Virtualbox VM for Bluespec Development



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Getting Started

□ Virtual machine with all tools installed, available at:

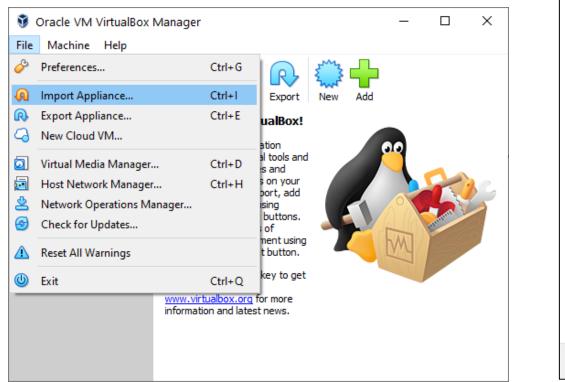
- o cs152-ubuntu.ova (4 GB!)
- Created for CS152 : Undergraduate computer systems architecture https://drive.google.com/file/d/1plT9o1QleDkci0l_jB4Si9BTwmqmelgF/view

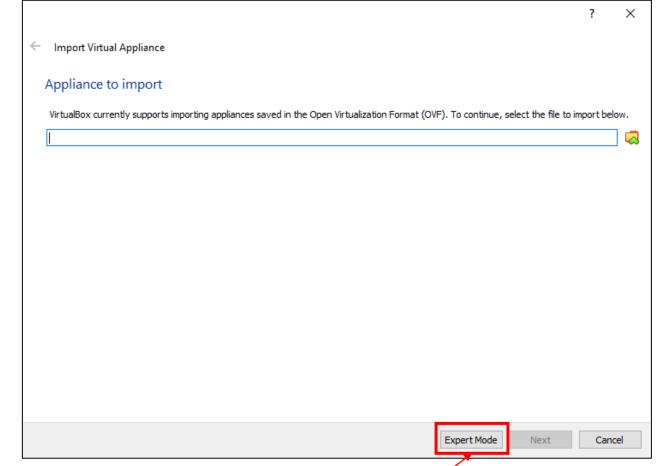
□ First, install Oracle Virtualbox

- Open-source virtual machine
- $\circ~$ High performance with minimal configuration

Getting Started

□ Import the downloaded VM





If core count/memory allowance needs changing

Getting started

	? ×		
- Import Virtual Appliance			
Appliance to import	\cs152-ubuntu.ova		
Appliance settings			
Virtual System 1	^		
😽 Name	cs152-ubuntu	🦸 Oracle VM VirtualBox Manager	- 🗆 X
🗮 Guest OS Type	Ubuntu (64-bit) Change core/memory assignm	ont if nocoscany	
🔲 СРИ			
RAM	2048 MB	New	
💿 DVD		CS152-uDuntu	General Preview
USB Controller		Powered Off	ne: cs152-ubuntu erating System: Ubuntu (64-bit)
🕩 Sound Card	✓ ICH AC97 🗸		System
modified.	which will host all the virtual machines. Home folders can also be individually (per virtual machine)	Base Proc Boot	e Memory: 2048 MB cessors: 4 t Order: Floppy, Optical, Hard Disk eleration: VT-x/AMD-V, Nested Paging, KVM Paravirtualization
C:\Users\aradi\VirtualBox V			
	ly NAT network adapter MAC addresses 🔹		Display
Additional Options: 🗹 Import h	iard drives as VDI	Grap Remo	to Memory: 16 MB phics Controller: VMSVGA note Desktop Server: Disabled ording: Disabled
	Guided Mode Restore Defaults Import Cancel		Storage

Getting started

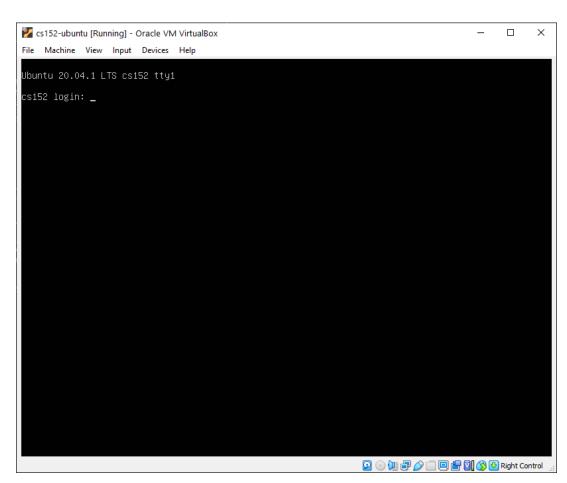
□ You can work in the VM window, OR

- Connect to it via a terminal
 - Putty, MobaXterm, OpenSSH, etc

The VM forwards its

- \circ port 22 (ssh) to
- o **3022**
- Connect to it by ssh <u>cs152@127.0.0.1:3022</u>
- □ Login: cs152/cs152
- Run ./clone-ulx3s.sh

Check it out!



X Forwarding for GUI

□ For Windows

- Install and run an X-server (Xming, MobaXterm, ...)
- $\circ~$ Enable X forwarding (+compression for performance) in your SSH client

For Linux

ssh –XC 127.0.0.1:3022

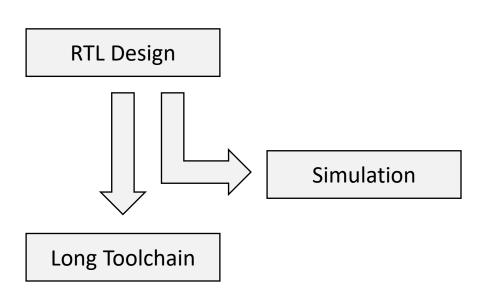
Category:		Category:		
Category: 	Options controlling SSH X11 forwarding X11 forwarding C Enable X11 forwarding X display location Remote X11 authentication protocol MIT-Magic-Cookie-1 ○ XDM-Authorization-1 X authority file for local display Browse	Window Appearance Behaviour Translation Selection Colours Colours Connection Proxy Telnet	Options controlling SSH connections Data to send to the server Remote command: Protocol options Don't start a shell or command at all Enable compression SSH protocol version: 2 1 (INSECURE) 	
Rogin SSH Kex Host keys Cipher Auth TTY X11 Tunnels Bugs More bugs V		SSH 	Sharing an SSH connection between PuTTY tools Share SSH connections if possible Permitted roles in a shared connection: Upstream (connecting to the real server) Downstream (connecting to the upstream PuTTY)	

Trying simulation - example

□ cs152-rv32i-bsv/projects/rv32i/

Compiling and running the simulation

- "make bsim" Stands for "bluesim"
- "make runsim" creates two files
 - system.log : log of processor operation
 - output.log : log of software output
- Default benchmark: Sudoku solver
 - o Source: sw/minisudoku.c
 - Resulting assembly: sw/minisudoku.dump
 - Binary for processor: sw/minisudoku.bin



155	0000023	c <solve>:</solve>	
156	23c:→	fd010113	→ addi→ sp,sp,-48
157	240: →	02112623	→ sw→ ra,44(sp)
158	244:→	02812423	→ sw→ s0,40(sp)
159	248: →	03010413	→ addi→ s0,sp,48
160	24c:→	fca42e23	→ sw→ a0, -36(s0)
161	250: →	fcb42c23	→ sw→ a1, -40(s0)
162	254: →	fd842703	→ lw→ a4, -40(s0)
163	258: →	00f00793	→ addi→ a5,zero,15
164	25c:→	00e7d663	→ bge→a5, a4, 268 <solve+0x2c></solve+0x2c>

Default hardware target platform

- □ Lattice ECP5-85F FPGA
- □ Host software loads software/data over USB to FPGA
- Host software communicates with FPGA via UART over USB



Synthesizing a bitfile - example

"make" creates a bitfile, and prints a lot of logs onto screen

"make | tee build.log" to analyze output

 \circ Log file is long!

- **Example log files from synthesis:**
 - Look for "Device utilisation" [sic]:

Info:	Device	utilisation:		
Info:	→	TRELLIS_SLICE:	4982/41820	11%

○ Look for "Max frequency" :

Info: Max frequency for clock '\$glbnet\$CLK_clk_25mhz\$TRELLIS_I0_IN': 69.80 MHz (PASS at 25.00 MHz)

• Look for "Critical path report for clock":

Info: Critical path report for clock '\$glbnet\$CLK_clk_25mhz\$TRELLIS_I0_IN' (posedge -> posedge):
Info: curr total
Info: 0.5 0.5 Source main_proc.imemRespQ.data0_reg_TRELLIS_FF_Q_30_DI_PFUMX_Z_SLICE.Q0
Info: 1.5 2.0 Net main_proc.imemRespQ_D_0UT[1] budget 5.041000 ns (33,27) -> (33,28)

Where is the critical path?

□ Look at the synthesis log!

Info: Critical path report for clock '\$glbnet\$CLK_clk_25mhz\$TRELLIS_I0_IN' (posedge -> posedge):
Info: curr total
Info: 0.5 0.5 Source main_proc.imemRespQ.data0_reg_TRELLIS_FF_Q_30_DI_PFUMX_Z_SLICE.Q0
Info: 1.2 1.7 Net main_proc.imemRespQ_D_OUT[1] budget 3.042000 ns (44,26) -> (43,27)

Info: 0.2 14.2 Source main_proc.d2e.data0_reg_TRELLIS_FF_Q_108_DI_L6MUX21_Z_D1_L6MUX21_Z_D0_PFUMX_Z_SLICE.0FX1
Info: 0.1 14.3 Net main_proc.d2e.data0_reg_TRELLIS_FF_Q_108_DI budget 5.039000 ns (8,40) -> (8,40)
Info: Sink main_proc.d2e.data0_reg_TRELLIS_FF_Q_108_DI_L6MUX21_Z_D1_L6MUX21_Z_D0_PFUMX_Z_SLICE.DI1
Info: 0.0 14.3 Setup main_proc.d2e.data0_reg_TRELLIS_FF_Q_108_DI_L6MUX21_Z_D1_L6MUX21_Z_D0_PFUMX_Z_SLICE.DI1
Info: 3.8 ns logic, 10.5 ns routing