

CS7381 Project 4

Verilog Code Development using Cadence Xcelium

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Distance

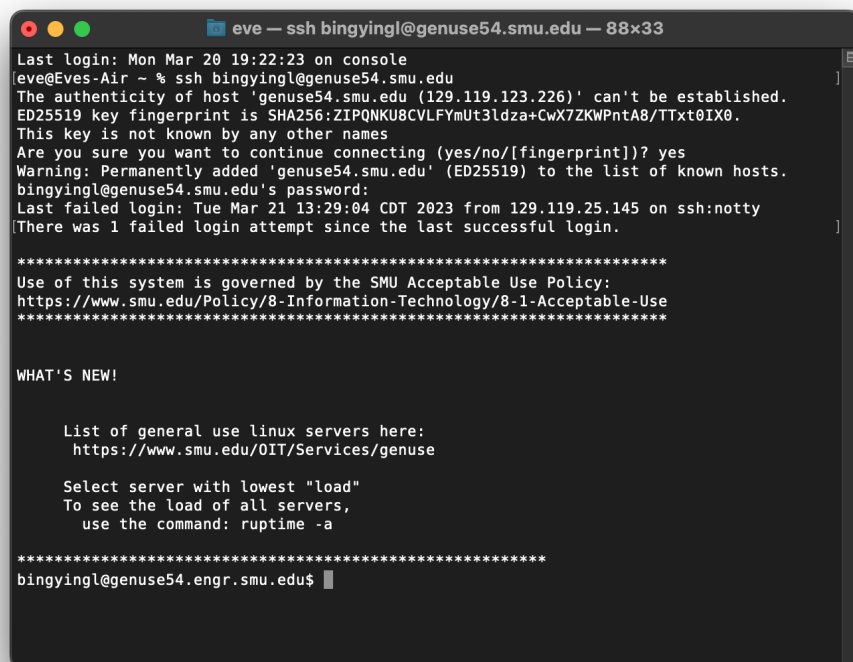
March 26 2023

In previous projects, we learned how to use the MARS tool to develop and simulate MIPS assembly code. Next, we will use the Verilog HDL (Hardware Description Language) to develop and simulate various MIPS components.

We will use the Cadence Xcelium tool on the Lyle Unix servers. Please go to my web site [Links to an external site.](#) for information on how to do the following steps:

1. Obtain a Lyle Unix account, if you do not already have one: [Links to an external site.](#)

Solution:



```
eve — ssh bingyingl@genuse54.smu.edu — 88x33
Last login: Mon Mar 20 19:22:23 on console
eve@Eves-Air ~ % ssh bingyingl@genuse54.smu.edu
The authenticity of host 'genuse54.smu.edu (129.119.123.226)' can't be established.
ED25519 key fingerprint is SHA256:ZIPQNKU8CVLFYmUt3ldza+CwX7ZKWPntA8/TTxt0IX0.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added 'genuse54.smu.edu' (ED25519) to the list of known hosts.
bingyingl@genuse54.smu.edu's password:
Last failed login: Tue Mar 21 13:29:04 CDT 2023 from 129.119.25.145 on ssh:notty
There was 1 failed login attempt since the last successful login.

*****
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https://www.smu.edu/Policy/8-Information-Technology/8-1-Acceptable-Use
*****

WHAT'S NEW!

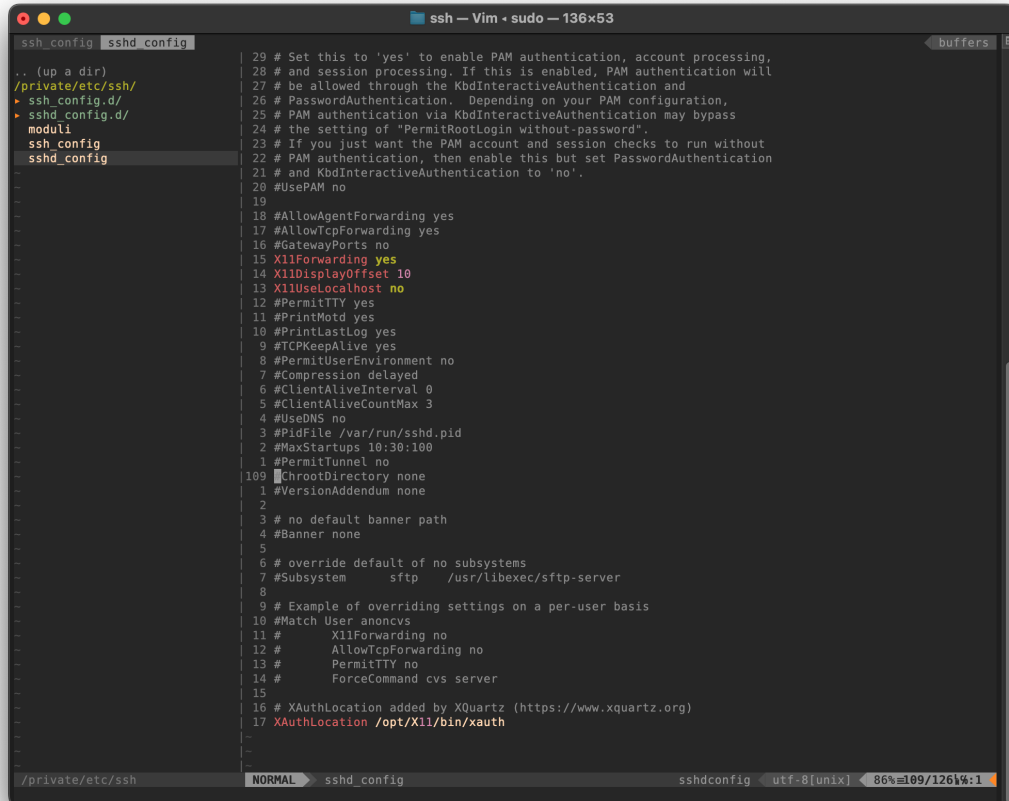
List of general use linux servers here:
https://www.smu.edu/OIT/Services/genuse

Select server with lowest "load"
To see the load of all servers,
use the command: ruptime -a

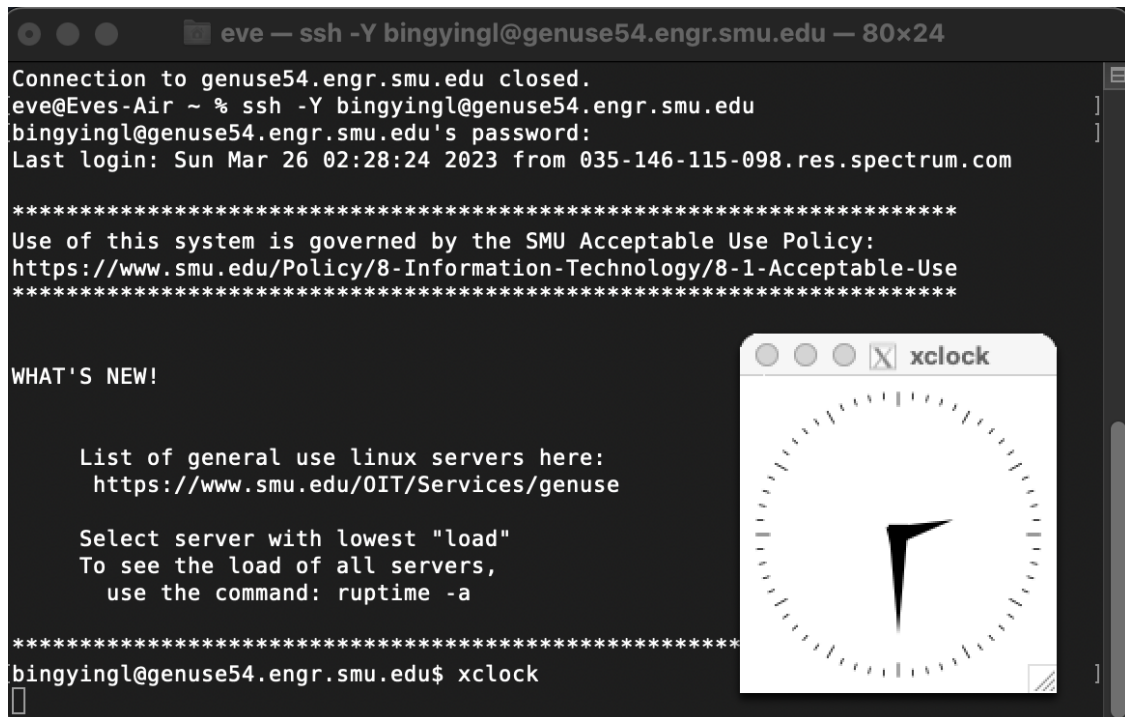
*****
bingyingl@genuse54.engr.smu.edu$
```

2. Set up an X-Windows emulator on your computer.

Solution: I use XQuartz. And for OS, have to modify sshd_config.



```
ssh_config  sshd_config  buffers
.. (up a dir)
/private/etc/ssh/
+ ssh_config.d/
+ sshd_config.d/
moduli
ssh_config
sshd_config
29 # Set this to 'yes' to enable PAM authentication, account processing,
28 # and session processing. If this is enabled, PAM authentication will
27 # be allowed through the KbdInteractiveAuthentication and
26 # PasswordAuthentication. Depending on your PAM configuration,
25 # PAM authentication via KbdInteractiveAuthentication may bypass
24 # the setting of "PermitRootLogin without-password".
23 # If you just want the PAM account and session checks to run without
22 # PAM authentication, then enable this but set PasswordAuthentication
21 # and KbdInteractiveAuthentication to 'no'.
20 #UsePAM no
19
18 #AllowAgentForwarding yes
17 #AllowTcpForwarding yes
16 #GatewayPorts no
15 X11Forwarding yes
14 X11DisplayOffset 10
13 X11UseLocalhost no
12 #PermitTTY yes
11 #PrintMotd yes
10 #PrintLastLog yes
9 #TCPKeepAlive yes
8 #PermitUserEnvironment no
7 #Compression delayed
6 #ClientAliveInterval 0
5 #ClientAliveCountMax 3
4 #UseDNS no
3 #PidFile /var/run/sshd.pid
2 #MaxStartups 10:30:100
1 #PermitTunnel no
109 #ChrootDirectory none
1 #VersionAddendum none
2
3 # no default banner path
4 #Banner none
5
6 # override default of no subsystems
7 #Subsystem sftp /usr/libexec/sftp-server
8
9 # Example of overriding settings on a per-user basis
10 #Match User anoncvs
11 # X11Forwarding no
12 # AllowTcpForwarding no
13 # PermitTTY no
14 # ForceCommand cvs server
15
16 # XAuthLocation added by XQuartz (https://www.xquartz.org)
17 XAuthLocation /opt/X11/bin/xauth
-
-
/private/etc/ssh  NORMAL  sshd_config  sshdconfig  utf-8[unix]  86%109/1261%:1
```



```
eve — ssh -Y bingyingl@genuse54.engr.smu.edu — 80x24
Connection to genuse54.engr.smu.edu closed.
eve@Eves-Air ~ % ssh -Y bingyingl@genuse54.engr.smu.edu
bingyingl@genuse54.engr.smu.edu's password:
Last login: Sun Mar 26 02:28:24 2023 from 035-146-115-098.res.spectrum.com

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https://www.smu.edu/Policy/8-Information-Technology/8-1-Acceptable-Use
*****

WHAT'S NEW!

List of general use linux servers here:
https://www.smu.edu/OIT/Services/genuse

Select server with lowest "load"
To see the load of all servers,
use the command: runtime -a

*****
bingyingl@genuse54.engr.smu.edu$ xclock
```

After you have set up your computer to run Xcelium, do the following to complete the project:

1. Please download the following Verilog files:
 - S23_MIPS_ALU_basic.v - a Verilog module for a simple MIPS arithmetic/logic unit (ALU).
 - S23_MIPS_ALU_basic_tb.v - the testbench for testing the ALU
2. This ALU performs the following 2 functions:
 - Function code 1 to implement bitwise OR (A or B)
 - Function code 7: set if $A < B$
3. Run the Verilog code using Xcelium:
 - Use the command: **xmverilog S23_MIPS_ALU_basic.v S23_MIPS_ALU_basic_tb.v**
 - Note that a copy of the testbench output will be stored in the log file by Xcelium
 - Please submit the resulting log file, edited with your name in the file.

Solution: Upload File to the Server, and run the Verilog code.

```
eve — -zsh — 86x26

Last login: Sun Mar 26 01:06:34 on ttys002
eve@Eves-Air ~ % scp /Users/eve/Desktop/CS7381_Computer_Architecture/Program/Project_4/S23_MIPS_ALU_basic_tb.v bingyingl@genuse54.engr.smu.edu:/users7/csegrad/bingyingl/CS7381/Project4
bingyingl@genuse54.engr.smu.edu's password:
S23_MIPS_ALU_basic_tb.v 100% 899 51.4KB/s 00:00
eve@Eves-Air ~ % scp /Users/eve/Desktop/CS7381_Computer_Architecture/Program/Project_4/S23_MIPS_ALU_basic.v bingyingl@genuse54.engr.smu.edu:/users7/csegrad/bingyingl/CS7381/Project4
bingyingl@genuse54.engr.smu.edu's password:
S23_MIPS_ALU_basic.v 100% 838 36.5KB/s 00:00
eve@Eves-Air ~ %
```

```
eve — ssh bingyingl@genuse54.smu.edu — 102x50
bingyingl@genuse54.engr.smu.edu$ ls
S23_MIPS_ALU_basic_tb.v  S23_MIPS_ALU_basic.v
bingyingl@genuse54.engr.smu.edu$ xmvverilog S23_MIPS_ALU_basic.v S23_MIPS_ALU_basic_tb.v
/usr/local/cds2008/XCELIUM/tools/bin/xmvverilog
T00L: xmvverilog 21.09-s002: Started on Mar 26, 2023 at 01:19:54 CDT
T00L: xmvverilog 21.09-s002: Started on Mar 26, 2023 at 01:19:55 CDT
xmvverilog(64): 21.09-s002: (c) Copyright 1995-2021 Cadence Design Systems, Inc.
file: S23_MIPS_ALU_basic.v
    module worklib.MIPSAU:v
        errors: 0, warnings: 0
file: S23_MIPS_ALU_basic_tb.v
    module worklib.test_alu:v
        errors: 0, warnings: 0
    Caching library 'worklib' ..... Done
    Elaborating the design hierarchy:
    Building instance overlay tables: ..... Done
    Generating native compiled code:
        worklib.MIPSAU:v <0x1c6a49a5>
            streams: 3, words: 926
        worklib.test_alu:v <0x22da9d33>
            streams: 7, words: 6160
    Building instance specific data structures.
    Loading native compiled code: ..... Done
    Design hierarchy summary:
        Instances  Unique
    Modules:      2      2
    Registers:    4      4
    Scalar wires: 1      -
    Vectored wires: 4      -
    Always blocks: 1      1
    Initial blocks: 3      3
    Cont. assignments: 1    1
    Pseudo assignments: 3    3
    Simulation timescale: lps
    Writing initial simulation snapshot: worklib.test_alu:v
    Loading snapshot worklib.test_alu:v ..... Done
xcelium> source /usr/local/cds2008/XCELIUM/tools/xcelium/files/xmsimrc
xcelium> run
    0 Zero=1 ALUctl= 1 A=00000000 B=00000000 ALUOut=00000000
    2 Zero=0 ALUctl= 1 A=0000000c B=00000005 ALUOut=0000000d
    4 Zero=0 ALUctl= 1 A=0000000f B=00000006 ALUOut=0000000f
    6 Zero=1 ALUctl= 7 A=0000000f B=00000006 ALUOut=00000000
    8 Zero=0 ALUctl= 7 A=00000001 B=00000006 ALUOut=00000001
Simulation complete via $finish(1) at time 108 NS + 0
./S23_MIPS_ALU_basic_tb.v:34      #finishtime $finish;
xcelium> exit
T00L: xmvverilog 21.09-s002: Exiting on Mar 26, 2023 at 01:19:57 CDT (total: 00:00:02)
bingyingl@genuse54.engr.smu.edu$ ls
S23_MIPS_ALU_basic_tb.v  S23_MIPS_ALU_basic.v  xcelium.d  xmvverilog.history  xmvverilog.log
bingyingl@genuse54.engr.smu.edu$
```

And then download the log file from the server

```
eve — -zsh — 86x26

Last login: Sun Mar 26 01:06:34 on ttys002
eve@Eves-Air ~ % scp /Users/eve/Desktop/CS7381_Computer_Architecture/Program/Project_4/
/S23_MIPS_ALU_basic_tb.v bingyingl@genuse54.engr.smu.edu:/users7/csegrad/bingyingl/CS7
381/Project4
bingyingl@genuse54.engr.smu.edu's password:
S23_MIPS_ALU_basic_tb.v 100% 899 51.4KB/s 00:00
eve@Eves-Air ~ % scp /Users/eve/Desktop/CS7381_Computer_Architecture/Program/Project_4
/S23_MIPS_ALU_basic.v bingyingl@genuse54.engr.smu.edu:/users7/csegrad/bingyingl/CS7381
/Project4
bingyingl@genuse54.engr.smu.edu's password:
S23_MIPS_ALU_basic.v 100% 838 36.5KB/s 00:00
eve@Eves-Air ~ % scp bingyingl@genuse54.engr.smu.edu:/users7/csegrad/bingyingl/CS7381/
Project4/xmverilog.log /Users/eve/Desktop/CS7381_Computer_Architecture/Program/Project
_4/Result
bingyingl@genuse54.engr.smu.edu's password:
xmverilog.log 100% 1956 45.0KB/s 00:00
eve@Eves-Air ~ %
```

```
xmverilog.log
Reveal Now Clear Reload Share
xmverilog(64): 21.09-s002: (c) Copyright 1995-2021 Cadence Design Systems, Inc.
TOOL: xmverilog 21.09-s002: Started on Mar 26, 2023 at 01:19:55 CDT
xmverilog
  S23_MIPS_ALU_basic.v
  S23_MIPS_ALU_basic.tb.v
file: S23_MIPS_ALU_basic.v
  module worklib.MIPSAU:v
    errors: 0, warnings: 0
file: S23_MIPS_ALU_basic.tb.v
  module worklib.test_alu:v
    errors: 0, warnings: 0
    Caching library 'worklib' ..... Done
  Elaborating the design hierarchy:
  Building instance overlay tables: ..... Done
  Generating native compiled code:
    worklib.MIPSAU:v <0x1c6a49a5>
      streams: 3, words: 926
    worklib.test_alu:v <0x22da9d33>
      streams: 7, words: 6160
  Building instance specific data structures.
  Loading native compiled code: ..... Done
  Design hierarchy summary:
    Instances Unique
  Modules: 2 2
  Registers: 4 4
  Scalar wires: 1 -
  Vectored wires: 4 -
  Always blocks: 1 1
  Initial blocks: 3 3
  Cont. assignments: 1 1
  Pseudo assignments: 3 3
  Simulation timescale: 1ps
  Writing initial simulation snapshot: worklib.test_alu:v
  Loading snapshot worklib.test_alu:v ..... Done
xcelium> source /usr/local/cds2008/XCELIUM/tools/xcelium/files/xmsimrc
xcelium> run
      0 Zero=1 ALUctl= 1 A=00000000 B=00000000 ALUOut=00000000
      2 Zero=0 ALUctl= 1 A=0000000c B=00000005 ALUOut=0000000d
      4 Zero=0 ALUctl= 1 A=0000000f B=00000006 ALUOut=0000000f
      6 Zero=1 ALUctl= 7 A=0000000f B=00000006 ALUOut=0000000f
      8 Zero=0 ALUctl= 7 A=00000001 B=00000006 ALUOut=00000001
Simulation complete via $finish(1) at time 108 NS + 0
./S23_MIPS_ALU_basic.tb.v:34 #finishtime $finish;
xcelium> exit
TOOL: xmverilog 21.09-s002: Exiting on Mar 26, 2023 at 01:19:57 CDT (total: 00:00:02)
```