

ND VARIABLES

```
static class Track {
    final int r = 0;
    final int c = 0;
    final int dir = 0;
}
```

```
private static String traverse(int R, int C, int[] a) {
    Track t = new Track();
    return IntStream.range(0, R*C).map(n -> {
        int val = a[t.r][t.c];
        switch (t.dir) {
            case 0: t.c++; t.dir=1; break;
            case 1: if (t.r == R-1) { t.c++; t.dir=2; }
                      else if (t.c == 0 ) { t.r++; t.dir=2; }
                      else { t.r++; t.c--; } break;
            case 2: if (t.c == C-1) { t.r++; t.dir=1; }
                      else if (t.r == 0) { t.c++; t.dir=1; }
                      else { t.r--; t.c++; } break;
            case 3: return val;
        }
    }).mapToObj(String::valueOf)
        .collect(Collectors.joining(" "));
}
```

• recursion

final $\text{C} = \text{C} + \uparrow$ $\Rightarrow \text{C} = \text{C} + \uparrow$

need to use this var further.

hint #1

hint #2

Track

EVERYTHING must BE FINAL

final $\text{C} = \text{C} + \uparrow$

```
final List<Integer> result = new LinkedList<>();
// result.add(45);

final Track[] t = {new Track()};
← you modify the + [α]
```

V

```
return IntStream.range(0, R*C).map(n -> {
    int nc=t[0].c;
    int ndir=t[0].dir;
    int nr=t[0].r;
    int val = a[nr][nc];
    switch (t[0].dir) {
        case 0: nc++; ndir=1; break;
        case 1:
            if (t[0].r == R-1) { nc++; ndir=2; }
            else if (t[0].c == 0 ) { nr++; ndir=2; }
            else { nr++; nc--; }
            break;
        case 2:
            if (t[0].c == C-1) { nr++; ndir=1; }
            else if (t[0].r == 0) { nc++; ndir=1; }
            else { nr--; nc++; }
    }
    t[0] = new Track(nc,ndir,nr);
    return val;
});
```



You have created 1000 ~ extra objects
 with reference count = 0

that's way faster to get rid of 1000 ~ objects with 0 ref
 than filter 10 objects with 100 references to them

1000

you need to modify only one link

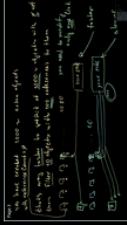
faster

slow

- 1.1 how to handle static content → 1 page
- 1.2 how to attach CSS, JS ... to PAGE → CSS → JS
- 2. how to inject your DATA into HTML ...
- 3. how to navigate between web pages
- 4. how to redirect to another webpage → /login

WEB works in terms of URL only
WEB has no idea about your services

`http://127.0.0.1/calc` == GET /calc



Page 5 /images /list
/images / abc.jpg
cde.jpg.

xxxxxx.jpg.
/images / * → /images /list

/images / * → Tomcat Servlet . doGet {
↳ 1. you parse ↳

Tomcat Servlet . doPost {
↳ 2. if you find the file → you display it
redirect to images /list

① GET /login
② GET /login
redirect to
LoginServlet

Redirect Life Cycle

RedirectServlet → /* /

Summary	Request #1				Request #2				Response				
URL:	GET /login565656				GET /login	GET /login				HTTP/1.1 200 OK			
Status:	200 OK				Date:	Fri, 17 Apr 2020 06:41:45 GMT				Date:	Fri, 17 Apr 2020 06:41:45 GMT		
Source:	Network Address: ::1.8080				Host:	localhost:8080/login				Content-Length:	559		
Address:	::1.8080				User-Agent:	Mozilla/5.0 (Macintosh; Intel Mac OS X 10_15_4) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/83.0.4103.106 Safari/537.36				Server:	Jetty(9.4.27.v20200227)		
Request	GET /login565656	Accept:	text/html,application/xhtml+xml,application/xml,application/rss+xml,application/javascript,application/json	Upgrade-Insecure-Requests:	1	Host:	localhost:8080	User-Agent:	Mozilla/5.0 (Macintosh; Intel Mac OS X 10_15_4) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/83.0.4103.106 Safari/537.36	Accept-Encoding:	gzip, deflate	Connection:	keep-alive
Redirect Response	302 Found	Date:	Fri, 17 Apr 2020 06:41:45 GMT	Location:	http://localhost:8080/login	Request	GET /login	Accept:	text/html,application/xhtml+xml,application/xml,application/rss+xml,application/javascript,application/json	Upgrade-Insecure-Requests:	1	Host:	localhost:8080
Request	GET /login	Accept:	text/html,application/xhtml+xml,application/xml,application/rss+xml,application/javascript,application/json	Upgrade-Insecure-Requests:	1	Host:	localhost:8080	User-Agent:	Mozilla/5.0 (Macintosh; Intel Mac OS X 10_15_4) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/83.0.4103.106 Safari/537.36	Accept-Encoding:	gzip, deflate	Connection:	keep-alive
Response	HTTP/1.1 200 OK	Date:	Fri, 17 Apr 2020 06:41:45 GMT	Content-Length:	559	Request	GET /login	Accept:	text/html,application/xhtml+xml,application/xml,application/rss+xml,application/javascript,application/json	Upgrade-Insecure-Requests:	1	Host:	localhost:8080

caught by RedirectServlet

caught by RedirectServlet

browser does it automatically

each response has HTTP response number

200
201
404
5xx

1xx = OK
2xx = Redirect
3xx = - permission / absence
4xx = - internal (server error)
5xx = - external (client error)

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta name="viewport"
        content="width=device-width, user-scalable=no, in
    <meta http-equiv="X-UA-Compatible" content="ie=edge">
    <title>Document</title>
</head>

<body>
    
    <form method="post">
        <input type="text" name="username"><br>
        <input type="text" name="password"><br>
        <input type="submit" value="Login">
    </form>
</body>
</html>
```



Page 8

Summary

Request

Response

①

Request #1

URL: <http://localhost:8080/login>

Status: 200 OK

Source: Network

Address: ::1.8080

User-Agent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10_15_3) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/80.0.3987.147 Safari/537.36

Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,image/apng,*/*;q=0.8

Upgrade-Insecure-Requests: 1

Host: localhost:8080

Accept-Language: en-us

Accept-Encoding: gzip, deflate

Connection: keep-alive

HTTP/1.1 200 OK

Date: Fri, 17 Apr 2020 06:52:07 GMT

Content-Length: 589

Server: Jetty(9.4.27.v20200227)

login.html

```
<body>

<form method="post">
    <input type="text" name="username"><br>
    <input type="text" name="password"><br>
    <input type="submit" value="Login">
</form>
</body>
```

each external (to file)
resource is a separate
another request

/images/hp.jpg

Request

GET /images/hp.jpg

Accept: image/png,image/svg+xml,image/*;q=0.8,

Referer: http://localhost:8080/login

User-Agent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10_15_3) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/80.0.3987.147 Safari/537.36

Summary

URL: http://localhost:8080/images/hp.jpg

Status: 200 OK

Source: Network

Address: ::1.8080

Initiator: login#12

Request

GET /static/js/abc.js HTTP/1.1

Accept: image/png,image/svg+xml,image/*;q=0.8,

Referer: http://localhost:8080/login

User-Agent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10_15_3) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/80.0.3987.147 Safari/537.36

Summary

URL: http://localhost:8080/static/js/abc.js

Status: 200 OK

Source: Network

Address: ::1.8080

Initiator: login#12

Request

GET /static/images/hp.jpg HTTP/1.1

Accept: image/png,image/svg+xml,image/*;q=0.8,

Referer: http://localhost:8080/login

User-Agent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10_15_3) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/80.0.3987.147 Safari/537.36

Summary

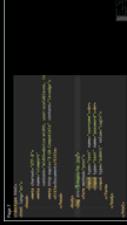
URL: http://localhost:8080/static/images/hp.jpg

Status: 200 OK

Source: Network

Address: ::1.8080

Initiator: login#12



Java`(new StaticServlet(), pathSpec: "/images/*");`

handler for
"/**"

HTML``

new Request

"images/hp.jpg"

```
String filename = req.getPathInfo();
"hp.jpg"
```

Request
GET /images/hp.jpg

Static
the contents
is always
the same

Dynamic
the contents
is always
different

for keyword static gives extra knowledge, Extra Semantic

