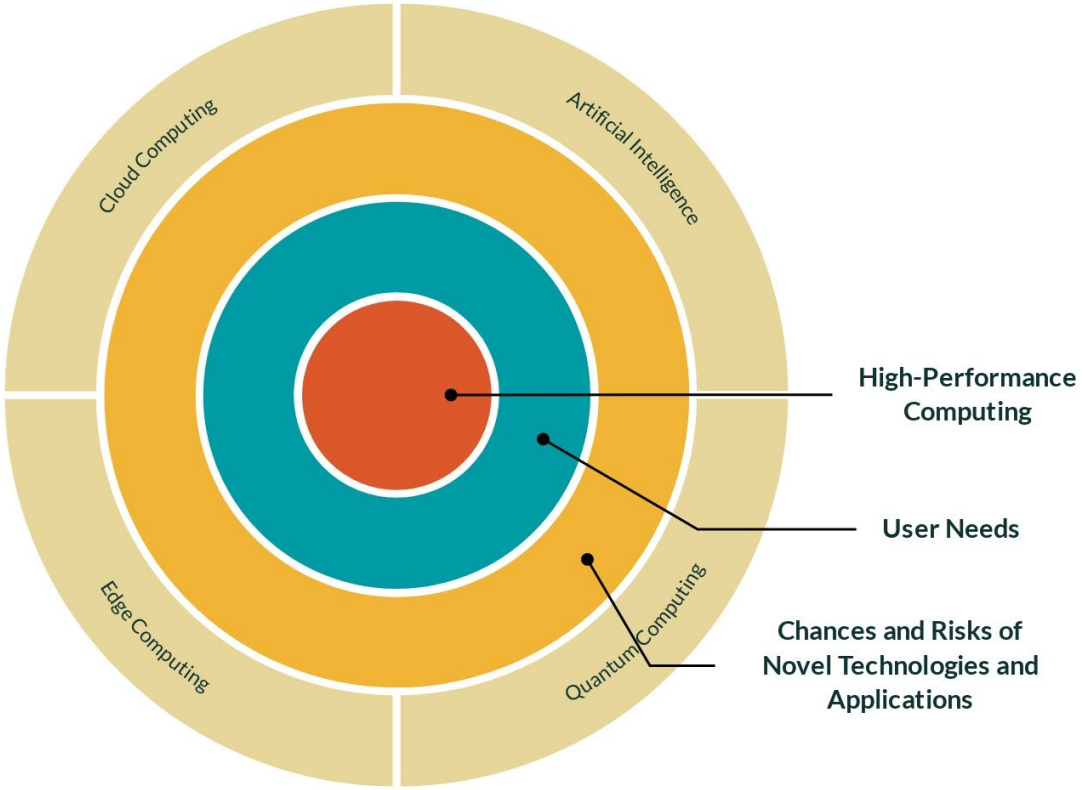
High-Performance
Computing Center
Stuttgart

# Welcome to the HPC/Quantum/AI Conference

**Dennis Hoppe**

High-Performance Computing Center Stuttgart (HLRS)

# Novel User Communities at HLRS



# Enabling Next-Generation HPC Solutions

H L R S

InHPC-DE

CYBELE

Catalyst

CIRCE

Computational Immediate Response Center for Emergencies

SiVeGCS

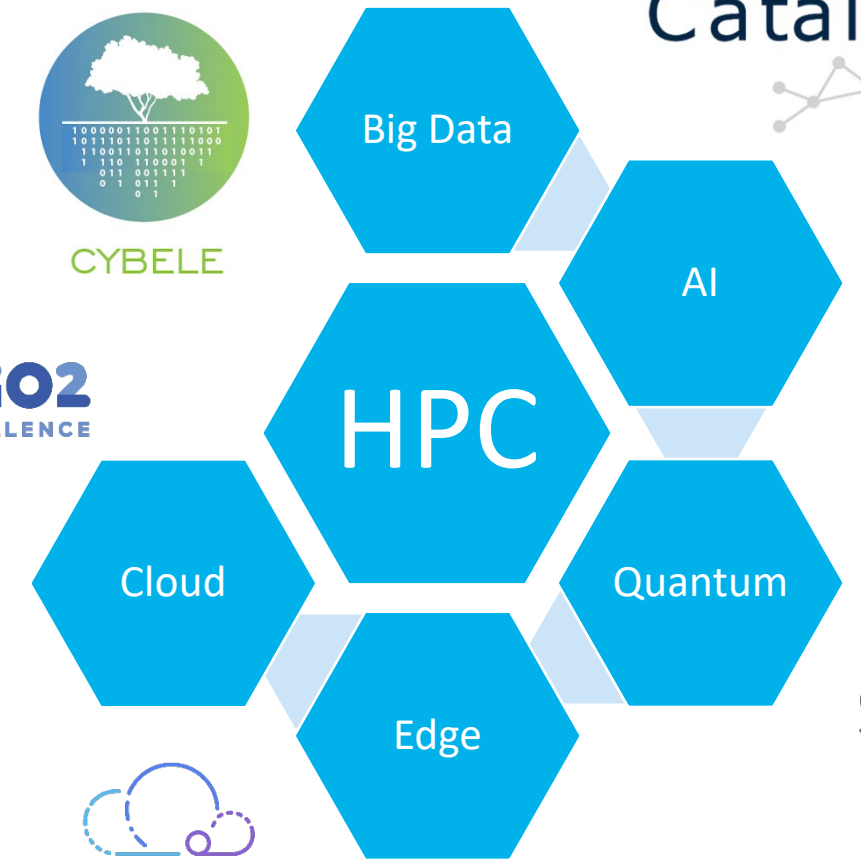
HiDALGO

HiDALGO2

CENTRE OF EXCELLENCE

GaiaX-4ICM

Sodalite




DECICE

SEQUOIA

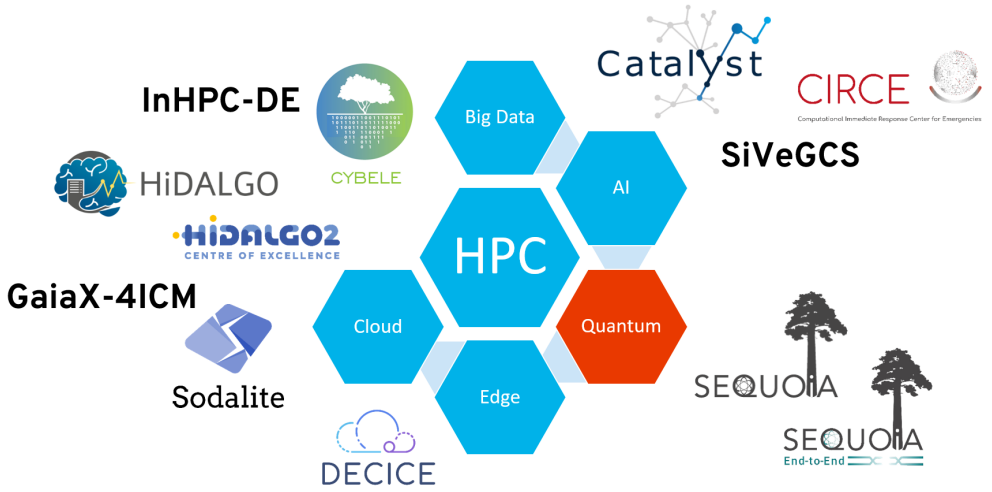
SEQUOIA

End-to-End

# Towards Convergence of Cloud, AI, and Quantum with HPC

- **Transformation of HPC** through emerging technologies and methodologies
  - We are entering an **era of workflows**
  - Compute Continuum: Cloud, AI, Edge, Quantum, …?

- **Key aspects**
  - Exploring **emerging technologies**
  - Identifying **synergies**
  - Evaluating **hybrid workflows**
  - Driving **seamless integration**
  - **User support** for novel technologies



# Technical Integration Challenges

01

**Hardware**
Installation next to the HPC system to minimize latency

02

**Interconnect**
High-speed data transfer between HPC and QC

03

**Software**
Unified programming environment to simplify usage

04

**Benchmarking**
Understanding scalability and bottlenecks for optimization

# Convergence of HPC, QC and AI

**HPC + QC**

HPC is essential for *simulating* quantum hardware and *benchmarking* quantum algorithms

**HPC + AI**

HPC provides the necessary scale for *training* large AI models (LLMs, Generative AI)

**QC + AI**

Quantum Machine Learning (QML) offers new potential for more efficient AI solutions

## The Synergy

True breakthroughs happen at the **intersection**

# A Look at Today's Program

| Time | Session Type | Details |
|---|---|---|
| 09:30 – 09:45 | Welcome | Welcome Talk by QAIConf Team |
| 09:45 – 10:10 | Presentation | Utz Bacher – Integrating HPC and Quantum Resources for an HPC Native Experience |
| 10:10 – 10:35 | Presentation | Muhammad Saeed – DesignQML: A Model-Based Framework for Quantum ML Systems |
| 10:35 – 11:00 | Presentation | Jean Senellart – MerLin: A PyTorch-Integrated Framework for Scalable QML |
| 11:00 – 11:15 | Break | |
| 11:15 – 11:40 | Presentation | Muhammad Saeed – Classical vs Quantum ML: Benchmarking Hybrid Architectures |
| 11:40 – 12:00 | Workshop | Ingolf Wittmann – Beyond Moore's Law: Current & Future Quantum Tech |
| 12:00 – 13:00 | Lunch | |
| 13:00 – 14:30 | Workshop | Prof. Dr. Gerhard Hellstern – Application-Based Quantum Computing |
| 14:30 – 15:30 | Workshop | Andreas Land and Araceli Venegas-Gomez – Quantum Learning Opportunities Tailored to Industry |

# Thank you!

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