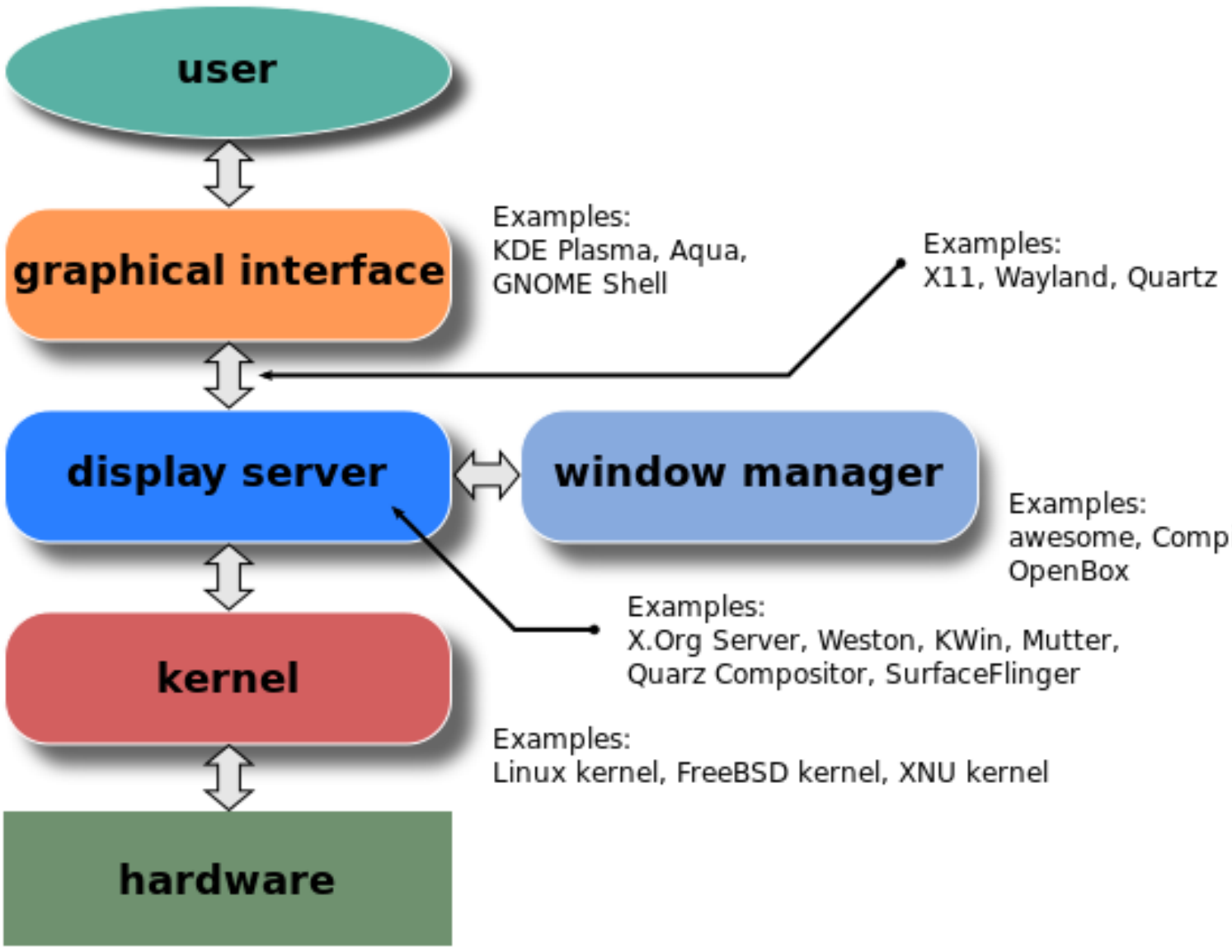
1. What is GUI composed of?

I guess everyone knows what GUI is.

Below is an illustration of the basic components of a GUI.



Windowing system is just a type of GUI that implements WIMP (windows, icons, menus, pointer) paradigm for a user interface.

Here is a list of major windowing systems for both Linux and Windows systems.

The key component of a windowing system is the display server (or window server, compositor). Any application that presents its GUI in a window is a ***client*** of the display server.

Since client and server are involved, communication protocol is necessary, which is called ***display server protocol*** of course.

A display server is a program whose primary task is to coordinate the input and output of its clients to and from the rest of the operating system, the hardware, and each other. It provides an abstraction of the graphics hardware for use by higher-level (no surprise that a GUI system has a hierarchical design) elements of the graphical interface such as a **window manager**.

There are several display servers available. Such as:

- X.Org server (mostly for *nix)
- Wayland (mostly for *nix)
- Mir (mostly for *nix)
- SurfaceFlinger (This is for Google Android.)
- Quartz Compositor (This is what Apple MacOS uses.)
- Desktop Window Manager (This is what Microsoft Windows uses.)

2. What does X mean exactly?

X, X11 and X Window System are synonyms. They all stand for a windowing system.

As said above, the key component, the display server, of the X windowing system is the X.Org Server.

Sometimes, X.Org server is also called X server for short.

Any application that runs and presents its GUI is a **client** of the **display server**. The display server and its clients communicate with each other over a communications protocol, which is usually called **display server protocol**, the display server being the **mediator** between the clients and the user. The display server receives all the input from the kernel, that the kernel receives from all attached input devices, such as keyboard, pointing devices, or touchscreen and transmits it to the correct client. The display server is also responsible for the output of the clients to the computer monitor. A *display server protocol* can be network capable or even network transparent. (so you can see, it is essentially just about data flow and routing, visual data is still data.)

3. What is Window Manager?

Gnome/Xfce/KDE are all **window managers**. Because they all work on the X display server, they are all called **X window manager**. The window manager collaborates with the X server and X clients. You can see where the window manager locates in the above GUI composition picture. Here are different types of windows managers.

컴퓨터 운영체제에서 윈도우 매니저란 말그대로, GUI 환경에서 각 프로그램들이 뜨는 창을 다루는 프로그램을 뜻한다. MS 윈도우 운영체제나 애플 Mac OS X 같은 운영체제에서는 운영체제 기본시스템에 포함되어있지만, 리눅스 및 BSD 유닉스 등은 윈도우 매니저 역시 애플리케이션 취급하기 때문에 원하는 윈도우 매니저를 골라서 인스톨하여 사용할 수 있다.