



# Extending the PHP language with static analysis

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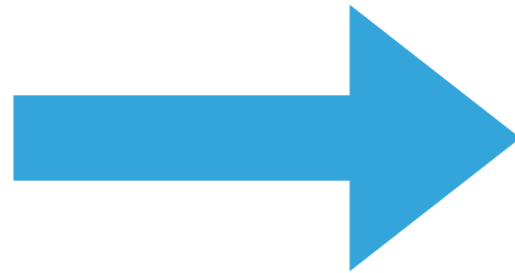
IF ONLY PHP HAD FEATURE ...  
SIMILAR TO LANGUAGE ...

WOULDN'T IT BE GREAT IF PHP COULD  
DO ...



# HOW I BUILT NEW LANGUAGE FEATURES

Very  
specific  
constraint

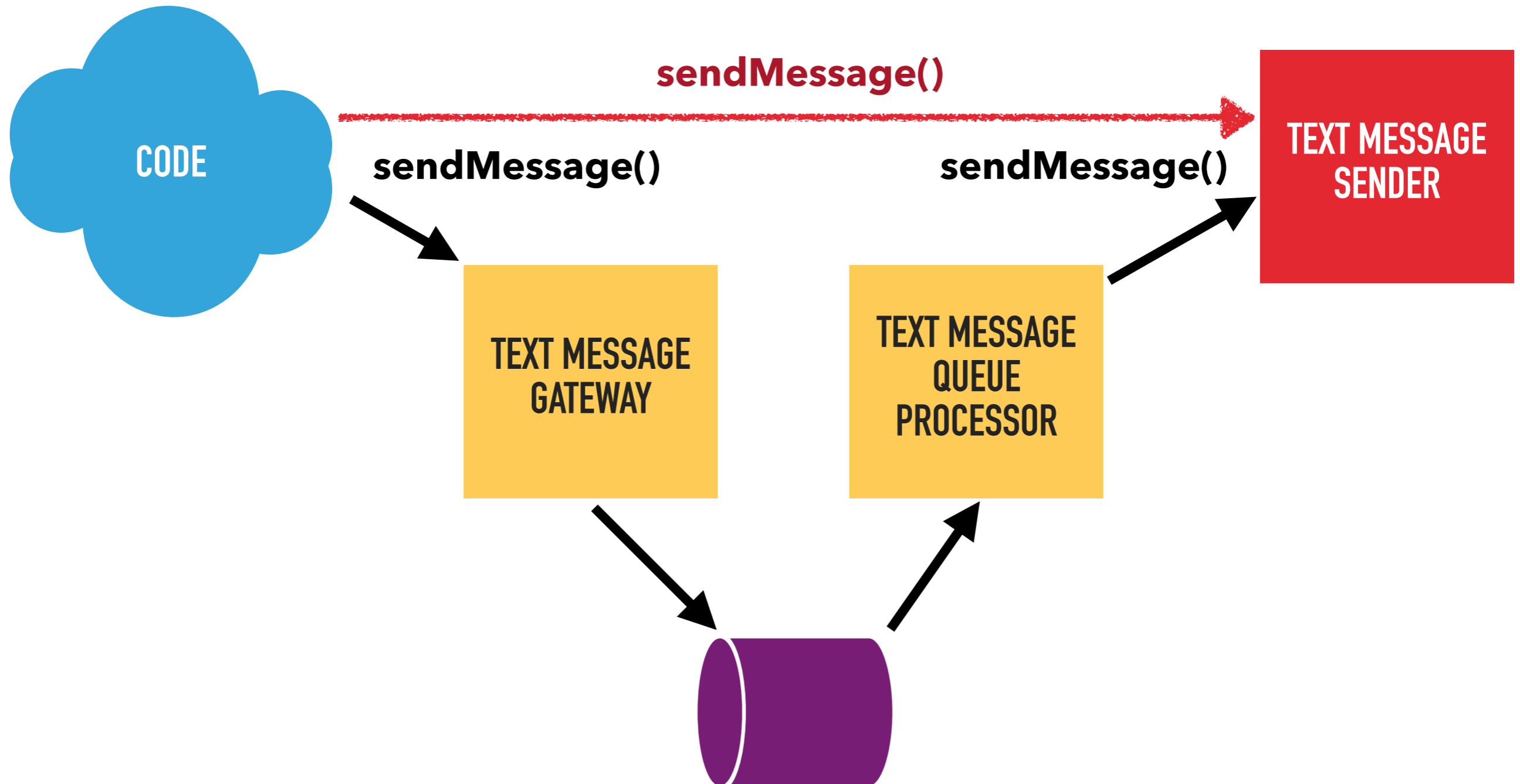


Generalised  
version that  
could be a  
useful on your  
project

# Preconditions

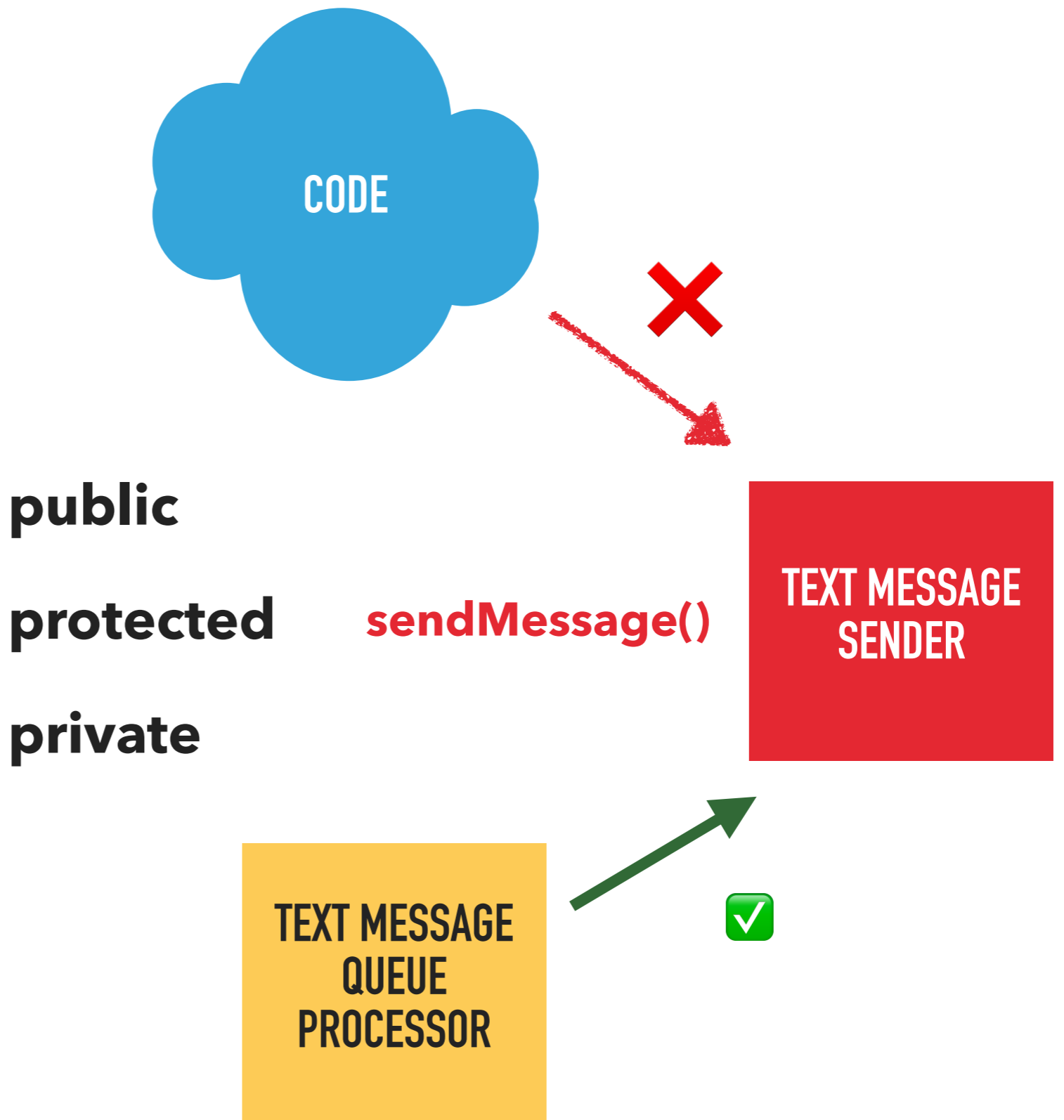


# One of many examples...

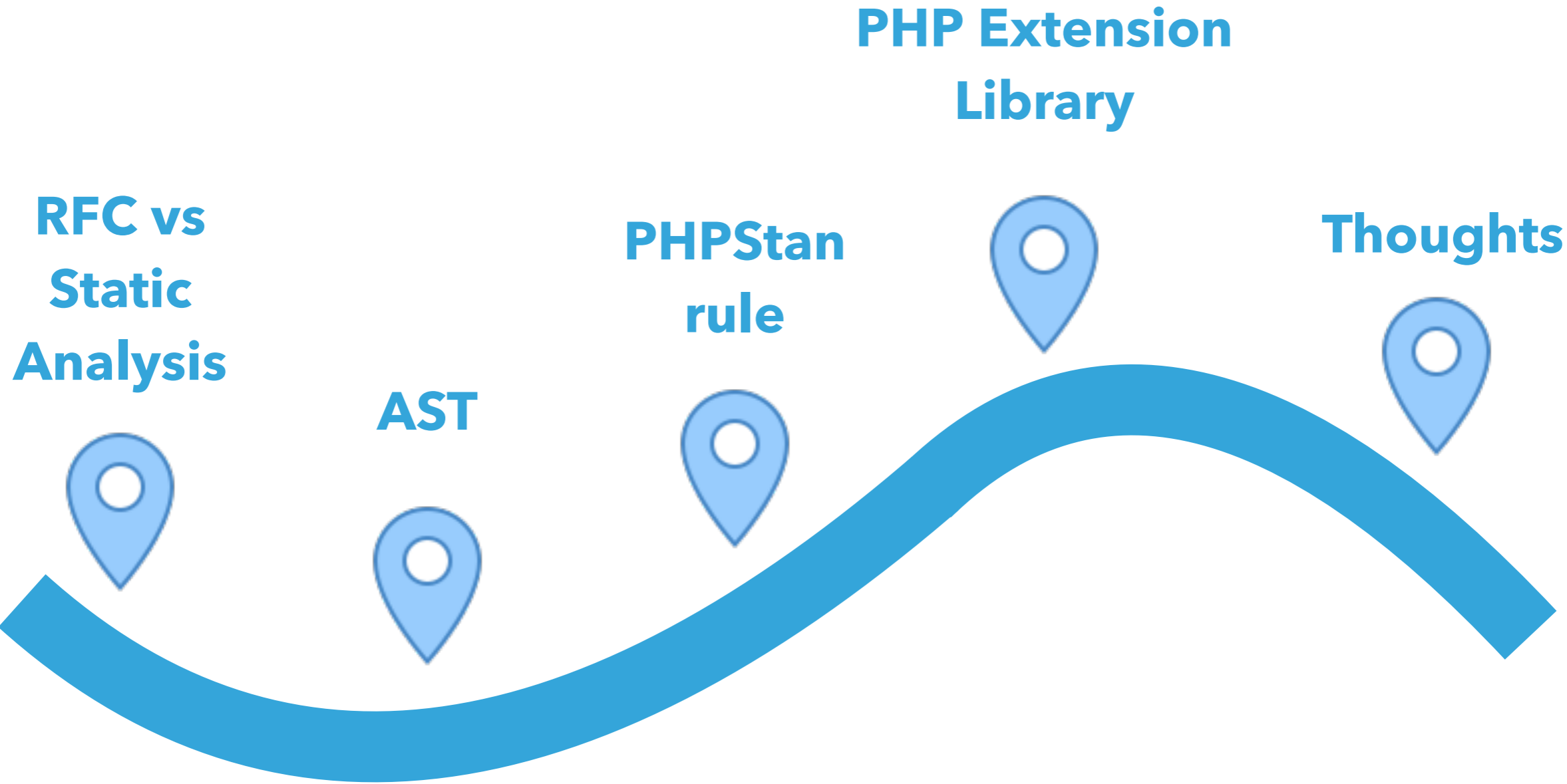


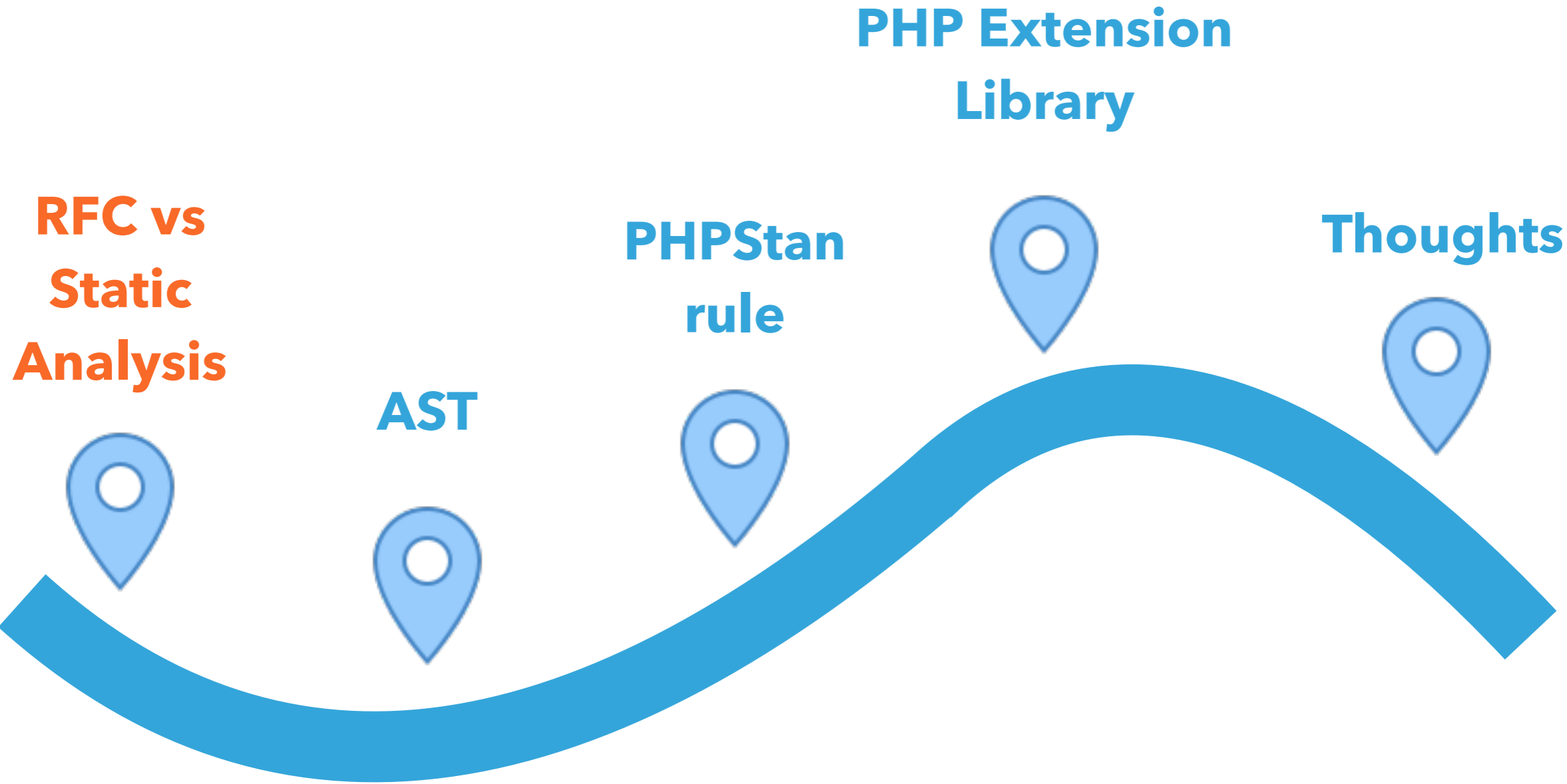
*Existing visibility modifiers are not fine grained enough.*

*We need more control.*



**Automate checks to stop me, or other developers, breaking this constraint**









TELL ME ABOUT PHP'S RFC PROCESS

FIRST YOUR WRITE AN RFC

TALK

VOTE

IMPLEMENT

**A LONG AND DIFFICULT PROCESS!**

**THERE IS ANOTHER WAY...**

**... FOR SOME FUNCTIONALITY**

# Run time

```
class Person
{
    private function update()
    {
        // Some code
    }
}
```

```
$person = new Person();  
$person->update();
```

**Uncaught Error: Call to private method Person::update()**

# Static analysis

```
class Person
{
    private function update()
    {
        // Some code
    }
}
```

```
$person = new Person();
```

```
$person->update(); ❌
```




# Static analysis gives us generics now

```
/** @return Person[] */  
function getPeople():array {...}
```

```
function process(Car $car) {...}
```

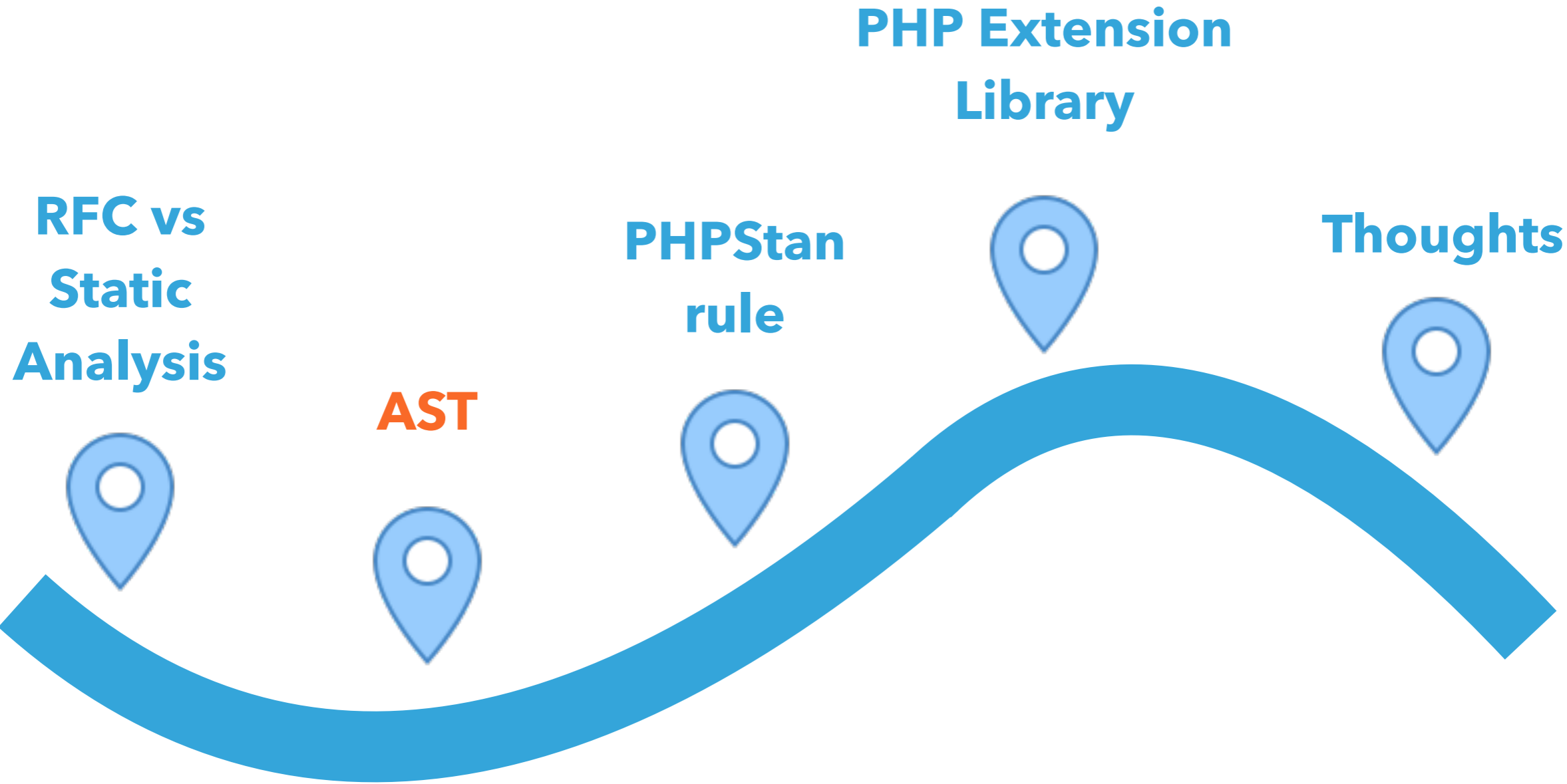
```
for (getPeople() as $person) {  
    process($person);  
}
```

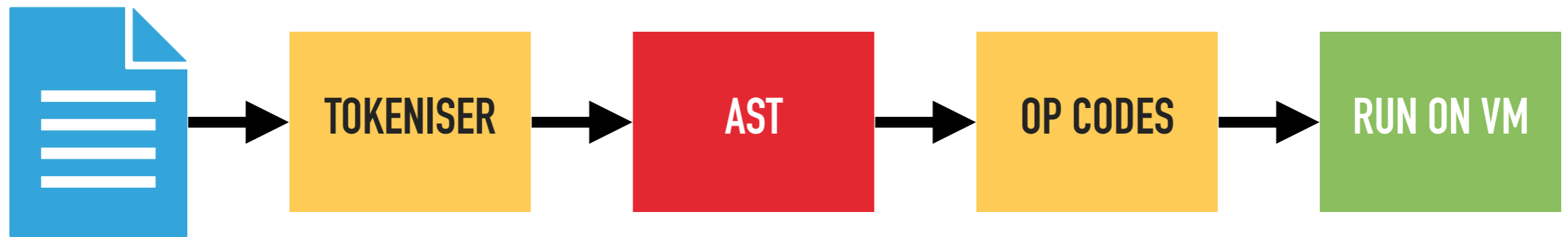


# Add static analysis to dev process



**Create custom rules to emulate new language features**

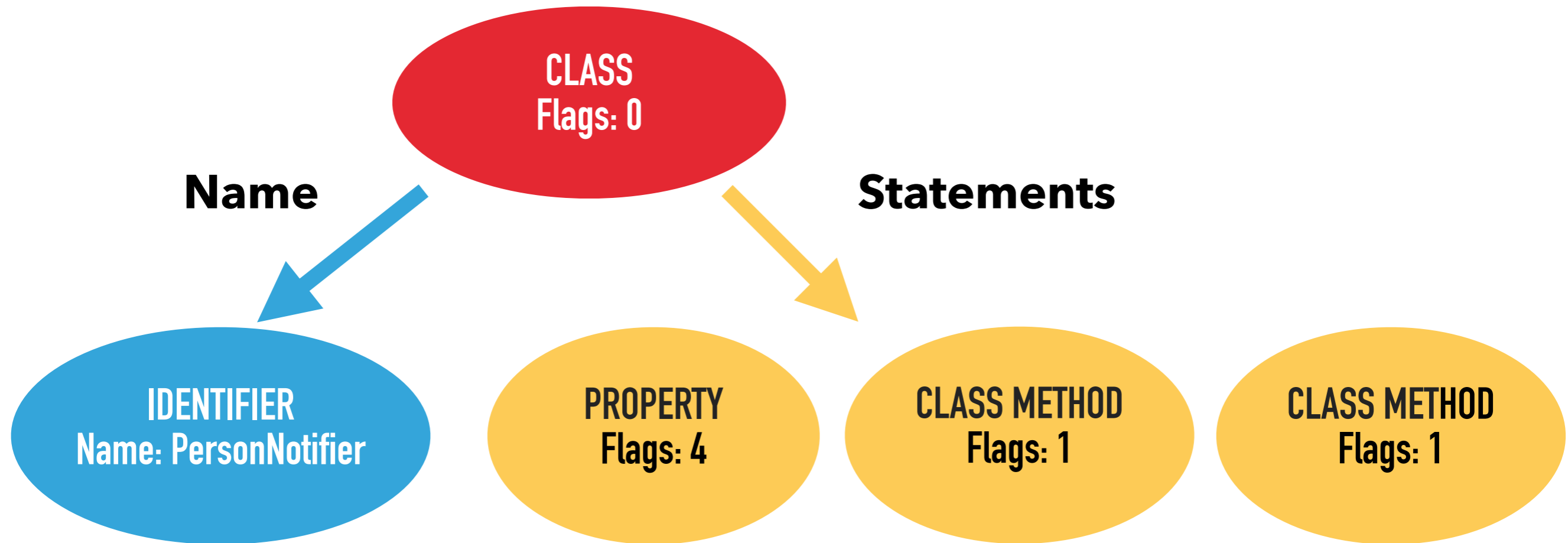




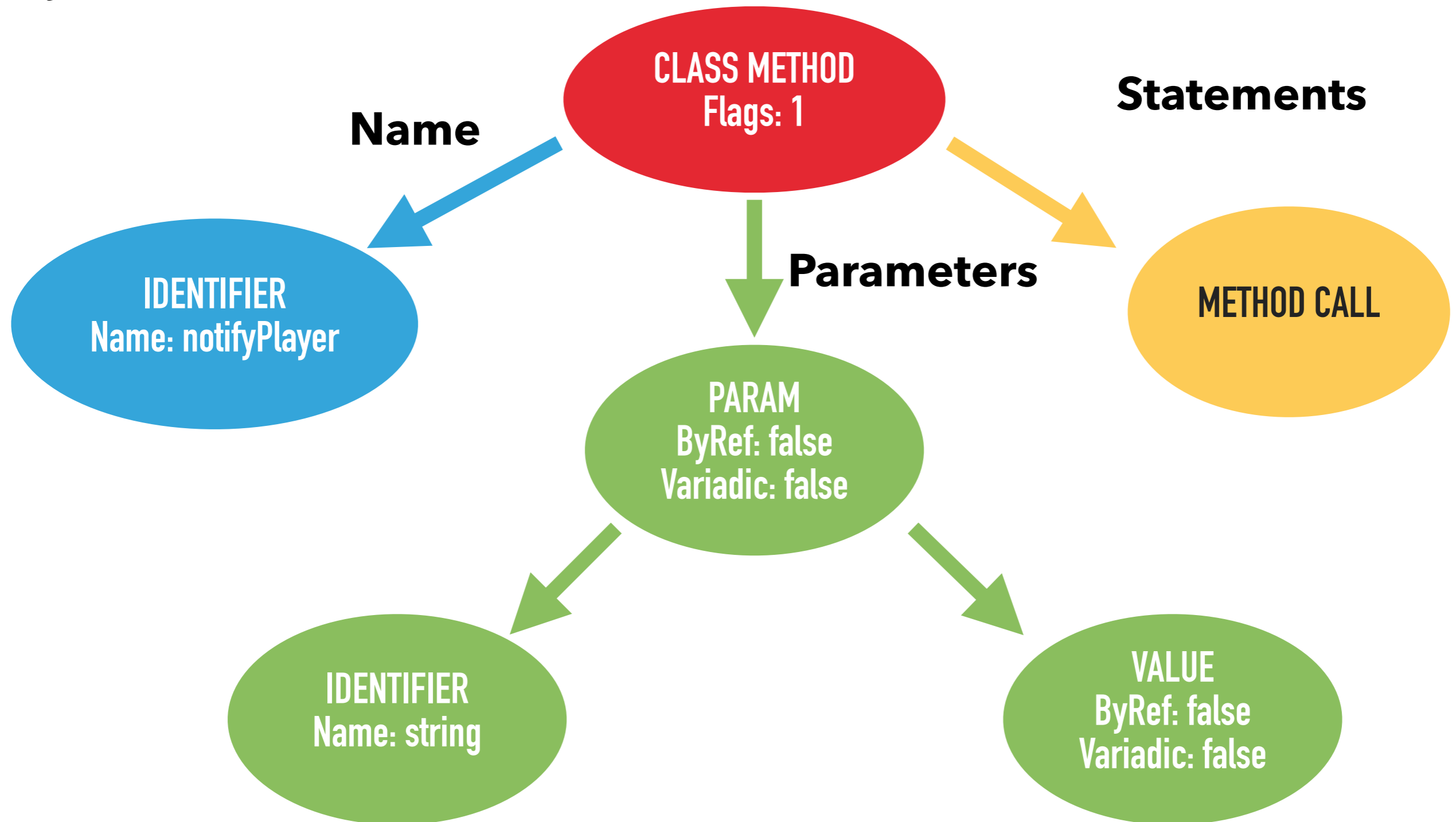


```
class PersonNotifier
```

```
{  
  private TextMessageSender $sender;  
  public function __construct() {...}  
  public function notifyPlayer() {...}  
}
```



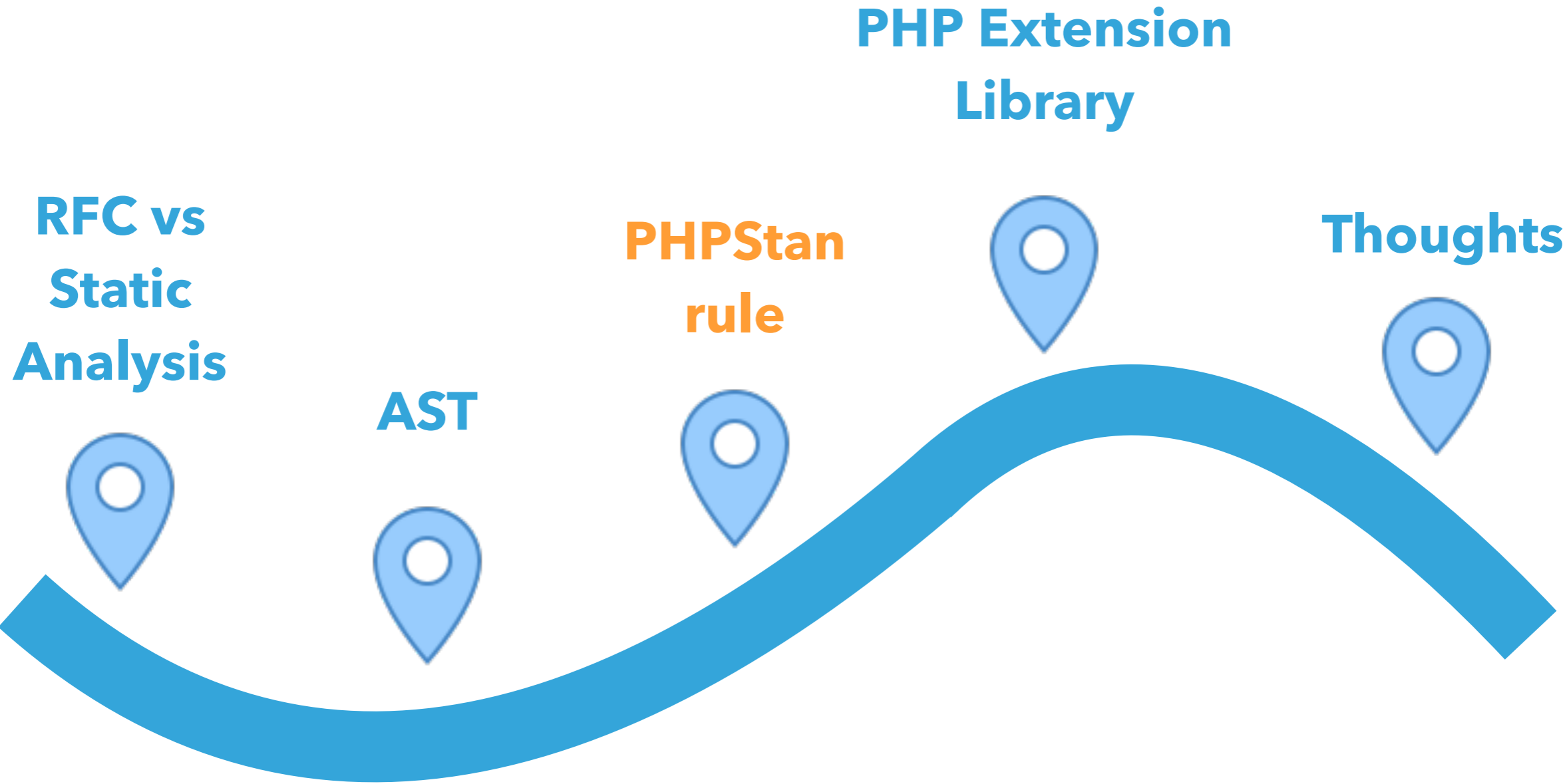
```
public function notifyPlayer (string $msg)
{
    $this->sender->sendMessage ($msg) ;
}
```

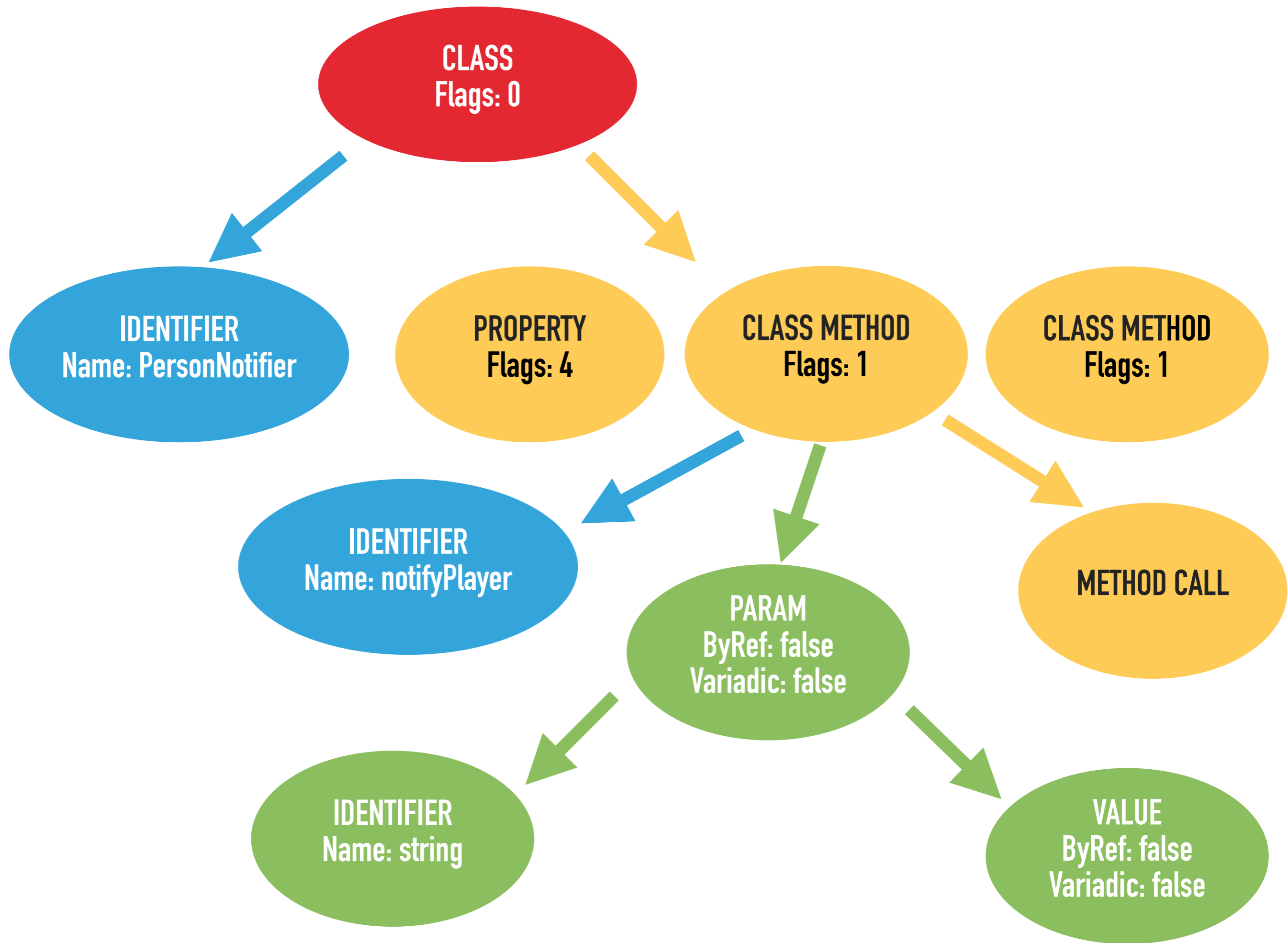


# https://github.com/nikic/PHP-Parser

The screenshot shows the GitHub repository page for 'nikic/PHP-Parser'. At the top, the repository name is displayed with a 'Public' badge. On the right, there are buttons for 'Watch' (232) and 'Fork' (891). Below this, a navigation bar includes links for 'Code', 'Issues' (44), 'Pull requests' (9), 'Actions', 'Wiki', 'Security', and 'Insights'. The main content area shows the current branch as 'master' with 9 branches and 80 tags. A commit by 'nikic' is highlighted, titled 'Bail out on PHP tags in removed code', with commit hash 'b0edd4c' and a timestamp of '2 hours ago'. Below the commit, a workflow is listed: '.github/workflows' with the name 'Test PHP 8.2 in CI' and a timestamp of '3 days ago'. On the right side, there is an 'About' section describing the repository as 'A PHP parser written in PHP' with tags for 'php', 'parser', 'static-analysis', and 'ast'. A 'Readme' link is also visible.

- ▶ PHP code can be represented by an AST
- ▶ Different types of Node
- ▶ Nodes contain information
- ▶ Each type of node has different information



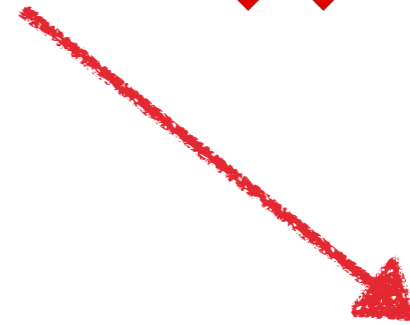
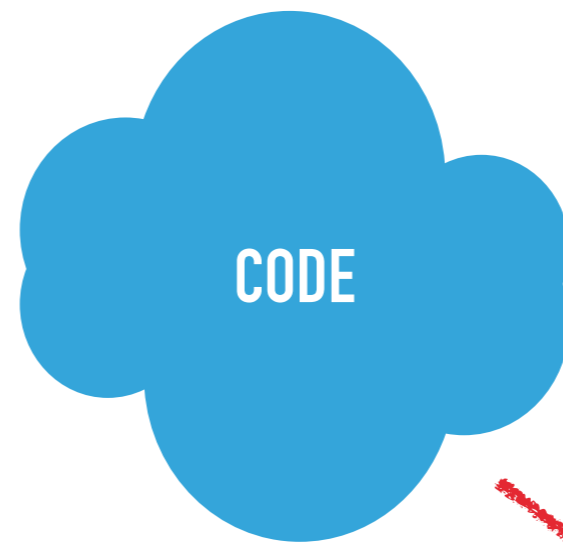


```
interface Rule
{

    public function getNodeTypes() : string;

    /**
     * @return (string|RuleError)[] errors
     */
    public function processNode(
        \PhpParser\Node $node,
        \PHPStan\Analyser\Scope $scope
) : array;

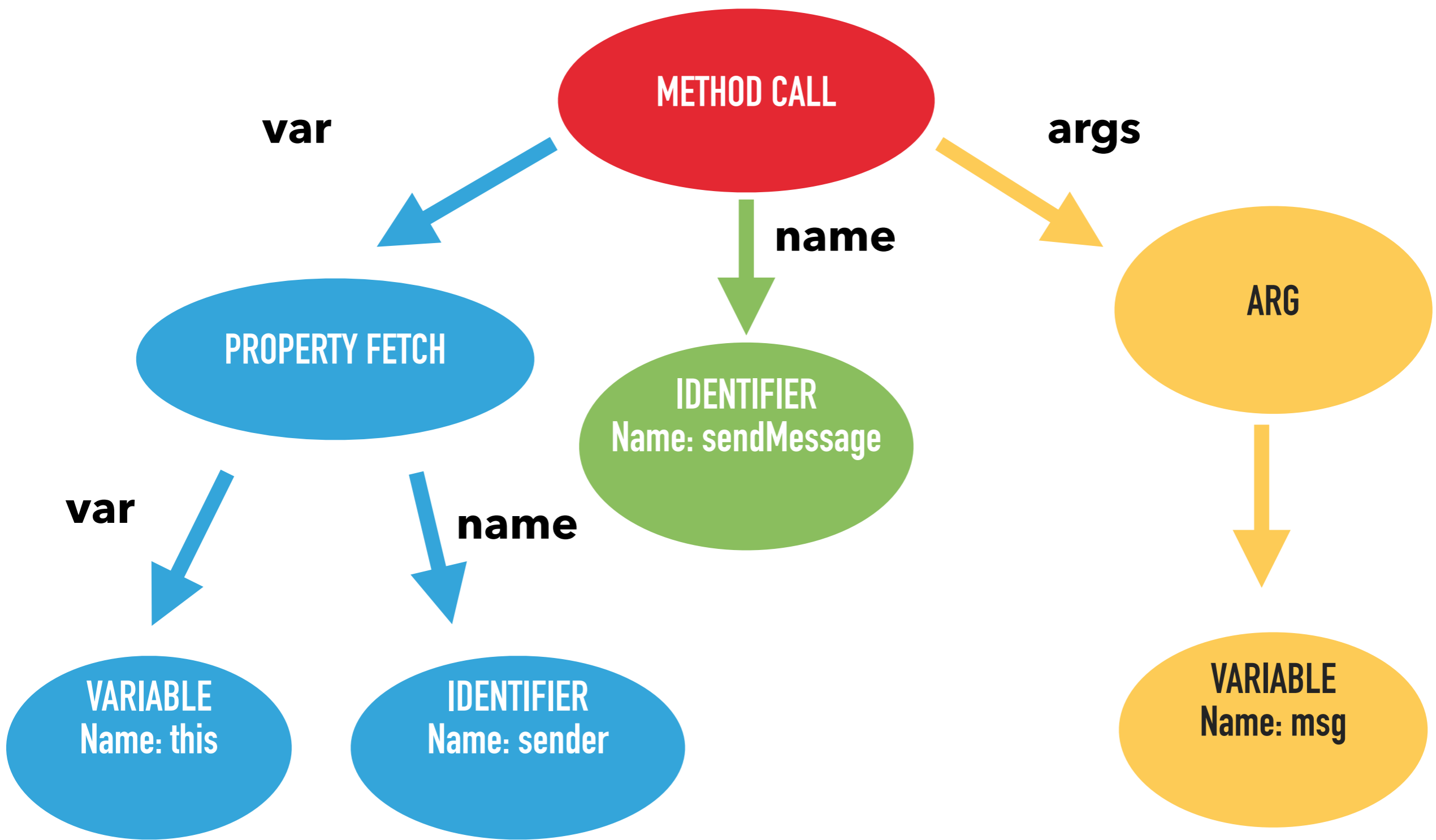
}
```



We can only call methods  
in **TextMessageSender** from  
**TextMessageQueueProcessor**



```
$this->sender -> sendMessage ($msg) ;
```





```
class MethodCall extends \PhpParser\Node\Expr\CallLike
{
```

```
/** @var Expr Variable holding object */
public $var;
```

```
/** @var Identifier|Expr Method name */
public $name;
```

```
/** @var array<Arg|VariadicPlaceholder> Arguments */
public $args;
```

```
// Rest of class ...
```

---

```
$this->sender -> sendMessage ($msg);
```

```
class TextMessageSenderCallerRule  
  implements Rule
```

```
{
```

```
  public function getNodeName() : string
```

```
{
```

```
  return MethodCall::class;
```

```
}
```

```
public function processNode(Node $node, Scope $scope): array
{
    $callingClass = $scope->getClassReflection()->getName();

    if ($callingClass === TextMessageQueueProcessor::class) {
        return [];
    }

    $type = $scope->getType($node->var);

    foreach ($type->getReferencedClasses() as $targetClass) {
        if ($targetClass === TextMessageSender::class) {
            $msg = "Cant call TextMessageSender from here";
            return [RuleErrorBuilder::message($message)->build()];
        }
    }

    return [];
}
```

```
public function processNode(Node $node, Scope $scope): array
{
    $callingClass = $scope->getClassReflection()->getName();

    if ($callingClass === TextMessageQueueProcessor::class) {
        return [];
    }

    $type = $scope->getType($node->var);

    foreach ($type->getReferencedClasses() as $targetClass) {
        if ($targetClass === TextMessageSender::class) {
            $msg = "Cant call TextMessageSender from here";
            return [RuleErrorBuilder::message($message)->build()];
        }
    }

    return [];
}
```

```
class PersonNotifier
```

```
{
```

```
    private TextMessageSender $sender;
```

```
    public function notifyPlayer(string $msg): void
```

```
{
```

```
    $this->sender->sendMessage($msg);
```

```
}
```

```
}
```

---

**`$this->sender` is called from `PersonNotifier`**

```
public function processNode(Node $node, Scope $scope): array
{
    $callingClass = $scope->getClassReflection()->getName();

    if ($callingClass === TextMessageQueueProcessor::class) {
        return [];
    }

    $type = $scope->getType($node->var);

    foreach ($type->getReferencedClasses() as $targetClass) {
        if ($targetClass === TextMessageSender::class) {
            $msg = "Cant call TextMessageSender from here";
            return [RuleErrorBuilder::message($message)->build()];
        }
    }

    return [];
}
```

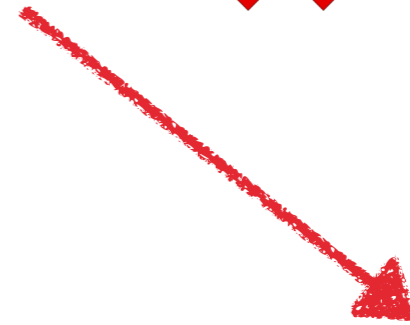
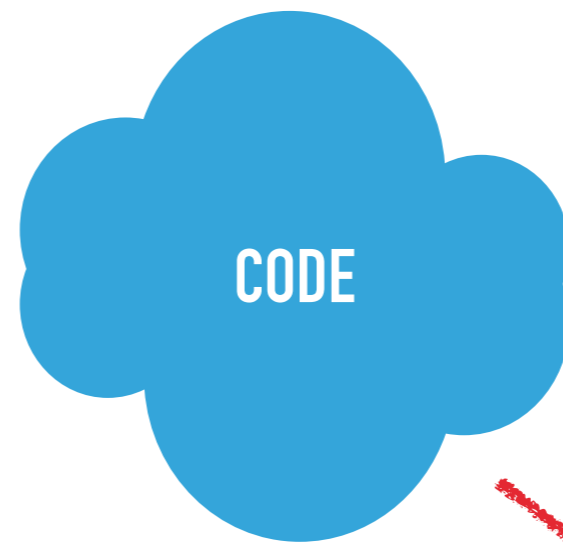
```
public function processNode(Node $node, Scope $scope): array
{
    $callingClass = $scope->getClassReflection()->getName();

    if ($callingClass === TextMessageQueueProcessor::class) {
        return [];
    }

    $type = $scope->getType($node->var);

    foreach ($type->getReferencedClasses() as $targetClass) {
        if ($targetClass === TextMessageSender::class) {
            $msg = "Cant call TextMessageSender from here";
            return [RuleErrorBuilder::message($message)->build()];
        }
    }

    return [];
}
```



We can only call methods  
in **TextMessageSender** from  
**TextMessageQueueProcessor**





```
public function processNode(Node $node, Scope $scope): array
{
    $callingClass = $scope->getClassReflection()->getName();

    if ($callingClass === TextMessageQueueProcessor::class) {
        return [];
    }

    $type = $scope->getType($node->var);

    foreach ($type->getReferencedClasses() as $targetClass) {
        if ($targetClass === TextMessageSender::class) {
            $msg = "Cant call TextMessageSender from here";
            return [RuleErrorBuilder::message($message)->build()];
        }
    }

    return [];
}
```

```
public function processNode(Node $node, Scope $scope): array
{
    $callingClass = $scope->getClassReflection()->getName();

    if ($callingClass === TextMessageQueueProcessor::class) {
        return [];
    }

    $type = $scope->getType($node->var);

    foreach ($type->getReferencedClasses() as $targetClass) {
        if ($targetClass === TextMessageSender::class) {
            $msg = "Cant call TextMessageSender from here";
            return [RuleErrorBuilder::message($message)->build()];
        }
    }

    return [];
}
```

```
$this->sender->notifyPlayer($msg);
```

↑  
var

↑  
name

↑  
args

```
class PersonNotifier
```

```
{
```

```
private TextMessageSender $sender;
```

```
public function notifyPlayer(string $msg): void
```

```
{
```

```
$this->sender->sendMessage($msg);
```

```
}
```

```
}
```

---

**`$this->sender` is of type `TextMessageSender`**

```
public function processNode(Node $node, Scope $scope): array
{
    $callingClass = $scope->getClassReflection()->getName();

    if ($callingClass === TextMessageQueueProcessor::class) {
        return [];
    }

    $type = $scope->getType($node->var);

    foreach ($type->getReferencedClasses() as $targetClass) {
        if ($targetClass === TextMessageSender::class) {
            $msg = "Cant call TextMessageSender from here";
            return [RuleErrorBuilder::message($message)->build()];
        }
    }

    return [];
}
```

```
public function processNode(Node $node, Scope $scope): array
{
    $callingClass = $scope->getClassReflection()->getName();

    if ($callingClass === TextMessageQueueProcessor::class) {
        return [];
    }

    $type = $scope->getType($node->var);

    foreach ($type->getReferencedClasses() as $targetClass) {

        if ($targetClass === TextMessageSender::class) {
            $msg = "Cant call TextMessageSender from here";
            return [RuleErrorBuilder::message($message)->build()];
        }
    }

    return [];
}
```

```
class PersonNotifier
```

```
{
```

```
private TextMessageSender | WhatsappSender $sender;
```

```
public function notifyPlayer(string $msg): void
```

```
{
```

```
$this->sender->sendMessage($msg);
```

```
}
```

```
}
```

---

**`$this->sender` is of type `TextMessageSender`**

**or `WhatsappSender`**

```
public function processNode(Node $node, Scope $scope): array
{
    $callingClass = $scope->getClassReflection()->getName();

    if ($callingClass === TextMessageQueueProcessor::class) {
        return [];
    }

    $type = $scope->getType($node->var);

    foreach ($type->getReferencedClasses() as $targetClass) {

        if ($targetClass === TextMessageSender::class) {
            $msg = "Cant call TextMessageSender from here";
            return [RuleErrorBuilder::message($message)->build()];
        }
    }

    return [];
}
```



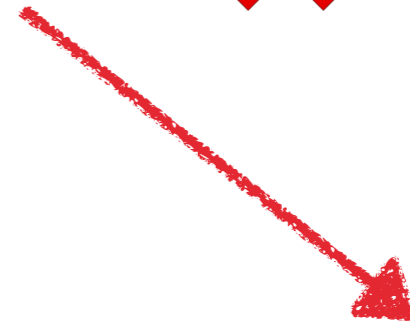
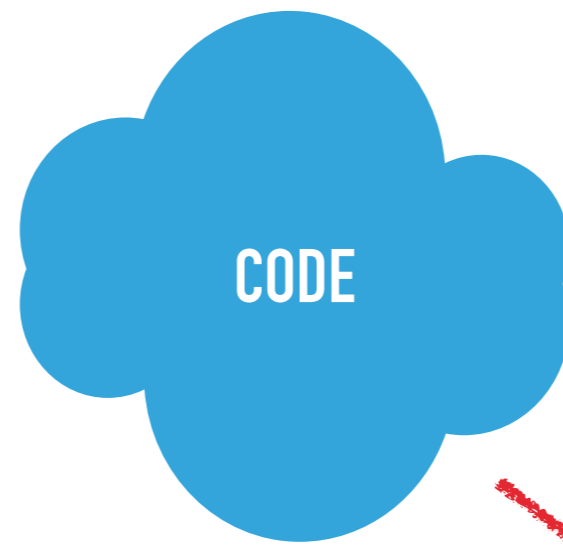
```
public function processNode(Node $node, Scope $scope): array
{
    $callingClass = $scope->getClassReflection()->getName();

    if ($callingClass === TextMessageQueueProcessor::class) {
        return [];
    }

    $type = $scope->getType($node->var);

    foreach ($type->getReferencedClasses() as $targetClass) {
        if ($targetClass === TextMessageSender::class) {
            $msg = "Cant call TextMessageSender from here";
            return [RuleErrorBuilder::message($message)->build()];
        }
    }

    return [];
}
```



We can only call methods  
in **TextMessageSender** from  
**TextMessageQueueProcessor**



```
public function processNode(Node $node, Scope $scope): array
{
    $callingClass = $scope->getClassReflection()->getName();

    if ($callingClass === TextMessageQueueProcessor::class) {
        return [];
    }

    $type = $scope->getType($node->var);

    foreach ($type->getReferencedClasses() as $targetClass) {

        if ($targetClass === TextMessageSender::class) {
            $msg = "Cant call TextMessageSender from here";
            return [RuleErrorBuilder::message($message)->build()];
        }
    }

    return [];
}
```

```
public function processNode(Node $node, Scope $scope): array
{
    $callingClass = $scope->getClassReflection()->getName();

    if ($callingClass === TextMessageQueueProcessor::class) {
        return [];
    }

    $type = $scope->getType($node->var);

    foreach ($type->getReferencedClasses() as $targetClass) {

        if ($targetClass === TextMessageSender::class) {
            $msg = "Cant call TextMessageSender from here";
            return [RuleErrorBuilder::message($message)->build()];
        }
    }

    return [];
}
```

```
public function processNode(Node $node, Scope $scope): array
{
    // Find the class that method call is in
    $callingClass = $scope->getClassReflection()->getName();

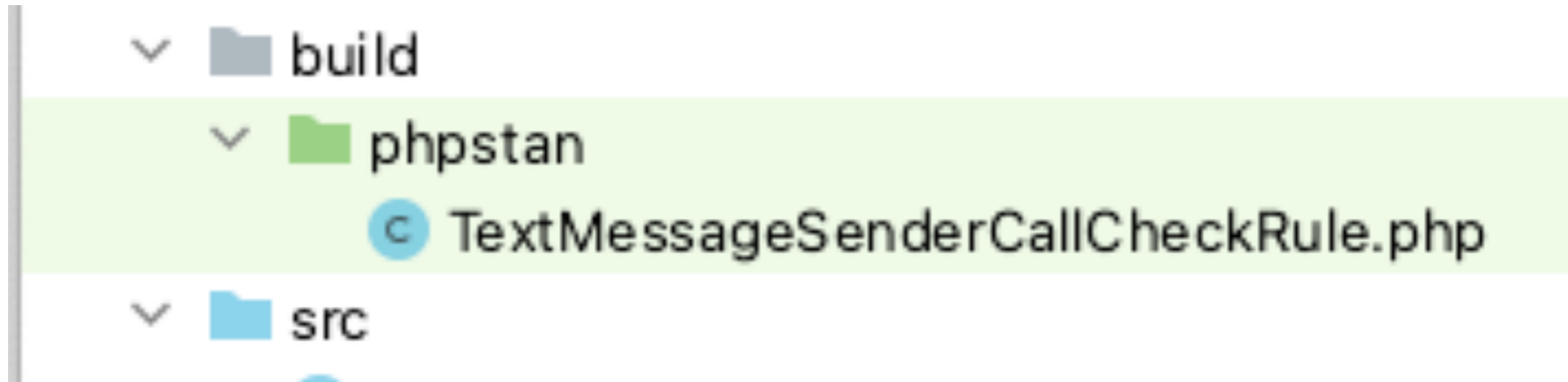
    // If in TextMessageQueueProcessor everything is OK
    if ($callingClass === TextMessageQueueProcessor::class) {
        return [];
    }

    // Get type of the class of the method call
    $type = $scope->getType($node->var);

    // Iterate through all the possible classes
    foreach ($type->getReferencedClasses() as $targetClass) {

        // Trying to call a method in TextMessageSender? Report error
        if ($targetClass === TextMessageSender::class) {
            $msg = "Cant call TextMessageSender from here";
            return [RuleErrorBuilder::message($message)->build()];
        }
    }

    // If we've got this far then there are no errors
    return [];
}
```



```
"autoload-dev": {  
    "psr-4": {  
        "DaveLiddament\\PhpstanRules\\": "build/phpstan/"  
    }  
},
```

**services:**

-

```
class: DaveLiddament\\PhpstanRules\\TextMessageSenderCallCheckRule  
tags:  
- phpstan.rules.rule
```

**AMAZING!**



**WE CAN DO BETTER...**



**We can only call  
methods in target class  
from a specified  
allowed calling class**



```
class TextMessageSenderCallerRule implements Rule  
{
```

```
    public function __construct(  
        private string $allowedCallingClass,  
        private string $targetClass,  
) {}
```

```
public function processNode(Node $node, Scope $scope): array
{
    $callingClass = $scope->getClassReflection()->getName();

    if ($callingClass === $this->allowedCallingClass) {
        return [];
    }

    $type = $scope->getType($node->var);

    foreach ($type->getReferencedClasses() as $targetClass) {

        if ($targetClass === $this->targetClass) {
            $msg = "Can not call {$this->targetClass} from here";
            return [RuleErrorBuilder::message($message)->build()];
        }
    }

    return [];
}
```

**services:**

-

**class: PhpstanRules\TextMessageSenderCallCheckRule**

**tags:**

- **phpstan.rules.rule**

**arguments:**

**allowedCallingClass: RuleDemo\TextMessageQueueProcessor**

**targetClass: RuleDemo\TextMessageSender**

**class: PhpstanRules\TextMessageSenderCallCheckRule**

**tags:**

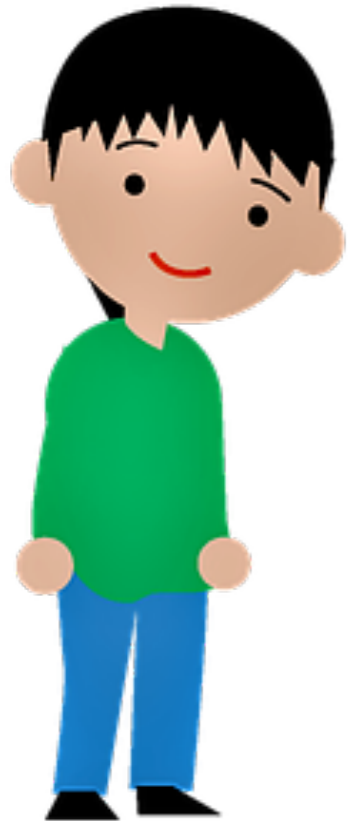
- **phpstan.rules.rule**

**arguments:**

**allowedCallingClass: Foo**

**targetClass: Bar**

**I WAS AMAZED BEFORE. NOW I'M  
EVEN MORE AMAZED!**



**WE CAN DO BETTER...**



```
/**
 * Can only be called from TextMessageQueueProcessor
 */
class TextMessageSender
{
}
}
```

- ▶ Remember to document
- ▶ Remember to setup some config
- ▶ What happens if we rename a class?

```
# [Attribute(Attribute::TARGET_CLASS)]  
class Friend  
{  
  
    /** @param class-string $friend */  
    public function __construct(  
        public string $friend,  
    ) {}  
}
```

```
# [Friend(TextMessageQueueProcessor::class)]  
class TextMessageSender  
{  
  
  
}
```

```
public function processNode(Node $node, Scope $scope): array
{
    $callingClass = $scope->getClassReflection()->getName();
    $type = $scope->getType($node->var);

    foreach ($type->getReferencedClasses() as $targetClass) {

        // TODO:
        // 1. Does $targetClass have a #[Friend] attribute
        // 2. Yes? Check $callingClass is a friend of $targetClass

    }

    return [];
}
```

```
class TextMessageSenderCallerRule implements Rule  
{
```

```
    public function __construct(  
        private ReflectionProvider $reflectionProvider,  
    ) {}
```



```
foreach ($type->getReferencedClasses() as $targetClass) {
```

```
// 1. Does $targetClass have a #[Friend] attribute
```

```
$info = $this->reflectionProvider->getClass($targetClass);
```

```
$nativeReflection = $info->getNativeReflection();
```

```
$friendAttributes = $nativeReflection  
                    ->getAttributes(Friend::class);
```

```
if (count($friendAttributes) !== 1) {  
    continue;  
}
```

```
$friendAttribute = $friendAttributes[0];  
$friendArguments = $friendAttribute->getArguments();
```

```
if (count($friendArguments) !== 1) {  
    continue;  
}
```

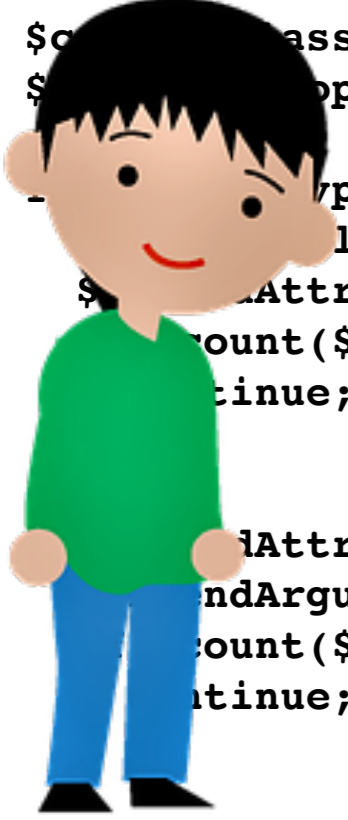
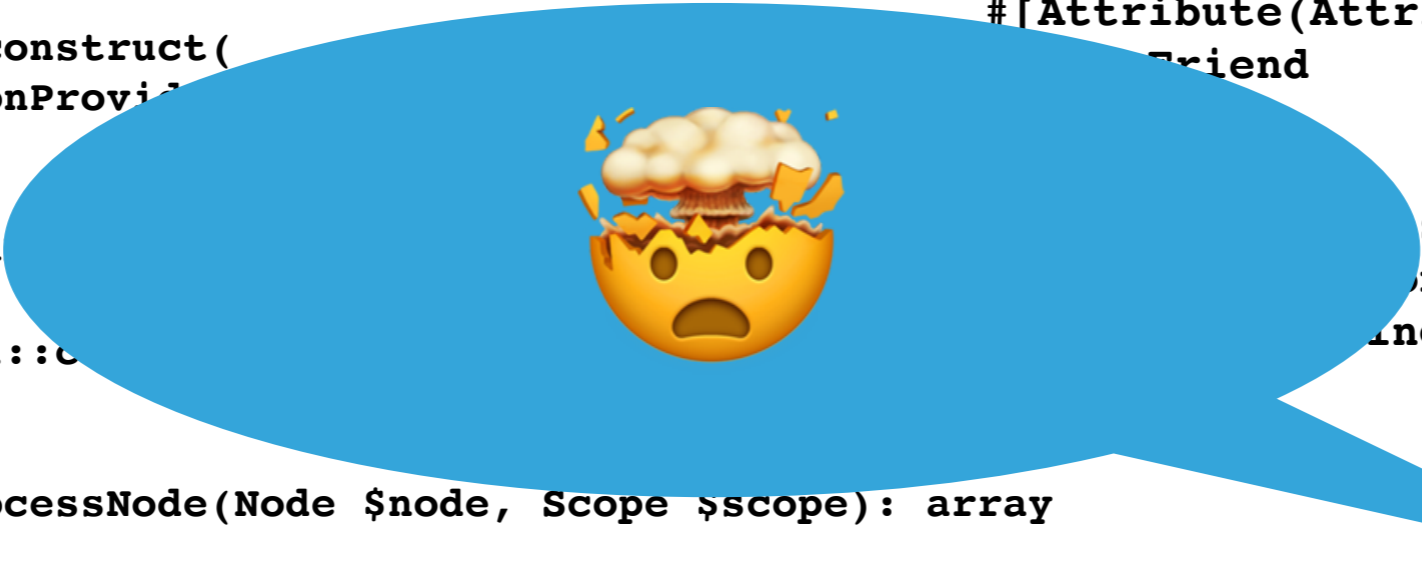
```
$friendClass = $friendArguments[0];
```

```
foreach ($type->getReferencedClasses() as $targetClass) {  
    // Step 1 see previous slide  
  
    // 2. Yes? Check $callingClass is a friend of $targetClass  
  
    if ($callingClass !== $friendClass) {  
  
        $msg = sprintf(  
            "%s can only be called its friend %s and not from %s",  
            $targetClass,  
            $friendClass,  
            $callingClass);  
  
        return [RuleErrorBuilder::message($msg)->build()];  
  
    }  
  
}
```

```
class TextMessageSenderCallCheckRule implements Rule
{
    public function __construct(
        private ReflectionProvider $reflectionProvider,
        #[Attribute(Attribute::TARGET_CLASS)]
        Friend $friend
    ) {}

    public function getTargetClassString($friend) /*
    {
        return MethodCall::class;
    }

    public function processNode(Node $node, Scope $scope): array
    {
        $callingClass = $scope->getClassReflection()->getName();
        $nodeType = $scope->getType($node->var);
        $referencedClassReflection = $this->reflectionProvider->getNativeReflection($node->var->getNativeReflection());
        $attribute = $this->reflectionProvider->getNativeReflection($node->var->getNativeReflection());
        $attributeCount = count($friendArguments);
        if ($attributeCount !== 1) {
            continue;
        }
        $friend = $friendArguments[0];
        if ($callingClass !== $friend) {
            $msg = sprintf("Can not call %s from %s", $targetClass, $callingClass);
            return [RuleErrorBuilder::message($msg)->build()];
        }
    }
}
```



I KNOW, IT'S AMAZING.  
2 HOURS OF WORK VS RFC

<https://github.com/DaveLiddament/phpstan-rule-demo>

**Custom Static Analysis Rules**

**+**

**Attributes**

**=**

**New Language Features**

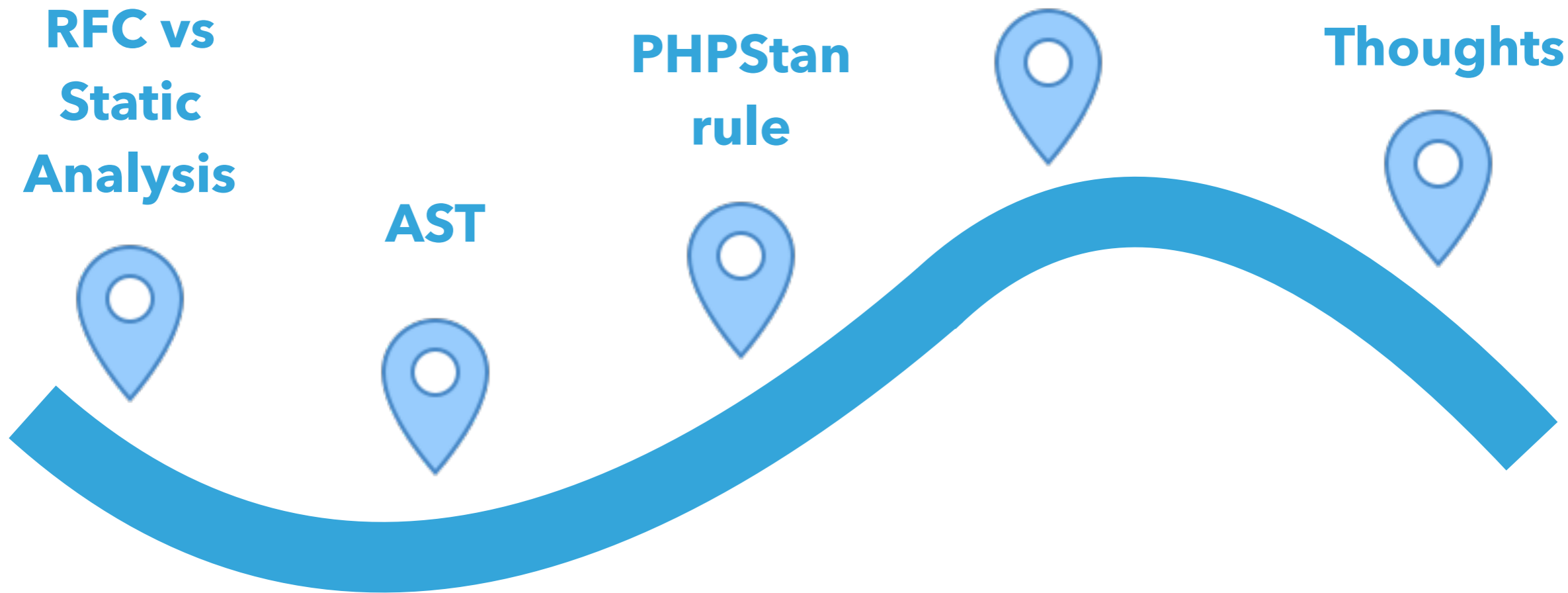
# PHP Extension Library

RFC vs  
Static  
Analysis

AST

PHPStan  
rule

Thoughts



main 1 branch 3 tags

Go to file Add file Code

	DaveLiddament Merge pull request #6 from DaveLiddament/fix/test-tag-attrib... aa2f632 8 days ago 22 commits
	.github/workflows FIX remove unused section of github actions 2 months ago
	examples ADD InjectableVersion Attribute 9 days ago
	src FIX copy and paste error with TestTag 8 days ago
	.gitignore ADD linting, coding standards and phpstan 2 months ago
	.php-cs-fixer.php ADD linting, coding standards and phpstan 2 months ago
	CONTRIBUTING.md ADD contributing notes and update example code 2 months ago
	LICENSE.md INITIAL CHECK IN 2 months ago
	README.md ADD InjectableVersion Attribute 9 days ago
	composer.json ADD keywords to composer.json 2 months ago
	composer.lock ADD psalm 2 months ago
	phpstan.neon UPDATE Friend and Sealed to use variadic for friends/permitted 2 months ago
	psalm.xml ADD psalm 2 months ago

README.md

## PHP Language Extensions (currently in BETA)

This library provides attributes for extending the PHP language (e.g. adding `package` visibility). The intention, at least initially, is that these extra language features are enforced by static analysis tools (such as Psalm, PHPStan and, ideally, PhpStorm) and NOT at runtime.

Language feature added:

- Friend
- InjectableVersion
- Package
- Sealed
- TestTag

### About

Attributes to define PHP language extensions (to be enforced by static analysis)

Readme MIT license 16 stars 2 watching 1 fork

### Releases 3

0.2.1 Latest 8 days ago

+ 2 releases

### Packages

No packages published Publish your first package

### Contributors 2

DaveLiddament Dave Liddament ruudk Ruud Kamphuis

### Languages

PHP 100.0%

<https://github.com/DaveLiddament/php-language-extensions>

```
class Person
```

```
{
```

```
    #[Friend(PersonBuilder::class)]
```

```
    public function __construct()
```

```
    {
```

```
    }
```

```
}
```

```
class DiscountCalculator  
{  
  
    # [NamespaceVisibility]  
    public function calculate(): int  
    {  
    }  
  
}
```



```
class Person
```

```
{
```

```
    # [TestTag]
```

```
    public function setId(int $id)
```

```
    {
```

```
    }
```

```
}
```

```
# [Sealed(Success::class, Failure::class)]  
abstract class Result  
{  
}
```

```
# [InjectableVersion]
```

```
interface class PersonRepository {...}
```

```
class DoctrinePersonRepository
```

```
    implements PersonRepository {...}
```

```
class PersonCreator {
```

```
    public function __construct(
```

```
        PersonRepository $personRepository,
```

```
    ) {...}
```

```
}
```

# Definition

<https://github.com/DaveLiddament/php-language-extensions>



<https://github.com/DaveLiddament/phpstan-php-language-extensions>

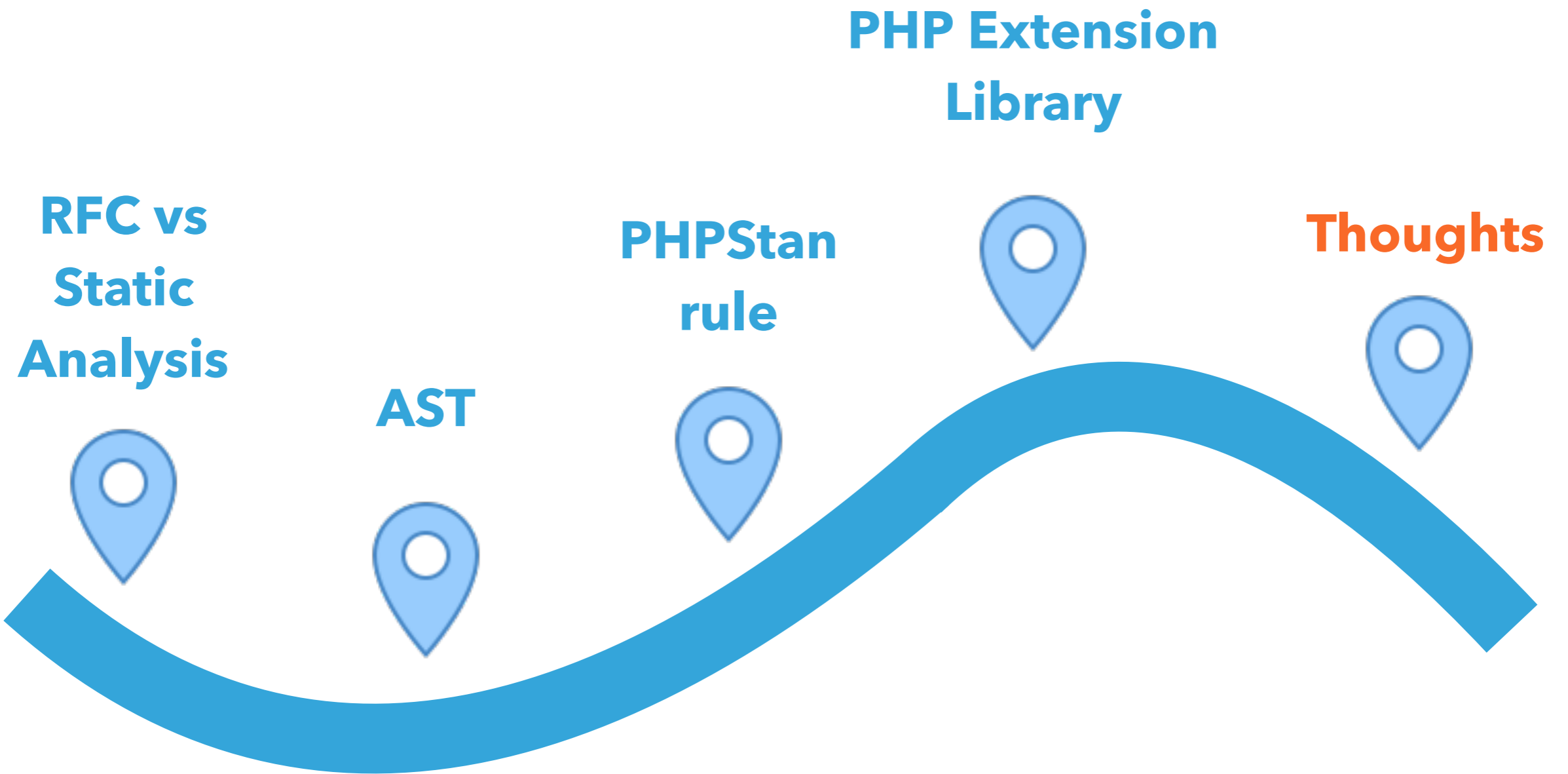


# <https://github.com/DaveLiddament/php-language-extensions>

- examples
  - callableFrom
  - friend
  - injectableVersion
  - namespaceVisibility
  - package
  - sealed

- testTag
  - testTagOnConstructor.php
  - testTagOnConstructorIgnoredInTestClass.php
  - testTagOnConstructorIgnoredInTestNamespace.php
  - testTagOnMethod.php
  - testTagOnMethodIgnoredInTestClass.php
  - testTagOnMethodIgnoredInTestNamespace.php
  - testTagOnStaticMethod.php
  - testTagOnStaticMethodIgnoredInTestClass.php
  - testTagOnStaticMethodIgnoredInTestNamespace.php

- src
  - CallableFrom.php
  - CheckInjectableVersion.php



**SYNTACTIC SUGAR**

**SECURITY**

**PERFORMANCE**

**NEW FEATURES**

**COMMUNICATING  
INTENTION**

**OVERLAP**

**SYNTACTIC SUGAR**

**SECURITY**

**PERFORMANCE**

**NEW FEATURES**

**COMMUNICATING  
INTENTION**



**public**

**final**

**protected**

**abstract**

**private**

**readonly**

**type declarations**

**Friend**

**type hints**

**Sealed**



**NamespaceVisibility**

**InjectableVersion**

**AUTOMATE CHECKS FOR VIOLATIONS**

# Try out ideas...

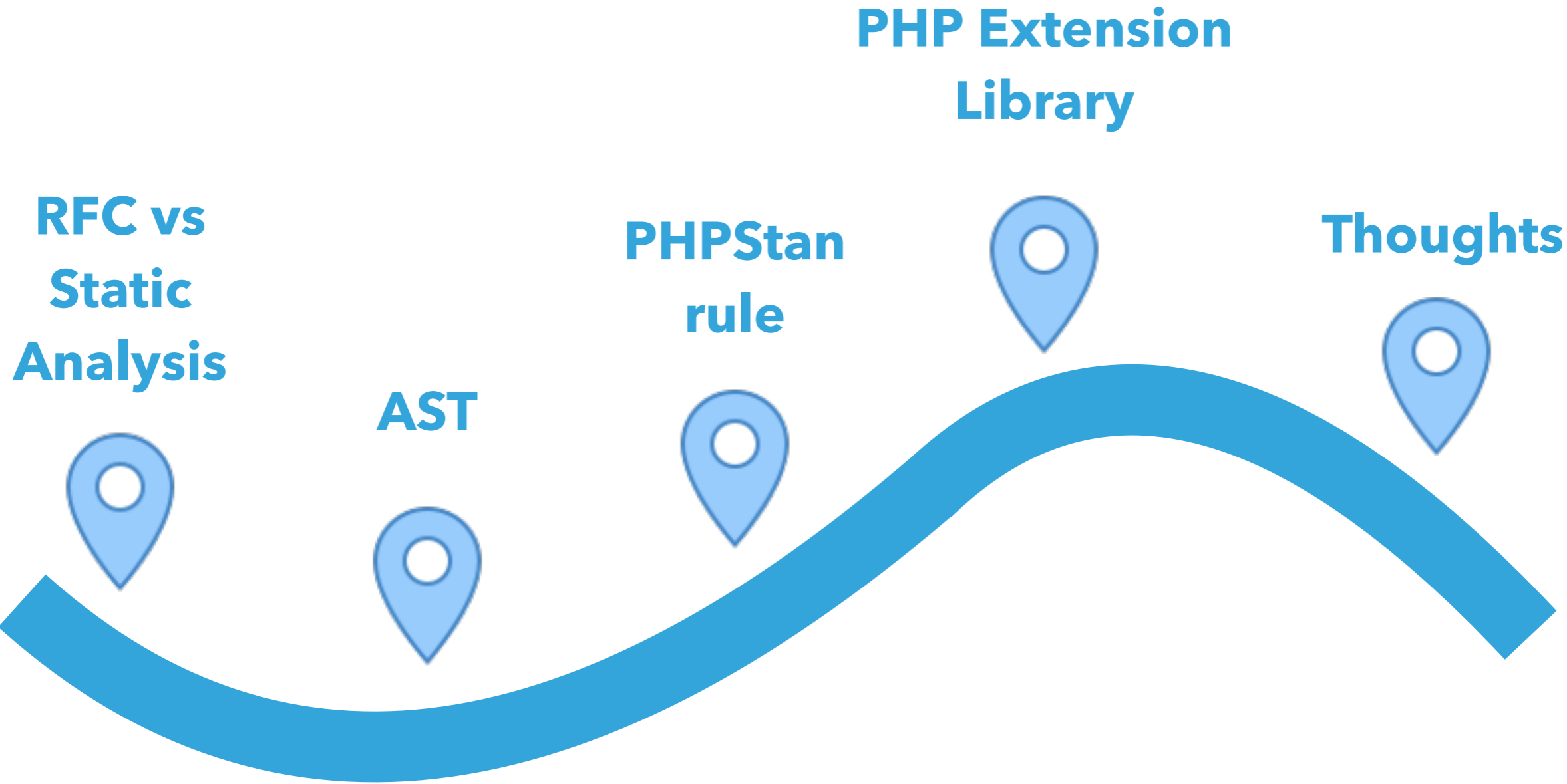
Today

```
#[Friend(TextMessageQueueProcessor::class)]  
class TextMessageSender  
{  
  
}
```

PHP 8.3+ ?

```
class TextMessageSender  
    friend TextMessageQueueProcessor  
{  
  
}
```

never return type (added in PHP 8.1)



# Custom static analysis rules allows developers to:

- ▶ automatically enforce project conventions
- ▶ create new language features

Thank you for  
listening



Dave Liddament

@daveliddament



# Further information

<https://phpstan.org/developing-extensions/rules>

