

Dart For Java Developers

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Farata Systems and SuranceBay



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- Java
- ADOBE AIR
- open source
- android
- apache flex
- HTML5
- YUI

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Enterprise Software Without the BS

Enterprise Development with Flex

Java Programming 24-Hour Trainer

Java 2 Enterprise Edition 1st Bible

ADOBE FLEX & JAVA

Java Tutorial for the real world

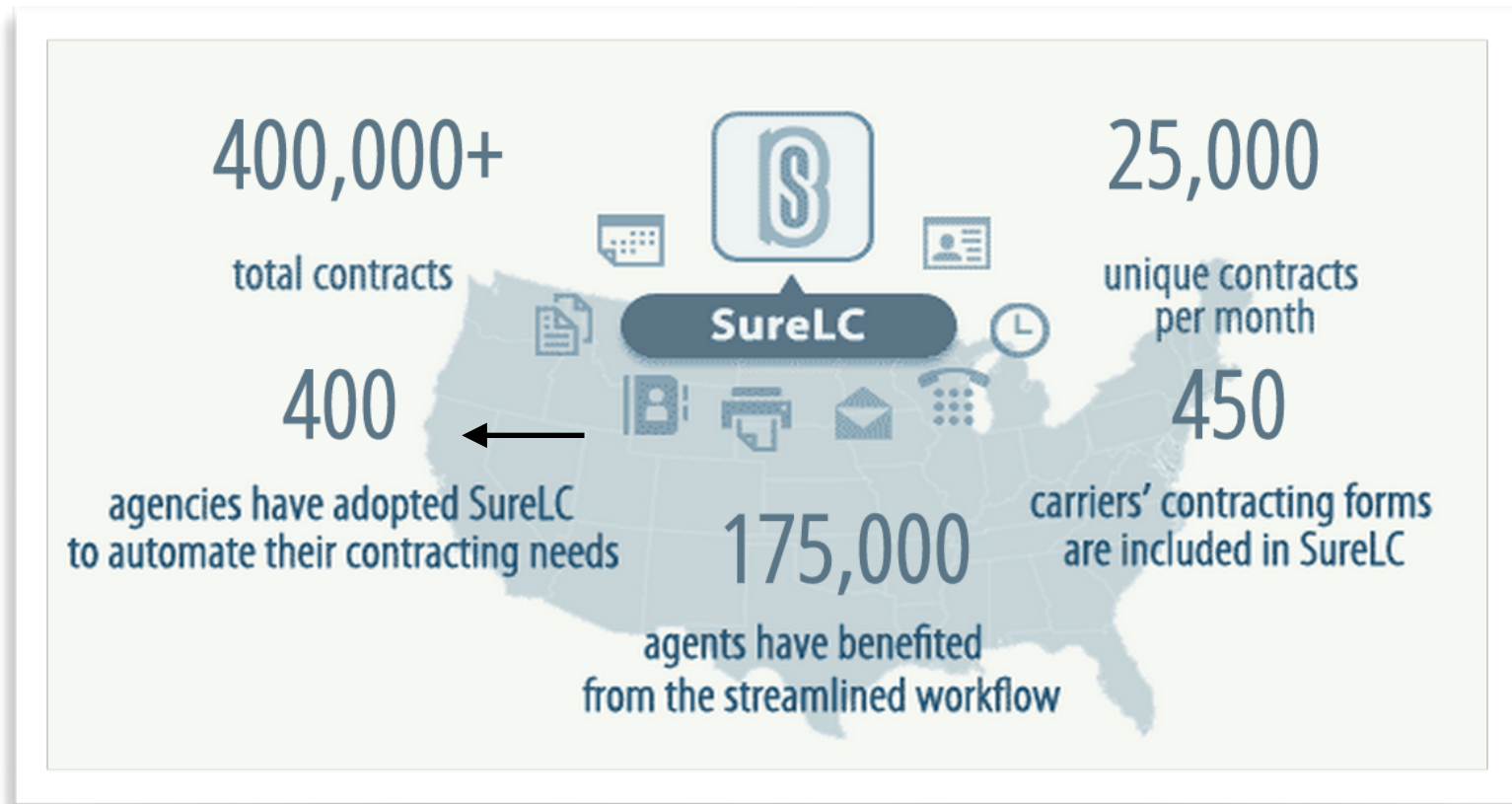
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Why Learn Google Dart

- 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

Who needs Dart VM if you'll
deploy JavaScript anyway?

Why not just use GWT?



Why Dart VM

- **Productive development.** Instantaneous feedback.
- No need to compile to JS to run the program in a browser as in GWT.
- Dart VM runs Dart. No bytecode, no compilation.
- Your program can run standalone in Dart VM.

Demo

HelloWorld as a console and Web app

Generating and running 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!' );  
}
```

The Dart App Entry Point

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?

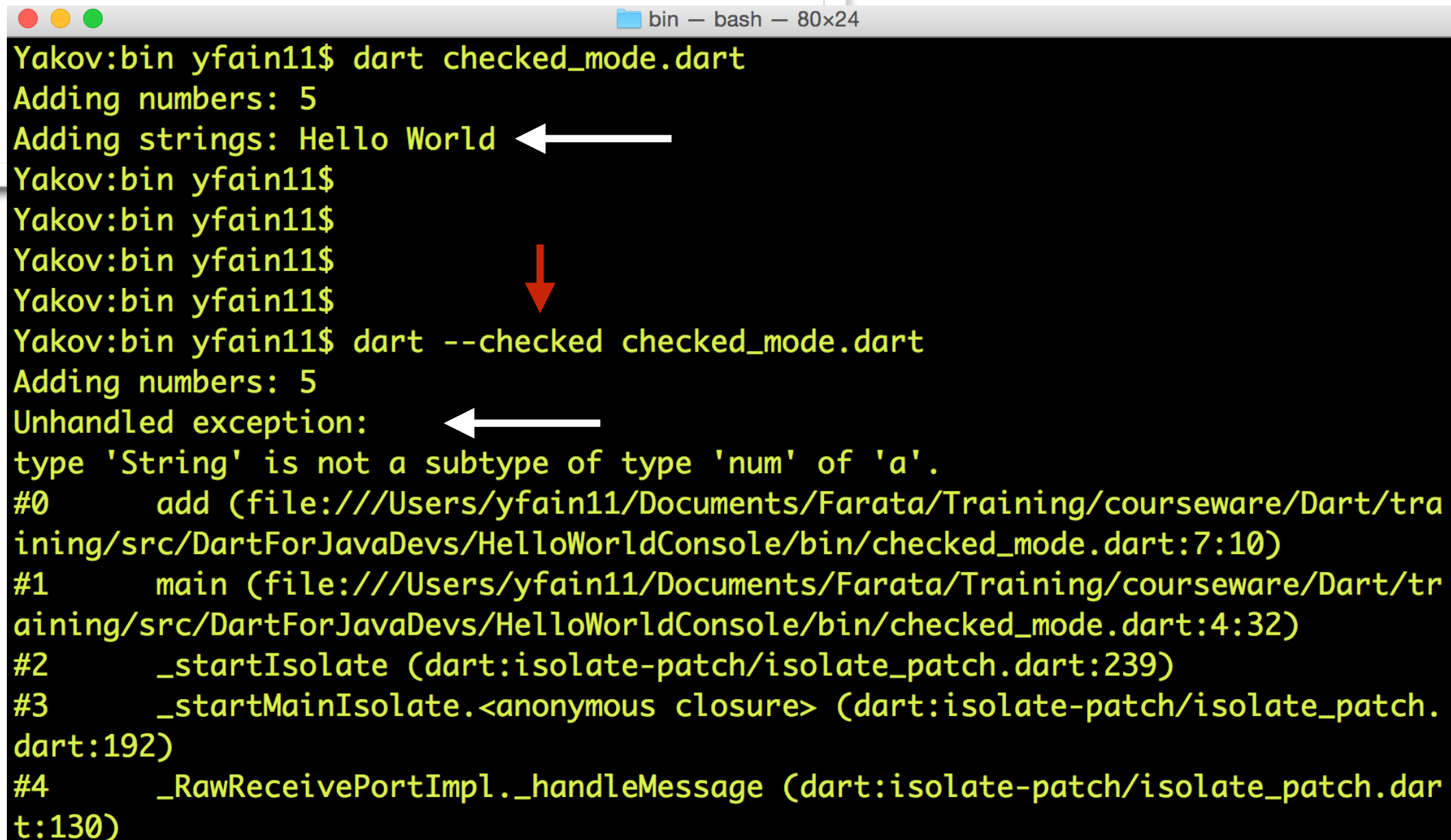
```
main() {  
    print('Adding numbers: ${add (2,3)}');  
    print('Adding strings: ${add ("Hello ", "World")}');  
}  
  
add (num a, num b){  
    return a+b;  
}
```

`$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;  
}
```



A terminal window titled 'bin — bash — 80x24' showing the execution of Dart code. The first command is 'dart checked_mode.dart', which outputs 'Adding numbers: 5' and 'Adding strings: Hello World'. A white arrow points to the second output. The next three lines are empty prompts. Then, the command 'dart --checked checked_mode.dart' is entered. This results in 'Adding numbers: 5' followed by an 'Unhandled exception:'. A white arrow points to the exception message. The stack trace shows the error originates from the 'add' function in 'checked_mode.dart' at line 7:10, where a 'String' is being added to a 'num'.

```
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/training/src/DartForJavaDevs/HelloWorldConsole/bin/checked_mode.dart:7:10)  
#1      main (file:///Users/yfain11/Documents/Farata/Training/courseware/Dart/training/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.dart: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 1100+ 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.

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

private vars

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

constructor

```
    Stock (this._symbol);
```

lazy getter

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

setter

```
    set price(double value){  
        _price = value;  
    }  
  
    String get symbol => _symbol;  
  
    set symbol(String value){  
        _symbol = value;  
    }  
}
```

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

Constructors

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

Constructors

short form →

named →

optional param →

factory →

```
class Customer {  
  
    int _id;  
    String name;  
  
    Customer(this._id, this.name);  
  
    Customer.taxExempt(int id, String name){  
        // Do something  
    }  
  
    Customer.optName(this._id, {this.name});  
  
    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

deploy/version →

Package

import →

Libraries

Classes




Functions

**Abstract
classes**

Mixins

Libraries

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




```
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) {
  ...
}
```



```
part of stock_quote;

class Stock {
  ...
}
```



```
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.

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 Dartium browser



JavaScript generation for other browsers



Google won't implement Dart VM in Chrome.

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

```
StockQuoteSimpleWeb — dart — 80x29
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 → browserlib/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_weblib/stock.dart
  GET /packages/stock_quote_simple_web/stock_quote_generator.dart → stock_quote_simple_weblib/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 → browserlib/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 → browserlib/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
```

Working with DOM in a Browser

```
<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>
```

```
import 'dart:html';

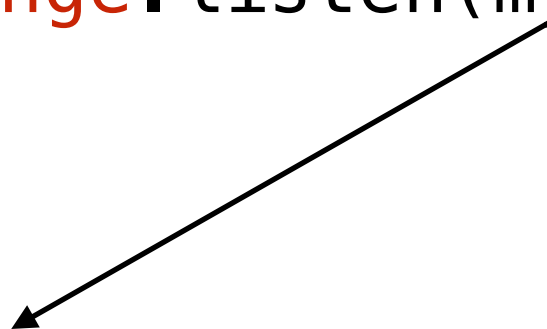
InputElement enteredSymbol;

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>
```

```
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");
```

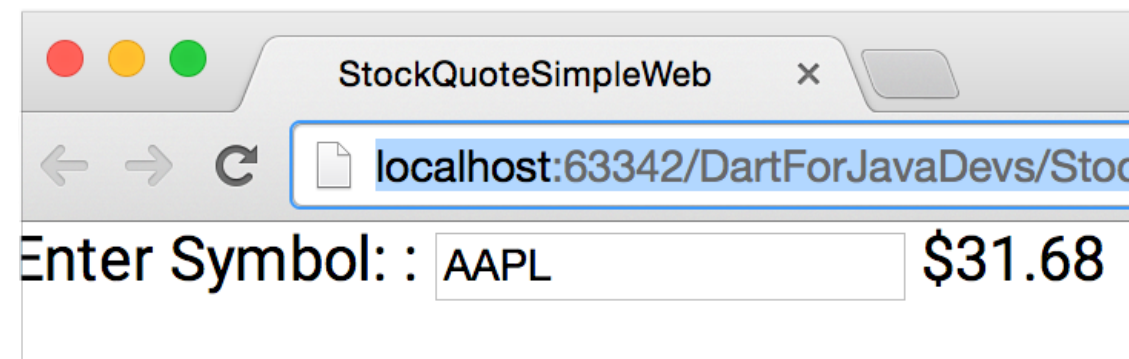
```
  enteredSymbol.onChange.listen(showPrice);
```

```
}
```

```
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. Event Handling.

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:

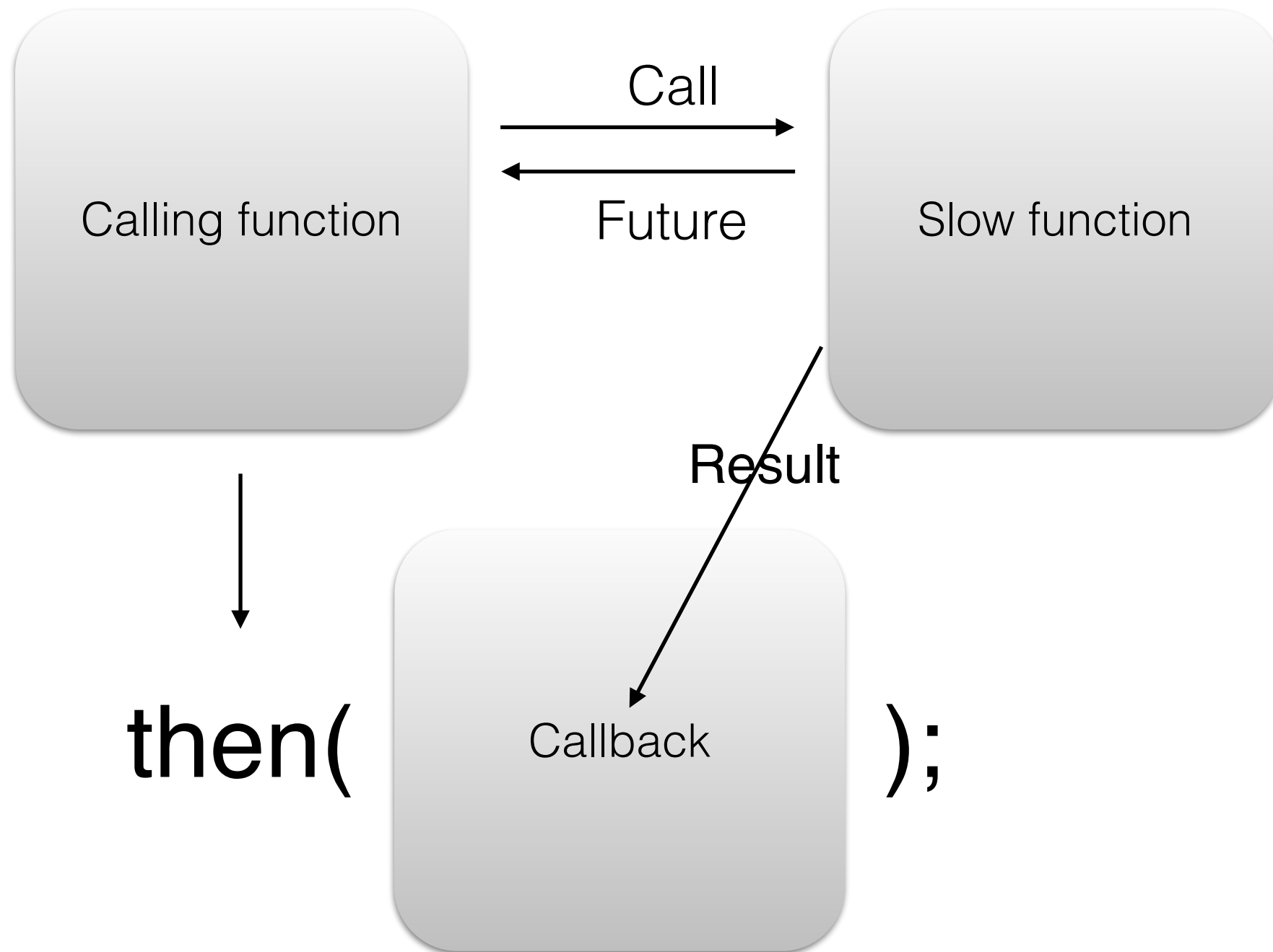
- In Chrome:

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

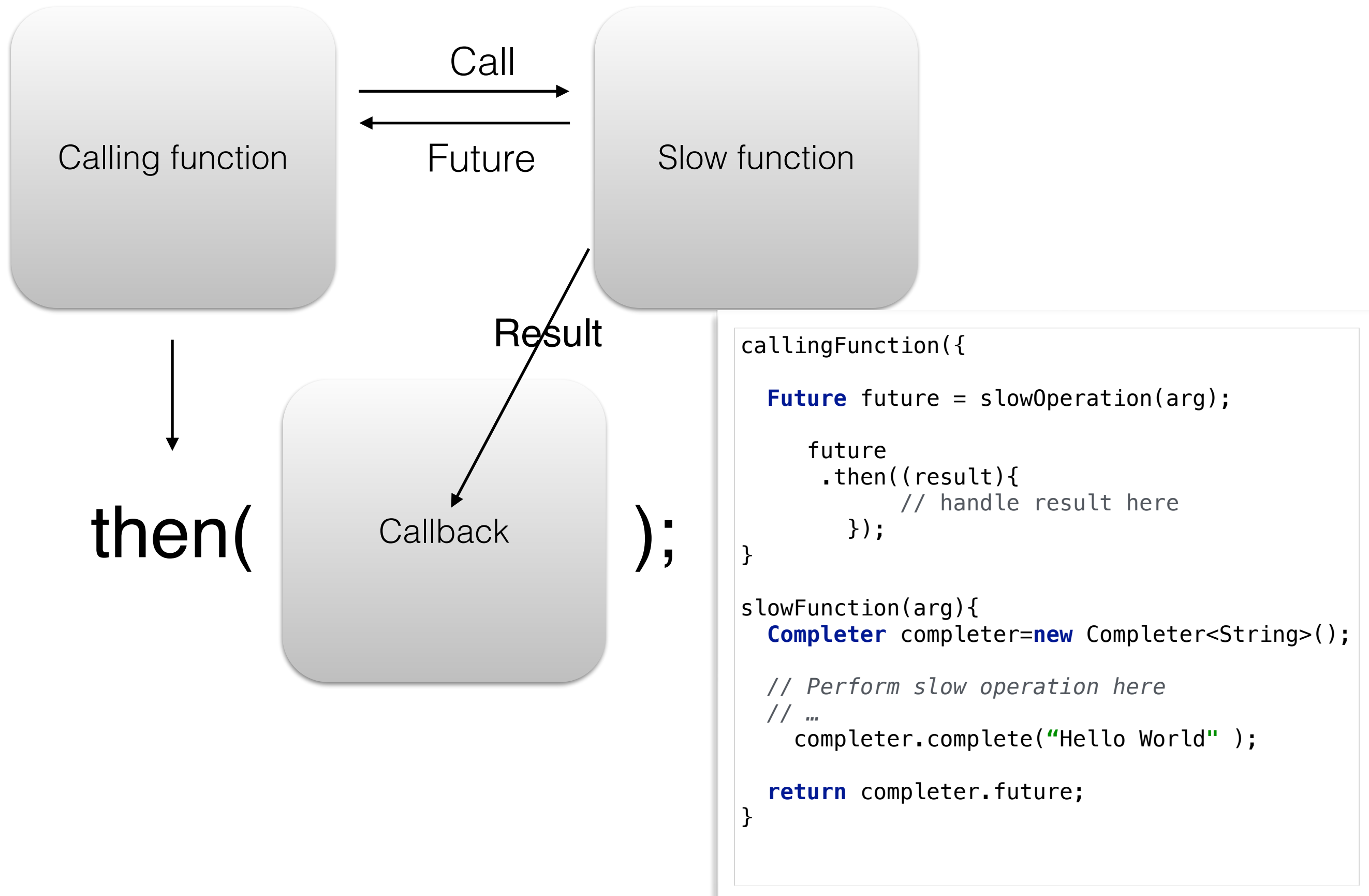
- In IntelliJ IDEA:

- 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.

Async Processing: Futures



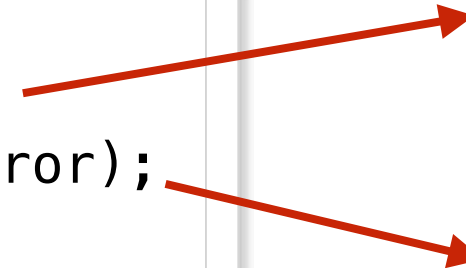
Async Processing: Futures



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 asynchronously using Future.

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.

Mixins

- Mixin is a class with functionality that can be added to another class using `with` keyword
- You can add multiple mixins to the class declaration
- Kind of a multiple inheritance

```
class Bond extends Security with TradeReporter{  
}
```

Java 8 interfaces are not mixins. They can't have state.

Mixin Sample

```
class Security{  
    String name;  
    Security(this.name);  
}
```

```
class Stock extends Security{  
    String symbol;  
    double previousClosingPrice;  
    Stock(String name): super(name);  
}
```

```
class Bond extends Security  
    → with TradeReporter{  
    double faceValue;  
    DateTime maturityDate;  
    Bond(String name): super(name);  
}
```

```
class TradeReporter{  
    String whereToReport;  
    reportMuniBondTrade(name){  
        print('Trade for municipal bond $name has been reported to $whereToReport');  
    }  
    reportCorpBondTrade(name){  
        print('Trade for corporate bond $name has been reported to $whereToReport');  
    }  
}
```

Demo

Mixins

Concurrency with Isolates

- Isolates are units of secure execution
- Code can access classes and values only from the same isolate
- Each isolate has its own heap - no shared memory
- Code can execute in parallel
- Isolates can communicate by sending messages via **send** and **receive** ports

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

Parallel execution with isolates.

Dart Tools

1. **IDEs:** Dart Editor, and plugins for all major IDEs
2. **dart2js** is a Dart-to-JavaScript transpiler and a tree-shaker
3. **pub** is a dependency management, development server and build tool.
4. **gulp** is a task manager. It's an analog of Grunt or Gradle.
5. **Dartium** is a Web Browser for developers.
6. **Dump-Info Visualizer** allows to inspect the generated JavaScript.
7. **Observatory** is Dart profiler.
8. **AngularDart** is a port of AngularJS framework.

Links

- Style Guide <https://www.dartlang.org/articles/style-guide>
- Dart API docs: <https://api.dartlang.org>
- Try Dart: <https://dartpad.dartlang.org>
- Hands-on labs: dartlang.org/codelabs
- List of languages that compile to JS: <http://bit.ly/1FGHtPT>

More Links

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

