

File Processing



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Welcome to Big Data



Getting Data Into Programs

- Put it directly in the program:
 - Define constants holding your values.
- Get it from the user:
 - Mouse events, **readLine**, etc.
- Generate it randomly:
 - Use a **RandomGenerator**.
- Get it from an external source.
 - Store it in a file and read it later.

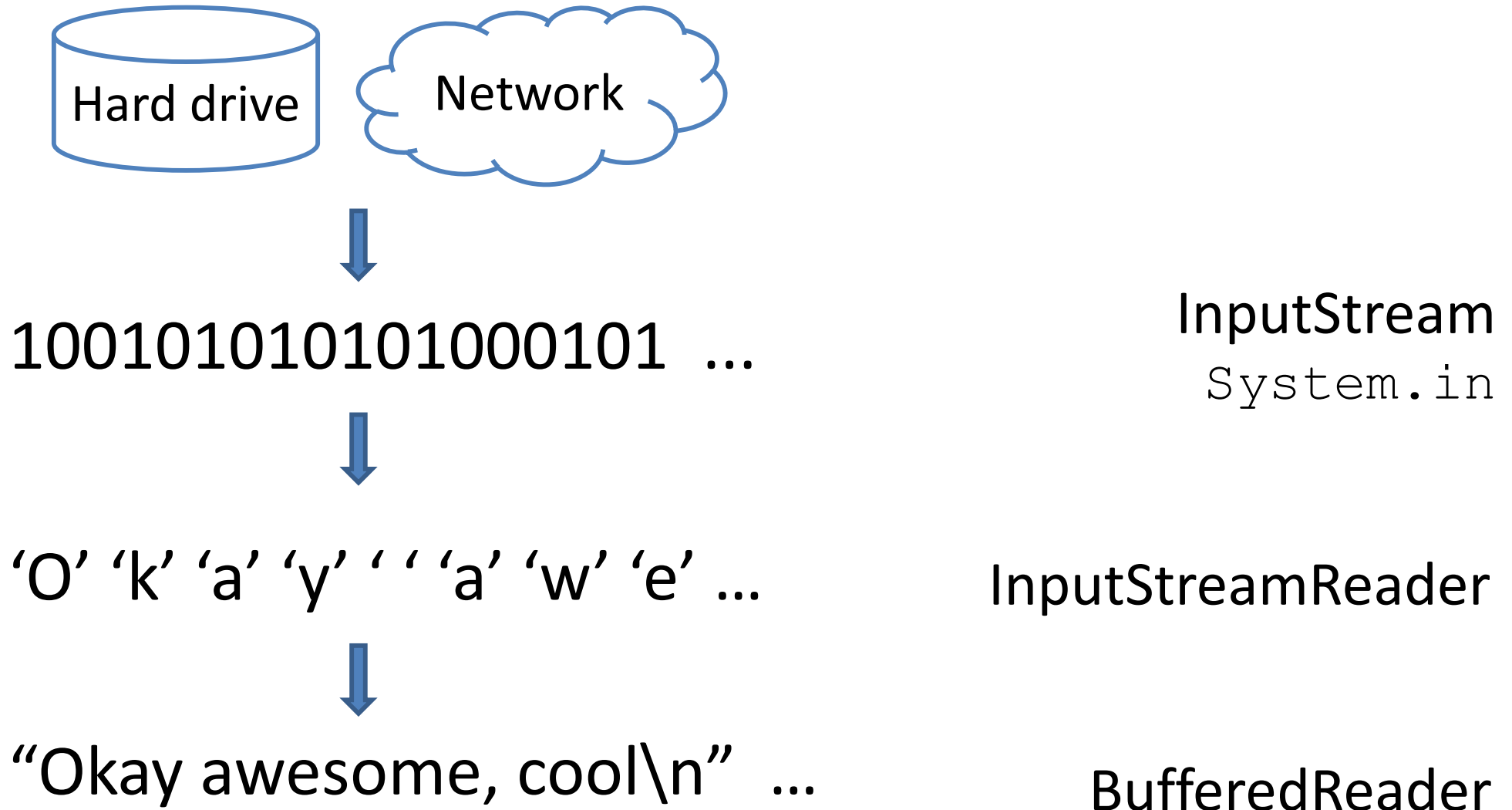
Reading Files

- Virtually all programs that you've used at some point read files from disk:
 - Word processing (documents)
 - Eclipse (Java files)
 - Web browser (cookies)
 - IM client (stored login information)
 - Games (saved progress)
 - Music player (songs)

The Structure of Files

- A file is just a series of **bits** (ones and zeros).
- Those bits can have structure:
 - Plain-text: Bits represent characters.
 - JPEG: Bits encode information about the structure of an image.
 - MP3: Bits encode frequency information about music.
 - etc.

The Full Picture



InputStream

- InputStream is a stream of bytes
 - Read one byte after another using `read()`
- A byte is just a number
 - Data on your hard drive is stored in bytes
 - Bytes can be interpreted as characters, numbers..

```
InputStream stream = System.in;
```

InputStreamReader

- Reader is a class for character streams
 - Read one character after another using `read()`
- InputStreamReader takes an InputStream and converts bytes to characters
- Still inconvenient
 - Can only read a character at a time

```
new InputStreamReader(stream)
```


BufferedReader

- **BufferedReader** buffers a character stream so you can read line by line
 - `String readLine()`

```
new BufferedReader(  
    new InputStreamReader(System.in) );
```

User Input

```
InputStreamReader ir = new  
    InputStreamReader(System.in);  
BufferedReader br = new BufferedReader(ir);  
  
br.readLine();
```

FileReader

- FileReader takes a text file
 - converts it into a character stream
 - `FileReader("PATH TO FILE");`
- Use this + `BufferedReader` to read files!

```
FileReader fr = new FileReader("readme.txt");  
BufferedReader br = new BufferedReader(fr);
```

The Structure of Files

A file is just a series of **bits** (ones and zeros).

Those bits can have structure:

- **Plain-text: Bits represent characters.**

JPEG: Bits encode information about the structure of an image.

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I wish, I wish he'd go away...
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Step one:
Open the file for reading.

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```
BufferedReader br =  
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```

To use the `BufferedReader` and
`FileReader` types, you need to

```
import java.io.*;
```


Yesterday, upon the stair,

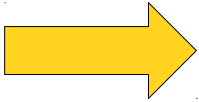
I met a man who wasn't there

He wasn't there again today

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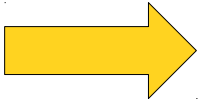
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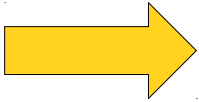
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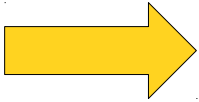
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```

Step Two:
Read the file,
one line at a time.



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```



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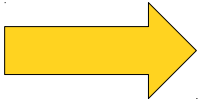
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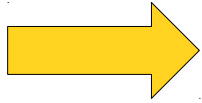
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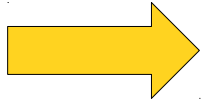
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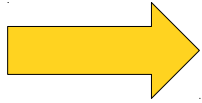
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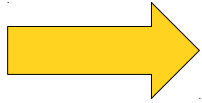
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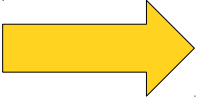
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String line6 = br.readLine();
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Step Three:
Close the file.

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String line6 = br.readLine(); // *Returns null*  
  
br.close();
```

FileReader Code

```
import java.io.BufferedReader;
import java.io.FileReader;
import java.io.IOException;

public class ReadFile {

    public static void main(String[] args) throws IOException{
        // Path names are relative to project directory (Eclipse Quirk )
        FileReader fr = new FileReader("./src/readme");
        BufferedReader br = new BufferedReader(fr);
        String line = null;
        while ((line = br.readLine()) != null) {
            System.out.println(line);
        }
        br.close();
    }
}
```

Exceptions Handling

Sometimes Things Break

- Programs sometimes encounter unexpected errors.
- Sometimes these are bugs:
 - Dividing by zero.
 - Sending a message to a **null** object.
- Sometimes these are due to external factors:
 - Network errors.
 - Missing files.

Exceptional Cases

- If Java encounters a case where it can't proceed as normal, it will cause an **exception**.
- Java requires that your program handle certain types of exceptions.
- Think of exceptions as rerouting control in an emergency:
 - If all goes well, program continues as usual.
 - If something goes wrong, handle the emergency.

Let's **try** It Out!

`try`-ing Your Best

- To use a method or class that might cause an exception, you need to tell Java to `try` its best, knowing that it might fail.

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- To use a method or class that might cause an exception, you need to tell Java to **try** its best, knowing that it might fail.

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try-ing Your Best

- To use a method or class that might cause an exception, you need to tell Java to **try** its best, knowing that it might fail.

```
try {  
    BufferedReader br =  
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```

There's a catch...

There's a **catch**...

try and catch me

- If an exception occurs, you may need to tell Java to **catch** that exception.

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    br.close();
} catch (IOException e) {
    println("An error occurred: " + e);
}
```


try and catch me

- If an exception occurs, you may need to tell Java to **catch** that exception.

If something fails up here...

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```

... we immediately jump down here.

Exceptions

- `NullPointerException`
- `ArrayIndexOutOfBoundsException`
- `ClassCastException`
- `RuntimeException`

Rethrowing it



main

Rethrowing it



main

The diagram consists of two blue rectangular boxes stacked vertically. The top box contains the text 'main' and the bottom box contains the text 'doBad'. Both boxes have a thin dark blue border.

doBad

Rethrowing it

main

doBad

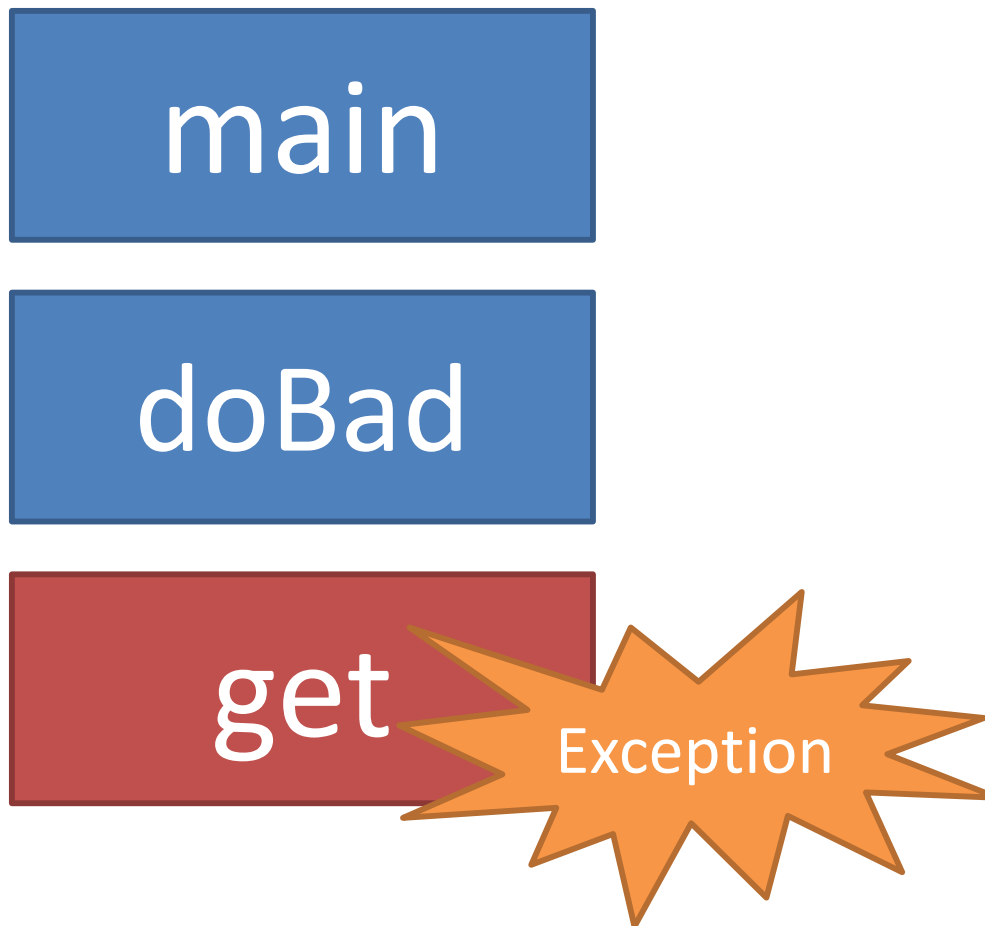
get

Rethrowing it

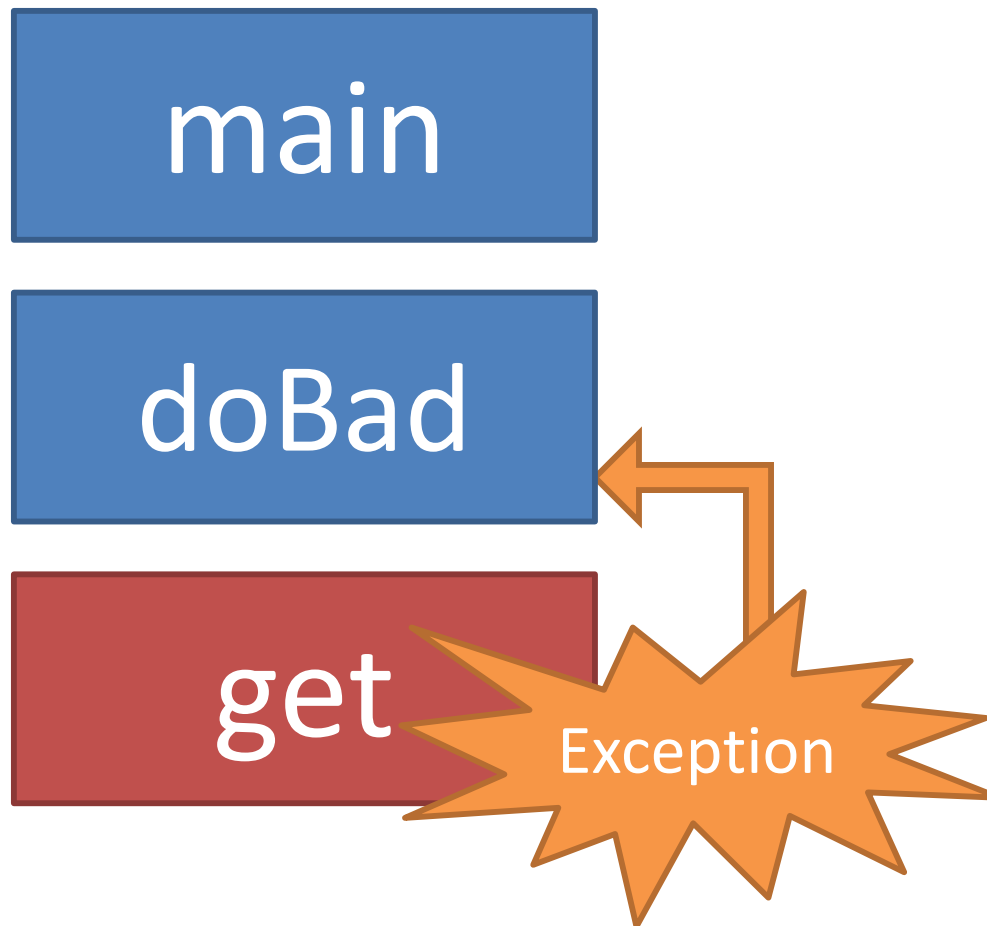


Uh Oh

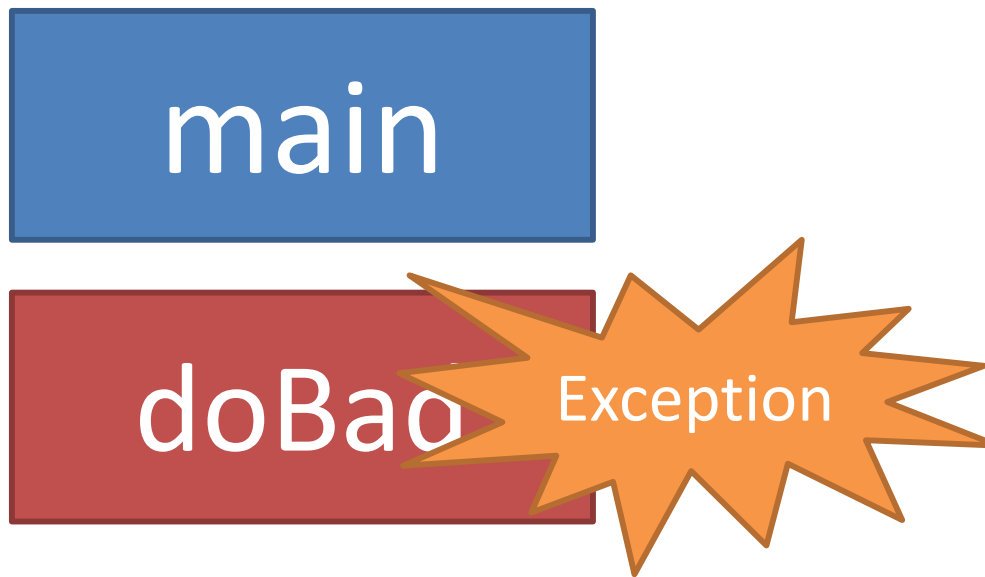
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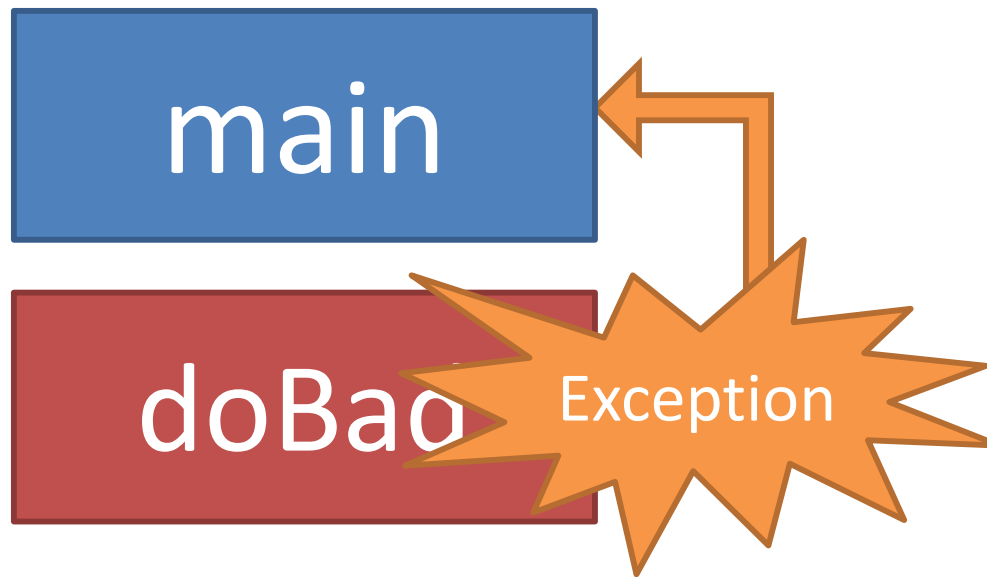
Rethrowing it



Rethrowing it



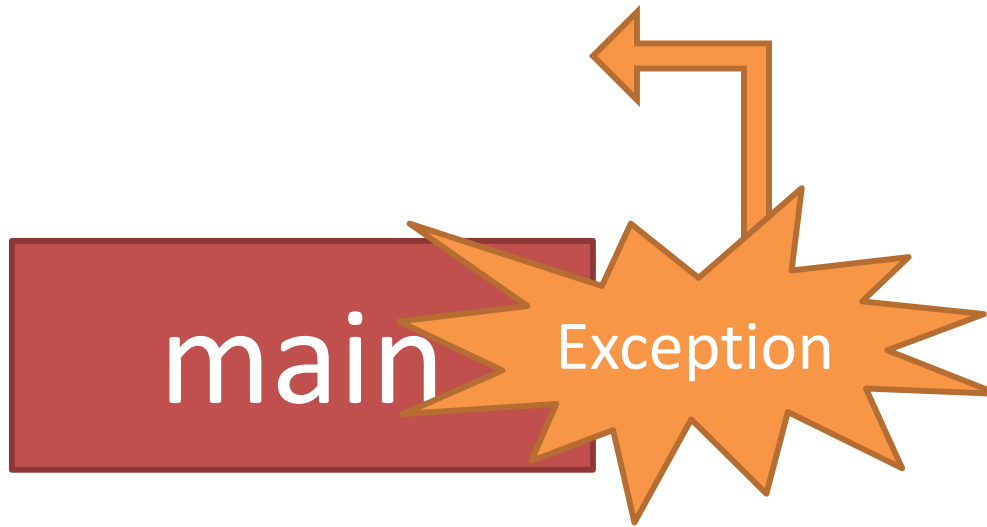
Rethrowing it



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What if no one catches it?

- If you run

```
public static void main(String[] args) throws Exception {  
    doBad();  
}
```

- Java will print that error message you see

```
Exception in thread "main"  
java.lang.ArrayIndexOutOfBoundsException: -1  
    at YourClass.get(YourClass.java:50)  
    at YourClass.doBad(YourClass.java:11)  
    at YourClass.main(YourClass.java:10)
```

Reading a File

- The idiomatic “read all the lines of a file” code is shown here:

```
try {  
    BufferedReader br = /* ... open the file ... */  
    while (true) {  
        String line = br.readLine();  
        if (line == null) break;  
  
        /* ... process line ... */  
    }  
    br.close();  
} catch (IOException e) {  
    /* ... handle error ... */  
}
```

Writing to Files

- Writing to files is conceptually similar to reading files.
 - Open the file for writing (using **PrintWriter** instead of **BufferedReader**).
 - Write the contents you'd like to the file.
 - Close the file.



**//////// DANGER \\\ \ \ **

Writing to an existing file will permanently overwrite the contents of that file. Don't write to a file unless you're okay setting it on fire!