From start to finish:
A product development roadmap for Sitara™ processors

Schuyler Patton
Sitara Processors
Overview

• Example Phases for a Product Development
• Evaluation Phase
• Board Development Phase
• Software Development Phase
• Production Phase / SW Lifecycle
Phases of Product Development
One Example of a Product Development Timeline
One Example of a Product Development Timeline

**HW Platform Options**

- **Sitara Processor Evaluation**
- **Board Development**
- **Software Development**
- **Product Lifecycle**

**Timeline**

- **t = 0**
- **t = Production**

**Custom (Product) Board**

- **TI EVM**
Processor Evaluation
Product Development Timeline - Evaluation

HW Platform Options

- Sitara Processor Evaluation
- Board Development
- Software Development

Timeline

- Processor Data Sheet
- White Papers / Application Notes
- SYSCONFIG Tool
- Power Estimation tool
- EVM with RTOS or Linux SDK
- TI Reference Designs
- Training
- e2e Forums

Custom (Product) Board

TI EVM

Timeline:

$t = 0$

$t = \text{Production}$
Processor Evaluation – Datasheet & TRM

• Datasheet
  – ARM processor frequencies supported
  – Available Peripherals
  – DDR Memory types supported
  – Power, Clocking Capabilities

• Technical Reference Manual (TRM)
  – Companion guide to Datasheet
  – details the integration, environment, functional description, programming models for each peripheral and subsystem in the device
Processor Evaluation – Technical Documentation

- White papers
  - Power Optimization Techniques
  - Sitara Processor Security
- Application Notes
  - Hardware Design Guide
  - Schematic Checklist
  - EMIF Tool
- E-Books
- Technical Articles
Processor Evaluation - SYSCONFIG Tool

- Software tool that provides a Graphical User Interface for configuring pin multiplexing settings, resolving conflicts
- Perform “what-if” on possible pin mux configurations for a particular application
Processor Evaluation - TI Reference Designs

- Leverage TI technology to solve your system-level challenges
- Some designs use TI Evaluation Modules
- Schematics and other documentation provided such as PCB layouts, Bill of Materials (BOM) and User Guide
Use TI Processor SDKs to run demos as well as build experimental applications on TI Evaluation Modules.
Product Evaluation Summary

• Use the Datasheet and The Technical Reference Manual to determine processor compatibility
• Review the available Application Notes, Whitepapers and other technical documentation available on ti.com
• Use the SYSCONFIG tool to evaluate possible pin mux outputs to determine “what if” processor configurations
• Review TI Reference Designs for design elements to be used in a new product
• Experiment with TI Evaluation Modules and the RTOS and Linux Software Development Kits to evaluate processor capabilities
Board Development
Product Timeline – Board Development

Sitara Processor Evaluation

Board Development

Software Development

Product Lifecycle

HW Platform Options

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Custom (Product) Board

Timeline

$t = 0$

$t = \text{Production}$

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Product Timeline – Board Development

• The purpose of this application report is to walk hardware designers through the various stages of designing a board on this platform.

• Block diagram of suggested of hardware design flow for a board design

• Use Reference material provided by TI in the Technical Documentation tab of the Processor Product folder
Product Timeline – Board Development

Figure 1. Hardware Design Timeline
Product Timeline – Board Development

Figure 1. Hardware Design Timeline

Processor Datasheet
Technical Reference manual
Board Development – Datasheet & TRM

- **Datasheet**
  - Designing
    - Device interconnections
    - Electrical & Timing requirements
    - Pin Muxing
    - Power
    - DDR Memory Interfacing

- **Technical Reference Manual (TRM)**
  - Boot Modes
  - Peripheral Clocking and operations
  - Control Module, register descriptions
Product Timeline – Board Development

Figure 1. Hardware Design Timeline

Timeline

\[ t = 0 \quad \text{to} \quad t = \text{Production} \]
• SYSCONFIG tool can be downloaded or has cloud access
Product Timeline – Board Development

IBIS Models for Timing Analysis
Product Timeline – Board Development

Figure 1. Hardware Design Timeline

EVM Schematics
AM335x Schematic Checklist (SPRABN2A)
Product Timeline – Board Development

Figure 1. Hardware Design Timeline

High Speed Interface Layout Guidelines (SPRAAR7H)
Product Timeline – Board Development

- The Technical documentation Tab of the product folder contains the list of available documentation for a Processor.
Board Development Summary

• Follow the steps shown in the Hardware Design guide
• Leverage the documentation provided in the processor product folder
• Use the Datasheet and TRM to create system block diagram
• The tools for SYS CONFIG, EMIF tool assists with determining pin mux configuration
Software Development
Product Timeline – Software Development

Sitara Processor Evaluation

Board Development

Software Development

Product Lifecycle

HW Platform Options

TI EVM

Custom (Product) Board

Timeline

$t = 0$

$t = \text{Production}$

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Product Timeline – Software Development

- **Software Development**
- **SW Development/Testing/Release**
- **Board Port Development – U-Boot/Linux**
- **Board Port Development – RTOS**

**HW Platform Options**
- Custom (Product) Board
- TI EVM

Timeline:
- $t = 0$
- $t = \text{Production}$
Product Timeline – Software Development

**Software Development**

**SW Development/Testing/Release**

- Processors SDK RTOS
- Processors SDK Linux

**HW Platform Options**

- Custom (Product) Board
- TI EVM

Timeline:

- $t = 0$
- $t = \text{Production}$

[Image of graph with timelines and platform options]
Product Timeline – Software Development RTOS

- Robust real-time TI-RTOS kernel including TCP/IP networking stack
- Posix thread-compatible API layer available
- Driver libraries that can be used with TI-RTOS or without a kernel
- Free and available as open source
Product Timeline – Software Development Linux

- Updated to the latest Long Term support (LTS) Linux kernel, boot loader and Yocto file system on an annual basis
- U-Boot community boot loader
- Robust, commercial-grade Linaro® GNU compiler collection (GCC) toolchain
- Yocto Project™ OE Core compatible file systems support enables tailored Linux application support
- RT-Linux releases include a fully pre-emptible kernel for real-time applications
Product Timeline – Software Development

Board Port Development – U-Boot/Linux

- Porting - Bring up U-Boot/Linux on Custom Hardware
  - Processor SDK Linux has the processor initialization, driver support for Linux and U-Boot
  - Leveraging TI EVM code makes porting straight forward
  - Use the EMIF and SYSCONFIG tools to assist with the port effort

HW Platform Options

Custom (Product) Board

TI EVM

Timeline

$t = 0$

$t = \text{Production}$
Product Timeline – Software Development

Board Port Development – U-Boot/Linux

Porting U-Boot

- Leverage TI Code
- DDR Settings
- Pin Mux Configuration

TI U-Boot Code in SDK

EMIF Tool

SYSCONFIG

EMIF Tool

TI Processors SDK Linux
The board.c file is a key file for porting U-Boot to a custom board.
Product Timeline – U-Boot Board Port

board/ti/am335x/board.c

EMIF Tool
Product Timeline – U-Boot Board Port

board/ti/am335x/board.c

board.c

EMIF Settings

Pin Mux Settings

SYSCONFIG

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Product Timeline – Software Development

Board Port Development – U-Boot/Linux

**Porting Linux**

- Leverage TI Code
- TI DTS Code
- Pin Mux Configuration
- SYSCONFIG
Product Timeline – Linux Board Port

The `<board>.dts` file is the key file for porting Linux to a custom board.

```
arch/arm/boot/dts/<board>.dts

<board>.dts
```

TI Processors SDK Linux
Product Timeline – Linux Board Port

arch/arm/boot/dts/<board>.dts

<board>.dts
devicetree.dtsi
Software Development Summary

• TI Provides an RTOS and Linux SDK operating system for each processor
• The SDKs provide the starting point for application development
• The SYSCONFIG and EMIF Tools should be used to accelerate porting operating systems to a new board
Production and Lifecycle
3.5. Board Utilis

3.5.1. UniFlash

3.5.1.1. Introduction

UniFlash is a UniFlash tool which provides utilities for flashing the application software images to non-removable flash devices on TI hardware platforms.

UniFlash for TI processors’ platform includes two components:

- Flash Programmer
- Host utility

Flash programmer runs on target platform which allow user of receiving the images from UniFlash host utility and programming them onto flash devices. Flash programmer communicates with UniFlash host utility over the UART interface.

Flash programmer which is part of the UniFlash release can be found at: “UniFlash Host/Processor/FlashWriter/Board Name”

Host utility runs on host machine which provides Command Line Interface (CLI) to communicate with flash programmer. Windows and Linux are the supported OS platforms for running UniFlash host utility. Host utility uses UART or JTAG interface to download the flash programmer to the target platform. All data transfers between UniFlash host utility and flash programmer happens over UART interface.

Refer to UniFlash Documentation for more details on UniFlash tool.

3.5.1.2. Supported Platforms

Below table shows the platforms supported by UniFlash and flash devices supported on each platform. Download mode indicates the mode of communication for downloading flash programmer to target platform.
Product Timeline – Lifecycle

- TI Processors Linux SDK
  - Current Annual LTS
  - Next LTS

Current SDK Support Window

SDK release date

Initial board port

Time

Production

Issue detected during testing; Fixed in later SDK version

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