Java and Eclipse for Beginner
Part II of III

Session: 1182

Presented by

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Agenda

- Exceptions and Exception Handling
  - Exercise 1, Exception Handling and I/O
- Array List
  - Exercise 2, extending the CommandLine exercise
- Supplementary Materials
  - JNI (Java Native Interface)
    - Calling Java from C
    - Calling C from Java
  - Remote Debugging
  - The Java (Class) API
    - The Collection API

Exceptions and Exception Handling

- Exceptions in Java are any abnormal, unexpected events or extraordinary conditions that may occur at runtime
- On such conditions java throws an exception object
- Exception handling involves catching the exception and taking the necessary actions

Exception Handling Syntax

- Throwing an exception

```
throw (exception);
```

- and catching it

```
try {
    // code that can throw Exceptions
}
catch (...) { }
catch (...) { }
finally {
    // tidy up code...
}
```

Exception Types 1

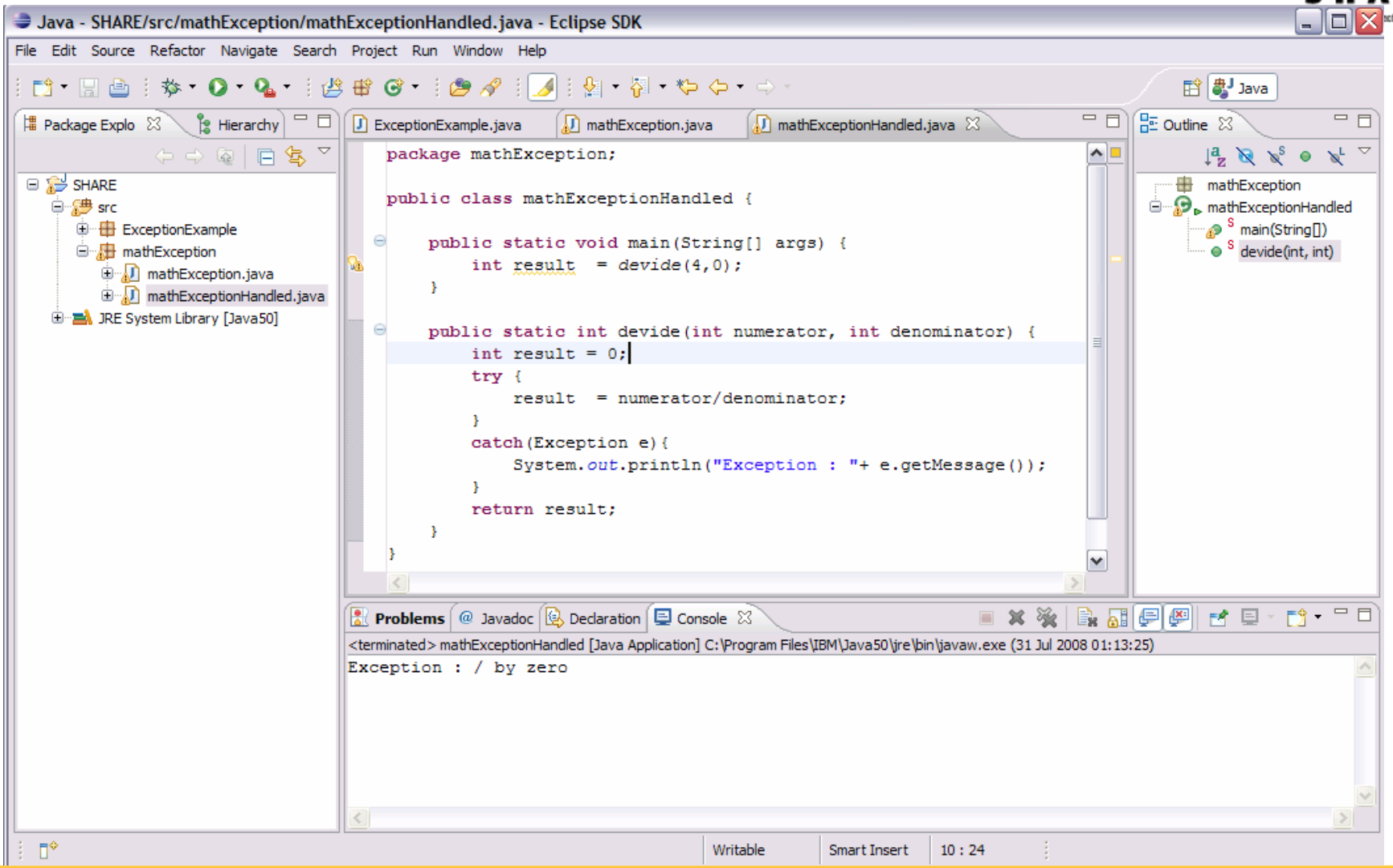
- Checked Exceptions are Exceptions which must be handled programmatically.
- Methods declare the exceptions that they can throw and the calling method must catch this exception.

```
public void foo() throws <Exception Type> {
}
```

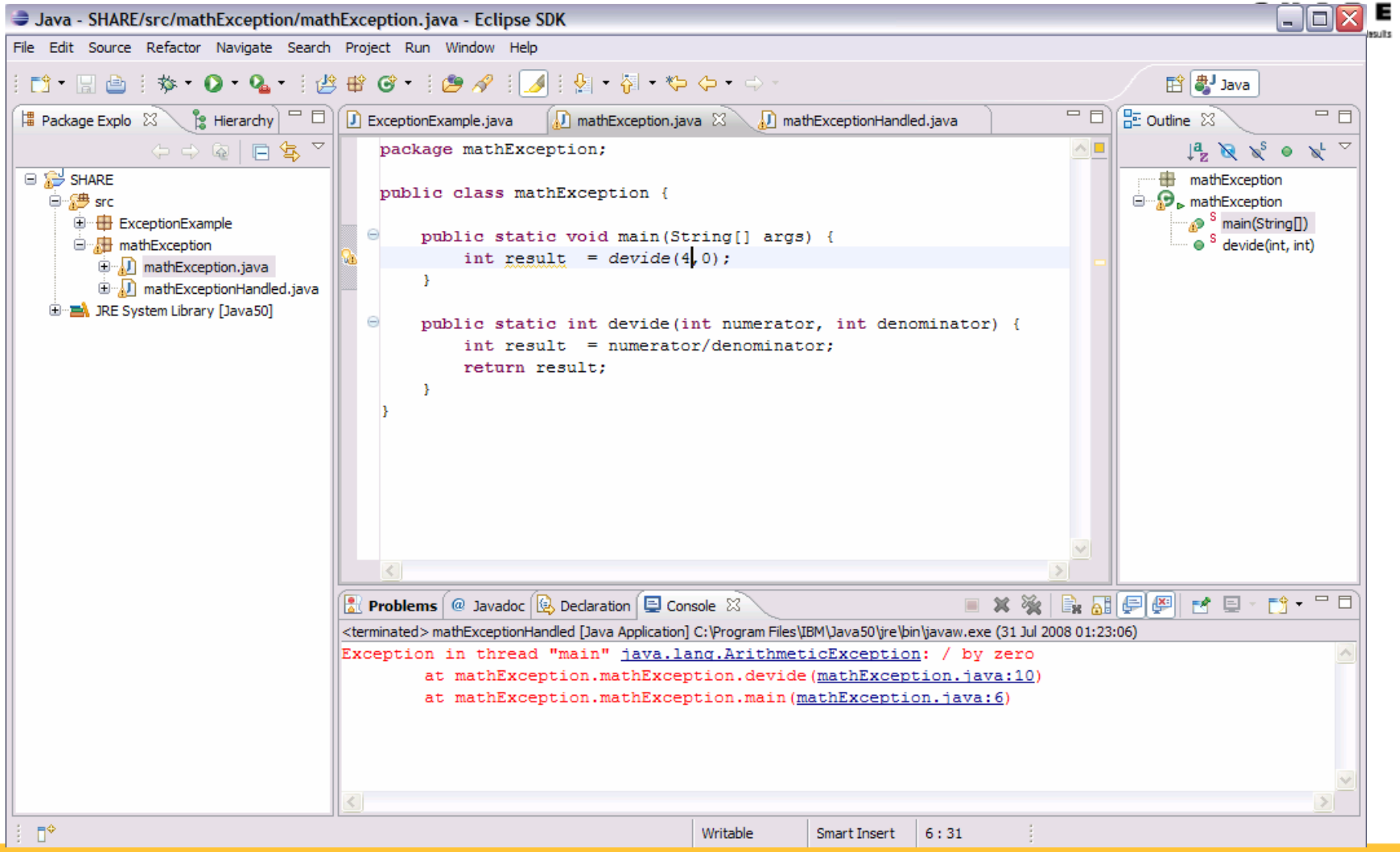
Exception Types 2

- Unchecked Exceptions are Exceptions which the compiler doesn't insist are handled.
- Unchecked exceptions don't need to be declared in a method's throw clause.
- Unchecked exceptions represent runtime problems which code cannot reasonably be expected to recover from.
- Examples of unchecked exceptions are:
  - ArithmeticException
  - ArrayStoreException
  - IndexOutOfBoundsException
  - NegativeArraySizeException
  - NullPointerException

Catching Exceptions



… and not Catching Exceptions



Exercise 1

- The FilePrinter.java program reads the files passed as arguments
- The file handling methods throw checked Expections which will need to be handled
- Use a finally block to clean up any resources that the application may have

ArrayList

- Example of creating an ArrayList

```
List myList = new ArrayList();
```

- Example List methods

http://java.sun.com/j2se/1.5.0/docs/api/java/util/ArrayList.html

add(Object element)

get(int index)

contains(Object element)

indexOf(Object element)

size()

ArrayList example

```
import java.util.*;

public class ArrayListExample1 {

    public static void main(String[] args) {

        List theChildren = new ArrayList();

        theChildren.add("Jon");
        theChildren.add("Jane");

        System.out.println("number of children: " + theChildren.size());
        System.out.println("First item: " + theChildren.get(0));
        System.out.println("Second item: " + theChildren.get(1));
    }
}
```

Problems with collections so far

- In Java 1.4.2 (and before) List entries are of class Object which means that there is no compile time check for what is added to a Collection
- Type checking was the responsibility of the programmer.
- Not very nice …
    1. Prone to mistakes
    2. Casting produces ugly code

Problems with collections so far

- Collections as described so far worked without compile warnings Java 1.4.2 but not for Java 5
- Against theArguments.add(i); in Java 5 (and later releases) is the warning:

  Type safety: The method add(object) belongs to the raw type List. References to Generic type List<E> should be parameterised.

- You'll probably encounter these warnings in the next Exercise

Java 5 and Generics

- Java 5 introduces Generics

  http://java.sun.com/j2se/1.5/pdf/generics-tutorial.pdf

```
// Before Java 5 ArrayLists entries are Objects
    List theArguments = new ArrayList();

// In Java 5 it is possible to define the class of entries eg String
    List <String> theArguments = new ArrayList <String> ();
```

Exercise 2

- Modify the CommandLine program to store the arguments in a ArrayList
- Query this array list to see if it contains a specific value

Supplementary Materials

Java Native Interface (JNI)

http://java.sun.com/j2se/1.5.0/docs/guide/jni/

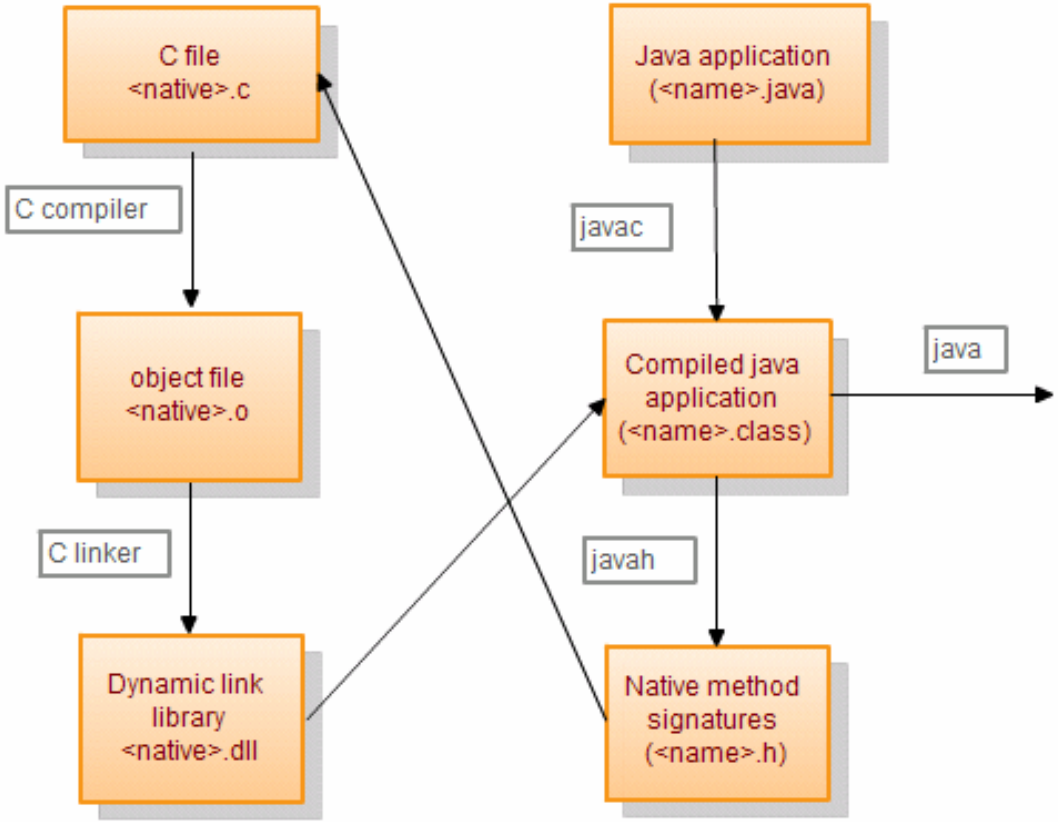
- Call Java code from native code
- Call native code (C, Cobol, Fortran, assembler, …) from Java. This may be needed where :
  - The Java class library doesn't support platform-dependent features
  - The code required already exists and was written in a different language
  - Requirements demand a bespoke implementation in assembly for example

Call Java code from native code

- JNI code from the Java launcher

```
...
/* Create Java VM */
res = JNI_CreateJavaVM(&jvm, (void**)&env, &vm_args);
...
cls = (*env)->FindClass(env, classname);
...
mid = (*env)->GetStaticMethodID(env, cls, methodname, methodsig);
...
(*env)->CallStaticVoidMethod(env, cls, mid);
...
/* Destroy JVM */
(*jvm)->DestroyJavaVM(jvm);
```

Call native code from java code



The Java Application

```
/*
 * ================================================================================
 * Licensed Materials - Property of IBM
 * "Restricted Materials of IBM"
 *
 * IBM SDK, Java(tm) 2 Technology Edition, v1.4.2
 * (C) Copyright IBM Corp. 1998, 2002. All Rights Reserved
 * ================================================================================
 */

public class  HelloSanJose
{
    public static native void  SayHello();

    public static void main (String[] args) {
        System.loadLibrary("HelloSanJose");
        SayHello();
    }
}
```

The <native>.h file


```
/* DO NOT EDIT THIS FILE - it is machine generated */
#include <jni.h>
/* Header for class HelloSanJose */

#ifndef _Included_HelloSanJose
#define _Included_HelloSanJose
#ifdef __cplusplus
extern "C" {
#endif
/*
 * Class:     HelloSanJose
 * Method:    SayHello
 * Signature: ()V
 */
JNIEXPORT void JNICALL Java_HelloSanJose_SayHello
  (JNIEnv *, jclass);

#ifdef __cplusplus
}
#endif
#endif
```

The native method implementation

```
#include <stdio.h>
#include <stdlib.h>
#include <jni.h>
#include <string.h>
#include <stdlib.h>

JNIEXPORT void JNICALL Java_HelloSanJose_SayHello
  (JNIEnv *env, jclass obj, jstring jstr) {

  printf("\n\nHi San Jose\n\n");

}
```

The build script

```
rm *.h *.o *.so *.x *.class

javac HelloSanJose.java

javah -jni  HelloSanJose

c++ -c -o HelloSanJose.o -W c,xplink,dll -W c,exportall -W "c,langlvl(extended)"
 -W"c,float(ieee)" -I/u/java9/J1.4/include -I. HelloSanJose.c

c++ -o libHelloSanJose.so -W l,xplink,dll  HelloSanJose.o
```

Run the application …

```
/u/flavell/Tests/JNISanJose:>java  -classpath ./SanJ HelloSanJose



Hi San Jose


/u/flavell/Tests/JNISanJose:>
```

Remote debugging

- In this exercise an application running on a z/OS box will be debugged from Eclipse running on a windows box
- The application consists of a loop which allocates a chunk of storage and writes a message to stdout, to confirm that the application is running on z/OS, on each iteration
- The exercise consists of 2 parts:
  - starting the application on a remote machine (z/OS)
  - debugging the application from Eclipse

The Application

```
package eclipseLab;

import  eclipseLab.RemoteMemGrab;

public class RemoteRunIt {
    public static void main(String[]
    args) {
        int i=0;
        System.out.println("Exercise 3");
        while (i++ < 3) {
            RemoteMemGrab aGrab =
    new
    RemoteMemGrab();
        }
    }
}
```

```
package eclipseLab;

public class RemoteMemGrab {
    public RemoteMemGrab()
    {
        System.out.println("About to
    allocate a        StringBuffer");
        StringBuffer buf= new
              StringBuffer(10000);
    }
}
```

On the remote machine

- The files and directory structure on z/OS

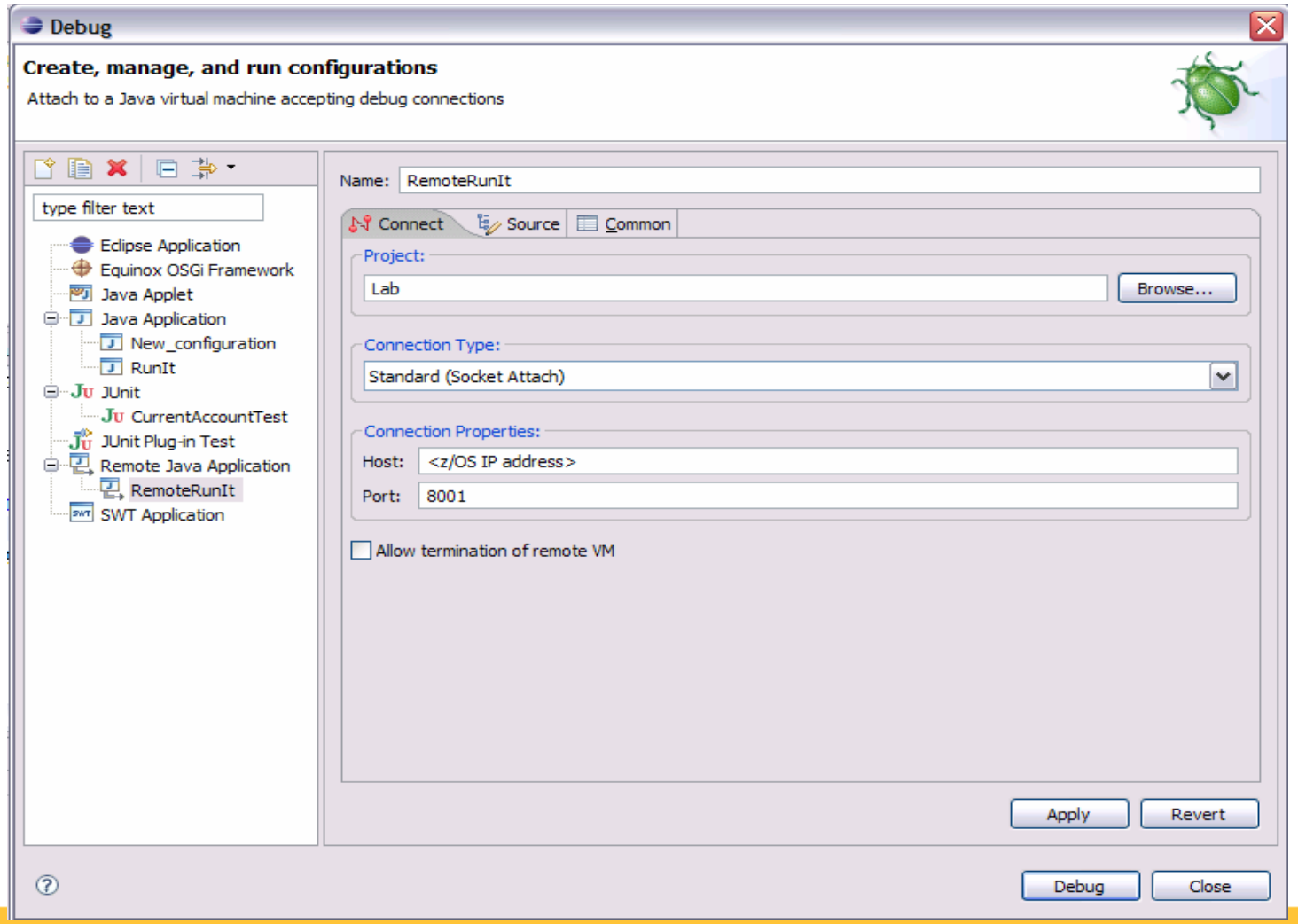
```
total 56
drwx------   3 FLAVELL  JAVA        8192 Aug  6 02:02 .
drwxrwx---  25 FLAVELL  JAVA        8192 Aug  6 01:57 ..
drwx------   2 FLAVELL  JAVA        8192 Aug  6 02:51 eclipseLab
-rwx------   1 FLAVELL  JAVA         163 Aug  6 02:56 runMeRemote

./eclipseLab:
total 64
drwx------   2 FLAVELL  JAVA        8192 Aug  6 02:51 .
drwx------   3 FLAVELL  JAVA        8192 Aug  6 02:02 ..
-rw-------   1 FLAVELL  JAVA         574 Aug  6 03:02 RemoteMemGrab.class
-rw-r-----   1 FLAVELL  JAVA         201 Aug  6 02:29 RemoteMemGrab.java
-rw-------   1 FLAVELL  JAVA         686 Aug  6 03:02 RemoteRunIt.class
-rw-r-----   1 FLAVELL  JAVA         246 Aug  6 03:09 RemoteRunIt.java
/u/flavell/Tests/JAVATests/RemoteTest:>
```

- run runMeRemote which starts RemoteRunIt suspended waiting on debug instructions on port 8001

```
javac -g eclipseLab/Remote*.java
java -Xdebug -Xnoagent -Djava.compiler=NONE  -Xrunjdwp:transport=dt_socket,addre
ss=8001,suspend=y,server=y eclipseLab.RemoteRunIt
```

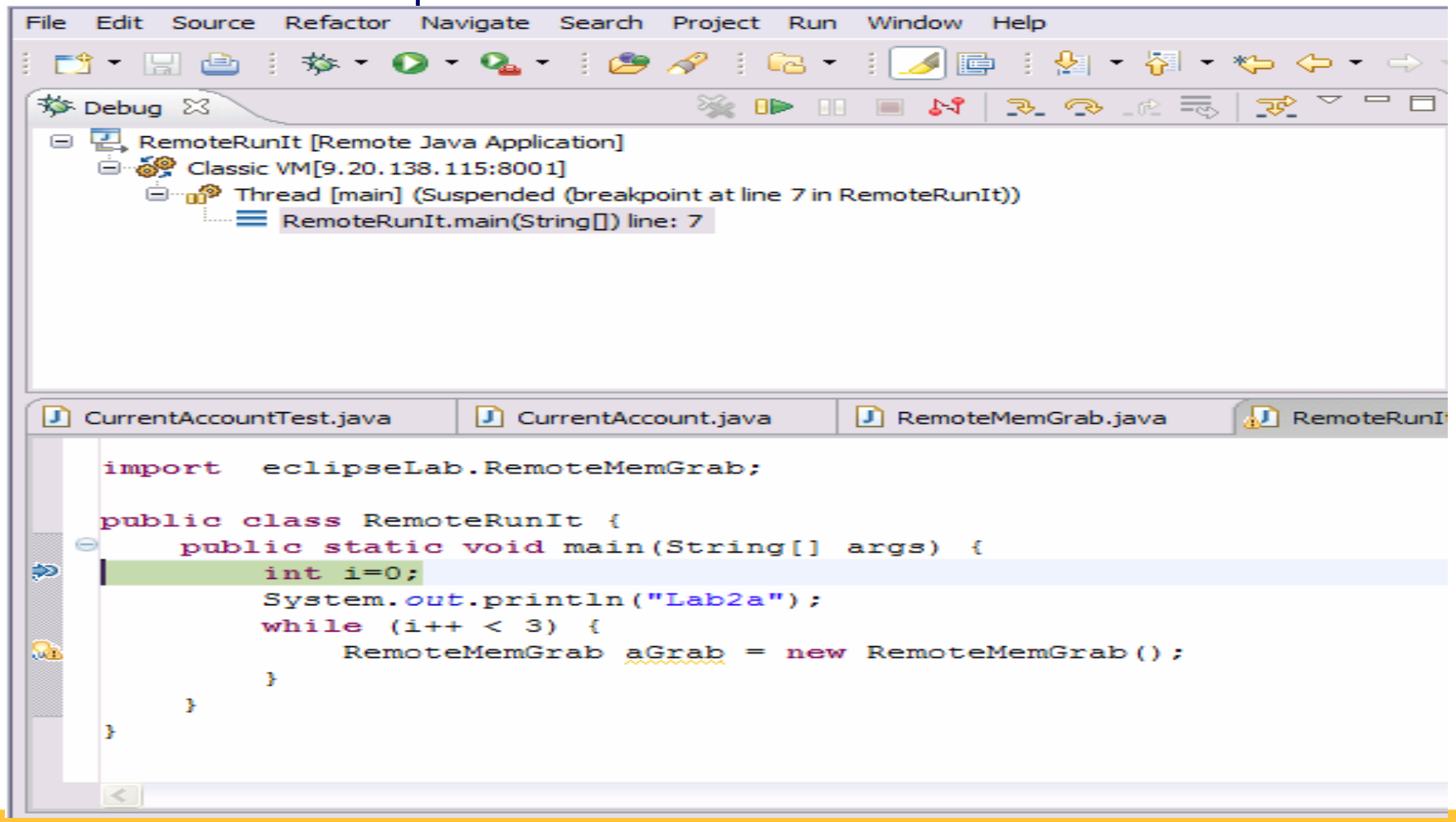
In Eclipse

- Select Run > Debug , enter the following settings and select Debug

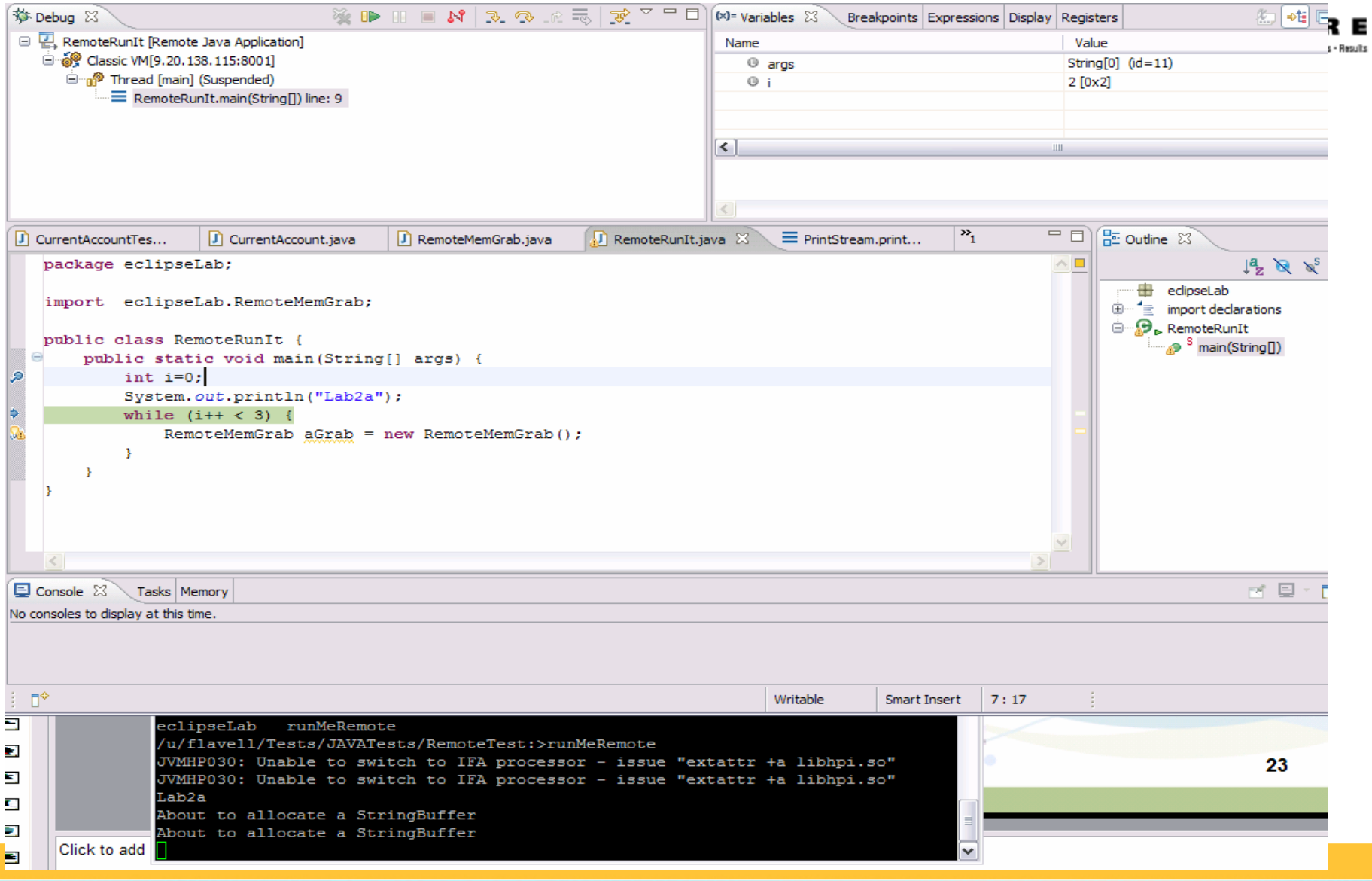


In Eclipse

- A breakpoint was set at the start of the main method and execution is suspended here.



An in flight snapshot



Java (Class) API

- As well as the Virtual Machine the Java sdk contains a class library
  - http://java.sun.com/j2se/1.5.0/docs/api/index.html
  - http://java.sun.com/j2se/1.4.2/docs/api/index.html
  - http://java.sun.com/javase/6/docs/api/index.html
- Java applications are written to this API
- Exercise 1 uses the I/O API available in the java.io package.
  - http://java.sun.com/j2se/1.4.2/docs/api/java/io/package-tree.html

Java (Class) API

The main Java packages are:

java.awt **Contains all of the classes for creating user interfaces and for painting graphics and images.**

java.io Provides for system input and output through data streams, serialization and the file system.

java.lang Provides classes that are fundamental to the design of the Java programming language.

java.net Provides the classes for implementing networking applications.

java.security Provides the classes and interfaces for the security framework.

java.util Contains the collections framework, legacy collection classes, event model, date and time facilities, internationalization, and miscellaneous utility classes.

The Collections API

http://java.sun.com/j2se/1.5.0/docs/api/index.html

- A Collection is an object that groups multiple elements into a single unit.
- Collections are used to store, retrieve, manipulate, and communicate aggregate data.

		Implementations				
		Hash Table	Resizable Array	Balanced Tree	Linked List	Hash Table + Linked List
Interfaces	Set	HashSet		TreeSet		LinkedHashSet
	List		ArrayList		LinkedList	
	Map	HashMap		TreeMap		LinkedHashMap

Thank You!

The Future Runs on System z