
catch
BOX

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Interfaces – an Intro

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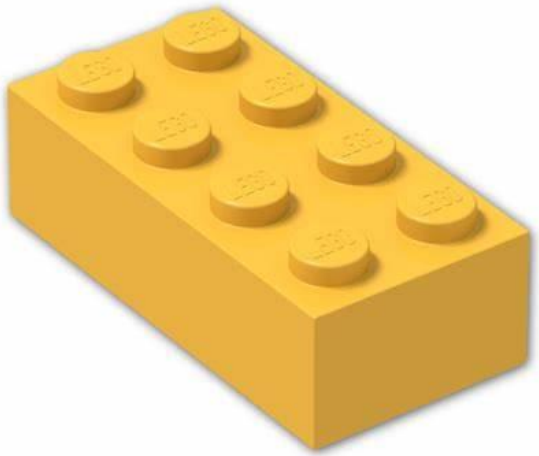
Componentization

Componentization

Define a component



Componentization

Describe the purpose

Componentization

Facilitates Clear Architecture and Interactions

Componentization

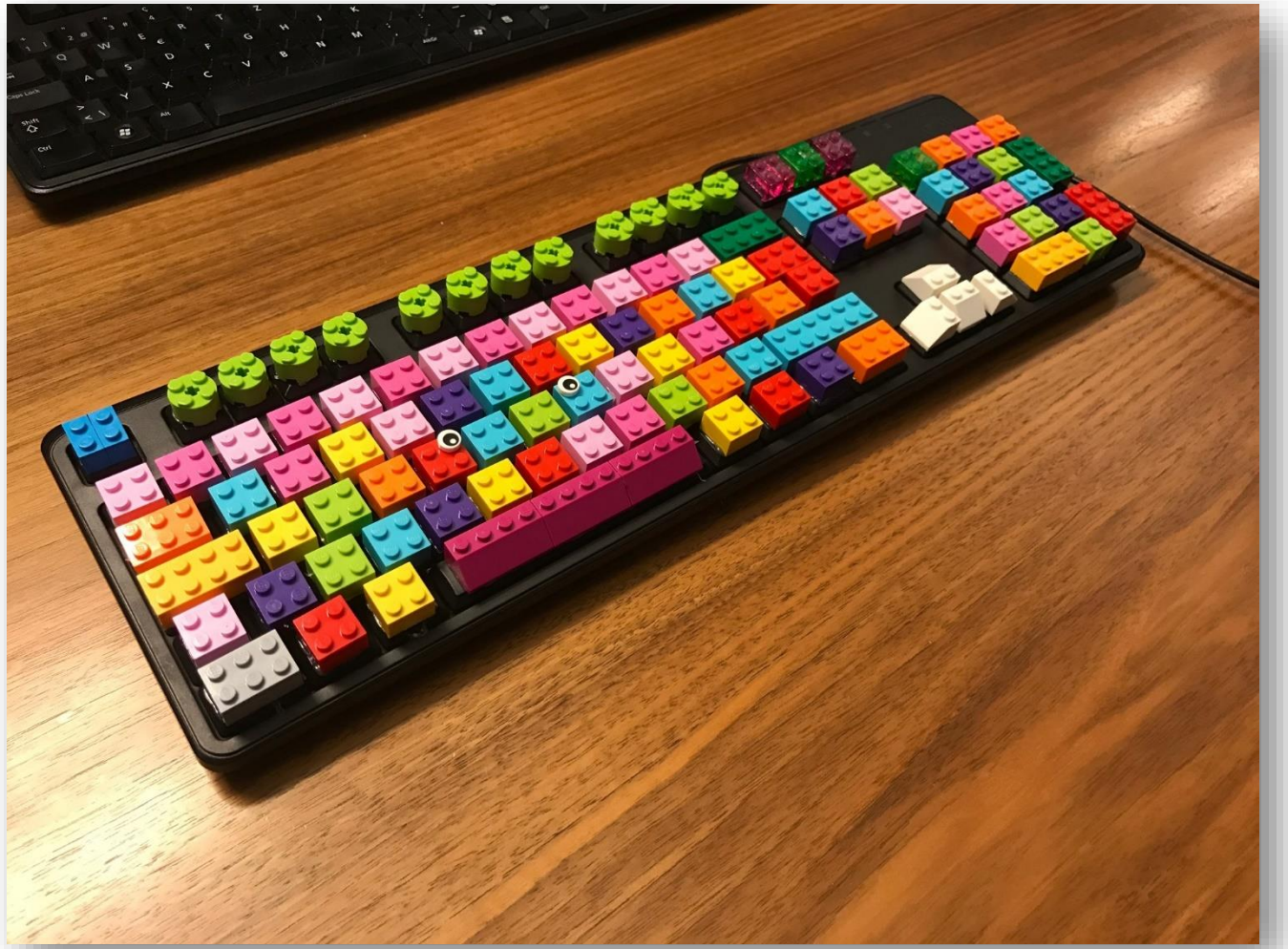
Replace a component
(decoupling)

Componentization

Switch implementation

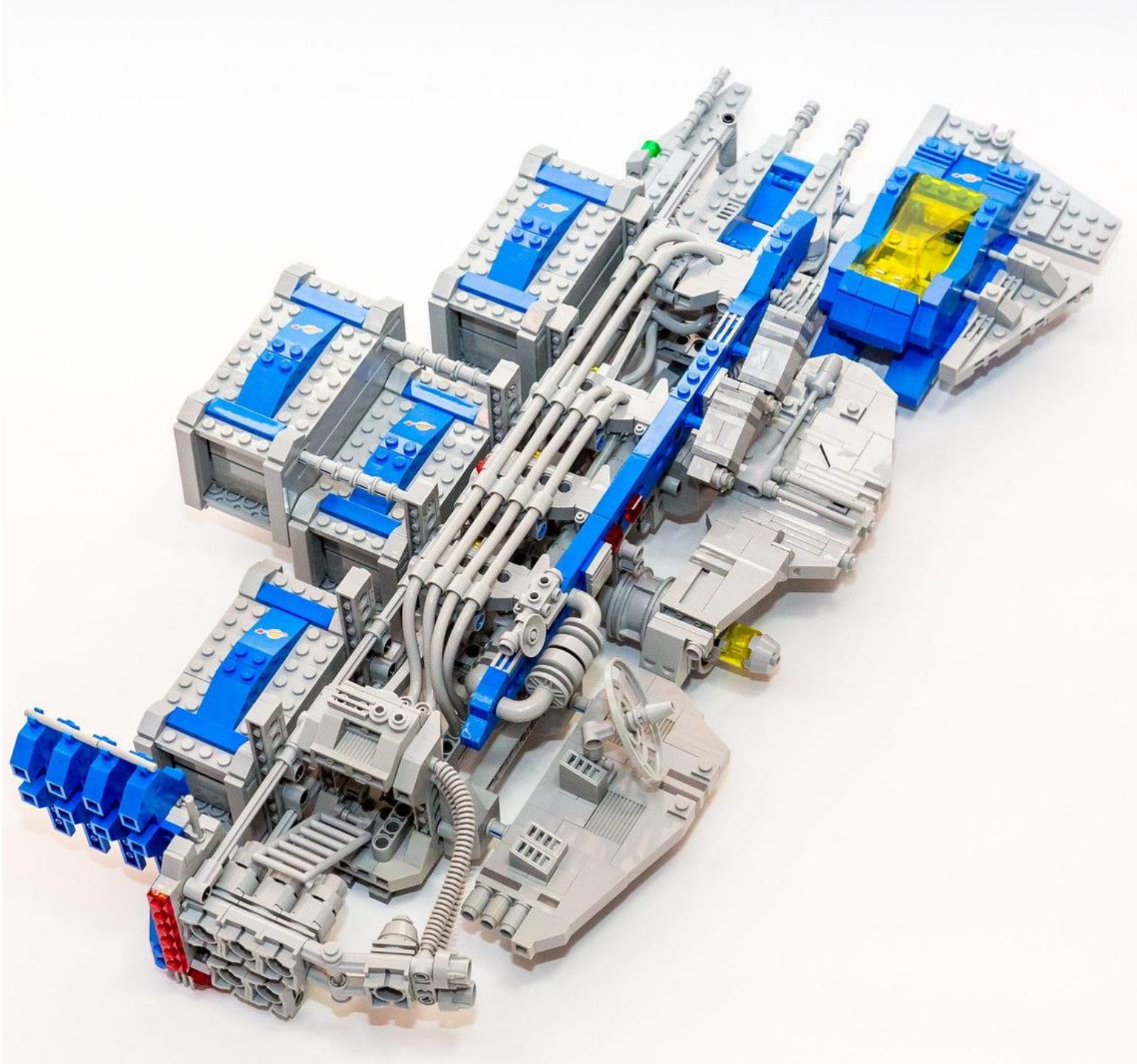
Componentization

Allow Override of Default Code



Componentization

Extend a Component



Componentization

Test a Component

For example...

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What is an Interface?

"In programming languages, an interface is a construct that defines a **contract** or a **set of methods** that a class must implement. It specifies the **signature** (name, parameters, return types) of the methods without providing their actual implementation."

```
interface "IScale"
{
    1 reference
    procedure GetWeight(): Decimal;
    0 references
    procedure Tare();
    2 references
    procedure Getinfo(): Text;
}
```

Interface Implementations

```
codeunit 50404 "Scale Foo" implements IScale
{
    0 references
    procedure GetWeight(): Decimal;
    begin
        Randomize();
        Exit(Random(30));
    end;

    0 references
    procedure Tare();
    begin
        //TODO: Implement Tare
    end;

    0 references
    procedure Getinfo(): Text;
    begin
        exit('Info: Scale "Foo"');
    end;

}
```

```
codeunit 50405 "Scale Tefal" implements IScale
{
    0 references
    procedure GetWeight(): Decimal;
    begin
        Randomize();
        Exit(Random(30) + 20);
    end;

    0 references
    procedure Tare();
    begin
        //TODO: Implement Tare
    end;

    0 references
    procedure Getinfo(): Text;
    begin
        exit('Info: Scale "Tefal"');
    end;

}
```

Factory

"an object that the client code can use to obtain instances of these objects, without explicitly knowing the concrete class being instantiated."

```
enum 50400 "Scales" implements IScale
{
    Extensible = true;

    0 references
    value(1; Tefal)
    {
        Caption = 'Tefal';
        Implementation = Iscale = "Scale Tefal";
    }
    0 references
    value(2; Foo)
    {
        Caption = 'Foo';
        Implementation = Iscale = "Scale Foo";
    }
}
```

Factory

"an object that the client code can use to obtain instances of these objects, without explicitly knowing the concrete class being instantiated."

```
enum 50400 "Scales" implements IScale
{
    Extensible = true;

    0 references
    value(1; Tefal)
    {
        Caption = 'Tefal';
        Implementation = Iscale = "Scale Tefal";
    }
    0 references
    value(2; Foo)
    {
        Caption = 'Foo';
        Implementation = Iscale = "Scale Foo";
    }
}
```

```
1 reference
local procedure DoGetWeight(var Item: Record Item; var Handled: Boolean);
var
    ScaleSetup: Record ScaleSetup;
    Scale: Interface IScale;
begin
    ScaleSetup.Get;

    Scale := ScaleSetup.Scale;

    Item.validate(Weight, scale.GetWeight());
    Item.Modify(true);

    if (scale.Getinfo() <> '') then
        message(scale.Getinfo());

end;
```

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ChatGPT

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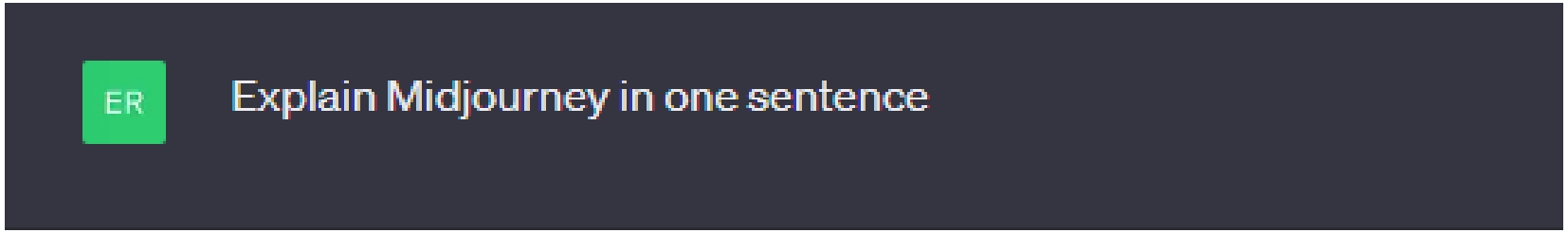
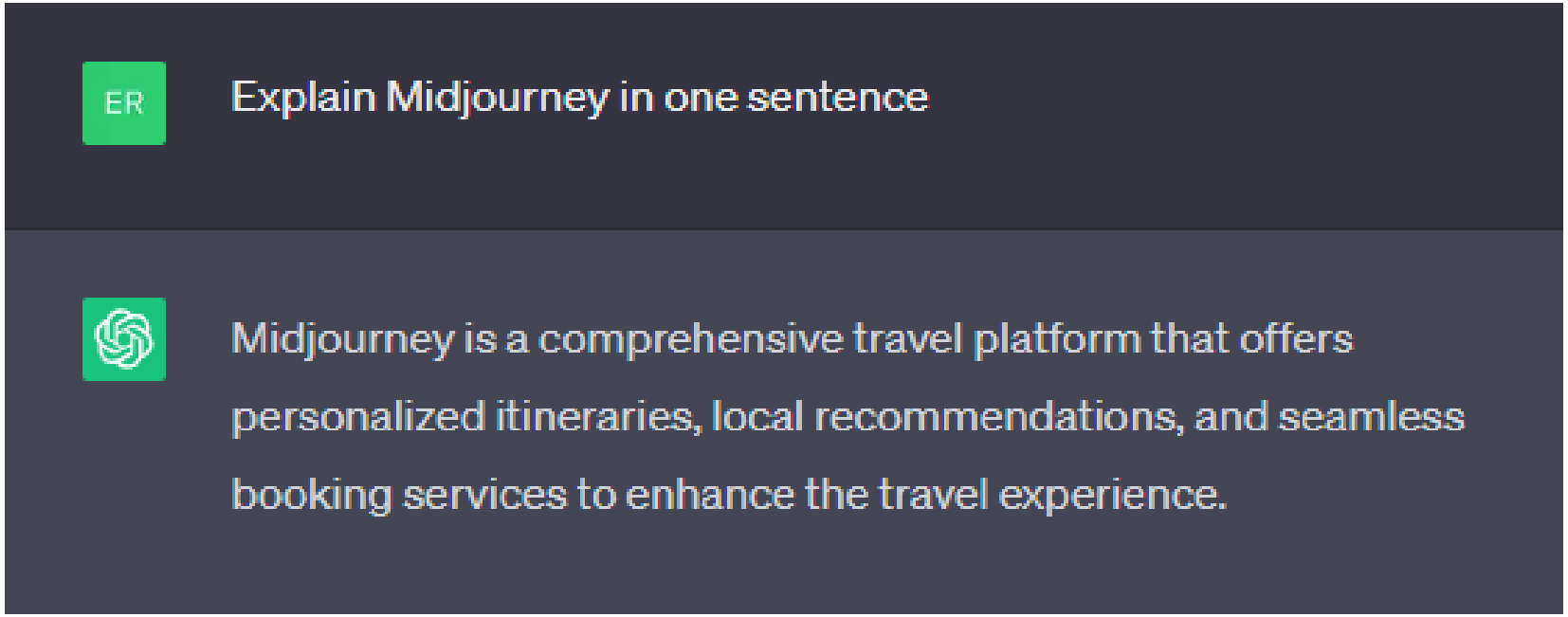
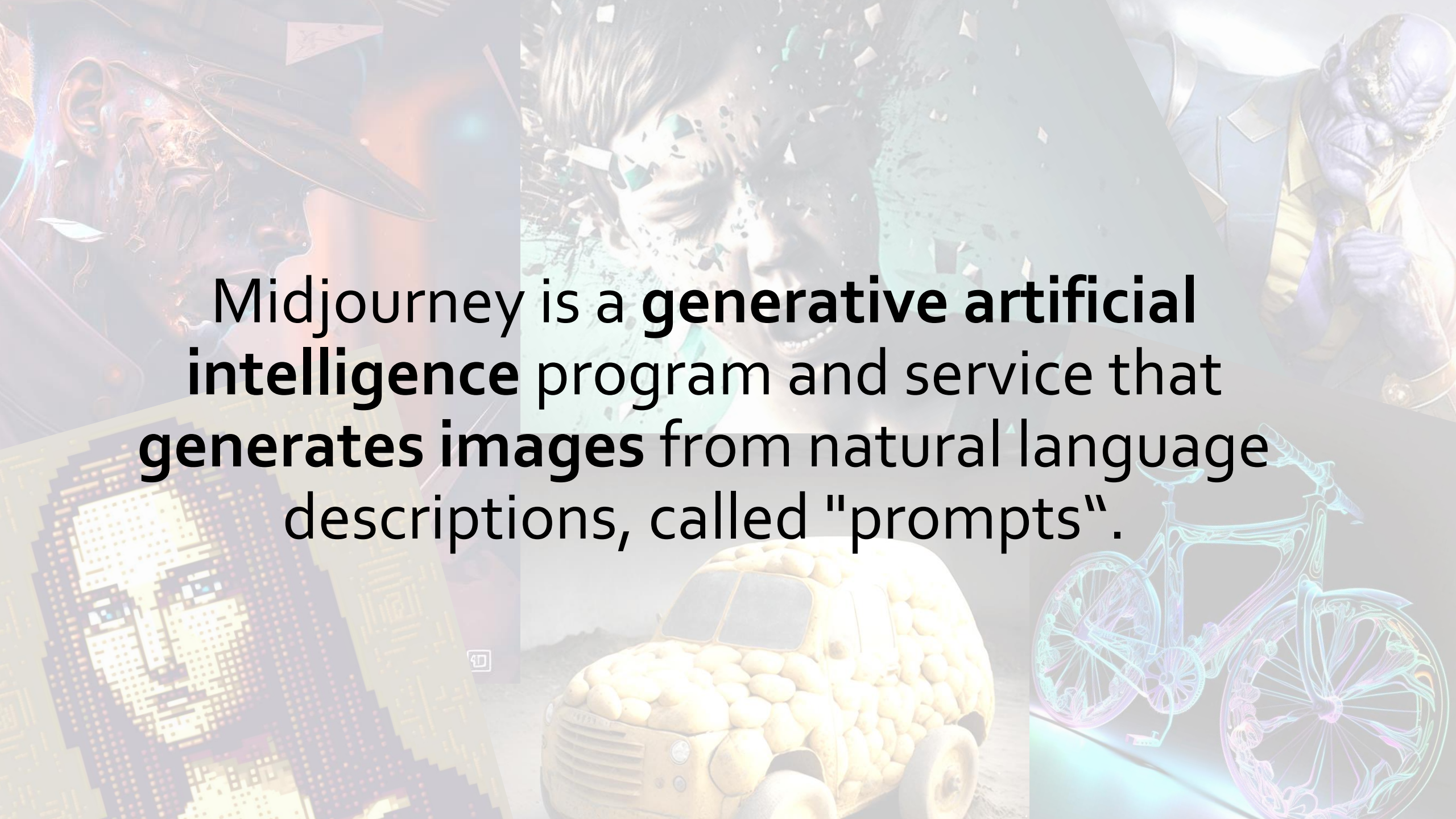
Midjourney

Midjourney



Midjourney


ER
Explain Midjourney in one sentence
Midjourney is a comprehensive travel platform that offers personalized itineraries, local recommendations, and seamless booking services to enhance the travel experience.



Midjourney is a **generative artificial intelligence** program and service that **generates images** from natural language descriptions, called "prompts".

Prompt:
“Imagine: Shocked Potato when seeing Belgian Fries” –ar 1:1

Prompt:
“Imagine: Shocked Potato when seeing Belgian Fries” –ar 1:1

Prompt:
“Imagine: Shocked Potato when seeing Belgian Fries” –ar 1:1

Prompt:
Imagine: <url to picture> hilarious caricature of both persons, drawing --ar 1:1

Prompt:
Imagine: <url to picture> hilarious caricature of both persons, drawing --ar 1:1

So… what if …

Item Card

Saved

1936-S · BERLIN Guest Chair, yellow

Imagine | Home | Request Approval | Item | Prices & Discounts | More options

Copy Item | Create Stockkeeping Unit | Apply Template

Item

Show more

No.	1936-S
Description	BERLIN Guest Chair, yellow
Blocked	
Type	Inventory
Base Unit of Measure	PCS
Item Category Code	CHAIR
Variant Mandatory if E...	Default (No)
Picture URL	https://cdn.discordapp.com/attac...

Inventory

Show more

Shelf No.	D7
Inventory	0
Qty. on Purch. Order	0
Qty. on Prod. Order	0
Qty. on Component Li...	0
Qty. on Sales Order	0
Stockout Warning	Default (Yes)
Unit Volume	0.25
Over-Receipt Code	

Details | Attachments (0)

Picture

Marketing Text

Prompt:
Imagine: <url to picture> on a beach, sunset, realistic --ar 1:1 --iw 1.25

Prompt:
Imagine: <url to picture> on a beach, sunset, realistic --ar 1:1 --iw 1.25

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Let’s see this in practice…

Action: Item.Imagine

Imagine With MidJourney Meth (GetImageUrl)

Import Picture to Item table

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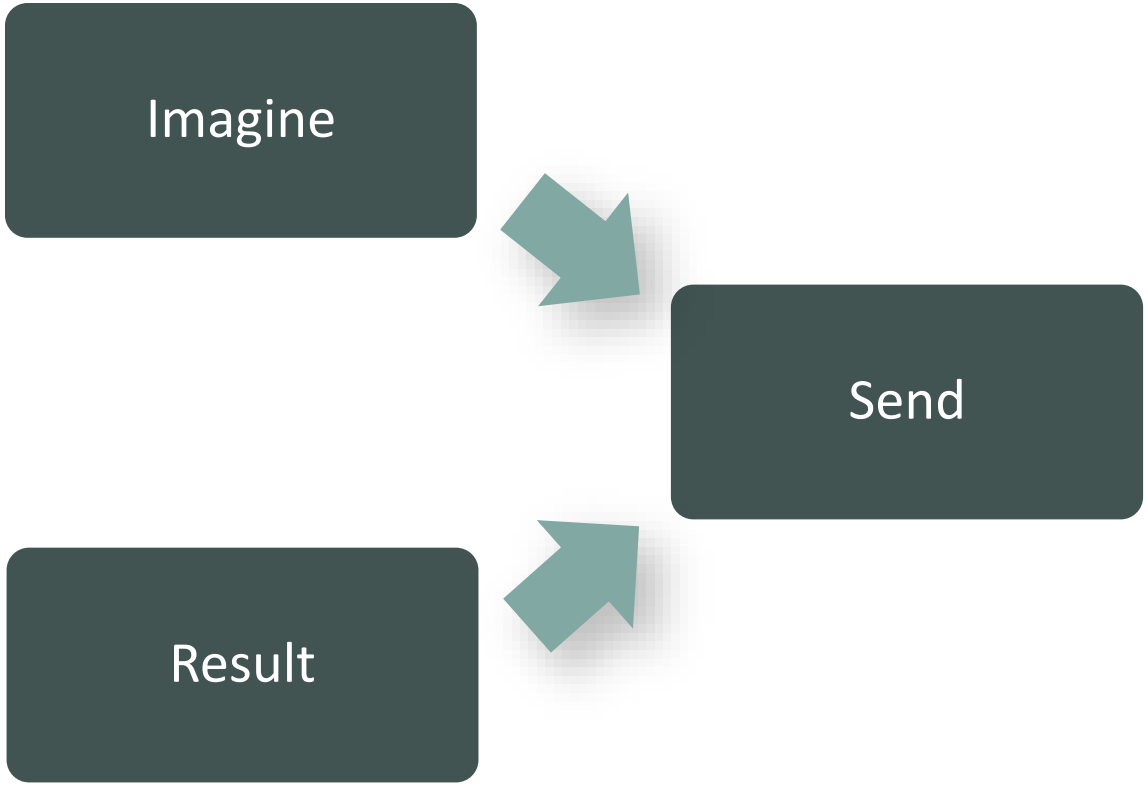
Imagine With MidJourney Meth (GetImageUrl)

Imagine With MidJourney Meth (GetImageUrl)

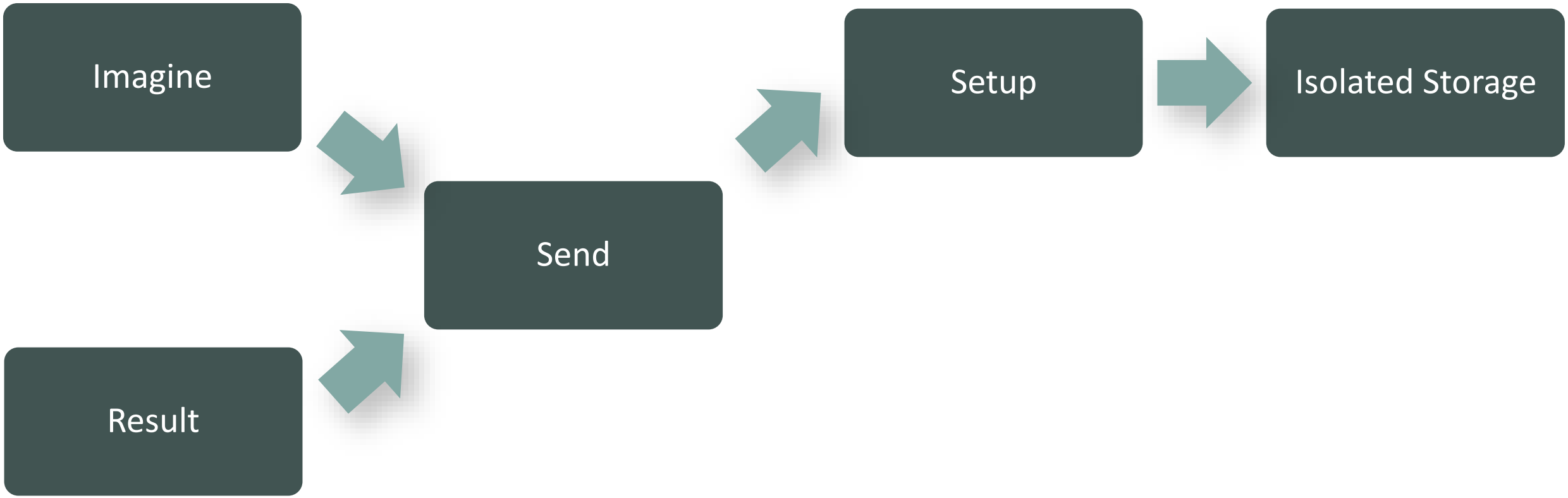
Imagine

Result

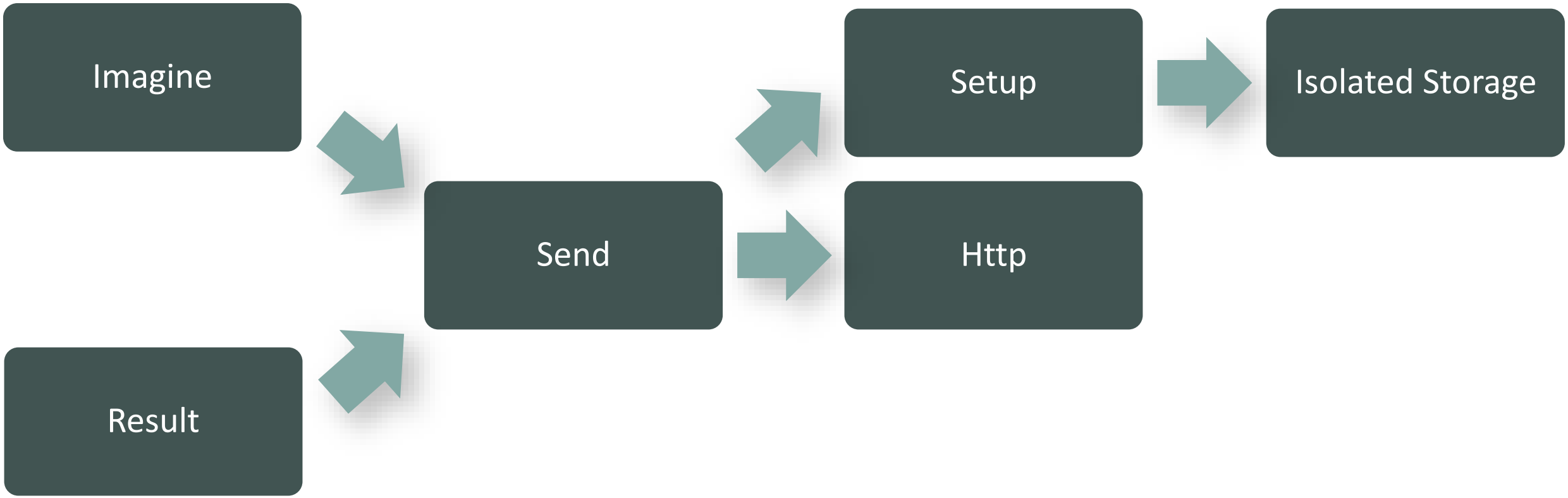
Imagine With MidJourney Meth (GetImageUrl)



Imagine With MidJourney Meth (GetImageUrl)



Imagine With MidJourney Meth (GetImageUrl)



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Like it?

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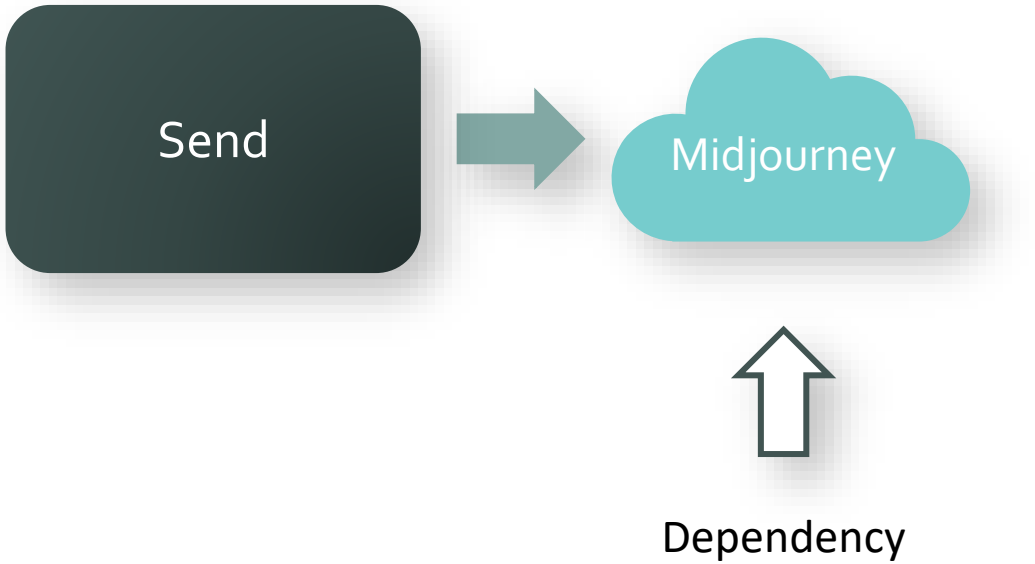
Dependencies

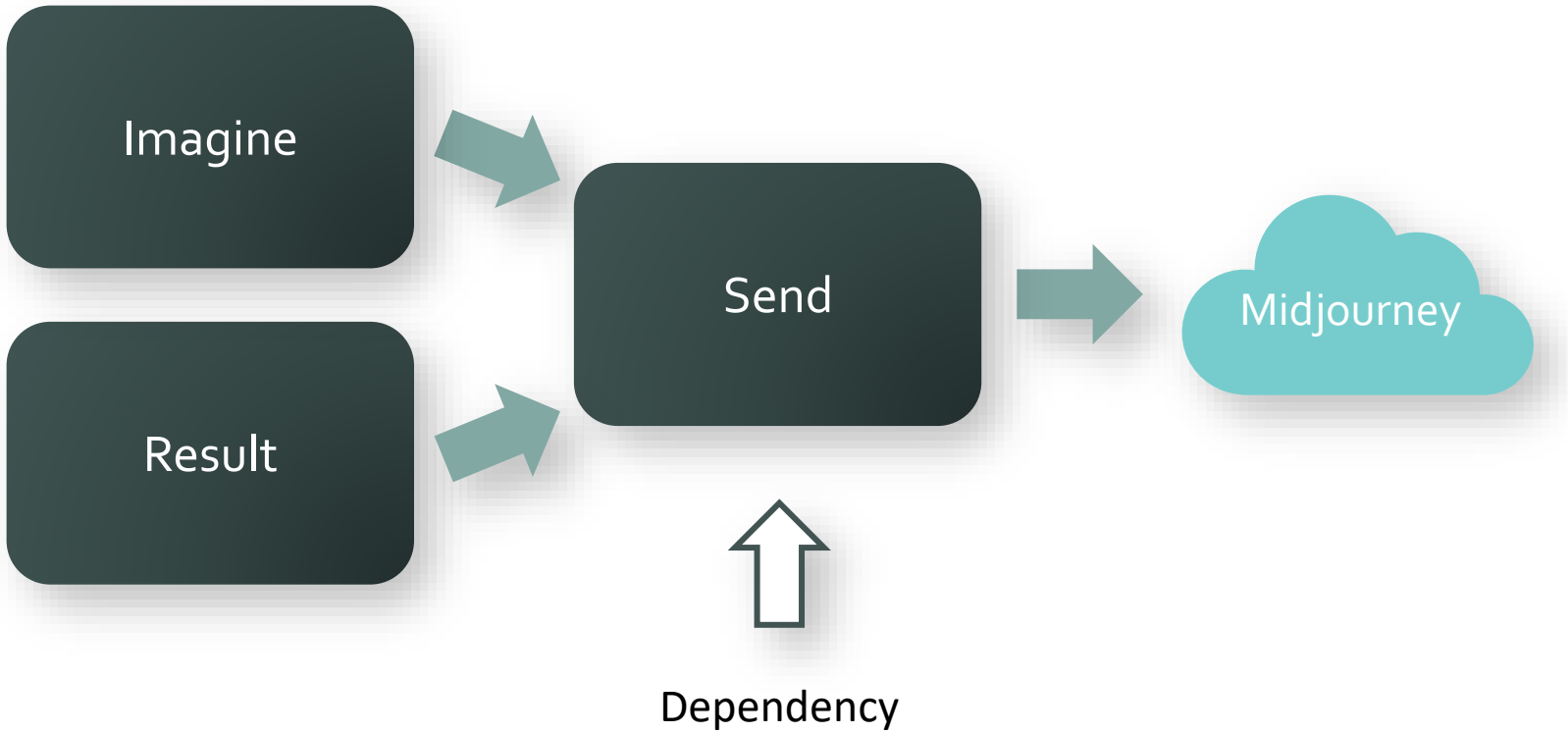
Dependencies

Any component or resource
that any other component
needs to fulfill its functionality

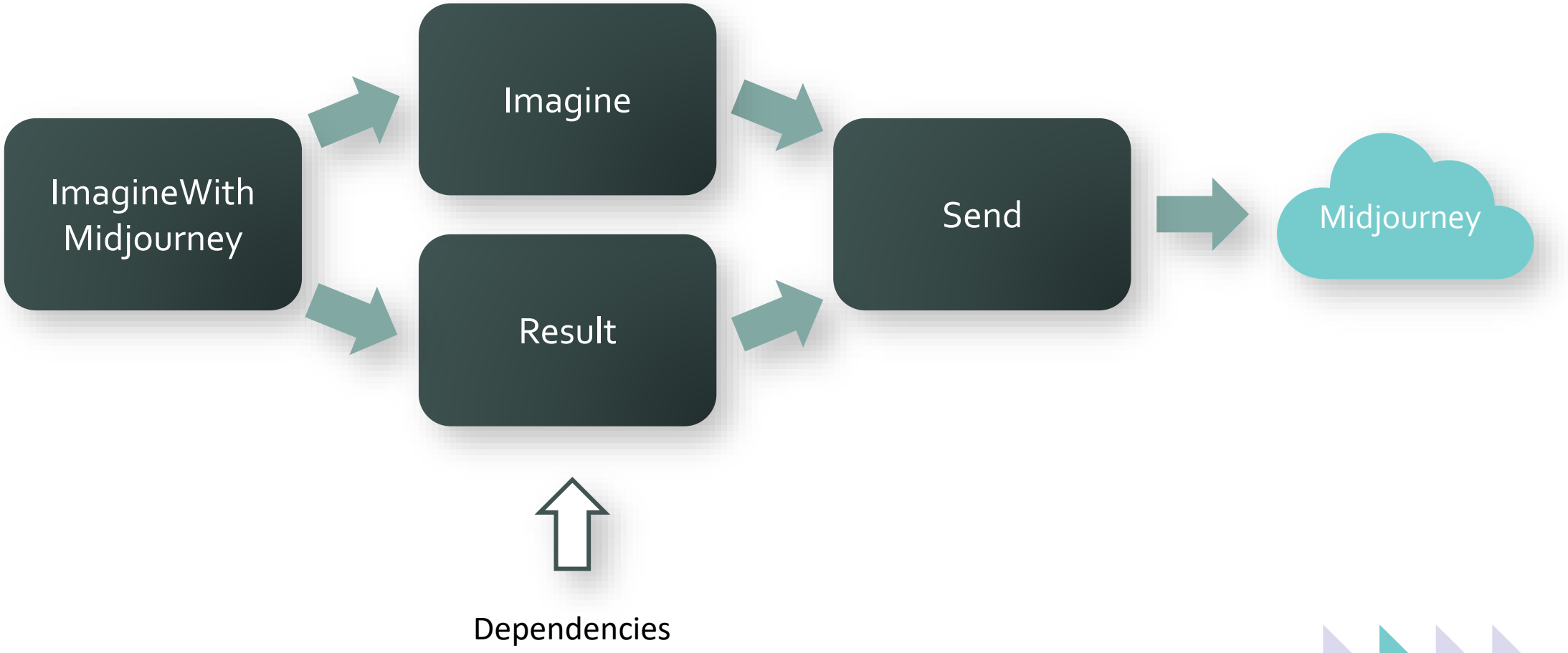
Dependencies



Dependencies



Dependencies



Dependencies

- Coupling vs. Cohesion

Dependencies

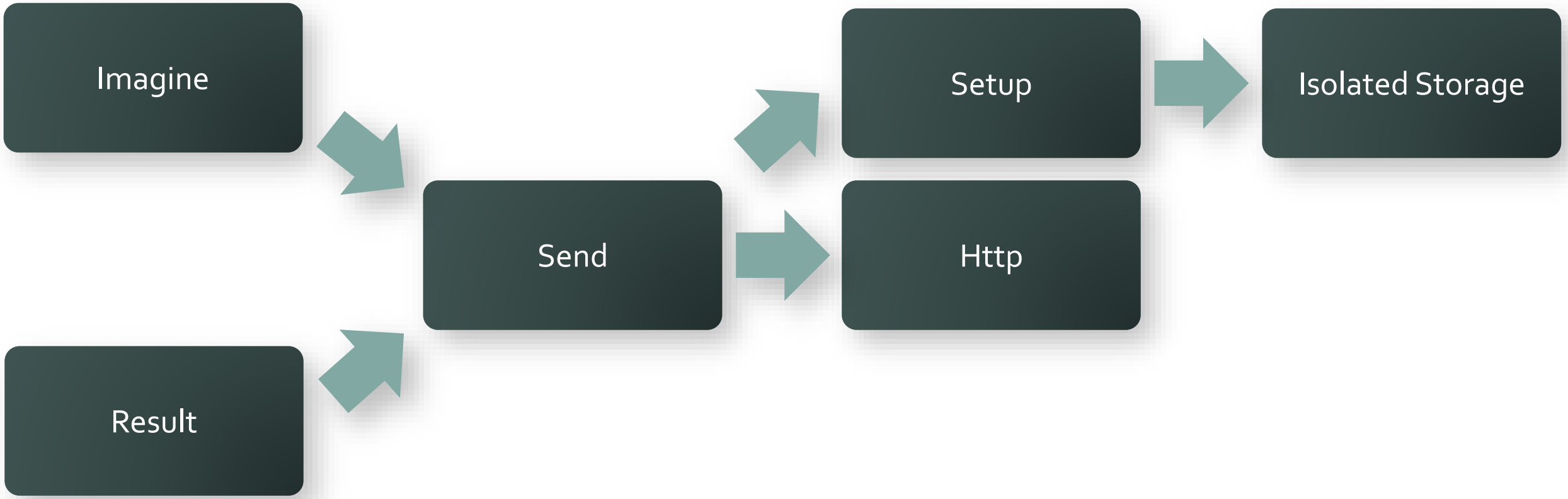
Coupling

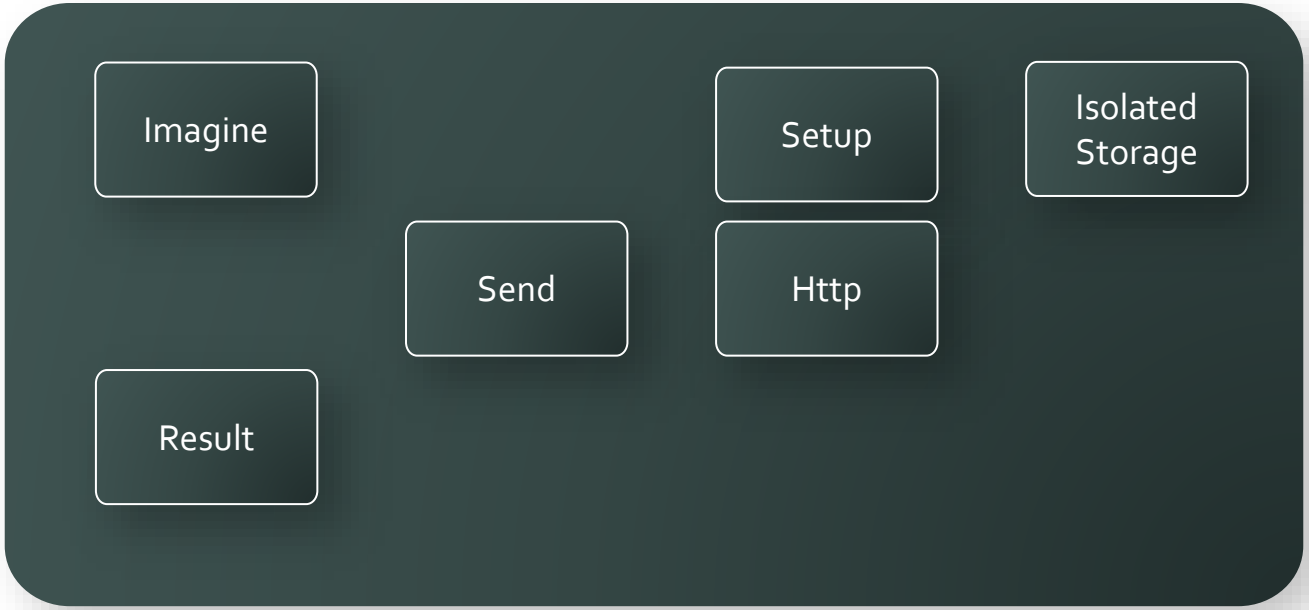
- Degree of interdependence of different components
- *How strongly are these components interdependent?*

Cohesion

- Degree to which components belong together
- *How well do these components belong together?*

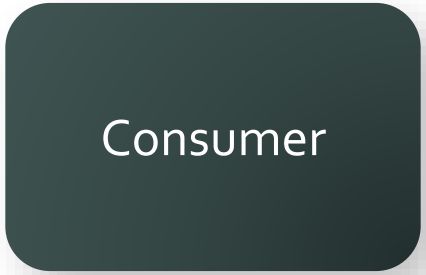
Imagine With MidJourney Meth (GetImageUrl)



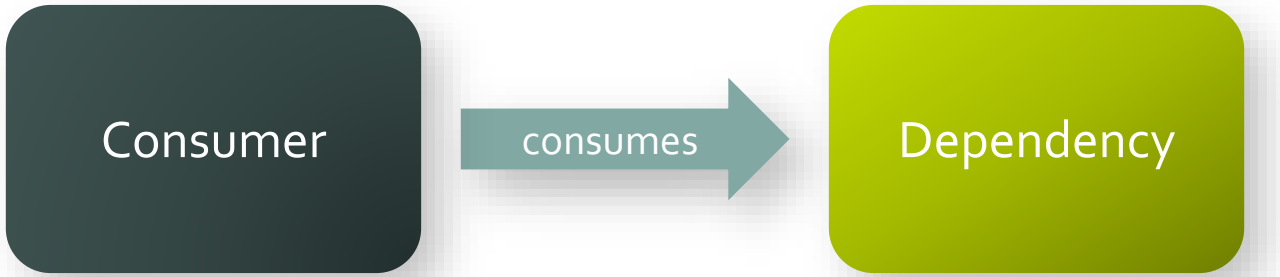

Imagine
Setup
Isolated Storage
Send
Http
Result

Inversion of control

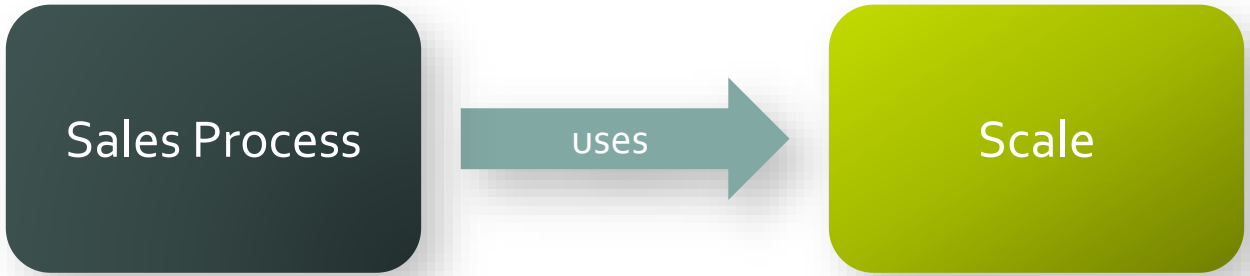
Inversion of control



Inversion of control

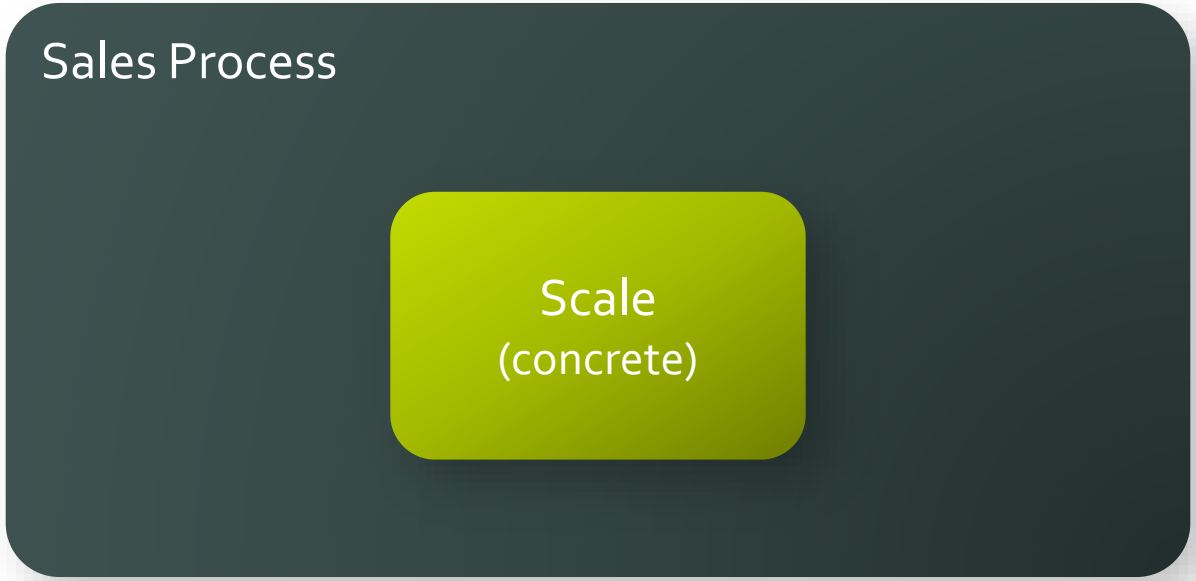


Inversion of control




```
procedure GetWeight(var SalesLine: Record "Sales Line")
var
    Scale: Codeunit "Scale - Mettler Toledo";
    Weight: Decimal;
begin
    Weight := Scale.GetWeight();
    SalesLine.Validate("Gross Weight", Weight);
end;
```

Inversion of control

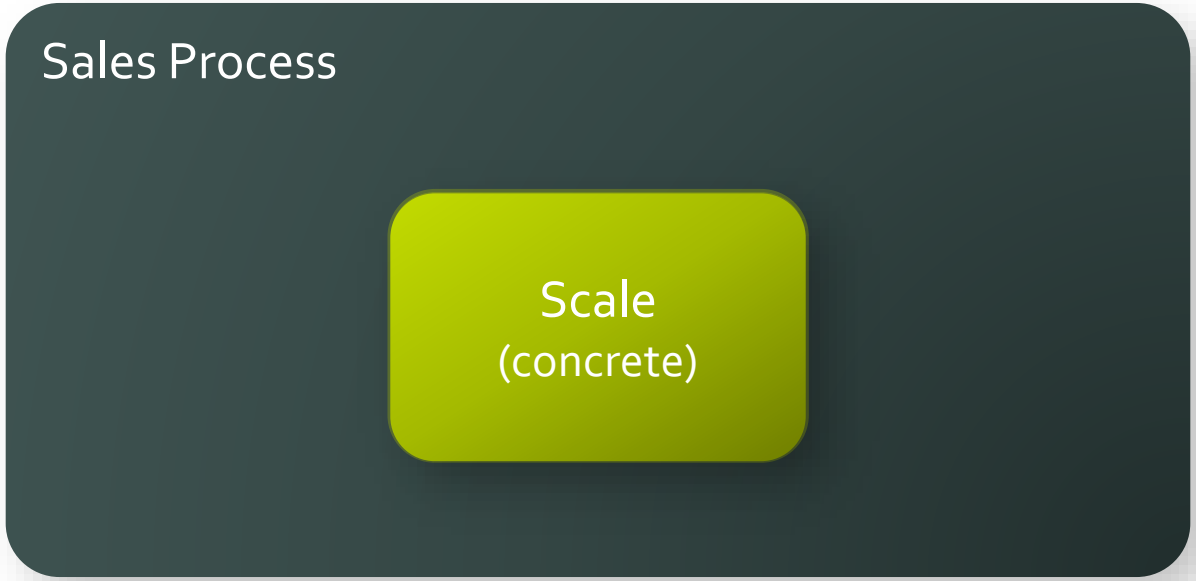


- Sales process declares ***concrete*** scale at compile time
- Sales process ***controls*** this dependency

Inversion of control

- Sales process declares ***abstract*** scale at compile time
- Sales process ***no longer*** controls this dependency

Inversion of control



- Sales process receives/obtains ***concrete*** scale at run time
- Another process ***controls*** this dependency

Dependency Injection

```
procedure GetWeight(var SalesLine: Record "Sales Line")
var
    Scale: Codeunit "Scale - Mettler Toledo";
    Weight: Decimal;
begin
    Weight := Scale.GetWeight();
    SalesLine.Validate("Gross Weight", Weight);
end;
```

Concrete
tightly coupled
dependency

Dependency Injection

```
procedure GetWeight(var SalesLine: Record "Sales Line"; Scale: Interface IScale)
var
    Weight: Decimal;
begin
    Weight := Scale.GetWeight();
    SalesLine.Validate("Gross Weight", Weight);
end;
```

Abstract
loosely coupled
dependency

Factory

Abstract
loosely coupled
dependency

```
procedure GetWeight(var SalesLine: Record "Sales Line")
var
    Scale: Interface IScale;
    Weight: Decimal;
begin
    Scale := GetScale();
    Weight := Scale.GetWeight();
    SalesLine.Validate("Gross Weight", Weight);
end;
```

Factory

Consumer ***asks*** for concrete implementation at run time

```
procedure GetWeight(var SalesLine: Record "Sales Line")
var
    Scale: Interface IScale;
    Weight: Decimal;
begin
    Scale := GetScale();
    Weight := Scale.GetWeight();
    SalesLine.Validate("Gross Weight", Weight);
end;
```

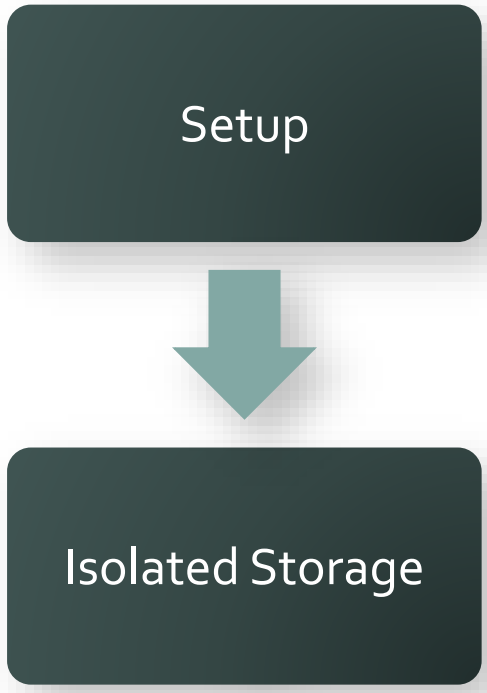
Factory

There are various techniques for providing concrete dependencies

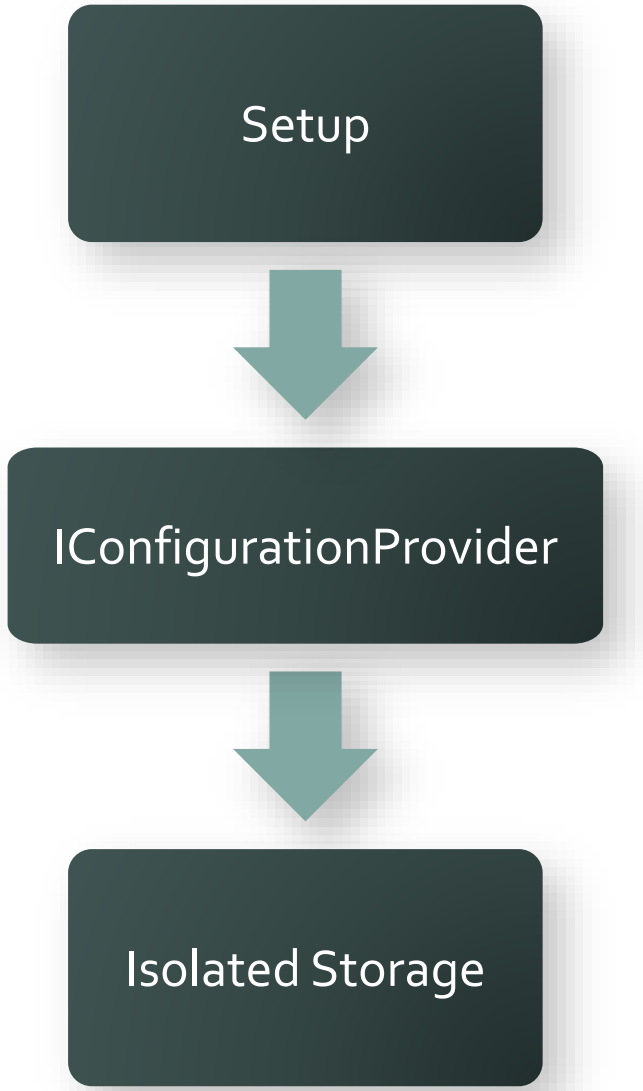
```
local procedure GetScale(): Interface IScale
begin
    // Here be dragons
end;

procedure GetWeight(var SalesLine: Record "Sales Line")
var
    Scale: Interface IScale;
    Weight: Decimal;
begin
    Scale := GetScale();
    Weight := Scale.GetWeight();
    SalesLine.Validate("Gross Weight", Weight);
end;
```

What about Isolated Storage?

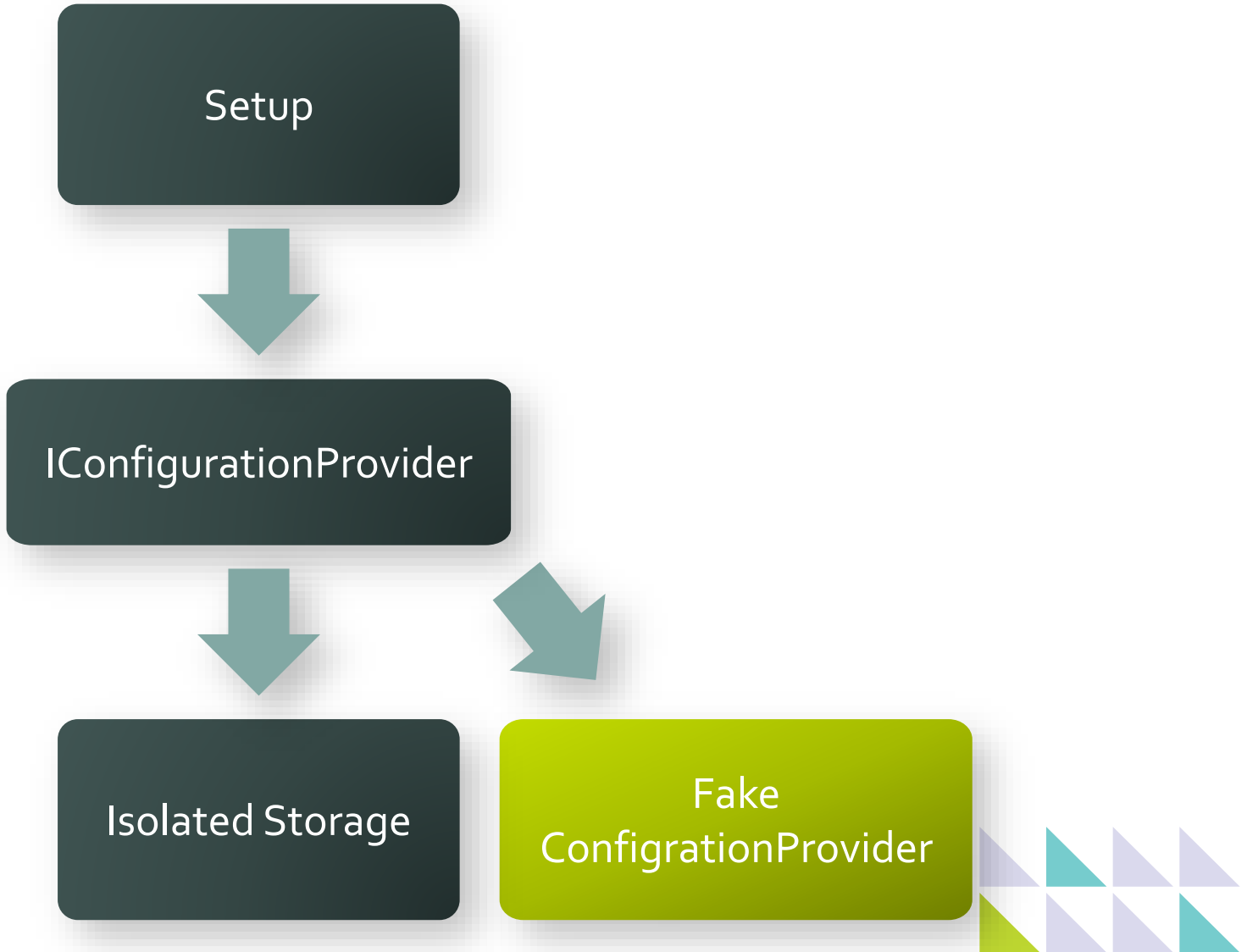
Decouple dependencies



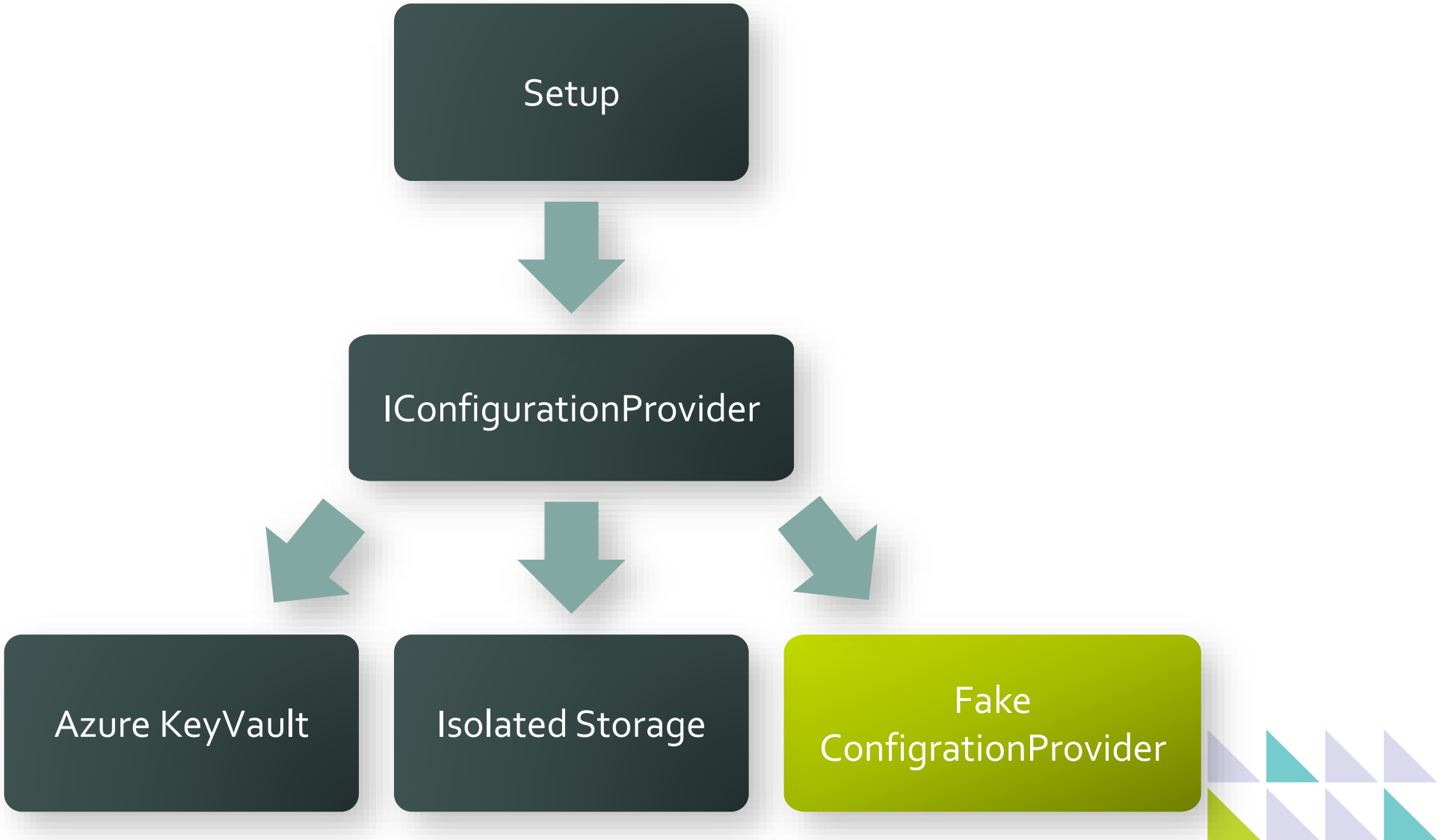
Decouple dependencies



Decouple dependencies



Decouple dependencies



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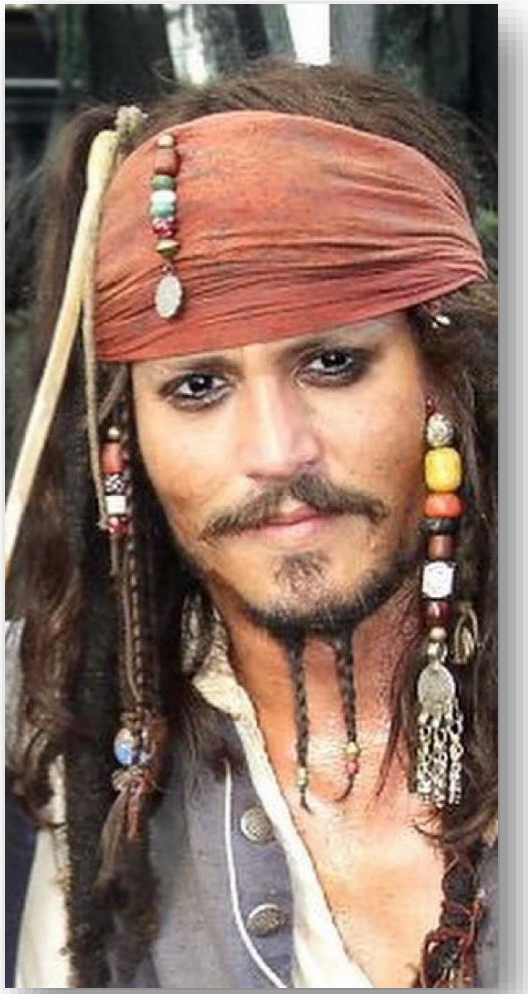
Test doubles

Test doubles



Test doubles

Test doubles

A test double is an object that
***stands in for a real object in a test**,*
just like a stunt double
stands in for an actor in a movie.

How do test doubles work?

```
procedure GetWeight(var SalesLine: Record "Sales Line")
var
    Scale: Interface IScale;
    Weight: Decimal;
begin
    Scale := GetScale();
    Weight := Scale.GetWeight();
    SalesLine.Validate("Gross Weight", Weight);
end;
```

Do we really
communicate
with a scale here?

How do test doubles work?

```
procedure GetWeight(var SalesLine: Record "Sales Line")
var
    Scale: Interface IScale;
    Weight: Decimal;
begin
    Scale := GetScale();
    Weight := Scale.GetWeight();
    SalesLine.Validate("Gross Weight", Weight);
end;
```

Does this function
really care about ***how exactly***
the weight was taken?

How do test doubles work?

```
procedure GetWeight(var SalesLine: Record "Sales Line")
var
    Scale: Interface IScale;
    Weight: Decimal;
begin
    Scale := GetScale();
    Weight := Scale.GetWeight();
    SalesLine.Validate("Gross Weight", Weight);
end;
```

```
interface IScale
{
    1 reference
    procedure TakeWeight(): Decimal;
}
```

The process is
abstracted
behind an interface

How do test doubles work?

```
procedure GetWeight(var SalesLine: Record "Sales Line")
var
    Scale: Interface IScale;
    Weight: Decimal;
begin
    Scale := GetScale();
    Weight := Scale.GetWeight();
    SalesLine.Validate("Gross Weight", Weight);
end;
```

Your process does not care which one of these interface implementations was invoked

```
interface IScale
{
    1 reference
    procedure TakeWeight(): Decimal;
}
```

```
codeunit 60219 "Scale - B-TEK" implements IScale
{
    procedure TakeWeight(): Decimal
    begin
        // Some complex hardware communication code
    end;
}
```

```
codeunit 60217 "Scale - Tefal" implements IScale
{
    procedure TakeWeight(): Decimal
    begin
        // Some complex hardware communication code
    end;
}
```

```
codeunit 60218 "Scale - Mettler Toledo" implements IScale
{
    procedure TakeWeight(): Decimal
    begin
        // Some complex hardware communication code
    end;
}
```

How do test doubles work?

```
procedure GetWeight(var SalesLine: Record "Sales Line")
var
    Scale: Interface IScale;
    Weight: Decimal;
begin
    Scale := GetScale();
    Weight := Scale.GetWeight();
    SalesLine.Validate("Gross Weight", Weight);
end;
```

… or if a mock implementation was invoked

```
interface IScale
{
    1 reference
    procedure TakeWeight(): Decimal;
}
```

```
codeunit 60219 "Scale - B-TEK" implements IScale
{
    procedure TakeWeight(): Decimal
    begin
        // Some complex hardware communication code
    end;
}
```

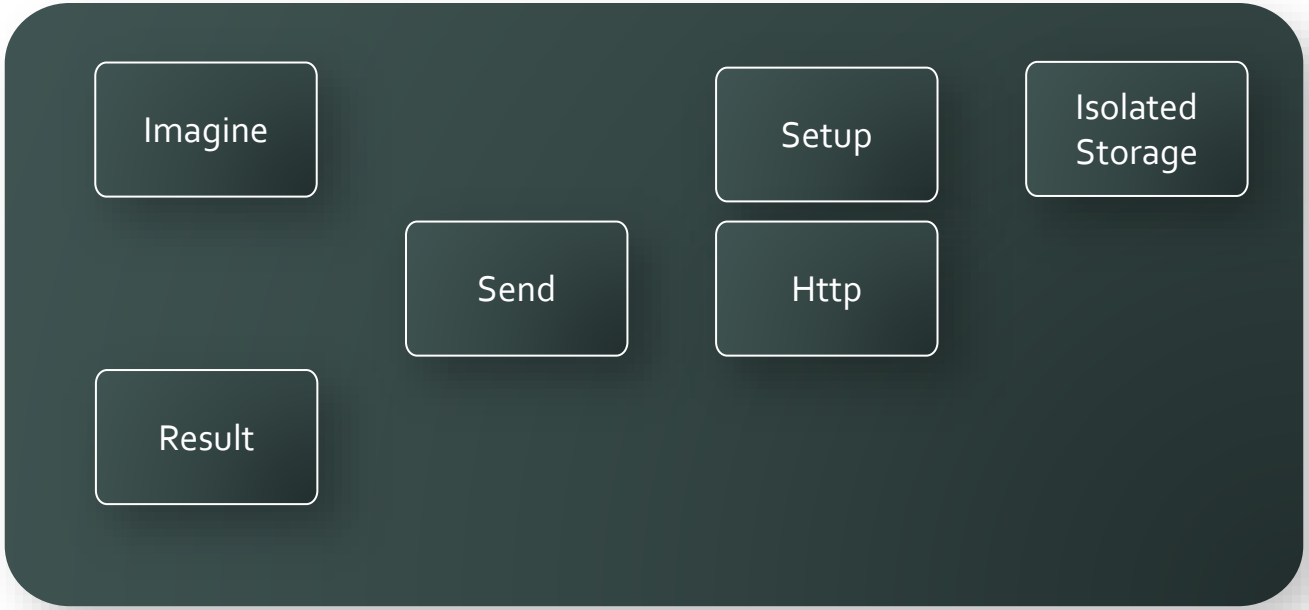
```
codeunit 60217 "Scale - Tefal" implements IScale
{
    procedure TakeWeight(): Decimal
    begin
        // Some complex hardware communication code
    end;
}
```

```
codeunit 60218 "Scale - Mettler Toledo" implements IScale
{
    procedure TakeWeight(): Decimal
    begin
        // Some complex hardware communication code
    end;
}
```

```
codeunit 60220 "Scale - Mock" implements IScale
{
    procedure TakeWeight(): Decimal
    begin
        exit(Random() * 100)
    end;
}
```

What have we done so far?

- Decoupled setup
- Decoupled Isolated Storage
- We can test isolated from setup or database
- We can exchange our components (eg, Azure Key Vault)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Setup
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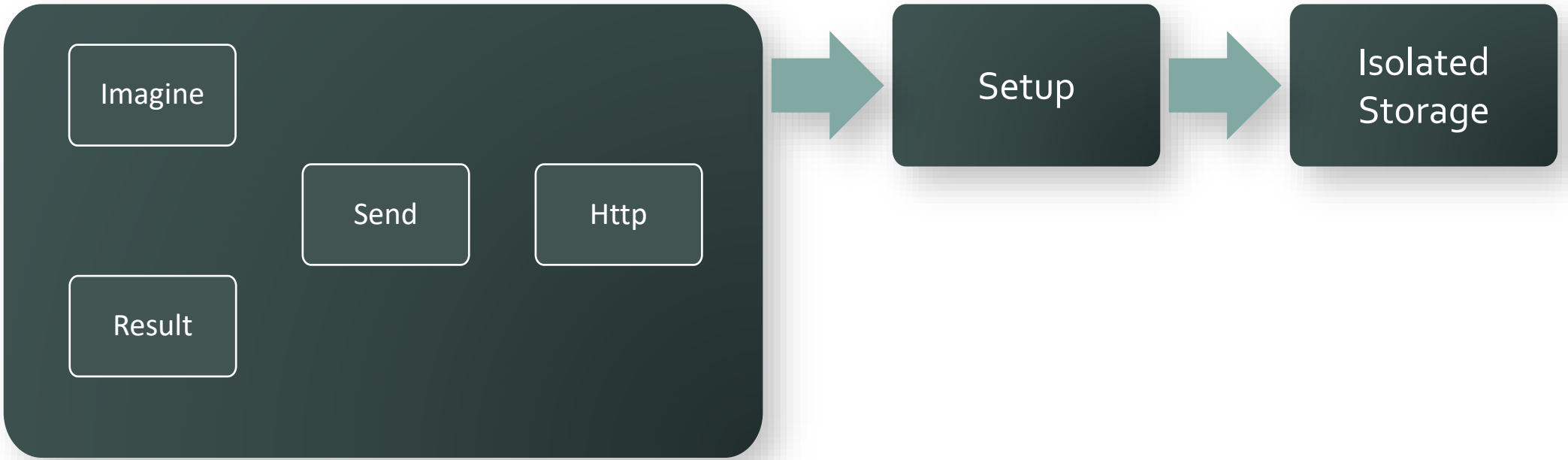
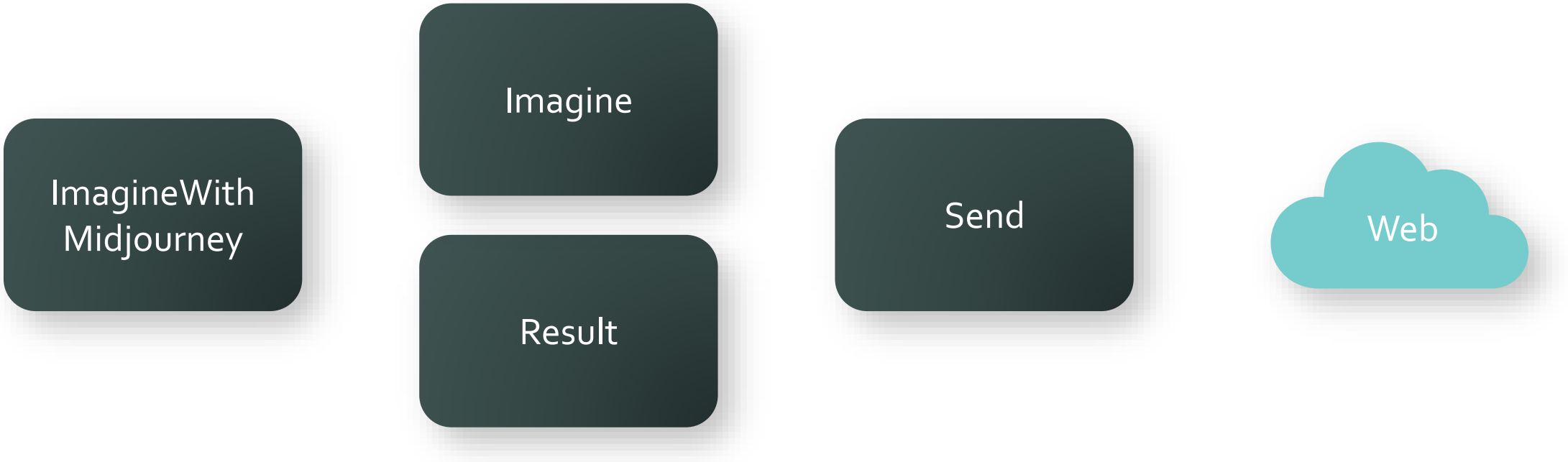
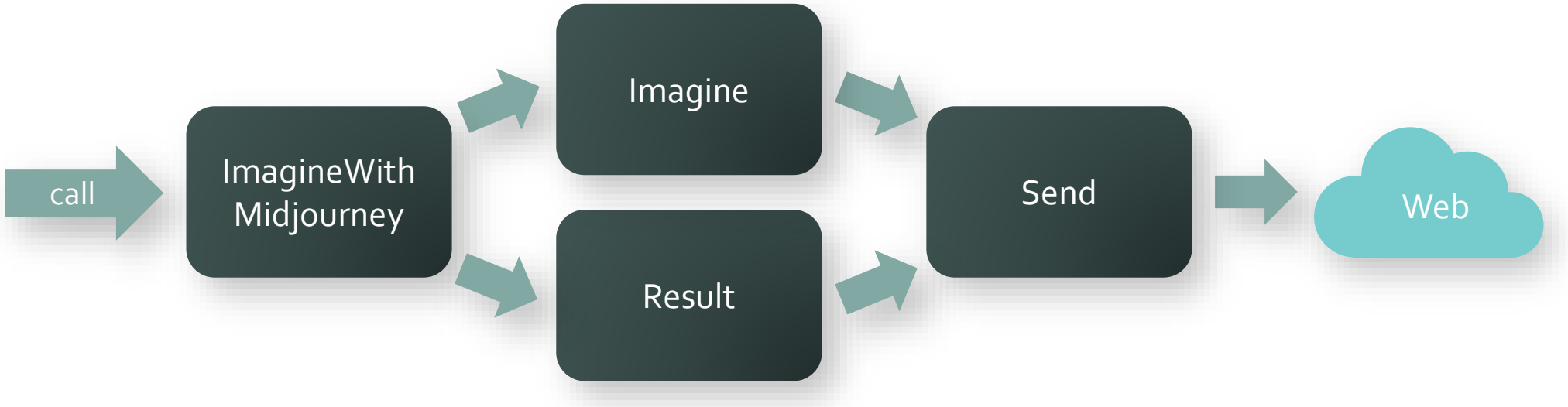

Imagine
Send
Http
Result
Setup
Isolated Storage

Testing in Isolation

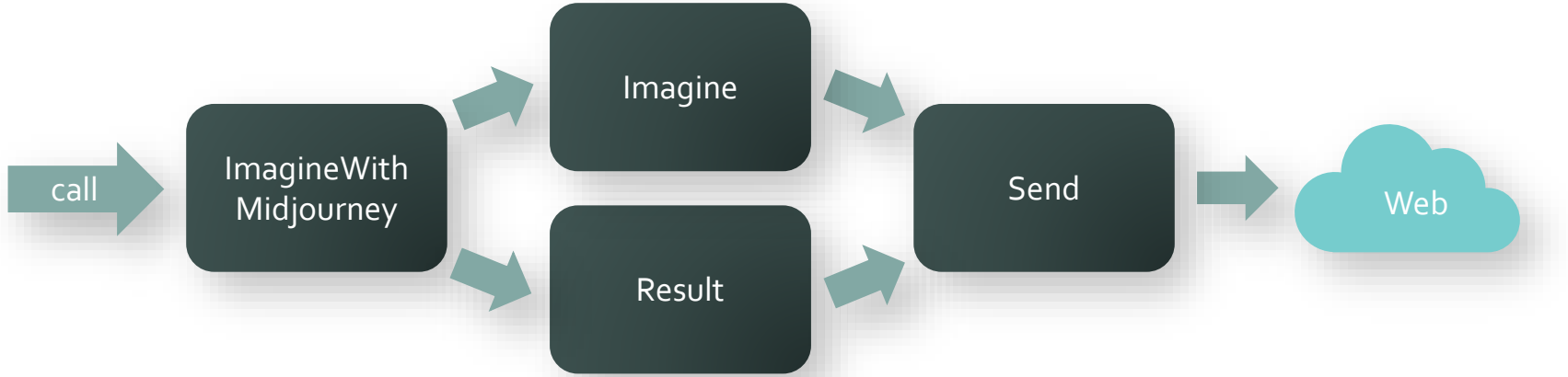
Testing in isolation



Testing in isolation



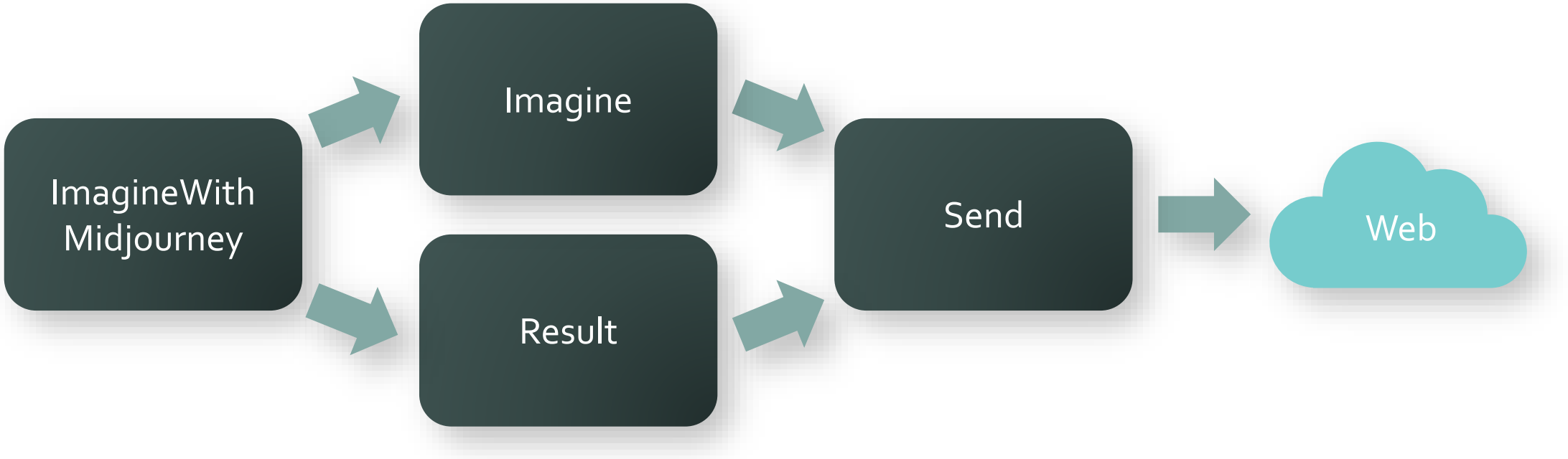
Testing in isolation



Testing directly is problematic:

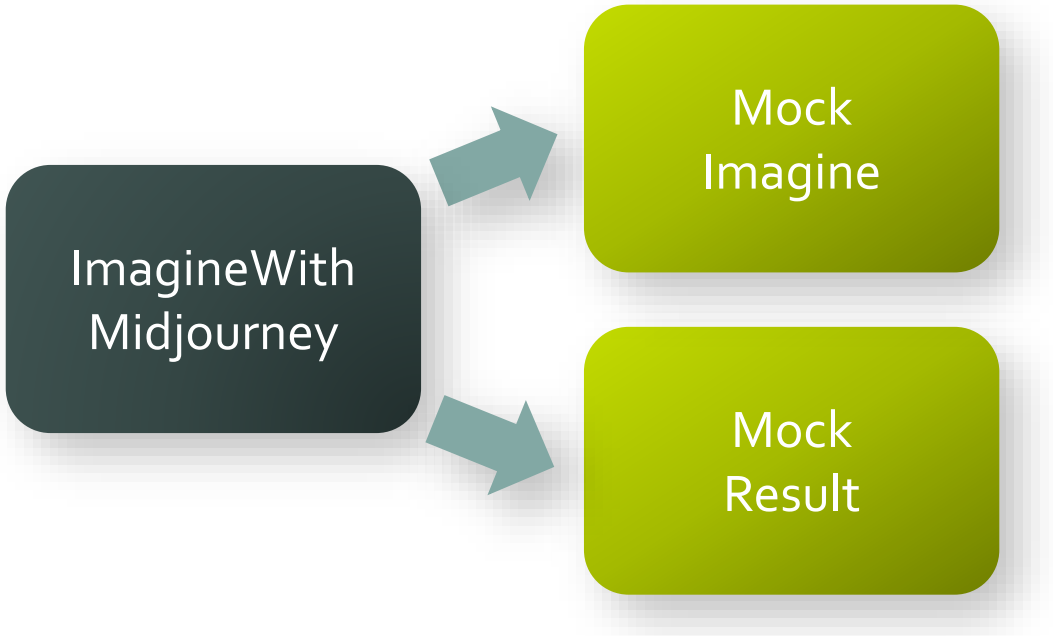
- Requires a lot of "givens"
- Takes a lot of time to properly set up
- Executes slowly
- ***Does not enable testing all flows***

Testing in isolation



We must test each component in isolation from its dependencies

Testing in isolation



At each level:

- We test the component directly
- We mock its direct dependencies

Testing in isolation

At each level:

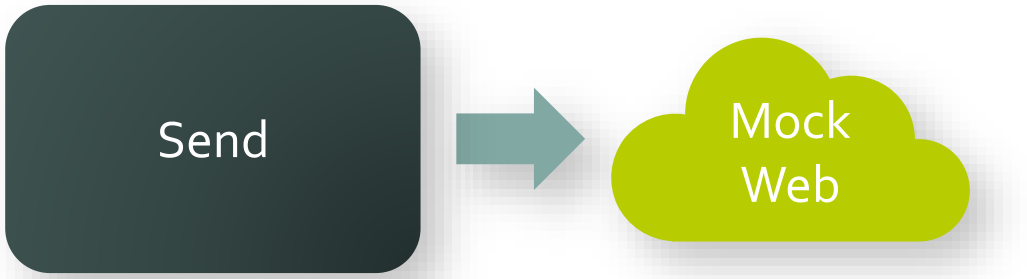
- We test the component directly
- We mock its direct dependencies

Testing in isolation

At each level:

- We test the component directly
- We mock its direct dependencies

Testing in isolation



At each level:

- We test the component directly
- We mock its direct dependencies

Testing in isolation

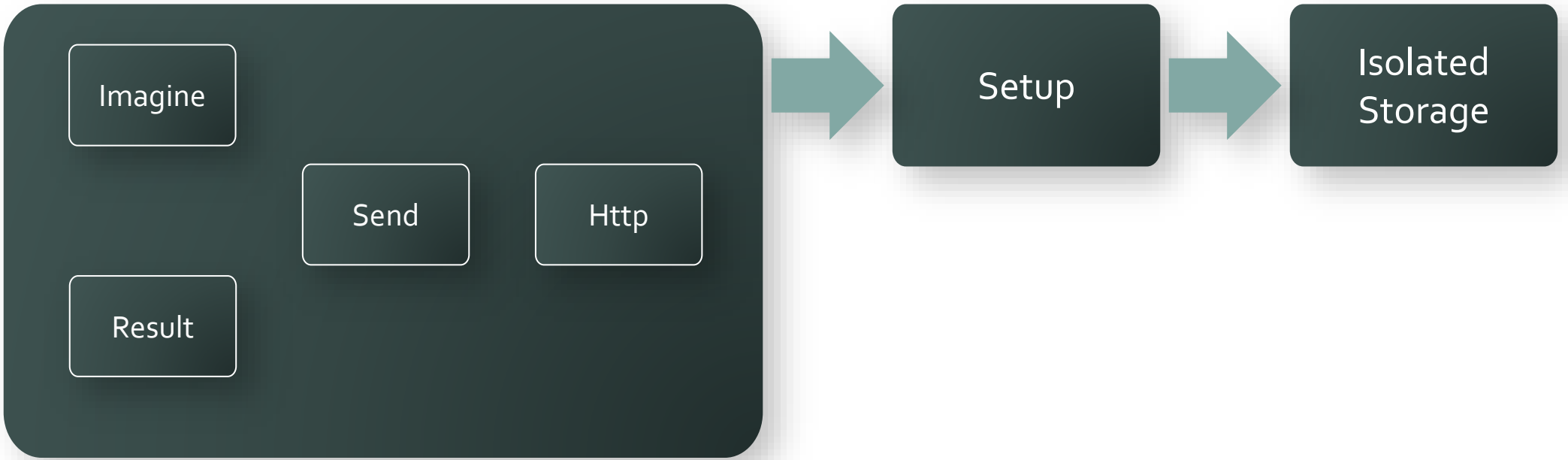
- We tested ***all components***
- We tested ***all code paths***
- We simulated ***all conditions***

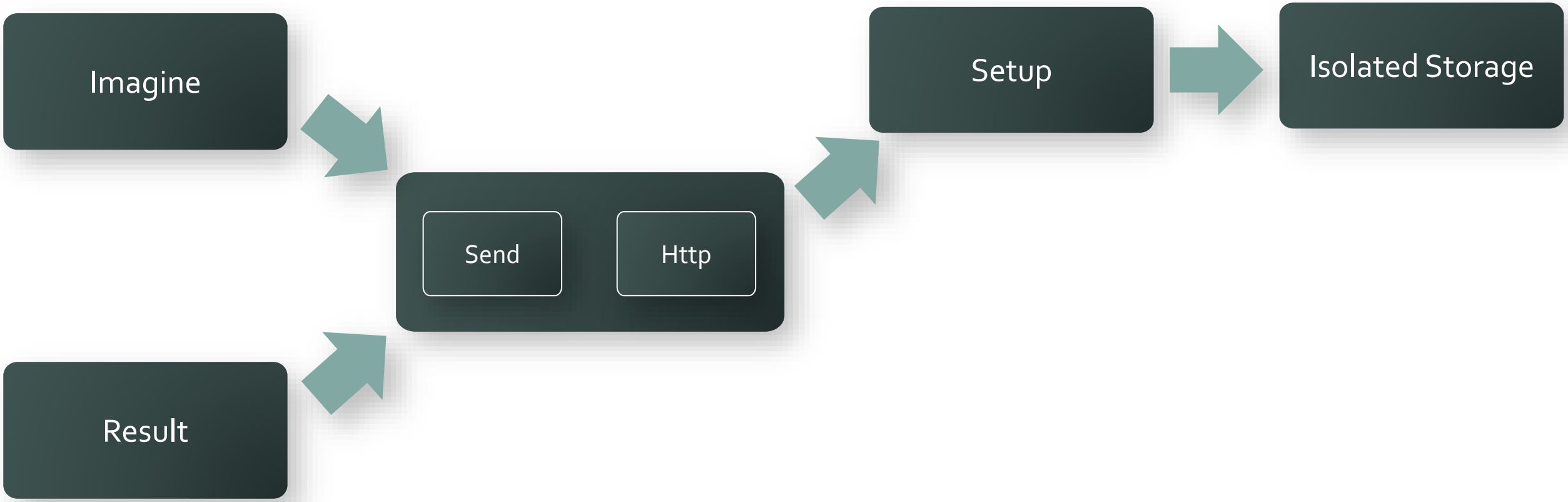
- Tests were ***simple to write***
- Tests ***performed fast***

Tests pinpoint design issues

When you can't test a component in isolation,
you know there is a problem with your design.

-- a wise man once said --


Imagine
Send
Http
Result
Setup
Isolated Storage


Imagine
Result
Send
Http
Setup
Isolated Storage

Where are we …

- Decoupling helps us to test
- But it also gives opportunities
  - Dall-E
  - Azure Key Vault
- Dependency Injection makes us able to control the implementations wherever we want..

But …

```
internal procedure GetImageUrl(Prompt: Text; Imagine: Interface IMidjourneyImagine; Result
var
    IsHandled: Boolean;
begin
```

```
t: Interface IMidjourneyResult; MidjourneySend: Interface IMidjourneySend) MidjourneyUrl: Text
```

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Factory

Factory

"An object that the client code can use to obtain instances of its dependencies, without explicitly knowing the concrete class being instantiated."

An object

```
codeunit 50074 "Midjourney Factory"
{
    SingleInstance = true;
```

“ that the client code can use to obtain instances of its dependencies, without explicitly knowing the concrete class being instantiated.”

An object
that the client code can use

```
codeunit 50074 "Midjourney Factory"
{
    SingleInstance = true;
```

```
codeunit 50061 "ImagineWithMidjourney Meth"
{
    var
        Factory: Codeunit "Midjourney Factory";
```

“ to obtain instances of its dependencies, without explicitly knowing the concrete class being instantiated.”

An object
that the client code can use
to obtain instances of its dependencies

```
codeunit 50074 "Midjourney Factory"
{
    SingleInstance = true;
```

```
codeunit 50061 "ImagineWithMidjourney Meth"
{
    var
        Factory: Codeunit "Midjourney Factory";
```

```
local procedure DoGetImage(Prompt: Text; var MidjourneyUrl: Text;
var
    Imagine: Interface IMidjourneyImagine;
    TaskId: Text;
begin
    if IsHandled then
        exit;

    if not _retryDelaySet then
        _retryDelay := 5000;

    Imagine := Factory.GetMidjourneyImagine();
    TaskId := Imagine.Imagine(Prompt);
    MidjourneyUrl := WaitForUrl(TaskId);
end;
```

```
internal procedure GetImageUrl(Prompt: Text; Imagine: Interface IMidjourneyImagine; Result
var
    IsHandled: Boolean;
begin
```

```
internal procedure GetImageUrl(Prompt: Text
var
    IsHandled: Boolean;
begin
```

```
internal procedure GetImageUrl(Prompt: Text) MidjourneyUrl: Text
var
    IsHandled: Boolean;
begin
```

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Demo:
Single Instance Factories

Single Instance Factories

Pros:

- Much easier to add/remove dependencies
- Easy to create/read tests

Cons:

- Dependency chains are now obscured
- Compiler doesn't help you
- Can be a liability, because developer might forget

Factory Injection

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Demo:
Factory Injection

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Hidden Dependencies

Key Takeaways

- **Interfaces** promote loose coupling and easier maintenance of the system.
- **Decoupling** enhances flexibility, testability, and maintainability.
- **Inversion of Control** inverts the control flow, improving modularity and extensibility.

Repo: https://github.com/vjekob/bctechdays2023

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TDD

TDD is not about tests

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TDD is not about tests
it's about design

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Q&A

Any Questions?

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Thank You!