Beyond the PhD: Adventures in Data, ML, and Quantum

EDBT 2025 PhD Workshop

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A little more about me

B. Eng. & M.Eng.

Tsinghua University

Consultant

SAP

Postdoc and AP

TUDelft

PhD

RWTH AACHEN UNIVERSITY

Our team and research

We are InfiniData Team

AI in data lakes

Quantum data management

Our team and research

AI in data lakes

Effectiveness

AutoFeat (ICDE'24)
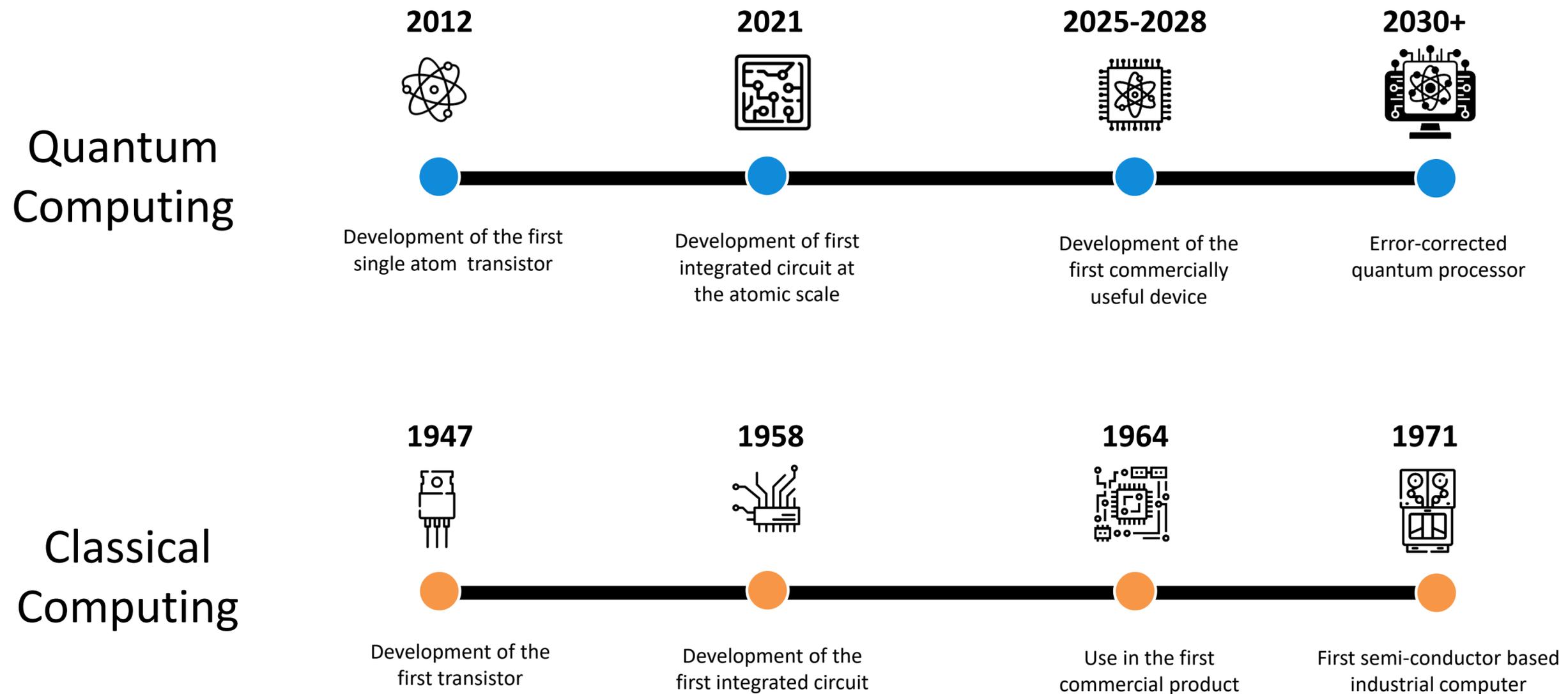TransferGraph (ICDE'24)

Privacy

SiloFuse
(ICDE'24)

Efficiency

Amalur (ICDE'23, TKDE'24)
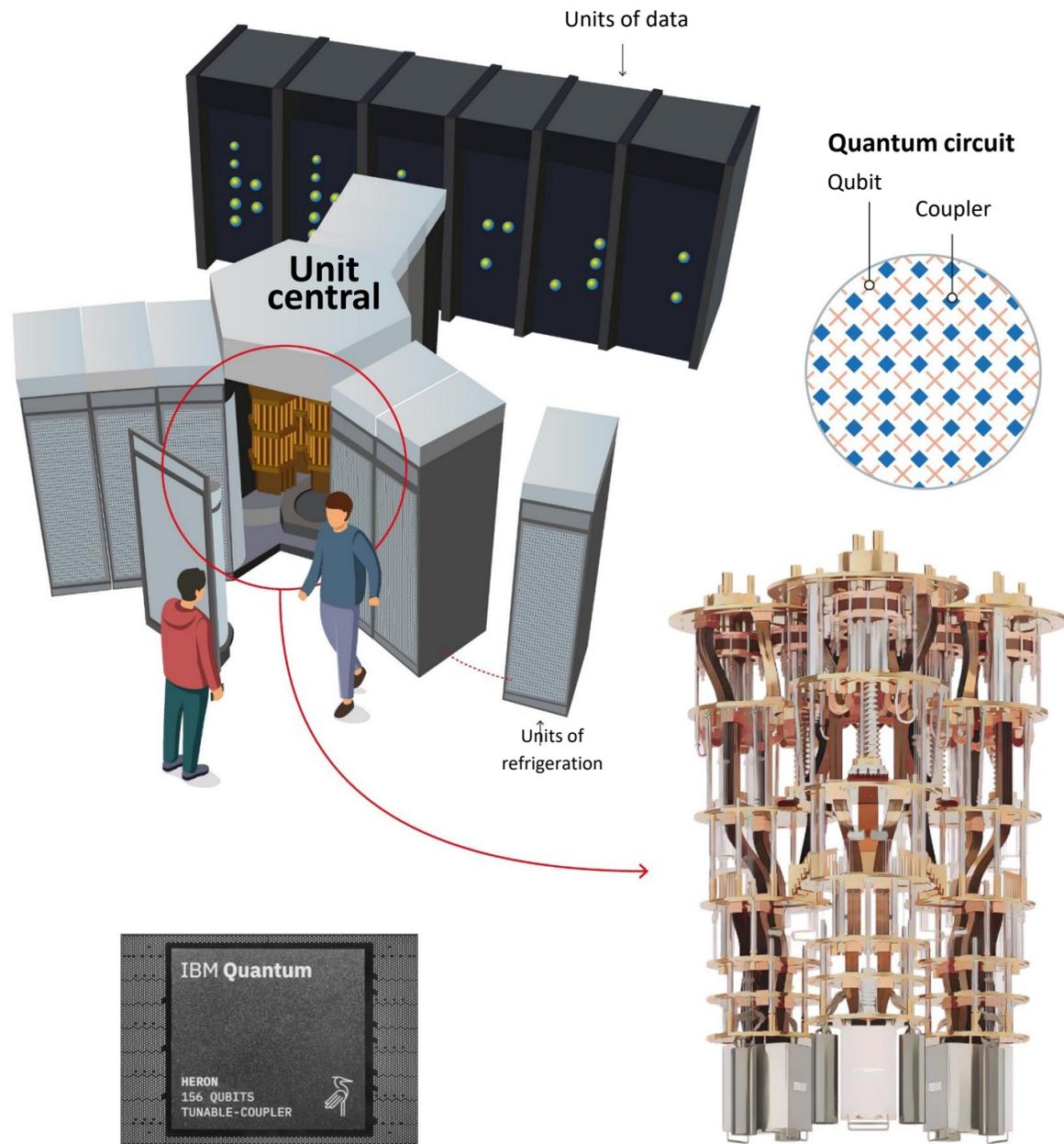TranSQL (SIGMOD'25 Demo)

Energy Efficiency
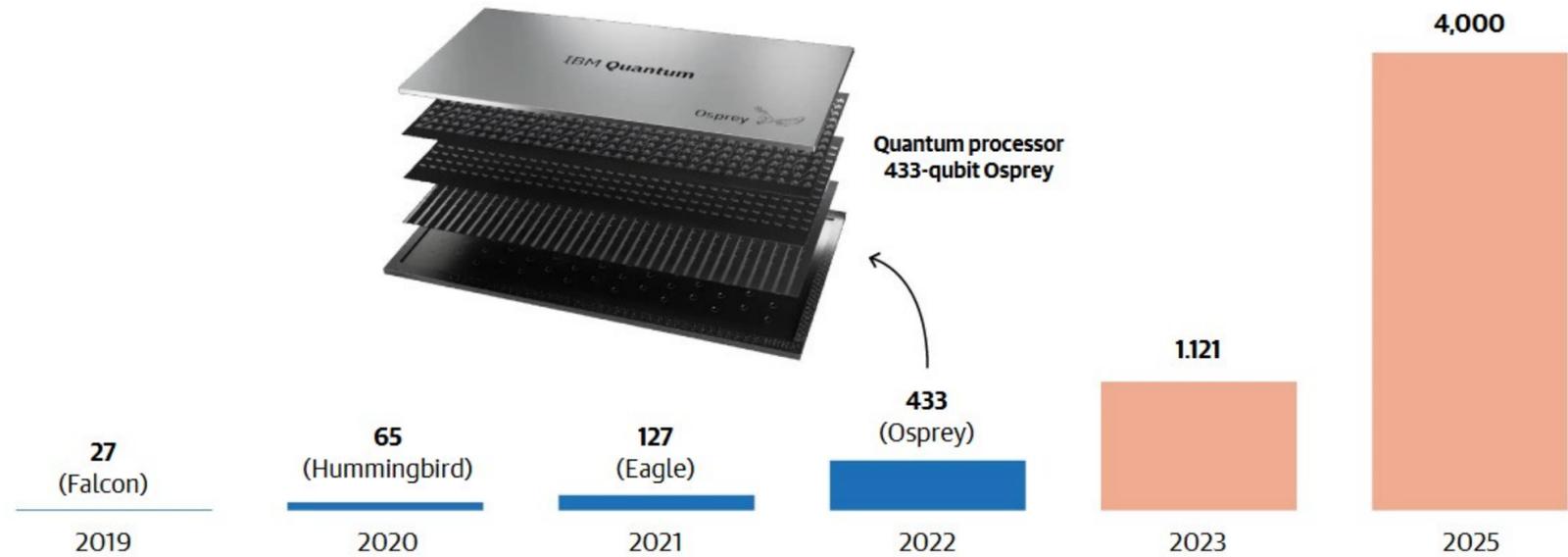
How far is quantum?

Development Roadmap

Quantum Computing

2012	**2021**	**2025-2028**	**2030+**
Development of the first single atom transistor	Development of first integrated circuit at the atomic scale	Development of the first commercially useful device	Error-corrected quantum processor

Classical Computing

1947	**1958**	**1964**	**1971**
Development of the first transistor	Development of the first integrated circuit	Use in the first commercial product	First semi-conductor based industrial computer

What's happening in 2025?

The IBM System Two

Units of data

Unit central

Units of refrigeration

Quantum circuit
Qubit
Coupler

System Two processor
Quantum processor
156-qubit Heron

Evolution of the number of qubits in IBM quantum processors

Quantum processor 433-qubit Osprey

Year	Qubits
2019	**27** (Falcon)
2020	**65** (Hummingbird)
2021	**127** (Eagle)
2022	**433** (Osprey)
2023	**1.121**
2025	**4,000**

Scaling system

Groups of 25, 000 qubits

6
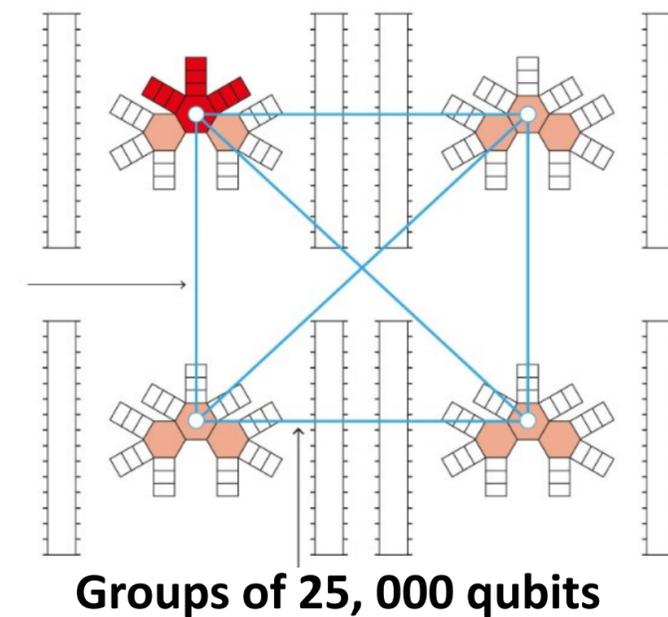
What can we do?

QC for DB

Reference	DB problem	Subproblem	Formulation	Intermediate quantum algorithm	Quantum computer
I. Trummer et al., VLDB'16	Query optimization	Multiple query optimization	QUBO	–	Annealing-based
T. Fankhauser et al., IEEE Access, 2023				QAOA	Gate-based
M. Schonberger et al., SIGMOD23		Join ordering		QAOA	Gate-based & annealing-based
N. Nayak et al., BiDEDE '23				QAOA, VQE	Gate-based & annealing-based
T. Winker et al., BiDEDE '23			–	VQC	Gate-based
K. Fritsch et al., VLDB'23 Demo	Data integration	Schema matching	QUBO	QAOA	Gate-based & annealing-based
T. Bittner et al., IDEAS'20, OJCC S. Groppe et al., IDEAS'21	Transaction management	Two-phase locking	QUBO	–	Annealing-based

DB for QC

In-DB Tensor Computation ➡ Classical simulation

Graph analytics ➡ Error correction

Distributed databases ➡ Quantum network

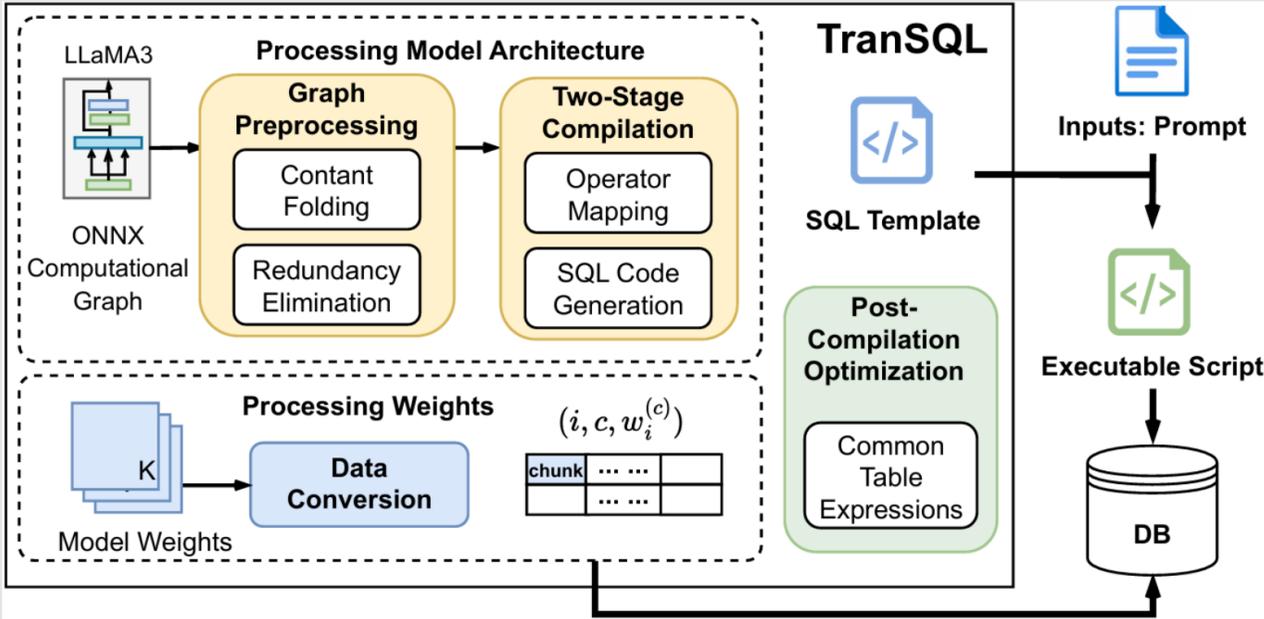Scientific data management ➡ Quantum experiments
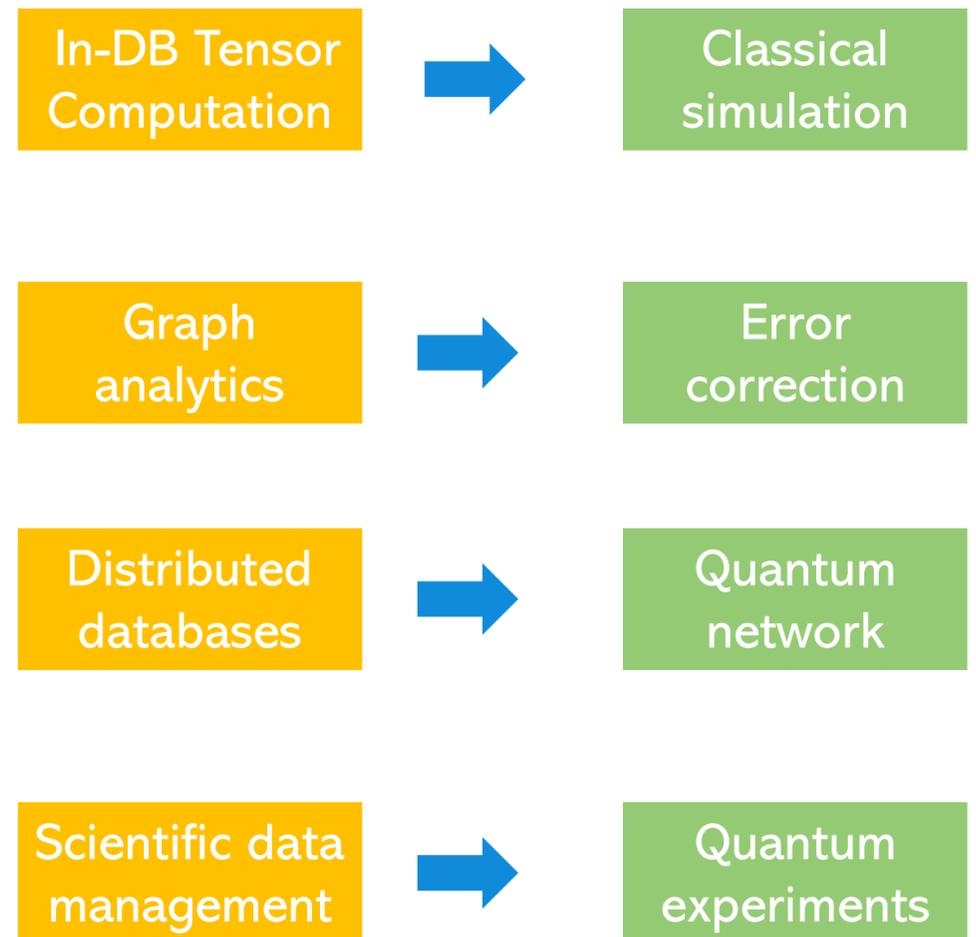
ICDE'24 Tutorial
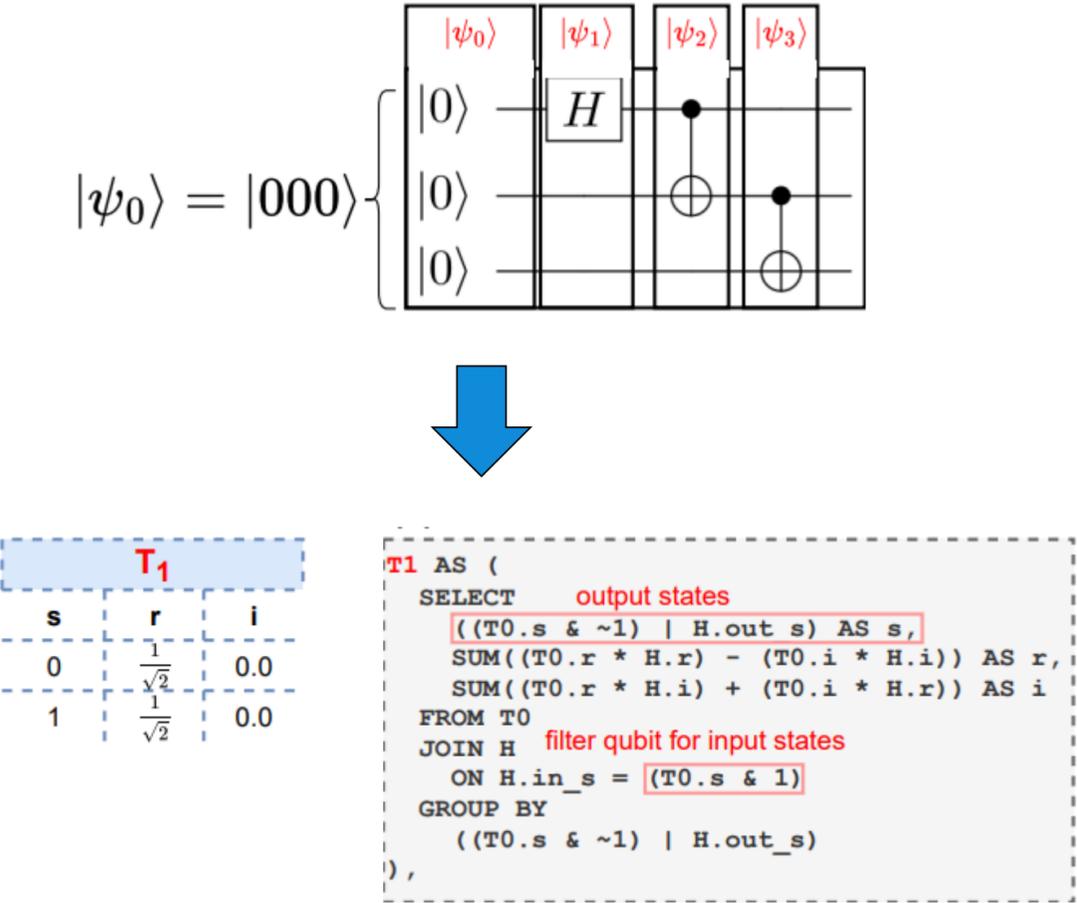
VLDB'25 Vision

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Systems: Repurposing DBs for AI and Quantum

DB for LLM serving
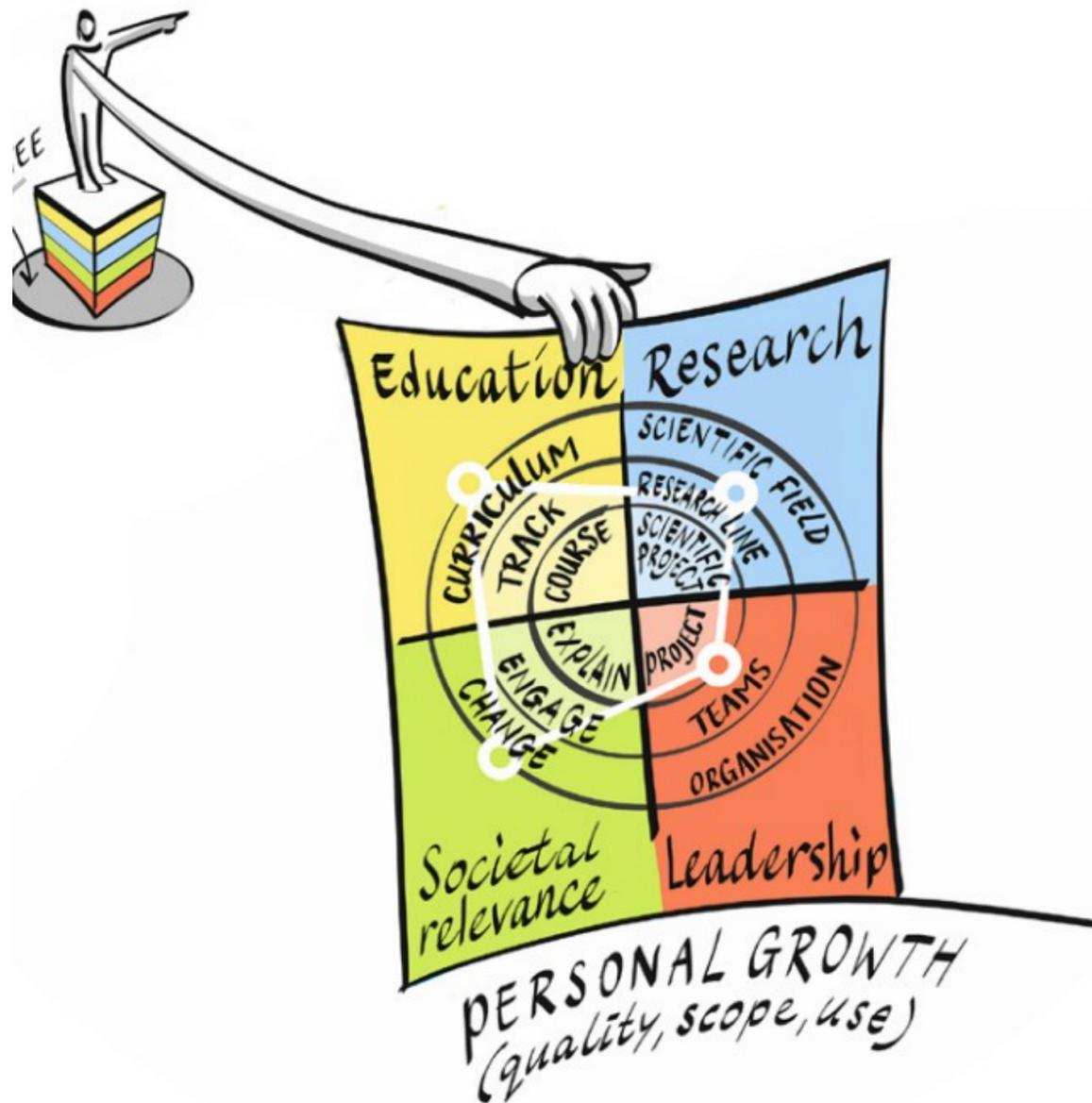### TranSQL (SIGMOD'25 Demo)

Wenbo Sun

DB for Quantum computing
Qymera (SIGMOD'25 Demo)

Tim Littau

Lessons from academia

Challenges:

- Balancing research, teaching, supervision, organization, and valorization
- Tenure-track pressure
- Funding cycles

Lessons from industry

Challenges:
- Impact & speed: Tighter timelines, product-focused
- Cross-functional team collaboration and communication
- Adapting to business priorities, sometimes limited freedom
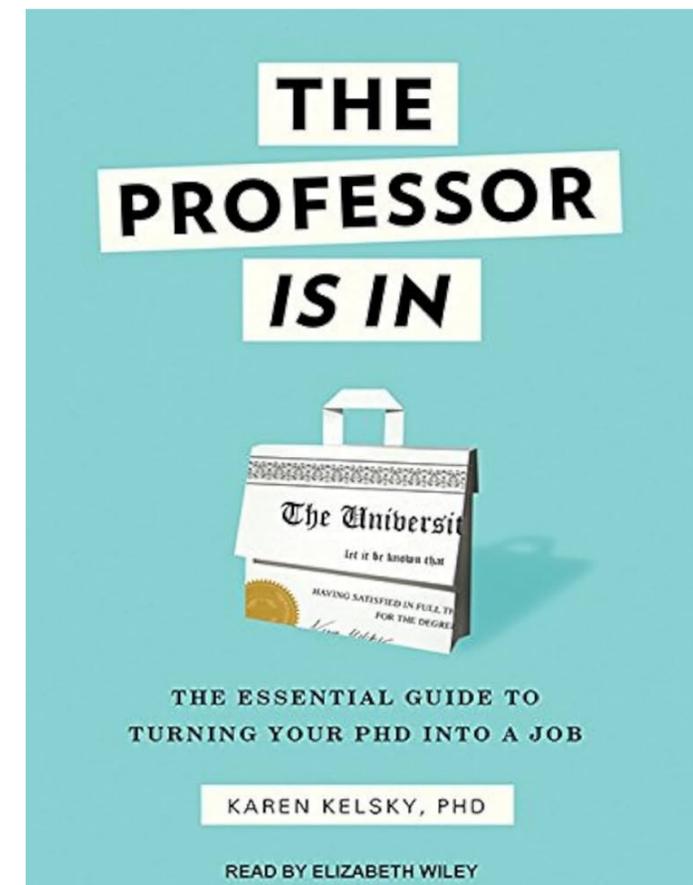
DISCOVER YOUR TALENTS

INDIVIDUAL

ORGANIZATION

Transitioning between roles & fields

- Embrace new roles
- Learning on the fly
- Networking & internal advocacy

- Heads-up
  - Cultural shifts
  - Overcommitment
  - Burnout

BUILD DIVERSE EXCELLENT TEAMS

finance
student affairs
external expert

research team
educational team

Academic job hunting tips & strategies

- Clarify your academic focus
- Clear vision and future research agenda
  - How is your vision built upon your past work?

- Visibility & networking
  - Give talks
  - Organize workshops

- Interview & job talk preparation
  - What's your funding plan?
  - Who will you collaborate with in the new institute?
  - What's your teaching philosophy?

THE PROFESSOR IS IN

The University

THE ESSENTIAL GUIDE TO TURNING YOUR PHD INTO A JOB

KAREN KELSKY, PHD

READ BY ELIZABETH WILEY

Conclusion and Q&A

- It's a marathon

- Plan ahead to stay ahead

- Don't go it alone—seek advice, share, and learn

- No single "right" path

- Follow your heart