The toolkit developer's perspective on X

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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
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
Successful 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 retained-mode for rendering? (what is role of SVG?)
• What windowing system enhancements are useful?
  – Output-only windows?
  – Better input-redirection? (Grabs are annoying)
  – Cover events?