Debugging for beginners

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Debugging

Debugging is a methodical process of finding and reducing the number of bugs, or defects, in a computer program thus making it behave as expected.

Wikipedia

Bugs

There are two types of bugs:

Trivial and very very difficult.

The 6 stages of debugging

1. That can’t happen.
2. That doesn’t happen on my machine.
3. That shouldn’t happen.
4. Why is that happening?
5. Oh, I see.
6. How did that ever work?

— John Chang, 2003

The debugging process

- Reproduce
- Diagnose
- Fix
- Reflect

Reproduce

Can *you* make the error happen on demand?

Where to start?

- Don’t trust the bug report!
- Find out what the correct operation is expected to be!
- Only ever work on one problem at a time!
- Check simple things first.
- Ask colleagues about problem area.

Reproduce

- Does it fail on the latest version?
- Does it fail on reported version?
- Match environment as closely as possible.
- Assume user didn’t do as expected.
- Last resort: add some logging and wait for new bug report!

Refine

Reduce the bug to the smallest possible number of steps

If it appears to be non-deterministic, it almost certainly can be made deterministic

Automate the bug - create a unit test!

Diagnose

Investigate the error and work out what has to be done!

Types of errors

The ones PHP tells you about

- Read any error messages and logs

The rest!

- Think & experiment!

Set up PHP to help you!

- Configure php.ini
- Install Xdebug

Useful php.ini settings

```
error_reporting = E_ALL | E_STRICT
display_errors = On
display_startup_errors = On
html_errors = On
log_errors = 1
error_log = /path/to/php_error.log
```

Xdebug

- var_dump() override
- set breakpoints
- inspect variables

Get it from http://xdebug.org (or your distro!)

Xdebug settings

```
xdebug.var_display_max_children = 99999
xdebug.var_display_max_data     = 99999
xdebug.var_display_max_depth    = 10000
xdebug.scream = 1
```

(This will save you *hours*)

Xdebug settings

Ensure Xdebug’s output is always readable regardless of your designer!

Set a custom CSS file in your browser and add this:

```
table.xdebug-error th,
table.xdebug-error td {
    color: black;
}
```

Types of error messages

- Fatal errors
- Syntax errors
- Recoverable errors
- Warnings
- Notices
- Deprecation notices

Don’t ignore any!

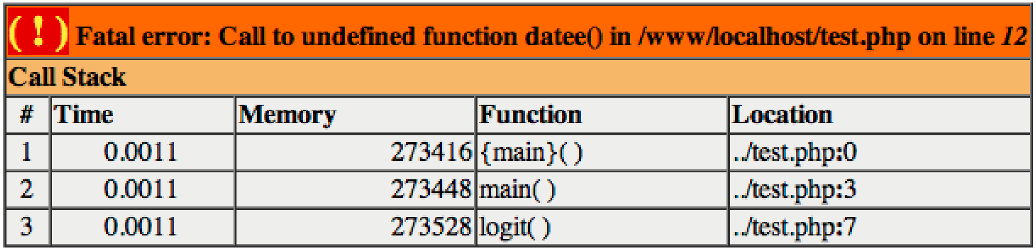
Reading error messages

- Actually *read* the error!
    - it's usually right
    - backtraces from Xdebug!
- Only worry about the first error

A Fatal error

```
Fatal error: Call to undefined function datee() in
//www/localhost/test.php on line 12
```

Xdebug display

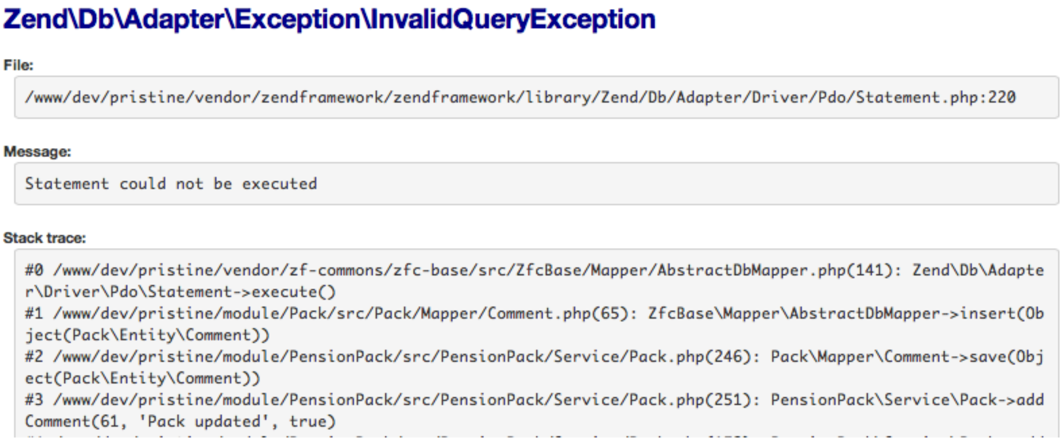


(!) **Fatal error: Call to undefined function datee() in /www/localhost/test.php on line *12***

Call Stack

#	Time	Memory	Function	Location
1	0.0011	273416	{main}( )	../test.php:0
2	0.0011	273448	main( )	../test.php:3
3	0.0011	273528	logit( )	../test.php:7

Exceptions



Zend\Db\Adapter\Exception\InvalidQueryException

File:

```
/www/dev/pristine/vendor/zendframework/zendframework/library/Zend/Db/Adapter/Driver/Pdo/Statement.php:220
```

Message:

```
Statement could not be executed
```

Stack trace:

```
#0 /www/dev/pristine/vendor/zf-commons/zfc-base/src/ZfcBase/Mapper/AbstractDbMapper.php(141): Zend\Db\Adapte
r\Driver\Pdo\Statement->execute()
#1 /www/dev/pristine/module/Pack/src/Pack/Mapper/Comment.php(65): ZfcBase\Mapper\AbstractDbMapper->insert(Ob
ject(Pack\Entity\Comment))
#2 /www/dev/pristine/module/PensionPack/src/PensionPack/Service/Pack.php(246): Pack\Mapper\Comment->save(Obj
ect(Pack\Entity\Comment))
#3 /www/dev/pristine/module/PensionPack/src/PensionPack/Service/Pack.php(251): PensionPack\Service\Pack->add
Comment(61, 'Pack updated', true)
```

Exceptions

Look for a previous exception!

```
$previousException = $e->getPrevious();
```

The other types of error

- Logical errors
- It doesn’t do what the user expects

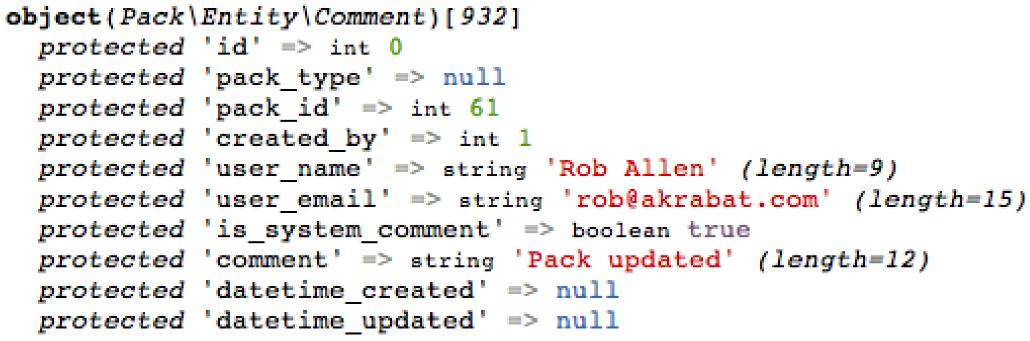
These are solved by experimentation and investigation

Var Dump Debugging

Quick and easy:

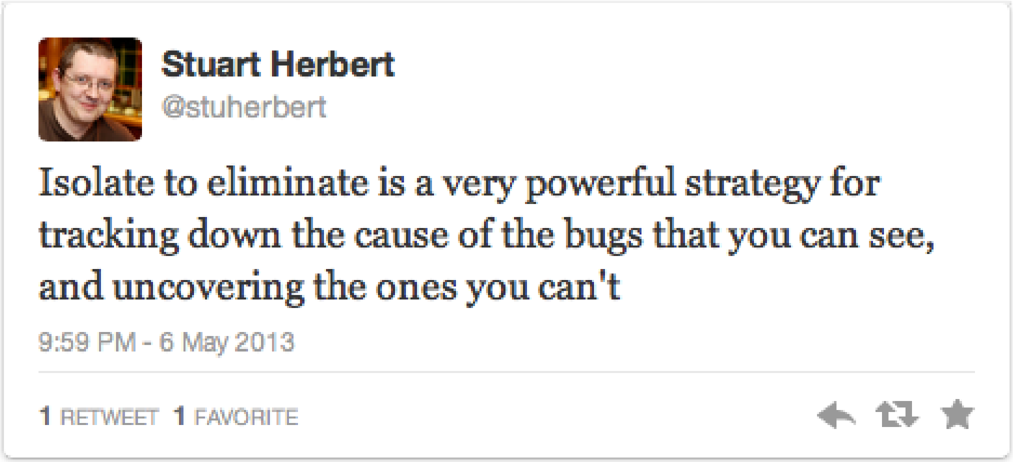
```
var_dump($comment);
exit;
```

Var Dump Debugging



```
object(Pack\Entity\Comment)[932]
  protected 'id' => int 0
  protected 'pack_type' => null
  protected 'pack_id' => int 61
  protected 'created_by' => int 1
  protected 'user_name' => string 'Rob Allen' (length=9)
  protected 'user_email' => string 'rob@akrabat.com' (length=15)
  protected 'is_system_comment' => boolean true
  protected 'comment' => string 'Pack updated' (length=12)
  protected 'datetime_created' => null
  protected 'datetime_updated' => null
```

(If you don’t have xdebug, then wrap in `<pre>` tags)



Stuart Herbert
@stuherbert

Isolate to eliminate is a very powerful strategy for tracking down the cause of the bugs that you can see, and uncovering the ones you can't

9:59 PM - 6 May 2013

1 RETWEET 1 FAVORITE

Divide and conquer

- Find halfway in process and inspect at that point
- Find halfway in correct half and inspect there
- etc.

Divide and conquer via git

- find a known working commit hash
- `git bisect` until you find the commit that caused the problem
- Read the diff carefully.

Choose logical check points

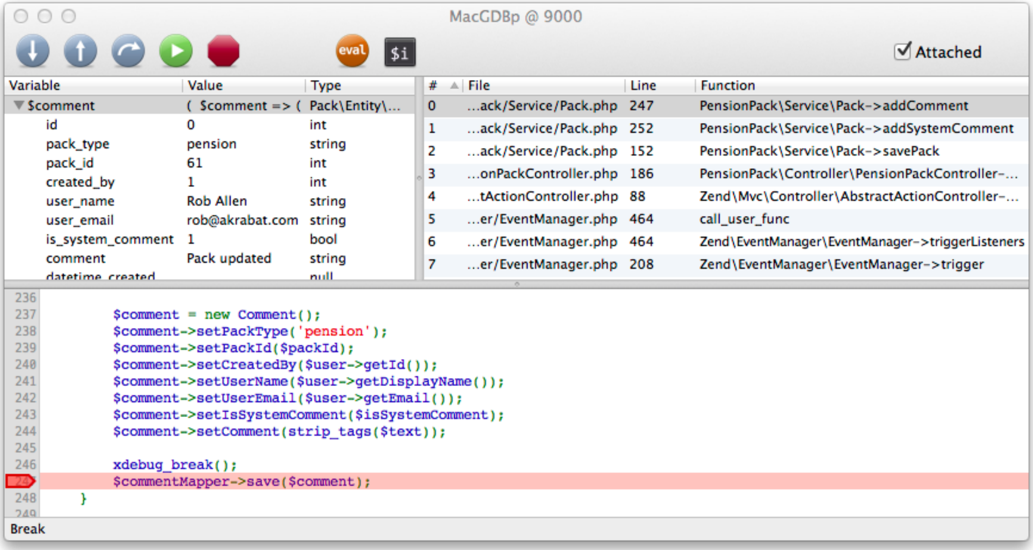
e.g.

- Test values sent into script
- Test storage
- Test retrieval
- Test display

Step by step with Xdebug

- Add `xdebug_break()` when you want stop.
- Run in browser
- debugger will kick in when break point reached.

MacGDBp



Variable	Value	Type
$comment	($comment => (	Pack\Entity\...
id	0	int
pack_type	pension	string
pack_id	61	int
created_by	1	int
user_name	Rob Allen	string
user_email	rob@akrabat.com	string
is_system_comment	1	bool
comment	Pack updated	string
datetime_created		null

#	File	Line	Function
0	...ack/Service/Pack.php	247	PensionPack\Service\Pack->addComment
1	...ack/Service/Pack.php	252	PensionPack\Service\Pack->addSystemComment
2	...ack/Service/Pack.php	152	PensionPack\Service\Pack->savePack
3	...onPackController.php	186	PensionPack\Controller\PensionPackController-...
4	...tActionController.php	88	Zend\Mvc\Controller\AbstractActionController-...
5	...er/EventManager.php	464	call_user_func
6	...er/EventManager.php	464	Zend\EventManager\EventManager->triggerListeners
7	...er/EventManager.php	208	Zend\EventManager\EventManager->trigger

```

        $comment = new Comment();
        $comment->setPackType('pension');
        $comment->setPackId($packId);
        $comment->setCreatedBy($user->getId());
        $comment->setUserName($user->getDisplayName());
        $comment->setUserEmail($user->getEmail());
        $comment->setIsSystemComment($isSystemComment);
        $comment->setComment(strip_tags($text));

        xdebug_break();
        $commentMapper->save($comment);
    }

```

Break

Logging

- Long term error reporting & tracing.
- Different levels for different types of message.
- I use `Zend\Log`. Also consider `monolog`.

Zend\Log setup

```
// setup
use Zend\Log\Logger;
use Zend\Log\Writer\Stream as LoggerStream;
$log = new Logger;
$writer = new LoggerStream($filename);
$log->addWriter($writer);
```

Zend\Log setup (2)

```
// Log PHP errors & exceptions too
Logger::registerErrorHandler($log);
Logger::registerExceptionHandler($log);
```

Zend\Log in use

```
$logger->log(Logger::INFO, 'My message');

// levels:
//      * EMERG     * WARN
//      * ALERT     * NOTICE
//      * CRIT      * INFO
//      * ERR       * DEBUG
```

Fix

A quality update is worth the effort!

Know the root cause

Never change the source unless you know *why* what you're doing fixes the problem

Clean up first

Start from a clean source tree - save you what you need first

`git reset` is good for this.

Create your test(s)

1. Add your new test(s)
2. Run them to prove that they fail
3. Fix the bug
4. Run the tests to prove that they pass
5. Run the full suite to ensure no (known) regressions

Refactor

The golden rule of refactoring is to not change functionality.

Therefore refactor before or after fixing the bug.

Commit

If it’s not in source control, then it hasn’t happened.

Reflect

Make sure it doesn’t happen again!

What went wrong?

- Requirements / spec
- Architecture / design
- Construction
- Testing

Change your dev practices?

- Coding standards
- Pair programming / code reviews
- Developer documentation
- Staff training
- Unit testing!
- Refactor

Historical records

- Log every bug in your bug tracker!

Questions?

Thank you

https://joind.in/8184

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