Doing GUI Programming with NetRexx on VM/ESA

Session M65

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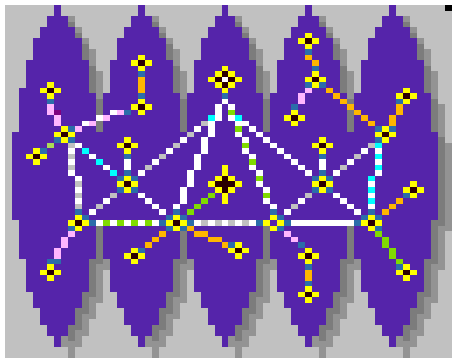

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Agenda

- **An Introduction to Java and NetRexx**
- **Java support on VM/ESA**
- **The Remote Abstract Windowing Toolkit**
- **Abstract Windowing Toolkit Examples**
- **Comparison to other Graphical User Interfaces on VM/ESA**

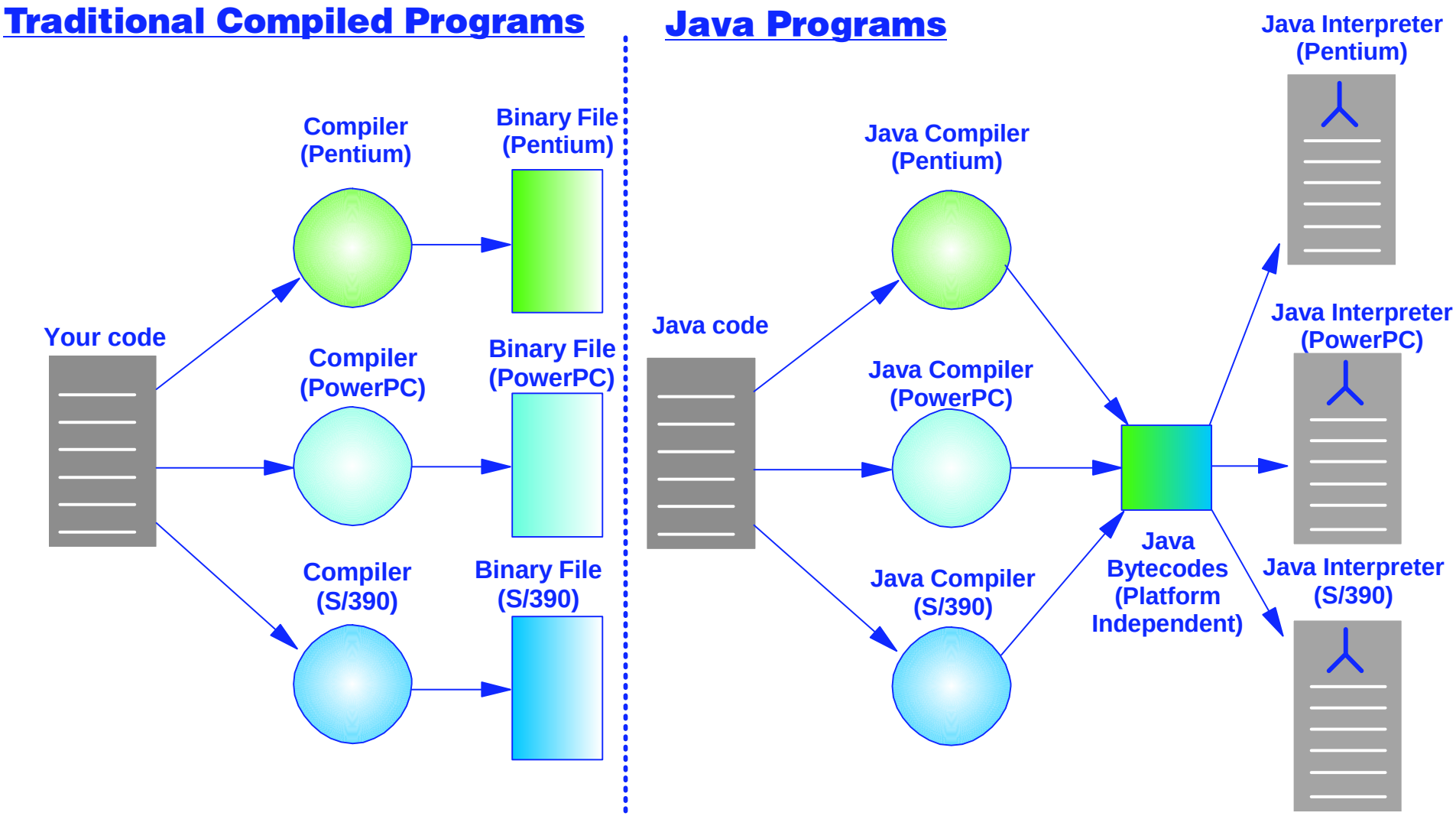
The Java Language

- **A simpler, safer dialect of C and C++ with things that are complex, dangerous, or error-prone eliminated**
  - No preprocessor, pointers, operator overloading, etc.
- **Object oriented with a rich set of classes**
  - Supports single inheritance
  - Networking, Threading, Windowing ...
- **Java compiler does extensive checking**
- **Write once, run anywhere philosophy**

The Java Virtual Machine

- **A software microprocessor with its own instruction set**
- **The JVM interprets bytecodes produced by the Java compiler**
  - Architecture independent
- **The JVM performs run time checking**
  - Type and bounds checking
  - File I/O errors, exceptions
- **Just-in-time (JIT) compilation may improve efficiency**

The Java Virtual Machine Concept

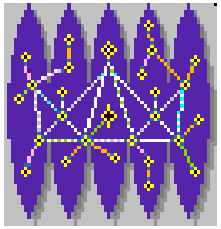


The Java Developer's Kit

- Packages (class libraries)
  - Common to every implementation
  - Java source included
    - java.lang, java.util, java.math, java.text [strings, numbers, date/time...]
    - java.io, java.net [file and network I/O]
    - java.awt [abstract window toolkit], java.applet [animation, audio]
    - java.security [public keys, cryptography]
    - java.sql [database], java.rmi [remote methods]
    - java.beans [library of pluggable components]
- Programs
  - javac — Compiles Java source into bytecodes
  - java — Invokes the JVM to run a compiled application
  - appletviewer — Previews a compiled applet
  - javadoc — Extracts interface documentation from source
  - javah — Generates C skeletons for native methods
  - javap — Disassembles Java class files
  - jdb — Runs the Java debugger
- Samples and demos to illustrate usage

The NetRexx Lineage

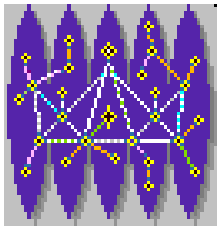
- Rexx is easy to use for scripting
  - Simple, readable syntax
  - Natural data typing
  - Decimal arithmetic
  - Safe for interpretation
- Java is robust for application development
  - Object oriented
  - Strong or static typing
  - Compilable
  - Portable



- NetRexx is a blend of Rexx and Java
  - Developed by IBM Fellow Mike Cowlishaw
  - Rexx syntax + Java object model
  - Rexx ease of use + Java portability
  - Automated type selection and declaration
  - High productivity and simplicity for users
  - A truly general-purpose language
  - "Designed for users, not compilers"
  - Available on web (see Appendix)

Interoperability with Java

- **NetRexx source translated to Java source code**
  - The translator is itself a Java program
  - Portable class files are assured
  - Built-in or external Java compiler may be used
  - Runs wherever there is a JVM
- **Any class written in Java can be used from NetRexx**
  - Type conversions are generally automatic
- **Any class written in NetRexx can be used from Java**



NetRexx Illustrative Examples

JAVA

```
HelloWorld.java
  public class HelloWorld {
    public static void main(String[ ] args {
    System.out.println("Hello World!");
    }
  }
```

NETREXX

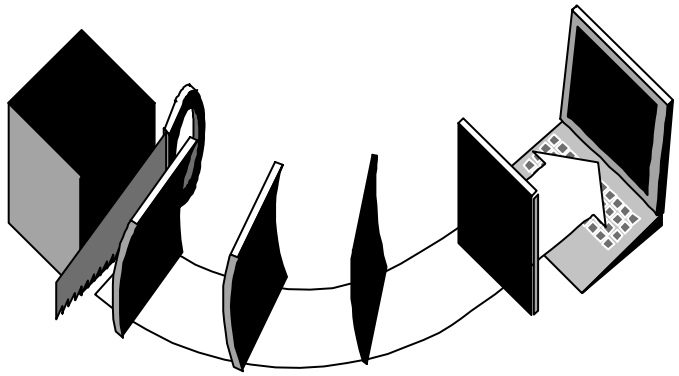
```
Toast.nrx
  /* This wishes you good health. */
  say "Cheers!"
```

Java & NetRexx on VM/ESA

- **Requires VM/ESA V2R3.0+**
  - Byte File System
  - OpenEdition Shell and Utilities
- **Java/NetRexx download instructions are at:**
  - http://www.ibm.com/s390/vm/java/
- **Available today via FTP**
  - NetRexx 1.160
  - The Java Compiler
  - The Java Debugger
  - The Java Virtual Machine
  - The Sun Microsystems' JDK 1.1.6 class libraries
    - Year 2000 ready
  - The Java Native Interface (JNI)
  - A Just-In-Time compiler (JIT)
  - Remote Abstract Windowing Toolkit (RAWT)
-

Remote Abstract Windowing Toolkit

- **What is it?**
  - Implementation of all AWT APIs In a client/server fashion transparent to Java application
    - Graphics services carried out on remote workstation
  - Allows the running of graphic Java applications on a powerful host that does not support graphics
  - No modifications required to graphics application
- **Requirements:**
  - TCP/IP on host and workstation
  - JDK 1.1.x on host and workstation
  - Workstation with graphics support



Installing the Remote AWT

- **RAWT host code is preinstalled with JDK 1.1.6 for VM/ESA**
  - Class files located in $JAVA_HOME/lib/RAWTApplHost.zip
  - See $JAVA_HOME/RAWT-readme.html for further info
- **Obtain workstation code from same location:**
  - Unzip or tar the workstation code following instructions in RAWT-readme.html

Installing the Remote AWT ....

- **Build host shell script for starting applications**

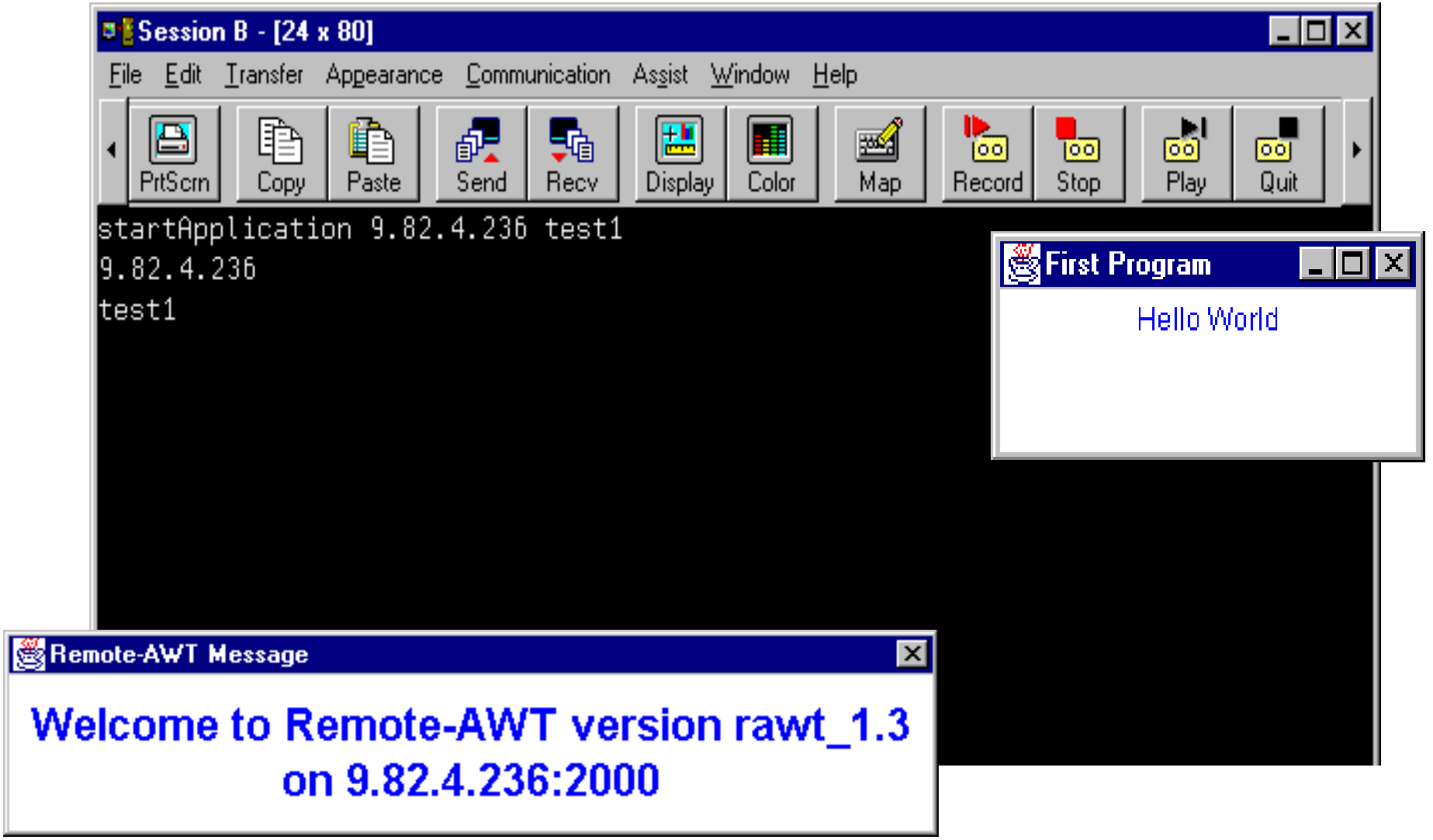
```
#REM  syntax:
#REM  java  <-DJdkVersion=xxxxx>
#REM        -Dawt.toolkit=com.ibm.rawt.client.CToolkit
#REM        -DRmtAwtServer=UserStationHostnameOrIPAddress
#REM        ApplicationName <arguments for ApplicationName>
echo $1
echo $2
export \
CLASSPATH=$JAVA_HOME/lib/RAWTApplHost.zip:$JAVA_HOME/classes:$CLASSPATH
$JAVA_HOME/bin/java -Dawt.toolkit=com.ibm.rawt.client.CToolkit  \
                    -DRmtAwtServer=$1 $2 $3 $4 $5 $6
```

- **chmod +x scriptname to make it executable**
- **On VM host make sure DNS configured in TCPIP DATA or HOST tables available that specify IP address for host name listed in TCPIP DATA**
  - Java networking package insists host be known by name

Using the Remote AWT

- **Start RAWT on the workstation**
  - Windows:
    - set RAWT_HOME=c:\RAWT
    - set PATH=%PATH%;%RAWT_HOME%\bin
    - runRAWT
- **Start Java application on VM/ESA host**
  - From within the shell type:
    - yourScriptName x.x.x.x application_name
    - Where: x.x.x.x is the IP address of the target workstation
    - Where: application_name is the Java class file to start (without specifying the .class extension)
- **Application window will appear on your workstation**
- **Ending application on workstation will end application on host (startApplication will complete, back to shell prompt)**

Remote AWT Example

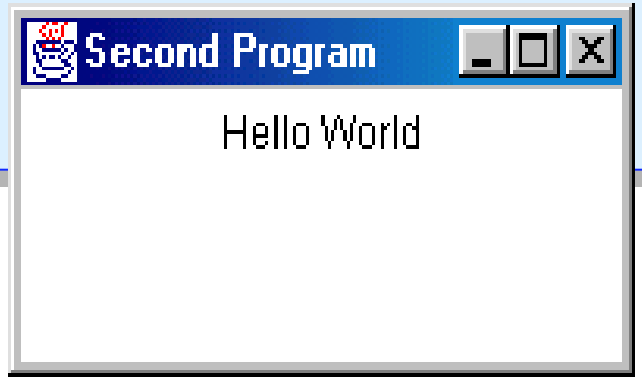


Hello World using AWT

```
 /*Test 1 - Hello World  */
class test1
  Properties inheritable
    window = Frame
  method main( args=String[] ) public static
    test1()  -- Creates an object of the class test1
  method test1() -- Create a frame window
    window = Frame('First Program')
    window.setSize(250,150) -- Set the window size
    window.addWindowListener( CloseWindowAdapter() )
-- Put the text 'Hello World in the center top of window
    window.setLayout(BorderLayout())
    banner = Label( "  Hello World  ",label.center)
    window.add("North",banner)
-- show the window
    window.setVisible(1)
class CloseWindowAdapter extends WindowAdapter
  method windowClosing( e=WindowEvent )
    exit 0
```

Centering the Window

```
 /* Test2 - Center the Window */
class test2
  Properties inheritable
    window = Frame
  method main( args=String[] ) public static
    test2()  -- Creates an object of the class test1 and shows the window
  method test2()  -- Create a frame window
    window = Frame('Second Program')
    window.setSize(250,150)  -- Set the size of the window
-- Set the window position to the middle of the screen
    d = window.getToolkit().getScreenSize()
    s = window.getSize()
    window.setLocation((d.width - s.width) % 2,(d.height - s.height)%2)
-- add the window event listener to the window for close window events
    window.addWindowListener( CloseWindowAdapter() )
    ....
    ....
    ....
```

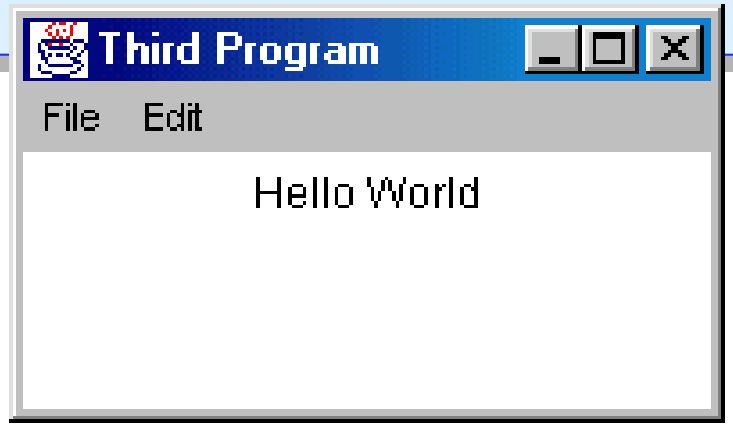


Adding a Menu Bar

```
/* Test3 - Adding a Menu Bar (page 1) */
class test3
  Properties inheritable
    window = Frame
  method main( args=String[] ) public static
    test3()  -- Creates an object of the class test1 and shows the window
  method test3()  -- Create a frame window
    window = Frame('Third Program')
    window.setSize(250,150)  -- Set the size of the window
-- Set the window position to the middle of the screen
    d = window.getToolkit().getScreenSize()
    s = window.getSize()
    window.setLocation((d.width - s.width) % 2,(d.height - s.height)%2)
-- add the window event listener to the window for close window events
    window.addWindowListener( CloseWindowAdapter() )
-- Put the text 'Hello World in the center top of window
    window.setLayout(BorderLayout())
    banner = Label( "  Hello World  ",label.center)
    window.add("North",banner)
    ...
```

Adding a Menu Bar (cont.)

```
/* Test3 - Adding a Menu Bar (page 2)*/
-- add a menu bar to the window
    mb=menuBar()
    mfile=Menu('File')
    medit=Menu('Edit')
    mb.add(mfile)
    mb.add(medit)
    window.setMenuBar(mb)
-- show the window
    window.setVisible(1)
class CloseWindowAdapter extends WindowAdapter
  method windowClosing( e=WindowEvent )
    exit 0
```

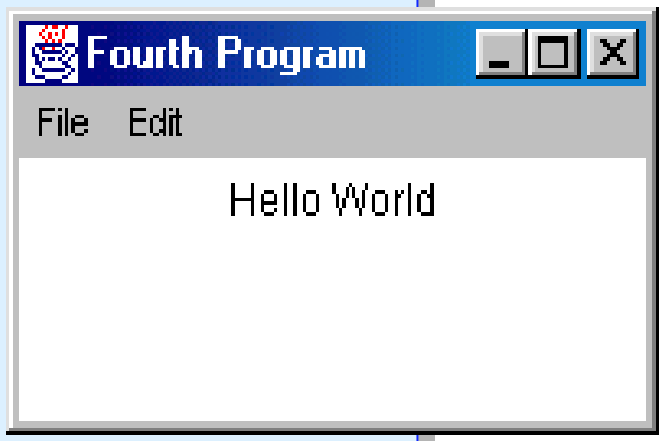


Adding Menu Items

```
/* Test4 - Adding Menu Items (Page 1) */
class test4
  Properties inheritable
    window = Frame
    mopen=MenuItem('Open')
    msave=MenuItem('Save')
    mcopy=MenuItem('Copy')
    mpaste=MenuItem('Paste')
    mexit=MenuItem('Exit')
  method main( args=String[] ) public static
    test4()  -- Creates an object of the class test1 and shows the window
  method test4()  -- Create a frame window
    window = Frame('Fourth Program')
    window.setSize(250,150)  -- Set the size of the window
-- Set the window position to the middle of the screen
    d = window.getToolkit().getScreenSize()
    s = window.getSize()
    window.setLocation((d.width - s.width) % 2,(d.height - s.height)%2)
```

Adding Menu Items (cont.)

```
/* Test4 - Adding Menu Items (page 2)*/
-- add the window event listener to the window for close
window events
    window.addWindowListener( CloseWindowAdapter() )
-- Put the text 'Hello World in the center top of window
    window.setLayout(BorderLayout())
    banner = Label( "  Hello World  ",label.center)
    window.add("North",banner)
-- add a menu bar to the window
    mb=menuBar()
    mfile=Menu('File')
    medit=Menu('Edit')
    mfile.add(mopen)
    mfile.add(msave)
    mfile.addSeparator()
    mfile.add(mexit)
    medit.add(mcopy)
    medit.add(mpaste)
    mb.add(mfile)
    mb.add(medit)
    window.setMenuBar(mb)
    ...
```

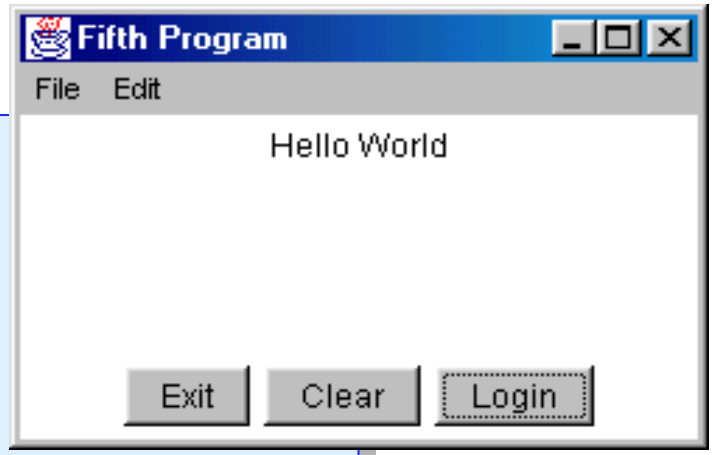


Adding Some Buttons

```
 /* Test5 - Adding some Buttons */
class test5
Properties inheritable
    window = Frame
    mopen=MenuItem('Open')
    msave=MenuItem('Save')
    mcopy=MenuItem('Copy')
    mpaste=MenuItem('Paste')
    mexit=MenuItem('Exit')
    bexit = Button("  Exit  ")
    bclear = Button("  Clear  ")
    blog = Button("  Login  ")
  method main( args=String[] ) public static
....
```

Adding Some Buttons (cont.)

```
....
    window.setMenuBar(mb)
    p1 = Panel()
    p1.add(bexit)
    p1.add(bclear)
    p1.add(blog)
    window.add("South", p1)
-- show the window
    window.setVisible(1)
class CloseWindowAdapter extends WindowAdapter
  method windowClosing( e=WindowEvent )
    exit 0
```

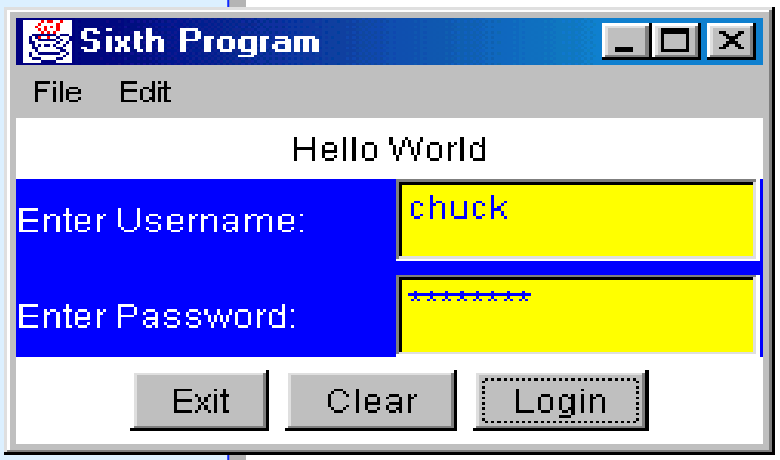


Adding Text Input Fields

```
/* Test6 - Adding Text Input Fields */
class test6
  Properties inheritable
    window = Frame
    mopen=MenuItem('Open')
    msave=MenuItem('Save')
    mcopy=MenuItem('Copy')
    mpaste=MenuItem('Paste')
    mexit=MenuItem('Exit')
    bexit = Button("  Exit  ")
    bclear = Button("  Clear  ")
    blog = Button("  Login  ")
    name = TextField(25)
    pw = TextField(25)
  method main( args=String[] ) public static
....
```

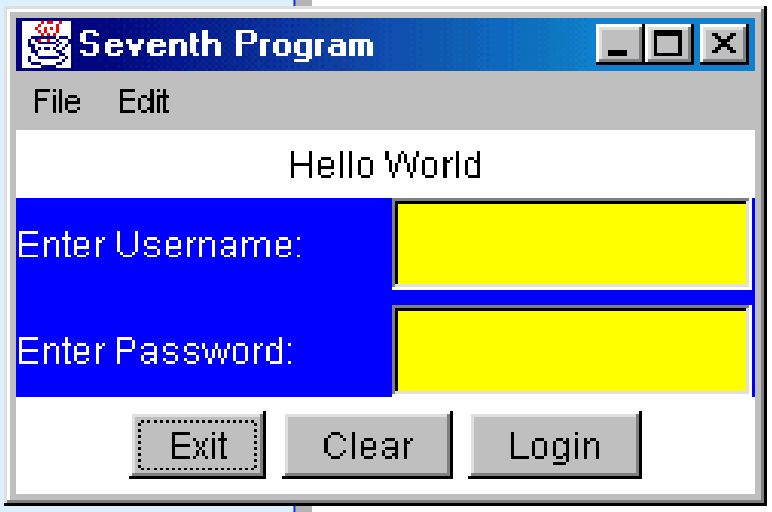
Adding Text Input Fields (cont.)

```
/* Test6 - Adding Text Input Fields (page 2)*/
....
    window.add("South", p1)
    p2 = Panel()
    p2.setLayout(GridLayout(2, 2, 5, 5))
    p2.setBackground(Color.blue)
    p2.SetForeground(Color.white)
    ulabel = Label("Enter Username:")
    plabel = Label("Enter Password:")
    name.setBackground(Color.yellow)
    name.SetForeground(Color.blue)
    pw.setBackground(Color.yellow)
    pw.SetForeground(Color.blue)
    pw.setEchoChar(char "*")
    p2.add(ulabel)
    p2.add(name)
    p2.add(plabel)
    p2.add(pw)
    window.add("Center", p2)
-- show the window
...
```



Making Things Happen

```
/* Test7 - Making things happen  */
class test7 implements ActionListener
....
    window.add("Center", p2)
-- Listen for Action Events
    mexit.addActionListener(this)
    bexit.addActionListener(this)
    bclear.addActionListener(this)
-- show the window
    window.setVisible(1)
method actionPerformed(e = ActionEvent)
    select
      when e.getsource = mexit then exit
      when e.getsource = bexit then exit
      when e.getsource = bclear then do
        name.setText('')
        pw.setText('')
      end
      otherwise nop
    end
class CloseWindowAdapter extends WindowAdapter
  method windowClosing( e=WindowEvent )
    exit 0
```



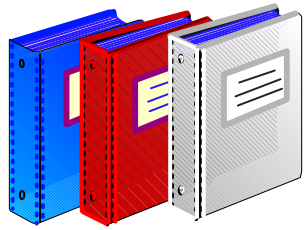
Graphical User Interfaces for Existing VM Applications

- **Screen Scraping Technology**
  - no change to application
  - normally must tailor screen scraper to the application
  - application dependent code must reside on each workstation
- **Web Technology**
  - No change to application
  - Easy to interface to existing applications using familiar CMS tools (Pipelines & Rexx)
  - Industry standard workstation agent (Web Browsers)
  - Easy to build new applications as well

Graphical User Interfaces for New VM Applications

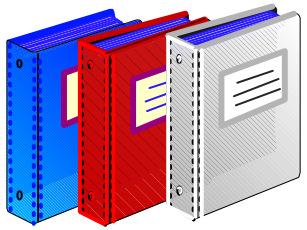
- **CMS GUI**
  - For new applications in C, C++, Rexx or Assembler
  - Common workstation agent on Windows, AIX or OS/2
    - No application dependent code on workstation
  - Communication via TCP/IP or APPC (Win 3.1 or OS/2 only)
  - High degree of difficulty
    - No GUI builder
- **Remote AWT with Java or NetRexx**
  - For new applications in Java or NetRexx
  - Allows porting of existing Java or NetRexx applications
  - Common workstation agent on any platform that supports JAVA
    - No application dependent code on workstation
  - Communication via TCP/IP
  - Several existing Java GUI builders
  - NetRexx makes coding GUI applications easy
  - High application startup costs
    - requires OpenEdition & BFS

Sources of Additional Information on the Web



- **IBM Centre for Java Technology Development**
  - http://ncc.hursley.ibm.com/javainfo/
    - Current information on Java-related activities
    - Downloadable code packages and links to other sites
- **Mike Cowlishaw's NetRexx Language page**
  - http://www2.hursley.ibm.com/netrexx/
    - Latest NetRexx documentation and status
    - Downloadable code packages and links to other sites
- **IBM's Redbook page: http://www.redbooks.ibm.com**
  - *Creating Java Applications Using NetRexx*, SG24-2216-00
  - *VM/ESA Network Computing with Java and NetRexx*, SG24-5148-00
- IBM's Java page: **http://www.ibm.com/java**
- Sun's Java page: **http://www.javasoft.com**
- The VM Java page: **http://www.vm.ibm.com/java**

Sources of Additional Information in Print



- **Mike Cowlishaw, *The NetRexx Language***
  - ISBN 0-13-806332-X, or IBM Puborder SR23-7771
- **Ken Arnold and James Gosling, *The Java Programming Language***
  - ISBN 0-201-63455-4
- **David Flanagan, *Java in a Nutshell***
  - ISBN 1-56592-183-6
- **Peter van der Linden, *Just Java***
  - ISBN 0-13-565839-X
- **J. Savit, S. Wilcox, B. Jayaraman, *Enterprise Java***
  - ISBN 0-07-057991-1