

RISC-V meets VLSI: A student's guide to chip design using "vsdsquadron"

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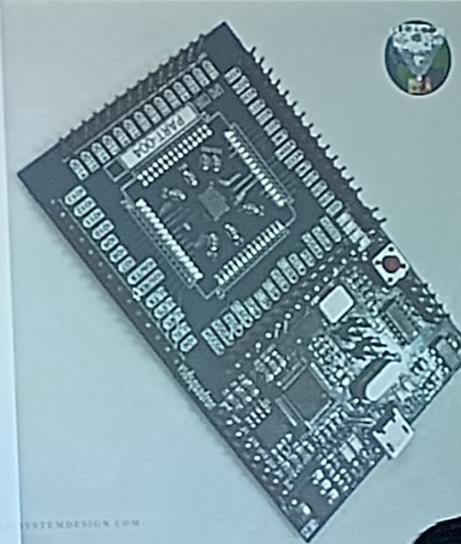
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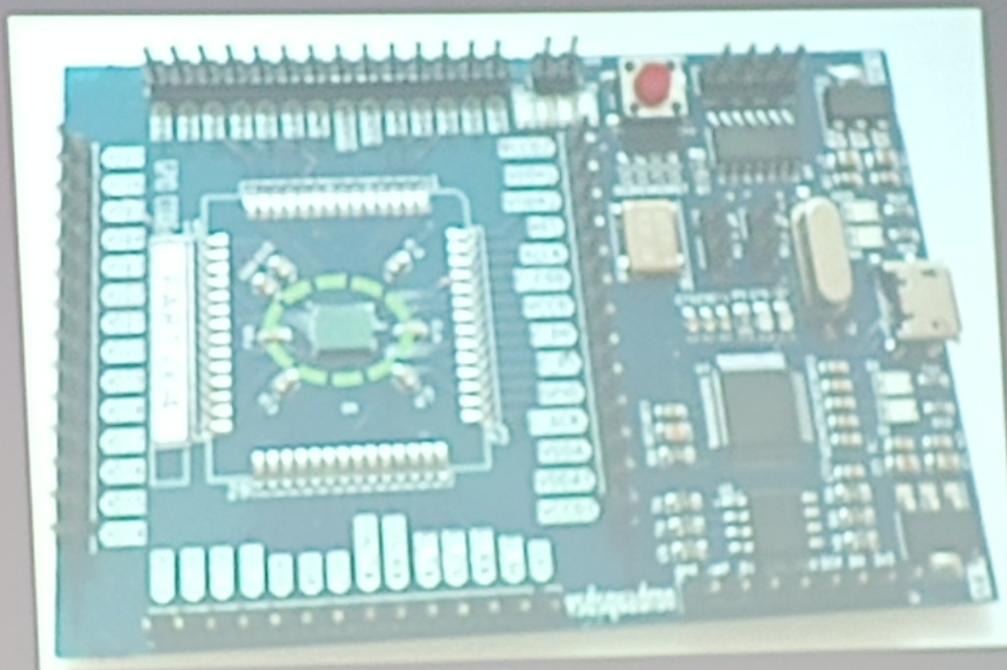


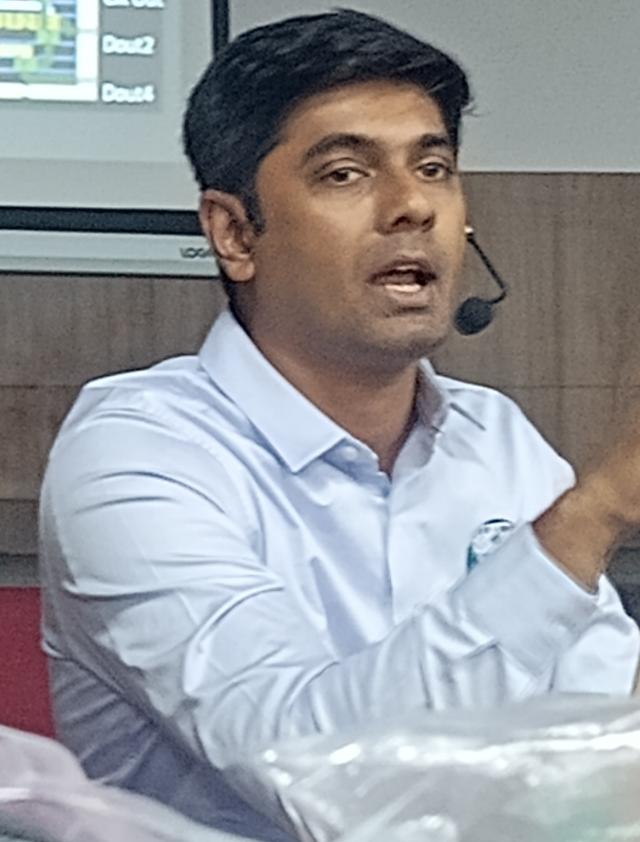
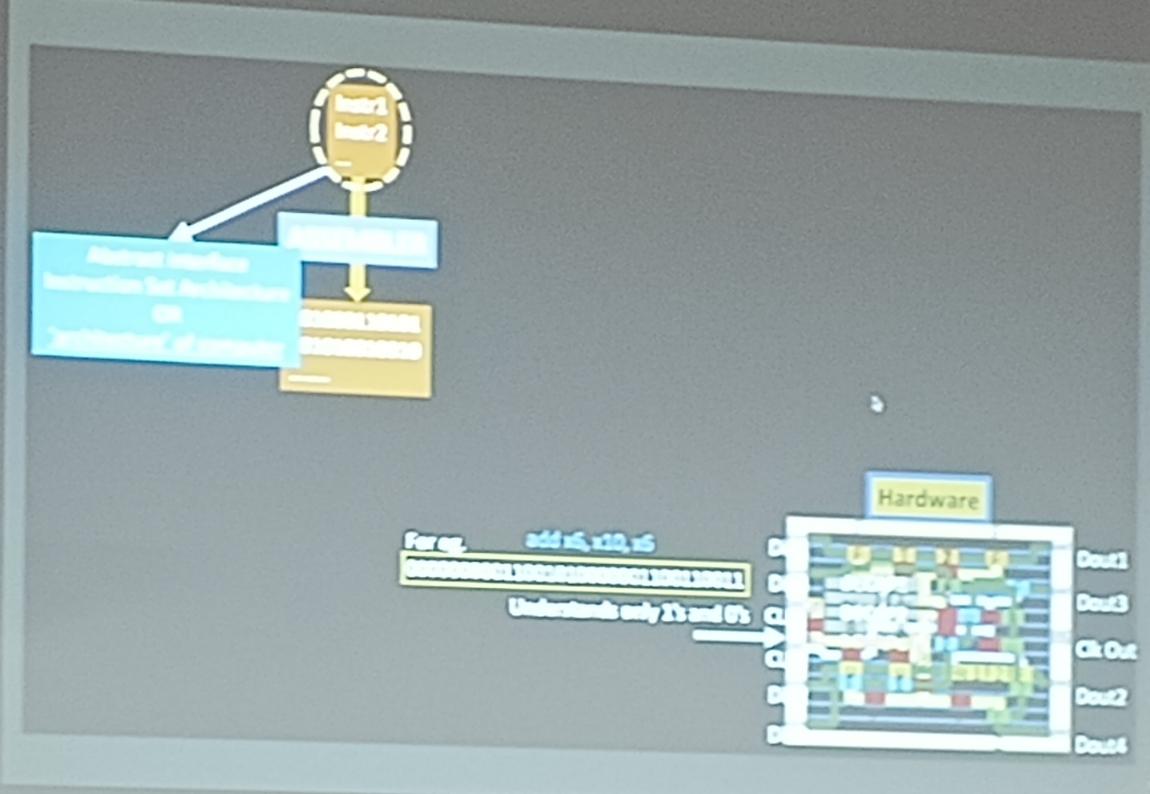
Tools Provider



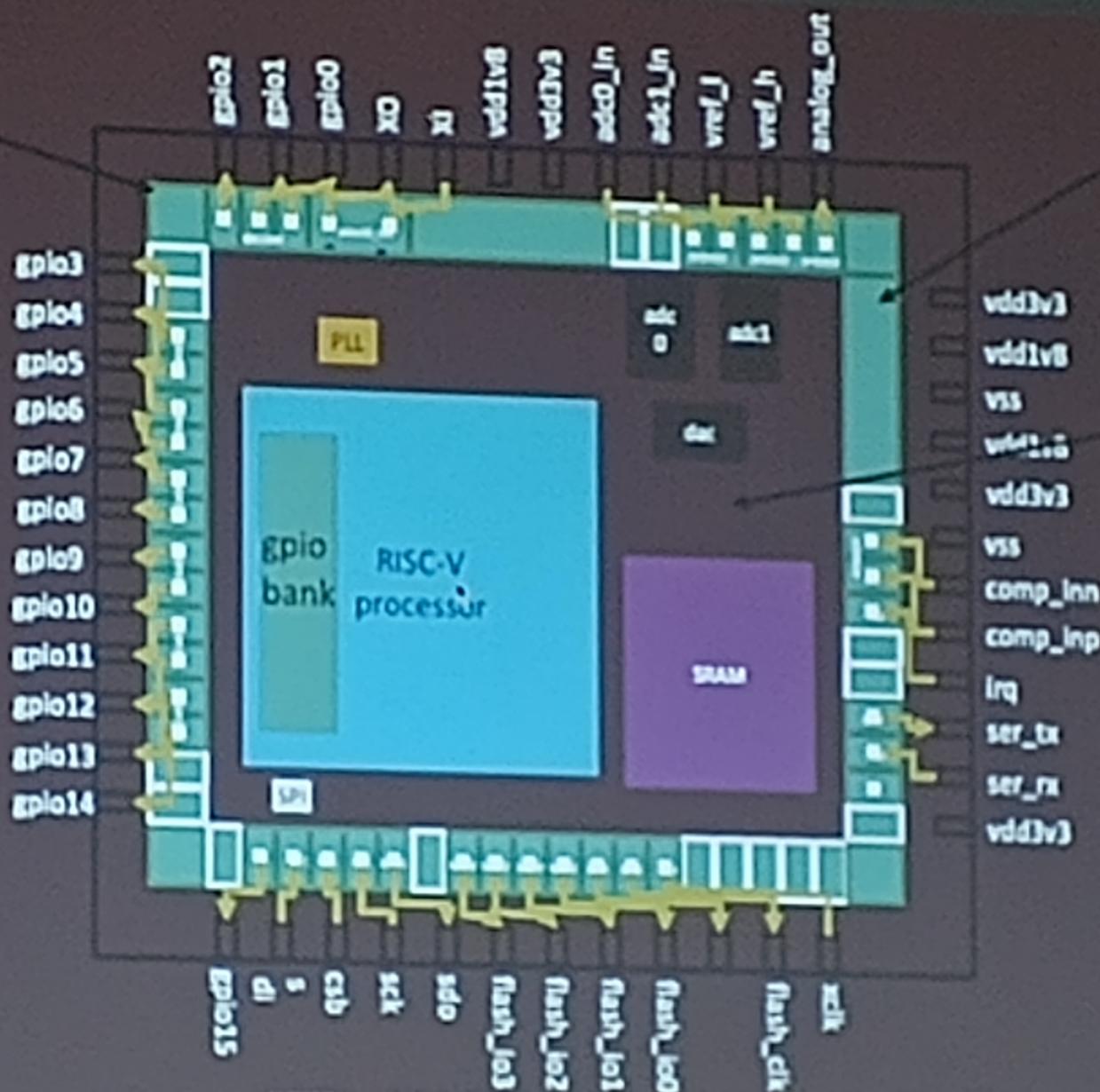
Three fundamental stages of learning chip design

- 1.Specification
- 2.RTL2GDS
- 3.Testing



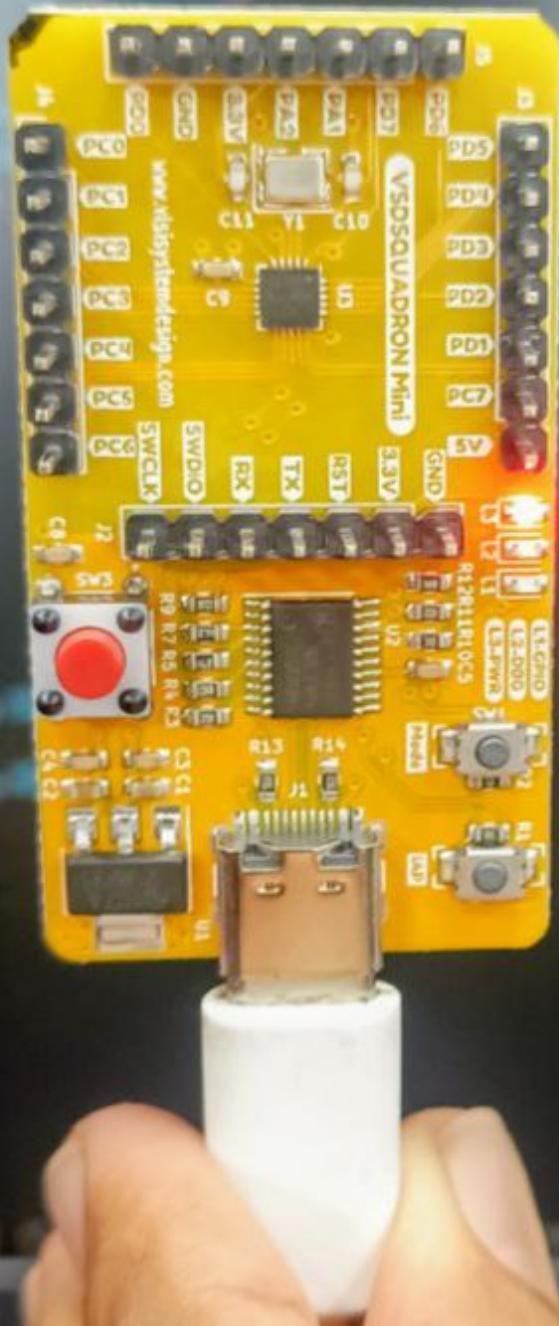


Die



PADS

Core



vsduser@vsduser-VirtualBox: ~

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vsduser@vsduser-VirtualBox: ~

```
vsduser@vsduser-VirtualBox:~$ riscv64-unknown-elf-gcc -O1 -mabi=lp64 -march=rv64i -o gou.o gou.c
```

```
vsduser@vsduser-VirtualBox:~$ spike pk gou.o
```

bbl loader

Enter the value of n = 20

The Sum of numbers from 1 to 20 is 210

```
vsduser@vsduser-VirtualBox:~$ gcc gou.c
```

```
vsduser@vsduser-VirtualBox:~$ ./a.out
```

Enter the value of n = 20

The Sum of numbers from 1 to 20 is 210

```
vsduser@vsduser-VirtualBox:~$
```

vsduser@vsduser-VirtualBox: ~

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vsduser@vsduser-VirtualBox: ~

vsduser@vsduser-VirtualBox: ~

```
7ef: 00
7f0: 4c 89 fa          mov    %r15,%rdx
7f3: 4c 89 f6          mov    %r14,%rsi
7f6: 44 89 ef          mov    %r13d,%edi
7f9: 41 ff 14 dc        callq  *(%r12,%rbx,8)
7fd: 48 83 c3 01        add    $0x1,%rbx
801: 48 39 dd          cmp    %rbx,%rbp
804: 75 ea              jne    7f0 <_libc_csu_init+0x40>
806: 48 83 c4 08        add    $0x8,%rsp
80a: 5b                pop    %rbx
80b: 5d                pop    %rbp
80c: 41 5c              pop    %r12
80e: 41 5d              pop    %r13
810: 41 5e              pop    %r14
812: 41 5f              pop    %r15
814: c3                retq
815: 90                nop
816: 66 2e 0f 1f 84 00 00    nopw   %cs:0x0(%rax,%rax,1)
81d: 00 00 00
```

0000000000000820 <_libc_csu_fini>:

```
820: f3 c3              repz  retq
```

Disassembly of section .fini:

0000000000000824 <_fini>:

```
824: 48 83 ec 08          sub    $0x8,%rsp
828: 48 83 c4 08          add    $0x8,%rsp
82c: c3                retq
```

vsduser@vsduser-VirtualBox:~\$

vsduser@vsduser-VirtualBox: ~/workshpd2

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vsduser@vsduser-VirtualBox: ~/workshpd2 x vsduser@vsduser-VirtualBox: ~ x vsduser@vsduser-VirtualBox: ~/workshpd2 x

```
2112c:    f79ff0ef      jal    ra,210a4 <_udivdi3>
21130:    00058513      mv    a0,a1
21134:    00028067      jr    t0
21138:    40b005b3      neg    a1,a1
2113c:    fe0558e3      bgez   a0,2112c <_moddi3+0xc>
21140:    40a00533      neg    a0,a0
21144:    f61ff0ef      jal    ra,210a4 <_udivdi3>
21148:    40b00533      neg    a0,a1
2114c:    00028067      jr    t0
21150:    01f29293      slli   t0,t0,0x1f
21154:    f45514e3      bne    a0,t0,2109c <_divdi3>
21158:    00008067      ret
```

000000000002115c <_clzdi2>:

```
2115c:    03800793      li    a5,56
21160:    00f55733      srl   a4,a0,a5
21164:    0ff77713     andi  a4,a4,255
21168:    00071663      bnez  a4,21174 <_clzdi2+0x18>
2116c:    ff878793     addi  a5,a5,-8
21170:    fe0798e3      bnez  a5,21160 <_clzdi2+0x4>
21174:    04000713      li    a4,64
21178:    40f70733      sub   a4,a4,a5
2117c:    00f557b3      srl   a5,a0,a5
21180:    00001517      auipc a0,0x1
21184:    cb050513      addi  a0,a0,-848 # 21e30 <_clz_tab>
21188:    00f507b3      add   a5,a0,a5
2118c:    0007c503      lbu   a0,0(a5)
21190:    40a7053b      subw  a0,a4,a0
21194:    00008067      ret
```

vsduser@vsduser-VirtualBox:~/workshpd2\$

A screenshot of a Linux desktop environment, likely Ubuntu, showing a terminal window and a code editor.

The terminal window (left side) shows the following command-line session:

```
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vsduser@vsduser-VirtualBox: ~/work... x vsduser@vsduser-VirtualBox: ~  
vsduser@vsduser-VirtualBox:~/workshpd2$ ls  
a.out counter.c counter.o  
vsduser@vsduser-VirtualBox:~/workshpd2$ gedit counter.c
```

The code editor window (right side) displays the following C code:

```
#include<stdio.h>  
int main() {  
    int counter = 0;  
    for(int i=0;i<10;i++) {  
        counter++;  
        printf("Counter value: %d\n", counter);  
    }  
    return 0;  
}
```

The code editor interface includes standard buttons for Open, Save, and file operations. Status bars at the bottom show "C" (code mode), "Tab Width: 8", "Ln 6, Col 9", and "INS".