



Porting Guide Industrial SDK to PRU-ICSS-Industrial & Processor SDK

May 1, 2017



Agenda

What are the changes from Industrial SDK 1.x and 2.x to PRU-ICSS-Industrial SW plus Processor SDK

Migrating an application from ISDK to PRU-ICSS-Industrial Processor SDK

Example of moving a starterware application to use an LLD

At a high level – What is changing

Industrial package has been modularized so that each industrial protocol has a separate add-on package that can be used with baseline Processor SDK RTOS SDK for any given SOC.

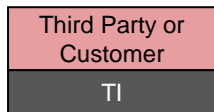
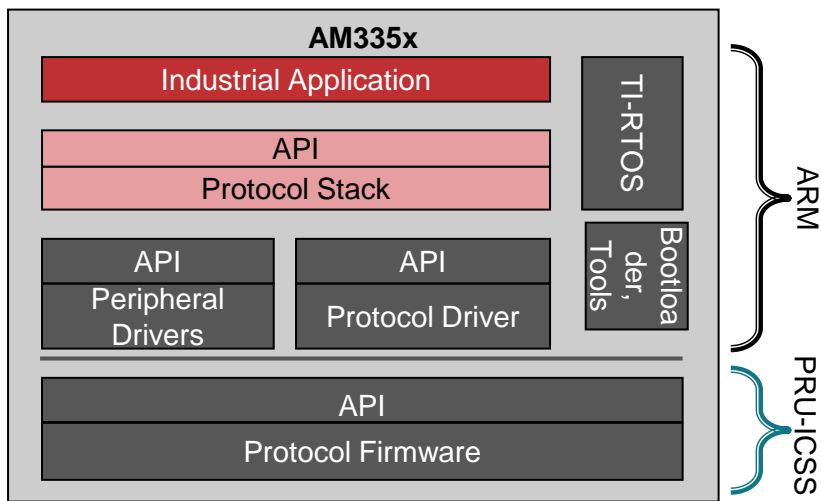
- Easier migration to custom application platforms because platform changes are consolidated in board software.
- Incremental software changes when moving to newer TI platforms like AM57xx and K2G.
- Improved maintenance of existing protocols
- Simplifies the addition of new protocols

Hardware interface through Chip Support Library and Low Level drivers in place of Starterware.

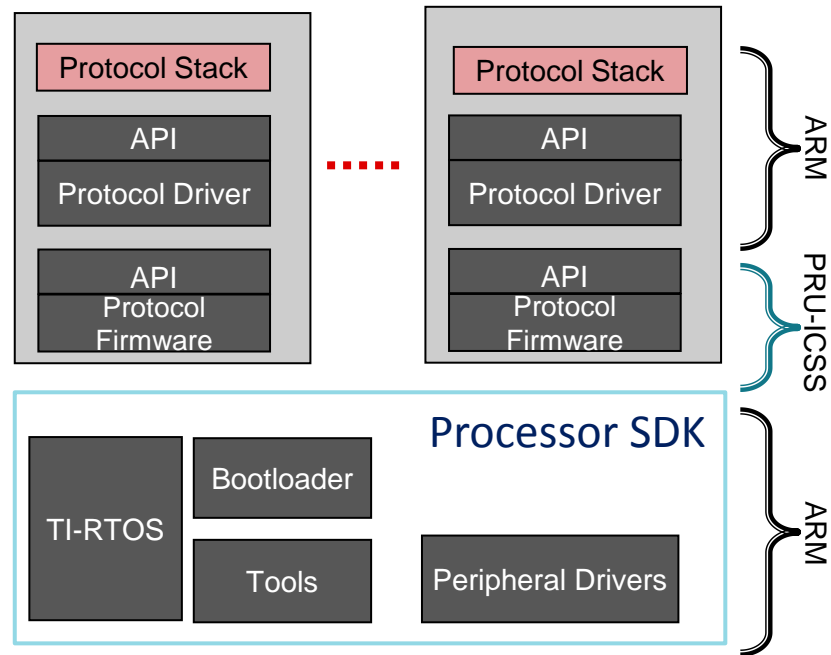
- Low Level Drivers allow for simpler integration with TI RTOS using OS abstraction layer (OSAL)
- Common API interface enables ease of migration for TI MCU customers moving to TI ARM or DSP platforms by maintaining the same API interface for common IPs like SPI, I2C, UART, etc.
- Continued support for AM335x and AM437x Starterware is provided for legacy development projects.
 - Refer: [Processor SDK RTOS Migration Guide history](#)

Each Industrial communications protocol will be contained in a separate package

Industrial SDK (AM335x, AM437x)



PRU-ICSS-SW Industrial Library Model (AM335x, AM437x, AM57x)

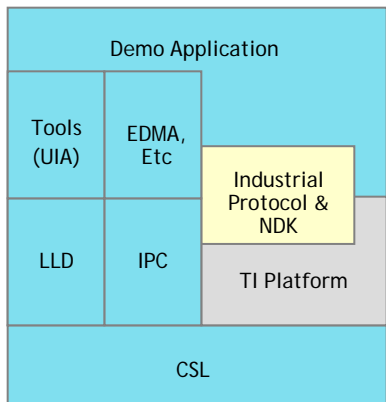


Each Industrial communications protocol will be contained in a separate package

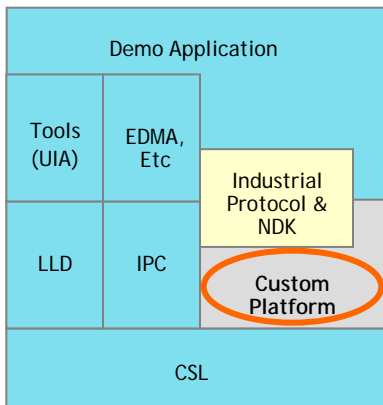
- Instead of all of the protocols and the common libraries being delivered in a single Industrial SDK
 - Each protocol is an individual PRU-ICSS-Industrial-SW package
 - Each PRU-ICSS-INDUSTRIAL-SW package runs on top of the Processor SDK
 - Available at www.ti.com/tool/PRU-ICSS-INDUSTRIAL-SW
- **SYSBIOSSDK-IND-SITARA: SYSBIOS Industrial Software Development Kit (SDK) for AM335x and AM437x** will continued to be delivered until all industrial protocols for the AM335x and AM437x are migrated to PRU-ICSS-Industrial-SW
 - TI will no longer provide SYSBIOSSDK-IND-AM335x after 31 March 2017, and will no longer provide SYSBIOSSDK-IND-SITARA after 30 June 2017

Why Change? - Processor SDK RTOS: Maximize Software Reuse

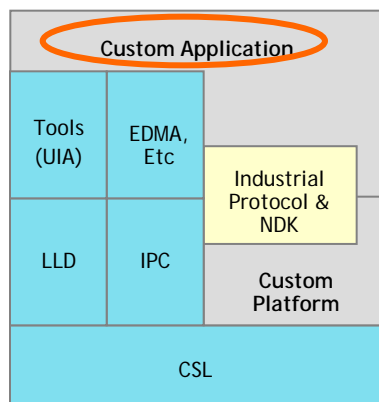
TI Demo Application on TI Evaluation Platform



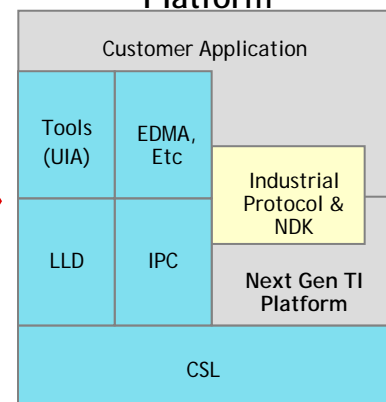
TI Demo Application on Customer Platform



Customer Application on Customer Platform






Custom App on Next Generation TI SOC Platform



Platform Migration

Application Migration

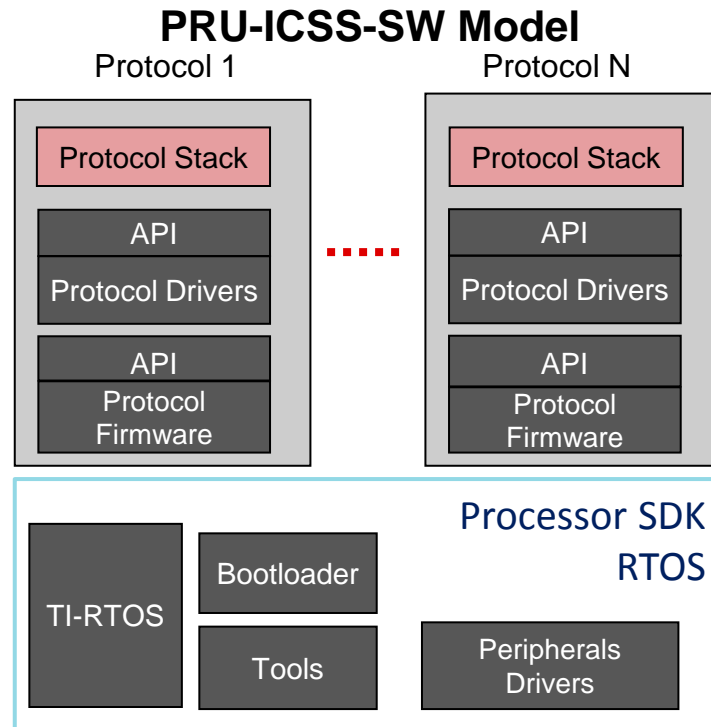
Future Proof

-  No modifications required
-  May be used "as is" or customer can implement value-add modifications
-  Needs to be modified or replaced with customer version

Software may be different, but API remains the same (CSL, LLD, etc.)

Why Change? - PRU-ICSS-SW Industrial Software Delivery

- Separate Industrial protocol packages provide:
 - Better support
 - Ease of migration to other platforms
 - Improved maintenance of existing protocols
 - Simplifies the addition of new protocols
- This change is transparent for stack engagement with third parties. No change is required from third parties.



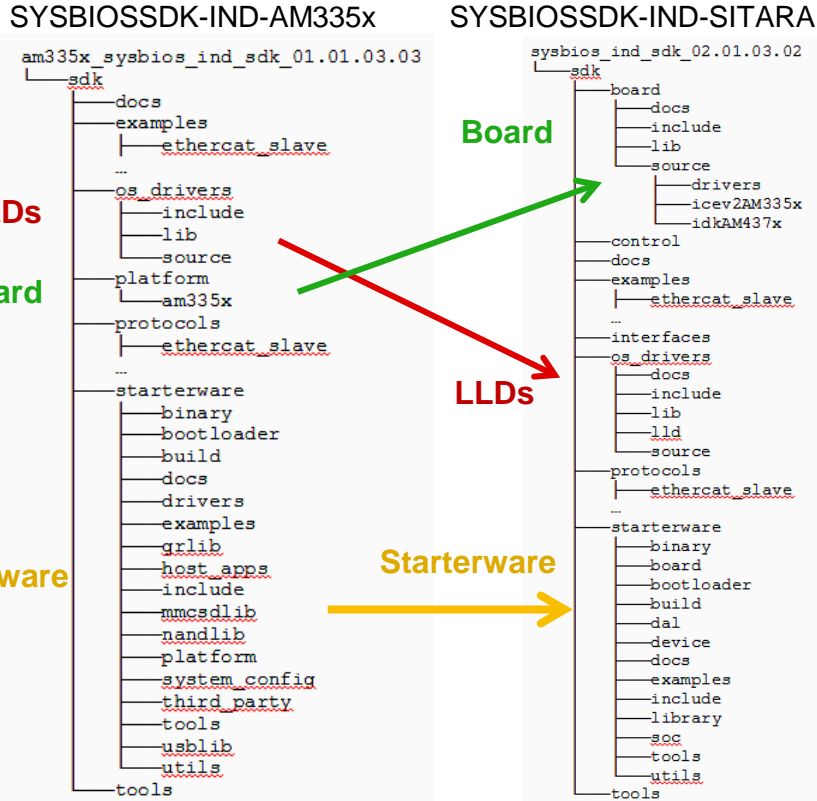


The Processor SDK hardware interface uses the Chip Support Library and Low Level Drivers in place of Starterware.

- Most peripheral and SOC specific configuration is done using the LLDs.
- The LLDs are built on top of the CSL layer and provide an interface to operate and control the peripherals on the device.
 - For more information see - Device driver section in http://processors.wiki.ti.com/index.php/Processor_SDK_RTOS_Software_Developer_Guide
- The CSL contains low level register level definitions and basic functionality to configure cores and registers on the device.
 - For more information see - http://processors.wiki.ti.com/index.php/Processor_SDK_RTOS_CSL
 - In the case of the AM335x and AM437x some of the CSL draws from starterware
- **However - Starterware is still provided in the AM335x and AM437x Processor SDKs for legacy support.**

Changes from Industrial SYSBIOSSDK-IND-AM335x to SYSBIOSSDK-IND-SITARA (SYSBIOS Industrial 1.1 to 2.1)

File Structure from Industrial SYSBIOSDK-IND-AM335x to SYSBIOSDK-IND-SITARA (SYSBIOS Industrial 1.1 to 2.1)



When migrating from ISDK 1.x two sets of modifications are required

1) There are a number of Starterware modifications that are needed to move to both the ISDK 2.0 and PRU-ICSS-Industrial and Processor SDK

These are described in the Starterware migration guide

http://processors.wiki.ti.com/images/5/55/Migration_guide.pdf

2) A few API's change when moving from ISDK1.x moving to ISDK 2.x. These are described in

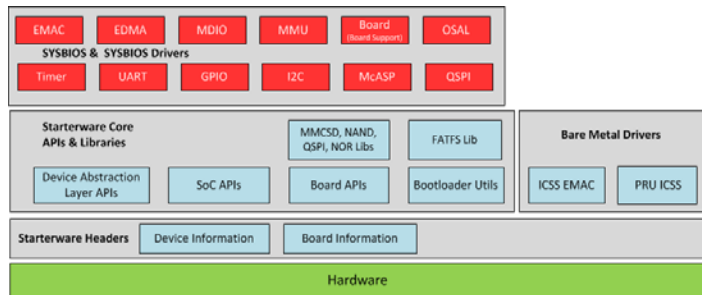
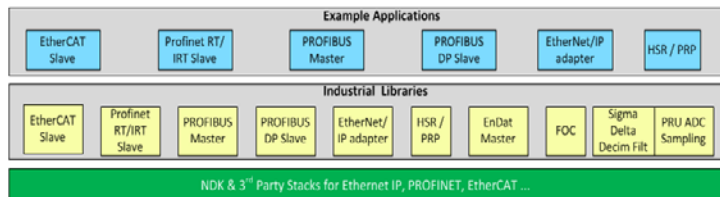
http://processors.wiki.ti.com/index.php/SYSBIOS_Industrial_SDK_Migration_guide_from_1.1_to_2.1

Examples have been removed for clarity

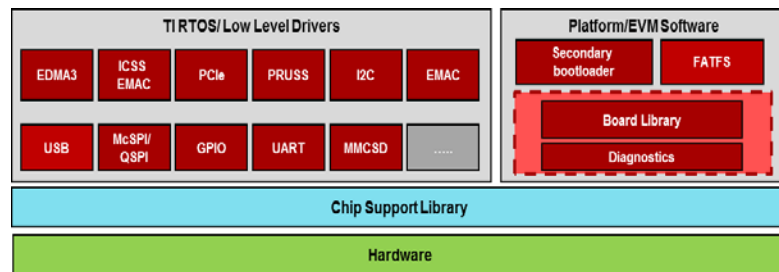
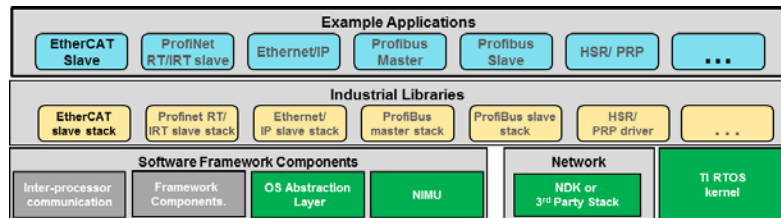
Changes from SYSBIOSSDK-IND-SITARA to PRU-ICSS- Industrial and Processor SDK

Overview of Industrial Software Stack

SYSBIOS Industrial SDK



PRU-ICSS-Industrial & Processor SDK



Few Changes in Protocol and Application



Improved partitioning, generality & uniformity

Not used in Industrial

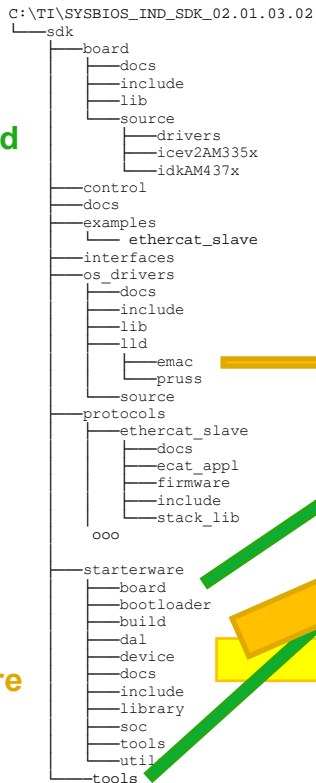
Grey text

Coming soon

Coming soon

File Structure from Industrial SDK to Processor SDK

Industrial SDK

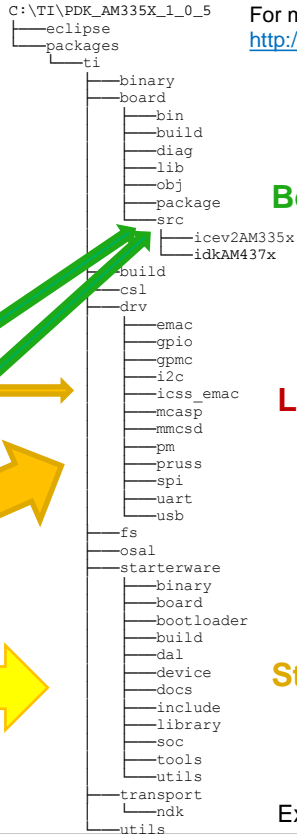


Board

LLDs

Starterware

PDK_AM335x



For more information

http://processors.wiki.ti.com/index.php/Processor_SDK_RTOS_Directory_Structure

Board

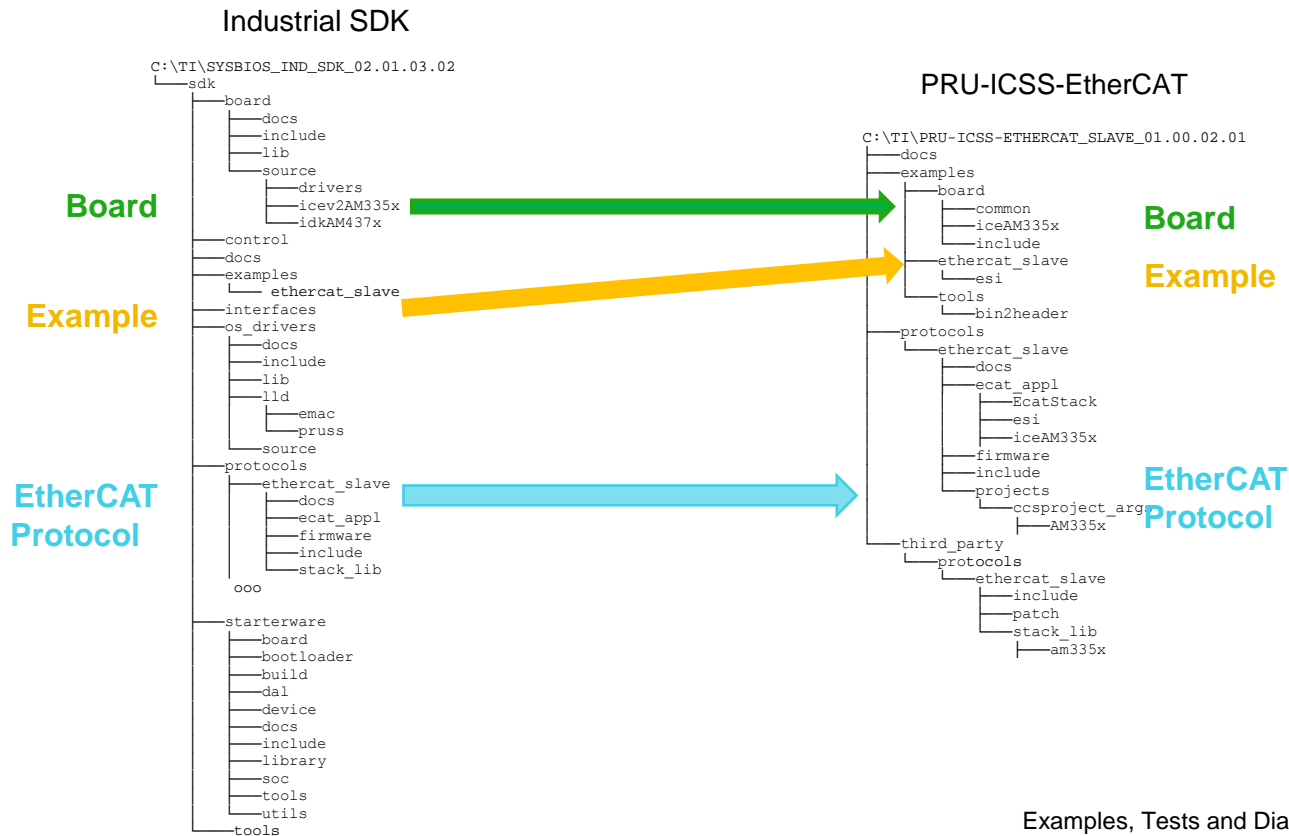
LLDs

Starterware

Optional

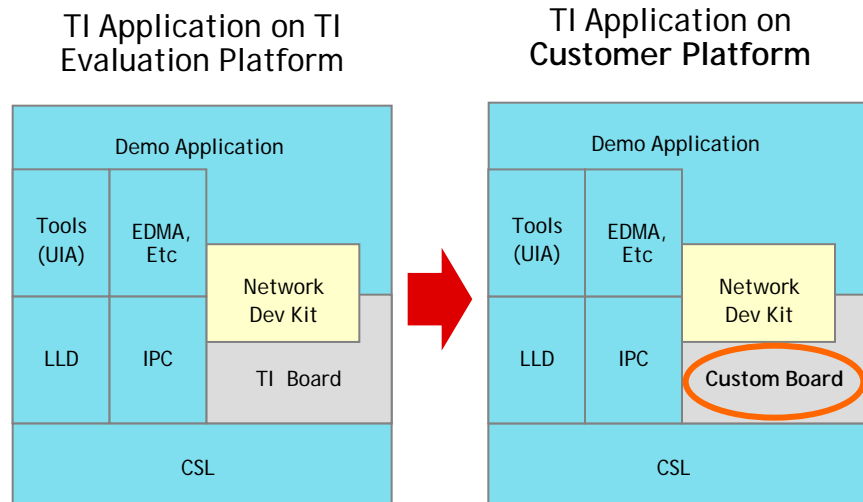
Examples, Tests and Diagnostics have been removed for clarity 13

File Structure going from Industrial SDK to PRU-ICSS EtherCAT






Examples, Tests and Diagnostics have been removed for clarity 14

Processor SDK RTOS – Porting to a custom board



Platform Migration

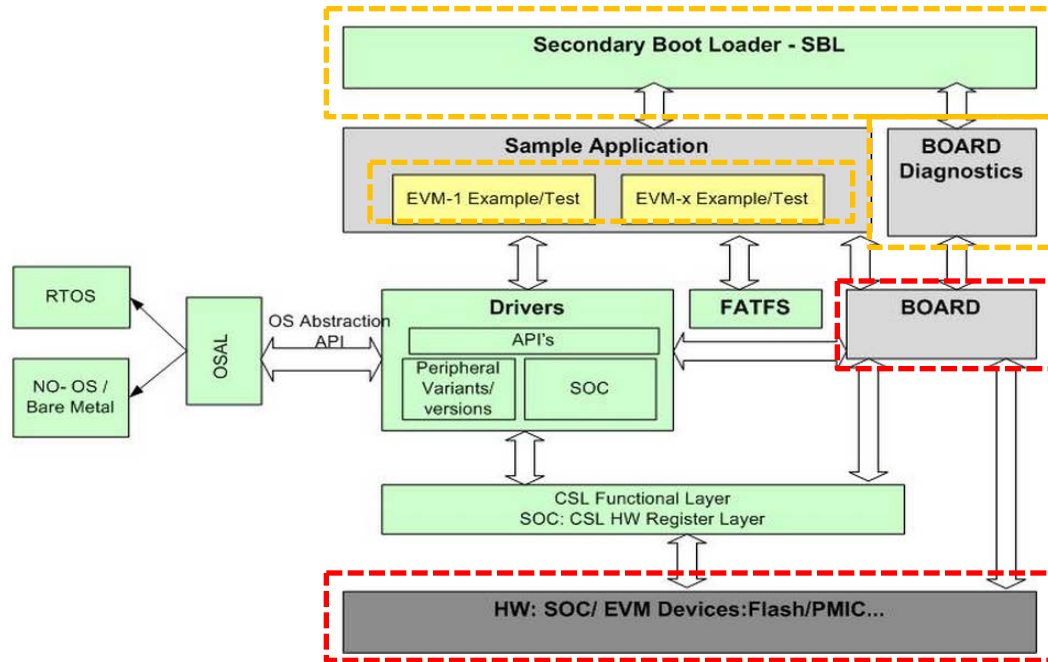
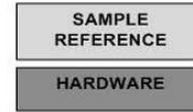
-  No modifications required
-  May be used "as is" or customer can implement value-add modifications
-  Needs to be modified or replaced with customer version

Processor SDK RTOS: Functional View



Components that will definitely need modification

Components that may need modification





Overview

What are the changes from Industrial SDK 1.x and 2.x to PRU-ICSS-Industrial SW plus Processor SDK

Moving an application from ISDK to PRU-ICSS-Industrial Processor SDK

Example of moving a starterware application to use an LLD



Moving a project from ISDK to PRU-ICSS-Industrial SW & Processor SDK

Preparation

- Identify the changes / additions that were made to:
 - ISDK starterware, board, and bootloader libraries
 - ISDK protocol and other industrial libraries (control & interface)
- Identify any BIOS configuration modifications.
- Identify the changes / additions that were made to the application

Moving a project from ISDK to PRU-ICSS-Industrial SW & Processor SDK

Migration

- Incorporate in the changes / additions that were made to the starterware, board library and bootloader into the Processor SDK
 - Starterware changes can be used directly or the modifications can be implemented using the LLDs.
 - The advantage of using the LLDs is that the modifications can be small – For example - Configuring the LLD and enabling the pinmux.
 - Additional information is in the LLD section of https://training.ti.com/sites/default/files/docs/Processor_SDK_RTOS_P2_Slides_0.pdf



Moving a project from ISDK to PRU-ICSS-Industrial SW & Processor SDK

Migration

- Incorporate the board library modifications into the board libraries of the SOC and the PRU-ICSS-Industrial
 - DRIVE:\ti\pdk_SOC_Vers\packages\ti\board\src\SOC_Board\
 - Additional information is available in the Board Library section of https://training.ti.com/sites/default/files/docs/Processor_SDK_RTOS_P2_Slides_0.pdf
 - DRIVE:\ti\PRU-ICSS-PRTOTOCOL_Slave_VERSION\examples\board\SOC_Board\
 - Note this is very similar to the ISDK
Drive:\ti\sysbios_ind_sdk_VERSION\sdk\board\source\
 - Incorporate the bootloader modifications

Moving a project from ISDK to PRU-ICSS-Industrial SW & Processor SDK

Migration

- Incorporate the changes / additions that were made to the ISDK protocol and other industrial libraries (board, control and interface)
 - The protocol sections in the PRU-ICSS-Industrial SW are very similar to the Industrial SDK
 - However, because PRU-ICSS-Industrial SW supports a broad range of devices -
#ifdef SOC_NAME is used to support the SOCs unique characteristics in defines and assignments
- Incorporate any TI RTOS configuration modifications.
- Incorporate any application changes / additions
 - The application sections in the PRU-ICSS-Industrial SW are very similar to the Industrial SDK



Overview

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Moving an application from ISDK to PRU-ICSS-Industrial Processor SDK

Example of moving a starterware application to use an LLD



Example of moving a Starterware Application to use the Processor SDK LLD

If we desired to change the Console from UART3 to UART 1

- **ISDK Implementation**

- Not all UART instances are supported in the Industrial SDK Starterware - it is necessary to

- Add code to enable the uart instance in PRCModuleEnable in `{IA_SDK_HOME}\starterware\soc\am335x\am335x_prcm.c` and
- Change the `BUILDCFG_MOD_UART` to specify UART 1 in `{IA_SDK_HOME}\starterware\board\am335x\am335x_icev2.c`
- Add code to configure the pin mux settings in `ConsoleUtilsUartPinMuxSetup` in `{IA_SDK_HOME}\starterware\utils\console_utils_uart.c`
- We then rebuild the Starterware soc, board, utils and the sysbios board_support library.



Example of moving a Starterware Application to use the Processor SDK LLD

If we desired to change the Console from UART3 to UART 1

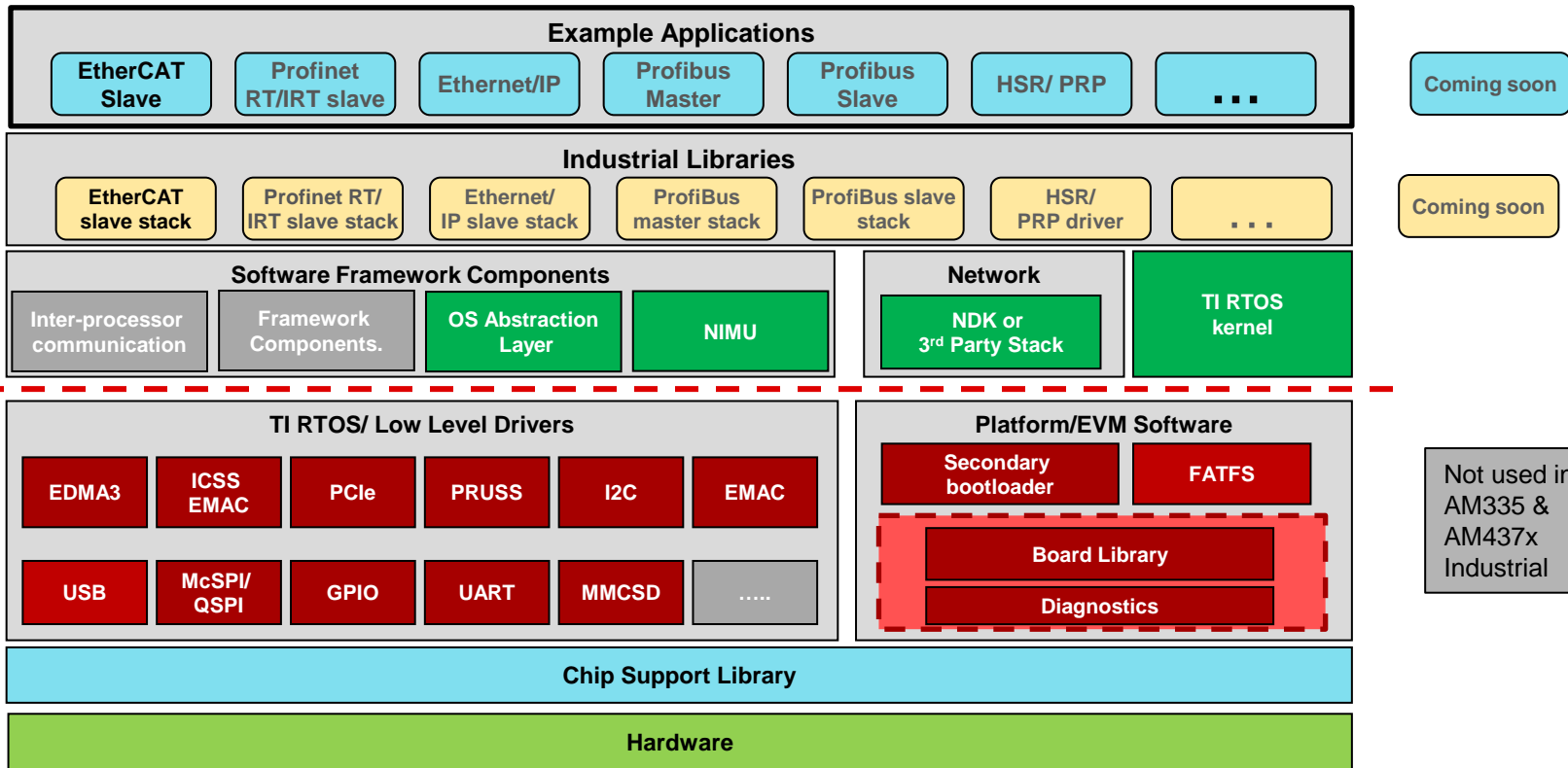
In the Processor SDK – there is a larger number of UARTs already supported in the library

- **Already done** - PRCM domain: In the board library - define the enable for the UART in
DRIVE:\ti\pdk_am335x_1_0_x\packages\ti\board\src\- **Already done** - PINMUX setting:
 - Add Pinmux definition for UART in
DRIVE:\ti\pdk_am335x_1_0_5\packages\ti\starterware\board\am335x\am335x_icev2_pinmux_data.c
static pinmuxModuleCfg_t gUartPinCfg[]
 - Add the pinmux module configuration for UART in
DRIVE:\ti\pdk_am335x_1_0_x\packages\ti\board\src\Board_STATUS Board_pinmuxConfig (void)
- In DRIVE:\ti\pdk_SOC_VER\packages\ti\board\src\SOC_BOARD\include\board_cfg.h
change #define BOARD_UART_INSTANCE to 1
- In DRIVE:\ti\pdk_am335x_1_0_x\packages\ti\drv\uart\soc\am335x\UART_soc.c,
edit uartInitCfg[CSL_UART_PER_CNT] interrupt number for the UART instance
- Rebuild: starterware library, board library and UART library

Appendix



Previous AM355x AM437x Processor SDK & PRU-ICSS Industrial Software Stack



Non-OS Software

For more Information: http://processors.wiki.ti.com/index.php/Processor_SDK_RTOS_Software_Stack

AM357x / AM437x Industrial SDK Software Stack

