XCL: An Xlib Compatibility Layer for XCB

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Overview

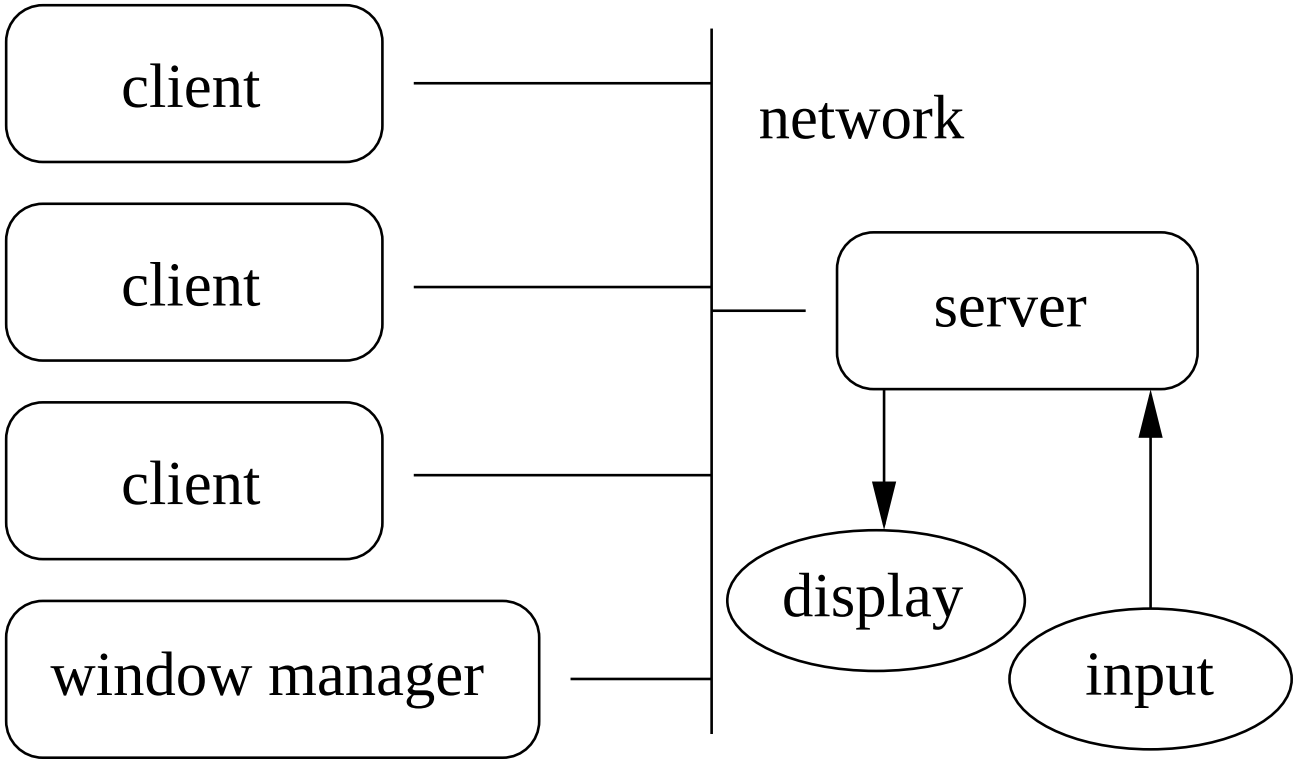
- The X Window System
- XCB
- XCL
- Summary

Thesis

Application of modern tools and X experience to X Window System client libraries can produce modern code

- by separation of concerns
- by design of new interfaces
- by re-implementing existing interfaces

What is X?

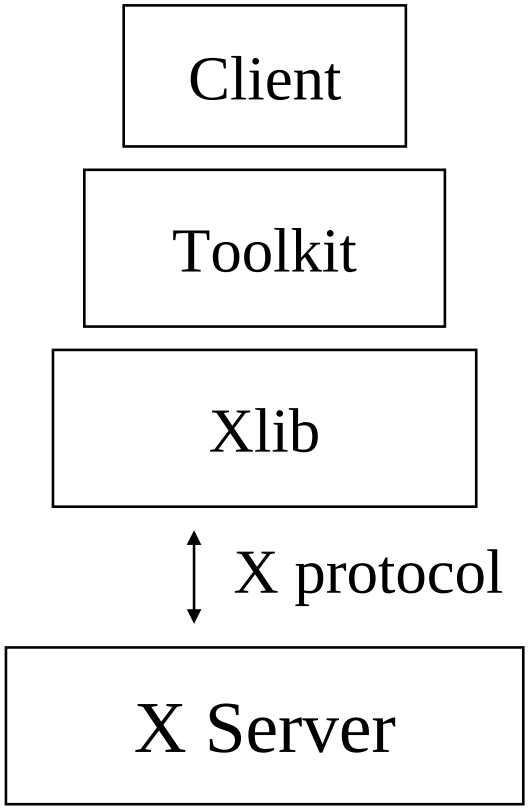


X Window System Architecture

X Strengths

- well designed
- separates policy from mechanism
  - window managers
  - toolkits
- network protocol specification separates hardware from apps
  - servers from XFree86, Sun, others
  - client libraries for many languages and platforms
  - client and server implementations are interoperable

Xlib: C Protocol Binding



Xlib's role in the X Window System

Motivations for XCB

Why change the Xlib API?

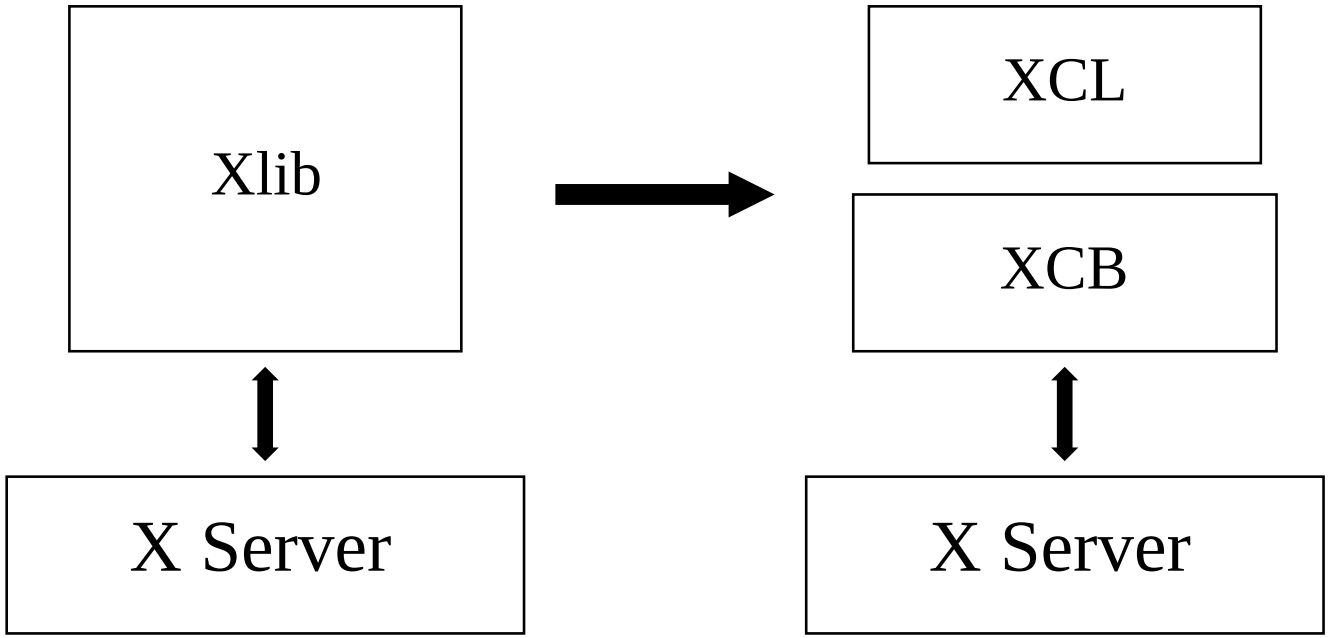
New API enables a light-weight, flexible implementation style.

- Smaller and simpler API and implementation
- Some optimizations affect API requirements
  - Latency is a problem for existing X applications
  - Xlib API supports latency hiding in special cases
  - XCB API supports latency hiding in all cases
- Support both single and multi-threaded clients with one API (c.f. Massey, "X meets Z")

XCB Evaluation

- most planned features implemented
- expected benefits have been successfully achieved
  - code size is particularly good: 27kB
- concept has been proven: modern implementation with new API

XCL: an Xlib Compatibility Layer for XCB

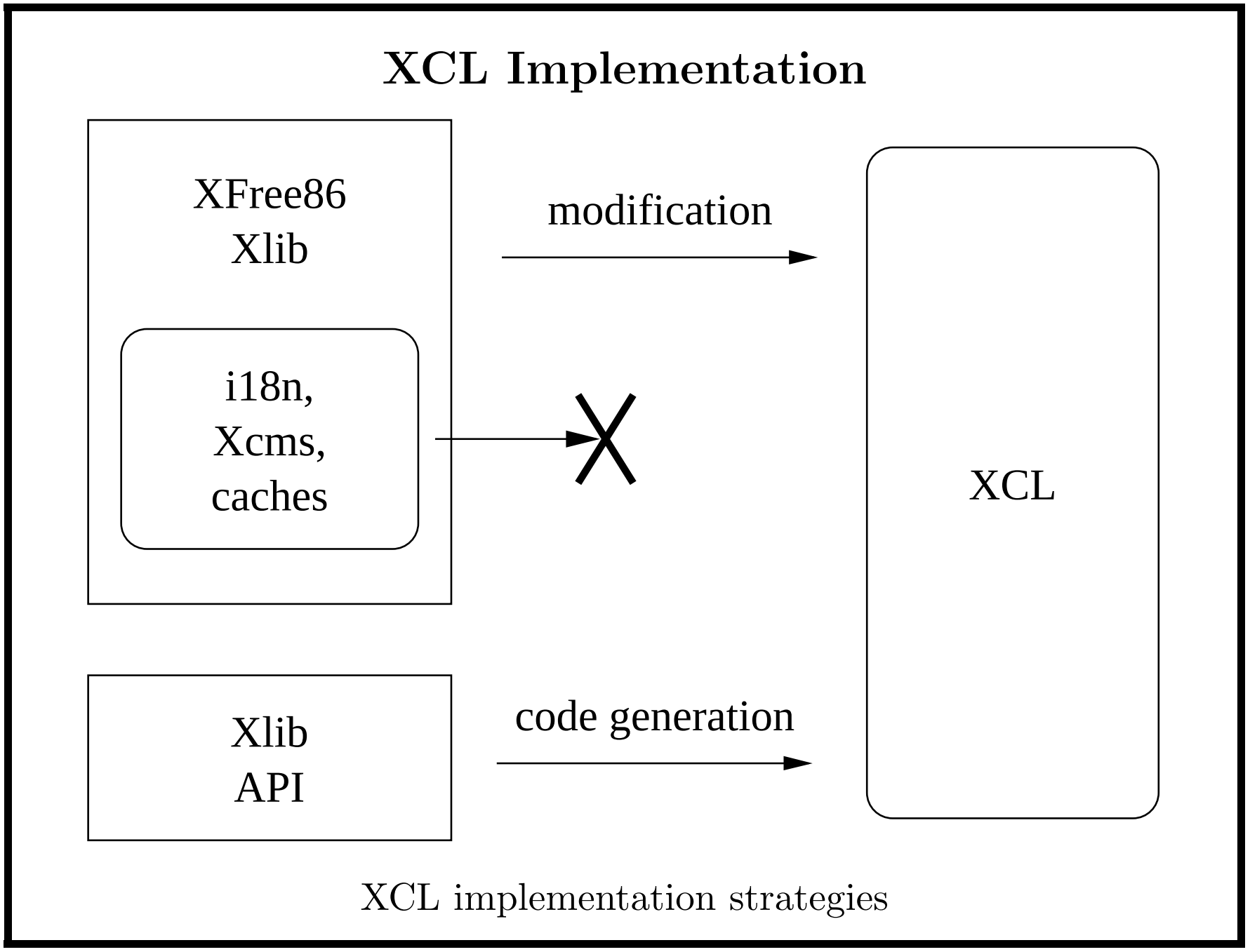


XCL's role compared with Xlib's

Motivations for XCL

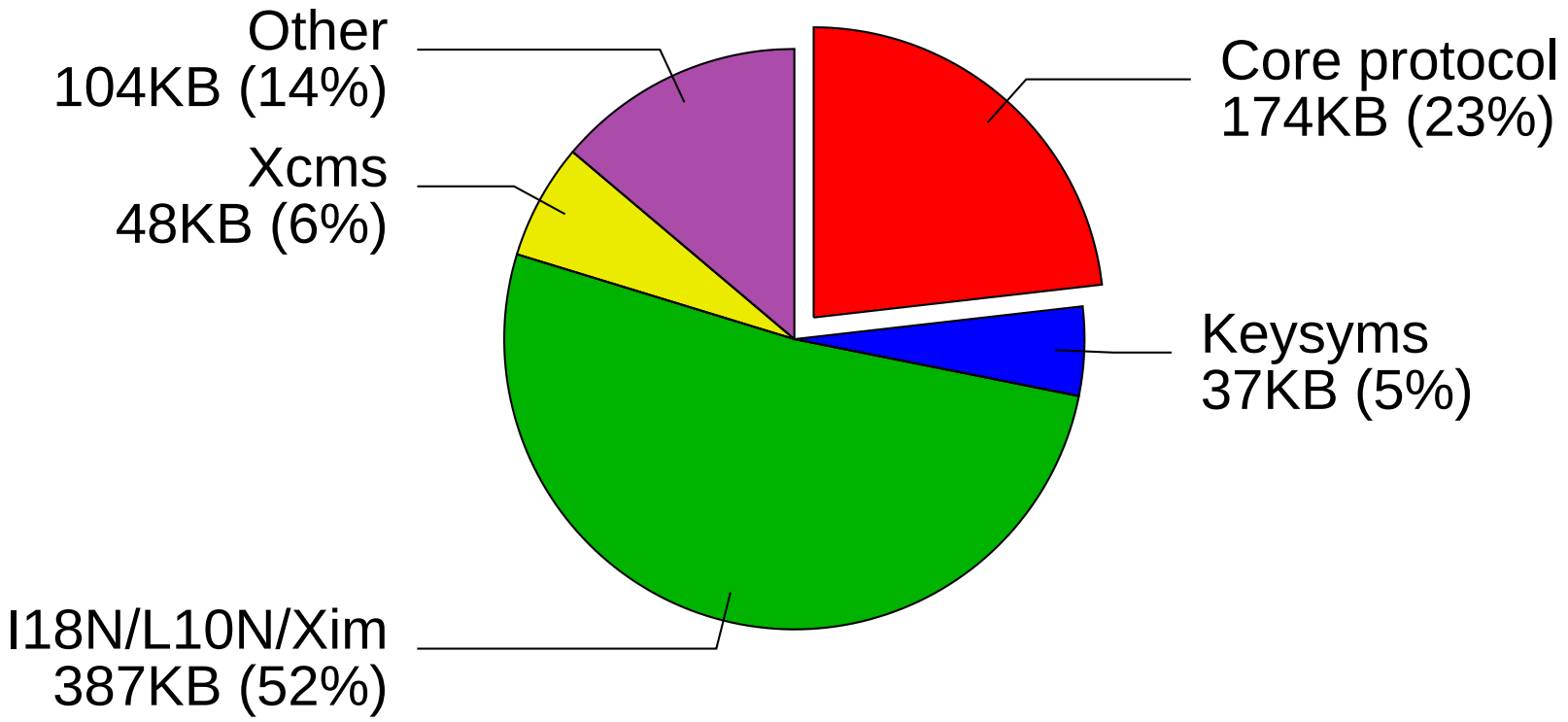
Why re-invent Xlib?

- Significant history: $>$ 15 years worth of software uses Xlib API
- In small environments like hand-held computers, Xlib implementation is big
- XCB implementation is small, but API is incompatible with Xlib applications
- Aid transition to XCB through XCL
- Anticipate possible benefits in performance, latency, reliability



XCL implementation strategies

Xlib Size Analysis



Total: 750KB

XCL Strengths

New design and implementation enables many of XCB's benefits without changing Xlib API.

- Easier maintenance
- More uniform optimization
  - e.g. request marshaling in not just XDrawPoint but also XDrawPoints

XCL Evaluation

- XCL not quite done yet
- Some applications tested without error, e.g.
  - rxvt: perfect behavior
  - gw: nearly perfect
- XCL+XCB is 55KB; Xlib is about 665KB
- XCL performance comparable to Xlib
- Concept has been proven: modern implementation of Xlib API

Future Work

- Complete XCL (extension support)
- Analyze: other Xlib functionality → additional modules
- Validate against existing Xlib-based toolkits (Qt, Gtk+)
- Implement caches on XCB
- Replace core font rendering with Xft

Related Work

- Libraries for other languages:
  - Java client libraries: XTC, Escher
  - Common Lisp: CLX
  - Smalltalk: STIX
  - ML: eXene
- Standalone client: Applegate and Jacobson's 1991 IOCCC entry plays Conway's "Game of Life" on X desktop

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- We are greatful for the significant contributions of Jim Gettys, one of the original authors of Xlib and of the design of the X Window System.
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Availability

Current implementations of XCL and XCB are freely available under an MIT-style license at `http://xcb.cs.pdx.edu/`.