Università della Svizzera italiana | Faculty of Informatics

Express.JS

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Modularity

./my_module.js

```
var msg = "x:"; //private
var f = function(x) {
  return msg + " " + x;
}
module.exports.f = f; //public
```

Export module functions making them part of `module.exports`

```
var module = require('module'); //library module
var my_module = require('./my_module'); //local module
console.log(my_module.f("hello"));
```

Import modules with `require`

package.json

./package.json

```
{
  "name": "my-app",
  "description": "My Web Application",
  "version": "0.0.1",
  "dependencies": {
    "express": "4.x"
  }
}
```

dependencies lists the required modules and their version

npm

The Node Package Manager helps you to:

```
npm init
```

interactively create a new package.json

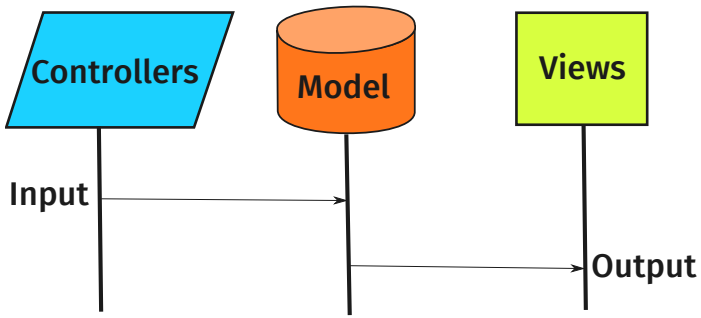
```
npm install
```

download and install the dependencies

```
npm install package --save
```

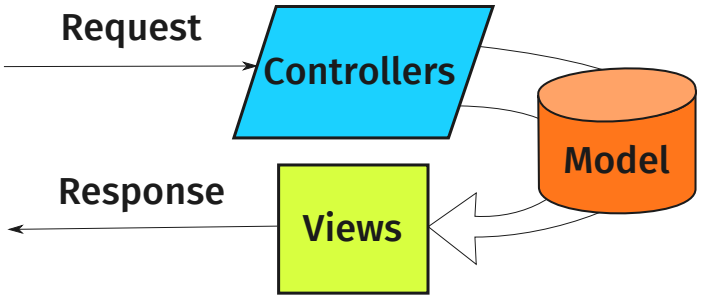
download and install the package and add it to the dependencies listed in package.json

Model View Controller



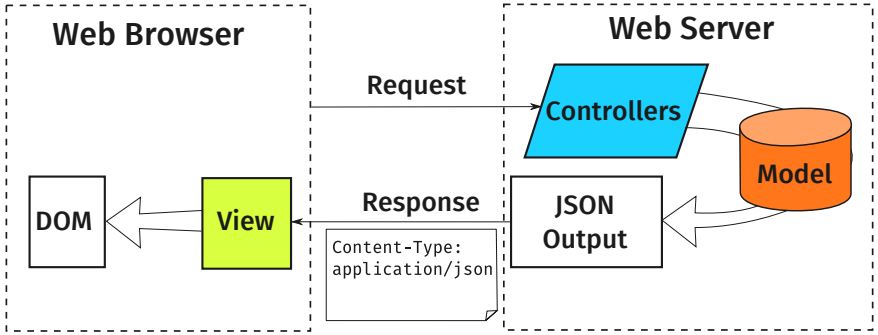
- User input is handled by the Controller which may change the state of the Model
- The Views display the current state of the Model (and may receive notifications about state changes by observing it)

MVC on the Web 1.0



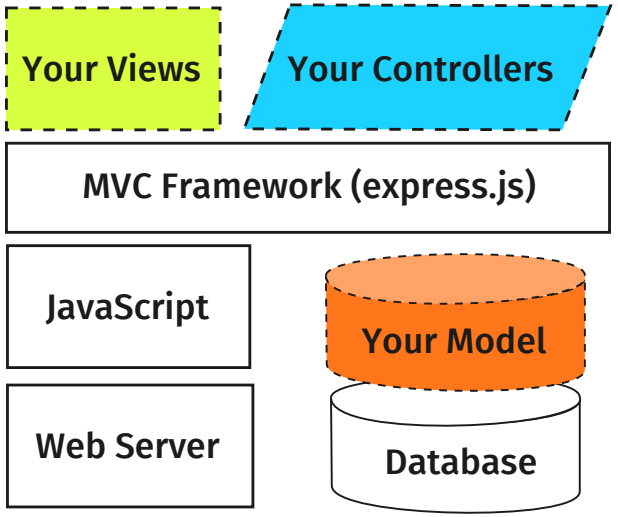
- In Web applications, views produce the actual HTML pages sent to the browser. The controller is the code that handles the input requests, reads/writes the data model and invokes the view to format the model in HTML (or other) representation. The data model manages the actual content and the state of the application, usually stored persistently in a database or XML files.

MVC on the Web 2.0



- The Web server responds with JSON data extracted from the model
- The view running on the client renders the JSON into HTML/DOM

Express MVC



Express MVC

```
var express = require('express');
var app = express();
app.get('/',
  function(req, res) {
    db.findAll(function(error, model) {
      res.render('view', model);
    })
  });
app.listen(8888);
```


Routing

```
var router = express.Router();
router.METHOD('URI Template', callback)
```

METHOD = {get, put, post, delete, all}

```
app.use('URI', router);
```

Activate the router under the 'URI' path

```
router.get('/user/:id',
  function(req, res){
    res.send('user ' + req.params.id);
  });
router.get('/file/*.*',
  function(req, res){
    res.send('file path: ' + req.params);
  });
```


Parse the Request Body

```
var bodyParser = require('body-parser');
app.use(bodyParser.json());
app.use(bodyParser.urlencoded({
  extended: true
}));
```

```
app.put('/blog/:year/:id?', //? optional
  function(req, res){
    var year = req.params.year;
    var id = req.params.id || 0; //default 0
    var body = req.body;
  });
```


Content-Type Negotiation

```
Content-Type: application/json
```

```
if (req.is("application/json")) {
  //request body is JSON
}
```

```
Accept: text/html
```

```
//request asks for HTML content in the response
if (req.accepts("html")) {
  //set Response Content-Type Header
  res.type("text/html");
}
```

```
Content-Type: text/html
```

Middleware

How to run the same code for all requests?

Use a middleware function, which can intercept, modify and validate all requests

```
app.use(function(req, res, next) {
//intercept the request
  console.log(req.method+" "+req.url);
//do not forget to call next
  next();
});
```

middleware can be attached to a specific router

```
router.use(function(req, res, next){...});
```

Reusable middleware: body-parser cookie-parser method-override serve-static Morgan (Logging).

Views

```
function(model) { return html }
```

Views are template files that present content to the user: variables, arrays and objects that are used in views are passed by the controller to be rendered by the view.

Views should not contain complex business logic; only the elementary control structures necessary to perform particular operations, such as the iteration over collections, and simple filters.

Views (Manual)

```
function(model) {
  var html = [];
  html.push('<html><body>');
  if (model.user) {
    html.push('<h2>' + model.user.name + '</h2>');
  }
  html.push('</body></html>');
  return html.join();
}
```

Views (Rendered)

```
res.render('view template', { model } );
```

Invoke a template to render the view

```
res.render('index.dust', { model } );
res.render('index.ejs', { model } );
```

Explicitly choose the template engine to use

```
app.set('view engine', 'dust');
res.render('index', { model } );
```

Configure express to choose the default template engine

Template Engines

Embedded JavaScript allowed

1. EJS
2. underscore.js
3. Jade
4. jQuery templates

Logic-less templates

5. dust.js
6. mustache
7. handlebars
8. Google Closure Templates

Logic-less code more likely to work both on client and server-side

Embedded JS Templates

app.js

```
var model = {
  user: { name: 'CP' }
};
res.render('index.ejs', model );
```

index.ejs

```
<html><body>
<% if (user) { %>
  <h2><%=user.name %></h2>
<% } %>
</body></html>
```

Result

```
<html><body>
  <h2>CP</h2>
</body></html>
```


Embedded JS Templates

.ejs

```
<h1><%= title %></h1>
<ul>
<% for(var i=0; i<list.length; i++) {%>
  <li><%= link_to(list[i],
                  'users/'+list[i]) %></li>
<% } %>
</ul>
```

- JavaScript between <% %> is executed
- JavaScript between <%= %> adds the result to the HTML

Dust.JS Templates

app.js

```
var model = {
  user: { name: 'CP' }
};
res.render('index.dust', model );
```

index.dust

```
<html><body>
{?user}
  <h2>{user.name}</h2>
{/user}
</body></html>
```

Result

```
<html><body>
  <h2>CP</h2>
</body></html>
```


Dust.JS Example

app.js

```
var model = { title: "Hello World",
              list: ["a", "b"] };
res.render("list.dust", model);
```

.dust

```
<h1>{title}</h1>
<ul>
{#list}
  <li><a href="users/{.}">{.}</a></li>
{/list}
</ul>
```

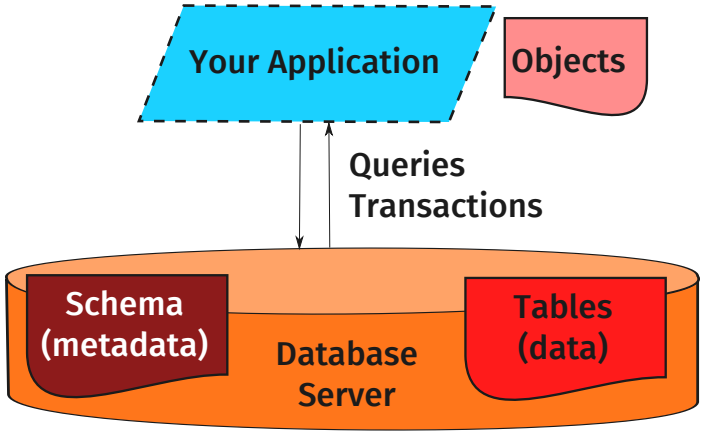
{#}{/} for each

{.} current array element

Databases

- Manage the persistent storage of structured information
- Simplify writing of programs to query the information (selection, filtering, sorting, aggregation, translation) with declarative query languages
- Guarantee consistency of the data as it is modified with concurrent transactions
- Guarantee reliability of the data thanks to advanced crash recovery features
- Very often used to implement the model of MVC Web applications on the server

Working with Databases



SQL

- Relational Databases
- Tables (Relations) store well-structured data according to a predefined Schema
- Queries defined according to the standard Structured Query Language
- Strong transactional guarantees (ACID)

NoSQL

- Non-relational Databases (Object-oriented databases, document databases, graph databases, key-value stores, XML databases)
- Schema-less (semi-structured heterogeneous data stores)
- Highly scalable with relaxed transactional guarantees and limited query expressivity

Examples

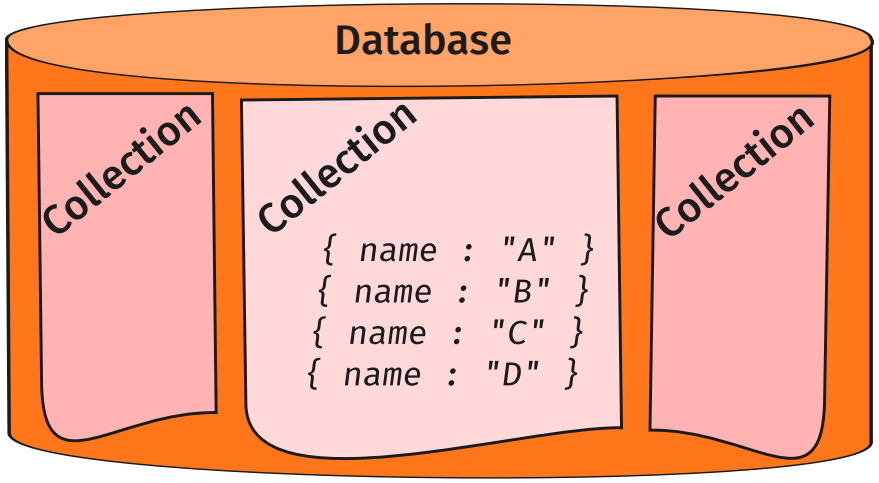
SQL

mySQL -- PostgreSQL -- Oracle -- Microsoft SQL Server -- IBM DB2

NoSQL

CouchDB -- **MongoDB** -- Apache JackRabbit -- Neo4j -- MemCacheDB -- BigTable -- Redis -- Apache Hadoop

MongoDB



A collection is a set of JSON objects, which may or may not have the same structure

1. Connecting

```
var mongoose = require('mongoose');
mongoose.connect('mongodb://localhost/db');
// The MongoDB Server should be running
// for the connection to work
```

2. Schema Definition

```
var CommentsSchema = new mongoose.Schema ({
   person     : String
 , comment    : { type: String, required: true }
 , created_at : { type: Date, default: Date.now }
});
```

By default fields are optional (`required: false`)

2. Schema Definition

```
var PostSchema = new mongoose.Schema({
    _id : mongoose.Types.ObjectId
  , author: String
  , title : String
  , body : String
  , created_at : Date
  , comments : [CommentsSchema]
});
//Create the Collection 'Post' using Schema
mongoose.model('Post', PostSchema);
var Post = mongoose.model('Post');
```

3. Queries

```
Post.find({},
  function (err, posts) {
        //for each post in posts
  });
Post.findById(id,
  function (err, post) {
        if (!err) {  //found post with id
    }
  });
```

3. Queries

```
Post.find({}, {title: 1}
  function (err, posts) {
    //for each post in posts
    //the post will only include
    //_id, title
  });
Post.find({}, {title: 0}
  function (err, posts) {
    //for each post in posts
    //the post will only include
    //_id, author, body, created_at, comments
  });
```

Control which fields to include (1) or exclude (0)

4. Create and Save

```
var post = new Post(
     { title: params['title'],
        body: params['body'],
  created_at: new Date() });
post.save(function (err) { //save failed
});
```

Save also works with updates

5. Delete

```
Post.findById(id,
  function (err, post) {
    if (!err) {
      post.remove(function (err, removed) {
        if (err) throw err;
        //post successfully removed
      });
    }
  });
```


Schema Middleware

```
var schema = new Schema(..);
schema.pre('save', function (next) {
  // here 'this' refers to the object being saved
  // do something before saving 'this'
  // call the next middleware
  next();
});
schema.post('save', function (doc) {
  // 'doc' refers to the object that has been saved
  // do something after saving 'doc'
});
```

Events can be `'init'`, `'validate'`, `'save'`, `'remove'`

Tools

- Express (http://expressjs.com/) (Node.js framework)
- Node.JS (http://nodejs.org/)
- Dust.JS (http://akdubya.github.io/dustjs/) (View Templating Engine)
- Embedded JS (http://code.google.com/p/embeddedjavascript/) (View Templating Engine)
- Mongoose (http://mongoosejs.com/) (Node-MongoDB Driver)
- MongoDB (http://www.mongodb.org/) (JSON Database)

References

- Understanding Express (http://evanhahn.com/understanding-express/) (tutorial)