REST APIs with Express.js

Olivier Liechti & Simon Oulevay
COMEM Web Services 2016

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Install Node.js

Install a real command line

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or

?

Good to go!

→ http://babun.github.io

Install a real code editor (not Notepad)

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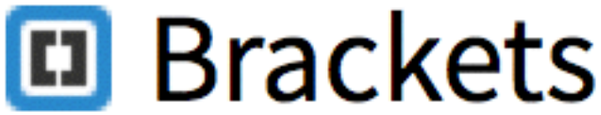
TextMate

Komodo IDE

Sublime Text



Cloud9 IDE

Install Node.js & npm

https://nodejs.org/

Setup #4
Make it work!

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```
$> node
> 1 + 2
3
```

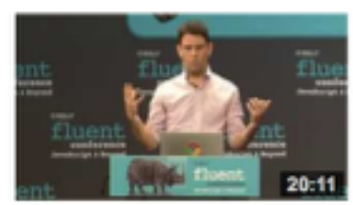
- Open your command line.
- Type **`node`** and press enter. A new prompt should appear, indicating that you are in the Node.js console.
- Type **`1 + 2`** and press enter. Node.js should give you the result.
- (Type `0.1 + 0.2` if you want to see that your CPU can't count.)

Scaffolding with Yeoman

How do I **bootstrap** and **structure** my project?

- Based on the specifications, we know that we will develop a REST API with Express, but we'll also use MongoDB and Mongoose, and probably other tools.
- What should we do? **Start from scratch** or use some kind of **skeleton**? What are our **options**? What are the **professional** front-end developers doing?

Paul Irish, "Delivering the goods" - Fluent 2014 Keynote
by O'Reilly • 7 months ago • 29,621 views
Fluent 2014, "Keynote With **Paul Irish**". About **Paul Irish** (Google): **Paul Irish** is a front-end developer who loves the web. He is on ...
HD



Fluent 2013: Paul Irish, "JavaScript Authoring Tooling"
by O'Reilly • 1 year ago • 35,810 views
http://fluentconf.com To view a complete archive of the Fluent 2013 tutorials and sessions, check out the All Access video ...
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https://www.youtube.com/watch?v=vDbbz-BdyYc

Meet Yeoman

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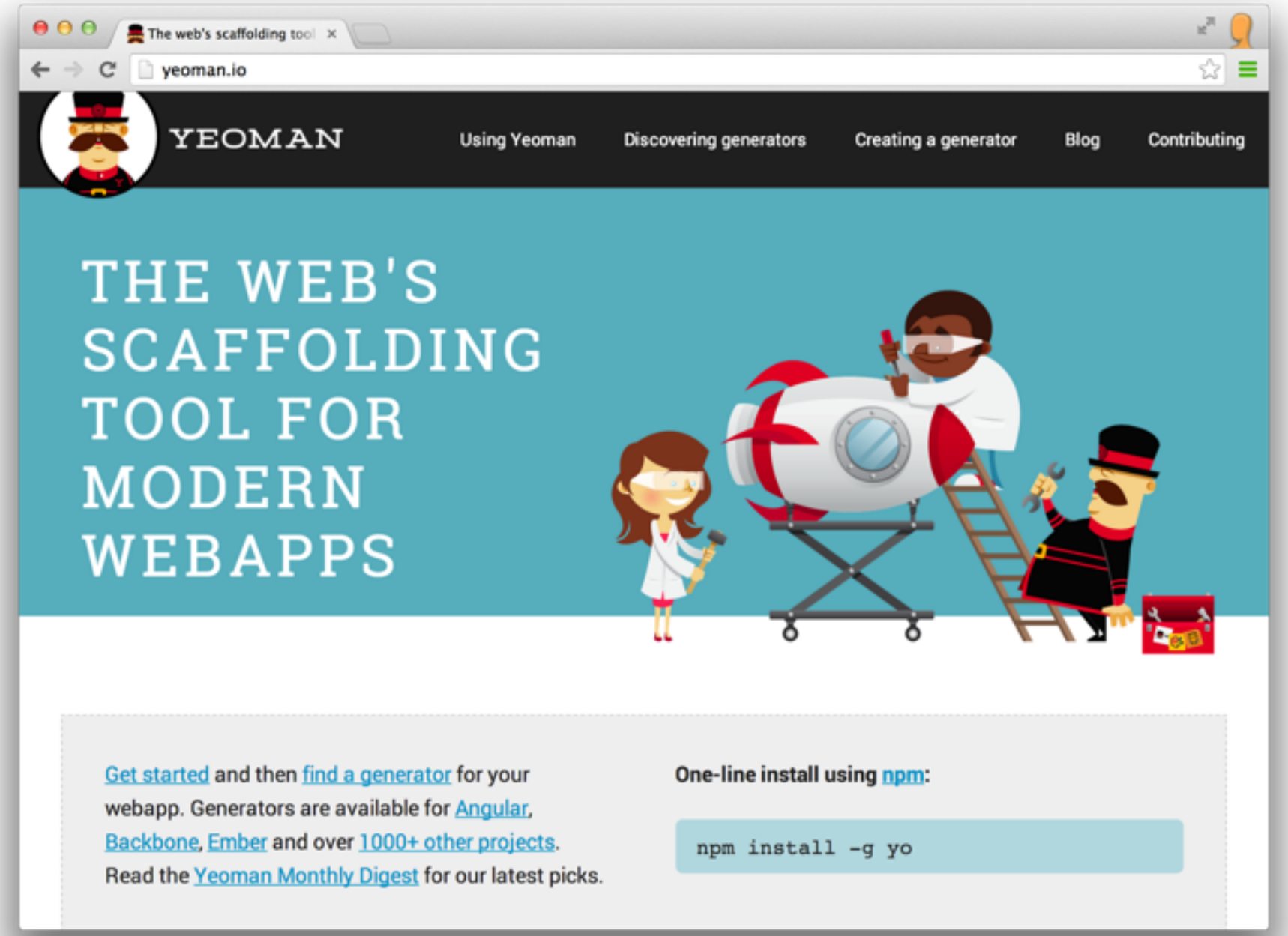

What is Yeoman?

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- Yeoman is a **combination of tools**, which allows to you to setup a **complete**, **automated**, **efficient** and **reliable development workflow**.
- **Yo** is a tool for generating project skeletons (**scaffolding**). You can create and share your skeletons. **Yo generators are npm modules** and you can find one for most popular web frameworks.
- **Bower** is a tool for managing "**web dependencies**". Not only javascript modules, but also CSS files, images, etc.
- **Grunt** is a **task runner**. It is the tool that drives your automated process, by executing a series of tasks. There are lots of grunt plugins provided by the community for all aspects of your project.

What is Yeoman?

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Generators | Yeoman

yeoman.io/generators/

YEOMAN

Using Yeoman | Discovering generators | Creating a generator | Blog | Contributing

GENERATORS

Your generator must have the "yeoman-generator" keyword and a repo description to be listed. Official generators are marked with

express

Name	Description	Author	Stars
angular-fullstack	AngularJS with an Express server	Tyler Henkel	2788
express	An express generator for Yeoman, based on the express command line tool	petecoop	245
mean-seed	MEAN Seed / MEAN Stack (AngularJS, node.js app) - MongoDB, Express, Angular, Node, Grunt, Bower, Yo. 'Core' and 'Module' subgenerators for customization outside of that	Luke Madera	113
yoogurt	A "Choose your own adventure" generator for creating static sites and single page applications. Helps you harness the power of your	Jake Larson	100

Install Yeoman

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YEOMAN

http://yeoman.io/learning/

```
$> sudo npm install -g npm
$> sudo npm install -g bower grunt-cli yo
```

How do you **pick a generator** for your project?

- You probably **have an idea of the framework(s) you want to use** on the server and or client side (express, angular, backbone, etc.). You will use this as a first filter.
- Some of the generators are **supported by the Yeoman Team**. That is probably a good indication about the quality and support over time (evolution).
- Developers who use generators can **“star”** those they like. **Sorting by popularity** is also an interesting indication. If the community is big, you can expect issues to be reported and fixed, to see new features, etc.
- After you have identified **promising candidates**, you need to get a **first impression**. Generate and build a project with each candidate. Look at their Github repository. Do you like what you see? Do you like the documentation?
- Often, you will need to choose between “**lightweight**” and very “**rich**” generators. Lightweight generators are easier to learn and give you more control (but more work). Rich generators do a lot of things out-of-the-box but can be intimidating at first (learning curve to understand the skeleton).

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express
web application
framework for
node

Express.js

Express.js: core functionality

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- **Implementation of the Model View Controller (MVC) pattern**
- **Routing**
  - **Mapping** between HTTP request attributes (URL, method, etc.) and **controllers** (handlers)
- **Middleware**
  - **Interception** and possibly **transformation** of HTTP requests and responses during their processing.
- **Template engines**
  - Rendering of views with **pluggable template engines**.

Meet the Yeoman **express** generator.

---

petecoop/generator-expre

GitHub, Inc. [US] https://github.com/petecoop/generator-express

Features

- Basic or MVC style file structure
- CoffeeScript Support
- Gulp or Grunt build tools with file watching and livereload
- .editorconfig for consistent coding styles within text editors
- Support View engines:
  - Jade
  - Handlebars
  - Swig
  - EJS
  - Marko
  - Nunjucks
- Supported CSS pre-processors
  - SASS (both node-sass and ruby sass)
  - LESS
  - Stylus
- Supported Databases (with MVC structure):
  - MongoDB
  - MySQL
  - PostgreSQL
  - RethinkDB
  - SQLite

Getting started

- Make sure you have yo installed: `npm install -g yo`
- Install the generator **globally**: `npm install -g generator-express`
- Run: `yo express` and select Basic. Add `--coffee` if you require CoffeeScript.
- Run: `grunt` or `gulp` to run the local server at `localhost:3000`, the grunt/gulp tasks include live reloading for views, css in public/css and restarting the server for changes to app.js or js in routes/

Why and **when** is this generator interesting?

- It is **more powerful** than the standard generator provided by the Express.js framework.
- It allows you to easily integrate **persistence** , with a choice of several relational (e.g. MySQL) and NoSQL (e.g. MongoDB) data stores. In that sense, it generates a full multi-tiered MVC application.
- It comes with a **Grunt file**, which includes the **live reload plugin**.
- The generated skeleton and Grunt file are rather **lightweight and straightforward**. It is fairly easy to get into the generated code and to add your application-specific code.

Install the Yeoman Express generator

express

```
$> sudo npm install -g generator-express
$> cd /path/to/project
```

```
$> yo express
? Would you like to create a new directory for your project? No
? Select a version to install: MVC
? Select a view engine to use: Jade
? Select a css preprocessor to use (Sass Requires Ruby): Stylus
? Select a database to use: MongoDB
? Select a build tool to use: Grunt
   create bower.json
   create package.json
   create .bowerrc
   create .editorconfig
   create .gitignore
   create app.js
   create app/controllers/home.js
   create app/models/article.js
   create config/config.js
   create config/express.js
   create app/views/error.jade
   create app/views/index.jade
   create app/views/layout.jade
   create public/css/style.styl
   create Gruntfile.js


I'm all done. Running npm install & bower install for you to install the required
dependencies. If this fails, try running the command yourself.
```

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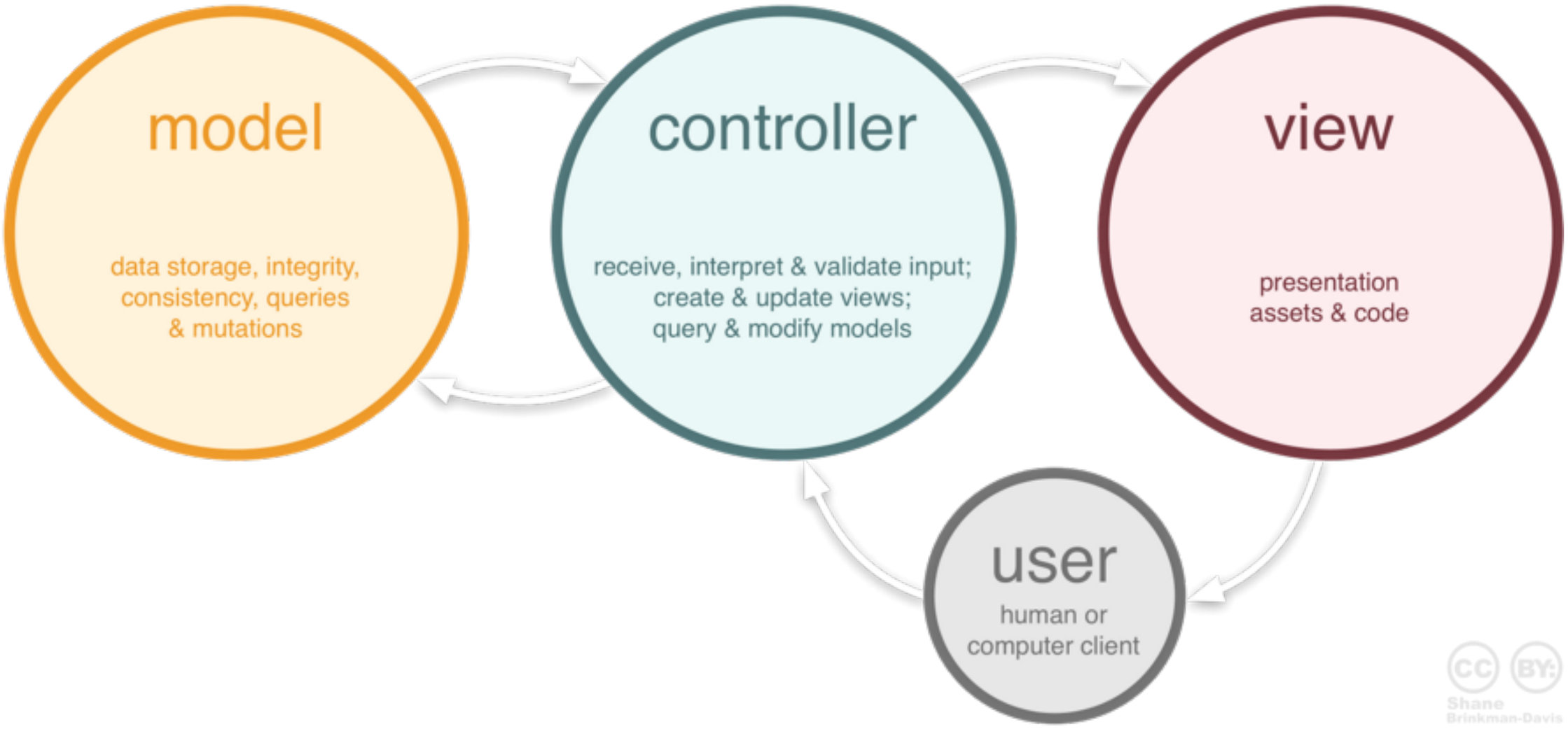
Express uses a **Model-View-Controller (MVC)** structure



Express File Structure

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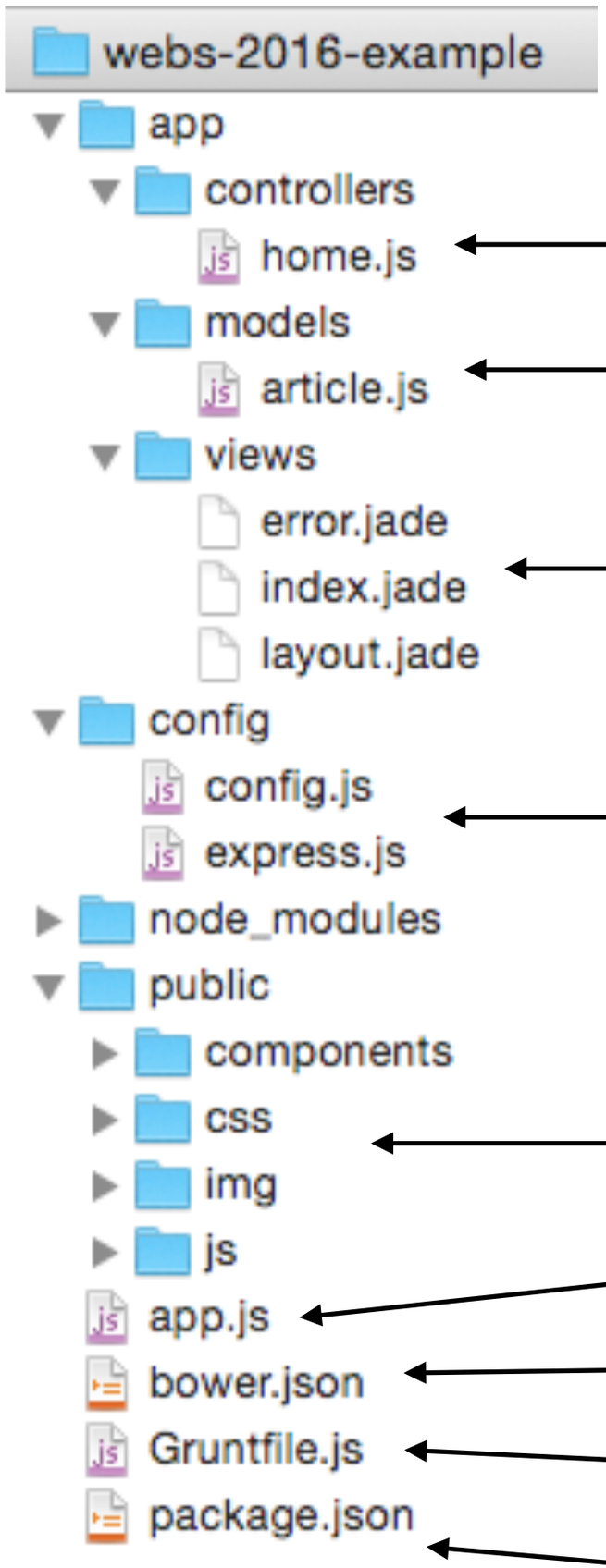

controller (HTML view or API resource)

model (data access with Mongoose)

view (Jade templates compiled to HTML)

configuration

client-side assets (CSS, JS, images, etc)

entry point

bower package definition

tasks configuration

npm package definition

Express Entry Point: `app.js`

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dependencies

npm packages

local modules

```
var express = require('express'),
  config = require('./config/config'),
  glob = require('glob'),
  mongoose = require('mongoose');

mongoose.connect(config.db);
var db = mongoose.connection;
db.on('error', function () {
  throw new Error('unable to connect to database at ' + config.db);
});

var models = glob.sync(config.root + '/app/models/*.js');
models.forEach(function (model) {
  require(model);
});
var app = express();

require('./config/express')(app, config);

app.listen(config.port, function () {
  console.log('Express server listening on port ' + config.port);
});
```

database connection

asynchronous callback on event

models

configuration

start the server

asynchronous callback function

Your Express app's `package.json`:

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```
{
  "name": "webs-2016-example",
  "version": "0.0.1",
  "private": true,
  "scripts": {
    "start": "node app.js"
  },
  "dependencies": {
    "express": "^4.13.3",
    "serve-favicon": "^2.3.0",
    "morgan": "^1.6.1",
    "cookie-parser": "^1.3.3",
    "body-parser": "^1.13.3",
    "compression": "^1.5.2",
    "method-override": "^2.3.0",
    "glob": "^6.0.4",
    "mongoose": "^4.1.2",
    "jade": "^1.11.0"
  },
  "devDependencies": {
    "grunt": "^0.4.5",
    "grunt-develop": "^0.4.0",
    "grunt-contrib-stylus": "^1.0.0",
    "grunt-contrib-watch": "^0.6.1",
    "request": "^2.60.0",
    "time-grunt": "^1.2.1",
    "load-grunt-tasks": "^3.2.0"
  }
}
```

how to start it

the express package

express **middleware** packages

other dependencies

development tools (not used in production)

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express
web application
framework for
node

Express.js Middleware

Express.js: middleware (filters)

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- **Incoming HTTP requests can be processed by multiple components, organized in a pipeline**
- The components can inspect and even modify the incoming HTTP requests and HTTP responses (think about security, compression, etc.).
- Express.js calls these components "**middleware**" functions
- Middleware can be chained. They can intercept requests at different levels (all requests, requests under a certain path, requests handled by a specific router, etc.)
- **Built-in middleware** components are available (in separate npm modules).
- We will use the **express.static** middleware to serve static content (e.g. HTML)

From the API reference

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Using middleware

Express is a routing and middleware web framework with minimal functionality of its own: An Express application is essentially a series of middleware calls.

Middleware is a function with access to the request object (`req`), the response object (`res`), and the next middleware in the application's request-response cycle, commonly denoted by a variable named `next`.

Middleware can:

- Execute any code.
- Make changes to the request and the response objects.
- End the request-response cycle.
- Call the next middleware in the stack.

If the current middleware does not end the request-response cycle, it must call `next()` to pass control to the next middleware, otherwise the request will be left hanging.

An Express application can use the following kinds of middleware:

- Application-level middleware
- Router-level middleware
- Error-handling middleware
- Built-in middleware
- Third-party middleware

You can load application-level and router-level middleware with an optional mount path. Also, you can load a series of middleware functions together, creating a sub-stack of the middleware system at a mount point.

Express Configuration: `config/config.js`

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```
var express = require('express');
var glob = require('glob');

var favicon = require('serve-favicon');
var logger = require('morgan');
var cookieParser = require('cookie-parser');
var bodyParser = require('body-parser');
var compress = require('compression');
var methodOverride = require('method-override');

module.exports = function(app, config) {
  var env = process.env.NODE_ENV || 'development';
  app.locals.ENV = env;
  app.locals.ENV_DEVELOPMENT = env == 'development';

  app.set('views', config.root + '/app/views');
  app.set('view engine', 'jade');

  // app.use(favicon(config.root + '/public/img/favicon.ico'));
  app.use(logger('dev'));
  app.use(bodyParser.json());
  app.use(bodyParser.urlencoded({
    extended: true
  }));
  app.use(cookieParser());
  app.use(compress());
  app.use(express.static(config.root + '/public'));
  app.use(methodOverride());
```

...

third-party **middleware** packages

use the middleware one after the other; each can modify the request, send a response, or pass the request along to the **next** middleware

From the API reference

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Application-level middleware

Bind application-level middleware to an instance of the app object with `app.use()` and `app.METHOD()`, where `METHOD` is is the HTTP method of the request that it handles, such as GET, PUT, POST, and so on, in lowercase. For example:

```
var app = express();

// a middleware with no mount path; gets executed for every request to the app
app.use(function (req, res, next) {
  console.log('Time:', Date.now());
  next();
});

// a middleware mounted on /user/:id; will be executed for any type of HTTP request to /user/:id
app.use('/user/:id', function (req, res, next) {
  console.log('Request Type:', req.method);
  next();
});

// a route and its handler function (middleware system) which handles GET requests to /user/:id
app.get('/user/:id', function (req, res, next) {
  res.send('USER');
});
```

Adding your own middleware

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...

```
app.use(express.static(config.root + '/public'));
app.use(methodOverride());

var controllers = glob.sync(config.root + '/app/controllers/*.js');
controllers.forEach(function (controller) {
  require(controller)(app);
});

app.use(function (req, res, next) {
  var err = new Error('Not Found');
  err.status = 404;
  next(err);
});

// ...

app.use(function (err, req, res, next) {
  res.status(err.status || 500);
    res.render('error', {
      message: err.message,
      error: {},
      title: 'error'
    });
});
```

middleware packages

controllers used as middleware

last middleware that will catch requests not already handled

error-handling middleware

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express
web application
framework for
node

Express.js Routing

Express.js: server-side routing

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- **Routing** consists in finding some piece of code (a function) to execute when an HTTP request has been issued.
- We will see later (in a few weeks) that routing can happen on the client side. Today, we are looking at **routing on the server side**.
- Routing is part of the typical **Model-View-Controller (MVC) pattern** implemented by web frameworks (not only in JavaScript, but also in other languages).
- **Routing consists in finding the right controller when a request comes in**.
- The controller will then get a model and delegate the rendering of a view to a template engine.

The home page

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In `app/controllers/home.js`

```
var express = require('express'),
  router = express.Router(),
  mongoose = require('mongoose'),
  Article = mongoose.model('Article');

module.exports = function (app) {
  app.use('/', router);
};

router.get('/', function (req, res, next) {
  Article.find(function (err, articles) {
    if (err) return next(err);
    res.render('index', {
      title: 'Generator-Express MVC',
      articles: articles
    });
  });
});
```

Express Router

Add the router as middleware (filtered by path)

Define a route: `GET /`

From the API reference

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Routing

Routing refers to the definition of end points (URIs) to an application and how it responds to client requests.

A route is a combination of a URI, a HTTP request method (GET, POST, and so on), and one or more handlers for the endpoint. It takes the following structure `app.METHOD(path, [callback...], callback)`, where `app` is an instance of `express`, `METHOD` is an HTTP request method, `path` is a path on the server, and `callback` is the function executed when the route is matched.

The following is an example of a very basic route.

```
var express = require('express');
var app = express();

// respond with "hello world" when a GET request is made to the homepage
app.get('/', function(req, res) {
  res.send('hello world');
});
```

- Route **methods** (GET, POST, PUT)
- Route **paths** ('/', '/home', '/students')
- **Request** and **response objects**

From the API reference

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Router

A `router` object is an isolated instance of middleware and routes. You can think of it as a "mini-application," capable only of performing middleware and routing functions. Every Express application has a built-in app router.

A router behaves like middleware itself, so you can use it as an argument to app.use() or as the argument to another router's use() method.

The top-level `express` object has a `Router()` function that creates a new `router` object.

Router([options])

Create a new router as follows:

```
var router = express.Router([options]);
```

- For large applications, it is better to split the controllers in multiple, isolated components. You should use multiple routers for that purpose.
- express.Router() creates a new router. (no need for r = new Router())

Express.js resources

Documentation

http://expressjs.com/en/4x/api.html

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MongoDB

NoSQL database

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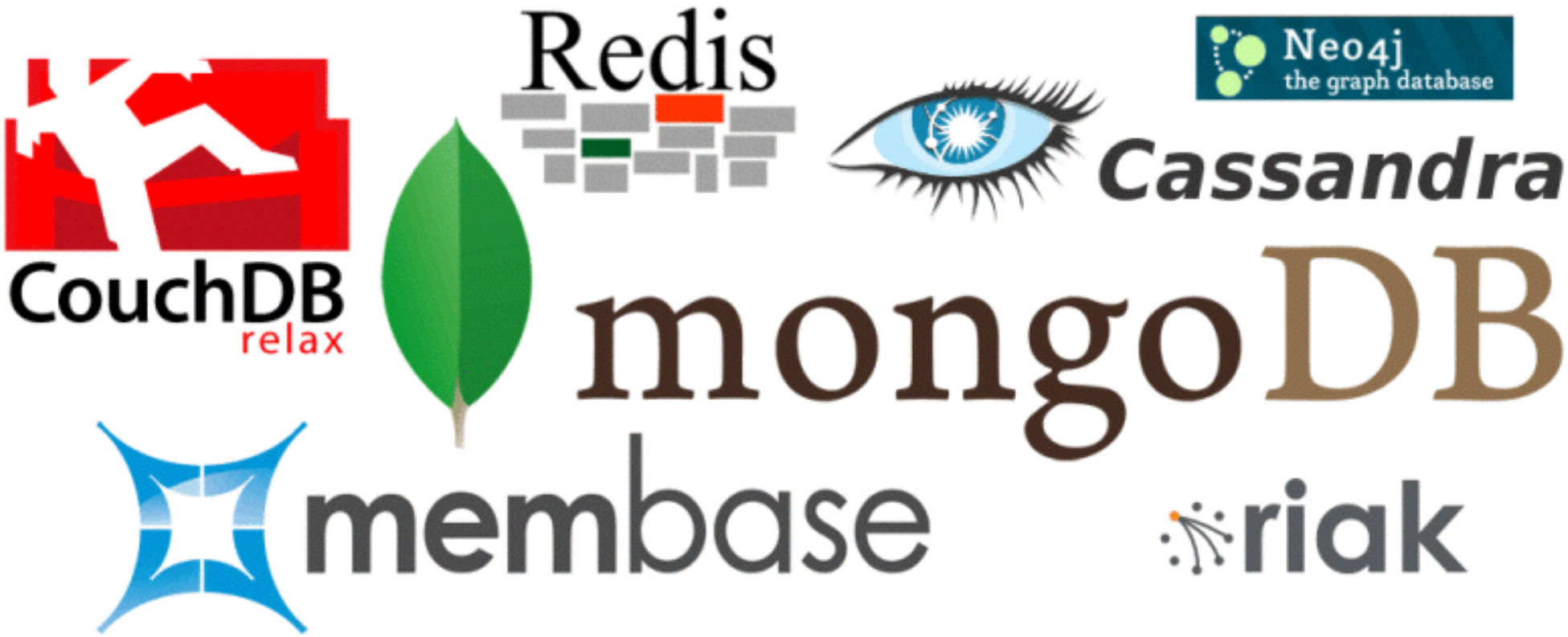

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Store **JSON**-like documents

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```
{
   "_id" : ObjectId("54c955492b7c8eb21818bd09"),
   "address" : {
      "street" : "2 Avenue",
      "zipcode" : "10075",
      "building" : "1480",
      "coord" : [ -73.9557413, 40.7720266 ],
   },
   "borough" : "Manhattan",
   "cuisine" : "Italian",
   "grades" : [
      {
         "date" : ISODate("2014-10-01T00:00:00Z"),
         "grade" : "A",
         "score" : 11
      },
      {
         "date" : ISODate("2014-01-16T00:00:00Z"),
         "grade" : "B",
         "score" : 17
      }
   ],
   "name" : "Vella",
   "restaurant_id" : "41704620"
}
```

Schema-less collections

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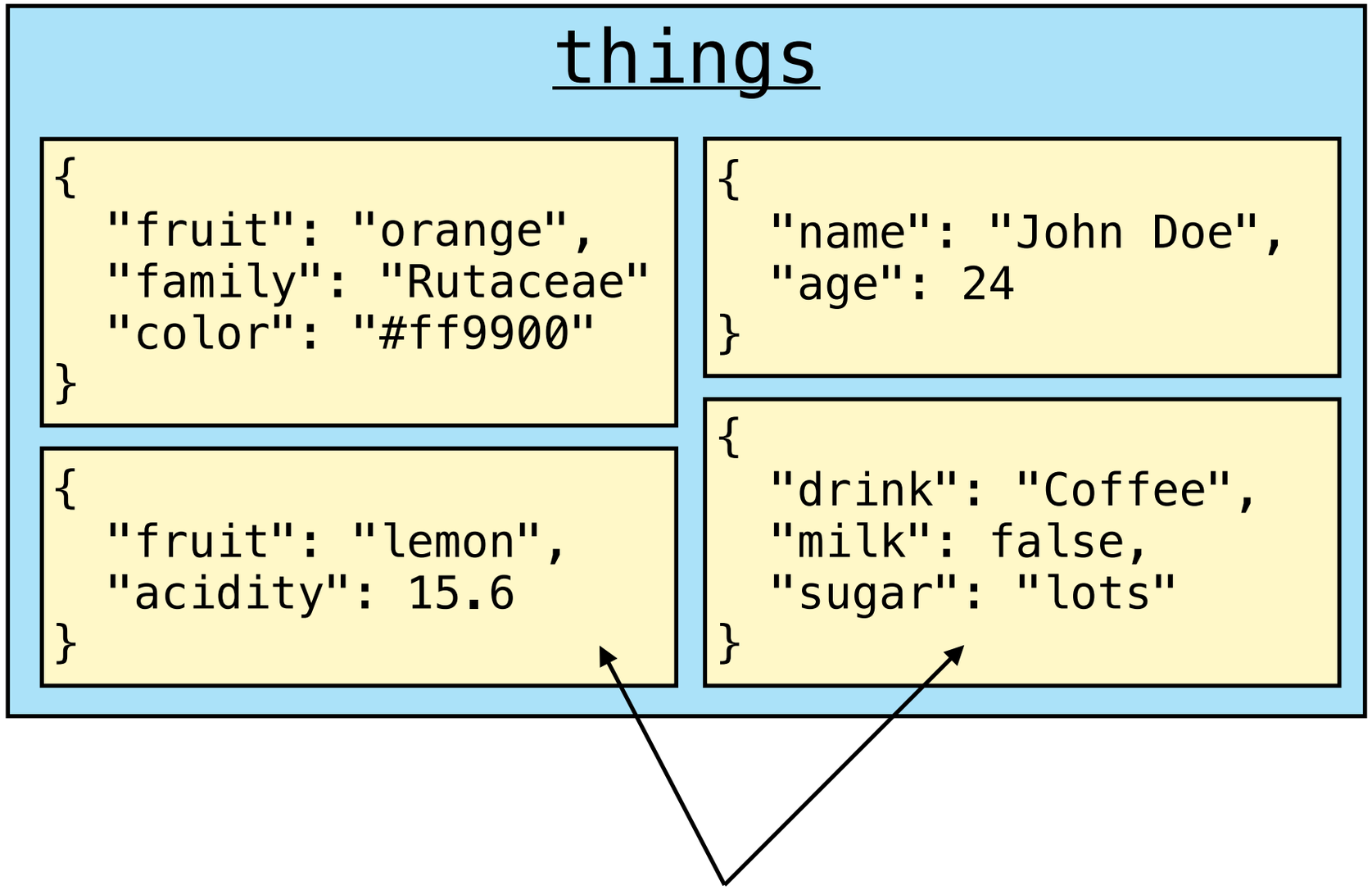
Collection (~ SQL table, but no schema)



Free-form documents (~ SQL table row)

Data modeling

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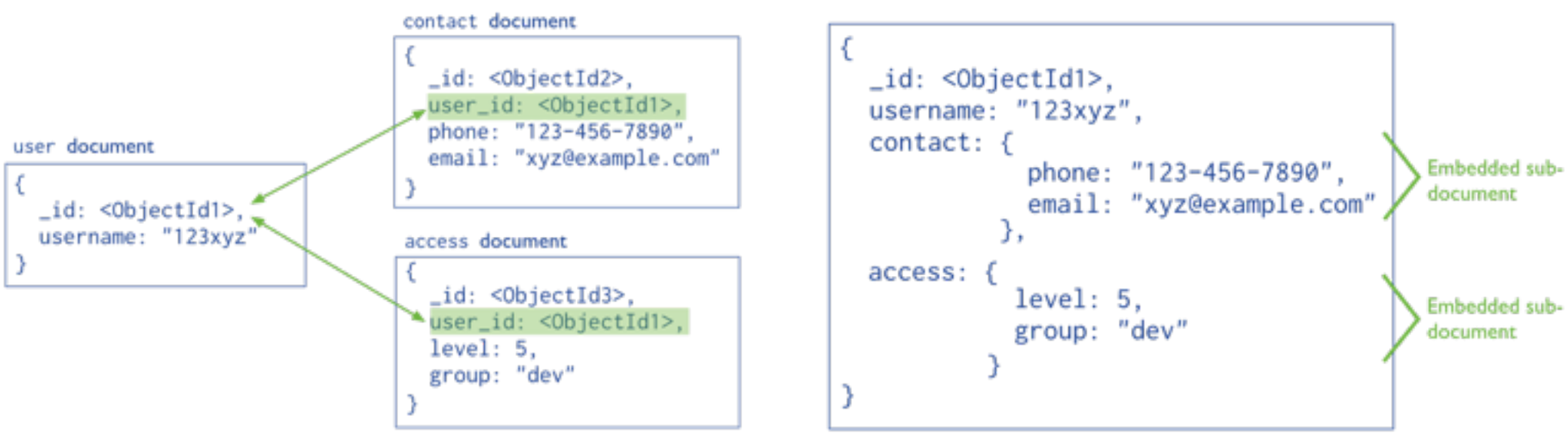
- Creating a data model with MongoDB does not have to follow the rules that apply for relational databases. Often, they should not.
- Consider theses questions: is this a **composition** relationship (**containment**)? Is this "**aggregate**" of documents often used at the same time (i.e. can we reduce chattiness)? Would embedding lead to "a lot" of data **duplication**?



Normalized data model
(references)

Embedded data model
(sub-documents)

https://docs.mongodb.org/manual/core/data-modeling-introduction/

Install & start MongoDB

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https://www.mongodb.org

You should be able to enter the MongoDB console from your command line, and insert and find some data:

```
$> mongo
MongoDB shell version: 3.2.3
connecting to: test
> db.things.insert({ "fruit": "apple" })
WriteResult({ "nInserted" : 1 })
> db.things.insert({ "name": "John Doe", "age": 24 })
WriteResult({ "nInserted" : 1 })
> db.things.find()
{ "_id" : ObjectId("56ca09b5d536b4526d219ba8"), "fruit" : "apple" }
{ "_id" : ObjectId("56ca095ed536b4526d219ba7"), "name" : "John Doe", "age" : 24 }
```

Getting started with MongoDB

We will learn more **tomorrow**.

This guide will instruct you on how to insert,
find, update and remove documents:

https://docs.mongodb.org/getting-started/shell/

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mongoose

elegant mongodb object modeling for node.js

Mongoose

Mongoose: an ODM for MongoDB

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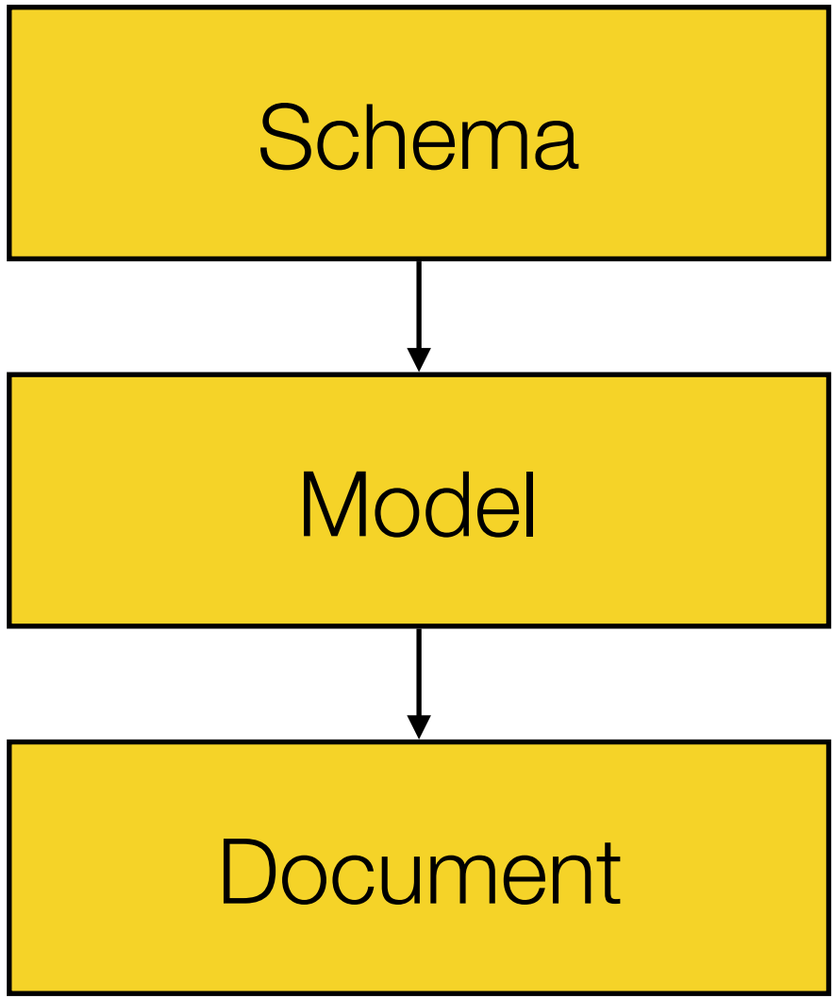
*"Mongoose provides a **straight-forward**, schema-based solution to **modeling** your application data and includes built-in type **casting**, **validation**, **query** building, business logic hooks and more, out of the box."*



"Everything in Mongoose starts with a Schema. Each **schema maps to a MongoDB collection** and defines the shape of the documents within that collection."

"**Models are fancy constructors** compiled from our Schema definitions."

"Mongoose documents represent a **one-to-one mapping** to documents as stored in MongoDB. Each document is an **instance of its Model**."

http://mongoosejs.com/docs/guide.html

Mongoose example

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```
var mongoose = require('mongoose'),
    Schema = mongoose.Schema;

var PersonSchema = new Schema({
  name: {
    first: String,
    last: { type: String, required: true }
  },
  age: { type: Number, min: 0 }
});

mongoose.model('Person', PersonSchema);
```

Define a **schema**

Create a **model** to manage documents with that schema and store them in a MongoDB **collection**

Create a **document** with the model

```
var mongoose = require('mongoose'),
    Person = mongoose.model('Person');

var johnDoe = new Person({
  name: {
    first: "John",
    last: "Doe"
  },
  age: 24
})

johnDoe.save(function(err) {
  if (err) {
    console.warn("John Doe could not be saved");
  }
});
```

Save it

Mongoose validations

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Mongoose has **built-in validations**, and you can also **write your own**

```
var PersonSchema = new Schema({
  name: {
    first: String,
    last: { type: String, required: true }
  },
  age: { type: Number, min: 0 },
  phone: {
    type: String,
    validator: function(value) {
      return /^\d{3}-\d{2}-\d{2}$/.test(value);
    },
    message: "{VALUE} must have the format 000-00-00"
  }
});
```

Ensure a property is present with **required**

Ensure a number is within bounds with **min/max**

Write your own **validator function** and **custom error message**

http://mongoosejs.com/docs/validation.html

Mongoose validations

If your document is invalid, the callback function will be called with an **error** describing which validations have failed.

```
johnDoe.save(function(err) {
  if (err) {
    console.warn("Validation error: " + err.message);
  }
});
```

http://mongoosejs.com/docs/validation.html

Mongoose queries

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you can chain conditions

```
Person
  .find({ occupation: /host/ })
  .where('name.last').equals('Ghost')
  .where('age').gt(17).lt(66)
  .where('likes').in(['vaporizing', 'talking'])
  .limit(10)
  .sort('-occupation')
  .select('name occupation')
  .exec(callback);
```

get at most 10 documents

retrieve only the fields you are interested in

Mongoose resources

Quick start guide

http://mongoosejs.com/docs/index.html

Queries

http://mongoosejs.com/docs/queries.html

Full documentation

http://mongoosejs.com/docs/guide.html

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Grunt: The JavaScript Task Runner

What is Grunt?

Getting Started | Configuring Tasks | Plugins | Documentation

GRUNT

The JavaScript Task Runner

Latest Version

- Stable: v0.4.5 (npm)
- Development: v1.0.0 (github)

Why use a task runner?

In one word: automation. The less work you have to do when performing repetitive tasks like minification, compilation, unit testing, linting, etc, the easier your job becomes. After you've configured it through a Gruntfile, a task runner can do most of that mundane work for you—and your team—with basically zero effort.

Why use Grunt?

The Grunt ecosystem is huge and it's growing every day. With literally hundreds of plugins to choose from, you can use Grunt to automate just about anything with a minimum of effort. If someone hasn't already built what you need, authoring and publishing your own Grunt plugin to npm is a breeze. See how to get started.

Grunt plugins

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```
{
  "name": "webs-2016-example",
  "version": "0.0.1",
  "private": true,
  "scripts": {
    "start": "node app.js"
  },
  "dependencies": {
    "express": "^4.13.3",
    "serve-favicon": "^2.3.0",
    "morgan": "^1.6.1",
    "cookie-parser": "^1.3.3",
    "body-parser": "^1.13.3",
    "compression": "^1.5.2",
    "method-override": "^2.3.0",
    "glob": "^6.0.4",
    "mongoose": "^4.1.2",
    "jade": "^1.11.0"
  },
  "devdependencies": {
    "grunt": "^0.4.5",
    "grunt-develop": "^0.4.0",
    "grunt-contrib-stylus": "^1.0.0",
    "grunt-contrib-watch": "^0.6.1",
    "request": "^2.60.0",
    "time-grunt": "^1.2.1",
    "load-grunt-tasks": "^3.2.0"
  }
}
```

The Yeoman express generator has already integrated Grunt and included a few **plugins** for us.

The Gruntfile

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The Gruntfile is where Grunt plugins are **configured**.

```
module.exports = function (grunt) {

  grunt.initConfig({
    pkg: grunt.file.readJSON('package.json'),
    develop: {
      server: {
        file: 'app.js'
      }
    },
    stylus: {
      dist: {
        files: {
          'public/css/style.css': 'public/css/style.styl'
        }
      }
    },
```

...

The **grunt-develop** plugin runs our app and reloads it every time we make a change.

The **grunt-contrib-stylus** plugin compiles Stylus files to CSS.

And more…

You can run these plugins from the command line:

```
$> grunt develop
$> grunt stylus
```

Composing tasks

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You can run multiple plugins at once by registering a **task**.

```
grunt.registerTask('dev', [
  'stylus',
  'develop',
  'watch'
]);
```

```
$> grunt dev
```

The **default** task is the task that is invoked if you simply run grunt without an argument.

```
grunt.registerTask('default', [
  'stylus',
  'develop',
  'watch'
]);
```

```
$> grunt
```

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RESTful API

GET PUT POST DELETE

Let's make a REST API

Testing tools

Google Chrome

Postman

Postman

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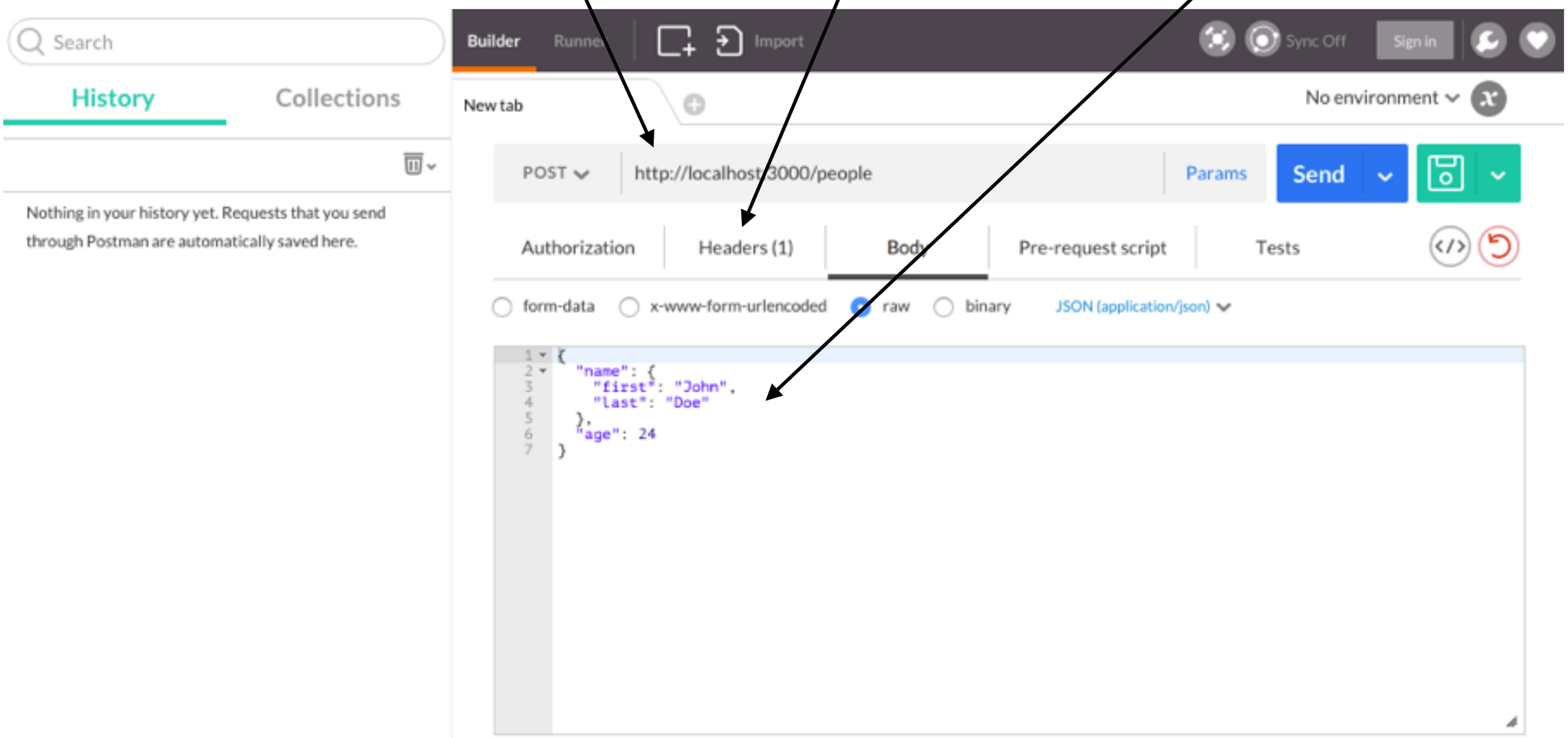
URL HTTP headers Request body



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CRUD

Create Read Update Delete

CREATE RUD

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Request

```
POST /people HTTP/1.1
Content-type: application/json

{
  "name": {
    "first": "John",
    "last": "Doe"
  },
  "age": 24
}
```

Response

```
HTTP/1.1 201 Created
Content-type: application/json

{
  "_id": "3orv8nrg",
  "name": {
    "first": "John",
    "last": "Doe"
  },
  "age": 24
}
```

The **POST** method is used to request that the origin server accept the entity enclosed in the request as a new subordinate of the resource identified by the Request URI.

HTTP 201 Created: The request has been fulfilled and resulted in a new resource being created.

C **READ** U D

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Request

```
GET /people HTTP/1.1
```

Response

```
HTTP/1.1 200 OK
Content-type: application/json

[
  { "_id": "3orv8nrg", … },
  { "_id": "a08un2fj", … }
]
```

The **GET** method means retrieve whatever information (in the form of an entity) is identified by the Request URI.

HTTP 200 OK: Standard response for successful HTTP requests. In a GET request, the response will contain an entity corresponding to the requested resource.

C **READ** U D

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Request

```
GET /people/3orv8nrg HTTP/1.1
```

Response

```
HTTP/1.1 200 OK
Content-type: application/json

{
  "_id": "3orv8nrg",
  "name": {
    "first": "John",
    "last": "Doe"
  },
  "age": 24
}
```

CR **UPDATE** D

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Request

```
PUT /people/3orv8nrg HTTP/1.1
Content-type: application/json

{
  "name": {
    "first": "John",
    "last": "Smith"
  },
  "age": 34
}
```

Response

```
HTTP/1.1 200 OK
Content-type: application/json

{
  "_id": "3orv8nrg",
  "name": {
    "first": "John",
    "last": "Smith"
  },
  "age": 34
}
```

The **PUT** method requests that the enclosed entity be stored under the supplied Request URI. If the Request URI refers to an already existing resource, the enclosed entity SHOULD be considered as a modified version of the one residing on the origin server.

HTTP 200 OK: In a PUT request, the response will contain an entity describing or containing the result of the action.

CRU **DELETE**

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Request

```
DELETE /people/3orv8nrg HTTP/1.1
```

Response

```
HTTP/1.1 204 No Content
Content-type: application/json
```

The **DELETE** method requests that the origin server delete the resource identified by the Request URI.

HTTP 204 No Content: The server successfully processed the request, but is not returning any content.

HTTP resources

HTTP request methods

HTTP status codes