Software Libraries

Provided. Open-source everywhere possible

User Application

Ready-to-use Libraries

LimiFrog **Set-up & Initializations**

LF **Utilities**

EmWin **Graphics Lib**

USB Device **Stack**

FatFS **File System**

LimiFrog BSP and Libs

STM32L4xx HAL
Abstraction layer for all STM32L4 on-chip peripherals

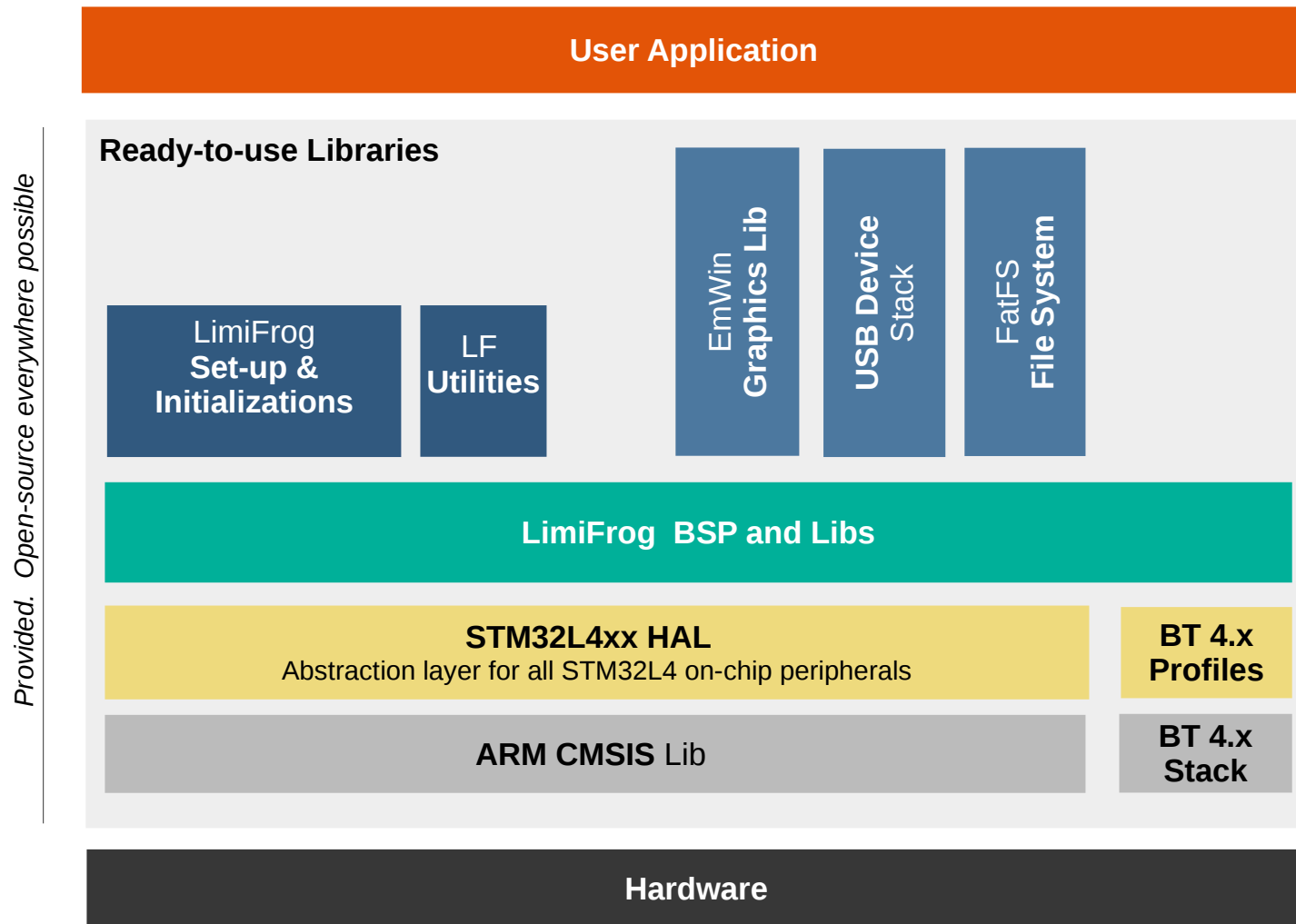**BT 4.x Profiles**

ARM CMSIS Lib

BT 4.x Stack

Hardware

Note : Various options available as real-time/embedded OS kernel if needed,
although not provided as part of imiFrog software package at this time.

Software Structure

/\<xxxx\>

    -- /libraries

        -- /LimiFrog-Lib

          # Board init and controls - LimiFrog specific   *LimiFrog libraries*

          # Adaptation Layers for Middlewares (USBD, FatFS, emWin)

        -- /CMSIS_L4xx

        -- /STM32L4xx_HAL_Driver   *ST- and 3rd-party supplied*

        -- /STM32L4_USB-Device_Library   *libraries*

        -- /FatFS_Lib

        -- /StemWin_Lib

        – /Sensors_APIs

    -- /projects

        -- /Project-A

            -- /inc   *Typically,*

            -- /src   *user would customize*

            -- Makefile   *these files*

            -- /obj

        -- /Project-B

            -- ....

        -- /Project-X

            -- ....

        -- /STARTUP

            -- startup_stm32l476xx.s

            -- STM32L476RE_FLASH.ld

            – sysmem.c

            – system_stm32l4xx.c

    -- /documentation

Software : LimiFrog-Lib Contents

```
/libraries

    -- /LimiFrog-Lib

        -- /src

            -- /Board_Support

            -- /LBF_API

            -- /Debug_Utilities

            -- /LBF_USB_MassStorage

            -- /LBF_DataFlash_FatFS

            -- /LBF_StemWin

        -- /inc

            -- <same structure>
```

> IO configuration routines
> On-chip peripheral inits
> On-board chip inits
*(fixed and selective – based on
 user configuration files in /Project-xx)*

API functions :
>For access to on-board hardware and busses (LED, Switches, Data Flash, I2C, …)
>To use some STM32 peripherals at higher level than HAL

Adaptation layer between ST-supplied middleware and Limirog
(any file that is a « template » in ST deliverable or needed customization is here)

Software : User Project Contents

```
/projects

    -- / <project name>

        -- /src
            -- /main.c
            -- /<other_user_files>.c
            -- /stm32_it.c


        -- /inc
            -- /stm32_it.h
            -- /User_Configuration.h
            -- /IT_Priorities_UserDefinable.h

        -- /obj

        -- Makefile

        -- BriefDesc.txt
```

> Proposed template does full board initialization and leaves user concentrate on his/her application.

Interrupt request handlers & associated callback functions. Template proposed.

User defined configurations, esp. :
- configuration of signals / interfaces provided on extension port
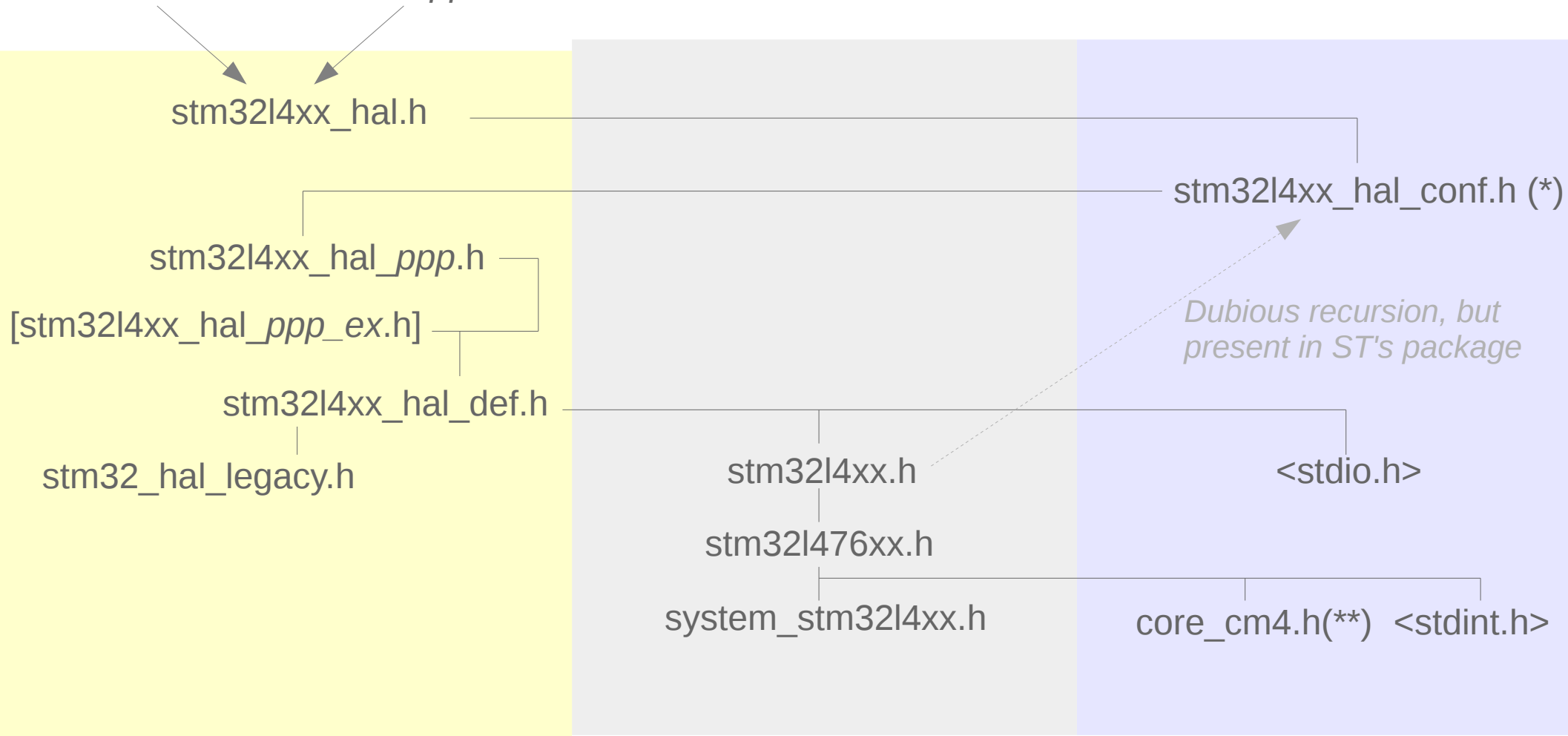- OLED and BTLE usage

User modifiable priorities of all LimiFrog potential interrupt sources.
All defined in this single central file.

Software : Include Model - HAL

HAL C source files

LimiFrog header files
Application header files

stm32l4xx_hal.h

stm32l4xx_hal_conf.h (*)

stm32l4xx_hal_*ppp*.h

Dubious recursion, but present in ST's package

[stm32l4xx_hal_*ppp*_ex.h]

stm32l4xx_hal_def.h

stm32_hal_legacy.h

stm32l4xx.h

<stdio.h>

stm32l476xx.h

system_stm32l4xx.h

core_cm4.h(**) <stdint.h>

Files located under :
…/STM32L4xx_HAL_Driver/Inc

Under :
…/CMSIS_L4xx/Device/
ST/STM32L4xx/Include

Other locations
(*) …/libraries/LimiFrog-Lib/inc
(**) .../CMSIS_L4xx/Include

_ppp = peripheral name

Software : Include Model - Others

- *main.c*
- *stm32_it.c*
- *Other user's application source files*

<application-specific header files>

LBF_Global.h

stm32l4xx_hal.h

Header files of :
 LimiFrog BSP and Libs
+ *Utilities*
+ *Sensor APIs*
+ *Middlewares*
  (USB, FatFs, emWin)

Header files located under :
…/LimiFrog_Lib/inc/...

Under :
…/STM32L4xx_HAL
_Driver/Inc

Some C files in LimiFrog-Lib :
- *LBF_User_Conf.c*
- *LBF_Board_Selective_Inits.c*
- *LBF_BTLE_Inits.c*

C files involving
IT set-up in
LimiFrog-Lib/src

User_Configuration.h

IT_Priorities_User_Defined.h

Header files located under
…/projects/<project_name>/inc