From OOP to OOPS

Escaping the One-Paradigm Trap

Masking Technology
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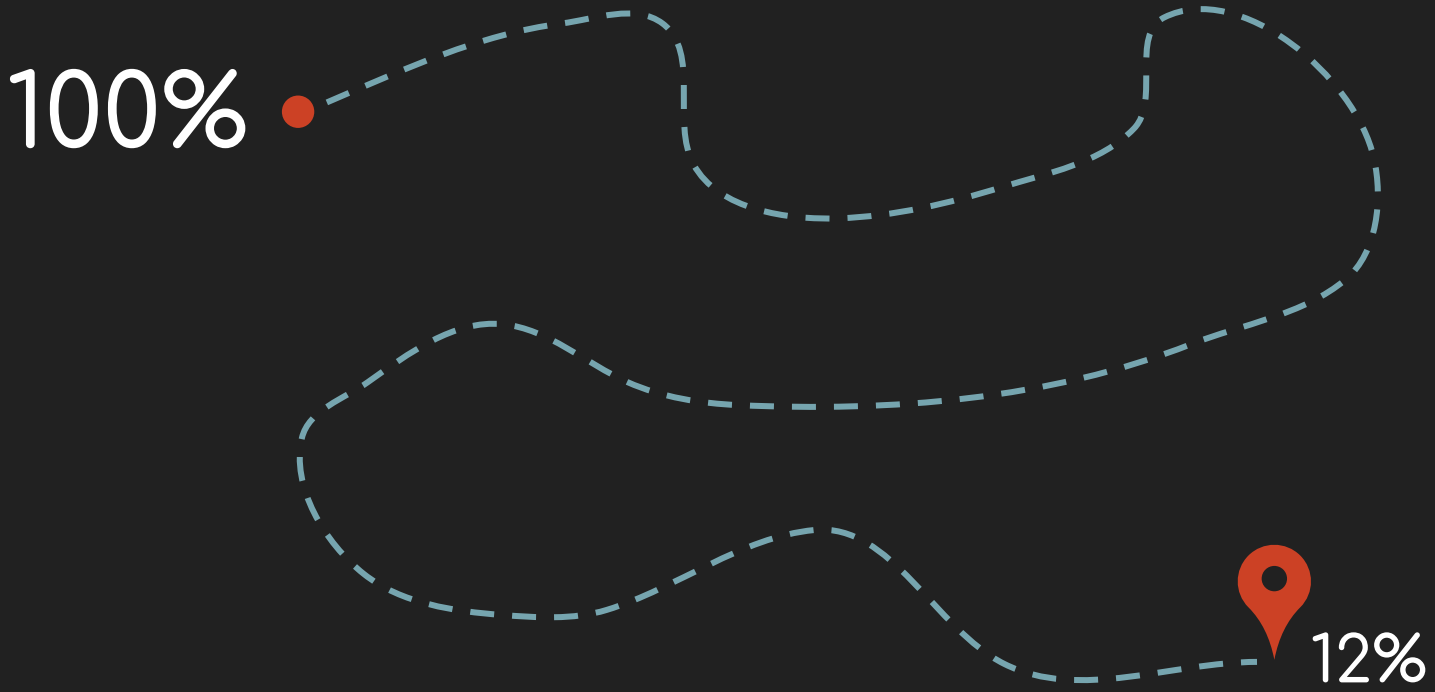
Masking Technology

Object-Oriented
Programming
is great!

But using it
for everything
is not.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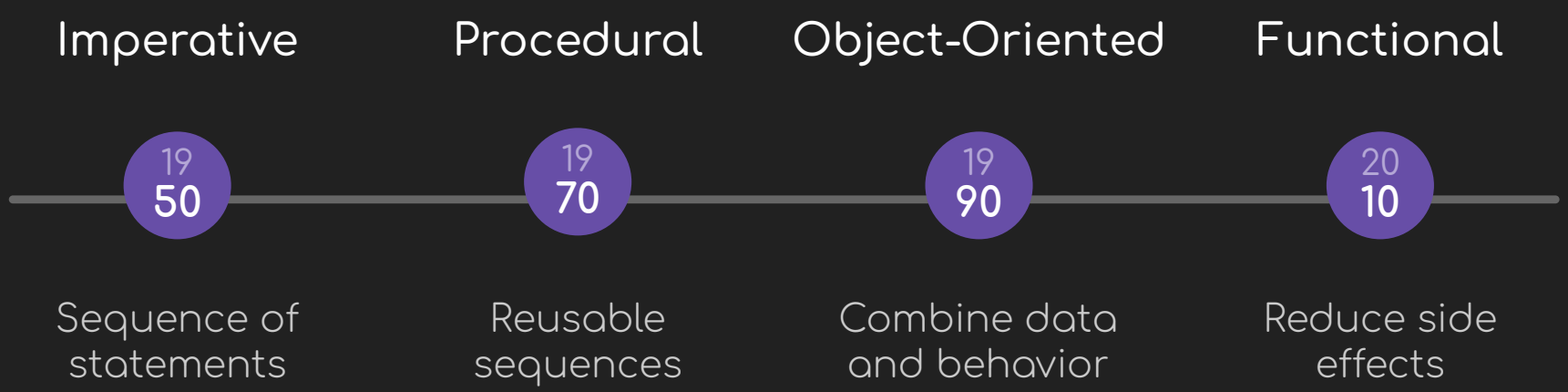
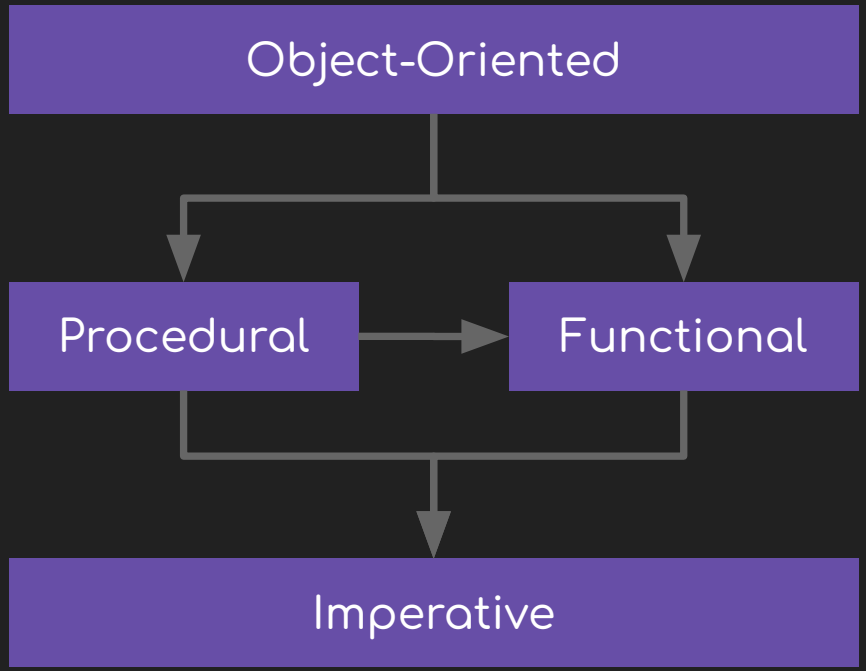
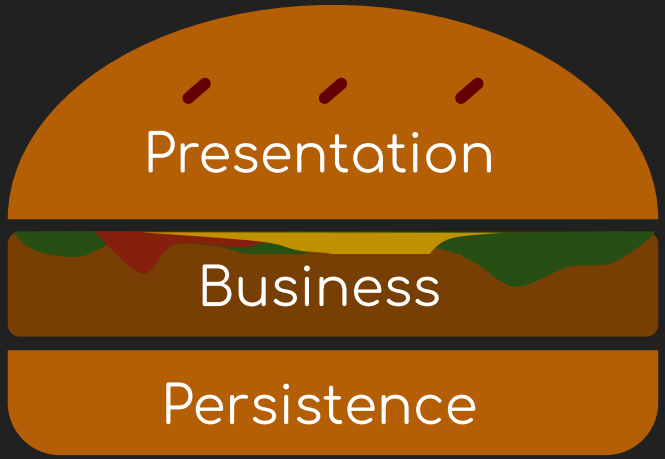
Mainstream Paradigms



Modern Multi-Paradigm Synthesis



Common web architecture



- Presentation
- Business
- Persistence

- Presentation
- Business
- Persistence

Presentation burger.controller.ts

```ts
@Controller('burgers')
export class BurgerController
{
  constructor(
    private service: BurgerService
  ) {}

  @Get('names')
  getnames(): string[]
  {
    return service.getNames();
  }
}
```

Business burger.service.ts

Persistence burger.entity.ts

Presentation BurgerController.php

```php
class BurgerController extends
Controller
{
  public function __construct(
    protected service $burgerService
  ) {}

  public function getNames(): array
  {
    return $this->service->getNames();
  }
}

Route::get('/burgers/names', [...]);
```

Business BurgerService.php

Persistence Burger.php

▶ **Presentation** burger.controller.ts

▼ **Business** burger.service.ts

```ts
@Injectable()
export class BurgerService
{
  constructor(
    private repository:
                  Repository<Burger>
  ) {}

  getNames(): string[]
  {
    return this.repository.find()
      .map(burger => burger.name);
  }
}
```

▶ **Persistence** burger.entity.ts

▶ **Presentation** BurgerController.php

▼ **Business** BurgerService.php

```php
class BurgerService
{
  public function __construct() {}

  public function getNames(): array
  {
    $burgers = Burger::all()->all();

    return array_map(
      fn ($burger) => $burger->name,
      $burgers
    );
  }
}
```

▶ **Persistence** Burger.php

▶ **Presentation** burger.controller.ts

▶ **Business** burger.service.ts

▼ **Persistence** burger.entity.ts

```ts
@Entity()
export class Burger
{
  @Column()
  name: string;
}
```

▶ **Presentation** BurgerController.php

▶ **Business** BurgerService.php

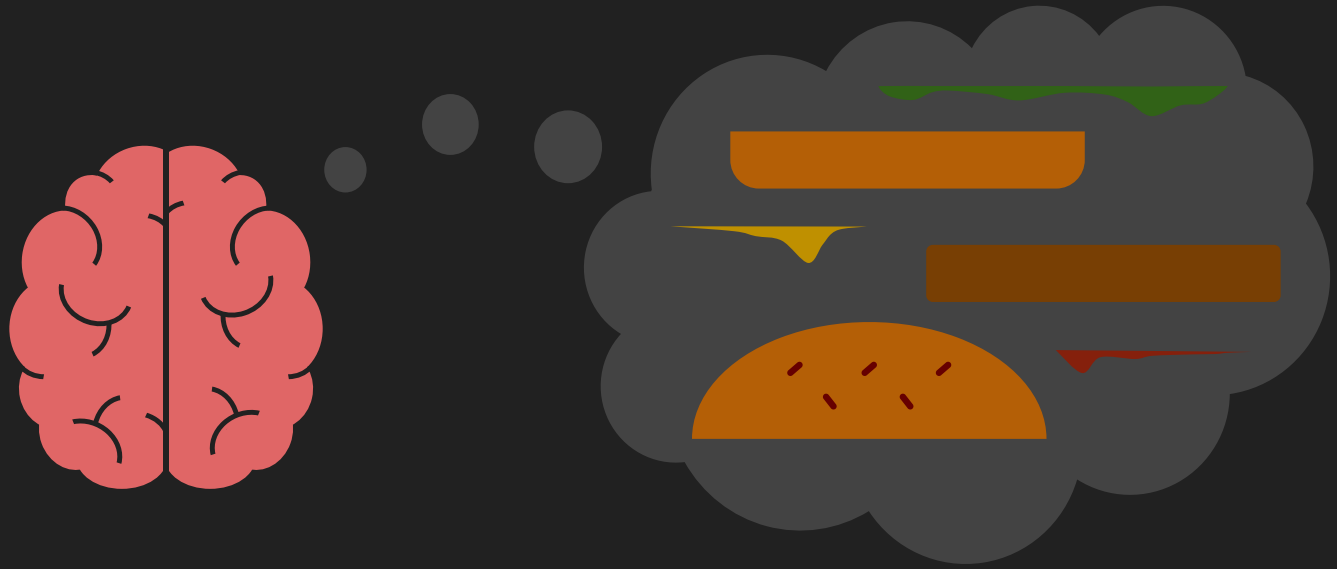
▼ **Persistence** Burger.php

```php
class Burger extends Model
{
  protected $fillable = ['name'];
}
```

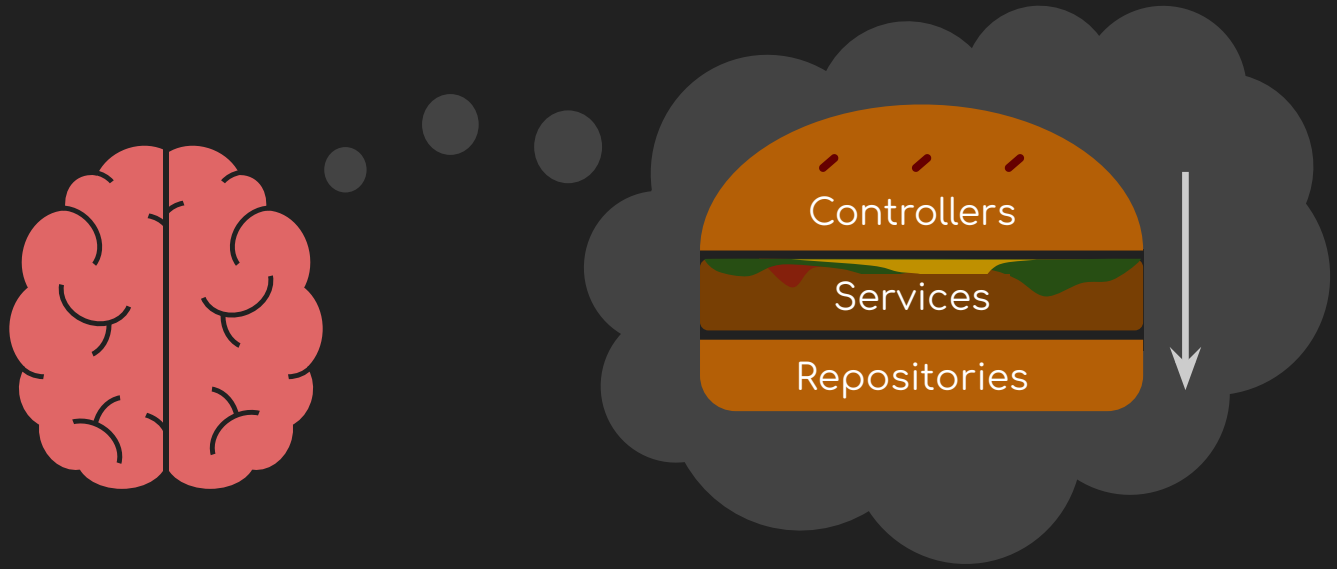
This is an established pattern that works.

But...

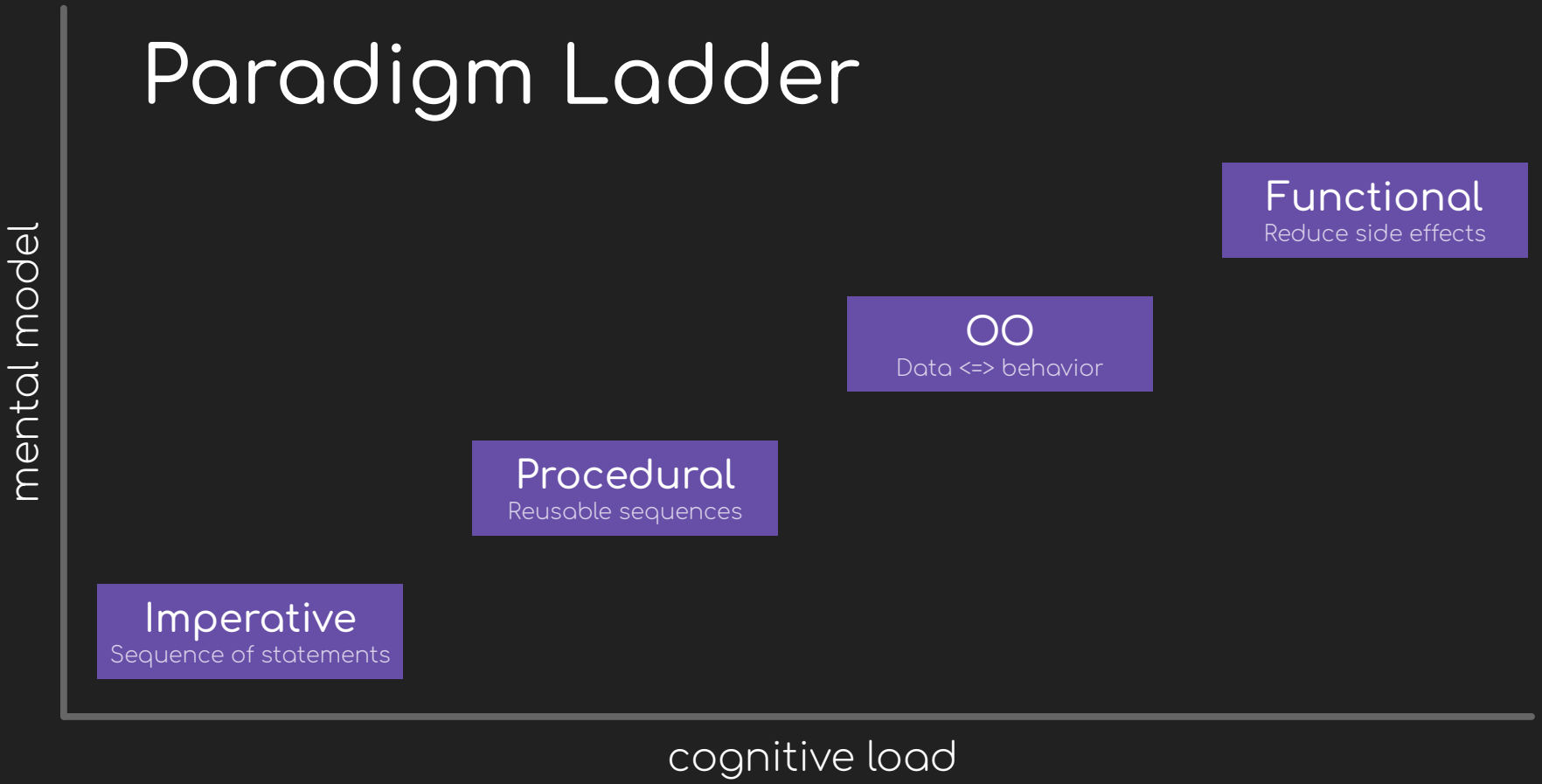
Cognitive Load



Mental Model



Paradigm Ladder



Paradigm Ladder

Most complex paradigm

Functional
Reduce side effects

OO
Data <=> behavior

- Classes & objects
- State management
- Abstractions
- Encapsulation
- Inheritance
- Polymorphism

Procedural
Reusable sequences

Imperative
Sequence of statements

mental model

cognitive load

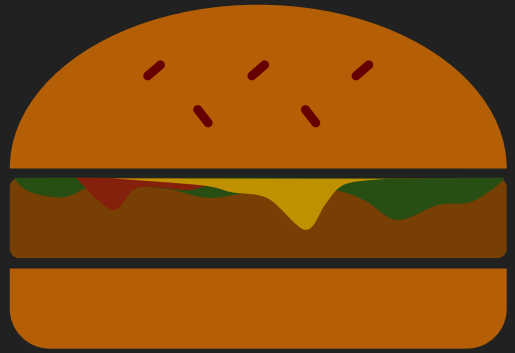
"Complexity is a measure of understandability, and lack of understandability leads to errors."

On the Relationship between Software Complexity and Maintenance Costs (2014)

Essential or Accidental Complexity?

App Assessment

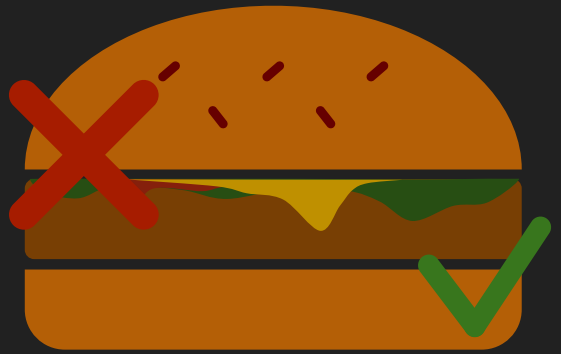
Stateless
Singletons



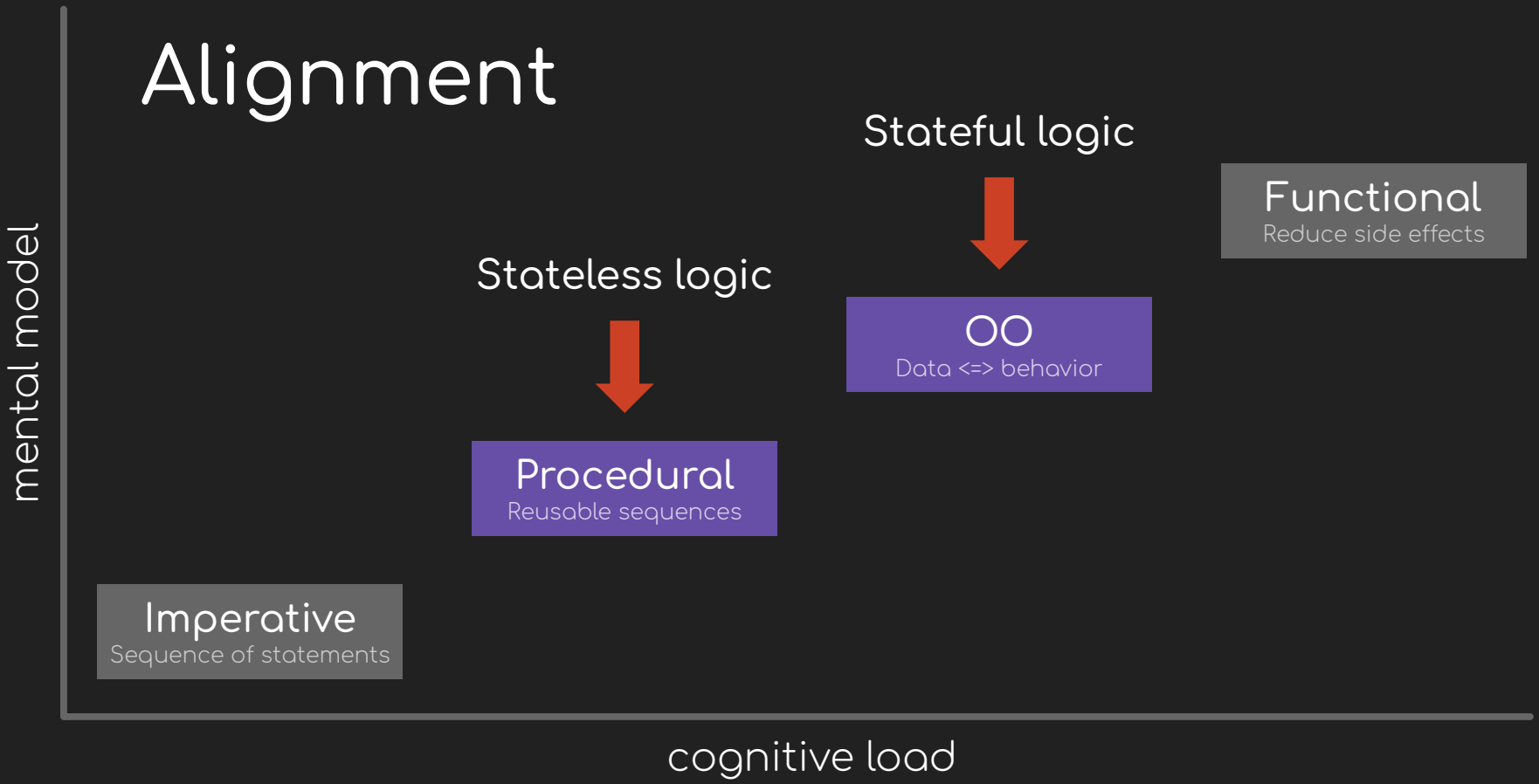
Statelful
Multiple instances

Partial Misalignment

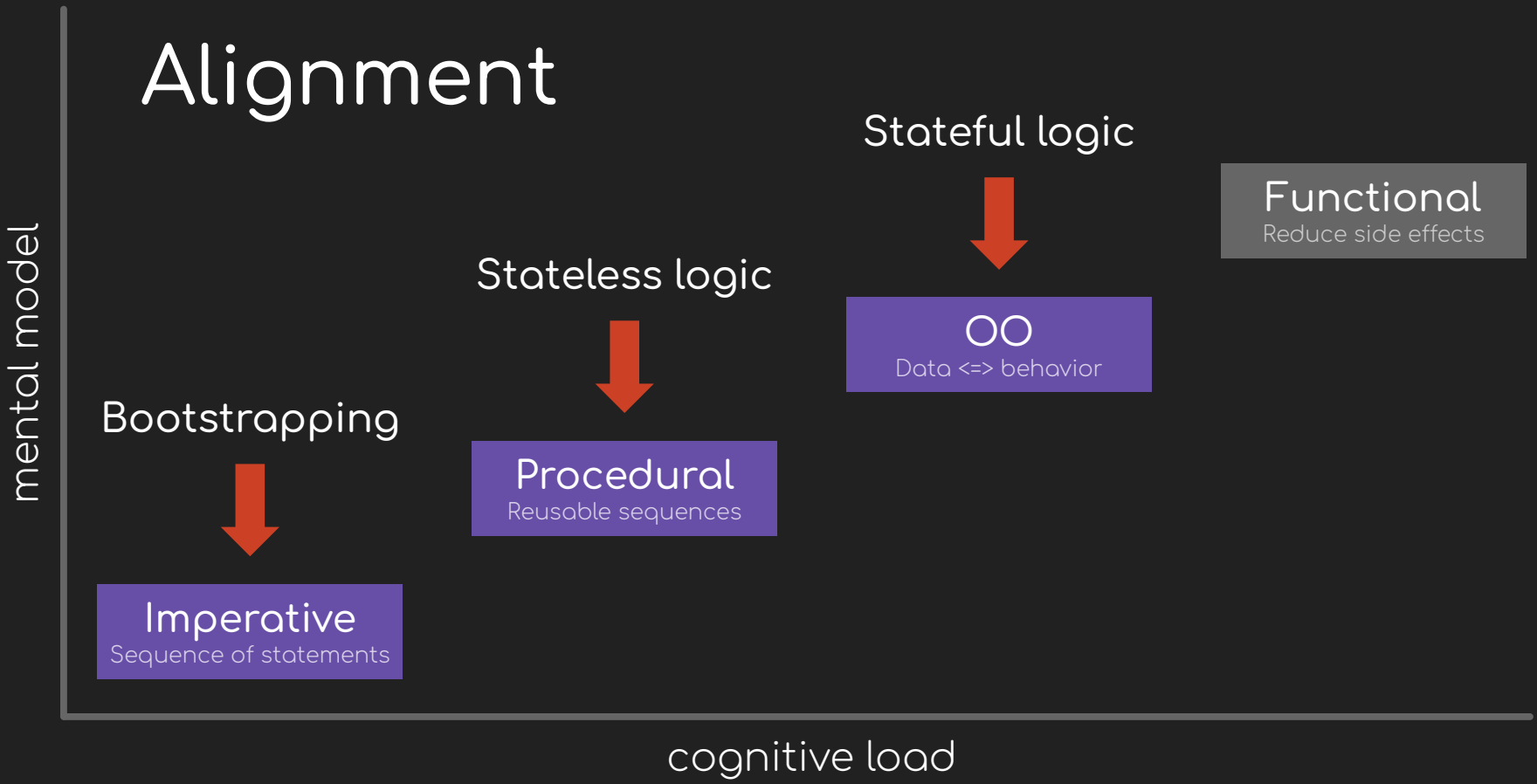
Stateless
Singletons



Statelful
Multiple instances


Alignment
Stateful logic
Functional
Reduce side effects
Stateless logic
OO
Data <=> behavior
Procedural
Reusable sequences
Imperative
Sequence of statements
mental model
cognitive load

But what about bootstrapping?


Alignment
Bootstrapping
Imperative
Sequence of statements
Stateless logic
Procedural
Reusable sequences
Stateful logic
OO
Data <=> behavior
Functional
Reduce side effects
mental model
cognitive load

Paradigm Fit

Imperative	**Simple tasks** bootstrapping, configuration, migration, etc.
Procedural	**Processes and flows** application, business and persistence logic.
OO	**State <=> behaviour** UI components, complex data models, etc.
Functional	**Helpers** data processing, calculations, concurrency, etc.

Top-level availability required

Language support is limited.

Time for Refactoring

express

Slim Framework

- Presentation
- Business
- Persistence

- Presentation
- Business
- Persistence

Presentation route.ts

```
app.get('/burgers/names', (
  request: Request, response: Response)
=> {
  const names = getBurgerNames();

  response.json(names);
});
```

Business getBurgerNames.ts

Persistence Burger.ts

Presentation route.php

```
$app->get('/burgers/names', function (
  Request $request, Response $response
){
  $names = getBurgerNames();

  $response->getBody()
    ->write(json_encode($names));

  return $response
    ->withHeader('Content-Type',
                 'application/json')
    ->withStatus(200);
});
```

Business getBurgerNames.php

Persistence Burger.php

▶ **Presentation** route.ts

▼ **Business** getBurgerNames.ts

```ts
function getBurgerNames(): string[]
{
  const burgers = retrieveBurgers();

  return burgers
    .map(burger => burger.name);
}
```

▶ **Persistence** Burger.ts

▶ **Presentation** route.php

▼ **Business** getBurgerNames.php

```php
function getBurgerNames(): array
{
  $burgers = retrieveBurgers();

  return array_map(
      fn ($burger) => $burger->name,
      $burgers
    );
}
```

▶ **Persistence** Burger.php

▶ **Presentation** route.ts

▶ **Business** getBurgerNames.ts

▼ **Persistence** retrieveBurgers.ts

```ts
function retrieveBurgers(): Burger[]
{
  // Query the database
  // Map the results
}
```

```ts
class Burger
{
  name: string;
}
```

▶ **Presentation** route.php

▶ **Business** getBurgerNames.php

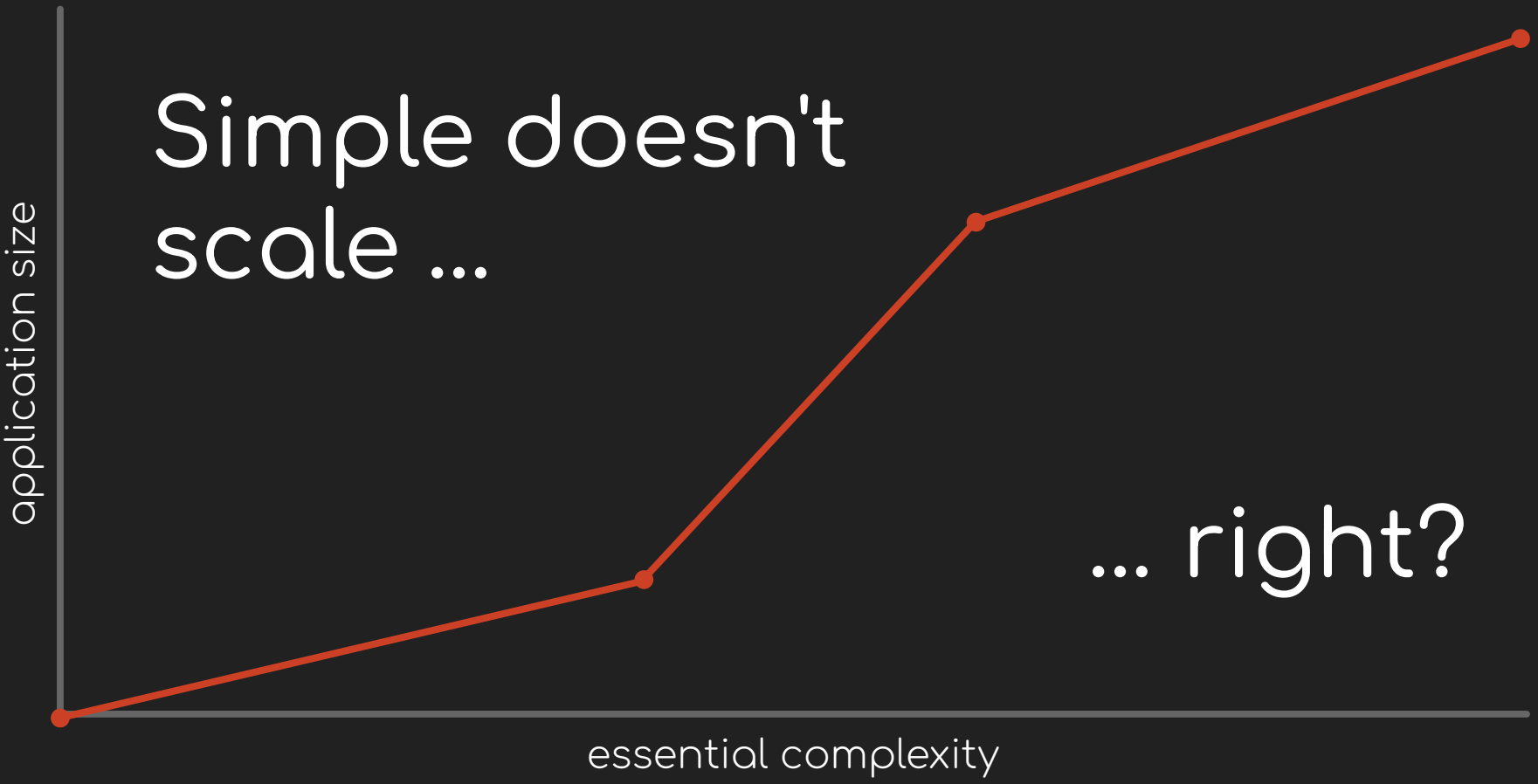
▼ **Persistence** retrieveBurgers.php

```php
function retrieveBurgers(): array
{
  // Query the database
  // Map the results
}
```

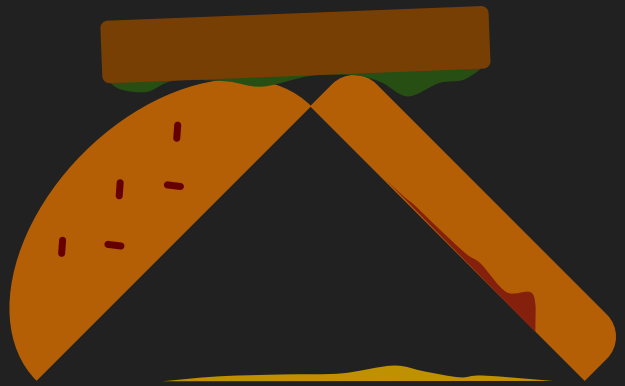
```php
class Burger
{
  public string $name;
}
```

Simplicity!

But...

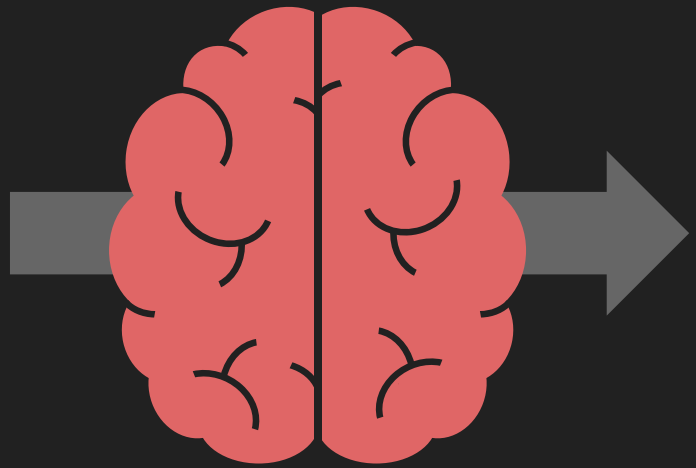

Simple doesn't scale ...
... right?
application size
essential complexity

It's all about proper Application Structure.



Mindset Shift

Taxonomy
(technical identity)



Topography
(business intent)

Taxonomy

- app root
  - controllers layer
    - BurgerController
  - services layer
    - BurgerService
  - repositories layer
    - BurgerRepository
  - models layer
    - Burger

Taxonomy

- app root
  - controllers layer
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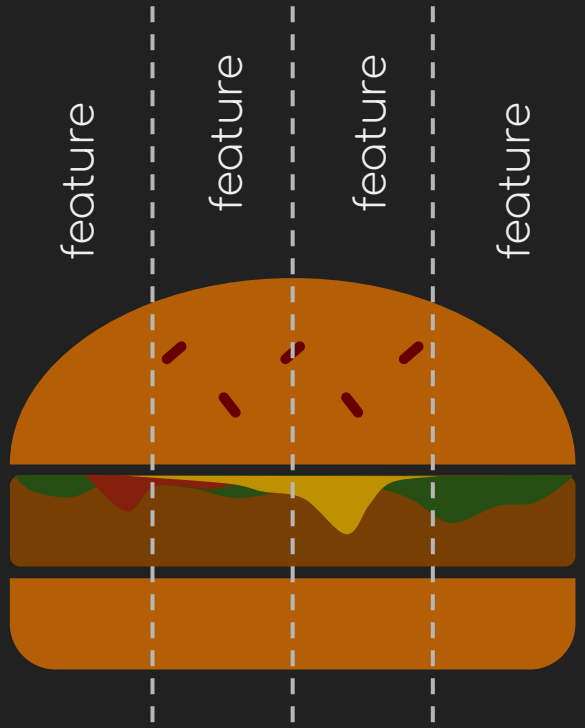
  - models layer
    - Burger

Topography

- app root
  - burger business concept
    - getNames intent
      - Controller
      - Service
      - Repository
      - Model

Vertical Slice Architecture



Object-Oriented

- app root
  - burger concept
    - getNames feature
      - Controller object-oriented
      - Service object-oriented
      - Repository object-oriented
      - Model object-oriented

Object-Oriented

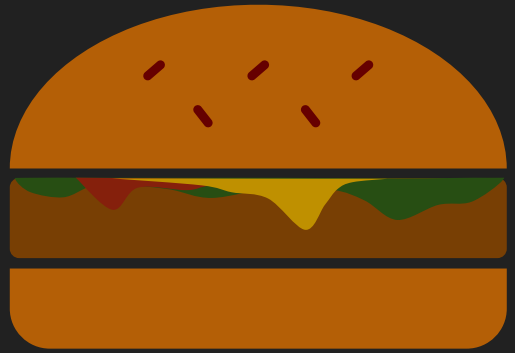
- app root
  - burger concept
    - getNames feature
      - Controller object-oriented
      - Service object-oriented
      - Repository object-oriented
      - Model object-oriented

Blended Approach

- app root
  - burger concept
    - getNames feature
      - route imperative
      - getNames procedural
      - retrieveBurgers procedural
      - Burger object(-oriented)

Cognitive Load Decrease

Avoids terminology drift



Avoids indirection

What About Testing?

Pragmatic Approach

Imperative	**End-to-End** run and verify.
Procedural	**Unit & Integration** per process / flow.
OO	**Unit & Integration** per class / composition.
Functional	**Mostly implicit** tested in the containing procedure or class.

Integration getNames.spec.ts

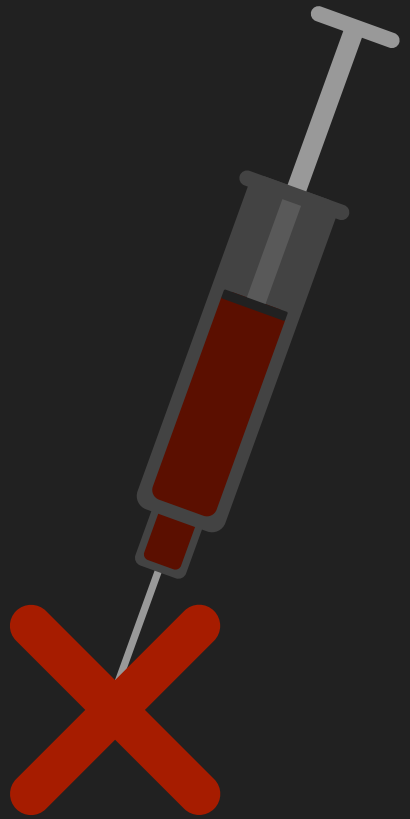
```ts
import
 { beforeEach, describe, it }
from 'vitest';

import { getNames } from '...';

beforeEach(() =>
{
  // reset database
));

describe('getNames', () =>
{
  it('should work', () =>
  {
    // conduct test
  }
});
```

Integration GetNamesTest.php

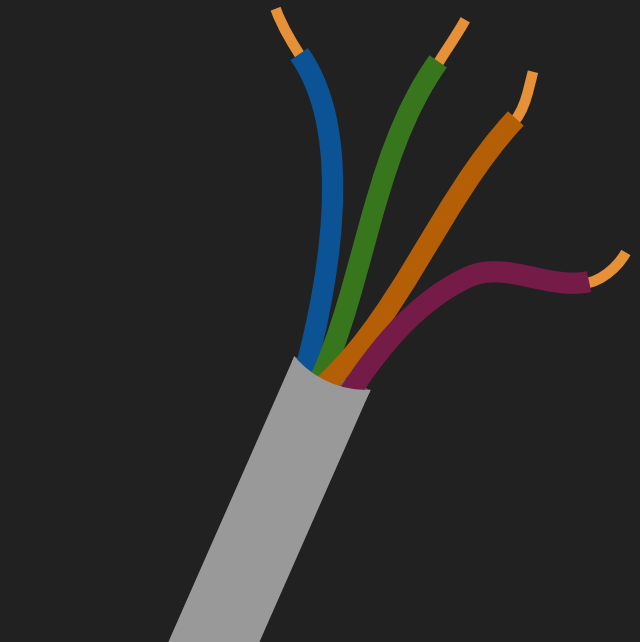
```php
use PHPUnit\Framework\TestCase;

use function App\Burger\getNames;

class GetNamesTest extends TestCase
{
  protected function setUp(): void
  {
    parent::setUp();

    // reset database
  }

  public function testItWorks(): void
  {
    // conduct test
  }
}
```

Don't we need Dependency Injection?

Houston ...



But there is an alternative.



Wiring database.ts

```ts
import { Database } from 'some-orm';

function setUpPostgres(): Database {
  // set up postgres
}

function setUpInMemory(): Database {
  // set up in memory
}

const driver = process.env.DB_DRIVER;
const database = driver === 'postgres'
  ? setUpPostgres()
  : setUpInMemory();

export default database;
```

```ts
import database from '../db';
```

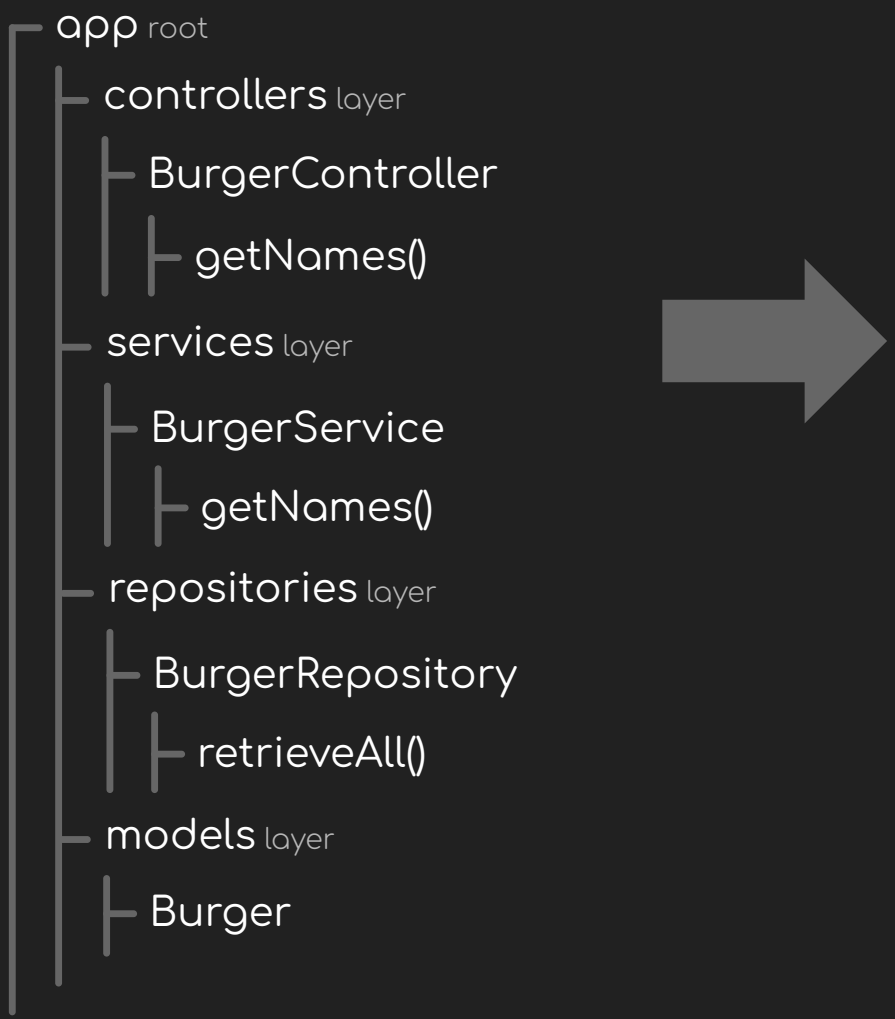
Wiring database.php

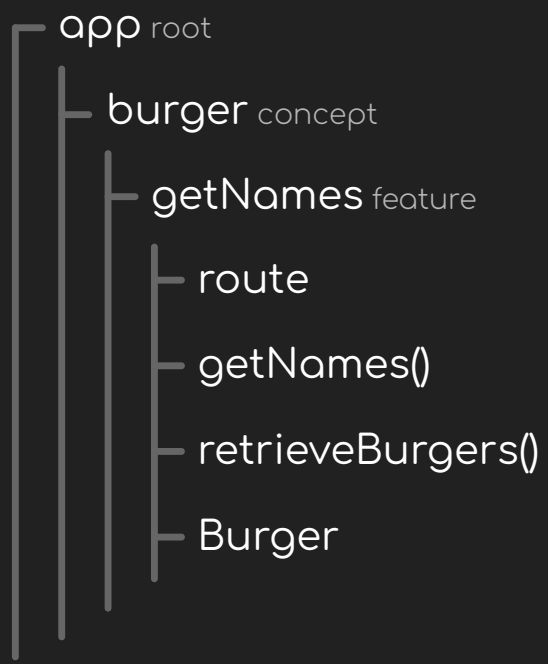
```php
use SomeOrm\Database;

function setUpPostgres(): Database {
  // set up postgres
}

function setUpInMemory(): Database {
  // set up in memory
}

$driver = $_ENV['DB_DRIVER'] ?? null;
$database = $driver === 'postgres'
    ? setUpPostgres()
    : setUpInMemory();

return $database; // avoid global scope
```

```php
$database = require_once '../db.php';
```

Wiring is less flexible than Dependency Injection.

Burger Time!





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Object-Oriented

EXAMPLE

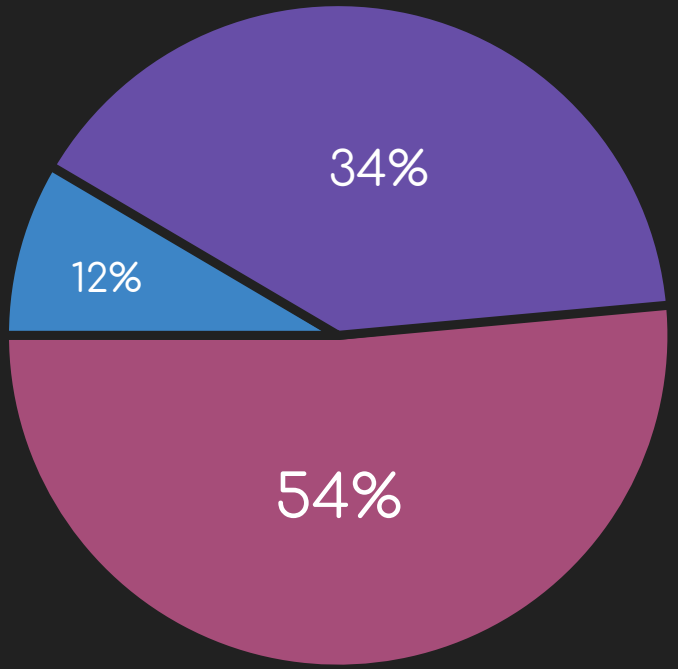
COMIFY

Comic based social media platform.

TS

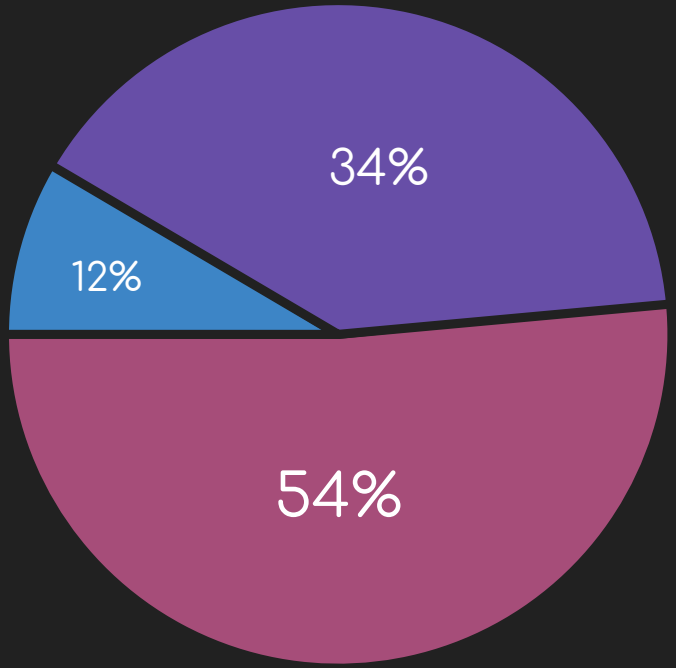
View on GitHub

COMIFY



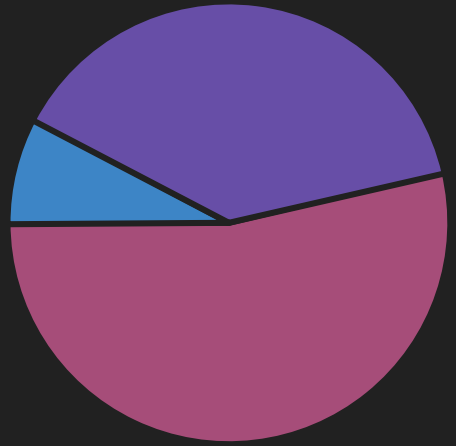
- Object-Oriented
- Procedural
- Imperative

COMIFY



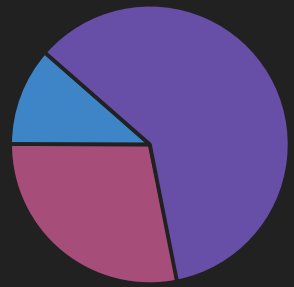
Domain

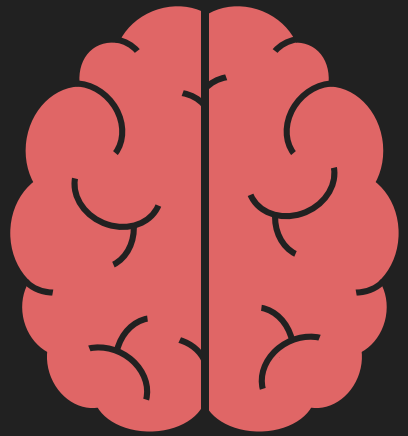
92 features



Integration

11 implementations





Use paradigms
where they fit best.

Thanks!

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