

Virginia Tech CS Ph.D. Opening 2023 Spring/Fall

Prof. Huaicheng Li

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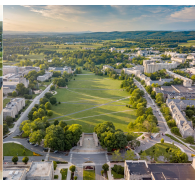
About Prof. Huaicheng Li



- Wuhan Univ. (BS), UChicago (PhD), CMU (Postdoc), Virginia Tech (Assistant Professor)
- **Research areas:** Operating Systems, File/Storage Systems, Computer Architecture
- **CV:** <https://huaicheng.github.io/cv.pdf>
- **Publications:**
 - Papers at top-tier conferences/journals, such as SOSP, ASPLOS, FAST, TOS, etc.
 - DBLP (<https://dblp.org/pid/197/7182.html>),
 - Google Scholar (<https://scholar.google.com/citations?user=PxZlXpkAAAAJ>)
- **Research theme**
 - Design and build novel computing systems for emerging storage/memory hardware (e.g., SmartSSDs, SmartNICs, DPUs, CXL, ZNS, etc.) for improved performance, efficiency and programmability.
- **Research impact**
 - **Best Paper Award** (SYSTOR'22), two **Best Paper Nominations** (FAST'17, '18)
 - LeapIO (ASPLOS'20) was **deployed** in Microsoft datacenters
 - MittOS (SOSP'17) findings have been partially merged to the Linux kernel
 - Developer and maintainer of [FEMU](#) (FAST'18), one of the most popular storage research platforms, which has been widely used by the research community

About Virginia Tech (VT) CS

- VT CS has a strong presence in the Systems area
 - [USNEWS 2022 Rankings](#):
 - CS Overall (#38), Systems (#26)
 - [CSRankings](#): CS Overall (#51), Systems (#35), **Operating Systems (#14)**
- VT CS PhD Program
 - Application deadline: <https://cs.vt.edu/Graduate/ApplicationDeadlines.html>
 - PhD students are fully-funded (\$2300-\$2600 monthly salary, tuition waived)
 - Please contact Prof. Li for more details
 - VT graduates are successful in both industry and academia
- VT Life
 - Blacksburg: <https://cnre.vt.edu/student-experience/life-in-blacksburg.html>
 - Beautiful campus: <https://www.apps.admissions.vt.edu/virtual-tour/VTTOUR.html>
 - We are moving to a new CS building in March 2023



Requirements for prospective students

- Interest in low-level systems, *e.g.*, experience with open-source projects such as Linux kernel is a plus, but not required
- Persevere/Self-motivated (Will you easily give up when facing challenges?)
- Systems skills
 - C/C++/Rust programming in Linux environment (one is enough)
 - Python/Bash for task automation
 - Knowledge about OS principles, OS/hardware interactions (If you have take a course similar to "[Introduction to Computer Systems](#)", you should be fine)
- Prior research experience (optional)
- Spoken/written communication skills in English

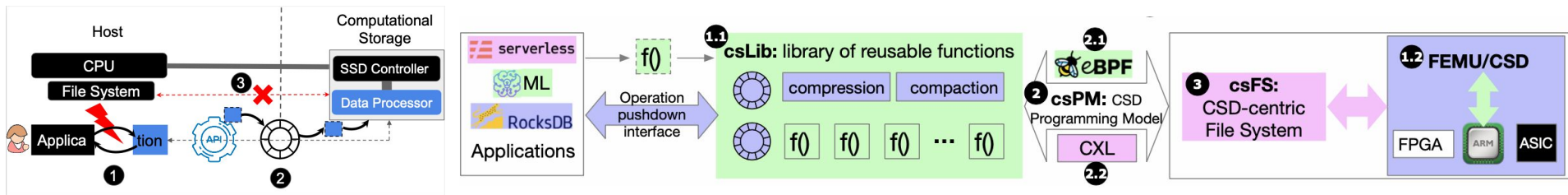
Are you interested? How to Apply?

- Fill in this application form: <https://forms.gle/F5hMwKwbAkuLCgJLg> (*Google account needed*)
- Or directly email Prof. Li (huaicheng@cs.vt.edu) the following materials
 - Your **CV**
 - Your **transcript** (unofficial one is fine)
 - Your **GPA and ranking**
 - One paragraph to briefly describe your research interests: (1). why you're interested in Systems research? (2). what systems skills do you have (or plan to acquire) for Systems research? (3). what research topics do you plan to work on?
 - [optional] One paragraph to briefly describe your understanding of my research: Which paper of mine interests you most and why? What are the pros and cons of this paper? How do you plan to improve it?
 - [optional] Your open-source code/project/contributions (if any)
 - [optional] One paragraph to describe your unique strengths

Some example research projects

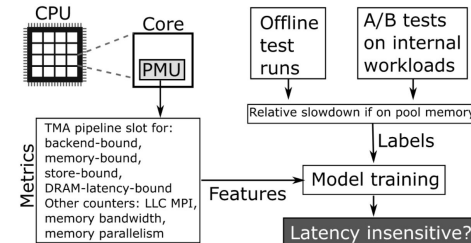
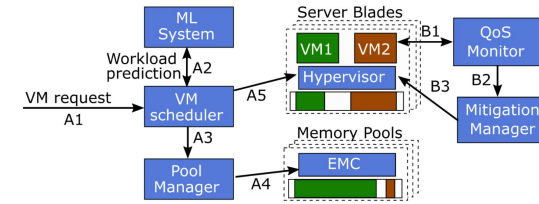
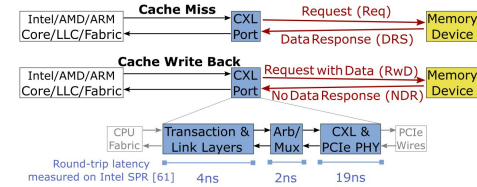
Project #1: Computational Storage (CSDs/SmartSSDs)

- SmartSSDs/CSDs (*computational storage devices*) are promising
 - **Better performance** via hardware acceleration (e.g., ARM, FPGA)
 - **Improved resource efficiency**, via reduced data movement between host and storage
- How to leverage SmartSSDs for workload acceleration?
 - Understanding the requirements to ensure the benefits of offloading tasks to device
 - Designing efficient host-device communication and programming interfaces
 - Efficient host-device cooperation to reduce data movement
 - Offloading support for complex storage functions without application redesign
 - Efficient I/O Path for Computational Storage
- **Background/Areas:** *Storage/File/Operating Systems, Computer Architecture, ML*



Project #2: Datacenter Memory Management

- DRAM in cloud datacenters
 - ~**50%** of server cost for Microsoft, Google, Amazon, etc.
 - Severely underutilized (Up to **25%** stranded DRAM)
- Memory pooling design for resource efficiency
 - Can we achieve both native/local memory performance and cost-efficiency for cloud platforms?
- How to leverage new memory interfaces (CXL) for efficient memory pooling?
 - Require full-stack memory pooling design across hardware, OS-level system software and distributed system layers
- **Background/Areas:**
 - *Operating Systems, Cloud Computing, Computer Architecture, ML*



Project #3: Zoned Storage Management

- ZNS is an emerging type of storage with
 - a new zone interface, disrupting the traditional block interface
 - new management schemes/constraints to allow direct flash access
- With ZNS, we need to rethink storage system designs
 - How should we restructure reliability traditionally guaranteed by redundancy (e.g., RAID)?
 - How should we manage disaggregated storage on remote server to reduce data movement?
 - How can modern data-intensive workloads benefit from ZNS with minimal changes?
 - What are the security implications of ZNS storage?
- **Background/Areas:**
 - Operating systems, networking, flash storage, SSDs

