# ECEN 5013

## Assignment 4: Buildroot Environment Bringup

# Github Classroom Link

https://classroom.github.com/a/zPyVteTw

# Github Classroom Start Instructions:

None needed for this assignment, since you'll use your assignment repo with template buildroot base source for your submission and make changes to your assignment 3 source as necessary to complete the assignment.

# Suggested Reading:

1. Lecture 8
2. Buildroot documentation, including:
   a. https://buildroot.org/downloads/manual/manual.html#customize
   b. https://buildroot.org/downloads/manual/manual.html#generic-package-tutorial
3. QEMU Documentation and network options:
   a. https://qemu.weilnetz.de/doc/qemu-doc.html#Network-options
4. Mastering Embedded Linux Programming Chapter 6

# Implementation:

1. After accepting the classroom assignment, your project repository will be created with a base_external directory at the root which will contain your buildroot image customizations.
2. Add buildroot as a git submodule in the root of your project repository.
   a. Use https://git.busybox.net/buildroot/ as the source
   b. Use the branch 2019.05.x as the release
3. Update provided files to complete the addition of a package "aesd-assignments" in the base_external/package directory and any other required files using the instructions discussed in lecture. This package should build your assignment 3 source using the git site method and include the tester.sh, writer application (cross compiled for the target) and finder.sh scripts in the /bin directory of the rootfs.

a. Ensure your tester.sh can be run from any directory (not just the directory where the script is located) or modify it as necessary.  In other words, you should be able to run /path/to/script/tester.sh and the script should run successfully, by changing the working directory to /path/to/script and assuming all necessary scripts are also located in that directory.  This change will be added to your [assignment 3 source](#) repository.

b. Modify your tester.sh script to write the result file to the system home directory instead of a relative directory path.

4. Run build.sh the first time
    a. This will generate a default buildroot /.config using qemu_aarch64_virt_defconfig.
    b. Run save_config.sh to save this configuration to your project specific defconfig file at base_external/configs/aesd_qemu_defconfig

5. Select the aesd-assignments package you added in your buildroot configuration to add it to your image using make menuconfig.

6. Run the save_config.sh script in the root folder which to save the configuration, including the selection of your aesd-assignments package, into the default buildroot configuration file.  After running this script you should see that the aesd-assignments package configuration is added to your aesd_qemu_defconfig file.  Check this change into your assignment repository.

7. Add a **runqemu.sh** script in the root folder which runs your generated qemu image using the commands at
[https://github.com/buildroot/buildroot/tree/2019.05.x/board/qemu/aarch64-virt](https://github.com/buildroot/buildroot/tree/2019.05.x/board/qemu/aarch64-virt).

8. Add a **clean.sh** script in the root folder which runs make distclean from the buildroot directory.

9. Add the dropbpear package to your image to support ssh and save the updated configuration with the save_config.sh script

10. Set the default root password to "root" using buildroot menuconfig and save with the save_config.sh script.

11. Update the runqemu script to pass through virtual machine port 10022 to port 22 on your qemu instance.

12. Verify you can use ssh to login to your host using port 10022 and the root user/password.

13. Use scp to transfer your ~/assignments/assignment4/assignment-4-result.txt file from your qemu instance to your [assignment-3 repository](#) in the assignments/assignment4 folder.


# Buildroot Speedup Suggestions:

1. These are some optional steps you can use to speed up your buildroot builds.  If you do use these, be sure to specify cache directories in relation to $HOME and not using absolute paths so your build will work when run by instructors or student assistants
    a. [BR2_DL_DIR](#) allows you to specify a package download directory outside your buildroot tree which is not removed with distclean

b. Turn on [Enable Compiler Cache](#) in build options.

## Validation:

1. You should be able to clone your final buildroot assignment repository to a new directory, run ./build.sh to build the system image and ./runqemu.sh to start the image with no other interaction necessary.
2. You should be able to run the ./clean.sh script, then run the ./build.sh and ./runquemu.sh script to start the image with no other interaction necessary.
3. Once the qemu image has started, you should be able to login and run "tester.sh" (without specifying path) to execute the tester script.
   a. The script should complete successfully, and should be using the writer executable which buildroot has cross compiled for the target.
   b. The script should be able to be run from any starting directory.
   c. /var/log/messages should contain your syslog messages from the writer application.
4. You should be able to login via ssh or perform file transfer using scp to/from the qemu virtual machine using port specified above.

## Submission:

1. Your submission repository should contain the buildroot setup used to generate and run the qemu image described above.
2. Your buildroot submission repository should reference your aesd-assignments repository containing content from [assignment 3](#), with any changes added as necessary.