

OPEN SOURCE IN TEACHING RISC-V

Open Source in Education @ BCS-OSSG

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Fakultät für Informatik und Mathematik

About Me

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 - ▶ Chair of the "academia and education"

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- ▶ Great for teaching computer organization and computer architecture, right?!

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- ▶ Goal: Reuse, improve and provide open source tooling for this purpose

Practical Computer Systems Education with Visual Studio

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 - ▶ Open source and easy to extend

Demo

The screenshot displays a RISC-V debugger interface with the following components:

- VARIABLES:** A list of registers (x0 to x24) and their current values. For example, x0 (zero) is 0x00000000, and x10 (a0) is 0x00000121.
- Code Editor:** Shows assembly code for `sevenssegboard.s`. The current instruction is `j loop` at line 11, column 1.
- Hardware Simulation:** A central diagram of a board with two 7-segment displays showing the number '99', two LEDs (LED 0 and LED 1), and two buttons (Button 0 and Button 1). A CPU and USB port are also visible.
- Assembly Window:** Shows the assembly code for the current instruction: `jal x0 -20` at line 12, column 1.

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 - ▶ Visualization with pipeline viewer tool

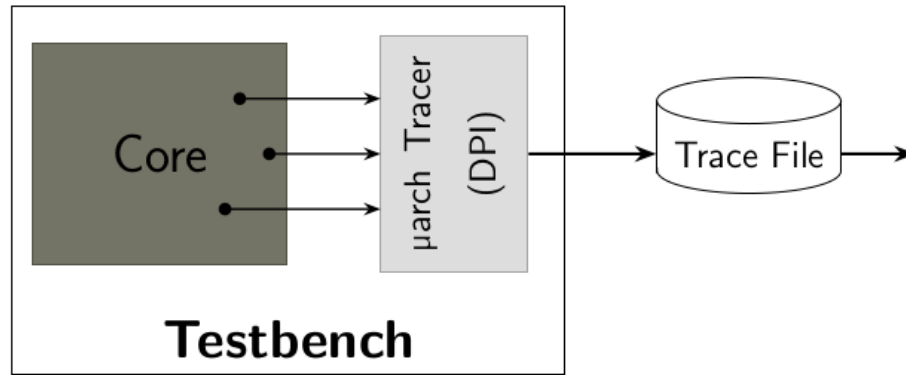
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- ▶ More at <https://riscv.cs.hm.edu>.

Demo



```
(.venv) wallento@wallento-hm:/data/ariane$ pipeline-viewer --modes U --width 16 ariane-text trace_hart_00.dasm.out
----- snip (mode) -----
i | ..... f=] U 1 272685- 272690 0000000080000104 auipc sp, 0x3
d=i | ..... f=] U 2 272686- 272692 0000000080000108 addi sp, sp, -260
---di | ..... f] U 3 272687- 272693 000000008000010c jal pc + 0x1f7c
f | ..... ] U 3 272688- ----- 0000000080000110
. f=====di | ..... ] U 4 272690- 272699 0000000080002088 lui a0, 0x1
---f---di | ..... ] U 5 272696- 272701 000000008000208c li a1, 35
i | ..... f=====] U 6 272697- 272706 0000000080002090 addi a0, a0, -2020
---di | ..... f] U 7 272703- 272708 0000000080002094 j pc - 0x94
f | ..... ] U 7 272704- ----- 0000000080002098
. f=====di | ..... ] U 8 272705- 272714 0000000080002000 or a4, a0, a1
---f---di | ..... ] U 9 272711- 272716 0000000080002004 andi a4, a4, 1
. f---di | ..... ] U 10 272712- 272717 0000000080002008 bnez a4, pc + 96
. f---di | ..... ] U 10 272713- ----- 000000008000200c srlw a0, a0, 1
. f---di | ..... ] U 10 272714- ----- 0000000080002010
f=====di | ..... ] U 11 272720- 272729 0000000080002068 li a4, 0
. f---di | ..... ] U 12 272726- 272731 000000008000206c j pc - 0x48
f | ..... ] U 12 272727- ----- 0000000080002070
i | ..... f=====] U 13 272729- 272738 0000000080002024 andi a5, a0, 1
---di | ..... f] U 14 272735- 272740 0000000080002028 bnez a5, pc + 16
f---di | ..... ] U 15 272736- 272741 000000008000202c srlw a0, a0, 1
. f=====di | ..... ] U 16 272737- 272746 0000000080002030 andi a5, a0, 1
---f---di | ..... ] U 17 272743- 272748 0000000080002034 beqz a5, pc - 8
f | ..... ] U 17 272744- ----- 0000000080002038
. f---di | ..... ] U 18 272745- 272750 000000008000202c srlw a0, a0, 1
. f---di | ..... ] U 19 272746- 272751 0000000080002030 andi a5, a0, 1
. f---di | ..... ] U 20 272747- 272752 0000000080002034 beqz a5, pc - 8
. f | ..... ] U 20 272748- ----- 0000000080002038
. f---di | ..... ] U 20 272749- ----- 000000008000202c srlw a0, a0, 1
```

Pipeline Viewer

`pip install pipeline-viewer`

Figure 1:

RISC-V Academia and Education SIG

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Ongoing Effort to Build Library of Educational Materials

- ▶ You can find many university courses that use RISC-V on the website

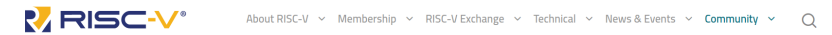
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Author/University	Link	Access	Level	Platform	Content	Type
Udemy	Link	Paid	2	Sim	HW	a,d
Oakland University	Link	Open	2	Unspecified	HW	f
University of Rochester	Link	Open	1	Unspecified	SW	f
University of Cambridge	Link	Open	2	FPGA	HW	f
University of Wisconsin-Madison	Link	Open	2	Sim	HW	f
Sarah Lawrence College	Link	Reg	2	Unspecified	SW	f
University of Virginia	Link	Reg	2	Unspecified	HW	f
UC Irvine	Link	Open	1	Sim	HW	a,f

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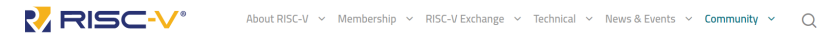
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- ▶ Goal: Platform for educational materials



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Thanks for your Attention!

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Find me on Twitter: @wallento