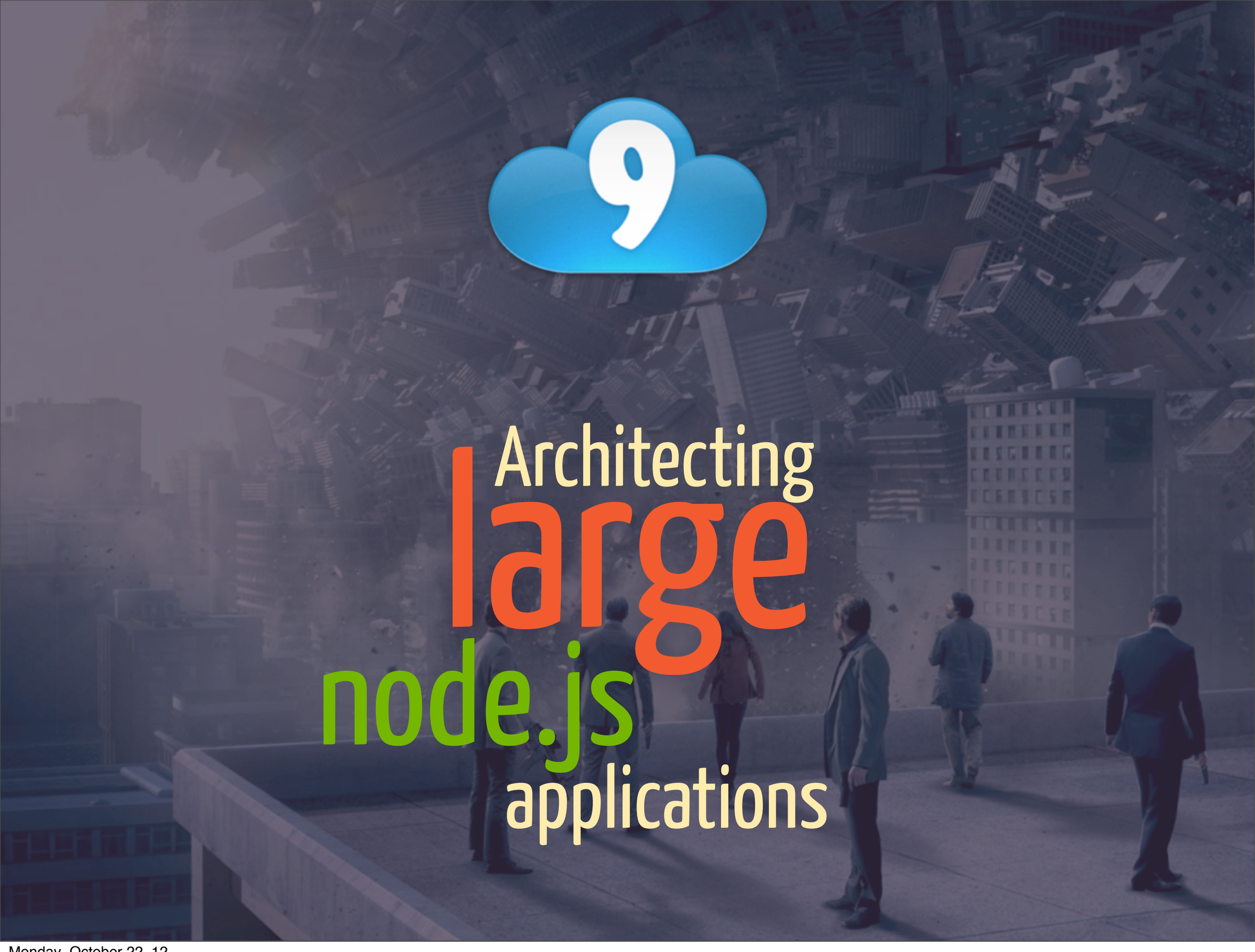

Architecting
large
node.js
applications

@sergimansilla

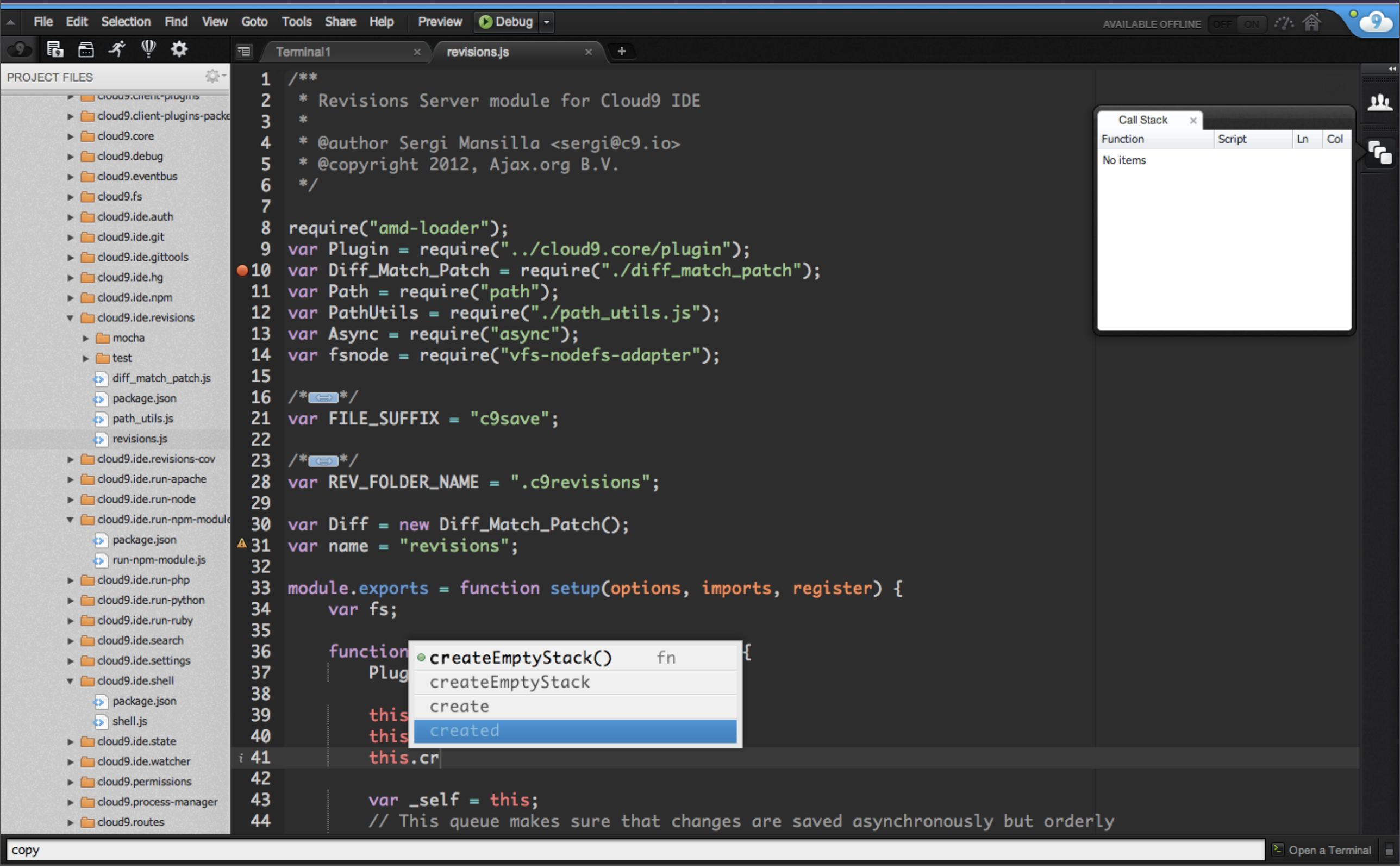
Program

- Cloud9 IDE?
- Growing pains
- Introducing Architect
- Lessons learned

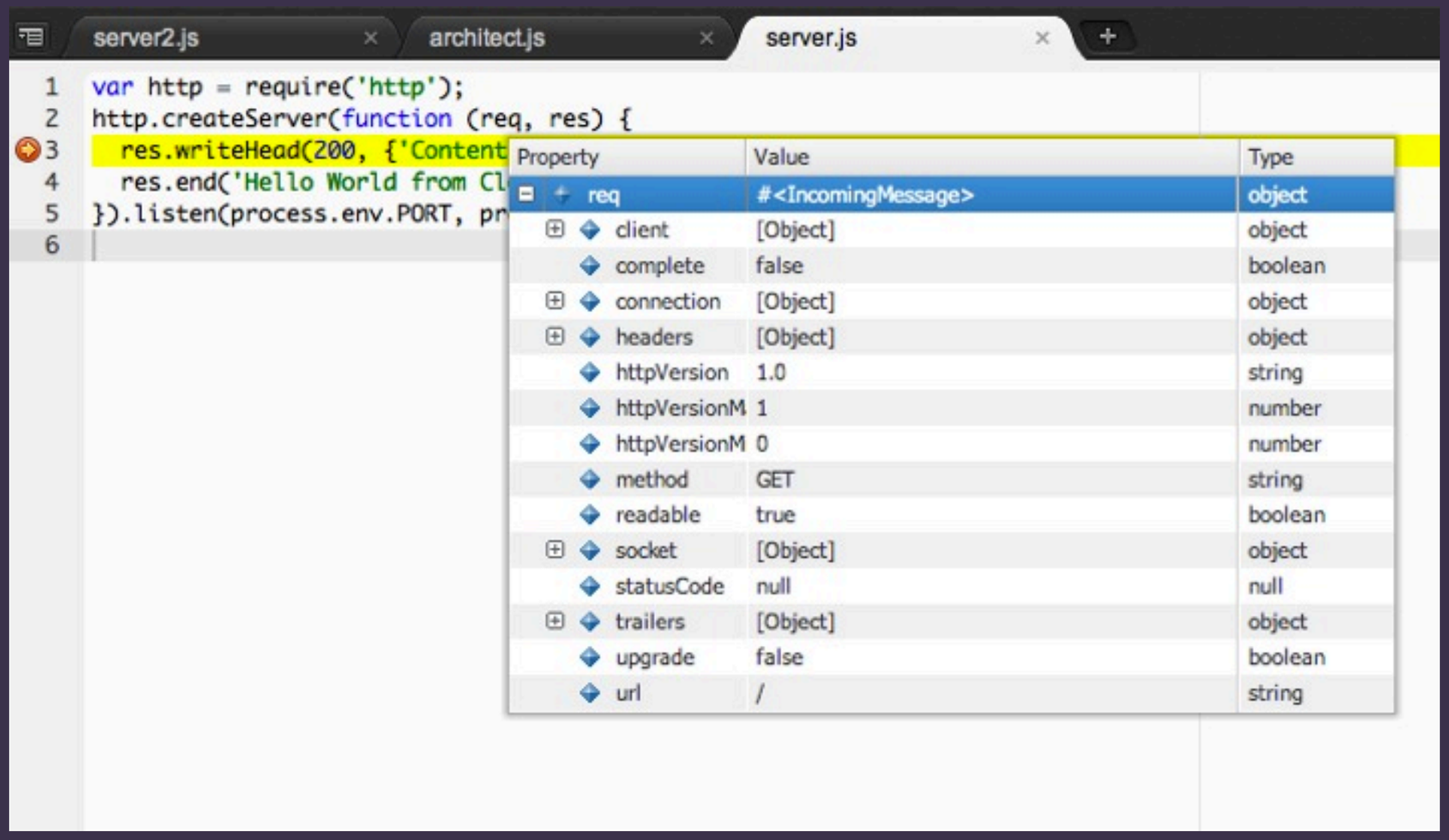
Normal developers

JavaScript Developer

Cloud9 IDE - http://c9.io



Real debugging



(Smart!)

Code completion

```
1  var http = require("http");
2  http.createServer(function(req, res) {
3      res.writeHead(200, {'Content-Type': 'text/plain'});
4
5      res.
6
7
8
9
10
11
12
13
14
15
16
17
18
19 }).listen(process.env.PORT, process.env.IP);
20
```

- addTrailers(headers)
- end([data], [encoding])
- getHeader(name)
- removeHeader(name)
- setHeader(name, value)
- statusCode
- write(chunk, [encoding])
- writeContinue()
- writeHead(statusCode, [reasonPhrase], [heade

getHeader(name) : String

Reads out a header that's already been queued but not sent to the client. Note that the name is case-insensitive. This can only be called before headers get implicitly flushed.

(more)

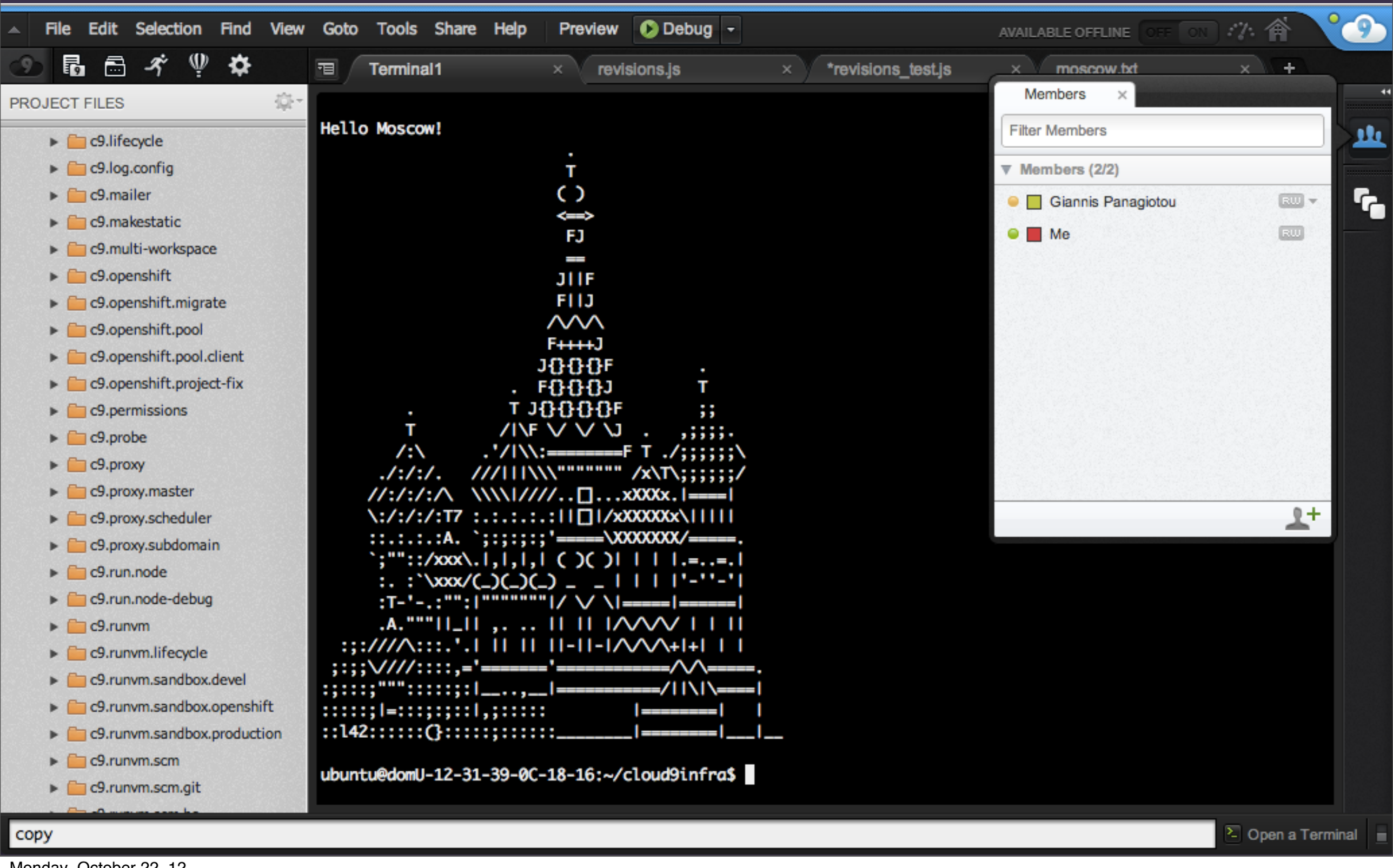
Static analysis

```
1
2  var ASSERT = require("assert");
3  var PATH = require("path");
4  var SYNCER = require("c9-vfs-sync/lib/syncer");
5  var CMD_WRAPPER = require("c9-vfs-sync/lib/cmd-wrapper");
6  var UTIL = require("util");
7  var HTTP_ERROR = require("http-error");
8  var FS_NODE = require("vfs-nodefs-adapter");
9  var fs = require("fs");
10
11 module.exports = function setup(options, imports, register) {
12
13     ASSERT(typeof options.enabled !== "undefined" "options.enabled is required")
       Expected ')' and instead saw 'options.enabled is
       required'. Missing semicolon. Expected an
       identifier and instead saw ')'.
18     var api = {
19         on: function(e) {
20             if (!syncer) return;
21
22             this.next();
23             syncer.on.apply(syncer, arguments);
24             syncer.const = "test";
25         },
```

Free Linux VM

Bring your own machine

Real terminal



Collaboration

See each other type Debug together Productivity++

Create

Run/Debug

Test

Share

Deploy

Program

- ☑ Cloud9 IDE?
- ☐ Growing pains
- ☐ Introducing Architect
- ☐ Lessons learned

10,000s

LOL

of JavaScript

dynamic, weakly typed language

one single thread

Cloud9 datacenter

IDE server

Openshift

Remote VM

Remote VM

Remote VM

Pure madness

Modularization

Black box coding

```
var db = require("database");
db.doStuff();
```

Java/.NET → `import(s)`

Node.js → `require`

require

Great for abstracting away

require

Not Great for application modularity

require

Relies on FS

duplicated modules

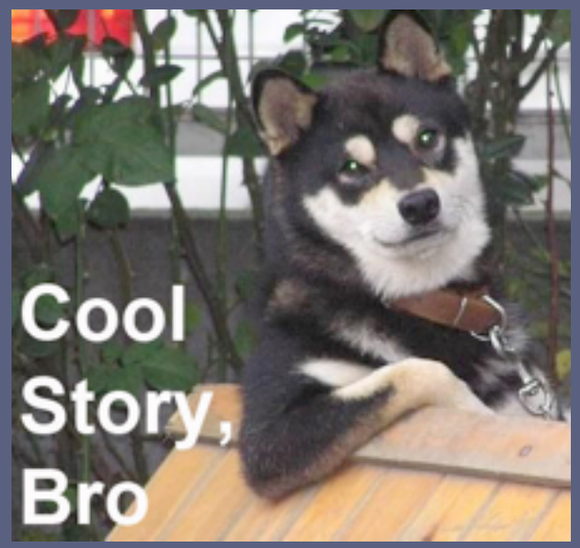
maps to folder names

Hard to configure module

Dependency error handling

coding time

compile time



run time

- Server crash
- Unhappy customers
- Developer gets fired

How to fix it?

Static dependency list → Resolve at startup

Named services → No FS required

Easy configuration → Pass an object

Program

- ☑ Cloud9 IDE?
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Architect

github.com/c9/architect

Architect

Everything is a plugin

Plugins can consume plugins

An application is just a set of plugins

Dependency model

require → runtime

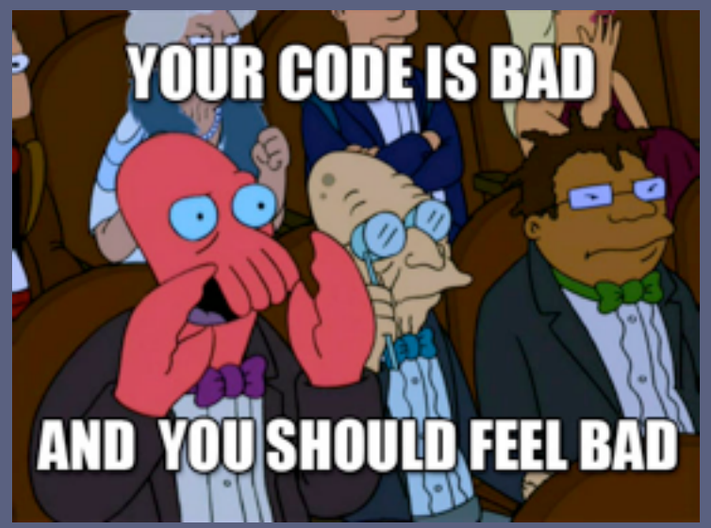
Architect → compile time

Dependency error handling

Architect

coding time

compile time



- Fails before release

run time

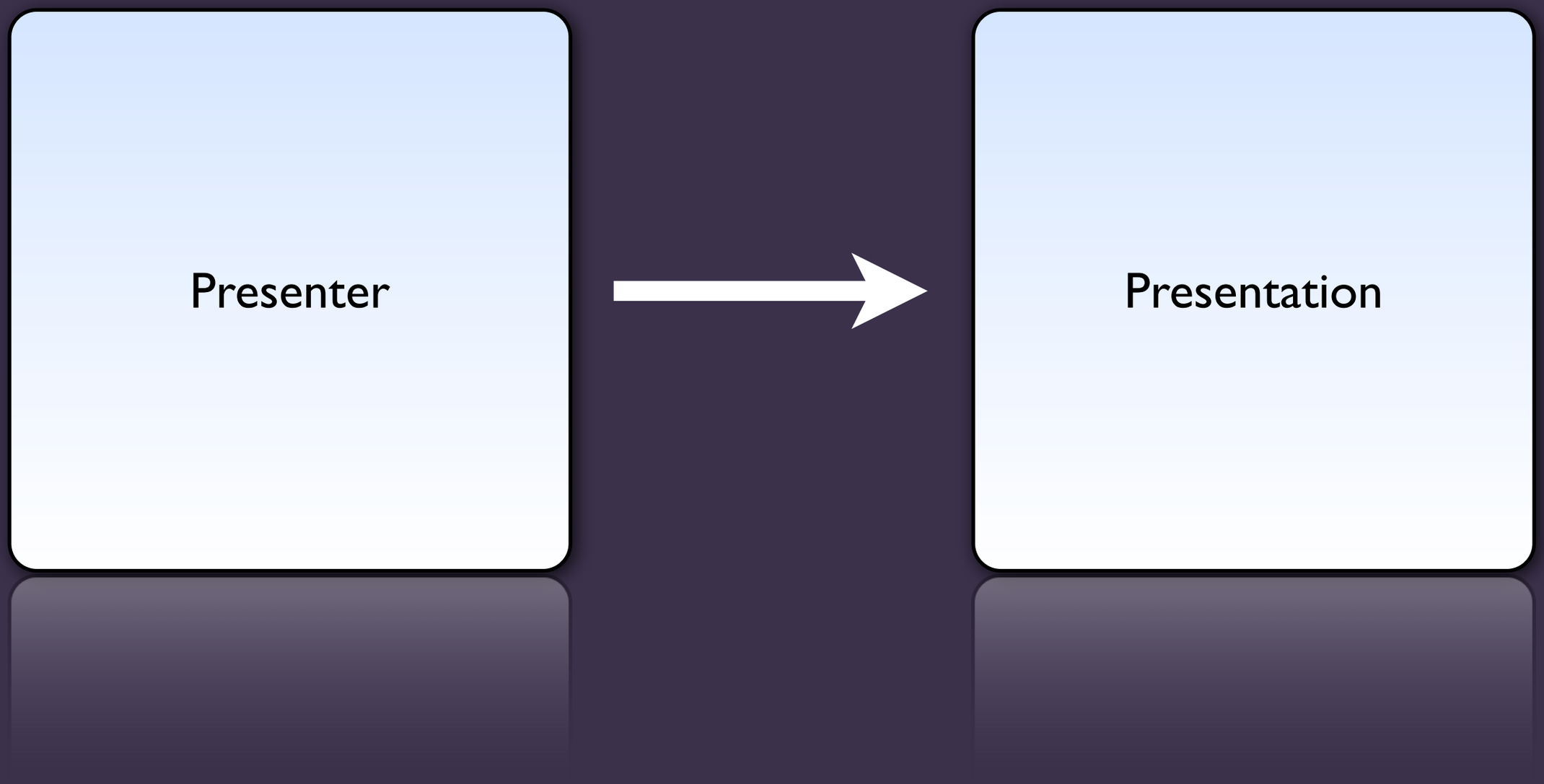
- Happy customers
- Developer keeps job

```
1  function doPresentation () {
2      var presenter = {
3          dance: function () {
4              /* implementation can be seen at the afterparty */
5          },
6          speak: function (subject) {
7              console.log("blah blah blah")
8          }
9      };
10
11     presenter.dance()
12     presenter.speak("javascript")
13
14     for (var i = 0; i < 10; i++)
15         presenter.dance()
16 }
```

Declare entity ‘presenter’ with behavior

Use ‘presenter’ to do a presentation

Dependency model



Express our model

package.json

Builds dependency tree

without

executing code

```
1  // presenter/package.json
2  {
3      "name": "presenter",
4      "main": "./presenter.js",
5
6      "plugin": {
7          "consumes": [],
8          "provides": [
9              "presenter"
10         ]
11     }
12 }
13
14 // do-presentation/package.json
15 {
16     "name": "presentation",
17     "main": "./presentation.js",
18
19     "plugin": {
20         "consumes": [ "presenter" ],
21         "provides": []
22     }
23 }
```

What's next?

Wrap in Architect plugin code

Extract the code

Make two plugins

Function signature

```
1  module.exports = function (options, imports, register) {
2      var presenter = {
3          dance: function () {
4              /* wait for the afterparty! */
5          },
6          speak: function (subject) {
7              console.log("blah " + subject + " blah")
8          }
9      };
10
11     register(null, {
12         "presenter": presenter
13     })
14 }
```

Call when done

Architect plugin code

Module.exports

Options - we'll get to that

Imports - everything you 'consume'

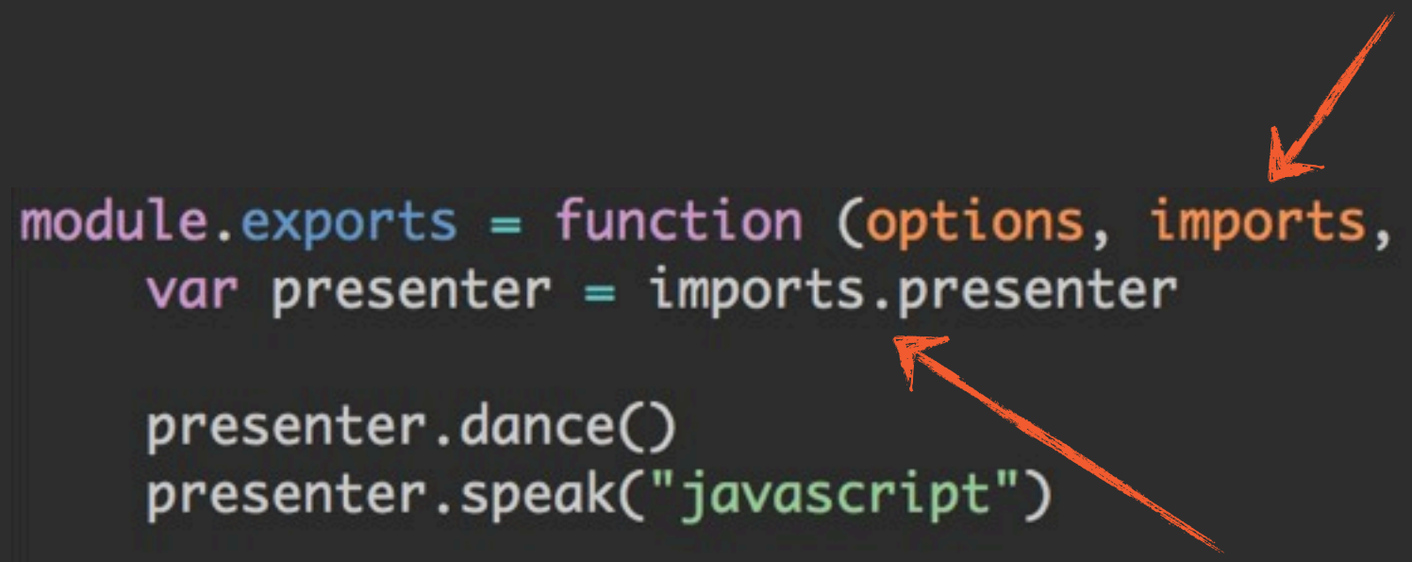
Register - invoke when done

```
module.exports = function (options, imports, register) {
    var presenter = imports.presenter

    presenter.dance()
    presenter.speak("javascript")

    for (var i = 0; i < 10; i++)
        presenter.dance()

    // nothing to provide
    register()
}
```



```
module.exports = function (options, imports, register) {
    var presenter = imports.presenter

    presenter.dance()
    presenter.speak("javascript")

    for (var i = 0; i < 10; i++)
        presenter.dance()

    // nothing to provide
    register()
}
```

Easy to test

Mock dependencies

Assert ‘dance’ is called 11 times

```
1  // just reference the plugin (no architect required)
2  var doPresentation = require("./presentation");
3
4  // when calling this we can mock it
5  var mockedPresenter = {
6      dance: createStub(),
7      speak: createStub()
8  };
9
10 var options = {};
11 var imports = {
12     "presenter": mockedPresenter
13 };
14
15 doPresentation(options, imports, function () {
16     // assert we called the dance function 11 times
17     assert.equal(mockedPresenter.dance.callCount, 11);
18 });
```

No black magic

Specify dependency model

Feed architect a config file

Call ‘createApp’

```
var config = [
    {
        packagePath: "./plugins/presenter"
    },
    {
        packagePath: "./plugins/do-presentation"
    }
];

// Create relative tree
var tree = architect.resolveConfig(config, __dirname);

// Start app
architect.createApp(tree, function () {
    console.log("Application started");
});
```

```
Could not resolve dependencies of these plugins:

[ { packagePath: '/plugins/do-presentation/package.json',
    provides: [],
    consumes: [ 'presentation' ],
```

Configuration

Per-plugin options

No global options object

Specify in config file

```
module.exports = function (options, imports, register) {
```

```
{
    packagePath: "./plugins/do-presentation",
    numberOfDances: 8
}
```

Options

Automatically passed in at startup

Options are also dependencies

Fail if options aren't present

```
1  var assert = require("assert");
2
3  module.exports = function (options, imports, register) {
4      // you can also do type assertion here, check if it's a number etc.
5      assert(options.numberOfDances, "Option 'numberOfDances' is required");
6
7      /* snip some code */
8
9      // usage
10     for (var i = 0; i < options.numberOfDances; i++)
11         presenter.dance();
12
13     register(null, null);
14 };
```

```
AssertionError: Option 'numberOfDances' is required
    at Object.setup (/plugins/do-presentation/presentation.js:4:5)
```

Architect makes you think of your app as

chunks of functionality

rather than sets of classes

Think ‘chunks of functionality’

Implicit type constraints

Keep implementation private

Swap features instead of interfaces

How does Cloud9 use it?

- Open source version
- Local version (OS + sync)
- Hosted version
  - Normal
  - FTP
  - SSH

```
var fs = imports.fs;

function saveFile (filename, contents) {
    fs.writeFile(filename, contents);
}
```

Swap feature per implementation

On Open source: talk local filesystem

On FTP: talk FTP library

On SSH: talk via a SSH bridge

Here is something your DI framework can't do

Single node.js process

Other code
(dashboard etc.)

IDE instance
(FTP)

IDE instance
(SSH)

IDE instance
(Normal)

IDE instance
(Normal)

```
// let's assume we're making a multi player online game
function getGameStatus(req) {
    var gameId = req.query.gameId
    var game = db.GetGame(gameId)

    return game.getStatus()
}
```

Architect can do

Multiple instances of same plugin

Run independently

But in the same process

```
function startNewGame (name) {
    var game = db.createNewGame(name);

    var config = [
        {
            packagePath: "./game-status",
            game: game
        }
    ];

    architect.createApp(/* snip */
```

```
// game-status.js
module.exports = function (options, imports, register) {
    assert(options.game, "Option 'game' is required");

    // even cache stuff in this specific context
    var localState = {};

    // define base url in init code (one time executed!)
    var baseUrl = "/" + options.game.name;

    // when request comes in
    http.get(baseUrl + "/status", function () {
        // no context switching!
        res.send(game.getStatus());
    });
};
```

HERE'S SOMETHING COOL

Centralized eventbus

Loose coupling between plugins

No hard dependencies!

Can also do inter-context communication

Other plugin

React on event

Event bus

Emit event

Plugin

```
var EventEmitter = require("events").EventEmitter;

module.exports = function (options, imports, register) {
    var emitter = new EventEmitter();

    register(null, {
        "eventbus": {
            emit: emitter.emit,
            on: emitter.on
        }
    });
}
```

```
var bus = imports.eventbus;

// every time a presenter makes a dance
bus.emit("dancing");

// react on events in other plugins
// see the dance-reactor in the repo
bus.on("dancing", function () {
    console.log("Someone is dancing!");
});
```

And now scale up

Need something inter-server

Swap it with i.e. Redis PubSub

Plugins will never notice

Modular awesomeness!

Program

- ☑ Cloud9 IDE?
- ☑ Growing pains
- ☑ Introducing Architect
- ☐ Lessons learned

Modularize in feature blocks

Don't over engineer

Don't create too small blocks

They aren't interfaces!

Use dependency injection

Architect (JavaScript)

StructureMap (.NET)

Spring (Java)

Avoid context switching

Less code!

Less errors!

Less boilerplate!

Loose coupling

Use an event bus

Smaller dependency graph

Cloud9 IDE

Your code anywhere, anytime

github.com/c9/architect

Happy coding!

Cloud9 IDE

Your code anywhere, anytime

http://c9.io

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