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The Keck Keyword Layer

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Each Keck instrument presents a consistent software view to the user interface programmer. The view consists of a small library of functions, which are identical for all instruments, and a large set of keywords, that vary from instrument to instrument. All knowledge of the underlying task structure is hidden from the application programmer by the keyword layer.

Image capture software uses the same function library to collect data for the image header. Because the image capture software and the instrument control software are built on top of the same keyword layer, a given observation can be "replayed" by extracting keyword-value pairs from the image header and passing them back to the control system.

The keyword layer features non-blocking as well as blocking I/O. A non-blocking keyword write operation (such as setting a filter position) specifies a callback to be invoked when the operation is complete. A non-blocking keyword read operation specifies a callback to be invoked whenever the keyword changes state. The keyword-callback style meshes well with the widget-callback style commonly used in X window programs.

The first keyword library was built for the two Keck optical instruments. More recently, keyword libraries have been developed for the infrared instruments and for telescope control. Although the underlying mechanisms used for inter-process communication by each of these systems vary widely (Lick MUSIC, Sun RPC, and direct socket I/O, respectively), a basic user interface has been written that can be used with any of these systems. Since the keyword libraries are bound to user interface programs dynamically at run time, only a single set of user interface executables is needed. For example, the same program, "xshow", can be used to display continuously the telescope's position, the time left in an instrument's exposure, or both values simultaneously. Less generic tools that operate on specific keywords, for example an X display that controls optical instrument exposures, have also been written using the keyword layer.