Generate aligned HEX and S-record data output with GNU in KDS 3.2

1. HEX, S-record generation

GNU tool can generate ELF, HEX, S-record and binary output file. Erich Styger ever wrote a blog for how to implement this feature:

https://mcuoneclipse.com/2012/09/13/s-record-generation-with-gcc-for-armkinetis/

The figures in this blog are captured from CodeWarrior 10.x. The location of the option for 'Create flash image' in KDS 3.2 is different with CodeWarrior 10.x

There is no 'Additional Tools' under 'C/C++ Build > Settings' in KDS. To find 'Create flash image', please go to the Toolchains tab as this figure:
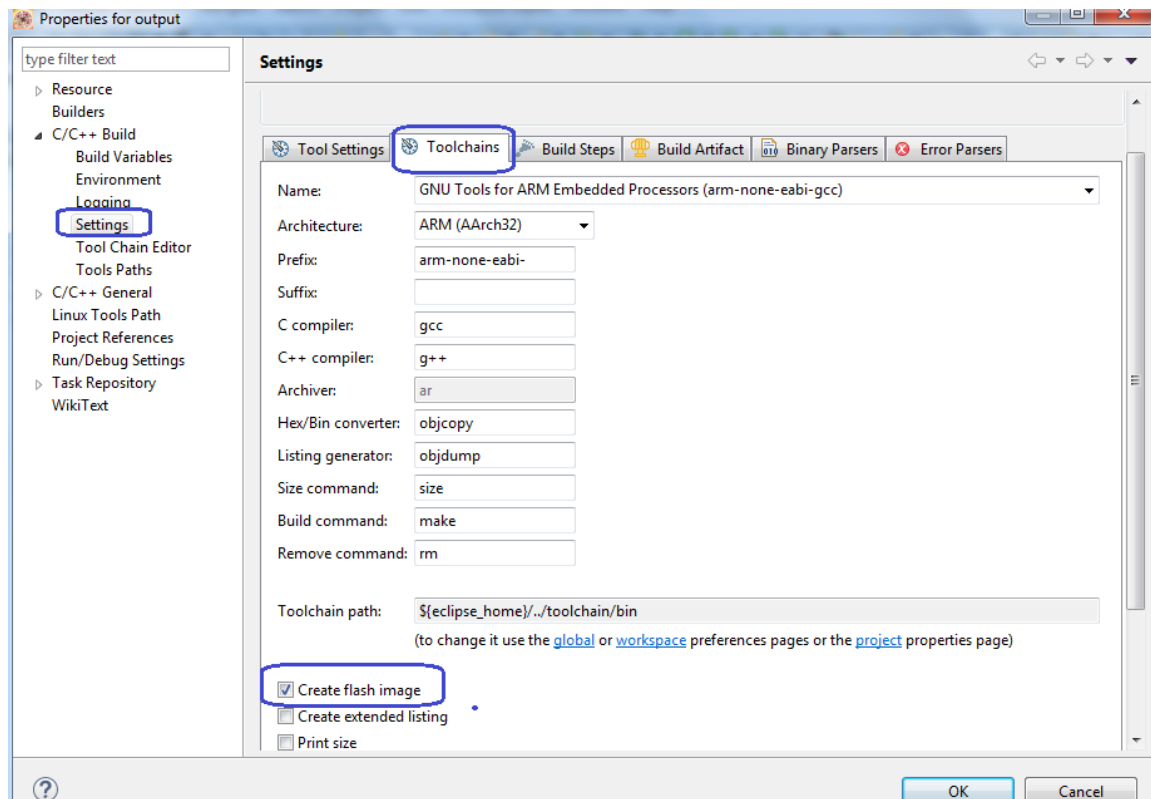

Figure 1 Create flash image

In cases that user has followed all the steps in the above blog, but still cannot get the output file, please refer to this blog:

2. The "arm-none-eabi-objcopy.exe" tool

When building project in KDS with option 'Create flash image', the HEX and S-record file is converted by tool "arm-none-eabi-objcopy.exe" from ELF file, this tool locates at:

C:\Freescale\KDS_v3\Toolchain\bin

For descriptions of this tool's options, please run "arm-none-eabi-objcopy.exe -help" . Or refer to this link:

https://manned.org/arm-none-eabi-objcopy

Here lists the options applied for Hex and S-record file generation with alignment in this document:

 -I --input-target <bfdname>   Assume input file is in format <bfdname>

 -O --output-target <bfdname>   Create an output file in format <bfdname>

--srec-len <number>   Restrict the length of generated Srecords

If user has requirement or restriction for output data on start address, end address, gap fill, these options will be helpful:

--gap-fill <val>   Fill gaps between sections with <val>

 --pad-to <addr>   Pad the last section up to address <addr>

 --set-start <addr>   Set the start address to <addr>

3. Misaligned HEX Data

Some customers have special requirements for the output data. They need them to be aligned, especially when they are using the customized bootloader or Flash Programmer. However, the hex file generated in KDS3.2 is not aligned as the customer expected. Below is extracted from the hex file generated in a KE06 project. The data from address 0x8300 to 0x084C is continues, there is no gap inside this memory section. However in the hex file, the data is not aligned at 16 bytes, and the size of each line is different.

```
     size  address
71 :1007A00000000000002008000070B50E4B0E4D002424
72 :1007B000ED1AAD101E1CAC4204D0A300F3589847AC
73 :1007C000134F8E700F02EF8084B094D0024ED1A2B
74 :1007D000AD101E1CAC4204D0A300F358984701345E
75 :1007E000F8E770BD4408000044080000440800019
76 :1007F00048080000031C8218934202D0197001338C
77 :10080000FAE770470023C25C0133002AFBD1581E6F
78 :10081000704700FEE7C0464154000043000005E
79 :10082000000F0FF1FF8B5C046F8BC08BC9E467047F4
80 :0C08300F8B5C046F8BC08BC9E467047F6
81 :08083C0034FCFF7F0100000005
82 :040844003904000073
83 :040848001104000097
84 :10084C0000000000000000000000000000000009C
85 :10085C00000000000000000000000000000000008C
86 :10086C0001C08000000000000000000000000000058
87 :10087C000000000000000000000000000000000006C
88 :10088C0000000000000000000000000000000005C
89 :10089C0000000000000000000000000000000004C
```

Figure 2 hex data generated in KDS

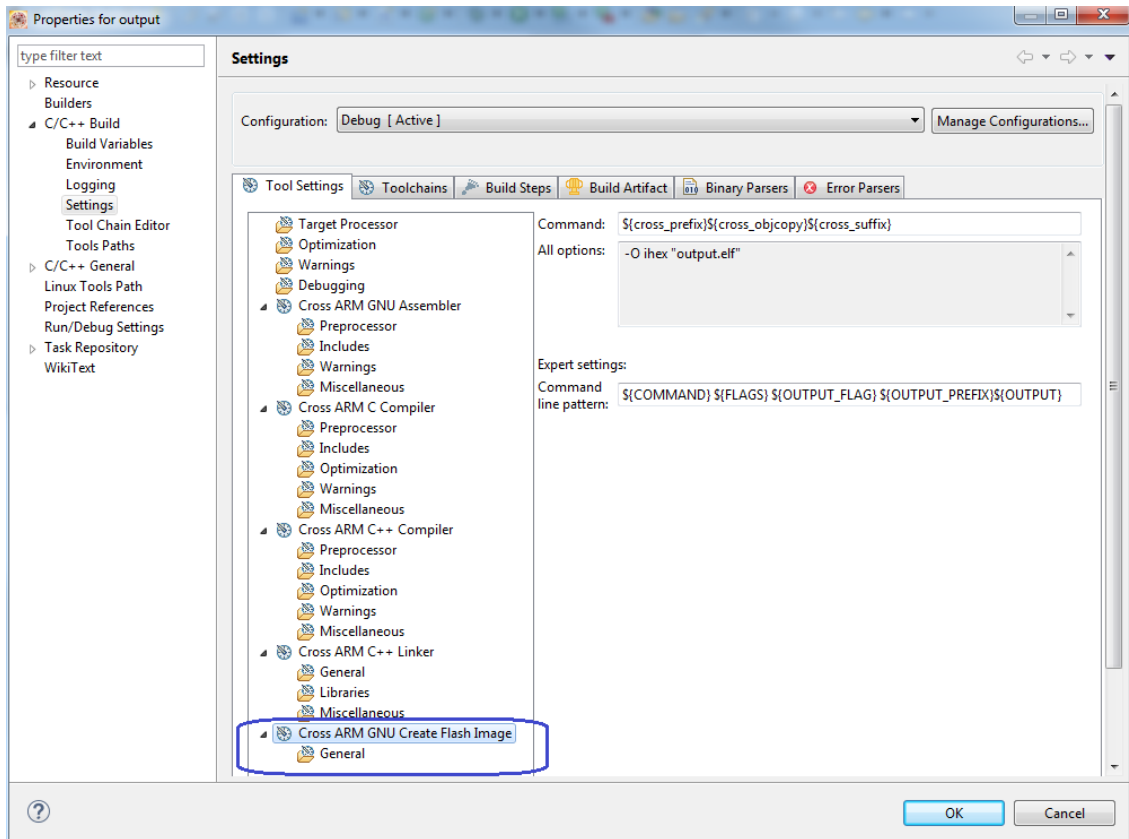The default tool setting for this hex file generation in KDS is as below:

Figure 3 hex file generation settings

When generating the above hex data, the corresponding command running in KDS is:

arm-none-eabi-objcopy -O ihex "output.elf" "output.hex"

4. Generate aligned output Data

The "arm-none-eabi-objcopy.exe" does not support aligning Hex data. To get the expected hex file, we need two steps as below:

 1) Generate aligned S-record data

The "arm-none-eabi-objcopy.exe" supports to align S-record data with option - --srec-len val

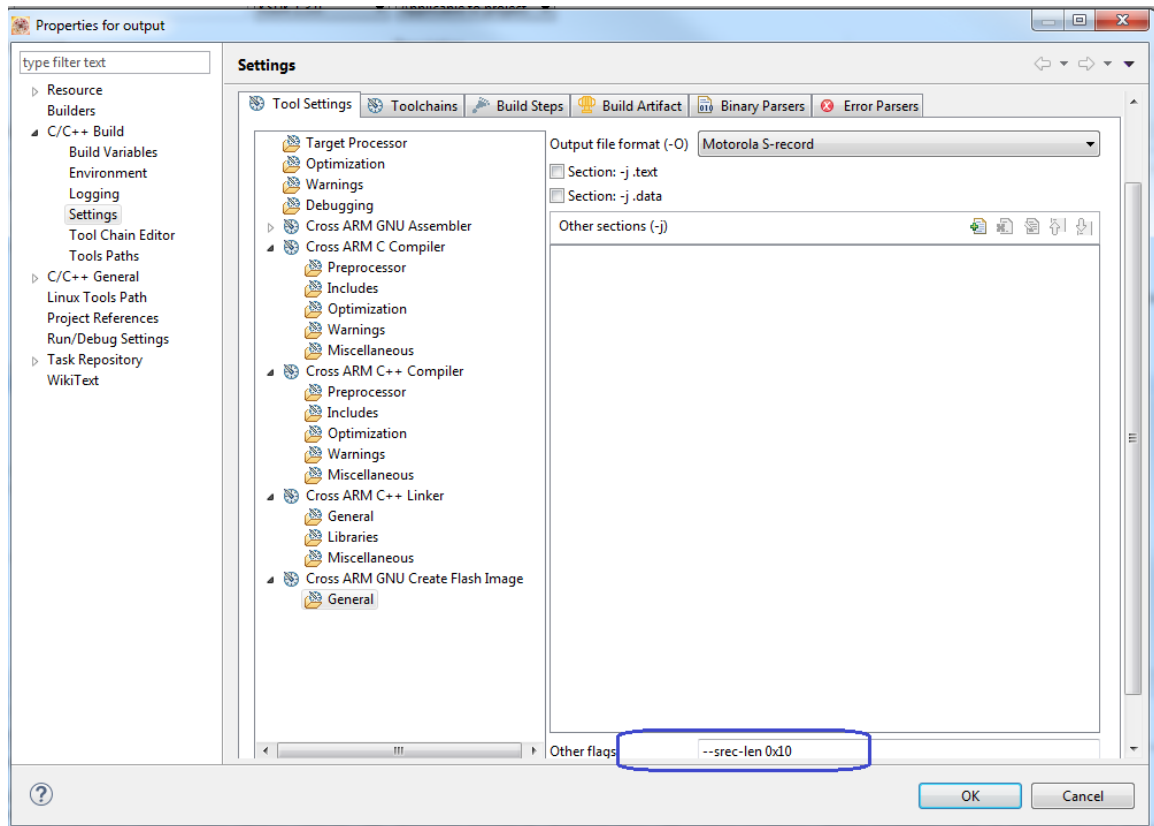In this example, we set the maximum length of S-record data to be 16byte as below.

Figure 4 S-record file generation settings

And its corresponding command is:

arm-none-eabi-objcopy -O srec --srec-len 0x10 "output.elf" "output.srec"

2) Convert S-record data into hex file

Open Dos Command Window, and run the "arm-none-eabi-objcopy.exe " tool , like below:

Figure 5 S-record file generation settings

Its DOS command is:

arm-none-eabi-objcopy.exe -I srec -O ihex output.srec output.hex

The file 'output.srec' is the S-record file generated in step1). And 'output.hex' is the hex file converted from S-record file.

Figure 6 aligned HEX data

This is the comparison of HEX file generated before and after alignment. The left one is the hex file generated directly in KDS, which is also show as Figure 1. The right one converted from S-record file by the Step 1) and 2).

5. Make it simplified

Here are two methods that will make the process more simplified.

1) With Post-build option

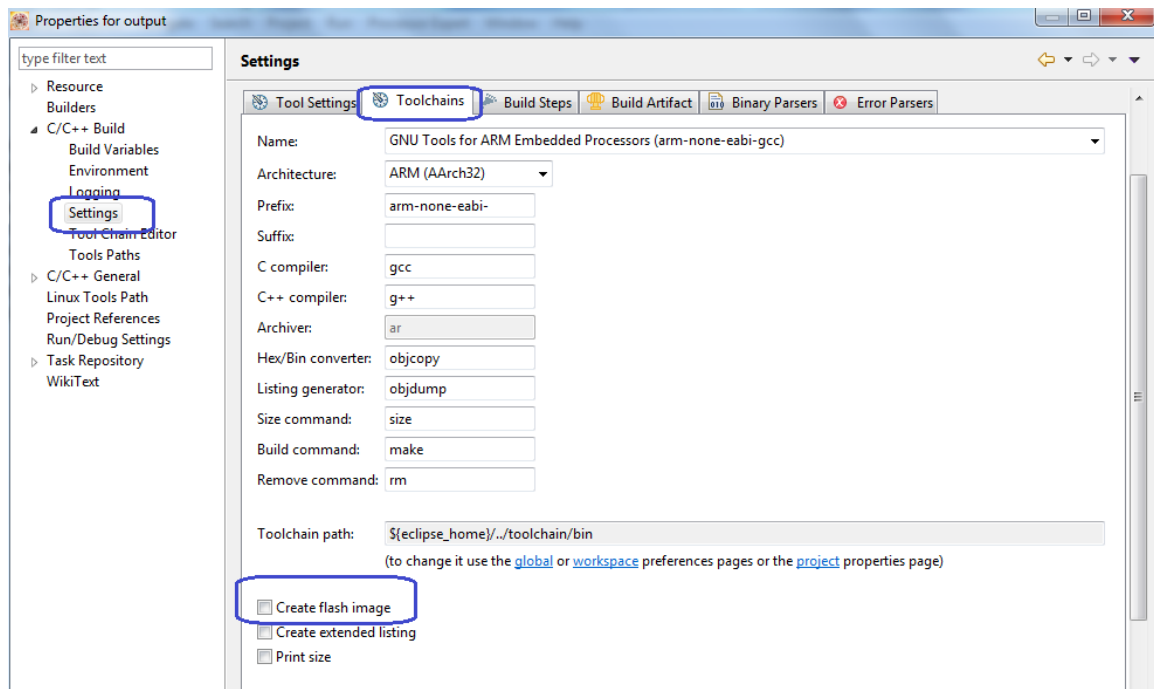Leave the 'Create flash image' option unchecked as default setting.

Figure 7 'Create flash image' Unchecked

Create a BAT file, and copy the commands for running "arm-none-eabi-objcopy.exe" into it, and place this BAT file under the project's \Debug subfolder.

Figure 8 Post build command

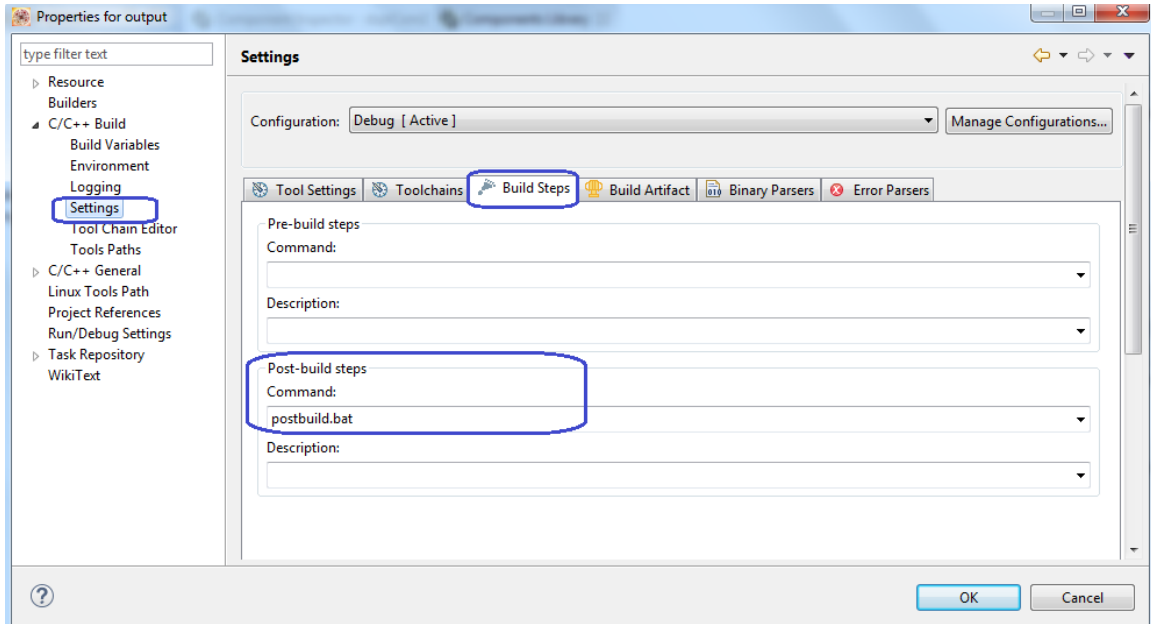Use Post-build step to run the commands:

Figure 9 Post-build steps

Build the proejct, S-record and Hex files are both generated under the project's \Debug subfolder.

2) With BAT commands

Here is a method to generate aligned S-record and Hex file outside of KDS IDE. Also leave the 'Create flash image' option unchecked as Figure 7. Make a BAT file to run "arm-none-eabi-objcopy.exe" as below.


```
1 set KDSFolder=C:\Freescale\KDS_v3
2 set ProjectFolder=E:\TEMP\KDS\output\Debug
3
4 set ELFFile=%ProjectFolder%\output.elf
5 set HexFile=%ProjectFolder%\output.hex
6 set SRecFile=%ProjectFolder%\output.srec
7
8 set PATH=%PATH%;%KDSFolder%\Toolchain\bin;%ProjectFolder%
9
10 REM cd %KDSFolder%\Toolchain\bin /d
11 %KDSFolder%\Toolchain\bin\arm-none-eabi-objcopy.exe -O srec --srec-len 0x10 %ELFFile% %SRecFile%
12 %KDSFolder%\Toolchain\bin\arm-none-eabi-objcopy.exe -I srec -O ihex %SRecFile% %HexFile%
```

Figure 9 BAT file

User can place this BAT file under any folder on his PC, just need to replace the settings for KDS installation folder, Project Folder, and File names into the paths and names on his PC.

After building the project in KDS and get the ELF file. Run this BAT to generate aligned Hex and S-record file.