

The Birds Project

The libBirds Library, Software Requirements Data

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1. Purpose of the SRD Document

This is a standard "Software Requirements Data" document, corresponding to the guidelines in RTCA DO-178B. In the words of DO-178B, it "is a definition of the high-level requirements including the derived requirements."

This document has been formatted in an attempt to make certification via DO-178B more efficient, essentially by providing a separate document section for each lettered item (a-h) found in DO-178B section 11.9. However, it should be noted that the ordering of the sections is not quite the same.

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2. System Functions

2.1. Fixed-Size Datatypes for External Operations

Traceability: SRD section 2.1 → SDD section 2.

2.1.1. Hardware-Software Allocation

This functionality is implemented in software.

2.2. Endian Conversions

Traceability: SRD section 2.2 → SDD section 3.

2.2.1. Hardware-Software Allocation

This functionality is implemented entirely in software.

2.3. Timekeeping Functions

Traceability: SRD section 2.3 → SDD section 4.

2.3.1. Hardware-Software Allocation

This shall be implemented by means of an interrupt service routine based on a hardware timer, such as an integrated CPU timer.

However, only the interrupt-service routine itself shall be provided by libBirds. The low-level details of setting up the interrupt and vectoring to the ISR are handled by a board-support package (not a part of libBirds), and hence this hardware dependence is transparent to libBirds.

2.4. String and Memory Manipulations

Traceability: SRD section 2.4 → SDD section 5.

2.4.1. Hardware-Software Allocation

This functionality shall be implemented entirely in software.

2.5. Text-Display Functions

Traceability: SRD section 2.5 → SDD section 6.

2.5.1. Hardware-Software Allocation

The implementation of this functionality will vary depending on whether the actual display screen is text-oriented or graphically-oriented in hardware. The primary

implementation difficulty is the conversion of character data to pixel data.

In the former case, this functionality can be completely provided by a board-support package (separate from libBirds). In the latter case, libBirds must break text operations down into pixel-manipulations, and the board-support package must provide the raw pixel manipulations.

Thus, libBirds is aware of hardware dependence only to the extent of knowing whether the display hardware is text-oriented or pixel-oriented.

2.6. Graphical Display-Output Functions

Traceability: SRD section 2.6 → SDD section 7.

2.6.1. Hardware-Software Allocation

This functionality is provided entirely in software, except that the hardware display must have the capability of manipulating arbitrary pixels. The raw-pixel manipulations are provided by a board-support package (separate from libBirds).

2.7. Keyboard-Input Functions

Traceability: SRD section 2.7 → SDD section 8.

2.7.1. Hardware-Software Allocation

An interrupt-service routine shall scan the keyboard with some (unspecified) degree of regularity, debounce the keystrokes, and insert key-pressed and key-released events into the keyboard buffer.

The physical keyboard, of course, shall be in hardware.

Low-level details of setting up the interrupts, vectoring to the ISR, and fetching raw data from the physical keyboard are handled not by libBirds, but by a board-support package (separate from libBirds).

2.8. Filesystem Manipulations

Traceability: SRD section 2.8 → SDD section 9.

2.8.1. Hardware-Software Allocation

The design criteria assume the use of flash-memory as a storage medium. In other words, the hardware medium must have the following properties: It may be erased in relatively large "erasable blocks", and erasure consists of setting the block to bits that are all 1; any bit which is 1 may be changed at will to 0, but not necessarily vice-versa. Of course, a file-system based on these limitations may also be implemented in other media (EEPROM, RAM, or magnetic disk), as well as flash-memory, though not with maximum efficiency.

All other capabilities are implemented in software.

In accordance with common practice, erasable blocks are sub-divided into smaller blocks ("sectors").

The following low-level functions are to be provided by a board-support package (separate from libBirds): mapping of the erasable blocks by address and size; erasure of blocks; reading sectors; writing sectors.

2.9. Filesystem Garbage Collection

Traceability: SRD section 2.9 → SDD section 10.

2.9.1. Hardware-Software Allocation

The hardware-software allocation for this functionality is the same as described above under "Filesystem Manipulations".

2.10. Audio Playback

Traceability: SRD section 2.10 → SDD section 11.

2.10.1. Hardware-Software Allocation

A compatible audio codec must exist within hardware to use this feature. An interrupt-service routine is used to transfer audio data from the file-system to the audio codec.

The low-level details of setting up the interrupts, vectoring to the ISR, setting up the codec, and outputting data to the codec are handled by a board-support package (separate from libBirds).

2.11. Serial I/O

Traceability: SRD section 2.11 → SDD section 12.

2.11.1. Hardware-Software Allocation

Providing this functionality is based on the existence of hardware UARTs, and an interrupt-service routine servicing these UARTs. The interrupt-service routine receives data from the UARTs and places the data into a "received data" FIFO from which the application software can remove it. Similarly, the application software can place data into a "transmitter" FIFO from which the interrupt-service return removes it and gives it to the UARTs.

Low-level details of setting up the interrupts, vectoring to the ISR, and inputting/outputting data from/to the UARTs is handled by a board-support package (separate from libBirds).

3. Hardware-Software Interfaces

As may be deduced from the descriptions of the hardware-software allocations in the 'System Overview' section, libBirds as such has almost no dependence on or knowledge of the hardware.

Instead, there is a hardware-abstraction layer (HAL), whose functions are defined in the libBirds design data, but which are actually provided by "board-support packages" (BSPs). The BSPs are separate from libBirds, and have life cycles separate from libBirds.

Since libBirds provides specifications for all HAL functions, as well as the test suites used for software verification of the BSPs, it is hoped that certification of the BSPs for given versions of libBirds will be a comparatively simple effort.

4. Safety Features

Because libBirds is a reusable library rather than a complete system, it does not attempt to provide safety features as such. The libBirds library promotes safety primarily in omitting functionality that can easily be misused to the detriment of system reliability, such as dynamic memory allocation.

5. Modes of Operation

TBD

6. Performance Criteria

TBD

7. Partitioning

TBD

7.1. Interaction of Partitions

TBD

7.2. Software Levels of the Partitions

TBD

8. Fault-Tolerance, Failure Detection, and Safety Monitoring

Not provided by the libBirds library.

9. Timing Requirements and Constraints

9.1. Limitations

TBD

10. Memory Size Constraints

10.1. Limitations

TBD

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