Towards Quantum Advantage and Useful Quantum, 2026 and Beyond

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Key takeaways from 2025 IBM Asia Pacific Quantum Summit

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Josephine Teo, Singapore Minister for Digital Development and Information, receives a token of appreciation following her keynote from Hans A.T. Dekkers, IBM General Manager for Asia Pacific & China.

An achievement of a significant breakthrough, the world first known trial in algorithmic bond trading using hybrid classical quantum computing approach was successfully conducted by HSBC using multiple IBM quantum computers within the European corporate bond market in September 2025. The algorithm used the data for backtesting, using real, production-scale bond trading data. HSBC reported that the results show the improvement of up to 34% in predicting on how likely a trade would be filled at a quoted price, compared to the standard classical techniques (Fintechfutures, 2025).

Is this quantum advantage? It seems that the algorithm, when combined with quantum computers, has exhibited the seed of quantum advantage.

In the simplest form, IBM defines quantum advantage as "*a quantum computer can run a computation more accurately, cheaply, or efficiently than a classical computer*" (IBM Quantum Research, 2025).

Further, a recent IBM paper in ArXiv (Olivia Lanes et. al) defines quantum advantage as follows: "*the ability to execute a task on a quantum computer in a way that satisfies two essential criteria. First, the correctness of the quantum computer's output can be rigorously validated. Second, it is performed with a quantum separation that demonstrates superior efficiency, cost-effectiveness, or accuracy over what is attainable with classical computation alone..*"

2025 IBM Asia Pacific Quantum Summit

The author had the opportunity to attend the 2025 IBM Asia Pacific Quantum Computing summit at the National University of Singapore (NUS), Singapore, held in 4th week of October 2025.

In a nutshell, the summit covers the updates on the quantum computing roadmap and the state-of-the-art advancements, including potential early applications for quantum advantage.

- The IBM Quantum roadmap and the path to Return on Investment (ROI).
- Integrating quantum and high-performance computing (HPC) with the Qiskit software stack.
- Cost-effective utility-scale quantum computing with new access plans.
- New work from IBM Quantum Network members demonstrating the seeds of quantum advantage.

Delivered topics include Embracing the Quantum Era in APAC: A Vision for the Region; The State of Quantum Computing and the Future of Computing; Real-World Use Cases for Quantum Computing; Quantum Application for Enterprise; Securing the Quantum Future: A Leadership Imperative; IBM Quantum Roadmap: The Path to Unlocking Advantage; Toward Quantum Advantage: Algorithm Discovery; Hybrid Classical & Quantum Computing: HPC Integration; Unlocking Quantum Potential: The Power of Collaborations, Partnerships, and Ecosystem; Building a Thriving Quantum Ecosystem: Policy, Collaboration, and Growth; Learning Pathways for Success: Quantum Education; and Pathways for Success: How to get started.

Keynote Speech

The IBM Quantum Summit opens in the morning with the keynote from the Minister for Digital Development and Information, Josephine Teo. She mentioned that "*Singapore must move from reactive regulation to proactive* *preparation, as the long-term implications of quantum computing cannot be fully predicted*" (Young Zhan Heng, 2025).

One of the initiatives from the Government of Singapore is SGD 350M in funding for 100 Ph.D. and 100 Master students pursuing research in quantum computing by 2030, encouraging researchers to turn their ideas into market-ready products. Drug discovery research for example, has the potential to reduce healthcare cost in the future.

Singapore even released the Quantum Readiness Index (QRI) in October 2025, a self-assessment questionnaire. "The QRI allows organisations to understand their levels of readiness and enables system owners and security practitioners to prioritise quantum-safe migration action areas" (Government of Singapore, 2025).

Quantum Advantage and Quantum-Centric Supercomputing

Hans A.T. Dekkers, IBM General Manager for Asia Pacific & China, mentioned in his speech that the technology convergence consists of three aspects: Artificial Intelligence (AI), Hybrid Cloud, and Quantum, which is reliable, flexible, and resilient. Towards Quantum-Centric Supercomputing, IBM will deliver FTQC, a fault-tolerant quantum computer by 2029.

We are now in the NISQ era, Noisy Intermediate-Scale Quantum, in which building a logical quantum bit (qubit) requires many physical qubits for error correction.

By 2026, IBM plans to demonstrate Quantum Advantage, a cheaper and faster quantum-centric supercomputing system that will solve complex problems faster than classical computing (HPC). The domain applications for quantum advantage include: simulation, optimization, and machine learning. Complex problems are hard for classical computers to solve (e.g., requiring years of computing time), whereas quantum computers can solve the problem cheaper and faster.

Oliver Dial, IBM CTO for Quantum from IBM Research, stated that quantum-centric supercomputing is CPU + GPU + QPU at scale. QPU is a quantum processing unit. Quantum-centric supercomputing is the convergence of supercomputing and quantum computing. A supercomputer (High Performance Computing/HPC) is a CPU + GPU at scale.

IBM's mission is to bring a useful quantum computer to the world. The world is now transitioning from *quantum utility* to *quantum advantage,* and later to *useful quantum*. Quantum utility is the era of quantum computing, in which quantum computers can provide real value and solve real-world problems beyond the capabilities of classical computers. Quantum advantage is the era of technical demonstration of quantum computing (Proof of Concept/PoC). Useful quantum is the era of real use cases of quantum computing, applied in production.

Quantum advantage use cases will focus on *incremental improvements* to complex problems (e.g., the many years spent in research for drug discovery) with *high impact* (e.g., significantly reducing the time required for drug discovery). For example, according to Ethan Groves, IBM Senior Marketing Manager for Quantum, "if you are in Banking and you are not starting quantum now, you are late."

Quantum Computing and Security

In security, there are two approaches for doing encryption — symmetric and asymmetric cryptography.

Symmetric cryptography uses the same key for encryption and decryption — while potentially maybe the target for attack by Grover's quantum algorithm, the mitigation may be just straightforward by expanding the key length to make it harder to attack.

Asymmetric cryptography uses different keys for encryption and decryption, such as the RSA public-key algorithm (PKA). The PKA relies on the difficulty of factoring the multiplication of two large prime numbers; even classical computers (supercomputers) would take many years to factor such a large number, making the algorithm assumed to be secure.

Existing payment and e-commerce systems worldwide rely on PKA to secure the data exchange (data in transit).

There is a quantum algorithm (published in 2021) that can factor the multiplication of two large prime numbers — Shor's algorithm. However, at this moment, the existing quantum computer hardwares to execute the algorithm to break current encryption in production does not have the required scale (e.g., the algorithm needs 20 million qubits to break 2048-bit RSA encryption in 8 hours, while current quantum computer hardware only available in the range of a few hundred qubits). This may change in the FTQC era.

Startup Companies

It's interesting to see one startup, *QEDMA,* that builds tools for quantum error mitigation to execute quantum algorithms much more efficiently.

Several quantum researchers and quantum-based startups are adopting the products to develop and run more complex quantum algorithms while waiting for better quantum error correction.

What's Next

While the *Useful Quantum* may seem far away, IBM believes it will arrive starting in the 2–4 years ahead, before 2030, at least with the quantum advantage.

Are we ready to embrace the exciting future of quantum computing? Are we doing something to at least be aware of what's coming? What will quantum computing enable the future of Artificial Intelligence, for example? Will AGI (Artificial General Intelligence), if even possible, be accelerated with quantum-centric supercomputing? and so on, and so on.

Well, may the future tell. And it will be coming soon, sooner than we expected.

References

- Andi Sama, 2025b, "*HPC and Quantum Computing,*" https://medium.com/@andisama/hpc-dan-quantum-computing-f8fc78082556.
- Andi Sama, 2025a, "*Mencermati Arah Perkembangan Teknologi dan Inovasi @CES 2025*," https://medium.com/@andisama/mencermati-arah-perkembangan-teknologi-dan-inovasi-ces-2025-9bd2d97459db.
- Andi Sama, Cahyati S. Sangaji, 2023, "*My Journey to the Exciting World of Quantum Computing — A Novice's Perspective,*"

https://medium.com/@andisama/my-journey-to-the-exciting-world-of-quantum-computing-a-novices-perspective-c6d66e9e997e.

- Andi Sama, 2022, "*Quantum.Tech 2022: Next Generation Insights of Technology Innovations,*" https://medium.com/@andisama/quantum-tech-2022-next-generation-insights-of-technology-innovations-4a88d83a2a26.
- Andi Sama, Cahyati S. Sangaji, 2021, "*Embarking on a Journey to Quantum Computing — Without Physics Degree,*" https://medium.com/@andisama/embarking-on-a-journey-to-quantum-computing-without-physics-degree-4f22a1fb6a2b.
- Fintechfutures, 2025, "*HSBC tests quantum bond trading in IBM partnership,*" https://www.fintechfutures.com/quantum-computing/hsbc-tests-quantum-bond-trading-in-ibm-partnership.
- Government of Singapore, 2025, "*Public Consultation — Quantum-Safe Handbook and Quantum Readiness Index,*" https://www.csa.gov.sg/resources/publications/quantum-safe-handbook-and-quantum-readiness-index/.
- IBM Quantum Research, 2025, "*The dawn of quantum advantage,*" https://www.ibm.com/quantum/blog/quantum-advantage-era.
- Olivia Lanes et. al, 2025, "*A Framework for Quantum Advantage,*" https://arxiv.org/abs/2506.20658.
- Young Zhan Heng, 2025, "*Singapore aims to be 'trusted enabler' of quantum innovation: Josephine Teo*", https://www.businesstimes.com.sg/companies-markets/singapore-aims-be-trusted-enabler-quantum-innovation-josephine-teo.

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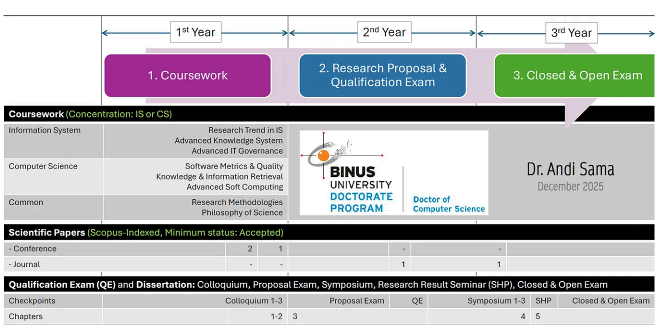

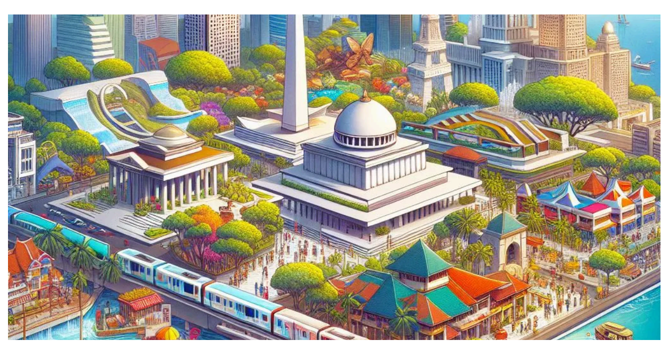

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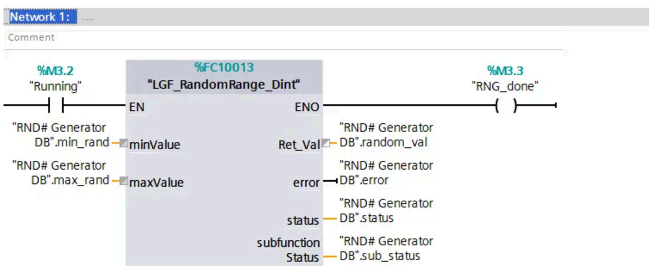

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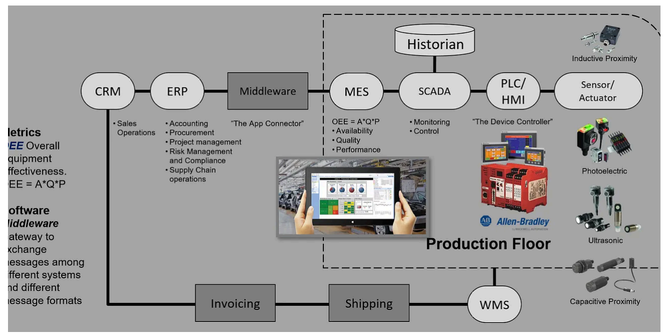

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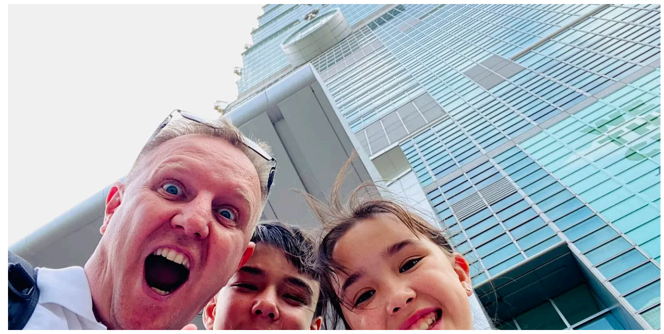

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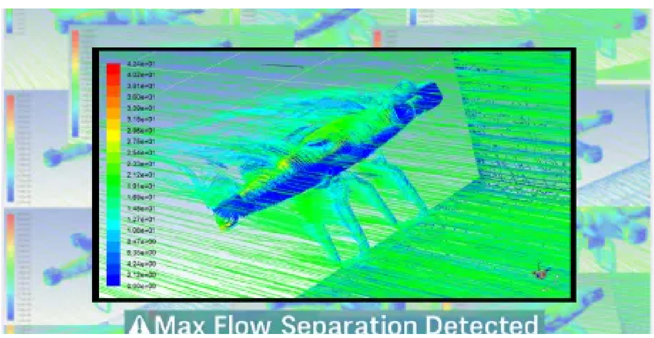

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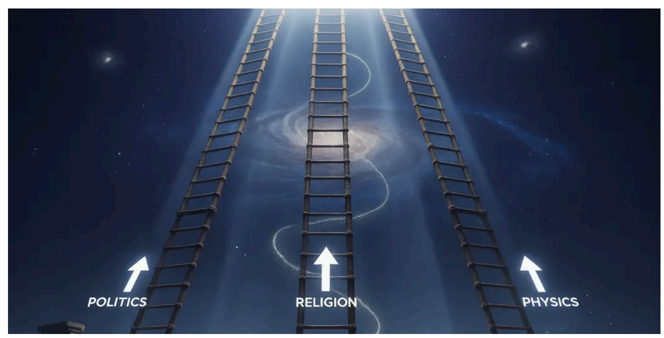

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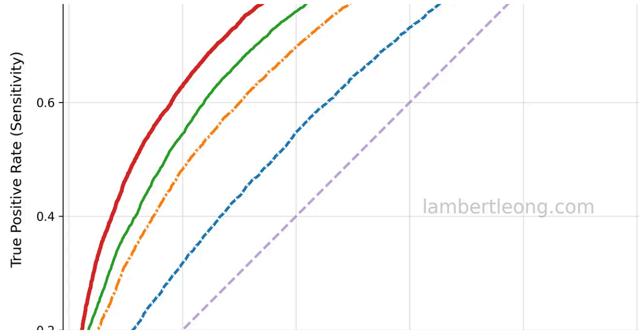

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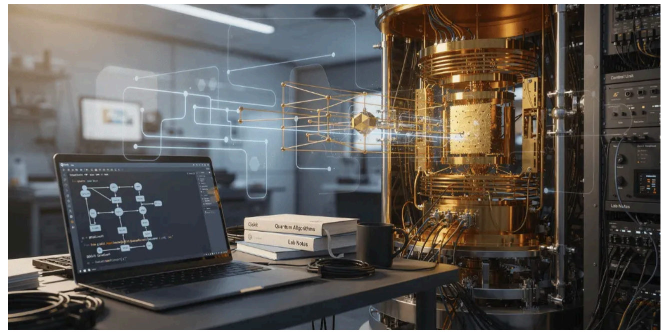

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