# The toolkit developer's perspective on X

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Boston, MA April 2004



#### Trends in hardware

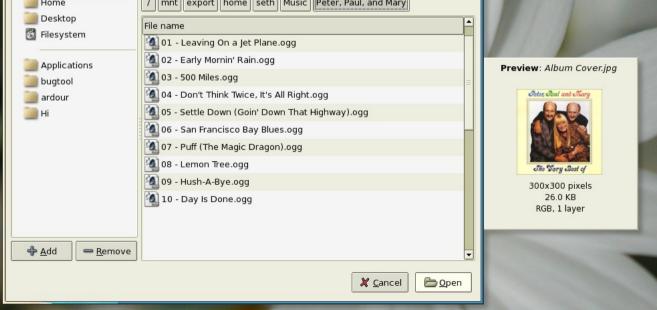
- Large screens: 21" or more
- Moderate resolutions (~5M pixels)
- Lots of memory
- Huge amounts of pixel-pushing power
- Diversity of form factor

### Trends in user interface

- Movement away from strict overlapping windows
  - Popups
  - Alpha transparency
- Proritization of information
  - Computer is actively seeking information
- Explanation
  - Computer is acting on behalf of user

#### Window-boundary example

Desktop	File name	Modified 👻 📤	-			
Filesystem	02 - Early Mornin' Rain.ogg	Today				
pixmaps	01 - Leaving On a Jet Plane.ogg	Today				
Music	Cover.jpg	Today	Preview: Album Cover.jpg			
bin	10 - Day Is Done.ogg	Today	Oster, Saul and Mary			
	🞑 14 - Gone the Rainbow.ogg	Today	Confer Column and Chary			
	20 - This Land is Your Land.ogg	Today				
	13 - All My Trials.ogg	Today				
	👰 09 - Hush-A-Bye.ogg	Today				
	19 - Blowin' In The Wind.ogg	Today	The Very Best of			
	18 - If I Had A Hammer.ogg	Today	300x300 pixels			
	16 - Cruel War.ogg	Today	26.0 KB			
	17 - Where Have All The Flowers.ogg	Today	RGB, 1 layer			
	15 - Tell It On The Mountain.ogg	Today				
		Today	]			
		_	Cancel Den			
			Home	/ mnt export home seth Music Peter, Paul, and Mary		
			📄 Desktop			
			Filesystem	File name		Preview: Album Cove
				01 - Leaving On a Jet Plane.ogg		
				02 - Early Mornin' Rain.ogg		
				🕘 03 - 500 Miles.ogg	=	
			ardour	04 - Don't Think Twice, It's All Right.ogg		Peter, Paul and Mary



#### User experience in 5 years

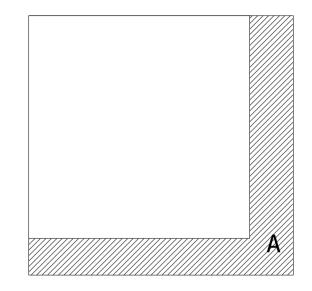
- Tight integration of multimedia
- Actions animated where appropriate
- Richly detailed desktop

#### User experience now

- Still many areas of improvement
- No excuse for:
  - Visible redraws
  - Inconsistent response times
  - Cut-and-paste / DND not "just working"

#### Example: anti-expose

- Window resized
- GTK+ marks new area "invalid", app redraws
- Redrawn area saved with request serial (*anti-expose*)
- Area subtracted from subsequent expose event



#### Xft1 was a success

- Got code, user improvements, out there quickly
- Pango handled core or Xft fonts

#### Extensions

• Used:

RENDER XKEYBOARD MIT-SHM SHAPE XInput RANDR Xinerama SYNC

#### Sucessful extensions

- Do things that apps can't do themselves
- Don't force particular architectures on apps
  - Common toolkits are cross-platform
- Provide obvious benefits to applications
- Beauty doesn't generally matter

# Performance

- Most apps do very few things
  - Draw solid rectangles
  - Draw images
  - Draw text
- Need benchmarks that accurately simulate
- Point-to-point
  - How long does it take to map and redraw a menu

# Conclusions

- Toolkits shield the user from the imperfections (and perfections) of the windowing
- If it isn't deployed we can't use it

# **Discussion Points**

- Do we need new latency-reduction infrastructure?
- Should toolkits be moving toward retainedmode for rendering? (what is role of SVG?)
- What windowing system enhancements are useful?
  - Output-only windows?
  - Better input-redirection? (Grabs are annoying)
  - Cover events?