DAVE LIDDAMENT

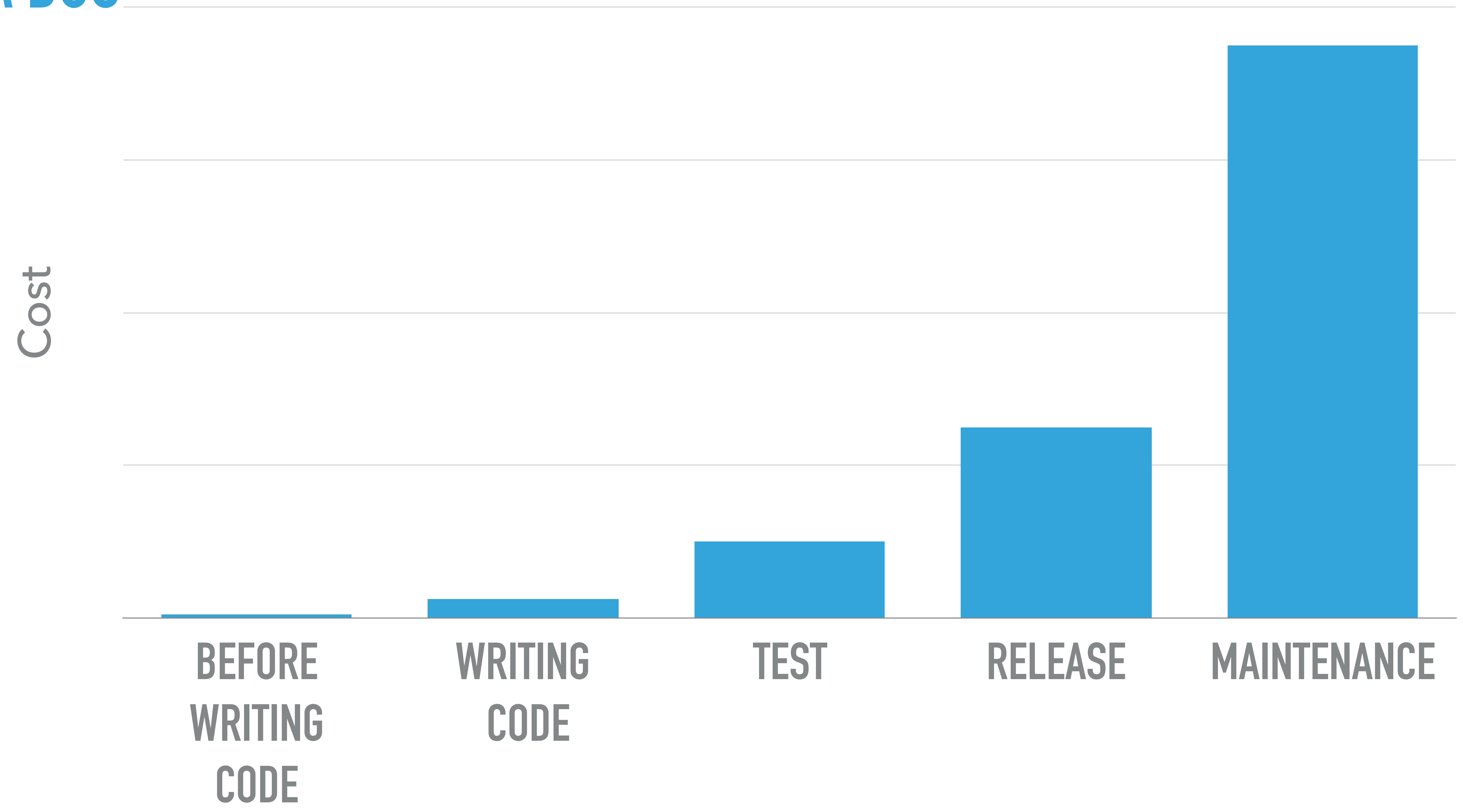
PRACTICAL STATIC ANALYSIS

php south wales

@daveliddament

APPROPRIATE APPLICATION OF STATIC ANALYSIS REDUCES THE OVERALL COST OF SOFTWARE DEVELOPMENT.

COST OF A BUG


Cost
BEFORE WRITING CODE
WRITING CODE
TEST
RELEASE
MAINTENANCE

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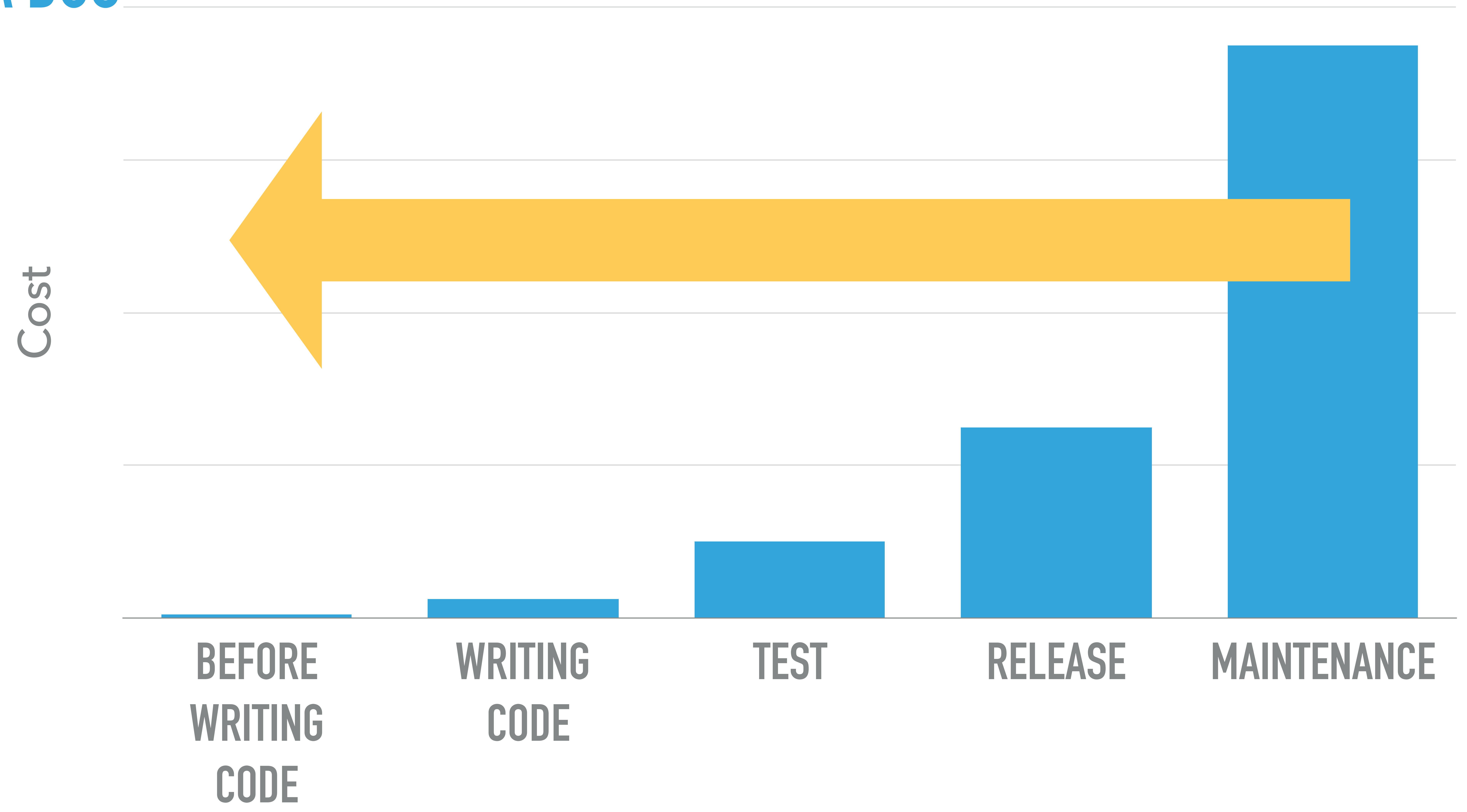
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AGENDA

What
Basic
Advanced
Practical

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Basic
Advanced
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STATIC ANALYSIS: IS THIS CORRECT CODE?

```
function process($user) {
  // some implementation
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Static analysis tells you that your code is incorrect.

TESTING

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```
function getPrice(string $type): int {
    if ($type === “CHILD") {
        $price = 10;
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    if ($type === “ADULT”) {
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TEST CASES

	Input	Expected output
Test 1	CHILD	10
Test 2	ADULT	20

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💯 Code coverage

Tests tell you a particular scenario is working correctly.

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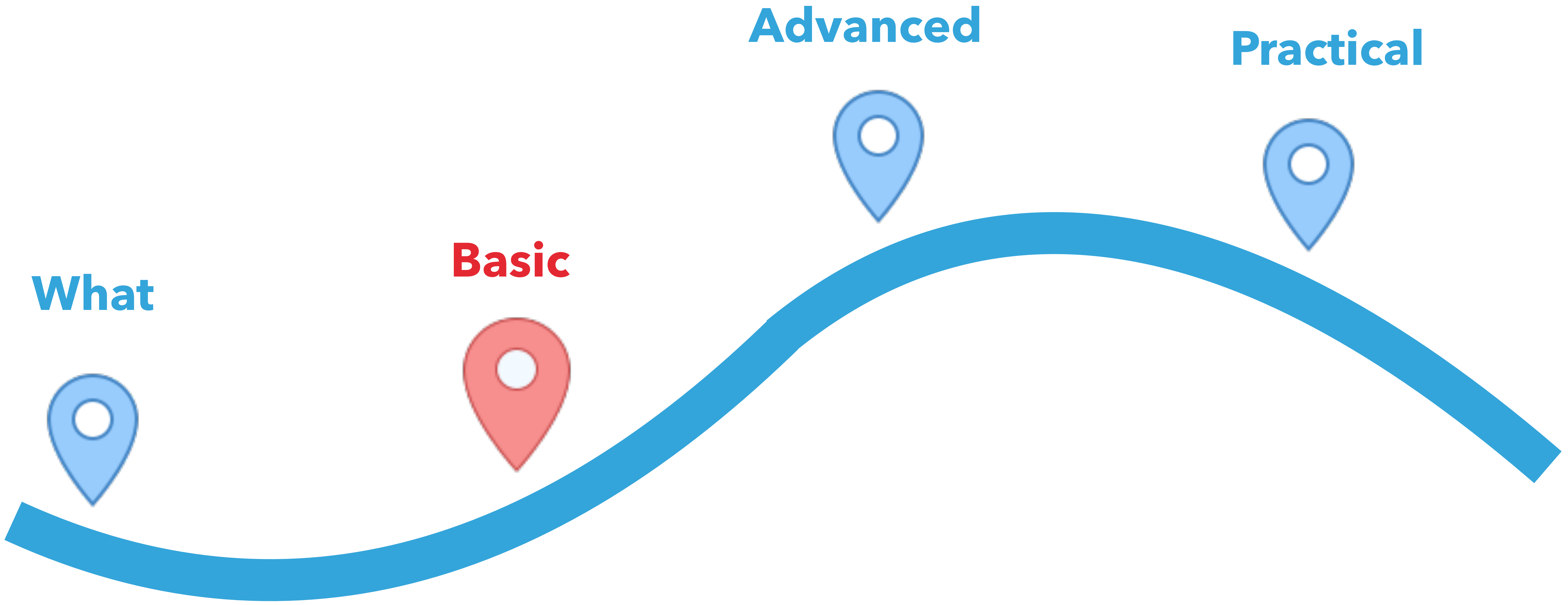

LINTING

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- Install:
  - `composer require —dev jakub-onderka/php-parallel-lint`

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  - `composer require —dev jakub-onderka/php-parallel-lint`
- Run:
  - `vendor/bin/parallel-lint src`

CODING STANDARDS

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- Auto fix code

SECURITY

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- `sensiolabs/security-checker`

OTHER CHECKS

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- https://github.com/exakat/php-static-analysis-tools

STATIC ANALYSIS FOR SYMFONY PROJECTS

- Twig lint: `console lint:twig <dir containing twig templates>`
- Yaml lint: `console lint:yaml <dir containing yaml config>`
- Doctrine : `console doctrine:schema:validate`

COMPOSER SCRIPTS

```
scripts: {
  "ci" : [
    "@composer validate —strict",
    "parallel-lint src tests",
   … other checks …
  ]
}
```

RUNNING A COMPOSER SCRIPT

```
composer run-script ci
```

COMPOSER SCRIPTS

```
scripts: {
   "cs-fix" : "php-cs-fixer fix -v"
}
```

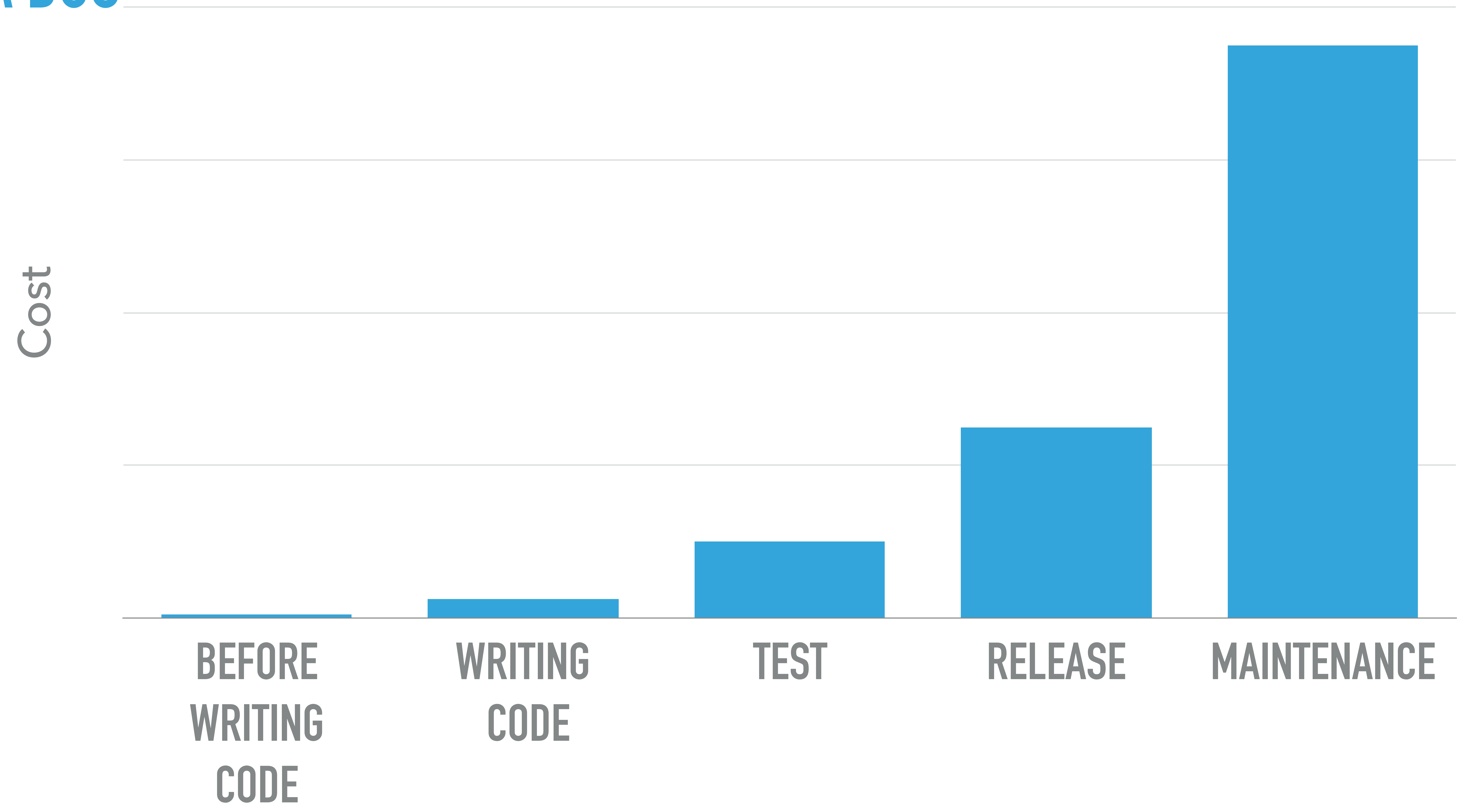
CI SERVER

```
version: 2
jobs:
  build:
    docker:
    - image: circleci/php:7.2-apache-stretch-node-browsers
    steps:
    - checkout
    - restore_cache:
        keys:
        - v1-dependencies-{{ checksum "composer.lock" }}
        - v1-dependencies-
    - run: composer install -n --prefer-dist --no-scripts
    - save_cache:
        key: v1-dependencies-{{ checksum "composer.lock" }}
        paths:
        - vendor
    - run: composer run-script ci
```

circleci

https://github.com/DaveLiddament/skeleton-ci-project

COST OF A BUG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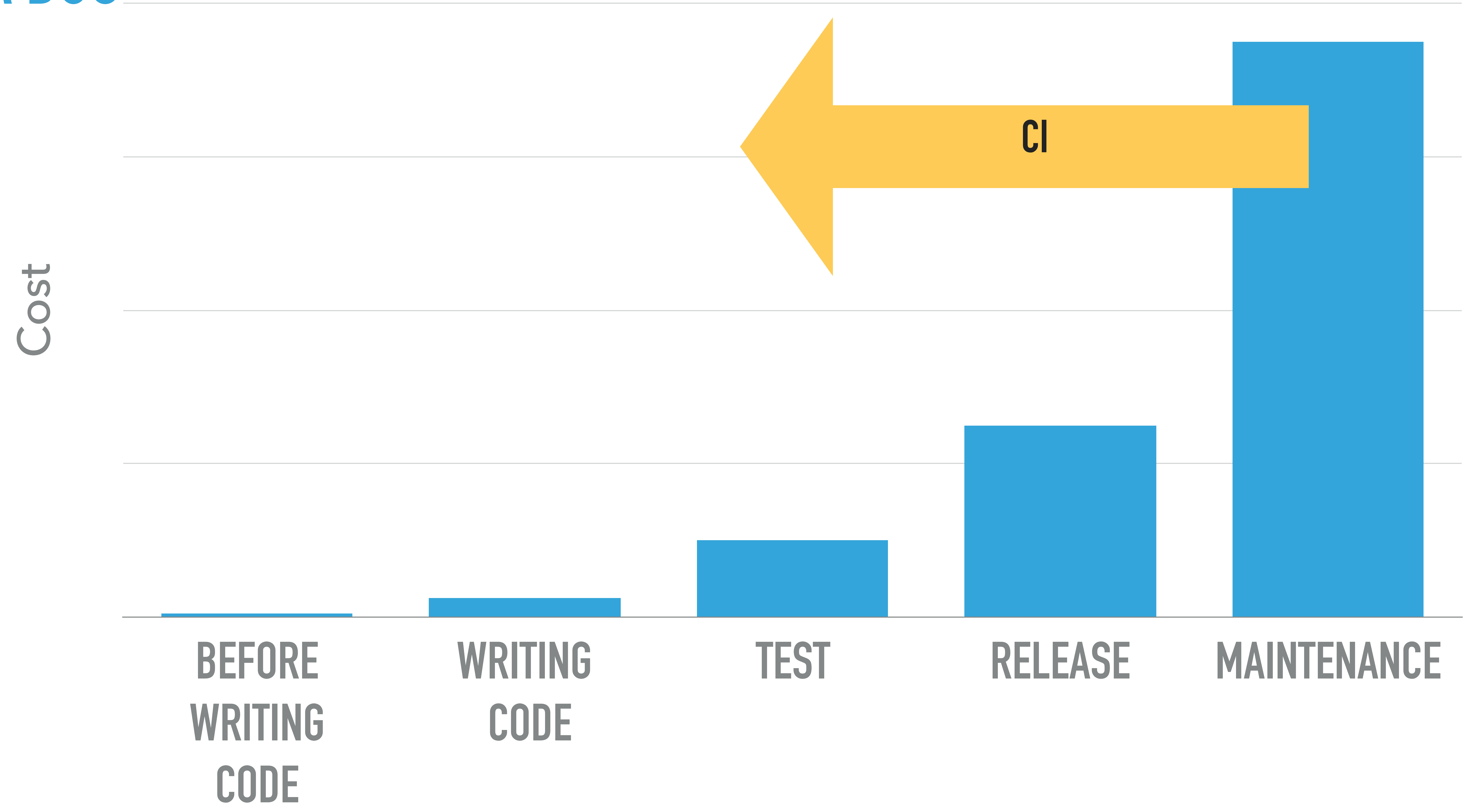
CI
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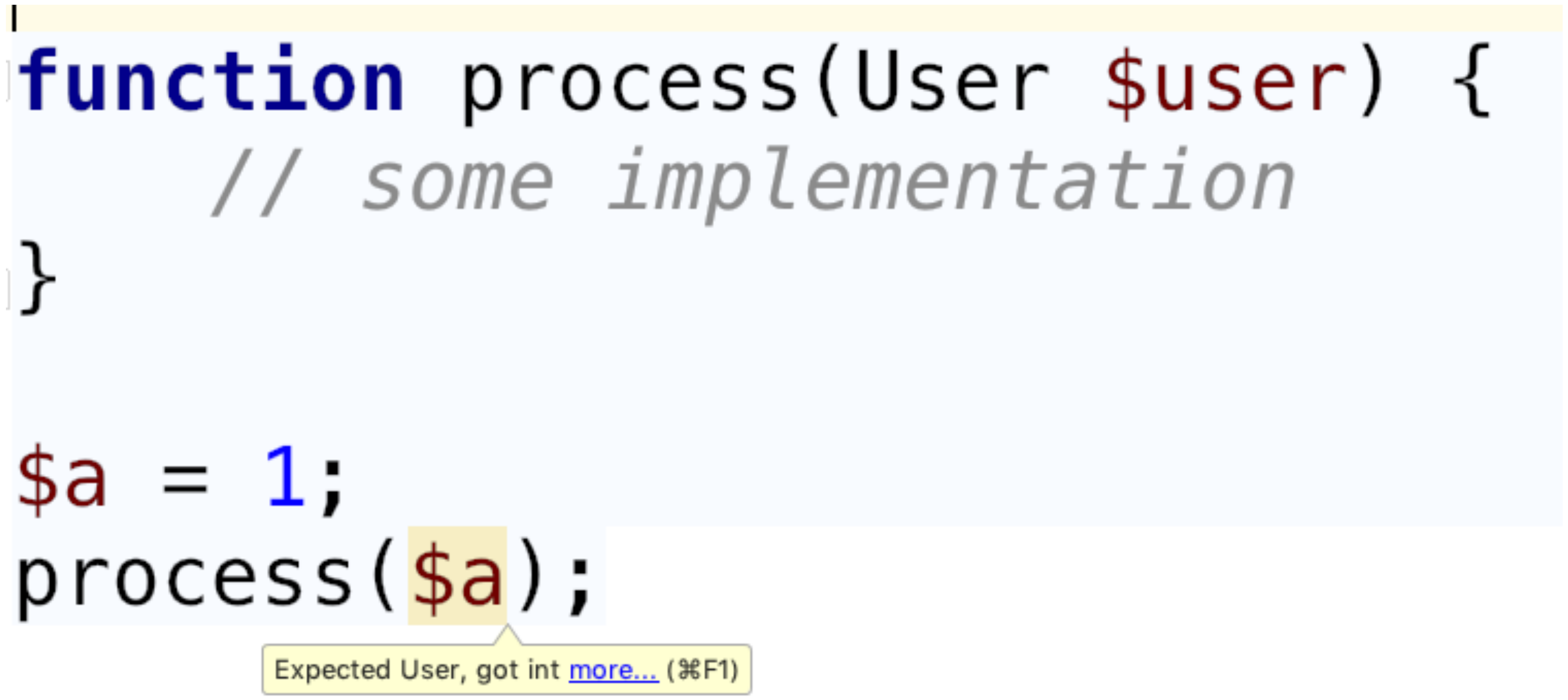
REQUIREMENTS FOR REAL TIME STATIC ANALYSIS TOOL (IDE)

- Understand entire codebase
- Highlight errors in real time
- Suggest / autocomplete based on context
- Refactoring (e.g. rename, move, extract)

USE AN IDE – SHOWS ERRORS IN REAL TIME



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Expected User, got int more... (⌘F1)

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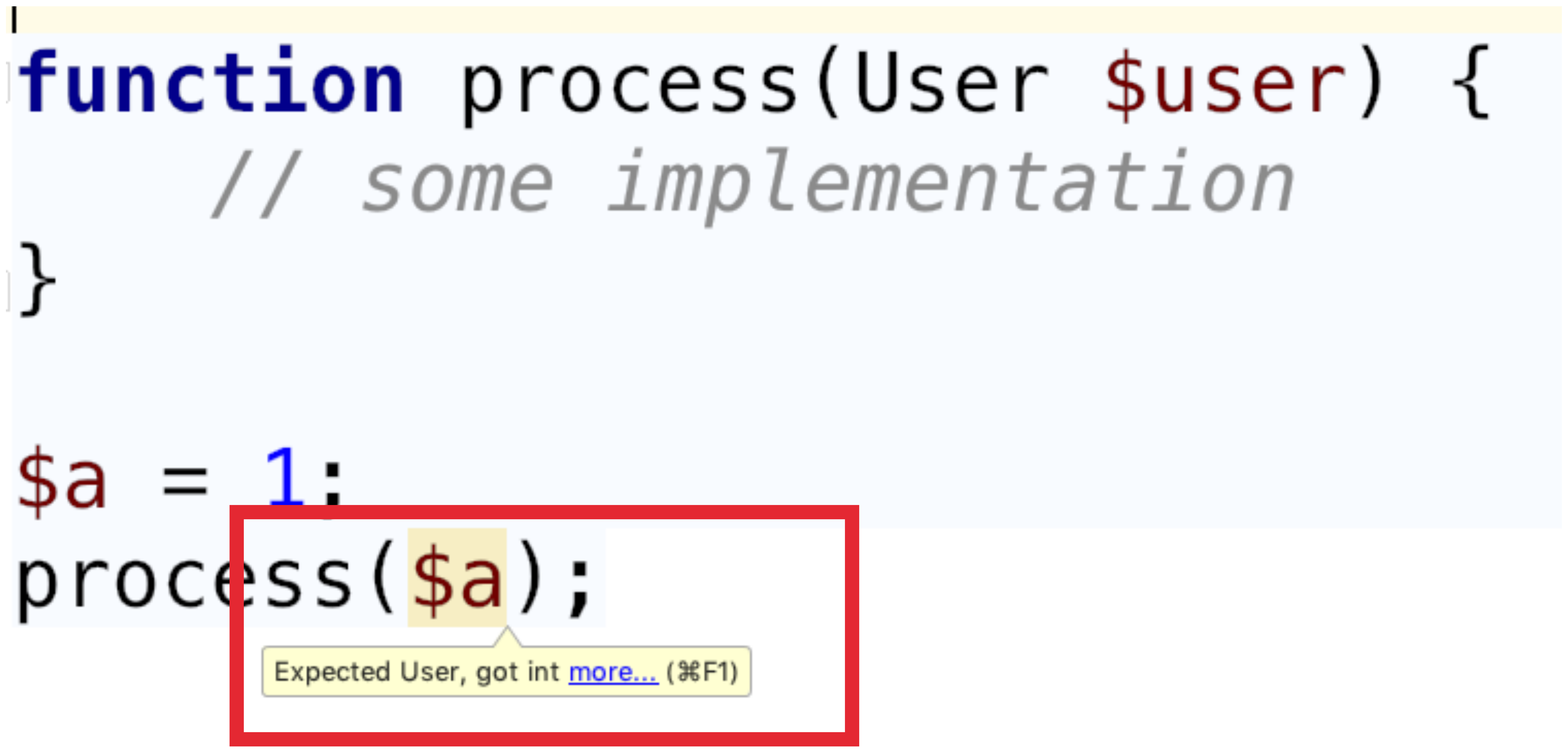

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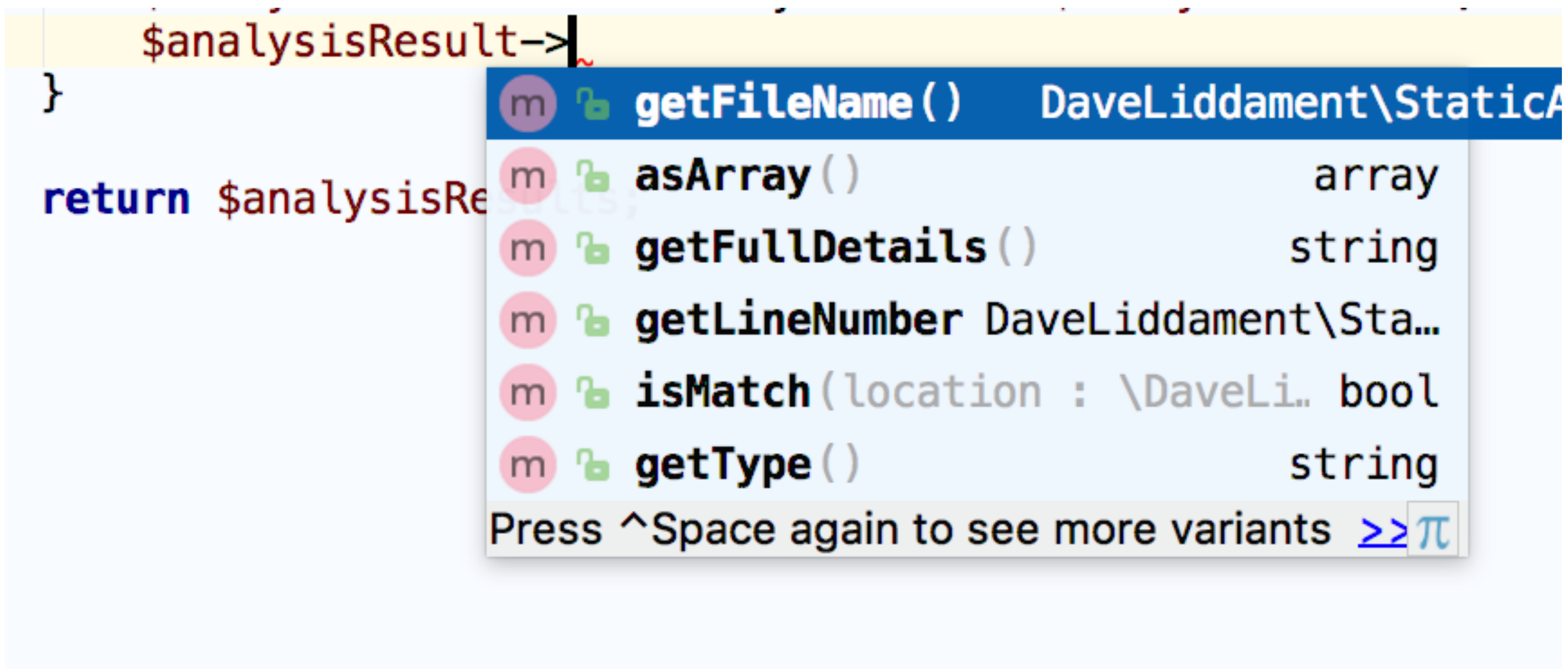

```
    $analysisResult->
}

return $analysisRe
```

```
m getFileName()      DaveLiddament\StaticA
m asArray()                          array
m getFullDetails()                  string
m getLineNumber DaveLiddament\Sta…
m isMatch(location : \DaveLi.. bool
m getType()                         string
Press ^Space again to see more variants >> π
```

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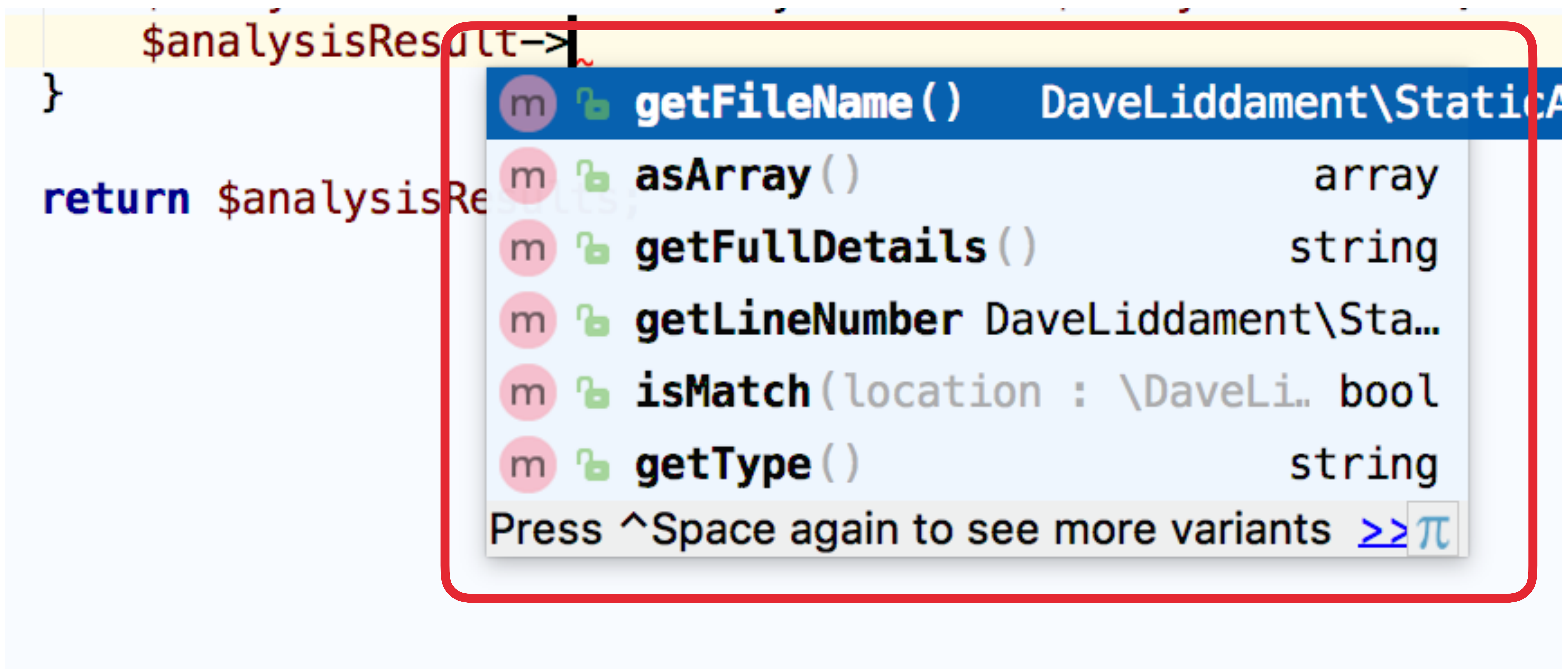

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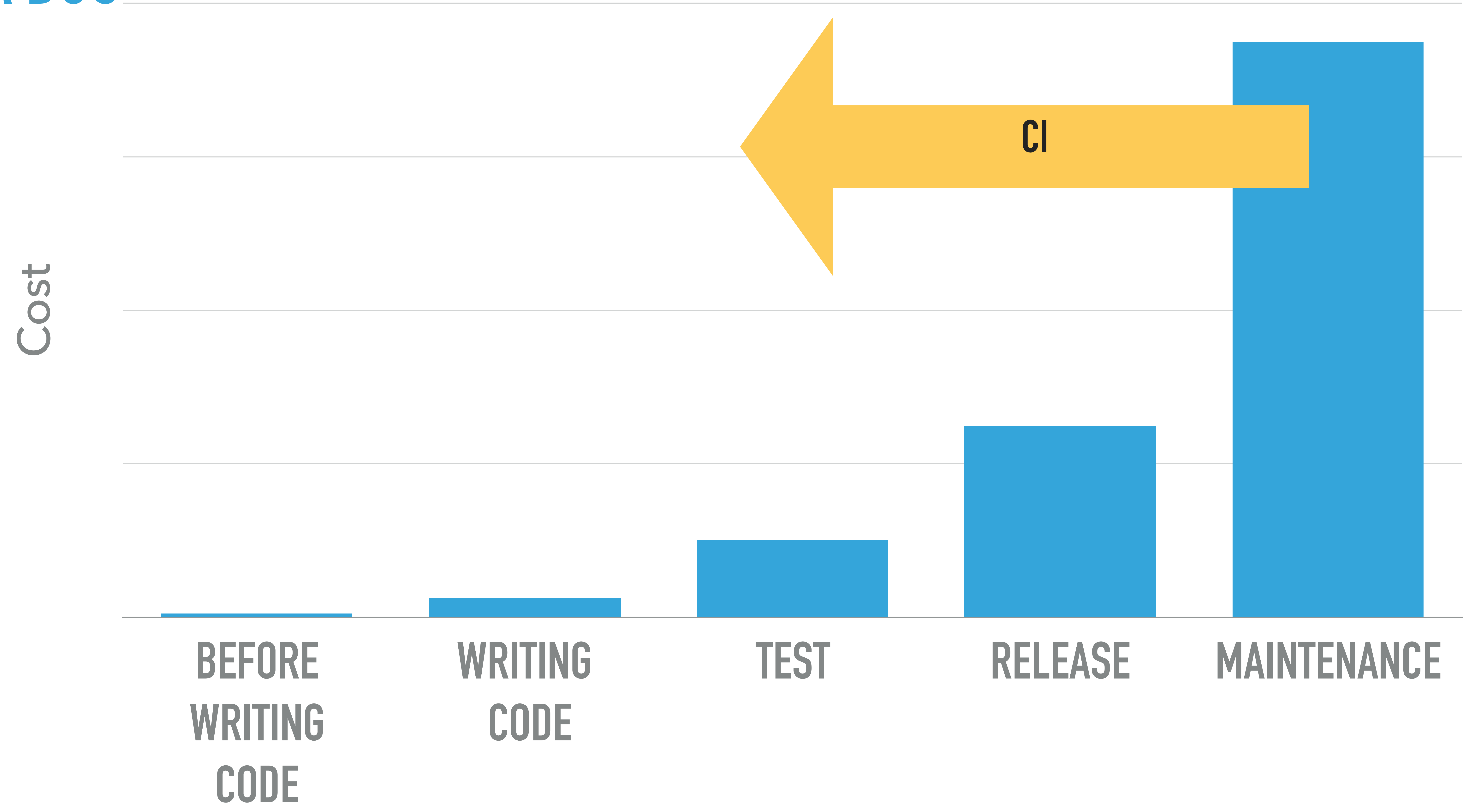
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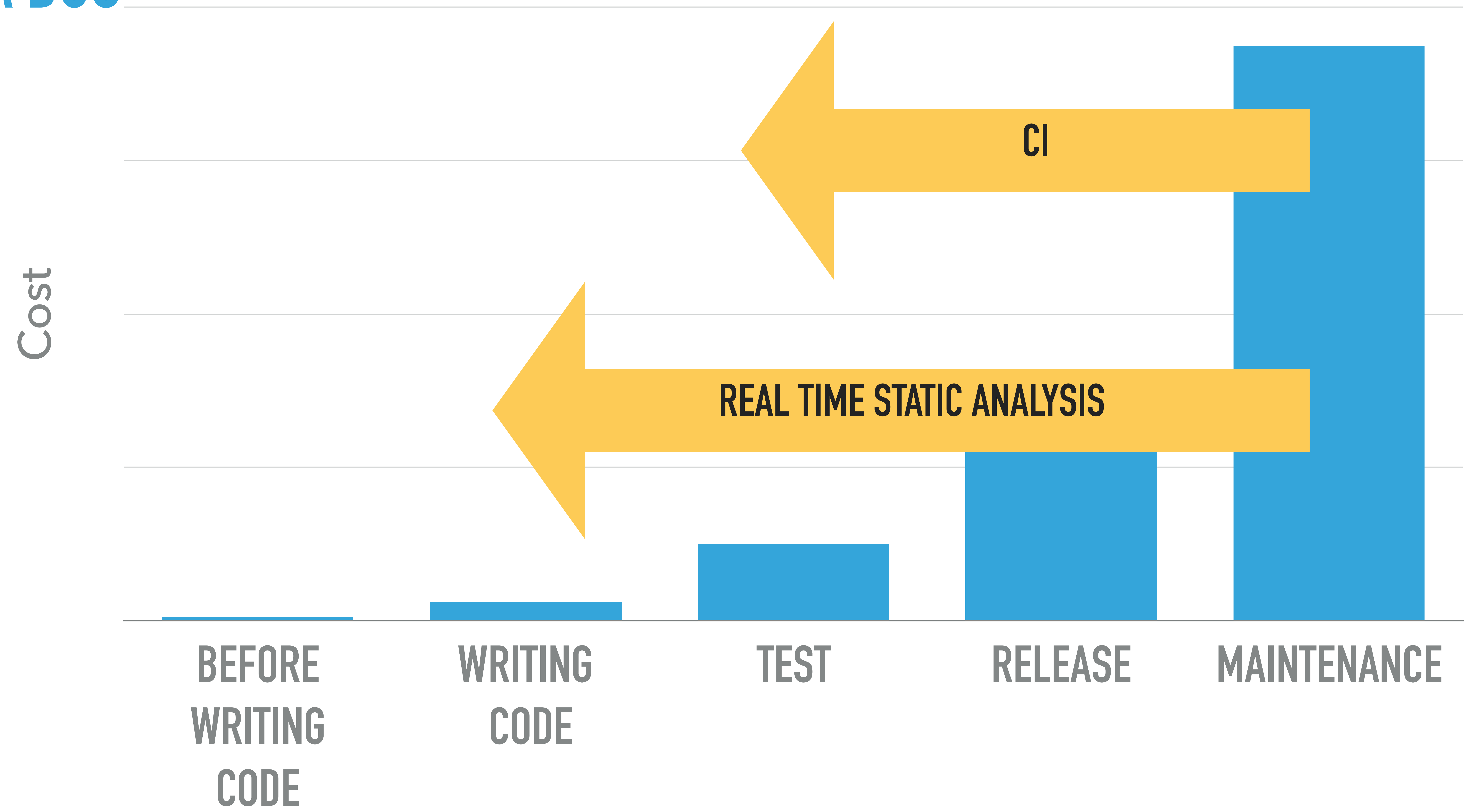
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REAL TIME STATIC ANALYSIS
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VALUE OF AN IDE

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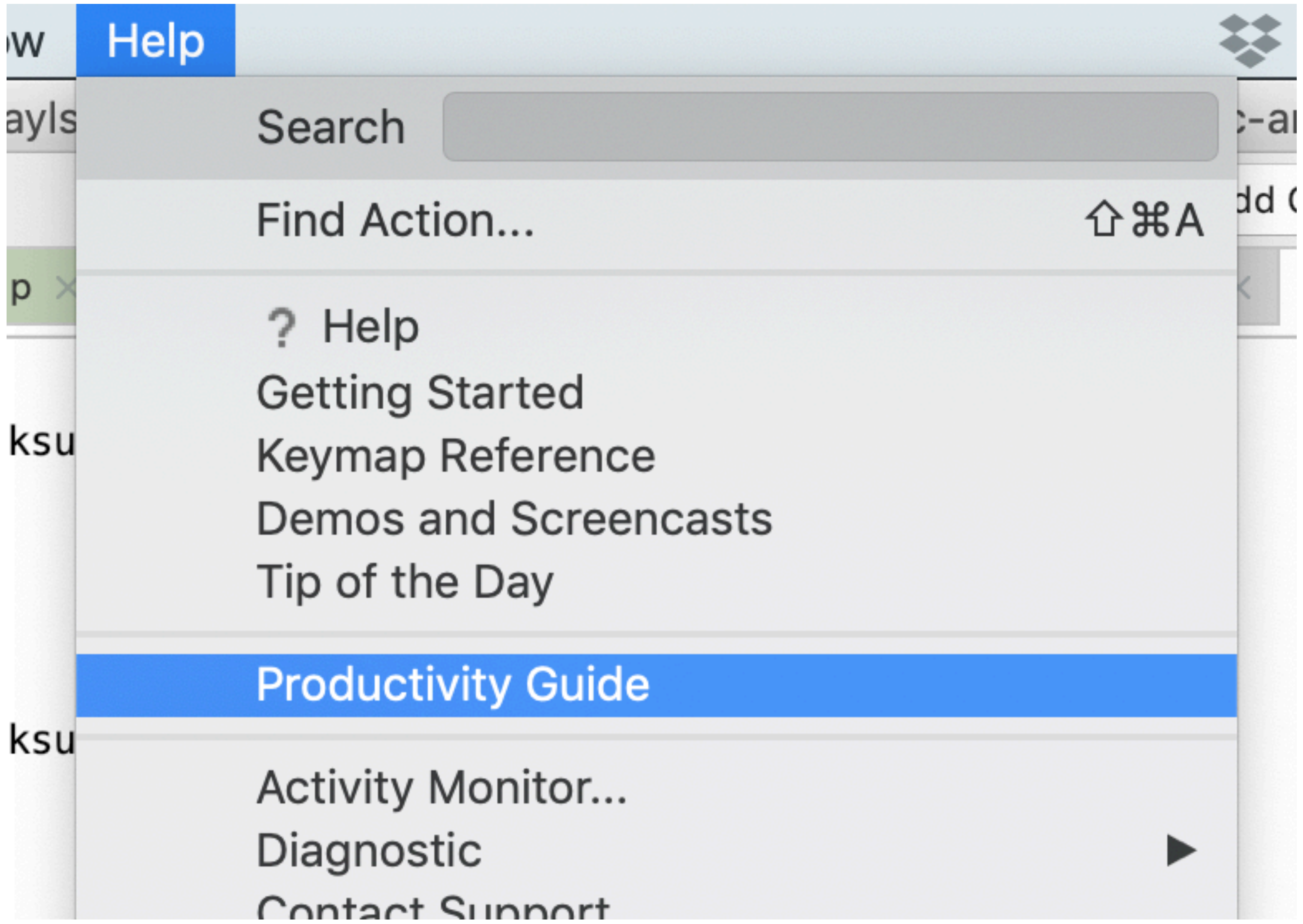
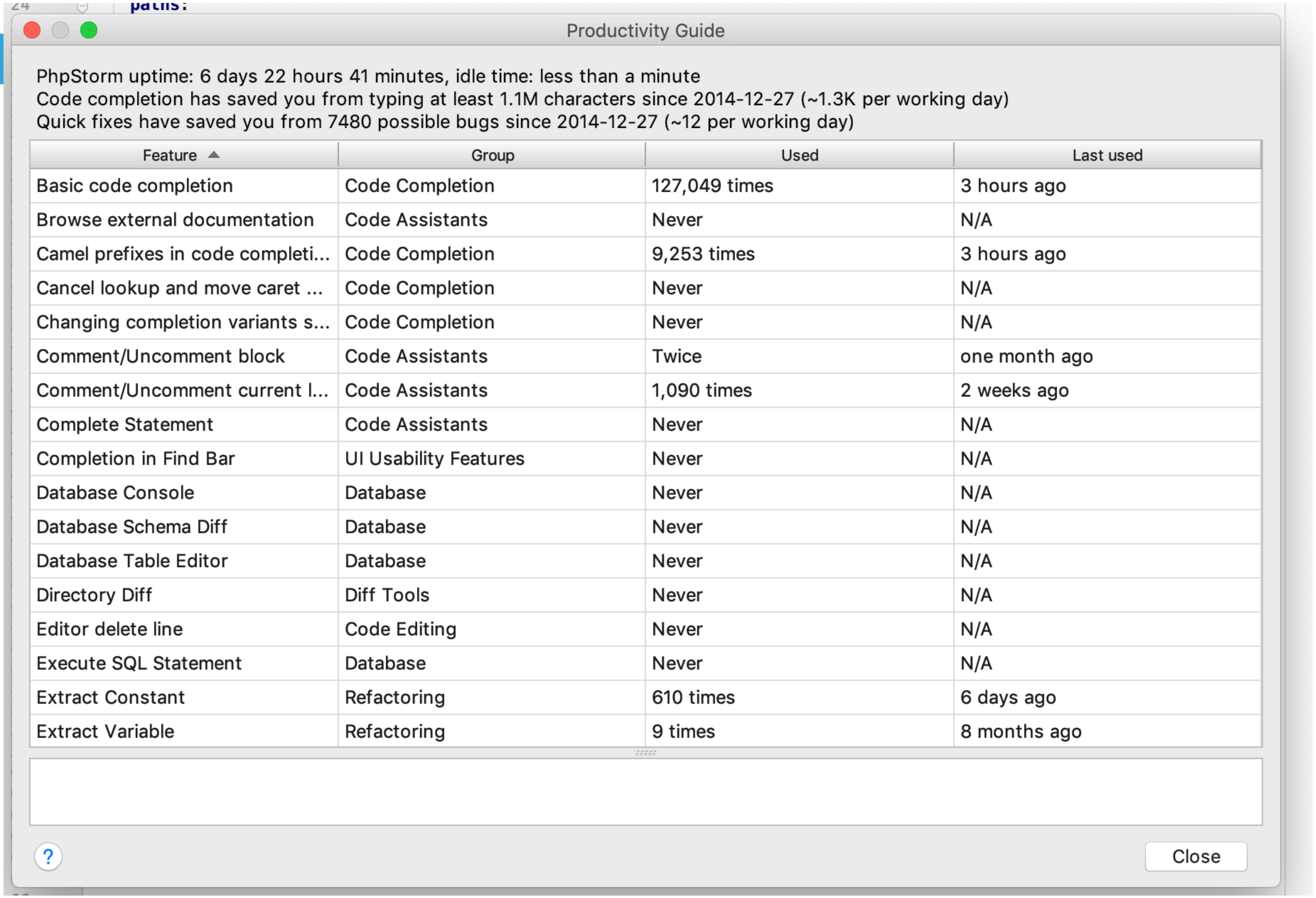


VALUE OI



Productivity Guide

PhpStorm uptime: 6 days 22 hours 41 minutes, idle time: less than a minute
Code completion has saved you from typing at least 1.1M characters since 2014-12-27 (~1.3K per working day)
Quick fixes have saved you from 7480 possible bugs since 2014-12-27 (~12 per working day)

Feature ▲	Group	Used	Last used
Basic code completion	Code Completion	127,049 times	3 hours ago
Browse external documentation	Code Assistants	Never	N/A
Camel prefixes in code completi...	Code Completion	9,253 times	3 hours ago
Cancel lookup and move caret ...	Code Completion	Never	N/A
Changing completion variants s...	Code Completion	Never	N/A
Comment/Uncomment block	Code Assistants	Twice	one month ago
Comment/Uncomment current l...	Code Assistants	1,090 times	2 weeks ago
Complete Statement	Code Assistants	Never	N/A
Completion in Find Bar	UI Usability Features	Never	N/A
Database Console	Database	Never	N/A
Database Schema Diff	Database	Never	N/A
Database Table Editor	Database	Never	N/A
Directory Diff	Diff Tools	Never	N/A
Editor delete line	Code Editing	Never	N/A
Execute SQL Statement	Database	Never	N/A
Extract Constant	Refactoring	610 times	6 days ago
Extract Variable	Refactoring	9 times	8 months ago

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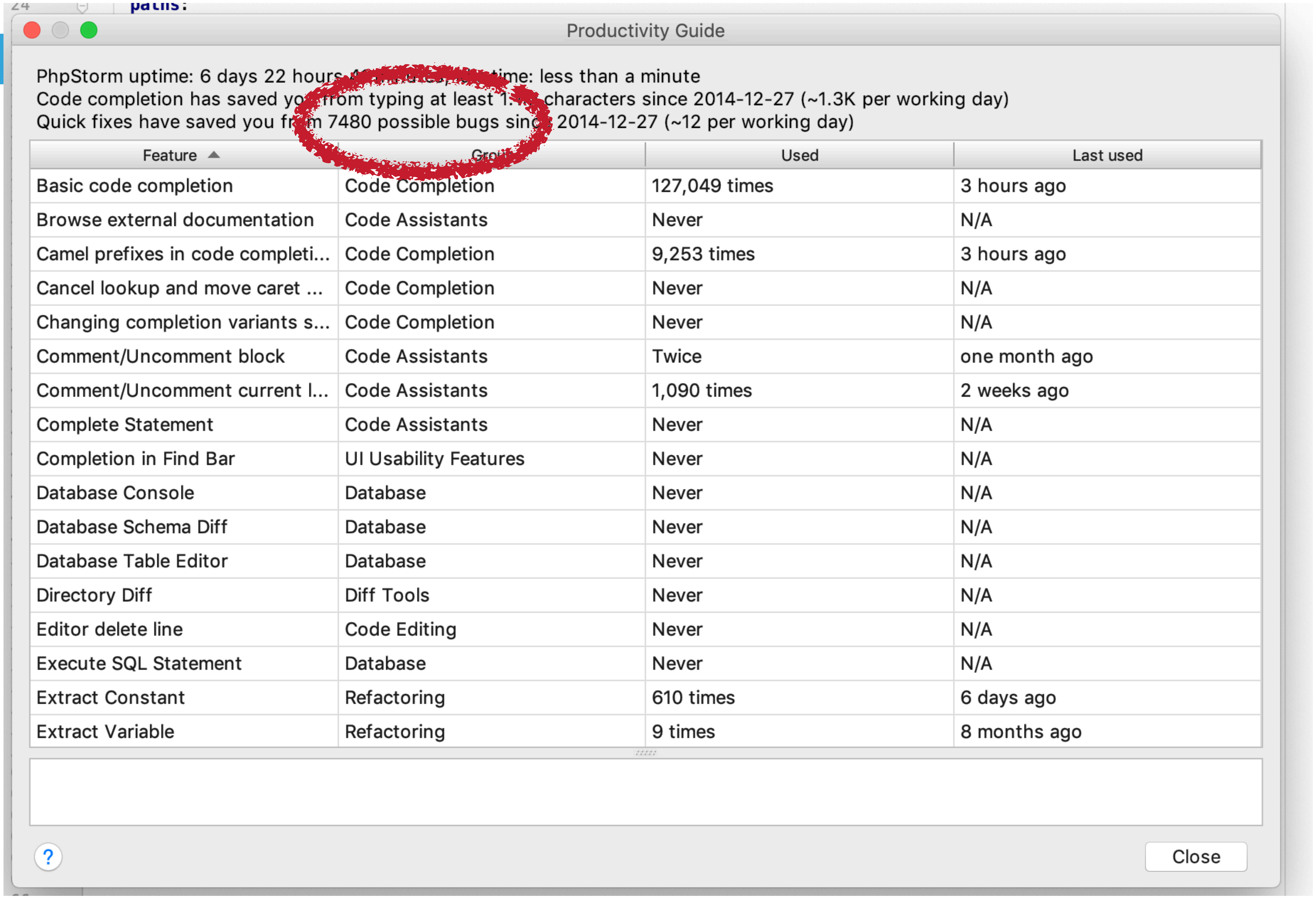
VALUE OI



paths:

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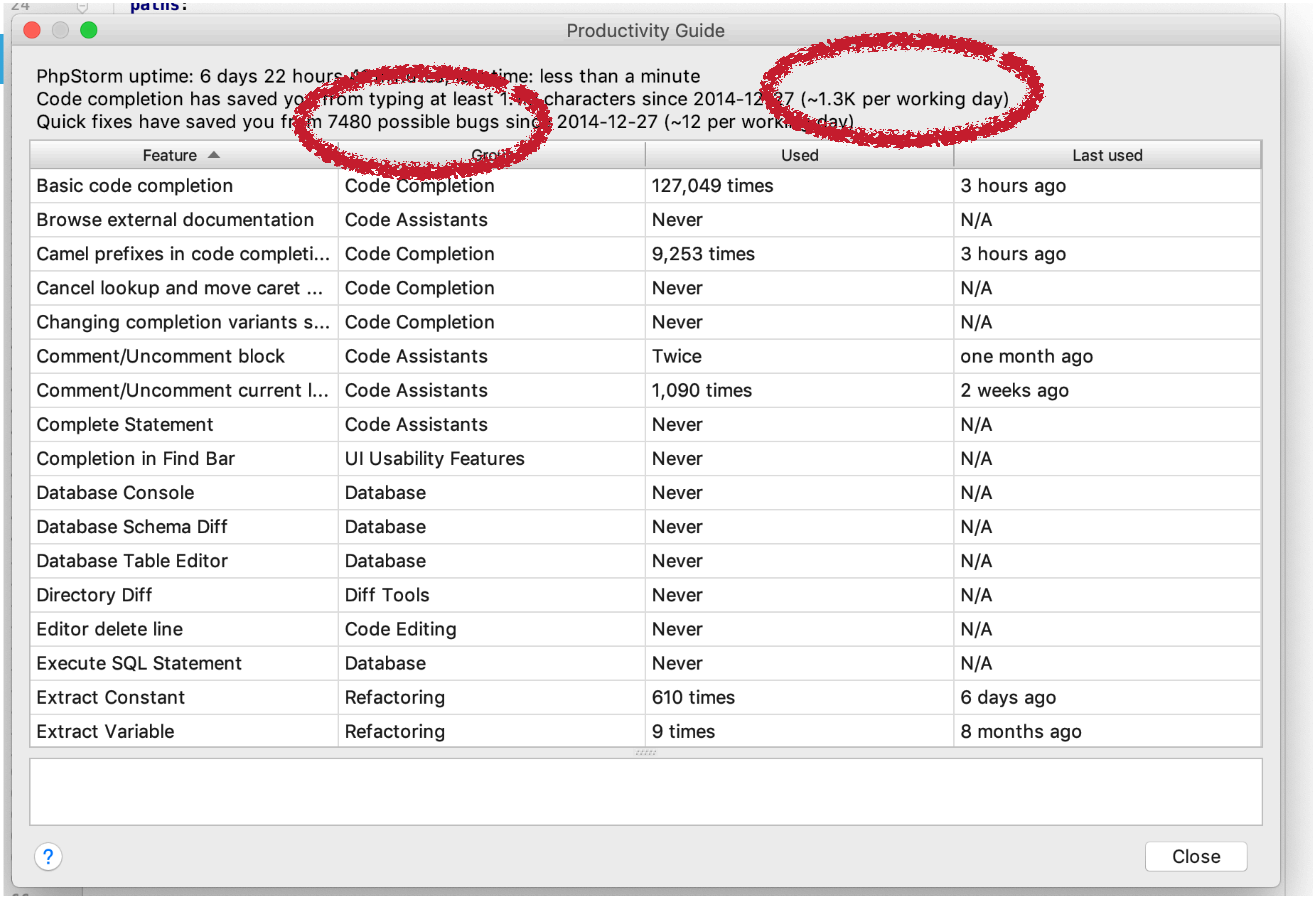

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BASIC STATIC ANALYSIS

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AGENDA

Advanced
Practical
Basic
What

STILL THIS NAGGING PROBLEM

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✅ Real time static analysis

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✅ Real time static analysis

❌ CI

ADVANCED STATIC ANALYSIS TOOLS

- Psalm https://getpsalm.org/
- Phan: https://github.com/phan/phan
- PHPStan https://github.com/phpstan/phpstan

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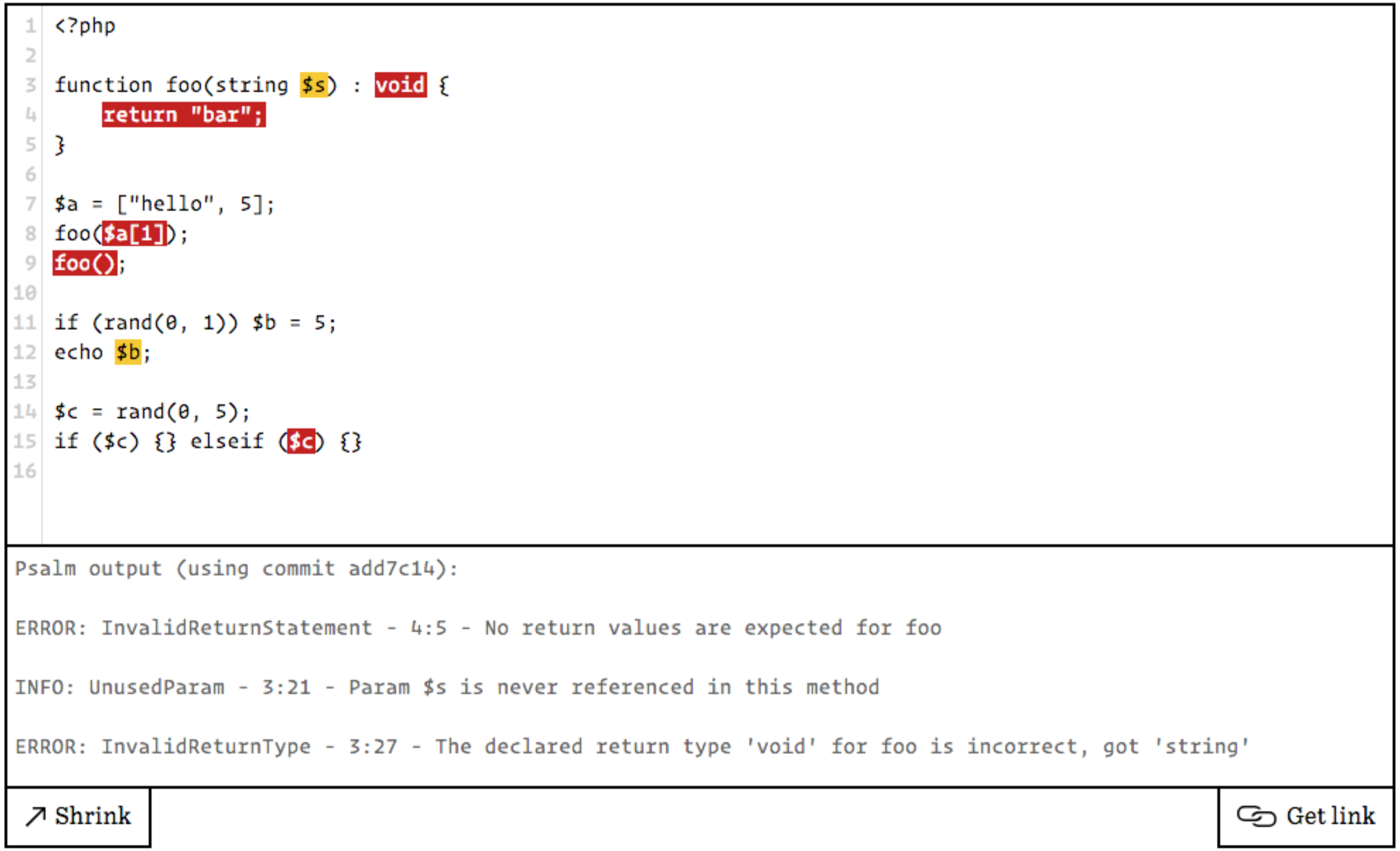

```php
<?php

function foo(string $s) : void {
    return "bar";
}

$a = ["hello", 5];
foo($a[1]);
foo();

if (rand(0, 1)) $b = 5;
echo $b;

$c = rand(0, 5);
if ($c) {} elseif ($c) {}

```

```
Psalm output (using commit add7c14):

ERROR: InvalidReturnStatement - 4:5 - No return values are expected for foo

INFO: UnusedParam - 3:21 - Param $s is never referenced in this method

ERROR: InvalidReturnType - 3:27 - The declared return type 'void' for foo is incorrect, got 'string'
```

https://getpsalm.org

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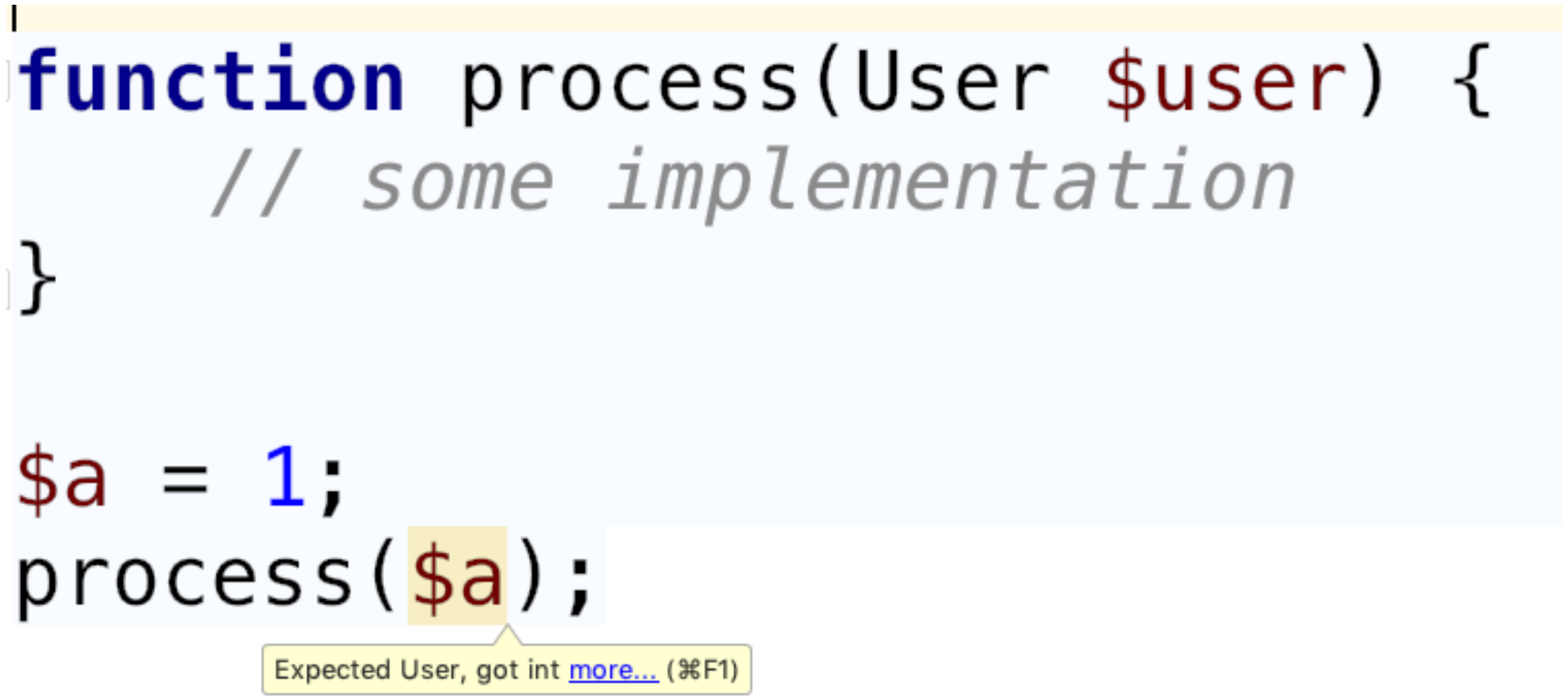
COMMON CONCEPTS: LEVELS

	Least strict	Strictest
Psalm	8	1
Phan	5	1
PHPStan	0	7

TYPE HINT EVERYTHING



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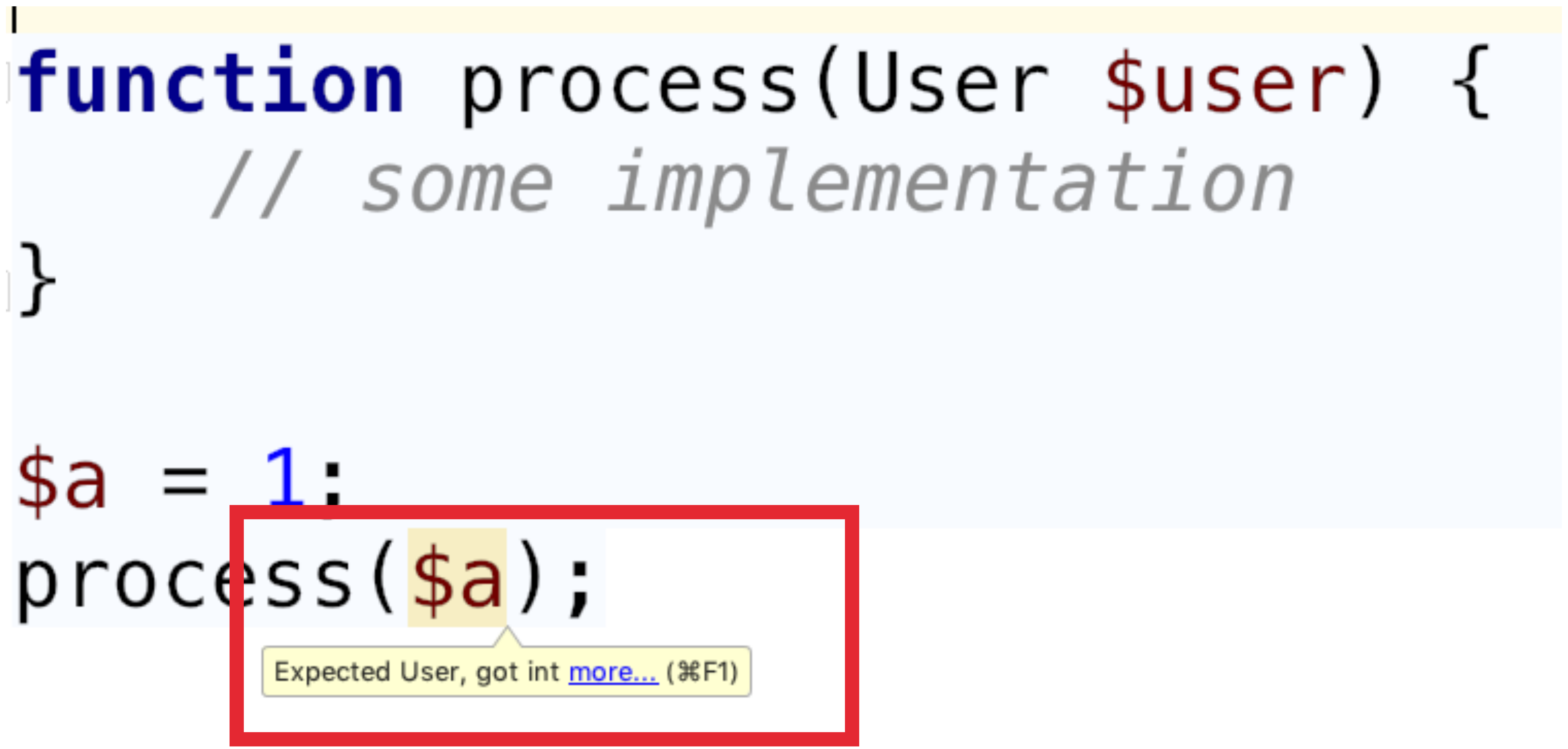

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COMMON CONCEPTS: GENERICS

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class Business {

    public function getEmployees(): array {…}
}
function promote(Employee $employee): void {…}


foreach($business->getEmployees() as $employee) {
    promote($employee);

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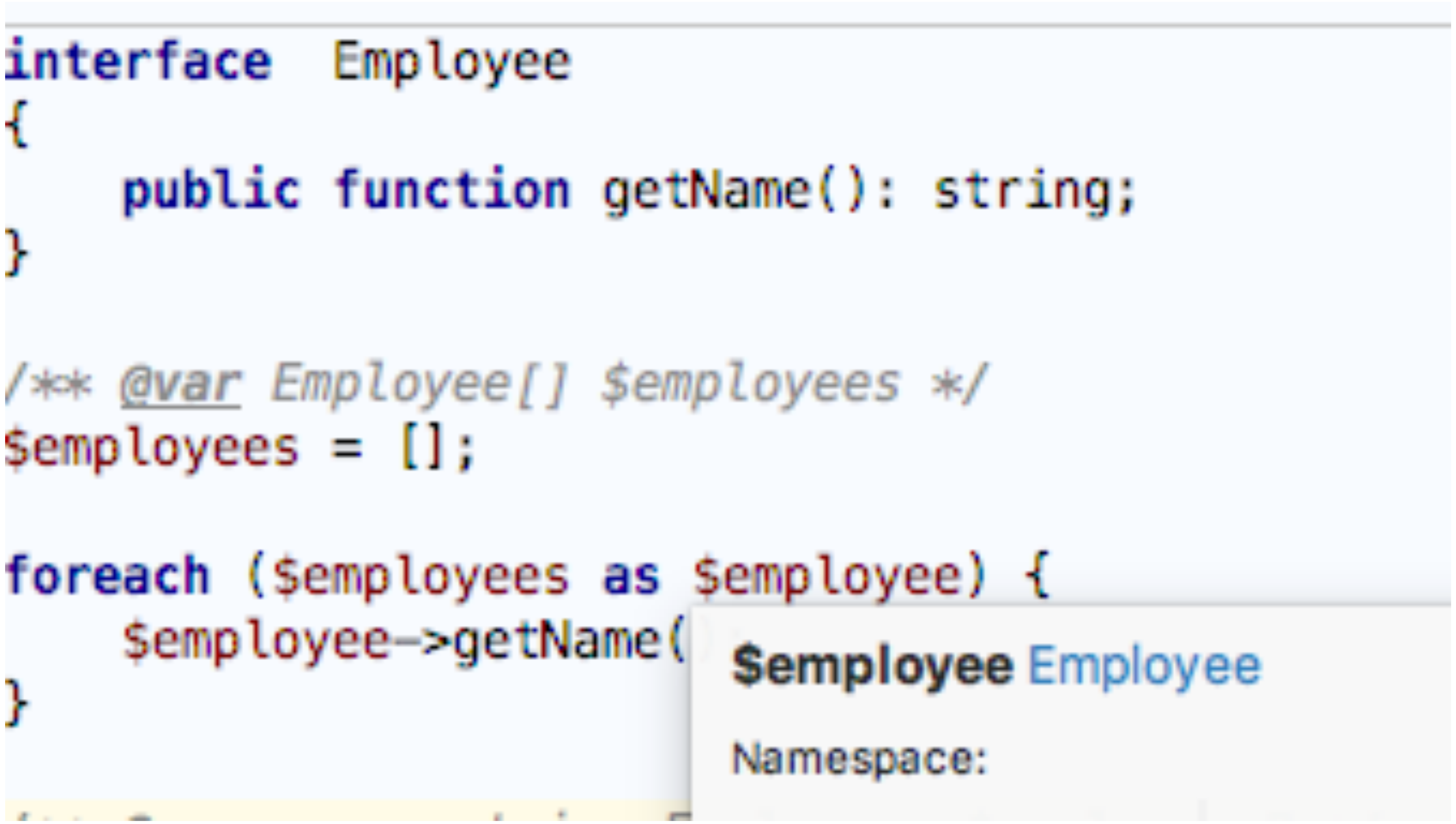


```
interface  Employee
{
    public function getName(): string;
}

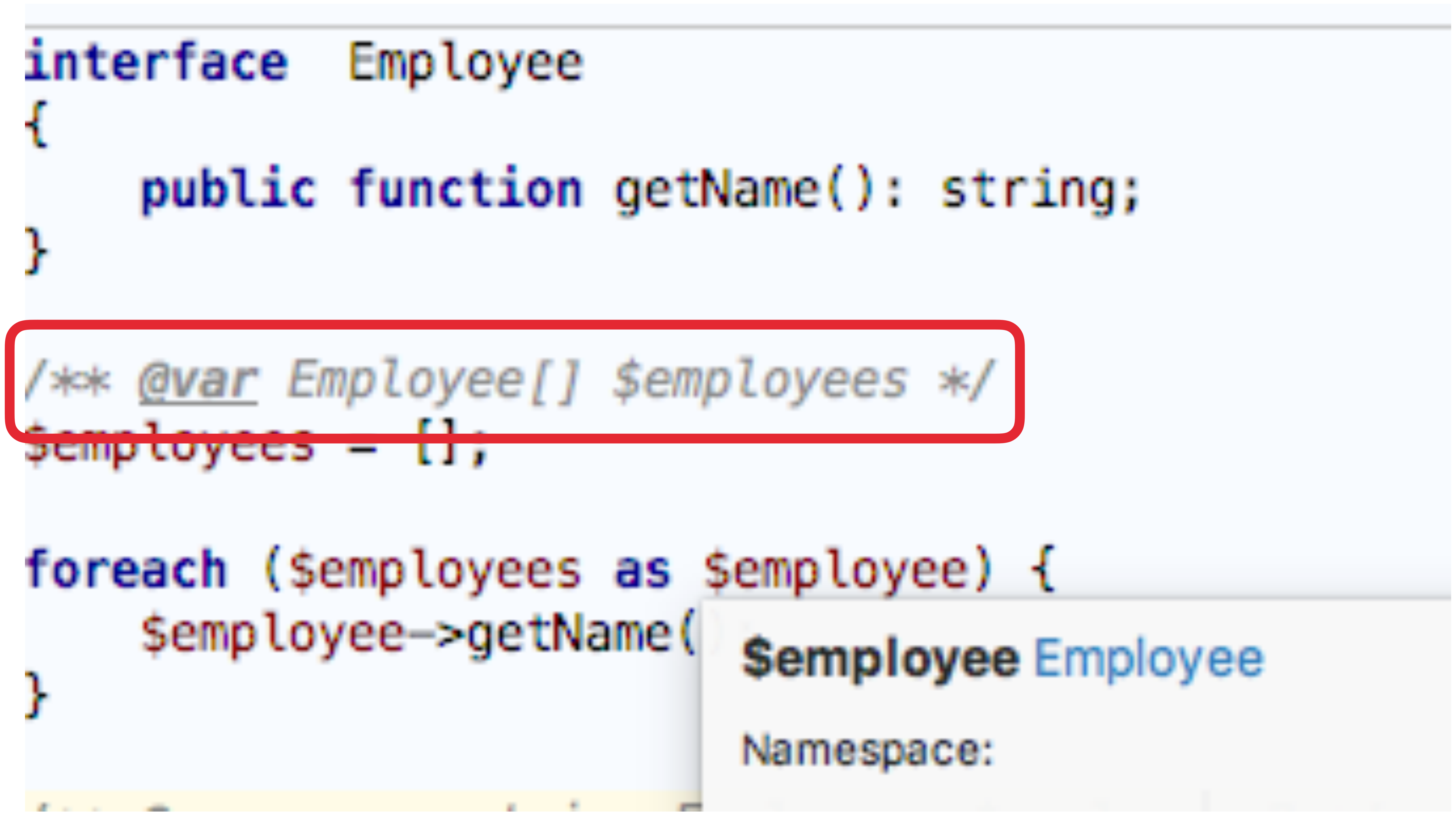
/** @var Employee[] $employees */
$employees = [];

foreach ($employees as $employee) {
    $employee->getName(
}
```

```
$employee Employee

Namespace:
```

COMMON CONCEPTS: GENERICS



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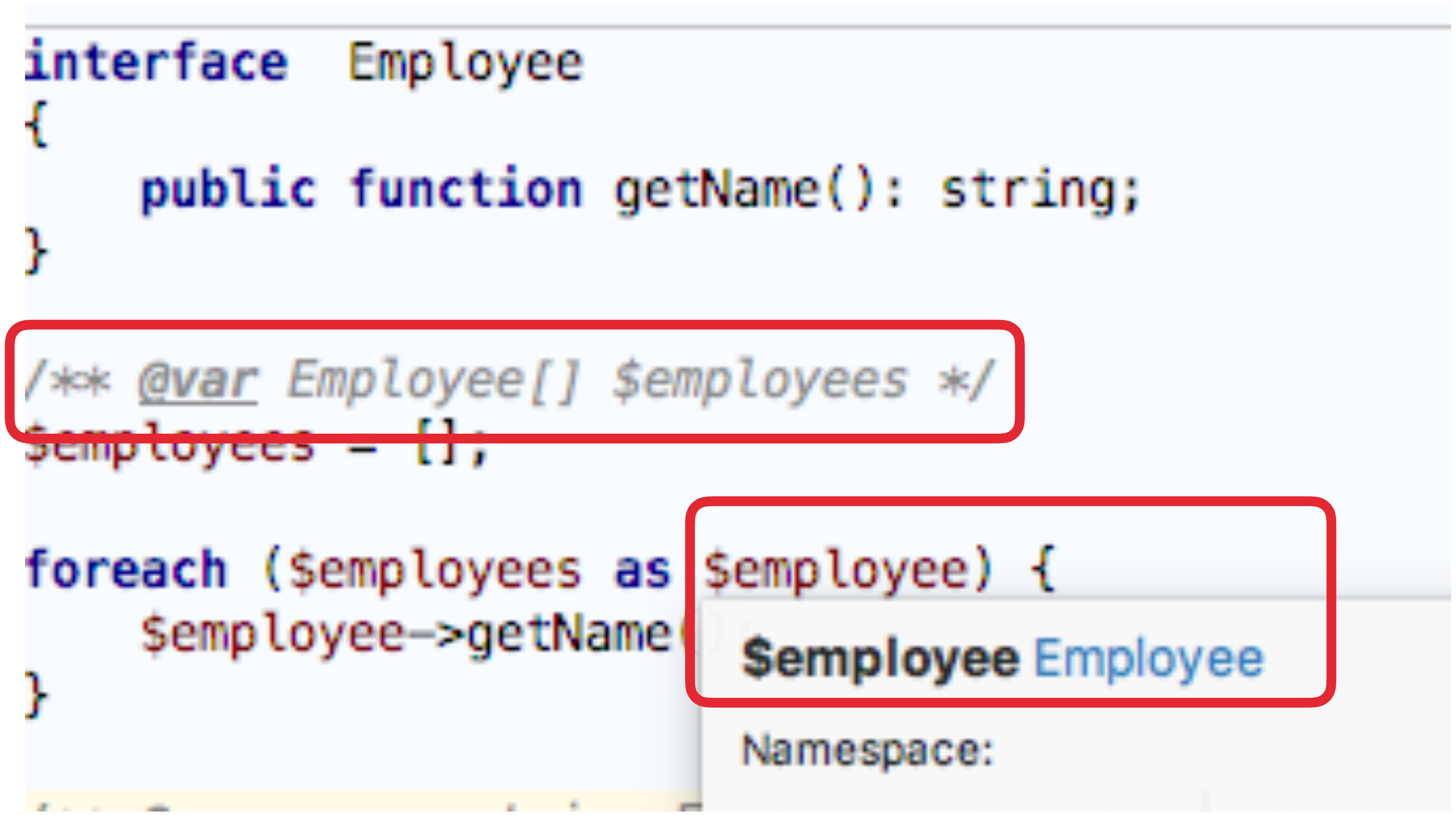
COMMON CONCEPTS: GENERICS



```
interface  Employee
{
    public function getName(): string;
}

/** @var Employee[] $employees */
$employees = [];

foreach ($employees as $employee) {
    $employee->getName(
}
```

$employee Employee

Namespace:

COMMON CONCEPTS: GENERICS

```
class Business {
    /** @return Employee[] */
    public function getEmployees(): array {…}
}
function promote(Employee $employee): void {…}
function welcome(string $name): void {…}

foreach($business->getEmployees() as $name => $employee) {
    welcome($name);
    promote($employee);
}
```

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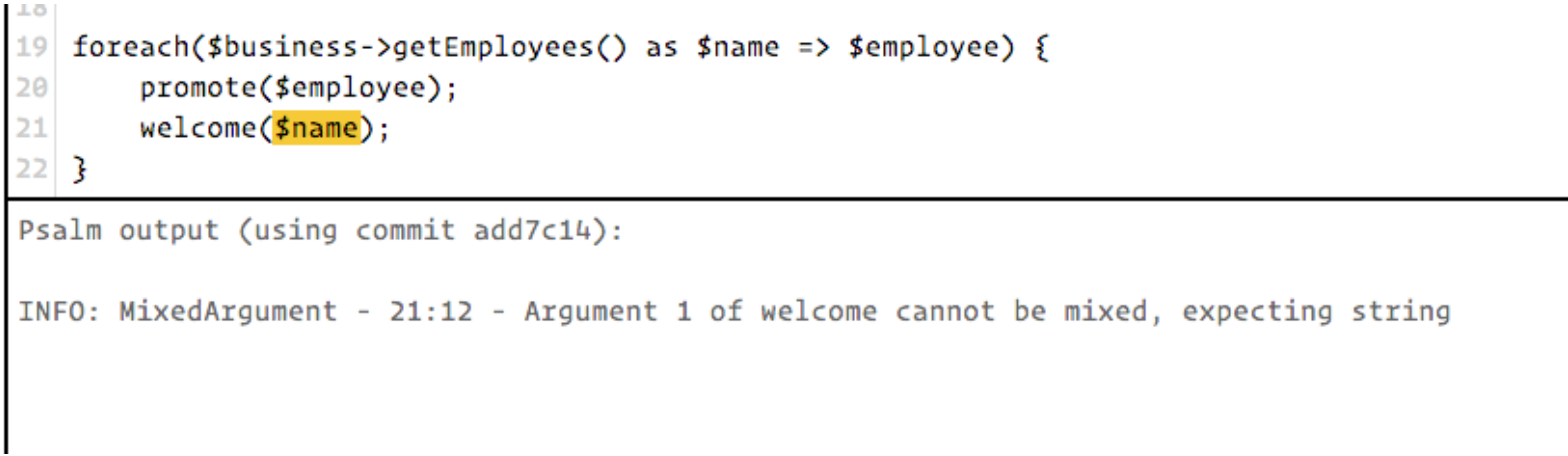

```
19  foreach($business->getEmployees() as $name => $employee) {
20      promote($employee);
21      welcome($name);
22  }
```

```
Psalm output (using commit add7c14):

INFO: MixedArgument - 21:12 - Argument 1 of welcome cannot be mixed, expecting string
```

COMMON CONCEPTS: GENERICS

```
class Business {
    /** @return array<string,Employee> */
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@daveliddament

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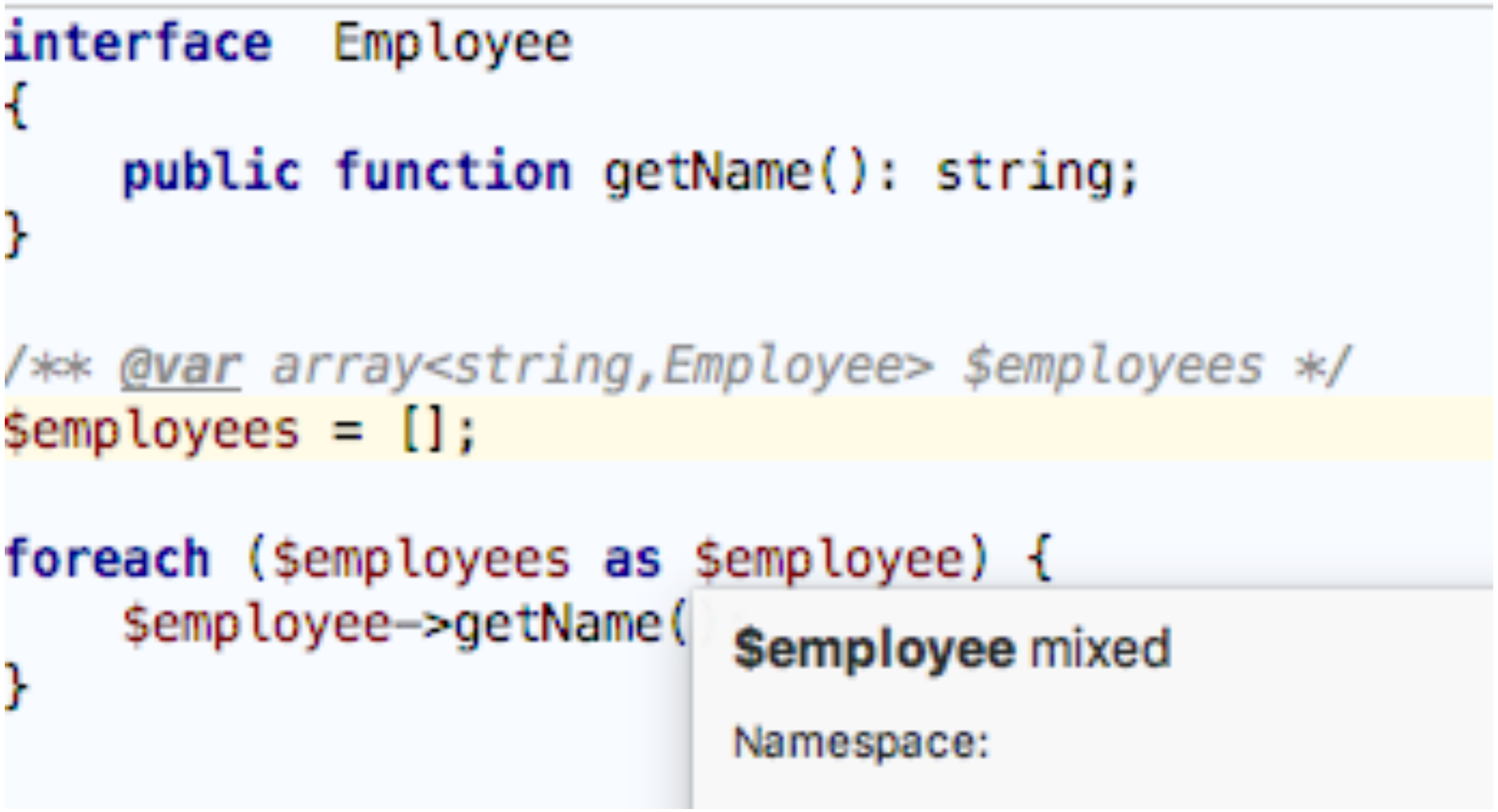

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$employee mixed

Namespace:

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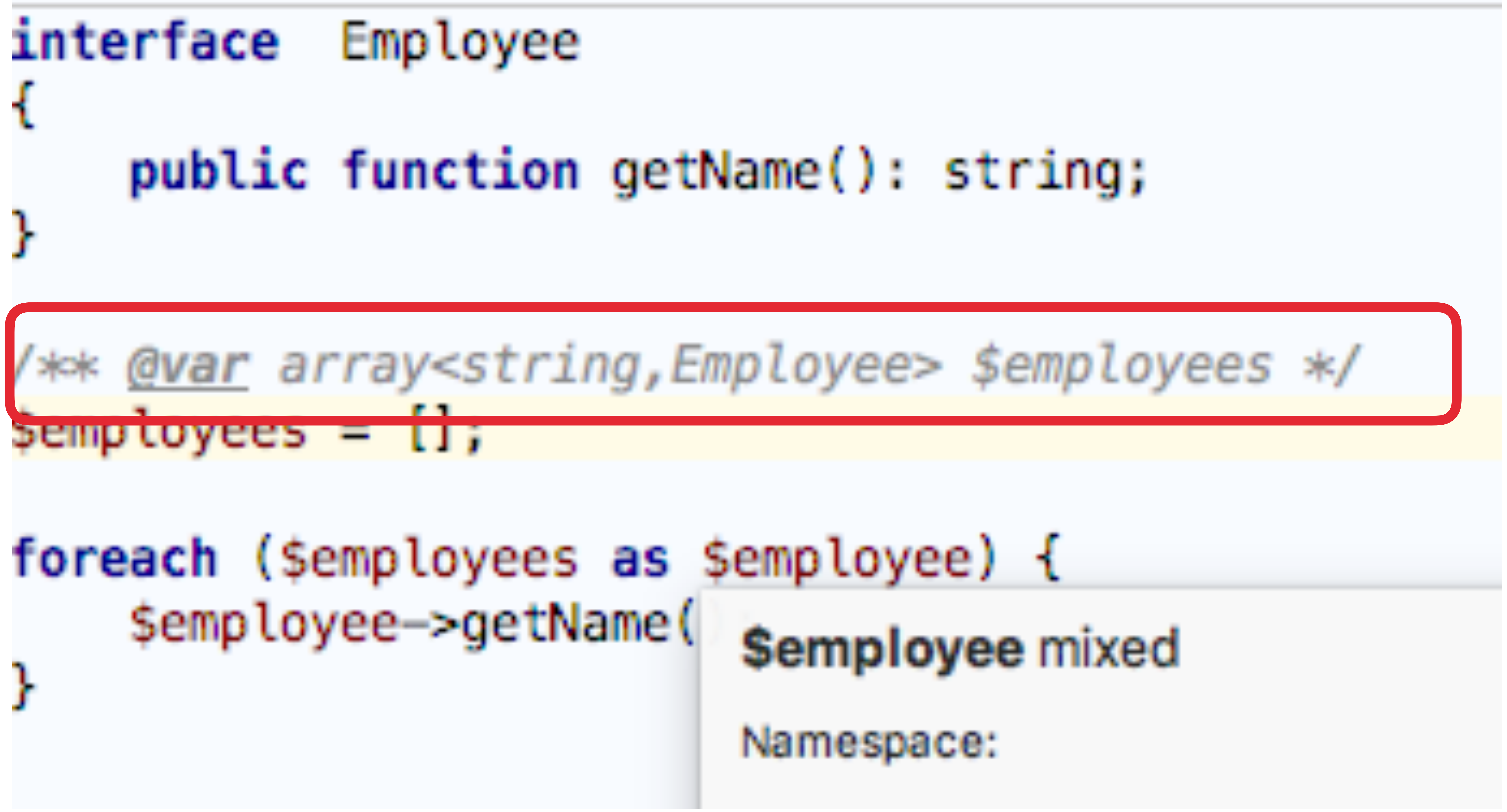

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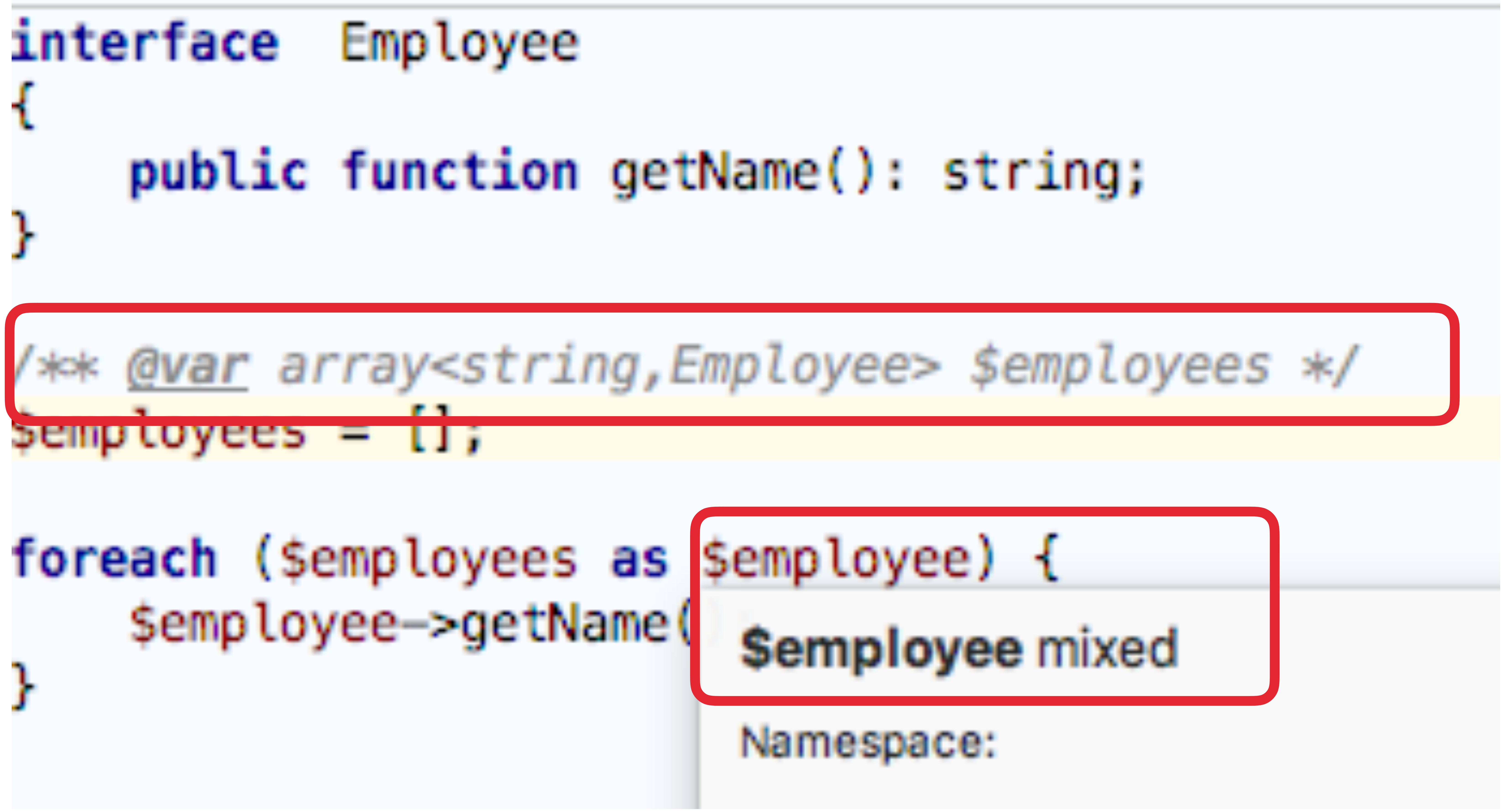

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COMMON CONCEPTS: GENERICS

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class Business {

    /**

     * @return Employee[]

     * @psalm-return array<string,Employee>

     */

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}
```

COMMON CONCEPTS: GENERICS

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class Business {
    /**
     * @return Employee[]
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COMMON CONCEPTS: GENERICS

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class Business {
    /**
     * @return Employee[]
     * @psalm-return array<string,Employee>
     */
    public function getEmployees(): array {…}
}
```

COMMON CONCEPTS: GENERICS

- In addition to normal annotations:
  - `@var, @param, @return`
- In Psalm:
  - `@psalm-var, @psalm-param, @psalm-return`
- In Phan:
  - `@phan-var, @phan-param, @phan-return`

COMMON CONCEPTS: IGNORE VIOLATIONS

- Set level
- Annotate code:
  - `@psalm-suppress <Issue>`
- Config:
  - Ignore directory
  - Turn off errors
  - Ignore types of errors in certain directories

PSALM: GETTING STARTED

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- Install:
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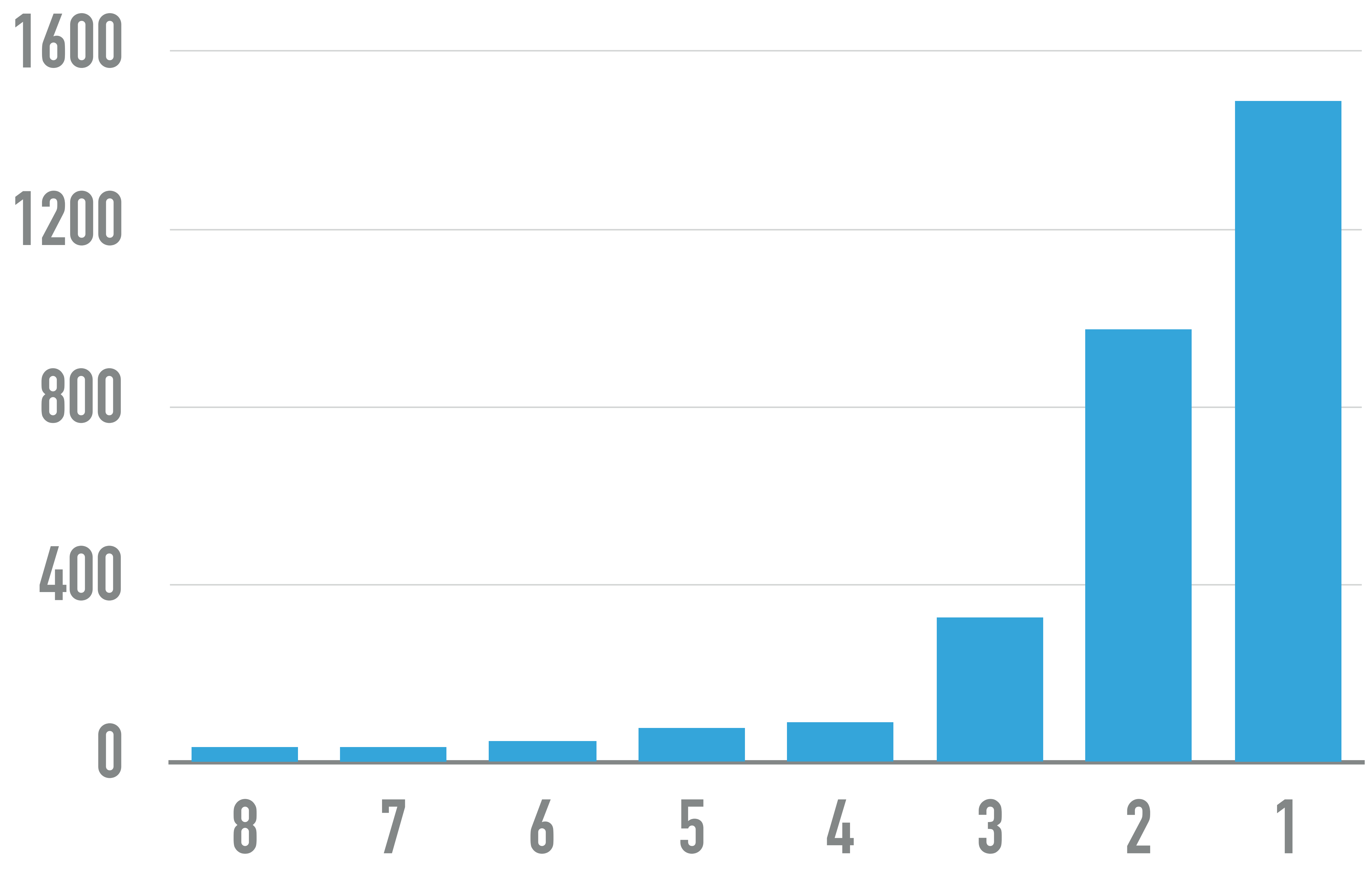
- Run:
  - `vendor/bin/psalm`

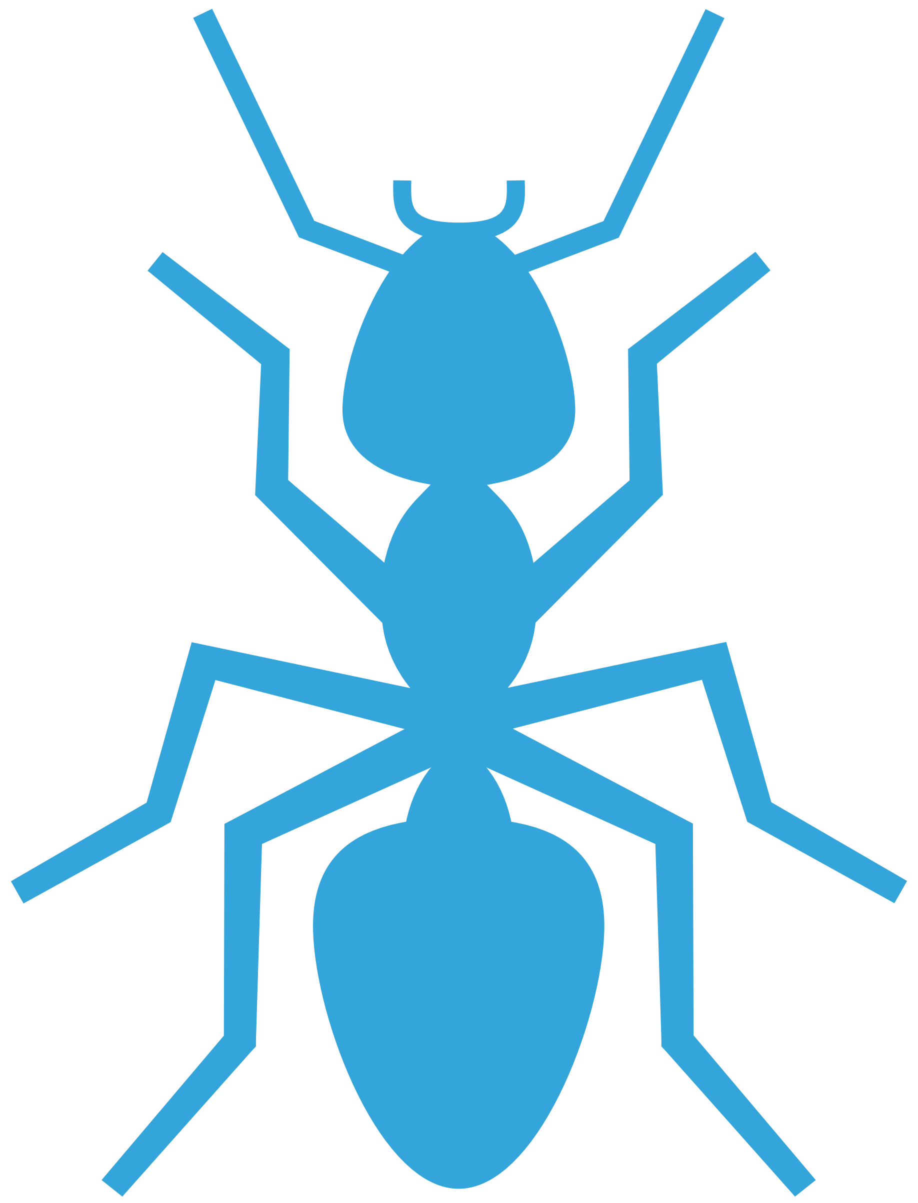
PSALM: GETTING STARTED

- Install:
  - `composer require —-dev vimeo/psalm`
- Create config file:
  - `vendor/bin/psalm —init <directory> <level>`
- Run:
  - `vendor/bin/psalm`
- `Cry.`

RESULTS

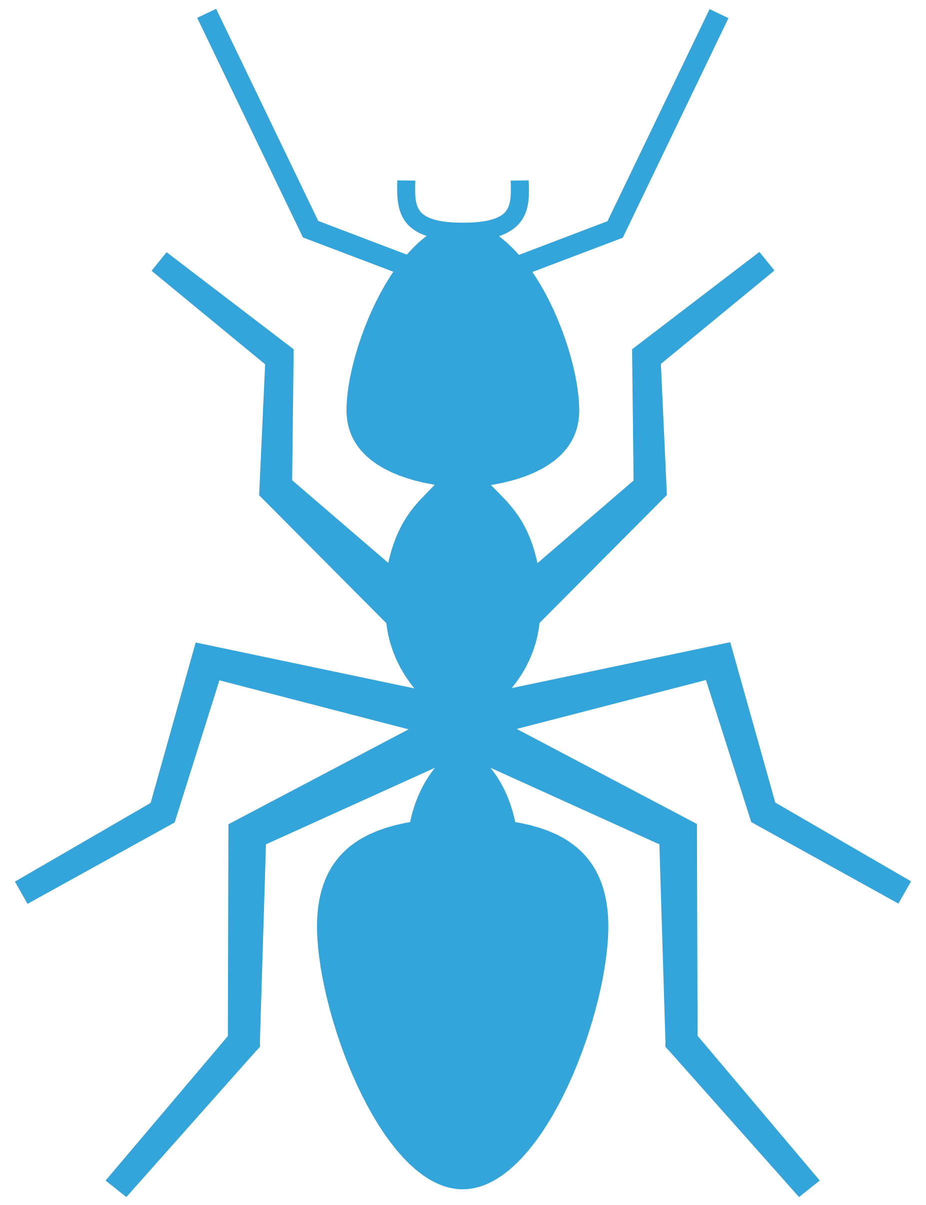


WHAT IS A BUG?



WHAT IS A BUG?

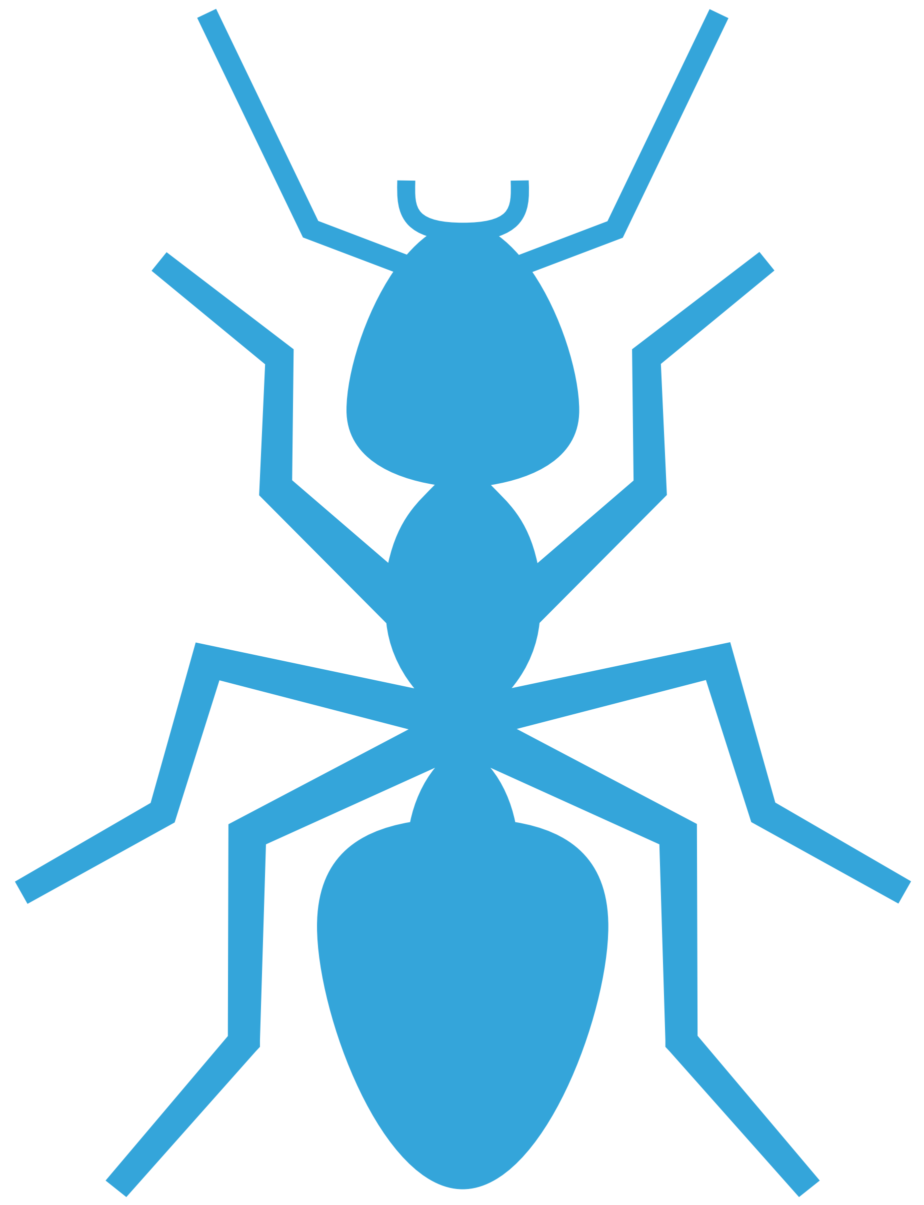
A "bug"



WHAT IS A BUG?

A "bug"

Deferred bug

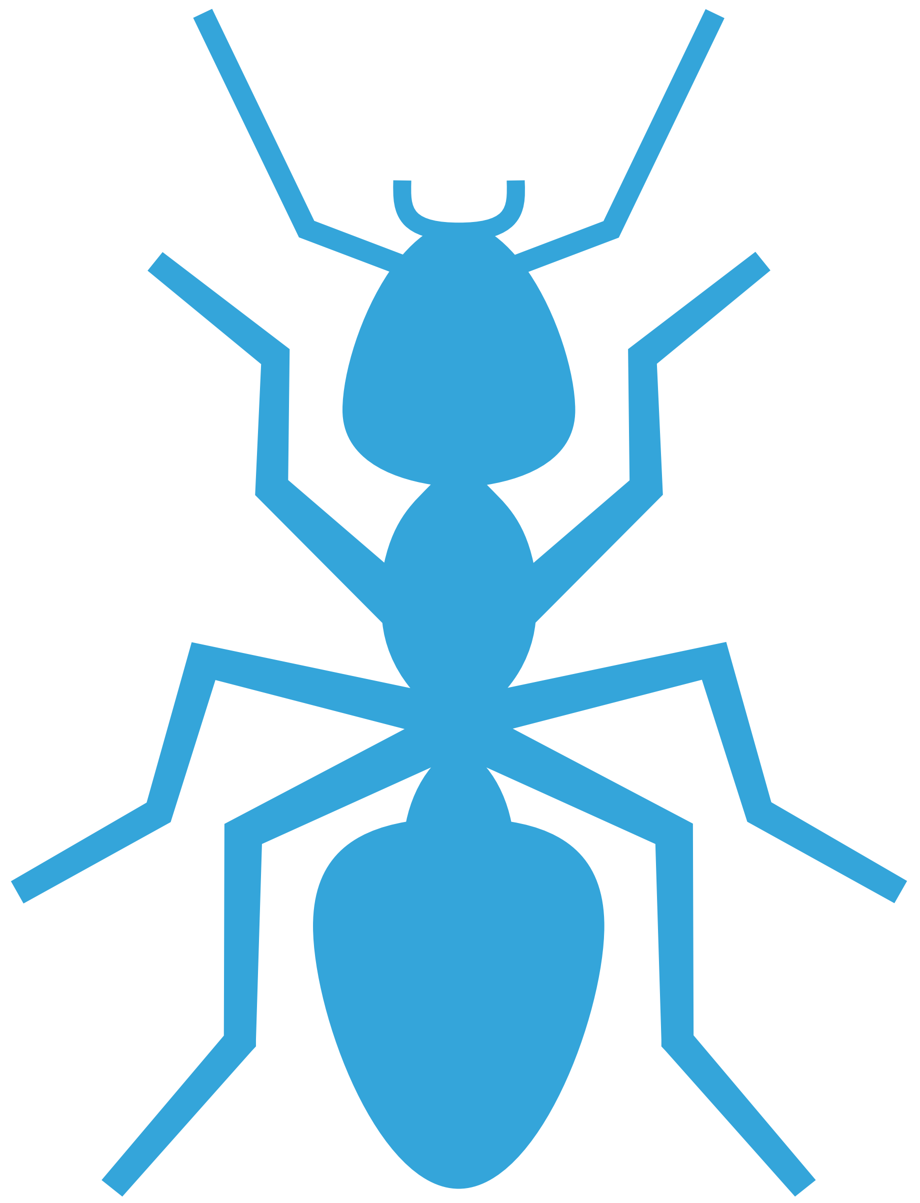


WHAT IS A BUG?

A “bug”

Evolvability defect

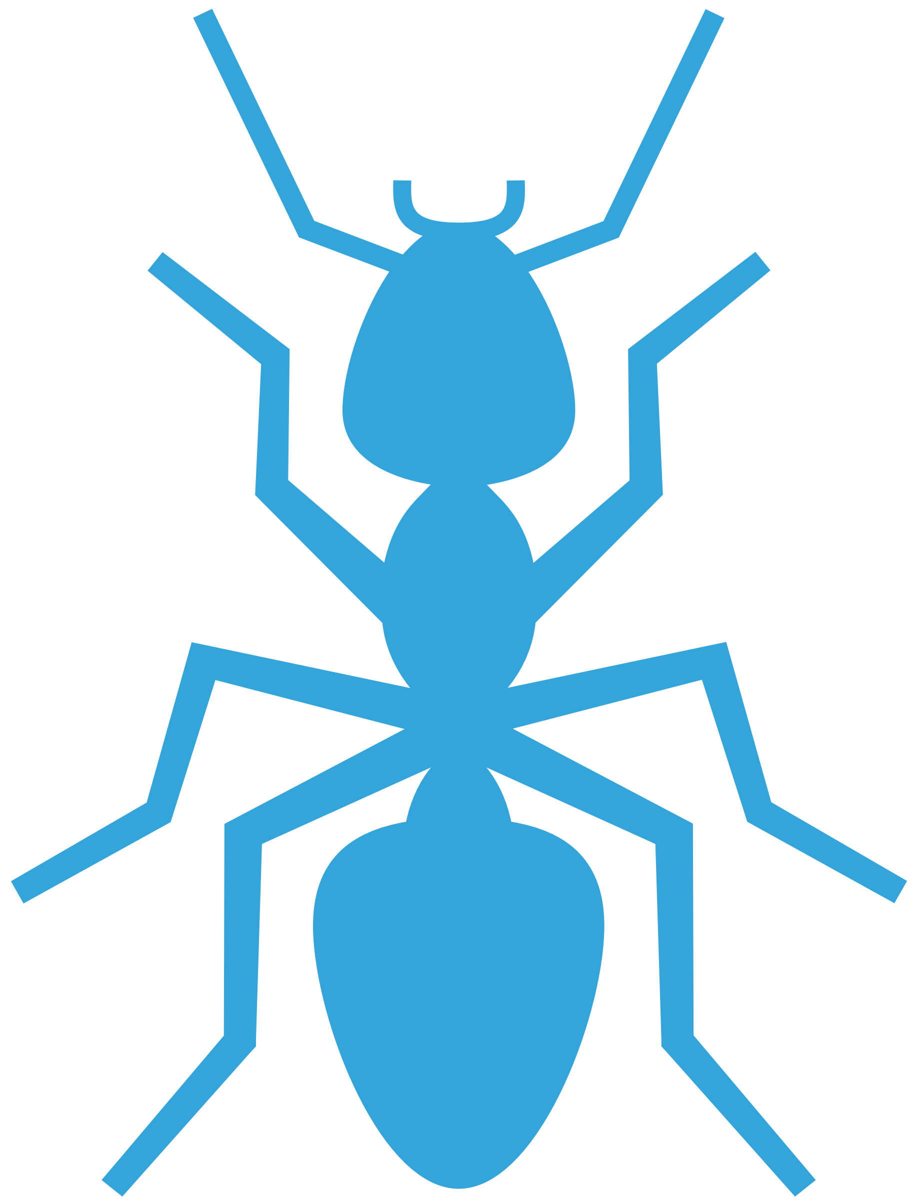
Deferred bug



WHAT IS A BUG?

A "bug"

Evolvability defect



Deferred bug

False positive

THIS IS A BUG

```
function process(User $user) {
  // some implementation
}

$a = 1;
process($a);
```

THIS IS A BUG TOO…

```
use Acme\Entity\Person;

function sayHello(Person $person)

{

  echo $person->hi();

}
```

THIS IS A BUG TOO…

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use Acme\Entity\Person;
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```
namespace Acme\Entity;
class Preson {
  … some code …
}
```

THIS IS A BUG TOO…

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THE GENESIS OF PSALM

Fixing code that ain’t broke by Matt Brown

https://medium.com/vimeo-engineering-blog/fixing-code-that-aint-broken-a99e05998c24

THESE ARE DEFERRED BUGS…

```
function getPrice(string $type): int {
    if ($type === “CHILD") {
        $price = 10;
    }
    if ($type === “ADULT”) {
        $price = 20;
    }
    return $price;
}
```

Are “deferred bugs” really bugs?

Are “deferred bugs” really bugs?

Probably quicker to fix than to risk it.

Evolvability Defect

CODE THAT MAKES CODE BASE LESS COMPLIANT WITH STANDARDS, MORE ERROR PRONE, OR MORE DIFFICULT TO MODIFY, EXTEND OR UNDERSTAND.

Evolvability Defect

EVOLVABILITY IS IMPORTANT

- Evolvability defects account for 80% of bugs found during code review [1, 2]
- Low evolvability costs money:
    - New features took 28% longer to implement [3]
    - Fixing bugs took 36% longer [3]

AN EVOLVABILITY DEFECT

```
/**
 * @param $person
 * @return int
 */
function getAgeNextBirthday($a)
{
   return “Age next birthday ” . $a->asI() + 1;
}
```

AN EVOLVABILITY DEFECT

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/**
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- Bug
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A REAL BUG

```
private function getEmailAddress(array $row): string
{
    $email = $row[self::EMAIL];
    if (empty($email)) {
        throw new ImportEntryException('Invalid or missing email address');
    }

    return $email;
}
```

A REAL BUG

```php
private function getEmailAddress(array $row): string
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A DEFERRED BUG

```
class Location {
  public function getSlug(): ?string {…}
}

function createSearchTerm(Postcode $postcode, string $slug): SearchTerm {…}


… some code …

$searchTerm = createSearchTerm($postcode, $location->getSlug());
```

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EVOLVABILITY DEFECT

```
$plots = array_map(function(Bookmark $bookmark)        {
      return $bookmark->getPlot();
   },$bookmarks);
```

EVOLVABILITY DEFECT

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You don’t really expect me to fix all those “bugs”?

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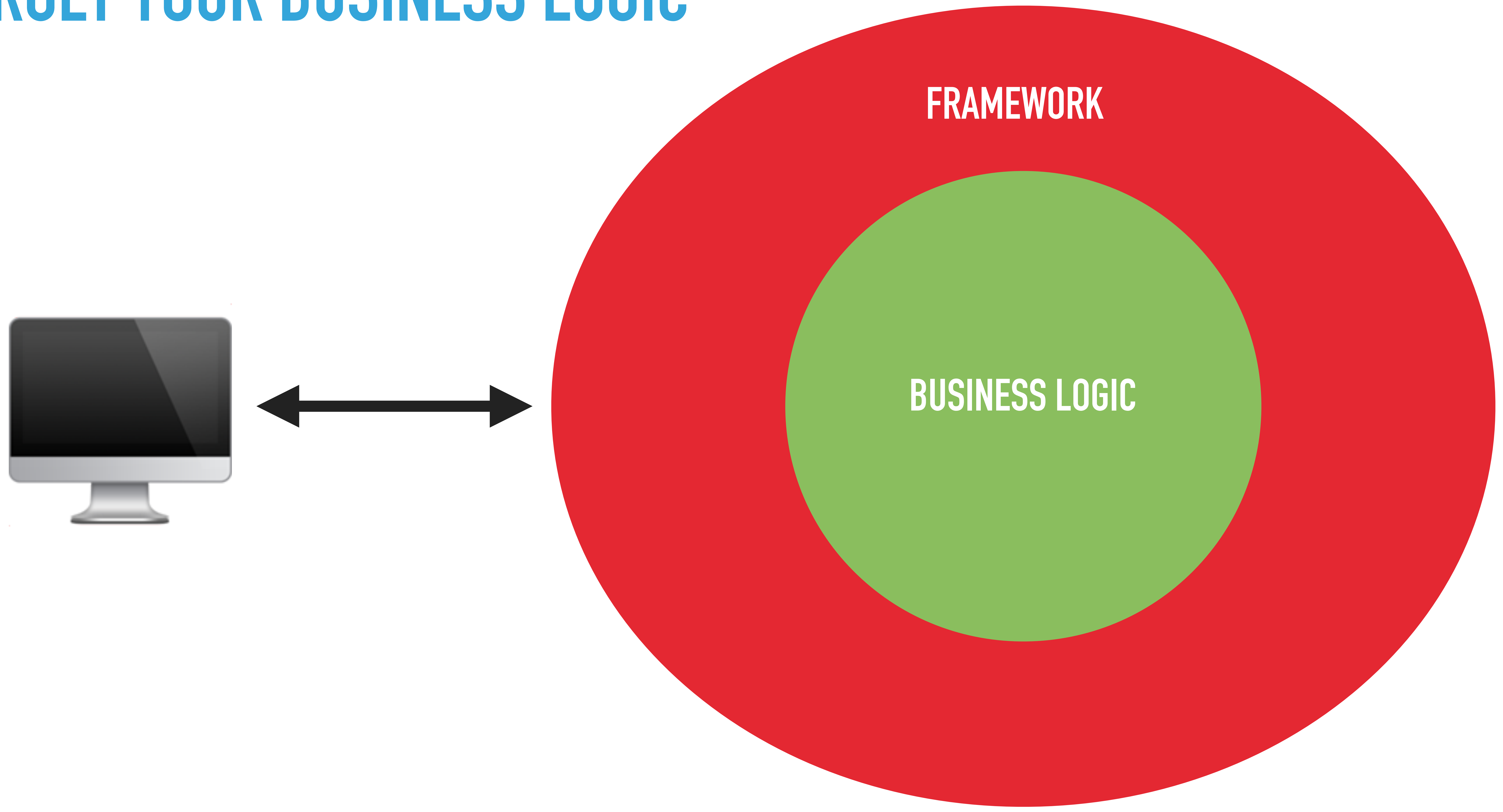
No. Here are some tips.

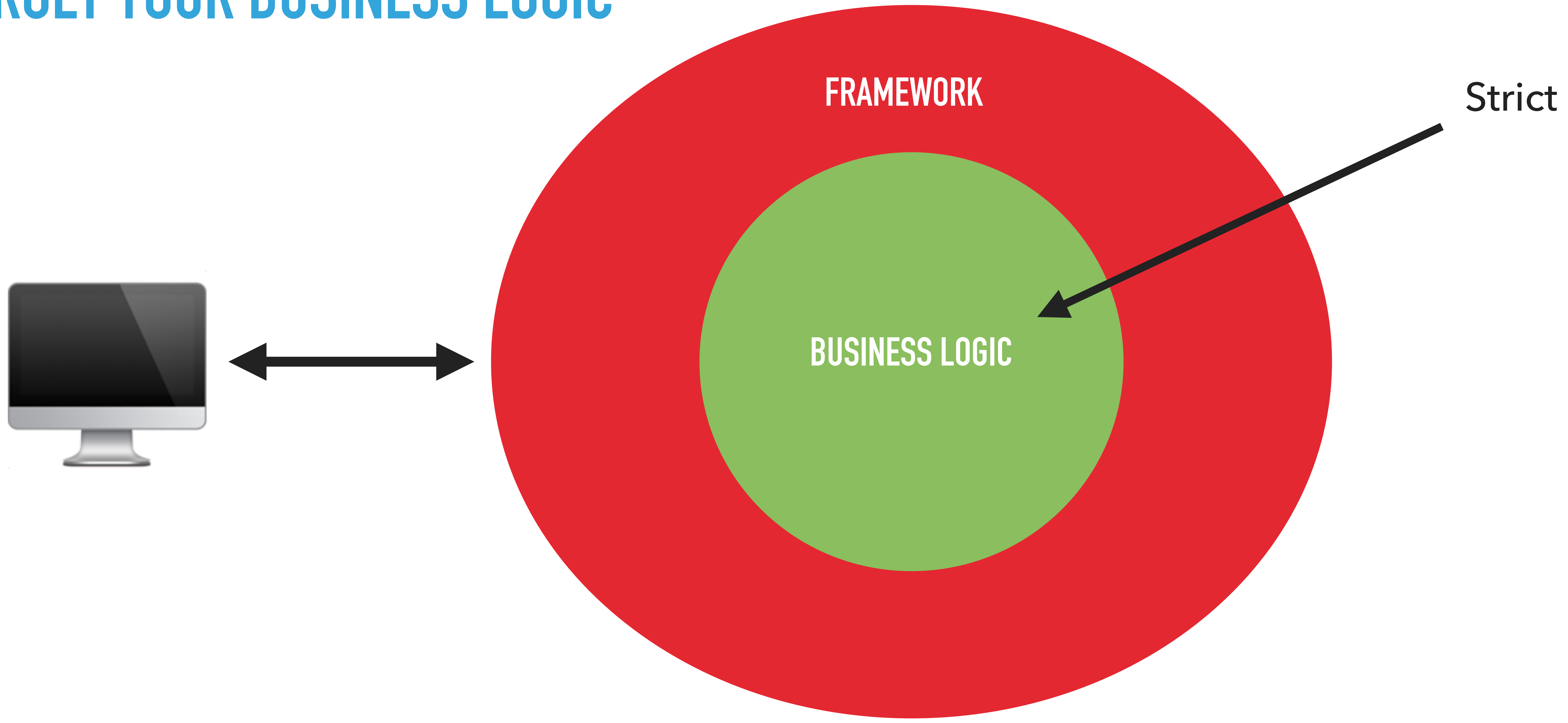
AGENDA

What
Basic
Advanced
Practical

TARGET YOUR BUSINESS LOGIC



TARGET YOUR BUSINESS LOGIC



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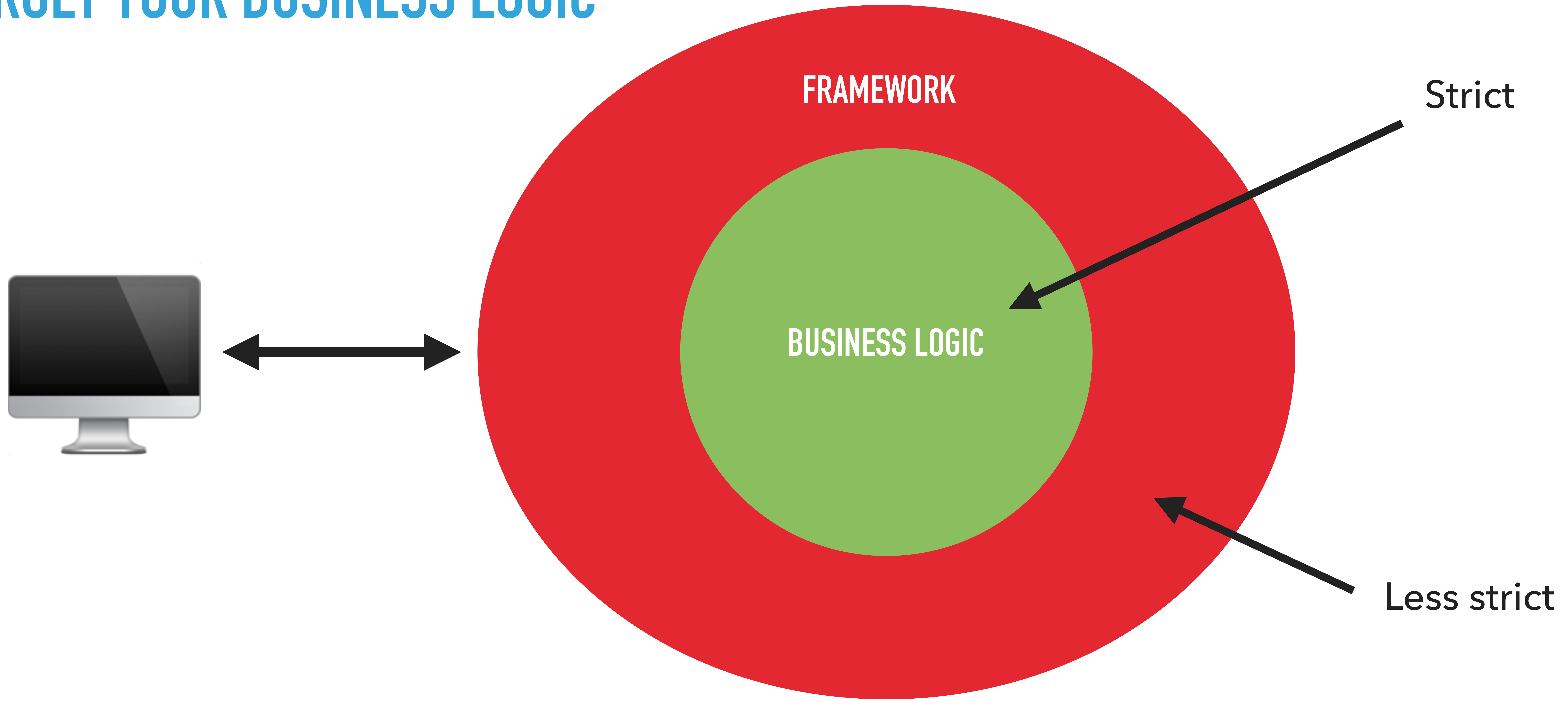

ADAPTORS FOR 3RD PARTY LIBRARIES: PROBLEM

```
interface Hasher {

   /**
    * @return string
    */
   public function encode();

}

… in our code …

$hash = $this->hasher->encode($id);
```

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ADAPTORS FOR 3RD PARTY LIBRARIES: A SOLUTION

```
class CleanHasher {

  /** @var Hasher $hasher */
  private $hasher;

  … constructor to inject Hasher …

  public function encode(int $id): string {
      return $this->hasher->encode($id);
  }
}


… in our code …

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FURTHER STATIC ANALYSIS TIPS

```
class Foo {
  public function sayHello(): void {…}
}

class DIContainer
{
   /**
    * @param string $className
    * @return mixed
    */
   public function make(string $className) {…}
}


$foo = $this->diContainer->make(Foo::class);
$foo->sayHello();
```

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}

/** @var Foo $foo */
$foo = $this->diContainer->make(Foo::class);
$foo->sayHello();
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FURTHER STATIC ANALYSIS TIPS

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/** @var Foo $foo */
$foo = $this->diContainer->make(Foo::class);
$foo->sayHello();
```

FURTHER STATIC ANALYSIS TIPS

```
$foo = $this->diContainer->make('\MyApp\Foo');
$foo->sayHello();
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$foo->sayHello();
```

FURTHER STATIC ANALYSIS TIPS

```
 $foo = $this->diContainer->make('\MyApp\Foo');
 $foo->sayHello();
```

```
class DIContainer
{
   /**
    * @param string $className
    * @psalm-param class-string $className
    * @return mixed
    */
   public function make(string $className) {…}
}
```

FURTHER STATIC ANALYSIS TIPS

```
$foo = $this->diContainer->make('\MyApp\Foo');
$foo->sayHello();
```

```
class DIContainer
{
    /**
     * @param string $className
     * @psalm-param class-string $className
     * @return mixed
     */
    public function make(string $className) {…}
}
```

FURTHER STATIC ANALYSIS TIPS

```
/** @var Foo $foo */
$foo = $this->diContainer->make(Bar::class);
$foo->sayHello();
```

FURTHER STATIC ANALYSIS TIPS

```
/** @var Foo $foo */
$foo = $this->diContainer->make(Bar::class);
$foo->sayHello();
```

FURTHER STATIC ANALYSIS TIPS

```
/** @var Foo $foo */
$foo = $this->diContainer->make(Bar::class);
$foo->sayHello();
```

FURTHER STATIC ANALYSIS TIPS

```
/** @var Foo $foo */
$foo = $this->diContainer->make(Bar::class);
$foo->sayHello();
```

```
class DIContainer
{
   /**
    * @param string $className
    * @psalm-param class-string $className
    * @template T
    * @template-typeof T $className
    * @psalm-return T
    */
   public function make(string $className) {…}
}
```

FURTHER STATIC ANALYSIS TIPS

```
/** @var Foo $foo */
$foo = $this->diContainer->make(Bar::class);
$foo->sayHello();
```

```
class DIContainer
{
   /**
    * @param string $className
    * @psalm-param class-string $className
    * @template T
    * @template-typeof T $className
    * @psalm-return T
    */
   public function make(string $className) {…}
}
```

FURTHER STATIC ANALYSIS TIPS

```
/** @var Foo $foo */
$foo = $this->diContainer->make(Bar::class);
$foo->sayHello();
```

```
class DIContainer
{
    /**
     * @param string $className
     * @psalm-param class-string $className
     * @template T
     * @template-typeof T $className
     * @psalm-return T
     */
    public function make(string $className) {…}
}
```

@daveliddament

FURTHER STATIC ANALYSIS TIPS

```
/** @var Foo $foo */
$foo = $this->diContainer->make(Bar::class);
$foo->sayHello();


class DIContainer
{
    /**
     * @param string $className
     * @psalm-param class-string $className
     * @template T
     * @template-typeof T $className
     * @psalm-return T
     */
    public function make(string $className) {…}
}
```

FURTHER STATIC ANALYSIS TIPS

```
class LoginCommand
{
  public function __construct(…) {…}

  public function execute(): void {…}

  public function getAccessToken(): string {…}
}
```

FURTHER STATIC ANALYSIS TIPS

```
class LoginCommand
{
  public function __construct(…) {…}

  public function execute(): void {…}

  public function getAccessToken(): string {…}
}



$login =  new LoginCommand();
$login->getAccessToken();
```

FURTHER STATIC ANALYSIS TIPS

```
/**
 * @var string
 */
private $accessToken;


public function getAccessToken(): string
{


    return $this->accessToken;
}
```

FURTHER STATIC ANALYSIS TIPS

```
/**
 * @var string
 */
private $accessToken;


public function getAccessToken(): string
{

    return $this->accessToken;
}
```

FURTHER STATIC ANALYSIS TIPS

```
/**
 * @var string|null
 */
private $accessToken;

public function getAccessToken(): string
{
    return $this->accessToken;
}
```

FURTHER STATIC ANALYSIS TIPS

```
/**
 * @var string|null
 */
private $accessToken;


public function getAccessToken(): string
{

    return $this->accessToken;
}
```

FURTHER STATIC ANALYSIS TIPS

```
/**
 * @var string|null
 */
private $accessToken;


public function getAccessToken(): string
{

    return $this->accessToken;
}
```

FURTHER STATIC ANALYSIS TIPS

```
/**
 * @var string|null
 */
private $accessToken;


public function getAccessToken(): string
{

    return $this->accessToken;
}
```

FURTHER STATIC ANALYSIS TIPS

```
/**
 * @var string|null
 */
private $accessToken;


public function getAccessToken(): string
{
    if ($this->accessToken === null) {
      throw new LogicException(… message …);
    }
    return $this->accessToken;
}
```

FURTHER STATIC ANALYSIS TIPS

```
/**
 * @var string|null
 */
private $accessToken;


public function getAccessToken(): string
{
     if ($this->accessToken === null) {
       throw new LogicException(… message …);
    }
    return $this->accessToken;
}
```

FURTHER STATIC ANALYSIS TIPS

```
/**
 * @var string|null
 */
private $accessToken;


public function getAccessToken(): string
{
     Assert::notNull($this->accessToken, …message…);

    return $this->accessToken;
}
```

FURTHER STATIC ANALYSIS TIPS

```
/**
 * @var string|null
 */
private $accessToken;


public function getAccessToken(): string
{
    Assert::notNull($this->accessToken, …message…);

    return $this->accessToken;
}
```

FURTHER STATIC ANALYSIS TIPS

```
class Assert
{

  /**
   * @param mixed|null $expression
   * @param string $message
   */
  public static function notNull($expression, string $message): void
  {
     if ($expression === null) {
        throw new LogicException($message);
     }
  }

}
```

FURTHER STATIC ANALYSIS TIPS

```
class Assert
{
  public static function notNull($expression, string $message): void
  {
     self::assertTrue($expression !== null, $message);
  }

  … other assertions …

  public static function assertTrue($expression, string $message): void
  {
     if ($expression !== true) {
        throw new LogicException($message);
     }
  }
}
```

FURTHER STATIC ANALYSIS TIPS

```
class Assert
{
  public static function notNull($expression, string $message): void
  {
     self::assertTrue($expression !== null, $message);
  }

  … other assertions …

  public static function assertTrue($expression, string $message): void
  {
     if ($expression !== true) {
        throw new LogicException($message);
     }
  }
}
```

FURTHER STATIC ANALYSIS TIPS

```
class Assert
{
  public static function notNull($expression, string $message): void
  {
     self::assertTrue($expression !== null, $message);
  }

  … other assertions …

  public static function assertTrue($expression, string $message): void
  {
     if ($expression !== true) {
        throw new LogicException($message);
     }
  }
}
```

FURTHER STATIC ANALYSIS TIPS

```
class Assert
{




  public static function notNull($expression, string $message): void
  {
     self::assertTrue($expression !== null, $message);
  }

 }
```

FURTHER STATIC ANALYSIS TIPS

```
class Assert
{

  /**
   * @psalm-assert !null $expression
   */
  public static function notNull($expression, string $message): void
  {
     self::assertTrue($expression !== null, $message);
  }

 }
```

FURTHER STATIC ANALYSIS TIPS

```
class Assert
{

  /**
   * @psalm-assert !null $expression
   */
  public static function notNull($expression, string $message): void
  {
     self::assertTrue($expression !== null, $message);
  }

 }
```

FURTHER STATIC ANALYSIS TIPS

What about 3rd party libraries?

FURTHER STATIC ANALYSIS TIPS

FURTHER STATIC ANALYSIS TIPS

Stubs/Assert.php

FURTHER STATIC ANALYSIS TIPS

Stubs/Assert.php

```
namespace Webmozart\Assert;

class Assert
{
  /**
   * @psalm-assert !null $value
   */
  public static function notNull($value, $message=“”) {}

  … other functions …
") {}

}
```

FURTHER STATIC ANALYSIS TIPS

Stubs/Assert.php

```
namespace Webmozart\Assert;

class Assert
{
  /**
   * @psalm-assert !null $value
   */
  public static function notNull($value, $message=“”) {}

  … other functions …
") {}

}
```

FURTHER STATIC ANALYSIS TIPS

```
<psalm …>

  … other config …

  <stubs>
    <file name="Stubs/Assert.php" />
    … other stub files …
  </stubs>

<psalm>
```

FURTHER STATIC ANALYSIS TIPS

```
<psalm …>

  … other config …

  <stubs>
    <file name="Stubs/Assert.php" />
    … other stub files …
  </stubs>

<psalm>
```

LEARN FROM MISTAKES AND DON'T BE SLOPPY

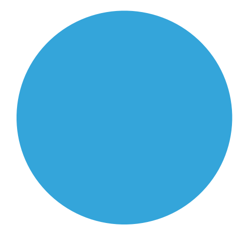
- Learn from issues raised
- Type hint everything
- Create / use plugins / stubs to give extra information to static analysis tools

Do you really expect me to fix all 3895 bugs before writing new code.

Do you really expect me to fix all 3895 bugs before writing new code.

No. Create a baseline.

BASELINE STATIC ANALYSIS RESULTS



BASELINE STATIC ANALYSIS RESULTS

Problem

Problem

Problem

Problem

Problem

BASELINE STATIC ANALYSIS RESULTS

Problem

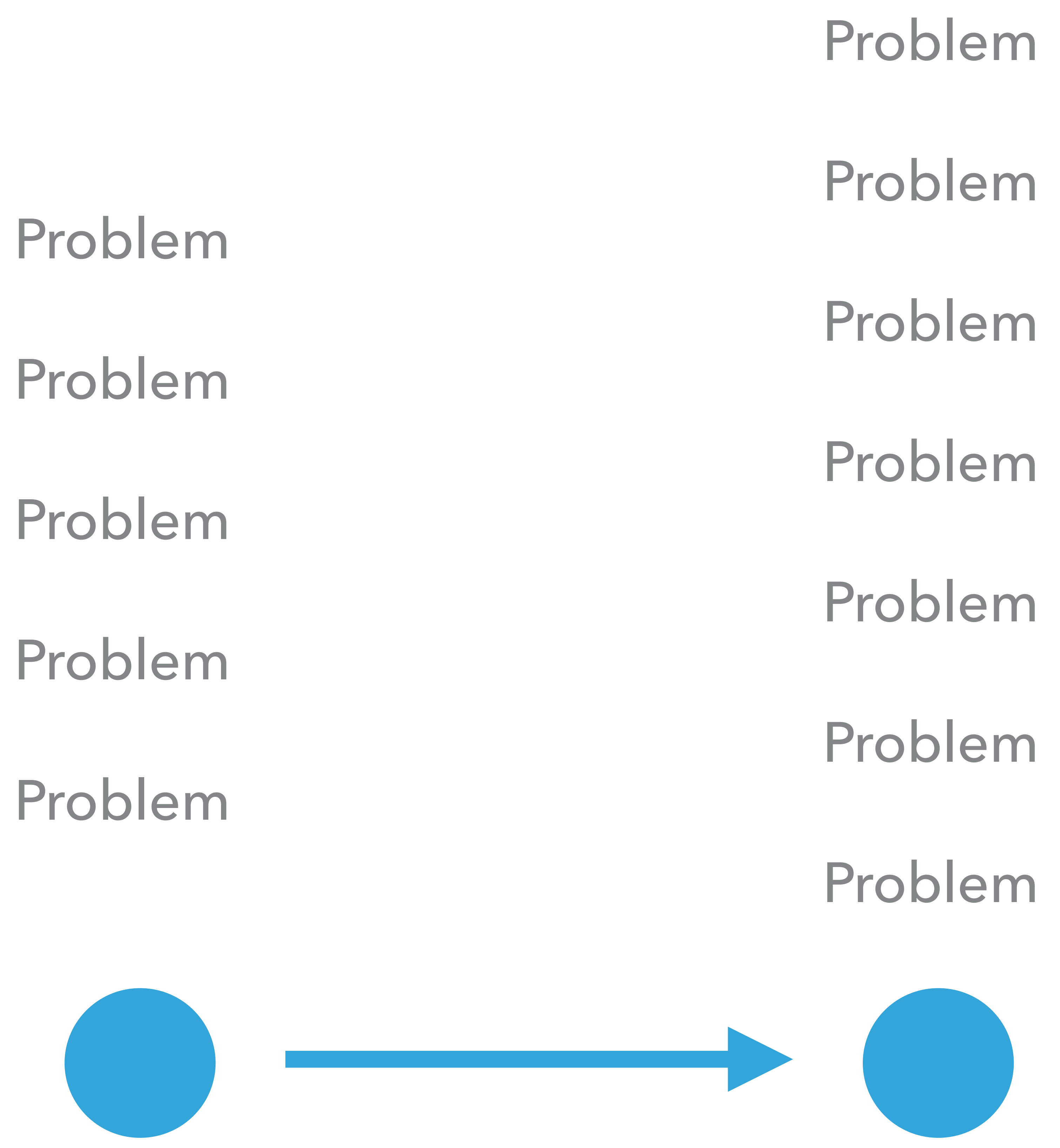
Problem

Problem

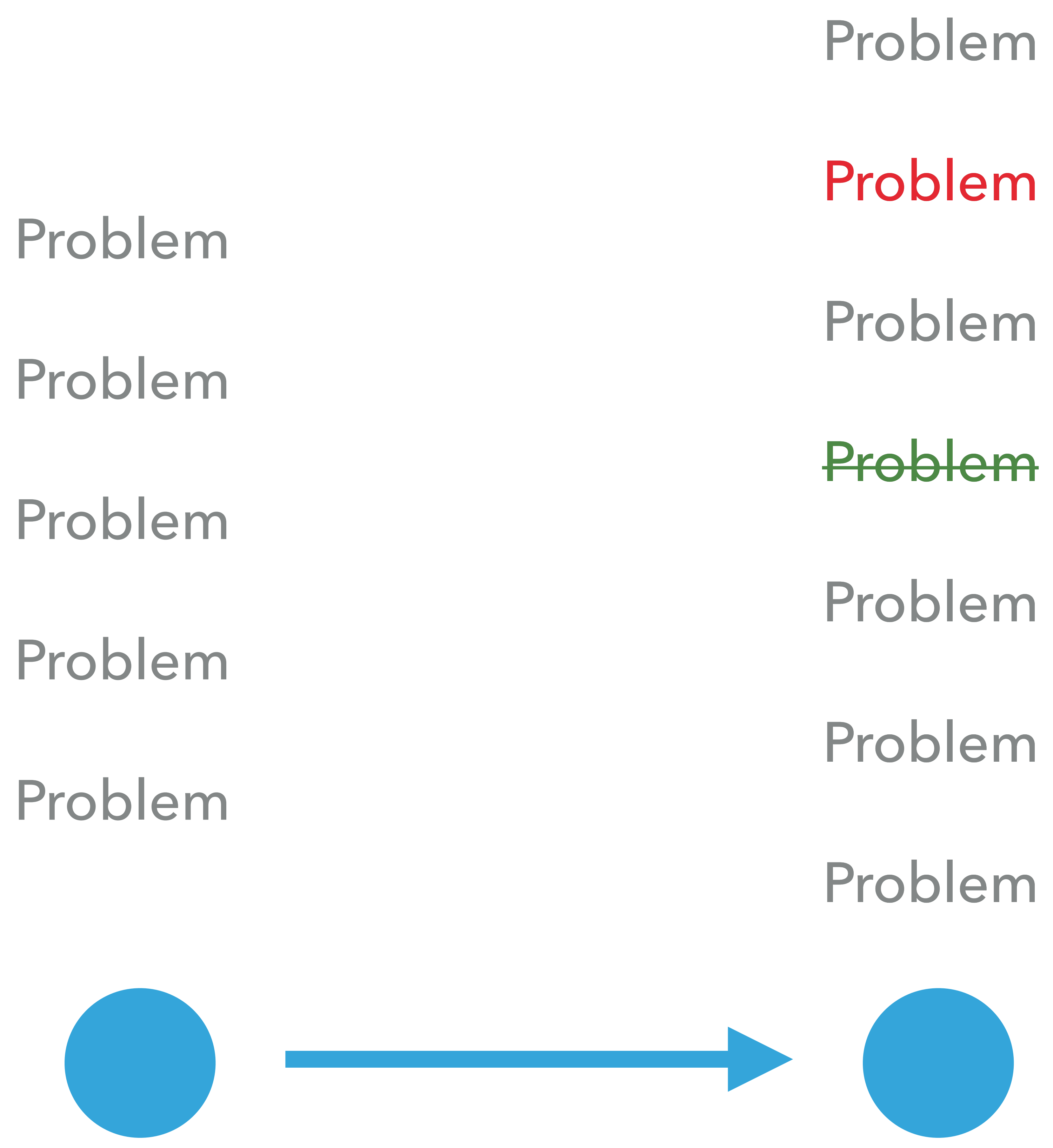
Problem

Problem

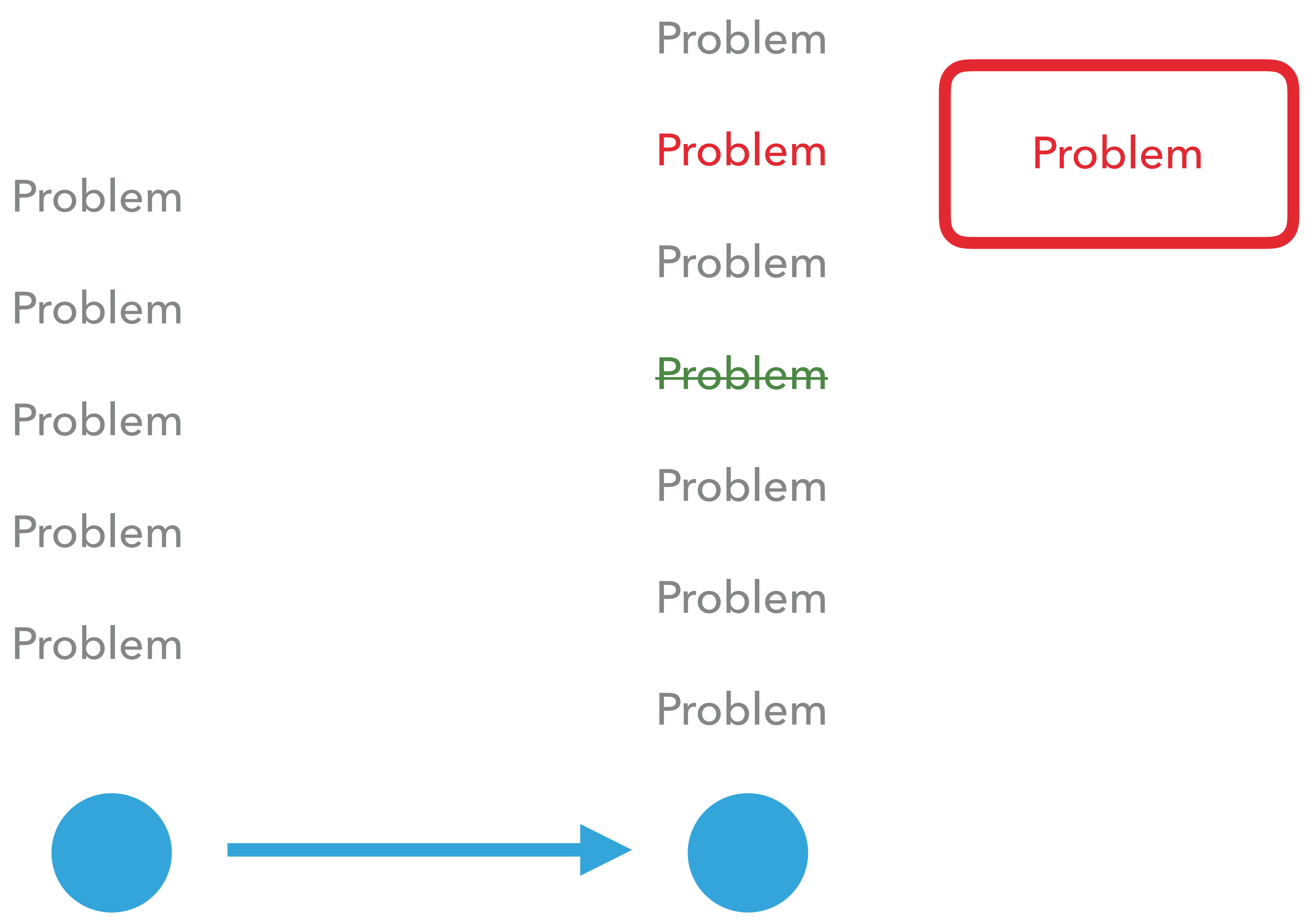
BASELINE STATIC ANALYSIS RESULTS



BASELINE STATIC ANALYSIS RESULTS



BASELINE STATIC ANALYSIS RESULTS



STATIC ANALYSIS RESULTS BASELINE (SARB)

- Available: https://github.com/DaveLiddament/sarb
  - Supports:
    - Psalm, PHPStan
    - Easy to add more static analysis tools. Don't need to be for PHP.
  - Requires repo uses git

SARB: CREATE BASELINE

```
# Run Psalm on the code


> sarb create-baseline … args …

Baseline created with 328 problems.

>
```

SARB: REMOVE BASELINE FROM RESULTS

```
# Run Psalm on the updated code



> sarb remove-baseline-results … args …


Original results contained 334 problems.
Baseline contained 328 problems.
After baseline removed there are 15 new problems.
>
```

SARB: REMOVE BASELINE FROM RESULTS

```
# Run Psalm on the updated code



> sarb remove-baseline-results … args …


Original results contained 334 problems.
Baseline contained 328 problems.
After baseline removed there are 15 new problems.
>
```

SARB BEHIND THE SCENES: BASELINE

Type: psalm-json **History Marker**: 06b982c6b3d15ef1eae827038d9d2bcb0ae71329

Type	File	Line number
InvalidNullableReturnType	src/Entity/Person.php	93
PossiblyNullReference	src/Entity/Shop.php	57
InvalidScalarArgument	src/Purchase/Begin.php	126

SARB BEHIND THE SCENES: BASELINE

```
class Person
{

… Some code …

public function foo()
{
… some code …
  return $bar
}
```

SARB BEHIND THE SCENES: BASELINE

```
class Person
{

… Some code …

public function foo()
{
… some code …
  return $bar
}
```

Line 93: InvalidNullableReturnType

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SARB BEHIND THE SCENES: AFTER CODING

```
class Person
{


… Some code …


public function foo()
{
… some code …
  return $bar
}
```

SARB BEHIND THE SCENES: AFTER CODING

```
class ~~Person~~  Employee
{

… Some code …

public function foo()
{
… some code …
  return $bar
}
```

SARB BEHIND THE SCENES: AFTER CODING

```
class ~~Person~~    Employee
{


~~… Some code …~~            Remove 20 lines of code


public function foo()
{
… some code …
  return $bar
}
```

SARB BEHIND THE SCENES: AFTER CODING

class ~~Person~~ **Employee**

{

~~… Some code …~~ **Remove 20 lines of code**

public function foo()

{

… some code …

return $bar **Line 73: InvalidNullableReturnType**

}

SARB BEHIND THE SCENES: REMOVING THE BASELINE RESULTS

SARB BEHIND THE SCENES: REMOVING THE BASELINE RESULTS

- **Problem:** InvalidNullableReturnType src/Entity/Employee.php:73

SARB BEHIND THE SCENES: REMOVING THE BASELINE RESULTS

- **Problem:** InvalidNullableReturnType src/Entity/Employee.php:73
- What is the location of src/Entity/Employee.php:73 at the baseline?

SARB BEHIND THE SCENES: REMOVING THE BASELINE RESULTS

- **Problem:** InvalidNullableReturnType src/Entity/Employee.php:73
- What is the location of src/Entity/Employee.php:73 at the baseline?
- History Analyser says: src/Entity/Person.php:93

SARB BEHIND THE SCENES: REMOVING THE BASELINE RESULTS

- **Problem:** InvalidNullableReturnType src/Entity/Employee.php:73
- What is the location of src/Entity/Employee.php:73 at the baseline?
- History Analyser says: src/Entity/Person.php:93
- Did we have a problem InvalidNullableReturnType at src/Entity/Person.php:93 in the baseline?

SARB BEHIND THE SCENES: BASELINE

Type: psalm-json **History Marker**: 06b982c6b3d15ef1eae827038d9d2bcb0ae71329

Type	File	Line number
InvalidNullableReturnType	src/Entity/Person.php	93
PossiblyNullReference	src/Entity/Shop.php	57
InvalidScalarArgument	src/Purchase/Begin.php	126

SARB BEHIND THE SCENES: BASELINE

Type: psalm-json

History Marker: 06b982c6b3d15ef1eae827038d9d2bcb0ae71329

Type	File	Line number
InvalidNullableReturnType	src/Entity/Person.php	93
PossiblyNullReference	src/Entity/Shop.php	57
InvalidScalarArgument	src/Purchase/Begin.php	126

SARB BEHIND THE SCENES: REMOVING THE BASELINE RESULTS

- **Problem:** InvalidNullableReturnType src/Entity/Employee.php:73
- What is the location of src/Entity/Employee.php:73 at the baseline?
- History Analyser says: src/Entity/Person.php:93
- Did we have a problem InvalidNullableReturnType at src/Entity/Person.php:93 in the baseline?
- Yes. This problem was in the baseline. Don't report as new issue.

STATIC ANALYSIS WITH SARB

STATIC ANALYSIS WITH SARB

- Run static analysis tool

STATIC ANALYSIS WITH SARB

- Run static analysis tool
- Fix all bugs you decide need fixing

STATIC ANALYSIS WITH SARB

- Run static analysis tool
- Fix all bugs you decide need fixing
- Run static analysis tool again

STATIC ANALYSIS WITH SARB

- Run static analysis tool
- Fix all bugs you decide need fixing
- Run static analysis tool again
- Generate SARB baseline

STATIC ANALYSIS WITH SARB

- Run static analysis tool
- Fix all bugs you decide need fixing
- Run static analysis tool again
- Generate SARB baseline
- Repeat forever:
  - Write code
  - Run analysis
  - Remove baseline results from latest analysis
  - Fix newly introduced bugs

STATIC ANALYSIS WITH SARB

- Run static analysis tool
- Fix all bugs you decide need fixing
- Run static analysis tool again
- Generate SARB baseline
- Repeat forever:
  - Write code
  - Run analysis
  - Remove baseline results from latest analysis
  - Fix newly introduced bugs

PSALM BASELINE

```
vendor/bin/psalm --set-baseline=baseline.xml
```

Type	File	Count
InvalidNullableReturnType	src/Entity/Person.php	3
PossiblyNullReference	src/Entity/Shop.php	1
InvalidScalarArgument	src/Purchase/Begin.php	2

PSALM BASELINE

Type	File	Baseline count	New count
InvalidNullableReturnType	src/Entity/Person.php	3	4
PossiblyNullReference	src/Entity/Shop.php	1	1
InvalidScalarArgument	src/Purchase/Begin.php	2	1

PSALM BASELINE

Type	File	Baseline count	New count
InvalidNullableReturnType	src/Entity/Person.php	3	4
PossiblyNullReference	src/Entity/Shop.php	1	1
InvalidScalarArgument	src/Purchase/Begin.php	2	1

AGENDA

What
Basic
Advanced
Practical

Static analysis tells you that your code is incorrect.

Tests tell you a particular scenario is working correctly.

SUMMARY

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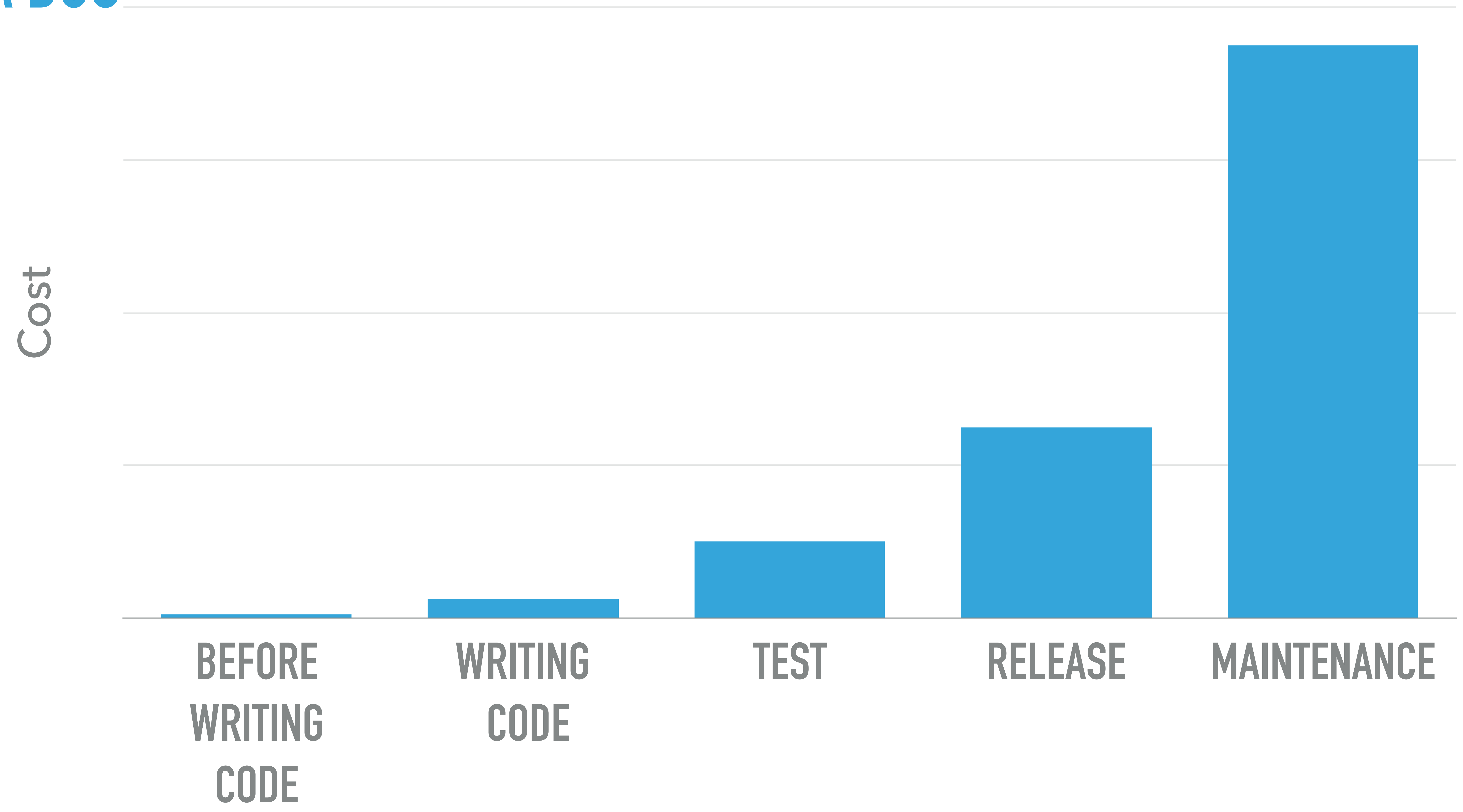
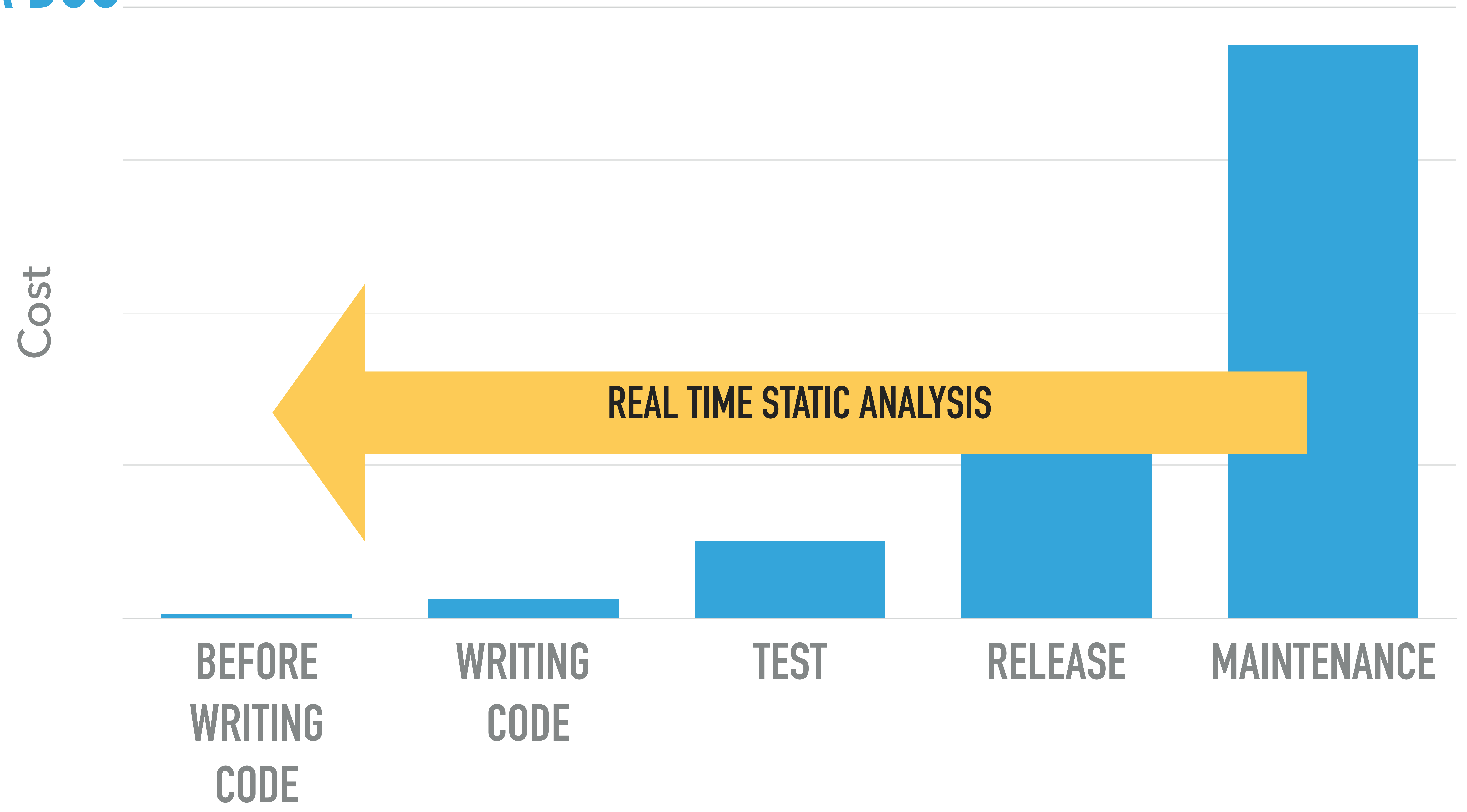
APPROPRIATE APPLICATION OF STATIC ANALYSIS REDUCES THE OVERALL COST OF SOFTWARE DEVELOPMENT.

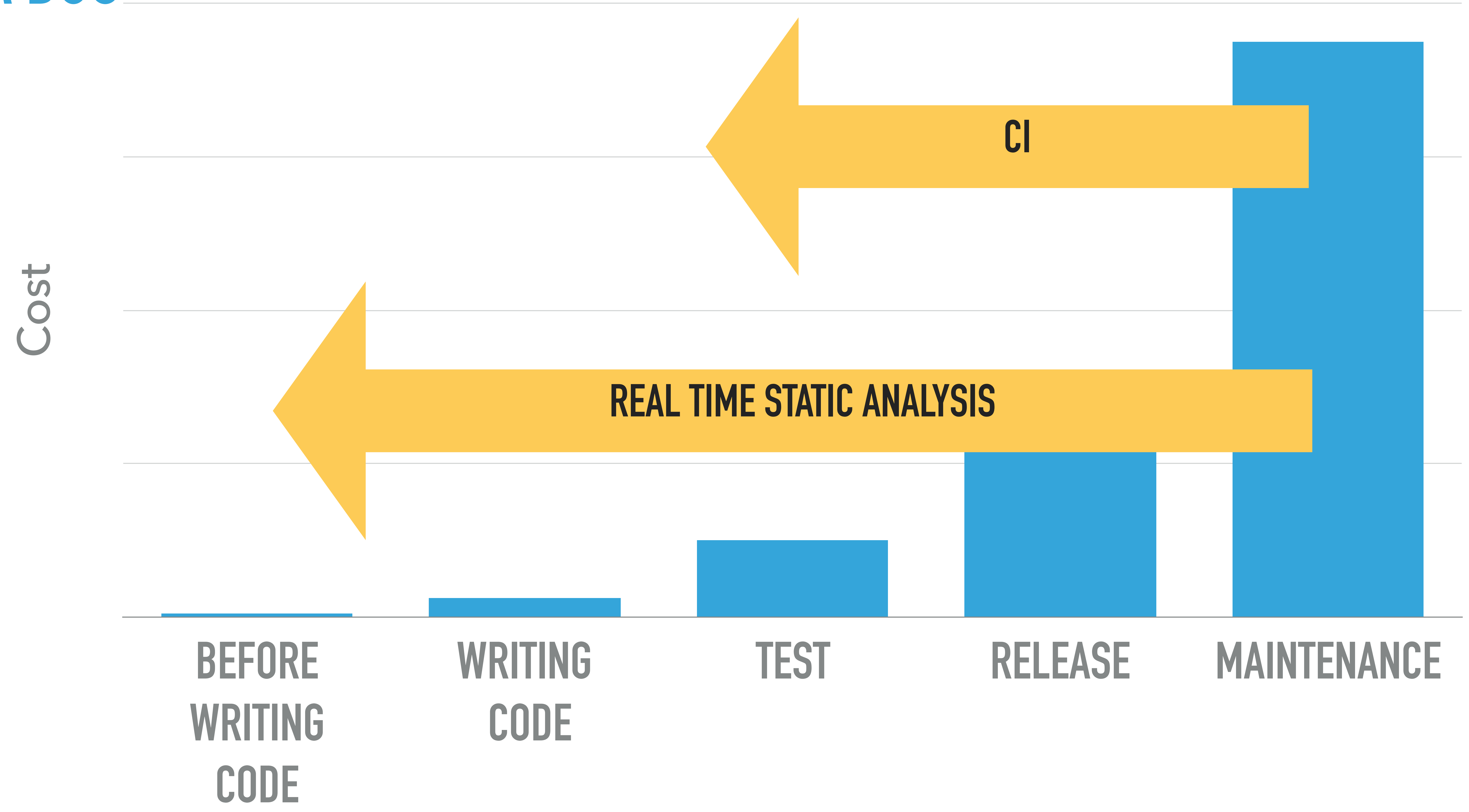
COST OF A BUG


Cost
BEFORE WRITING CODE
WRITING CODE
TEST
RELEASE
MAINTENANCE

COST OF A BUG


Cost
REAL TIME STATIC ANALYSIS
BEFORE WRITING CODE
WRITING CODE
TEST
RELEASE
MAINTENANCE

COST OF A BUG


CI
REAL TIME STATIC ANALYSIS
Cost
BEFORE WRITING CODE
WRITING CODE
TEST
RELEASE
MAINTENANCE

CI TOOLSET

- Composer validate: **`composer validate --strict`**
- Parallel lint: **`jakub-onderka/php-parallel-lint`**
- PHP CS fixer: **`friendsofsymfony/php-cs-fixer`**
- Var dump checker: **`jakub-onderka/php-var-dump-checker`**
- Security checker: **`sensiolabs/security-checker`**

PHP bible for static analysis tools: https://github.com/exakat/php-static-analysis-tools

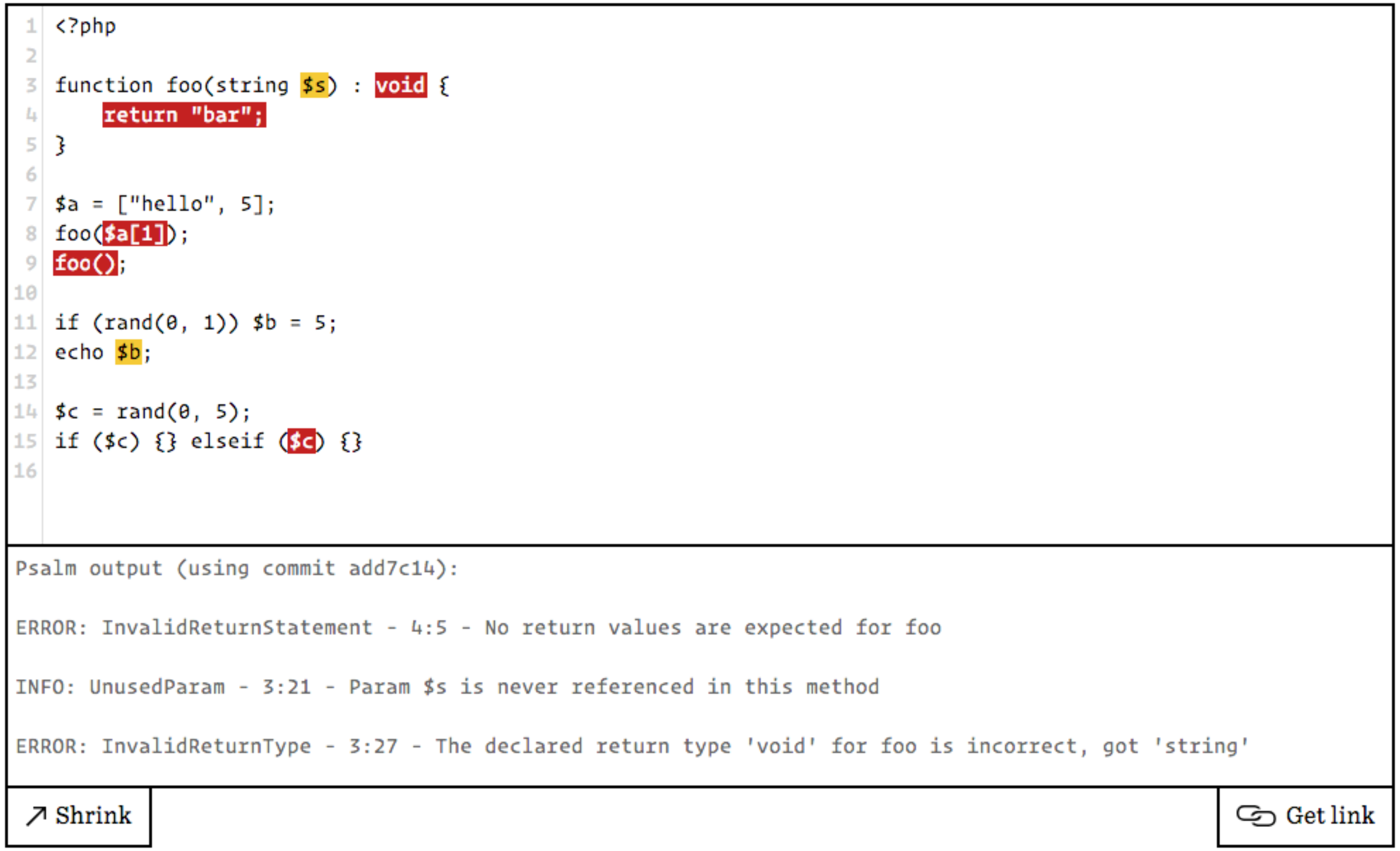
REQUIREMENTS FOR REAL TIME STATIC ANALYSIS TOOL (IDE)

- Understand entire codebase (including vendor directory)
- Highlight errors in real time
- Suggest / autocomplete based on context
- Refactoring (e.g. rename, move, extract)

REQUIREMENTS FOR REAL TIME STATIC ANALYSIS TOOL (IDE)

- Understand entire codebase (including vendor directory)
- Highlight errors in real time
- Suggest / autocomplete based on context
- Refactoring (e.g. rename, move, extract)

USE ADVANCED STATIC ANALYSIS TOOLS IN CI



```
<?php

function foo(string $s) : void {
    return "bar";
}

$a = ["hello", 5];
foo($a[1]);
foo();

if (rand(0, 1)) $b = 5;
echo $b;

$c = rand(0, 5);
if ($c) {} elseif ($c) {}

```

```
Psalm output (using commit add7c14):

ERROR: InvalidReturnStatement - 4:5 - No return values are expected for foo

INFO: UnusedParam - 3:21 - Param $s is never referenced in this method

ERROR: InvalidReturnType - 3:27 - The declared return type 'void' for foo is incorrect, got 'string'
```

Dave Liddament

Lamp Bristol

Organise PHP-SW and Bristol PHP Training

17 years of writing software (C, Java, Python, PHP)

@daveliddament

Dave Liddament

Lamp Bristol

Thank you for listening

Organise PHP-SW and Bristol PHP Training

17 years of writing software (C, Java, Python, PHP)

@daveliddament

SUMMARY

REFERENCES

- [1] Mika V. Mantyla and Casper Lassenius "What Types of Defects Are Really Discovered in Code Reviews?" IEEE Transactions on Software Engineering
- [2] Harvey Siy, Lawrence Votta "Does The Modern Code Inspection Have Value?"
- [3] R.K. Bandi, V.K. Vaishnavi, and D.E. Turk, "Predicting Maintenance Performance Using Object-Orientated Design Complexity Metrics"

LINKS

- Static Analysis tools: https://github.com/exakat/php-static-analysis-tools
- Sample CircleCI project: https://github.com/DaveLiddament/skeleton-ci-project
- Psalm https://getpsalm.org/
- Phan: https://github.com/phan/phan
- PHPStan https://github.com/phan/phan
- Parallel lint https://github.com/JakubOnderka/PHP-Parallel-Lint
- PHP CS fixer https://github.com/FriendsOfPHP/PHP-CS-Fixer
- Var dump checker https://github.com/JakubOnderka/PHP-Var-Dump-Check
- Security checker https://security.sensiolabs.org/