

Koa2源码解读

课前准备

1. koa2 <https://github.com/koajs/koa>

知识点

koa

- 安装: `npm i koa -S`
- 中间件机制、请求、响应处理

```
const Koa = require('koa')
const app = new Koa()
app.use((ctx, next) => {

  ctx.body = [
    {
      name: 'tom'
    }
  ]
  next()
})

app.use((ctx, next) => {
  // ctx.body && ctx.body.push(
  //   {
  //     name: 'jerry'
  //   }
  // )
  console.log('url' + ctx.url)
  if (ctx.url === '/html') {
    ctx.type = 'text/html; charset=utf-8'
    ctx.body = `我的名字是: ${ctx.body[0].name}</b>`
  }
})

app.listen(3000)
```

```
// 搞个小路由
const router = {}
router['/html'] = ctx => {
  ctx.type = 'text/html; charset=utf-8'
  ctx.body = `<b>我的名字是:${ctx.body[0].name}</b>`
}
router[ctx.url](ctx)
```

常见的中间件操作

- 静态服务

```
app.use(require('koa-static')(__dirname + '/'))
```

- 路由

```
const router = require('koa-router')()
router.get('/string', async (ctx, next) => {
  ctx.body = 'koa2 string'
})
router.get('/json', async (ctx, next) => {
  ctx.body = {
    title: 'koa2 json'
  }
})
app.use(router.routes())
```

- 日志

```
app.use(async (ctx, next) => {
  const start = new Date().getTime()
  console.log(`start: ${ctx.url}`);
  await next();
  const end = new Date().getTime()
  console.log(`请求${ctx.url}, 耗时${parseInt(end-start)}ms`)
})
```

koa 原理:

- 一个基于nodejs的入门级http服务，类似下面代码：

```
const http = require('http')
const server = http.createServer((req, res) => {
  res.writeHead(200)
  res.end('hi kaikeba')
})

server.listen(3000, () => {
  console.log('监听端口3000')
})
```

- koa的目标是用更简单化、流程化、模块化的方式实现回调部分

```
// 创建kkb.js
const http = require("http");

class KKB {
  listen(...args) {
    const server = http.createServer((req, res) => {
      this.callback(req, res);
    });
    server.listen(...args);
  }
  use(callback) {
    this.callback = callback;
  }
}
module.exports = KKB;

// 调用, app.js
const KKB = require("./kkb");
const app = new KKB();

app.use((req, res) => {
  res.writeHead(200);
  res.end("hi kaikeba");
});

app.listen(3000, () => {
  console.log("监听端口3000");
});
```

目前为止，KKB只是个马甲，要真正实现目标还需要引入上下文（context）和中间件机制（middleware）

context

- koa为了能够简化API，引入上下文context概念，将原始请求对象req和响应对象res封装并挂载到context上，并且在context上设置getter和setter，从而简化操作。

使用方法，接近koa了

```
// app.js
app.use(ctx=>{
  ctx.body = 'hehe'
})
```

- 封装request、response和context

<https://github.com/koajs/koa/blob/master/lib/response.js>

```
// request.js
module.exports = {
  get url() {
    return this.req.url;
  }

  get method(){
    return this.req.method.toLowerCase()
  }
};
```

```
// response.js
module.exports = {
  get body() {
    return this._body;
  },
  set body(val) {
    this._body = val;
  }
};
```

```
// context.js
module.exports = {
  get url() {
    return this.request.url;
  },
  get body() {
    return this.response.body;
  },
  set body(val) {
    this.response.body = val;
  },
  get method() {
    return this.request.method
  }
};
```

```
// kkb.js
// 导入这三个类
const context = require("./context");
const request = require("./request");
const response = require("./response");

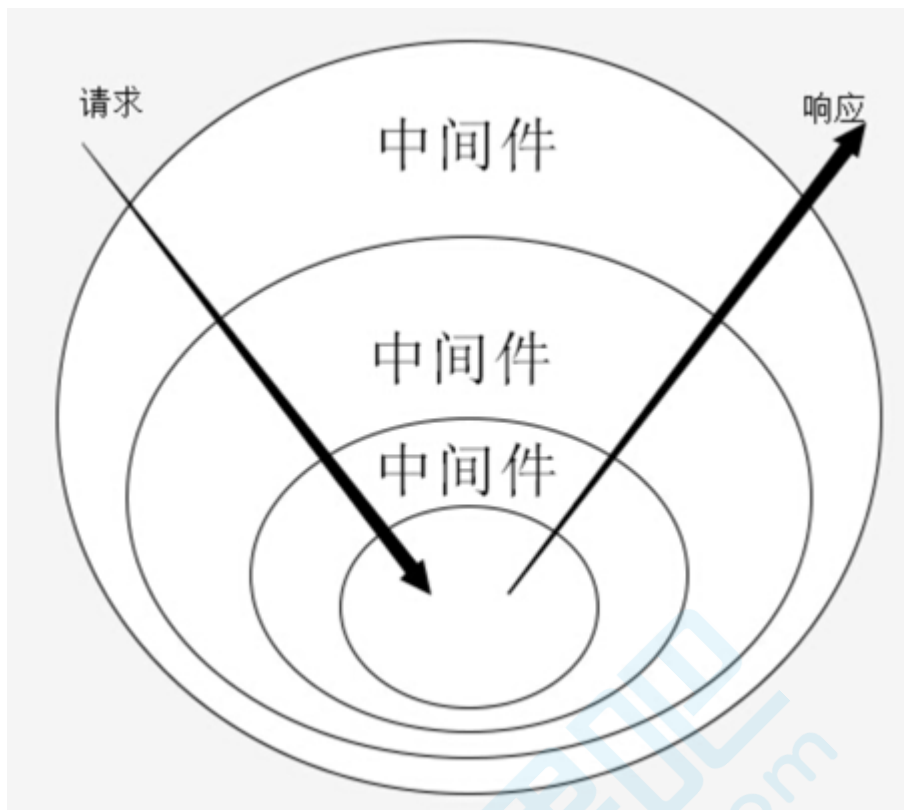
class KKB {
  listen(...args) {
    const server = http.createServer((req, res) => {
      // 创建上下文
      let ctx = this.createContext(req, res);

      this.callback(ctx)
      // 响应
      res.end(ctx.body);
    });
    // ...
  }
  // 构建上下文，把res和req都挂载到ctx之上，并且在ctx.req和ctx.request.req同时保存
  createContext(req, res) {
    const ctx = Object.create(context);
    ctx.request = Object.create(request);
    ctx.response = Object.create(response);

    ctx.req = ctx.request.req = req;
    ctx.res = ctx.response.res = res;
    return ctx;
  }
}
```

中间件

- Koa中间件机制：Koa中间件机制就是函数组合的概念，将一组需要顺序执行的函数复合为一个函数，外层函数的参数实际是内层函数的返回值。洋葱圈模型可以形象表示这种机制，是[源码](#)中的精髓和难点。



- 知识储备：函数组合

```
const add = (x, y) => x + y
const square = z => z * z
const fn = (x, y) => square(add(x, y))
console.log(fn(1, 2))
```

上面就算是两次函数组合调用，我们可以把他合并成一个函数

```
const compose = (fn1, fn2) => (...args) => fn2(fn1(...args))
const fn = compose(add, square)
```

多个函数组合：中间件的数目是不固定的，我们可以用数组来模拟

```
const compose = (...[first, ...other]) => (...args) => {
  let ret = first(...args)
  other.forEach(fn => {
    ret = fn(ret)
  })
  return ret
}
const fn = compose(add, square)
console.log(fn(1, 2))
```

- 异步中间件：上面的函数都是同步的，挨个遍历执行即可，如果是异步的函数呢，是一个promise，我们要支持async + await的中间件，所以我们要等异步结束后，再执行下一个中间件。

```
function compose(middlewares) {
  return function() {
    return dispatch(0);
    // 执行第0个
    function dispatch(i) {
      let fn = middlewares[i];
      if (!fn) {
        return Promise.resolve();
      }
      return Promise.resolve(
        fn(function next() {
          // promise完成后, 再执行下一个
          return dispatch(i + 1);
        })
      );
    }
  };
}

async function fn1(next) {
  console.log("fn1");
  await next();
  console.log("end fn1");
}

async function fn2(next) {
  console.log("fn2");
  await delay();
  await next();
  console.log("end fn2");
}

function fn3(next) {
  console.log("fn3");
}

function delay() {
  return new Promise((resolve, reject) => {
    setTimeout(() => {
      resolve();
    }, 2000);
  });
}

const middlewares = [fn1, fn2, fn3];
const finalFn = compose(middlewares);
finalFn();
```

```
→ koa git:(master) x node test.js
fn1
fn2
fn3
end fn2
end fn1
→ koa git:(master) x
```

- compose用在koa中, kkb.js

```
const http = require("http");
const context = require("./context");
const request = require("./request");
const response = require("./response");

class KKB {
  // 初始化中间件数组
  constructor() {
    this.middlewares = [];
  }
  listen(...args) {
    const server = http.createServer(async (req, res) => {
      const ctx = this.createContext(req, res);
      // 中间件合成
      const fn = this.compose(this.middlewares);
      // 执行合成函数并传入上下文
      await fn(ctx);
      res.end(ctx.body);
    });
    server.listen(...args);
  }
  use(middleware) {
    // 将中间件加到数组里
    this.middlewares.push(middleware);
  }
  // 合成函数
  compose(middlewares) {
    return function(ctx) { // 传入上下文
      return dispatch(0);
      function dispatch(i) {
        let fn = middlewares[i];
        if (!fn) {
          return Promise.resolve();
        }
      }
    }
  }
}
```



```

        return Promise.resolve(
          fn(ctx, function next() { // 将上下文传入中间件, mid(ctx,next)
            return dispatch(i + 1);
          })
        );
      }
    };
  }
  createContext(req, res) {
    let ctx = Object.create(context);
    ctx.request = Object.create(request);
    ctx.response = Object.create(response);

    ctx.req = ctx.request.req = req;
    ctx.res = ctx.response.res = res;
    return ctx;
  }
}
module.exports = KKB;

```

使用, app.js

```

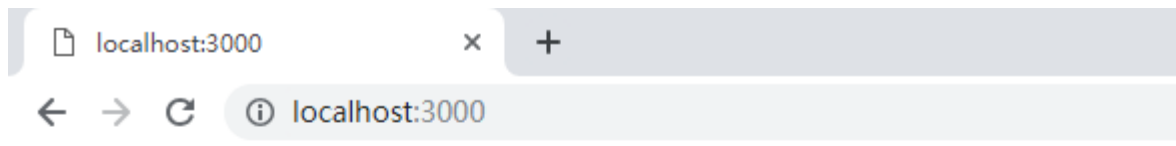
const delay = () => Promise.resolve(resolve => setTimeout(() => resolve() ,2000));

app.use(async (ctx, next) => {
  ctx.body = "1";
  setTimeout(() => {
    ctx.body += "2";
  }, 2000);
  await next();
  ctx.body += "3";
});

app.use(async (ctx, next) => {
  ctx.body += "4";
  await delay();
  await next();
  ctx.body += "5";
});

app.use(async (ctx, next) => {
  ctx.body += "6";
});

```



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koa-compose的[源码](#)

常见koa中间件的实现

- koa中间件的规范：
 - 一个async函数
 - 接收ctx和next两个参数
 - 任务结束需要执行next

```
const mid = async (ctx, next) => {  
  // 来到中间件, 洋葱圈左边  
  next() // 进入其他中间件  
  // 再次来到中间件, 洋葱圈右边  
};
```

- 中间件常见任务：
 - 请求拦截
 - 路由
 - 日志
 - 静态文件服务
- 静态文件服务koa-static
 - 配置绝对资源目录地址, 默认为static
 - 获取文件或者目录信息
 - 静态文件读取

◦ 返回

```
// static.js
const fs = require("fs");
const path = require("path");

module.exports = (dirPath = "./public") => {
  return async (ctx, next) => {
    if (ctx.url.indexOf("/public") === 0) {
      // public开头 读取文件
      const url = path.resolve(__dirname, dirPath);
      const fileName = path.basename(url);
      const filepath = url + ctx.url.replace("/public", "");
      console.log(filepath);
      // console.log(ctx.url, url, filepath, fileName)
      try {
        stats = fs.statSync(filepath);
        if (stats.isDirectory()) {
          const dir = fs.readdirSync(filepath);
          // const
          const ret = ['<div style="padding-left:20px">'];
          dir.forEach(filename => {
            console.log(filename);
            // 简单认为不带小数点的格式，就是文件夹，实际应该用statSync
            if (filename.indexOf(".") > -1) {
              ret.push(
                `<p><a style="color:black" href="${
                  ctx.url
                }/${filename}">${filename}</a></p>`
              );
            } else {
              // 文件
              ret.push(
                `<p><a href="${ctx.url}/${filename}">${filename}</a></p>`
              );
            }
          });
          ret.push("</div>");
          ctx.body = ret.join("");
        } else {
          console.log("文件");

          const content = fs.readFileSync(filepath);
          ctx.body = content;
        }
      } catch (e) {
        // 报错了 文件不存在
        ctx.body = "404, not found";
      }
    } else {
      // 否则不是静态资源，直接去下一个中间件
      await next();
    }
  }
}
```

```
};  
};
```

```
// 使用  
const static = require('./static')  
app.use(static(__dirname + '/public'));
```

- 路由 router

将来可能的用法

```
const Koa = require('./kkoa')  
const Router = require('./router')  
const app = new Koa()  
const router = new Router();  
  
router.get('/index', async ctx => { ctx.body = 'index page'; });  
router.get('/post', async ctx => { ctx.body = 'post page'; });  
router.get('/list', async ctx => { ctx.body = 'list page'; });  
router.post('/index', async ctx => { ctx.body = 'post page'; });  
  
// 路由实例输出父中间件 router.routes()  
app.use(router.routes());
```

routes()的返回值是一个中间件，由于需要用到method，所以需要挂载method到ctx之上，修改request.js

```
// request.js  
module.exports = {  
  // add...  
  get method() {  
    return this.req.method.toLowerCase()  
  }  
}
```

```
// context.js  
module.exports = {  
  // add...  
  get method() {  
    return this.request.method  
  },  
}
```

```
class Router {  
  constructor() {  
    this.stack = [];  
  }  
  
  register(path, methods, middleware) {  
    let route = {path, methods, middleware}
```

```

    this.stack.push(route);
  }
  // 现在只支持get和post, 其他的同理
  get(path,middleware){
    this.register(path, 'get', middleware);
  }
  post(path,middleware){
    this.register(path, 'post', middleware);
  }
  routes() {
    let stock = this.stack;
    return async function(ctx, next) {
      let currentPath = ctx.url;
      let route;

      for (let i = 0; i < stock.length; i++) {
        let item = stock[i];
        if (currentPath === item.path && item.methods.indexOf(ctx.method) >= 0) {
          // 判断path和方法
          route = item.middleware;
          break;
        }
      }

      if (typeof route === 'function') {
        route(ctx, next);
        return;
      }

      await next();
    };
  }
}
module.exports = Router;

```

使用

```

const Koa = require('./kkb')
const Router = require('./router')
const app = new Koa()
const router = new Router();

router.get('/index', async ctx => {
  console.log('index,xx')
  ctx.body = 'index page';
});
router.get('/post', async ctx => { ctx.body = 'post page'; });
router.get('/list', async ctx => { ctx.body = 'list page'; });

router.post('/index', async ctx => { ctx.body = 'post page'; });

// 路由实例输出父中间件 router.routes()
app.use(router.routes());

```

```
app.listen(3000,()=>{  
  console.log('server runing on port 9092')  
})
```

