



The Future of Java For Rich Internet Applications

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Agenda

- Introduction
- JavaFX overview and update
- JavaFX details
 - > scripting
 - > media and animation
- Java SE 6 update 10
 - > Simplified Java deployment
 - > Draggable applets
- Resources and conclusions

What does RIA mean today?

KAYAK Flights | Hotels | Cars | Cruises | Deals | Buzz | 22,848 kayak.com online

San Francisco to Honolulu Tue 25 Mar 2008 - Sun 30 Mar 2008

Filters (help) | List | Matrix | Chart | Get fare alerts for this route

Best USD 538 of 544 shown (show all) | Prev | Next

Price	Airline	Depart	Arrive	Stops (Duration)
\$726	Northwest / Multiple Airlines	SFO 3:15p HNL 10:20p	HNL 5:52p SFO 9:00a	0 (ch 37m) 1 (7h 40m)
\$765	Northwest / Multiple Airlines	SFO 3:15p HNL 10:20p	HNL 5:52p SFO 11:23a	0 (ch 37m) 1 (10h 03m)
\$765	Northwest / Multiple Airlines	SFO 3:15p HNL 10:20p	HNL 5:52p SFO 9:21a	0 (ch 37m) 1 (8h 01m)

Flight Times: Leave Tue 5:30a - 7:00p, Return Sun 7:00a - Mon 10:00a

YouTube Broadcast Yourself

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AIR is Adobe's 4th Platform, After Postscript, PDF and Flash

From: **uberpulse** Joined: 1 year ago Videos: 313

About This Video: For Adobe CEO, Sh... (more) Added: February 25, 2008

Shantanu Narayan, CEO, Adobe (c) 2008, UberPulse.com

myspace.com a place for friends

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Cool New Videos 62,837 uploaded today!

Horrible Towel Truck Driver, Coal Mine Test Explosion, Spidey The Sign Spinner, British Discuss Star Wars

Member Login: E-Mail, Password, Remember Me, LOGIN, SIGNUP, Forgot It?

Find Your Friends on MySpace: Check your Yahoo!, Hotmail, AIM and Gmail contacts and find them on MySpace!

Cool New People: Eli, Antonia, Lucas

facebook Profile edit Friends Networks Inbox

Param V. Singh What are you doing right now?

Networks: None, Sex: Male, Interested in: Looking For, Relationship Status: Friend, Looking For: Network, Birthday: April 1, Political Views: Moderating, Religious Views: My polls have been viewed!

Mini-Feed: Information, Books I Read, Education and Work, Circle of Friends, Friends, 37 Friends, See All

Would you use... Yes

Talks Roy Gould & Curtis Wong: WorldWide Telescope

Filmed Feb 2008; Posted Feb 2008

NFL NETWORK

PLAY

myspace 12:45 pm Update

Friends' Status

- Merrit - bored there's nothing good on TV
- Charlotte - happy mmmm...cookies
- Ashley - busy too much work to do!!!

Options Select Back

Find | NFL.com Home | NFL Network

Video Info

State of the Franchise: Steelers

Sunday, April 6, 2008 | 4:30 PM

Terrell Suggs joins Rich Eisen and Rod Woodson to discuss the state of the Steelers franchise.

Send to a Friend | Subscribe

URL: http://www.nfl.com/videos?videoid=09000

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Rich Internet Apps are Java's future

- Visually compelling applications
- Powered by the intersection of many Internet services
- Monetized in ways previously under-utilized in the application space
- Running on all of the screens of the customer's life

JavaFX Vision

JavaFX is the platform for creating and delivering
Rich Internet Applications
across all the screens of your life



JavaFX is Powered by Java

JavaFX Product Family

- JavaFX Platform (JavaFX Script)
 - > JavaFX Desktop
 - > JavaFX Mobile
 - > JavaFX TV
 - > Other devices and screens to follow
- Tools Suite
 - > JavaFX Developer (IDE Plugins, media converters, RAD tools)
 - > JavaFX Designer (Authoring, video encoding)
- Suite of applications built on JavaFX

Targeting Developer/Designer workflow

Creative Community

Consumers

Karl May
(Mashup author/builder)

Sean Wani
(Graphic Designer)

Saloni Sarin
(Creative Director)



Livleen (Student)



Amy Lewis
(Suburban wife/mom)



Samir Arora
(Business Professional)

Rich
Internet
Apps +
content

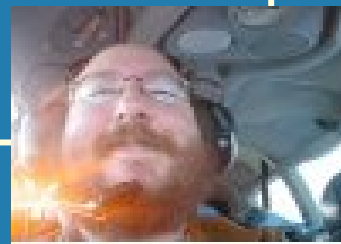
Across
desktop,
mobile, TV,
car



Wayne Stidolph
(Programmer)



Tom Hammer
(Media Editor)



Adam Nielson
(Web Master)

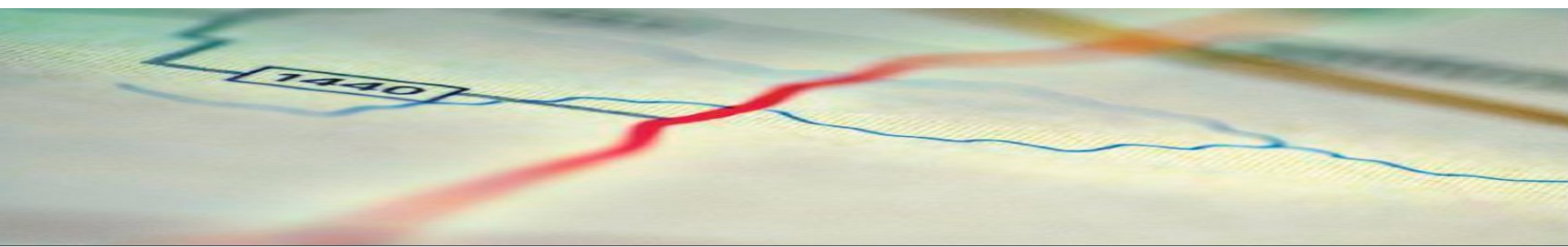
JavaFX roadmap

Desktop Product Line *JavaFX Desktop*
(Autumn 2008)

Mobile Product Line *JavaFX Mobile*
(Spring 2009)

TV Product Line *JavaFX TV*
(Summer 2009)

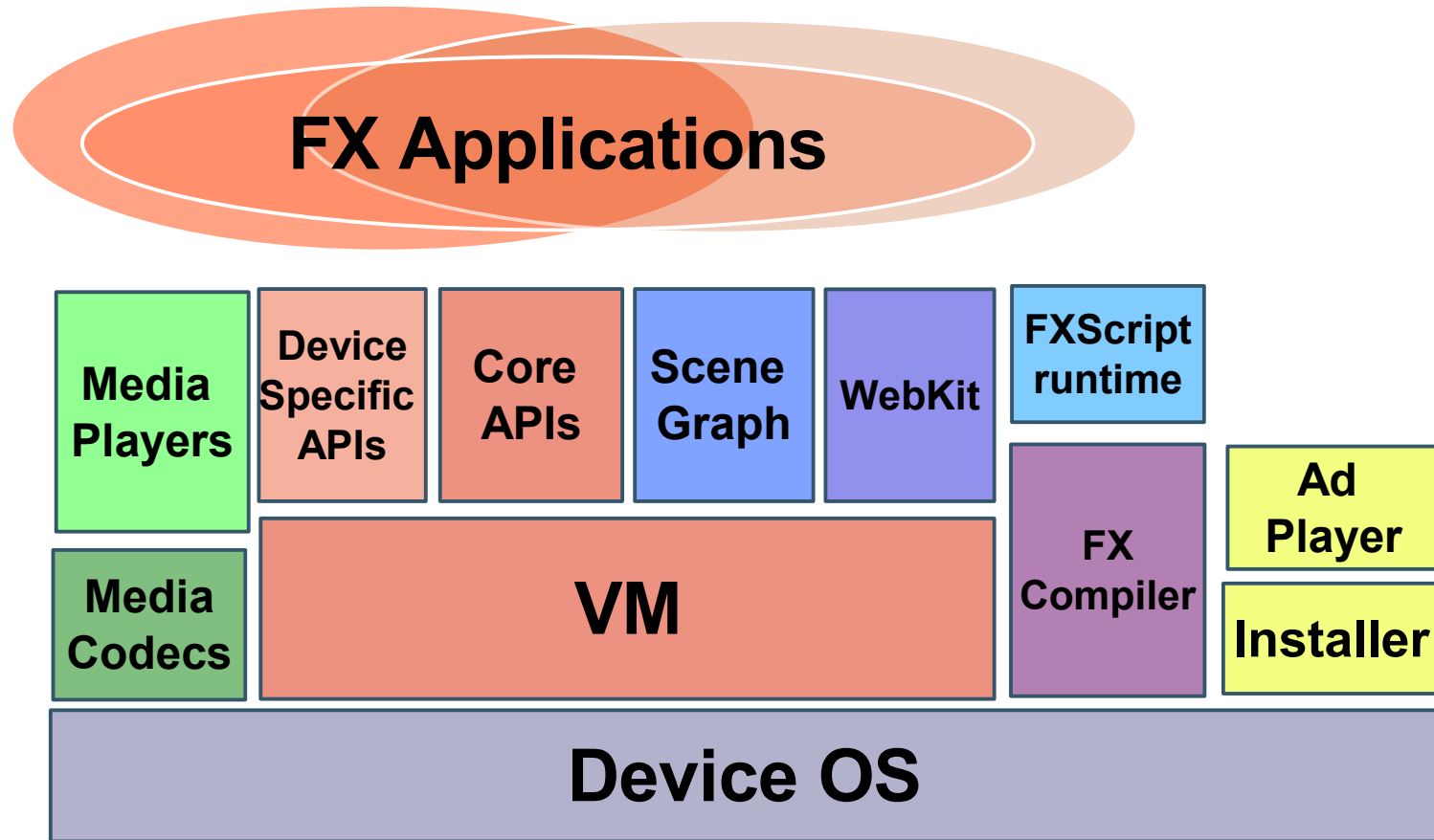
Other Platforms *With Partner platforms/OSs*



JavaFX Details



JavaFX Platform Architecture



JavaFX: Design Questions

- Why does it take a long time to write Java GUI programs?
- How can we avoid the “Ugly Java GUI” stereotype?
- Why do Flash programs look different to Java programs?
- Why does it seem easier to write web-apps than Swing programs?
- And how can I avoid having an enormous, writhing mass of listener patterns?

Java GUIs: Why are they not so rich?

- AWT/Swing Container/Component Hierarchy
 - > A tree of rectangular (mostly grey) boxes
 - > If all you do is compose Swing components together, the result is typically “the Ugly Java GUI”
 - > Same problem exists with other toolkits, e.g., GTK, VB
- UI Designers and Swing programmers are using different building blocks
 - > UI Designers compose designs in tools like Photoshop and Illustrator
 - > The building blocks they use have direct analogs in Java 2D, but not always directly in Swing

A Basic Java GUI: Not Very Pretty



Java 2D API

- To match the designs of UI designers requires using Java 2D API
- Java 2D API doesn't have compositional behavior
 - > Makes it too complex for many programmers to use efficiently
- JavaFX combines elements of Swing with Java2D
- Goal is to move away from direct Swing usage to a node based scene graph
 - > More like 3D (which will also be supported)

JavaFX Script Basics

- Declarative, statically-typed scripting language
- Facilitates rapid GUI development
- Many cool, interesting language features
- Runs on the Java Virtual Machine
- Deployment options same as Java programs
- Fully utilizes Java class libraries behind the scenes
- For content designers and media engineers

Declarative Syntax

- Stop thinking in Java, start thinking more scripting
- Think “what”, not “how”
- In Java we need to program how a GUI is displayed
 - > Layout managers, Panels, Components, etc
- JavaFX is more like HTML
 - > Tell JavaFX what you want
 - > Let JavaFX figure out how to display it
 - > No porting between screens (desktop, mobile, etc)

Simple JavaFX Example

```
Frame {  
    stage: Stage {  
        content: Circle {  
            centerX: 50  
            centerY: 50  
            radius: 50  
            fill: Color.RED  
        }  
        fill: null // turn off the background  
    }  
    visible: true  
}
```

JavaFX Types

- Number
- Integer
- Boolean
- String
- Duration
- Void can be used for function return types

Variable Declaration

- `var name : type [?, +, *] = initializer;`
 - > ? = optional
 - > + = one or more
 - > * = zero or more
- `var digits : Number* = [1, 2, 3];`
- `var digits = [1, 2, 3];`
- `var name = 'foo'; // or = "foo";`
- `{ }` for variable name in strings
- `<< >>` to use reserved word for variable name
- Newlines can be placed directly in strings

Sequences

- Arrays on steroids
- Compared for equality on value
- Series notation

```
var days = [1..31];
```

- Slices via syntax and predicate

```
var week1 = days[0..<7];
```

```
var oddDays = days[n|n % 2 == 1];
```

- Insert/delete

```
delete 1 from days; // result is [2..31]
```

Querying Arrays (List Comprehension)

```
var titleTracks =  
    select indexof track + 1 from  
        album in albums,  
        track in album.tracks  
    where track == album.title;  
  
var squares = select n*n from n in [1..10];
```

Classes

```
class Person {  
    attribute name: String;  
    attribute parent: Person inverse  
        Person.children;  
    attribute children: Person* inverse  
        Person.parent;  
    function getNumberOfChildren(): Number {  
        return sizeof this.children;  
    }  
}
```

Binding in JavaFX

- Cause and Effect - Responding to change
- bind operator - Allows dynamic content to be expressed declaratively
- Automated by the system—Rather than manually wired by the programmer
- You just declare dependencies and the JavaFX runtime takes care of performing updates when things change
- Eliminates listener patterns

Binding

- Dependency-based evaluation of expressions
- Enables expression of dynamic data relationships

```
var x = 10;  
var y = bind x + 100;  
x = 50;  
y == 150; // true
```

- Any expression can be bound
 - > conditionals, loops, functions, etc...
- bind “with inverse” when 2-way is needed
- lazy binding to only evaluate when used

Binding Example

```
Class SceneElement extends SceneNode {
  attribute sx: Number;
  attribute sy: Number;
  attribute r: Number;
  attribute canSee: Boolean;

  public function create(): Node {
    return Circle {
      radius: bind r
      centerX: bind sx
      centerY: bind sy
      fill: Color.RED
      translateX: bind sx + transX
      translateY: bind sy + transY
      visible: bind canSee
    }
  }
}
```

Binding Example

```
function update(nx: Number, ny: Number) {  
  sx = nx;  
  sy = ny;  
  
  // Even one line if statement must have {}  
  if (nx > 0 and ny > 0) {  
    canSee = true;  
  } else {  
    canSee = false;  
  }  
}  
}
```

Formatting

- expr format as << directive >>
- directive can be:
 - > java.text.DecimalFormat
 - > java.text.SimpleData
 - > java.util.Formatter (always starts with %)

`100.896 format as <<%f>> // 100.896000`

`31.intValue() format as <<%02X>> // 1F`

Expressions

- if, while, try – Same syntax as Java
- `for (i in [0..10]) ...`
- `for (i in [0..10] where i%2 == 0)`
...
- `for (i in [0..10], j in [0..10]) ...`

Avoiding the Event Dispatch Thread

```
do {  
    // block of code executes in  
    // separate thread  
}
```

```
do later {  
    // block of code using  
    // java.awt.EventQueue.invokeLater  
}
```

Triggers

```
class X {
    attribute nums: Number*;
}

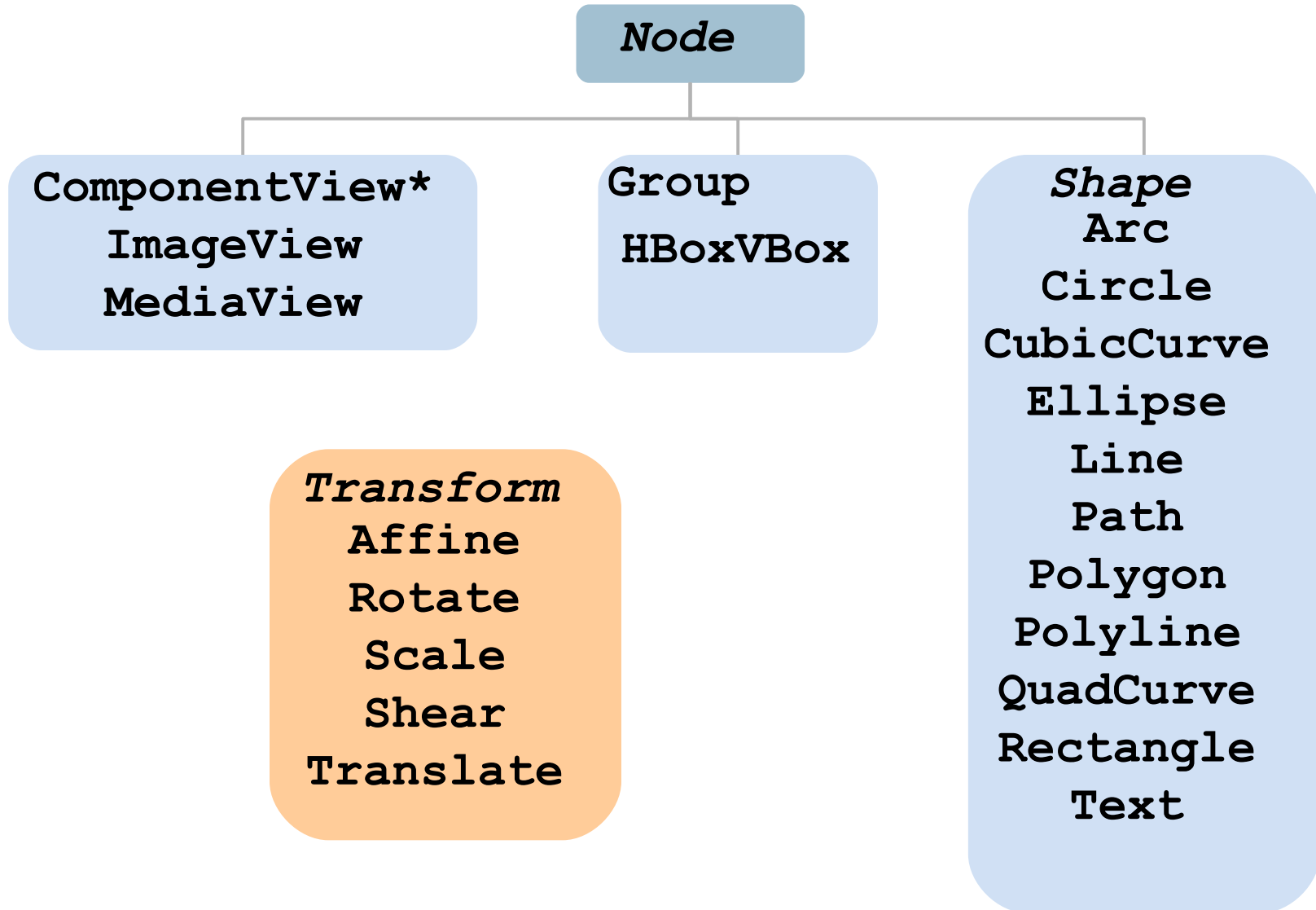
trigger on new X { // Creation trigger
    insert [1,2] into this.nums;
}

trigger on insert num into X.nums {
    System.out.println("{num} added to X");
}

trigger on delete num from X.nums {
    System.out.println("{num} deleted from X");
}

trigger on X.nums[oVal] = nVal {
    System.out.println("{nVal} replaced {oVal} in X");
}
```

Scene Graph Nodes: `javafx.gui.*`



Effects: `javafx.gui.effects.*`

Effect

	<code>DisplacementMap</code>
<code>Blend</code>	<code>PerspectiveTransform</code>
<code>Bloom</code>	<code>InvertMask</code>
<code>Glow</code>	<code>ColorAdjust</code>
<code>Lighting</code>	<code>SepiaTone</code>
<code>Flood</code>	
<code>Reflection</code>	<code>GaussianBlur</code>
<code>Shadow</code>	<code>MotionBlur</code>
<code>InnerShadow</code>	
<code>DropShadow</code>	

Light

`DistanceLight`
`PointLight`
`SpotLight`

Animation - `javafx.animation.*`

Timeline
autoReverse
INDEFINITE
keyFrames
repeatCount
running
toggle

KeyFrame
action
canSkip
time
timelines
values

Interpolator

DISCRETE
EASEBOTH
EASEIN
EASEOUT
LINEAR

Animation

- Timelines handles the animation in JavaFX
- Timelines are first-class citizen in the language along with the duration time constants (1s, 10s)
- They can have one or more KeyFrames
- Methods: start(), stop(), pause(), resume()
- Properties: autoReverse, repeatCount, toggle
- *Timelines are nestable!*

Animation

```

var t = Timeline {
  repeatCount: bind rep
  autoReverse: bind autoRevCheckBox.selected
  toggle: bind toggleCheckBox.selected
  keyFrames: [
    KeyFrame {
      time: 0ms
      values: [
        x => 0,
        y => 0]
    },
    KeyFrame {
      time: 2000ms
      values: [
        x => 200 tween interpolate,
        y => 200 tween interpolate]
    }
  ]
};

```

The “=>” literal constructor

```
values: [x => 100 tween Interpolator.LINEAR]
```

is equivalent to

```
values: [KeyValue {target: pX, value: 100,  
  interpolate: Interpolator.LINEAR}]
```

JavaFX Media Design Goals

- Media Playback is of primary importance
- Simple API: only a few lines of code needed
- Cross platform A/V format required
- Native support also desirable
 - > “Mash ups”
 - > Viewing local media
- Zero Configuration plug in support
 - > Drop in format support
- Going beyond rectangular video
 - > Support lightweight rendering

Java Media Components (JMC)

- Cross Platform Video Format Support
 - > Encode once, play anywhere
 - > Over time, multiple formats may be supported
 - > Sun Open Media Stack (OMS)
- Leverages native platform
 - > Windows
 - > Play Windows Media via DirectShow
 - > Flash via the ActiveX control
 - > Mac
 - > Quicktime and Core Audio/Video.
 - > Linux and Solaris
 - > GStreamer

Media in JavaFX

- Media classes are part of `javafx.gui` package
- Media, MediaPlayer and MediaView
 - > MediaView is a Node
 - > has a MediaPlayer
 - > MediaPlayer has a Media object.
 - > MediaView may be rotated, translated, sheared, and have filter effects applied to it.
 - > Multiple views may be bound to single player.
- MediaTimers allow functions to be invoked at key points in Media.
- Other media events may be triggered

JavaFX Media Example

```
var media = Media{source:"movie.mov"};
var player = MediaPlayer{media: media, autoPlay:true};
var mediaView = MediaView{mediaPlayer: player};

// To enable audio only, don't create MediaView
MediaView{
    mediaPlayer: player,
    onMouseClicked: function(e) { // Play/pause control
        if (player.paused) {
            player.play();
        } else {
            player.pause();
        }
    }

    // Rotate
    rotate: 90;
}
```

JavaFX NetBeans IDE Plugin

- New for NetBeans 6.1 and later
- Supports conventional development cycle
 - > edit, compile, run, test
 - > Also has preview mode (avoid compile/run)
- Specific project type for JavaFX
- Automatic installation of JavaFX SDK
- Editor supports code completion, drag and drop of components
 - > Not fully polished yet

JavaFX SDK Components

/docs

/lib

javafx.jar
 javafxrt.jar
 javafxgui.jar
 javafx-swing.jar
 Scenario.jar
 Decora-D3D.jar
 Decora-HW.jar
 jmc.jar
 jogl.jar
 jaxb*.jar

/bin

javafx.exe
 javafx.jar

/samples

SmokeScreenSample
 Stopwatch

JavaFX Command Line Development

- Include <javafx-sdk-path>/bin in PATH
- Use javafx to compile
- Use javafx to run
- Same idea as java
 - > javafx testfx.Main (explicit package)
 - > javafx Main (default package)

Java SE 6 update 10



Java Platform Success

- >91% of all PCs run Java platform*
- ~77% of all Java technology-enabled PCs run Sun's Java Platform, Standard Edition (Java SE platform)**
- Distribution through PC OEMs
 - > Nine of the top ten PC OEMs ship the Sun JRE software
 - > Representing >60% of all shipped PCs
 - > 58 white box vendors have signed JRE software redistribution agreements
- Download/installs
 - > ~44m installations / month for the last six months on Windows
 - > >50M in Jan, Feb, April, 2007

* Omniture, April 2007

**Mapsolute/Map24.com, April 2007

Three Deployment Routes

There are three major ways a Java platform program can be distributed today

- Applets (Java Plug-In software)
- Java Web Start
 - > Java Network Launch Protocol (JNLP)
- Standalone Programs (Custom Installers)

All three paths share similar challenges

Deployment Challenges

- What versions of Java Technology are installed?
- How do I launch Java Technology?
- What's the best way to install a new version?

When you consider the number of platform and browser combinations Java technology supports, none of these questions have simple answers

Present-Day Solutions

- Possible to detect JRE version 1.4.2+ using JavaScript Technology
- Exact version details not available
- Auto-install too complex
 - > Only available for Internet Explorer on Windows
- Sun only provides sample scripts
 - > No complete, working solution
- Outside the browser, you're on your own
 - > Fun with registry manipulation
- Installation could be smoother

Next-Generation Installer

- New Windows look-and-feel
- More streamlined
- Less intimidating
- Improved messaging
- More visually appealing

Deployment Toolkit

- JavaScript script
 - > <http://java.com/js/deployJava.js>
- Developer uses simple script on their site
 - > Link to Sun's script
 - > Simplified applet or JNLP Application launching
- Detects JRE software existence and version
- Depending on application requirements
 - > Redirects to download site
 - > Polls for successful install
 - > Redirects back to original site and launches app or applet

Deployment Toolkit

- ActiveX Control and NPAPI Plugin included in JRE
- Script will use the plugins if available
 - > Fine grained JRE detection
 - > Pure javascript can only detect at the family granularity.
 - > Allows application or applet to check that a specific version, a specific family, or a specific minimum version is installed.
 - > Install any available JRE version
 - > Pure javascript will only install latest JRE version
 - > Select installation type (kernel or online installer)
 - > Declare application or applet required packages
- Plugins remain installed after JRE uninstallation

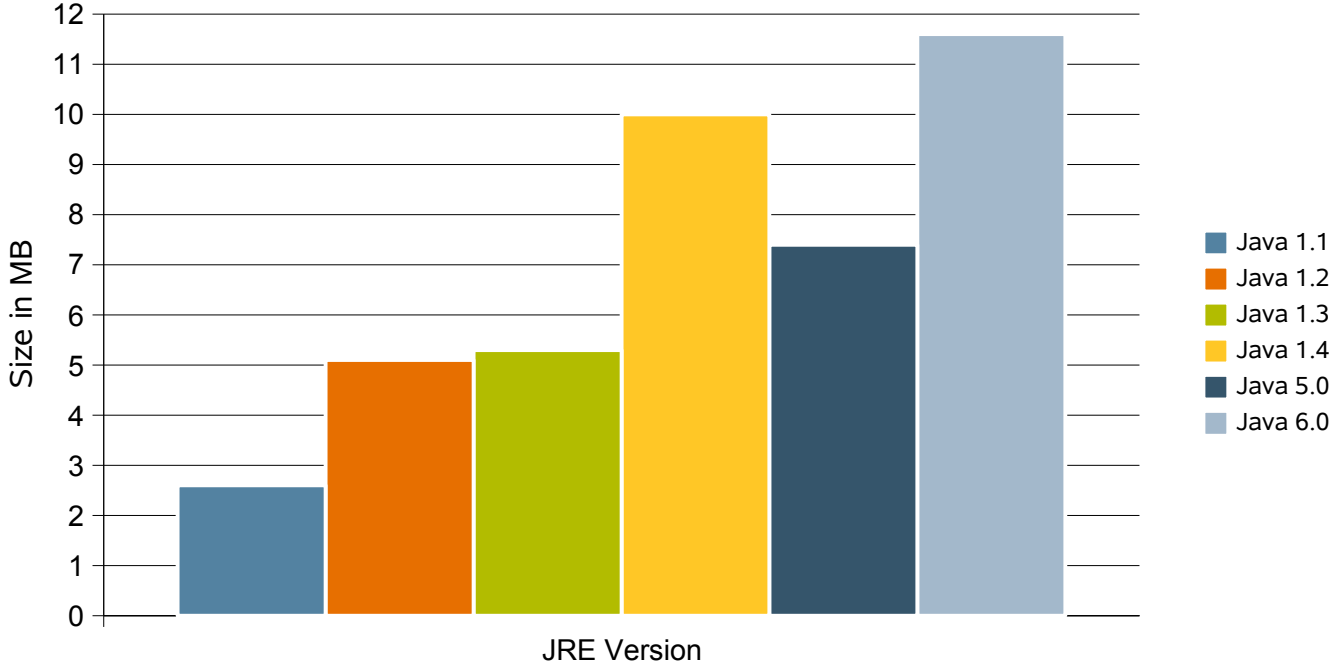
Browser Plug-Ins

- Use native code to perform tests
- JavaScript solution will check for the plug-in
 - > If found, delegate to plugin
- Deployment unchanged: call to JavaScript function
 - > Improved accuracy on which JRE versions are installed

Patch in Place

- Patch in Place allows updating an existing Java version to a later update of the same family.
- Static installation will be available for enterprises that need to rely on static versioning.
- Add / Remove Programs will only see one non-static Java Runtime installation in each family.
 - > Existing installations are all Static
 - > New versions explicitly installed statically will also be shown.

JRE Release Size



Size Impact

- The JRE contains an enormous number of APIs
- This gives developers great power and flexibility
 - > Most applications only use a small percentage
 - > Some classes have more deprecated methods than valid ones
- Biggest impact on small, light-weight applications

Incremental Update

- Download only the incremental changes from the version that the client machine actually has.
 - > Separate patches depending on existing install.
 - > For example, for 6 update 8, this would include : 6u5 -> 6u8, 6u6 -> 6u8, and 6u7 -> 6u8.
- No longer need to copy and install base images during initial install of the first version of a family.
 - > Faster installation of initial version
- Occupy less disk space by not retaining base images.

JRE Modularization

- A core part of the JRE is defined as the kernel
 - > Enough functionality to run basic program like 'Hello World'
- The remaining JRE components are downloaded on demand, or lazily downloaded

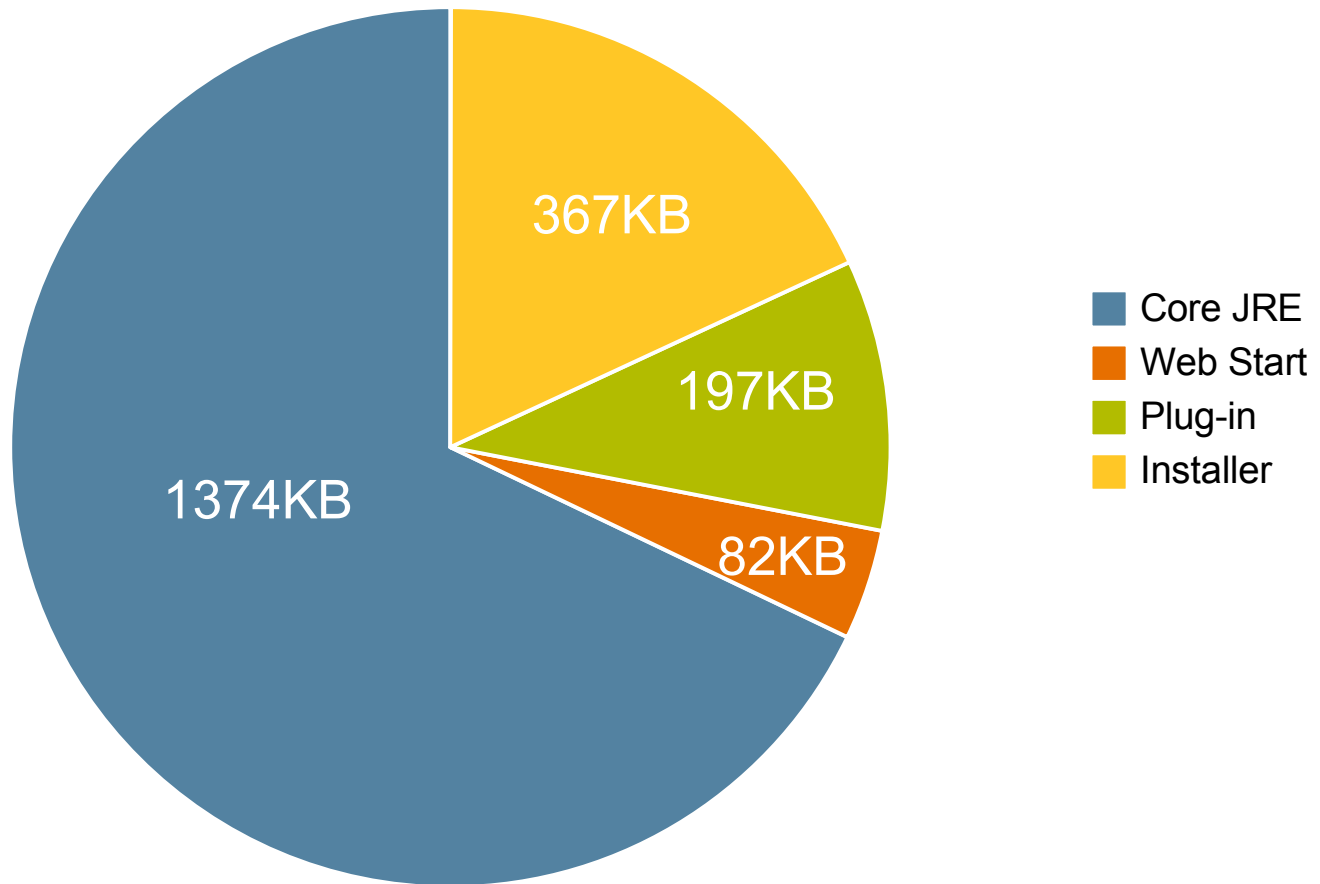
Java Kernel

- Every app needs some core functionality
 - > VM, networking, security, classloader
- ... plus other stuff on demand
 - > Swing, AWT, 2D
- Kernel downloads and installs:
 - > Bare essentials immediately
 - > Additional dependencies on demand
 - > Referencing a class
 - > `Class.getResource()` or equivalent
 - > `System.loadLibrary()` or equivalent
 - > Everything else in the background

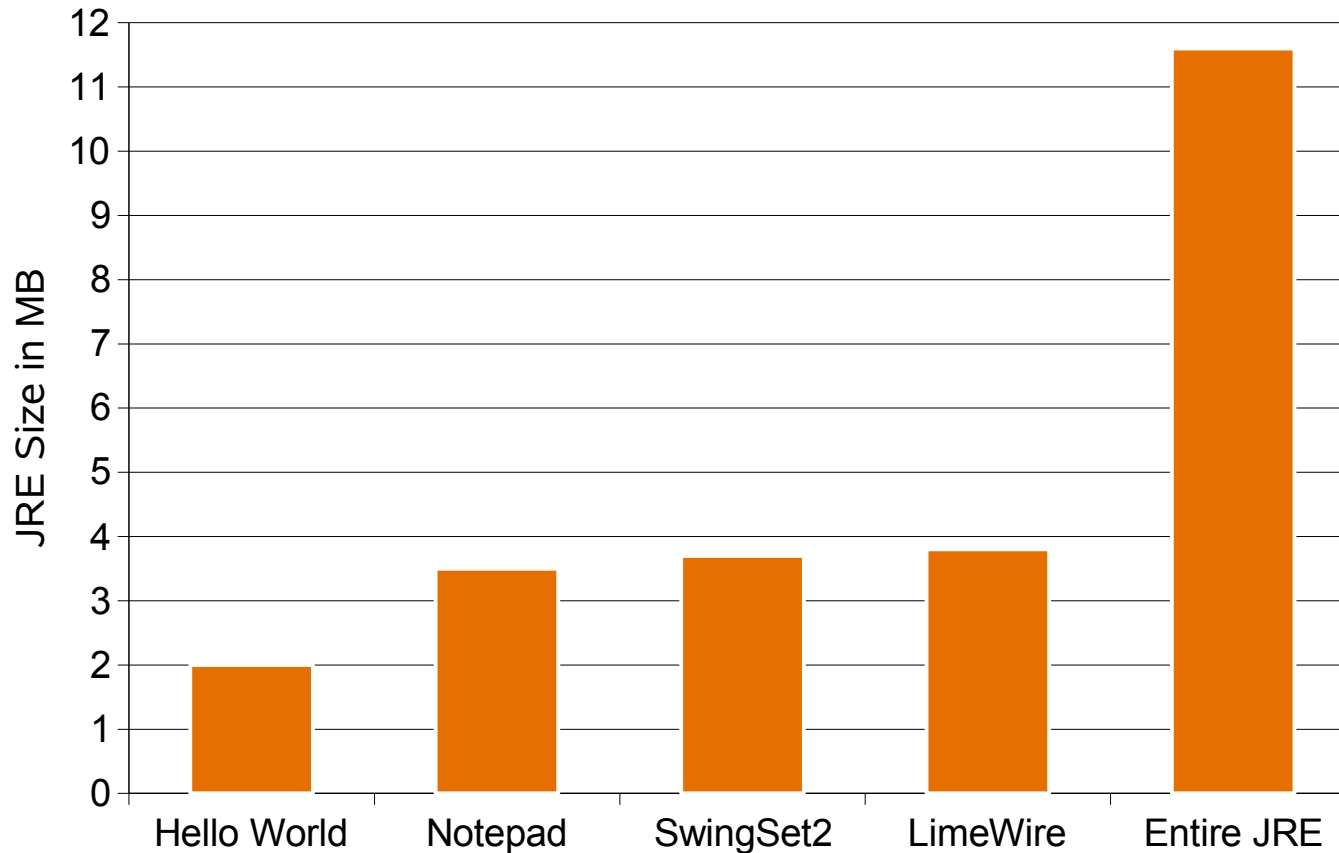
Java Kernel Structure

- Similar to the JRE structure
- Primary differences
 - > Much smaller rt.jar file
 - > Many files not present
- Missing class files are grouped into logical components
 - > javax_swing, java_net, etc
 - > Based on package boundaries

Kernel: Bare Essentials



Estimated Download Sizes



Java Quickstarter

- Pre-load the disk cache, **before** launch
 - > At boot, at browser launch, whenever
- **Note:** This is not the same as having a running VM
- Co-operates with the OS
 - > Memory still available for other apps
 - > OS will flush disk cache pages as necessary

Draggable Applets

- Applet now runs in a VM that is outside the browser
 - > No changes to security model
 - > Still sandboxed or signed for additional privileges
- Applet can be dragged off web page onto desktop
 - > Continues to run when browser closed
- Can be added to desktop as webstart application
- Supported in FireFox 3 and IE 7

Draggable Applets

- Additions to **APPLET** tag
 - > `<PARAM name="draggable" value="true">`
- New methods in **Applet** Class
 - > `boolean isAppletDragStart(MouseEvent e);`
 - > `void appletDragStarted();`
 - > `void appletDragFinished();`
 - > `void setAppletCloseListener(ActionListener l);`
 - > `void appletRestored();`

Summary

- JavaFX is a family of products and technologies aimed at content creators
- JavaFX script simplifies GUI programming
 - > Let the graphic artists do the hard work
- NetBeans plugin simplifies code development
- Java SE 6 update 10 eases the task of deployment

Further Information

<http://www.javafx.com>

<http://www.sun.com/javafx>

<http://openjfx.org>

http://jfx.wikia.com/wiki/Planet_JFX_Wiki

<http://learnjavafx.typepad.com/>

<http://blogs.sun.com/chrisoliver>



The Future of Java For Rich Internet Applications

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Technology Evangelist
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