



Rusty Linux: Advances in Rust for Linux Kernel Development

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BOISE STATE
UNIVERSITY

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RQ1: Existing
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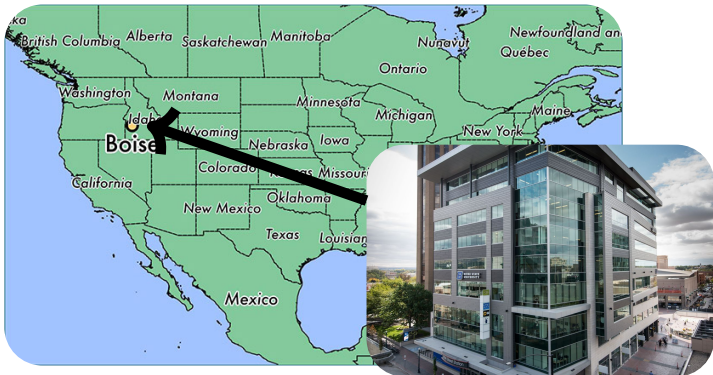
RQ2: Performance
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Boise State University

The Computer Science Department is located in Beautiful downtown Boise Idaho, United States!



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We aim to find the current advances in using Rust in Kernel development to reduce the number of memory safety vulnerabilities in one of the most critical pieces of software that underpins all modern applications.

► Paper Link

Figure: A rusty computer¹



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¹AI Prompt: A rusty computer with a penguin next to it



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- **RQ1:** What are the existing approaches for implementing operating system kernels in Rust?



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- **RQ1:** What are the existing approaches for implementing operating system kernels in Rust?
- **RQ2:** What are the performance implications of using Rust for operating system kernel development?



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Questions?

- **RQ1:** What are the existing approaches for implementing operating system kernels in Rust?
- **RQ2:** What are the performance implications of using Rust for operating system kernel development?
- **RQ3:** What are the major challenges and limitations when developing operating system kernels in Rust?



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Questions?

- **RQ1:** What are the existing approaches for implementing operating system kernels in Rust?
- **RQ2:** What are the performance implications of using Rust for operating system kernel development?
- **RQ3:** What are the major challenges and limitations when developing operating system kernels in Rust?
- **RQ4:** What are the lessons learned when developing operating systems kernels in Rust?



Process Diagram

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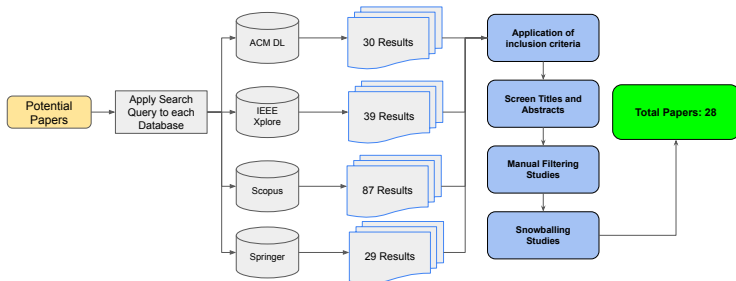
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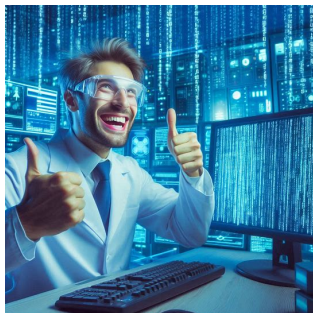
Questions?





Our findings!

Figure: Super happy researcher!¹



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¹AI Prompt: scientist getting research results and is super happy in a cyberpunk universe with lots of computers showing matrix code on them



Table: Approaches and Methodologies for Rust in the Kernel

Approach	Papers	Operating System in Rust
Monolithic	4	Linux Kernel v6.1+
Micro-kernel	5	Atmosphere, Redox, Redleaf
Embedded	2	Tock, Hubris, Drone, Bern, HarSaRK
Unikernel	4	RustyHermit, Theseus
Exokernel	1	W-Kernel



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Table: Performance Implications of Rust in the Kernel

No.	Implication	Studies that Reported the challenge
1	Performance	3
2	Throughput	1
3	Latency	1



RQ3: Challenges and Limitations

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- Binary Size - Rust can produce larger binaries



RQ3: Challenges and Limitations

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Questions?

- Binary Size - Rust can produce larger binaries
- Missing Features - Rust still evolving and adding features



RQ3: Challenges and Limitations

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- Binary Size - Rust can produce larger binaries
- Missing Features - Rust still evolving and adding features
- Soundness - How to deal with raw memory



RQ3: Challenges and Limitations

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- Binary Size - Rust can produce larger binaries
- Missing Features - Rust still evolving and adding features
- Soundness - How to deal with raw memory
- Panics - What happens when things go wrong?



RQ3: Challenges and Limitations

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Questions?

- Binary Size - Rust can produce larger binaries
- Missing Features - Rust still evolving and adding features
- Soundness - How to deal with raw memory
- Panics - What happens when things go wrong?
- C Interop - Specific to mixed language kernels



RQ4: Lessons Learned

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- Impossible to use 100% rust



RQ4: Lessons Learned

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Questions?

- Impossible to use 100% rust
- Rust is not as expressive as other formal verification techniques



RQ4: Lessons Learned

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Questions?

- Impossible to use 100% rust
- Rust is not as expressive as other formal verification techniques
- Ownership root - An OS provides memory to rust so if the OS is itself written in rust who is the root owner?



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Questions?

- We are still in the early stages of figuring out who to do kernel dev in Rust



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Questions?

- We are still in the early stages of figuring out who to do kernel dev in Rust
- High potential for enhanced security and stability



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Questions?

- We are still in the early stages of figuring out who to do kernel dev in Rust
- High potential for enhanced security and stability
- Need to address integration issues (FFI)



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Questions?

- We are still in the early stages of figuring out who to do kernel dev in Rust
- High potential for enhanced security and stability
- Need to address integration issues (FFI)
- Need to expand the body of empirical evidence on Rust's impact!



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Figure: Happy People¹



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¹AI Prompt: People attending a conference who all want to ask a question and are really excited!