# One year of asynchronous Php in production


Benoit Viguier
@b_viguier

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@b_viguier

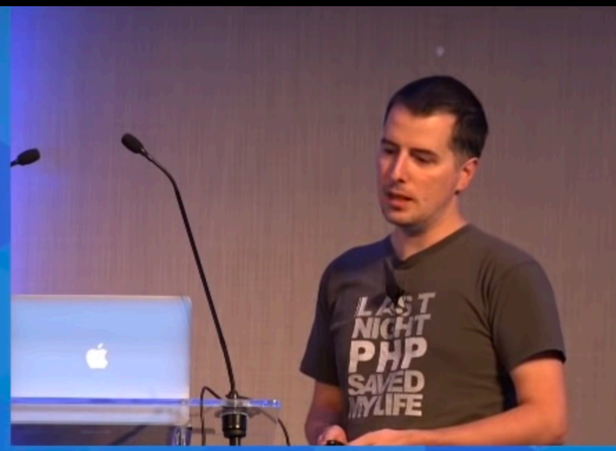
*Previously…*

# Episode I

# Generators for Asynchronous Programming

## User Manual

Benoit Viguier
@b_viguier




FORUMPHP
PARIS2018

# Générateurs et Programmation Asynchrone: Mode d'emploi - Benoit Viguier - Forum PHP 2018

716 vues

22 1 PARTAGER

**AFUP PHP**
Ajoutée le 13 nov. 2018

Plus d'informations sur cette conférence : https://afup.org/talks/2752-generateu...

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PLUS

2 commentaires TRIER PAR

**Seb7876557** il y a 8 mois

J'ai pas compris "le truc" technique, sûrement parce que je manque de connaissance sur les générateurs :/

RÉPONDRE

**SOLenG** il y a 9 mois

vendre du synchrone comme étant de l'asynchrone, c'est pas parce qu'il parle de 'tick' que ça rend le paradigme différent xD

1 RÉPONDRE

**SOLenG** il y a 9 mois

vendre du synchrone comme étant de l'asynchrone, c'est pas parce qu'il parle de 'tick' que ça rend le paradigme différent xD

1 RÉPONDRE

# ASYNCHRONOUS PHP

# IS POSSIBLE


I WANT TO BELIEVE

# *Once Upon a Time...*

## Context


6play
W9
M6
6ter

# 6play Family

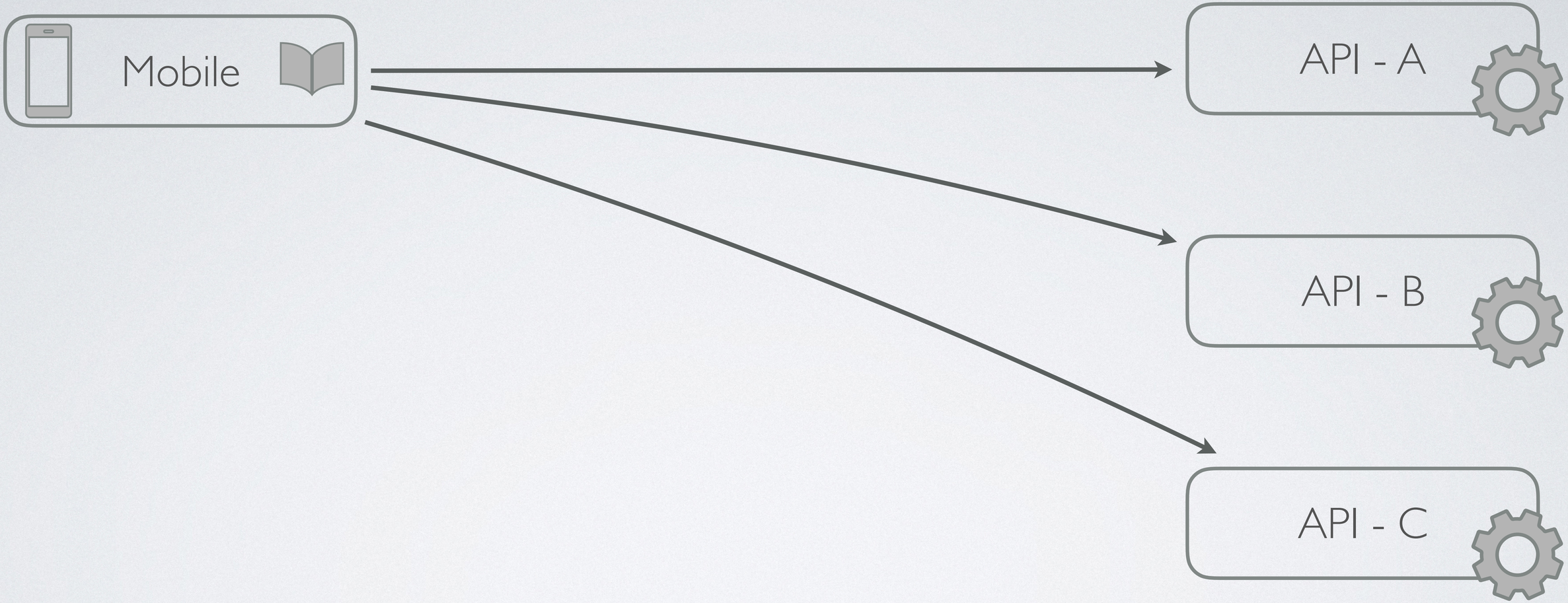



Benoit Viguier
Backend
Lead Developer

API - A

API - B

API - C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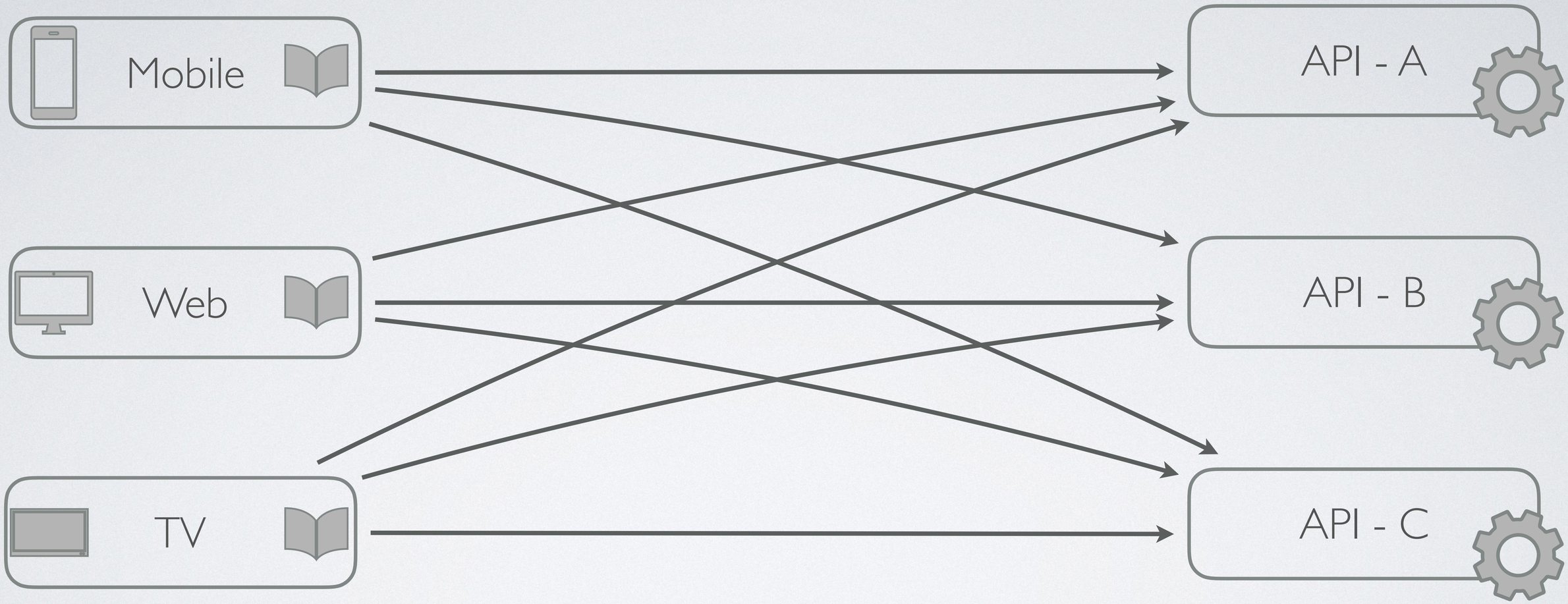
API - A
API - B
API - C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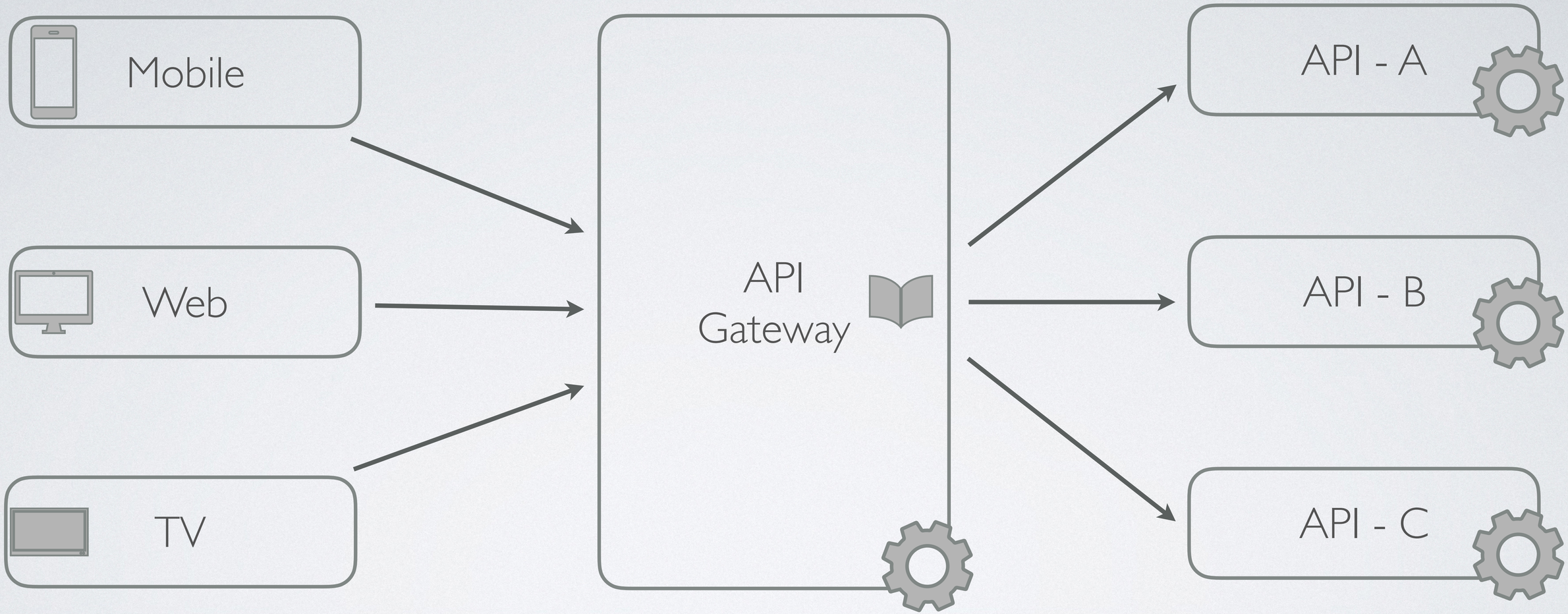
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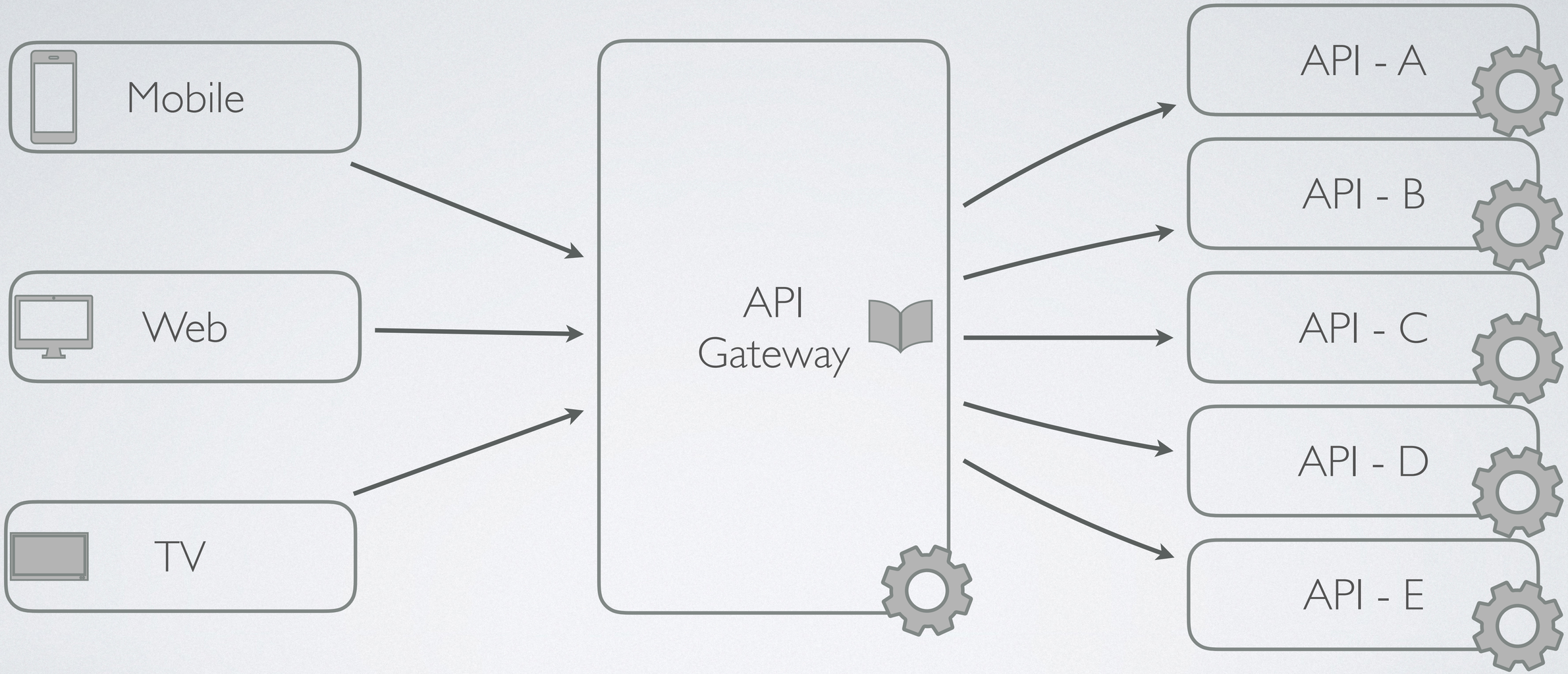
Mobile
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Gateway
API - A
API - B
API - C
API - D
API - E

*Chapter 1*

# Technical overview

Let's send *some* HTTP requests!

# Synchronous

```php
function foo1(ClientInterface $client, RequestInterface ...$requests)
{
    $entities = [];
    foreach ($requests as $request) {
        $response = $client->sendRequest($request);

        $jsonArray = json_decode(
            (string) $response->getBody(), true
        );

        $entities[] = Entity::fromArray($jsonArray);
    }
}
```

# Synchronous

```php
function foo1(ClientInterface $client, RequestInterface ...$requests)
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        $jsonArray = json_decode(
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        $entities[] = Entity::fromArray($jsonArray);
    }
}
```
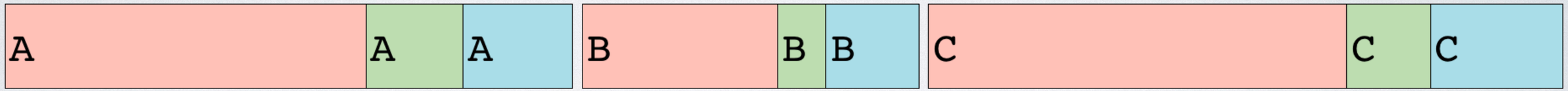

HTTP request

Parsing

Business logic

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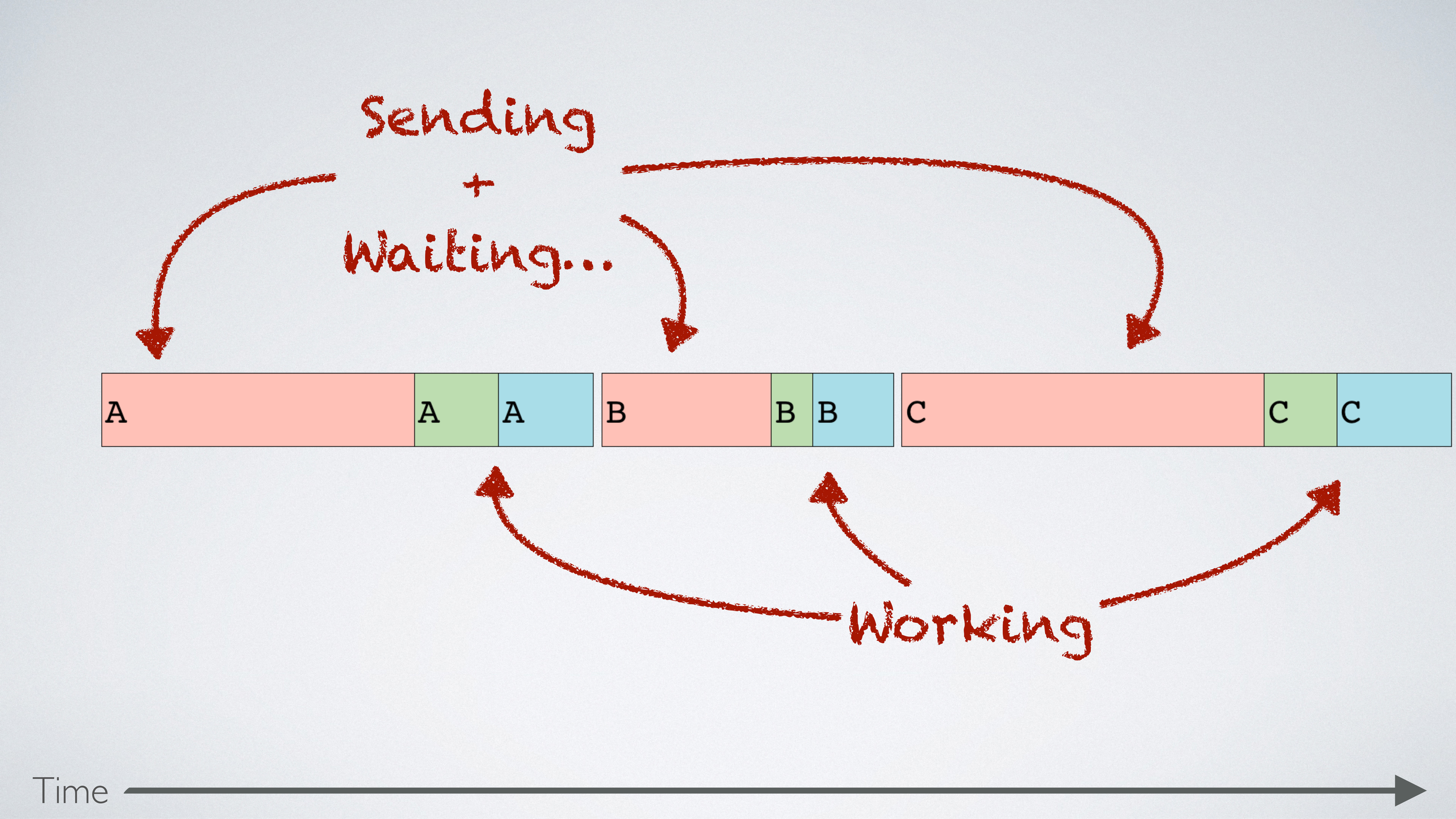
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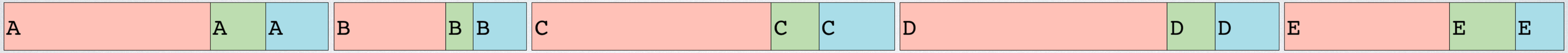
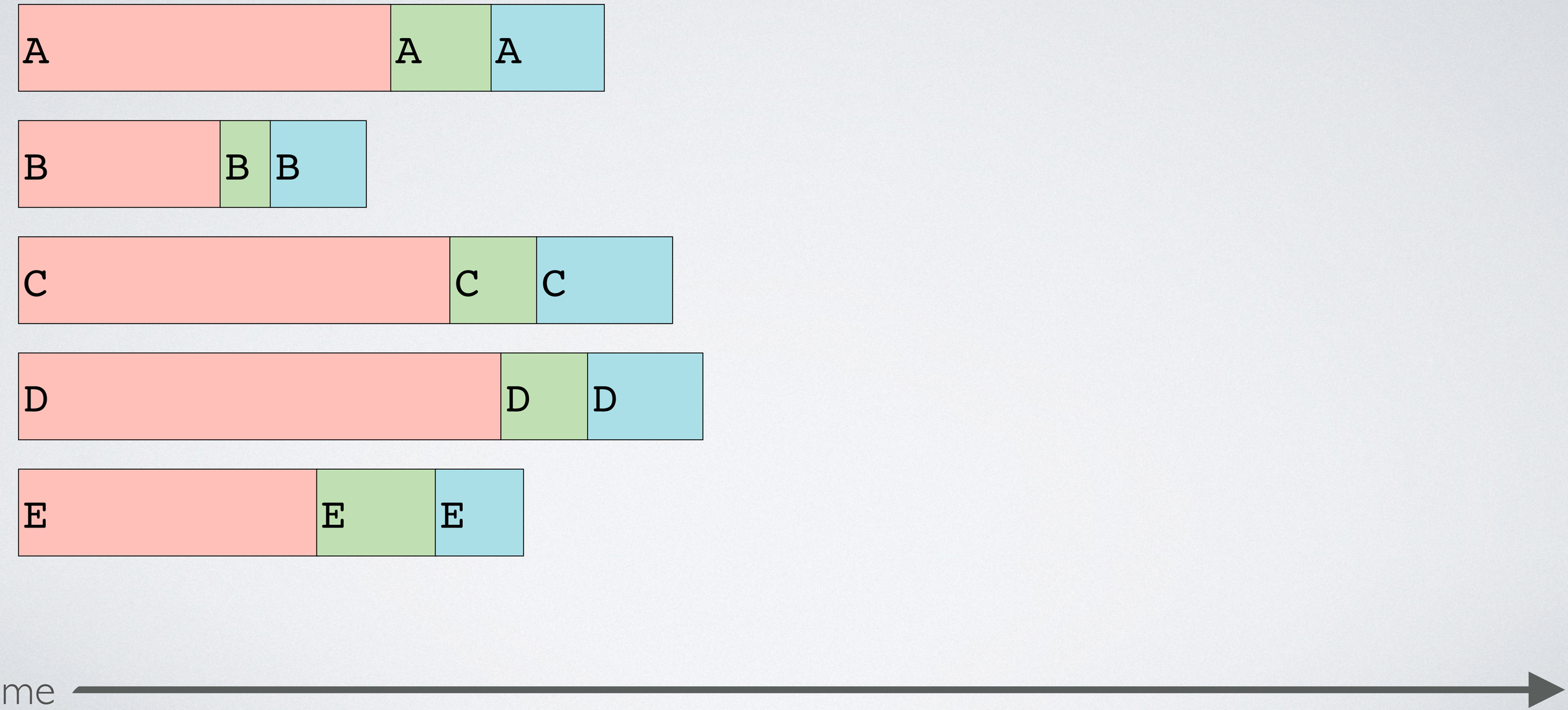



Time

# What about concurrency ?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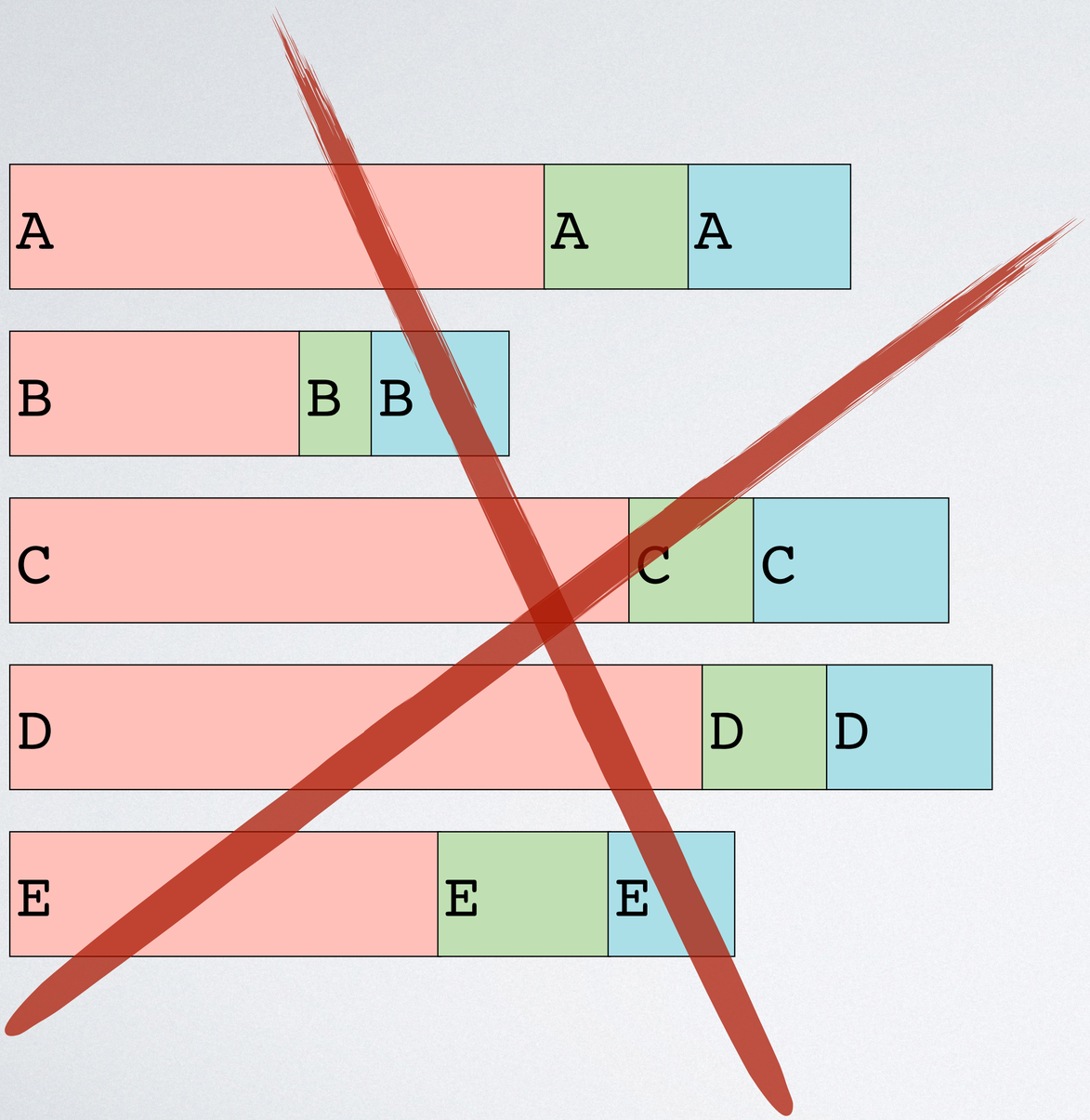


# 🚫 Php is Single-Threaded

# Asynchronous HTTP calls

## Thanks to Guzzle

# Asynchronous way

```php
function foo2(\GuzzleHttp\Client $client, RequestInterface ...$requests)
{
    $promises = [];
    foreach ($requests as $request) {
        $promises[] = $client->sendAsync($request);
    }

    $entities = [];
    foreach (\GuzzleHttp\Promise\unwrap($promises) as $response) {
        $jsonArray = json_decode(
            (string) $response->getBody(), true
        );

        $entities[] = Entity::fromArray($jsonArray);
    }
}
```

# Asynchronous way

```php
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            (string) $response->getBody(), true
        );

        $entities[] = Entity::fromArray($jsonArray);
    }
}
```

Sending

# Asynchronous way

```php
function foo2(\GuzzleHttp\Client $client, RequestInterface ...$requests)
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        );

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}
```

Waiting...

# Asynchronous way

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        $promises[] = $client->sendAsync($request);
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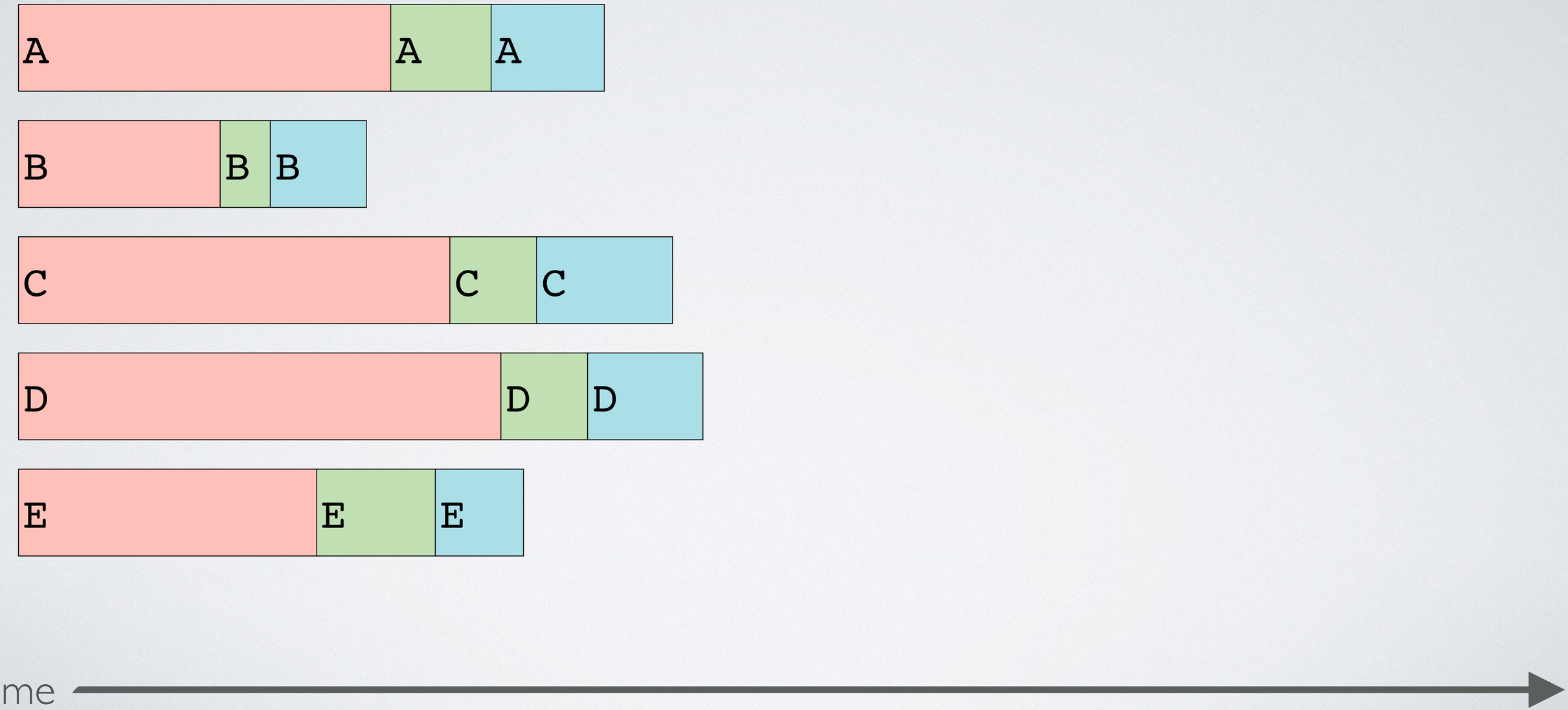
        $jsonArray = json_decode(
            (string) $response->getBody(), true
        );

        $entities[] = Entity::fromArray($jsonArray);
    }
}
```

Working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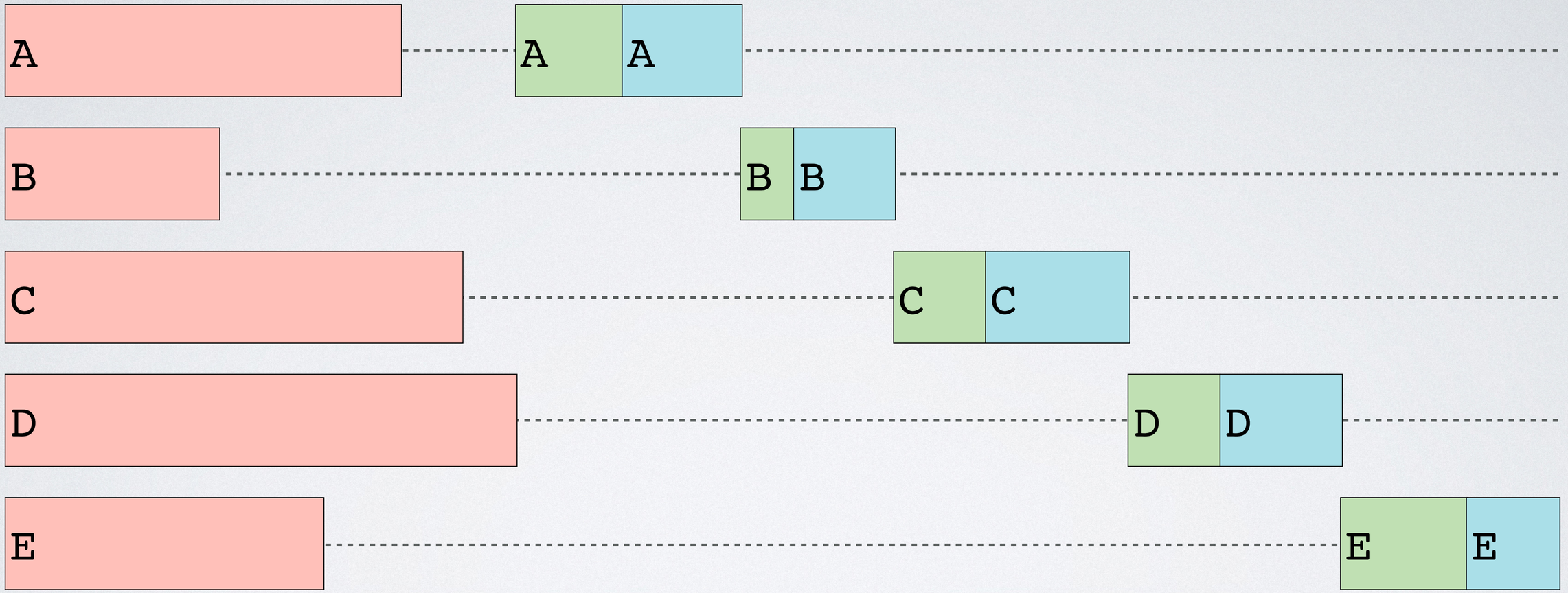
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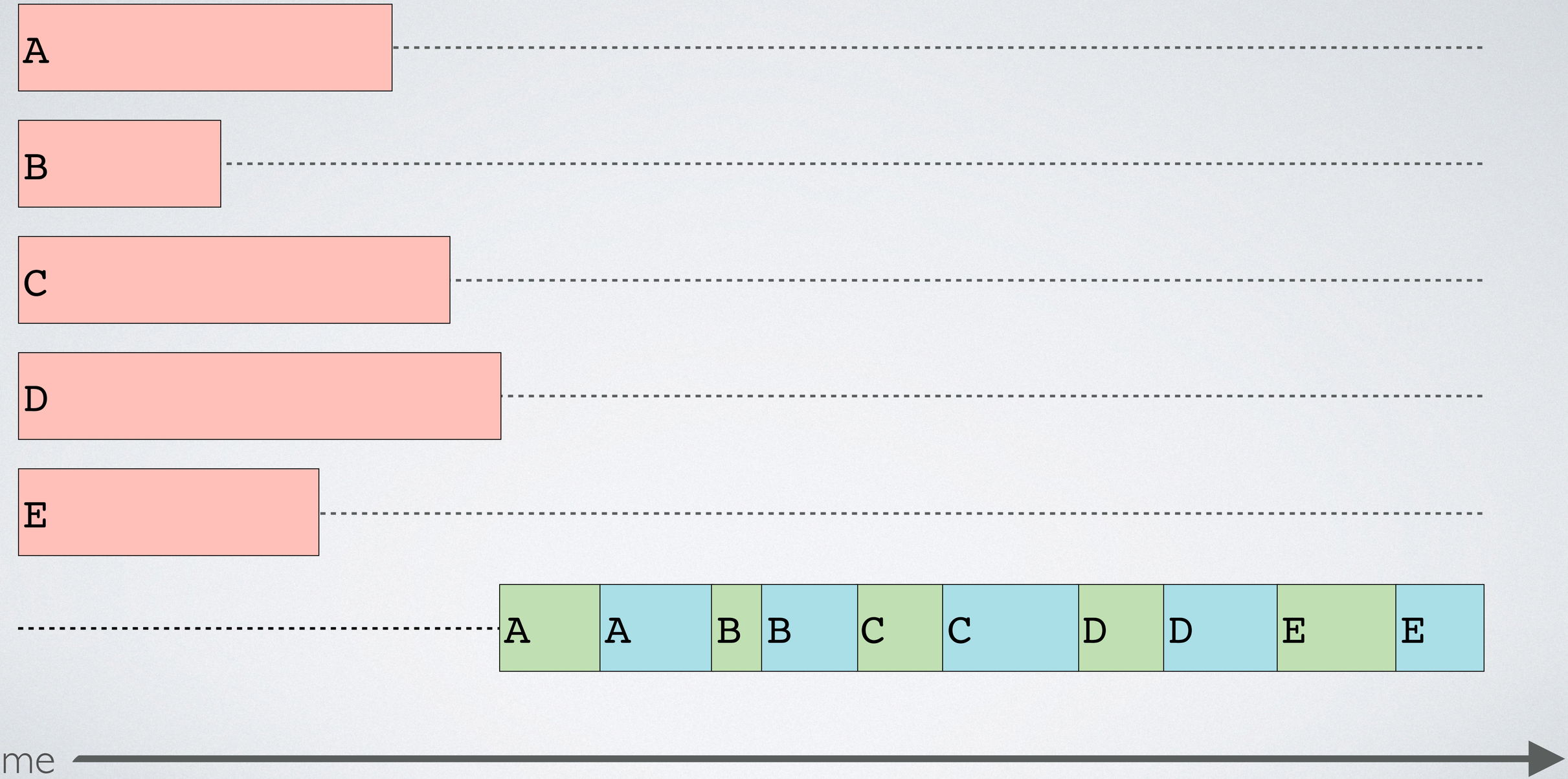
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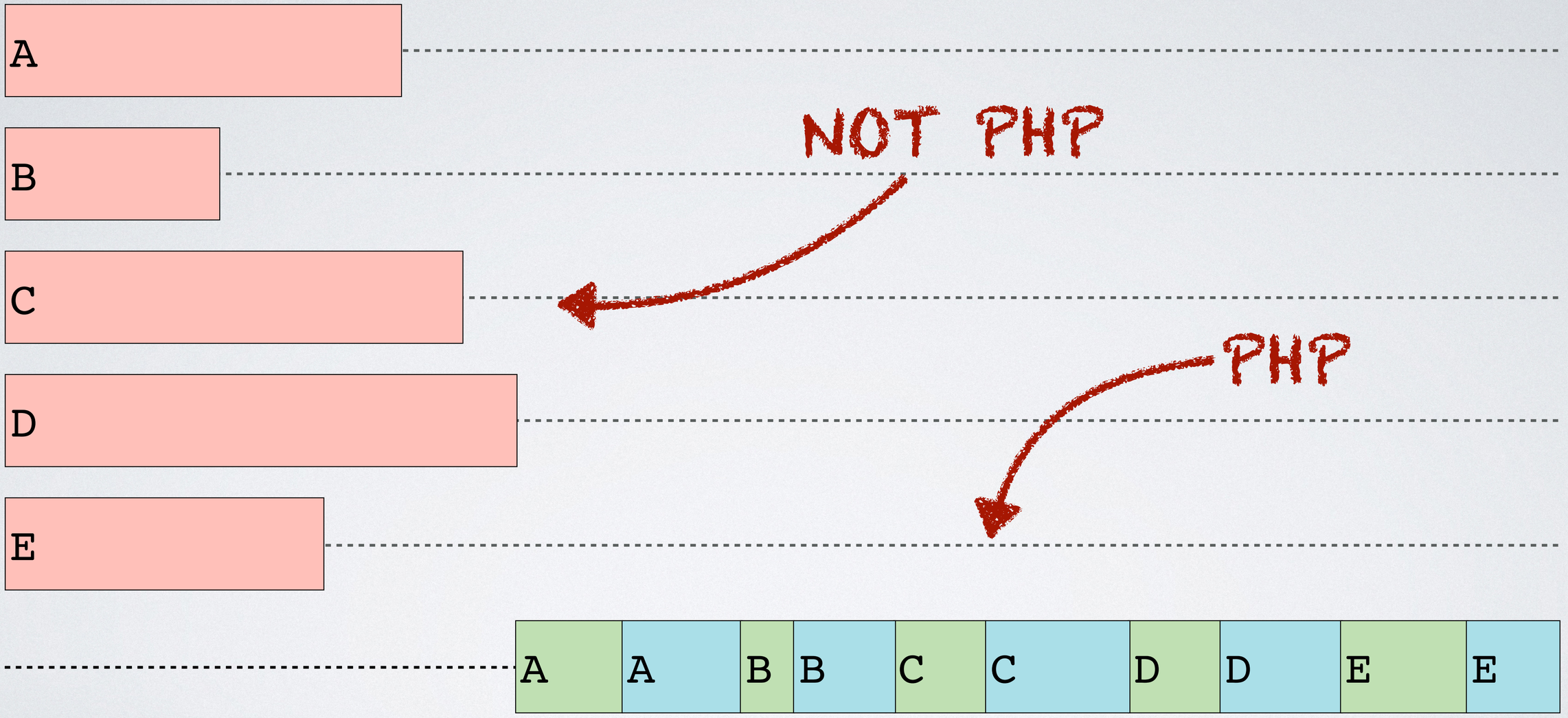
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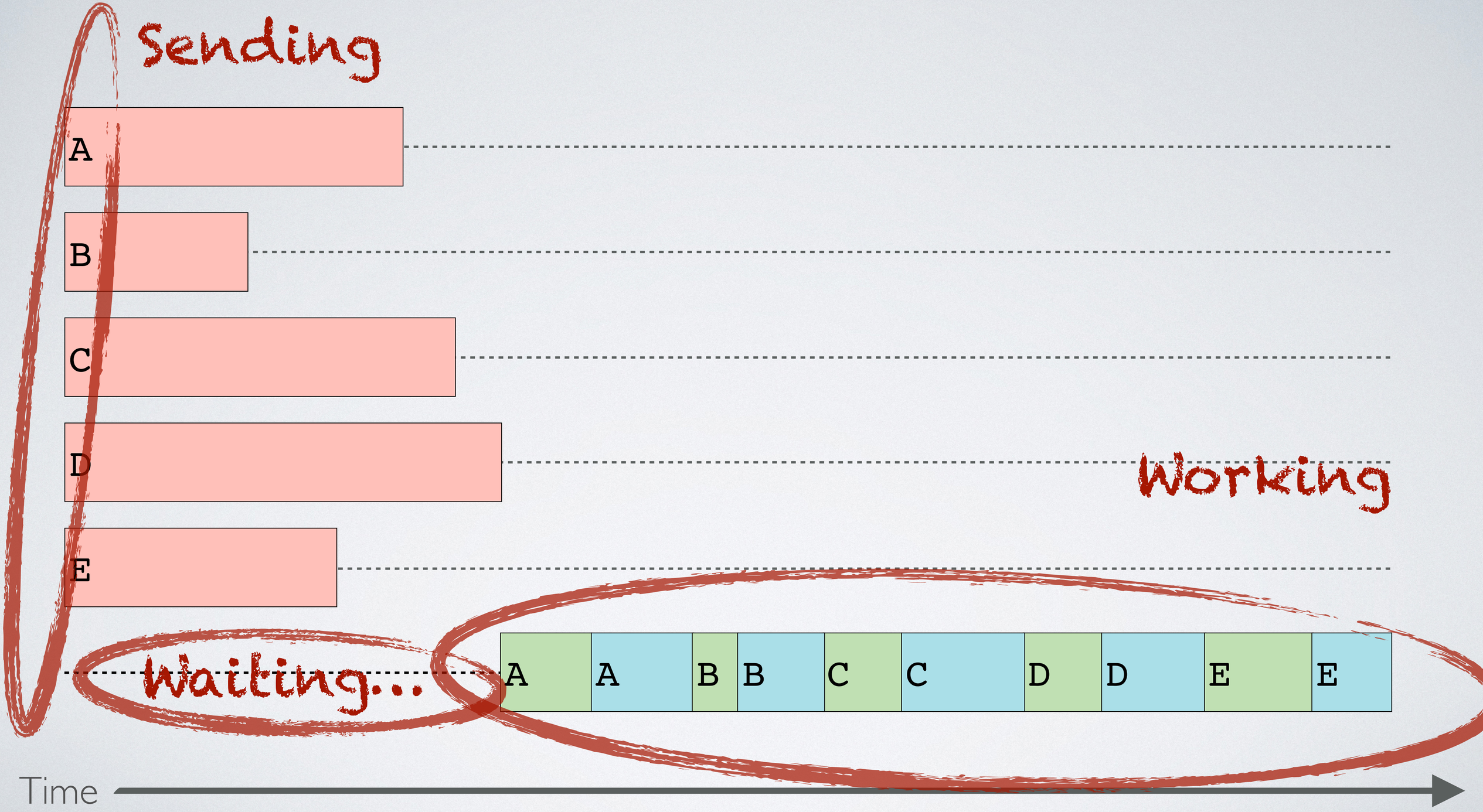
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Working
Waiting...
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Time

# We can do even better!

# Promises

```
function foo3(\GuzzleHttp\Client $client, RequestInterface ...$requests)
{
    $promises = [];
    foreach ($requests as $request) {
        $promises[] = $client->sendAsync($request)->then(
            function (ResponseInterface $response) {
                $jsonArray = json_decode(
                    (string) $response->getBody(), true
                );

                return Entity::fromArray($jsonArray);
            }
        );
    }

    $entities = \GuzzleHttp\Promise\unwrap($promises);
```

# Promises

```
function foo3(\GuzzleHttp\Client $client, RequestInterface ...$requests)
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                );

                return Entity::fromArray($jsonArray);
            }
        );
    }

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```

Sending

# Promises

```php
function foo3(\GuzzleHttp\Client $client, RequestInterface ...$requests)
{
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                );

                return Entity::fromArray($jsonArray);
            }
        );
    }

    $entities = \GuzzleHttp\Promise\unwrap($promises);
```

Waiting
1 Request...

# Promises

```
function foo3(\GuzzleHttp\Client $client, RequestInterface ...$requests)
{
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            }
        );
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```

Working

# Promises

```
function foo3(\GuzzleHttp\Client $client, RequestInterface ...$requests)
{
    $promises = [];
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                );

                return Entity::fromArray($jsonArray);
            }
        );
    }

    $entities = \GuzzleHttp\Promise\unwrap($promises);
```
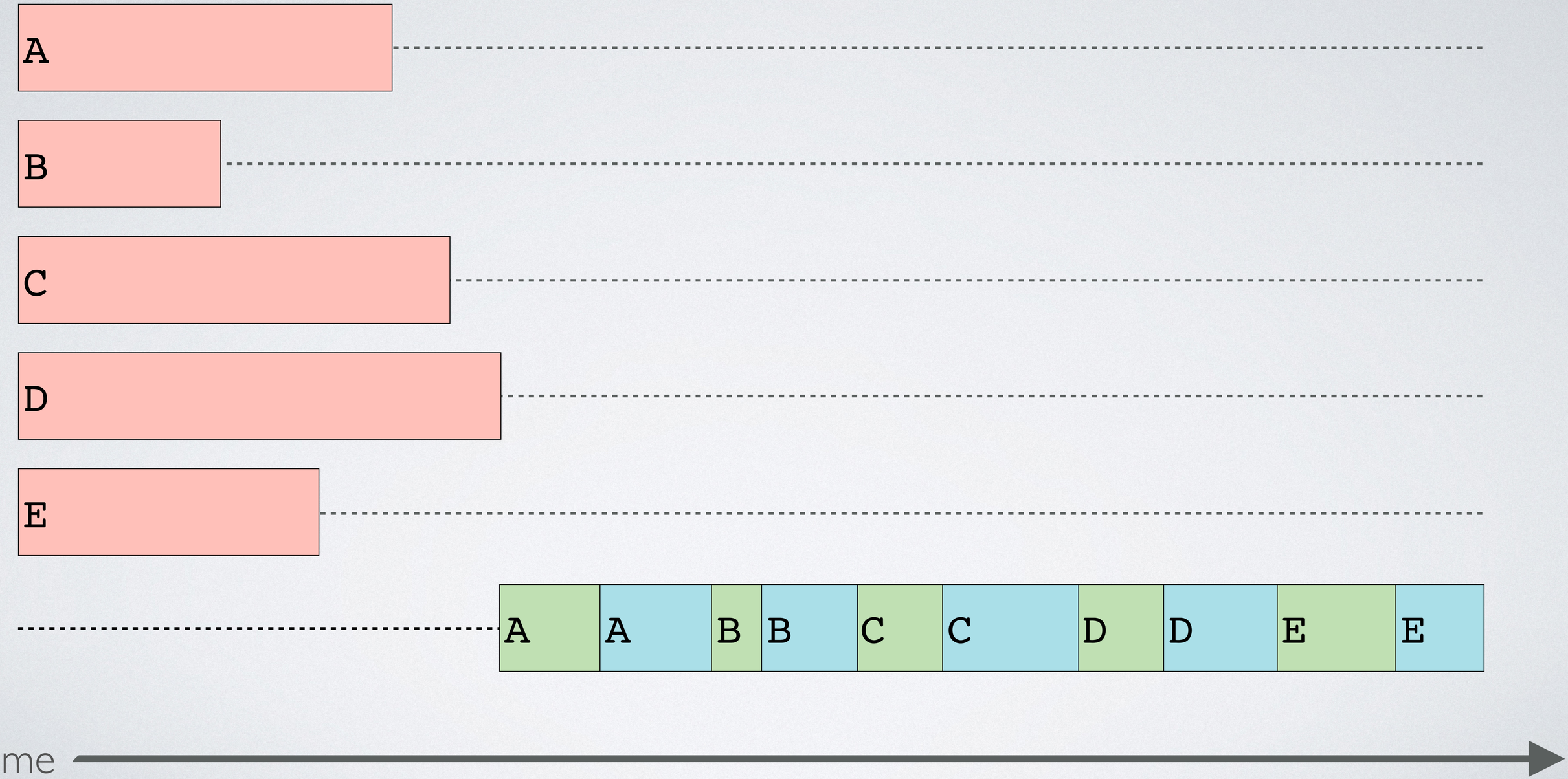

Waiting all the jobs...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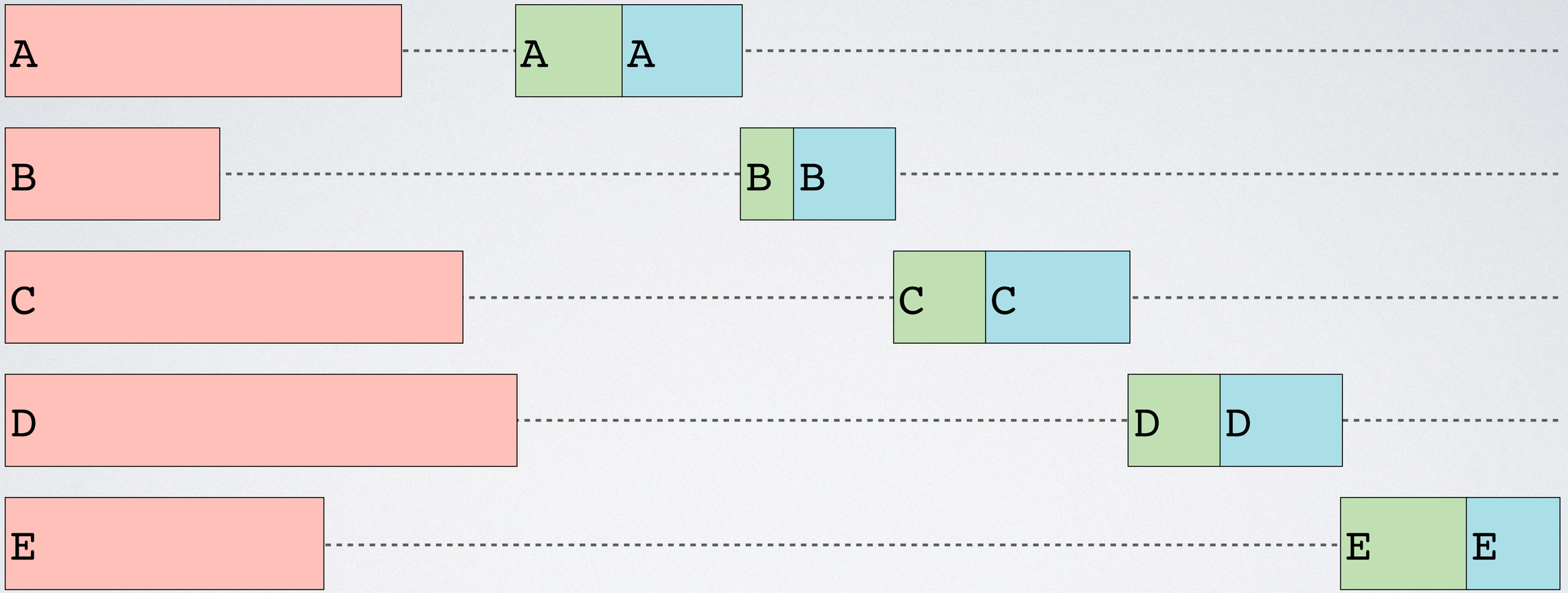
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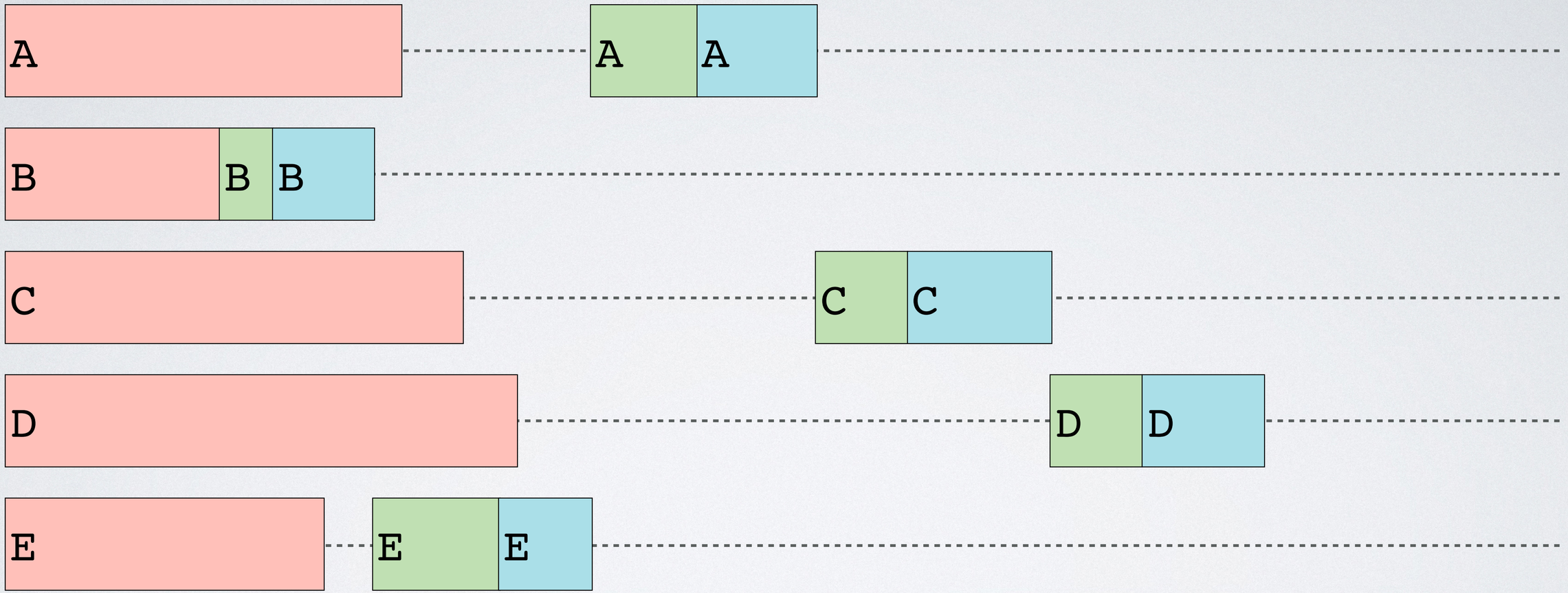
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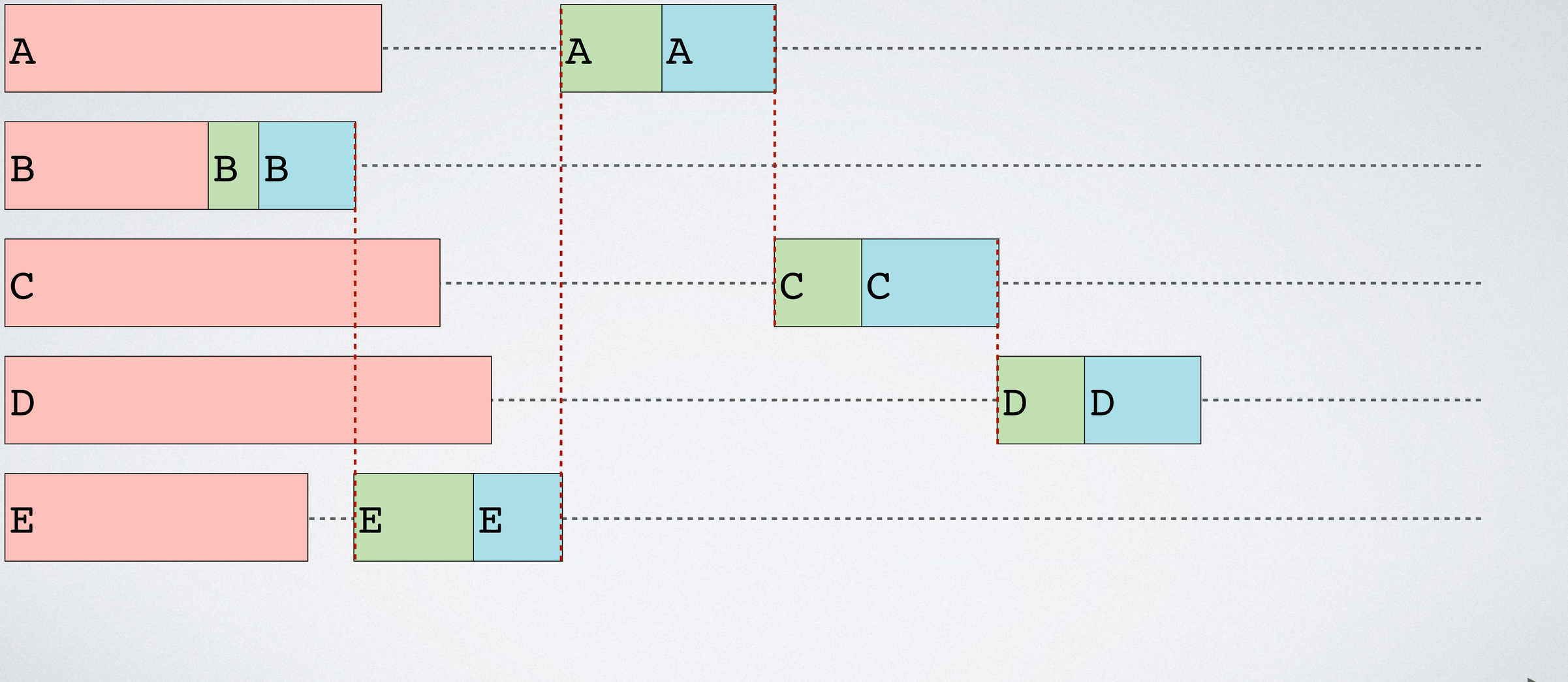
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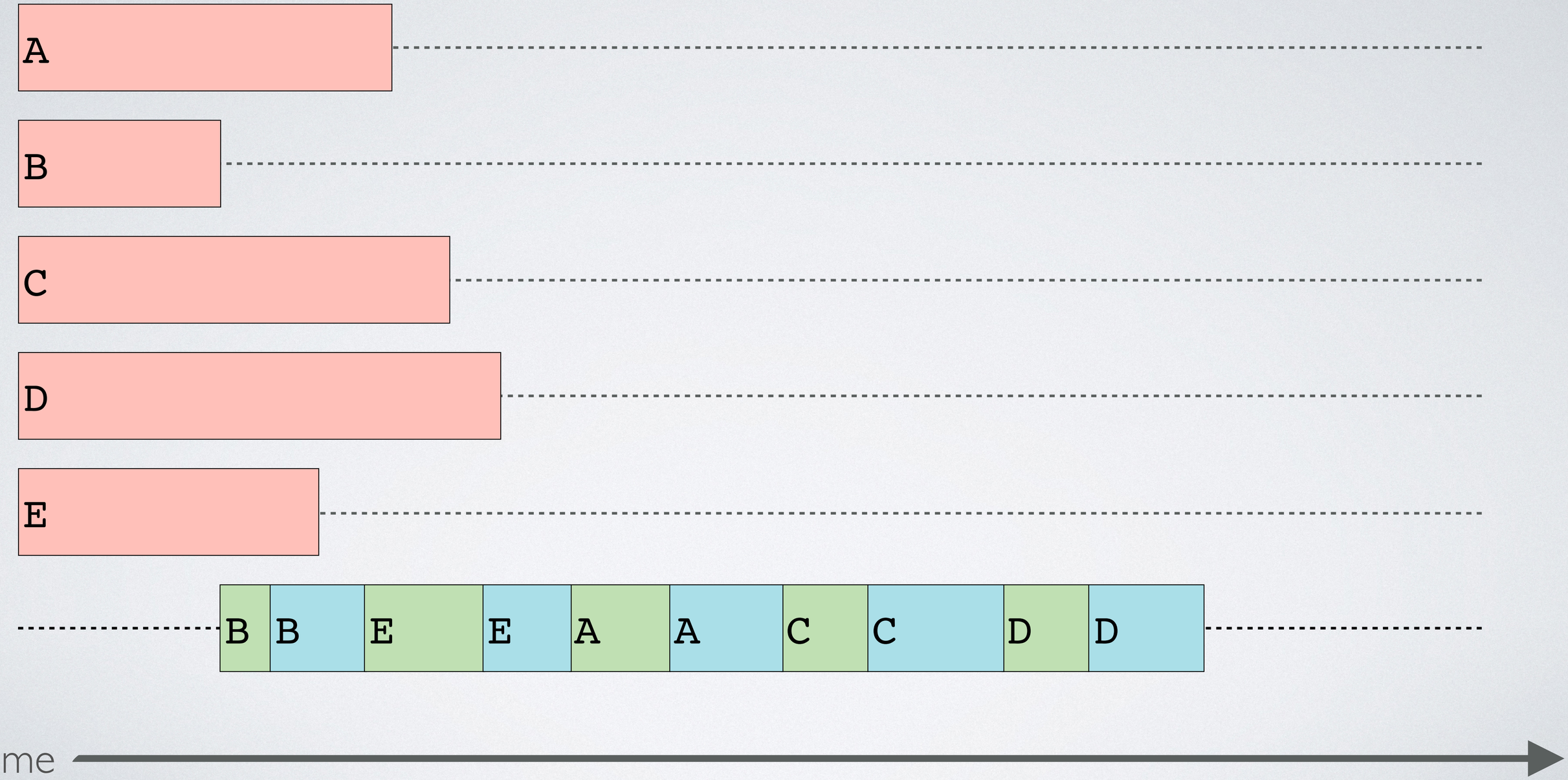
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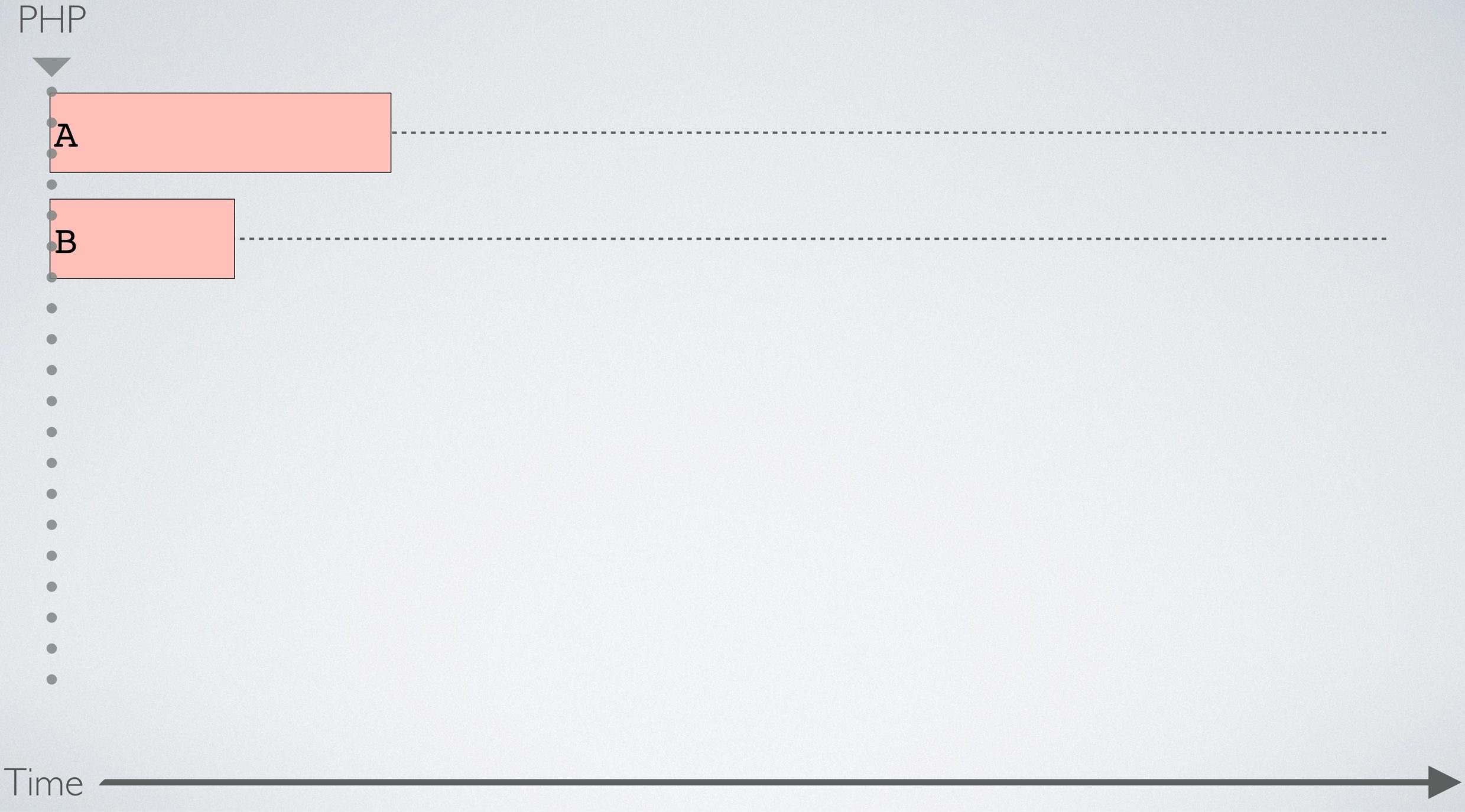
ASYNCHRONOUS PROGRAMMING
SPACE RANGER
LIGHTYEAR
EVERYWHERE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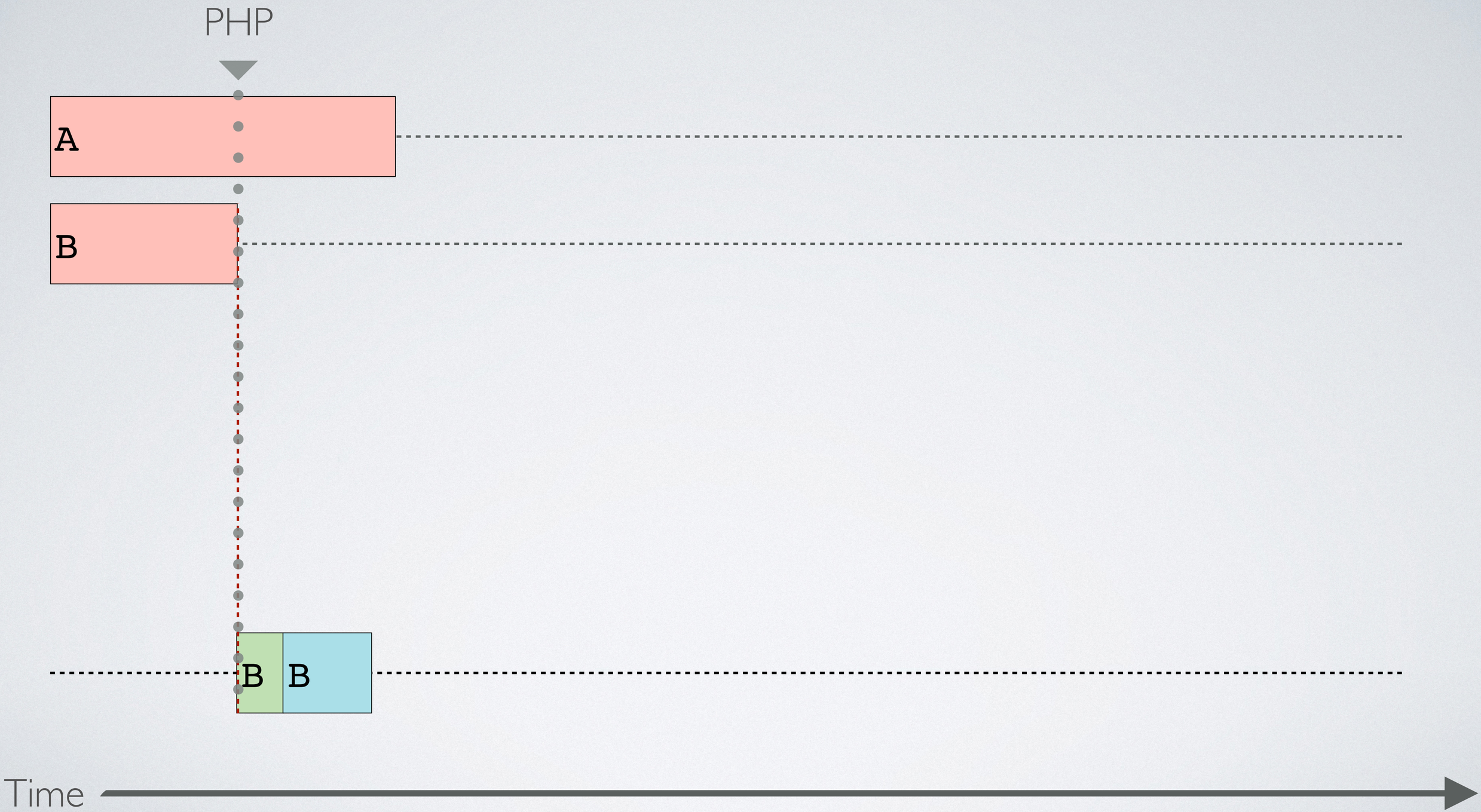
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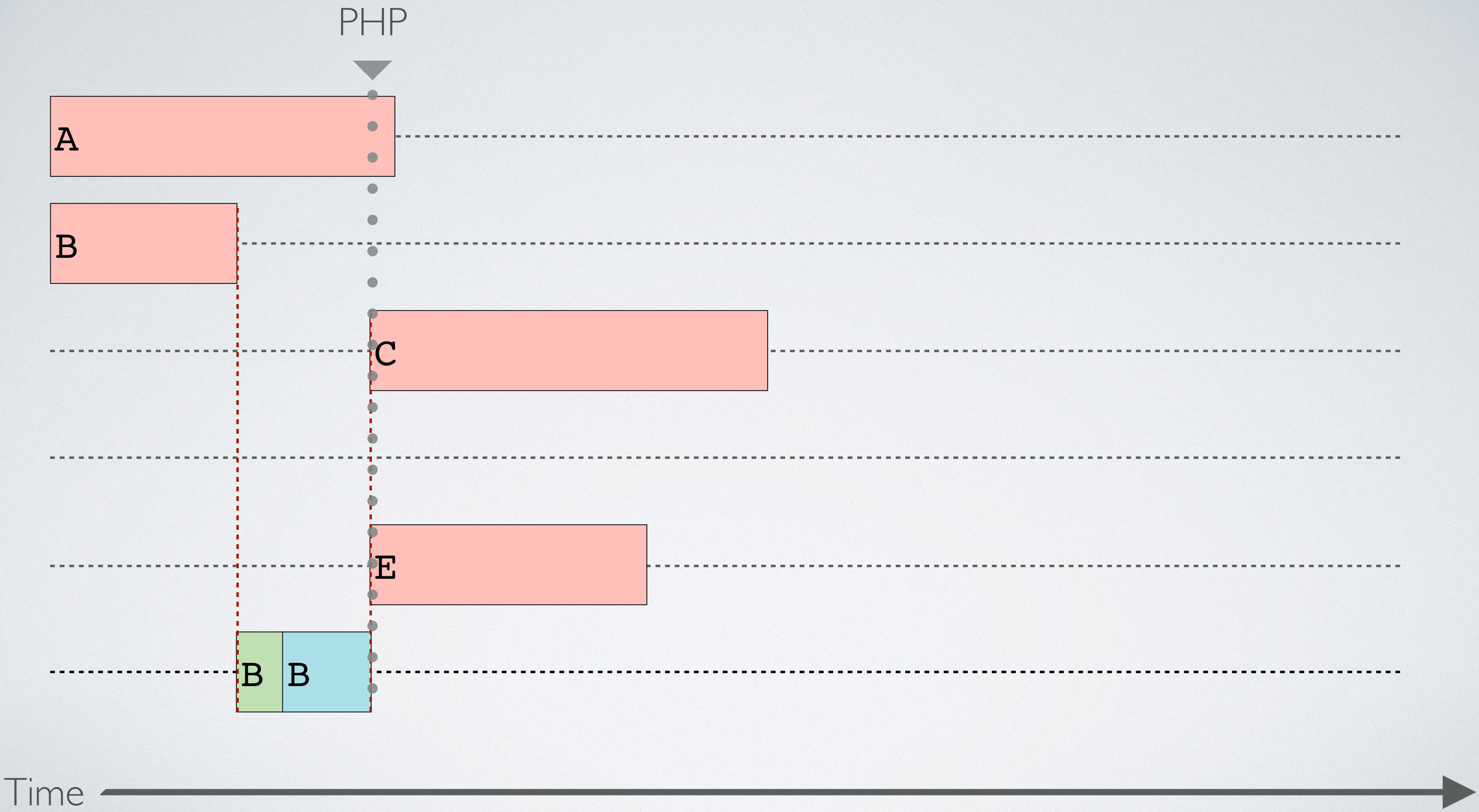
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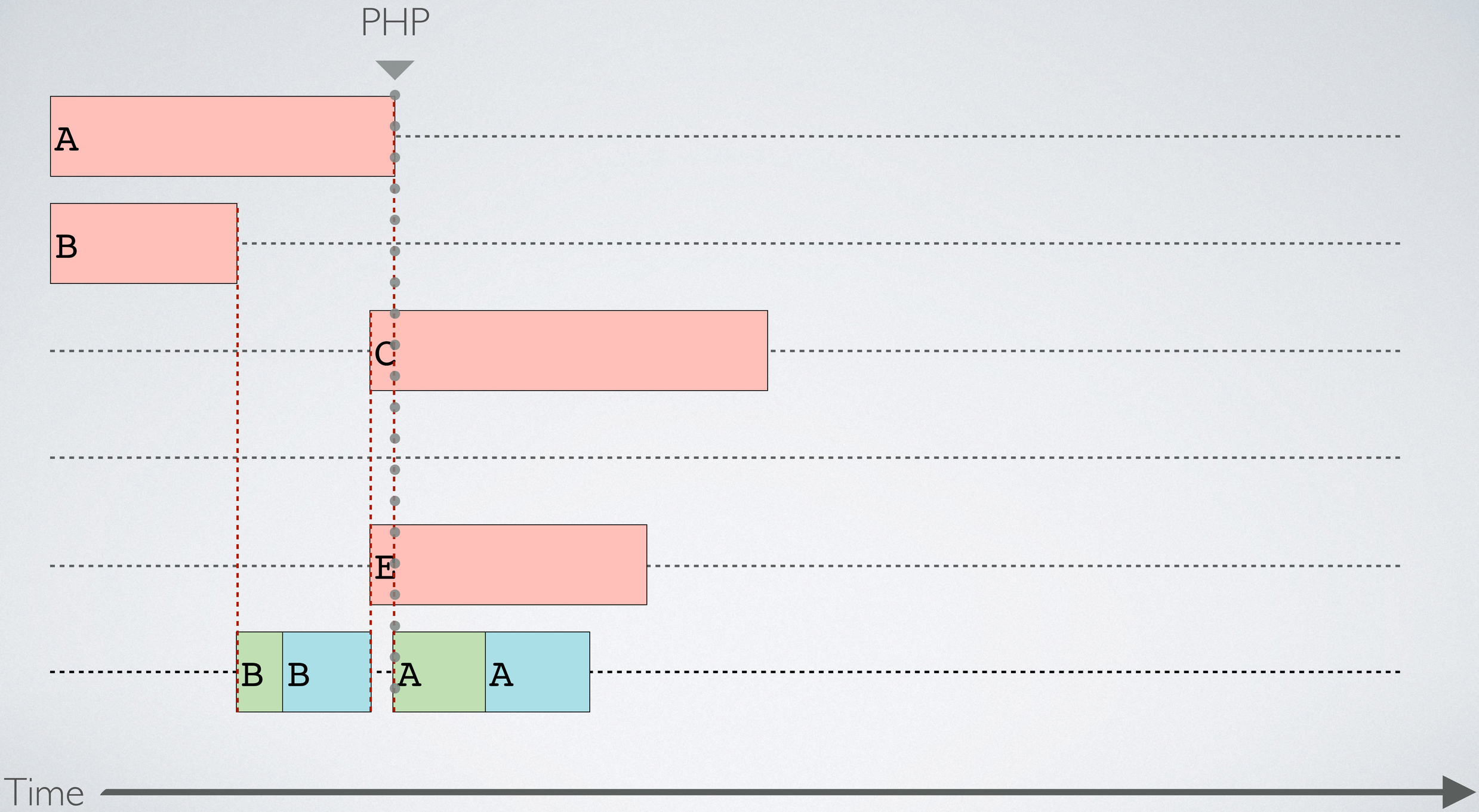
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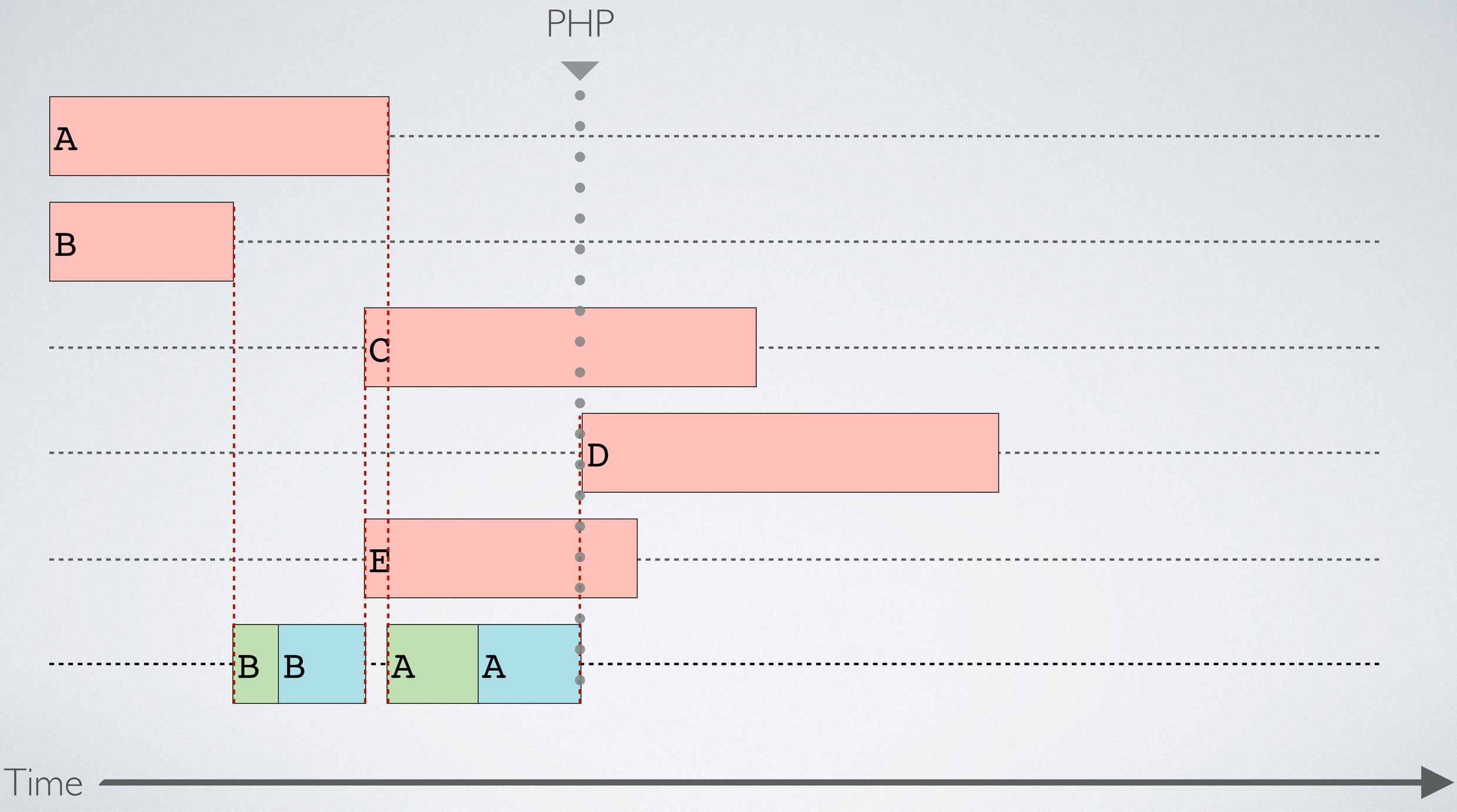
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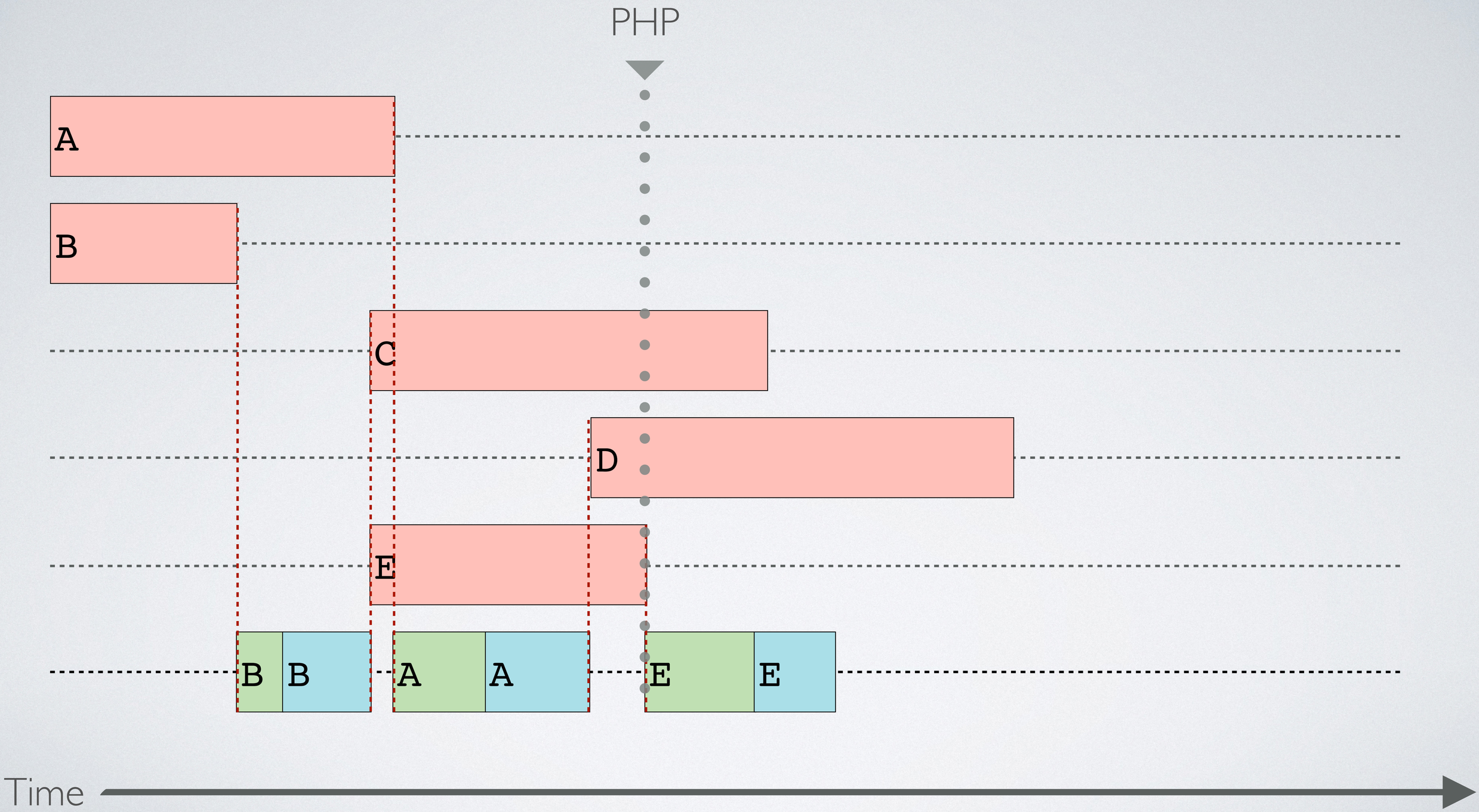
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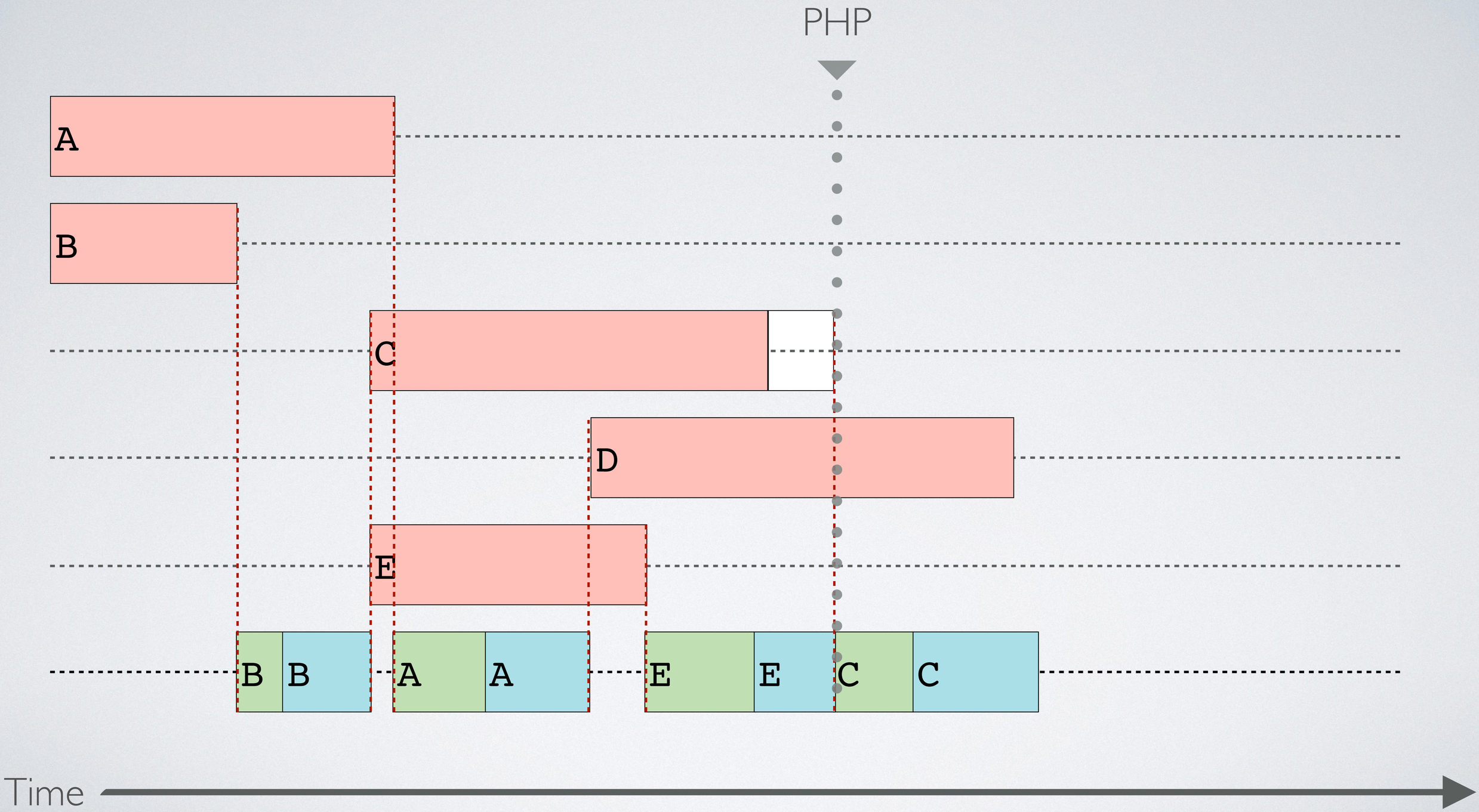
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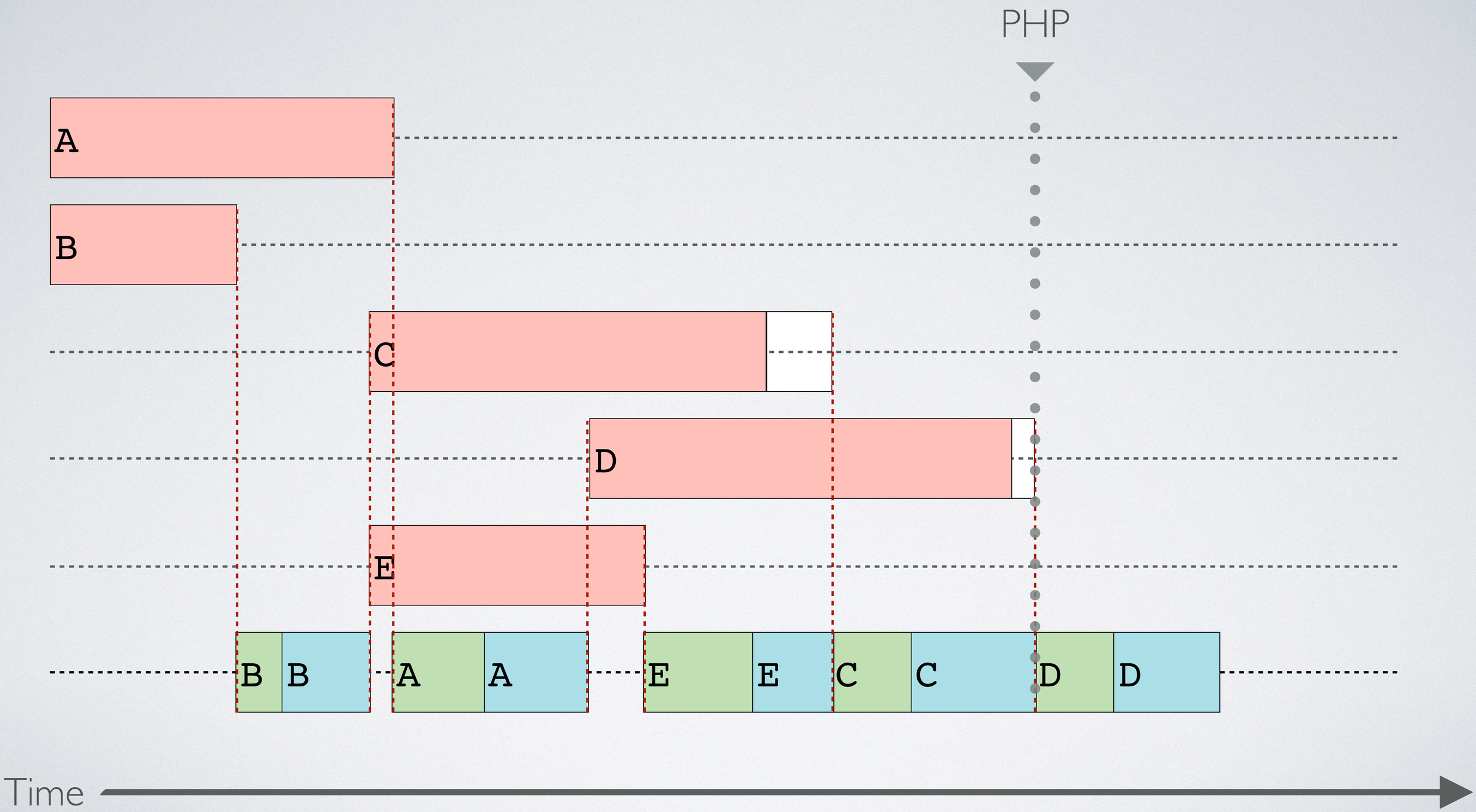
PHP
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Time

Asynchronous programming goal is to reduce **useless wait**.

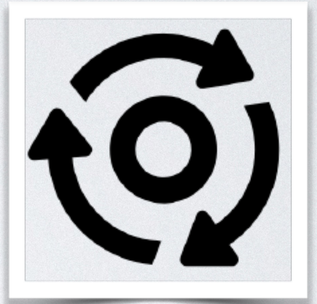
# Which framework can I use?

Kraken

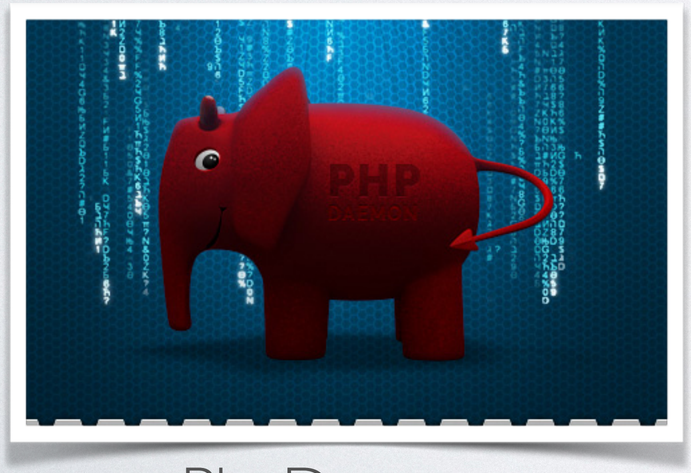
icicle.io

swoole


Amp



Recoil




PhpDaemon

Guzzle


Amp

# Extensions

- ext-event
- ext-ev
- ext-uv
- ext-libevent
- ext-libev


SO MANY CHOICES

# Promises

```php
echo 'A';
$promise = asyncFunction();

$promise->then(function () {
    echo 'B';

    return asyncFunction();

})->then(function () {
    echo 'C';
});
```

# *Thenable*

# *Yieldable*

```php
echo 'A';
$promise = asyncFunction();
yield $promise;

echo 'B';

yield asyncFunction();

echo 'C';
```

```php
echo 'A';
$promise = asyncFunction();

$promise->then(function () {
    echo 'B';

    return asyncFunction();

})->then(function () {
    echo 'C';
});
```

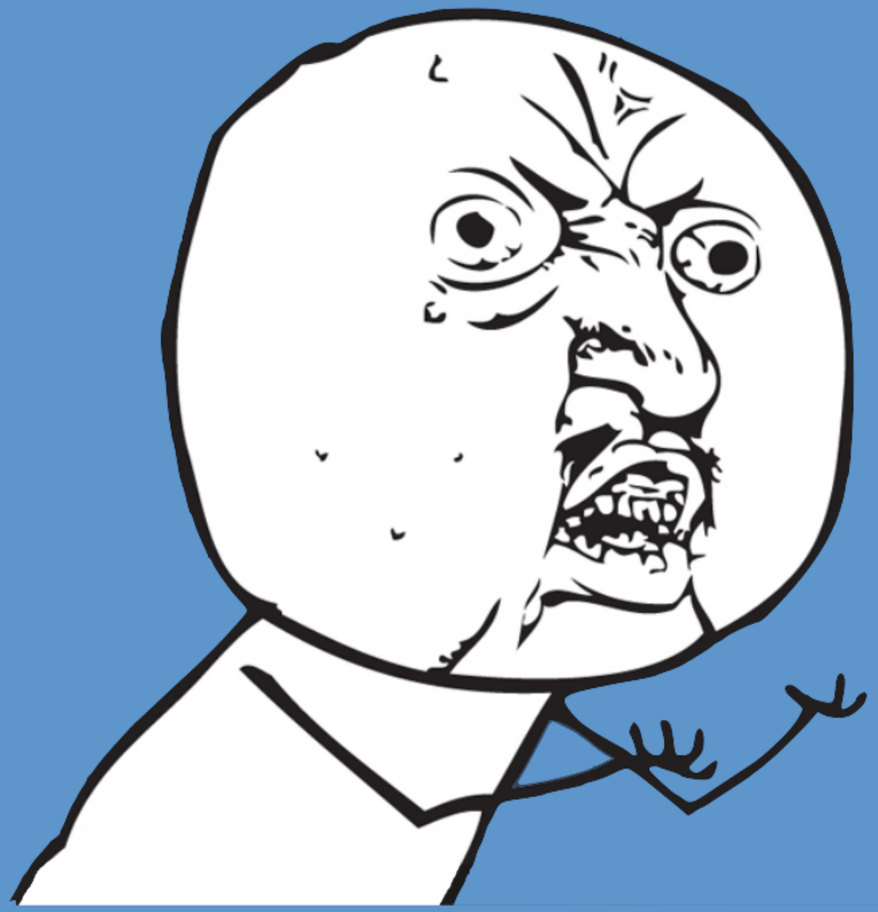
```php
echo 'A';
$promise = asyncFunction();
yield $promise;

echo 'B';

yield asyncFunction();

echo 'C';
```

To asynchronously *wait* a **promise**'s value, `yield` it.

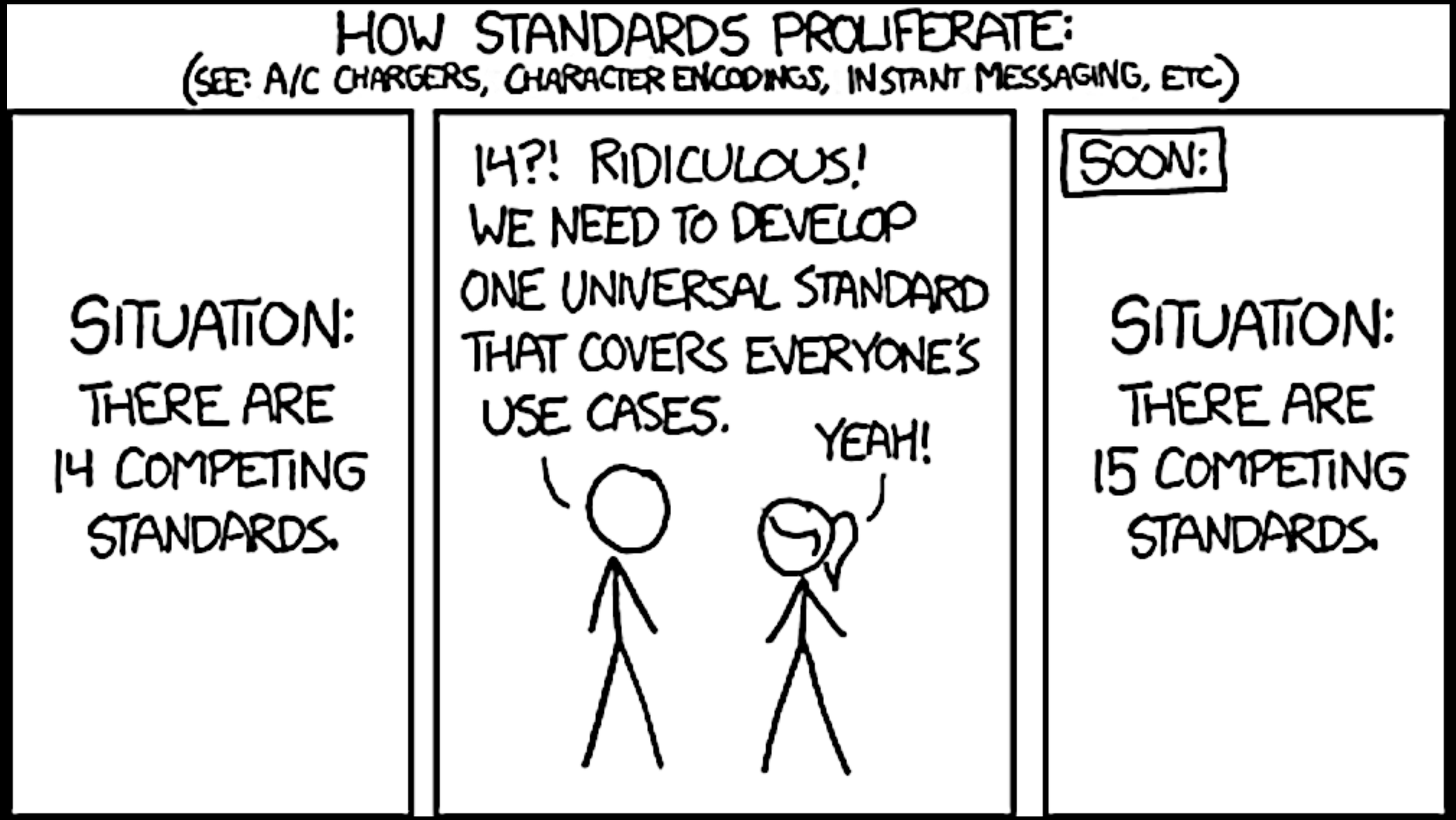


# ASYNCHRONOUS PROGRAMMING SHOULD BE A DETAIL OF IMPLEMENTATION

A synchronous program is **different** from an asynchronous one

# What about a standard?


IT’S COMPLICATED




https://xkcd.com/927/

# Tornado

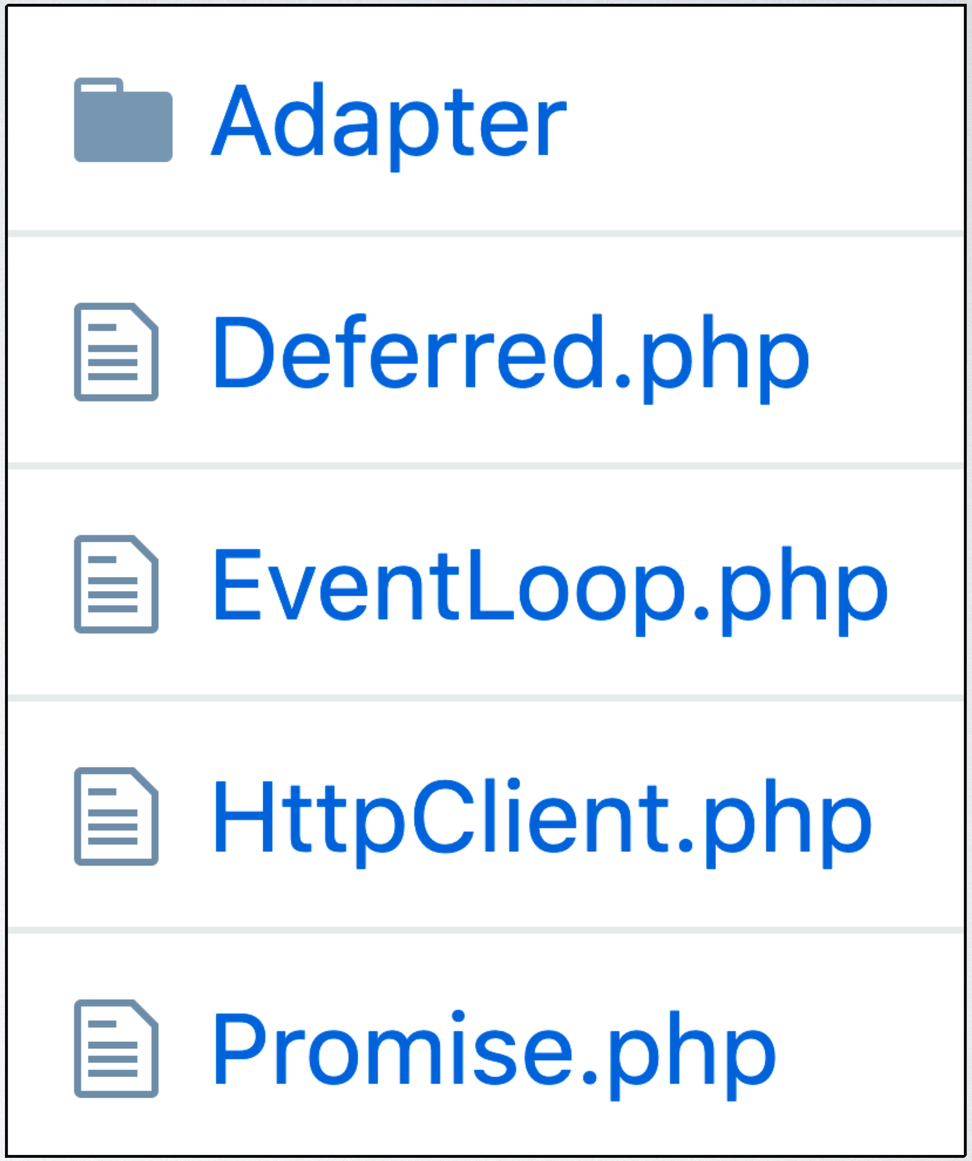
https://github.com/M6Web/Tornado

```
composer require m6web/tornado
```

Generators Inside

# Interfaces

## Weak coupling



# Must we run the HTTP Server in PHP?

# ReactPhp Example

```php
$loop = React\EventLoop\Factory::create();

$server = new React\Http\Server(function (ServerRequestInterface $request) {
    return new React\Http\Response(
        200,
        array('Content-Type' => 'text/plain'),
        "Hello World!\n"
    );
});

$socket = new React\Socket\Server(8080, $loop);
$server->listen($socket);

echo "Server running at http://127.0.0.1:8080\n";

$loop->run();
```

# Long Running Process

⚠️ Memory

⚠️ What if it crashes?

⚠️ Is your stack ready for that?

Asynchronous programing does **not** require to run a Php **Http Server**

# « Local » Event Loop

```php
function myController(RequestInterface $request)
{
    // Choose your adapter.
    $eventLoop = new Adapter\Amp\EventLoop();
    // $eventLoop = new Adapter\ReactPhp\EventLoop(
    //     new React\EventLoop\StreamSelectLoop()
    // );
    // $eventLoop = new Adapter\Tornado\EventLoop();
    // $eventLoop = new Adapter\Tornado\SynchronousEventLoop();

    $response = $eventLoop->wait(
        myAsynchronousFunction($request)
    );
}
```

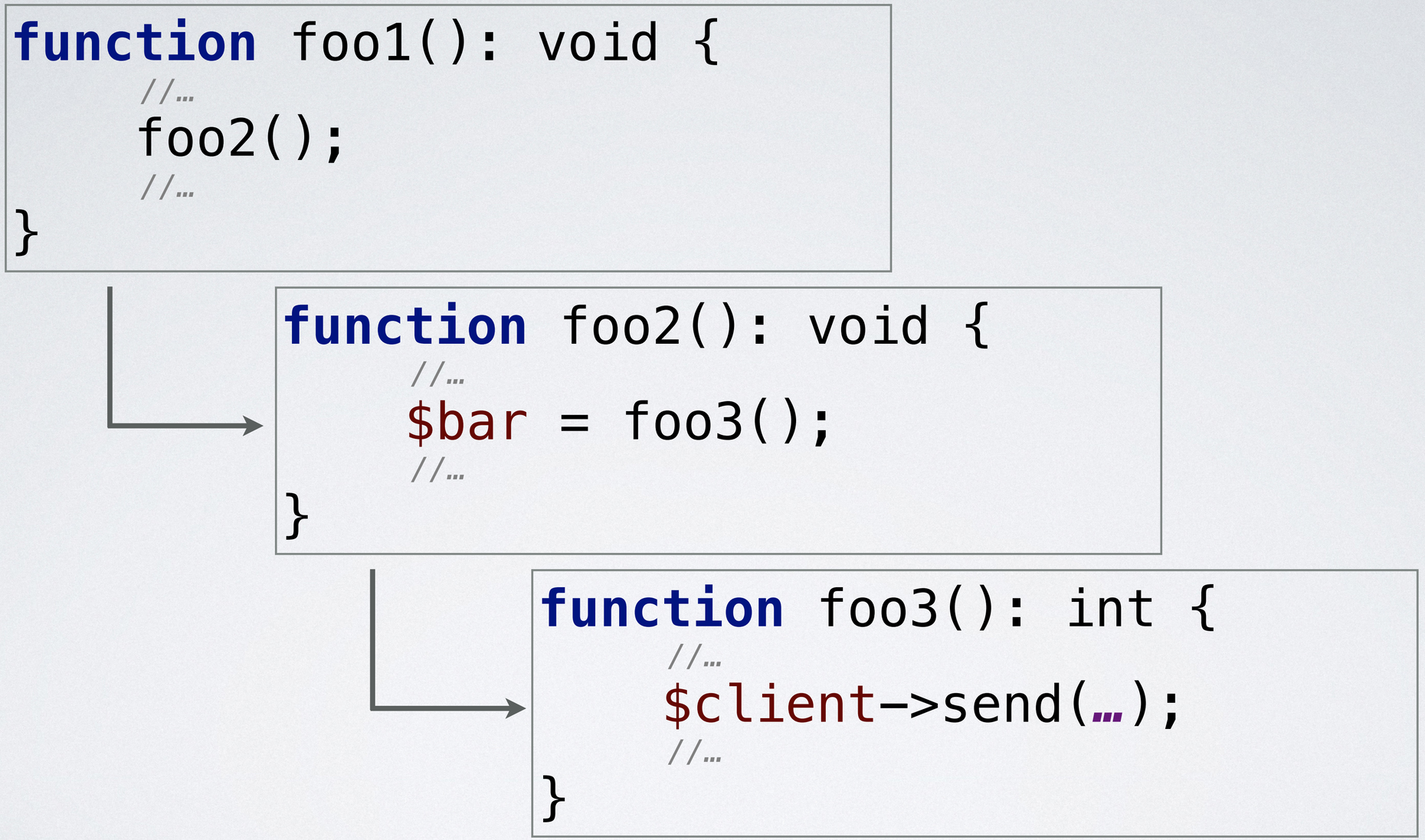
# Technical Decisions

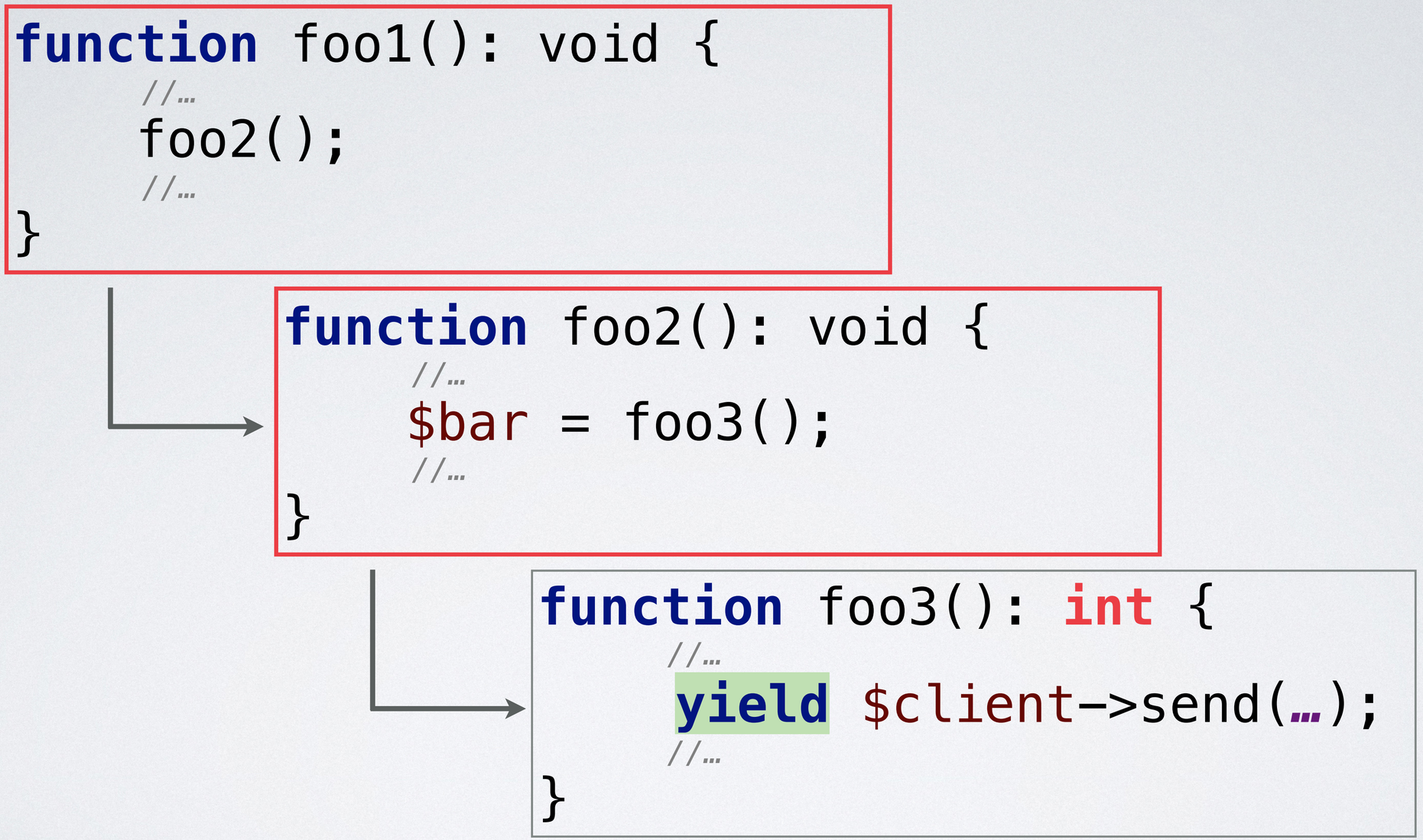
- ✓ Asynchronous programing
- ✓ Generators
- ✓ Tornado interfaces
- ✓ Local event loop

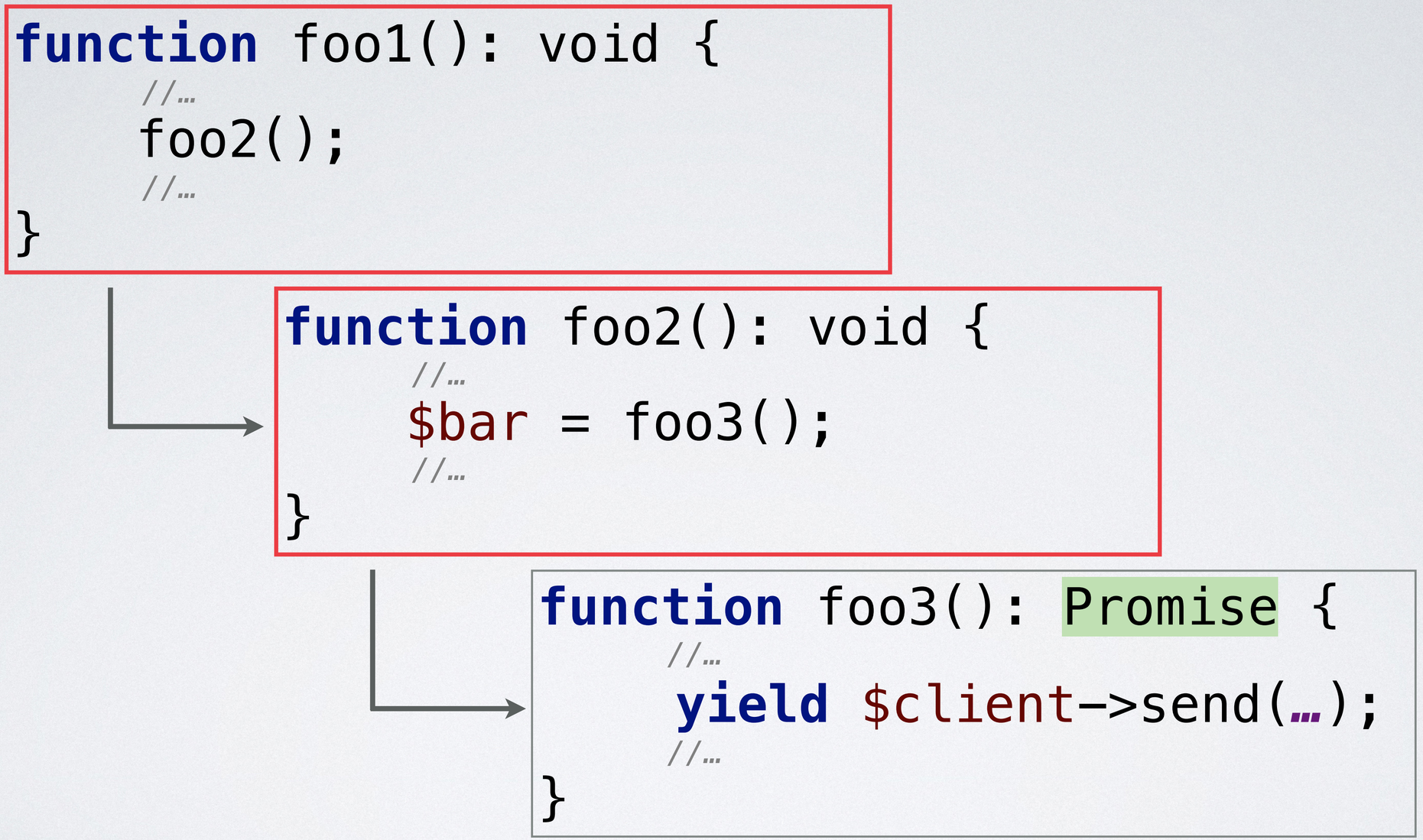
# *Chapter 2*

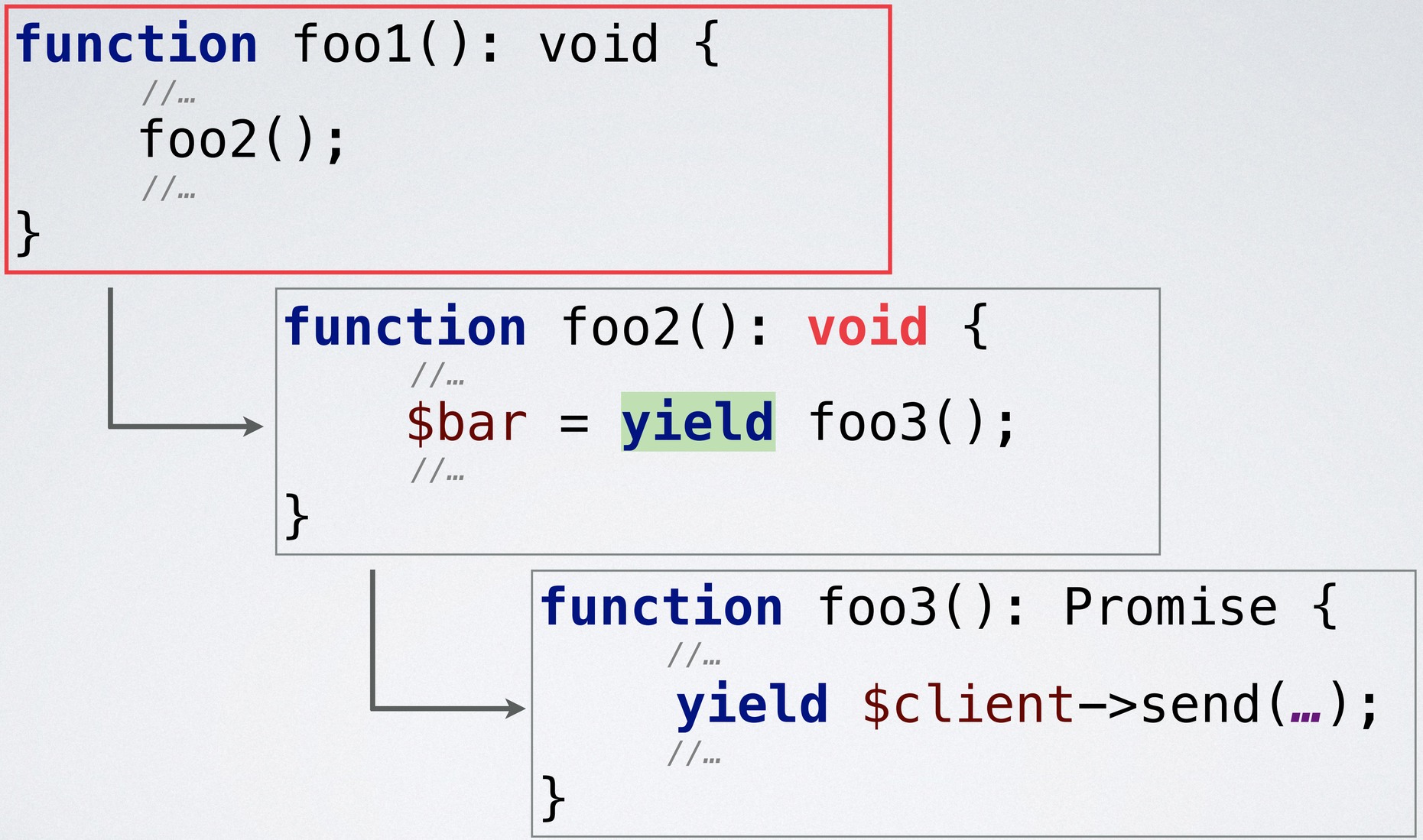
## Let's go!

# Where do I start?


function foo1(): void {
//…
foo2();
//…
}
function foo2(): void {
//…
$bar = foo3();
//…
}
function foo3(): int {
//…
$client->send(…);
//…
}


function foo1(): void {
//…
foo2();
//…
}
function foo2(): void {
//…
$bar = foo3();
//…
}
function foo3(): int {
//…
yield $client->send(…);
//…
}


function foo1(): void {
//…
foo2();
//…
}
function foo2(): void {
//…
$bar = foo3();
//…
}
function foo3(): Promise {
//…
yield $client->send(…);
//…
}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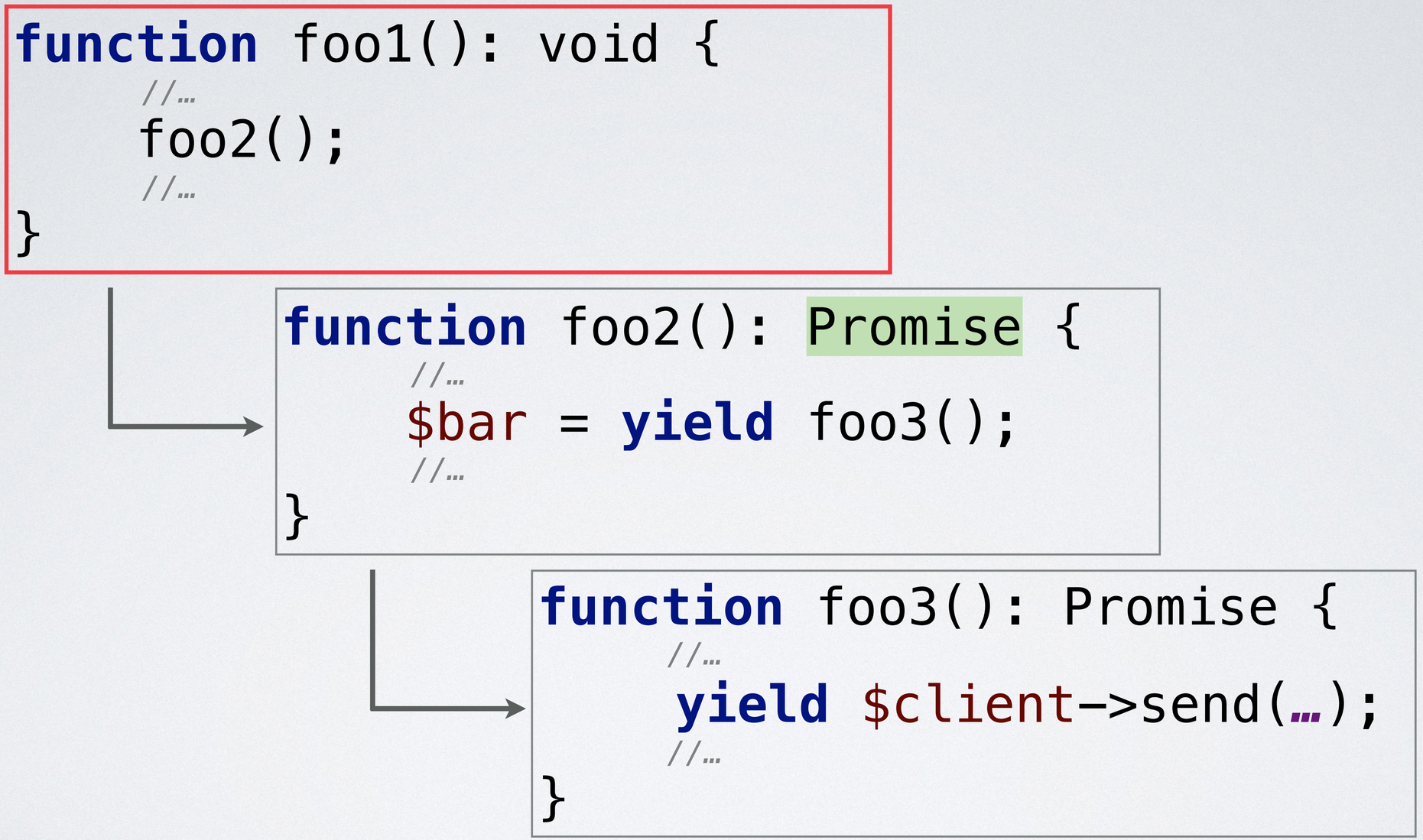
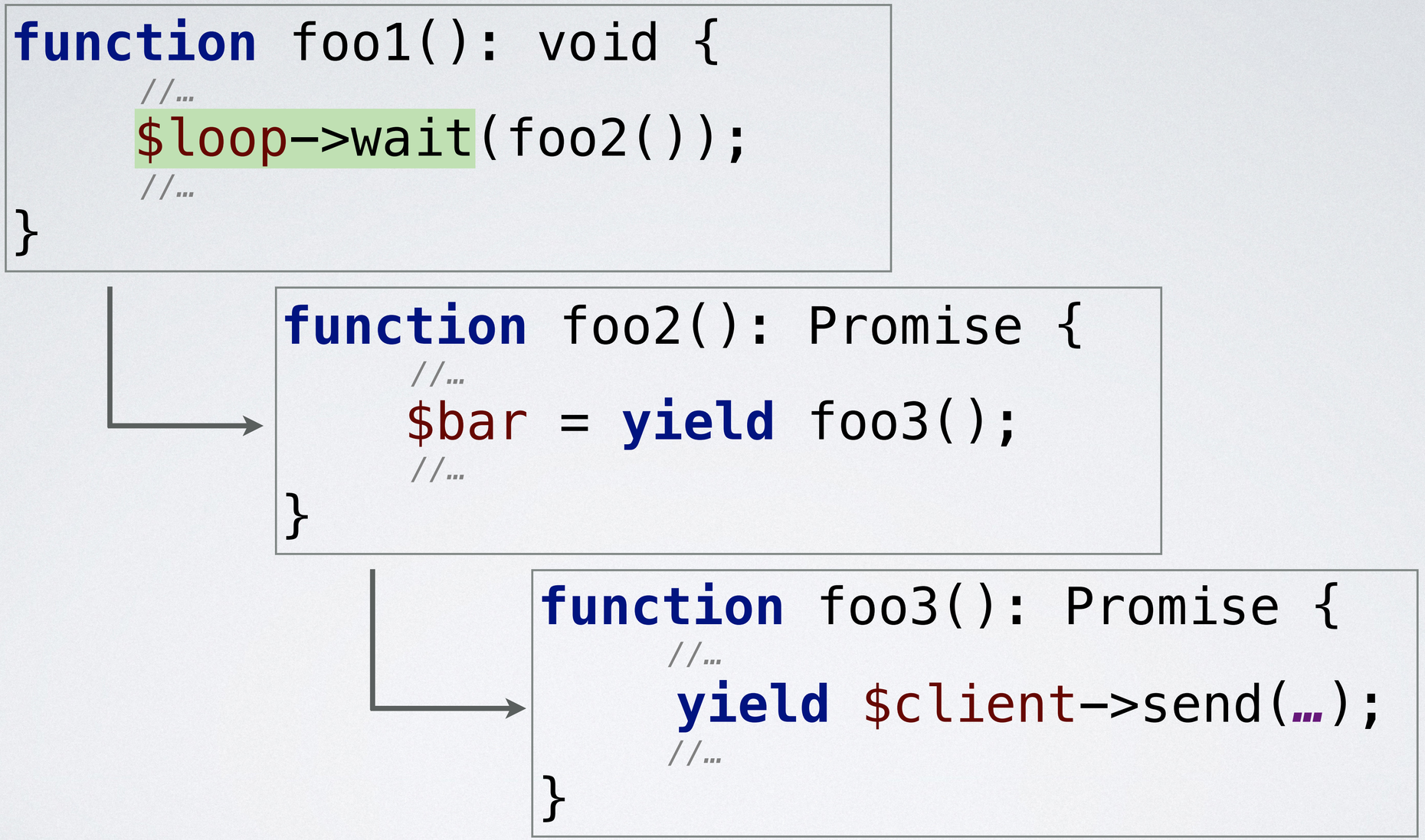
//…
foo2();
//…
}
function foo2(): void {
//…
$bar = yield foo3();
//…
}
function foo3(): Promise {
//…
yield $client->send(…);
//…
}


function foo1(): void {
//…
foo2();
//…
}
function foo2(): Promise {
//…
$bar = yield foo3();
//…
}
function foo3(): Promise {
//…
yield $client->send(…);
//…
}


function foo1(): void {
//…
$loop->wait(foo2());
//…
}
function foo2(): Promise {
//…
$bar = yield foo3();
//…
}
function foo3(): Promise {
//…
yield $client->send(…);
//…
}

```php
function foo1(): void {
    //…
    foo2();
    //…
}
```

```php
function foo2(): void {
    //…
    $bar = foo3();
    //…
}
```

```php
function foo3(): int {
    //…
    $client->send(…);
    //…
}
```

```php
function foo1(): void {
    //…
    $loop->wait(foo2());
    //…
}
```

```php
function foo2(): Promise {
    //…
    $bar = yield foo3();
    //…
}
```

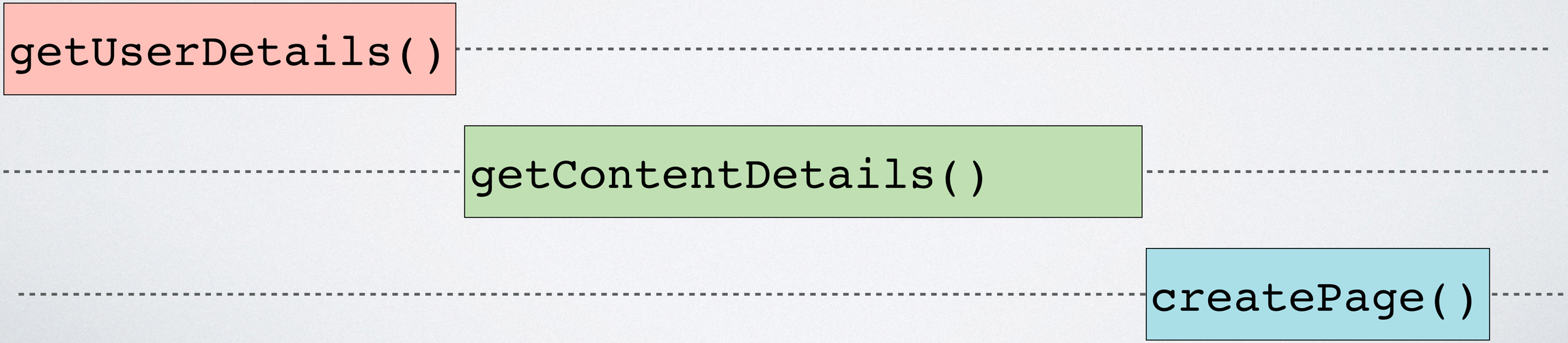
```php
function foo3(): Promise {
    //…
    yield $client->send(…);
    //…
}
```

A function calling an **asynchronous** function is also **asynchronous**.

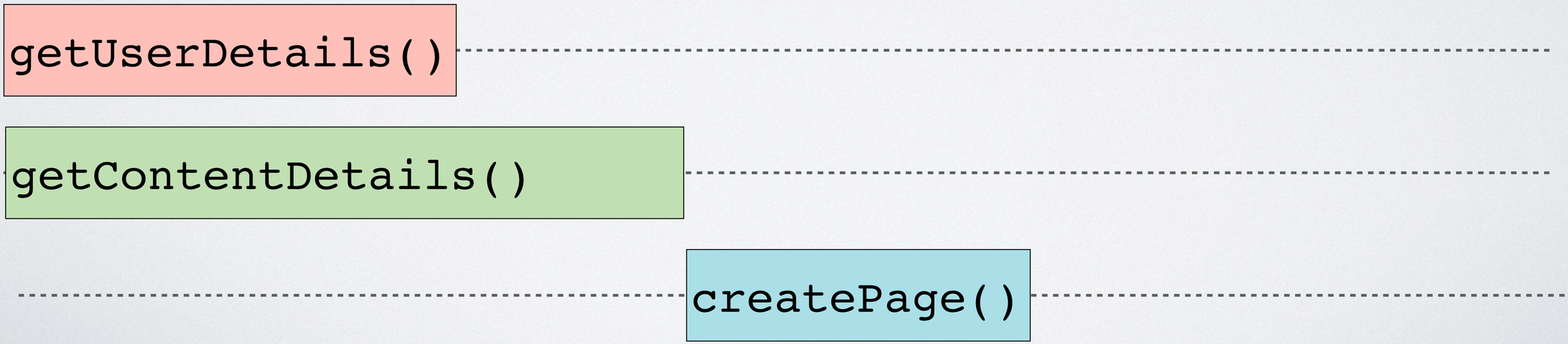
# How to enable concurrency?

Asynchronous
programming
is **useless**
without **concurrency**.

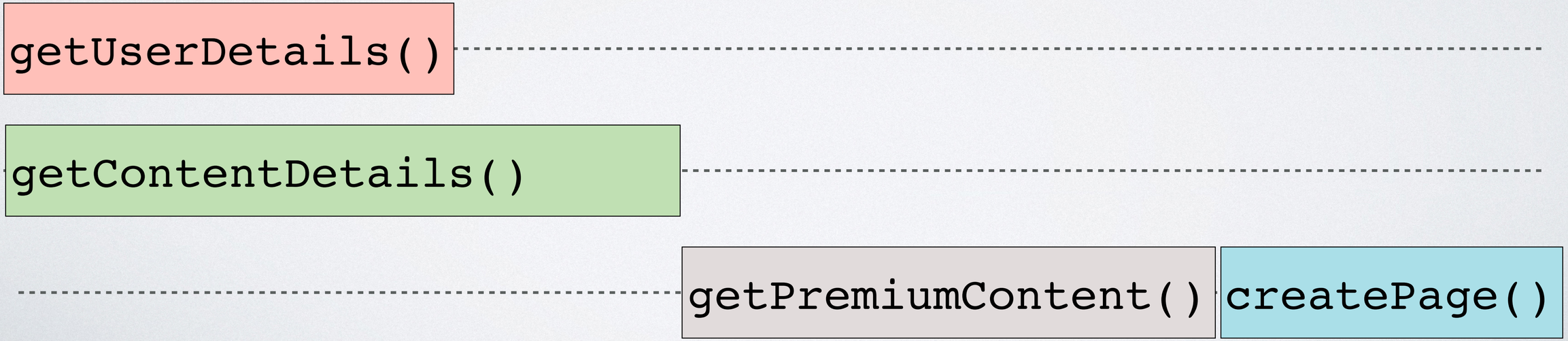
```php
public function foo()
{
    $user = yield getUserDetails();
    $content = yield getContentDetails();

    return createPage($user, $content);
}
```



```php
public function foo(): \Generator
{
    [$user, $content] = yield $this->eventLoop->promiseAll(
        getUserDetails(),
        getContentDetails()
    );

    return createPage($user, $content);
}
```

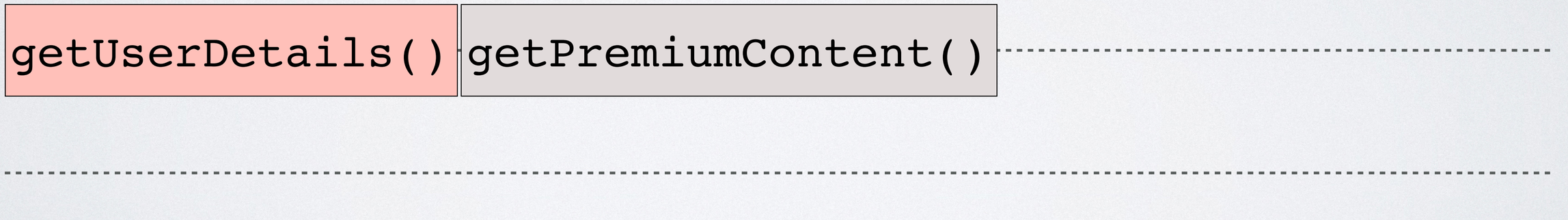


```php
public function foo(): \Generator
{
    [$user, $content] = yield $this->eventLoop->promiseAll(
        getUserDetails(),
        getContentDetails()
    );
    $premium = yield getPremiumContent($user);

    return createPage($user, $content, $premium);
}
```



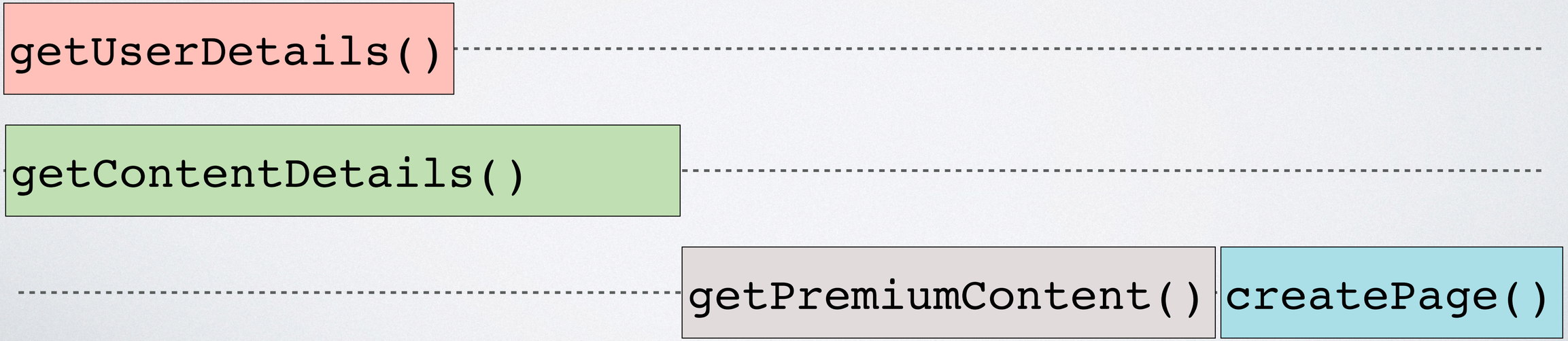
**Consecutive** `yield` instructions means **dependency** between **promises**.

```php
// Intermediate function
private function userAndPremium(): \Generator
{
    $user = yield getUserDetails();
    $premium = yield getPremiumContent($user);

    return [$user, $premium];
}
```

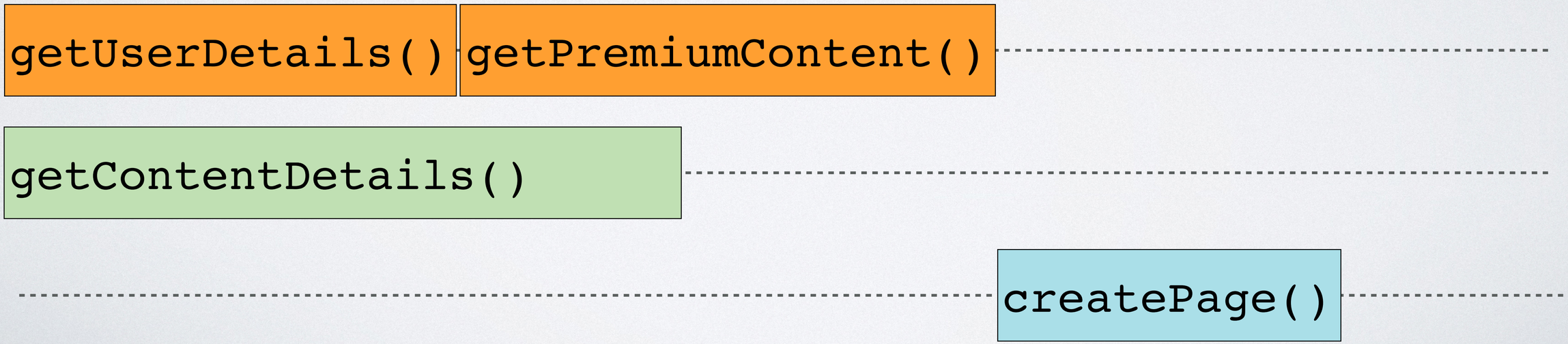


```php
// Intermediate function
private function userAndPremium(): \Generator
{
    $user = yield getUserDetails();
    $premium = yield getPremiumContent($user);

    return [$user, $premium];
}
```

```php
public function foo(): \Generator
{
    [$user, $content] = yield $this->eventLoop->promiseAll(
        getUserDetails(),
        getContentDetails()
    );
    $premium = yield getPremiumContent($user);

    return createPage($user, $content, $premium);
}
```



```php
public function foo(): \Generator
{
    [[$user, $premium], $content] = yield $this->eventLoop->promiseAll(
        $this->eventLoop->async($this->userAndPremium()),
        getContentDetails()
    );

     return createPage($user, $content, $premium);
}
```

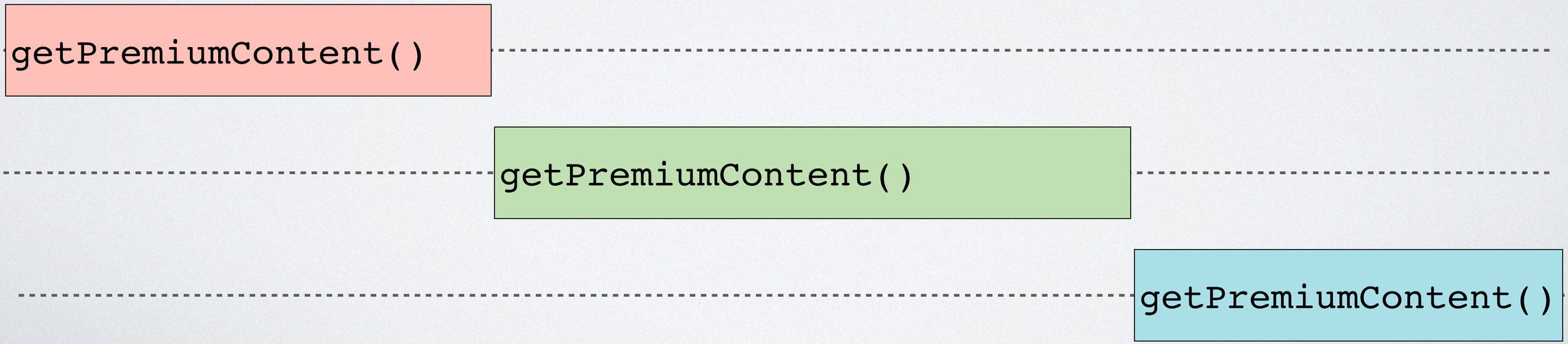


Create an

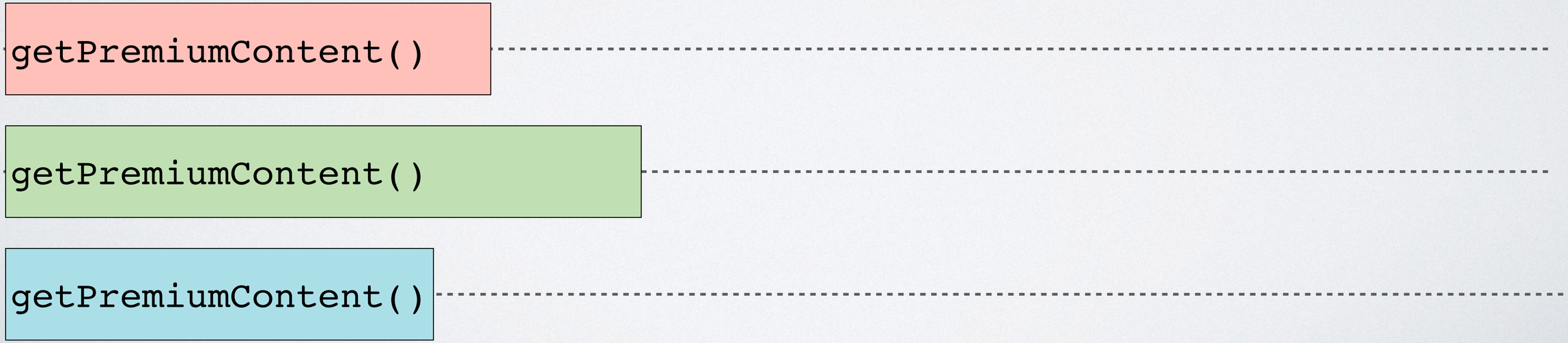
**asynchronous**

function per **goal**.

```php
public function allPremiumContent(array $users): \Generator
{
    $allPremium = [];
    foreach ($users as $user) {
        $allPremium[] = yield getPremiumContent($user);
    }

    return $allPremium;
}
```



```php
public function allPremiumContent(array $users): \Generator
{
    $promises = [];
    foreach ($users as $user) {
        $promises[] = getPremiumContent($user);
    }
    $allPremium = yield $this->eventLoop->promiseAll(...$promises);

    return $allPremium;
}
```



```php
public function allPremiumContent(array $users): \Generator
{
    $promises = [];
    foreach ($users as $user) {
        $promises[] = getPremiumContent($user);
    }
    $allPremium = yield $this->eventLoop->promiseAll(...$promises);

    return $allPremium;
}
```

```php
public function allPremiumContent(array $users): \Generator
{
    $allPremiumPromise =
        $this->eventLoop->promiseForeach($users, function ($user) {
        return yield getPremiumContent($user);
    });

    return yield $allPremiumPromise;
}
```

Identical

# Should I return a Promise or a Generator?

Return a **Promise** from **public** asynchronous functions.

# Constant promises

```
public function foo(): Promise
{
    //...
    if (isset($this->cache[$key])) {
        return $this->eventLoop->promiseFulfilled(
            $this->cache[$key]
        );
    }

    return $this->cache[$key] = asyncFunction();
}
```

*Chapter 3*

# Drawbacks

# Some noise…

```php
public function myFunction(): Promise
{
    $myAsyncFunction = function(): \Generator  {
        // ...
        yield $promise;
        // ...
    };

    return $this->eventLoop->async($myAsyncFunction());
}
```

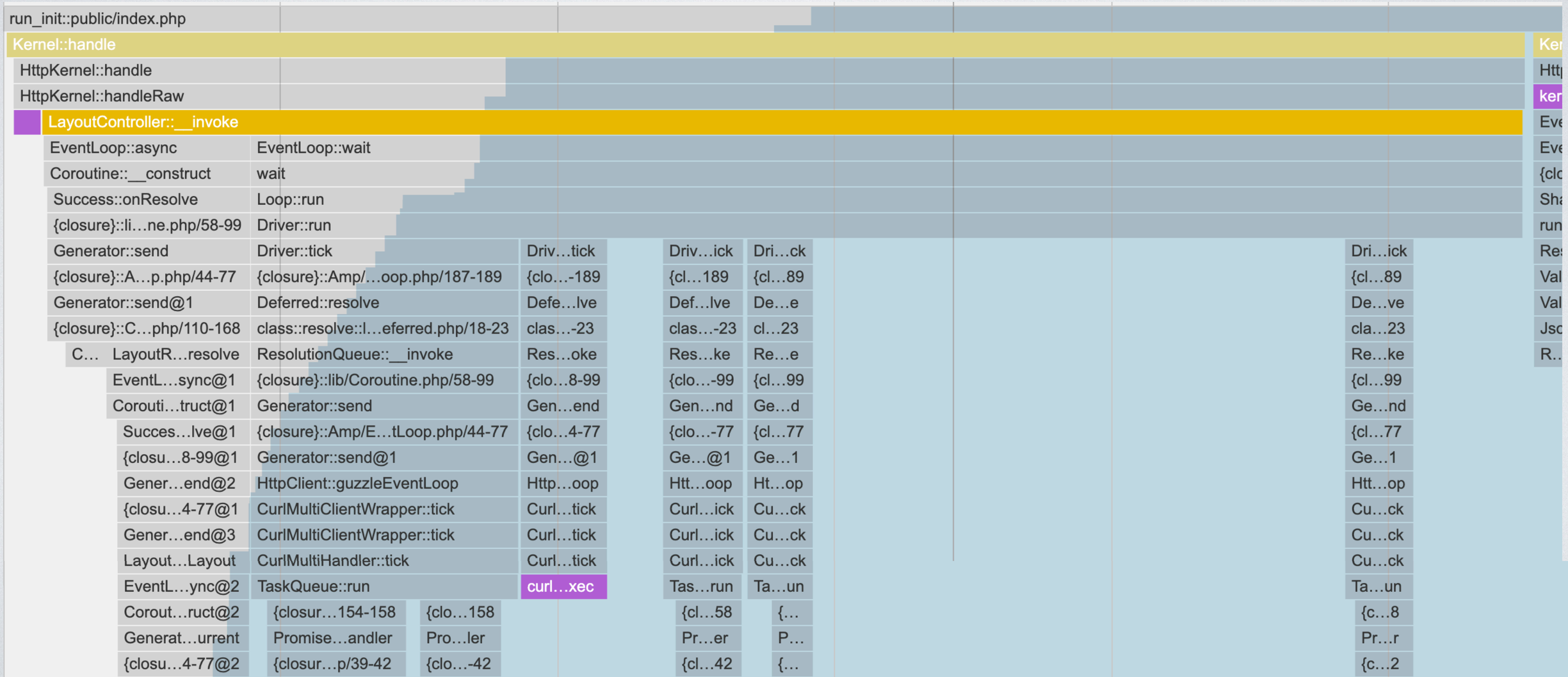
# Promise hide actual type

```php
function createRandomNumber(): int;


/**
 * @return Promise Will be resolved with an integer
 */
function createRandomNumber(): Promise;


/** @var int $number */
$number = yield createRandomNumber();
```

# Stacktrace

```
Call Stack:
1. {main}() /workspace/Tornado/examples/01-async-countdown.php:0
2. M6Web\Tornado\Adapter\Amp\EventLoop->wait() /workspace/Tornado/examples/01-async-countdown.p…
3. Amp\Promise\wait() /workspace/Tornado/src/Adapter/Amp/EventLoop.php:18
4. Amp\Loop::run() /workspace/Tornado/vendor/amphp/amp/lib/functions.php:170
5. Amp\Loop\NativeDriver->run() /workspace/Tornado/vendor/amphp/amp/lib/Loop.php:84
6. Amp\Loop\NativeDriver->tick() /workspace/Tornado/vendor/amphp/amp/lib/Loop/Driver.php:72
7. M6Web\Tornado\Adapter\Amp\EventLoop->M6Web\Tornado\Adapter\Amp\{closure:/workspace/Tornado/…
8. Amp\Deferred->resolve() /workspace/Tornado/src/Adapter/Amp/EventLoop.php:188
9. {anonymous-class:/workspace/Tornado/vendor/amphp/amp/lib/Deferred.php:20-25}->resolve() /…
10. Amp\Internal\ResolutionQueue->__invoke() /workspace/Tornado/vendor/amphp/amp/lib/Internal/…
11. Amp\Coroutine->Amp\{closure:/workspace/Tornado/vendor/amphp/amp/lib/Coroutine.php:79-135}() …
12. Generator->send() /workspace/Tornado/vendor/amphp/amp/lib/Coroutine.php:105
13. M6Web\Tornado\Adapter\Amp\EventLoop->M6Web\Tornado\Adapter\Amp\{closure:/workspace/Tornado…
14. Generator->send() /workspace/Tornado/src/Adapter/Amp/EventLoop.php:67
15. asynchronousCountdown() /workspace/Tornado/src/Adapter/Amp/EventLoop.php:67
```

# Blackfire


run_init::public/index.php
Kernel::handle
HttpKernel::handle
HttpKernel::handleRaw
LayoutController::__invoke
EventLoop::async
EventLoop::wait
Coroutine::__construct
wait
Success::onResolve
Loop::run
{closure}::li…ne.php/58-99
Driver::run
Generator::send
Driver::tick
{closure}::A…p.php/44-77
{closure}::Amp/…oop.php/187-189
Generator::send@1
Deferred::resolve
{closure}::C…php/110-168
class::resolve::l…eferred.php/18-23
C…
LayoutR…resolve
ResolutionQueue::__invoke
EventL…sync@1
{closure}::lib/Coroutine.php/58-99
Corouti…truct@1
Generator::send
Succes…lve@1
{closure}::Amp/E…tLoop.php/44-77
{closu…8-99@1
Generator::send@1
Gener…end@2
HttpClient::guzzleEventLoop
{closu…4-77@1
CurlMultiClientWrapper::tick
Gener…end@3
CurlMultiClientWrapper::tick
Layout…Layout
CurlMultiHandler::tick
EventL…ync@2
TaskQueue::run
Corout…ruct@2
{closur…154-158
{clo…158
Generat…urrent
Promise…andler
Pro…ler
{closu…4-77@2
{closur…p/39-42
{clo…-42
Driv…tick
{clo…-189
Defe…lve
clas…-23
Res…oke
{clo…8-99
Gen…end
{clo…4-77
Gen…@1
Htt…oop
Curl…tick
Curl…tick
Curl…tick
curl…xec
{cl…58
Pr…er
{cl…42
Driv…ick
{cl…189
Def…lve
clas…-23
Res…ke
{clo…-99
Gen…nd
{clo…-77
Ge…@1
Htt…oop
Curl…ick
Curl…ick
Curl…ick
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{cl…58
Pr…er
{cl…42
Dri…ck
{cl…89
De…e
cl…23
Re…e
{cl…99
Ge…d
{cl…77
Ge…1
Ht…op
Cu…ck
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{…
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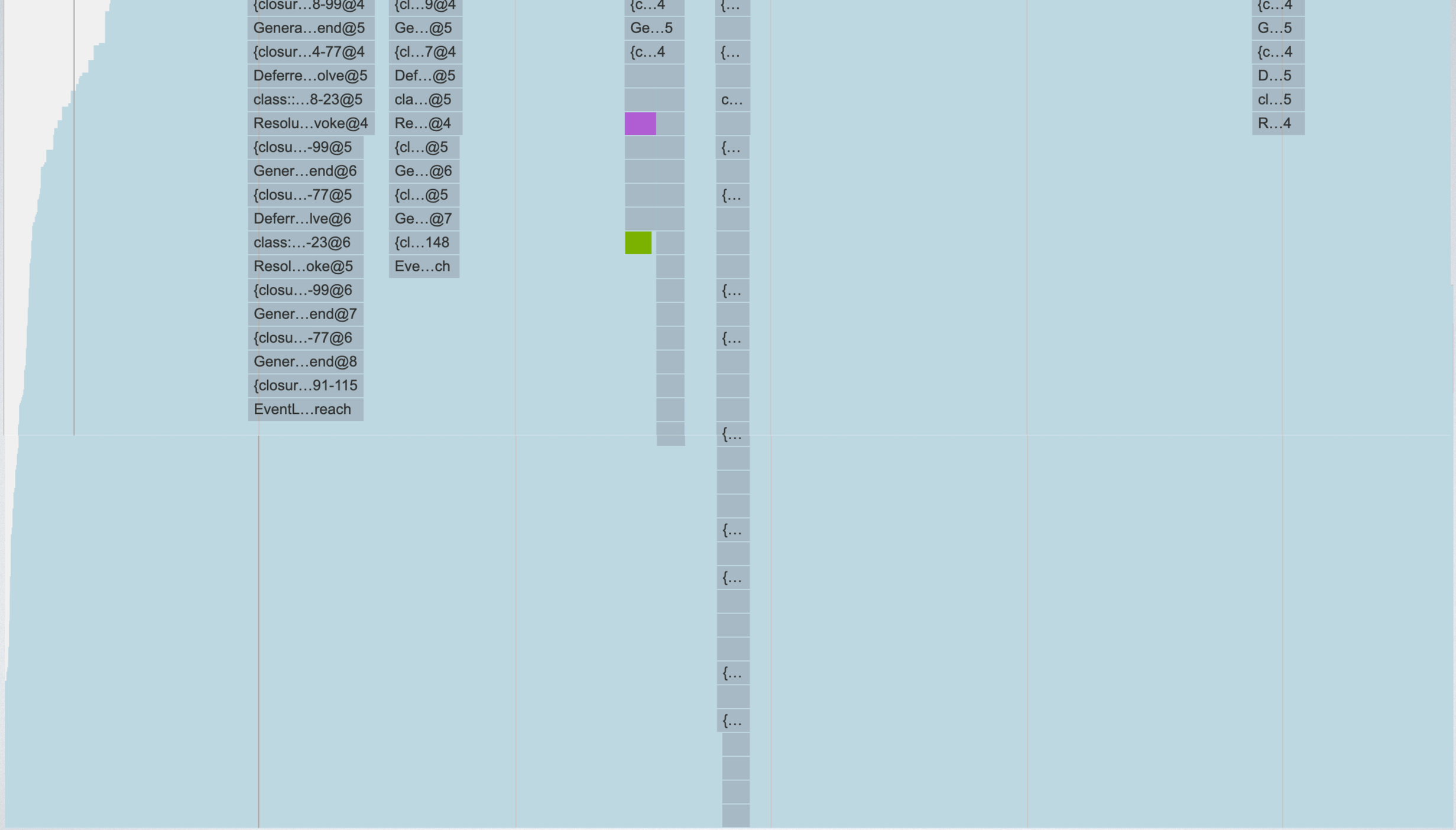
Ta…un
{c…8
Pr…r
{c…2


{closur…8-99@4
Genera…end@5
{closur…4-77@4
Deferre…olve@5
class::…8-23@5
Resolu…voke@4
{closu…-99@5
Gener…end@6
{closu…-77@5
Deferr…lve@6
class:…-23@6
Resol…oke@5
{closu…-99@6
Gener…end@7
{closu…-77@6
Gener…end@8
{closur…91-115
EventL…reach
{cl…9@4
Ge…@5
{cl…7@4
Def…@5
cla…@5
Re…@4
{cl…@5
Ge…@6
{cl…@5
Ge…@7
{cl…148
Eve…ch
{c…4
Ge…5
{c…4
{…
c…
{…
{…
{…
{…
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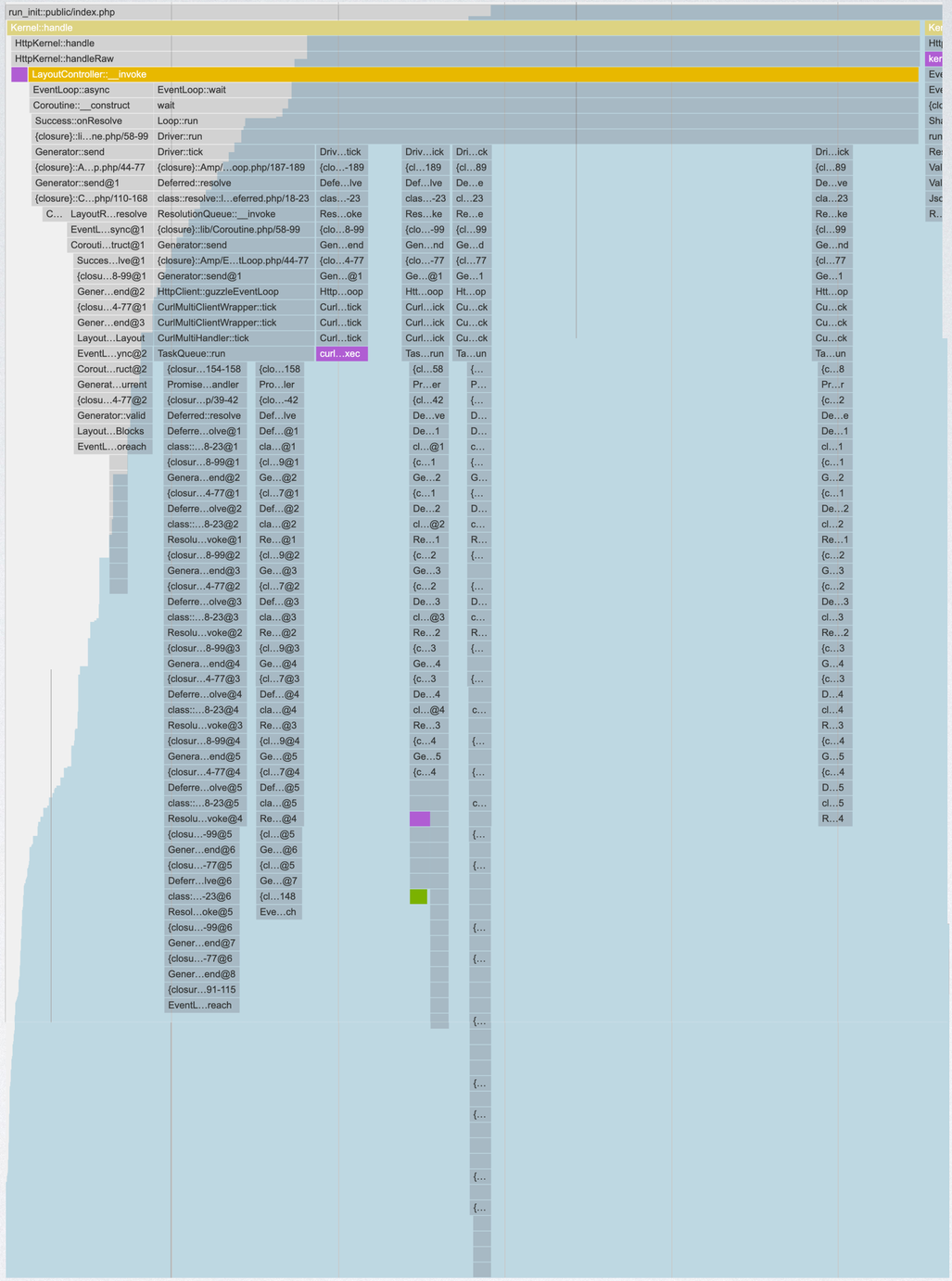
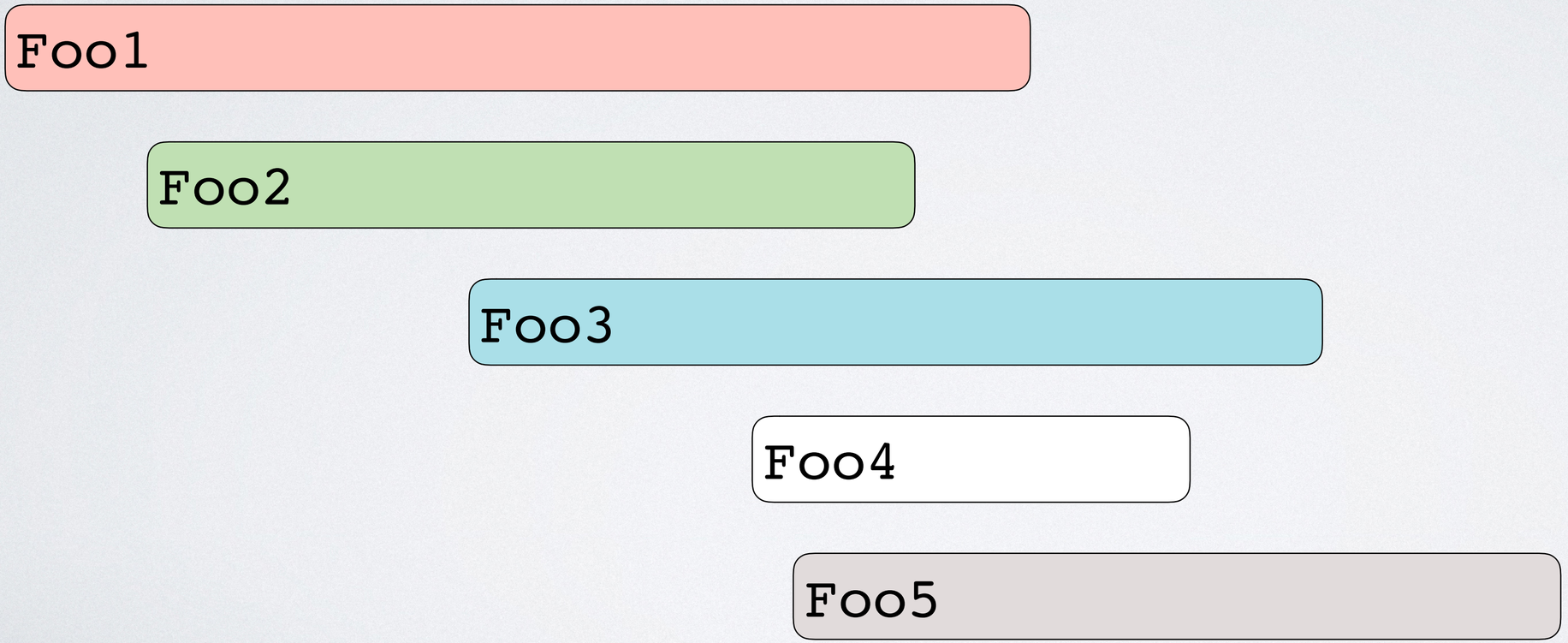
{…
{…
{…
{c…4
G…5
{c…4
D…5
cl…5
R…4




Work In progress…

# Homemade tricks



# An event loop is always running!

⚠️ Takes care of your CPU ⚠️

It's **really** (too) easy to send **too many** requests.

True story…

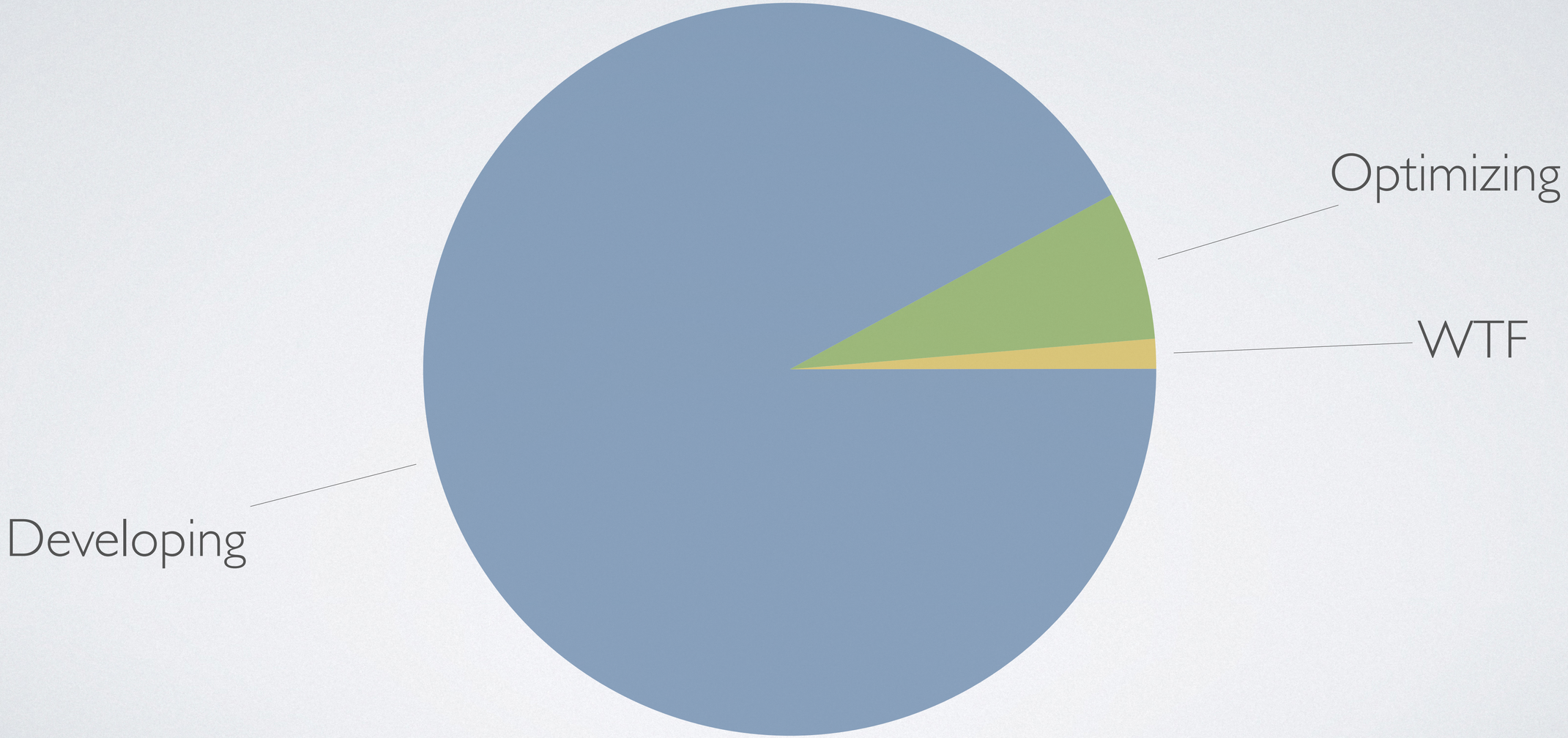
# *Asynchronously ever After…*

## Conclusion

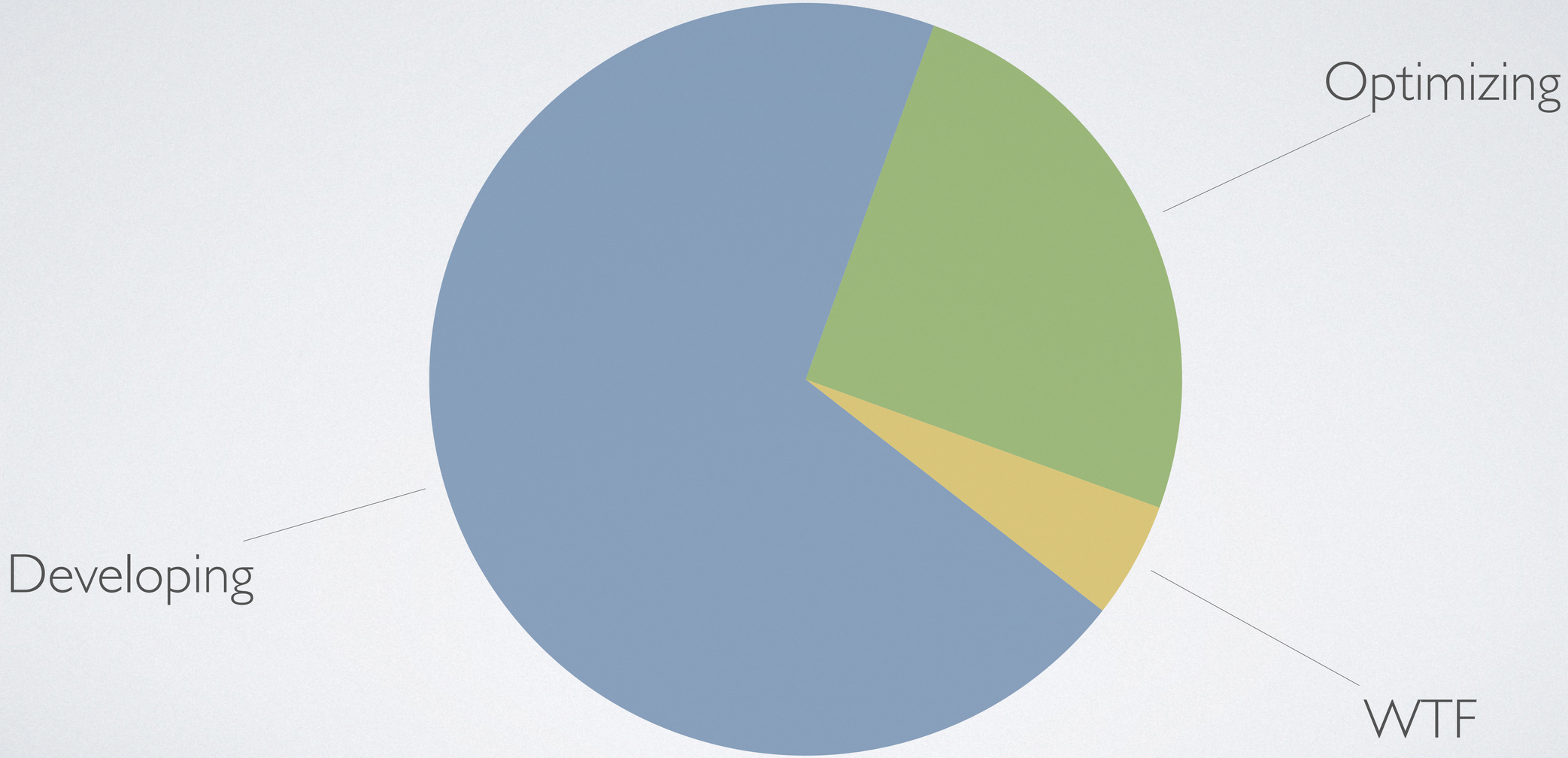
# Training?

Using asynchronous programing is **not** a **problem**.

# Synchronous



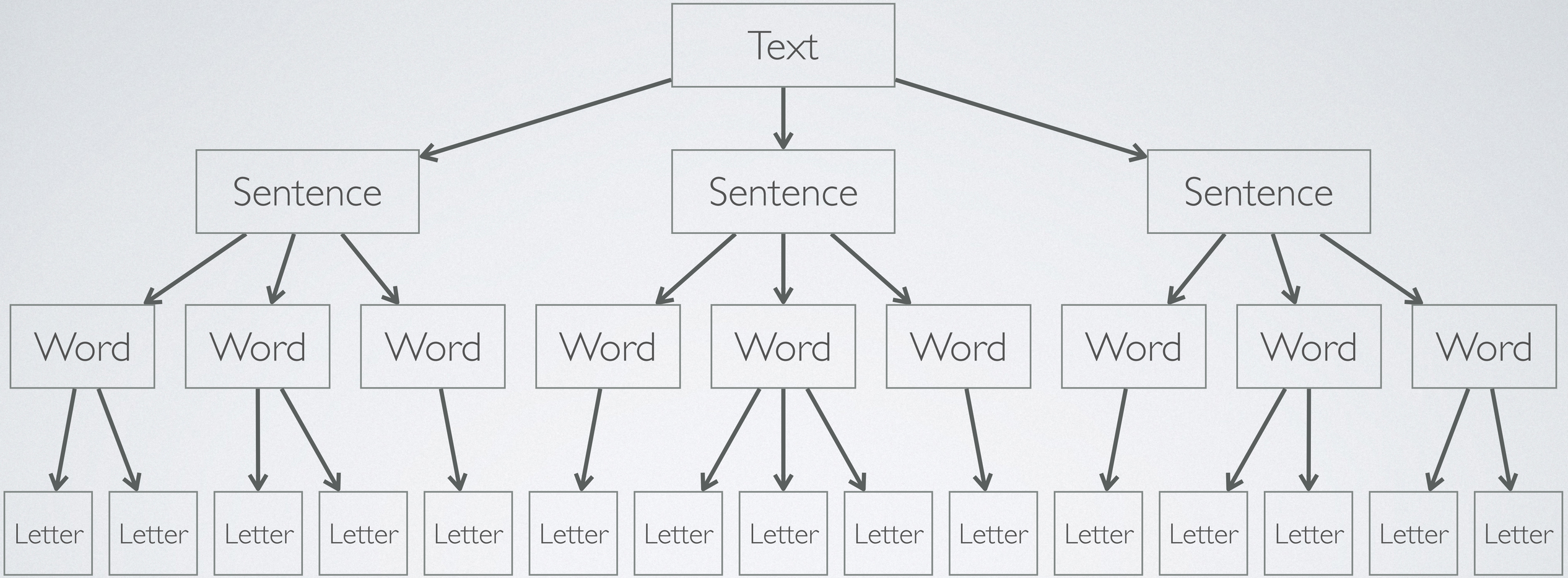
# Asynchronous



# Metrics?

Depends **a lot** of your use case…

# https://github.com/b-viguier/tornado-workshop




About 8000 requests…

https://github.com/b-viguier/tornado-workshop

Synchronous program: 20 **minutes**
Asynchronous program: 20 **seconds**

# Technical Decisions

- ✓ Asynchronous programing
- ✓ Generators
- ✓ Tornado interfaces
- ✓ Local event loop

# Thanks!

Comments are welcome!

https://joind.in/talk/78f3d

Benoit Viguier
@b_viguier

WEB

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PARIS2019