Project Looking Glass:

3D Desktop Exploration...

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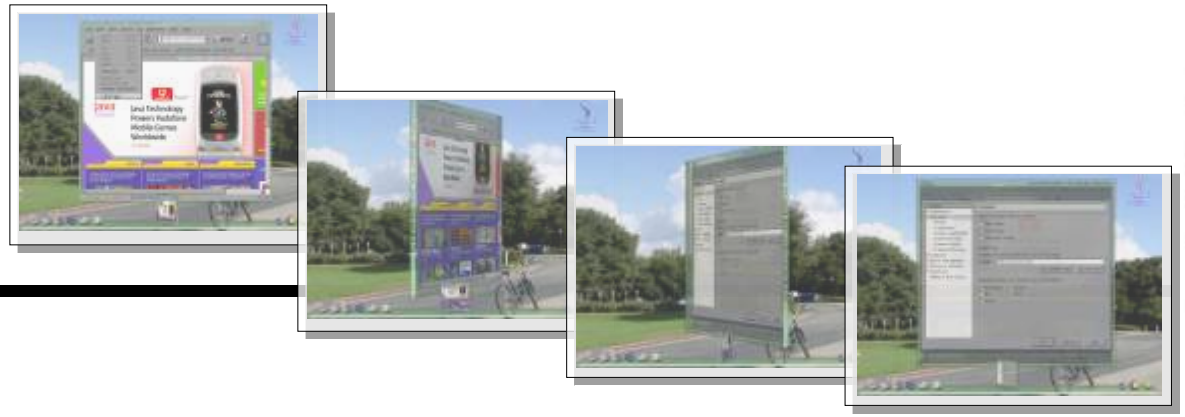
Just wanted to break the boundary...



The Opportunity

We all know about it...

- 20 year old 2D desktop metaphor
- Significant improvement of 3D capabilities
- How we can capitalize on this?

What would be the right next step?

The Opportunity

Key question...

- **Go beyond accelerating 2D GUIs**
- **But without forcing users into unfamiliar Virtual Reality world**

The Approach...

Evolving the “Paper Paradigm!”

Existing 2D Applications

New 3D Applications

Demo

Proof-of-concept

Explore the New Frontier

Now, how to do it...

- **Integration with existing system is key**
- Totally new area

  Need to experiment aggressively...

  ... what we've shown must be a tip of iceberg
- How we started:

  Leveraged Java™ technology's productivity...

  ... delivering “a reference platform”

Explore the New Frontier

Goals

Leveraging Project Looking Glass...

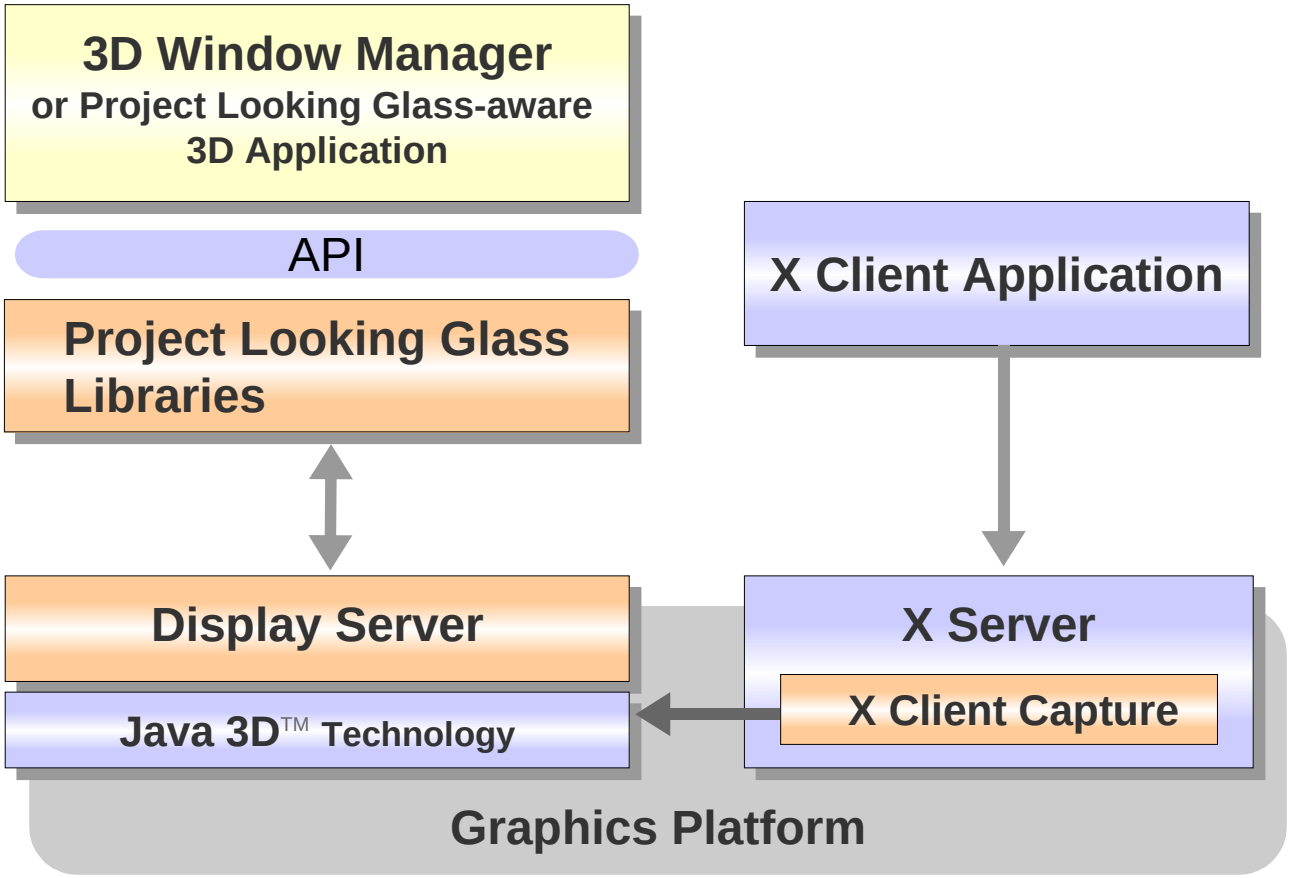
- **Add a new dimension to the desktop while following the standards used by well established Linux desktops (GNOME and KDE)**
- **Collaboratively develop additional standards relative to 3D interaction and UI**

Overview of Technical Info

- High-level Architecture Overview
- Graphics Platform
- Client-side API
- How All the Pieces Interact
- Possible Areas of Collaboration

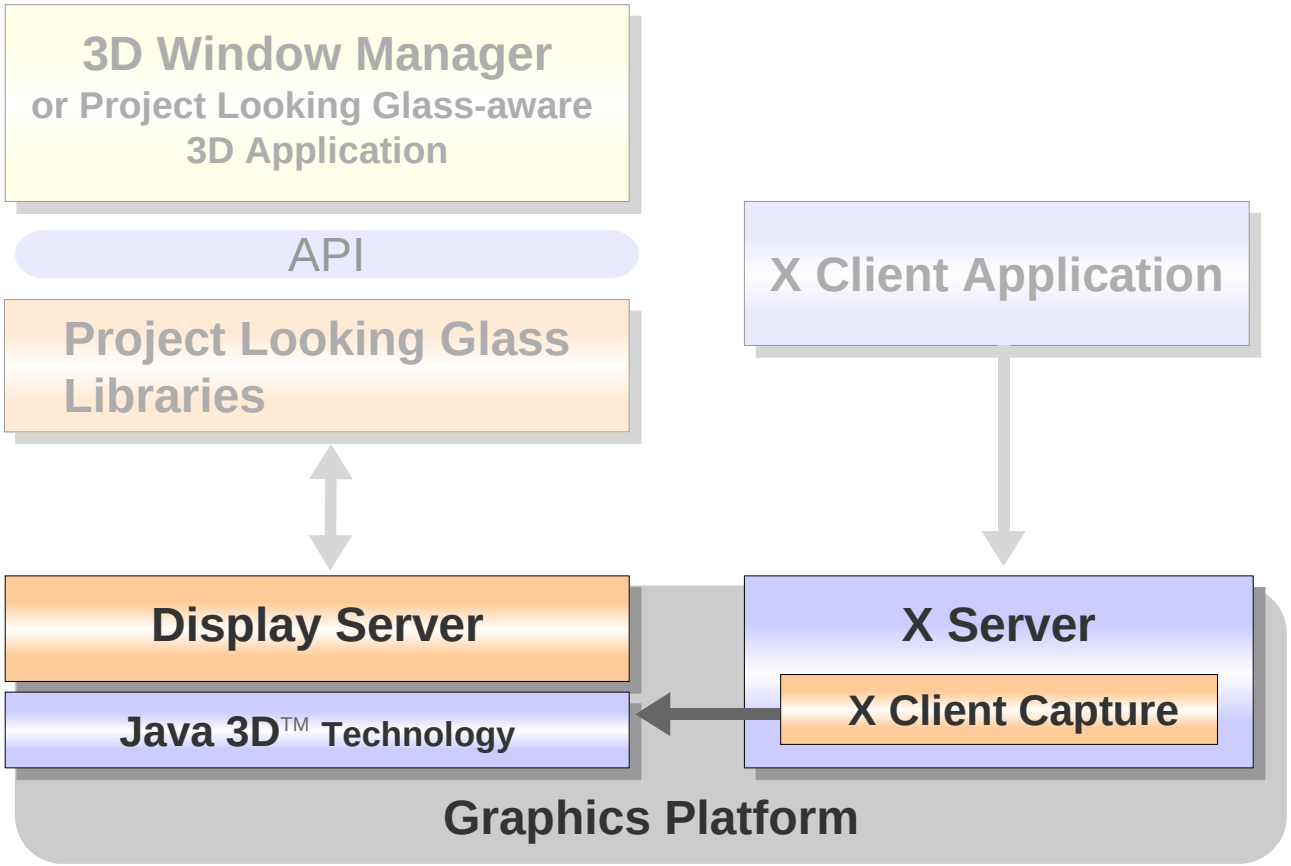
Super High-level Architecture Overview

Platform for further exploration



APIs for 3D Desktop Development

Platform for further exploration



Project Looking Glass Graphics Platform

or “How to Draw 3D X Windows”

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Presentation Goals

- Reveal the magic behind the pretty pictures
- Overview of Project Looking Glass Graphics architecture
- How Project Looking Glass fits in with X Server
- Graphics Futures

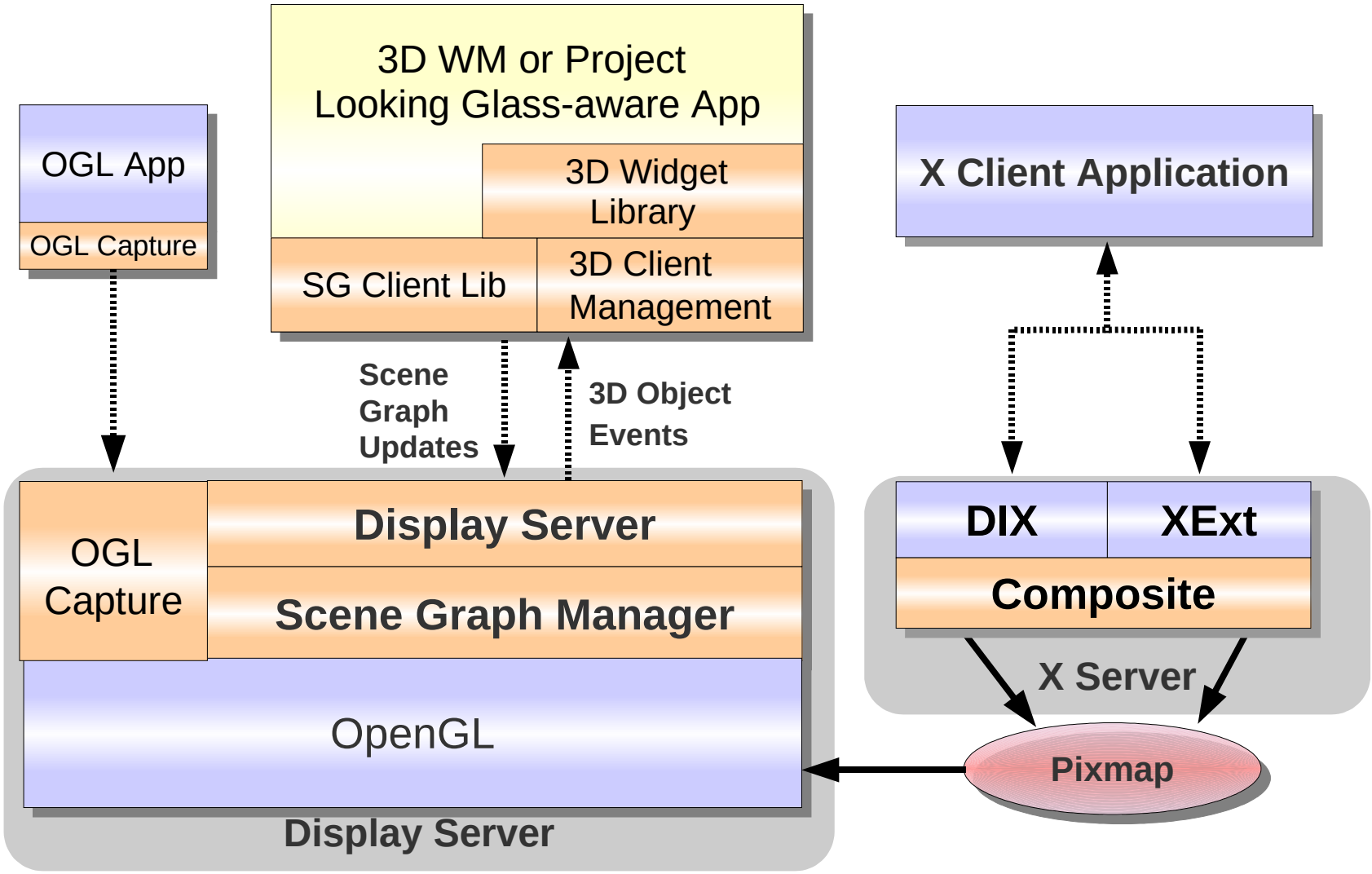
Project Looking Glass – Demo vs. Product

- Currently Available: Proof-of-concept Demo
  - Proof-of-concept only
  - Goal: Stir people's imaginations
  - Graphics layer is very basic -> Needs improvement
- Working On: Refined Graphics Platform
  - Goals:
    - New Architecture: Client-Server, More modular
    - New Features: OpenGL capture
    - Productizable
  - Planned Availability:
    - Mid-2004: Developer's Release (Linux only)
    - Eventual Product for Linux, Solaris™ x86, and Solaris SPARC™

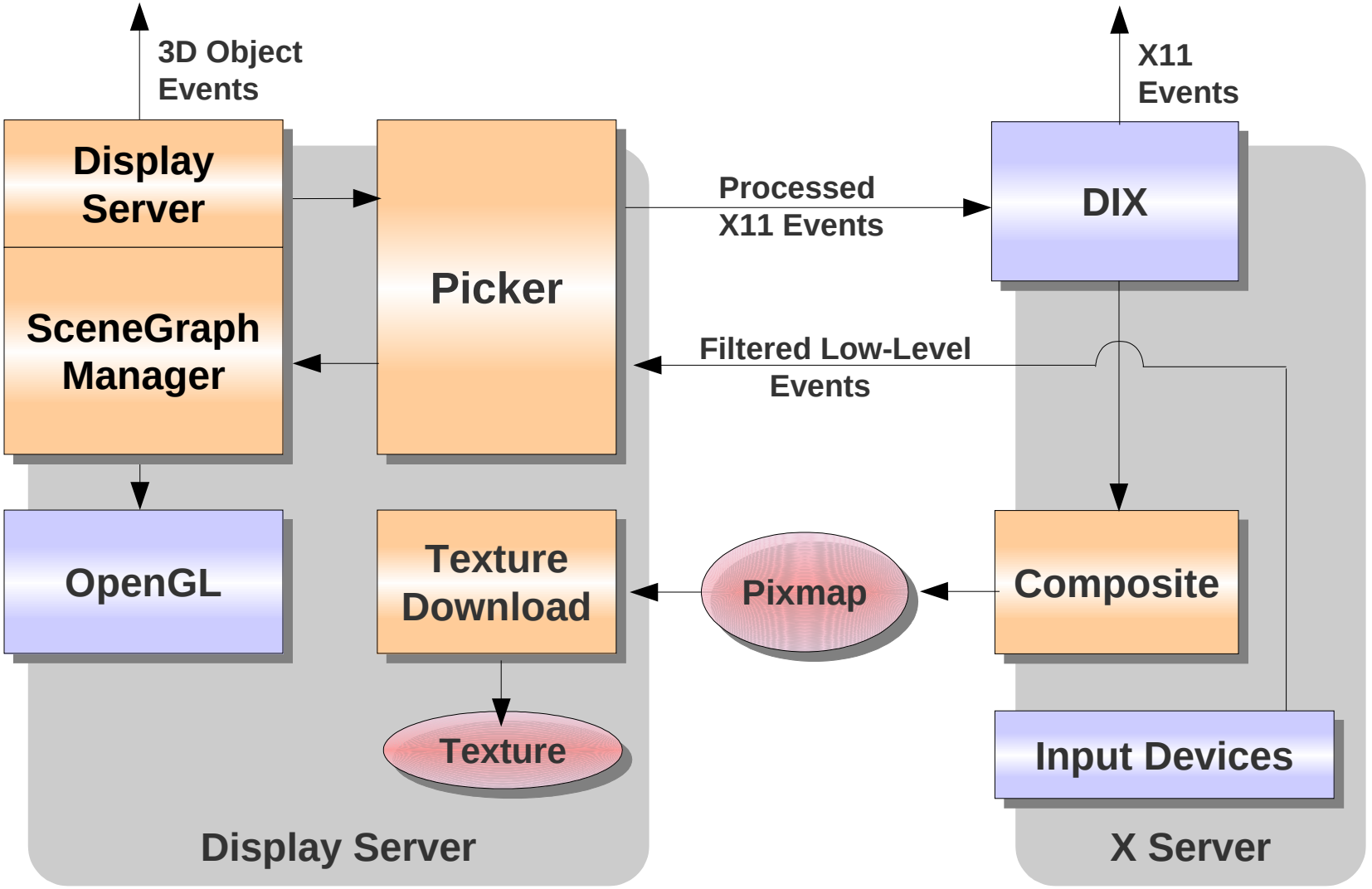
Project Looking Glass Graphics Platform

- X Server (XS) + new 3D Display Server (DS)
- Output Redirection
  - XS: Redirects window rendering -> backing pixmap
  - DS: Loads pixmap into texture
    - Whenever pixmap contents change
    - For example: damage event
- Input Redirection
  - XS: Sends low-level device events to DS
  - DS: Determines which window event is for
    - Also determines coordinates in window space
    - Sends events back to XS for further processing

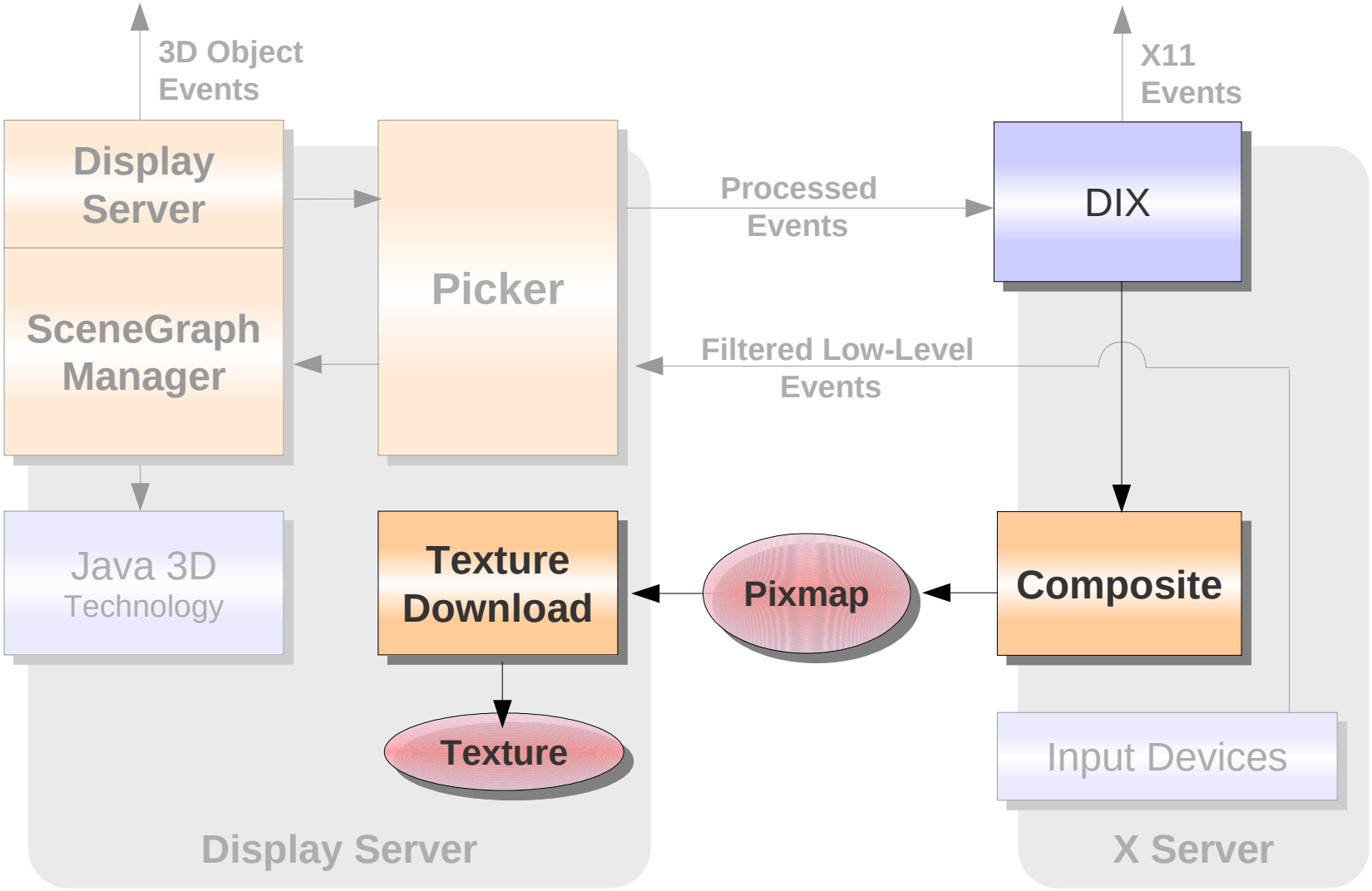
Graphics System and X11 Integration



Graphics Platform Detailed View



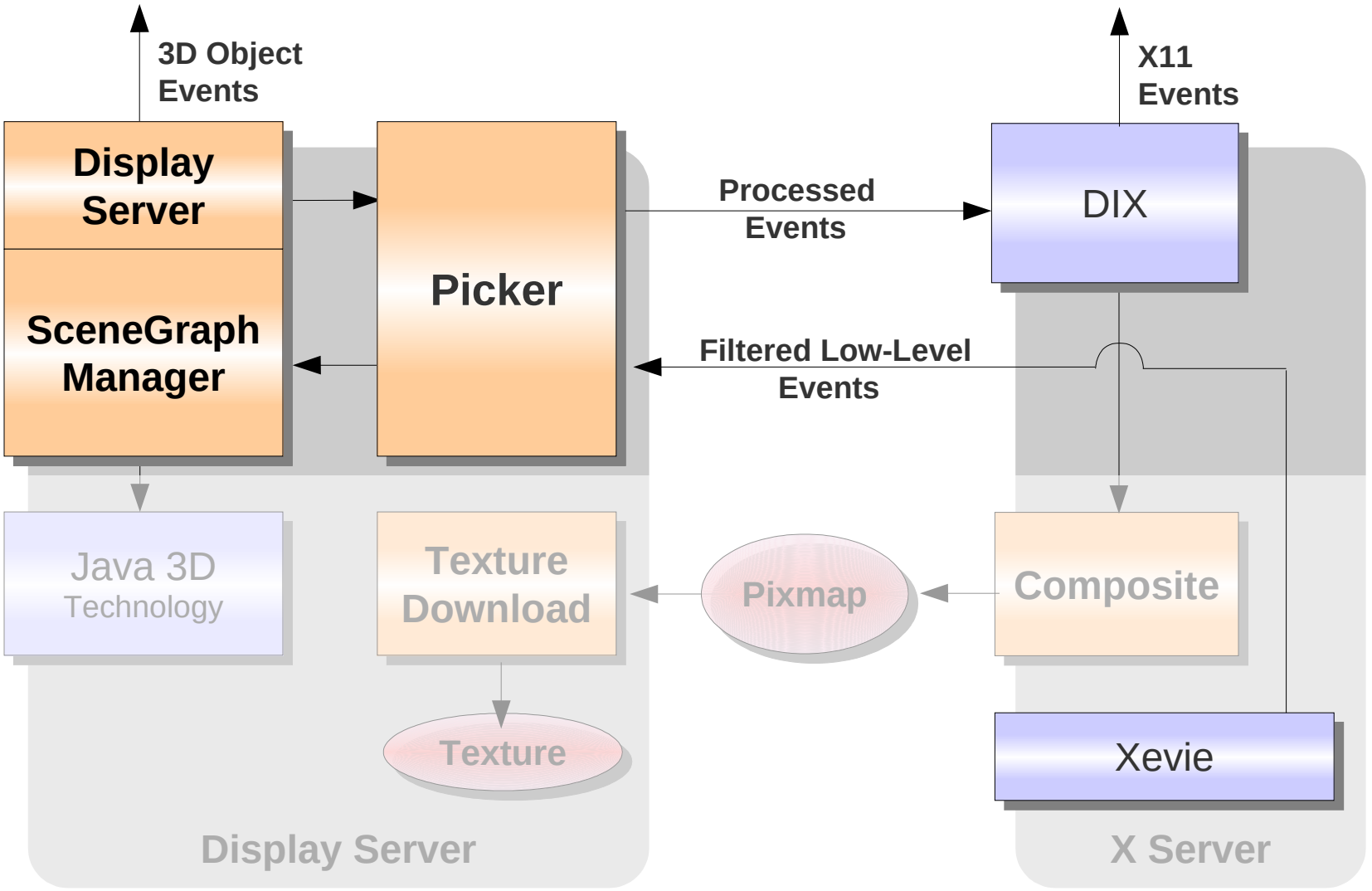
Output Redirection Detailed View



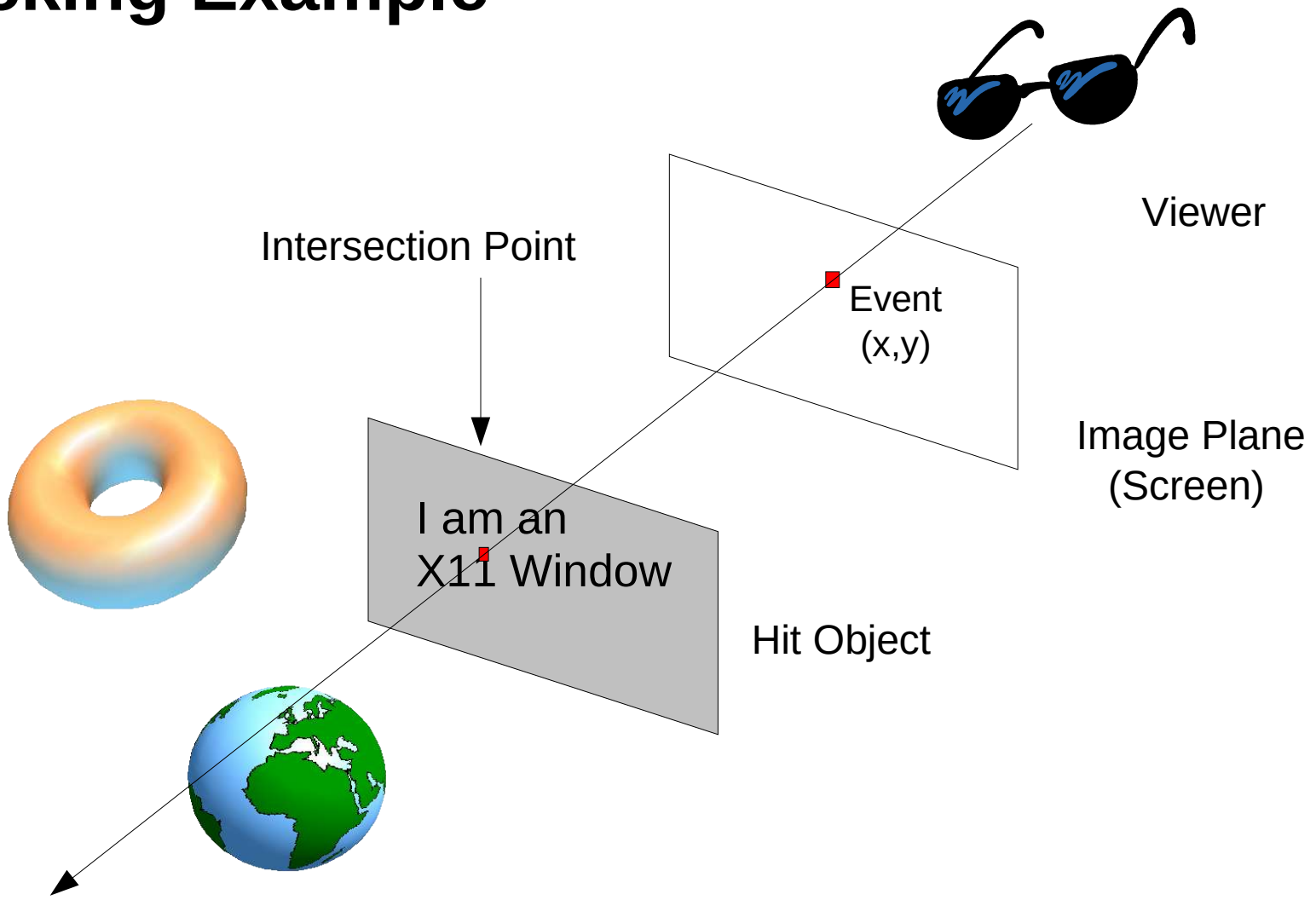
Key: Composite Extension

- Developed by Keith Packard of HP, et al.
- Redirects X11 rendering to a backing pixmap
  - New coordinate space: Pixmap Space
  - DDXs: must translate abs screen coords into this space
    - Primitive coordinates
    - GC composite clip
  - This will give best performance
  - But to avoid modifying a DDX
    - CompTran: a GC wrapper layer that does the translation for you
    - Can use when you don't have the DDX source

Input Redirection Detailed View



Picking Example



Picker

- X Server device events -> Picker
  - Uses Xevie, a proposed Xorg standard
  - Co-developed by Sun and SUSE
- Fires ray toward event x,y into scene
- Determines hit object (intersection)
- Hit object = X11 window
  - Translates intersection point to window space
  - Updates event x,y
  - Sets event window field
  - Sends event back to X Server
  - DIX: modified to handle events with windows already set
    - XYToWindow()

Future Possibilities

- Window Capture Performance
  - Direct Render-to-Texture (both X11 and OpenGL)
  - Interprocess shared textures
- Input Devices connected to DS?
- Scene Graph
  - Spatialized audio (aural cues for 3D chat windows!)
  - Programmable shaders
  - Wild stuff
    - Physics simulation
    - Collision detection
    - Particle systems
    - What can you imagine?

Let's Collaborate!

- 3D window system area is in its infancy
- Lots of room for collaborative innovation
- Let's collaborate to build a premier 3D window system platform
- Sun is willing to contribute:
  - Ideas
  - Code
  - Engineering

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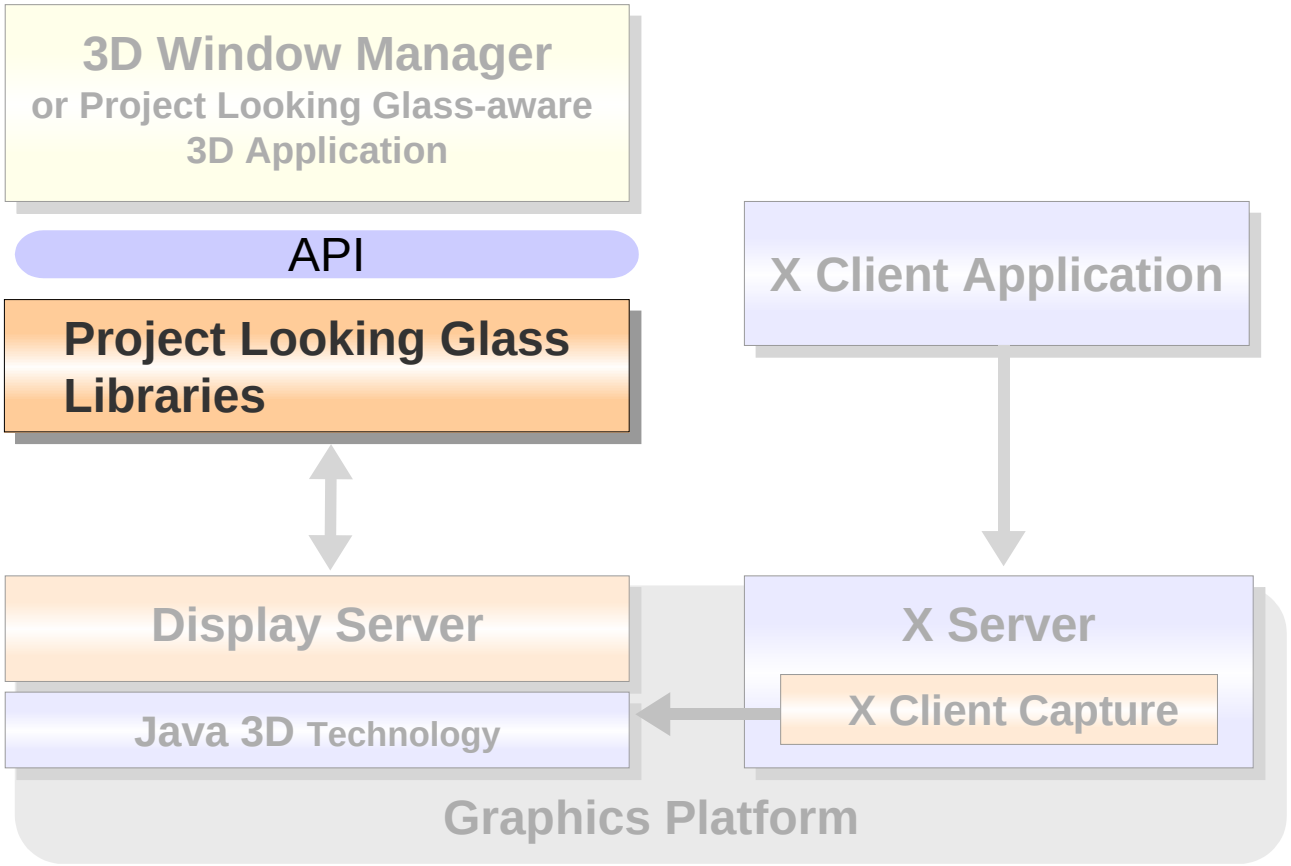
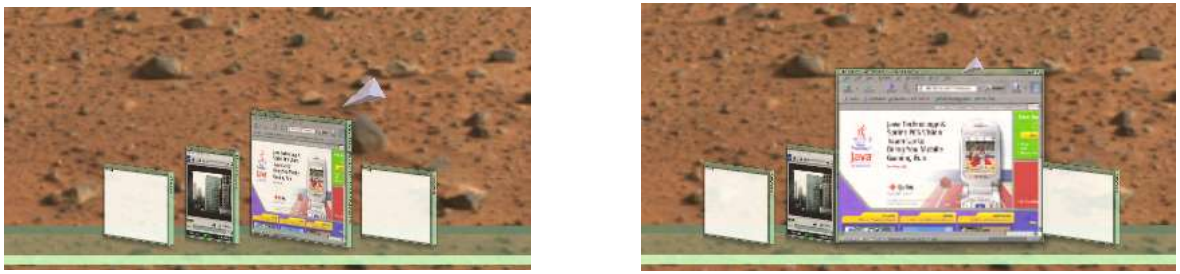


APIs for 3D Desktop Development

Platform for further exploration - Proposal

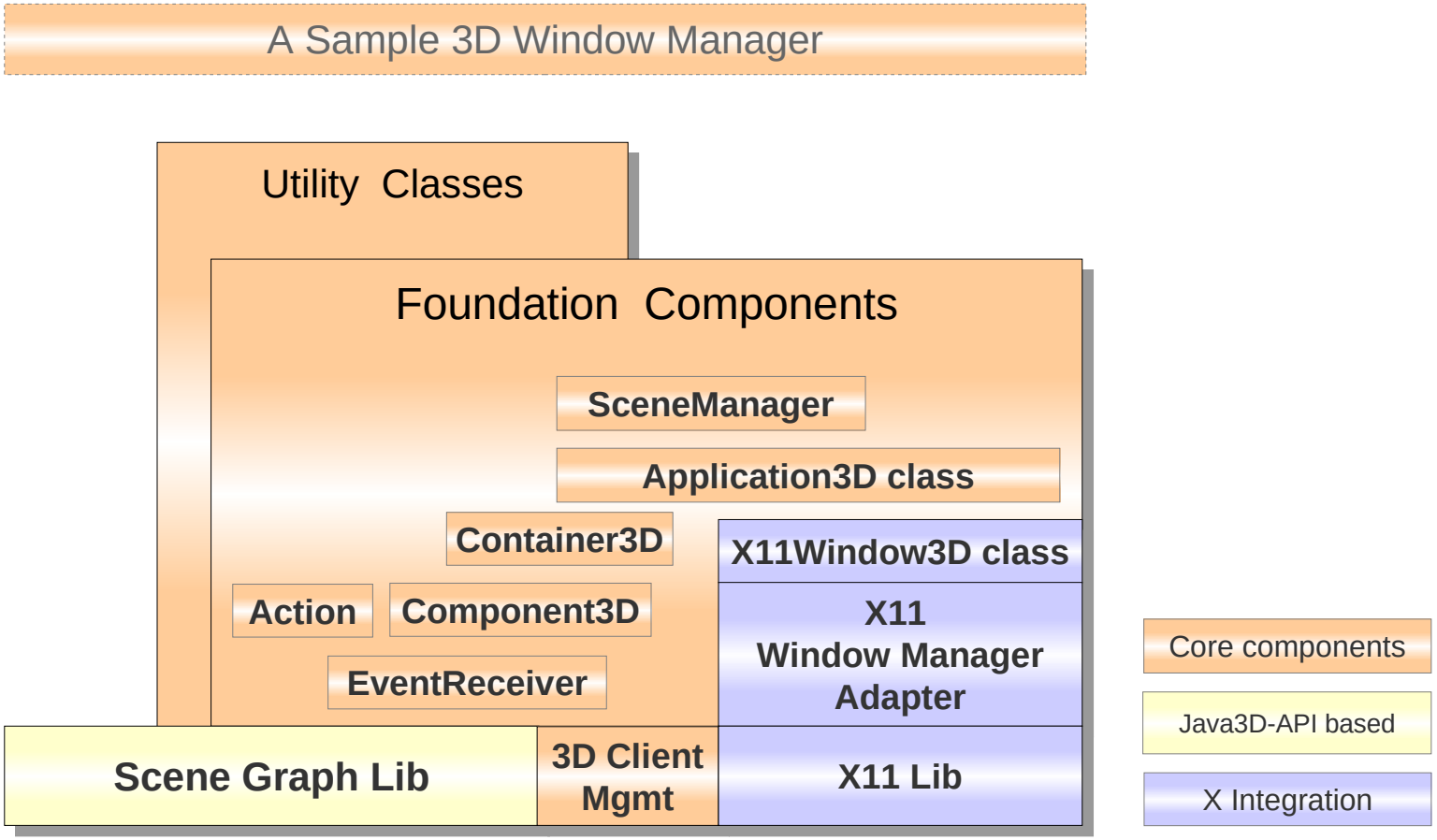
- Core APIs to kick start the exploration
- Java technology based reference implementation
- Java 3D API-based scene graph (feature subset) + Base classes for developing 3D widget set
- Support for integration of existing applications
- Focus on animation support



An example of 3D Container with animation

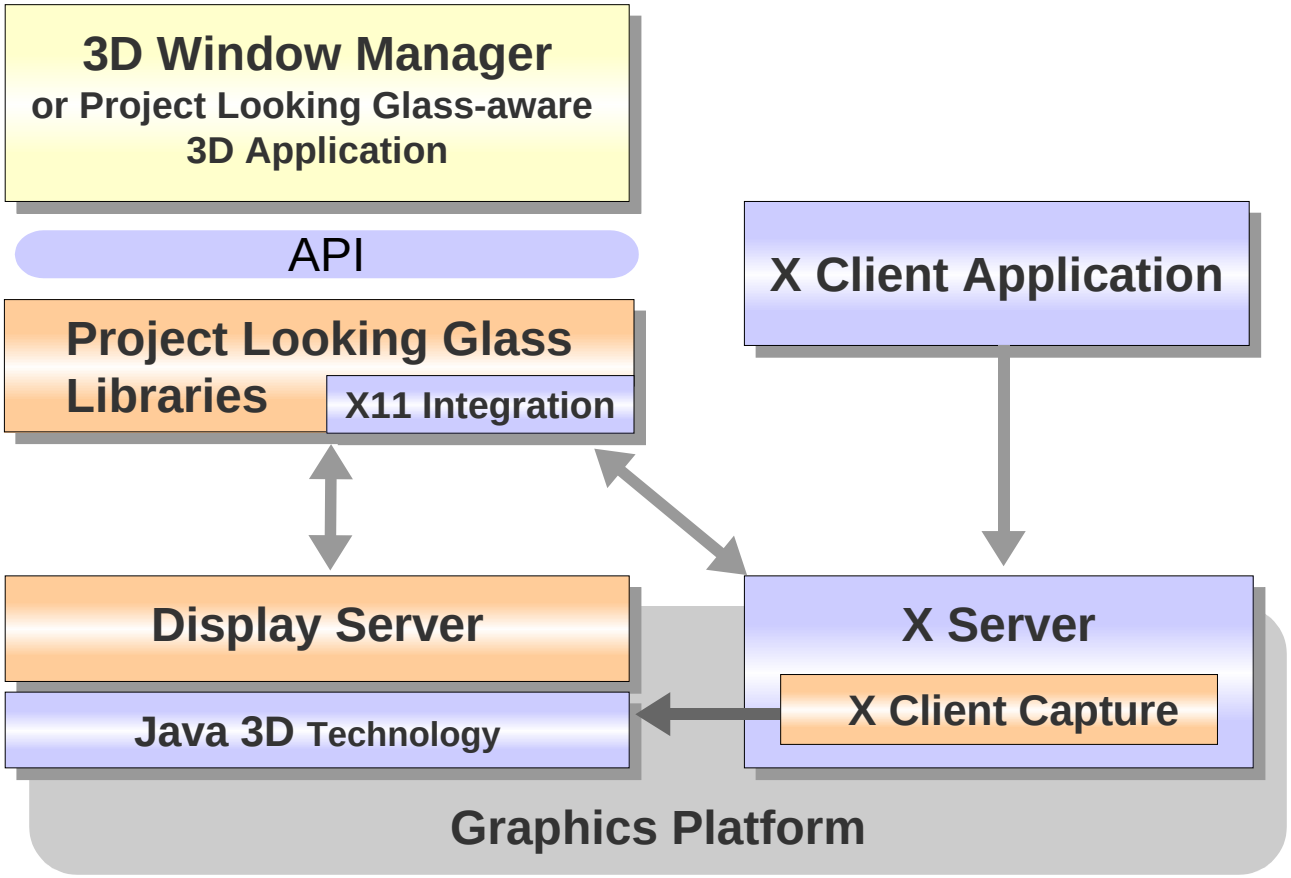
APIs for 3D Desktop Development

High-level block diagram - Proposal



How All the Pieces Interact...

Example: Window creation and resize



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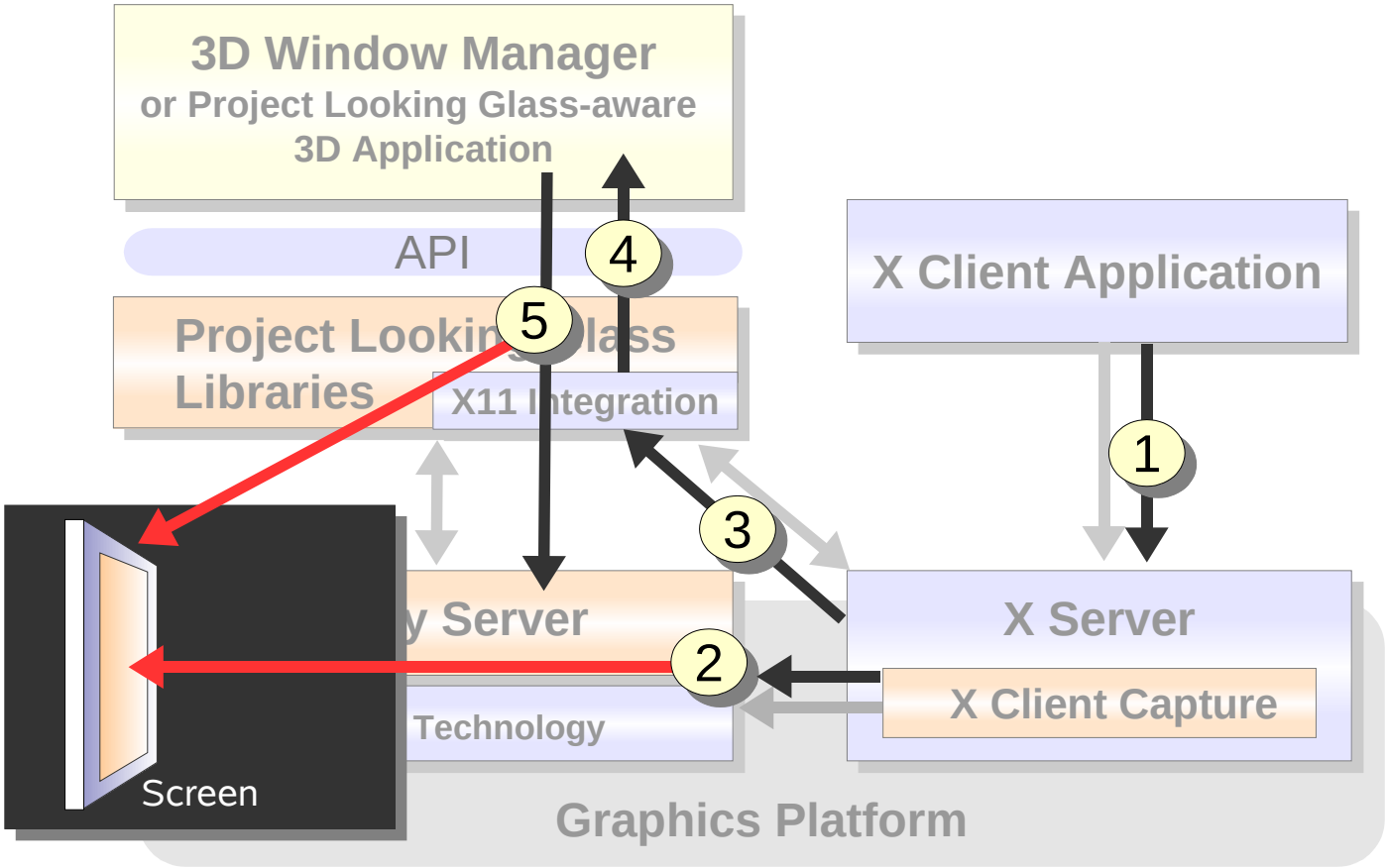
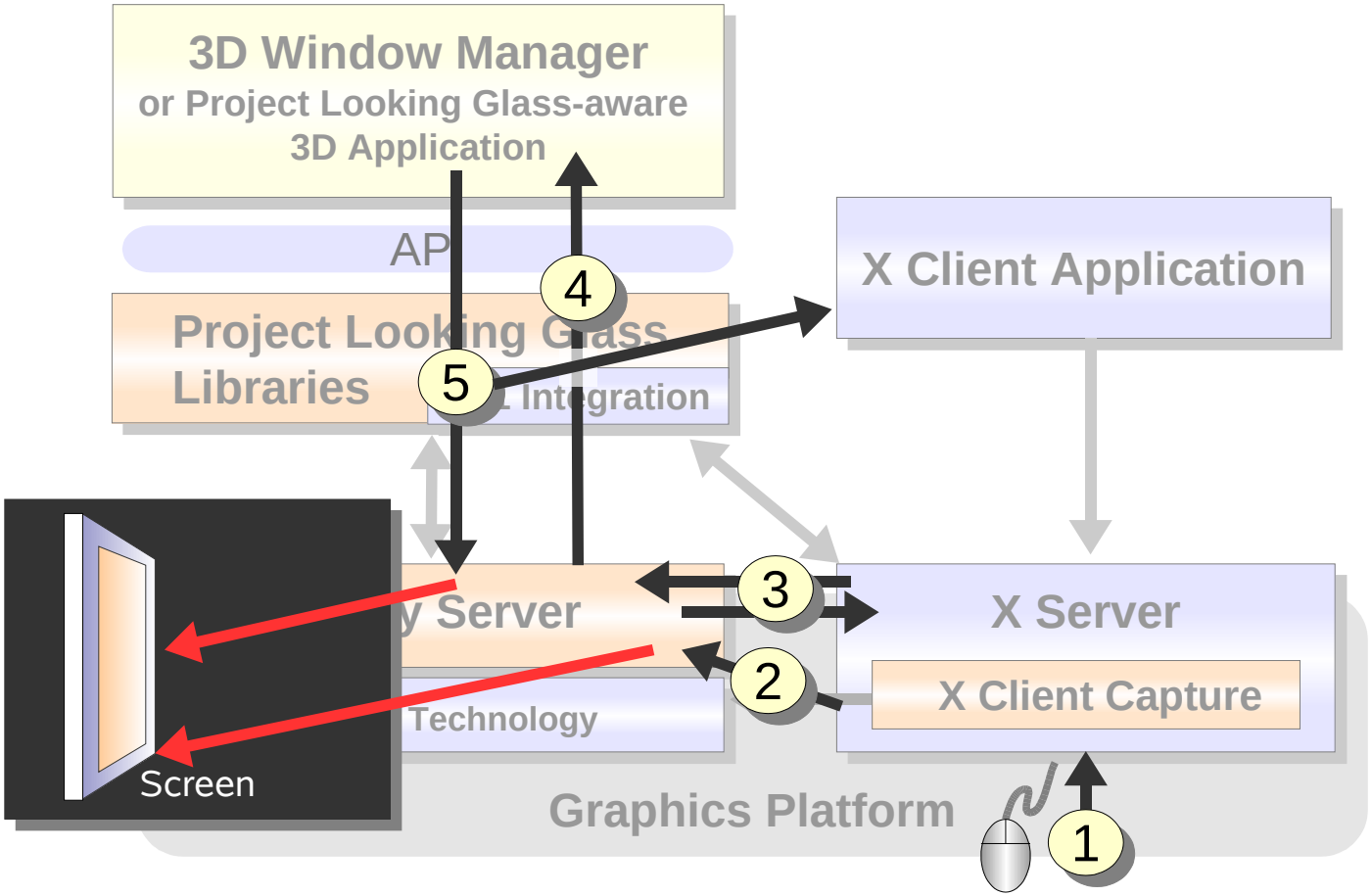
Example: Window Creation



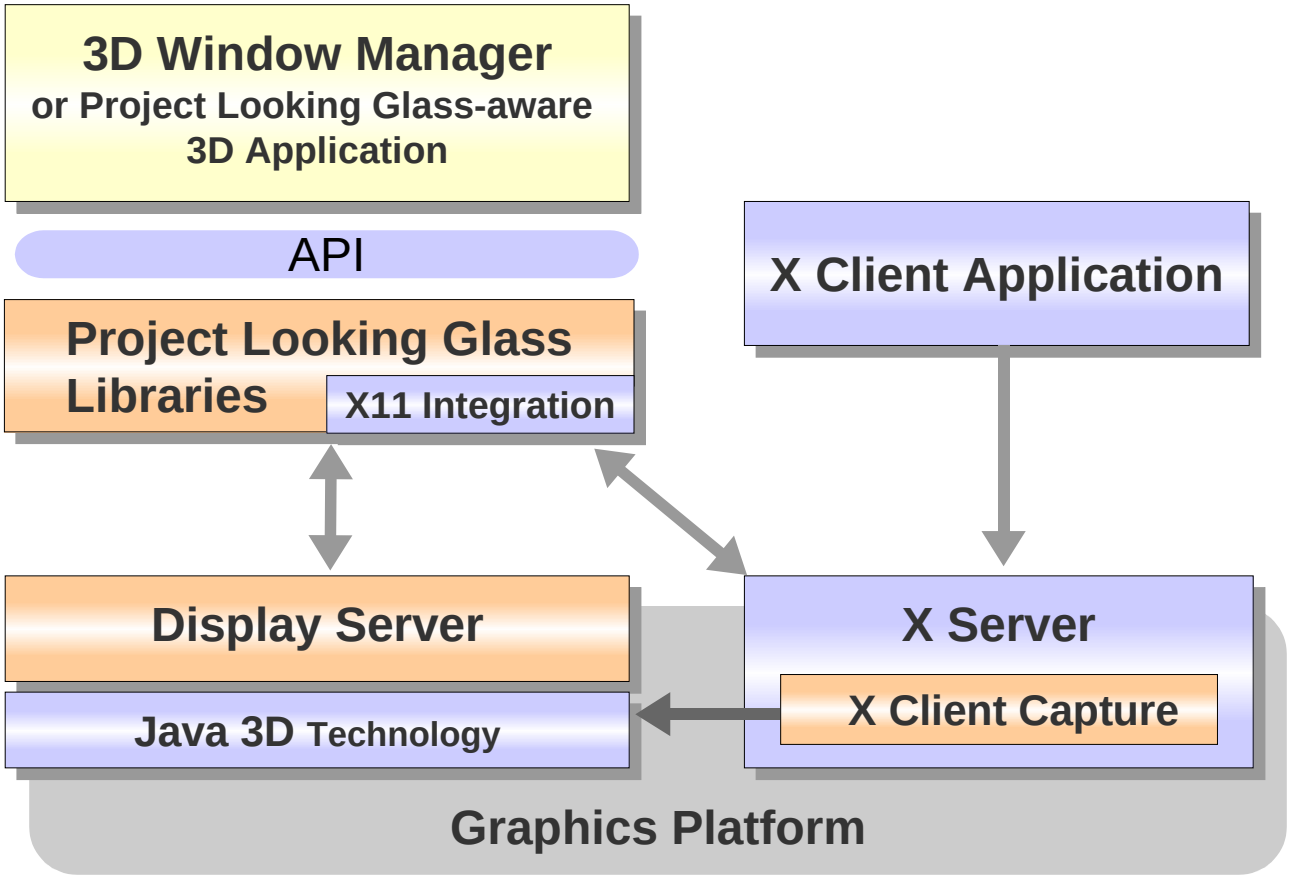
How All the Pieces Interact...

Example: Window Resize



Moving Forward...

Let's collaborate!



Moving Forward...

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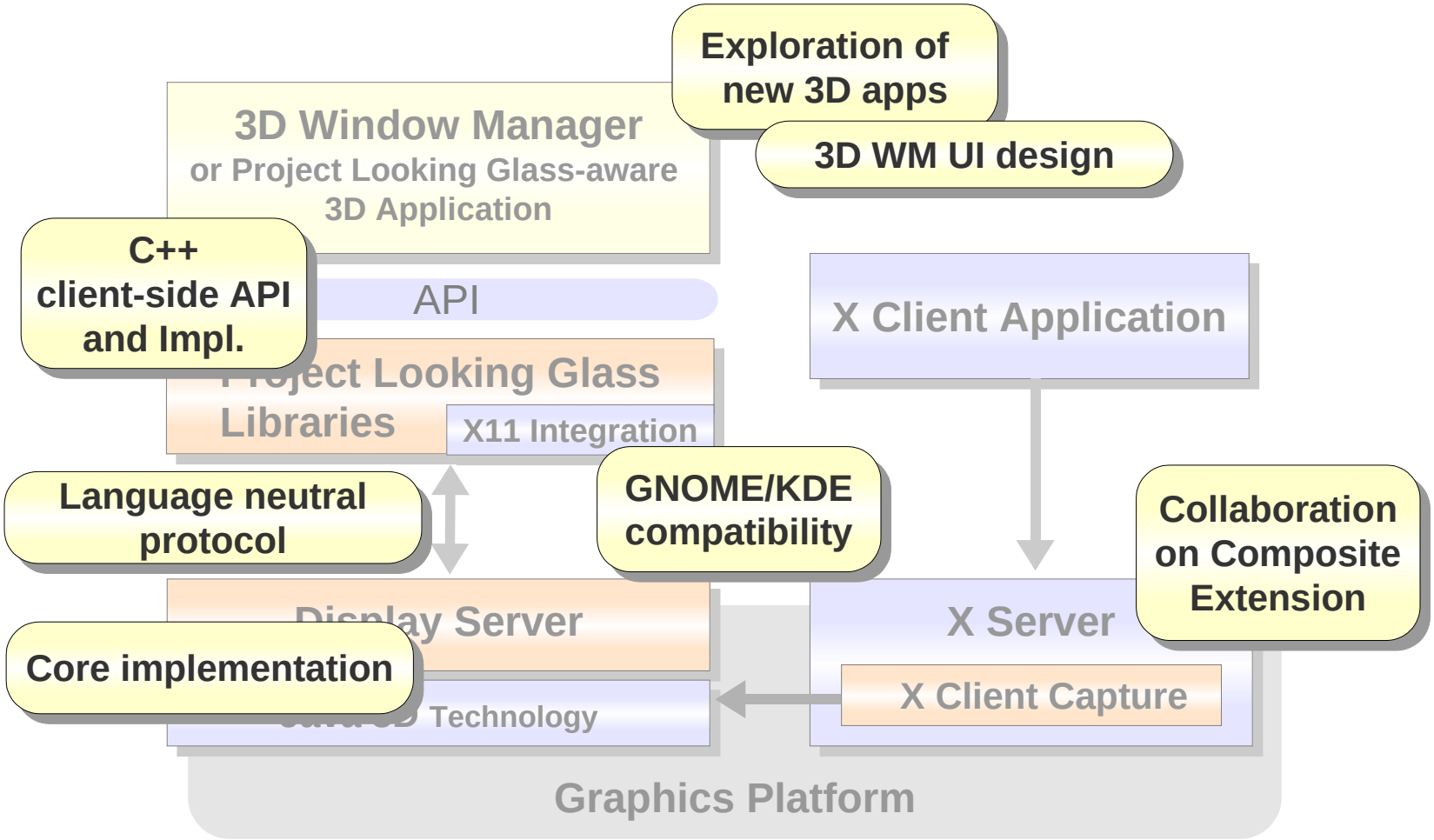
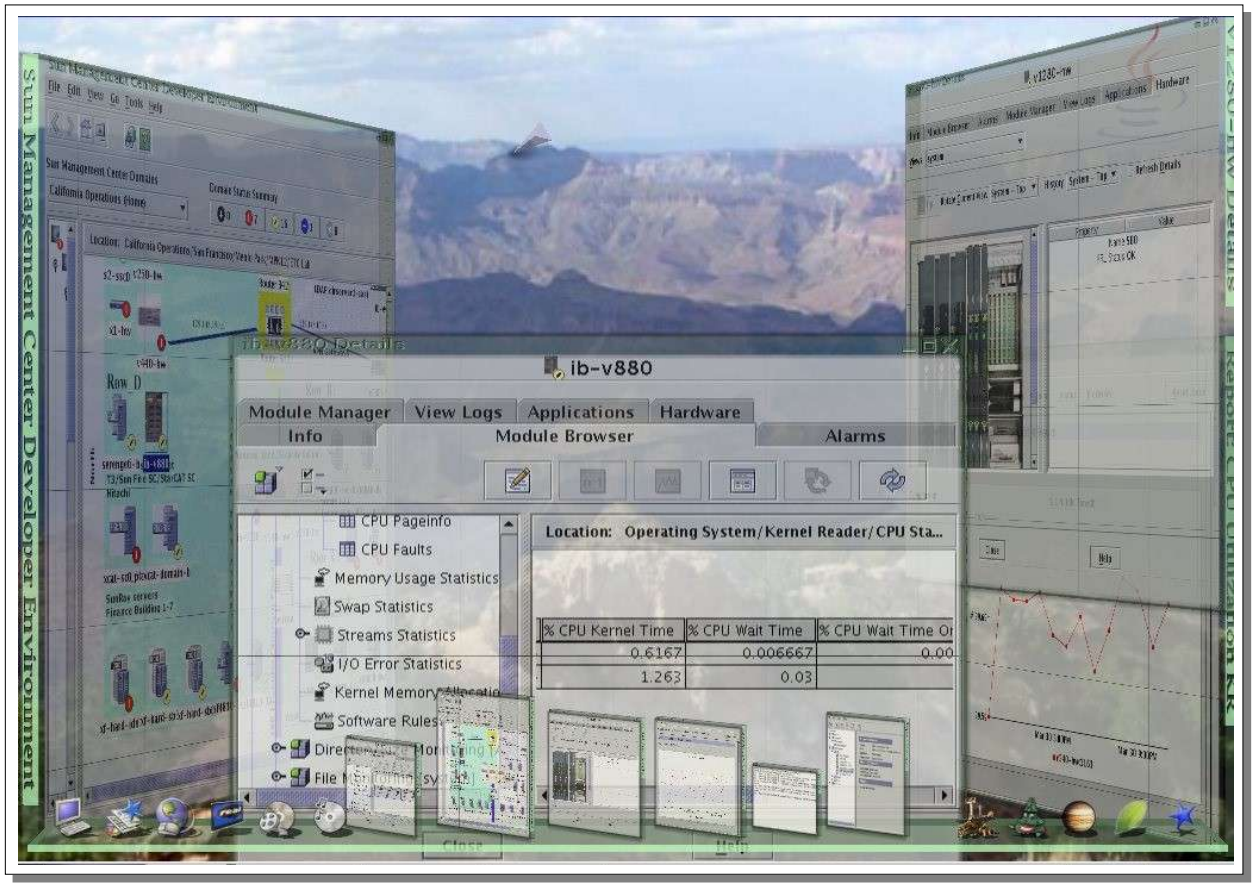


Moving Forward...

Let's collaborate!

- Graphics platform (short term)
  - Composite extension
  - Direct Render-to-Texture (both X11 and OpenGL)
  - Interprocess shared textures
  - Event Redirection and Xevie
- Experiments around 3D (long term)
  - 3D WM, apps, Widget Set
  - GNOME/KDE to leverage Project Looking Glass for 3D enhancements
  - Language independence support (C++ binding, UNO integration?)
- Suggestions...?

By the way...



How would this look on today's 2D desktop?

By the way...

Would you believe this is exactly the same software?

Q&A

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