

# Intern with the GraalOS-in-DB team at Oracle!

Are you looking for an exciting internship opportunity? If so, this might be the perfect fit for you. The GraalOS-in-DB team at Oracle has an opening for an internship to help extend Oracle Database with new exciting functionality!

## Oracle

Oracle, a global provider of enterprise cloud computing, is empowering businesses of all sizes on their journey of digital transformation. Oracle Cloud provides leading-edge capabilities in software as a service, platform as a service, infrastructure as a service, and data as a service.

Oracle's application suites, platforms, and infrastructure leverage both the latest technologies and emerging ones – including artificial intelligence, machine learning, blockchain, and Internet of Things – in ways that create business differentiation and advantage for customers. Continued technological advances are always on the horizon.

## GraalOS-in-DB

### Background & Motivation

Modern microservice architectures face significant data access inefficiencies due to network overhead, database connection management, and query execution latency.

Our work explores a novel approach: embedding a serverless runtime directly within an Oracle RDBMS process, enabling co-located execution of application logic and database operations. By eliminating unnecessary indirection and leveraging advanced runtime optimisations, we aim to significantly improve data access efficiency in microservice applications.

### GraalOS: A New Approach to Virtualization

Our work is built on GraalOS [1], a new virtualization technology that provides fast startup and suspend-resume features, making it well-suited for serverless computing. GraalOS leverages binary static analysis and modern hardware capabilities to enable lightweight in-process sandboxing.

In our project, GraalOS allows microservices to safely execute inside the database process while maintaining isolation, eliminating the need for external execution environments and network calls. This tight integration between application logic and the database opens new opportunities for cross-stack optimisation.

## Research Focus & Optimisations

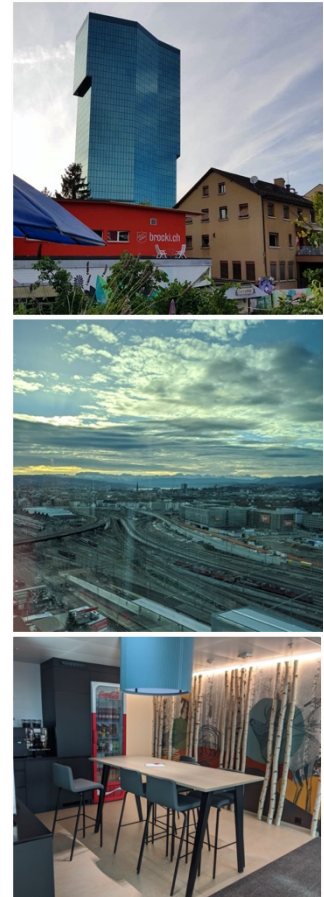
We are investigating techniques that optimise the entire technology stack from the application framework and language runtime to the serverless runtime and database system.

One example is optimised database access. Since we know at compile time which queries the application will execute, we can statically analyse and pre-optimize access patterns. If a query is sufficiently simple, we bypass the SQL layer entirely and execute the operation directly within the database system, avoiding unnecessary parsing, planning, and interpretation overhead.

## Research Directions

As an intern, you will contribute to one or more of the following areas:

- Cross-stack optimizations: Investigate opportunities to improve efficiency across the entire tech stack, ranging from application frameworks like Micronaut to DBMS internals.
- Workload placement and adaptive migration: Develop heuristics and runtime policies to decide when to execute application logic inside the database versus externally, and to dynamically migrate workloads in response to load or cost.
- Integration with sharding and replication: Investigate how application pushdown can be combined with sharding strategies and read replicas to optimize performance and scalability.
- Workload analysis and benchmarking: Design representative benchmarks and profiling tools to quantify the benefits, limits, and trade-offs of application pushdown under realistic microservice patterns
- Efficient application loading: Explore techniques for fast loading of user application binaries from database-backed storage to minimize startup overhead.
- Python integration: Explore approaches to safely enable Python-based extensibility within the database environment. Focus on establishing a secure, scalable foundation for Python-driven analytics and user-defined functionality.



Our beautiful offices at Prime Tower in Zurich.

## References

[1] <https://blogs.oracle.com/java/post/introducing-graalos>

## Required Skills

The person stepping into this role is expected to complete the internship using a wide and diverse set of skills.

- Basic understanding of databases and SQL (having completed advanced database systems courses is a plus)
- Depending on the particular topic, a background in operating systems, computer security, compilers or application development is useful.
- Experience with C and Java programming. Experience with JavaScript and/or Python is a plus
- Experience with Linux (e.g., bash scripts)
- An average grade of at least 5.0 in the master studies is a plus

## Internship Facts

The duration of the internship can vary based on the candidate's constraints. The usual duration is 6 months. We pay a competitive salary. The research topics listed are informative, we are open to suggestions depending on your skills and qualifications. By sending in your application, you opt-in for processing your personal information.

If this sounds like you, we hope to meet you!

## How to Apply

Please provide us with the following information to apply:

- Your CV or link to your home page containing your curriculum
- Description of your motivation and area(s) of interest
- Availability and preferred internship duration
- Preferred location

If available, please apply to this topic via the internship portal of your university. Alternatively, send an email with the aforementioned information to [aleksei.kashuba@oracle.com](mailto:aleksei.kashuba@oracle.com)

“During my 3-month internship I worked with state-of-the-art technology and conducted research whose (future) benefit to Oracle’s products was very apparent for me. Whenever I faced any hurdles, I had great mentors and colleagues to help me out with their vast knowledge and experience. Overall, I had a great time working at Oracle Labs.”

### Tom Papke

TU Munich student, 3-months intern

## About Us

Innovation starts with inclusion at Oracle. We are committed to creating a workplace where all kinds of people can be themselves and do their best work. It's when everyone's voice is heard and valued, that we are inspired to go beyond what's been done before. That's why we need people with diverse backgrounds, beliefs, and abilities to help us create the future, and are proud to be an affirmative-action equal opportunity employer.

Oracle is an Equal Employment Opportunity Employer. All qualified applicants will receive consideration for employment without regard to race, color, religion, sex, national origin, sexual orientation, gender identity, disability and protected veterans status, age, or any other characteristic protected by law. Oracle will consider for employment qualified applicants with arrest and conviction records pursuant to applicable law.

## Life at Oracle

An Oracle career can span industries, roles, countries and cultures, giving you the opportunity to tackle new roles and challenges, while blending work and life. Oracle has thrived through 40+ years of change by innovating and operating with integrity while delivering for the top companies in almost every industry. To nurture the talent that makes this happen, we work hard to build a vibrant and inspiring workplace that celebrates diverse, hardworking teams where everyone can contribute. We take care of each other, and value giving back to the community. We have flexible work arrangements and offer benefits including generous paid parental leave and comprehensive premium medical insurance.

We will ensure that individuals with disabilities are provided reasonable accommodation to participate in the job application or interview process, to perform crucial job functions, and to receive other benefits and privileges of employment. Please contact us to request accommodation.

At Oracle, we don't just respect differences—we celebrate them. We believe that innovation starts with inclusion and to create the future we need people with diverse backgrounds, perspectives, and abilities. That's why we're committed to creating a workplace where all kinds of people can do their best work. It's when everyone's voice is heard and valued that we're inspired to go beyond what's been done before.

[More information on Oracle's stance on diversity and inclusion](#)