Practical Experiences about COBOL Programming. Make SOA Possible in batch COBOL

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Aug 7, 2014

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Title: Practical experiences about COBOL programming. Make SOA possible in COBOL

- Introduction
- Invoking web services in IMS, CICS and WAS
- ‘Calling’ Java from COBOL
- Example from COBOL Programming Guide
- Our ‘simple’ solution
- Recommended approach
- Hints and tips

Title: Practical experiences about COBOL programming. Make SOA possible in COBOL

- Many applications are being rewritten as Web Services
- New applications are often written as Web Services
- These parts can be combined into new applications
- In some cases, 'old' applications need to use these new forms of applications
  - Invoke a web service anywhere instead of just calling a sub program in my z/OS region!
- Some solutions are available….

IMS Enterprise Suite SOAP Gateway

- IBM® IMS™ Enterprise Suite SOAP Gateway is an XML-based solution that enables your IBM IMS applications to communicate outside the IMS environment using SOAP, without requiring changes to your business logic. The solution helps you modernize and gain more value from your IMS assets, and is available at no cost.
- IMS Enterprise Suite SOAP Gateway provides these features and benefits:
  - IMS applications can provide and request web services regardless of platform, environment, application language or programming model.
  - Client applications, such as Microsoft .NET and Java, can submit SOAP requests into IMS to drive the business logic of your COBOL or PL/I applications.
  - IMS applications can send business event data to business event processing and monitoring engines such as IBM WebSphere® Business Events and IBM Business Monitor.

CICS Transaction Gateway

- IBM® CICS Transaction Gateway (CICS TG), a market-leading Enterprise connector, is production proven by over a thousand customers as a high performing, security-rich, and scalable method of service-oriented architecture (SOA) access to CICS, which:
  - Delivers Java Enterprise Edition (JEE) standards-based access to CICS applications, while requiring minimal changes to CICS and usually no changes to existing CICS applications
  - Provides quick and easy connector access to CICS applications from a wide variety of environments, including Java, C/C++, Microsoft .NET, and COBOL run times
  - Allows the reuse of existing CICS applications as services in comprehensive and sophisticated JEE and web services solutions hosted on powerful application servers such as WebSphere Application Server

WebSphere Application Server for z/OS

- IBM® WebSphere® Application Server for z/OS® helps provide availability and security while reducing costs for business critical applications. It uses the full capabilities of IBM System z® and IBM z/OS and enables: prioritized workload management, advanced transactional integrity, horizontal and vertical scalability and data and workload co-location.
- WebSphere Application Server for z/OS helps you:
  - **Optimize developer productivity** and provide continuous availability using System z features and Liberty profile, a streamlined runtime environment for web application deployments.
  - **Deploy and manage applications and services** to meet the demands of your growing business.
  - **Improve operations and resiliency** through advanced application availability, elasticity and quality of service.
  - **Provide rapid, scalable and secure enablement of web, cloud and mobile access to z/OS assets using IBM WebSphere Liberty z/OS Connect.**
  - **Enhance security and control** using integrated management and administrative tools.

What about z/OS batch?

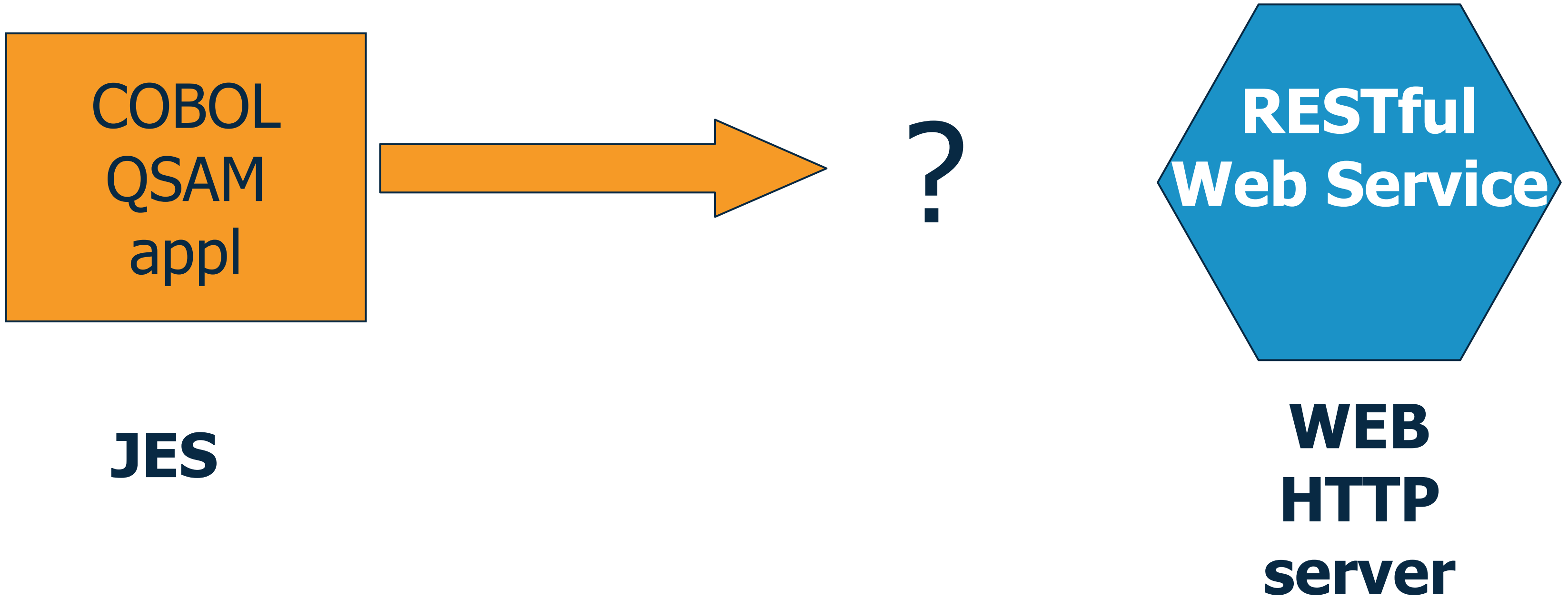
- Typically no J2EE server available
- Java can still do SOME things more easily than COBOL can

  ☺

- HTTP calls!
- But my batch programs are COBOL!
- ‘Call’ Java from batch COBOL on z/OS?’

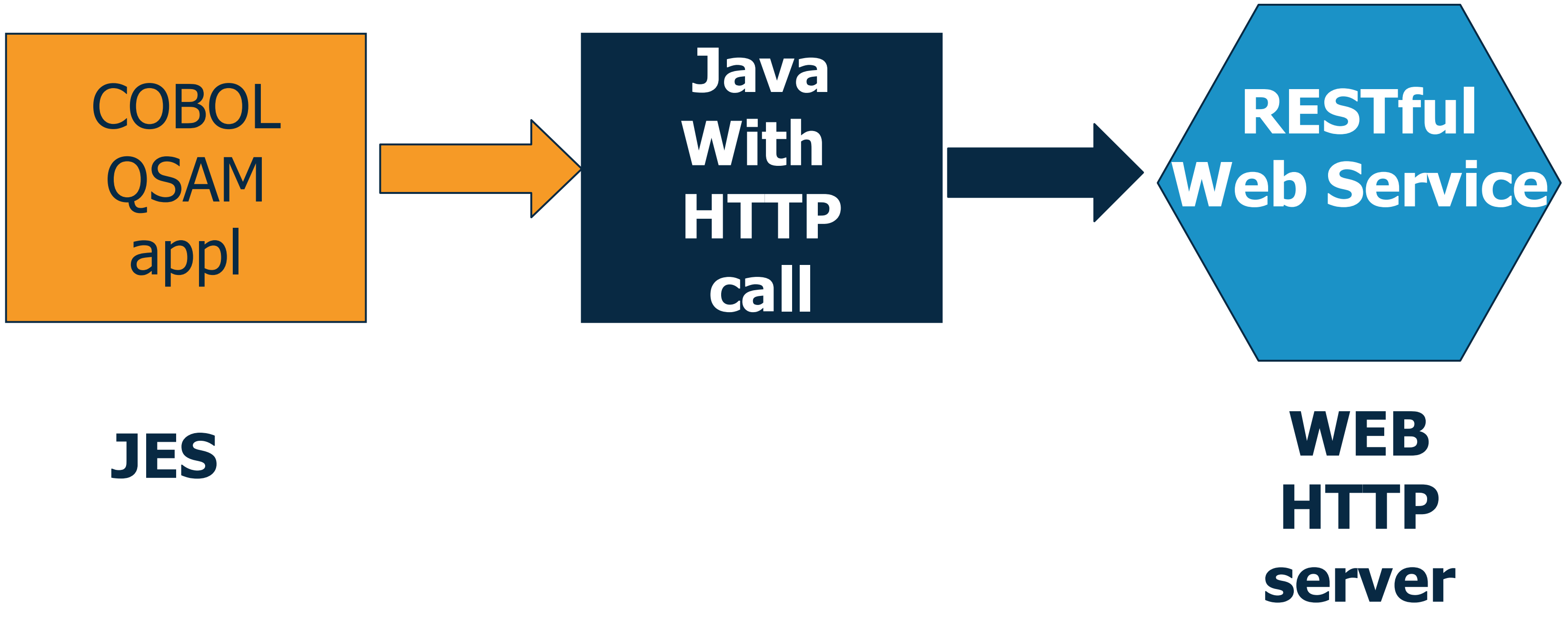
What about z/OS batch?

- What we wanted to do:



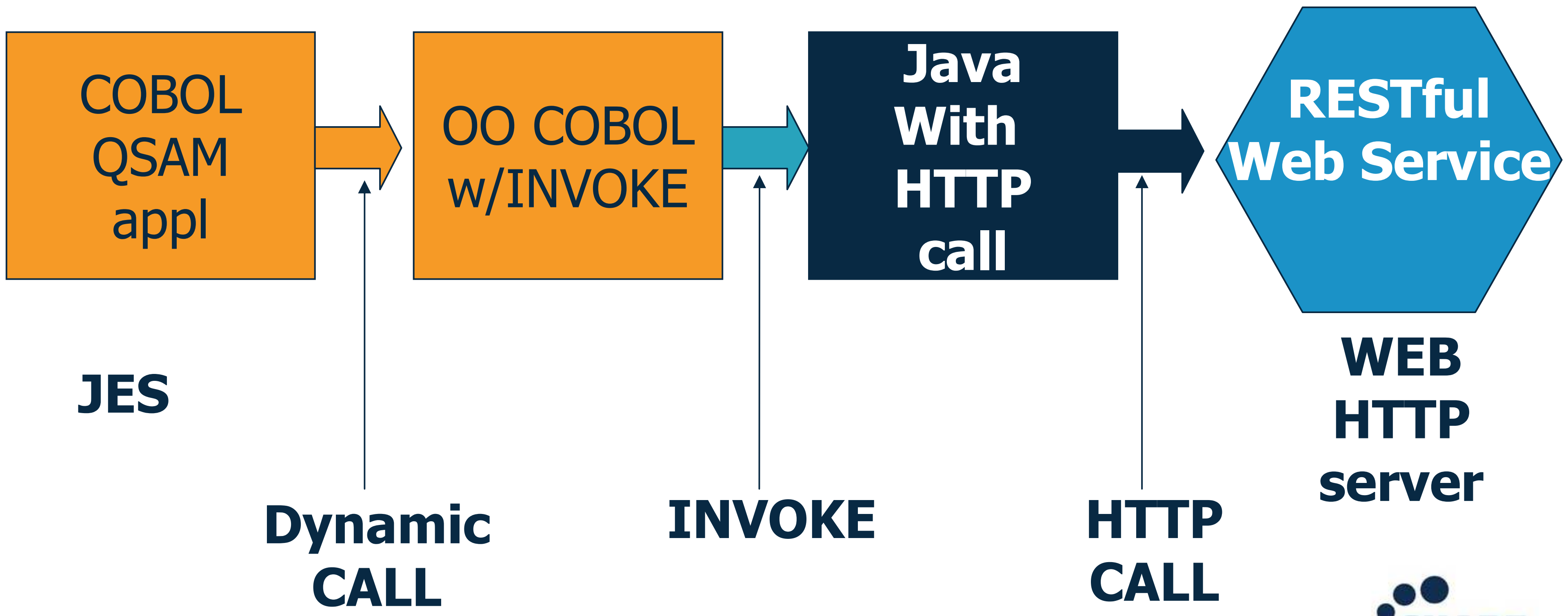
What about z/OS batch?

- What we tried to do:



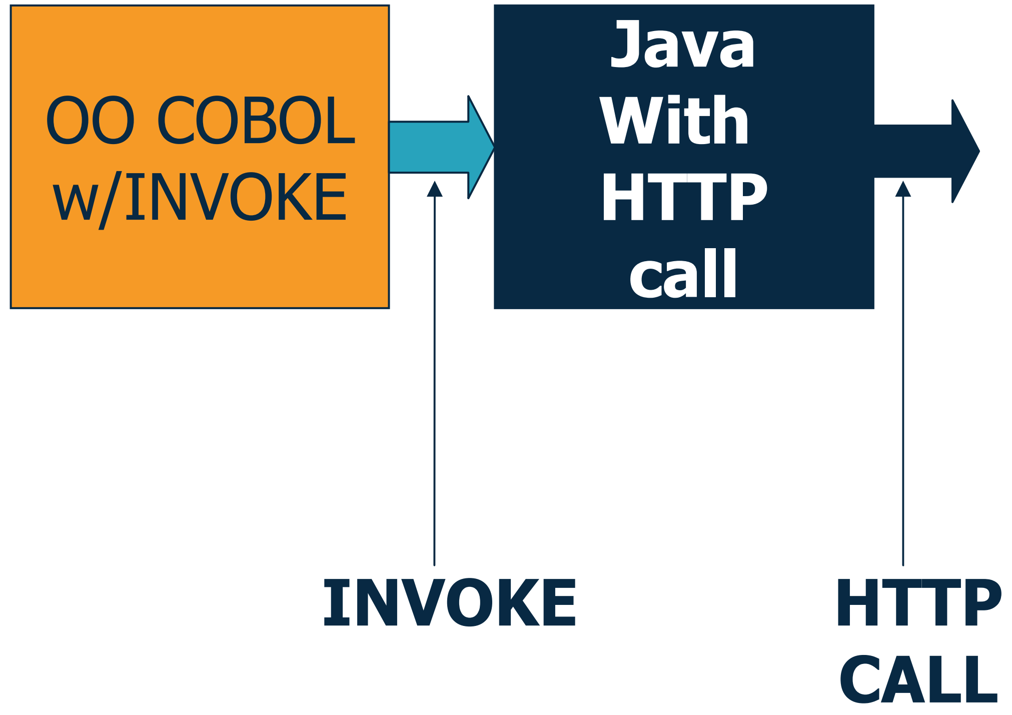
What about z/OS batch?

- More detail about what we tried to do:



What about z/OS batch?

- This presentation will focus on these parts



‘Calling’ Java from COBOL

- Change the mindset
  - No programs in Java, no CALLs
  - You CAN Invoke a **Method** in a **Java class**
- Let’s start with the example in COBOL Programming Guide!
- Chapter 16, TSTHELLO example in section: **Example: compiling, linking, and running an OO application using JCL**
- Well, I thought it would be easy…

Problems found in PG example

- Copying text from .pdf to ISPF EDIT gave me non-editable chars for apostrophes
  - Or the apostrophes did not get copied in at all
- Executable (SYSLMOD) could not be in temp dataset!
- Bad format of run-time options
- Wrong attribute on STEPLIB
- Extraneous comma in JAVAOUT DD
- Invalid indentation for JAVAERR DD
- Missing .: in ENV file

Problems found in PG example

- Executable (SYSLMOD) could not be in temp dataset

```
//SYSLMOD DD
   DSN=&&GOSET(TSTHELLO),DISP=(MOD,PASS),UNIT=VIO,
// SPACE=(CYL,(1,1,1)),DSNTYPE=LIBRARY
```

- I could not get this to work with COBOL V5!

Problems found in PG example

This is what I got when I tried temp PDSE load library:

```
$HASP373 TSTHELLO STARTED - WLM INIT  - SRVCLASS PRDBATHI - SYS SA0W
HTRT01I                                 CPU (Total)  Elapsed      CPU
HTRT02I Jobname  Stepname RC    I/O hh:mm:ss.th  hh:mm:ss.th  hh:mm:ss.th
HTRT03I TSTHELLO COMPILE  00   9972       00.05        01.77        00.05
HTRT03I TSTHELLO LKED     00    460       00.02        00.23        00.02
IEW4009I FETCH FAILED FOR MODULE TSTHELLO FROM DDNAME STEPLIB  BECAUSE OF
   AN I/O ERROR.
CSV031I LIBRARY SEARCH FAILED FOR MODULE TSTHELLO, RETURN CODE 24, REASON
   CODE 2706043E, DDNAME STEPLIB
CSV028I ABEND806-2C  JOBNAME=TSTHELLO  STEPNAME=GO
IEA995I SYMPTOM DUMP OUTPUT  938
SYSTEM COMPLETION CODE=806  REASON CODE=0000002C
```

- I changed to a permanent dataset and it worked fine!

Problems found in PG example

- Bad format of run-time options

```
//GO EXEC PGM=TSTHELLO,COND=(4,LT,LKED),
//
   PARM='/ENVAR("_CEE_ENVFILE=/u/userid/ootest/tst
   hello/ENV")
// POSIX(ON)
XPLINK(ON)'
```

- Should be:

```
//GO EXEC PGM=TSTHELLO,COND=(4,LT,LKED),
//
   PARM='/ENVAR("_CEE_ENVFILE=/u/userid/ootest/tst
   hello/ENV")
//          POSIX(ON) XPLINK(ON)'
```

Problems found in PG example

- Wrong attribute on STEPLIB

```
//STEPLIB DD DSN=*.LKED.SYSLMOD,DISP=SHR
```

- Should have been (for temp dataset):

```
//STEPLIB DD DSN=*.LKED.SYSLMOD,DISP=PASS
```

Problems found in PG example

- Missing PATHOPTS for JAVAOUT DD

```
//JAVAOUT DD PATH='/u/userid/ootest/tsthello/javaout',
```

- Should have been:

```
//JAVAOUT DD PATH='/u/userid/ootest/tsthello/javaout',
//           PATHOPTS=(OWRONLY,OCREAT,OTRUNC),
//           PATHMODE=(SIRUSR,SIWUSR,SIRGRP
```

- Result? No println output!

Problems found in PG example

- Invalid indentation for JAVAERR DD

```
//JAVAERR DD PATH='/u/userid/ootest/tsthello/javaerr',
// PATHOPTS=(OWRONLY,OCREAT,OTRUNC),
// PATHMODE=(SIRUSR,SIWUSR,SIRGRP)
```

- Should have been:

```
//JAVAERR DD PATH='/u/userid/ootest/tsthello/javaerr',
//            PATHOPTS=(OWRONLY,OCREAT,OTRUNC),
//            PATHMODE=(SIRUSR,SIWUSR,SIRGRP)
```

Problems found in PG example

Environment variable settings file, ENV

```
PATH=/bin:/usr/lpp/java/J5.0/bin.
LIBPATH=/lib:/usr/lib:/usr/lpp/java/J5.0/bin:/usr
  /lpp/java/J5.0/bin/j9vm
CLASSPATH=/u/userid/ootest/tsthello
```

Should be:

```
CLASSPATH=.:/u/userid/ootest/tsthello
```

Our ‘simple’ solution

- Batch program processing QSAM data
- Needs actuarial information from Internet Web Service
  - In our example, we used a simple system status Web Service instead ☺
- Make DYNAMIC call to COBOL Web Service wrapper
- Web service wrapper uses INVOKE of Java
- Java will make HTTP call to Web Service using Apache
- Return info to Java, then to COBOL wrapper, then to Batch application
- Is it do-able?

Our ‘simple’ solution

- Changes to batch application?
  - Add dynamic CALL to COBOL wrapper
  - Add runtime options:
    - Must run with XPLINK runtime option
    - Must also have ENVAR set

```
//GO EXEC PGM=CALLINVK,COND=(4,LT,LKED),
//
  PARM='/ENVAR("_CEE_ENVFILE=/home/tmross
  /Java/ENVS")
//             POSIX(ON) XPLINK(ON)'
```

- If no pointer to ENV file with LIBPATH to JVM, then:

If no pointer to ENV file with LIBPATH to JVM, then:

```
COBOL program CALLINVK entered
CEE3501S The module libjvm.so was not found.
         From entry point GetJVMPtr at compile
  unit offset
       +000000B2 at entry offset +000000B2 at
  address 26EDF6F2.
CEE3DMP V2 R1.0: Condition processing resulted
  in the unhandled
        condition.              06/02/14 10:06:08 PM
```

Our ‘simple’ solution

COBOL wrapper for getting to Java
First: TSTHELLO example from PG

```
      cbl dll,thread,pgmname(longmixed)
      Identification division.
      Program-id. "TSTHELLO" recursive.  <*
 Upper case name
      Environment Division.
      Configuration Section.
      Repository.                          <* Case
 of class name
          Class HelloJ  is "HelloJ".   <* must
 match class
      Data Division.
      Procedure Division.
          Display "COBOL program TSTHELLO
 entered"
```

Our ‘simple’ solution

COBOL wrapper for getting to Java
First: TSTHELLO example from PG

- This was what we ‘wrapped’: HelloJ.sayHello
- Hello in System.out.println

```
class HelloJ {
    public static void sayHello() {
      System.out.println("Hello World, from
   Java!");
    }
}
```

Our ‘simple’ solution

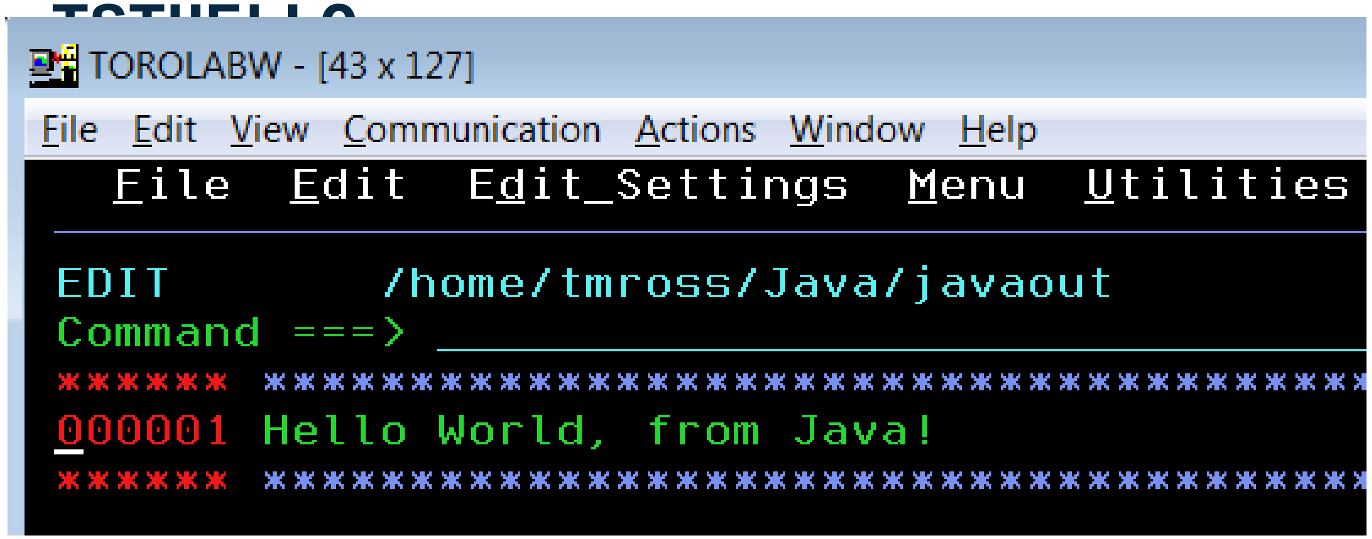
`COBOL wrapper for getting to Java`
`First: TSTHELLO example from PG`

- **Job output:**

```
 **** END OF MESSAGE SUMMARY
REPORT ****

COBOL program TSTHELLO entered
Returned from java sayHello to
TSTHELLO
```

-



```
   File   Edit   Edit_Settings   Menu   Utilities
 EDIT       /home/tmross/Java/javaout
 Command ===> 
 ****** ****************************************
 000001 Hello World, from Java!
 ****** ****************************************
```

Our ‘simple’ solution

COBOL wrapper for getting to Java gradually add more: HelloString

```
cbl dll,thread,pgmname(longmixed)
Program-id. "INVKHSTR" recursive.
Environment Division.
Configuration Section.
Repository.
    Class HelloString is "HelloString"
    Class jstring is "jstring".
Data Division.
Working-Storage Section.
77  Url          Pic X(50) Value
       z'Tom'.
77  jstring1 Object Reference jstring.
77  jstring2 Object Reference jstring.
77  rc           Pic s9(9) Comp-5.
77  ptr          Pointer
```

Our ‘simple’ solution

COBOL wrapper for getting to Java gradually add more: HelloString

```
    Procedure Division.
        Display "COBOL program INVKHSTR
entered"

*****************************************************
***************
 *   Convert string into Java string object

*****************************************************
***************
        Call "NewStringPlatform"
<* Case matters
               using by value JNIEnvPtr
                              address of Url
<* input
                              address of jstring1
<* output
                              0
```

Our ‘simple’ solution

COBOL wrapper for getting to Java gradually add more: HelloString

```
 *****************************************************************
*  Convert Java string object back into string – get length
 *****************************************************************
     Set  ptr To address of jstringlen       <* Get output addr
     Call "GetStringPlatformLength"          <* Case matters
               using by value JNIEnvPtr
                              jstring2       <* input
```

Our ‘simple’ solution

COBOL wrapper for getting to Java
gradually add more: HelloString

```
***********************************************
  **************
*  Convert Java string object back into string
  – get string
***********************************************
  **************
    Call "GetStringPlatform"               <*
  Case matters
                  using by value JNIEnvPtr
                                 jstring2
                                 address of
  Returned_string
                                 length  of
  Returned_string
                                 0
                  returning rc
```

Our ‘simple’ solution
`COBOL wrapper for getting to Java`
`gradually add more: HelloString`

- This is newer version of the Java: HelloString.sayHello
- Hello in println and in return value

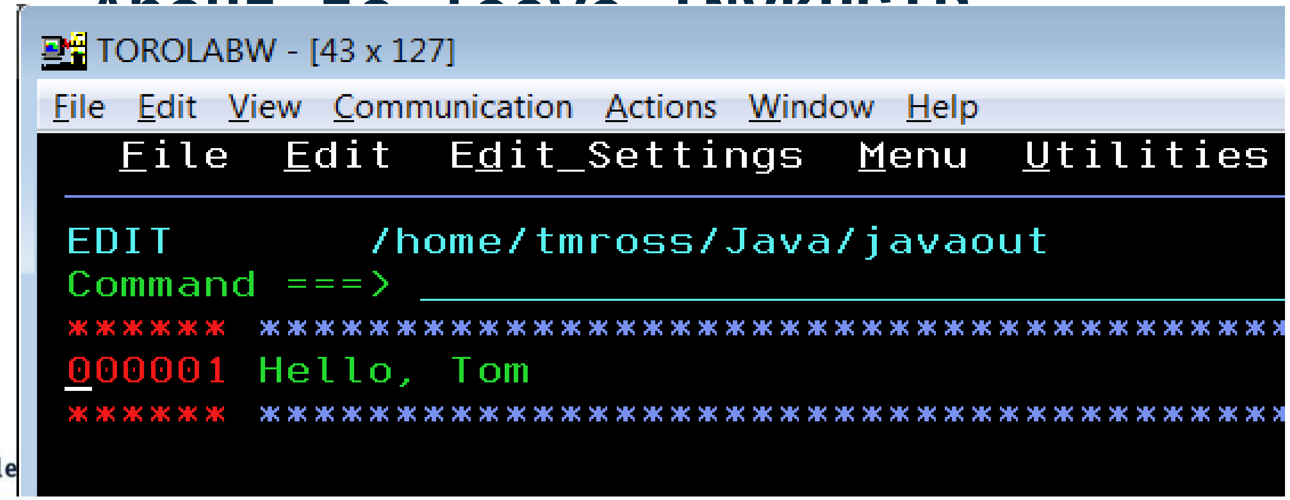
```
class HelloString {
 public static String sayHello(String name) {
  System.out.println("Hello, " + name);
  return "Hello, " + name + " from Java!";
 }
}
```

Our ‘simple’ solution
COBOL wrapper for getting to Java gradually add more: HelloString

- Job output:

```
  **** END OF MESSAGE SUMMARY REPORT ****
 COBOL program INVKHSTR entered
 Returned from java sayHello to INVKHSTR
 Returned from GetStringPlatformLength
 The length of returned string
is:0000000022
 sayHello returned: Hello, Tom from Java!
 About to leave INVKHSTR
```

-


TOROLABW - [43 x 127]
File Edit View Communication Actions Window Help
File Edit Edit_Settings Menu Utilities

```
EDIT       /home/tmross/Java/javaout
Command ===>
****** ****************************************
000001 Hello, Tom
****** ****************************************
```

Debugging JNI calls is hard!

- A parm with no storage usually gets an 0C4, but with JNI services…

```
HTRT01I                                                 CPU (Total)  Elapsed
HTRT02I Jobname  Stepname ProcStep    RC    I/O hh:mm:ss.th  hh:mm:ss.th
JVMDUMP032I JVM requested System dump using 'TMROSS.JVM.TDUMP.INVKREST
.D140519.T182116' in response to an event

IGD101I SMS ALLOCATED TO DDNAME (SYS00007)  925
        DSN (TMROSS.JVM.TDUMP.INVKREST.D140519.T182116   )
        STORCLAS (OS390) MGMTCLAS (STANDARD) DATACLAS (        )
IGD104I TMROSS.JVM.TDUMP.INVKREST.D140519.T182116   RETAINED,  DDNAME=S
JVMDUMP032I JVM requested Java dump using '/home/tmross/javacore.20140
519.182116.33558008.0002.txt' in response to an event

BPXM023I (TMROSS)  929
JVMDUMP032I JVM requested Snap dump using '/home/tmross/Snap.20140519.
182116.33558008.0003.trc' in response to an event

HTRT03I INVKREST GO                     01  48292       01.36       09.49
```

Debugging COBOL to Java is hard!

- What happens when the JVM cannot find your called Java method?
  - For example, incorrect location of Java package in CLASSPATH…
    - .:   comes first in CLASSPATH
    - Name the .jar package, not just the directory
    - If you make a mistake…

```
**** END OF MESSAGE SUMMARY REPORT ****

Exception in thread "main"
*************************** BOTTOM OF DATA ***
```

- And I did not have a main method!

Debugging COBOL to Java is hard!

- Name the .jar package, not just the directory
  - Two things here
    1. '.' For current directory
    2. Directory that contains hello.jar
       - hello.jar contains HelloJ.sayHello and HelloString.sayHello

```
CLASSPATH=.:/home/tmross/Java/hello.jar
```

Our ‘simple’ solution

COBOL wrapper for getting to Java finally add: invokeGETAsXML

- We wrote a Java method invokeGETAsXML
- It makes an HTTP call using Apache
- The HTTP server returns a system status
  - In XML or JSON (we chose XML)
- Pass a url from COBOL to Java for the HTTP server

Our ‘simple’ solution

COBOL wrapper for getting to Java finally add: invokeGETAsXML

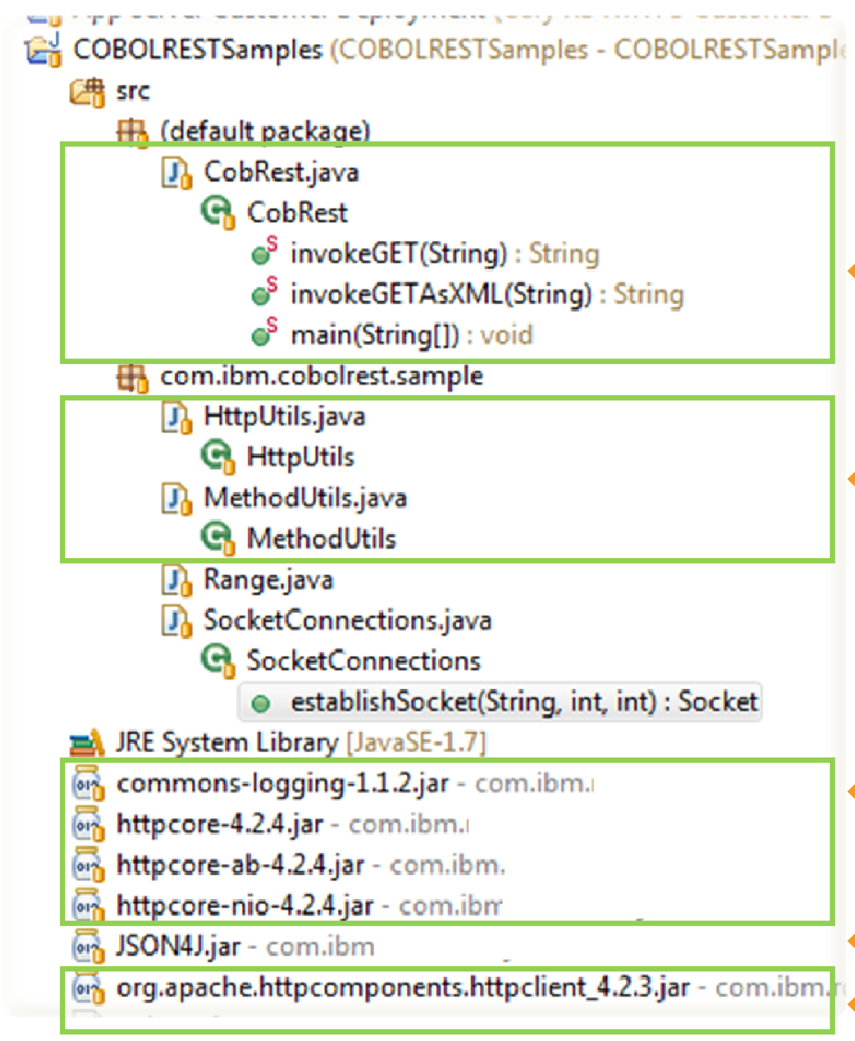
```
77  Url            Pic X(60) Value
 z'http://rdpweb01.ibm.com:7999/ZOS/resserv/status'.



   Invoke CobRest 'invokeGETAsXML'
          using by value jstring1
          returning jstring2
```

Structure of the sample project

Invoke Apache HttpClient from Java on z



```
COBOLRESTSamples (COBOLRESTSamples - COBOLRESTSampl
  src
    (default package)
      CobRest.java
        CobRest
          invokeGET(String) : String
          invokeGETAsXML(String) : String
          main(String[]) : void
    com.ibm.cobolrest.sample
      HttpUtils.java
        HttpUtils
      MethodUtils.java
        MethodUtils
      Range.java
      SocketConnections.java
        SocketConnections
          establishSocket(String, int, int) : Socket
  JRE System Library [JavaSE-1.7]
  commons-logging-1.1.2.jar - com.ibm.
  httpcore-4.2.4.jar - com.ibm.
  httpcore-ab-4.2.4.jar - com.ibm.
  httpcore-nio-4.2.4.jar - com.ibm
  JSON4J.jar - com.ibm
  org.apache.httpcomponents.httpclient_4.2.3.jar - com.ibm.
```

Our sample methods to invoke from COBOL

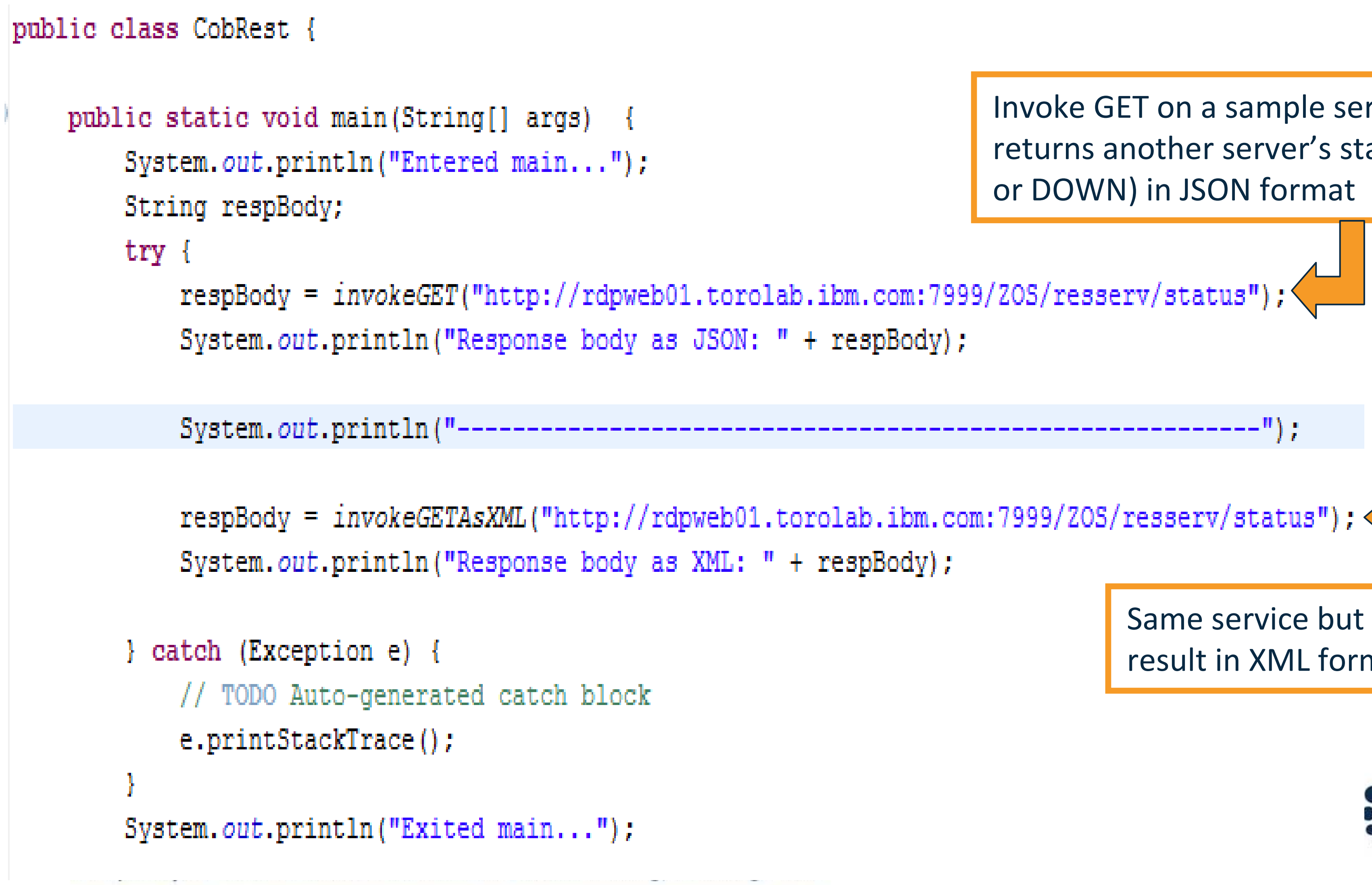
Our sample convenience and utility methods that invoke Apache HttpClient

Apache HttpComponent libraries

IBM JSON4J libraries

More Apache HttpComponent libraries

Simple REST interface



```
public class CobRest {

    public static void main(String[] args)  {
        System.out.println("Entered main...");
        String respBody;
        try {
            respBody = invokeGET("http://rdpweb01.torolab.ibm.com:7999/ZOS/resserv/status");
            System.out.println("Response body as JSON: " + respBody);

            System.out.println("------------------------------------------------------------");

            respBody = invokeGETAsXML("http://rdpweb01.torolab.ibm.com:7999/ZOS/resserv/status");
            System.out.println("Response body as XML: " + respBody);

        } catch (Exception e) {
            // TODO Auto-generated catch block
            e.printStackTrace();
        }
        System.out.println("Exited main...");
```

Invoke GET on a sample service that returns another server’s status (UP or DOWN) in JSON format

Same service but returning result in XML format

What is needed for Java on z/OS? Same as on other platforms!

- File system - HFS / zFS
- Where is Java installed? What level is installed?
- Some handy environment variables
- RDz – Makes Java easier on/for z/OS
- Java Basics
  - To compile – javac
  - To execute the byte code - java

The Environment setup for Java – things to know

- Where is Java Installed?
  - JAVA_HOME=/usr/lpp/java/IBM/J7.0
    export JAVA_HOME

- Where is the Java application executable?
  - CLASSPATH=.:/home/tmross/Cobrest.jar
    export CLASSPATH

- Where are the tool executables?
  - PATH=.:/usr/lpp/java/IBM/J7.0/bin
    export PATH

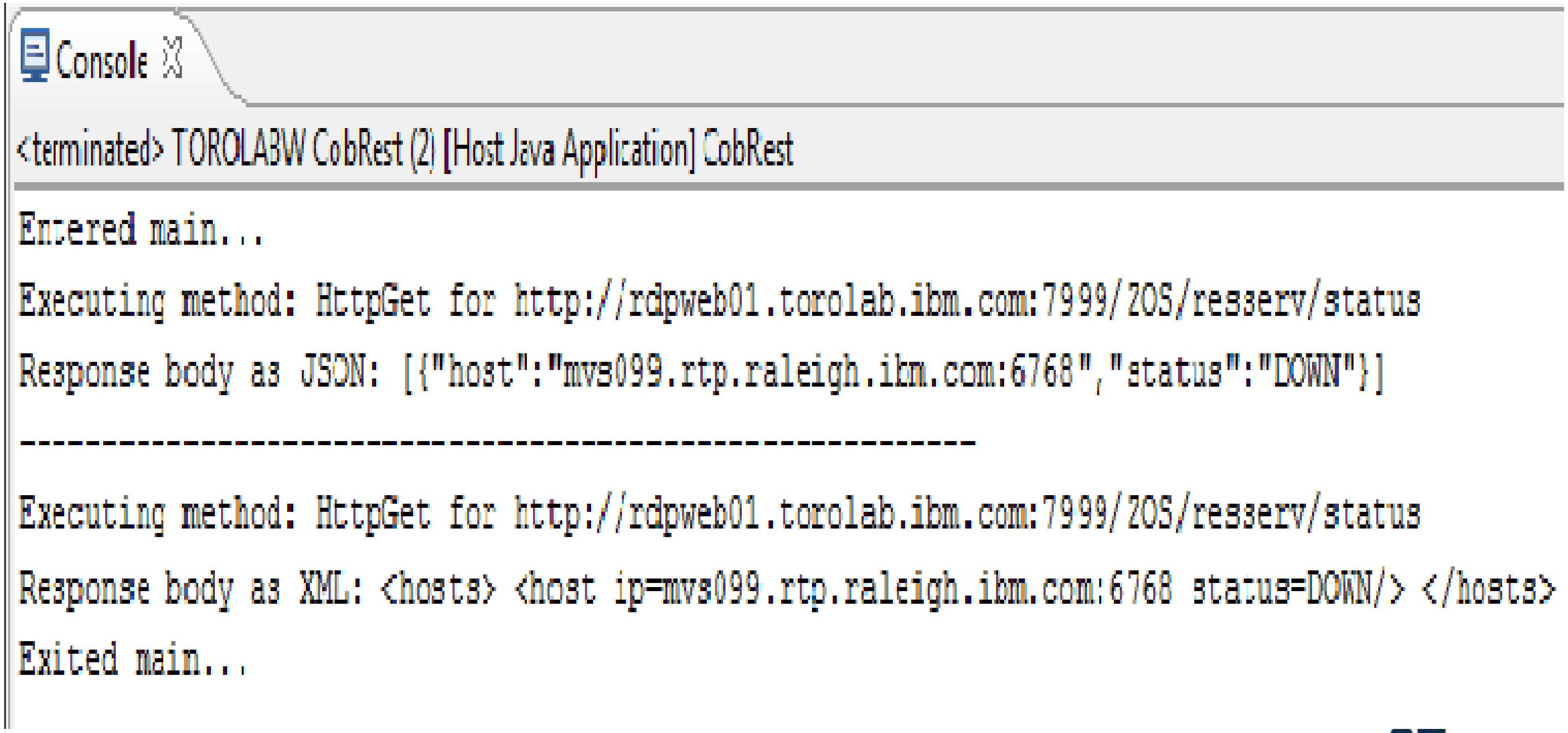
Writing, building, execution of Java 7 – similar to other platforms

- Java application (CobRest.java)
- Use the Java Perspective in RDz, create a project and write the Java application using all of the Eclipse support
- Export the jar file (external jar)
- Setup a launch configuration to test
  - Run … -> Host Java Application (New)
  - Fill in details, include the CLASSPATH and any environment variables

Writing, building, execution of Java 7 – similar to other platforms

- Now you are ready to test the application – a few ways to do this in RDz:
  - From the Java Perspective
    - Run … -> Host Java Application
      (select the launch configuration you setup)
  - From the zOS Perspective
    - Launch the USS Shell
    - Set the CLASSPATH, TZ, other env vars
      (I use a shell script)
    - java <thePackageName>

Result of running CobRest.java in RDz



```
<terminated> TOROLAB3W CobRest (2) [Host Java Application] CobRest
Entered main...
Executing method: HttpGet for http://rdpweb01.torolab.ibm.com:7999/ZOS/resserv/status
Response body as JSON: [{"host":"mvs099.rtp.raleigh.ibm.com:6768","status":"DOWN"}]
------------------------------------------------------------
Executing method: HttpGet for http://rdpweb01.torolab.ibm.com:7999/ZOS/resserv/status
Response body as XML: <hosts> <host ip=mvs099.rtp.raleigh.ibm.com:6768 status=DOWN/> </hosts>
Exited main...
```

Our 'simple' solution

`COBOL wrapper for getting to Java`
`finally add: invokeGETAsXML`

My ENV file in: `/home/tmross/Java/ENVS`

- **First attempt we put all packages in CobRest.jar**
- **So, my ENVS file looked like this:**

```
PATH=/bin:/usr/lpp/java/IBM/J7.0/bin
LIBPATH=/lib:/usr/lib:/usr/lpp/java/IBM/J7.0/bi
  n:/usr/lpp/java/IBM/J7.0/bin/j9vm
CLASSPATH=.:/home/tmross/Java/CobRest.jar
COBJVMINITOPTIONS=-Xdump:ceedump -Xcheck:jni -
  Xjit:verbose
```

- **Explanation of JVM options:**

```
-Xdump:ceedump     *> Tells the JVM to put out a
  CEEDUMP
```

Result of running CobRest.java from COBOL return of “Debugging Java is hard!”

- With the Apache and other .jar files in CobRest.jar we got abort in JVM when calling JNI services to convert returned string object to string
- We used the extra debugging options for JVM and pulled in a Java expert to diagnose the problem
- If we commented out the JNI GetString* calls, the job ended with no clue that there had been an exception in the Java code!

Result of running CobRest.java from COBOL

- With JNI trace option set on, we got this:

```
HTRT02I Jobname  Stepname ProcStep    RC    I/O hh:mm:ss.th
JVMJNCK028E JNI error in GetStringLength: This function cannot
   be called when an exception is pending
VMJNCK080E Error detected in the outermost frame of an attached
   thread
JVMJNCK024E JNI error detected. Aborting.
HTRT03I INVKREST GO                   1111  24755       00.41
```

Result of running CobRest.java from COBOL

- -Xcheck:jni:trace was what gave us the information

```
java.lang.NoClassDefFoundError: org.apache.http.client.methods.HttpRequestBase
    at java.lang.J9VMInternals.verifyImpl(Native Method)
    at java.lang.J9VMInternals.verify(J9VMInternals.java:94)
    at java.lang.J9VMInternals.initialize(J9VMInternals.java:171)
    at CobRest.invokeGETAsXML(CobRest.java:65)

Caused by: java.lang.ClassNotFoundException:
    org.apache.http.client.methods.HttpRequestBase
    at java.net.URLClassLoader.findClass(URLClassLoader.java:599)
    at java.lang.ClassLoader.loadClassHelper(ClassLoader.java:760)
    at java.lang.ClassLoader.loadClass(ClassLoader.java:728)
    at sun.misc.Launcher$AppClassLoader.loadClass(Launcher.java:325)
    at java.lang.ClassLoader.loadClass(ClassLoader.java:707)
```

Result of running CobRest.java from COBOL

- It turns out we could not put all of the jar files in CobRest.jar.
- We separated them out, added the .jar paths to JENVS file:

```
PATH=/bin:/usr/lpp/java/IBM/J7.0/bin
LIBPATH=/lib:/usr/lib:/usr/lpp/java/IBM/J7.0/bin:/usr/lpp/java/IBM/J7.0/
   bin/j9vm
CLASSPATH=.:/home/tmross/Java/httpcore-ab-4.2.4.jar:
  /home/tmross/Java/commons-logging-1.1.2.jar:
  /home/tmross/Java/org.apache.httpcomponents.httpclient_4.2.3.jar:
   /home/tmross/Java/JSON4J.jar:
   /home/tmross/Java/httpcore-nio-4.2.4.jar:
   /home/tmross/Java/httpcore-4.2.4.jar:
   /home/tmross/Java/CobRest.jar
COBJVMINITOPTIONS=-Xdump:ceedump -Xcheck:jni
```

Result of running CobRest.java from COBOL

- Better, we got data back from the Web Service!
- But, we broke the Java compiler….

```
 **** END OF MESSAGE SUMMARY REPORT ****
JVMJNCK001I JNI check utility installed. Use -Xcheck:jni:help for usage
COBOL program INVKREST entered
Unhandled exception
Type=Floating point error vmState=0x000565ff
J9Generic_Signal_Number=00040020 Signal_Number=00000008 Error_Value=000
Handler1=277155D8 Handler2=278145C8
Program_Unit_Name=./Profiler.cpp
Program_Unit_Address=27F86090 Entry_Name=TR_BranchProfileInfoManager::g
R_Compilation*)
Entry_Address=27F86090

Method_being_compiled=java/util/zip/InflaterInputStream.read([BII)I
Target=2_60_20140106_181350 (z/OS 02.01.00)
CPU=s390 (24 logical CPUs) (0x1000000000 RAM)
----------- Stack Backtrace -----------
```

Result of running CobRest.java from COBOL

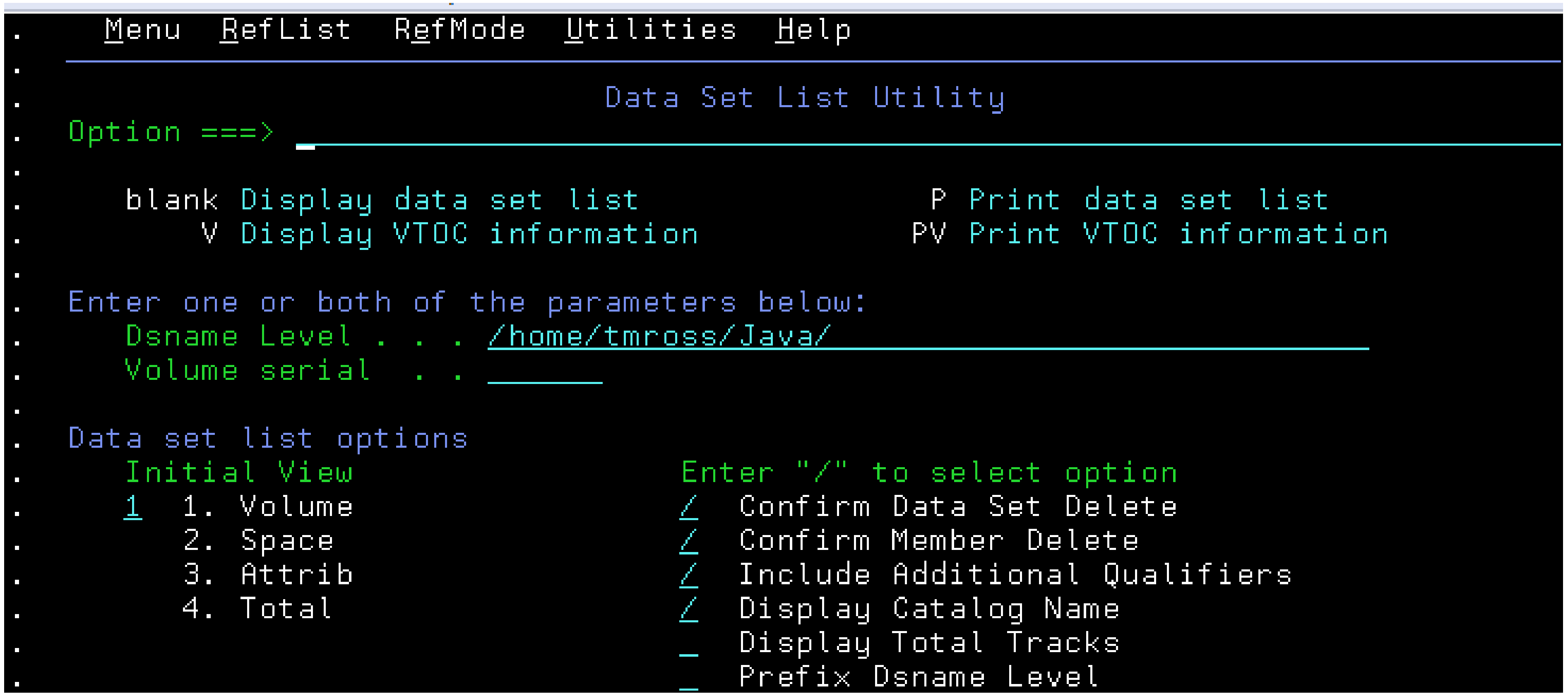
- So, until we get the Java fix, we turned off profiling in JSENV…
- **COBJVMINITOPTIONS= -Xjit:disableInterpreterProfiling**

```
 **** END OF MESSAGE SUMMARY REPORT ****
JVMJNCK001I JNI check utility installed. Use -Xcheck:jni:help
   for usage
COBOL program INVKREST entered
Returned from Java invokeGETAsXML to INVKREST

Returned from GetStringPlatformLength
The length of returned string is:0000000070
invokeGETAsXML returned: <hosts> <host
   ip=mvs099.rtp.raleigh.ibm.com:6968 status=UP/> </hosts>
About to leave INVKREST
******************************** BOTTOM OF DATA ****************
```

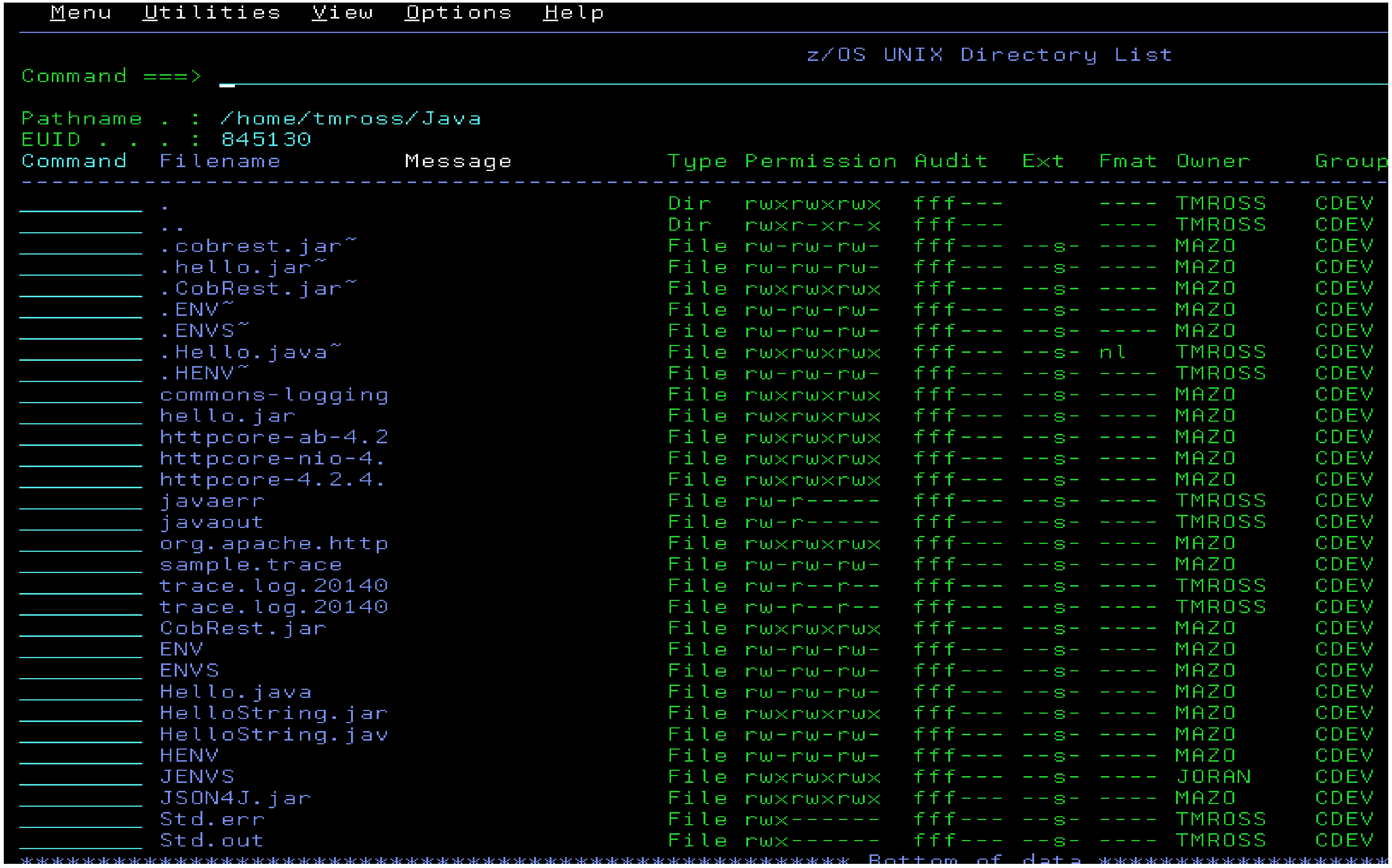
ISPF tip, it helped me a lot in this exercise!

I could avoid jumping back and forth from OMVS to ISPF



```
.      Menu  RefList  RefMode  Utilities  Help
.    ------------------------------------------------------------------------------
.                            Data Set List Utility
.    Option ===> _
.
.       blank Display data set list                    P Print data set list
.           V Display VTOC information                PV Print VTOC information
.
.    Enter one or both of the parameters below:
.       Dsname Level . . . /home/tmross/Java/______________________________
.       Volume serial  . . ______
.
.    Data set list options
.       Initial View                     Enter "/" to select option
.       1  1. Volume                     /  Confirm Data Set Delete
.          2. Space                      /  Confirm Member Delete
.          3. Attrib                     /  Include Additional Qualifiers
.          4. Total                      /  Display Catalog Name
.                                        _  Display Total Tracks
.                                        _  Prefix Dsname Level
```

ISPF tip, helped a lot in this exercise!



```
  Menu  Utilities  View  Options  Help
 ------------------------------------------------------------------------------------------
                                                     z/OS UNIX Directory List
 Command ===> _
 
 Pathname . : /home/tmross/Java
 EUID . . . : 845130
 Command  Filename        Message           Type Permission Audit  Ext  Fmat Owner    Group
 -----------------------------------------------------------------------------------------
 ________ .                                 Dir  rwxrwxrwx  fff---      ---- TMROSS   CDEV
 ________ ..                                Dir  rwxr-xr-x  fff---      ---- TMROSS   CDEV
 ________ .cobrest.jar~                     File rw-rw-rw-  fff--- --s- ---- MAZO     CDEV
 ________ .hello.jar~                       File rw-rw-rw-  fff--- --s- ---- MAZO     CDEV
 ________ .CobRest.jar~                     File rwxrwxrwx  fff--- --s- ---- MAZO     CDEV
 ________ .ENV~                             File rw-rw-rw-  fff--- --s- ---- MAZO     CDEV
 ________ .ENVS~                            File rw-rw-rw-  fff--- --s- ---- MAZO     CDEV
 ________ .Hello.java~                      File rwxrwxrwx  fff--- --s- nl   TMROSS   CDEV
 ________ .HENV~                            File rw-rw-rw-  fff--- --s- ---- TMROSS   CDEV
 ________ commons-logging                   File rwxrwxrwx  fff--- --s- ---- MAZO     CDEV
 ________ hello.jar                         File rwxrwxrwx  fff--- --s- ---- MAZO     CDEV
 ________ httpcore-ab-4.2                   File rwxrwxrwx  fff--- --s- ---- MAZO     CDEV
 ________ httpcore-nio-4.                   File rwxrwxrwx  fff--- --s- ---- MAZO     CDEV
 ________ httpcore-4.2.4.                   File rwxrwxrwx  fff--- --s- ---- MAZO     CDEV
 ________ javaerr                           File rw-r-----  fff--- --s- ---- TMROSS   CDEV
 ________ javaout                           File rw-r-----  fff--- --s- ---- TMROSS   CDEV
 ________ org.apache.http                   File rwxrwxrwx  fff--- --s- ---- MAZO     CDEV
 ________ sample.trace                      File rw-rw-rw-  fff--- --s- ---- MAZO     CDEV
 ________ trace.log.20140                   File rw-r--r--  fff--- --s- ---- TMROSS   CDEV
 ________ trace.log.20140                   File rw-r--r--  fff--- --s- ---- TMROSS   CDEV
 ________ CobRest.jar                       File rwxrwxrwx  fff--- --s- ---- MAZO     CDEV
 ________ ENV                               File rw-rw-rw-  fff--- --s- ---- MAZO     CDEV
 ________ ENVS                              File rw-rw-rw-  fff--- --s- ---- MAZO     CDEV
 ________ Hello.java                        File rw-rw-rw-  fff--- --s- ---- MAZO     CDEV
 ________ HelloString.jar                   File rwxrwxrwx  fff--- --s- ---- MAZO     CDEV
 ________ HelloString.jav                   File rw-rw-rw-  fff--- --s- ---- MAZO     CDEV
 ________ HENV                              File rw-rw-rw-  fff--- --s- ---- MAZO     CDEV
 ________ JENVS                             File rwxrwxrwx  fff--- --s- ---- JORAN    CDEV
 ________ JSON4J.jar                        File rwxrwxrwx  fff--- --s- ---- MAZO     CDEV
 ________ Std.err                           File rwx------  fff--- --s- ---- TMROSS   CDEV
 ________ Std.out                           File rwx------  fff--- --s- ---- TMROSS   CDEV
 ****************************************************** Bottom of data ******************
```

QUESTIONS?