NIOS-V Software Setup

Last updated 10/29/26

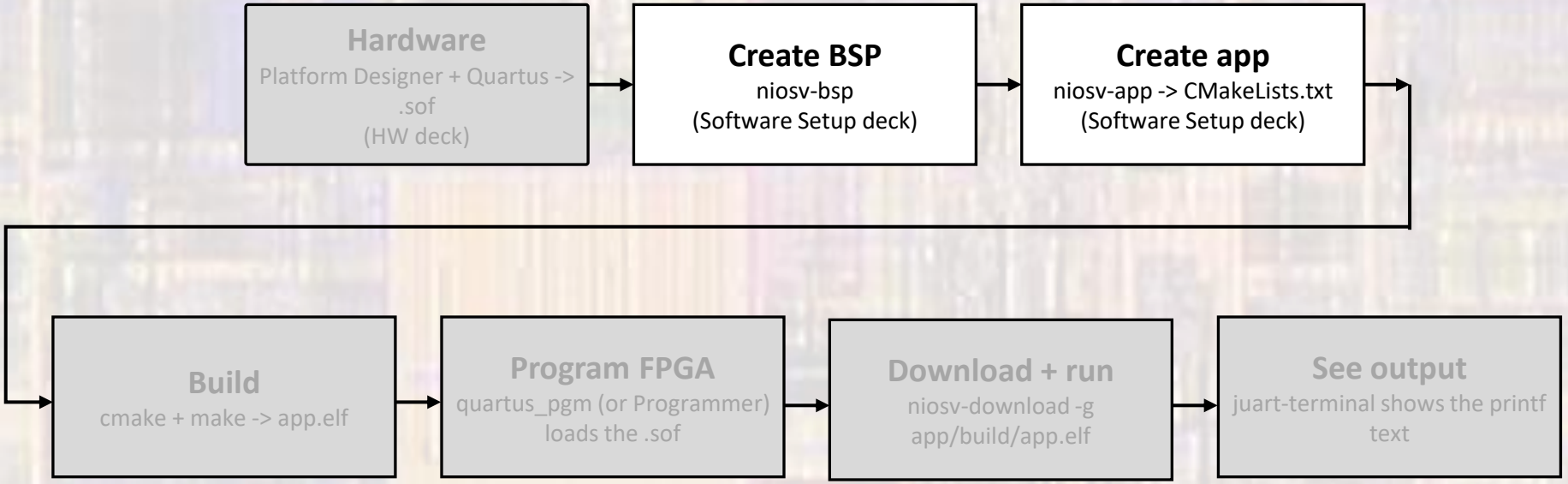
NIOS-V Software Setup

Just like the rest of Quartus, the NIOS-V system does not allow spaces in files names and directory paths.

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NIOS-V Software Setup

- From hardware to a running program



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NIOS-V Software Setup

- Our hardware solution is custom
  - NIOS-V processor + our selected library blocks + our custom created blocks
- To use the custom hardware solution we created, we need to create all the hardware related support software
  - Device drivers
  - Module functions
  - Hardware Abstraction Layer (HAL)
  - Interrupt service routines
  - Standard C library components
  - Memory map
- We will not be using an operating system – this is called a bare-metal implementation
- This support software is typically called a Board Support Package (BSP)

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NIOS-V Software Setup

- 5 steps
  - Setup the directory structure
  - Create an applications (c program) file
  - Create the BSP
  - Attach the BSP to our applications code
  - Edit the BSP

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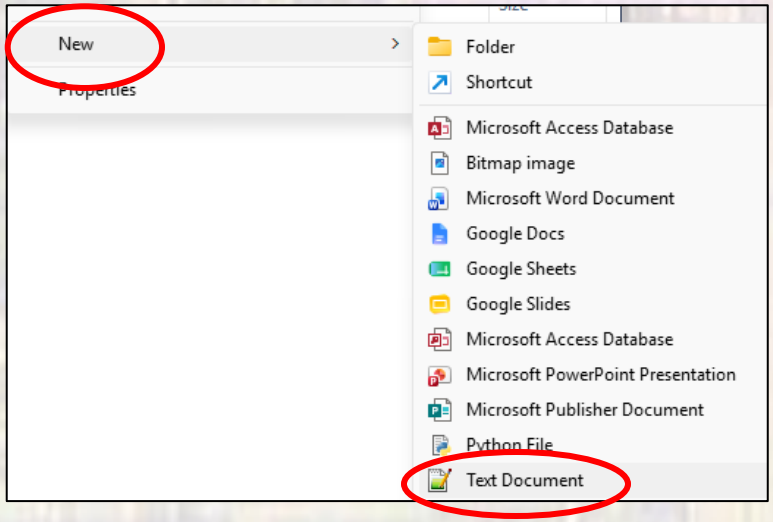
NIOS-V Software Setup

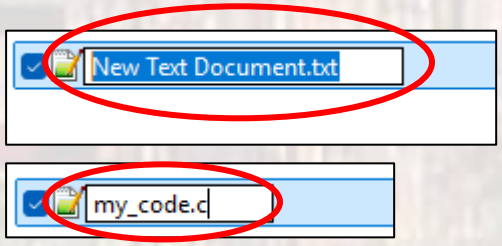
- Setup the directory structure
  - In Windows, go to your hardware project directory
    - c:\users\yourid\ELExxxx\quartus_projects\project_xyz
  - Make a new directory called software
  - Go into the software directory
    - Make a new directory called hal_bsp
    - Make a new directory called app

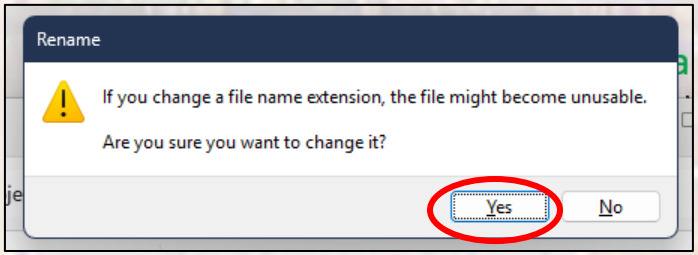
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NIOS-V Software Setup

- Create an applications (c program) file
  - In Windows, go to your software/app directory
    - c:\users\yourid\ELExxxx\quartus_projects\project_xyz\software\app
  - Rt click → New → Text Document
    - Change the entire name to what you want your code file name to be (be sure to replace the .txt with .c) my_code.c in this example



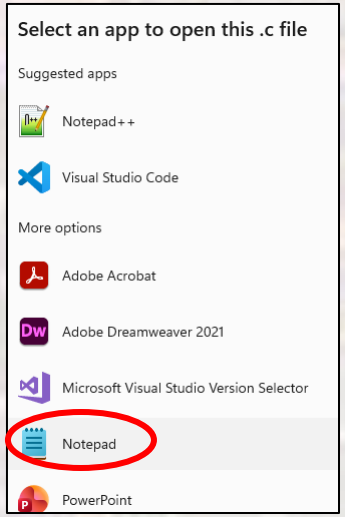




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NIOS-V Software Setup

- Create an applications (c program) file – cont'd
  - Open the empty file in notepad
    - Touch the file
    - Rt click → open with → choose another app → notepad
  - Create a minimal C program, save




```
////////////////////////////
//
// my_code.c
//
// Place holder for applications code
//
////////////////////////////
#include <stdio.h>

int main(void){
    printf("hello\n");

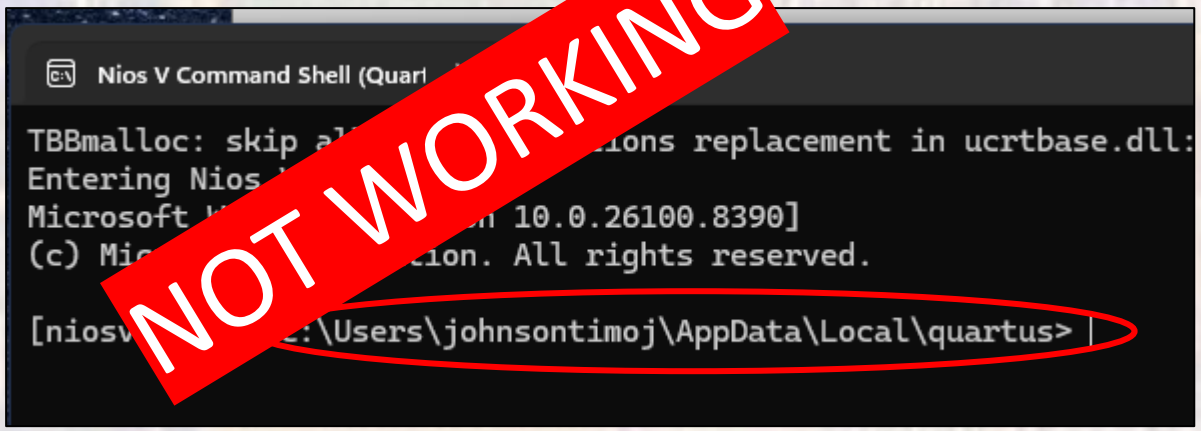
    return 0;
}// end main
```

  - You do not need to use this file once the system is fully setup – you can select the desired program file to compile in the Ashling (Eclipse) tool (Resource Configurations)

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NIOS-V Software Setup

- Create the BSP
  - Start the NIOS-V Command shell
    - START Menu → All → Altera 25.1std.0.1129 Lite Edition → NIOS V Command Shell



  - The command prompt includes the current directory location
  - Use dir to see the contents of the current directory
  - Use cd .. to traverse the hierarchy backwards
  - Use cd directory_name to traverse into a directory

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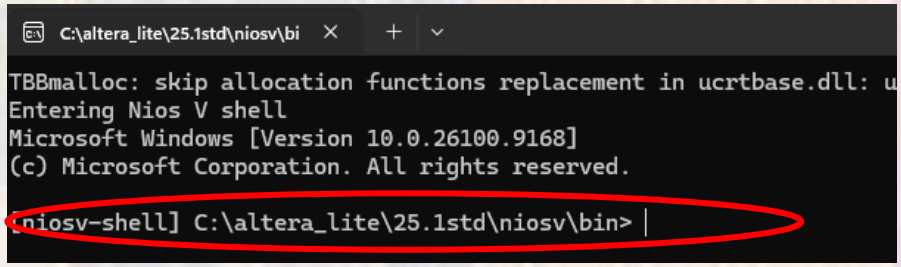
NIOS-V Software Setup

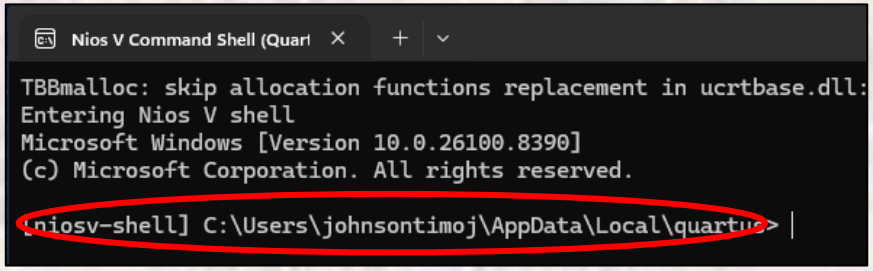
- Create the BSP
  - Start the NIOS-V Command shell

C:\altera_lite\25.1std\niosv\bin\niosv-shell.exe

OR

START Menu → All → Altera 25.1std.0.1129 Lite Edition → NIOS V Command Shell



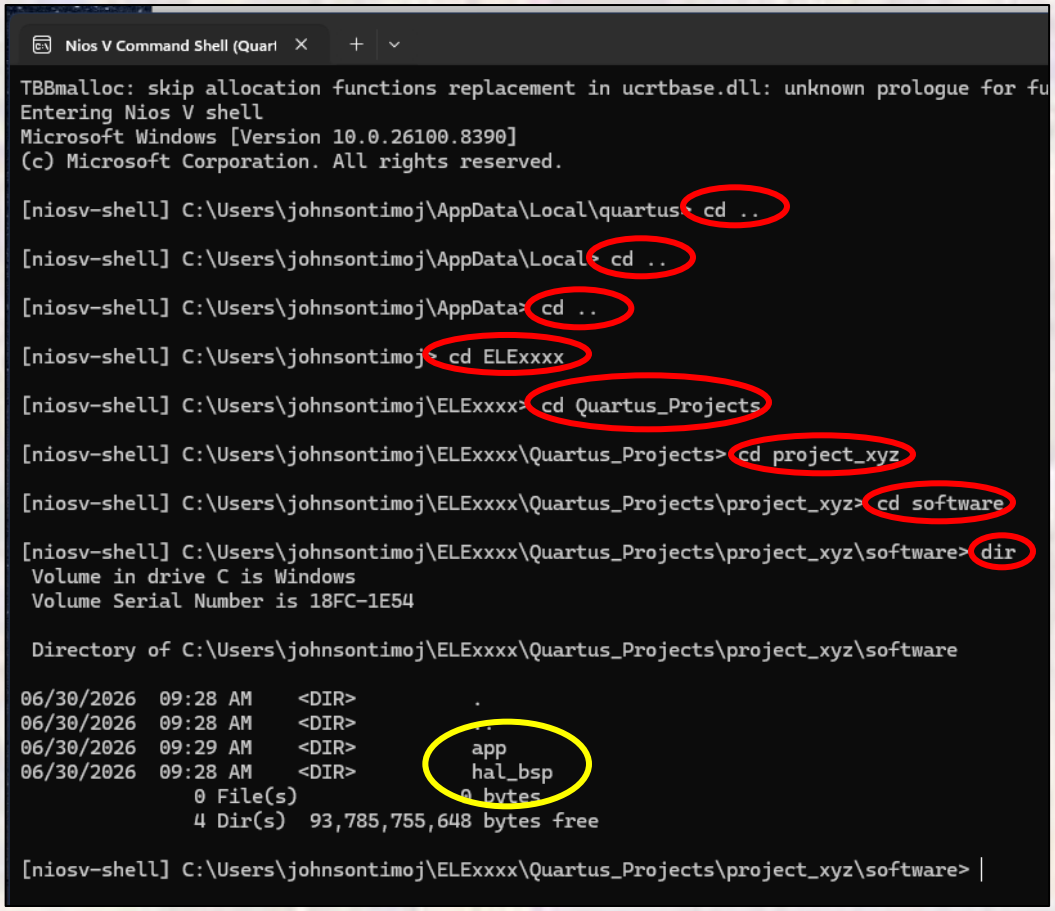


- The command prompt includes the current directory location
- Use dir to see the contents of the current directory
- Use cd .. to traverse the hierarchy backwards
- Use cd directory_name to traverse into a directory

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NIOS-V Software Setup

- Create the BSP – cont'd
  - Traverse to your software directory



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NIOS-V Software Setup

Option 1

2 dashes

- Create the BSP – Option 1
  - From the software directory - Run the BSP creation command

```
niosV-bsp  -c  --sopcinfo=../project_name.sopcinfo  --type=hal  hal_bsp/settings.bsp
```

```
[niosv-shell] C:\Users\johnsontimoj\ELExxxx\Quartus_Projects\project_xyz\software> niosV-bsp -c --sopcinfo=../project_xyz.sopcinfo --type=hal hal_bsp/settings.bsp
2026.06.30.10:19:13 Info: Searching for BSP components with category: os_software_element
2026.06.30.10:19:14 Info: Creating BSP settings.
2026.06.30.10:19:14 Info: Initializing SOPC project local software IP
2026.06.30.10:19:14 Info: Finished initializing SOPC project local software IP. Total time taken = 2 seconds
2026.06.30.10:19:14 Info: Searching for BSP components with category: driver_element
2026.06.30.10:19:14 Info: Searching for BSP components with category: software_package_element
2026.06.30.10:19:14 Info: Loading drivers from ensemble report.
2026.06.30.10:19:14 Info: Finished loading drivers from ensemble report.
2026.06.30.10:19:14 Info: Evaluating default script "c:\altera_lite\25.1std\quartus\..\niosv\scripts\bsp-defaults\bsp-set-defaults.tcl".
2026.06.30.10:19:14 Info: Tcl message: "STDIO character device is jtag_uart_0"
2026.06.30.10:19:14 Info: Tcl message: "System timer device is intel_niosv_m_0"
2026.06.30.10:19:14 Info: Tcl message: "Default linker sections mapped to onchip_memory2_0"
2026.06.30.10:19:14 Info: Tcl message: "No bootloader located at the reset address."
2026.06.30.10:19:14 Info: Tcl message: "Application ELF allowed to contain code at the reset address."
2026.06.30.10:19:14 Info: Tcl message: "The alt_load() facility is enabled."
2026.06.30.10:19:14 Info: Tcl message: "The .rwdata section is copied into RAM by alt_load()."
2026.06.30.10:19:14 Info: Saving BSP settings file.
2026.06.30.10:19:14 Info: Default memory regions will not be persisted in BSP Settings File.
2026.06.30.10:19:14 Info: Generated file "C:\Users\johnsontimoj\ELExxxx\Quartus_Projects\project_xyz\software\hal_bsp\settings.bsp"
2026.06.30.10:19:14 Info: Generating BSP files in "C:\Users\johnsontimoj\ELExxxx\Quartus_Projects\project_xyz\software\hal_bsp"
2026.06.30.10:19:14 Info: Default memory regions will not be persisted in BSP Settings File.
2026.06.30.10:19:14 Info: Generated file "C:\Users\johnsontimoj\ELExxxx\Quartus_Projects\project_xyz\software\hal_bsp\settings.bsp"
2026.06.30.10:19:15 Info: Finished generating BSP files. Total time taken = 2 seconds
```

  - Check for errors

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NIOS-V Software Setup

Option 2

- Create the BSP – Option 2
  - From the software/hal_bsp directory - Run the BSP editor command

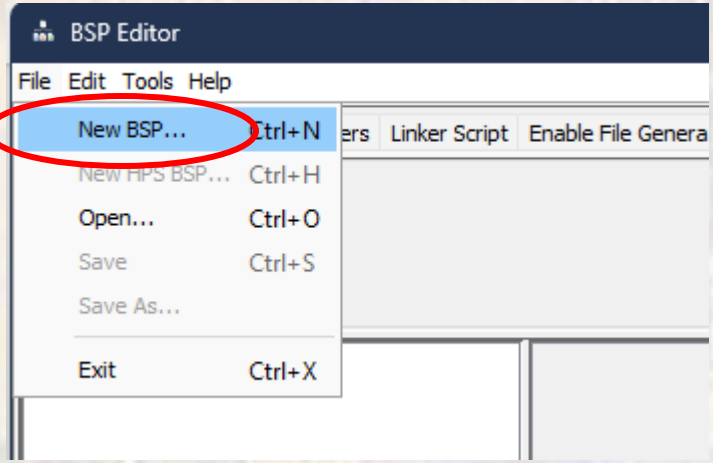
niosV-bsp-editor

```
[niosv-shell] C:\Users\johnsontimoj\ELExxxx\Quartus_Projects\project_xyz> cd software

[niosv-shell] C:\Users\johnsontimoj\ELExxxx\Quartus_Projects\project_xyz\software> cd hal_bsp

[niosv-shell] C:\Users\johnsontimoj\ELExxxx\Quartus_Projects\project_xyz\software\hal_bsp> niosV-bsp-editor
```

  - File → New BSP …

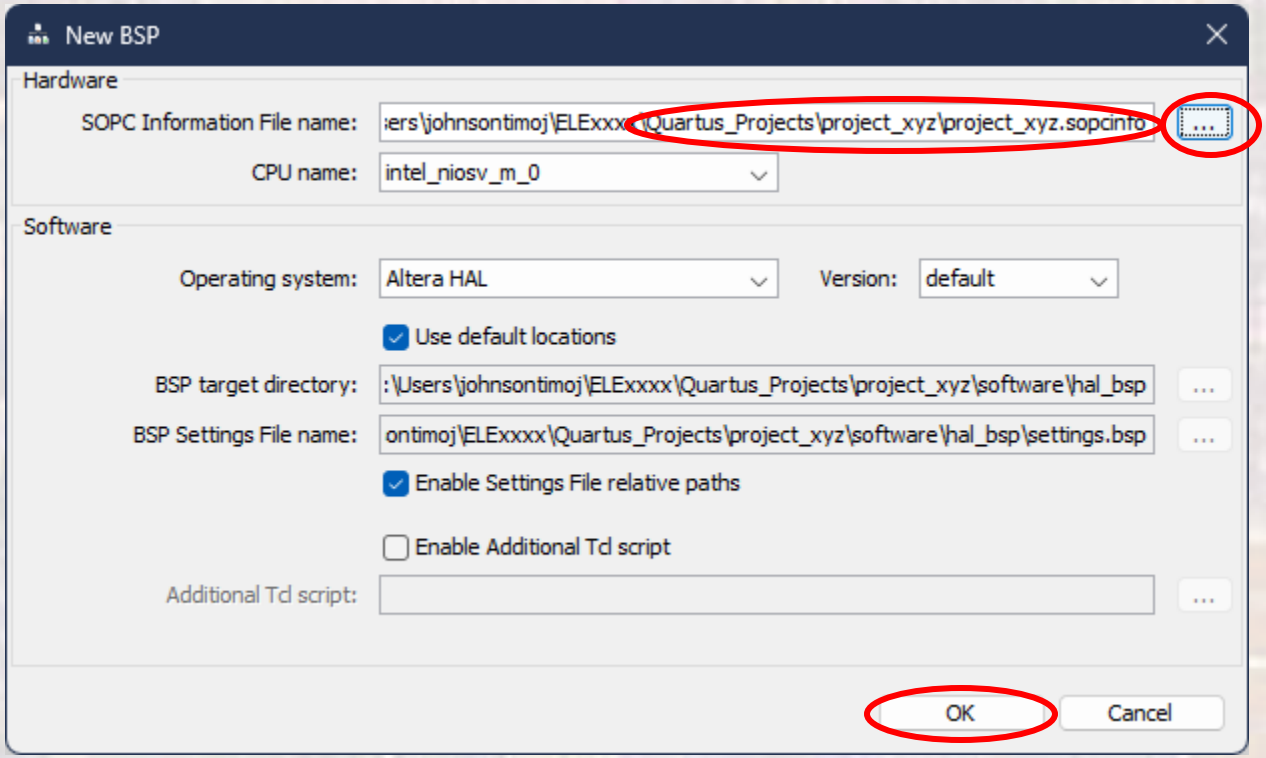


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NIOS-V Software Setup

Option 2 – cont'd

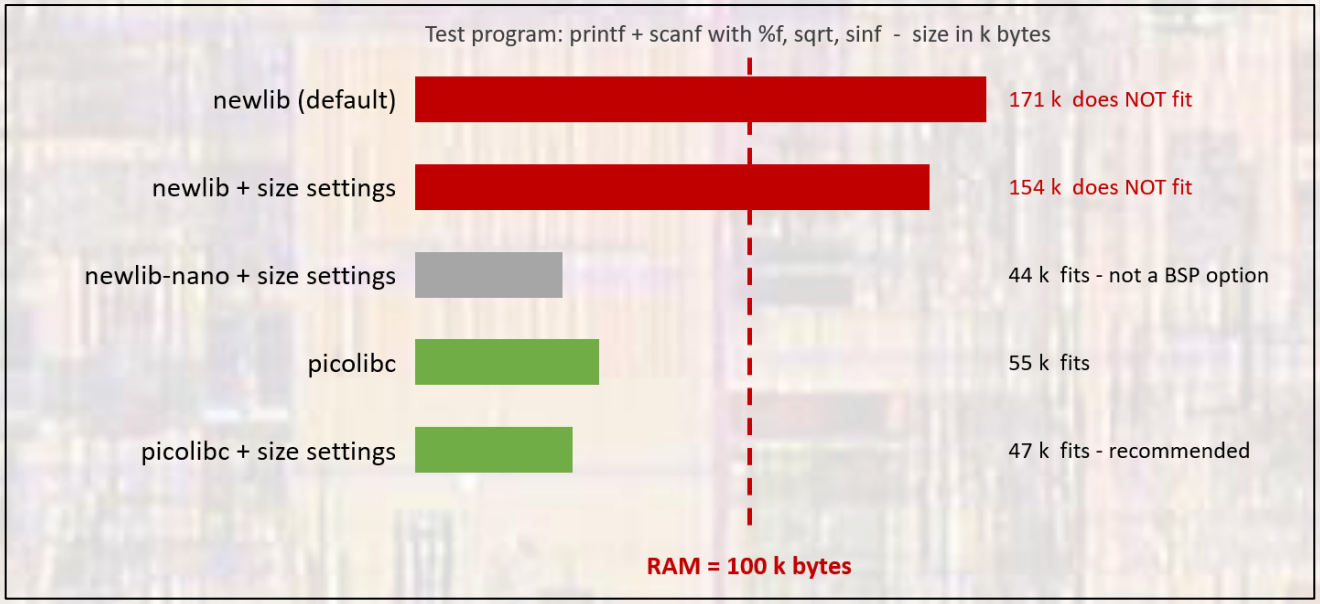
- Create the BSP – Option 2 - cont'd
  - Fill in the SOPC file field
    - It is backwards (up) in the hierarch 2 levels in the top level project directory (use …)
    - Leave all the other fields at their default values



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NIOS-V Software Setup

- The default NIOS-V C library - newlib
  - With even a small program will not fit on our FPGA
  - Our Nios V/m has no floating-point hardware - float math is done in software, so the library choice decides whether %f, printf, and scanf fit



  - Select the picolibc for our C library
    - Choose as many options as possible to limit size

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NIOS-V Software Setup

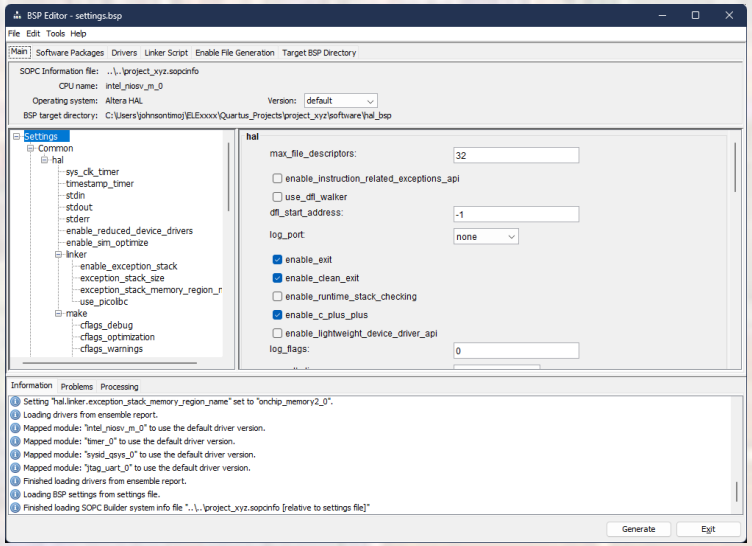
- Edit the BSP
  - If you chose option 1
    - cd into the hal_bsp directory
    - Run the BSP editor command

niosV-bsp-editor

```
[niosv-shell] C:\Users\johnsontimoj\ELExxxx\Quartus_Projects\project_xyz\software> cd hal_bsp

[niosv-shell] C:\Users\johnsontimoj\ELExxxx\Quartus_Projects\project_xyz\software\hal_bsp> niosV-bsp-editor
```

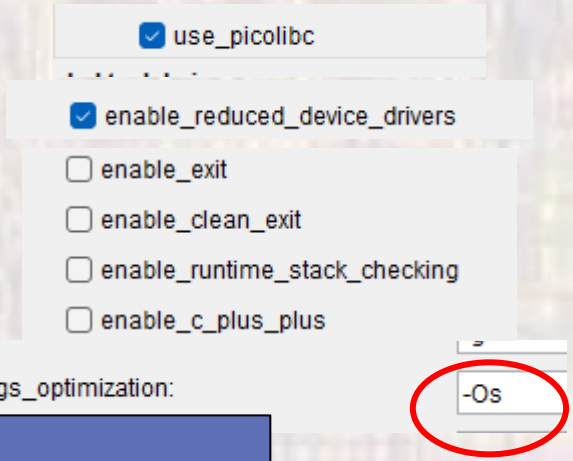
  - If you chose option 2
    - The BSP is already open

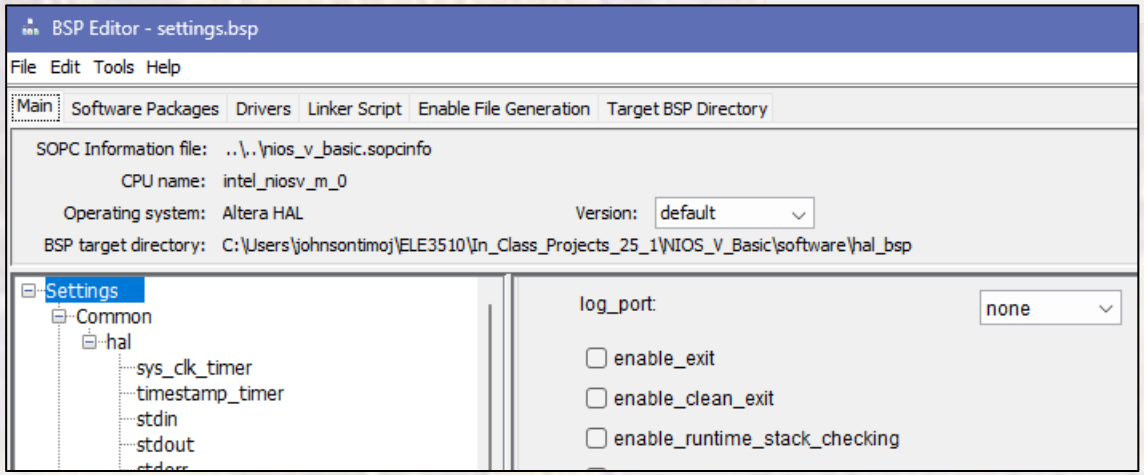


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NIOS-V Software Setup

- Edit the BSP – cont'd
  - In the Main tab
    - Scroll down and
    - hal.linker.use_picolibc - check (the C library)
    - hal.enable_reduced_device_drivers - check
    - hal.enable_exit - uncheck
    - hal.enable_clean_exit - uncheck
    - hal.enable_c_plus_plus - uncheck
    - hal.make.cflags_optimization = -Os

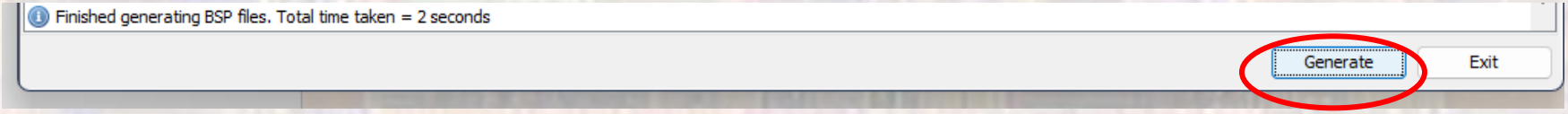




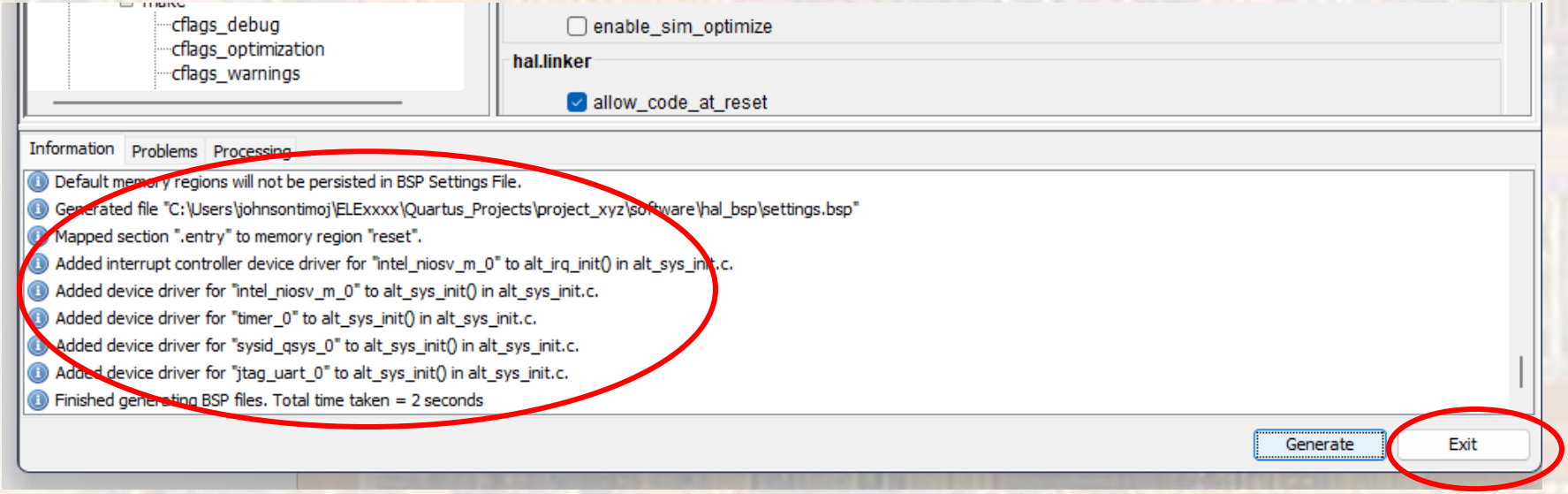
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NIOS-V Software Setup

- Edit the BSP – cont'd
  - In the Main tab
    - Generate



    - Verify and Exit



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NIOS-V Software Setup

2 dashes

- Attach the BSP to our applications code
  - From the hal_bsp directory, Run the App creation command

```
niosV-app  --app-dir=../app  --bsp-dir=.  --srcs=../app/my_code.c
```

```
[niosv-shell] C:\Users\johnsontimoj\ELE3510\In_Class_Projects_25_1\NIOS_V_Basic\software\hal_bsp> niosV-app --app-dir=../app --bsp-dir=. --srcs=../app/my_code.c
2026.10.12.14:51:31 Info: "..\app\CMakeLists.txt" was generated
```

  - Check for errors

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NIOS-V Software Setup

- You need to re-generate the BSP if you:
  - Make changes in the hardware
    - → changes to the sopcinfo file
  - Make changes in the BSP settings

- You can edit the bsp or re-generate by:

  type: niosV-bsp-editor in the HAL_BSP folder from the NiosV Command Shell

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