

FPGA快速入门

——LatticeMico8软核的实现

STEP团队

2016/7/4



主要内容

- LatticeMico8 软核介绍
 - IP核
 - LatticeMico8的结构和特点
- LatticeMico System的开发流程
 - 建立工程平台
 - 搭建Mico System硬件结构
 - 开发应用程序
 - 整合软硬资源生成系统
- 练习
 - 流水灯实验
 - UART通信实验



LatticeMico8 软核

◆ IP Core (Intellectual Property Core)

IP Core is a **reusable** unit of logic, cell, or chip layout design that is **the intellectual property** of one party. IP cores can be used as building blocks within **ASIC chip designs** or **FPGA logic designs**.

硬核：专用的经过验证的设计版图

软核：通用性的可综合RTL模型

◆ 几大CPU软核

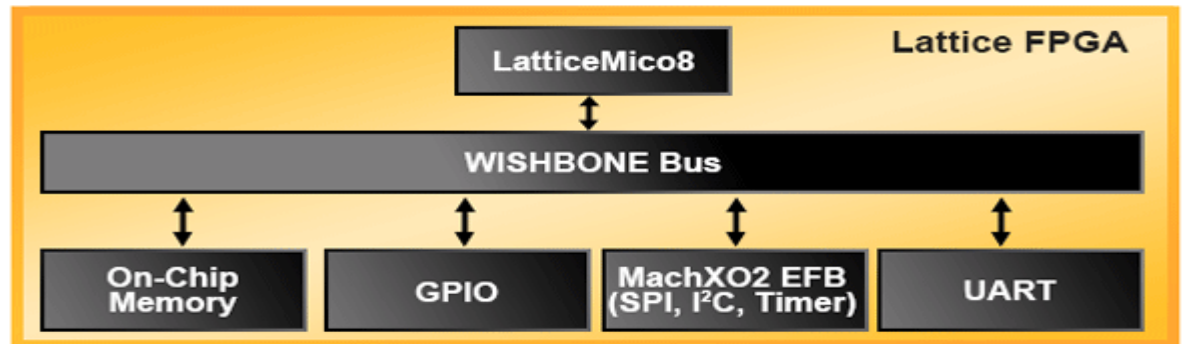
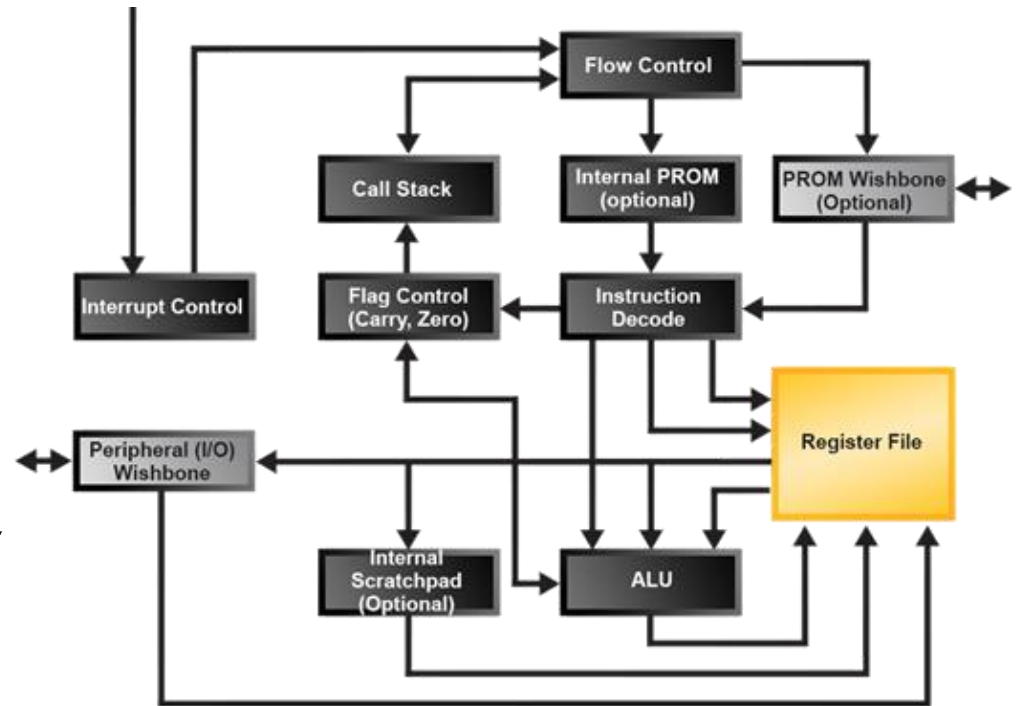
Processor	Developer	License	Bus Support	Architecture
Nios/Nios II	Altera	Proprietary	Avalon	32bits
LEON3/4	AeroflexGaisler	Open source	AMBA2	SPARC-v8
MicroBlaze	Xilinx	Proprietary	PLB, OPB,etc.	MicroBlaze
LatticeMico32/8	Lattice	Open source	Wishbone	32Bits/8Bits
Cortex-M1	ARM	Proprietary	AHB	ARMv6
8051	Intel	Open source		8 Bits



LatticeMico8 的结构和特点

特点

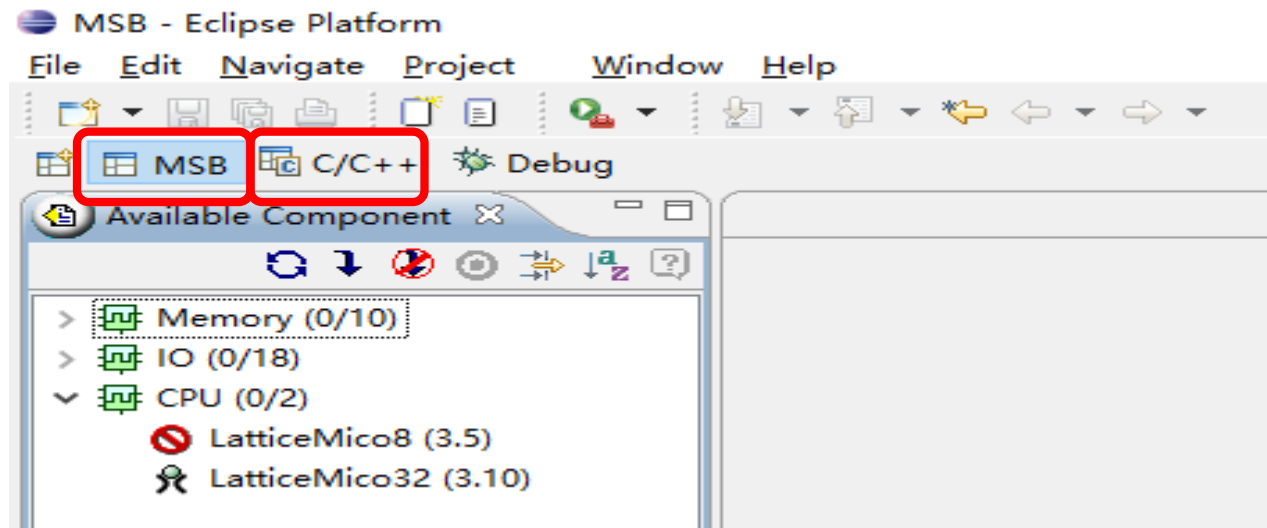
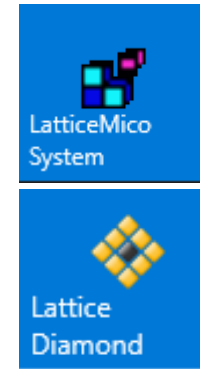
- 8位数据宽度
- 18位指令长度
- 可配置的ROM
- 可配置的暂存区
- WISHBONE总线外设接口
- 最少2个周期执行一条指令
- 可配置的16位/32位通用寄存器
- 可配置的Call Stack





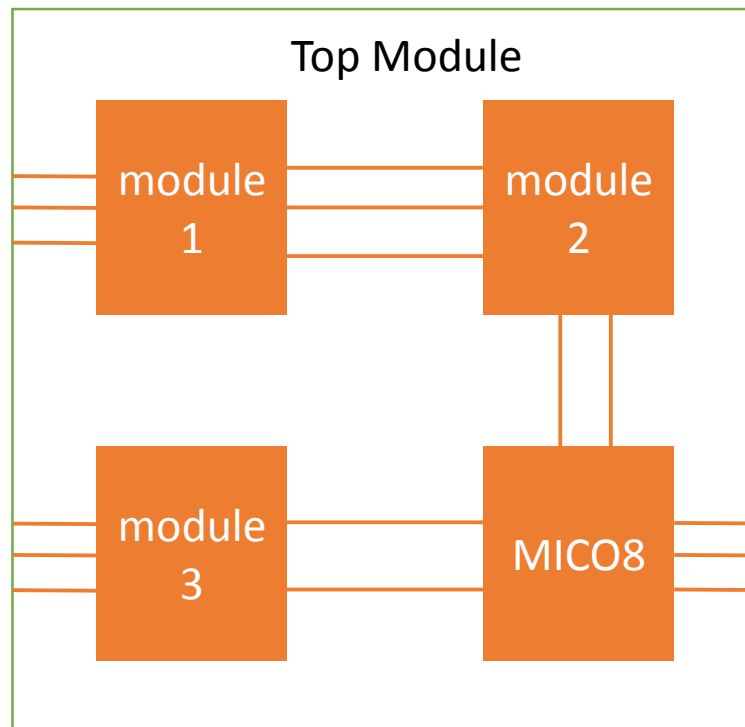
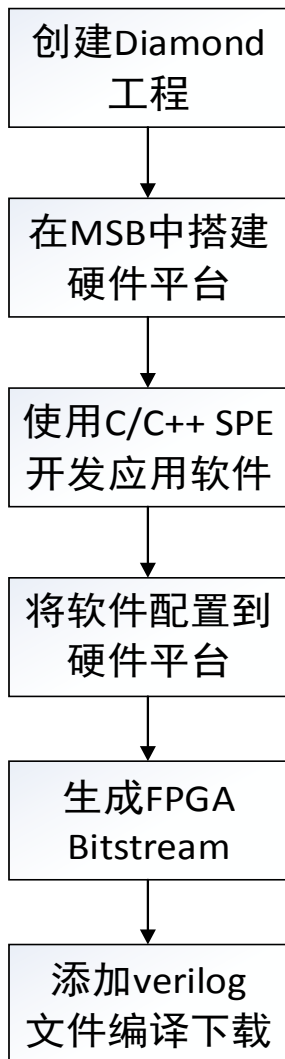
LatticeMico System的开发工具

- ▶ Mico System Builder (MSB)
- ▶ C/C++ Software Project Environment (C/C++ SPE)
- ▶ Deployment





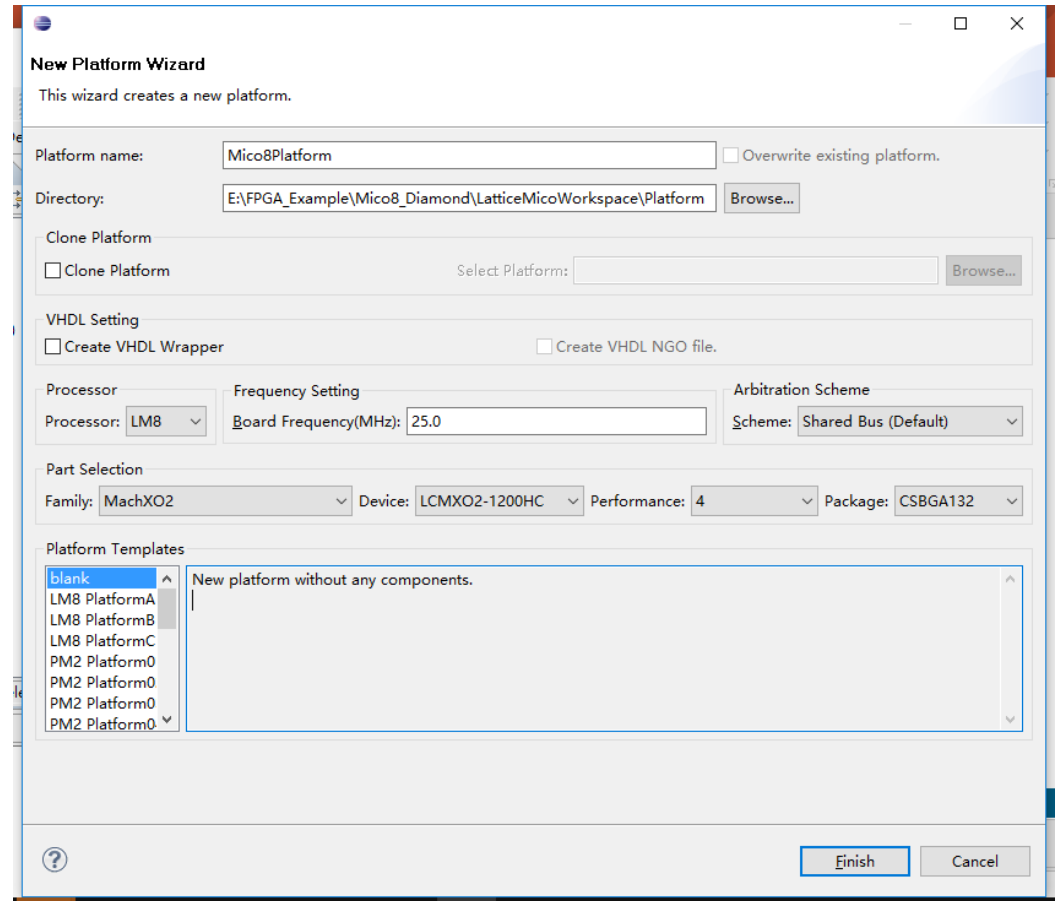
LatticeMico System的开发流程





Creating the LatticeMico8 Platform in MSB

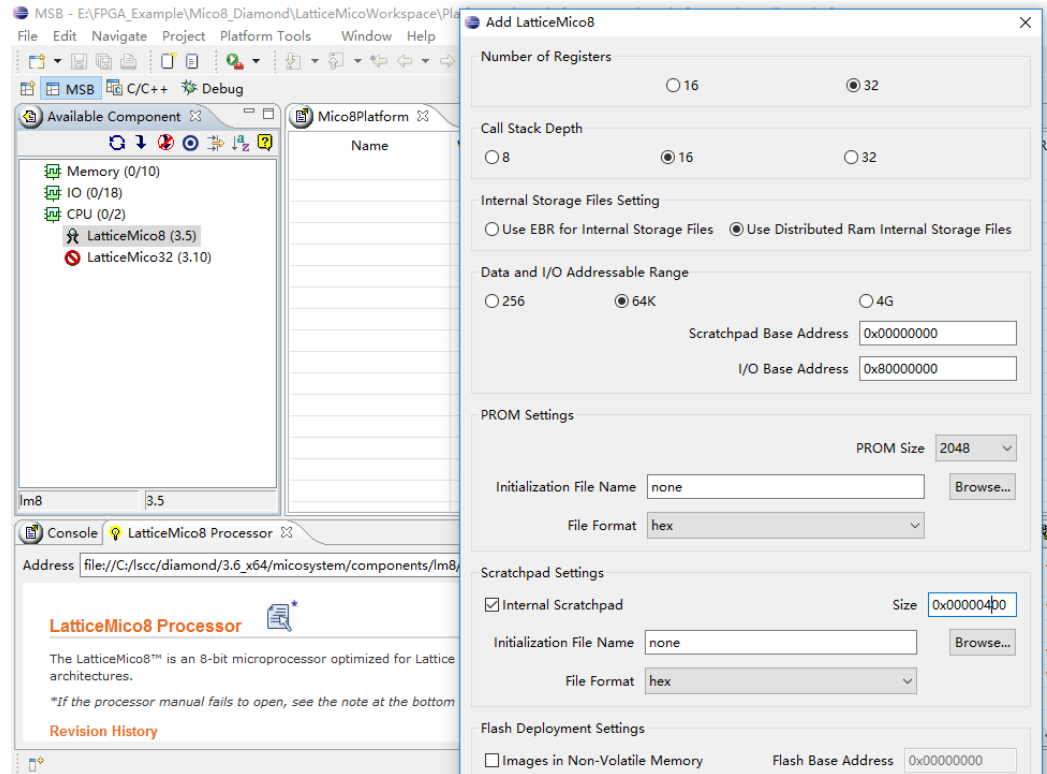
- 打开LatticeMicoSystem软件
- 选择workspace目录，放在Diamond工程目录下
- File新建Platform
- 填写Platform名和存放目录（最好在workspace文件夹下新建一个文件夹存放Platform）
- 编辑Processor属性
- 选择芯片型号
- 选择Platform模板





Adding Microcontroller to Your Platform

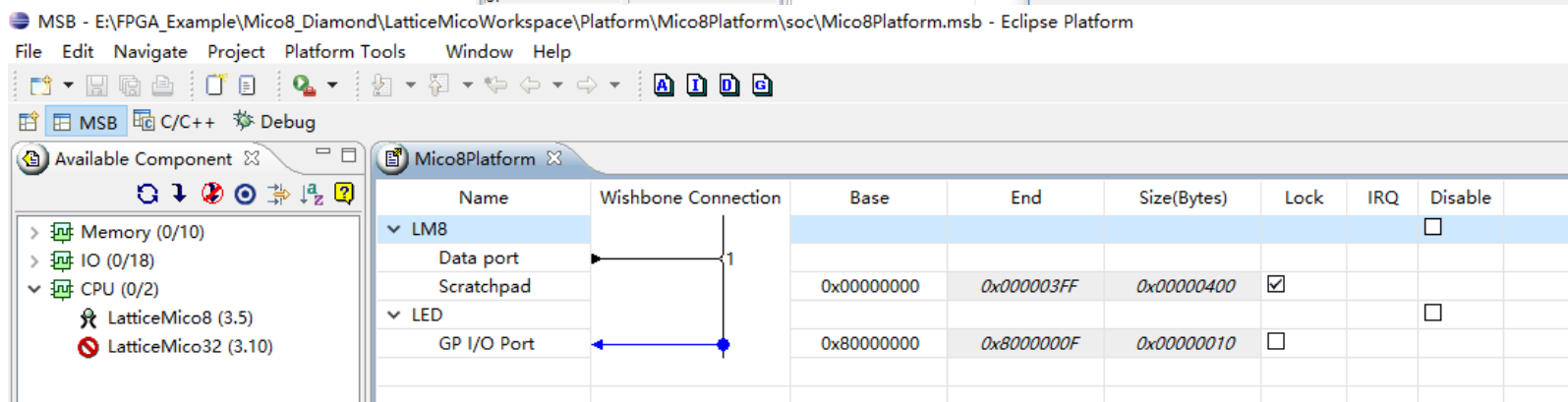
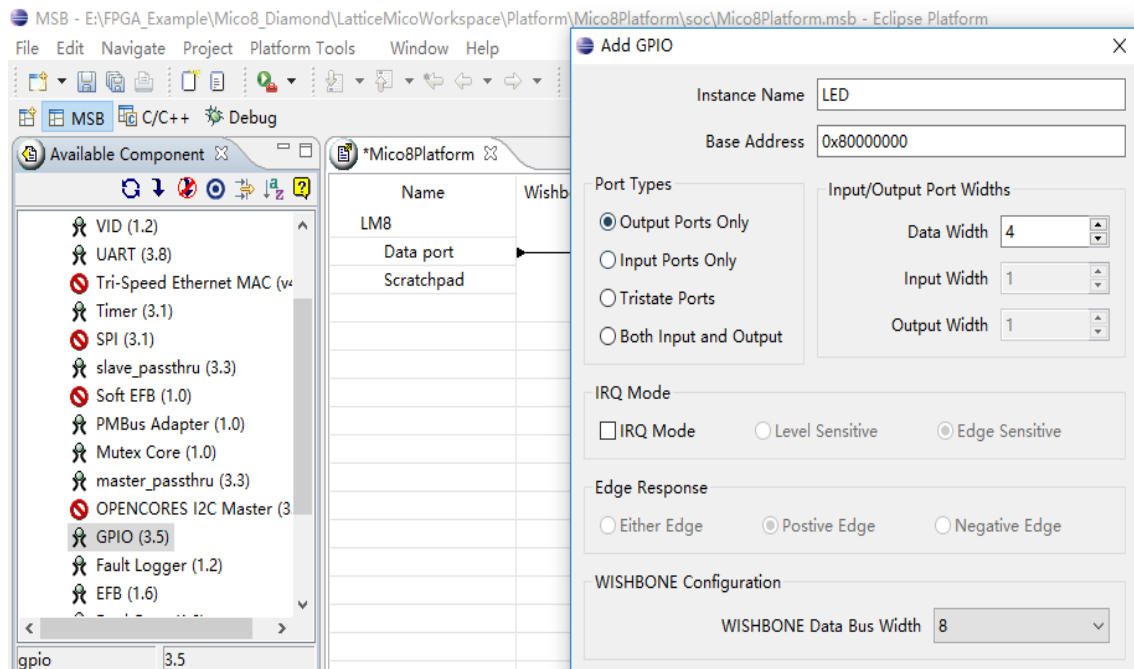
- 在左侧AvailableComponent一栏中选择LatticeMico8双击添加Mico核
- 编辑Mico8的属性
- PROM Settings和Scratchpad Settings可以忽略，需要编写完软件后初始化





Adding Peripherals to Your Platform

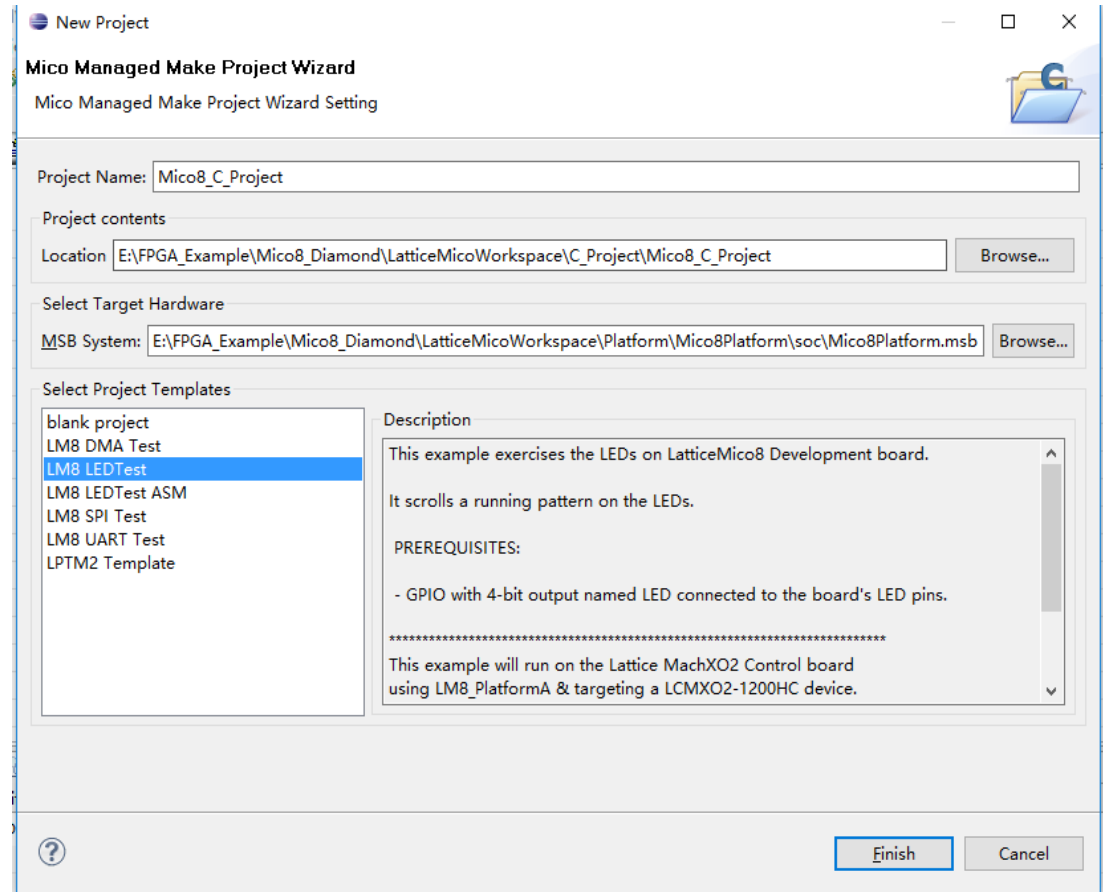
- 在左侧AvailableComponent的IO一栏中选择添加需要的外设
- 编辑外设的属性
- Platform Tools依次点击A I D G, 生成硬件平台 (ROM未初始化, 需要开发完软件后再次生成)





Using C/C++ SPE to Develop Your Software

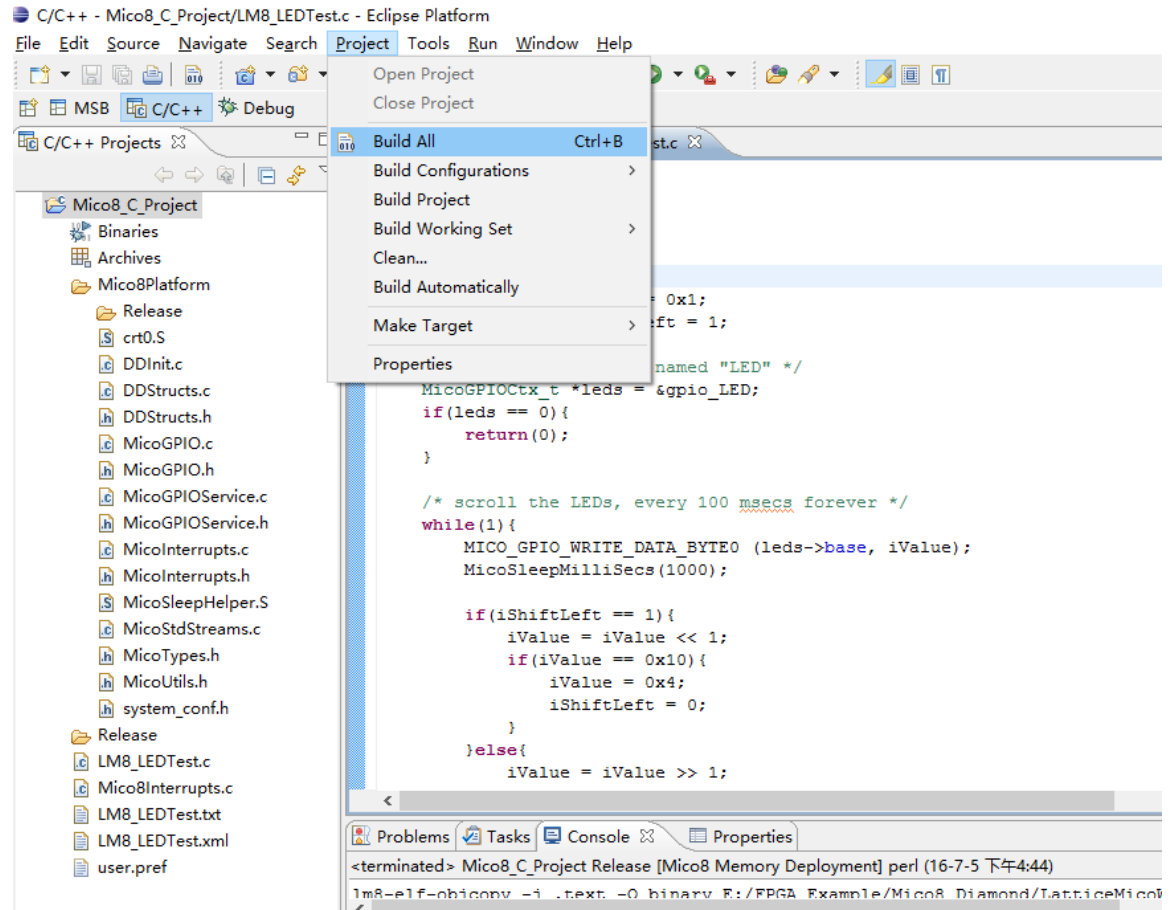
- 切换到C/C++ SPE
- File新建mico Managed Make C Project
- 编辑工程名，选择存放目录（建议保存在workspace目录下新建一个文件夹来保存工程）
- 选择工程模板或是空的工程





Using C/C++ SPE to Develop Your Software

- File新建mico Managed Make C Project
- Project—Build All, 软件会根据MSB的Platform自动生成相应的头文件和驱动函数
- 调用头文件和驱动函数编写应用软件
- Project—Build Project





Generate Mem Data and Initialize Memory

- Tools—Software Deployment
- 选中左侧 Mico8_C_Project Release
- 在Main一栏中选择 Project名称
- 保存PROM 和Scratchpad memory初始化文件目录，点击Start生成
- 切换到MSB，编辑LM8 属性，添加PROM Settings和Scratchpad Settings的数据文件
- 重新生成FPGA Bitstream

The screenshot shows the 'Software Deployment Tools' window. The title bar reads 'Software Deployment Tools'. The main window has a 'Name' field containing 'Mico8_C_Project Release'. Below this is a 'Main' tab with several configuration fields:

- Project:** Mico8_C_Project (with a 'Browse...' button)
- C/C++ Application:** Release/Mico8_C_Project.elf (with a 'Search Project...' button and a 'Browse...' button)
- Connect process input & output to a terminal.
- Save Memory Initialization Files to directory...** (with a 'Browse...' button)
- Directory: E:\FPGA_Example\Mico8_Diamond\LatticeMicoWorkspace\C_Project
- Click "Start" to generate deployment file

Below the main configuration is a 'PROM Settings' section:

- PROM Size:** 2048 (dropdown)
- Initialization File Name:** E:/FPGA_Example/Mico8_Diamond/LatticeM (with a 'Browse...' button)
- File Format:** hex (dropdown)

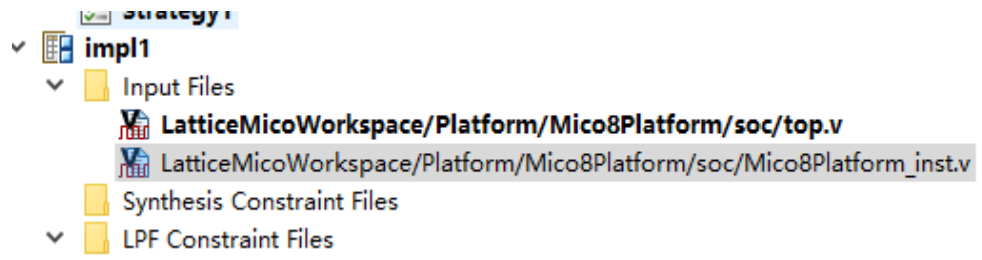
Below that is a 'Scratchpad Settings' section:

- Internal Scratchpad (with a 'Size' field set to 0x00000400)
- Initialization File Name:** E:/FPGA_Example/Mico8_Diamond/LatticeN (with a 'Browse...' button)
- File Format:** hex (dropdown)



Program the Bitstream to Configuration PROM

- 在Platform目录soc文件夹中新建一个top.v文件
- 将Mico8Platform模块添加到top模块中
(在xxxx_inst.v文件中已经例化直接复制)
- 在module开头使用`include`语句将MSB生成mico核.v文件添加进来
- 综合、分配引脚、编译下载



```
1 `include "../soc/Mico8Platform.v"
2 module Top(
3     input clk_i,
4     input reset_n,
5     output [3:0]LEDPIO_OUT
6 );
7
8 Mico8Platform Mico8Platform_u (
9     .clk_i(clk_i),
10    .reset_n(reset_n)
11    , .LEDPIO_OUT(LEDPIO_OUT) // [4-1:0]
12 );
13
14 endmodule
15
```



练习

- 流水灯实验










为MICO8核分配8位GPIO口，循环点亮小脚丫上的8个LED灯

- 串口通信实验

为MICO8核分配一个UART接口，通过外设板上的CH340与PC实现串口通信



参考资料

-  LatticeMico EFB.pdf
-  LatticeMico8DevelopmentToolsUserGuide.PDF
-  latticemico8devug36.pdf
-  latticemico8processorreferencemanual36.pdf
-  LatticeMico8Tutorial35.pdf
-  LatticeMico32HWDDeveloperUG35.pdf
-  LatticeMico32MasterPassthrough.PDF
-  LatticeMicoSPI31.pdf
-  lm32_hw_ug.pdf