// @jamescardona11

Decoding isolates

Content

intro

who has used isolates?

what is the goal of this talk?

who is this for?

- I’m: James Cardona
- Role: Mobile developer
- Company: phononx.com
- LinkedIn/Github/Medium: @jamescardona11
- Web: j11.io

wwh

what

- concurrent processing
- thread wrapper
- actor model

why

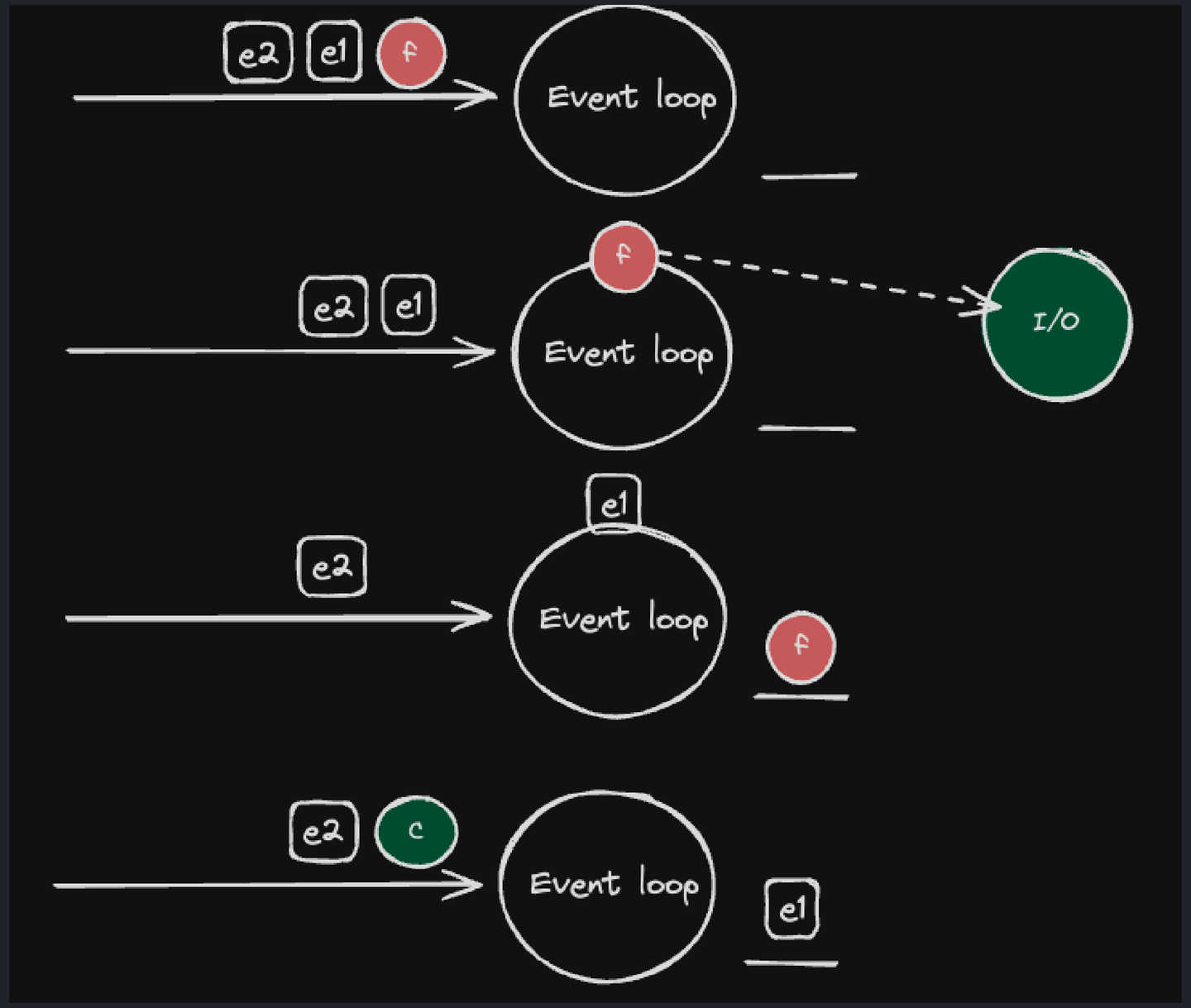
- event loop
- async - await
- event handling

how

- compute/ run
- spawn

why

- event loop
- async - await
- event handling



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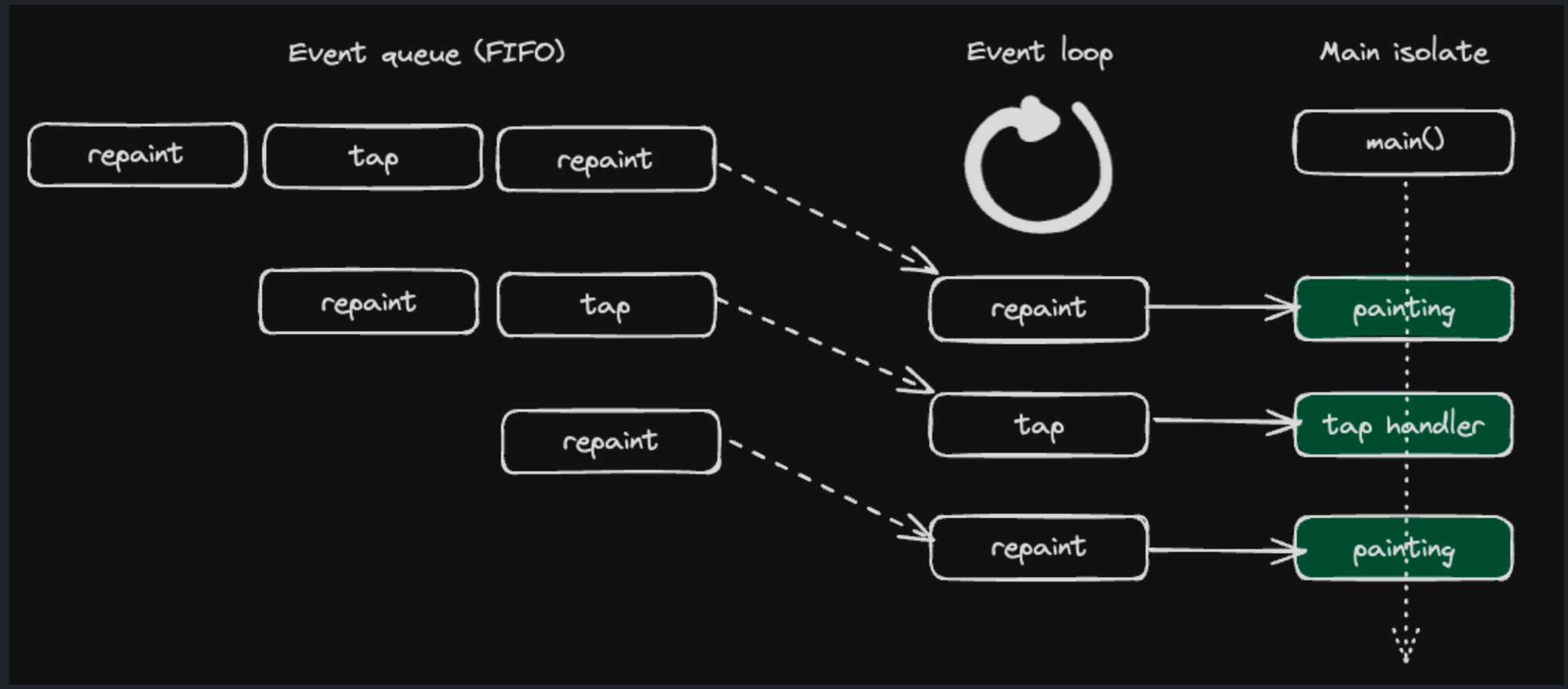

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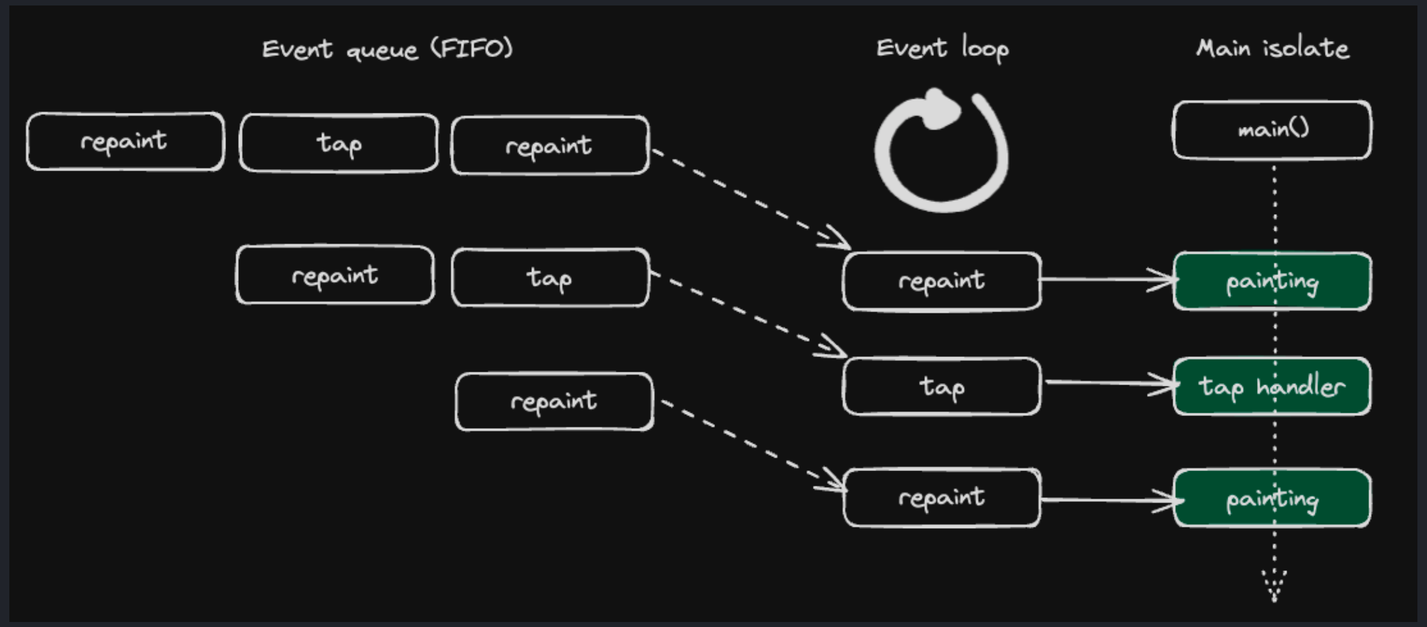

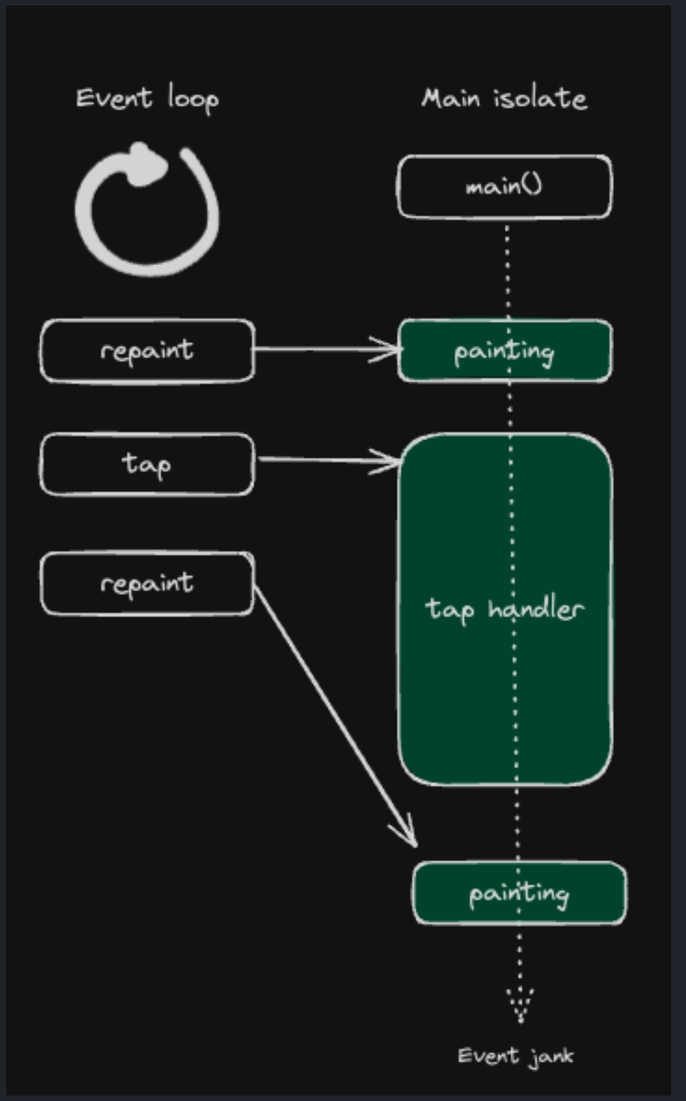

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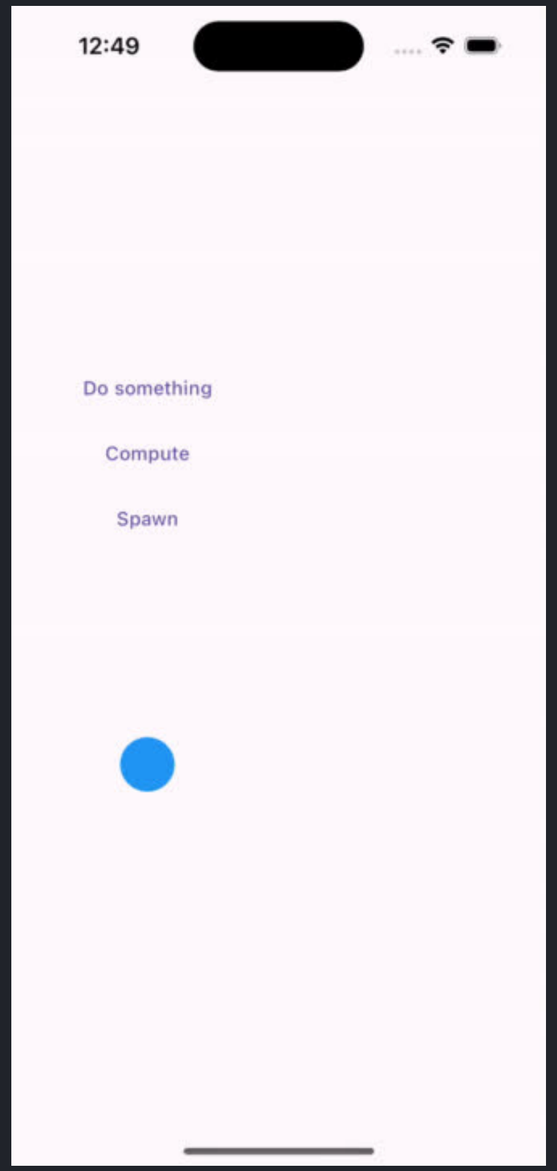

wwh

what

- concurrent processing
- thread wrapper
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why

- event loop
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- Concurrency
- Isolation/memory
- Parallelism
- Communication
- Heavy task

how

- compute/ run
- spawn

how

- compute/ run
- spawn

compute/run

```dart
void computeIsolate() {
  print('Compute');
  compute(doSomething, 1000000000);
}

void runIsolate() {
  print('Run');
  Isolate.run(() => doSomething(1000000000));
}
```

how

- compute/ run
- spawn

Spawn

```
void spawn() async {
    print('Spawn');
    final rcvPort = ReceivePort();

    final isolate = await Isolate.spawn(_doSomethingForSpawn, rcvPort.sendPort);

    final completer = Completer<SendPort>();
    rcvPort.listen((message) {
      if (message is SendPort) completer.complete(message);

      print(message);

      if (message is! SendPort) {
        rcvPort.close();
        isolate.kill();
      }
    });

    final send2Isolate = await completer.future;
    send2Isolate.send(1000000000);
  }
```

Content

01 ~~intro~~

02 ~~what, why, how?~~ 5 -8 min

03 wrapper/controller

- Actor Model
- Communicate
- Bidirectional (demo)
- Controller

04 demo time

05 questions?

Actor model

Concurrency models

- Processes
- Threads
- Futures
- Coroutines
- Actor
- etc

what is?

encapsulates state and behavior

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Actor model

- Actors are persistent.
- Encapsulate internal state (Private).
- Actors are asynchronous.
- Communication through messages.
- Independence between actors.
- Supervision.

what is?

encapsulates state and behavior

key concepts

features

??

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Actor model

- Create new actors.
- Send messages to other actors.
- Receive messages and in-responses.
- Process exactly one message at a time.

"Do not communicate by sharing memory; instead, share memory by communicating" | Effective Go

what is?

encapsulates state and behavior

key concepts

features

what can actors do?

functions

??

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Actor model

- NO channels or intermediaries.
- “best effort” delivery.
- Messages can take an arbitrarily long time to deliver.
- No message ordering guarantees.

what is?

encapsulates state and behavior

key concepts

features

what can actors do?

functions

properties of communication

safe

??

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Actor model

- Each actor has an address.
- Actors can communicate with other actors using their addresses (Use SendPort to send messages).
- The actor receives addresses from other actors in messages (Listen ReceivePort).
- One actor can have more than one address.
- Address != identify; this means two actors with the same identity can have different addresses.

what is?

encapsulates state and behavior

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what can actors do?

functions

properties of communication

safe

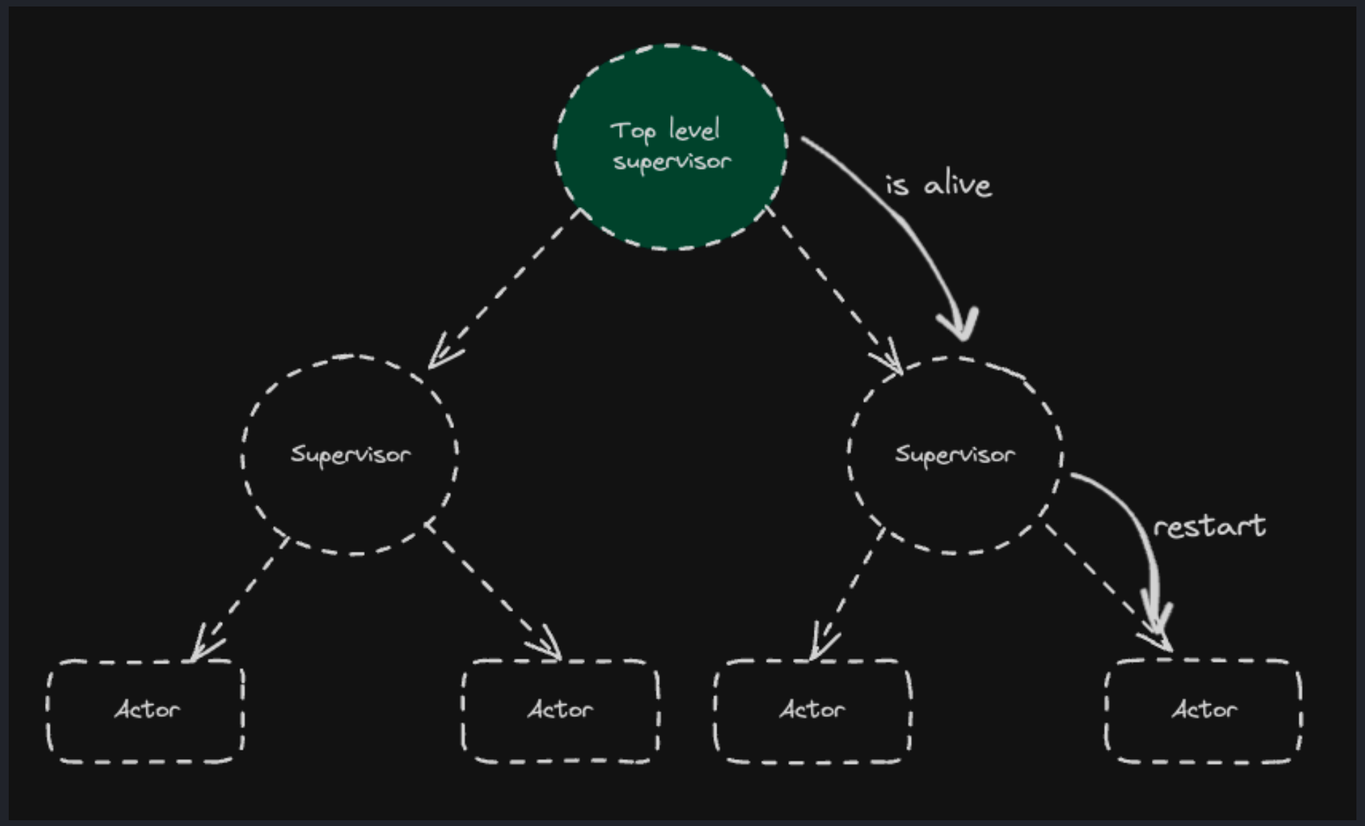
address

mailbox

??

??

Actor model



what is?

encapsulates state and behavior

key concepts

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what can actors do?

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properties of communication

safe

address

mailbox

supervision

state

Actor Model

Isolates similarities

- ReceiverPort is a similar concept to Actor Mailbox.
- The Mailbox is a message queue
- SendPort is a similar address concept in the actor.

Isolates vs Threads

- Isolation of memory
- Lightweight
- Safe concurrency

Actor Model

Isolates similarities

- ReceiverPort is a similar concept to Actor Mailbox.
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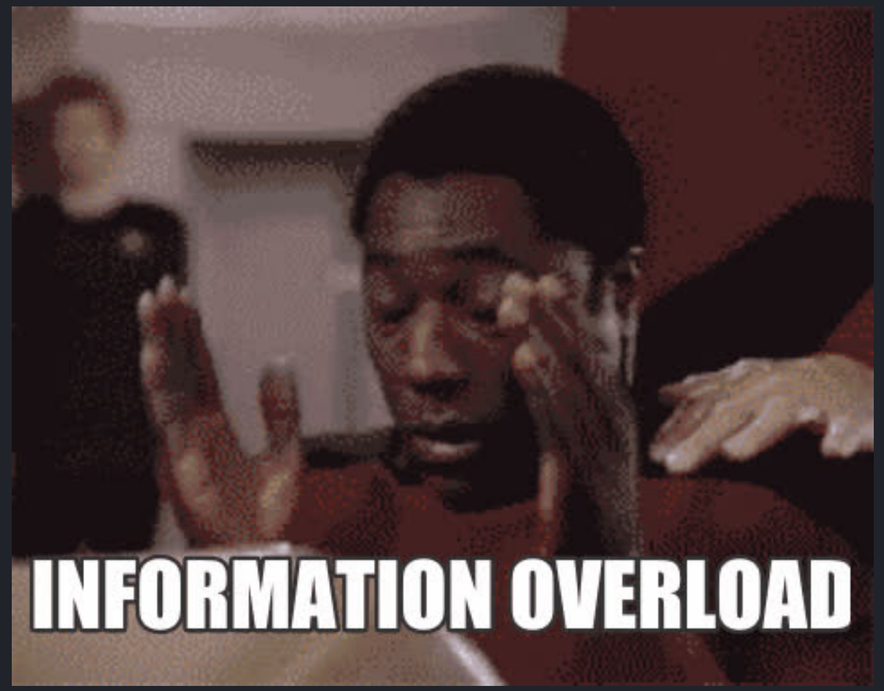
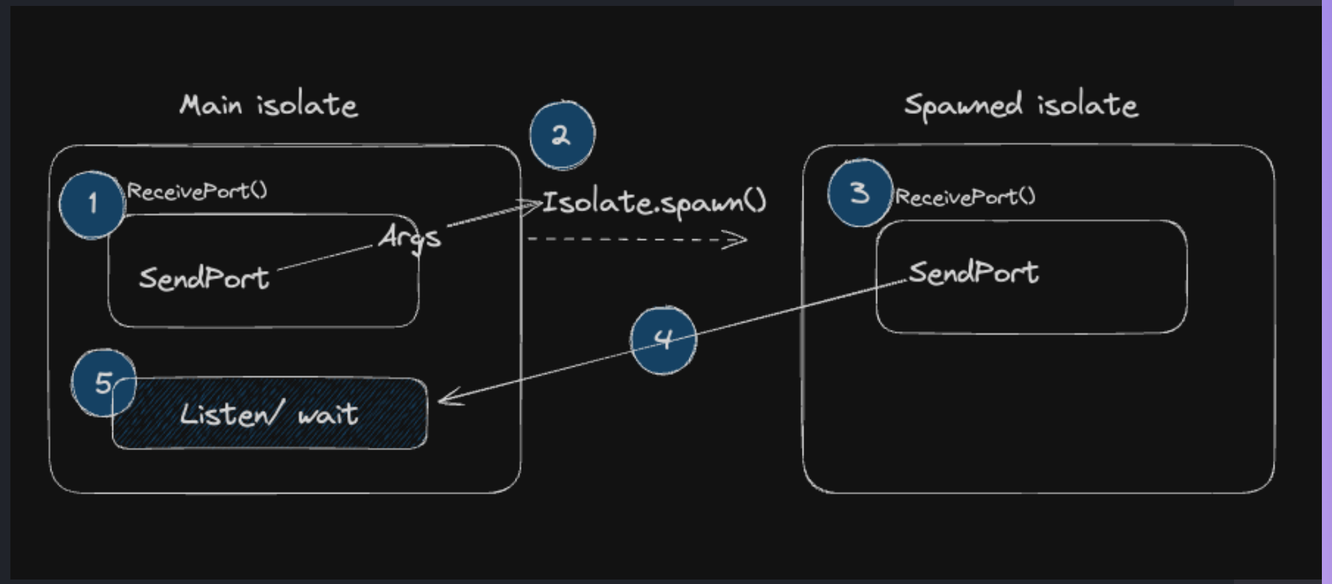
Isolates vs Threads

- Isolation of memory
- Lightweight
- Safe concurrency



Communicate between two isolates

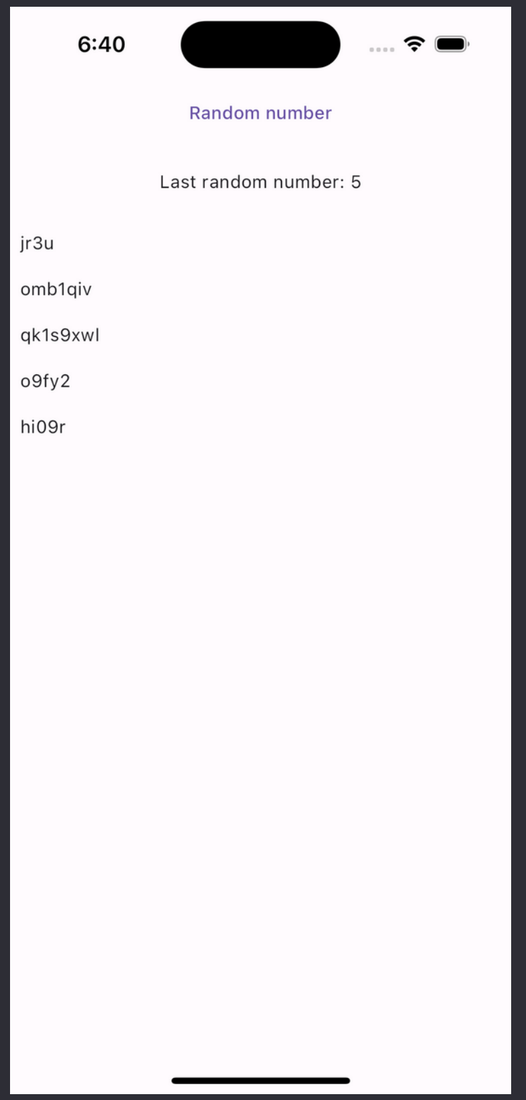



```dart
void spawn() async {
  print('Spawn');
  final rcvPort = ReceivePort(); // --> Step 1

  // --> Step 2
  final isolate = await Isolate.spawn(_doSomethingForSpawn, rcvPort.sendPort);

  final completer = Completer<SendPort>();
  rcvPort.listen((message) {
    // --> Step 5
    if (message is SendPort) completer.complete(message);

    if (message is! SendPort) {
      rcvPort.close();
      isolate.kill();
    }
  });

  final send2Isolate = await completer.future;
  send2Isolate.send(1000000000);
}

void _doSomethingForSpawn(SendPort sendPort) {
  // --> Step 3
  final rcvPort = ReceivePort();

  // --> Step 4
  sendPort.send(rcvPort.sendPort);

  rcvPort.listen((bigNumber) {
    var sum = 0;
    for (var i = 0; i <= bigNumber; i++) {
      sum += i;
    }

    sendPort.send(sum);
  });
}
```

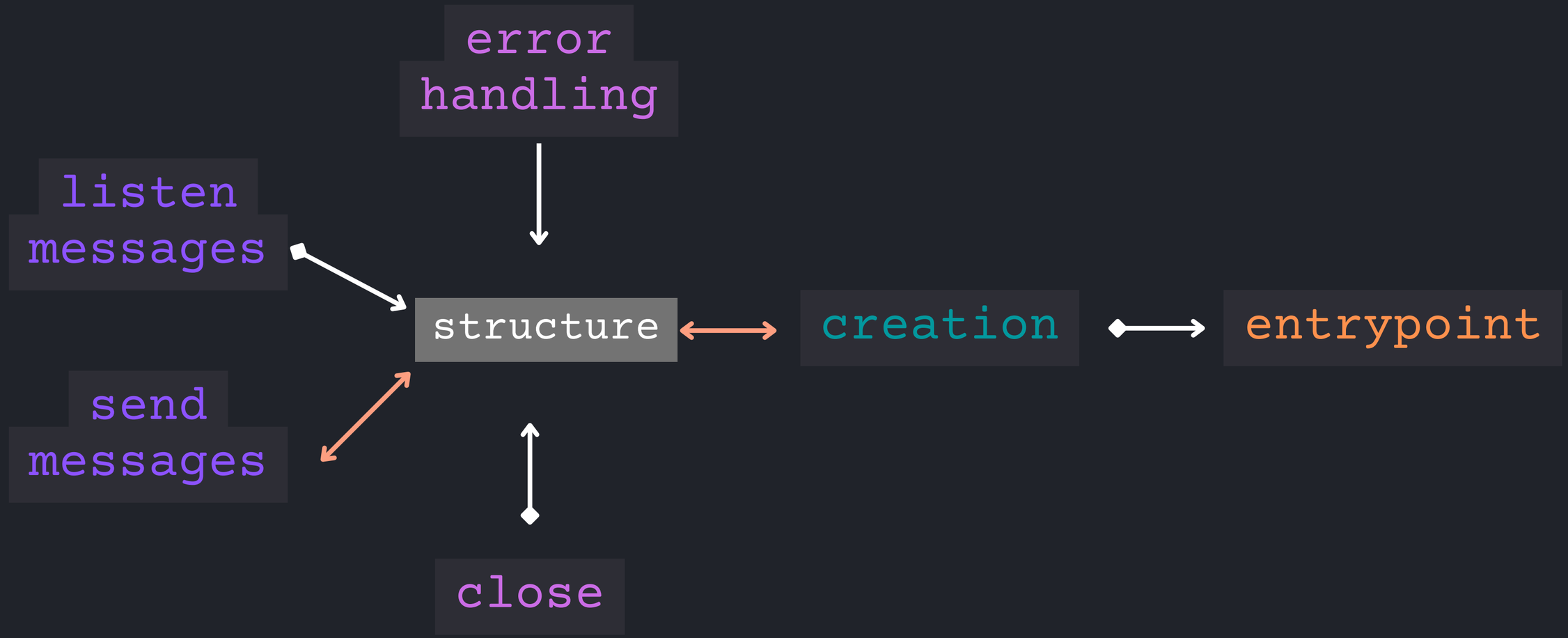
bidirectional

best practices with isolates

- Error handling: Always handle errors in isolates to prevent crashes
- Kill isolates: Always kill isolates when they’re no longer needed.
- Limit communication: Avoid sending large objects between isolates.



wrapper/controller



controller v1

```dart
class IsolateController<T> {
  final Isolate _isolate;
  final ReceivePort _receivePort;
  final Stream<dynamic> _broadcastRp;
  final SendPort _sendPort;

  static Future<IsolateController<T>?> create<T>();

  Stream<dynamic> get broadcastRp;

  void send(T message);

  void close();
}
```

controller v2

```dart
class IsolateController<I, O> {
  final SendPort _commands;
  final ReceivePort _responses;

  final StreamController<O> _controller =
      StreamController<O>.broadcast();
  late final StreamSubscription<O> _subscription;

  static Future<IsolateController<I, O>?> create<I, O>();

  Stream<O> get broadcastRp;

  void send(I message);

  void dispose();
}
```

Content

01 ~~intro~~

02 ~~what, why, how?~~ 5-8 min

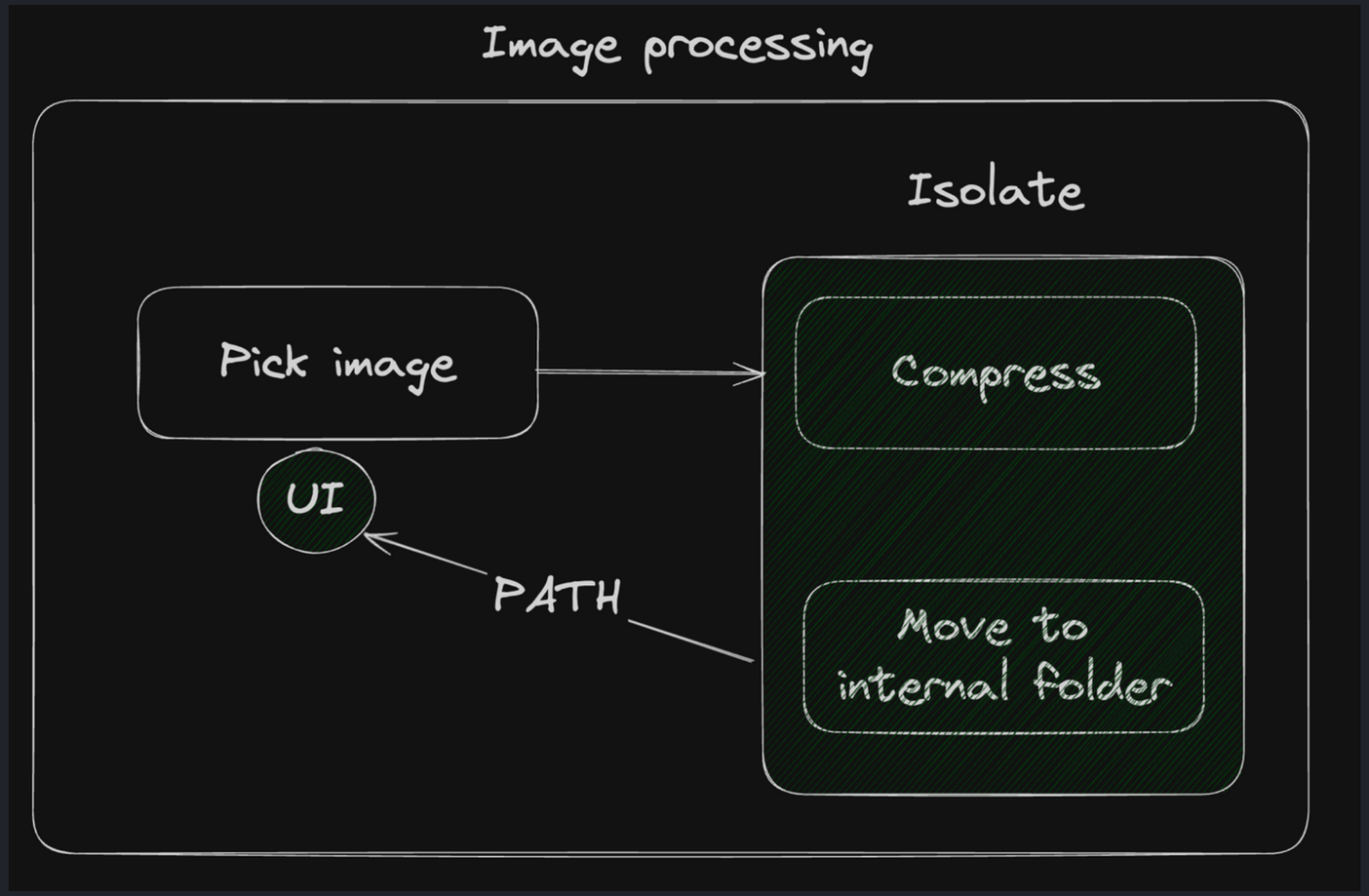
03 ~~wrapper/controller~~

- ~~Actor Model~~
- ~~Communicate~~
- ~~Bidirectional (demo)~~
- ~~Controller~~

04 demo time 25 min

05 questions?

demo



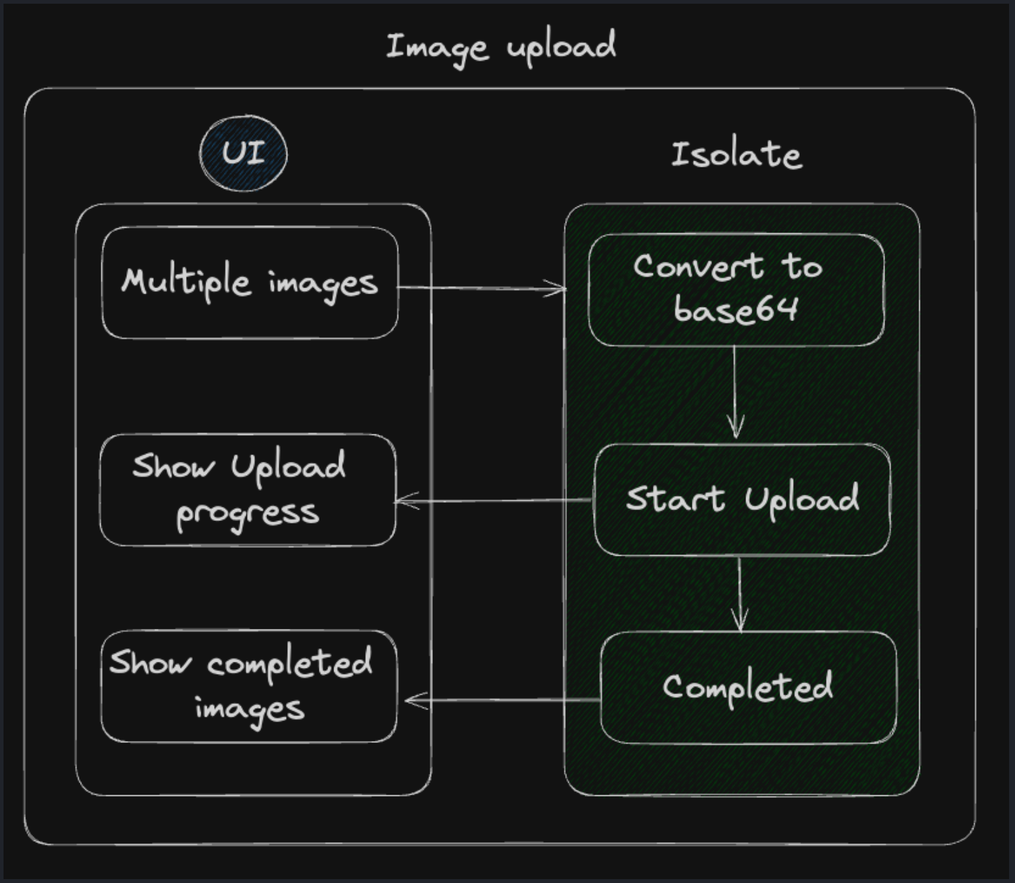
problem

Create a solution to compress an image; move it to the internal folder of the device and show the compressed image.

solution

- Use a compute/Isolate.run because is a single operation
- Pick an image from the UI (MainIsolate) and send the image path to the Isolate
- Use a compress algorithm
- Move the isolate to the internal folder
- Return the new Path to the Main Isolate

demo



problem

Upload the images to the server as a String in Base64; you can pick the images and go to another screen; the upload will be kept in the background and all screens need to listen to the updates.

solution

- Use a Spawn Isolate to send images to Isolates
- Starts uploading images as you select images
- Inform when the upload Start
- Inform when the Image completes the Upload
- Change the Image state—Uploading/ Completed
- Show progress in the UI (How many images are left?)
- Use a provider to listen and send messages to the isolate.

// @jamescardona11

Gracias {}

- code/presentation:https://github.com/jamescardona11/isolates
- posts: https://medium.com/@jamescardona11
- linkedIn: @jamescardona11
- web: j11.io