



## WebSphere Micro Environment - The Right Platform

In WebSphere™ Micro Environment, IBM® has extended the WebSphere software platform onto devices. Using the same programming model that has made WebSphere the industry-leading platform for e-business, IBM has created the foundation for the deployment of e-business applications to small devices. By using open standards to combine the portability of Java™ technology with the power of WebSphere, IBM helps bring the convenience of mobile devices to e-business. Together with the superior messaging of MQe, the advanced data management capabilities of DB2e™ and the scalability of WebSphere, IBM has created a complete platform for extending e-business onto millions of devices.

WebSphere Micro Environment provides the developer with a production level J2ME™ “Java powered”™ runtime environment, plus a whole lot more. It has been tested and certified to meet Connected Limited Device Configuration (CLDC™), Mobile Information Device Profile (MIDP™), Connected Device Configuration (CDC™), Foundation Profile standards.

The right platform must balance the device’s memory constraints with the user’s need for speed; critical for taking maximum advantage of battery powered devices where the user pays a per minute connection charge. At the core of WebSphere Micro Environment is the IBM J9™ virtual machine, which has been optimized for each supported device, helping to ensure application performance. This performance has been proven in independent testing.

Finally, what really sets WebSphere Micro Environment apart is that it provides the foundation for extending existing e-business applications to these convenience devices. By taking advantage of the middleware provided by WebSphere family of products, a complete platform for end-to-end device to services applications is provided.

With proven performance, certified compatibility and the assurance of WebSphere, IBM WebSphere Micro Environment provides the right platform to mobilize an enterprise.

## WebSphere Micro Environment – Standards

- **Certified Java Powered** – <http://java.sun.com/j2me/licenses.html>
- J2ME Specifications Supported – Certified Java Powered to the following specifications
  - Handsets / Smartphones
    - Connected Limited Device Configuration (CLDC 1.0a) – JSR 030
    - Mobile Information Device Profile (MIDP 1.0a) – JSR 037
  - PDA / PDA Phones
    - Connected Device Configuration (CDC 1.0\_0.1) – JSR 036
    - Foundation Profile – JSR 046
- **OS Support (Handsets/Smartphones):** Linux, OSE, Windows CE, Windows Powered Smartphone 2002, BREW, REX, ITRON
- **OS Support (PDA, PDA Phones):** PocketPC 2002, PocketPC2002 Phone Edition, PalmOS, Windows CE, Linux
- **OS Support (embedded):** QNX, MontaVista Linux, Solaris soft kernel, AIX, Windows NT, Linux
- **Microprocessor Support:** ARM, StrongArm, Xscale, x86, PowerPC, MIPS, 68K, Hitachi
- **Class Library Support:** Full implementation of the classes contained in the following packages (including sub classes). Java Powered:
  - **CLDC** – java.io (system io), java.lang (programming language), java.util (collections, data/time, misc), java.microedition (corrections)
  - **MIDP** – java.microedition.rms (record storage), java.microedition.midlet (MIDLets), java.microedition.io (HTTP), java.microedition.lcdui (User Interface toolkit)
  - **CDC** - java.io (system io), java.lang (programming language), java.lang.ref (special reference classes), java.lang.reflect (reflection), java.math (math), java.net (network classes / tools), java.security (security), java.security.cert (certificates), java.text (text manipulation), java.util (collections, date/time support, misc.), java.util.jar (Jar file), java.util.zip (zip file), javax.microedition (connections)
  - **Foundation** - java.io (system io), java.lang (programming language), java.lang.ref (special reference classes), java.lang.reflect (reflection), java.math (math), java.net (network classes / tools), java.security (security), java.security.acl (access control list), java.security.cert (certificates), java.security.interfaces (security interface), java.security.spec (key specifications), java.text (text manipulation), java.util (collections, date/time support, misc.), java.util.jar (Jar file), java.util.zip (zip file), javax.microedition (connections)
  - **Personal** – Personal Profile provides an environment for applications that rely upon the AWT heavyweight components. It provides full AWT support (relative to JDK 1.1 AWT) and includes a number of feature improvements introduced by





J2SE. This Profile serves as a suitable platform for web applets and as a J2ME migration path for PersonalJava applications.

The Personal Profile is still in the JCP process, but advanced beta is made available in WebSphere Studio Device Developer. IBM will certify the Personal Profile, as the TCK testing is completed.

Packages: java.applet, java.awt, java.awt.color, java.awt.datatransfer, java.awt.event, java.awt.image, java, java.beans, java.io, java lang (programming language), java.lang.ref (special reference classes), java.lang.reflect (reflection), java.math (math), java.net (network classes / tools), java.rmi (rmi), java.rmi.registry (registry), java.security (security), java.security.acl (access control list), java.security.cert (certificates), java.security.interfaces (security interface), java.security.spec (key specifications), java.text (text manipulation), java.util (collections, date/time support, misc.), java.util.jar (Jar file), java.util.zip (zip file), javax.microedition.io, javax.microedition.xlet, javax.microedition.xlet.ixc.

- **Device Management Support** – Open Services Gateway initiative – OSGi.org
- **Connectivity Support** – TCP/IP, RMI, 802.11b, JDBC, JMS, GPRS, USB, Serial
- **Tools Support** – WebSphere Studio Device Developer, an Integrated Development Environment (IDE) or any tool that supports the development of J2ME that and the following interfaces - Java Debug Interface (JDI), Java Virtual Machine Profiling Interface (JVMPI)
- **Partner Offerings** integrated using open standards
  - Secure Sockets - SSL – Wedgetail
  - Relational Database (JDBC) – IBM DB2e
  - Object Oriented Database (OODB) – Cloudscape
  - Application Development Tools – Eclipse Plug-in technology – eclipse.org
  - Messaging Middleware – JMS, IBM MQe, Applied Reasoning Mobile Classic Blend
  - Browsers enabled for the Java runtime environment – Opera, NetClue
  - Streaming Multimedia (MPEG4) – Emblaze, PacketVideo
  - Jini Networking (Jini) – PsiNaptic
  - Bluetooth – Rococco Software
  - Linux PIM applications – Trolltech QT/e
- **New in Version 5**
  - Native Browser integration (Pocket IE)
    - MIDP Over the Air (OTA) Extensions for carriers (MIDP Extensions)
  - Device Management – SyncML/DM (Beta) to the 1.1.1 level of specification
  - Personal Profile (Beta implementation subject to TCK test suite availability).

## WebSphere Micro Environment – Features

WebSphere Micro Environment – V5.0		
<b>VM Speed</b>		
	Ahead-of-time compiler	Much faster than interpreted byte codes (order of magnitude), without the overhead of memory increase. Used primarily for startup code, error recovery code and for 5% developer code that is in need for performance boosting.
	JIT (Just-in-time) Compiler	Much faster than interpreted bytecodes (order(s) of magnitude), but requires JIT compiler on target - space / time tradeoff. Used for highly repetitive code.
	Adaptive JIT optimization	Frequently used code is compiled at higher level of optimization
	Can pre-locate/digest whole application	Can reduce startup time & footprint significantly
	Fast JNI Implementation	Can reduce time in calling C/C++ routines
	Fast Interpreter	12 years experience in building VMs
	Is the speed of the VM validated by third parties	<a href="http://www.csc.ncsu.edu/embedded-java/">http://www.csc.ncsu.edu/embedded-java/</a>
	Optimized for ARM processor	AOT is new in version 5.0 for ARM
<b>VM Size</b>		
	JXE support	Compresses executables and resources into a single, easy-to-distribute, compact package.
	Supports XIP (execute in place)	Can reduce RAM footprint significantly: fixed bytes stay in flash ROM, only variable part copied to RAM
	Class Libraries can be selected to span across device types. From extremely small to Internet Appliance Devices and gateways:	Size is critical for resource-constrained devices where cost per unit is key. Functionality needs to be scalable, and customizable.
	Tiny J9	Devices under 1MB - ie: Static ARM processor
	CLDC/MIDP - Static Arm processor	Library for minimal functions for limited devices (CLDC). Java.io, lang, util, x.microedition. MIDlet support.
	Full J9	Devices (2 Meg Plus) – Smart Phones, PDAs, Residential Service Gateways, Set Top Boxes, Commercial Gateways, Internet Appliance Devices – Advanced support for floating point, advanced GC (mark / sweep), finalization, Math lib enhancements.
	Supports PersonalJava 1.1 and 1.2 applications	These applications can be run, but are not optimized to J2ME. Applications written to the old specifications (JDK 1.1.8) will take considerable amount of refactoring to move to J2ME
	Customization of runtime to maintain compatibility, yet reduce the size of the footprint.	More room for the application. Less room on the target device for the runtime - available upon request.
<b>VM Standards</b>		
	Supports Latest J2ME Standards	Supports the latest JDK levels
	JDK 1.3 JRE levels	Newer, more stable base

	Certified CLDC (1.0a)	TCK Tested and certified compatible to the specifications as outlined in the Java Community Process(SM)
	Certified CLDC/MIDP (1.0a)	"
	Certified CDC (1.0_01)	"
	Certified CDC/Foundation	"
	J2ME CDC/Foundation/Personal Profile (NG)	Awaiting TCK for certification, beta level only
	Web Update for new specifications as they become available	Having a web update feature to distribute the latest tested profiles and configurations, as they become available (MIDP NG),...
	TCK Tested to earn the Java Powered(TM) logo.	Product, not reference implementation. Supported.
(debug)	Supports JDI (Java Debugging Interface)	Can use standard debugging tools
(debug)	JDI code on host or remote target	Code on host saves space / increases speed on target
(profiler)	Supports JVMPi (JVM Profiler Interface)	Can use standard tools (I.e. JProbe)
<b>VM Special Features</b>		
	Supports Multiple Memory Configurations (flash, ROM, discontinuous)	Flexibility to choose the device that is right for the application based on speed, cost, maintenance and upgrades
	Run Multiple VMs concurrently (per thread, per process)	Allows application isolation and flexible RTOS process control
	Execute from ROM	Useful when you want to offer additional aftermarket parts, services to a device that has shipped
	Allows multiple VMs with shared or separate stacks	Allows memory Isolation
	Single-source JCL and VM	Consistency across all target platforms for portability of application, can ease migration and can delivers uniform execution environments
	Structure with portability layer for the application and optimization layer for the platform	Portability layer for applications allows multiple platforms to be targeted Optimization layer takes advantage for each platform for speed,...
<b>Memory Management</b>		
<b>Garbage Collection (GC)</b>		
	Realtime extensions for deterministic execution	Threads can execute at higher priority than GC for critical tasks
	Precise or conservative?	Precise = better (Conservative = not all objects collected)
	Configurable / tunable?	Can improve speed & space
	Incremental	Can reduce minimum timeslice needed/GC does not lock VM (needed for realtime)
	Interruptable	Required to handle time-critical interrupts & tasks
	Generational	Scanning of generational objects saves lookup time and can increase CPU efficiency.
<b>OSGi</b>		
<b>Development Environment</b>		





	Test Environment provided / available - for development use only	Needed for OSGi development
<b>Flash support</b>		
	Can write bundles directly to flash	Enables component update and activation without interrupting the customer
	Can execute downloaded code in place (XIP)	Can save RAM - fixed bytes stay in flash ROM, only variable part copied to RAM
<b>Natives</b>		
	Supports download of native code, drivers, (non-Java) files	Standardizes downloads, allows config management of non-Java files
<b>IDE support</b>		
	Built in bundle upload to server	Greatly simplifies OSGi server management
	Debug Support for bundles	Debugging bundles can avoid Printf debugging
	Assists in defining prerequisites	Simplifies complex bundle / package relationships, helps debug pre req issues
<b>Other</b>		
	Follows prereq chain	Helps ensure required prerequisites are also downloaded, even if not specified by client
<b>GUI</b>		
<b>AWT</b>		
	AWT / SWT standards-based UI for Java	Allows interoperability of apps - however, significantly larger and slower than bitmap-based systems: full windowing controls
<b>Browser Integration</b>		
	Browser Integration across multiple platforms	Has partnerships with Browser companies who support browsing across multiple platforms (NetClue, Opera)
	Browser Integration on popular devices (Pocket IE)	Can reduce memory required when original browser on device is used - This will be shipped via web update.
<b>Connectivity to Data Services</b>		
<b>Carrier</b>		
	Provides a J2ME Java Powered runtime environment	Device becomes a platform for multiple applications written by different developers. Opens up device to applets, midlets,... written by the development community.
	MIDP Extensions - Can be modified for individual carrier extensions.	Each carrier has their own extensions to MIDP to control application flow on handsets.
	SyncML/DM synchronization engine for	For synchronization of files, applications, PIM data and data services
	CLDC/MIDP	
	CDC/Foundation	
	Integrates with provisioning servers	
	BREW	
	JSR 124 Generic Provisioning Servers	Upon Request
	Extensions for individual carriers provisioning engines	Upon Request





e-business		
	Integrated with device databases using Open Standards (JDBC)	DB2e
	Integrated with Object Oriented databases	Cloudscape
	Integrated with messaging middleware	
	MQSeries / WebSphere MQ	Asynchronous Messaging