IBM Software Group

IBM WebSphere® Application Server V6

Application Server Java™ Class Loader

Problem Determination and Best Practices

This presentation will focus on problem determination and best practice techniques for the WebSphere Application Server Java class loader.
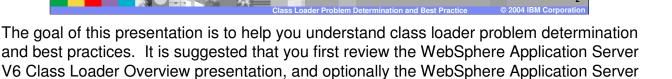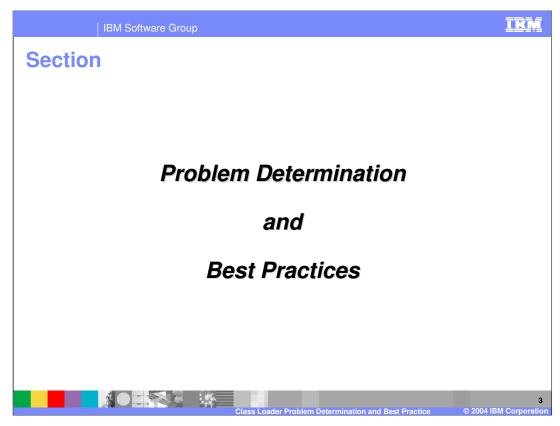
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Goals

- Understand Class loader Problem Determination and Best Practice Techniques

- Prerequisite:
  - Understanding of WebSphere V6 Class Loader provided in the WebSphere Application Server V6 Class Loader Overview presentation
  - Optional: Class loader Examples

The goal of this presentation is to help you understand class loader problem determination and best practices. It is suggested that you first review the WebSphere Application Server V6 Class Loader Overview presentation, and optionally the WebSphere Application Server V6 Class Loader Examples presentation.

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Section

Problem Determination

and

Best Practices

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Class Loader Problem Determination and Best Practice   © 2004 IBM Corporation

This section will discuss problem determination and best practices.
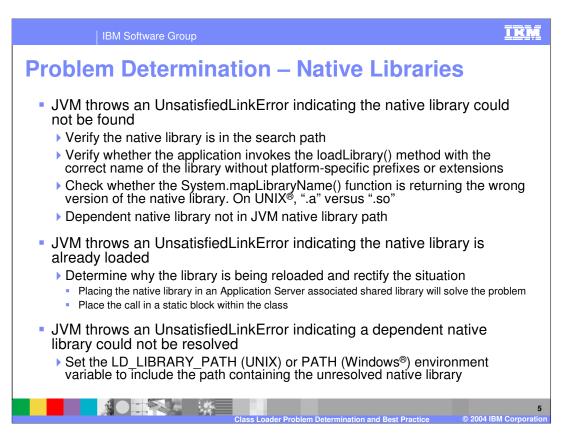
Problem Determination

- JVM classpath, Library path and WebSphere Application Server extension directories are included in the SystemOut.log

- JVM classloader "–verbose" and "-verboseJNI" JVM options
  - ▶ Can be enabled from the administrative console: Server ➔ Application Server ➔ <Server> ➔ Java and Process Management ➔ Process Definition ➔ Java Virtual Machine
  - ▶ Diagnostic messages appear in file native_stderr.log

- WebSphere Application Server Extension class loader diagnostics
  - ▶ Specify system property -Dws.ext.debug=true (via administrative console)
  - ▶ Diagnostic messages appear in file native_stderr.log

- Diagnostic Trace specification
  - ▶ com.ibm.ws.classloader.*=all=enabled

- Classloader dump – snap shot of loaded classes – IBM support site

The JVM classpath values for Library path and WebSphere Application Server extension directories can be found in the SystemOut.log file. In addition, the –verbose and –verboseJNI JVM options can be used to obtain additional diagnostic information. These options can be enabled from the administrative console and will write diagnostic messages to the native_stderr.log file. WebSphere Application Server Extension class loader diagnostics can be obtained using the –Dws.ext.debug=true directive, which can also be set from the administrative console. Again, diagnostic messages will be written to the native_stderr.log file. The diagnostic trace specification com.ibm.ws.classloader.*=all=enabled can also be used to obtain classloader diagnostic information.

Problem Determination – Native Libraries

- JVM throws an UnsatisfiedLinkError indicating the native library could not be found
  - ▶ Verify the native library is in the search path
  - ▶ Verify whether the application invokes the loadLibrary() method with the correct name of the library without platform-specific prefixes or extensions
  - ▶ Check whether the System.mapLibraryName() function is returning the wrong version of the native library. On UNIX®, ".a" versus ".so"
  - ▶ Dependent native library not in JVM native library path

- JVM throws an UnsatisfiedLinkError indicating the native library is already loaded
  - ▶ Determine why the library is being reloaded and rectify the situation
    - ▪ Placing the native library in an Application Server associated shared library will solve the problem
    - ▪ Place the call in a static block within the class

- JVM throws an UnsatisfiedLinkError indicating a dependent native library could not be resolved
  - ▶ Set the LD_LIBRARY_PATH (UNIX) or PATH (Windows®) environment variable to include the path containing the unresolved native library

Error messages related to the Native Library can be categorized as follows:

UnsatisfiedLinkError indicates that the native library could not be found – either the native library is not in the search path or the application invokes the loadLibrary() method with an incorrect library name or with platform-specific prefixes or extensions.

UnsatisfiedLinkError indicates that the native library is already loaded – and an attempt is being made to reload the library. Placing the native library in the shared library associated with the application server should solve this problem.

UnsatisfiedLinkError indicates that a dependent native library could not be resolved –the unresolved native library is not included in the platform appropriate environment variable, for example: LD_LIBRARY_PATH for UNIX platforms, or PATH for Windows platforms.

Hints and Tips

- Never place WebSphere Application Server resources or application resources on the JVM class path
  - ▶ Downward class dependencies cannot be resolved, resulting in ClassNotFoundException and ClassCastException errors

- Never expand the visibility of the WebSphere Application Server Extensions class loaders by modifying the ws.ext.dirs system property or otherwise
  - ▶ This is equivalent to extending the WebSphere Application Server runtime environment and often leads to problems

- Use the <WAS_HOME>/classes directory for installing patches, not interim fix and cumulative fix installation processes

- Loading native library - Call System.loadLibrary() within a static block of exactly one class within an application

- If Dynamic Reloading is enabled, and the application needs to load native library, load them using server-scoped Shared libraries
  - ▶ This will be loaded by WebSphere Application Server "Server" class loader and will be present for the lifetime of the Application Server

Listed here are some hints and tips to help you avoid classpath problems.

Common Problems

- ClassCastException
  - ▶ Duplicate class loaded by two different class loaders and have dependencies

- ClassNotFoundException
  - ▶ Classes not in the classpath
  - ▶ Loaded classes that have dependencies that are lower in the hierarchy

- NoClassDefFoundError

Listed here are some common classpath related exceptions along with the most common causes. This concludes this presentation covering classpath problem determination and best practices.

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