

Montgomery
Hackathon 2021,
Keynotes

Changxu Luo

A Little About Me

STEM/EE/CS?

What is Cloud?

STEM, EECS & A Little Touch on Cloud

Montgomery Hackathon 2021 Keynotes

Speaker: Changxu Luo, Software Engineer @Google

github.com/camelboat

Outlines

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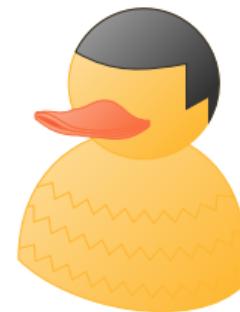
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A Little About Me

STEM/EE/CS?

What is Cloud?

- 1 A Little About Me
- 2 STEM/EE/CS?
- 3 What is Cloud?



“This is a 45-min presentation with 15-min Q&A”

A Little About Me

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A Little About Me

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What is Cloud?

- BS in Electrical and Computer Engineering @Shanghai Jiaotong University
- MS in Electrical Engineering @Columbia University
- Worked as Software/Electrical Engineer @GE Appliances, Bosch, and Rover Diagnostics
- Software Engineer @Google - Google Cloud Networking Control Qualification
- Research Assistant on distributed storage, instructed by Prof. Asaf Cidon.

A Little About Me, Cont.

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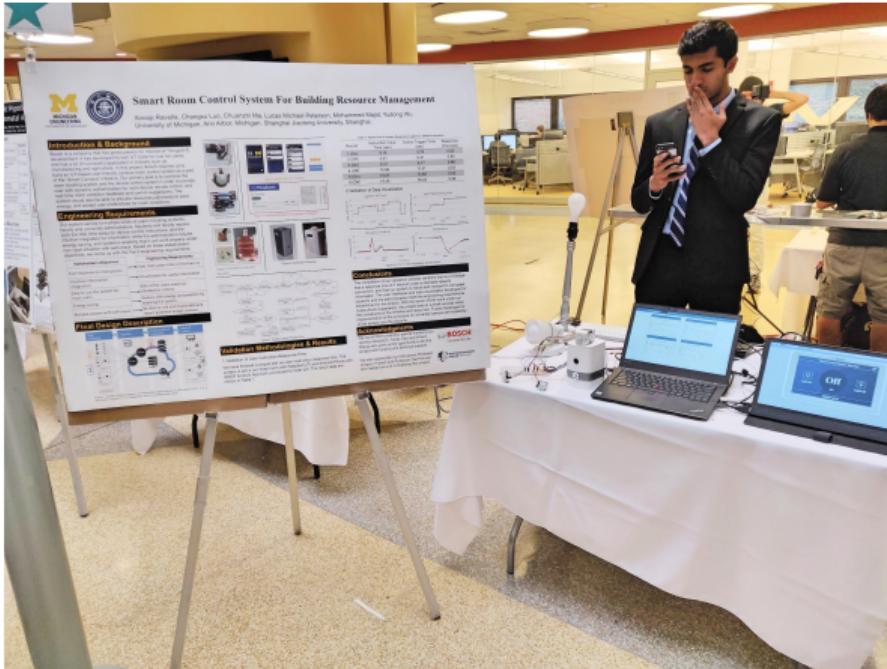


Figure: Project Expo at UMich

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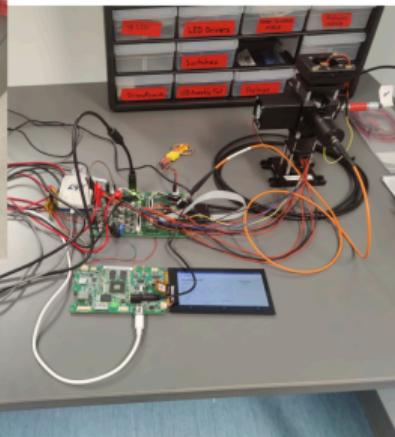
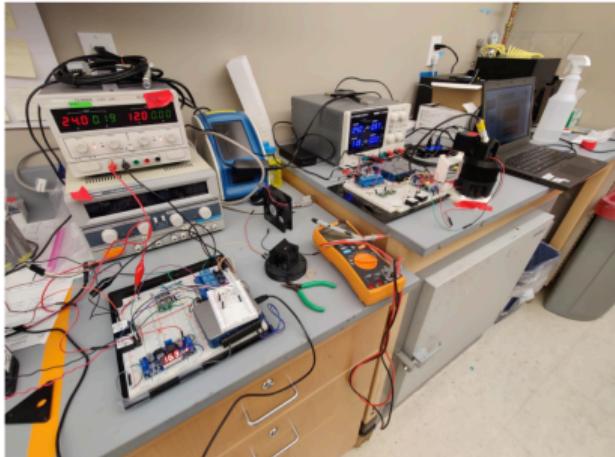


Figure: Prototypes developed at Rover Diagnostics

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What is Cloud?

At Google, I've worked for two teams:

- 1 Assistant and Search(internship, Google Assistant Feature Development for Google Home)
- 2 Google Cloud Platform(current position, GCP Networking Release Qualification Framework)

No worries, you don't have to understand my work now 😊

(and I am not able to show you any details 😊, but wait for the second session for the Cloud ice-breaker!)

STEM?

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“What is STEM?”

STEM?

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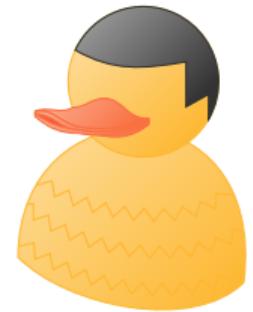
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“What is STEM?”



“I am glad you asked!”

STEM? Cont.

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What is Cloud?

STEM

Science, technology, engineering, and mathematics(STEM), a term to group together these academic disciplines¹.

And if we name some of those disciplines(with the narrow definition²)

- Science: Physics, Chemistry, **Computer Science**, etc.
- Engineering: **Electrical Engineering**, Computer Engineering, Mechanical Engineering, etc.
- Mathematics: Mathematics

¹ <https://fas.org/sgp/crs/misc/R42642.pdf>

² In a general definition, all these disciplines can be a form of science, such as Formal Science(Math), Natural science(Physics, Chemistry), Applied science(Engineering)

STEM? EE? CS?

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What is Cloud?

Relations of Science, Technology, Engineering, and Math (with the narrow definition)

- 1 Math is the language for describing science(study of the natural world).
- 2 Engineering is the systematic and iterative approach to the human applications of science.
- 3 Technologies are those applications.

STEM? Cont.

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“Let's see an example technology, say Wi-Fi”

STEM? Cont.

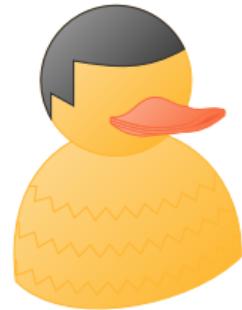
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“What's Wi-Fi?”

Wi-Fi

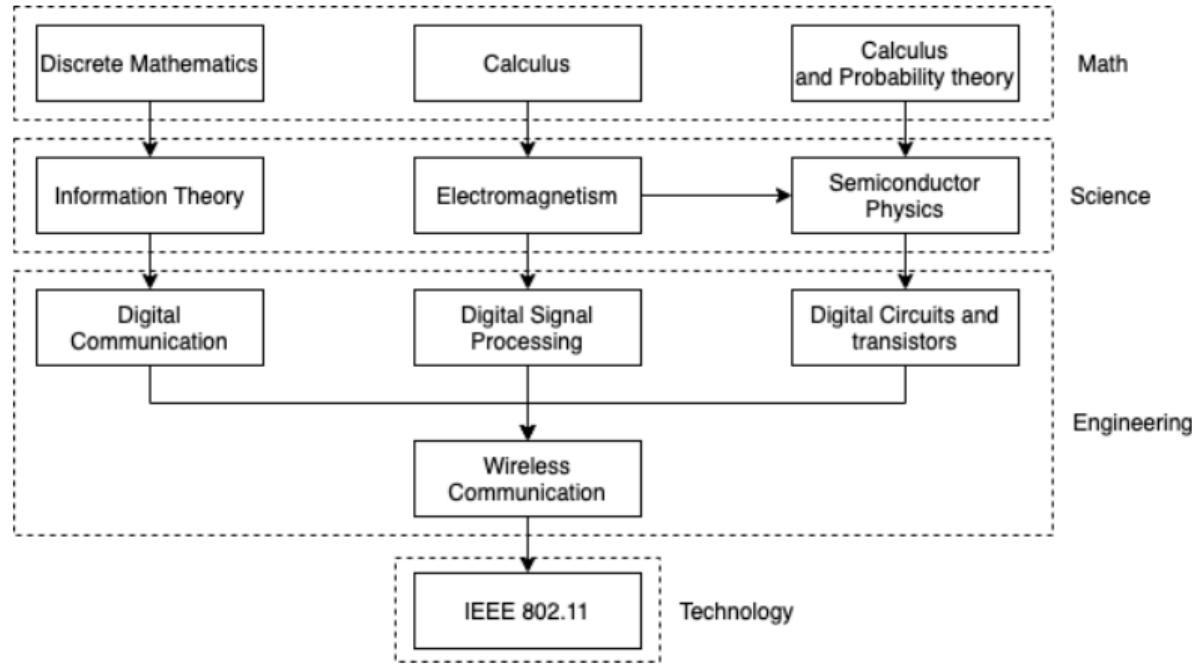
- A family of wireless network protocols, based on the IEEE 802.11 family of standards.
- Allowing nearby digital devices to exchange data by radio waves.

A VERY brief overview for Wi-Fi knowledge stack

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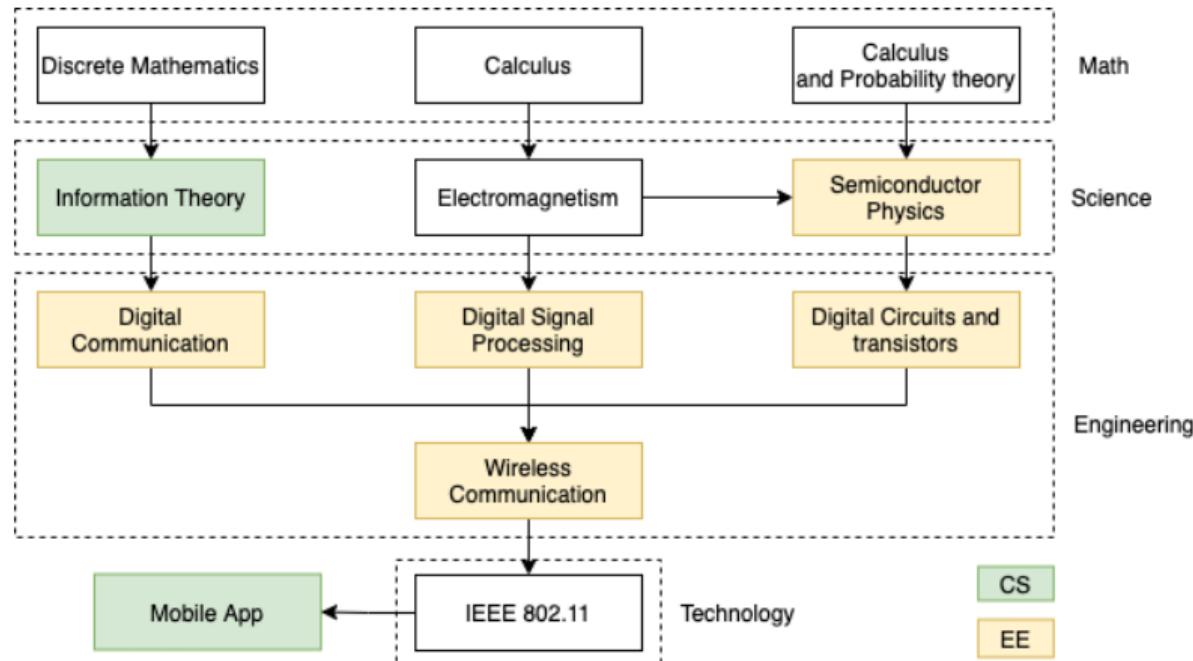


A VERY brief overview for Wi-Fi knowledge stack, Cont.

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EE, Overview by Phrases⁴

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Electrical Engineering

Study, design and application of equipment, devices and systems which use electricity, electronics, and electromagnetism.

- Computer Engineering(often an individual discipline nowadays)
- Automation and Control
- Power and Energy
- Electronics
- Telecommunications
- Signal Processing
- Optics and Photonics ³

³ I simply copy them from Wikipedia, not a strict catalog.

⁴ If you want to have a more details among which courses should you expect to take in EECS, visit the curriculum map at <https://ocw.mit.edu/courses/mit-curriculum-guide/>

CS, Overview by Phrases

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Computer Science

Study of algorithmic processes, computational machines and computation itself⁵.

- Theoretical computer science(Computation Theory, Information and coding theory, Data structures and algorithms, Programming language theory and formal methods, etc.)
- Computer systems and computational processes(Artificial Intelligence, Computer architecture and organization, Concurrent, parallel and distributed computing, Computer networks, Cryptography, Databases, Graphics, etc.)
- Applied computer science(computational science, finance and engineering, software engineering, social computing and human-computer interaction, etc.)

5

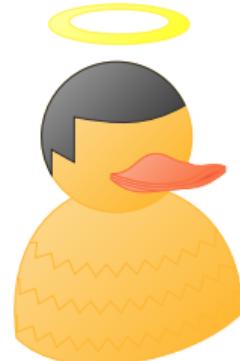
<https://www.cs.york.ac.uk/undergraduate/what-is-cs/>

The Magic of EECS

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“Magic!”

To me(as well as many others), the magic of EECS is that for the first time in human history, it frees us from following the restriction of physical laws and allows us to create and present the logics that is never seen before(just think about any video games!), and applies the logics that can be proved before(for math development).

And as a student in EECS, you can be part of the magic!

The Magic of EECS⁶

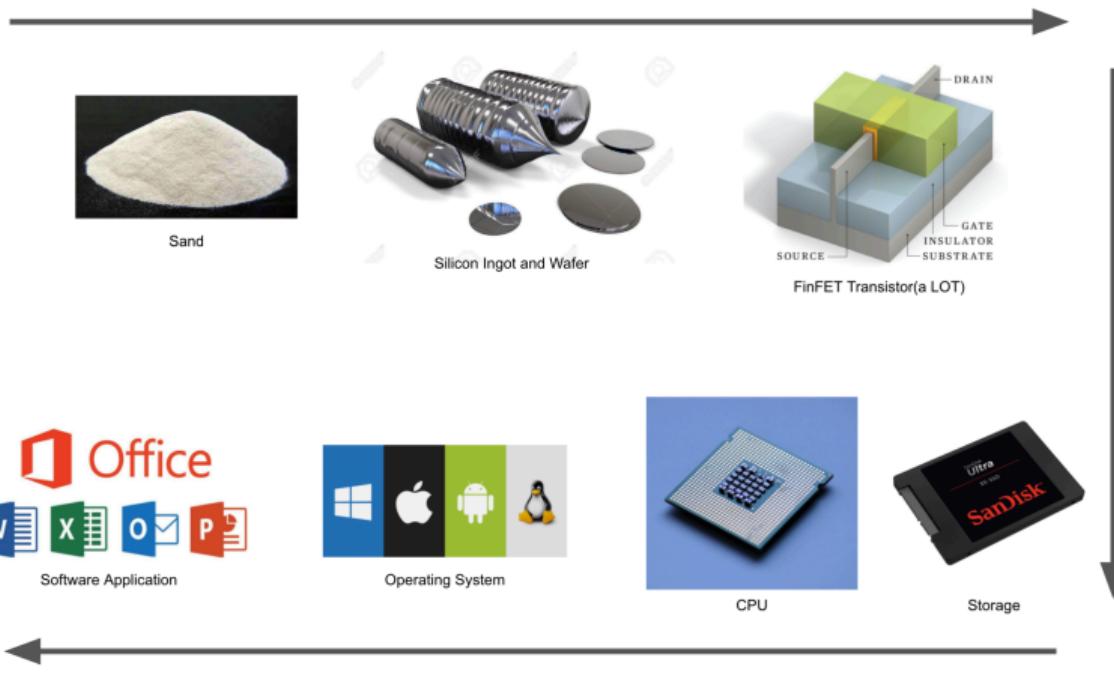
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⁶ I found a great video made by Intel for the introduction of making a microchip: https://www.youtube.com/watch?v=_VMYPLXnd7E

Why EE? Why CS?

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In EE, you can learn how to manipulate the electrics physical laws and how it grows until something that can bear pure logics(Sand→Instruction Code, Signal→Digital Data).



```
1 def main():
2     print('Hello world!')
3
4 if __name__ == '__main__':
5     main()
```



In CS, you can then learn to extend this logic and make system that is large-scale, complex, based on the human logic laws(system interfaces) instead of physical laws.

Why EE? Why CS?

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What is Cloud?

Of course, this is not the whole story, since EE and CS are considered together in so many ways. Just name two:

- The signal processing requires complex algorithms and computer science theories, and before applying all the fancy artificial intelligence algorithms, it is better for you to understand what is happening in the physical world.
- Programmer needs sophisticated understanding on hardware in order to get the best software performance. For beginners, you may feel like the resources on a system is unlimited, unfortunately, they are limited⁷.

7

This is a hard job which is pursued by a lot of advanced software community like operating system, scientific computing, and programming languages communities.

Why EE? Why CS?

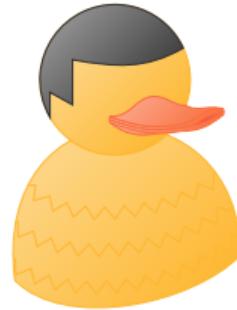
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“This is a good time!”

Thanks to the development of computation hardware and open-source communities, we have prototyping hardwares and software tools that are highly accessible.

Resources to Get Started!

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Prototype Hardware

- Arduino
- Raspberry Pi

Workstation

- Any personal device with a browser⁸!(thanks to the cloud services)

What Language to Learn

- TL;DR, Python, or follow your course instructors

⁸ Maybe also a USB port.

Recourses to Get Started! Cont.

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Documents

- Go to your target's official website and follow the tutorial.
- Search engine is powerful.

Sites you want to know as a beginner

- github.com
- colab.research.google.com, run Python notebook on cloud freely
- codepen.io, front-end dev playground

Recourses to Get Started! Cont.

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“And feel free to reach out me!”

changxu.luo@columbia.edu

What is Cloud? Taking Cloud Gaming as an Example

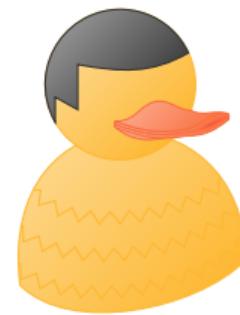
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“Anyone heared of Cloud Gaming?”

What is Cloud? Cont.

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What is Cloud?



Project xCloud



PlayStation™ Now



GEFORCE NOW™



STADIA

What is Cloud? Taking Cloud Gaming as an Example

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As a normal consumer(gamer), what is different with the cloud gaming service?

Without Cloud Gaming

- You buy a PS5/gaming PC.
- You buy and download Celesta.
- You start playing Celesta and the game(computation) is running mainly on your local machine.

With Cloud Gaming

- You have a machine with Chrome.
- You buy Stadia membership.
- You start playing Celesta and the game(computation) is running mainly on Google's service with the video data streaming to your machine.

What is Cloud? Taking Cloud Gaming as an Example

Cont.

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As a (normal)gamer, what is your main purpose?

- ✗ Maintain and upgrade your hardware.
- ✗ Save, load, and maintain gaming data manually.
- ✓ Play the game(have the accessory input and get visual/sound feedback).

Cloud gaming maintain the most expensive hardware and backup data for you and let you focus on the game itself⁹.

⁹

Current cloud gaming services still have their problem like the requirement to the networking conditions, but they also have other benefits as a cloud services

Cloud for Developer

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What is Cloud?

Now let's say you are a developer, what is your main purpose?

- ✗ Maintain and upgrade your hardware and infrastructure(server, networking, data center place, etc.)
- ✗ Maintain your business data manually(backup, recover, anti-hacking)
- ✓ Implement the business logic¹⁰ for the application and get the things done.

Cloud services maintain the infrastructure for you(with a lot of helpful services like load-balancing, authentication, and data storage etc.) and let the developer focus on their application's business logic.

¹⁰

Just think of business logic as the normal application logic, i.e., the code you write

Cloud for Developer

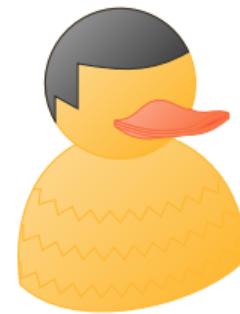
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“Anyone with experience of developing on Cloud?”

Cloud for Developer

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Google Cloud

DEMO

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What is Cloud?

Rambling

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What is Cloud?



“Enjoy your hackathon!”

- Demo is fun and easy, research and production are hard, but try to keep your passion.
- If you want to go STEM, or even go EECS, try to find what's your passion among hundreds of subfields. Go broad, and then go top.
- Start your project now!

Q&A

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“Ask me anything”

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