Cloud and Web Applications

Part 4: **Lab**

Build a Course Material Sharer

Table of Contents

- Project Design
- Install Tools
- Implementation
- Deployment

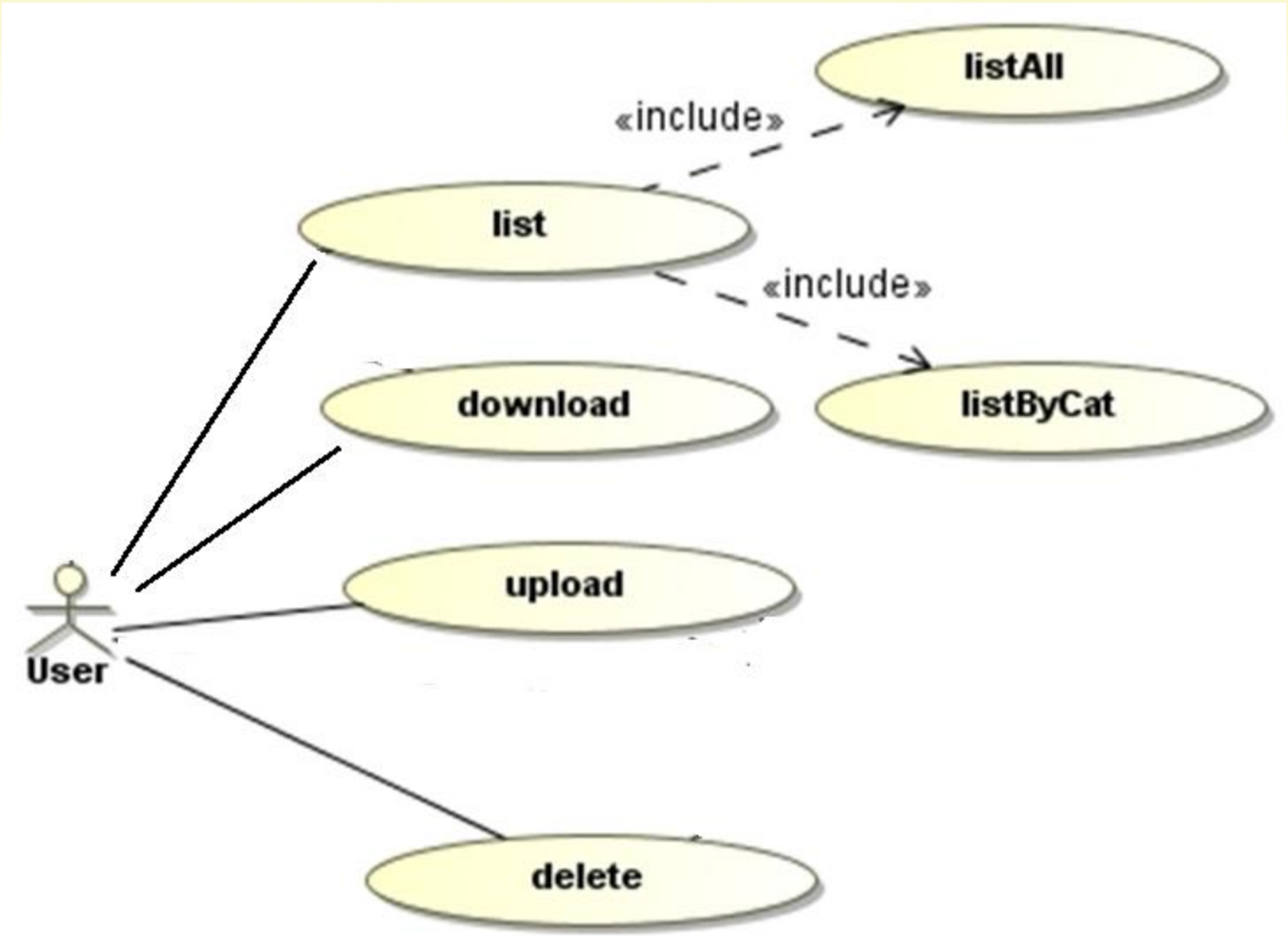
➢ The source code pieces showed in this slide can be found at :
https://github.com/lidangz/2016CourseMaterials/blob/master/Code_pieces_Part4_Lab.txt
➢ The source code files can be downloaded from:
https://github.com/lidangz/2015CourseMaterials/blob/master/Code_Part4_Lab.zip
➢The full project can be found at:
https://github.com/lidangz/MaterialSharer
➢ The tools used in the lab can also be downloaded from:
http://pan.baidu.com/s/1AWzZg#path=%252FCourseTools

PROJECT DESIGN

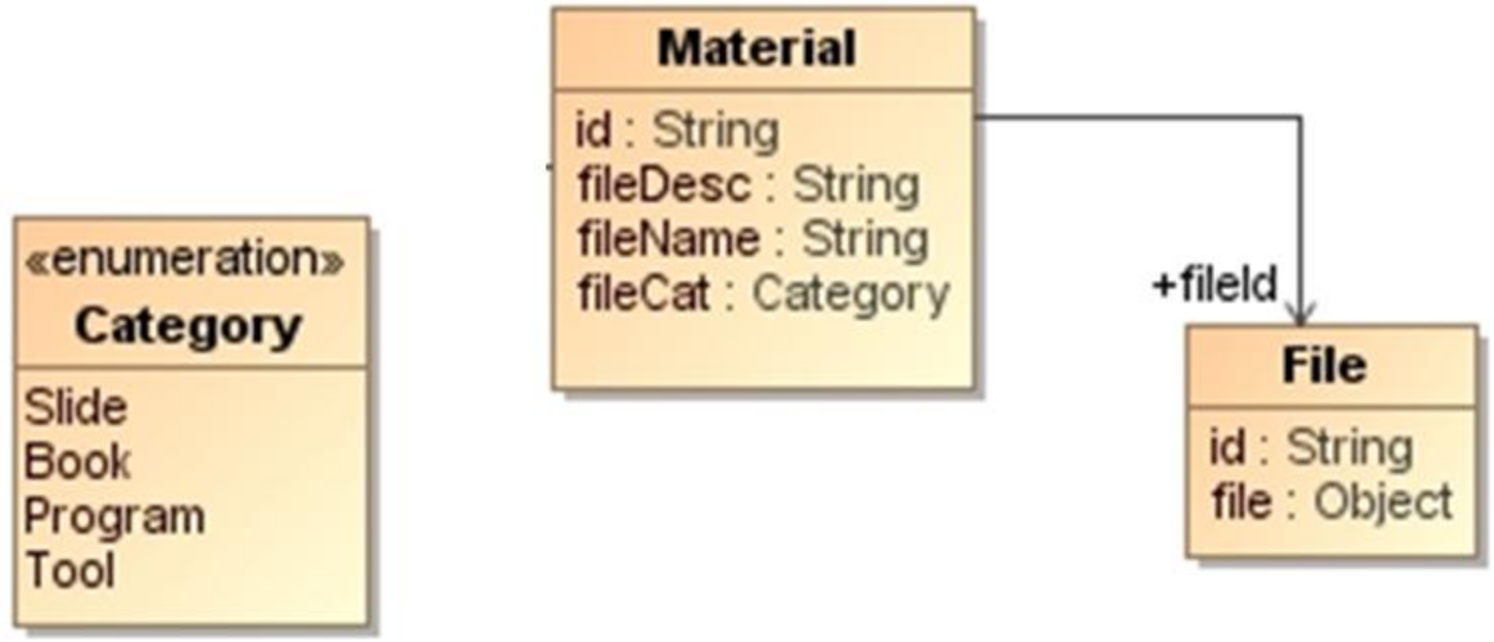
Course Material Sharer : Ideas

- We want to build a course material sharing app. and deploy it in cloud
- A user can list the all the sharing materials or a category of materials, and download the interested one.
- A user can upload new material and delete the materials.

App Design : Use Case



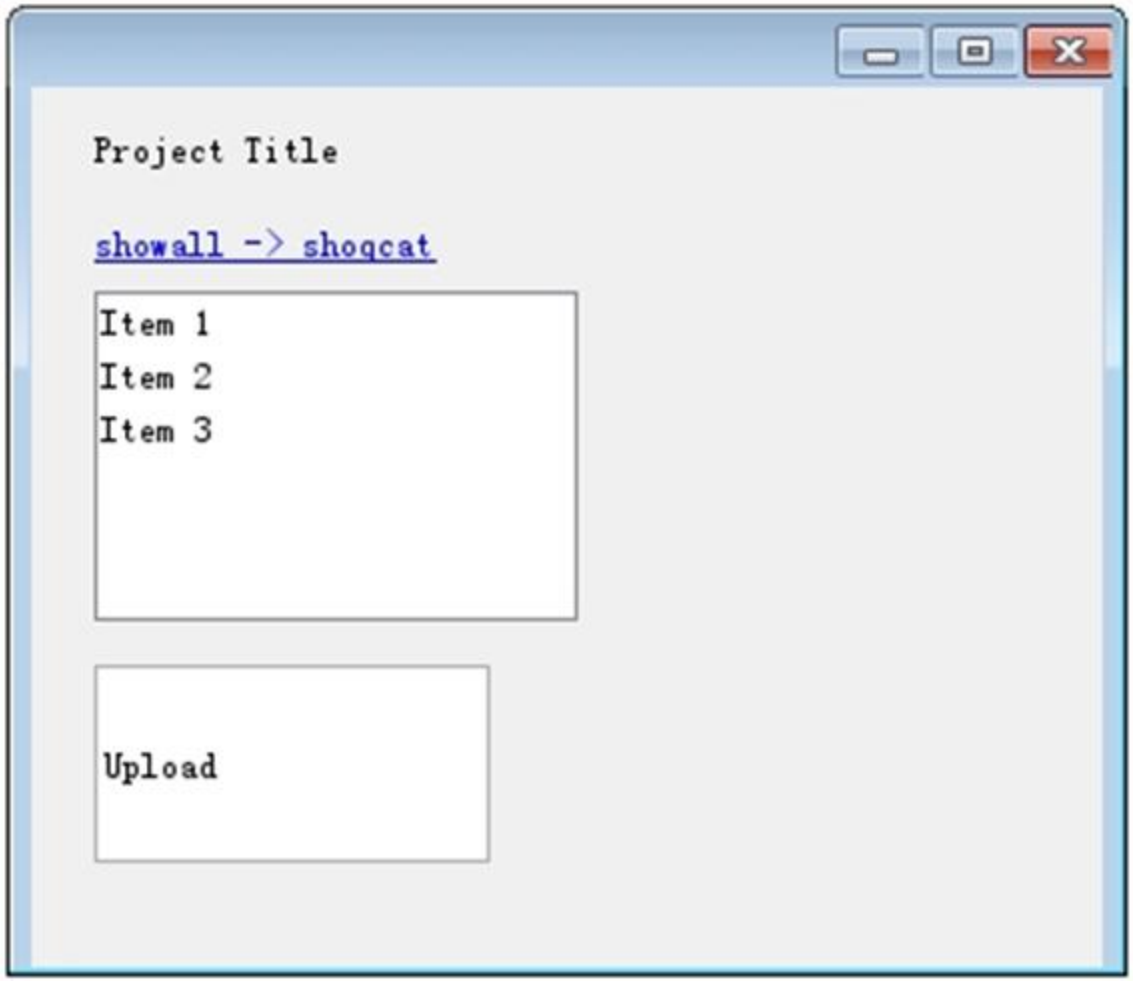
App Design : Class Diagram



Technical Stacks

- Use HTML + JavaScript + Ajax + REST in the front-end;
- Use Node.js + MongoDB + Express in the back-end;
- The developing version will be installed on localhost using the 8080 port.
- The app will be deployed on the OpenShift online.

UI Design of a Single-page App



REST API Design

Action	HTTP Method	URL
listAll	GET	http://localhost:8080/materials
listByCat	GET	http://localhost:8080/materials/{catalog}
upload	POST	http://localhost:8080/materials
delete	DELETE	http://localhost:8080/materials/{materialId}
download	GET	http://localhost:8080/files/{fileId}

INSTALL TOOLS

Install MongoDB

- Download mongoDB from

  http://www.mongodb.org/downloads

  (msi for windows)
- Create a new folder *c:\mongodb*, and install mongodb to the folder
- Create a new folder *data* inside the folder *mongodb* to store data

Start MongoDB

- Open a cmd, goto folder *c:\mongodb\bin*
- Start monfoDB by typing

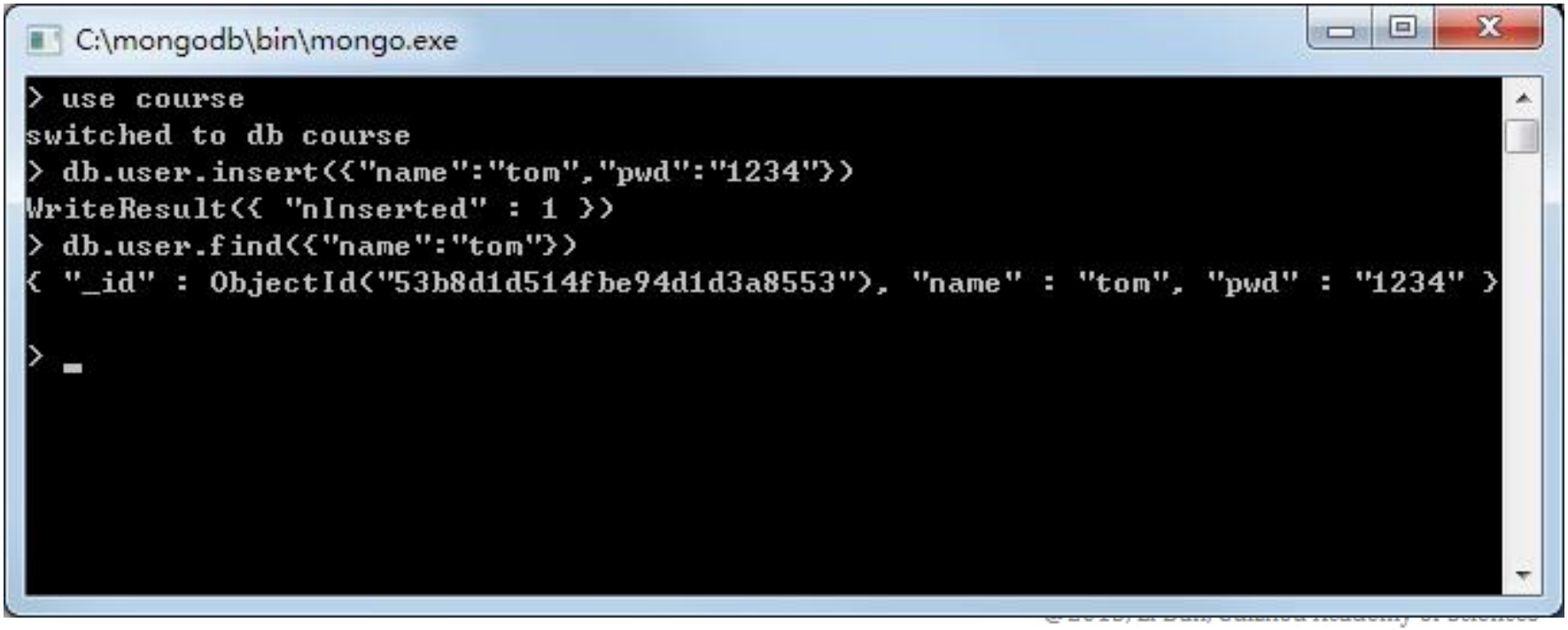
```
mongod.exe --dbpath c:\mongodb\data
```

- Open another cmd, goto folder *c:\mongodb\bin ,* and type `mongo.exe` to open a management window.

Add a User to MongoDB

- Go to the management window.
  - Open database course
  - Add to collection user a user

```
> use course
> db.user.insert({“name”:“tom",”pwd”:”1234”})
> db.user.find({name:”tom”})
```

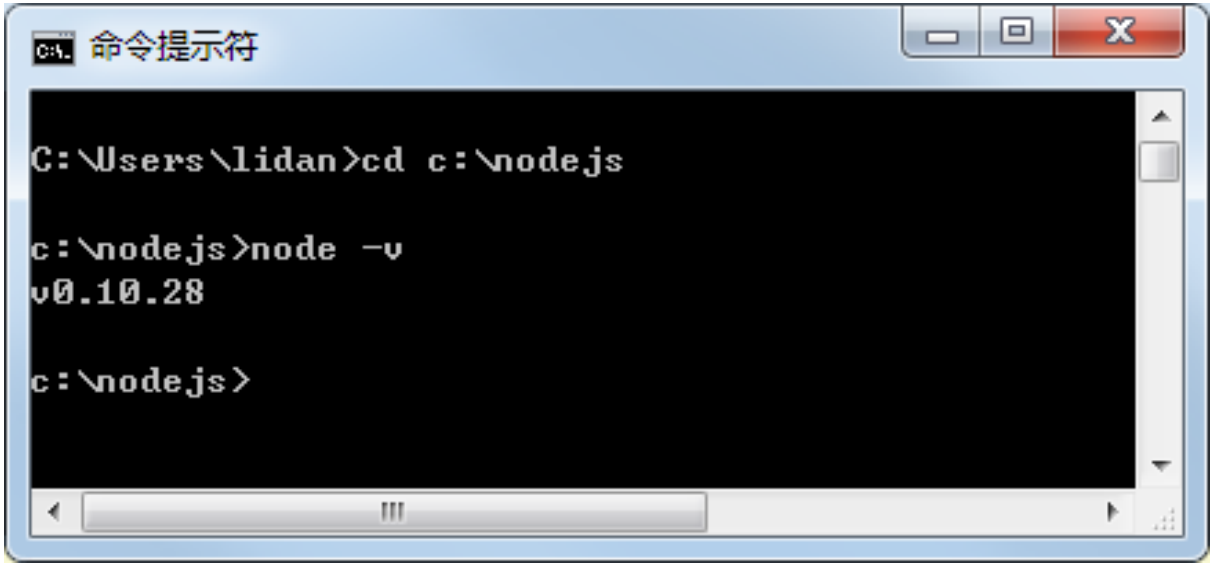


Install Node.js

- Create a new folder *c:\nodejs*
- Download and install Node.js : http://nodejs.org/
  - Click ‘Install’ or go to the ‘Downloads’ page
  - Once downloaded, run the installer
  - Install Node.js in directory *c:\nodejs*

Test Node.js Installation

- In a cmd window, go to *c:\nodejs* directory
- Type **`node -v`** in the command line
- If the version information is shown, Node.js is correctly installed.



Install OpenShift Client Tools

Installing the client tools (rhc) on Windows requires three steps:

- **Step 1**: Install **Ruby** with RubyInstaller
- **Step 2**: Install **Git** version control
- **Step 3**: Install the **rhc** Ruby gem

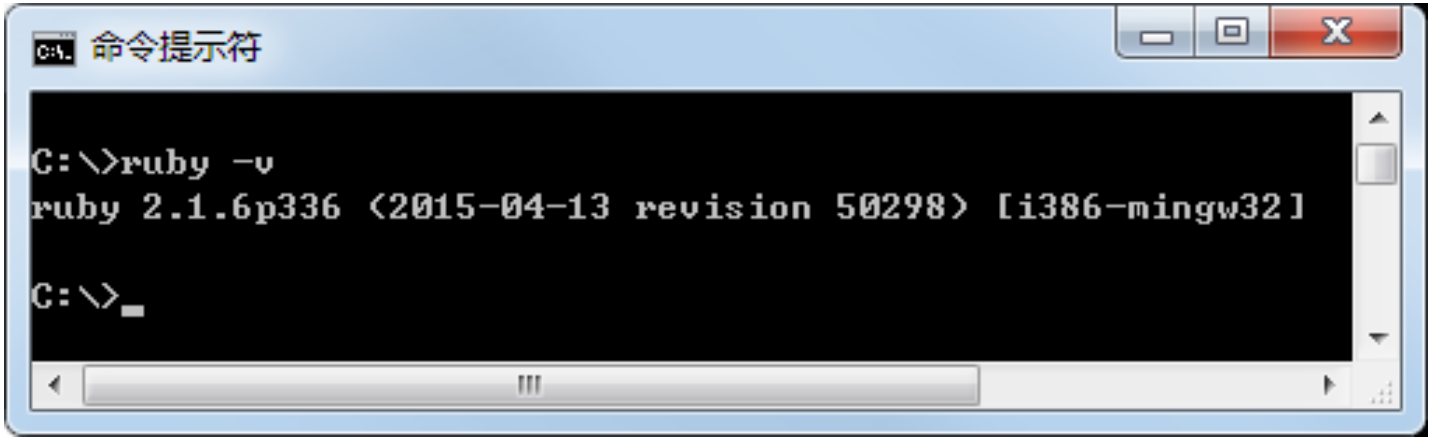
- https://developers.openshift.com/en/getting-started-windows.html for details.

RubyInstaller

RubyInstaller provides the best experience for installing Ruby on Windows.

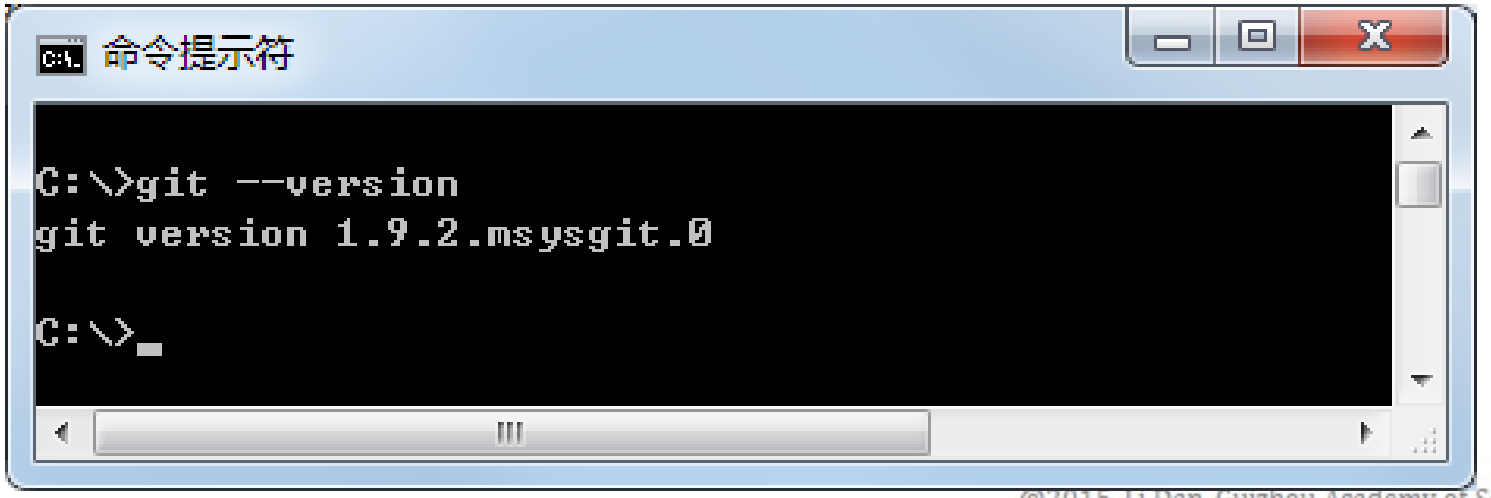
Step 1: Install Ruby

- Download the 2.1.xx version of RubyInstaller from http://rubyinstaller.org/)
- Launch the installer, select the **Add Ruby executables to your PATH** check box.
- Verify that the installation:



Step 2: Install Git

- Download Git for Windows from https://git-for-windows.github.io/
- Install the Git, selecting the ***Run Git from the Windows Command Link Prompt*** checkbox, also, selecting **Checkout Windows-style, commit Unix-style line endings**.
- Verify the installation:



Git Basics

- Git is a distributed revision control system. Git keeps a repository in your working directory. It can push/pull the source code to/from remote server.
- `git clone <url>` Clone an existing repository from remote server. It creates a working directory indicated by the url, and pulls down all the data for that repository.
- `git add <files>` Specify the files you want to track.
- `git commit –a “<msg>”` commit the changes to local git repository and provide an explanation as <msg>
- `git push` Upload the changed files of local repository to remote repository.
- `git status` Checking the status of local repository

More about git:

http://git-scm.com/book/en/v2/Getting-Started-Git-Basics

Step 3: Install OpenShift gem

- Download rhc gem and all its dependency gems from https://rubygems.org/gems/rhc into a folder (using http instead of https)*.
- Goto that folder, install rhc locally:

```
gem install rhc --local .\rhc-1.35.3.gem
```

* The gems package can also be downloaded from http://pan.baidu.com/s/1qWLtjB2

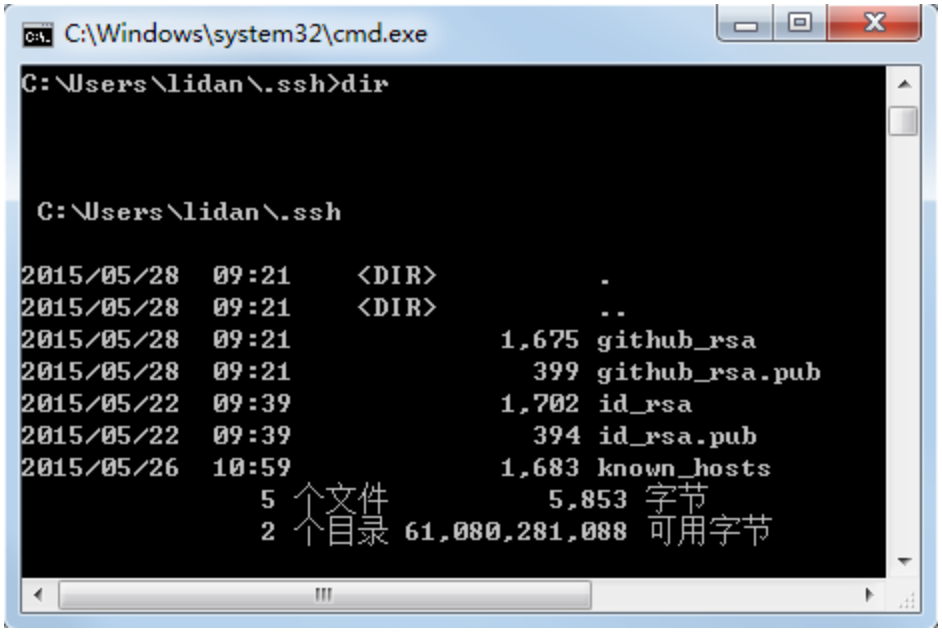
Configure OpenShift gem

- Open a cmd and run:

```
rhc setup
```

- Input OpenShift username and password;
- In this process, a pair of SSH keys will be generated and kept in .ssh folder in your personal folder.

Answering yes to generate the keys, and yes to upload the public key.

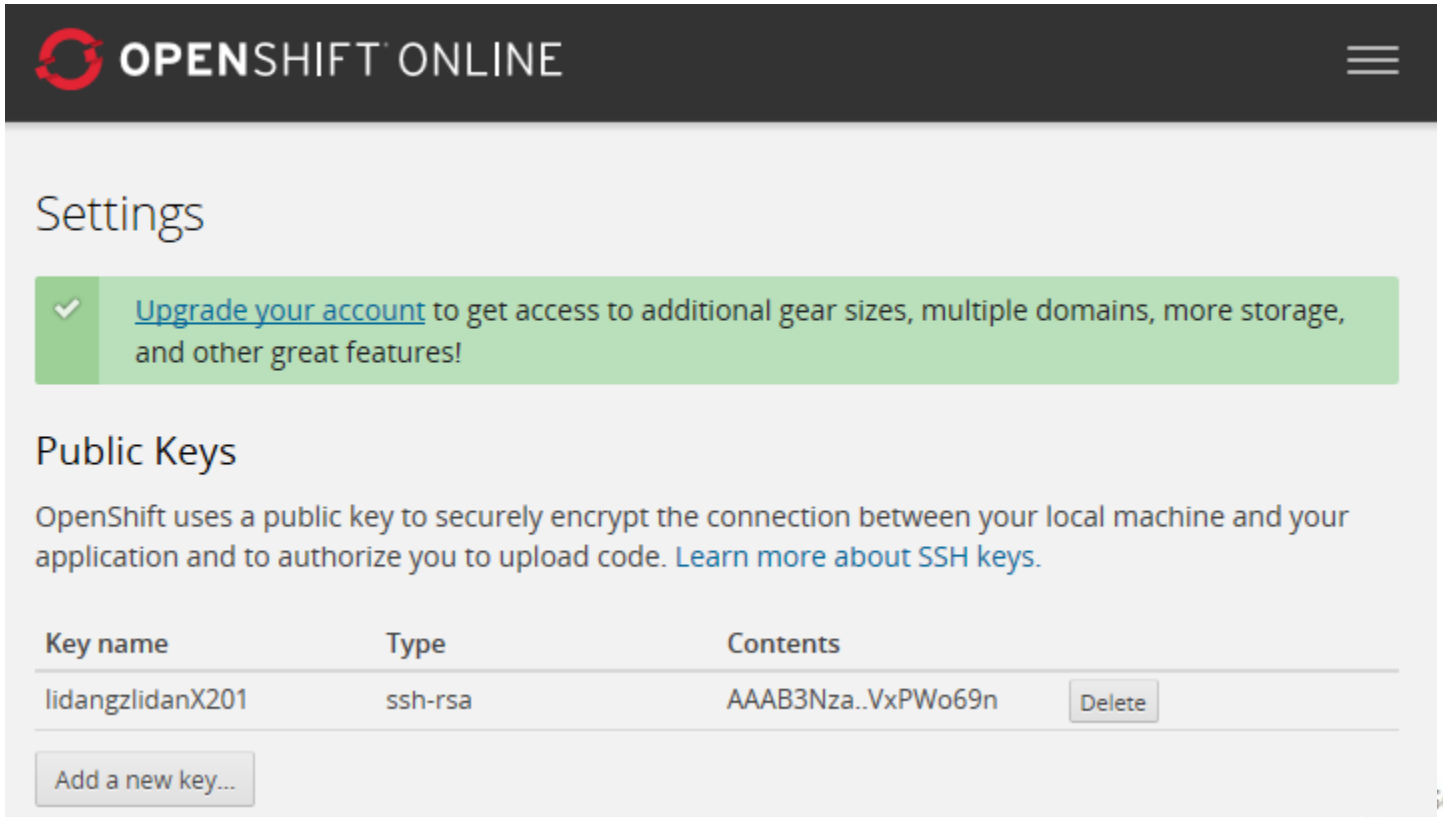


Secure Shell (SSH)

- A cryptographic network protocol client-server communication in a secure way.
- SSH uses automatically generated public-private key pairs to encrypt a network connection.
- The public key is present on the server end and the matching private key is present on the local machine.

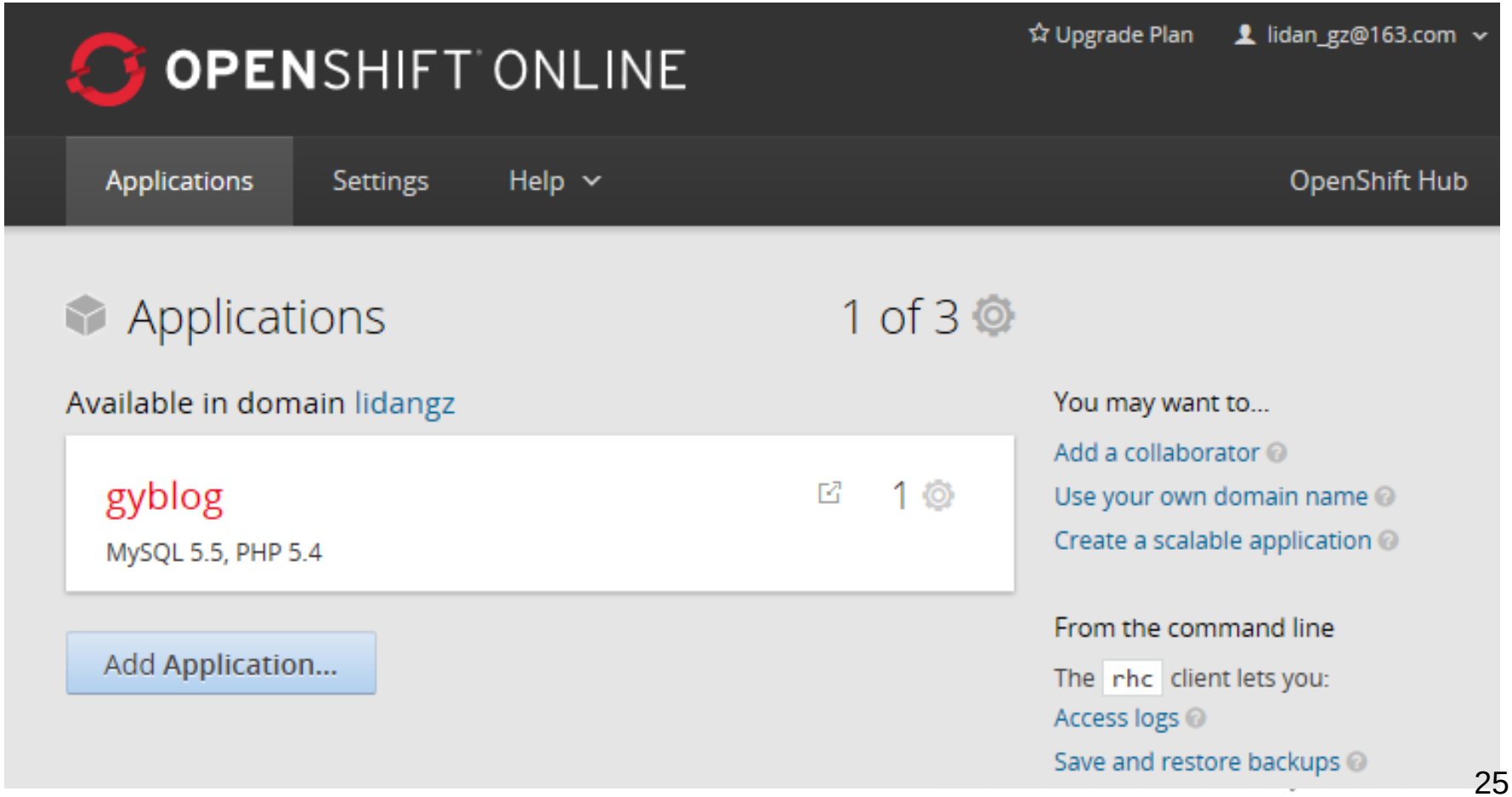
Check SSH Key in OpenShift

- Login the web console (https://www.openshift.com/)
- Click on *Settings* to check the Public Keys. If there are more than one, delete all others except the one you just uploaded.



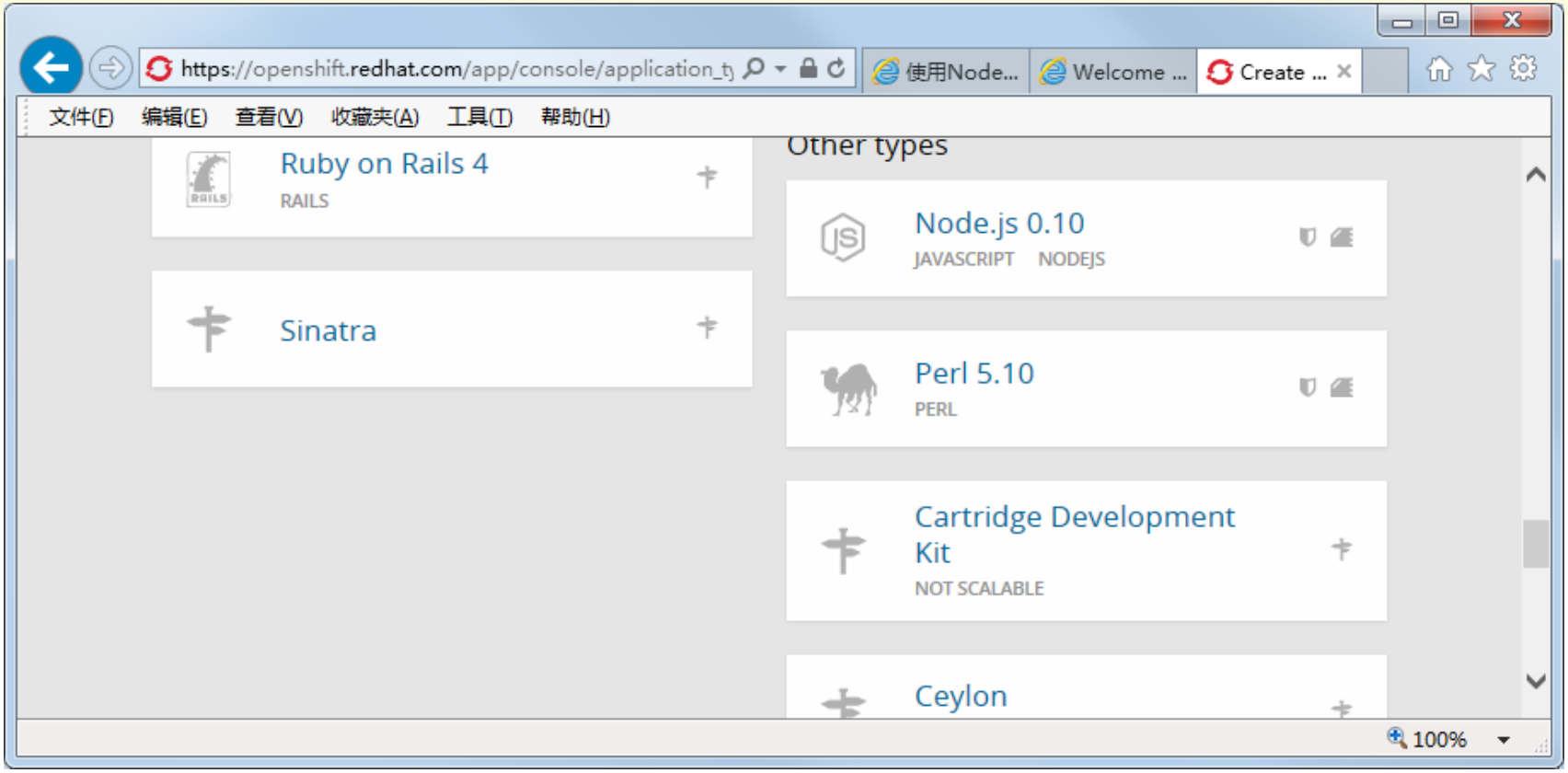
Create an App

- Click on Applications and
- Add Application…



Choose Type of the Application

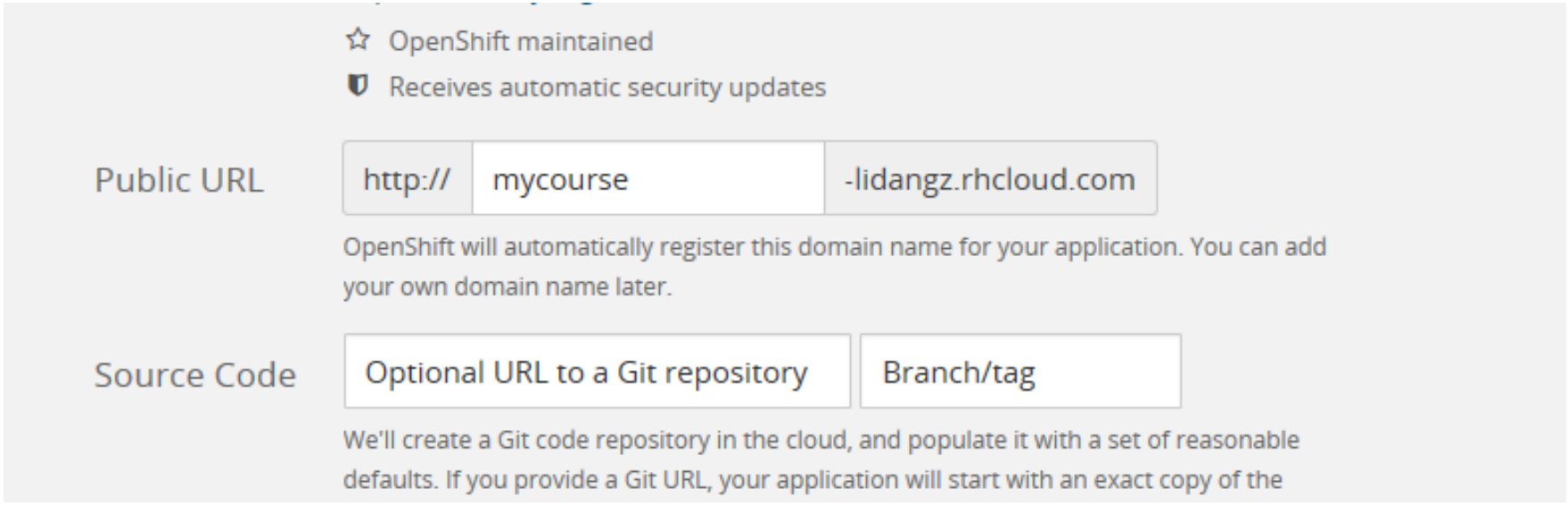
- Select cartridge *Node.js 0.10*



- *Continue to configure the application.*

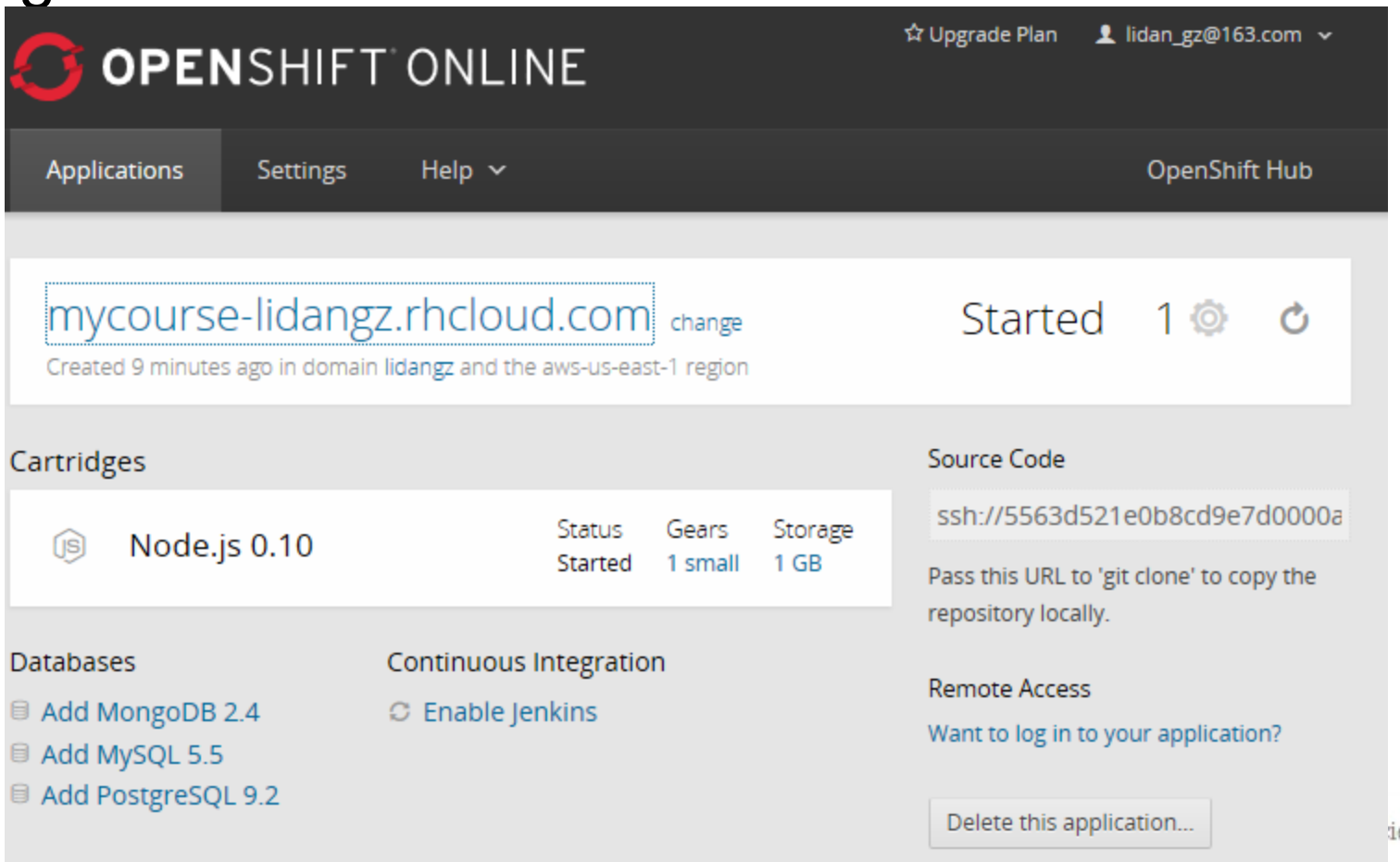
Configure the Application

- Input mycourse in *Public URL*
- Press button *Create Application*

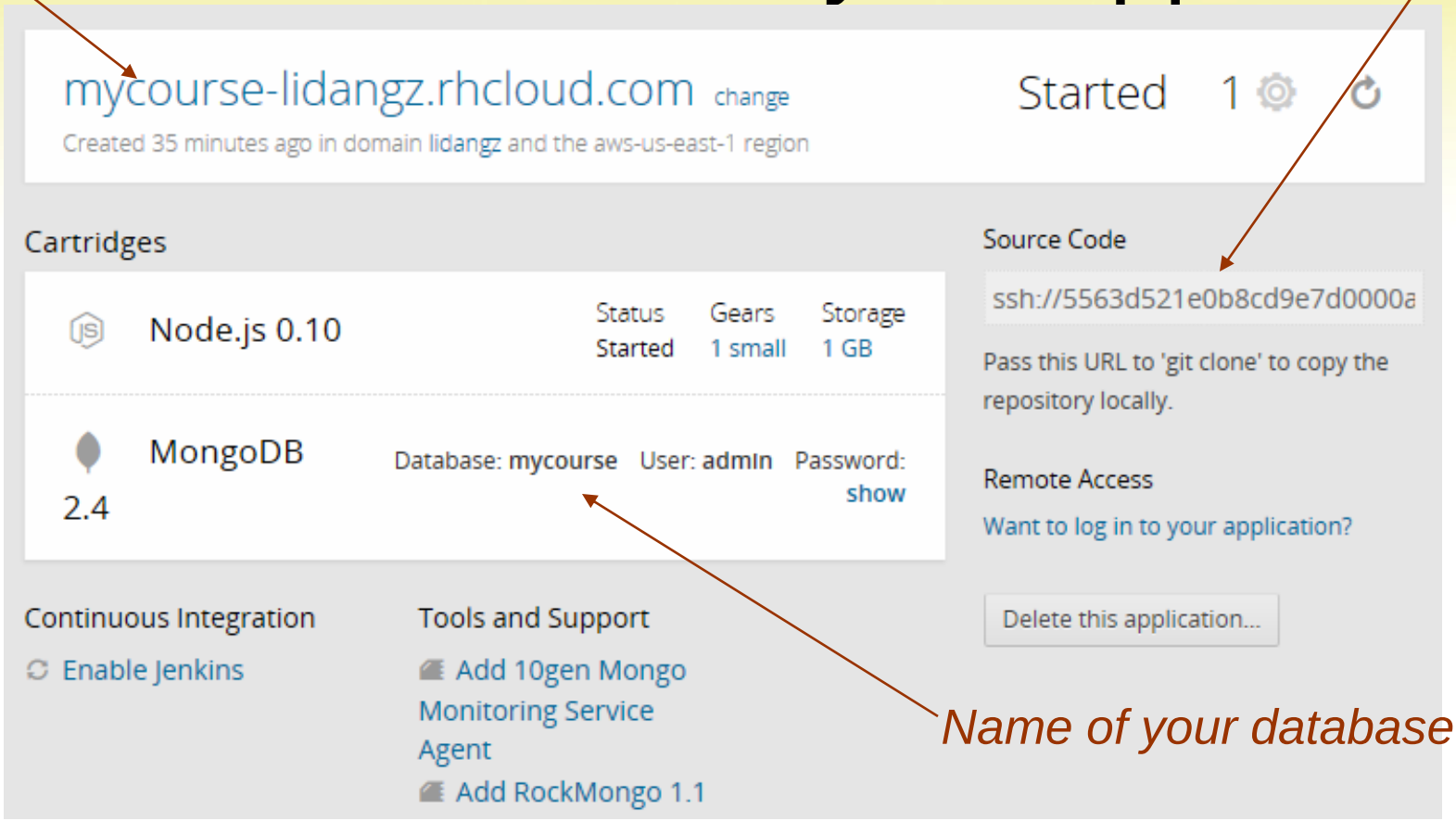


Add NongoDB to the App

- *Continue to the application overview page*
- *Click* Add MongoDB 2.4, and Add Cartridge in next page



Overview of your App.

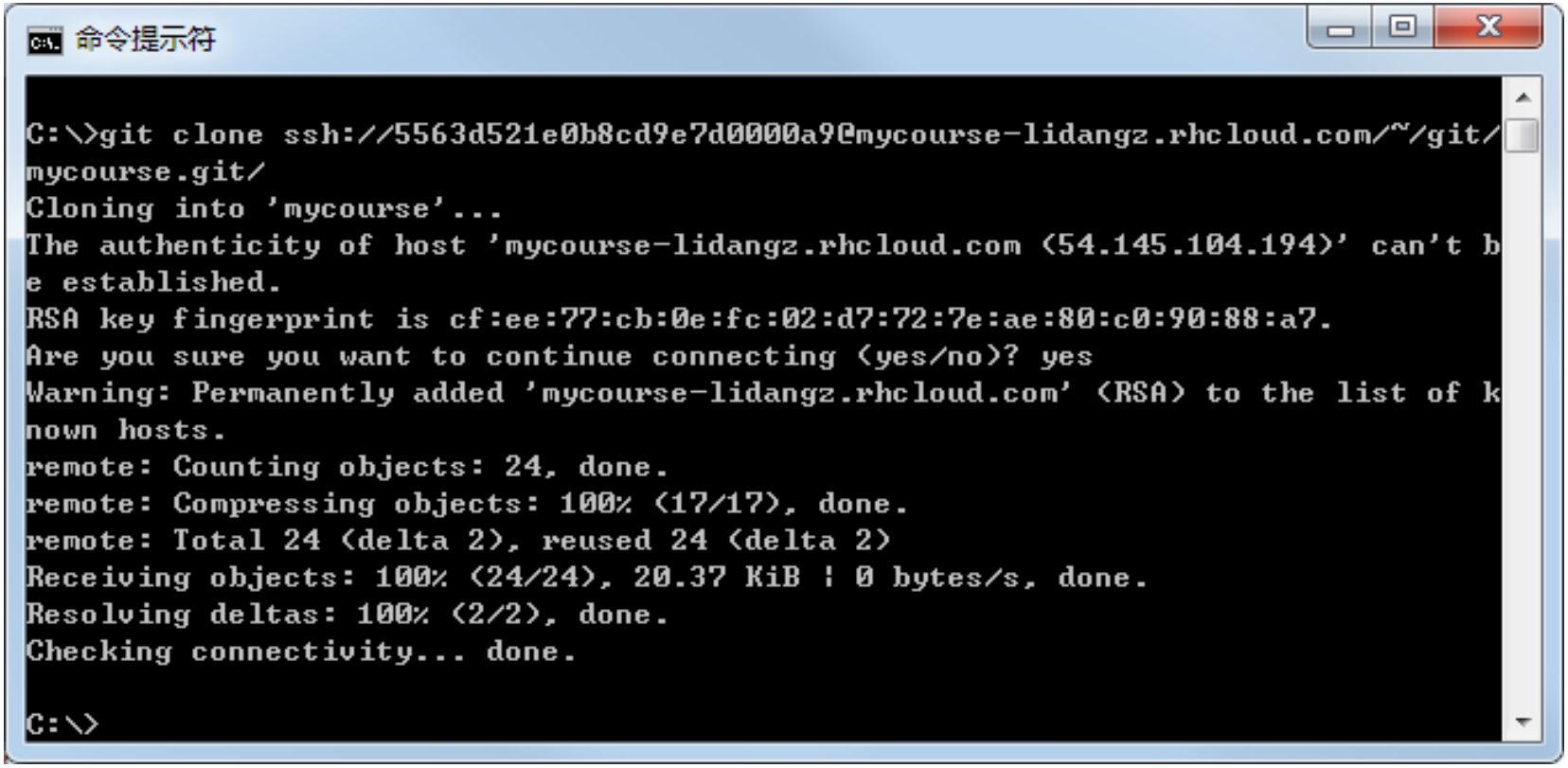


- Copy your ssh url under the Source Code

Download Source Code

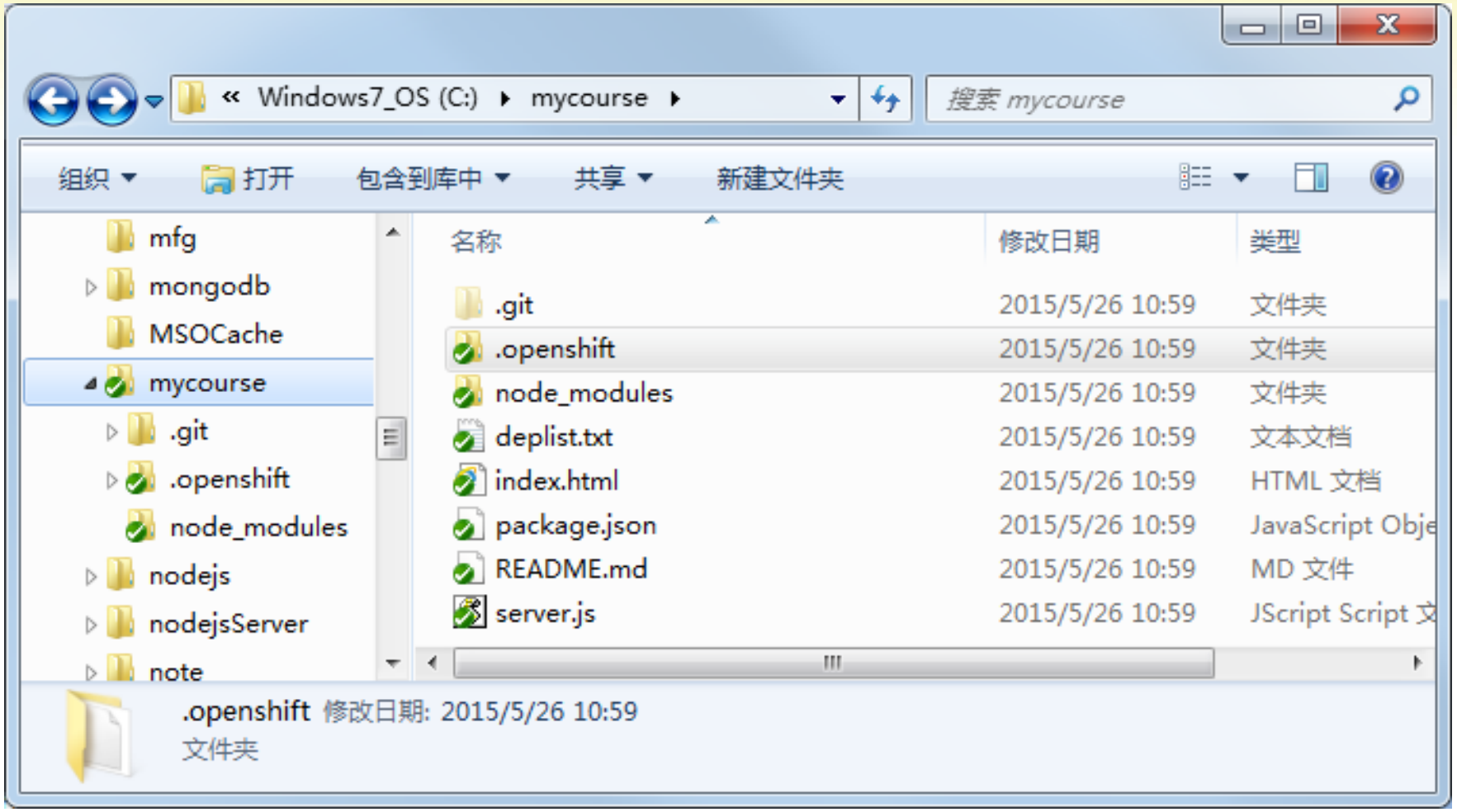
- Open a cmd, goto c:\, and run

```
git clone <sshUrl>
```



- Now, the c:\mycourse is your project folder.

Structure of the Project Folder



Modify *package.json*

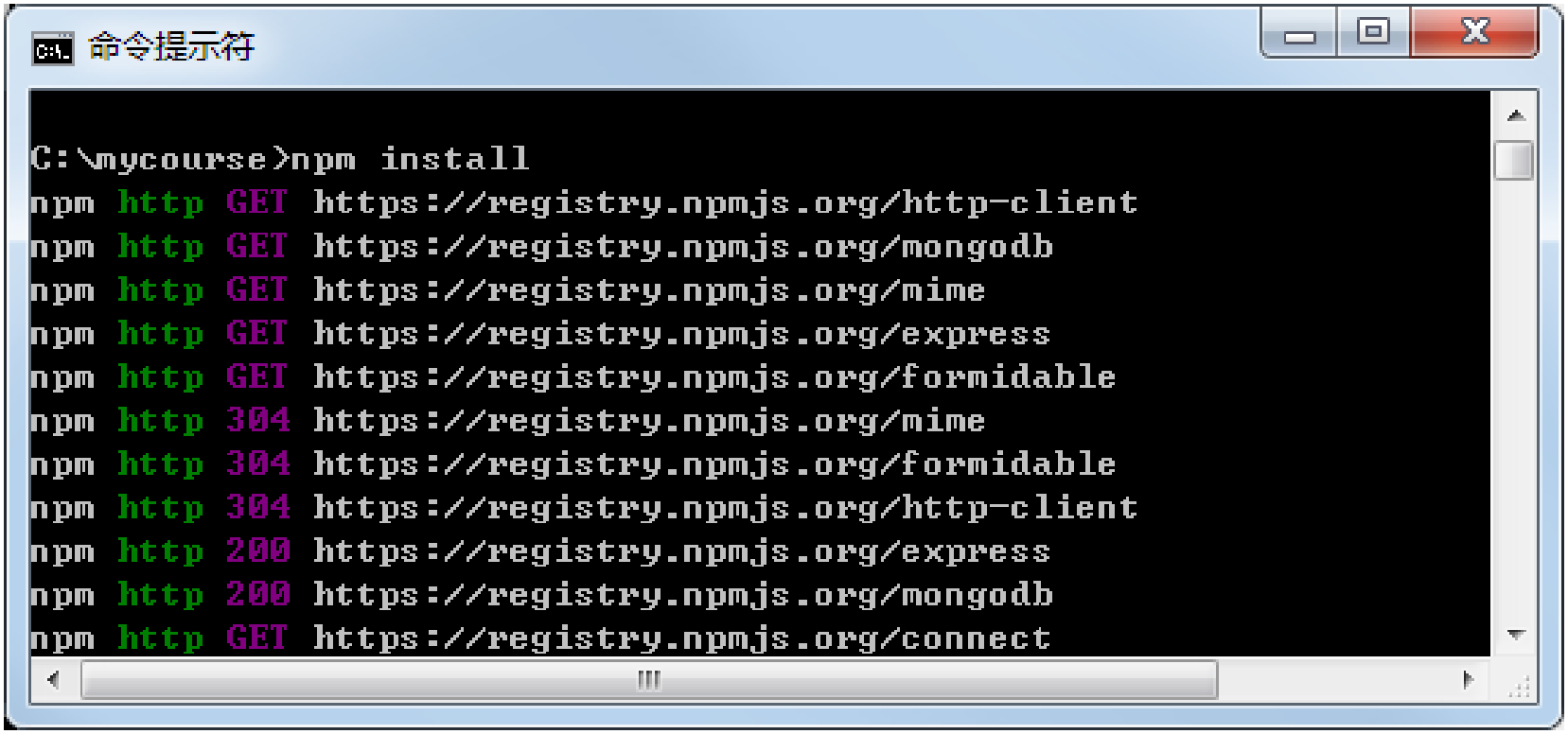
• Open the package.json file with an editor, and change it so it looks like this:

```
  "dependencies": {
    "express": "~3.4.4",
      "formidable": "~1.0.15",
      "mime": "~1.2.11",
      "mongodb": "~1.4.7",
    "http-client": "~1.0.0"
  },
  "devDependencies": {},
  "bundleDependencies": [],
  "private": true,
  "scripts": {
      "start": "supervisor server.js"
  },
  "main": "server.js"
}
```

Install Dependencies

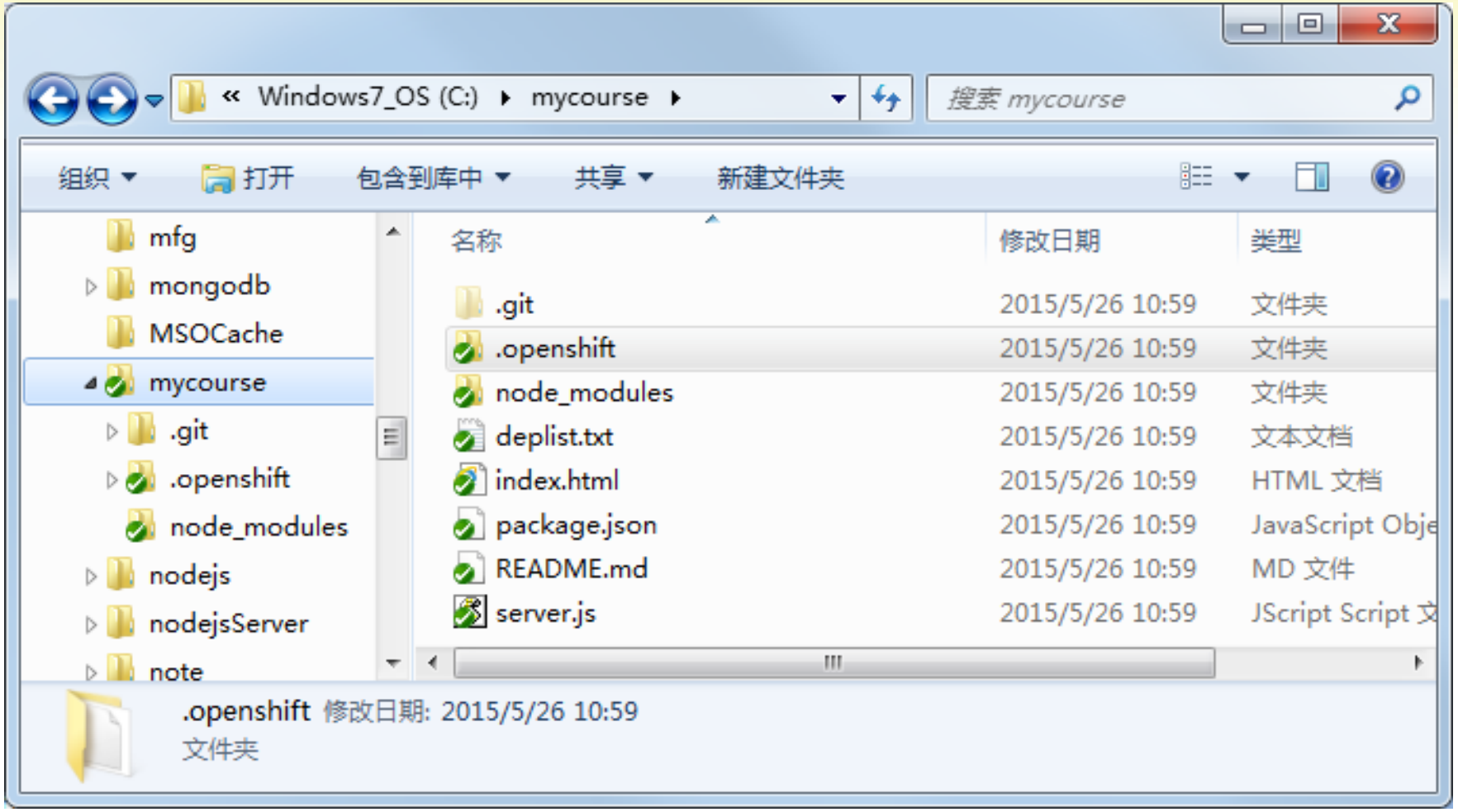
- In the cmd, goto the project folder, run:

```
npm install
```



IMPLEMENTATION

Files in the Project Folder



Start the Development

- Create the following two files in the project folder.

  handlers.js

  dbutils.js

- Now the project folder has the following files.
  - Server-side
    - *server.js* -- app main entry, route the requests
    - *handlers.js* -- actually deal with the requests
    - *dbutils.js* -- database connection
    - *package.json* -- configuration file
  - Client-side
    - *Index.html* -- front-end html file

Design an Empty Client-side Html

- Replace the contents of index.htm with the following code:

```
<html>
    <head>
      <meta http-equiv="Content-Type" content="text/html; charset=UTF-8" />
           <title>Course material sharer</title>
           <script type="text/javascript">

           </script>
    </head>
    <body>
        <h2>Training Course Material Sharer</h2></p>
        <div id="catDiv">

        </div>
        <div  id="listDiv">

        </div>
        <p> ==============================================
        <div id="upLoadDiv“>

        </div>
   </body>
</html>
```

Server-side Design*: server.js*

• Here we start the app, and route the requests to functions in *handler.js.* Replace the contents of server.js with the following code:

```
var express = require('express');
var handlers = require('./handlers');

var ip_address = process.env.OPENSHIFT_NODEJS_IP || '127.0.0.1';
var port      = process.env.OPENSHIFT_NODEJS_PORT || 8080;

var app = express();
app.configure(function () {
    app.use(express.logger('dev'));
    app.use(express.bodyParser());
});
```

server.js (2)

- Followed by the code below:

```
console.log ('registering event routes with express');

app.get('/', handlers.start);
app.get('/materials', handlers.listAll);
app.get('/materials/:cat', handlers.listByCat);
app.post('/materials', handlers.upload);
app.get('/files/:fileId/:fileName', handlers.download);
app.delete('/materials/:id', handlers.delete);

console.log ('About to start listening');
app.listen(port,ip_address);
console.log('Listening on port: ', port, ' of ', ip_address);
```

handlers.js

- Here we write the logic to handle the requests . Update *handlers.js* as below:

```
var fs  = require('fs');
var mime = require('mime');
var formidable = require("formidable");
var mongo = require('mongodb');
var BSON = mongo.BSONPure;
var dbutils = require('./dbutils');
var mongoUrl = dbutils.getMongoUrl();

exports.start = function(req, res) {
  console.log("Request handler 'start' was called.");
  fs.readFile('index.html', 'utf-8', function (err, data) {
      if (err) {return console.dir(err);}
      res.setHeader('Content-Type', 'text/html');
      res.send(data);
  });
}
```

Deal with *upload* in *handlers.js*

```
exports.upload = function(req,res) {
    console.log("Request handler 'upload' was called.");

    var form = new formidable.IncomingForm();
    form.parse(req, function(err, fields, files) {
            mongo.Db.connect(mongoUrl, function (err, db) {
                    var idobj=new mongo.ObjectID();
                    var fileId=idobj.toString();
                    var gridStore = new mongo.GridStore(db, fileId, 'w');
                    gridStore.writeFile(files.upload.path, function(err, fileInfo) {
                            db.collection('material',{safe:true},function(err,collection){
                                    fields["fileName"]=files.upload.name;
                                    fields["fileId"]=fileId;
                                    collection.insert(fields,{safe:true},function(err,result){
                                            fields["_id"]=result._id;
                                            db.close();
                                            res.setHeader('Content-Type', 'text/html');
                                            res.send(JSON.stringify(fields));
                                    });
                            });
                    });
    });
  });
}
```

Functions listAll, listByCat in *handlers.js*

```
exports.listAll = function(req, res) {
    console.log("Request handler 'listAll' was called.");

    readList(res,null);
}

exports.listByCat = function(req, res) {
    console.log("Request handler 'listByCat' was called.");

   var cat =  req.params.cat;
   readList(res,cat);
}
```

Function Called by listAll, listByCat

```
function readList(res,cat) {
  var qstr = {};
  if (cat!=null) {
      qstr=eval('({"fileCat" : "'+ cat +'"})');
  };

  mongo.Db.connect(mongoUrl, function (err, db) {
    db.collection('material', function(err, collection) {
      collection.find(qstr).toArray(function(err, items) {
              res.setHeader('Content-Type', 'text/html');
              res.send(JSON.stringify(items));
        db.close();
      });
    });
  });
}
```

Deal with *download* in *handlers.js*

```
exports.download = function(req,res) {
    console.log("Request handler 'download' was called.");

    var fileId = req.params.fileId;
    var fileName = req.params.fileName;
    mongo.Db.connect(mongoUrl, function (err, db) {
            var gridStore = new mongo.GridStore(db, fileId, 'r');
            gridStore.open(function(err, gridStore) {
                    var stream = gridStore.stream(true);
                    stream.on("end", function(err) {
                            db.close();
                            res.end();
                    });
                    var contentType=mime.lookup(fileName).toString();
                    res.setHeader('Content-Type', contentType);
                    stream.pipe(res);
    });
  });
}
```

Deal with *delete* in *handlers.js*

```
exports.delete = function(req, res) {
  console.log("Request handler 'delete' was called.");
  var id = req.params.id;
  mongo.Db.connect(mongoUrl, function (err, db) {
    db.collection('material', {safe:true}, function(err, collection) {
       collection.findOne({'_id':new BSON.ObjectID(id)}, function(err, doc) {
            var fileName=doc.fileName;
            collection.remove({'_id':new BSON.ObjectID(id)}, {safe:true}, function(err, result) {
                if (doc.fileId) {
                     var gridStore=mongo.GridStore;
                     gridStore.unlink(db, doc.fileId, function(err) {
                          console.log('delete '+fileName);
                          db.close();
                          readList(res,null);
                     });
                 } else {   db.close();
                            readList(res,null);
                };
            });
       });
    });
  });
}
```

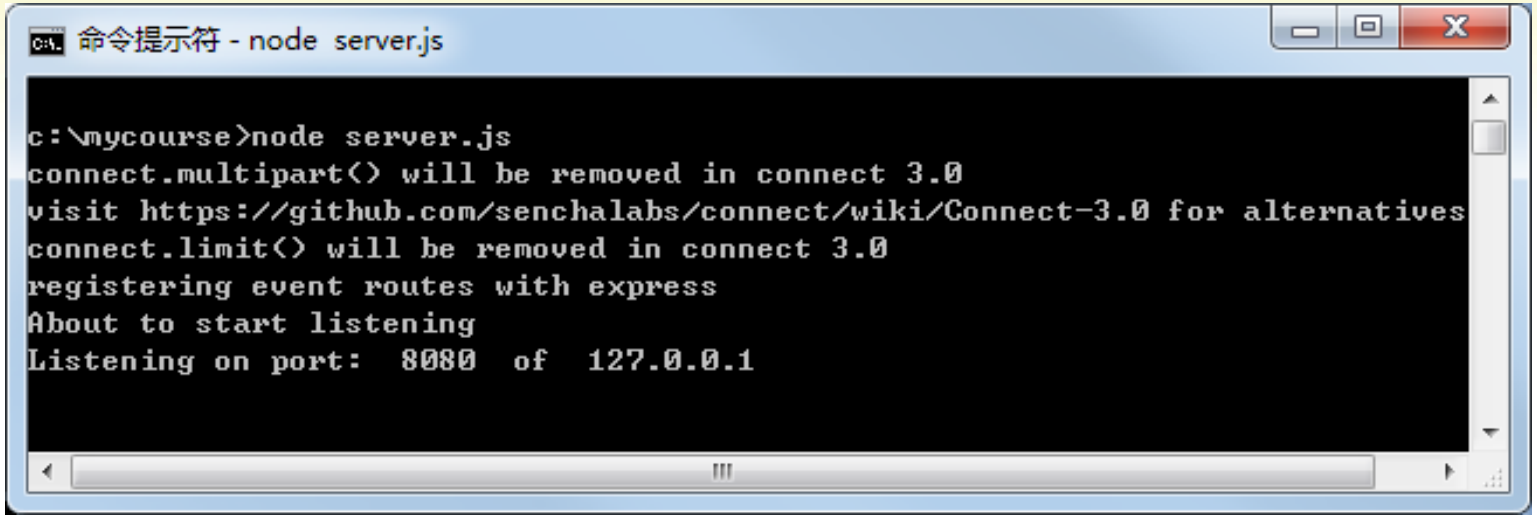
Add the Follows to *dbutils.js*

```
var mongostr = {                                        // local machine
                "hostname":"localhost",
                "port":27017,
                "username":“tom",
                "password":"1234",
                "name":"",
                "db":"course"
}
if(process.env.OPENSHIFT_NODEJS_PORT){                  // OpenShift
        mongostr = {
                "hostname":process.env.OPENSHIFT_MONGODB_DB_HOST,
                "port":process.env.OPENSHIFT_MONGODB_DB_PORT,
                "username":process.env.OPENSHIFT_MONGODB_DB_USERNAME,
                "password": process.env.OPENSHIFT_MONGODB_DB_PASSWORD,
                "name":"",
                "db":"mycourse"
        }
}
exports.getMongoUrl = function() {
    return "mongodb://" + mongostr.username + ":" +
                                mongostr.password + "@" + mongostr.hostname + ":"
                                + mongostr.port + "/" + mongostr.db;
}
```

Change to the name of your database

Test the App in Local

- Cd to the project folder, and start the server



- Access http://localhost:8080/ from a browser
- Check the log message showed by Nodejs

Client-side Design
Upload in index.html

- Replace the `uploadDiv` by :

```
<div id="upLoadDiv">
  <fieldset><legend>Select a file to upload:</legend>
   <p>File Cat:
   <select size="1" id="fileCat">
               <option selected>Slide</option>
               <option>Book</option>
               <option>Program</option>
               <option>Tool</option>
   </select> </p>
   <p>File Desc. : <input type="text" id="fileDesc" size="40"> </p>
   <p>Select File: <input type="file" id="upload"></p>
   <p><input type="button" value="Upload File" onclick="uploadFile()”/>
    </p>
 </fieldset>
</div>
```

Design Upload in index.html (2)

- Add function uploadFile to the script section:

```
function uploadFile(){
    var urlstr = "/materials";
    var fileObj = document.getElementById("upload").files[0];
    var fileName=document.getElementById("upload").value;
    var fileDesc=document.getElementById("fileDesc").value;
    var fileCat=document.getElementById("fileCat").value;

    if (validate(fileName,fileDesc)){
        var form = new FormData();
        form.append("fileDesc", fileDesc);
        form.append("fileCat", fileCat);
        form.append("fileName", document.getElementById("upload").value);
        form.append("upload", fileObj);
```

Design Upload in index.html (3)

- Second part of function uploadFile:

```
        xmlhttp =  new XMLHttpRequest();
        xmlhttp.open("post", urlstr, true);
        xmlhttp.setRequestHeader("Content-type", "multipart/form-data");
        xmlhttp.onreadystatechange = function(){
         if(xmlhttp.readyState === 4){
          if(xmlhttp.status === 200){
             var json = JSON.parse(xmlhttp.responseText);
             var ihtm = getOneLi(json);
             document.getElementById("listDiv").innerHTML += ihtm;
             document.getElementById("upload").value =null;
               fileDesc=document.getElementById("fileDesc").value=null;
           }else{
               alert('Error: '+xmlhttp.status);
          }
         }
        }
       xmlhttp.send(form);
    }
}
```

Design Upload in index.html (4)

- Two more functions to the script section:

```
function validate(fileName, fileDesc) {
        if (fileName == null || fileName =="") {
             alert("Please select a file to upload.");
             return false;
        }
    if (fileDesc == null || fileDesc =="") {
        alert("Please input the file description.");
        return false;
    }
    return true;
}

function getOneLi(json) {
        var fpath= '/files/'+json["fileId"]+'/'+json["fileName"];
        var str='<li><u><a onclick="listAll(\''+json["fileCat"]+'\')">'+
                json["fileCat"]+'</a></u> :  <a href="'+fpath+'">'+
                json["fileDesc"]+ ' ('+json["fileName"]+')</a>  '+
                '<a onclick="delItem(\''+json["_id"]+'\',\''+json["fileName"]+
                '\')">[delete]</a></li>';
        return str;
}
```

Design List in index.html

- Replace the `catDiv` by :

```
<div id="catDiv">
   <u><a onclick="listAll(null)">All </a></u>
</div>
```

- Add event to the *body*:

```
<body onload="listAll(null)">
```

Design List in index.html (2)

- Add function listAll to the script section:

```
function listAll(cat){
    var urlstr = "/materials";
    if (cat!=null && cat !='') {
        urlstr = urlstr+"/"+cat;
    }
    xmlhttp =  new XMLHttpRequest();
    xmlhttp.open("get", urlstr, true);
    xmlhttp.onreadystatechange = function(){
        if(xmlhttp.readyState === 4){
           if(xmlhttp.status === 200){
                showItems(xmlhttp.responseText,cat);
           }else{
                alert('Error: '+xmlhttp.responseText); // An error occurred
           }
        }
   };
   xmlhttp.send(null);
}
```

Design List in index.html (3)

- Add function showItems to the script section:

```
function showItems(jsontxt,cat) {
    var alljson = JSON.parse(jsontxt);
    var ihtm ='<ul>';
    for(var i=0;i<alljson.length;i++){
        ihtm += getOneLi(alljson[i]);
    }
    var titlelstr='<u><a onclick="listAll(null)">All</a></u>';
    if (cat!=null && cat !='') {
        titlelstr += '<u>-->'+cat+'</ul>';
    }

    document.getElementById("listDiv").innerHTML=ihtm+'</ul>';
    document.getElementById("catDiv").innerHTML=titlelstr;
}
```

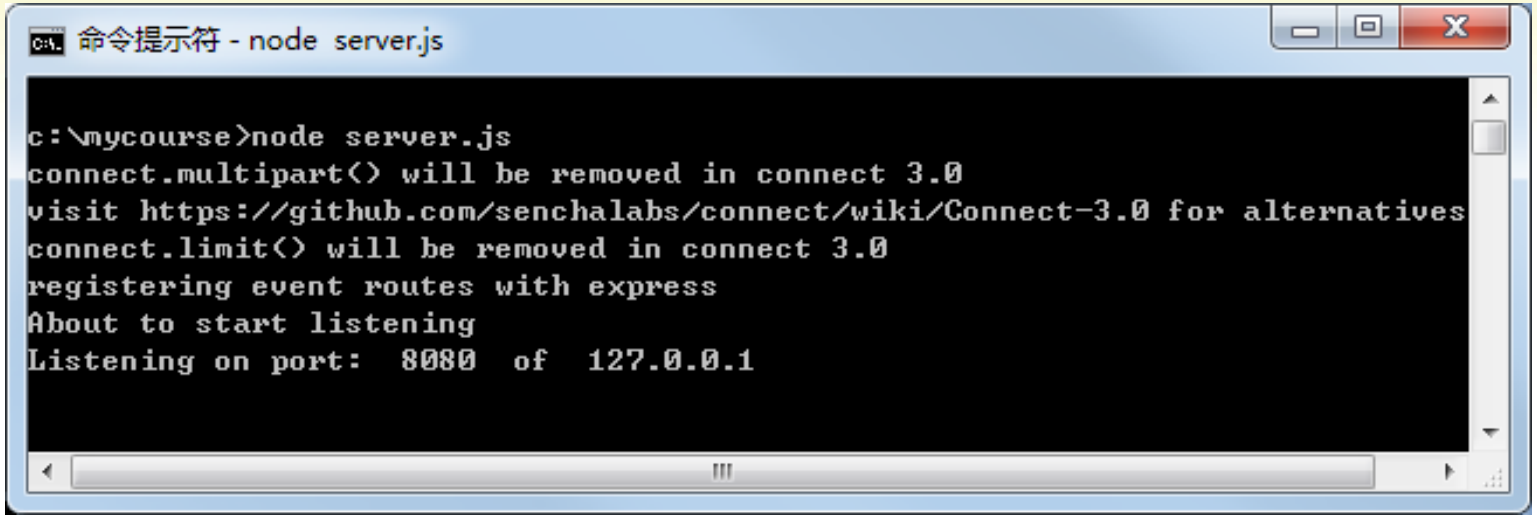
Design Delete in index.html

- Add function delItem to the script section:

```
function delItem(mid, fileName) {
    if(confirm('Do you want to delete file '+ fileName +' ?')){
        var urlstr = '/materials'+'/'+mid;
        xmlhttp =  new XMLHttpRequest();
        xmlhttp.open("delete", urlstr, true);
        xmlhttp.send();
        xmlhttp.onreadystatechange = function(){
           if(xmlhttp.readyState === 4){
            if(xmlhttp.status === 200){
                showItems(xmlhttp.responseText,null);
            } else {
                alert('Error: '+xmlhttp.responseText);
            }
         }
        }
   };
}
```

Again Test the App

- Cd to the project folder, and start the server



- Access http://localhost:8080/ from a browser
- Check the log message showed by Nodejs

DEPLOYMENT

Upload Code to OpenShift

- Open a cmd, cd to the project folder, runing
  1. Add the two new js files to git control

```
git add handlers.js dbutils.js
```

  2. Commit the changes to local git repository

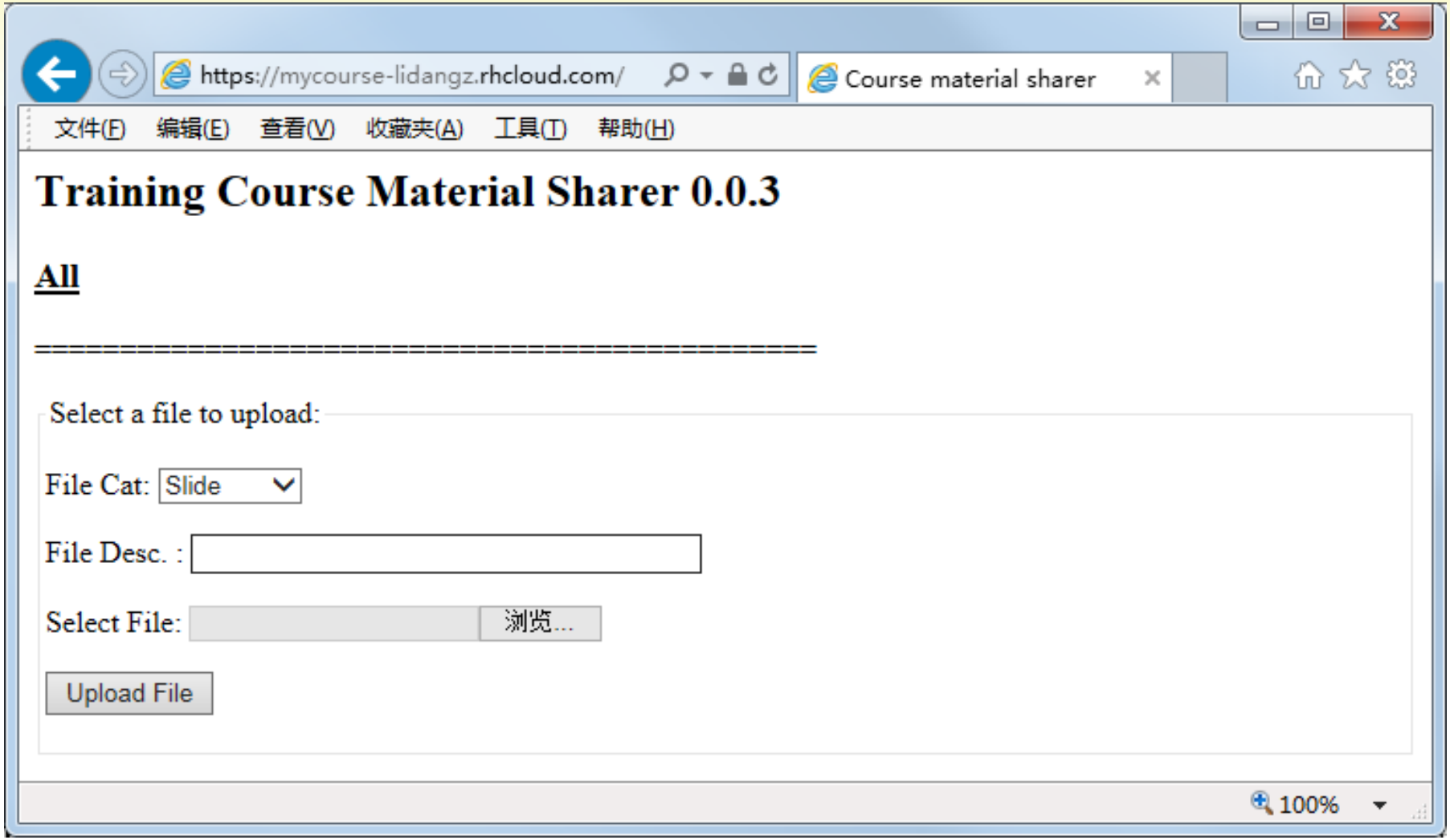
```
git commit -am “My first change”
```

  3. Push the code to OPENSHIFT server*

```
git push
```

* Try several times if errors

Test the App in OpenShift



References

- Manuel Kiessling, “The Node Beginner Book”, http://leanpub.com/nodebeginner