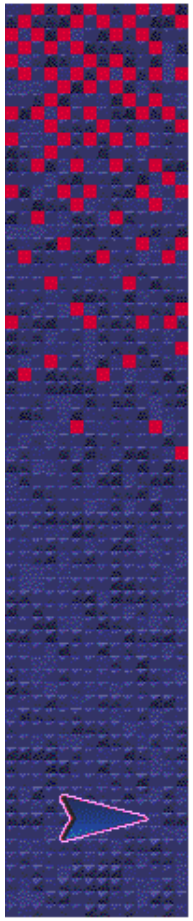


# JavaBeans™ Components Architecture

## Graham Hamilton

## Sun Microsystems, Inc.

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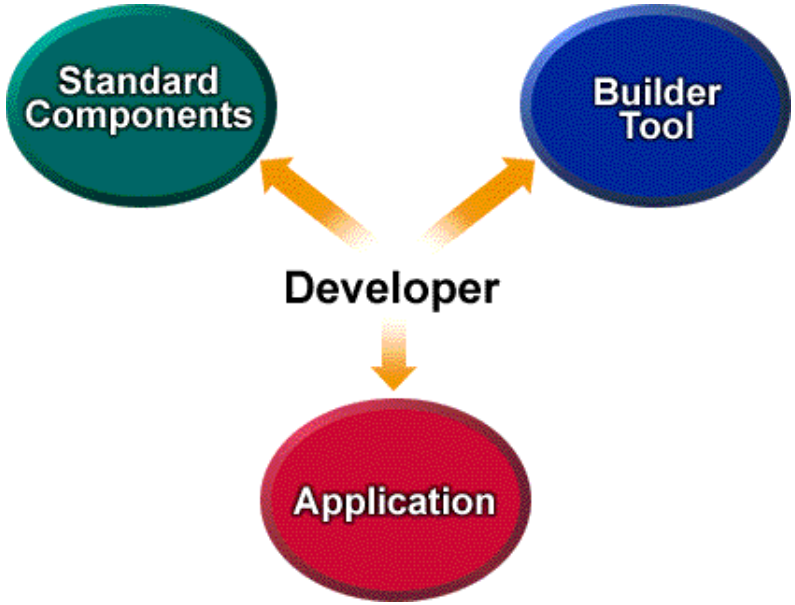
# JavaBeans™ APIs

The JavaBeans technology is the component model for the Java™ Platform

It defines Java software components

And how they fit together

# What We're Enabling




# What’s a Bean?

**"A JavaBeans component is a reusable software component that can be visually manipulated in builder tools."**

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# Kinds of Beans

**Buttons, sliders, GUI controls**

**Database viewers, stock data feeds**

**In-house customizable mini-applications**

**Word processors, spreadsheets**

**Invisible server beans**


# Kinds of builders

**Simple GUI layout managers**

**Web page builders**

**Full-scale application environments**

**Builders for invisible server applications**


# Platform integration

- Have to integrate well with ActiveX/COM
  - Beans must work well in COM containers
  - Including Visual Basic, Delphi, IE, Word, ..
- Integration in Navigator is very important
- Plus normal window system integration
  - X11, win32, Mac, whatever
- But still run everywhere!


# Key Strategies

**Make beans look simple**
  **But allow complexity**

**Exploit Java language features**

**Make beans usable without tools**

**Make people productive quickly**
  **And keep a smooth learning curve**


# Key Technologies

**Events**
**Properties**
**Introspection**
**Customization**
**Persistence**
**Distributed systems**


# Events

- AWT team has designed a new event model
  - We’ve adopted it for beans
- Goals were:
  - Make it easier to connect methods to events
  - Use strong typing
  - Use standard "design patterns"
- When a bean fires an event
  - It invokes a named, typed method
  - On a named, typed interface
- Bean must allow registration of listeners


# Properties

- Properties are chunks of a bean’s state
  - E.g. background, font, price, ...
- Accessible via getter/setter methods

- "bound" => change notification
- "vetoable" => changes can be rejected


# Introspection

**How does a tool learn about a bean?**

**You might use a component descriptor file**
- **But that tends to be pretty ugly**

**Beans uses analysis of class methods**
- **Applying standard design patterns**
- **To deduce properties/events/methods**

**Developers can also specify them precisely**


# Customization

**In builders you want to tailor components**

**We support standard "property sheets"**
- **This is good for simple things**
- **But awkward for complex controls**

**Beans also supports "Customizer" classes**
- **These can provide "wizard" guides**

**Custom property editors**
- **We supply default editors for many types**
- **Beans may provide their own type editors**


# Persistence

- Beans persistence uses serialization
  - Automagic persistence
  - Using the Java virtual machine.
  - Analyzes objects, pointers, fields
- People can override default behavior
- Note: Many tools use "generated source code" to achieve persistence


# Distributed Beans

**CORBA**

**RMI**

**RMI over IIOP**


# New Beans Developments

**InfoBus: For exchanging structured data**

**JavaBeans Activation Framework**
- **For using beans as MIME viewers**

**Containment and Services Protocol**
- **For grouping beans into contexts**

**Enterprise JavaBeans™ components**
- **They support middle-tier "server" apps**
- **Components reflect business logic**
- **Typically are run in OLTP transactions**


# Major Partners

**We developed beans with many partners:**

**Apple, Baan, Borland, CI Labs, Corel, Informix, IBM, JUSTSYSTEM, Lotus, Microsoft, Netscape, Novell, Oracle, ParcPlace, Silicon Graphics, SunSoft, Sybase, Symantec, Texas Instruments, Visual Edge, ...**

**Plus many external reviewers**

**Many thanks to everyone who contributed!**



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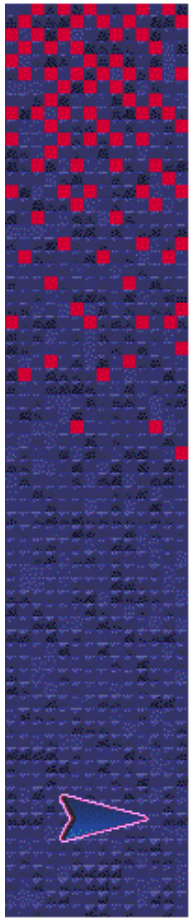


# Developing JavaBeans™ Components

Reginald Adkins

Sun Microsystems, Inc.

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# Overview

- The Beans Development Kit (BDK)
- How To Build and Interconnect JavaBeans Components
- How To Create Well Behaved Bean Components


# BDK 1.0

- BDK
  - Supports early development of Beans
  - Standard reference for developers and tool vendors
- Contents
  - The BeanBox test container
  - Example Beans
  - Reusable reference source code
  - Makefile information
  - Information located on our web site http://java.sun.com/beans


# Building Beans

- Programming
- Packaging
- Reuse


# Programming

- JavaBeans components are implemented in the Java™ programming language
- We exploit the strengths of the Java platform
- AWT 1.1. Event Model
- Standard design patterns


# Strengths of the Java™ Platform

- Reflection API
  - Used for Introspection
- Object Serialization
  - Used to persistently package beans for reuse


# Packaging

- Serialized Prototypes
  - Used for pre-customization
- JAR Archives
  - Used as the standard mechanism for delivering Beans


# Reuse

- Builder tools and human programmers can easily instantiate existing beans
- Further customization through subclassing
- BeanInfo


# BeanInfo

- Crucial for reuse in builder tools
- Allows control over what properties, events and methods are exposed


# Interconnecting Beans

- AWT 1.1 Event model
  - Fire events against interfaces
- What a builder may choose to interconnect
  - Properties
  - Methods


# Interconnecting Beans

- **Interconnecting Properties**
  - **Target beans can veto a pending property change, and/or be notified of a completed change**
- **Interconnecting Methods**
  - **Events sources can invoke listener methods directly, or**
  - **Adaptors can be used to invoke arbitrary (zero-arg) target methods**


# Interconnection Types

- Adaptors
- Persistent connections


# Tips

- Follow the design patterns
- You may already be following the design conventions!
- Provide associated BeanInfo classes


# JavaBean Sessions

- **Advanced topics in JavaBeans components**
  **Hall B, Thursday 2:45 pm**
- **JavaBeans components & ActiveX/COM**
  **Hall B, Friday 2:45 pm**
- **InfoBus: Data exhange for the entire family**
  **Esplanade, Friday 12:15 pm**
- **JavaBeans, New Technologies Discussion**
  **Room 220, Friday 1:30 pm**