Deploying Java™ Platform, Standard Edition (Java SE Platform) in Today's Embedded Devices

Bob Vandette

Senior Staff Engineer
Sun Microsystems, Inc.
http://www.sun.com

TS-2602

Deploying Java SE Platform in Today's Embedded Devices

Goal of this presentation

Learn the basic steps involved in developing and deploying embedded solutions based on Java Standard Edition platform for Embedded

Agenda

Define Your Target Device Requirements

Which Java Platform Edition Is Right for You

Selecting Support Libraries

Developing Your Application Code

Building Your Target Image

Debugging

Performance Tuning

Q&A

Agenda

Define Your Target Device Requirements

Which Java Platform Edition Is Right for You

Selecting Support Libraries

Developing Your Application Code

Building Your Target Image

Debugging

Performance Tuning

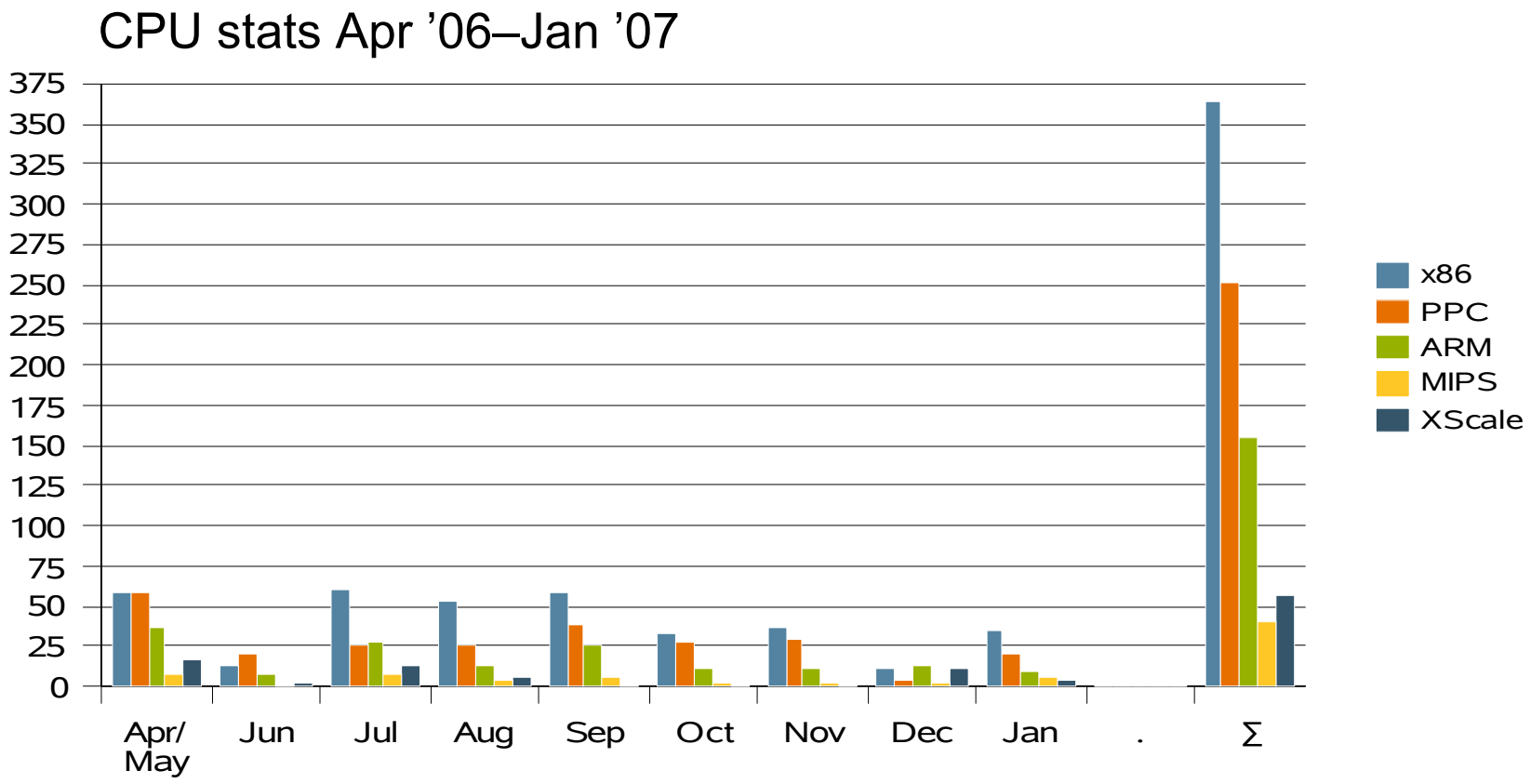
Q&A

Defining Target Device Requirements

- Hardware
  - CPU
  - Persistent memory: ROM, flash/stick, disk
  - Volatile memory: RAM
  - Peripheral I/O (optional):
  - Networking: Ethernet, wireless, Bluetooth
  - Parallel (IEEE-1284, ...)
  - Serial (RS-232/422/485, USB, ...)
  - Graphics (2D, 3D, acceleration ...)
- Software
  - Operating Systems
    - Linux, Windows XP-Embedded or other
  - User software: Java Runtime Environment (JRE™), Java applications, Java Libraries, native apps

Embedded Processor Adoption

Data from Java SE platform embedded Web site survey (1000 responses)



Defining Target Device Requirements

How much RAM do you need?

- Factors Impacting RAM consumption
  - How many Java technology processes
  - Complexity of Java application
  - How much Java technology eap space
  - How much Just-In-Time Compilation do you need for best performance
  - Size of non-Java technology processes
  - Which Operating System you choose

RFID Reader Single Func Dev

PDA

Telco CSCF Server (Call Session Control Function)

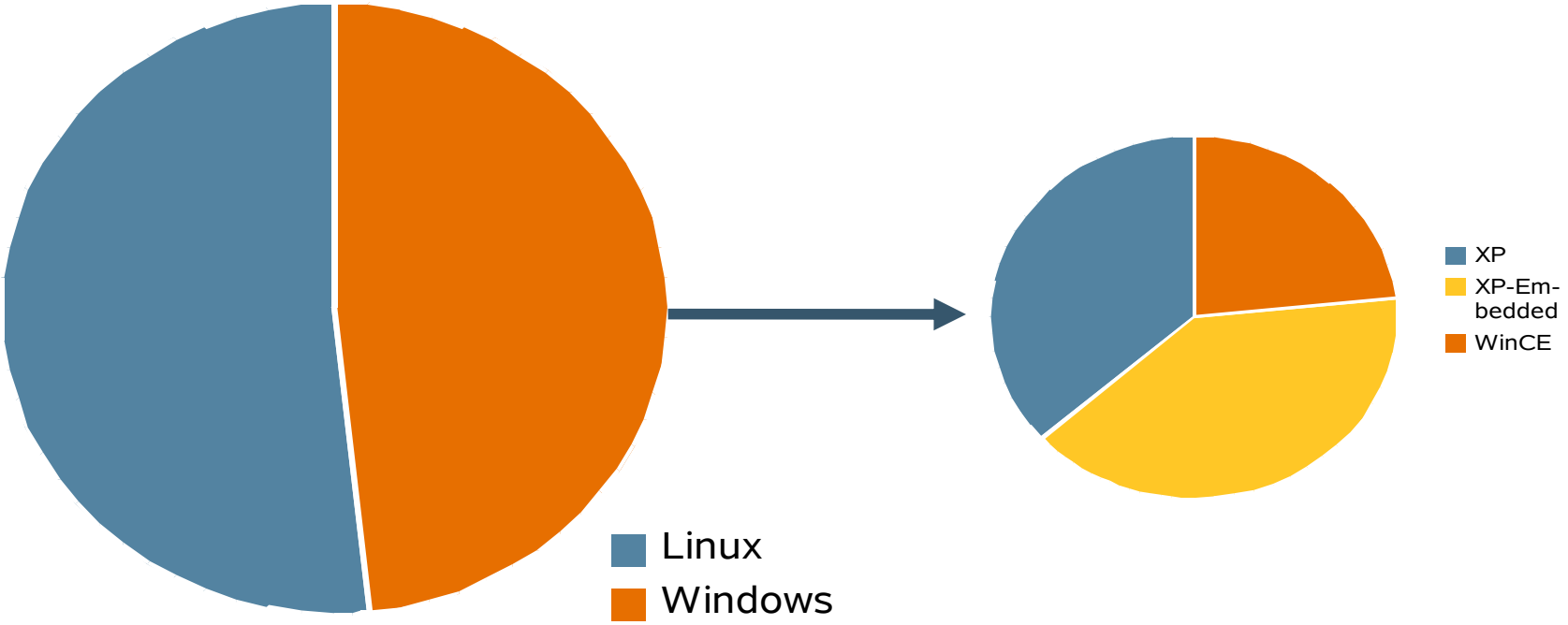
Display Device

Headless or Headfull?

- We Offer a Headless version of Java SE platform Embedded; Still full Java SE platform compatibility but...
  - No mouse, keyboard input
  - No window creation or display graphics
  - Graphics APIs throws HeadlessException
  - Java 2D™ API graphics still fully functional for printing or off screen rendering
  - Saves RAM and DISK space

Embedded Operating System Selection

Sun Java Platform embedded survey data 5/06 to 2/07



Windows vs. Linux

Windows Breakdown

Agenda

Define Your Target Device Requirements

Which Java Platform Edition Is Right for You

Selecting Support Libraries

Developing Your Application Code

Building Your Target Image

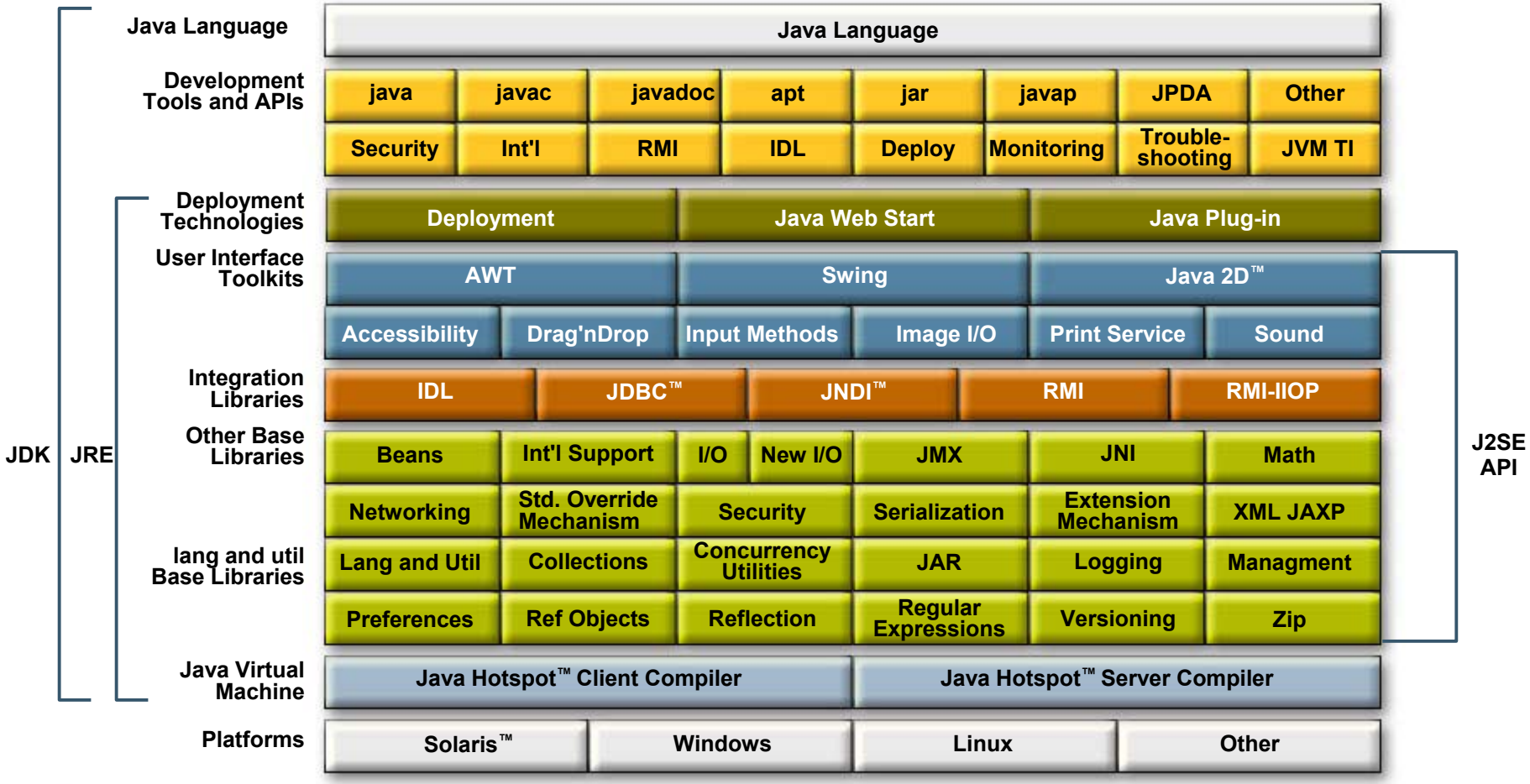
Debugging

Performance Tuning

Q&A

Java 2 Platform, Standard Edition (J2SE™ Platform) 5.0

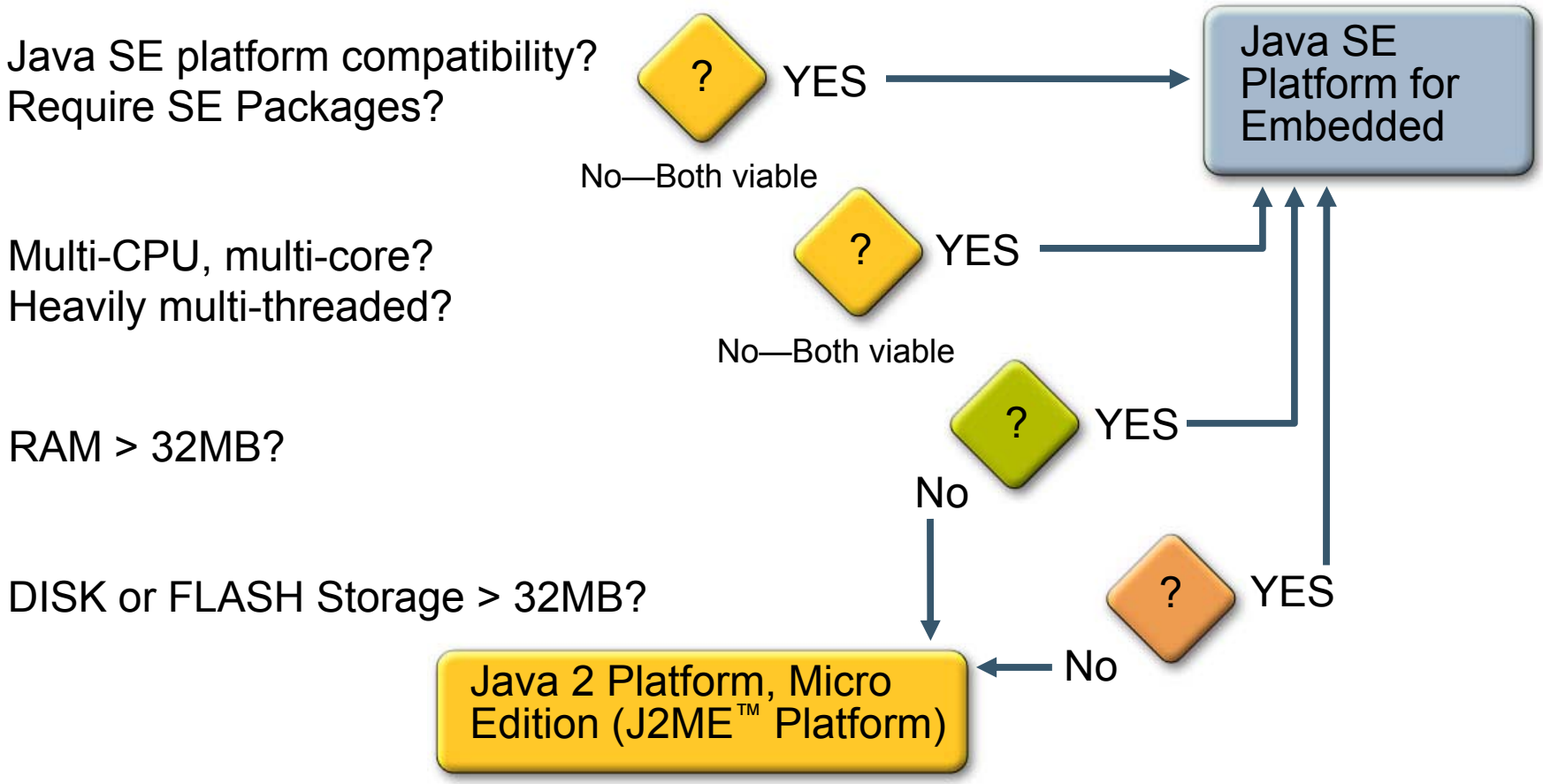
Rich set of APIs for embedded developers



Java Standard Edition Platform for Embedded

Selection guidelines

Embedded Device Requirements



Java SE Embedded Platforms

Continually updating

Release	Platform	Headless	Small Footprint	Full Featured
Java SE Platform 1.4.2	Linux PowerPC	Yes	Yes	
	Linux ARM (New)	Yes	Yes	
Java SE Platform 5.0	Linux x86	Yes	Yes	Yes
	Linux PowerPC	Yes	Yes	
	Windows XP Embedded	No	Reduced	Yes
Java SE Platform 6.0	Linux x86	Yes	Yes	Yes

Other combinations available by request

Agenda

Define Your Target Device Requirements

Which Java Platform Edition Is Right for You

Selecting Support Libraries

Developing Your Application Code

Building Your Target Image

Debugging

Performance Tuning

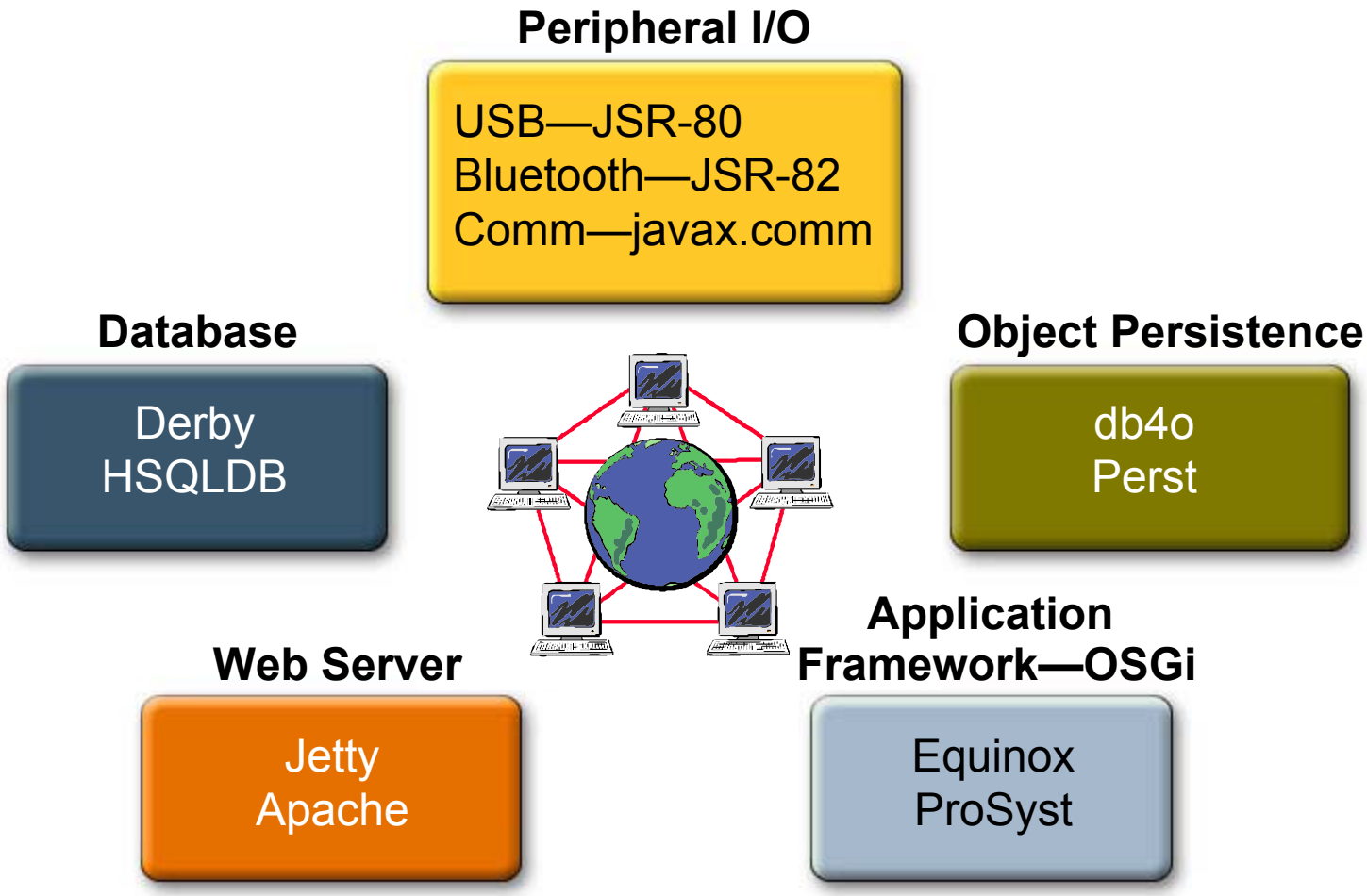
Q&A

Third Party Tools, Utilities, Libraries

Abundant

- ***Main software sources: community development, collaboration/participation platforms, companies***
  - http://apache.org/ Apache
  - http://sourceforge.net/ SourceForge
  - http://freshmeat.net/ FreshMeat
  - http://gnu.org/ GNU's Not Unix
- ***Companies providing free software or promoting free software development (Sun: http://java.net/)***

Examples of Third-Party Middleware for Embedded Java Platform



Agenda

Define Your Target Device Requirements

Which Java Platform Edition Is Right for You

Selecting Support Libraries

Developing Your Application Code

Building Your Target Image

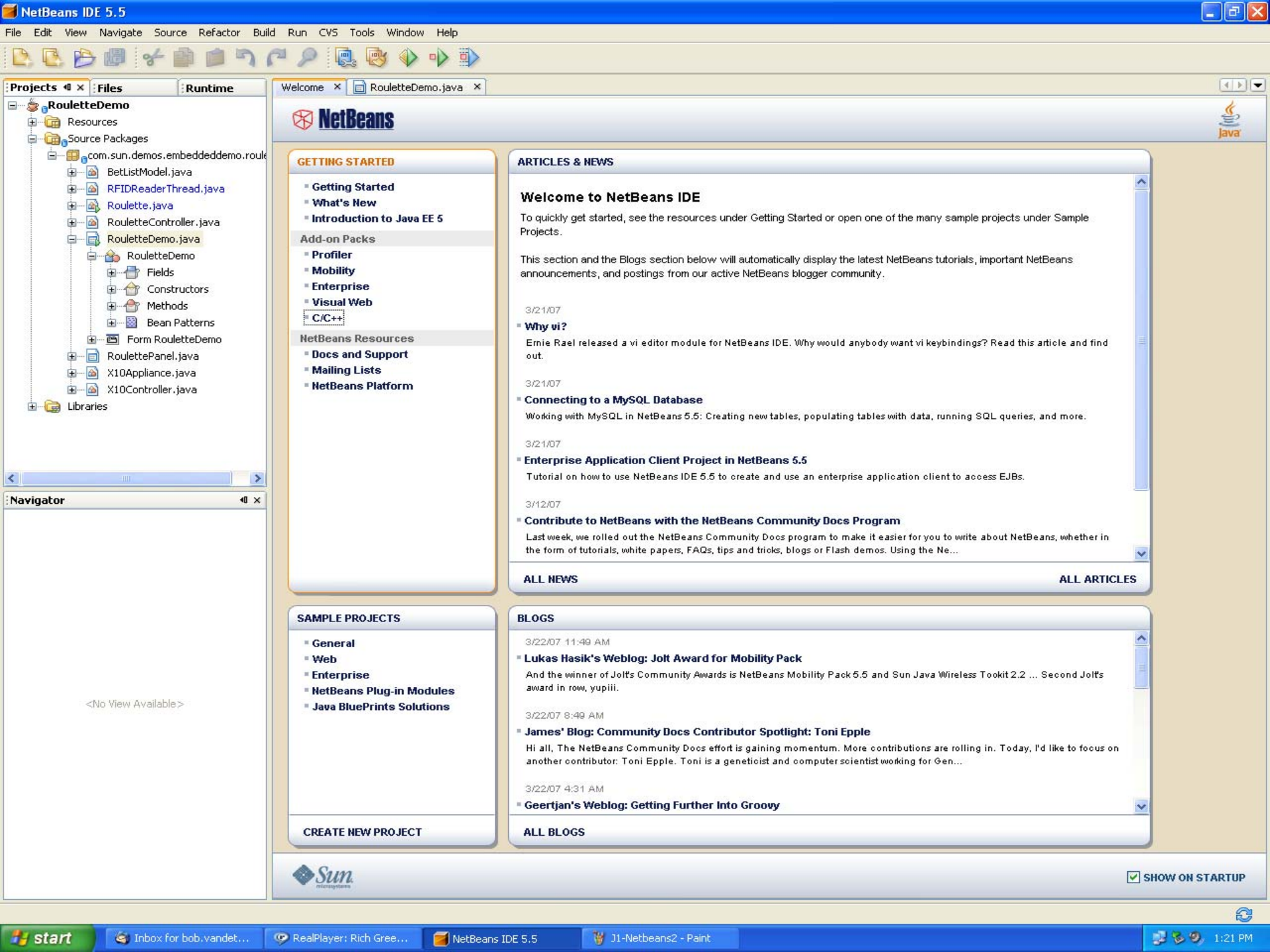
Debugging

Performance Tuning

Q&A

NetBeans™ Software

- Besides Java SE platform support, also support for: Java ME platform (Mobility pack), Java Platform, Enterprise Edition (Java EE platform) (Enterprise pack)
  - Java EE platform: web apps [servlets, JavaServer Pages™ (JSP™) technology, Enterprise JavaBeans™ (EJB™) architecture], remote deployment
- Advanced, descriptor-based project management (XML descriptors):
  - Development (editing, configuration, version control)
    - Advanced editing: automatic code generation (RAD) for common design/implementation patterns, context-sensitive auto-completion, color-coding, etc.
  - Building, bundling (e.g., using Apache ant tool)
  - Deployment/installation (local, remote)


NetBeans IDE 5.5
File Edit View Navigate Source Refactor Build Run CVS Tools Window Help
Projects Files Runtime
RouletteDemo
Resources
Source Packages
com.sun.demos.embeddeddemo.roule
BetListModel.java
RFIDReaderThread.java
Roulette.java
RouletteController.java
RouletteDemo.java
RouletteDemo
Fields
Constructors
Methods
Bean Patterns
Form RouletteDemo
RoulettePanel.java
X10Appliance.java
X10Controller.java
Libraries
Navigator
<No View Available>
Welcome
RouletteDemo.java
NetBeans
Java
GETTING STARTED
Getting Started
What's New
Introduction to Java EE 5
Add-on Packs
Profiler
Mobility
Enterprise
Visual Web
C/C++
NetBeans Resources
Docs and Support
Mailing Lists
NetBeans Platform
ARTICLES & NEWS
Welcome to NetBeans IDE
To quickly get started, see the resources under Getting Started or open one of the many sample projects under Sample Projects.
This section and the Blogs section below will automatically display the latest NetBeans tutorials, important NetBeans announcements, and postings from our active NetBeans blogger community.
3/21/07
Why vi?
Ernie Rael released a vi editor module for NetBeans IDE. Why would anybody want vi keybindings? Read this article and find out.
3/21/07
Connecting to a MySQL Database
Working with MySQL in NetBeans 5.5: Creating new tables, populating tables with data, running SQL queries, and more.
3/21/07
Enterprise Application Client Project in NetBeans 5.5
Tutorial on how to use NetBeans IDE 5.5 to create and use an enterprise application client to access EJBs.
3/12/07
Contribute to NetBeans with the NetBeans Community Docs Program
Last week, we rolled out the NetBeans Community Docs program to make it easier for you to write about NetBeans, whether in the form of tutorials, white papers, FAQs, tips and tricks, blogs or Flash demos. Using the Ne...
ALL NEWS
ALL ARTICLES
SAMPLE PROJECTS
General
Web
Enterprise
NetBeans Plug-in Modules
Java BluePrints Solutions
CREATE NEW PROJECT
BLOGS
3/22/07 11:49 AM
Lukas Hasik's Weblog: Jolt Award for Mobility Pack
And the winner of Jolt's Community Awards is NetBeans Mobility Pack 5.5 and Sun Java Wireless Tookit 2.2 ... Second Jolt's award in row, yupiii.
3/22/07 8:49 AM
James' Blog: Community Docs Contributor Spotlight: Toni Epple
Hi all, The NetBeans Community Docs effort is gaining momentum. More contributions are rolling in. Today, I'd like to focus on another contributor: Toni Epple. Toni is a geneticist and computer scientist working for Gen...
3/22/07 4:31 AM
Geertjan's Weblog: Getting Further Into Groovy
ALL BLOGS
Sun microsystems
SHOW ON STARTUP
start
Inbox for bob.vandet...
RealPlayer: Rich Gree...
NetBeans IDE 5.5
J1-Netbeans2 - Paint
1:21 PM

NetBeans Software

- ***Profiling*** *(Including BCI: byte code instrumentation)*
  http://profiler.netbeans.org/
- ***Debugging*** *(Java Platform Debugger Architecture product (JPDA) based)*
  http://debugger.netbeans.org/
- ***Database connectivity/interaction*** *(JDBC software-based)*
  http://db.netbeans.org/
- ***GUI RAD: Project Matisse*** *(Form-based: XML GUI descriptor)*
  http://www.netbeans.org/kb/articles/matisse.html

NetBeans IDE 5.5 - RouletteDemo

File Edit View Navigate Source Refactor Build Run CVS Tools Window Help

Projects | Files | Runtime

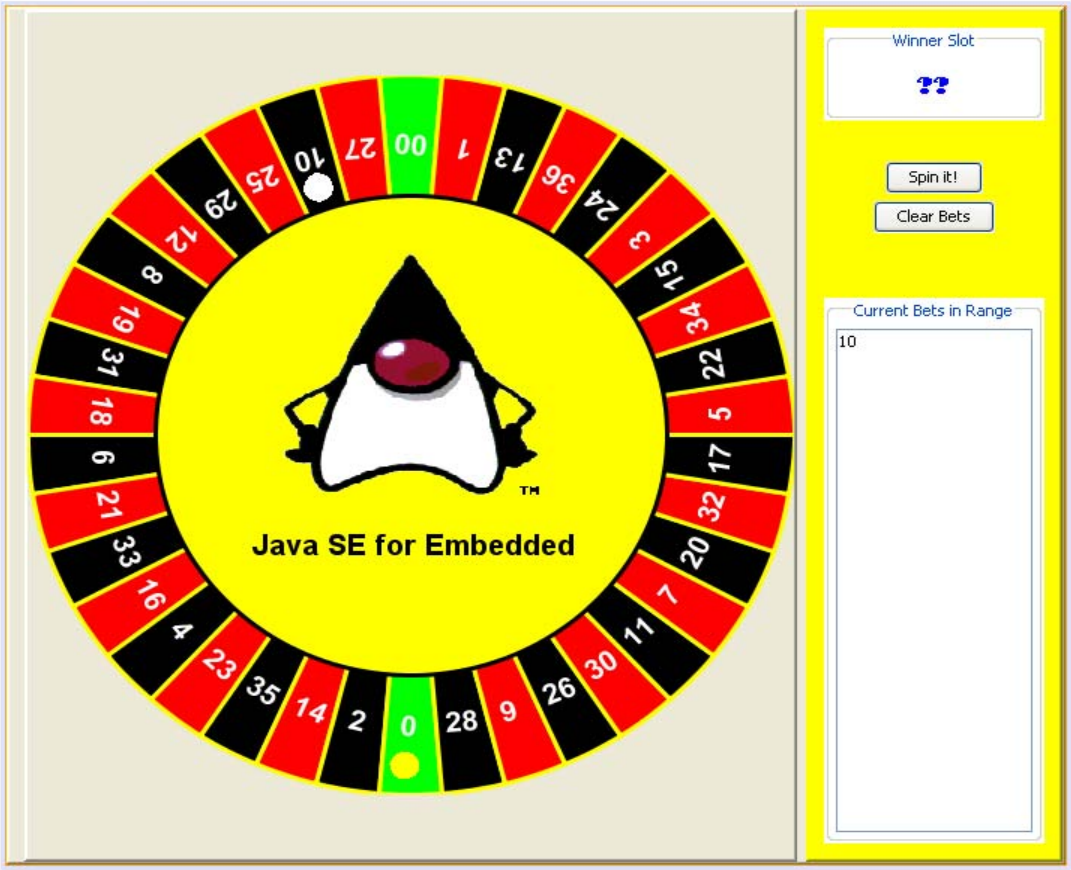
- RouletteDemo
  - Resources
  - Source Packages
    - com.sun.demos.embeddeddemo.r
      - BetListModel.java
      - RFIDReaderThread.java
      - Roulette.java
      - RouletteController.java
      - RouletteDemo.java
        - RouletteDemo
          - Fields
          - Constructors
          - Methods
          - Bean Patterns
        - Form RouletteDemo
      - RouletteDemo.java
        - RouletteDemo
          - Fields
          - Constructors
          - Methods
          - Bean Patterns
      - X10Appliance.java

Navigator | Inspector

- Form RouletteDemo
- Other Components
- [JFrame]
  - GridLayout
  - mainPanel [JPanel]
    - BoxLayout
    - roulettePanel1 [RouletteDemo]

Welcome | RouletteDemo.java

Source | Design



Palette

- Swing
  - JLabel
  - JButton
  - JToggleButton
  - JCheckBox
  - JRadioButton
  - ButtonGroup
  - JComboBox
  - JList
  - JTextField
  - JTextArea
  - JPanel
  - JTabbedPane
  - JScrollBar
  - JScrollPane
  - JMenuBar
  - JPopupMenu
  - JSlider
  - JProgressBar

roulettePanel1 [RouletteDemo] - Pro...

Properties | Events | Code

Property	Value
Properties	
background	[236,233,216]
border	[BevelBorder]
componentPopupMenu	<none>
foreground	[0,0,0]
toolTipText	null
Other Properties	
UIClassID	PanelUI
accessibleContext	[AccessibleJPanel]
alignmentX	0.0
alignmentY	0.5
ancestorListeners	[Array of javax.swing.e
autoscrolls	☑
components	[Array of java.awt.Com
containerListeners	[Array of java.awt.ever
debugGraphicsOptions	NO_CHANGES
doubleBuffered	☑
enabled	☑

roulettePanel1 [RouletteDemo]

JUnit Test Results

Finished building RouletteDemo (test).

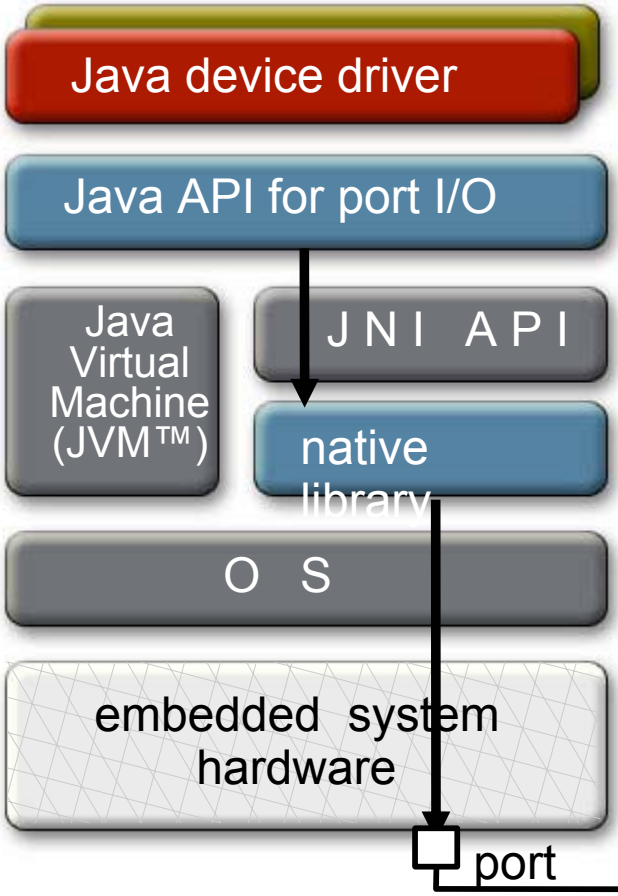
start | RealPlayer: Rich Gree... | NetBeans IDE 5.5 - R... | Financial Services: In... | 1:46 PM

Use of Native Libraries

- Leverage legacy native code for embedded systems
  - Retain value/benefits of, and previous investment in,existing native code, and gain benefits of Java platform
- Java technology provides interface for this: Java Native Interface (JNI™) API
  http://java.sun.com/j2se/1.5.0/docs/guide/jni/
  http://java.sun.com/products/jdk/faq/jnifaq.html
- JNI API allows you to write “glue code” to bind/ link Java code to native code: Java code wrapper, Java API

Peripheral I/O

Java device drivers



Java device drivers implemented in 100% Pure Java code—100% **portable** to other platforms for which a Java API/binding for the port I/O protocol is available

One implementation per I/O protocol, reusable for **multiple** different devices

Implementation examples:
javax.comm ··· //
javax.usb

Multiple types of devices can be connected to port, one at a time

Each device type uses a different Java device driver

The terms “Java Virtual Machine” and “JVM” mean a Virtual Machine for the Java™ platform.

Use of Native Libraries

- ***Process of writing JNI API glue code can be largely automated—a.k.a. auto-wrapping/ binding:***
  - ***GlueGen:*** ***https://gluegen.dev.java.net/***
  - ***SWIG:*** ***http://www.swig.org/***
  - ***JANET:*** ***http://janet-project.sourceforge.net/***

Agenda

Define Your Target Device Requirements

Which Java Platform Edition Is Right for You

Selecting Support Libraries

Developing Your Application Code

Building Your Target Image

Debugging

Performance Tuning

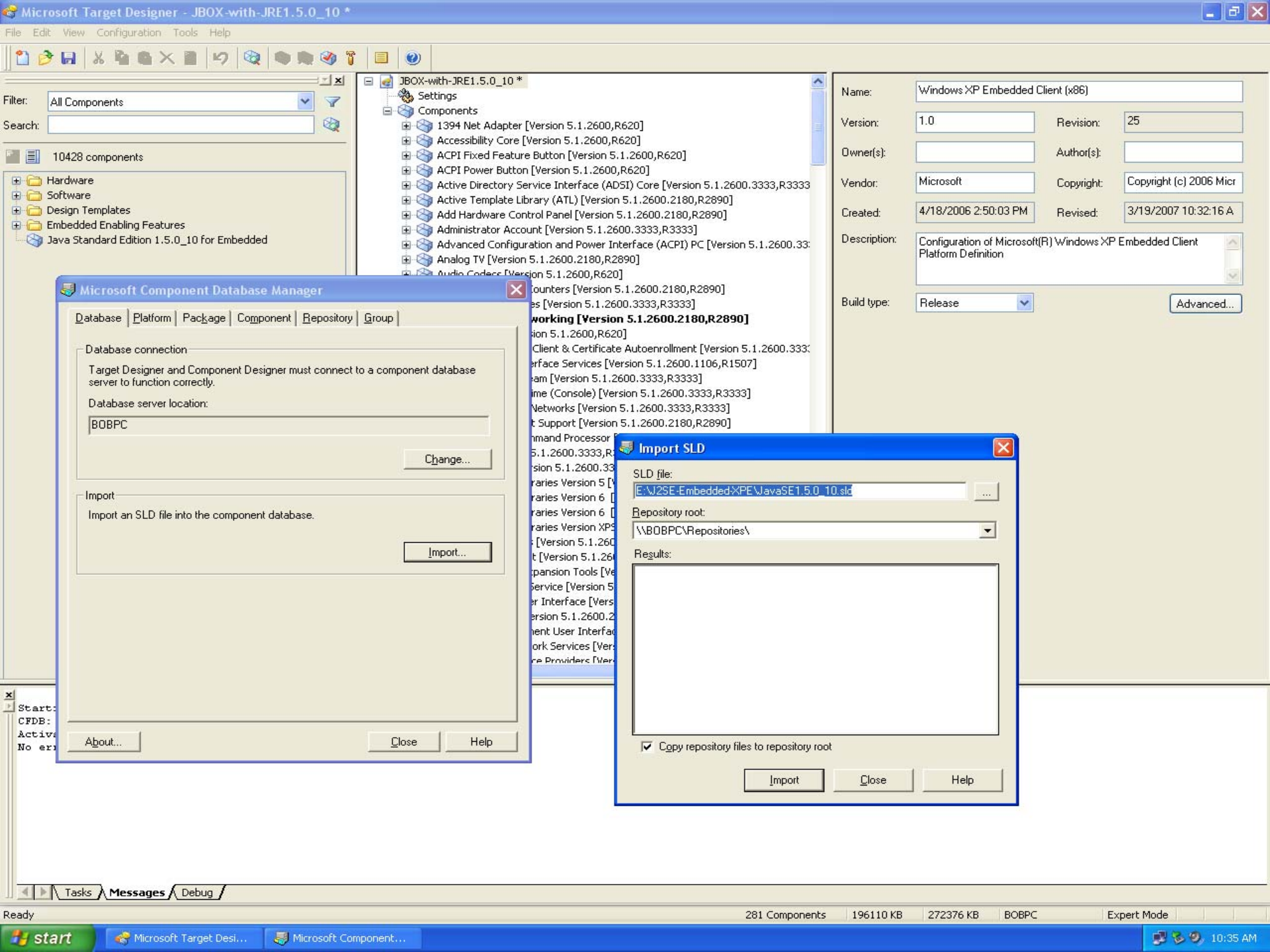
Q&A

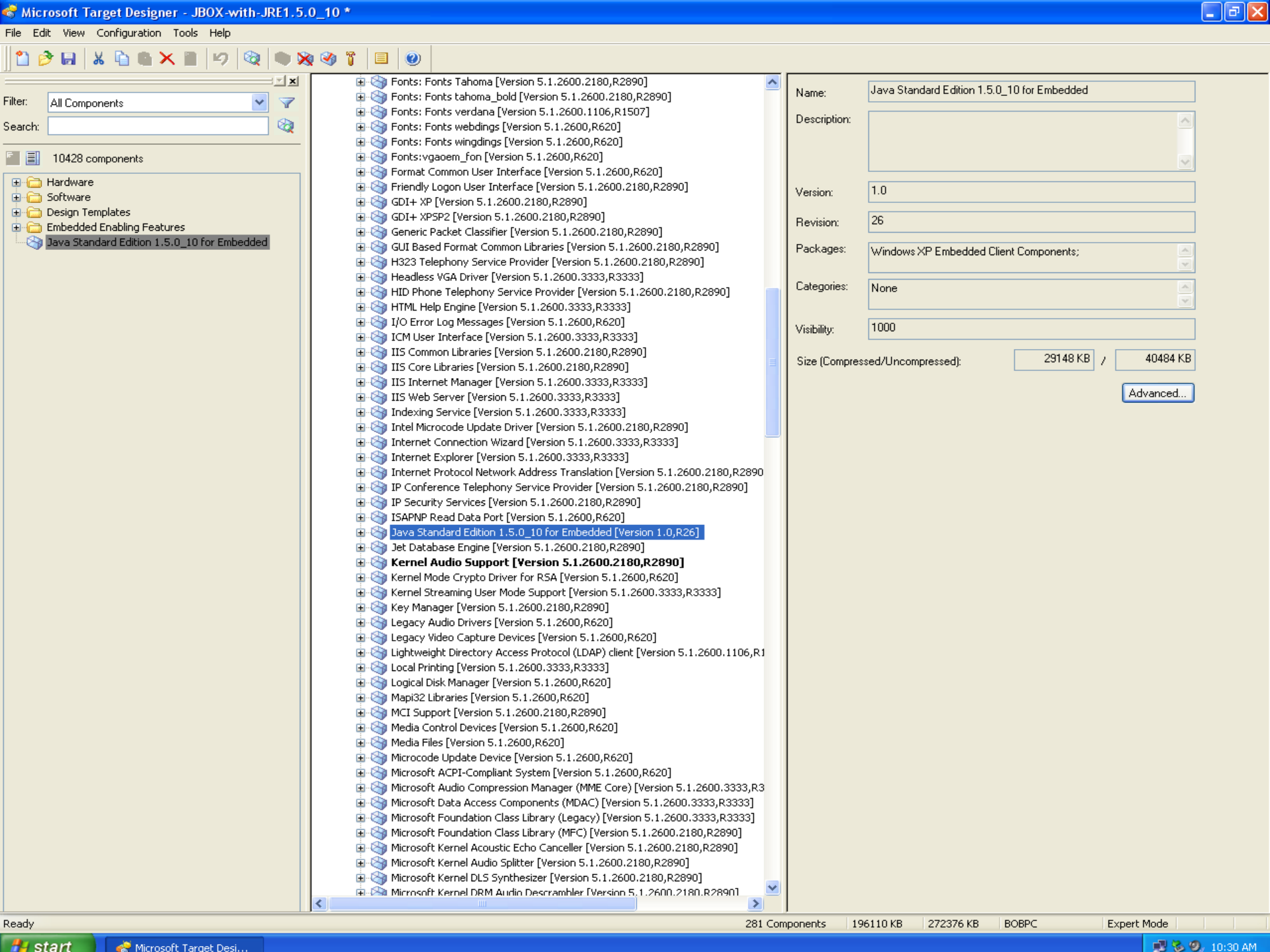
Adding Java Technology to Your Embedded OS

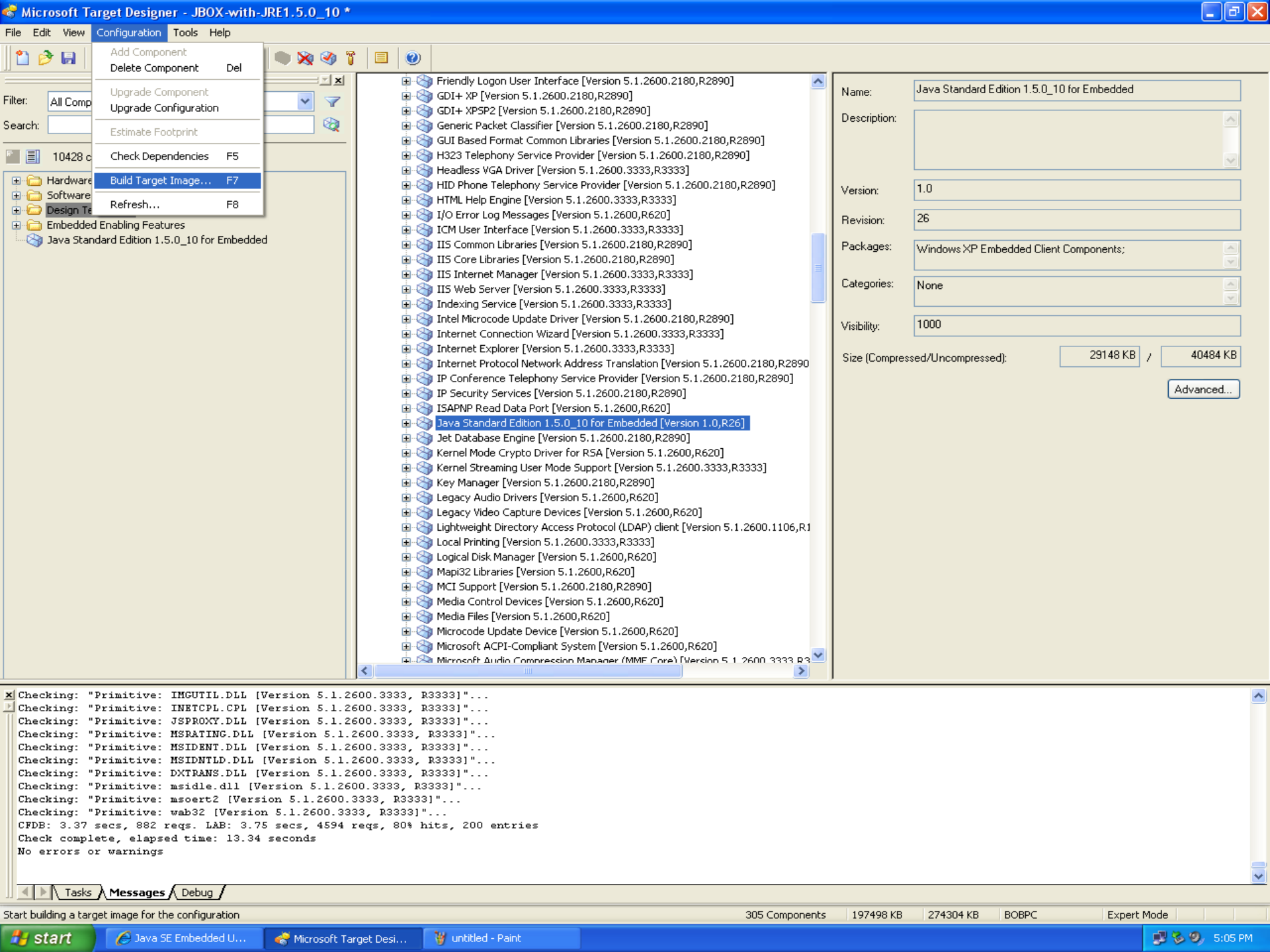
- Linux
  - Embedded OS vendor specific
  - ftp/nfs transfer to FLASH/DISK common
  - Unzip/untar Java SE platform distribution
- Windows XP Embedded
  - Microsoft provides Platform Builder GUI

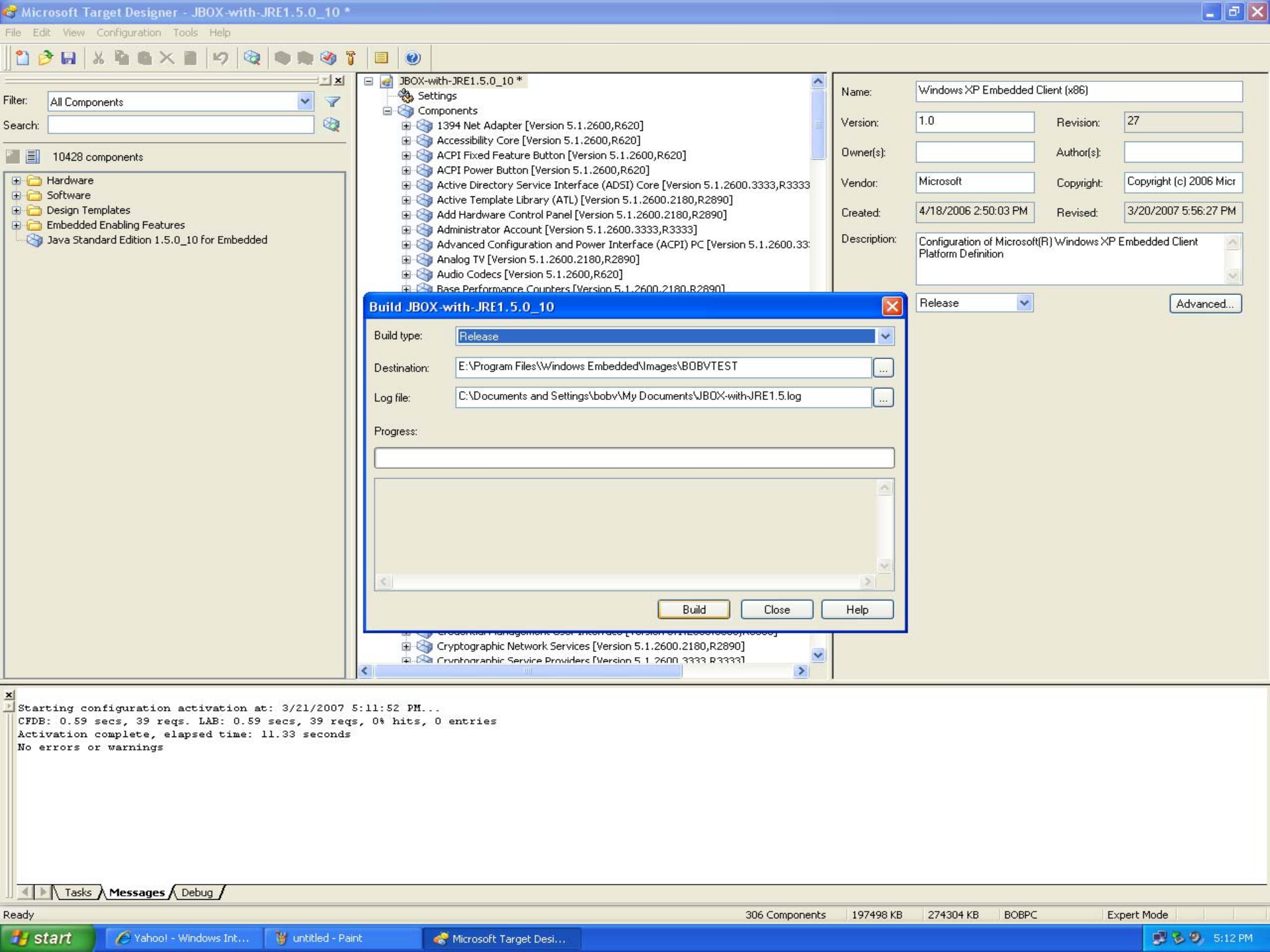
Building a Java Technology Enabled Windows XP Embedded OS Image

- System Level Definition File (.sld) distribution of Java SE platform Embedded now available
  - Eases development of XP Embedded OS image
- Uses Microsoft Windows Embedded Studio Target Designer
  - Import Java platform .sld file into Target Designer
  - Double Click on Java Component
  - Java platform now available
- Java SE platform for Embedded Requires Windows Application Compatibility Macro Component


Microsoft Target Designer - JBOX-with-JRE1.5.0_10 *
File Edit View Configuration Tools Help
Filter: All Components
Search:
10428 components
Hardware
Software
Design Templates
Embedded Enabling Features
Java Standard Edition 1.5.0_10 for Embedded
JBOX-with-JRE1.5.0_10 *
Settings
Components
1394 Net Adapter [Version 5.1.2600,R620]
Accessibility Core [Version 5.1.2600,R620]
ACPI Fixed Feature Button [Version 5.1.2600,R620]
ACPI Power Button [Version 5.1.2600,R620]
Active Directory Service Interface (ADSI) Core [Version 5.1.2600.3333,R3333
Active Template Library (ATL) [Version 5.1.2600.2180,R2890]
Add Hardware Control Panel [Version 5.1.2600.2180,R2890]
Administrator Account [Version 5.1.2600.3333,R3333]
Advanced Configuration and Power Interface (ACPI) PC [Version 5.1.2600.33
Analog TV [Version 5.1.2600.2180,R2890]
Name: Windows XP Embedded Client (x86)
Version: 1.0
Revision: 25
Owner(s):
Author(s):
Vendor: Microsoft
Copyright: Copyright (c) 2006 Micr
Created: 4/18/2006 2:50:03 PM
Revised: 3/19/2007 10:32:16 A
Description: Configuration of Microsoft(R) Windows XP Embedded Client Platform Definition
Build type: Release
Advanced...
Microsoft Component Database Manager
Database Platform Package Component Repository Group
Database connection
Target Designer and Component Designer must connect to a component database server to function correctly.
Database server location:
BOBPC
Change...
Import
Import an SLD file into the component database.
Import...
About...
Close
Help
Import SLD
SLD file:
E:\J2SE-Embedded-XPE\JavaSE1.5.0_10.sld
Repository root:
\\BOBPC\Repositories\
Results:
Copy repository files to repository root
Import
Close
Help
Tasks Messages Debug
Ready
281 Components
196110 KB
272376 KB
BOBPC
Expert Mode
start
Microsoft Target Desi...
Microsoft Component...
10:35 AM


Microsoft Target Designer - JBOX-with-JRE1.5.0_10 *
File Edit View Configuration Tools Help
Filter: All Components
Search:
10428 components
Hardware
Software
Design Templates
Embedded Enabling Features
Java Standard Edition 1.5.0_10 for Embedded
Fonts: Fonts Tahoma [Version 5.1.2600.2180,R2890]
Fonts: Fonts tahoma_bold [Version 5.1.2600.2180,R2890]
Fonts: Fonts verdana [Version 5.1.2600.1106,R1507]
Fonts: Fonts webdings [Version 5.1.2600,R620]
Fonts: Fonts wingdings [Version 5.1.2600,R620]
Fonts:vgaoem_fon [Version 5.1.2600,R620]
Format Common User Interface [Version 5.1.2600,R620]
Friendly Logon User Interface [Version 5.1.2600.2180,R2890]
GDI+ XP [Version 5.1.2600.2180,R2890]
GDI+ XPSP2 [Version 5.1.2600.2180,R2890]
Generic Packet Classifier [Version 5.1.2600.2180,R2890]
GUI Based Format Common Libraries [Version 5.1.2600.2180,R2890]
H323 Telephony Service Provider [Version 5.1.2600.2180,R2890]
Headless VGA Driver [Version 5.1.2600.3333,R3333]
HID Phone Telephony Service Provider [Version 5.1.2600.2180,R2890]
HTML Help Engine [Version 5.1.2600.3333,R3333]
I/O Error Log Messages [Version 5.1.2600,R620]
ICM User Interface [Version 5.1.2600.3333,R3333]
IIS Common Libraries [Version 5.1.2600.2180,R2890]
IIS Core Libraries [Version 5.1.2600.2180,R2890]
IIS Internet Manager [Version 5.1.2600.3333,R3333]
IIS Web Server [Version 5.1.2600.3333,R3333]
Indexing Service [Version 5.1.2600.3333,R3333]
Intel Microcode Update Driver [Version 5.1.2600.2180,R2890]
Internet Connection Wizard [Version 5.1.2600.3333,R3333]
Internet Explorer [Version 5.1.2600.3333,R3333]
Internet Protocol Network Address Translation [Version 5.1.2600.2180,R2890
IP Conference Telephony Service Provider [Version 5.1.2600.2180,R2890]
IP Security Services [Version 5.1.2600.2180,R2890]
ISAPNP Read Data Port [Version 5.1.2600,R620]
Java Standard Edition 1.5.0_10 for Embedded [Version 1.0,R26]
Jet Database Engine [Version 5.1.2600.2180,R2890]
Kernel Audio Support [Version 5.1.2600.2180,R2890]
Kernel Mode Crypto Driver for RSA [Version 5.1.2600,R620]
Kernel Streaming User Mode Support [Version 5.1.2600.3333,R3333]
Key Manager [Version 5.1.2600.2180,R2890]
Legacy Audio Drivers [Version 5.1.2600,R620]
Legacy Video Capture Devices [Version 5.1.2600,R620]
Lightweight Directory Access Protocol (LDAP) client [Version 5.1.2600.1106,R1
Local Printing [Version 5.1.2600.3333,R3333]
Logical Disk Manager [Version 5.1.2600,R620]
Mapi32 Libraries [Version 5.1.2600,R620]
MCI Support [Version 5.1.2600.2180,R2890]
Media Control Devices [Version 5.1.2600,R620]
Media Files [Version 5.1.2600,R620]
Microcode Update Device [Version 5.1.2600,R620]
Microsoft ACPI-Compliant System [Version 5.1.2600,R620]
Microsoft Audio Compression Manager (MME Core) [Version 5.1.2600.3333,R3
Microsoft Data Access Components (MDAC) [Version 5.1.2600.3333,R3333]
Microsoft Foundation Class Library (Legacy) [Version 5.1.2600.3333,R3333]
Microsoft Foundation Class Library (MFC) [Version 5.1.2600.2180,R2890]
Microsoft Kernel Acoustic Echo Canceller [Version 5.1.2600.2180,R2890]
Microsoft Kernel Audio Splitter [Version 5.1.2600.2180,R2890]
Microsoft Kernel DLS Synthesizer [Version 5.1.2600.2180,R2890]
Name: Java Standard Edition 1.5.0_10 for Embedded
Description:
Version: 1.0
Revision: 26
Packages: Windows XP Embedded Client Components;
Categories: None
Visibility: 1000
Size (Compressed/Uncompressed): 29148 KB / 40484 KB
Advanced...
Ready
281 Components
196110 KB
272376 KB
BOBPC
Expert Mode
start
Microsoft Target Desi...
10:30 AM


Microsoft Target Designer - JBOX-with-JRE1.5.0_10 *
File Edit View Configuration Tools Help
Add Component
Delete Component Del
Upgrade Component
Upgrade Configuration
Estimate Footprint
Check Dependencies F5
Build Target Image... F7
Refresh... F8
Filter: All Comp
Search:
10428 c
Hardware
Software
Design Te
Embedded Enabling Features
Java Standard Edition 1.5.0_10 for Embedded
Friendly Logon User Interface [Version 5.1.2600.2180,R2890]
GDI+ XP [Version 5.1.2600.2180,R2890]
GDI+ XPSP2 [Version 5.1.2600.2180,R2890]
Generic Packet Classifier [Version 5.1.2600.2180,R2890]
GUI Based Format Common Libraries [Version 5.1.2600.2180,R2890]
H323 Telephony Service Provider [Version 5.1.2600.2180,R2890]
Headless VGA Driver [Version 5.1.2600.3333,R3333]
HID Phone Telephony Service Provider [Version 5.1.2600.2180,R2890]
HTML Help Engine [Version 5.1.2600.3333,R3333]
I/O Error Log Messages [Version 5.1.2600,R620]
ICM User Interface [Version 5.1.2600.3333,R3333]
IIS Common Libraries [Version 5.1.2600.2180,R2890]
IIS Core Libraries [Version 5.1.2600.2180,R2890]
IIS Internet Manager [Version 5.1.2600.3333,R3333]
IIS Web Server [Version 5.1.2600.3333,R3333]
Indexing Service [Version 5.1.2600.3333,R3333]
Intel Microcode Update Driver [Version 5.1.2600.2180,R2890]
Internet Connection Wizard [Version 5.1.2600.3333,R3333]
Internet Explorer [Version 5.1.2600.3333,R3333]
Internet Protocol Network Address Translation [Version 5.1.2600.2180,R2890
IP Conference Telephony Service Provider [Version 5.1.2600.2180,R2890]
IP Security Services [Version 5.1.2600.2180,R2890]
ISAPNP Read Data Port [Version 5.1.2600,R620]
Java Standard Edition 1.5.0_10 for Embedded [Version 1.0,R26]
Jet Database Engine [Version 5.1.2600.2180,R2890]
Kernel Mode Crypto Driver for RSA [Version 5.1.2600,R620]
Kernel Streaming User Mode Support [Version 5.1.2600.3333,R3333]
Key Manager [Version 5.1.2600.2180,R2890]
Legacy Audio Drivers [Version 5.1.2600,R620]
Legacy Video Capture Devices [Version 5.1.2600,R620]
Lightweight Directory Access Protocol (LDAP) client [Version 5.1.2600.1106,R1
Local Printing [Version 5.1.2600.3333,R3333]
Logical Disk Manager [Version 5.1.2600,R620]
Mapi32 Libraries [Version 5.1.2600,R620]
MCI Support [Version 5.1.2600.2180,R2890]
Media Control Devices [Version 5.1.2600,R620]
Media Files [Version 5.1.2600,R620]
Microcode Update Device [Version 5.1.2600,R620]
Microsoft ACPI-Compliant System [Version 5.1.2600,R620]
Name: Java Standard Edition 1.5.0_10 for Embedded
Description:
Version: 1.0
Revision: 26
Packages: Windows XP Embedded Client Components;
Categories: None
Visibility: 1000
Size (Compressed/Uncompressed): 29148 KB / 40484 KB
Advanced...
Checking: "Primitive: IMGUTIL.DLL [Version 5.1.2600.3333, R3333]"...
Checking: "Primitive: INETCPL.CPL [Version 5.1.2600.3333, R3333]"...
Checking: "Primitive: JSPROXY.DLL [Version 5.1.2600.3333, R3333]"...
Checking: "Primitive: MSRATING.DLL [Version 5.1.2600.3333, R3333]"...
Checking: "Primitive: MSIDENT.DLL [Version 5.1.2600.3333, R3333]"...
Checking: "Primitive: MSIDNTLD.DLL [Version 5.1.2600.3333, R3333]"...
Checking: "Primitive: DXTRANS.DLL [Version 5.1.2600.3333, R3333]"...
Checking: "Primitive: msidle.dll [Version 5.1.2600.3333, R3333]"...
Checking: "Primitive: msoert2 [Version 5.1.2600.3333, R3333]"...
Checking: "Primitive: wab32 [Version 5.1.2600.3333, R3333]"...
CFDB: 3.37 secs, 882 reqs. LAB: 3.75 secs, 4594 reqs, 80% hits, 200 entries
Check complete, elapsed time: 13.34 seconds
No errors or warnings
Tasks Messages Debug
Start building a target image for the configuration
305 Components 197498 KB 274304 KB BOBPC Expert Mode
start
Java SE Embedded U...
Microsoft Target Desi...
untitled - Paint
5:05 PM


Microsoft Target Designer - JBOX-with-JRE1.5.0_10 *
File Edit View Configuration Tools Help
Filter: All Components
Search:
10428 components
Hardware
Software
Design Templates
Embedded Enabling Features
Java Standard Edition 1.5.0_10 for Embedded
JBOX-with-JRE1.5.0_10 *
Settings
Components
1394 Net Adapter [Version 5.1.2600,R620]
Accessibility Core [Version 5.1.2600,R620]
ACPI Fixed Feature Button [Version 5.1.2600,R620]
ACPI Power Button [Version 5.1.2600,R620]
Active Directory Service Interface (ADSI) Core [Version 5.1.2600.3333,R3333
Active Template Library (ATL) [Version 5.1.2600.2180,R2890]
Add Hardware Control Panel [Version 5.1.2600.2180,R2890]
Administrator Account [Version 5.1.2600.3333,R3333]
Advanced Configuration and Power Interface (ACPI) PC [Version 5.1.2600.33
Analog TV [Version 5.1.2600.2180,R2890]
Audio Codecs [Version 5.1.2600,R620]
Cryptographic Network Services [Version 5.1.2600.2180,R2890]
Name: Windows XP Embedded Client (x86)
Version: 1.0
Revision: 27
Owner(s):
Author(s):
Vendor: Microsoft
Copyright: Copyright (c) 2006 Micr
Created: 4/18/2006 2:50:03 PM
Revised: 3/20/2007 5:56:27 PM
Description: Configuration of Microsoft(R) Windows XP Embedded Client Platform Definition
Release
Advanced...
Build JBOX-with-JRE1.5.0_10
Build type: Release
Destination: E:\Program Files\Windows Embedded\Images\BOBVTEST
Log file: C:\Documents and Settings\bobv\My Documents\JBOX-with-JRE1.5.log
Progress:
Build
Close
Help
Starting configuration activation at: 3/21/2007 5:11:52 PM...
CFDB: 0.59 secs, 39 reqs. LAB: 0.59 secs, 39 reqs, 0% hits, 0 entries
Activation complete, elapsed time: 11.33 seconds
No errors or warnings
Tasks
Messages
Debug
Ready
306 Components
197498 KB
274304 KB
BOBPC
Expert Mode
start
Yahoo! - Windows Int...
untitled - Paint
Microsoft Target Desi...
5:12 PM

Software Deployment Options

Physical Transfer

1) ***Software is prepared separately (e.g., on PC), then copied to portable persistent memory: ROM/flash/stick***

2) ***Portable persistent memory is inserted into embedded device (on board or through I/O port)***

   - ***Software is run directly from inserted memory***
   - ***Software is first copied to non-portable persistent memory in embedded device (ROM/flash/stick/disk), then run from there***

Software Deployment Options

Network Transfer

Software is migrated across network to non-portable persistent memory (ROM/flash/stick/disk), then run from there

- ***Software "push"/upload to device***
  - ***cp (using NFS mount), rcp, ftp, etc.***
- ***Software "pull"/download***
  - ***An agent running on device "pulls" software in, e.g., a servlet (using HTTP) or Java Web Start software (using JNLP)***

Agenda

Define Your Target Device Requirements

Which Java Platform Edition Is Right for You

Selecting Support Libraries

Developing Your Application Code

Building Your Target Image

Debugging

Performance Tuning

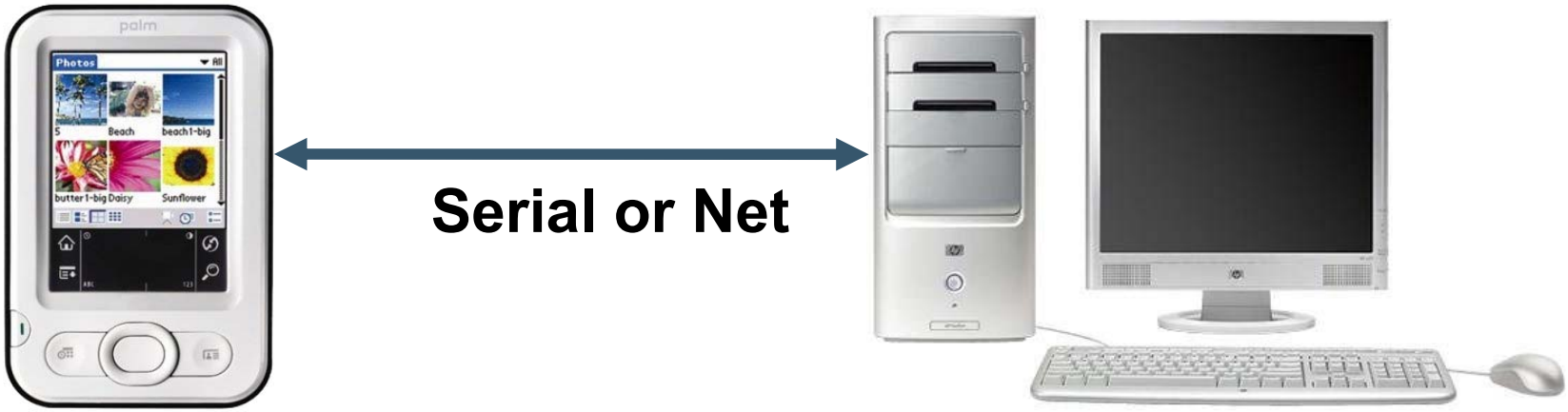
Q&A

Troubleshooting

- ***Three broad categories***
  - ***Monitoring and Management***
  - ***Profiling***
  - ***Debugging***

  See also Troubleshooting and Diagnostic Guide:
  http://java.sun.com/j2se/1.5/pdf/jdk50_ts_guide.pdf
- ***Basic strategies***
  - ***Local*** ***(using local filesystem, in-process)***
  - ***Remote*** ***(using network, client-server)***

Troubleshooting



Target Device

Development Platform

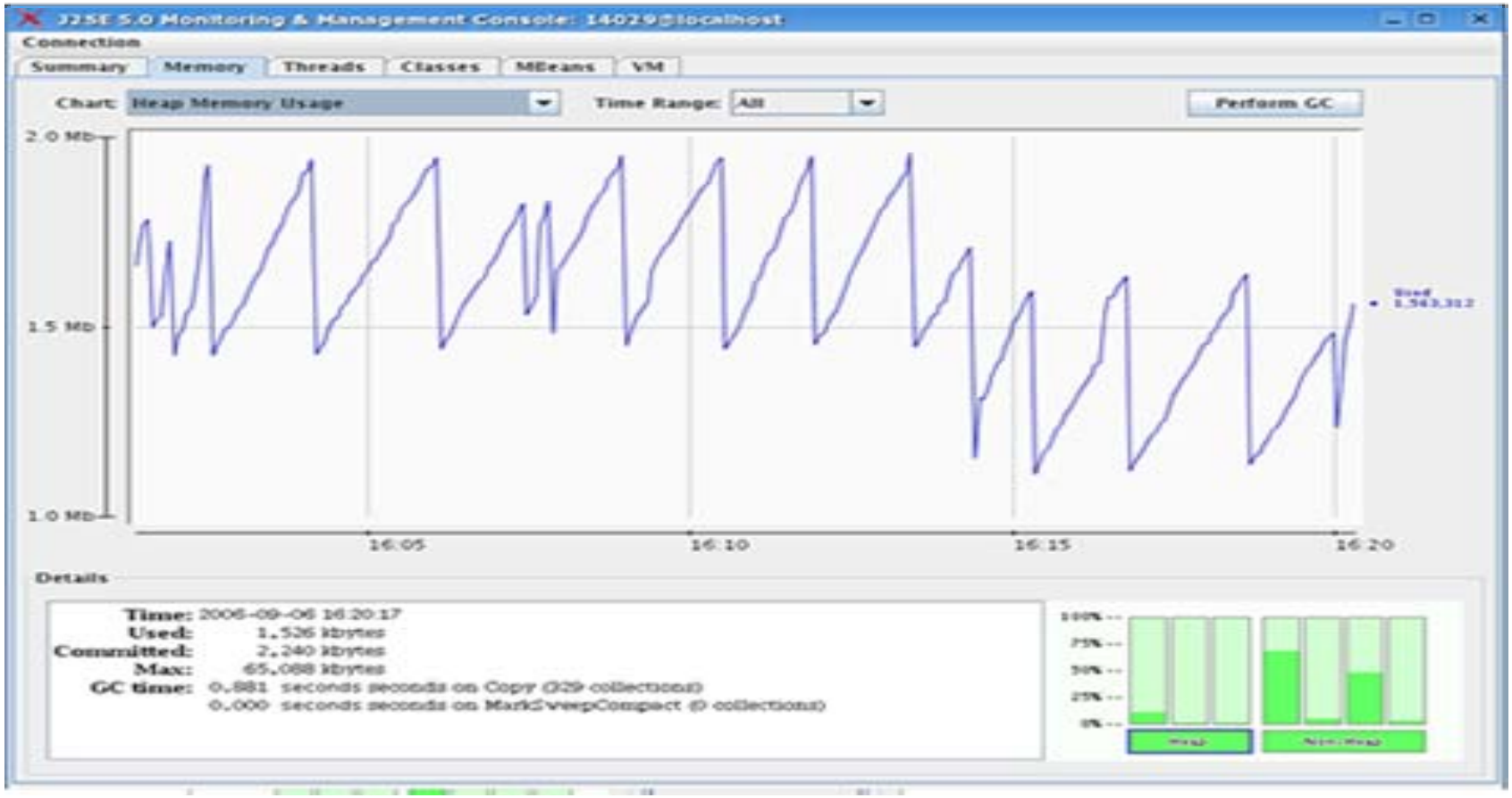
Troubleshooting

Monitoring and Management

- Get info about: JVM machine, memory consumption, thread use, class loading, etc.
  - http://java.sun.com/j2se/1.5.0/docs/guide/management/
- Based on Java Management Extension (JMX™). Lightweight agent, minimally intrusive to JVM machine being monitored/managed
- Basic strategies: local or remote
- Convenient GUI front-end tool (separate): jconsole
  - http://java.sun.com/javase/6/docs/technotes/guides/management/agent.html
  - http://java.sun.com/javase/6/docs/technotes/tools/share/jconsole.html

Troubleshooting

Monitoring and Management—jconsole



Troubleshooting

Profiling

- hprof—Heap/CPU profiling tool
  - Based on JVM Tool Interface as of 5.0
  - http://java.sun.com/developer/technicalArticles/Programming/HPROF.html
- jhat—heap dump analysis tool
  - http://java.sun.com/javase/6/docs/technotes/tools/share/jhat.html
- NetBeans software profiler
  - http://profiler.netbeans.org/
- Basic strategies: local or remote

Troubleshooting

Debugging

- Java Platform Debugger Architecture (JPDA) product software
  - Tiered architecture comprising three interface layers: Java Debug Interface (JDI) software (high-level), Java Debug Wire Protocol (JDWP) software (mid-level), JVM Tool Interface (low-level)
  - Based on JVM Tool Interface as of 5.0
  - jdb—Java platform debugger (Sun's JDI implementation)
  - http://java.sun.com/j2se/1.5.0/docs/guide/jpda/
- NetBeans software debugger: GUI front-end to jdb
- Basic strategies: Local or remote

Troubleshooting

Remote debugging example

- ***On embedded system, start Java application in JVM Tool Interface-based debugging mode:***
  - ***java -Xint -agentlib:jdwp=transport=dt_socket, server=y,suspend=n,address=7778 JavaMain***
  - ***Remote JPDA-compliant debuggers (debug clients) can now attach/connect***
- ***Remote debugger (e.g., NetBeans software) attaches/connects; must know:***
  - ***Location of Java binary code (jars) produced with javac -g:***
    Used for symbol names, line numbers
  - ***Location of corresponding Java source code:***
    used for display of current line, surrounding lines, context

Agenda

Define Your Target Device Requirements

Which Java Platform Edition Is Right for You

Selecting Support Libraries

Developing Your Application Code

Building Your Target Image

Debugging

Performance Tuning

Q&A

Performance Tuning

- Garbage Collection
- Proper Heap Sizing
- Compilation Policy
- Tuning Application Code
- Calling Native Code (JNI API overhead)
- Using Hardware Acceleration Efficiently

For More Information

http://java.sun.com/javase/embedded

Q&A

Deploying Java™ Platform, Standard Edition (Java SE Platform) in Today's Embedded Devices

Bob Vandette

Senior Staff Engineer
Sun Microsystems, Inc.
http://www.sun.com

TS-2602