Dart For Java Developers

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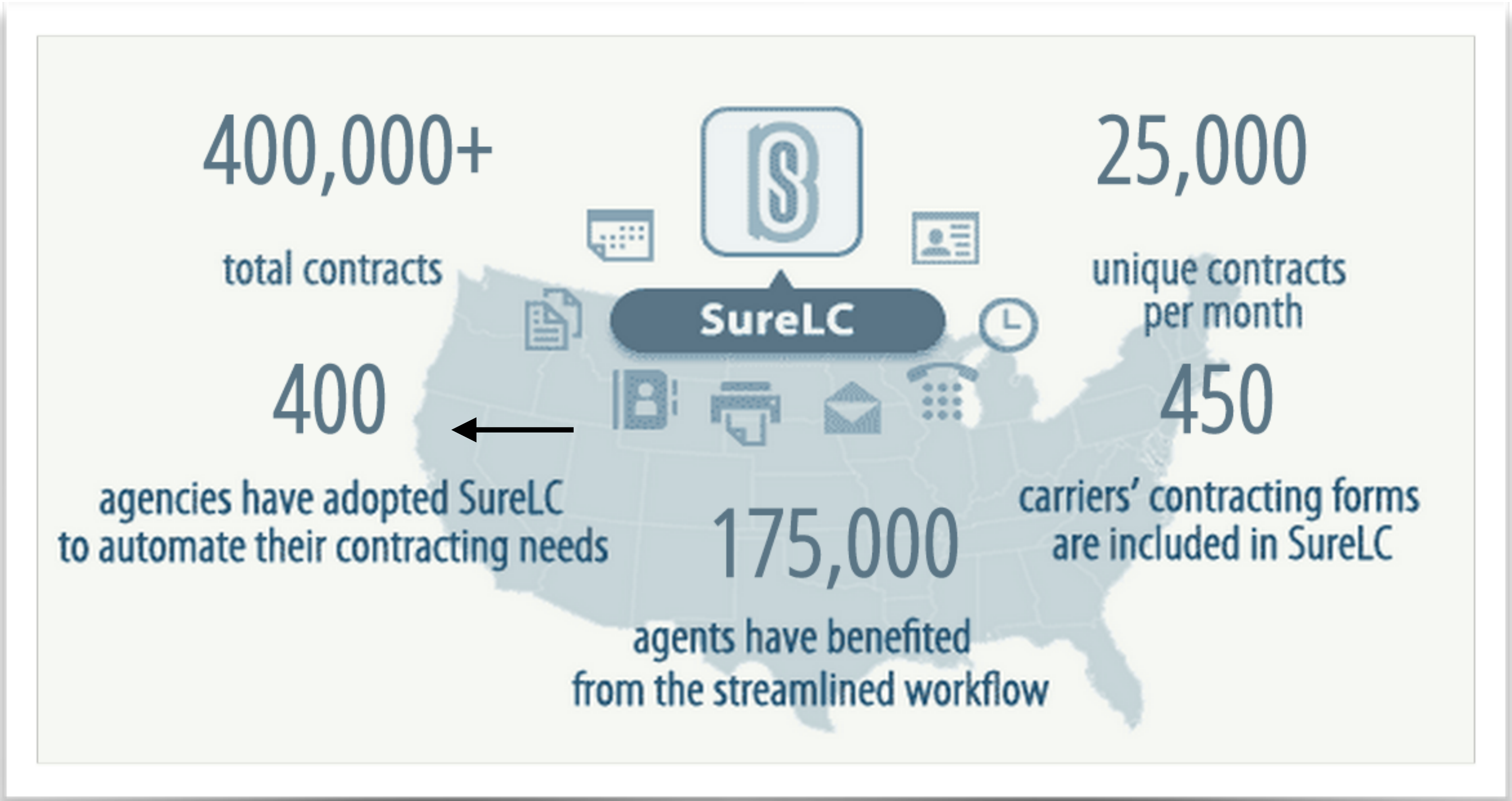

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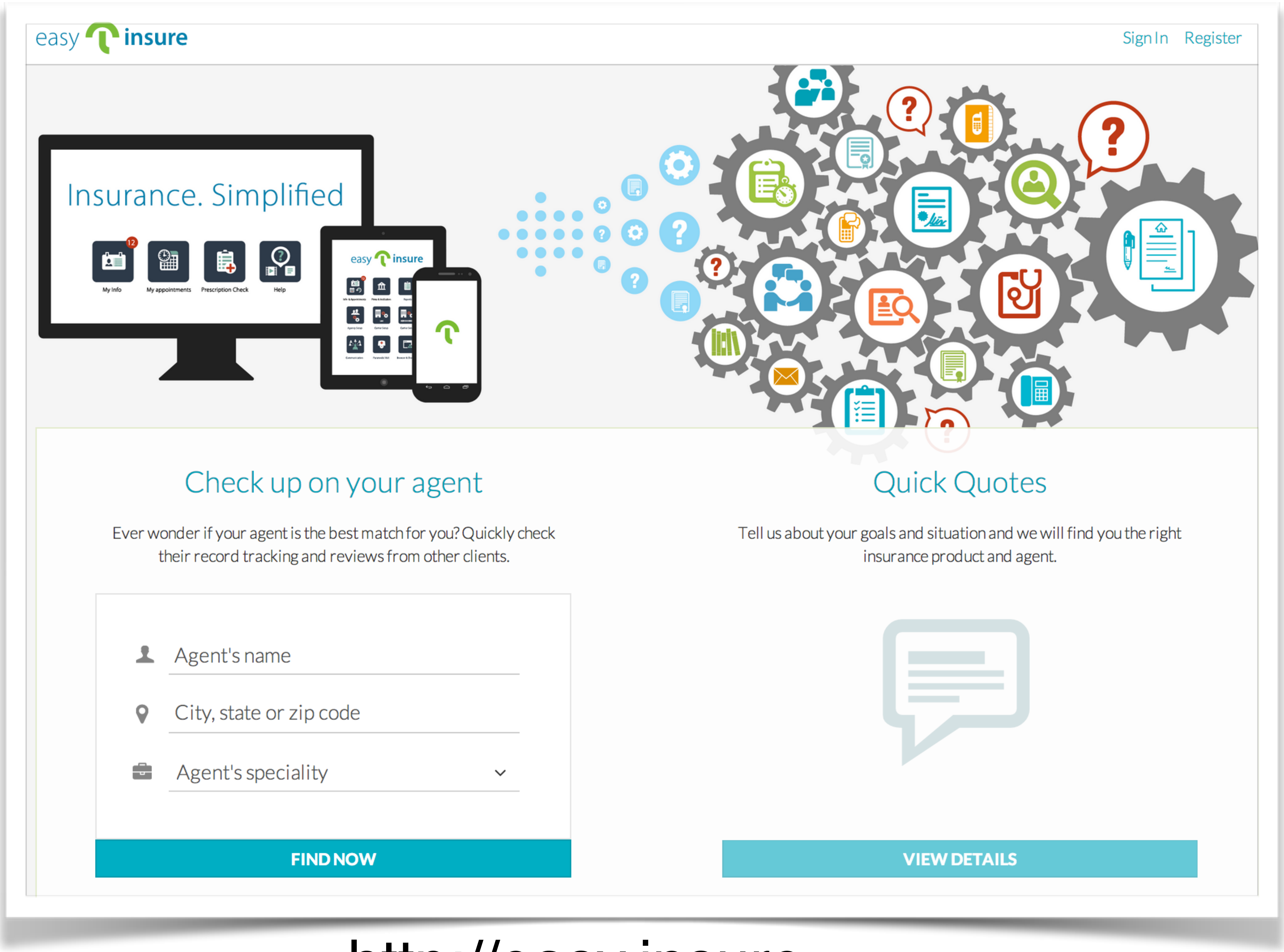
Our First Dart App: Easy Insure



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Agent's name

City, state or zip code

Agent's speciality

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Why Learn Google Dart

- Its a productive way to develop JavaScript apps today
- Comes with a complete set of dev tools
- Will help you to ease into the EcmaScript 6 developement in 2016

Dart: Java Simplified

- Program with classes and/or with functions
- You can, but don't have to declare variable types.
- Any class is an interface
- No data access qualifiers
- No checked exceptions
- No autoboxing/unboxing
- IDEs: Dart Editor, IntelliJ IDEA, WebStorm, Eclipse Sublime Text…
- Write in Dart and run either in Dart VM or as JavaScript on any browser

Dart VM

- You can run standalone apps in Dart VM
- Dartium, a special version of Chrome browser includes Dart VM
- Dart VM is created by engineers that used to work on Java VM

Why Dart VM if you'll deploy JavaScript anyway?

Why not just use

GWT?

Why Dart VM

- Productive development. Instanteneous feedback.
- No need to compile to JS to run the program in a browser as in GWT.
- Dart VM runs Dart, not the bytecode
- Your program can run on the server in Dart VM.

Demo

HelloWorld as a console and Web app

Generating and runnig the app in Dart Editor and IDEA

The Dart App Entry Point

A single entry point to any Dart app is a function `main()`:

```
main() {
  print('Hello world!');
}
```

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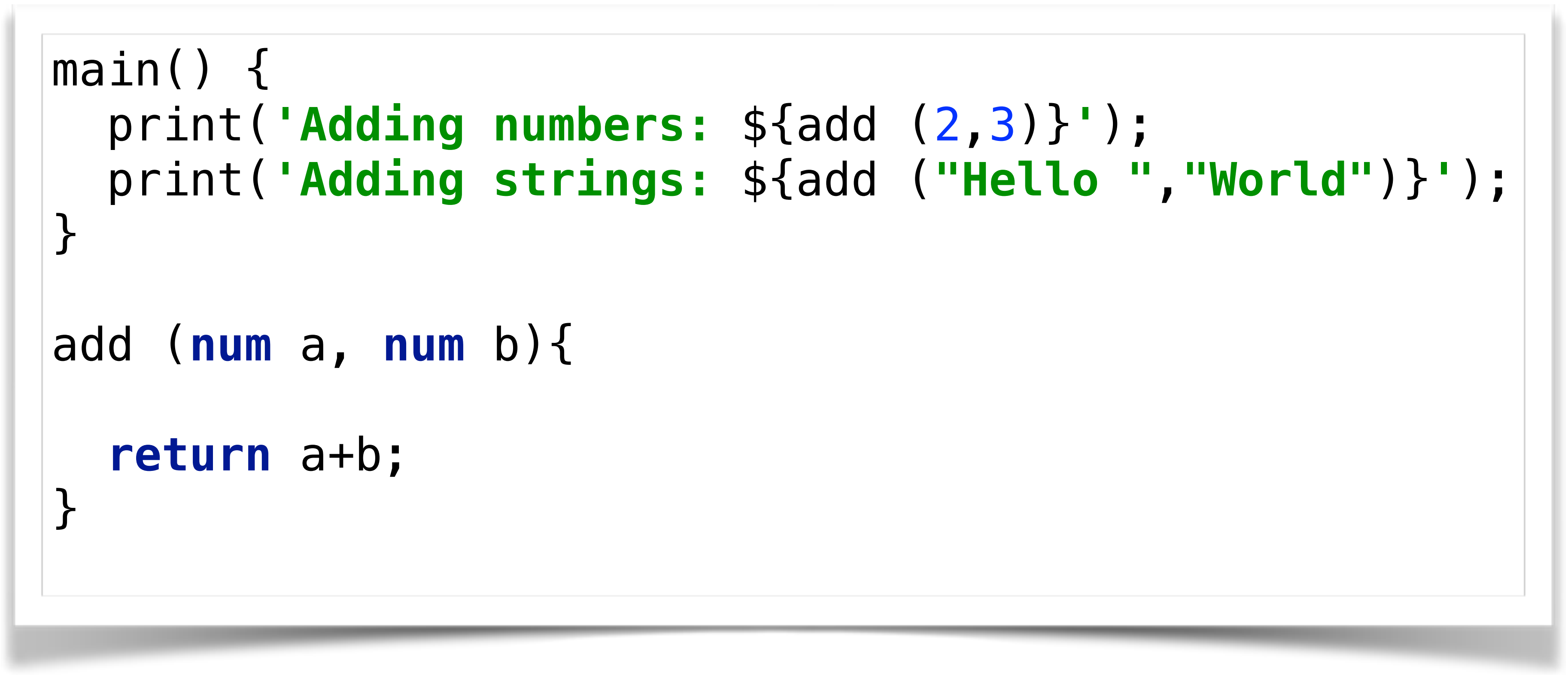
A single entry point to any Dart app is a function main():

```
main() {
  print('Hello world!');
}
```

Or with command-line arguments:

```
import 'package:args/args.dart';

main(List<String> args) {

  final parser = new ArgParser();
  argResults = parser.parse(args);

  List<String> someArgs = argResults.rest;

  print(‘Got the argument ${someArgs[0]}');

}
```

What this code will print?

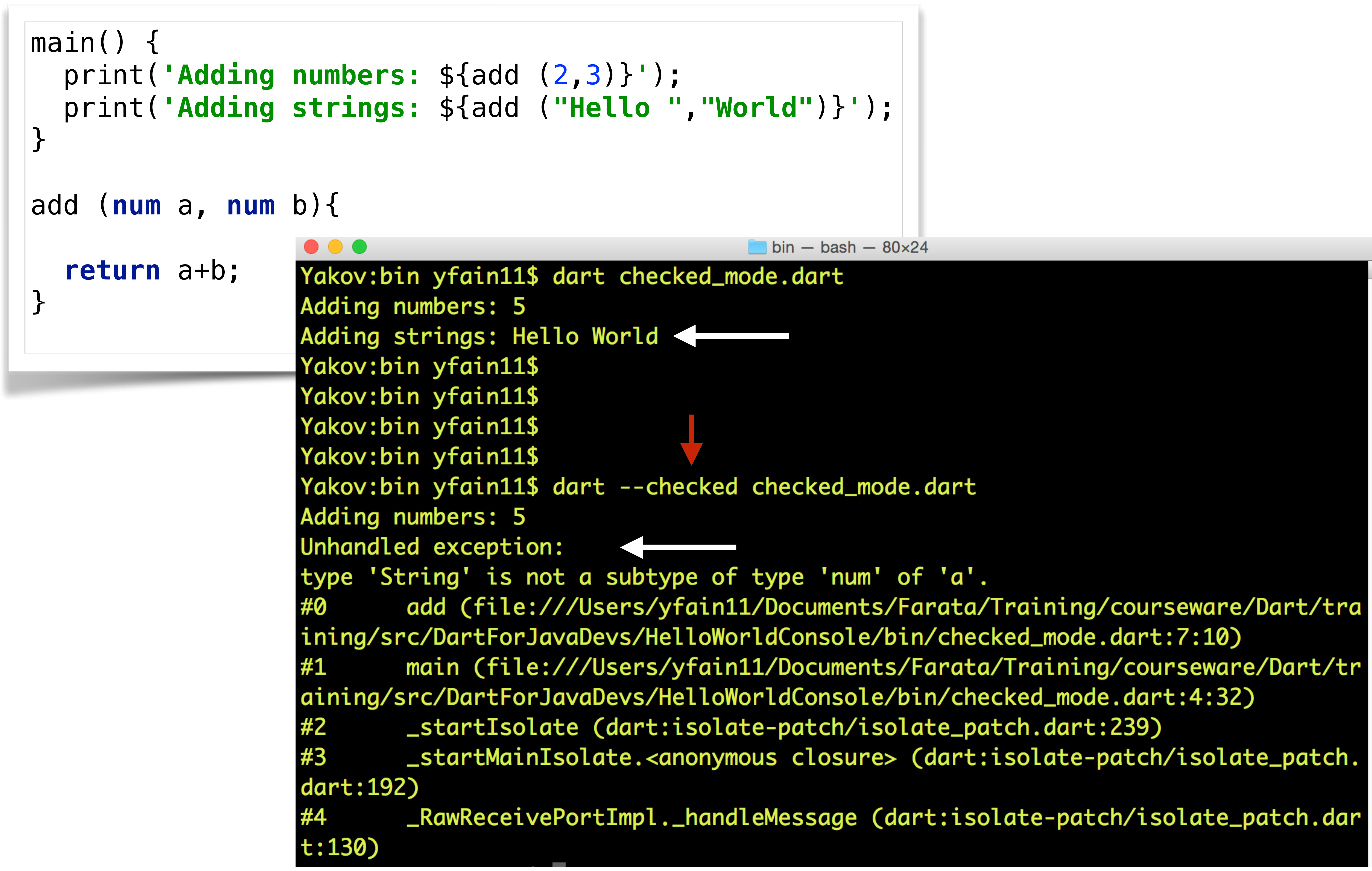


```
main() {
  print('Adding numbers: ${add (2,3)}');
  print('Adding strings: ${add ("Hello ","World")}');
}

add (num a, num b){

  return a+b;
}
```

`$variableName` (or `${expression}`)

String interpolation: including a variable or expression’s string equivalent inside of a string literal.

In Checked Mode: runtime error



```
main() {
  print('Adding numbers: ${add (2,3)}');
  print('Adding strings: ${add ("Hello ","World")}');
}

add (num a, num b){

  return a+b;
}
```

```
Yakov:bin yfain11$ dart checked_mode.dart
Adding numbers: 5
Adding strings: Hello World
Yakov:bin yfain11$
Yakov:bin yfain11$
Yakov:bin yfain11$
Yakov:bin yfain11$
Yakov:bin yfain11$ dart --checked checked_mode.dart
Adding numbers: 5
Unhandled exception:
type 'String' is not a subtype of type 'num' of 'a'.
#0      add (file:///Users/yfain11/Documents/Farata/Training/courseware/Dart/tra
ining/src/DartForJavaDevs/HelloWorldConsole/bin/checked_mode.dart:7:10)
#1      main (file:///Users/yfain11/Documents/Farata/Training/courseware/Dart/tr
aining/src/DartForJavaDevs/HelloWorldConsole/bin/checked_mode.dart:4:32)
#2      _startIsolate (dart:isolate-patch/isolate_patch.dart:239)
#3      _startMainIsolate.<anonymous closure> (dart:isolate-patch/isolate_patch.
dart:192)
#4      _RawReceivePortImpl._handleMessage (dart:isolate-patch/isolate_patch.dar
t:130)
```

Importing Packages

- SDK comes with packages whose names start with `dart:`

```
import 'dart:math';
```

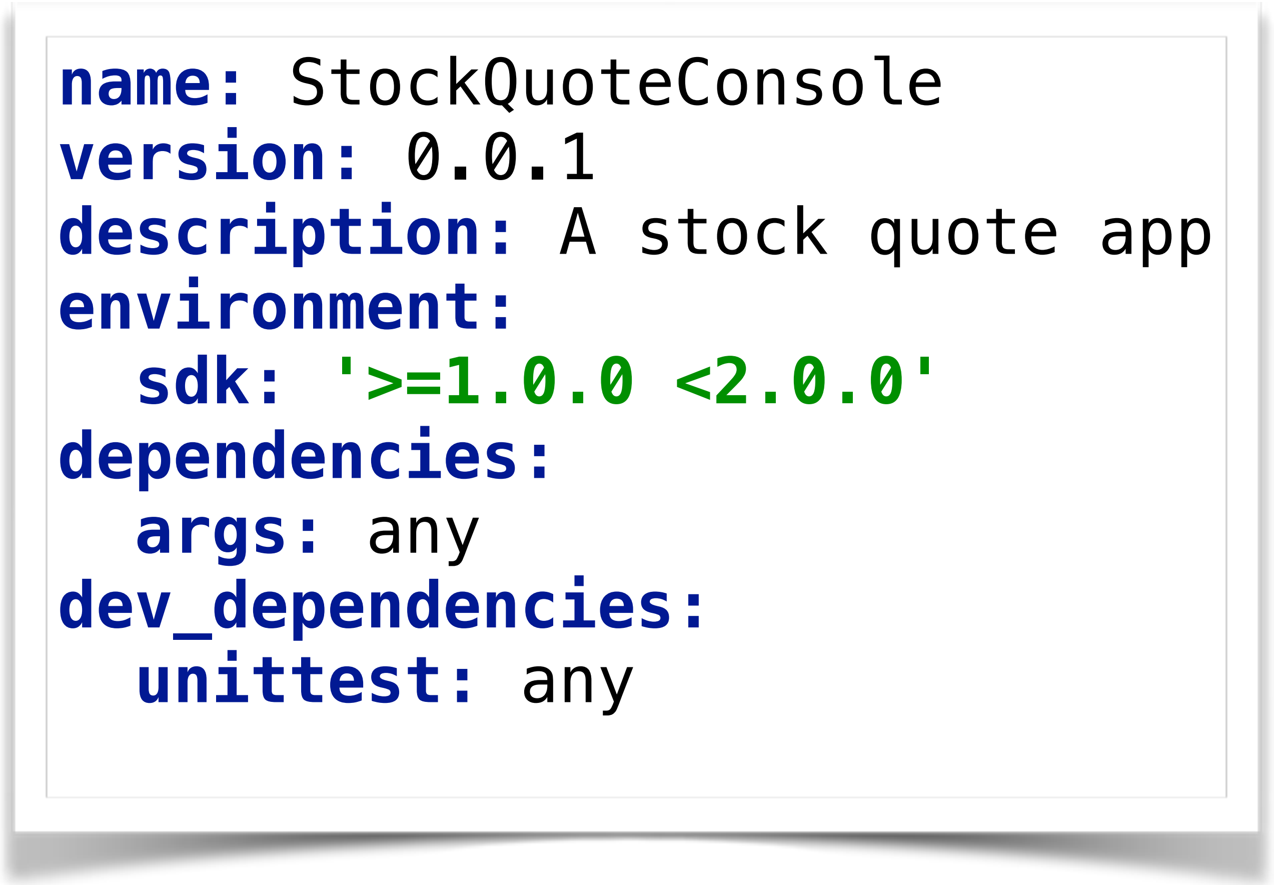
- Other packages located in the directory *packages* of your project. can be included as app dependencies. Imports start with `package:`

```
import 'package:args/args.dart';
```

Package Dependencies

- Dart package manager is called **pub**
- Dependencies are specified in the file **pubspec.yaml**.
- Package versions are locked in the file **pubspec.lock**.

pubspec.yaml



```
name: StockQuoteConsole
version: 0.0.1
description: A stock quote app
environment:
  sdk: '>=1.0.0 <2.0.0'
dependencies:
  args: any
dev_dependencies:
  unittest: any
```

The central repo pub.dartlang.org has 1500+ packages

Selected pub commands

- **pub get** - retrieves packages (dependencies)
- **pub upgrade** - upgrades packages and regenerates pubspec.lock
- **pub serve** - starts dev http server
- **pub run** - runs Dart scripts using dependencies from pubspec.yaml
- **pub build** - generates and copies assets into the build dir
- **pub global** - run Dart packages installed anywhere on the computer,

  pub.dartlang.org or GitHub

More on pub at http://bit.ly/1wDMhTi

Demo

Stock Quote Generator. Take 1.

Functions only. Using pub to get dependencies. Command-line arguments.

IDEA module: StockQuoteConsole

Dart Classes

- FIles names are in small letters with _ as word separator
- Constructors support short syntax for variable initializations
- No keywords for public, protected, private.
- If a var name start wit _ it’s private on a library level
- No method overloading
- Getters and setters specified with `get` and `set` keywords

Class Stock

private vars

constructor

lazy getter

setter

```
class Stock {
  String _symbol;
  double _price;

  Stock (this._symbol);

  double get price => _price==null?
                          _price=getFromYahoo():_price;

  set price(double value){
    _price = value;
  }

  String get symbol => _symbol;

  set symbol(String value){
       _symbol = value;
  }
}
```

Class Stock

```
Stock stock = new Stock();
var price = stock.price;
```

private vars →

constructor →

lazy getter →

setter →

```
class Stock {
  String _symbol;
  double _price;

  Stock (this._symbol);

  double get price => _price==null?
                          _price=getFromYahoo():_price;

  set price(double value){
    _price = value;
  }

  String get symbol => _symbol;

  set symbol(String value){
        _symbol = value;
  }
}
```

Constructors

- Short form with `this`
- Optional parameters
- Named constructors
- factory constructors

Constructors

```
                  class Customer {

                    int _id;
                    String name;

short form     →    Customer(this._id, this.name);

optional param →    Customer.optName(this._id, {this.name});

named          →    Customer.taxExempt(int id, String name){
                      // Do something
                    }

factory        →    factory Customer.mafia(int id, String name){
                      if (name == "Don Carleone")
                          return new Customer.taxExempt(id, name);
                      else
                        return new Customer(id, name);
                    }
                  }
```

Cascade Operator ..

You can use method cascades .. on any object.

Every .. refers to the original object, not to the result of the previous method.

```
querySelector('#abutton') // Get an object.
  ..text = 'Confirm'      // Use its members.
  ..classes.add('important')
  ..onClick.listen((e) => window.alert('Confirmed!'));
```

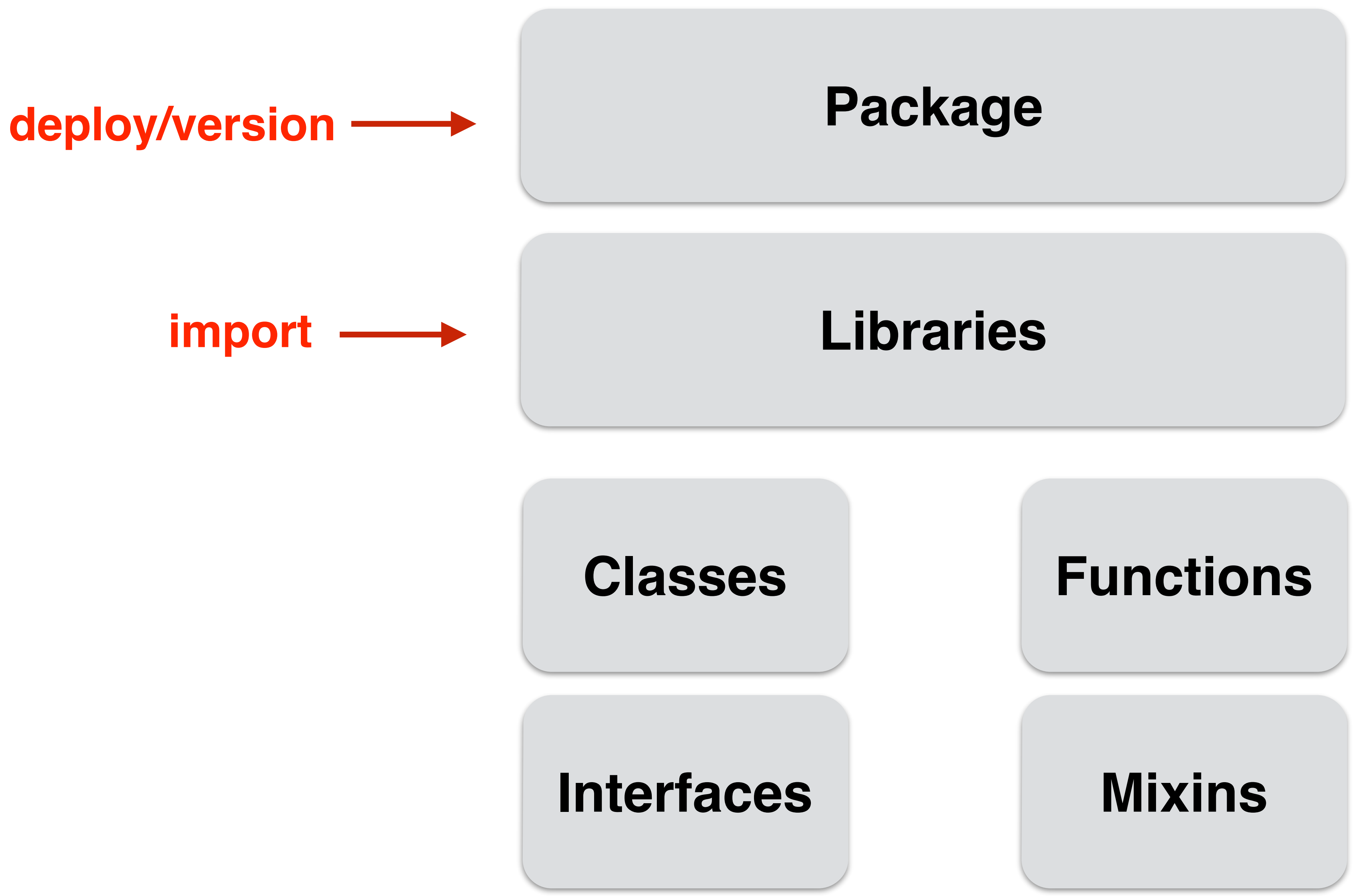
Exceptions

- All exceptions are unchecked
- You can throw any objects:

```
throw “Something happened”;
```

```
try {
  // Do stuff here
} on NoSuchMethodError catch (e) {
    print(‘Error: ${e.stackTrace}');
} on RangeError catch (e) {
    print(‘Error: ${e.stackTrace}');
} on TypeError catch (e) {
    print(‘Error: ${e.stackTrace}');
} catch (e) {
    print('$e');
}
```

Code Structure



Libraries

You can encapsulate classes and top-level functions into libraries.

```dart
library stock_quote;

import 'dart:math';
import 'dart:io';
import 'package:args/args.dart';

part "stock.dart";
part "stock_quote_generator.dart";

main(List<String> args) {
…
}
```

```dart
part of stock_quote;

class Stock {
   …
}
```

```dart
part of stock_quote;

class StockQuoteGenerator {

 …
}
```

Dart Libraries

- dart:core
- dart:async
- dart:io
- dart:html

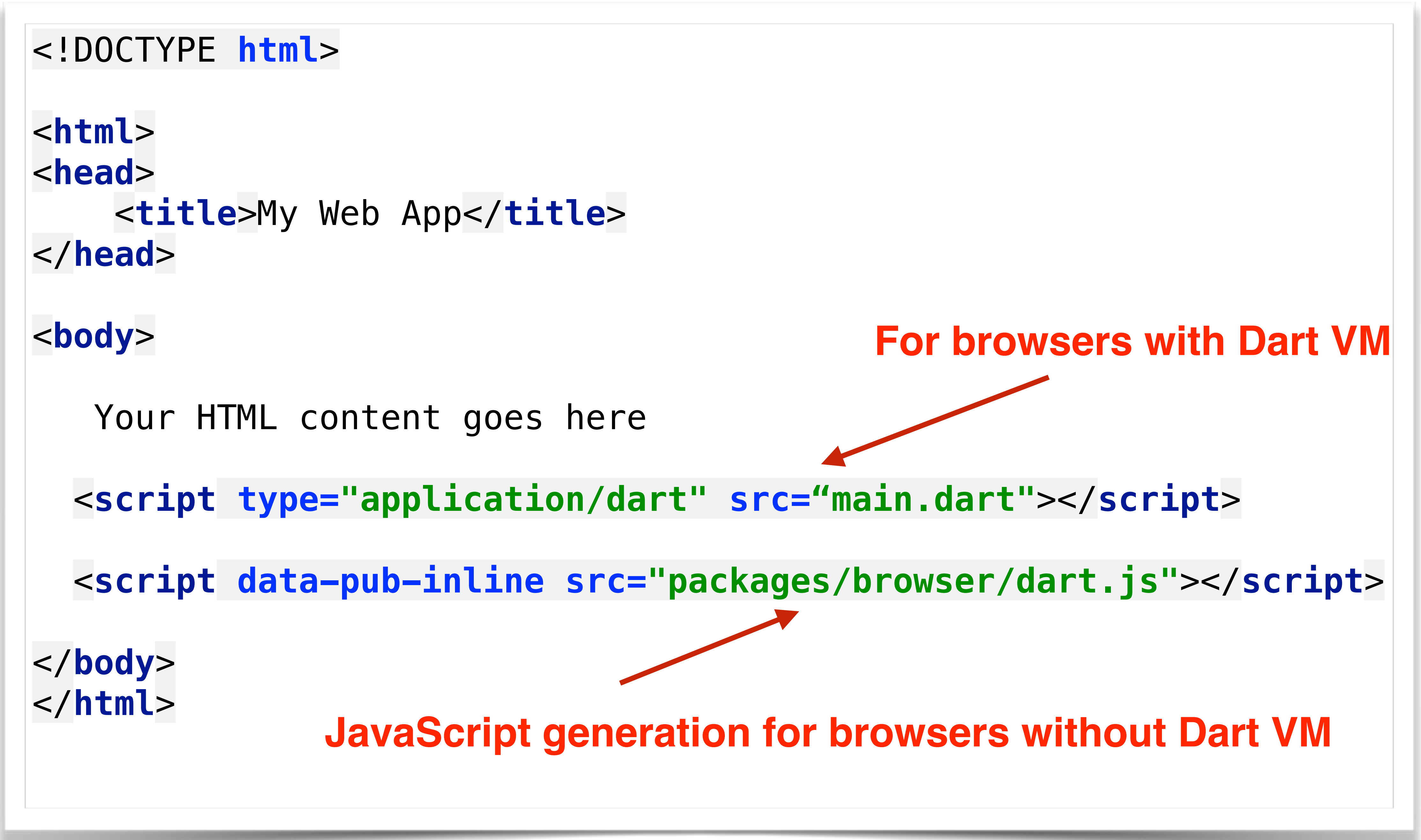
Demo

Stock Quote Generator. Take 2.

Classes, getters, setters, library.

IDEA module: StockQuoteClassesConsole

Web Apps



```
<!DOCTYPE html>

<html>
<head>
    <title>My Web App</title>
</head>

<body>

   Your HTML content goes here

  <script type="application/dart" src="main.dart"></script>

  <script data-pub-inline src="packages/browser/dart.js"></script>

</body>
</html>
```

For browsers with Dart VM

JavaScript generation for browsers without Dart VM

Running Dart Web App

1. **From a command line:**

   pub serve and refresh the Web page

2. **From IDEA:**

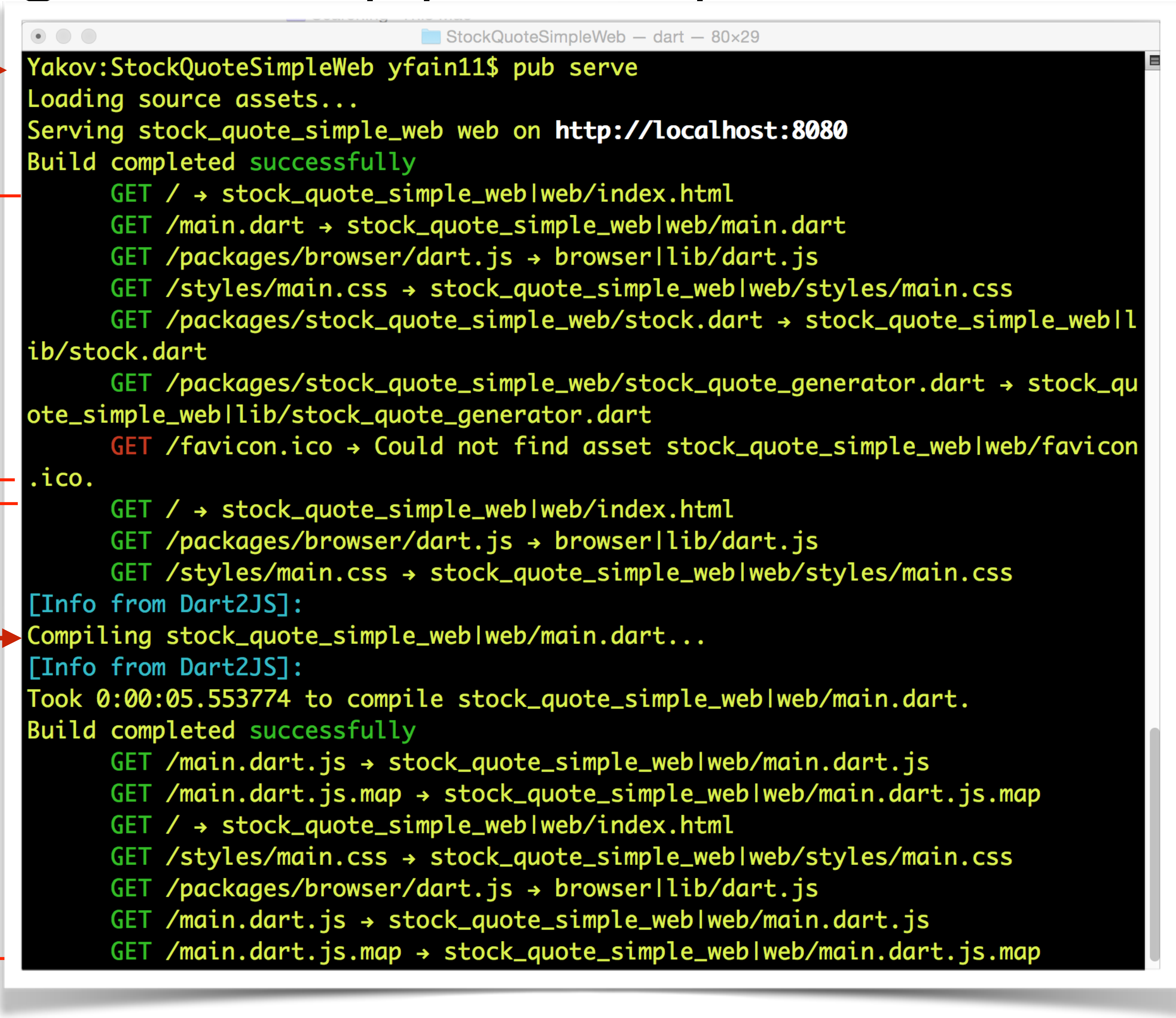
   Right-click on your index.html file and open (or run) it in any Web browser

Running Web app with pub serve

Running pub serve

Visiting localhost:8080 in Dartium

Visiting localhost:8080 in Chrome



```
Yakov:StockQuoteSimpleWeb yfain11$ pub serve
Loading source assets...
Serving stock_quote_simple_web web on http://localhost:8080
Build completed successfully
      GET / → stock_quote_simple_web|web/index.html
      GET /main.dart → stock_quote_simple_web|web/main.dart
      GET /packages/browser/dart.js → browser|lib/dart.js
      GET /styles/main.css → stock_quote_simple_web|web/styles/main.css
      GET /packages/stock_quote_simple_web/stock.dart → stock_quote_simple_web|l
ib/stock.dart
      GET /packages/stock_quote_simple_web/stock_quote_generator.dart → stock_qu
ote_simple_web|lib/stock_quote_generator.dart
      GET /favicon.ico → Could not find asset stock_quote_simple_web|web/favicon
.ico.
      GET / → stock_quote_simple_web|web/index.html
      GET /packages/browser/dart.js → browser|lib/dart.js
      GET /styles/main.css → stock_quote_simple_web|web/styles/main.css
[Info from Dart2JS]:
Compiling stock_quote_simple_web|web/main.dart...
[Info from Dart2JS]:
Took 0:00:05.553774 to compile stock_quote_simple_web|web/main.dart.
Build completed successfully
      GET /main.dart.js → stock_quote_simple_web|web/main.dart.js
      GET /main.dart.js.map → stock_quote_simple_web|web/main.dart.js.map
      GET / → stock_quote_simple_web|web/index.html
      GET /styles/main.css → stock_quote_simple_web|web/styles/main.css
      GET /packages/browser/dart.js → browser|lib/dart.js
      GET /main.dart.js → stock_quote_simple_web|web/main.dart.js
      GET /main.dart.js.map → stock_quote_simple_web|web/main.dart.js.map
```

Debugging Dart

1. Run **pub serve** from the dir containing *pubspec.yaml*.
2. It'll run **pub build** and will deploy the app at http://localhost:8080
3. Debug the app in the browser or in IDE, for example:

- In Chrome:

  - Enter the URL http://localhost:8080
  - Open Chrome Development Tools, enable JavaScript sourcemaps
  - Set breakpoints, refresh.

- In IntelliJ IDEA:

  - In Chrome install the extension JetBrains IDE Support
  - In IDEA go to the menu Run | Edit Configuration | + | JavaScript Debug, give it a name and the URL http://localhost:8080
  - Set the breakpoint in IDEA in Dart code and click on Debug.

Working with DOM in a Browser

```html
<body>
  Enter Symbol: :
  <input id="enteredSymbol" type="text">


<script type="application/dart" src="main.dart"></script>
<script data-pub-inline src="packages/browser/dart.js"></script>
</body>
```

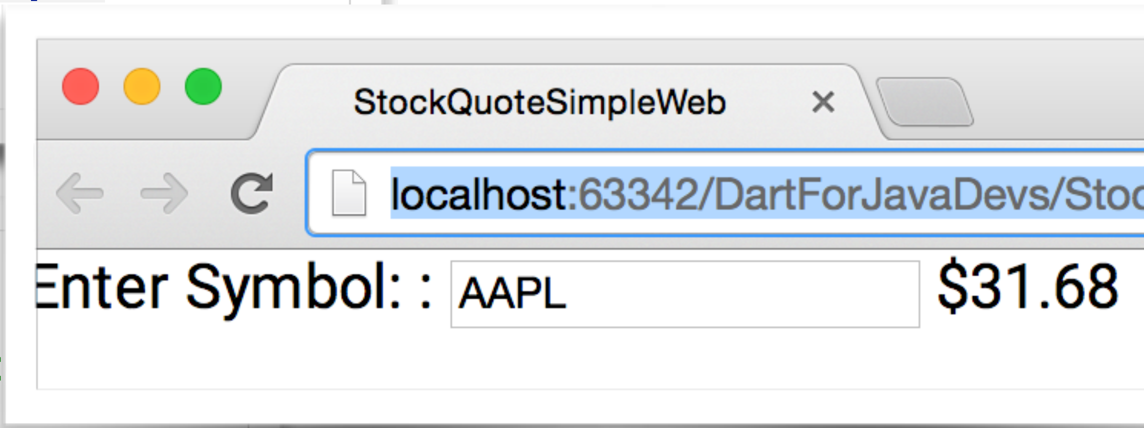
```dart
import 'dart:html';

InputElement enteredSymbol;

void main() {

  InputElement enteredSymbol = querySelector(“#enteredSymbol");

}
```

Event Handling

```
Element myHtmlElement = querySelector("#myElementID");

myHtmlElement.onChange.listen(myEventHandler);



    void myEventHandler(Event e){
       // Handle event here
    }
```

A Simple Stock Quote Web App

```
<body>
  Enter Symbol: :
  <input id="enteredSymbol" type="text" placeholder="AAPL, IBM, or MSFT">

  <span id="priceQuote"></span>

<script type="application/dart" src="main.dart"></script>
<script data-pub-inline src="packages/browser/dart.js"></script>
</body>
```



nter Symbol: : AAPL $31.68

```
import 'dart:html';
import 'package:stock_quote_simple_web/stock.dart';
import 'package:stock_quote_simple_web/stock_quote_generat

StockQuoteGenerator generator = new StockQuoteGenerator();

InputElement enteredSymbol;
SpanElement priceQuote;

void main() {

  enteredSymbol = querySelector(“#enteredSymbol");
  priceQuote = querySelector(‘#priceQuote');

  enteredSymbol.onChange.listen(showPrice);
}

void showPrice(Event e){
  Stock stock = generator.getQuote(enteredSymbol.value);
  priceQuote.text = stock.price.toString();
}
```

DOM search

Event listener

Event handler

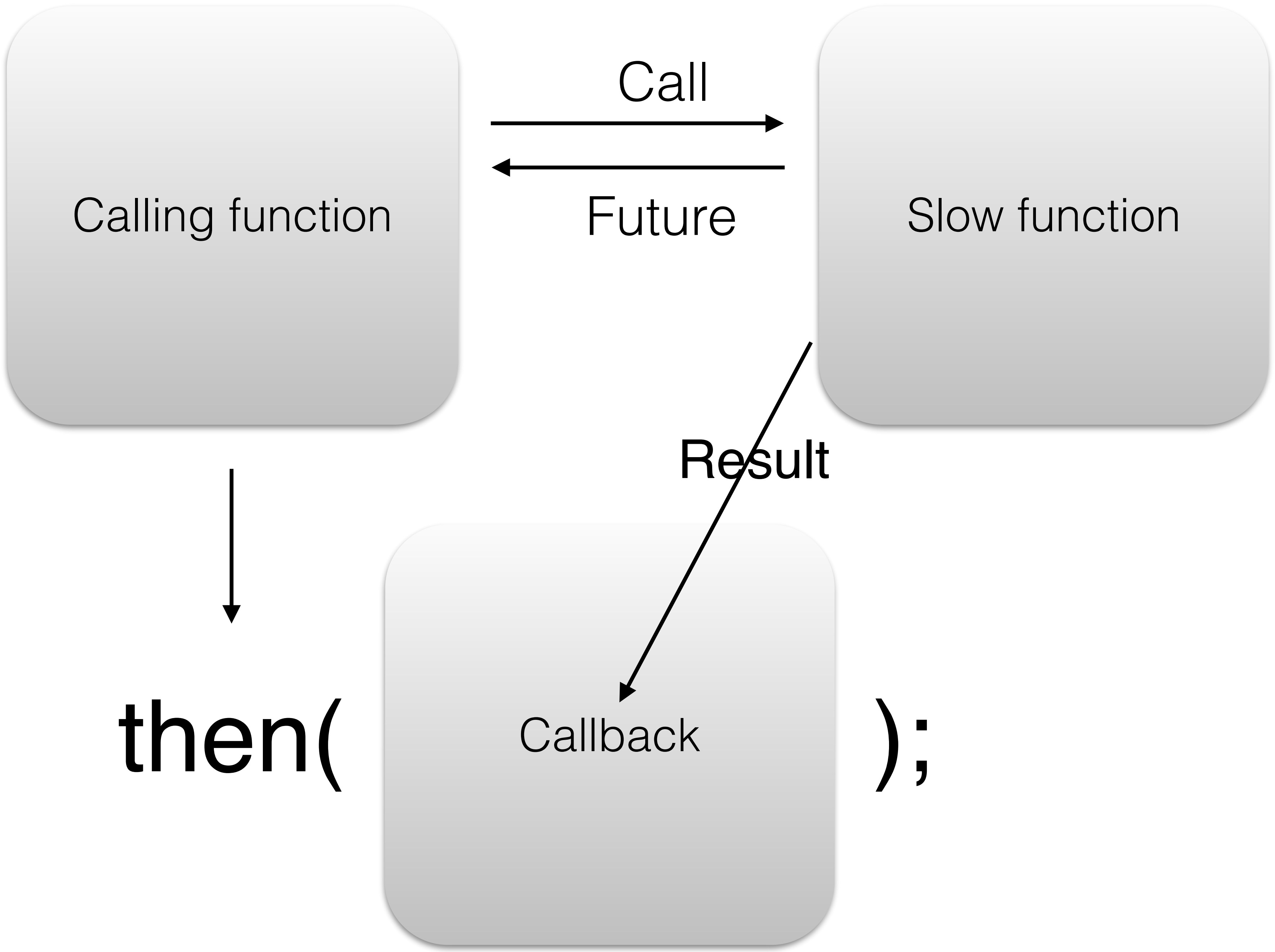
Demo

Stock Quote Generator. Take 3.

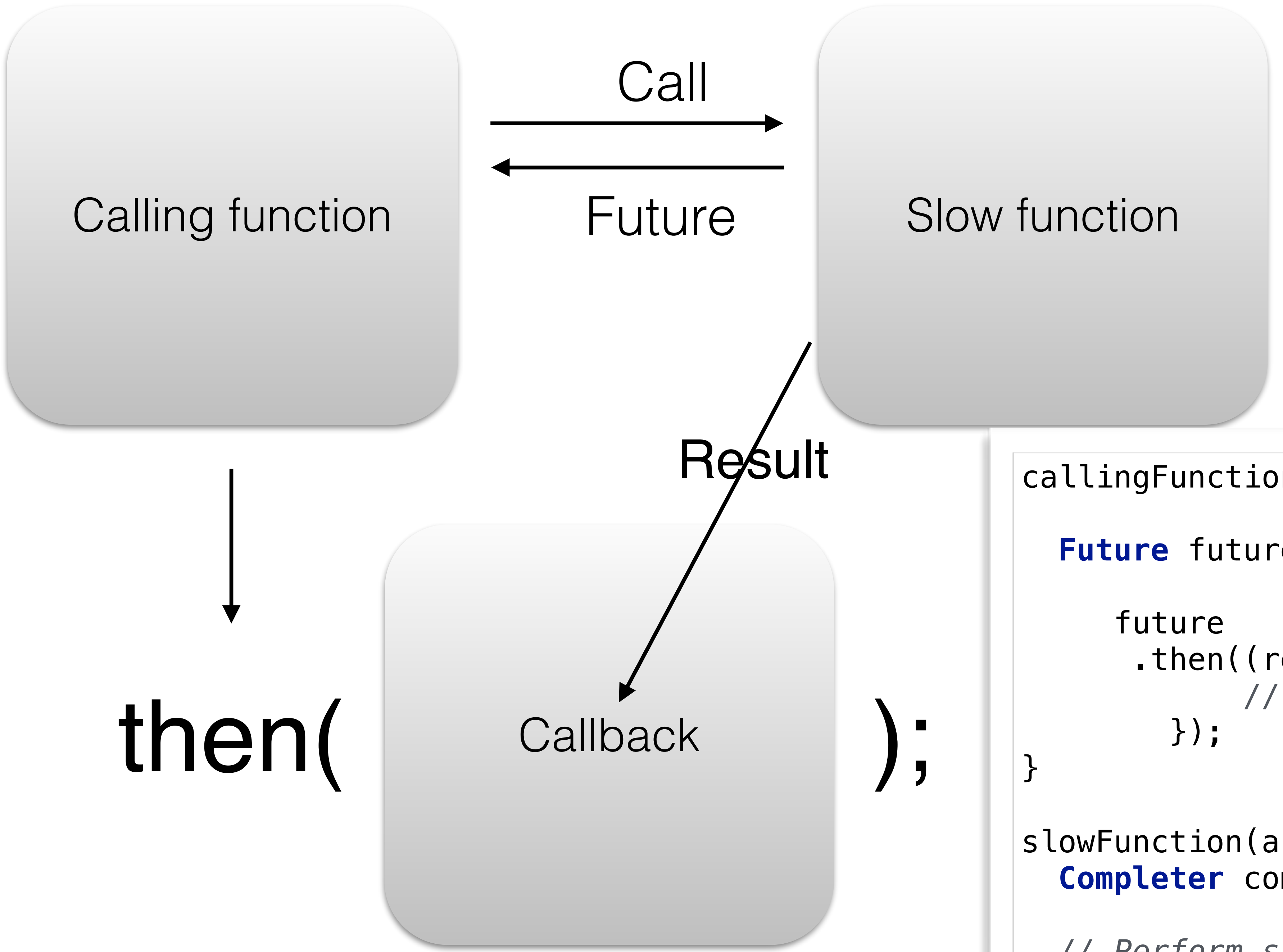
Web app. Working with DOM. Eent Handling.

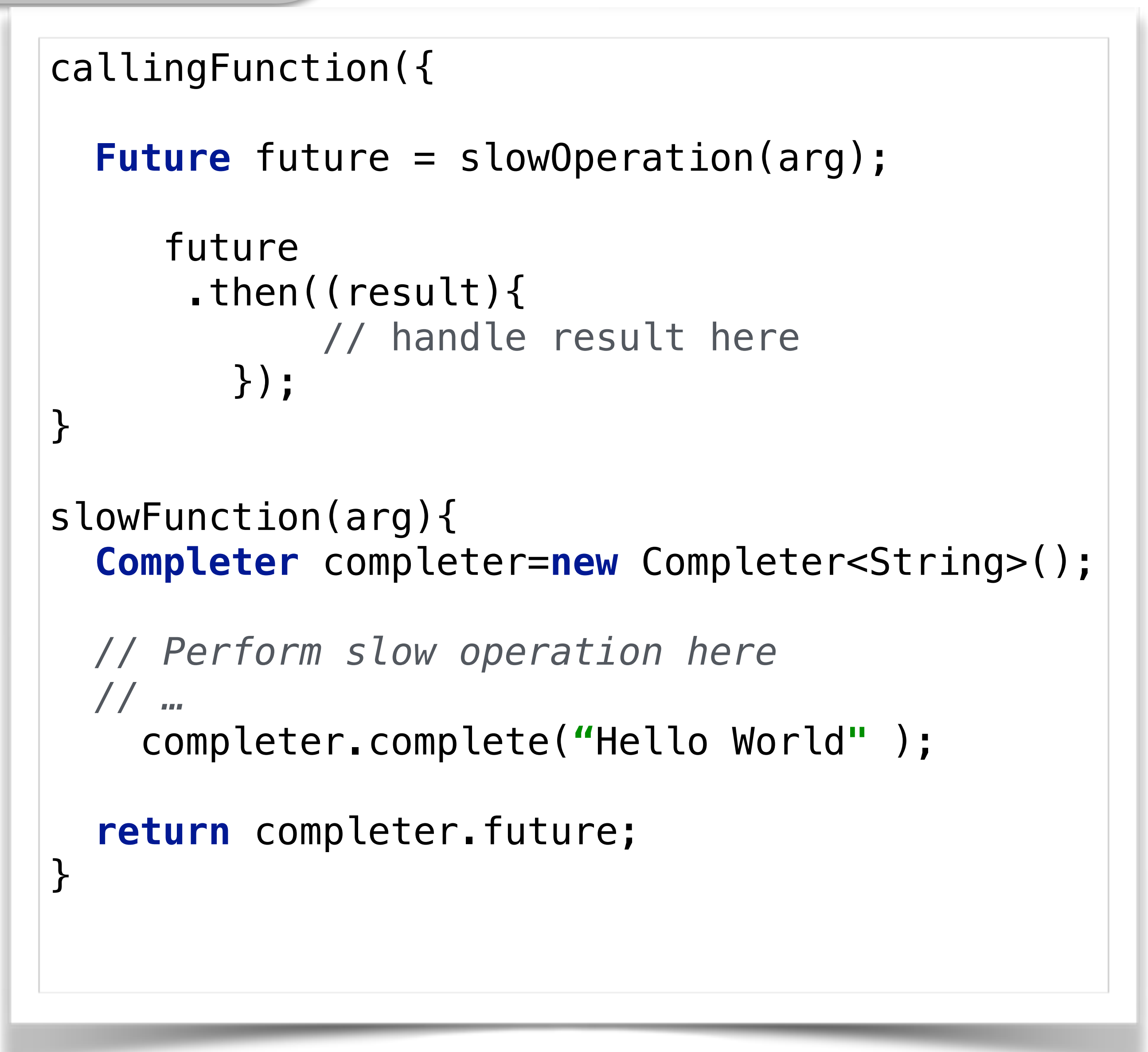
IDEA module: StockQuoteSimpleWeb

Async Processing: Futures



Async Processing: Futures





```
callingFunction({

  Future future = slowOperation(arg);

     future
      .then((result){
            // handle result here
        });
}

slowFunction(arg){
  Completer completer=new Completer<String>();

  // Perform slow operation here
  // …
    completer.complete("Hello World" );

  return completer.future;
}
```

Futures and Error Handling

- A `Future` represents a deferred result of a function call
- Register callbacks for success and errors

```
doStuff()
    .then(callbackForSuccess)
    .catchError(callBackForError);
```

```
void callbackForSuccess() {
  //...
}

void callbackForError(Error error){
  // ...
}
```

NOTE: For parallel execution use isolates.

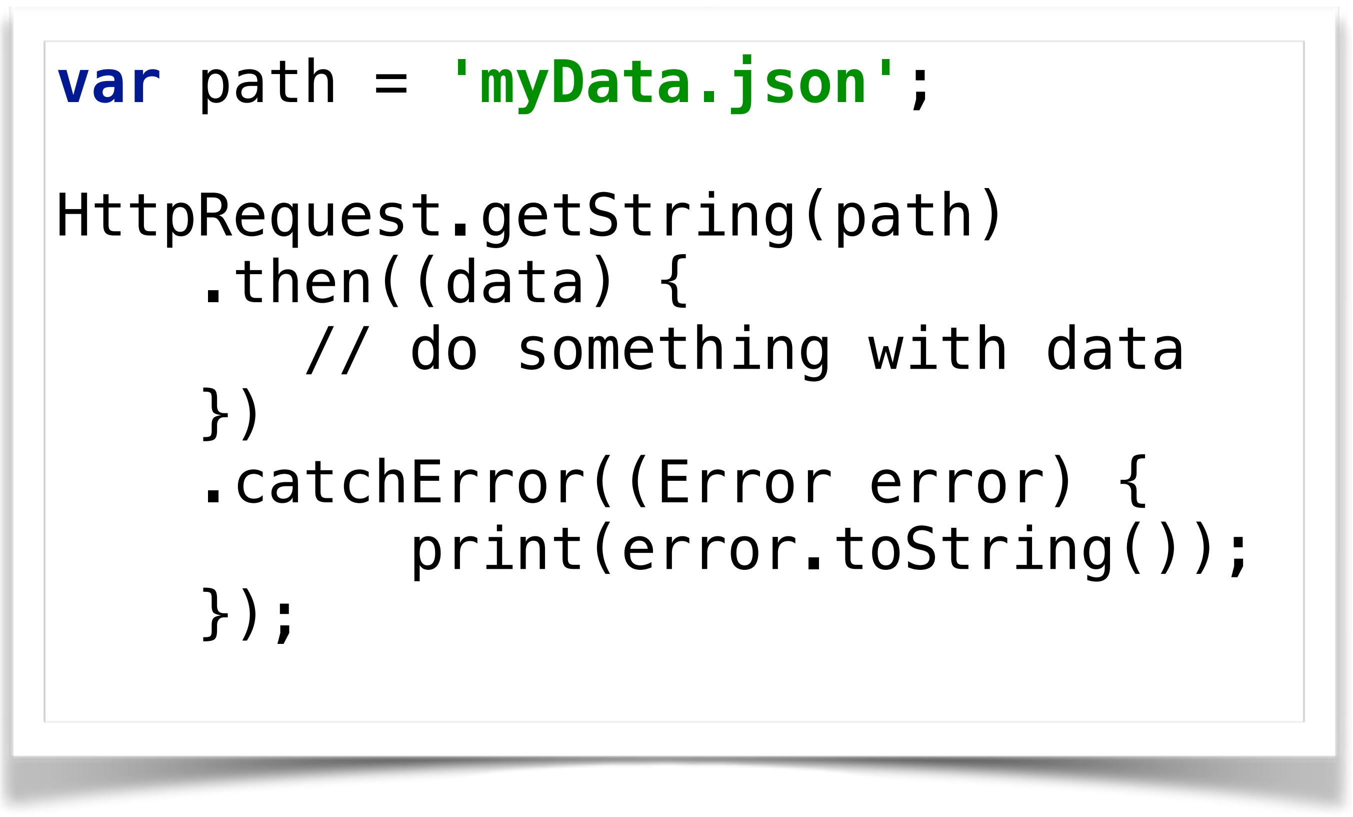
Demo

Stock Quote Generator. Take 4.

Web app. Calling a slow operation asyncrhonously using Future.

IDEA module: StockQuoteFutureCompleter

AJAX:HttpRequest



```
var path = 'myData.json';

HttpRequest.getString(path)
    .then((data) {
       // do something with data
    })
    .catchError((Error error) {
          print(error.toString());
    });
```

Demo

Stock Quote Generator. Take 5.

Ajax + JSON.

IDEA module: StockQuoteWebJSON

Concurrency with Isolates

- Isolates are units of security
- Each isolate has its own heap - no shared memory
- Isolates communicate with each other via ports by sending messages

Isolates: Standalone vs Web Browser

Standalone Apps

- run isolates in parallel using available CPU cores

- isolates can be created by invoking `spawn()` or `spawnUri()`

Web Browser Apps

- run isolates in Dart VM or as JavaScript Web workers

- isolates can be created by invoking `spawnUri()`

Isolates: Standalone vs Web Browser

Standalone Apps

- run isolates in parallel using available CPU cores

- isolates can be created by invoking `spawn()` or `spawnUri()`

Web Browser Apps

- run isolates in Dart VM or as JavaScript Web workers

- isolates can be created by invoking `spawnUri()`

Use `spawnUri()` to load Dart code dynamically

Demo

Using isolates with `spawn()` and `spawnUri()`

IDEA module: IsolatesConsole

Mixins

Generics

Streams

Functions

- Top-level functions
- You can pass a funct as a arg to another func
- You can return a function from another func
- Single-line functions =>
- functions with optional params (positionals and named):

```
myFunct (String a, [int b], [int c])
    myFunc(“Mary, 2”);
myFunc  (String a, {int b, int c})
    myFunc(“Mary”, c:3);
```

dart2js Transpiler

- Tree shaking
- File Watcher in IDEA https://www.jetbrains.com/idea/help/transpiling-dart-to-javascript.html

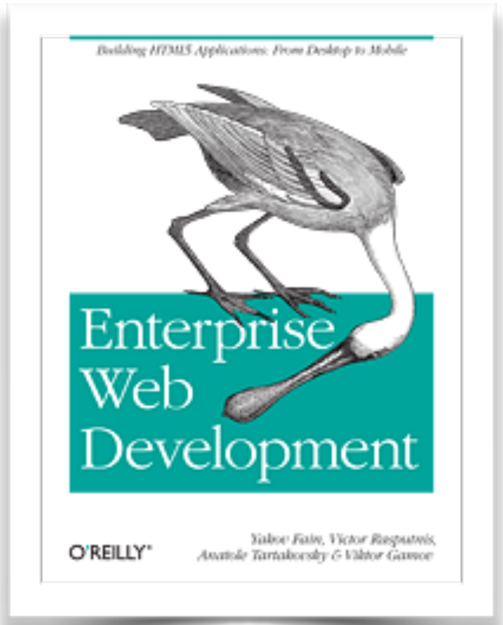
Dart Ecosystem

Links

- Style Guide https://www.dartlang.org/articles/style-guide
- Dart API docs: https://api.dartlang.org
- Try Dart: try.dartlang.org
- Hands-on labs: darlang.org/codelabs
- List of languages that compile to JS: https://github.com/jashkenas/coffeescript/wiki/List-of-languages-that-compile-to-JS
- Dart Language Specification:
- http://www.ecma-international.org/publications/files/ECMA-ST/ECMA-408.pdf

More Links

- Our Dart app: https://easy.insure
- Farata Systems: faratasystems.com
- Twitter: @yfain
- Personal blog: yakovfain.com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