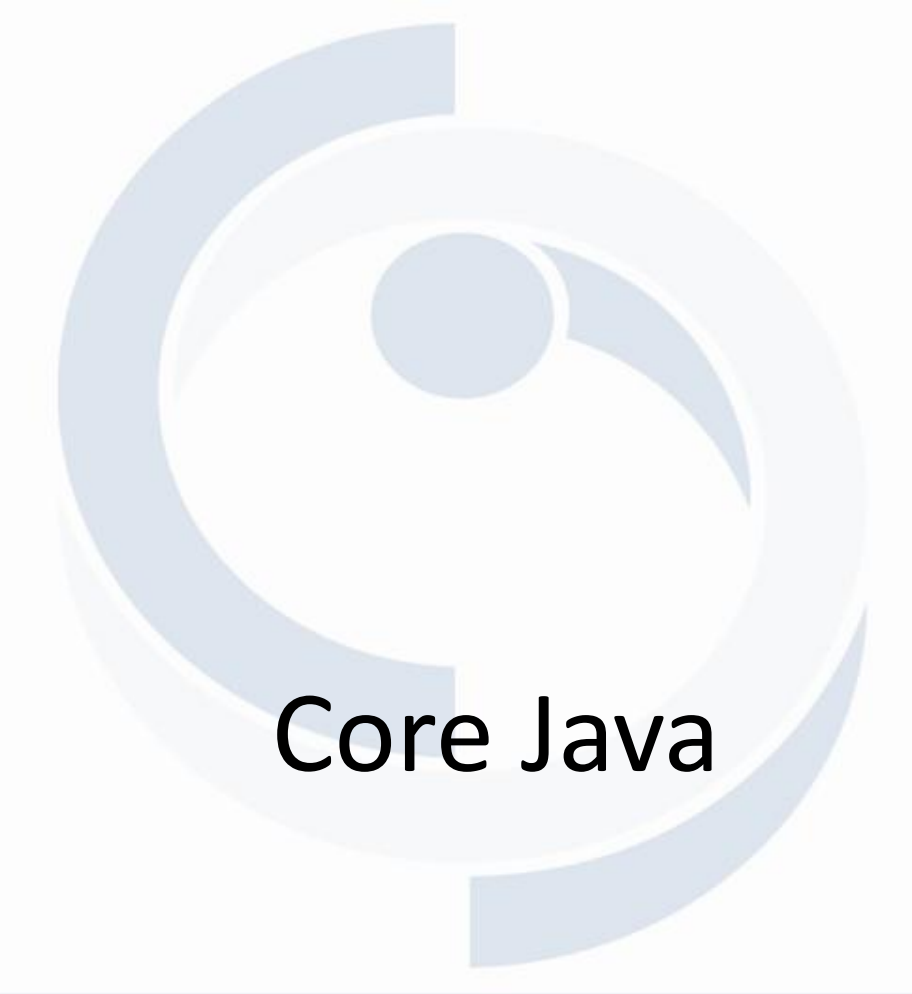

Core Java

Exception Handling

- **A built in mechanism for trapping & handling errors**
- **Usually deals with abnormal events or code execution which prevents the program from continuing, like:**
  - Array out of bounds accesses
  - Divide by Zero
  - Null pointers & so on…
- **Exception Handling handles these errors whenever they happen**

What is Exception?

- **An Exception is a Java class**
- **A variety of subclasses allows handling different kinds of errors & abnormal events**
- **Basic concept:**
  - Whenever an abnormal event occurs, Java *throws* an Exception
  - It means Java instantiates a subclass of the Exception class
  - Whenever an Exception could possibly be thrown, we must provide a mechanism for *catching* it in our code

Throwing Exceptions

- **If the programmer does not catch the exception, it is thrown automatically to the caller function**

- **If an exception is thrown from the *main* function, the program is terminated abnormally**

Throwing Exceptions (Contd…)

- **Exceptions may be thrown explicitly by using the *throws* keyword**
- **Throwing exceptions in Java terminates method execution**

```
public class String
{
   public char charAt(int index)
      throws IndexOutOfBoundsException
   {
      . . .
      throw new IndexOutOfBoundsException();
      . . .
      return c;
   }
}
```

Catching Exceptions

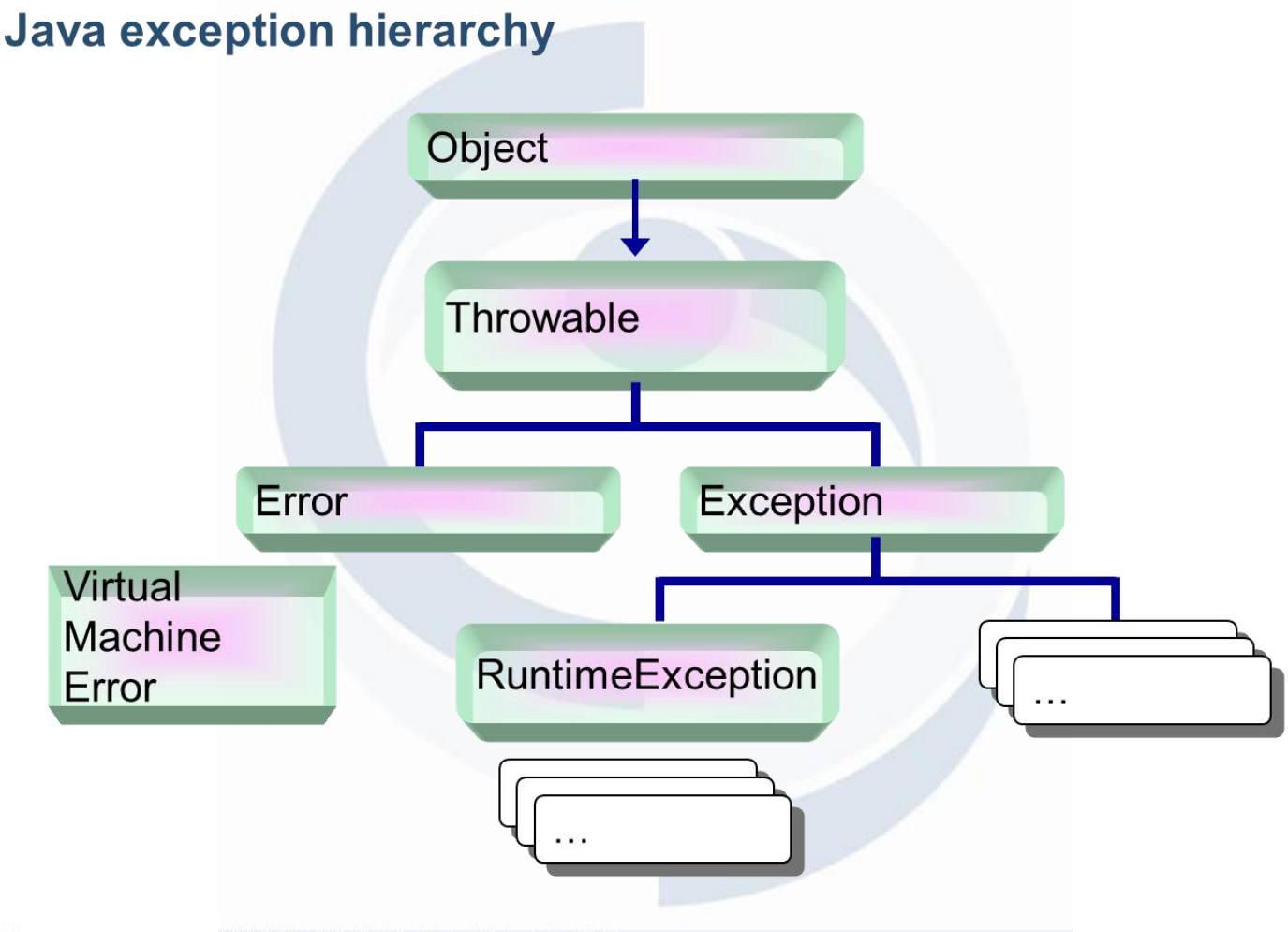
- **A *try* statement executes a block and oversees the execution of enclosed statements for exceptions**
- **try also defines the scope for exception handlers (defined in catch clause)**
- **A try block must be accompanied by at least one *catch* block or one *finally* block**
- **Any method declared as being able to throw an Exception, can have a try / catch block to handle the exception**

Catching Exceptions

```
try {
    String text = "text";
    System.out.println(text.charAt(10));
} catch(IndexOutOfBoundsException e) {
    System.err.println("Index out of bounds");
    e.printStackTrace();
}
```

- **If an Exception is thrown inside of a try block, the returned exception is forwarded as an argument to the catch block where the Exception can be handled**

Exception Hierarchy



Categories of Exceptions

- **Java exceptions fall in two categories:**

1. Unchecked
   - **Not checked by the compiler at compile time**
   - **Does not force the client program / method to declare each exception thrown by a method, or even handle it**
   - **All exceptions are derived from RuntimeException class**

2. Checked
   - **Checked by the compiler to see if these exceptions are properly caught or specified, & if not, the code fails to compile**
   - **Forces client program to deal with the scenario in which an exception may be thrown**
   - **All exceptions which are not derived from RuntimeException class**

Dealing with Exceptions

1. **By using a try / catch block as seen**

2. **By indicating that the *calling method* throws the same Exception, essentially forwarding the responsibility of catching the exception to the code that calls your method**

```
public void myMethod() throws IOException
{
    //calls a method that throws an IOException
}
```

Multiple Catch Blocks

- **A method can throw more than one possible Exceptions, or the try block could call two different methods that throw two different Exceptions**

```
  int x=0,y=0,result=0;
         x= 10;
         y= 0;
   int nums[]= (1,2,3)
try
{
        result =x/y;
        System.out.println(result);
         nums[5]=result;
} catch(ArrithmeticException  e) {
   System.out.println(e);

} catch(ArrayIndexOutOfBoundsException e) {
   System.out.println(e);

}
```

Catch Blocks

- Since all Exceptions are subclasses of the Exception class, we can generalize catch blocks to accept multiple different types of Exceptions by using a super class

```
try {
   String text = "text";
   System.out.println(text.charAt(10));
   int n = Integer.parseInt("abc");
} catch(Exception e) {
   System.err.println("Something bad happened");
   e.printStackTrace();
}
```

The *finally* Block

- **Sometimes, while in a try / catch block, an Exception could be thrown before some important code at the end of the try block**
- **The *finally* block can be used to run this code**
- **Code in *finally* always executes (even in case of unhandled exceptions)**

```
try {
   String text = "text";
   System.out.println(text.charAt(10));
} catch(IndexOutOfBoundsException e) {
   System.err.println("Index out of bounds");
   e.printStackTrace();
} finally {
   //important code
}
```

Rethrowing Exceptions

- **We can *rethrow* an exception after catching it & processing it**

```
try {
    String text = "text";
    System.out.println(text.charAt(10));
} catch(IndexOutOfBoundsException e) {
    System.err.println("Index out of bounds");
    e.printStackTrace();
    throw e;
}
```

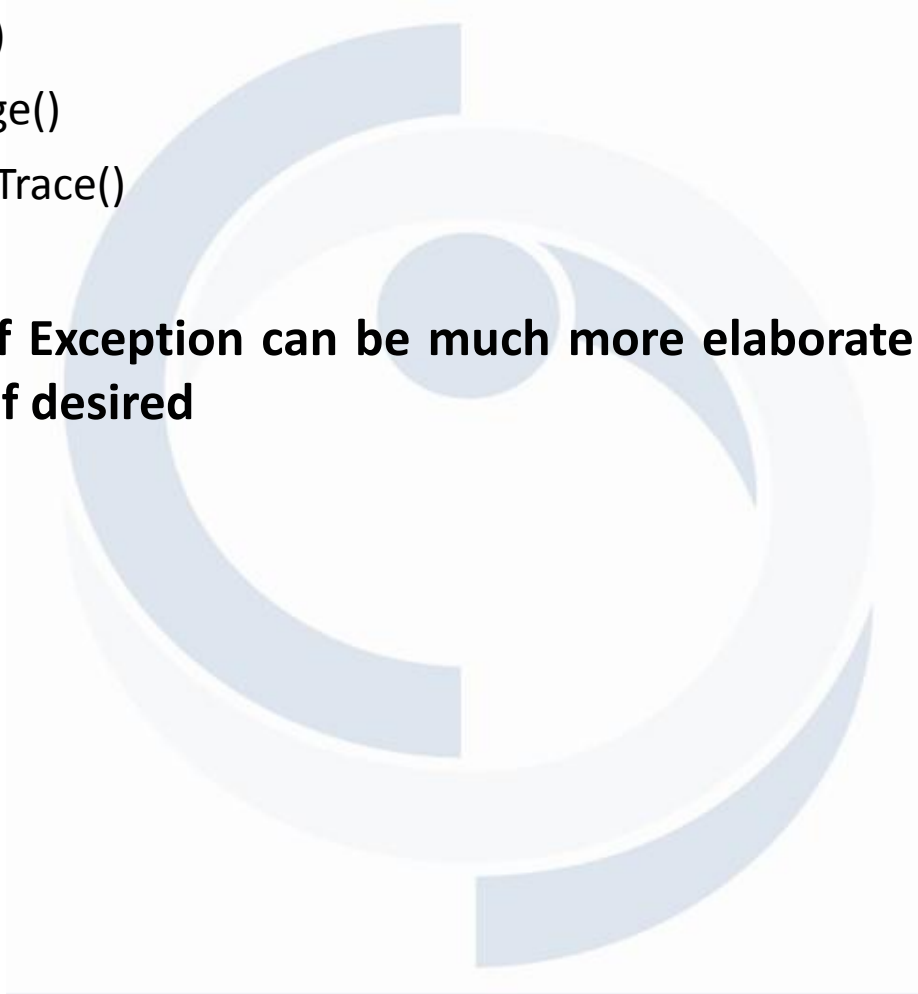
- **If we *rethrow* an Exception, we must specify that the calling method throws the Exception**

Rethrowing.java (Rethrowin

Exception Methods

- **What type of information do we get from the Exception objects:**
  - getCause()
  - getMessage()
  - printStackTrace()

- **Subclasses of Exception can be much more elaborate and contain more information if desired**



Exception Propagation

- **Exceptions are always propagated from the *called* method to the *caller* method, if thrown from the *called* method**
- **If an Exception is thrown from the *main()* method, it will be propagated to the Java Runtime**
- **In exception propagation, all statement executions are ignored until finding the exception handler**

Exception Propagation (Contd…)

```
public  class  Propagate {
        void  calculate() {
            int  m = 25,  i = 0;
                i = m / i;
            }
    public static void main(String[] args) {
            Propagate p = new Propagate();
                p.calculate();
            }
    }
```

ArithmeticExceptio n Occurred

Exception propagated from calculate() to main() method

Exception propagated from main( ) function to java

```
Exception in thread "main" java.lang.ArithmeticException: / by zero
        at Propagate.calculate(Propagate.java:4)
        at Propagate.main(Propagate.java:8)
```

User Defined Exceptions

- **A User Defined Exception must be a subclass of Exception or one of its subclasses**

```
class AgeException extends Exception
{
 public AgeException(String message)
 {
  super(message);
 }
}
```

```
class Employee
{
 public void setAge(int age) throws AgeException
 {
  if(age<18)
   throw new AgeException("Age must be > 10");
 }
}
```