Canonical Written Interview

In this document, I review my life from when I was 16 years old in 2008 until 2024, and I think about the signs of the future. After you read this document, you will understand me well.

This document was based on my personal experience and ordered by date. There are four sections: Early Education, Career Experience, Present Situation and Future Perspective. I hope you can enjoy reading it.

But if you want to check the Question and Answer quickly and efficiently, please jump to the "Question and Answer List." I put the navigator link to help you find the answer quickly.

Early Education

Academic achievements obtained at school

High School

My first challenge came from my high school entrance exam. Under the "Hukou"(户口) system, getting an offer from Shanghai High School was difficult since my birthplace was not in Shanghai. The "Hukou" system is China's household registration system, tying access to local services like education to one's birthplace. Non-local people can't access the foundation server, such as education and retirement security.

After a struggling seeking process, I was admitted to a private high school. Since my high school's purpose is to provide education for non-local students, they find it hard to get enough resources to support their education process. But it didn't bother me too much. I established a good relationship with my high school teachers, learned considerable knowledge from them, and achieved satisfactory results in the university entrance examination.

I was one of the top five in my High School. My mathematics and Mandarin courses were the top ones in my class. As one of the few students who got an offer from the university in my High School, my University Entrance examination result was 484 points. For context, Since 1985, Shanghai has used a different scoring system and test papers in the university entrance examination compared to other provinces. The maximum score is 630 points, and in 2011, the admission score for the university entrance examination was above 393 points. In 2011, about 19.70% of students in Shanghai scored higher than 462 points. 1, 2

My high school experience taught me if there is a wall between me and the target, I should try to climb it. If I fail, try again.

University

Based on my interest in automation at that time, I chose mechanical design, manufacturing, and automation as my major. I applied to three universities far away from Shanghai, located in the north and northwest, as I wanted to learn not only academic knowledge but also a different culture.

My university is in the top 100 of 2820 universities in China. In addition to its ranking and location, I also like that it is a comprehensive university, which means that I can not only learn scientific knowledge but also be exposed to various literature and philosophy. For example, the debate competition in which I actively participated.

My results and performance during university can be reflected in my Graduation Project. In my second year, my tutor was unable to find suitable candidates from among his graduate students to participate in his project on metal 3D printers. I recommended myself, and with my extracurricular competition experience in high school, I became a member of his team, responsible for microcontroller control and sensor debugging. I used the control algorithm part of it as my graduation project. I got 91 points out of 100, and my GPA was 8.73 in the final term; the maximum is 10 points.

My interest in embedded systems also started from that project. My skill in C language was practised well, and I grabbed a lot of basic hardware knowledge.

Extracurricular achievements obtained at school

China Adolescents Science & Technology Innovation Contest

From 2006 to 2008, I found a fairer platform to present my ability than the high school entrance exam without local or no-local bias. I attend CASTIC, one of the biggest national science competitions in China.

My topic is *The herbicidal and bacteriostatic effects of Solidago canadensis*. As the background, Solidago canadensis is an alien species in Shanghai; it has a great competitive advantage over native plants in Shanghai and China, causing society to spend a lot of money on the removal of it. However, if we can find its commercial value, then we can recover part of the cost.

I started the personal research in my final year of junior high school in 2006, and I got help from my teacher from junior high school, who helped me contact a professor at Shanghai University and lent me the Sterile laboratory. My teacher and I established multiple control groups and finally found that its extract would cause the roots of other plants to shrink and hinder the growth of mould colonies at a certain concentration.

It won the first prize in Shanghai in 2007 and won the third prize in China in 2008. The skills I learned here, such as problem-solving, perseverance, and the courage to try, stay with me.

Travelling

As a hobby, I travelled a lot during my high school and university vacations. I learned about different cultures and social situations from all over China deeply. I spend a lot of time in the most underdeveloped areas of China, such as Xinjiang, Qinghai, and Tibet.

Those experiences sharpened my attributes with an open mind and empathy. Also, in high school, that vivid story helped me become a passionate speaker; I believe my high school peers still remember my speech and how impressed they were.

A Campus Newspaper Reporter

From 2011 to 2012, I was a reporter for the campus newspaper at my university. I followed up and reported the university's canteen safety and hygiene improvements. The difficulty lies in how to collect real information and successfully publish it under strict supervision.

I have made incredible friendships, and we are always in touch now.

University Debate Contest

I participated in the newbie's debate contest as the first speaker in my first university term. I consistently participated in the university debate during my second term. In that term, my team won the third prize.

I was elected as the debate team leader of the Manufacturing College of my university and switched my position to conclusion speaker when I was a Sophomore. We defeated the teams of Journalism College, Spanish Language College, Computer Information College and Philosophy College. We lost the game with Law College and won second place.

During the debate contest, our team had moments of high morale but also experienced downturns under great pressure. Those stresses came from other top priorities, an unfavourable topic for us or losing a game. As a team leader, I encouraged my team members in two ways: Firstly, I showed my attitude, hard work and perseverance. Second, I believe we will activate our potential when we want to achieve self-target. I encourage them to find the various target for themself, not only to win the contest. Some want to show their gifts in speech, some like to practice their verbal skill, and some value our team's friendship.

Summary of Early Education

I have achieved substantial achievements during my education years, such as the control algorithm part of my tutor's project, and won awards from various contests. However, I value more the personal qualities that education has helped shape in me. These qualities have helped me to overcome challenges during my career.

Career Experience

During my 7 years of experience, I have developed various systems. Based on the Canonical written interview questions, I listed 3 projects in order by date.

I described the details of the project at the start of each section and the list of my responsibilities after that.

Android Audio Systems

My software engineering career started in embedded Linux. I was an Android Audio System engineer in my first company. My responsibilities were configuring, adjusting and debugging audio systems based on the Qualcomm platform. Since Qualcomm provided detailed documentation and completed codes, its learning curve is smooth, and that position allowed me to learn a wide range of technologies:

1. Linux Device Tree: I need to enable and select the correct audio system modules
2. Advanced Linux Sound Architecture: I need to debug and develop the audio device based on it.

3. I2S, I2C and SPI: Those peripheral buses are used in most audio devices
4. The audio component of the Android Hardware Abstract Layer (HAL): It is a middleware layer between the Linux driver and user space, written in C++. I need to debug it to support our application developer.
5. Basic audio noise cancellation principles: I need to measure audio performance in a noise-cancelling room, including external amplifiers, headphones and noise cancellation and use the software provided by Qualcomm to adjust the effect.

The Solid-state drive Controller Firmware

This project came from my third company, an enterprise store solution with hardware compress. This makes it quite complex and has a low tolerance for errors. Its firmware code is based on the ARM A55 without an operating system to exclude the additional overhead caused by thread switching. We developed it based on C++.

1. I developed algorithms for garbage collection and were-levelling
2. I was involved in the hardware design verification and finished the verification for the Coherence Hub Interface (CHI) and the Direct Memory Access (DMA) module.

The Unit Test Code System

I want to highlight the unit test code system of this SSD controller firmware. Because of the low tolerance for errors, we decided to develop a simulator for our hardware. Based on that simulator, we can make mock data and build a special situation to test our firmware. Furthermore, in order to test our simulator, we developed a set of unit tests, which we also used in the hardware design verification.

1. I developed the simulator module for the CHI module and the DMA module.
2. I developed the unit test of the CHI and DMA modules, and as a result, I successfully located a coherence problem between DMA and Arm Advanced High-performance Bus (AHB) in our FPGA prototype.

AI Accesstor

The production of my last company is an enterprise AI Accesstor card for Linux servers. As a startup company, when I joined it, we faced an extreme human source shortage. Therefore, I took on multiple roles:

1. I designed and coded the Linux PCIe driver.
2. I designed and implemented the firmware of the PCIe controller. That firmware is bare-metal on a RISC-V chip.
3. I address and improve the software performance, including the PCIe driver, PCIe firmware and AI compiler.
4. I provided and implemented the Python APIs for the QA team to test the firmware and driver.
5. I provided and implemented the APIs for the K8S team for the virtualization function.

Address and Improve the Software Performance

I did a lot of work related to software performance for the last company. I would take different steps in both cases: Based on Linux or bare-metal.

Based on Linux, Linux offers complete toolchains for us. I would first use the command `perf` to record the stack trace information, then use the Flame Graph to analyze it.

Based on bare-metal, it would be more complex. In most situations, I will add some logs and print the time stamp to try to address the hot point. In some situations, it is too hard to localize the hot point. I will try to review the code and the git history. Then, I expect I can figure out which commit led to this performance issue.

Package the driver and middleware layer for the QA team and K8s team

We didn't share the source code with the QA team and K8s team. Instead of that, we package our driver and middleware layer into `.deb` file and `.rpm` file. I was involved in configuring GitLab's CI pipeline for that.

Topics outside the project

How do you think about and ensure quality in your software products?

There are two aspects to the "quality of software products". First, code robustness. My ultimate answer is "completely, automatically unit test." Second, code readability and maintainability. It's harder than the previous one. I believe the deliberate architecture, code refactoring, proficient programming skills and complete documents will help us achieve that goal.

How do you prefer to drive documentation for your products?

I have gone through multiple teams that had different documentation processes. But no matter what kind of documentation process they use, they all face the problem of documentation decay.

I personally have a good habit of recording the results of my work every day at the end of the day. This process helps me in many ways, including self-reflection, time management, and document writing. It will help me to figure out which document I need to update and provide detailed materials.

It also helped me complete this detailed written interview.

Programming Language

My C software development experience was described above, except for *The Solid-stater drive Controller Firmware*, which was developed in C++. I'm proficient in C. For C++, I was familiar with C++11.

I am familiar with Python but haven't used it in enterprise projects. I only use it as a convenient tool. I learned the various Python libraries such as Numpy, Django and Panda.

I understand the Golang by being self-taught.

Other languages which I can use include Java, Javascript, Kotlin, and Swift.

What interesting syscalls are used by the “uname” binary? How did you find out?

There are three ways that can be considered:

1. `strace`: We can use this command to record system calls.
2. Modify the kernel log print level, then read the log from `dmesg`.
3. The `/proc/$pid/` also can tell us a lot of information.

Summary of Career Experience

Throughout my career, I developed some embedded software systems, including the USB/PCIE Linux driver and firmware of AI Accesstor/storage devices. This has allowed me to develop a versatile skill set, which includes proficiency in C/C++ language, Linux driver layer, and high-speed bus protocol. Additionally, my background in hardware verification, specifically verifying PCIe PHY, SSD controllers, and the DMA module at USB PHY, has given me a solid foundation in computer architecture.

After seven years of intense career, I felt like I was looking for a gap year for myself. During the gap year from 2022-9 to 2023-4, I constantly reflected on my past experiences and searched for the goals I truly wanted in my heart.

With curiosity about the wider world, not just technology but also culture and language, and a desire to become a global citizen, I applied for a post-degree at a Canadian college.

Present situation

Study in Application Development

I started pursuing my post-degree at college in Canada in May 2023. The application development course expands my knowledge domain, especially in UI design and development.

The complexity of UI development comes from two aspects: one is user interaction, and another is computer science. The front-end engineer did a lot of work to reduce the complexity, which really impacted me, especially the declarative programming framework and using the compiler to improve the performance.

This journey satisfied my curiosity in many ways, not only in technical skills but also in different cultures and languages.

I'm in my last term now. In my first term and my second term, I got a GPA of 4.08 and 4.1, with a maximum of 4.2.

Next to Learn

There are some new skills I want to learn:

1. Proficient in Rust language. Since the Linux kernel Officially supported Rust in 2022, proficiency in it will be necessary. I've been learning about it for a while now and plan to start using it in personal projects later in 2024.

2. Grab VHDL or Verilog. Hardware description language will boost my ability in the embedded system domain.
3. Seeking the project manager measure. I think the project manager can be used not only in the team project but also in achieving personal goals.

I believe most obstacles in the world are just a door, not a filter. If we observe, think, keep trying, and follow the plan step by step, we can find a way to open the door.

Career Development

During the 7 years of a tight career, my software experience spans multiple embedded projects, and I play multiple roles in some of them. My curiosity drives me to explore a wider range of areas. And my qualities help me overcome those challenges successfully again and again.

All of the above helped me to sharpen my strengths as a software engineer:

1. Proficiently C programming skills.
2. Understand multiple Chip Architecture. Arm, MIPS, RISC-V.
3. Solidly embedded knowledge.
4. Strong problem-solving ability. I'm good at finding solutions to current problems from multiple fields.
5. Excellent communication and document skills, which are shown in this document.
6. Self-management, self-motivation, never giving up, and curiosity. This is my ultimate competitiveness.

My proudest success, for now, is designing and implementing the data path of an AI accessory card in my last company. It's simple and efficient.

In the next five years, I hope that I can continually explore my interests in the software field as much as possible and become an expert in the embedded field within ten years.

Future Perspective

Open source

I was involved in a task that followed up and pushed drivers of the BSP group upstream into the Android kernel branch at my second company.

I developed a background process for `vim-autotag` and sent a pull request.

During my university, I submitted some issues for the Marlin project and wrote some Chinese blogs to introduce it to Chinese 3D printer enthusiasts.

I was involved in open-source software that could publish my course schedule. I implemented the spider part in Python.

Canonical and I

I appreciate Canonical's contributions to open-source software.

Additionally, I think the Ubuntu Core has great significance in the embedded domain. Embedded development will always be considered a long research and development cycle and high investment. Because of the diversity of hardware devices, embedded engineers need a lot of hardware knowledge. All of these prevent the development of embedded ecology. If the Ubuntu Core can provide a platform that handles the details of the hardware and makes application development easier, it will greatly promote the development of the entire embedded field.

I hope I have the honour to join that group.

Canonical and competitors

Based on the position I applied for, I think we can focus on discussing the Ubuntu Core. From my understanding, the goal of Ubuntu Core is to provide an application development environment. The low-level hardware detail will be handled by Canonical. This is different from some embedded system providers, such as FreeRTOS and VxWorks. Their purpose is to provide a framework to help customers handle the low-level hardware detail.

Based on the above understanding, I listed Ubuntu Core's competitors as follows:

1. Wind River Linux, Yocto Project and Linux distributions of each equipment manufacturer

   They are our fiercest direct competitors. They have advantages in customized equipment. The advantage of Ubuntu Core is a more convenient application development environment, especially the `Snap`. I suggest two options to win the competition.

   1. Broaden the range of hardware supported by Ubuntu Core.
   2. Respond proactively to the needs of our partners.

2. FreeRTOS, VxWorks, Zephyr and bare-metal firmware

   Ubuntu Core was limited by Linux, which can not run on some platforms that they can. But in other situations, our potential customers may select them because of concerns about the performance.

   1. Ubuntu Core can provide performance debugging tools that are more suitable for embedded systems.

3. The QNX system of BlackBerry

   BlackBerry consistently reinforces the advantage of the QNX system in the Automotive Embedded System domain. To win that race, Ubuntu Core should:

   1. Enhanced support for automotive sensors, such as radar distance sensors.

4. Android

   Android is worth learning in the field of application development environment. They have powerful development kits, Android Studio, and complete application markets.

   1. Ubuntu Core can launch an Easy-to-use development kit.

In summary, Ubuntu Core can be enhanced from two aspects: Working closely with partners to add support for different hardware and providing more kits for application development, such as performance debugging kits and UI development kits.

Question and Answer List

Experience

- Describe a skill or knowledge you acquired recently that has been impactful for you. Why did you make this investment? What has the outcome been?
    - Study in Application Development
- What new skill would you like to learn? Why do you think this is important or timely or interesting? Why do you think you will be good at it?
    - Next to Learn
- Describe your experience as a developer on embedded Linux.
    - Android Audio Systems
    - AI Accesstor
    - I developed the USB driver for the WIFI chip at my second company, which I considered a repeat of the above two projects since I didn't describe it in detail.
- Describe your experience with Linux kernel development and debugging.
    - Android Audio Systems
    - AI Accesstor
    - I developed the USB driver for the WIFI chip at my second company.
- Describe your experience of low-level boot processes and BIOS / firmware.
    - The Solid-state drive Controller Firmware
    - AI Accesstor
    - I developed the audio data path for a headset project at my second company based on Zephyr.
- How do you address software performance in your coding practice?
    - Address and Improve the Software Performance
- How do you prefer to drive documentation for your products?
    - How do you prefer to drive documentation for your products?
- How do you think about and ensure quality in your software products?
    - How do you prefer to drive documentation for your products?
- Describe a case where it was very difficult to test code you were writing, but you found a reliable way to do it.
    - The Unit Test Code System
- Describe your C/C++ software development experience to date. How would you rate your competency with C/C++?
    - Experience:
        - Android Audio Systems
        - The Solid-state drive Controller Firmware

        - AI Accesstor
        - I developed the USB driver for the WIFI chip at my second company.
        - I developed the audio data path for a headset project at my second company based on Zephyr.
    - Rate my competency with C/C++
        - Programming Language
- Describe your experience in Golang and Python.
    - Programming Language
- Which Linux middleware/user space stacks are you the most familiar with? For example gstreamer, libinput, audio subsystems etc
    - Android Audio Systems. The Android Hardware Abstract Layer can be considered as Linux middleware.
- What interesting syscalls are used by the “uname” binary? How did you find out?
    - What interesting syscalls are used by the “uname” binary? How did you find out?
- Have you created .deb or .rpm packages? Please describe your experience with Linux packaging.
    - Package the driver and middleware layer for the QA team and K8s team
- What kinds of software projects have you worked on before? Which operating systems, development environments, languages, databases?
    - Projects:
        - Android Audio Systems
        - The Solid-state drive Controller Firmware
        - AI Accesstor
        - I developed the USB driver for the WIFI chip at my second company.
        - I developed the audio data path for a headset project at my second company based on Zephyr.
    - Operating system:
        - All of them I worked on Ubuntu Desktop Operating System
    - development environments
        - My commonly used development tools are multiple versions of GCC, vim, GDB, jlink and qemu/KVM.
    - languages
        - Most are in C, and one is in C++ (The Solid-state drive Controller Firmware).
    - databases
        - SQLite

Education

- How did you rank in your final year of high school in mathematics? Were you a top student? On what basis would you say that?
    - High School
- How did you rank in your final year of high school, in your home language? Were you a top student? On what basis would you say that?
    - High School
- Please state your high school graduation results or university entrance results, and explain the grading system used. For example, in the US, you might give your SAT or ACT scores. In Germany, you might give your scores out of a grading system of 1-5, with 1 being the best.
    - High School
- Can you make a case that you are in the top 5% in your academic year, or top 1%, or even higher? If so please outline that case. Make reference where possible to standardised testing results at regional or national level, or university entrance results. Please explain any specific grading system used.
    - High School
- What sort of high school student were you? Outside of class, what were your interests and hobbies? What would your high school peers remember you for?
    - China Adolescents Science & Technology Innovation Contest
    - Travelling
- Which university and degree did you choose? What other universities did you consider, and why did you select that one?
    - University
- Overall, what was your degree result and how did that reflect on your ability? Please help us understand the grading system for your results.
    - University
- During all of your education years, from high school to university, can you describe any achievements that were truly exceptional?
    - China Adolescents Science & Technology Innovation Contest
    - University
    - University Debate Contest
    - Summary of Early Education
- What leadership roles did you take on during your education? Did you conceive of, and drive to completion, any initiatives outside of your required classwork?
    - University Debate Contest

Career development

- How would you describe your experience as a professional software engineer?
  - Here is a concise answer to this question: Summary of Career Experience. For details, please review the section: Career Experience.
- What are your strengths as a software engineer?
  - Career Development
- What is your proudest success as an engineer?
  - Career Development
- What would you like to achieve in your career and skills development?
  - Career Development

Context

- Are you involved in maintaining or developing open source software projects?
  - Open source
- Why do you most want to work for Canonical?
  - Canonical and I
- What do you think Canonical needs to improve in its engineering and products?
  - Canonical and competitors
- Who do you think are key competitors to Canonical? How do you think Canonical should plan to win that race?
  - Canonical and competitors