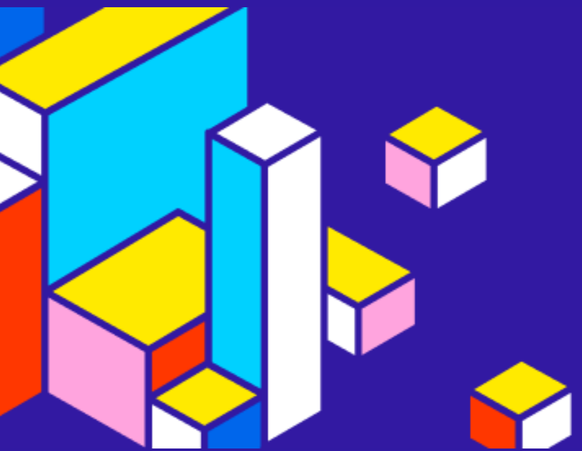
PHP GENERICS TODAY

DAVE LIDDAMENT

www.daveliddament.co.uk



LARAVEL LIVE DENMARK

Copenhagen · 20-21 August 2026

```
function process(User $user): void { … }
```

Type declaration

- **Communicate intent**

```
function process(User $user): void { … }
```

Type declaration

- **Communicate intent**
- **Run time checks**

```
process(“Bob”);
```

Bug. A string is not a User object.

```
function process(User $user): void { … }
```

Type declaration

- **Communicate intent**
- **Run time checks**
- **Static analysis checks**

```
process(“Bob”);
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Bug. A string is not a User object.

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function process(User $user): void { … }
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Type declaration

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process(“Bob”);
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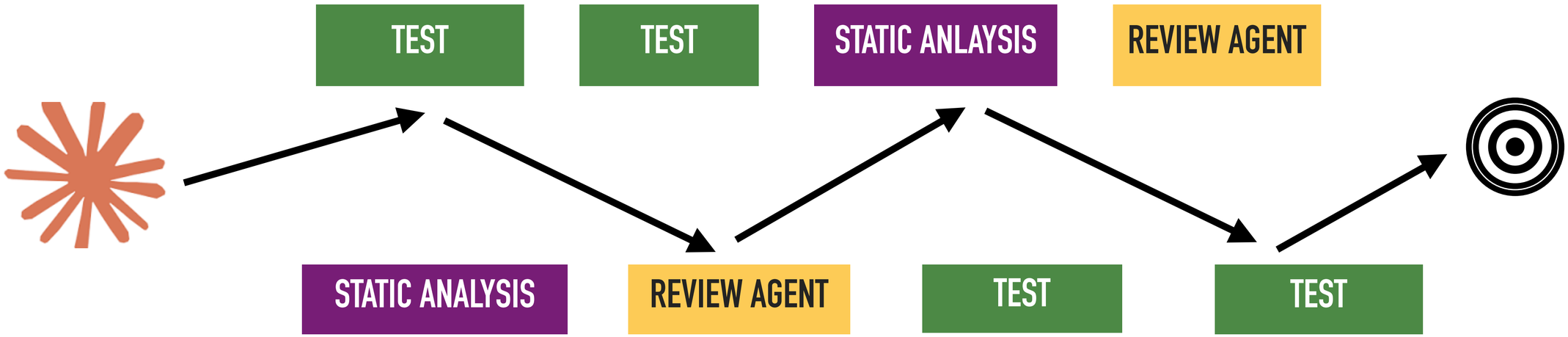
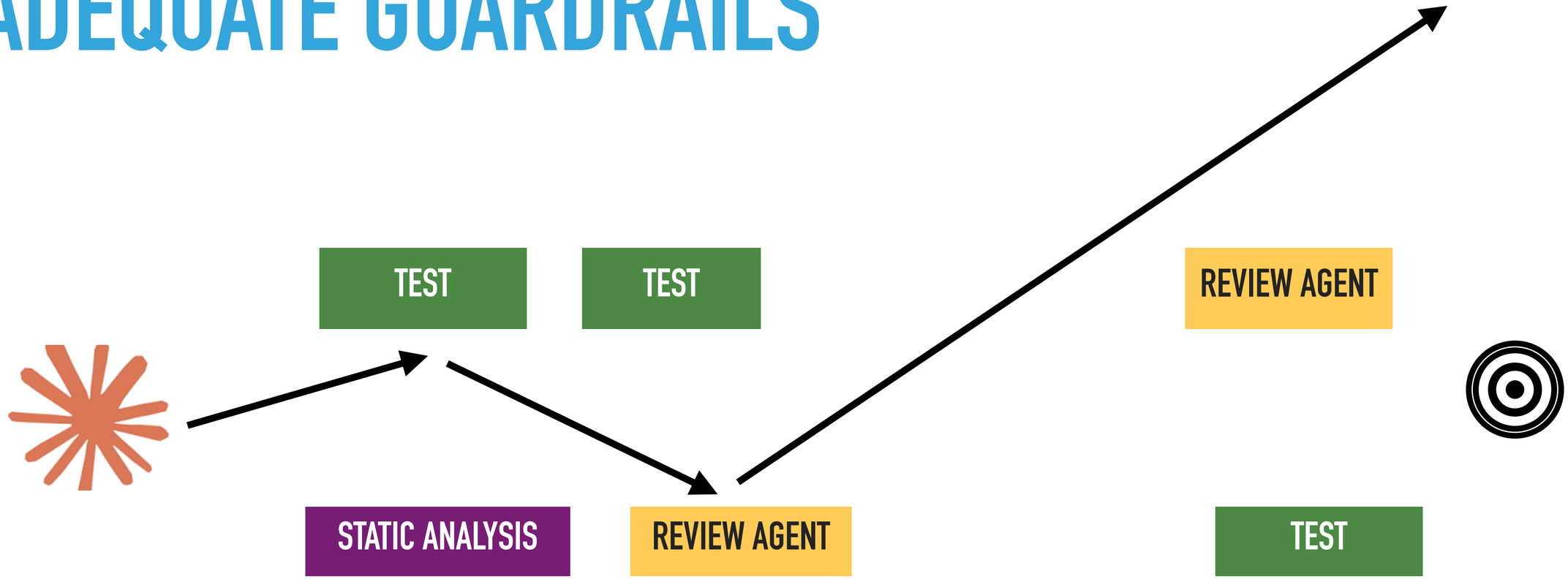
Bug. A string is not a User object.

- **Communicate intent**
- **Run time checks**
- **Static analysis checks**
- **Enable refactoring**
- **AI Assisted Development**

AI ASSISTED CODING WITH GUARDRAILS



INADEQUATE GUARDRAILS



Higher type coverage = more accurate static analysis

- Communicate intent
- Run time checks
- Static analysis checks
- Enable refactoring
- AI Assisted Development

```php
class PhpTypeSystemImprovements {
 public const string PHP_83 = 'typed class constants';
 private string $php74;
 public function php70(int $n): string {}
 public function php71(?string $s): void {}
 public function php72(object $o): object {}
 public function php80(int|string $id, mixed $anything): static {}
 public function php81(Countable&Traversable $c): never {}
 public function php82((Countable&Traversable)|null $c): true {}
}
```

BUT...

```
function process(array $users): void { … }
```

What is stored in the array?

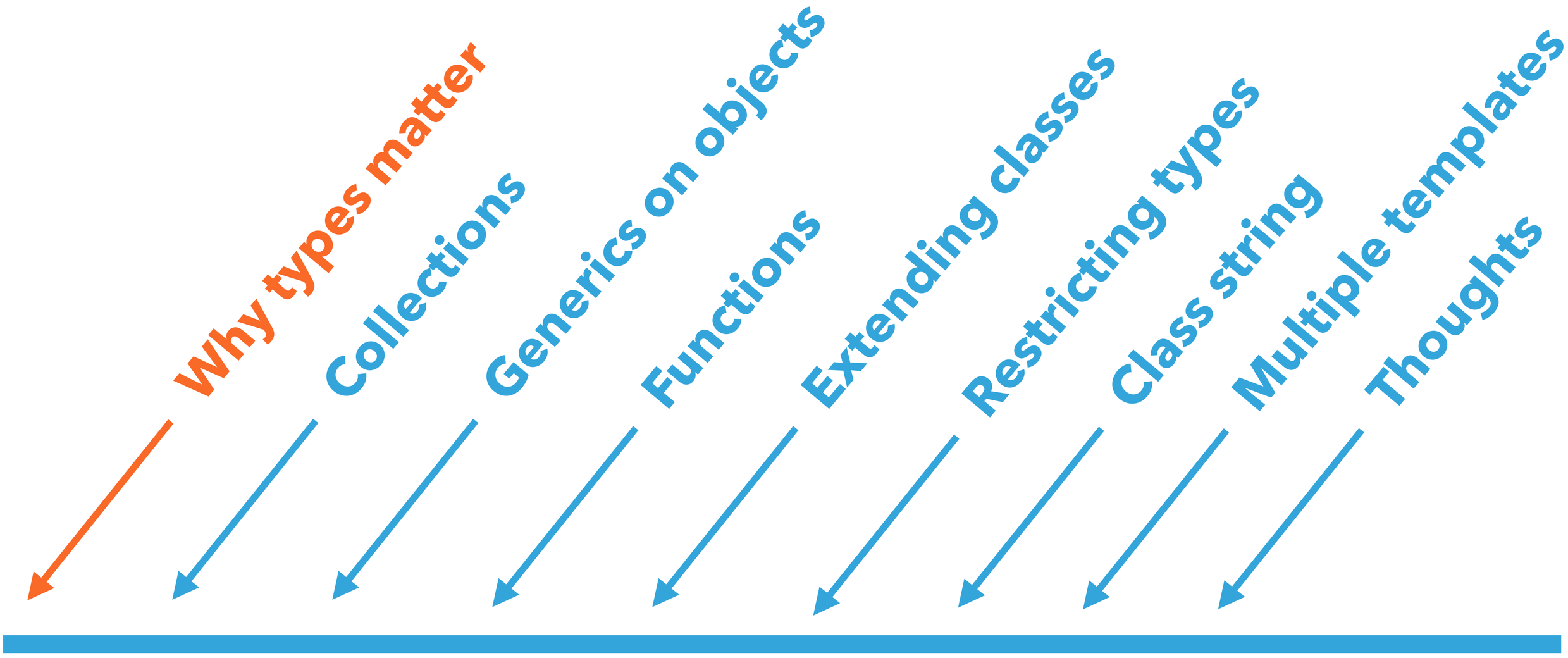
AND...

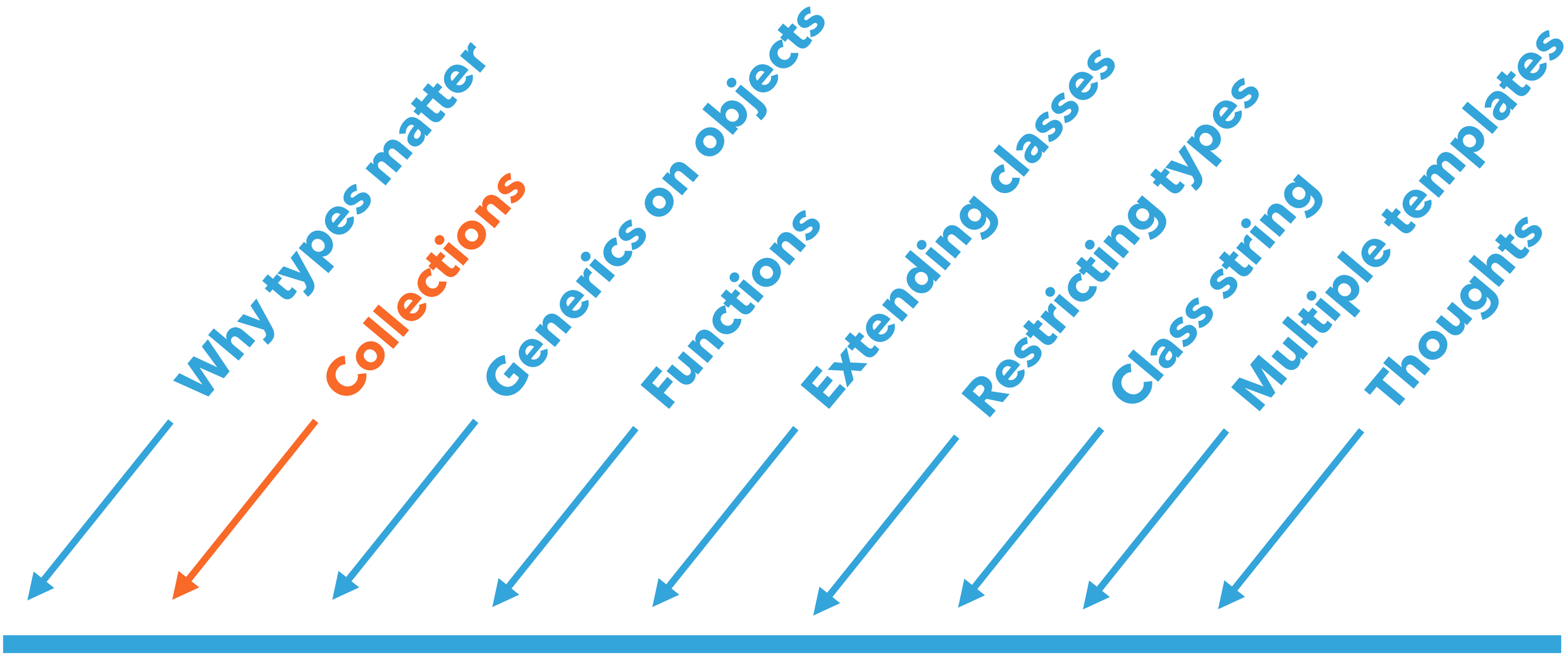
```
class Queue {

    public function add(??? $item): void {…}

    public function getNext():??? {…}
}
```

What are these types?


Why types matter
Collections
Generics on objects
Functions
Extending classes
Restricting types
Class string
Multiple templates
Thoughts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```php
/** @return User[] */
function getUsers(): array {…}
```

```php
foreach(getUsers() as $user) {
  processUser($user);
}
```

```php
function processUser(User $user): void {…}
```

Type Hint

```
/** @return User[] */
function getUsers(): array {…}
```

Type Declaration

Psalm

PHPStan

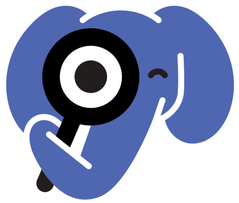
```
/** @return User[] $users */
function getUsers(): array
{
    return [
        new User(“Jane”),
        “james”,
    ];
}
```

```php
<?php declare(strict_types = 1);

class User {
    public function __construct(public string $name){}
}


/** @return User[] */
function getUsers(): array
{
    return [
        new User("jane"),
        "bob",
    ];
}
```

Share | Level 10 | Options

PHP 8.0 – 8.5 (1 error) | PHP 7.2 – 7.4 (2 errors)

Line	Error
11	Function getUsers() should return array<User> but returns array<int, string|User>.



Psalm

Type Hint

(Only checked by static analysis)

```
/** @return User[] */
function getUsers(): array {…}
```

Type Declaration

(Checked by PHP at runtime and by static analysis)

```
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);
}
```

```
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
```

```
class Business {
    /** @return array<string,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);
}
```

```
/** @var array<V> */
```

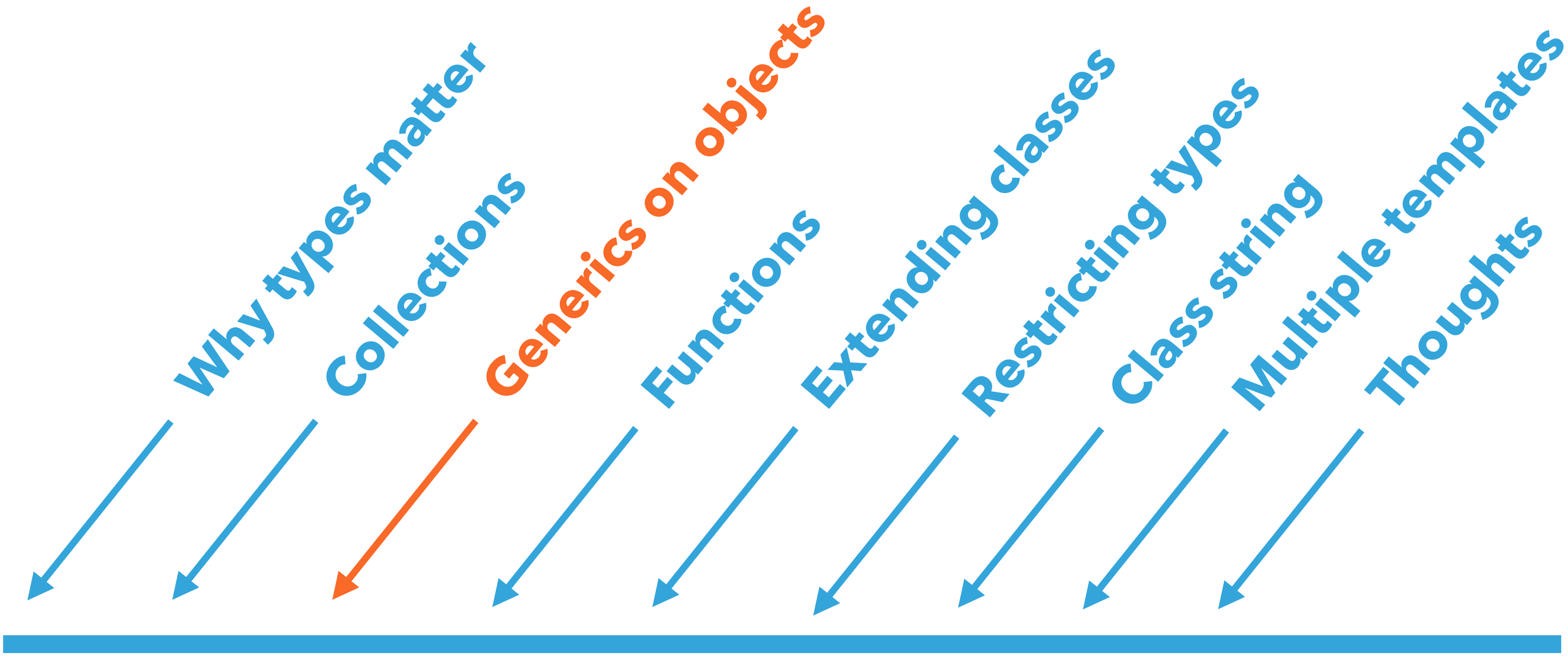
```
/** @var array<Person> */
$people = [ … ];
```

```
/** @var array<K, V> */
```

```
/** @var array<string, Person> */
$people = [ … ];
```

```
/** @var Collection<K, V> */
```

```
/** @var Collection<string, Person> */
$people = new Collection();
```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```
class Queue {

    public function add(??? $item): void {…}

    public function getNext():??? {…}
}
```

What are these types?

```
class Queue <T> {

  public function add(T $item): void {…}

  public function getNext():T {…}
}
```

```php
/** @template T */
class Queue <T> {

    /** @param T $item */
    public function add(T $item): void {…}

    /** @return T */
    public function getNext(): T{…}
}
```

```
/** @var Queue<User> $userQueue */
$userQueue = new Queue();
```

```php
/** @var Queue<User> $userQueue */
$userQueue = new Queue();
```

```php
/** @template User */
class Queue
{
    /** @param User $item */
    public function add(  $item): void {…}

    /** @return User */
    public function getNext()   {…}
}
```

```php
/** @var Queue<User> $userQueue */
$userQueue = new Queue();

$userQueue->add(new User()); ✅

$userQueue->add("Bob"); ❌
```

WITHOUT GENERICS

```
$userQueue = new Queue();

$userQueue->add(new User());   ✅

$userQueue->add("Bob"); ✅
```

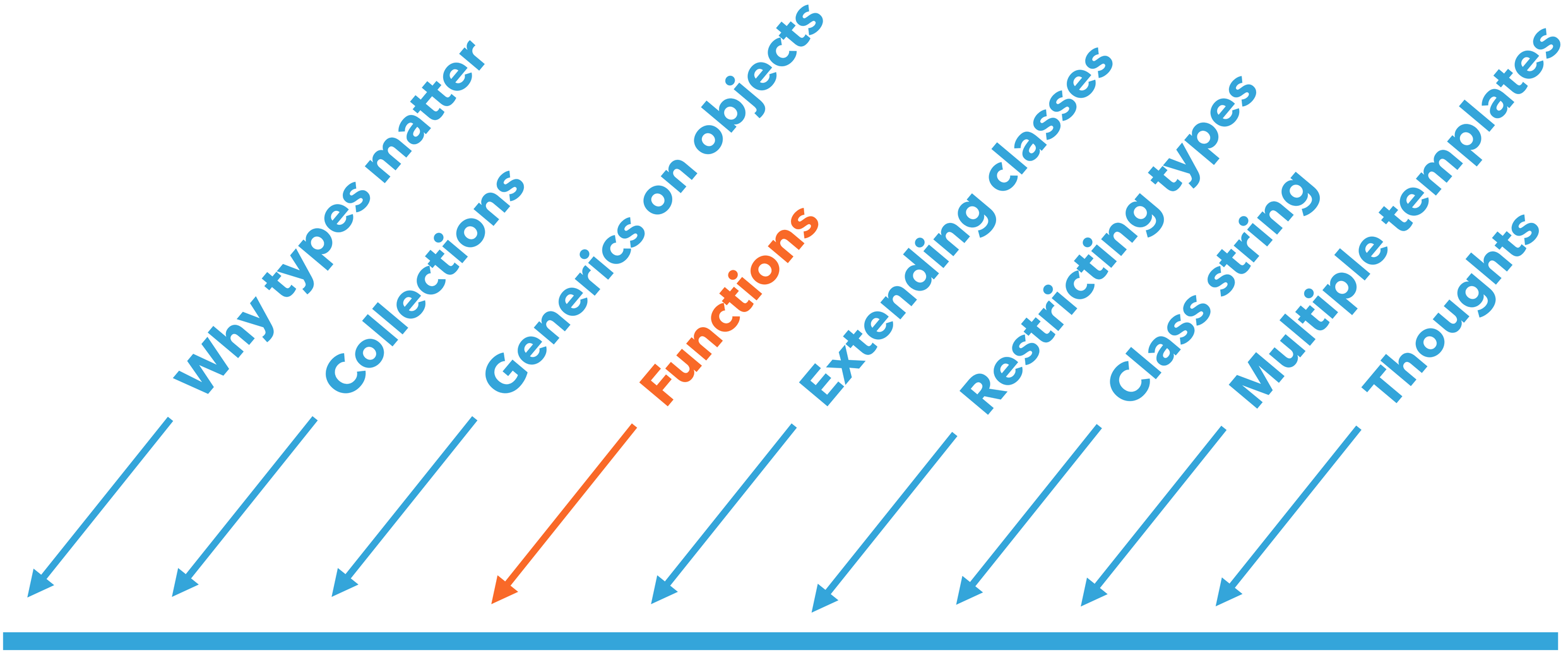
```php
/** @var Queue<Book> $userQueue */
$userQueue = new Queue();
```

```php
/** @template Book */
class Queue    {

  /** @param Book $item */
  public function add(  $item): void {…}

  /** @return Book */
  public function getNext()   {…}
}
```

```php
/** @var Queue<Book> $readingList */
$readingList = new Queue();

$readingList->add(new Book()); ✅

$readingList->add(new User()); ❌
```

```php
/** @template T */
class Queue() { … }

/** @var Queue<User> $userQueue */
$userQueue = new Queue();
```

- Communicate intent
- ~~Run time checks~~
- Static analysis checks
- Enable refactoring
- AI Assisted Development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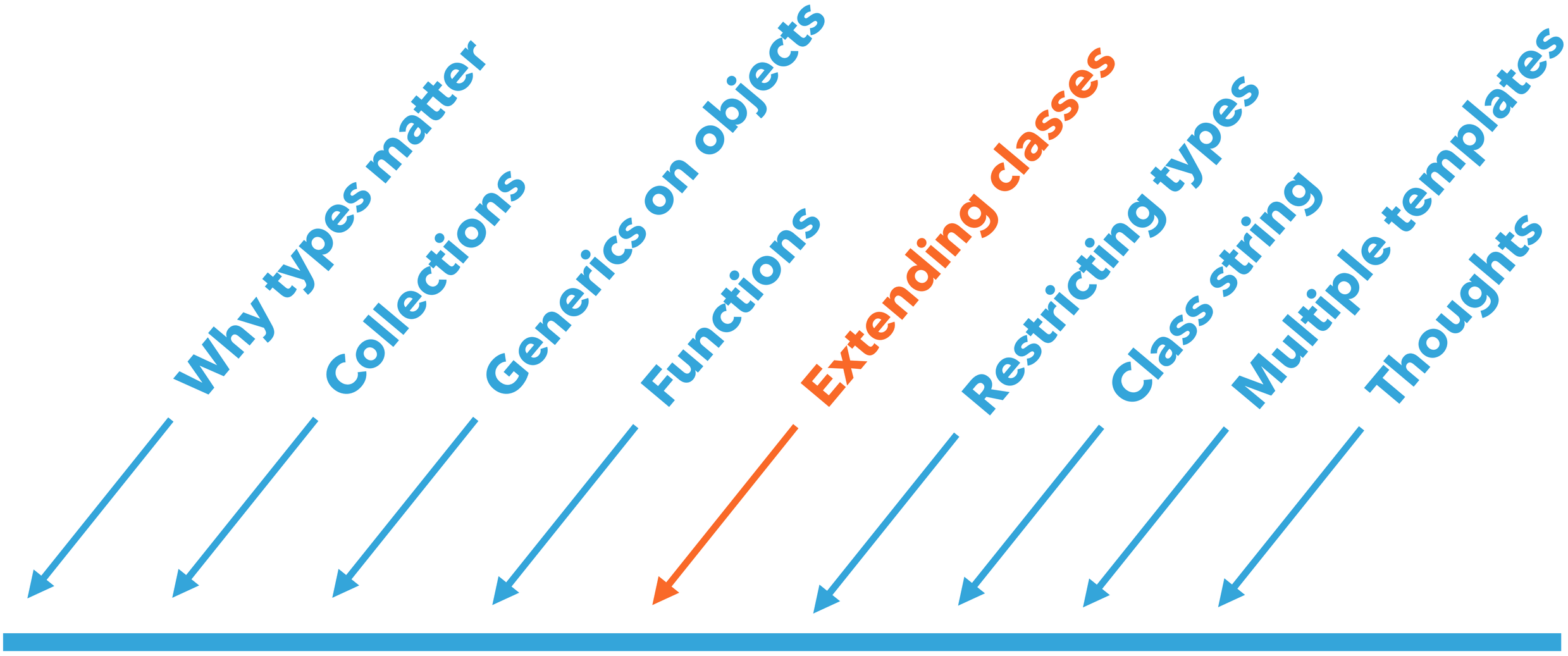
```
/**
 * @template T
 * @param T $value
 * @return T
 */
function mirror($value) { return $value; }
```

```php
/**
 * @template T
 * @param T $input
 * @return T
 */
function mirror($input) { return $input; }
$value = mirror(5);
```

```
/**
 * @template T
 * @param T $value
 * @return array<T>
 */
function asArray($value) { return [$value]; }
$values = asArray(5);
```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```
class Animal { … }

class Dog extends Animal {
  public function bark(): void {…}
}

class Cat extends Animal {
  public function meow(): void {…}
}
```

```
/** @template T */
interface AnimalGame {

    /** @param T $animal */
    public function play($animal): void;
}
```

```
/** @implements AnimalGame<Dog> */
class DogGame implements AnimalGame {…}
```

```php
/** @implements AnimalGame<Dog> */
class DogGame implements AnimalGame {…}
```

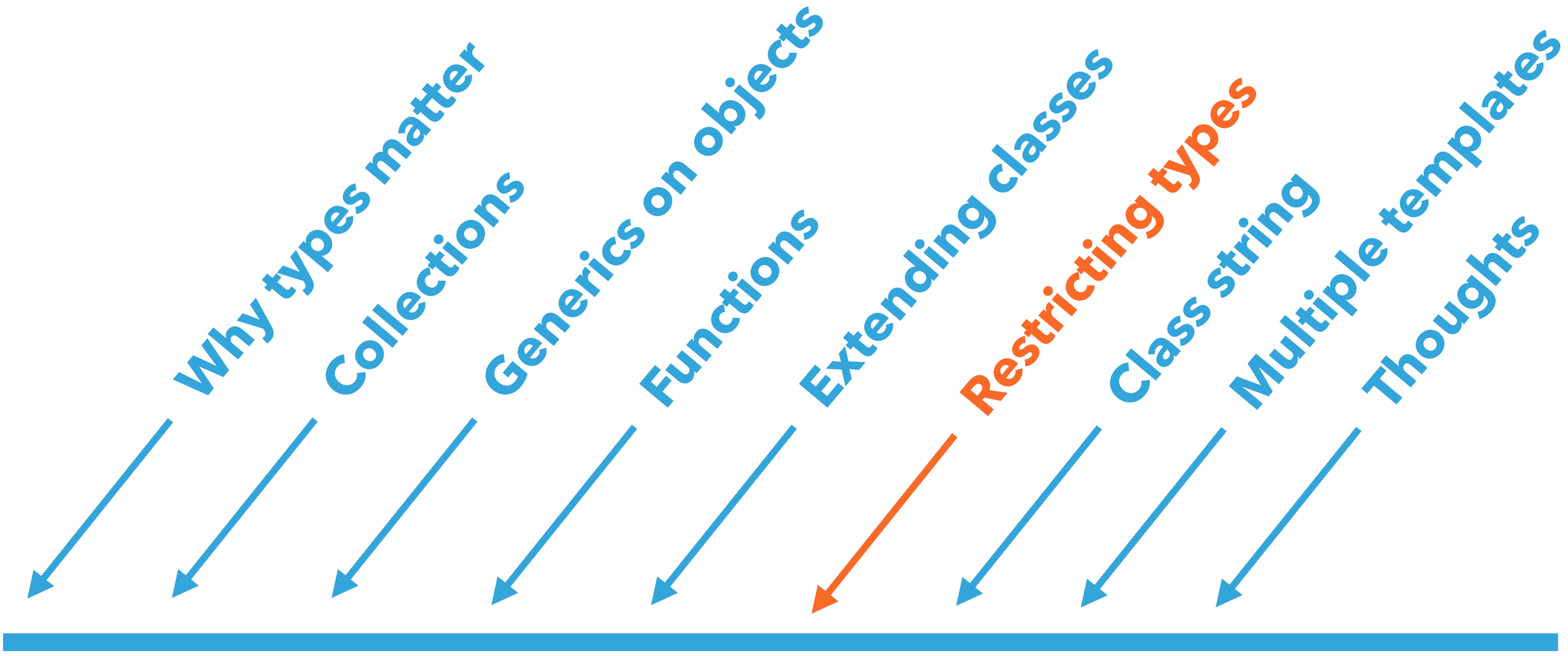
```php
/** @template Dog */
interface AnimalGame {

  /** @param Dog $animal */
  public function play($animal): void;
}
```

```
/** @implements AnimalGame<Dog> */
class DogGame implements AnimalGame {

    public function play($animal): void {
        $animal->bark(); // We know $animal is a dog
    }
}
```

```
/** @implements AnimalGame<Dog> */
class DogGame implements AnimalGame {

  public function play($animal): void {
    $animal->meow(); // Dogs can't meow
  }
}
```

```
/** @implements AnimalGame<Dog> */
class DogGame implements AnimalGame {…}
```

```
/** @extends AnimalGame<Dog> */
class DogGame extends AnimalGame {…}
```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```
/** @implements AnimalGame<Car> */
class CarGame implements AnimalGame { … }
```

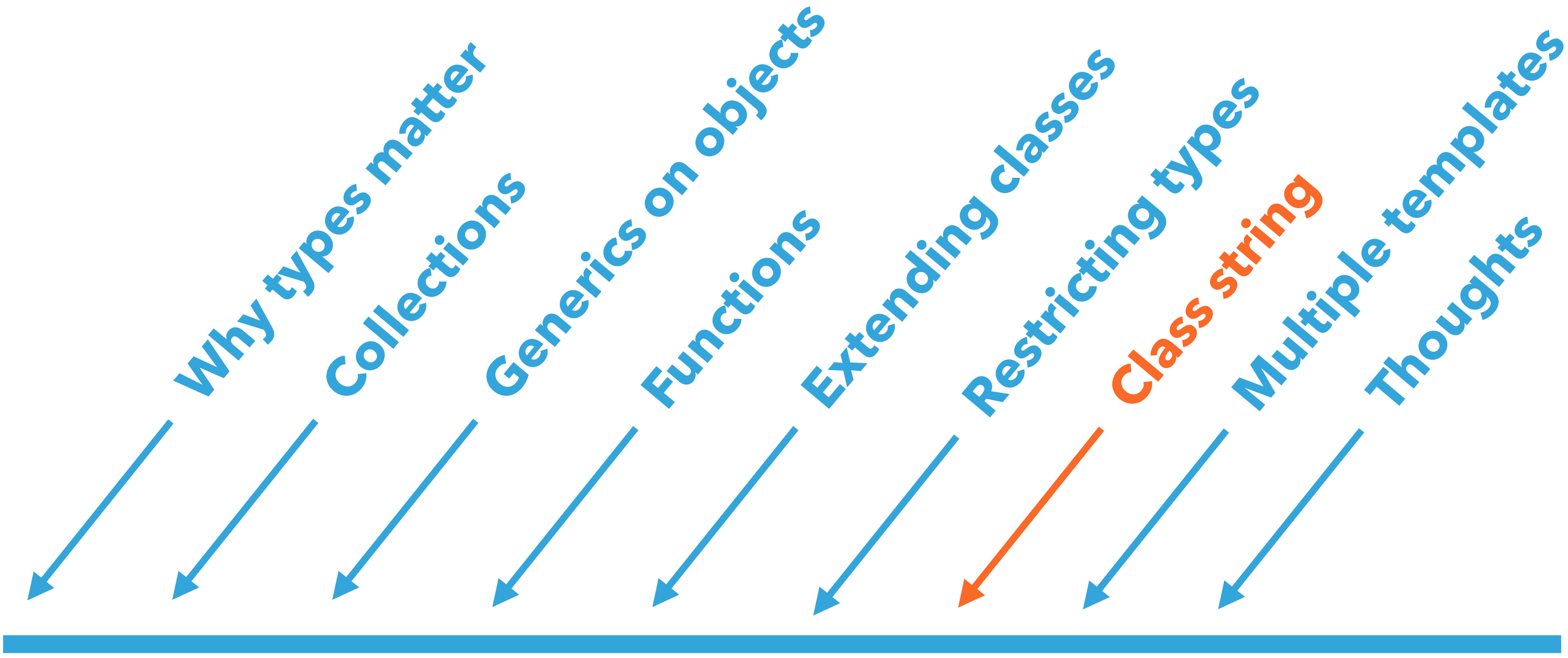
```
/** @template T of Animal */
interface AnimalGame { … }

/** @implements AnimalGame<Car> */
class CarGame implements AnimalGame { … }

/** @implements AnimalGame<Cat> */
class CatGame implements AnimalGame { … }
```

❌

✅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CLASS STRING

```
App\Entities\Person
```

```
Person::class
```

```
class Person {…}
```

```
/**
 *
 * @param string $className
 * @return object
 */
function app(string $className): object {…}
```

```
$person = app(Person::class);
```

```
class Person {…}
```

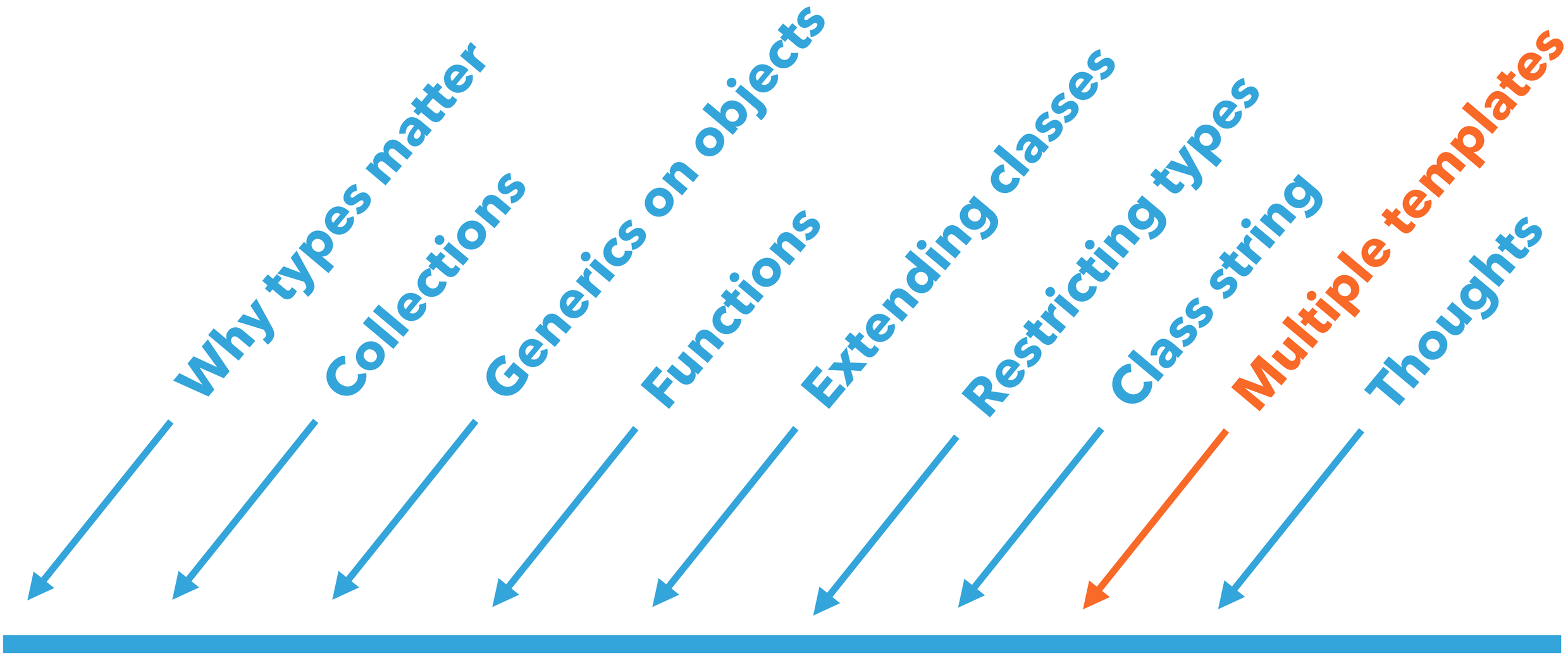
```
 /**
  *
  * @param string $className
  * @return object
  */
 function app(string $className): object {…}
```

```
 $person = app(Person::class);
```

```
class Person {…}
```

```
/**
 * @template T of object
 * @param class-string<T> $className
 * @return T
 */
function app(string $className): object {…}
```

```
$person = app(Person::class);
```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```
/**
 * @template T
 * @template U
 */
final readonly class Tuple {

    /**
     * @param T $a
     * @param U $b
     */
    public function __construct(
            public $a,
            public $b,
        ) {}
 }
```

```php
/**
 * @template T
 * @template U
 */
final readonly class Tuple {

 /**
  * @param T $a
  * @param U $b
  */
 public function __construct(
        public $a,
        public $b,
     ) {}
 }
```

```php
/**
 * @param Tuple<User,Book> $result
 */
function process(Tuple $result)
{

  // $user is a User object
  $user = $result->a;

  // $book is a Book object
  $book = $result->b;
}
```

```php
/**
 * @template T
 * @template U
 */
final readonly class Tuple {

 /**
  * @param T $a
  * @param U $b
  */
 public function __construct(
        public $a,
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function process(Tuple $result)
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  // $user is a User object
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  $book = $result->b;
}
```

```php
/**
 * @template T
 * @template U
 */
final readonly class Tuple {

 /**
  * @param T $a
  * @param U $b
  */
 public function __construct(
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        public $b,
    ) {}
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function process(Tuple $result)
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  // $book is a Book object
  $book = $result->b;
}
```

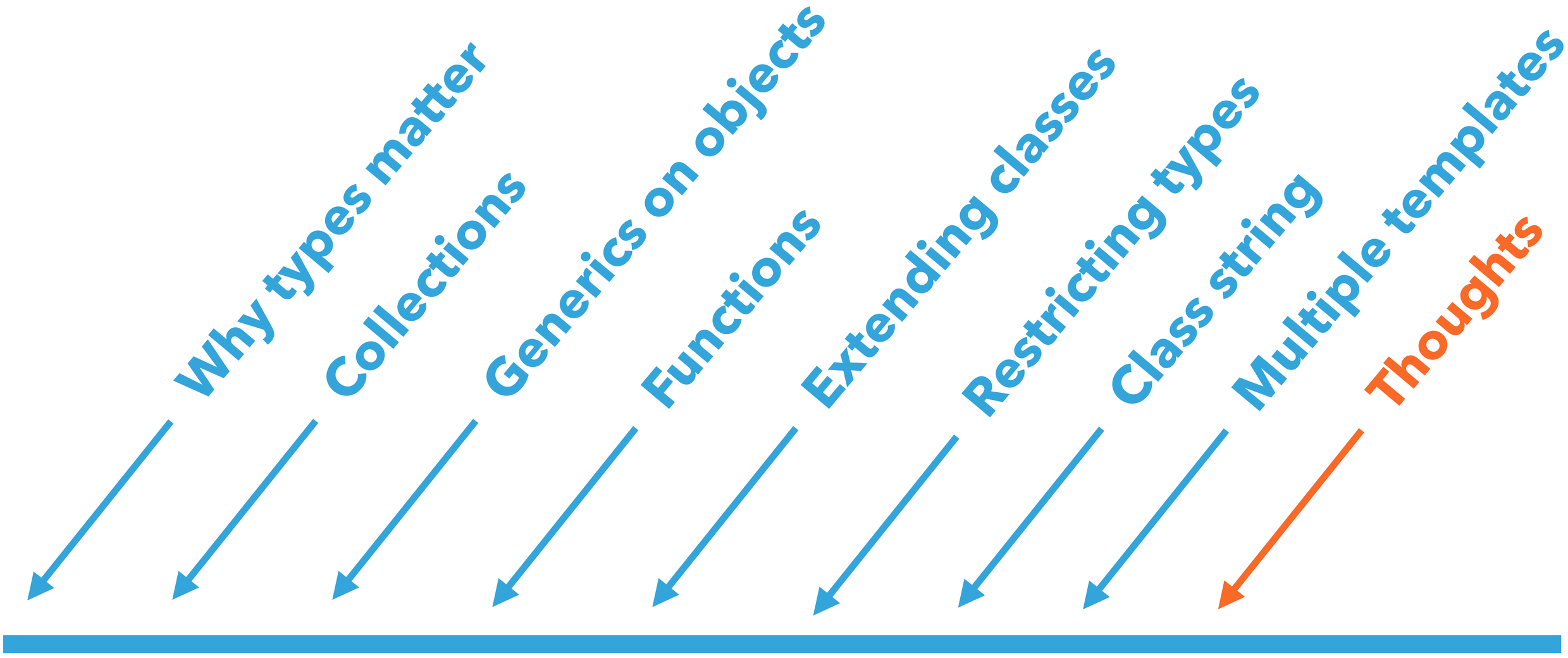
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Type Hint

(Only checked by static analysis)

```
/** @return User[] */
function getUsers(): array {…}
```

Type Declaration

(Checked by PHP at runtime and by static analysis)

- Communicate intent
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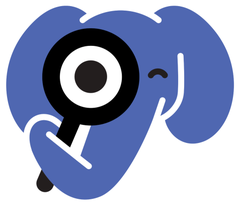
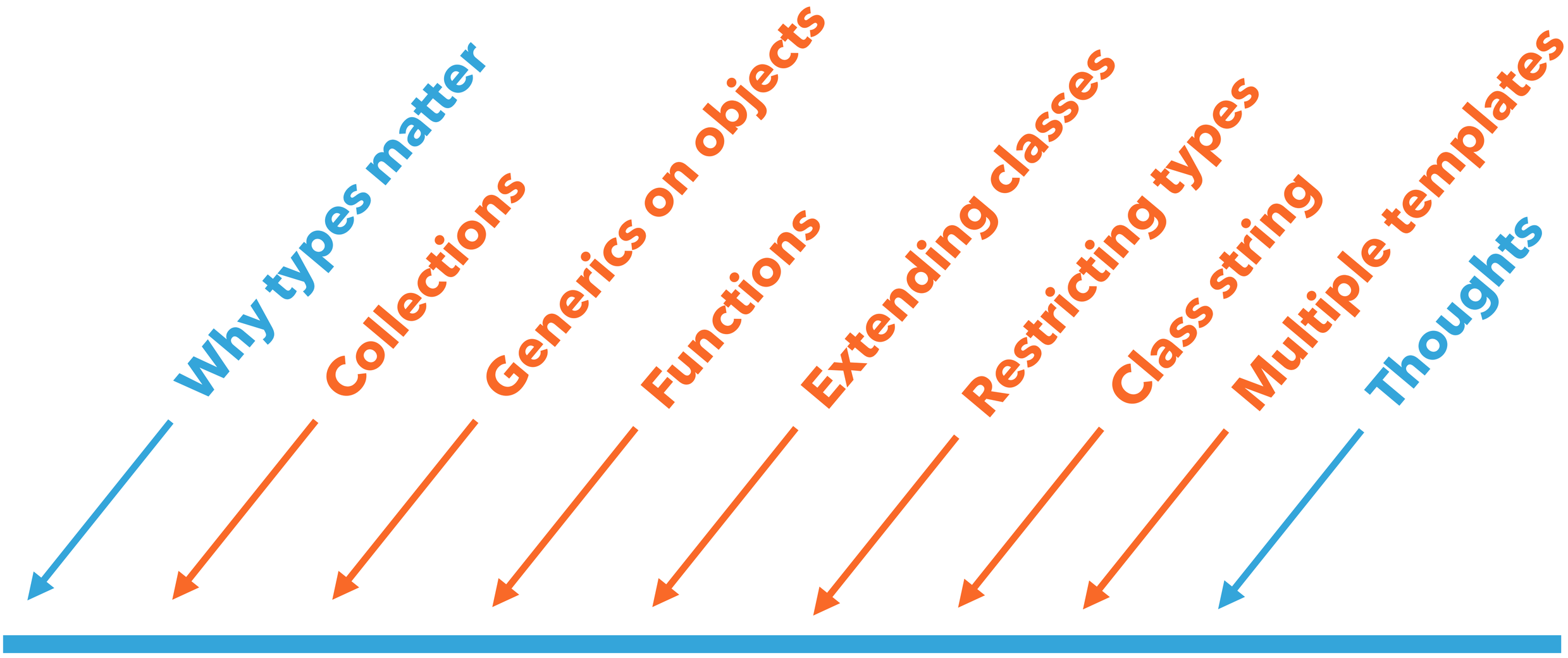


Psalm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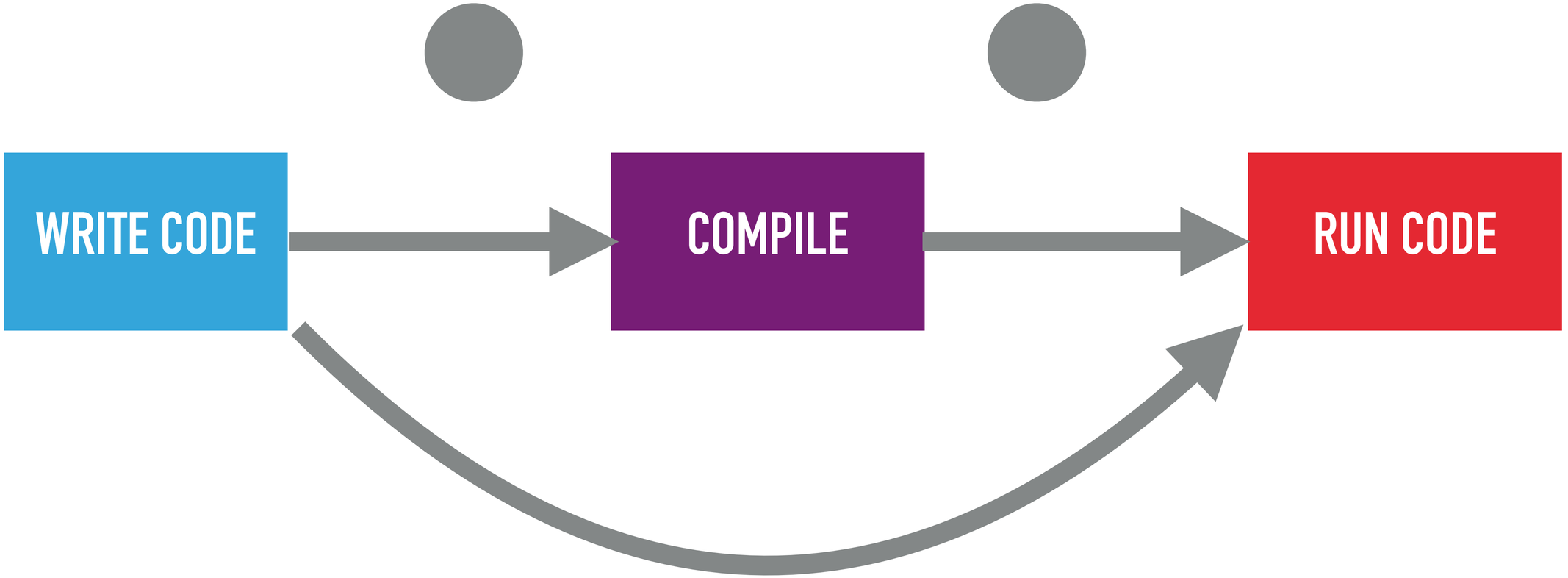
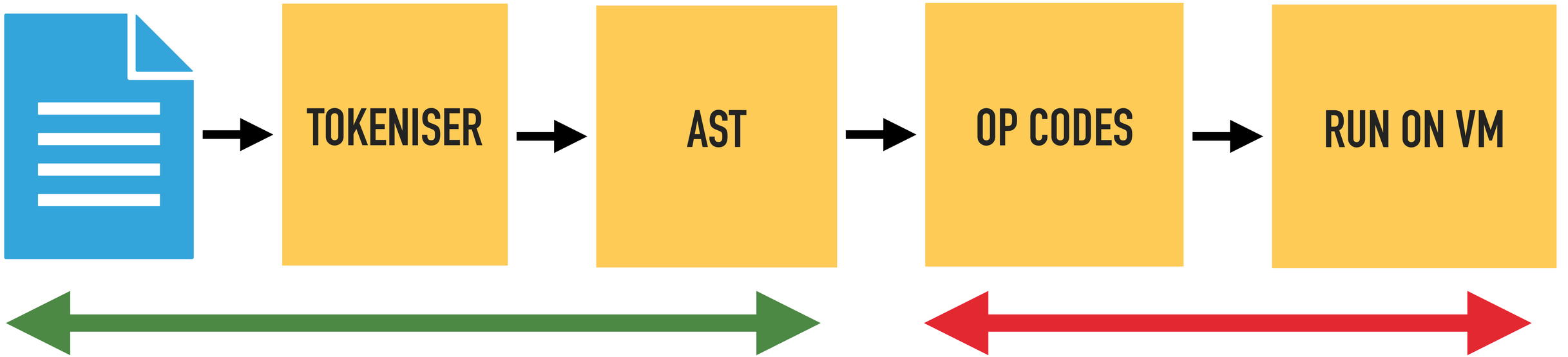
WHY NOT JUST USE JAVA?



IMPLEMENTING GENERICS

- Full language support
- Partial language support
  - Valid syntax
  - Ignored at run time
- PSR / similar

PARTIAL LANGUAGE SUPPORT



Validated by Static Analysis, not at run time.

https://wiki.php.net/rfc/bound_erased_generic_types

```
class Queue <T: Animal>
{
  private array<int,T> $queue = [];

  public function add(T $item): void {…}

  public function next(): T {…}
}

$personQueue = new Queue::<Dog>();
```

PHP GENERICS TODAY (ALMOST)

USING GENERICS NOW

Psalm

WE ALREADY HAVE GENERICS!

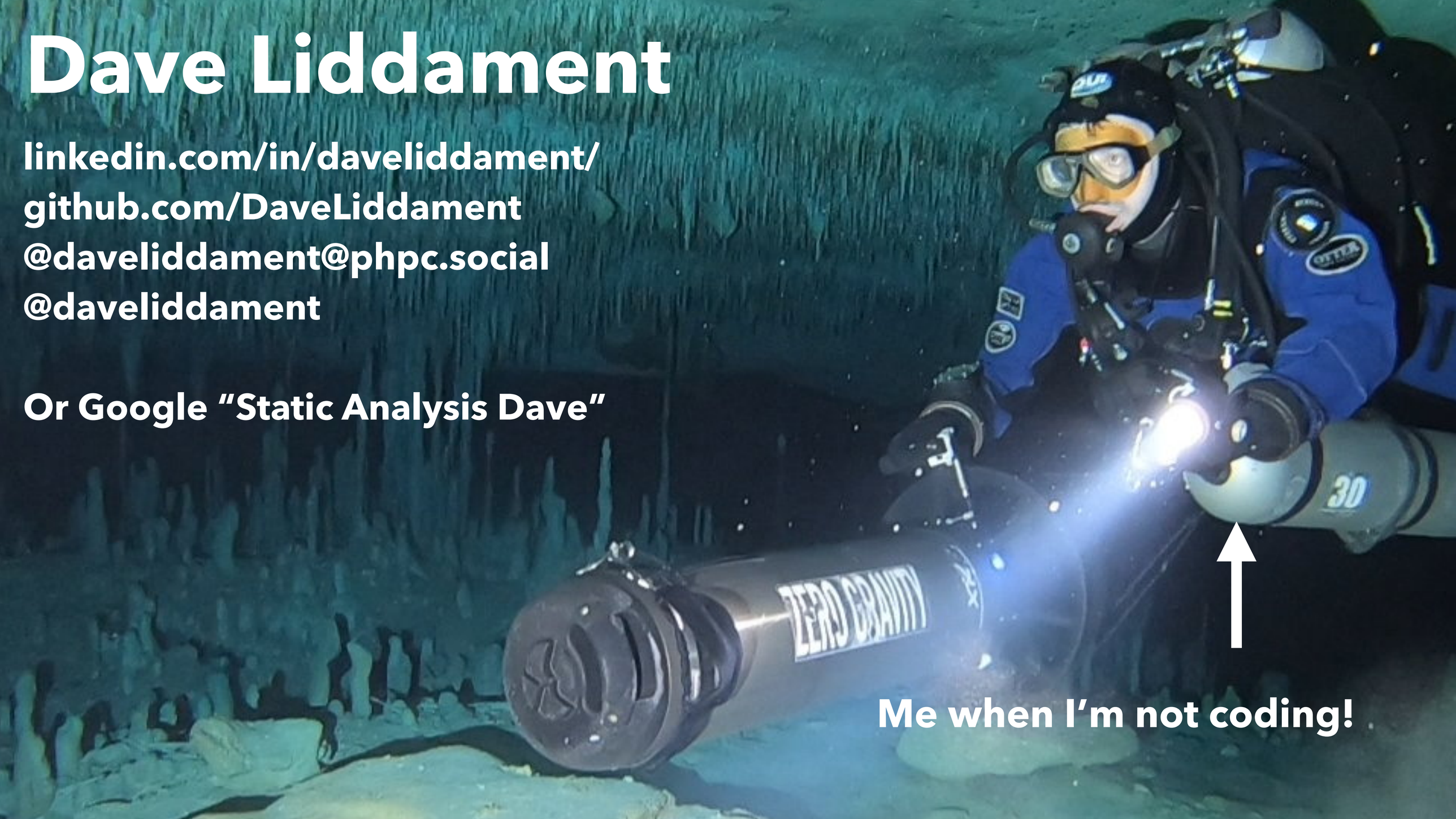
I'VE BEEN DOING THIS FOR 6 YEARS.

NOW YOU CAN TOO!

Dave Liddament

linkedin.com/in/daveliddament/
github.com/DaveLiddament
@daveliddament@phpc.social
@daveliddament

Or Google “Static Analysis Dave”



Me when I’m not coding!