HIGH-RESOLUTION MONITORS

Make Your User Interfaces Scale with the Future
Agenda

- Introduction
- Some broken apps
- Scaling modes
- Testing your apps
- Swing tips
What is DPI

Artwork by Studiomx.eu
What is DPI
What is DPI

1280 pixels

800 pixels
What is DPI

1280 pixels / 13.3 inch = 96 pixels per inch
800 pixels / 8.3 inch = 96 pixels per inch
Example: Printing

- Translating a logical “point” to multiple ink “pixels”

Desktop publishing point – 1/72 of an inch

As displays become denser, this translation becomes necessary as well

12-point font should always be 1/6 of an inch under different DPI conditions
Different pixel size, same point size

12 points

300 DPI

96 DPI
Pixels, points, and your display

- Points
  - logical unit of layout
  - (text, controls, primitive drawing)

- Pixels
  - literal physical unit of display

- Scale factor
  - how points are converted to pixels for your specific hardware
What is High DPI?

**QSXGA – Quad Super eXtended Graphics Array**

- 13.3 inch by 16.6 inch
- 2048 pixels by 2560 pixels
- 154 DPI
- Priced in $13,000-15,000 range

- Planar Dome C5i
- Eizo Radiforce G51
- Barco Coronis 5MP
- WIDE IF2105MP
What is High DPI?

WQUXGA – Wide Quad Ultra eXtended Graphics Array

18.8 inch by 11.8 inch
3840 pixels by 2400 pixels
204 DPI
Priced at around $9,000

IDTech MD22292 series

sold as:
• IBM T220, T221
• Iiyama AQU5611DTBK
• ViewSonic VP2290b
• ADTX MD22292B

Toshiba will produce a WQUXGA monitor in Q2 2008
High DPI – beyond the desktop

- Sony W810i 148 DPI
- Sony W810i 200 DPI
- Amazon Kindle 167 DPI
- Apple iPhone 163 DPI
- Apple iPod Nano 204 DPI
- Nokia N770 225 DPI
Point Of Sale / Presentation

www.microsoft.com/dynamics/pos
www.visualbusiness.com.au
www.komtelpe.biz
www.posmagic.com.au
What does this have to do with me?

- Even jump from 96 DPI to 120 DPI can break visuals
- Convergence with handhelds (200+ DPI)
- Point of sale systems (touch screens)
- Presentations and demos
- Hardware always gets cheaper…
Let’s see a few applications scaled to 150-200%
Type the name of a program, folder, document, or Internet resource, and Windows will open it for you.
Windows XP - Paint
Windows Vista – Photoshop CS3
Windows Vista - Minesweeper
Ubuntu 8.04 – Eclipse 3.4m5
Mac OS X Leopard - Photoshop
UI scaling modes

Magnification
Application scaling
Framework scaling
Magnification

- simplest option
- fuzzy
- best choice for legacy apps
Magnification

Magnification – Mac OS X

Preferences

New Document  Open and Save

Format
Use the Format menu to choose settings for individual documents.

- Rich text
- Wrap to page

Preferences

General
- Interface
- File Handling
- Performance
- Cursors
- Transparency & Gamut
- Units & Rulers

Color Picker: Adobe

Image Interpolation: Bicubic (best for smoothness)

UI Font Size: Small

Options
- Automatically Launch Bridge

Note: This image appears to be a screenshot of the preferences settings in a Mac OS X application, specifically showing the options for a new document and format settings.
Magnification – Windows Vista

Options

Calendar

First day of week: Sunday

Start of work week: Monday

Reminders should show when Windows V

Play sound for reminders

Display time zone information
Applications that don’t use modern native UI libs (WPF / Cocoa)

Applications that use UI toolkits that don’t provide magnification / toolkit scaling (Swing on non-Mac platforms)
What should be scaled?

- Icons
- Control visuals and inner metrics
- Inter control layout
- Custom application painting
Scaling Icons

- Hard to see
- Hard to understand
- Hard to operate
Scaling icons

- Icon bundles
  - Multiple files
  - “Archive” format – ICO (Win), ICNS (Mac)
  - “Layered” format – TIFF
- Vector icons – SVG, PDF
Icons – Multiple Versions

16*16, 22*22, 32*32, 48*48, 64*64, 128*128 + SVG

Artwork by Crystal and Oxygen
Scaling Controls
Internal Metrics

Borders
Internal Metrics

- Borders
- Focus ring margin
Internal Metrics

- Borders
- Focus ring margin
- Focus ring
Internal Metrics

- Borders
- Focus ring margin
- Focus ring
- Focus ring insets
Internal Metrics

- Borders
- Focus ring margin
- Focus ring
- Focus ring insets
- Icon text gap
Using Scalable Units For Control Layout – Vista approach

Actual control size:

- 50 DLUs (75 pixels)
- 14 DLUs (23 pixels)
- 4 DLUs (6 pixels)

Visible size:

- 49 DLUs (73 pixels)
- 13 DLUs (21 pixels)
- 5 DLUs (8 pixels)

The visible size is smaller than the control size because there is a transparent 1 pixel border around the outside of the control.

Dialog Units

- The **vertical dialog box unit** is equivalent to the character height.
- The **horizontal dialog box unit** is equivalent to the average character width of the dialog box's font.

- The average character width is calculated by finding the average text extent of the alphabetic character set.

http://support.microsoft.com/kb/145994/en-us
Preserving Inter-Control Alignment

Capture mode: Window Under Cursor
Snapshot delay: No delay

New Snapshot
Save As...
Open With
Copy to Clipboard
Help
Quit
Preserving Inter-Control Alignment

Degraded user experience
# Inter-Control Alignment

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Inter-Control Alignment
Scaling custom app visuals
Framework Scaling

most exhaustive option
requires deep integration from graphics drivers to the widget toolkit
minimal changes to "modern" apps
Framework Scaling

Framework scaling – Mac OS X

Energy Saver

Settings for: Power Adapter
Optimization: Custom

Your energy settings are optimized for high performance.
Current battery charge: 100%

Sleep Options

Put the computer to sleep when it is inactive for:

1 min 15 min 1 hr 3 hrs Never

Put the display(s) to sleep when the computer is inactive for:

1 min 15 min 1 hr 3 hrs Never

The display will sleep before your screen saver activates. Click the button to change screen saver settings.

Put the hard disk(s) to sleep when possible
Framework scaling – Vista
Framework scaling – back to pixels

- Sometimes the default scaling isn’t right
  - Per-pixel custom art (Google map tiles)
  - Custom controls
  - Custom views where physical size fidelity matters (show 1 inch, irrespective of DPI)

- Obtain the “scale factor”

- Apply an “inverse” affine transform to get back to the “device” coordinate space
Testing your app

- Changing the DPI setting for testing purposes
  - Windows Vista
  - Mac OS X
  - Ubuntu with Gnome
  - Ubuntu with KDE
Windows Vista

- Display -> Personalize -> Adjust Font Size (DPI)
Mac OS X Leopard

- /Developer/Applications/Graphics Tools/Quartz Debug.app
  - Tools -> Show User Interface Resolution

![User Interface Resolution](image)
Ubuntu 8.04 Gnome

- System -> Preferences -> Appearance -> Fonts -> Details
Ubuntu 8.04 KDE 4.0

- Computer -> System Settings -> Appearance -> Fonts
Swing Recommendations

- Don’t hard-code pixel values
- Bundling multiple images from existing icon sets (Tango, Oxygen, Crystal, …)
- Use SVG and Apache Batik
  - Use Flamingo transcoder on SVG images for pure Java2D rendering code
- JGoodies Plastic / Substance / Nimbus LAFs
- JGoodies Form layout manager with dialog units
- MiG layout manager with logical pixels
Swing Recommendations - Windows

- Use `Toolkit.getScreenResolution()` to convert pixels to points
- OS-specific properties to query desktop font settings
  - `win.defaultGUI.font`
  - `win.icon.font`
Swing Recommendations - Linux

- Use `Toolkit.getScreenResolution()` to convert pixels to points
- OS-specific properties under Gnome to query desktop font settings
  - `gnome.Gtk/FontName`
  - `gnome.Xft/DPI`
Swing Recommendations – Mac OS X

- OS-specific property
  - apple.awt.UIScaleFactor
  - Use inverse affine transform in `paintComponent()`

- Translating the affine transform to avoid pixel cracks
  - Using the modulo of the scaled vs. unscaled coordinate space
  - Published example forthcoming
One more thing...

Multi-display, multi-resolution
Related sessions

- **TS-6096** – Nimbus: The New Face of Swing. Thursday 10:50AM
- **BOF-6101** – Nimbus: Beyond the Basics. Thursday 7:30PM
- **TS-4928** - Creating Simple to Advanced Swing and SWT Layouts Easily with MiG Layout. Friday 1:30PM
Kirill Grouchnikov, Amdocs Inc.  
Mike Swingler, Apple Inc.