COMPUTER SYSTEMS AND ORGANIZATION

Part 1

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UNIVERSITY of VIRGINIA | ENGINEERING

1. Goals
2. Communication & Office Hours
3. Enrollment and Grading
4. Lectures
5. Labs
6. Homework
7. Exams

Bonus (Map of things we'll cover)

GOALS

Students should be able to reason from first principles about the programs they write. For example, students should be able to answer the following questions about the C program below.

```c
#include <stdio.h>
int main() {
        printf("Hello, World!");
        return 0;
}
```

- Why is the stdio.h file needed? How does its associated code get added to the final binary?
- What binary is generated when the program is compiled? What instruction does the binary implement?
- How does the CPU execute these instructions? What components are needed? How are they designed
- How can the program be optimized? Can we execute it with fewer assembly instructions (a smaller binary)?

COMMUNICATION & OFFICE HOURS

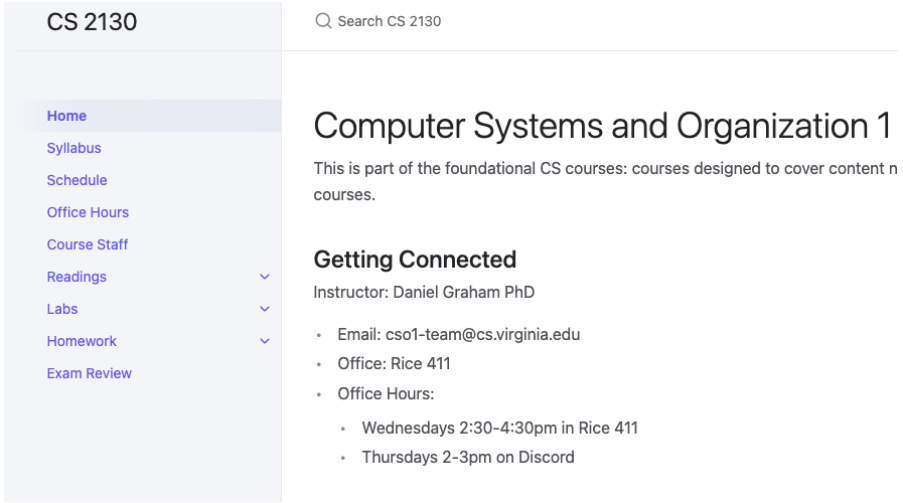
Email:

- **DO NOT** email me.
- Instead, email cs2130@cshelpdesk.atlassian.net
    - This email goes to a ticketing system where the TAs, GTAs, and I can see your request.
        - Eg. Need to schedule an alternative exam time, email this list.

COMMUNICATION OFFICE HOURS

Course Website:

- https://researcher111.github.io/uva-cso1-F23-DG/
- Take 1 minute to visit the site. (you'll need it up for the next slide)
- The course website contains:
    - Course Schedule
    - Syllabus
    - Office Hours (Calendar)
    - Office Hours Queue
    - Labs
    - Homework
    - Past Exams
    - Course Staff Directory.



COMMUNICATION AND OFFICE HOURS

Discord:

- We'll use **Piazza** as our communication forum.
- If you have questions about the labs ask them on **Piazza**.
- If you have homework questions ask them, Piazza.
- Feel free to meet with your classmates study groups are OK.
- Some TAs will have office hours on Zoom and in-person.
- Keep your post in the relevant channel. Example: Talk about homework 1 in the hw-01 channel

COMMUNICATION AND OFFICE HOURS

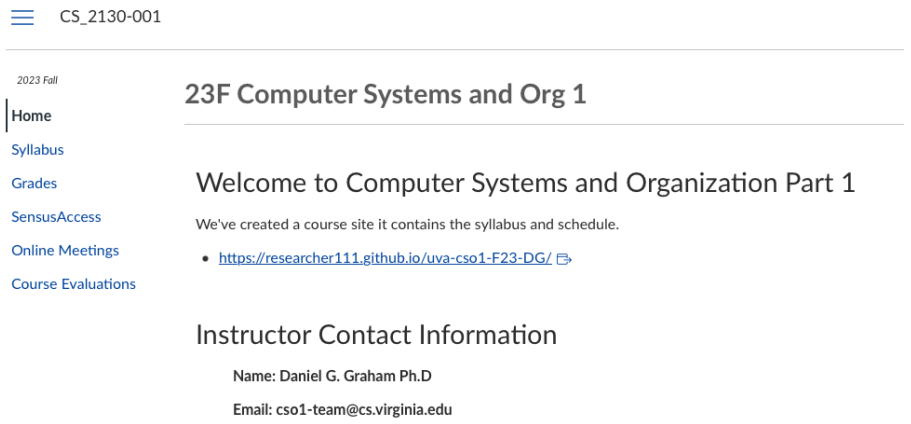
Discord All-Stars.

- 10% Extra credit will be awarded to the top 10 most helpful students on Piazza. (No junk posting)
- If you post distracting or misleading content, we will remove you from the top ten.
- You are expected to behave professionally on Piazza. (Unprofessional behavior will in a 10% penalty)

ENROLLMENT AND GRADING

We will use Canvas as our learning management system.

- ❑ Check to see if you can access the course on Canvas. If not, email: cs2130@cshelpdesk.atlassian.net
- ❑ The Grade book will be available in Canvas at the end of the semester.
- ❑ You can also find links to the course website on Canvas
- ❑ Most assignment and exam grades will be available through Gradescope. You can access Gradescope through Canvas.



ENROLLMENT AND GRADING

Grade are split roughly equally between exams and assessments. Homework and labs account for 54% of the grade, while all three exams account for 46% of the grade.

Task	Weight
Homework	40%
Lab	14%
Exams	15% Each
Final Exam	16%

LECTURES

- All lectures will be recorded and available (via the course site).
- Lectures will be approximately 45 minutes.
- At the end of each lecture, we'll look at a past exam question or a new sample question. You will get 5 minutes to work on the question (feel free to talk to your classmates) and then, we'll go over the solution. Leaving time for questions.
- All lecture slides will be made available on the course website. Old lecture slides will remain on the course site until they are replaced by newer slides.

LABS

- **DON'T** drop your lab section to try to change labs; you might not be able to get back into the course. There is a SIS feature that allows you to switch sections.
- Labs will be in Olsson 018.
  - You'll need to bring your own laptop to the lab.
  - Engineers need to work in teams. You need to learn to work in a team. Therefore, you need to attend labs. You'll work in person that you sit next to at the begin of the first lab and you'll rotate partners after each exam.
  - The TAs will take attendance at the end of the lab.
    - Don't be late for lab
    - Late lab attendance will be considered absence.
  - You can miss **one** lab. The attendance portion is dropped
    - But you will still need to **submit the lab**
    - **This includes lab that are TA check off labs**

Task	Weight
Attend Lab	70%
Submit Files	10%
Pass test cases	20%

HOMEWORK

- Submit your homework to Gradescope for auto-grading. Submit your homework early, you want to give yourself enough time to pass the test cases.
- Gradescope will display your grade at the end of the assignment period. Grades from Gradescope will be moved to Canvas at the end of the semester.
- Work on the homework by yourself, but free to ask questions to your fellow students on Piazza or during TA office hours.
- **Due on Monday, No Late homework is accepted DUE 5:30pm**

CS 2130 DEDICATED OFFICE HOURS

Day:	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Location:	Homework Due	Lab Day			Olsson 001		
5-6pm	Homework Due	Lab Day	Online OH	Devang Ray	Dhriti	Justin	Nathan
	Homework Due	Lab Day	Online OH	Yingming	Srikar	Jackson	
	Homework Due	Lab Day	Online OH	Hao	Shreepa	Tao	
	Homework Due	Lab Day	Online OH	Vincent Song	Aaryan		
	Homework Due	Lab Day	Online OH	Feyona Zhang	Srilakshmi		
	Homework Due	Lab Day	Online OH	Lilli Hrncir	Justin		
6-7pm	Homework Due	Lab Day	Online OH	Devang Ray	Dhriti	Justin	Nathan
	Homework Due	Lab Day	Online OH	Anika Malhotra	Srikar	Jackson	
	Homework Due	Lab Day	Online OH	Yingming	Shreepa	Tao	
	Homework Due	Lab Day	Online OH	Hao	Aaryan		
	Homework Due	Lab Day	Online OH	Vincent Song	Srilakshmi		
	Homework Due	Lab Day	Online OH	Feyona Zhang	Justin		
7-8pm	Homework Due	Lab Day	Online OH	Anika Malhotra	Dhriti	Jackson	Nathan
	Homework Due	Lab Day	Online OH		Srikar	Lilli Hrncir	
	Homework Due	Lab Day	Online OH		Shreepa		
	Homework Due	Lab Day	Online OH		Aaryan		
	Homework Due	Lab Day	Online OH		Srilakshmi		

OLSON 001 DEDICATED OFFICE HOURS

If Olson is closed for a football game or any other reason office hours will be on Zoom.

EXAMS

- Exams will be in-class
- You can find the exam dates on the schedule of the website.
- Past exams are also available on the course website.
- The lecture before each exam will be a review lecture. During this lecture, I'll go over exam questions that I didn't cover in any of the previous lectures.
- For the final exam see the schedules for the times for your section.
- Exams can be taken before but not after the scheduled exam date

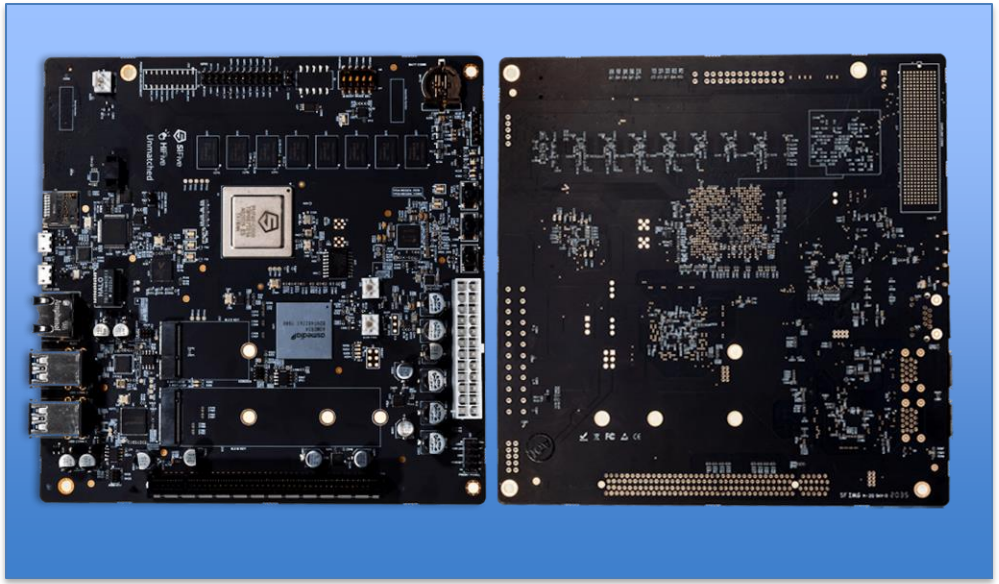
QUESTIONS?

LET'S TAKE MACHINE AND BREAK IT APART

Alibaba Roma RISC-V laptop

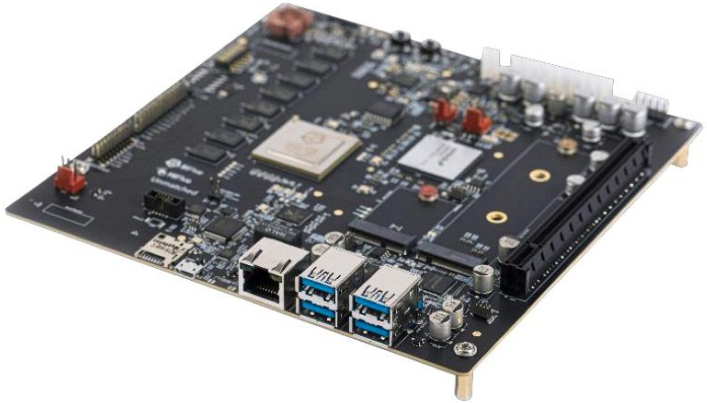
BOTTOM-UP APPROACH

Alibaba Roma RISC-V laptop

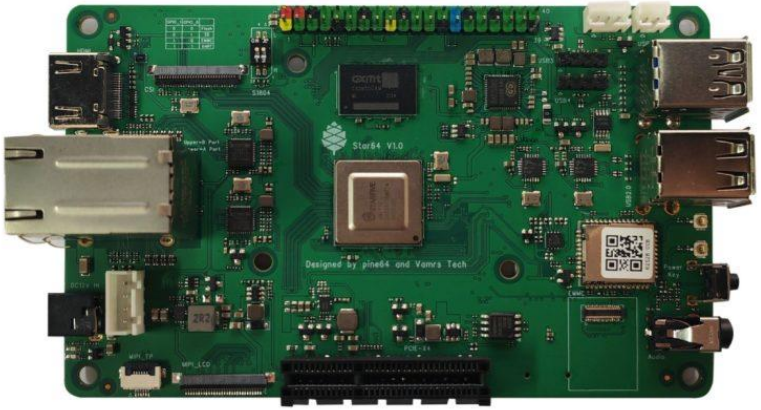


HiFive Unmatched Risc-V development board

BOTTOM-UP APPROACH

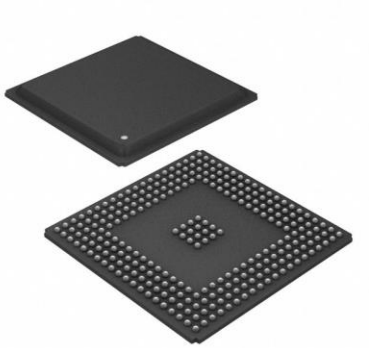


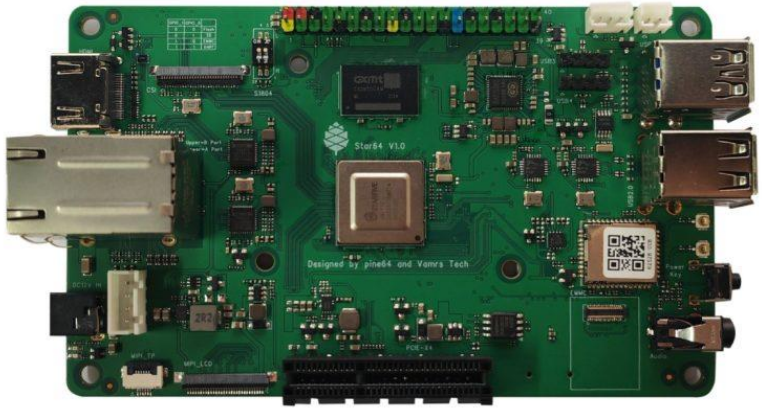
HiFive Unmatched Risc-V

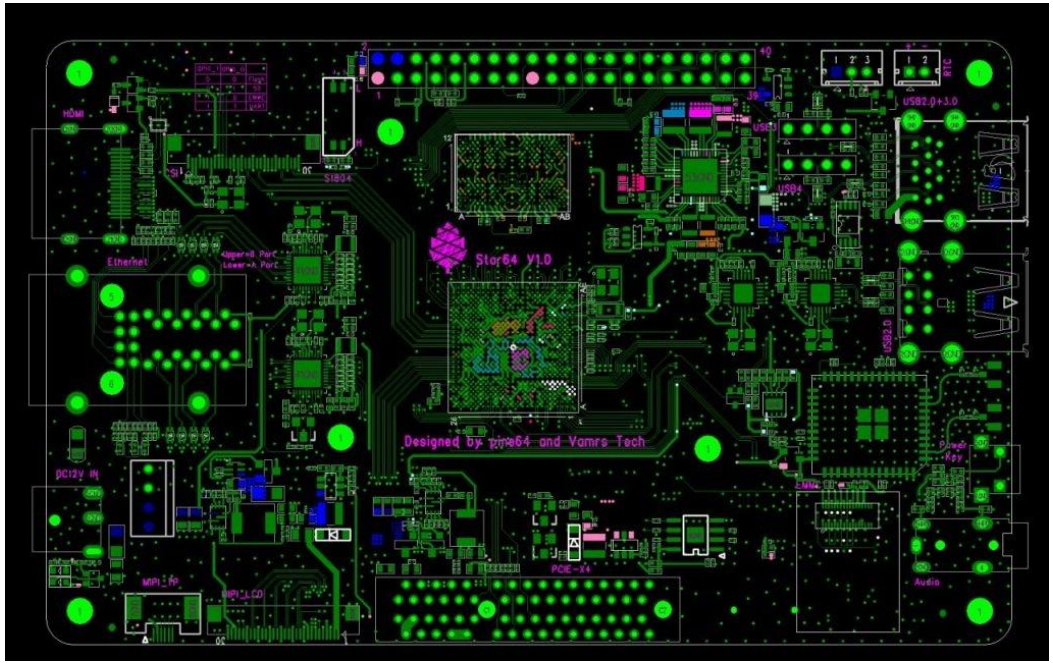


STAR64

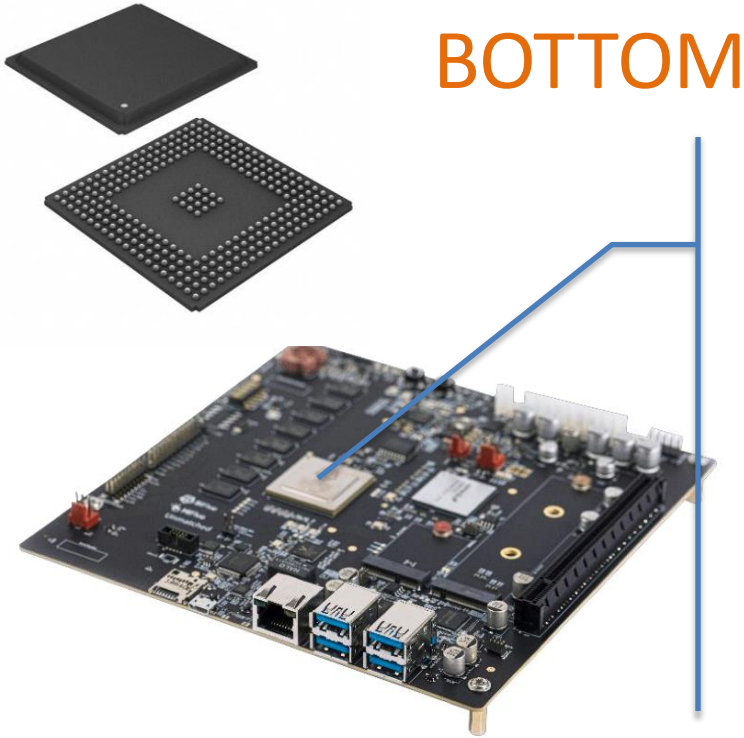
BOTTOM-UP APPROACH

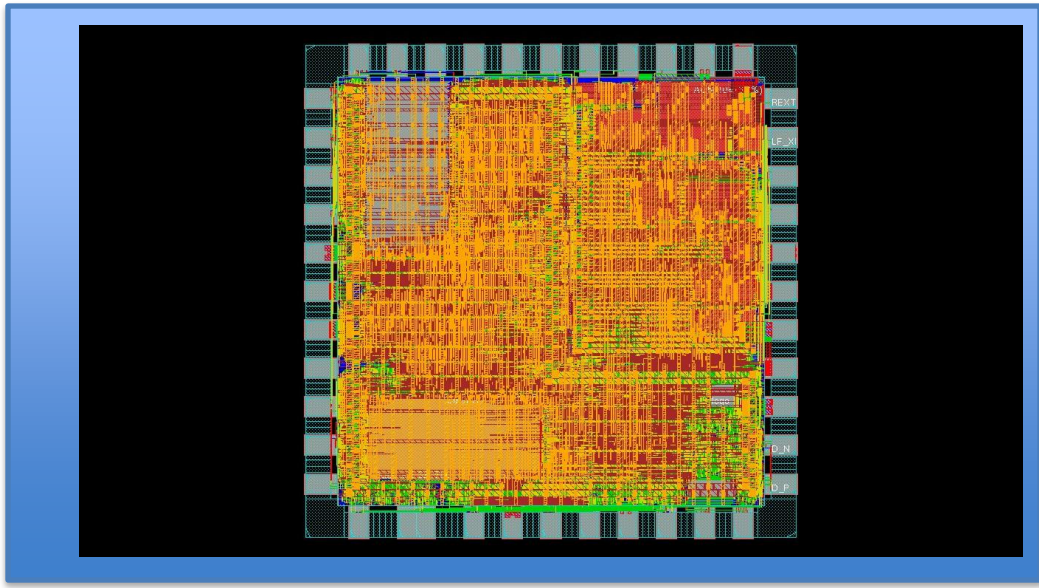






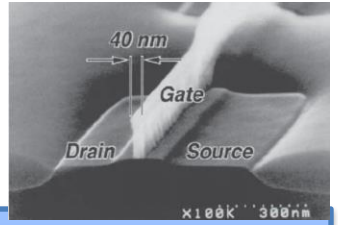
BOTTOM-UP APPROACH

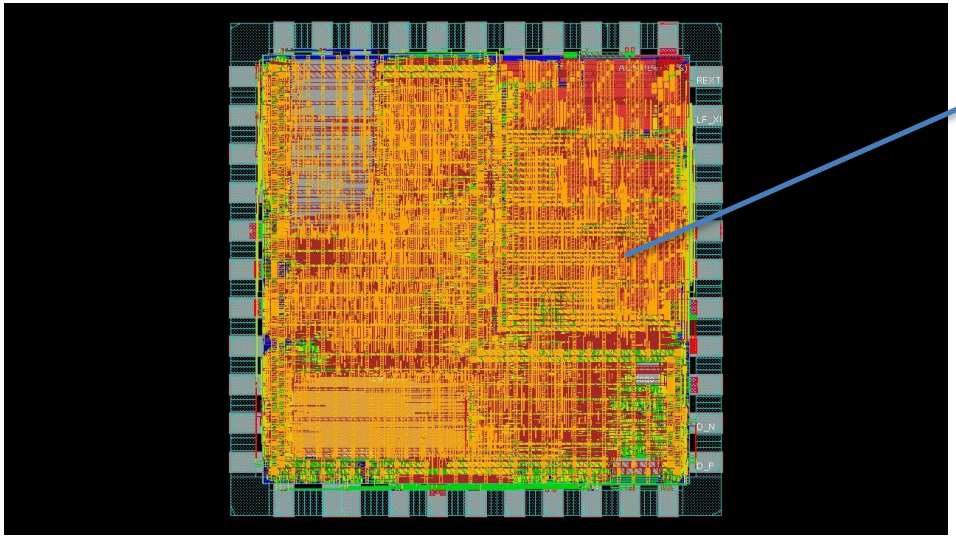


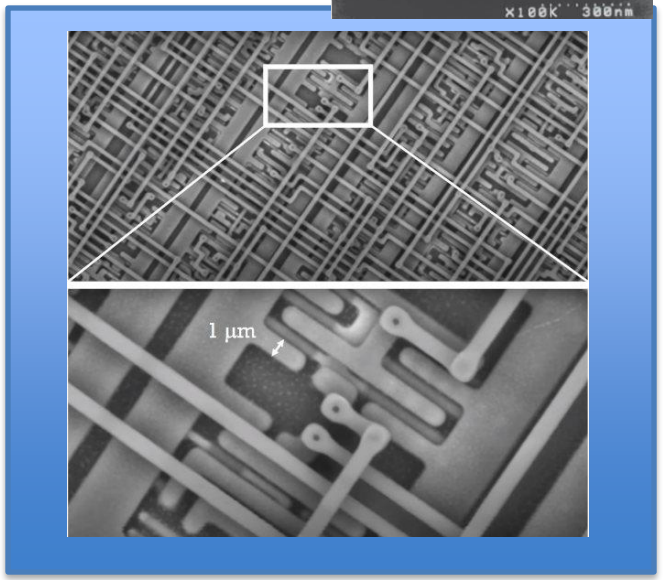


SiFive – Chip

BOTTOM-UP APPROACH

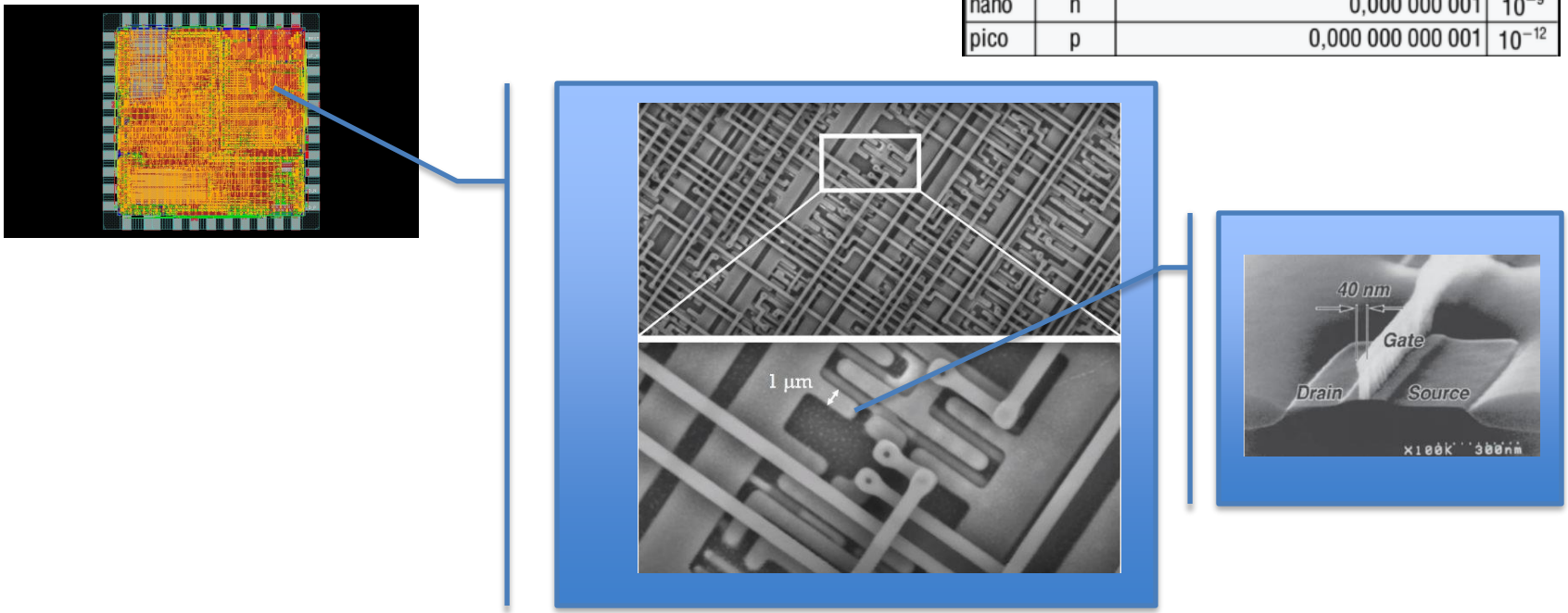






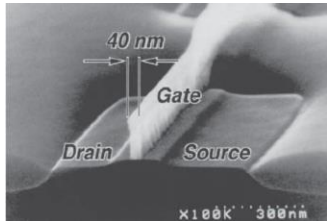
BOTTOM-UP APPROACH

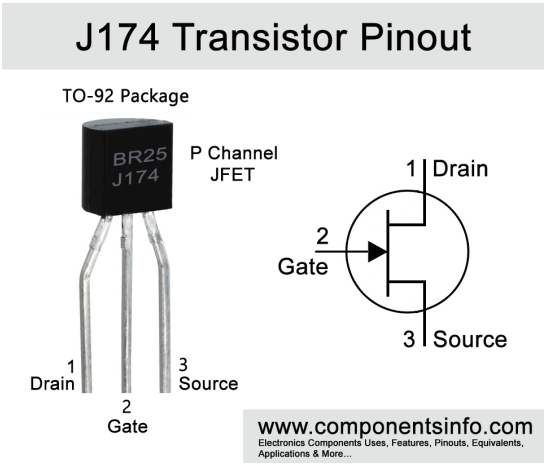
milli	m	0,001	10^{-3}
micro	μ	0,000 001	10^{-6}
nano	n	0,000 000 001	10^{-9}
pico	p	0,000 000 000 001	10^{-12}



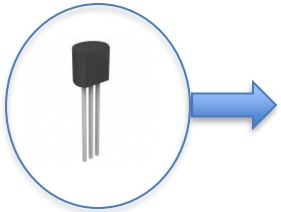
https://www.bbvaopenmind.com/en/technology/innovation/mini-transistors-technological-revolution-20th-century/

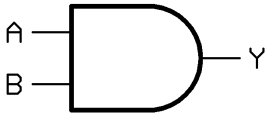
THIS WERE WE'LL START OUR JOURNEY

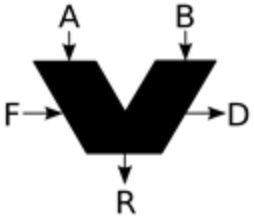


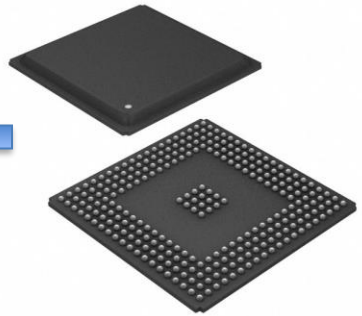


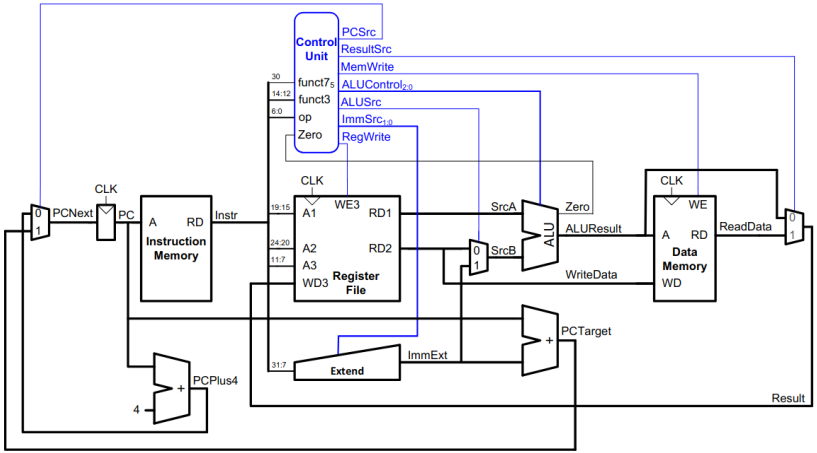
THE MAP (THE MACHINE)











https://github.com/MKrekker/SINGLE-CYCLE-RISC-V

THE MAP (THE CODE)

```c
#include <stdio.h>
int main() {
        printf("Hello, World!");
        return 0;
}
```

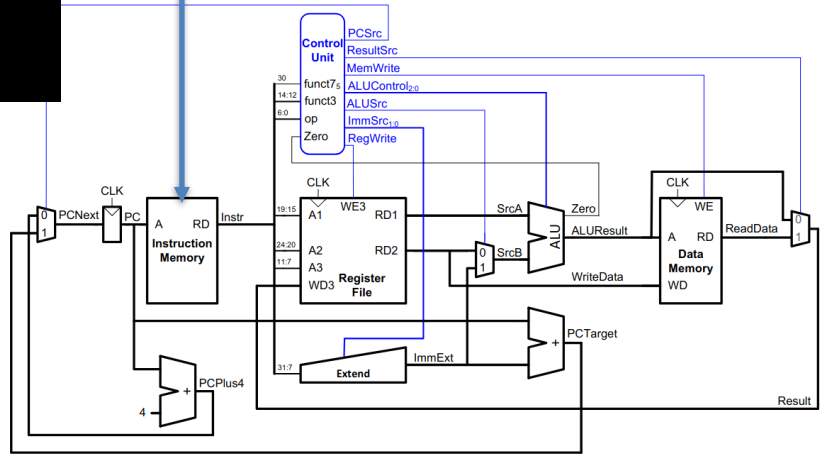
```
0000000000001149 <main>:
   1149: f3 0f 1e fa        endbr64
   114d: 55                 push   %rbp
   114e: 48 89 e5           mov    %rsp,%rbp
   1151: 48 8d 05 ac 0e 00 00 lea    0xeac(%rip),%rax       # 2004
<_IO_stdin_used+0x4>
   1158: 48 89 c7           mov    %rax,%rdi
   115b: e8 f0 fe ff ff     call   1050 <puts@plt>
   1160: b8 00 00 00 00     mov    $0x0,%eax
   1165: 5d                 pop    %rbp
   1166: c3                 ret
```

We will not cover this conversion in detail. CS 4620 - Compilers is a class dedicated to building and understanding the program designed to do this conversion.

We'll focus on understanding the output of the program and how this output gets executed on a machine

THE MAP (THE CODE)

```
0000000000001149 <main>:
   1149: f3 0f 1e fa        endbr64
   114d: 55                 push   %rbp
   114e: 48 89 e5           mov    %rsp,%rbp
   1151: 48 8d 05 ac 0e 00 00 lea    0xeac(%rip),%rax       # 2004
<_IO_stdin_used+0x4>
   1158: 48 89 c7           mov    %rax,%rdi
   115b: e8 f0 fe ff ff     call   1050 <puts@plt>
   1160: b8 00 00 00 00     mov    $0x0,%eax
   1165: 5d                 pop    %rbp
   1166: c3                 ret
```



QUESTIONS WE'LL ANSWERS

What is a **Logic Gate** and how can transistors be combined to create one?

Why are logic gates useful? How could you build one?

How can logic gates be combined to create a circuit that does computation

How can programs be run on a logic circuit?

How can we make it easier to write programs for these circuits?