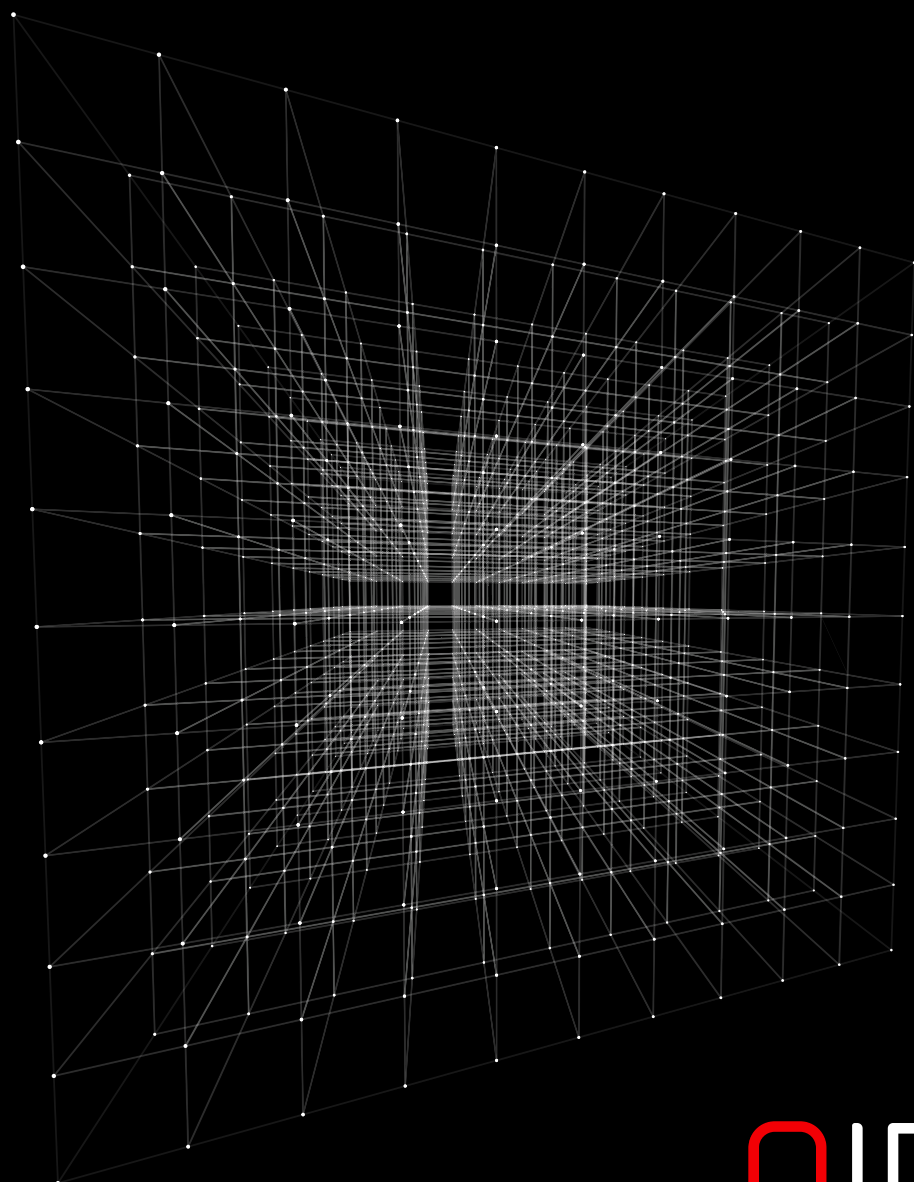

QIR

Quantum Index Report 2025

MIT INITIATIVE ON THE DIGITAL ECONOMY

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Interactive website and public data

The Quantum Index Report 2025 is accompanied with interactive tools available on our website (qir.mit.edu) and we share our raw data with the community available to download from our website (qir.mit.edu/data).

In memory of Shawneric Hachey, whose unique talent and dedication shaped the way this project is presented today.

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This research is a collaboration between Accenture and the MIT Initiative on the Digital Economy (IDE) and was performed under the MIT and Accenture Convergence Initiative for Industry and Technology.

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9 | Quantum Networking

9.1 | Quantum networks

Quantum networks are emergent communication systems that leverage the principles of quantum mechanics to transmit information in new ways. Just as the classical internet enabled email, video calls, and online banking, quantum networks aim to enable things we can't yet do with classical networks—especially in security, computing, and sensing. Quantum networking has profound implications for national security, scientific discovery, and economic competitiveness.[1]

Quantum networking refers to the tools, protocols, and systems that enable the transmission of quantum information between different devices or locations. It incorporates fiber-optic cables, quantum repeaters to extend range, quantum routers, and the software layers needed to manage the system. The quantum internet is a closely related concept: it refers to the broader vision of what we can do once those quantum networks are built and scaled.

According to the 2024 report by the US National Quantum Initiative Advisory Committee (NQIAC), quantum networking capabilities will "play a role in US economic prosperity and national security" and continued investment in R&D of quantum networking is also necessary to clarify the magnitude of that role.[2]

In 2022, the European Commission supported the creation of the Quantum Internet Alliance (QIA) with €24 million in funding to build "a global quantum internet made in Europe."[3] In March 2025, QIA announced the creation of "the first operating system designed for quantum networks" which will facilitate program applications for quantum networks.[4] The system is planned to be made accessible for a broader audience through QIA's quantum internet demonstrator.[5]

It is critical to note that as they are understood today, quantum networks might not replace classical communications or the internet, however they have potential to offer novel functionalities such as more secure communication and the ability to connect quantum computers for enhanced computing power.[6]

9.2 | Quantum networking testbeds

Testbeds play a crucial role in the development of quantum networking and, by extension, the quantum internet. The National Quantum Initiative Advisory Committee defines a testbed as "a platform or facility that is accessible to multiple users to conduct replicable and rigorous testing of component technologies, protocols, and systems integration" and distinguishes it from demonstrators, prototypes and user facilities.[7]

Testbeds are essential for advancing quantum networking because they provide realistic environments in which to explore the performance, interoperability, and scalability of quantum components. According to the NQIAC, "strategically chosen and properly timed quantum networking testbeds will serve an important role in developing the theoretical underpinnings, technologies, security models, and application scenarios" for quantum networks.[8]

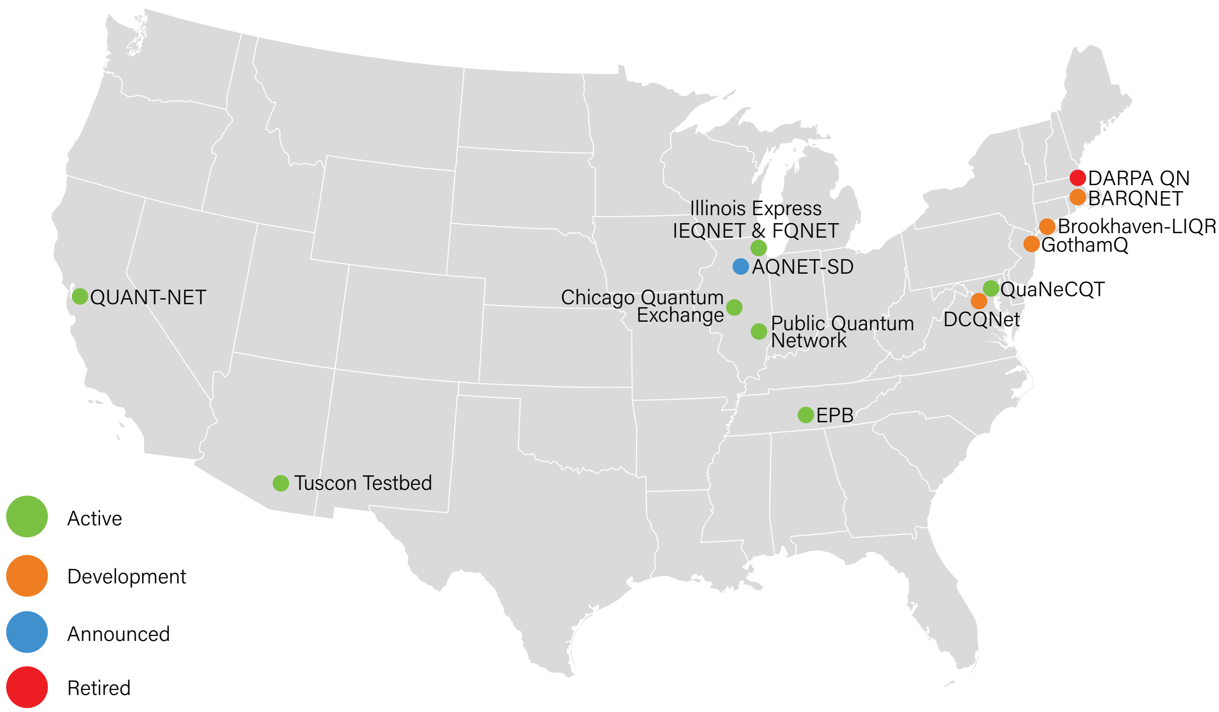
The importance of testbeds lies not only in technological validation but also in risk mitigation. Developing "right-sized" testbeds, those tailored in scope and cost to specific research objectives, has been a priority both in the 2021 and 2024 reports.[9,10] This strategic investment approach aims to ensure that only mature, promising technologies are scaled up for more extensive networks.

Investments in testbeds are not merely about testing hardware, they also represent a commitment to advancing the foundational science and engineering needed for a transformative quantum era.

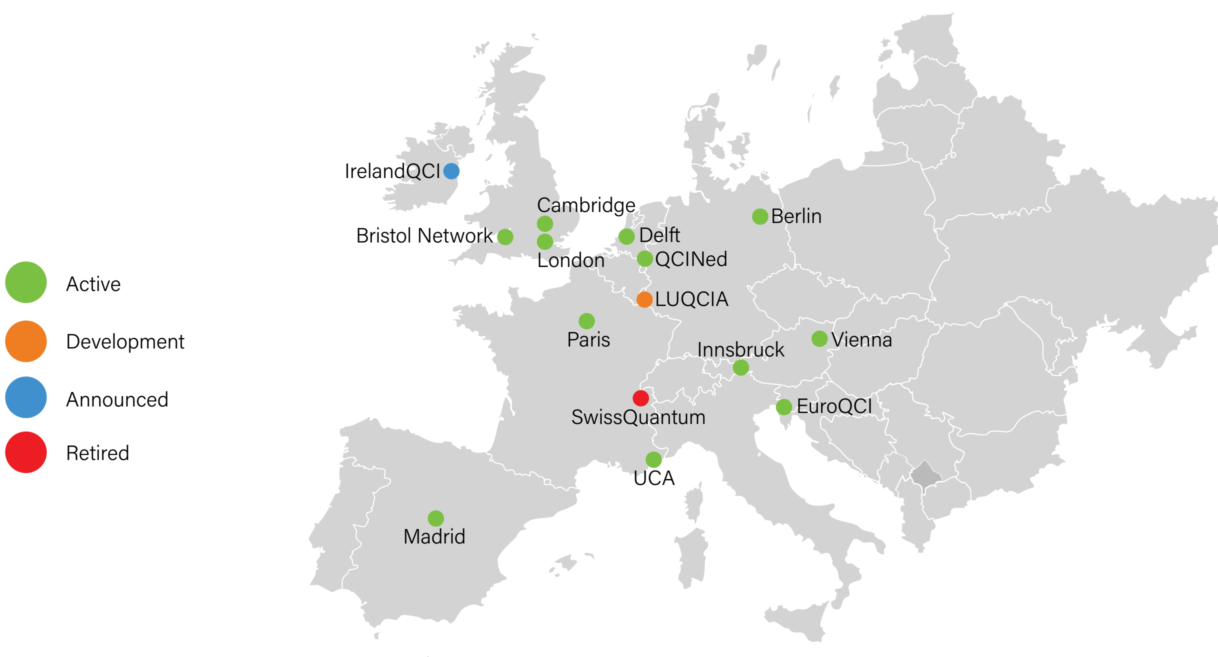
Beyond technical development, testbeds also play a critical role in workforce training and industry engagement. They provide hands-on opportunities for students, researchers, and engineers from diverse backgrounds to develop quantum skills in a practical setting. For industry, testbeds offer a collaborative space to test products, explore market-ready solutions, and align with government and academic research. In this way, testbeds not only advance technology but also support a broader ecosystem necessary for the growth of quantum networking.

In this chapter we present data that maps quantum networking testbeds across the world from publicly available sources and in consultation with experts. Our current dataset lists 13 testbeds in the US and 15 in Europe (including UK). The distribution of these testbeds is illustrated in the maps below:

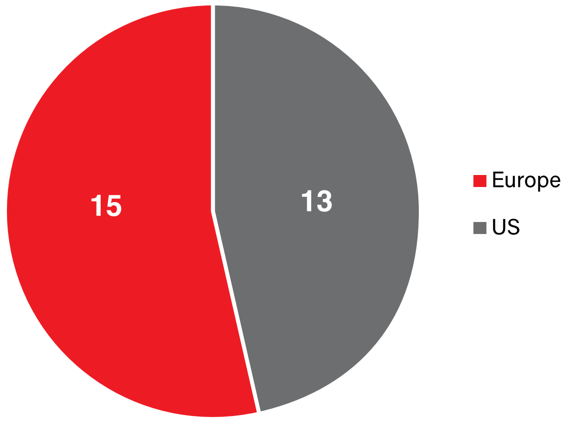
Quantum network testbeds in the US



Quantum network testbeds in Europe



Number of quantum networking testbeds



9.3 | Future research

We aim to systematically map and document the locations of quantum networking testbeds worldwide, creating a comprehensive open database accessible to researchers, policymakers, and industry stakeholders. We will be making this data publicly available to accelerate collaborative research, facilitate international partnerships, and inform evidence-based policy decisions regarding quantum infrastructure development. We would like to invite contributors and collaborators to join us in these efforts.

You can reach us at contact@qir.mit.edu.

Footnotes

[1] The White House National Quantum Coordination Office, 'A Strategic Vision for America's Quantum Networks' (2020).

[2] 'Quantum Networking: Findings and Recommendations for Growing American Leadership' [2024] National Quantum Initiative Advisory Committee.

[3] Quantum Internet Alliance, 'The Quantum Internet Alliance Will Build an Advanced European Quantum Internet Ecosystem' (14 October 2022) <https://quantuminternetalliance.org/2022/10/14/the-quantum-internet-alliance-will-build-an-advanced-european-quantum-internet-ecosystem/> accessed 31 March 2025.

[4] C Delle Donne and others, 'An Operating System for Executing Applications on Quantum Network Nodes' (2025) 639 Nature 321.

[5] QIA, 'QIA Researchers Create First Operating System for Quantum Networks' (Quantum Internet Alliance, 12 March 2025) <https://quantuminternetalliance.org/2025/03/12/qia-researchers-create-first-operating-system-for-quantum-networks/> accessed 31 March 2025.

[6] 'Quantum Networking: Findings and Recommendations for Growing American Leadership' (n 6).

[7] ibid.

[8] ibid.

[9] National Science and Technology Council (n 3).

[10] 'Quantum Networking: Findings and Recommendations for Growing American Leadership' (n 6).

11 | Appendix

Chapter 9 | Quantum networking testbeds

The dataset was created by merging input from the Center for Quantum Networks (CQN) researchers, QIR professional network and publicly available information by GQI Quantum Computing Report (accessed in June 2024).

Chapter 10 | Quantum processor benchmarking

The dataset of QPUs was composed by a combination of a keyword-based online search and official announcements, references to QPU lists made available to us, and direct query to QPU manufacturers. The data was collected from January 2024 to April 2025.

In particular, a list of known manufacturers was created based on the sources of The Quantum Insider, Olivier Ezratty, and Wikipedia. For each manufacturer, the official website was interrogated to retrieve the indicated benchmarks. For datasets not on manufacturer's websites, we utilized web searches (Google) for official announcements from manufacturers and related news articles.

Additionally, scholarly articles were identified via Arxiv and Google Scholar using the following keywords for benchmarks: Quantum Volume, CLOPS, EPLG, Q-Score, benchmarking.

During this process, additional manufacturers/QPUs were identified and added to the QPU list. Lastly, each manufacturer was contacted for verification of records—either to an existing contact of the QIR team, or to the communications address listed on manufacturer's website. The final list was reviewed by the QIR team and experts in their professional network.

Footnotes

[1] Gaida, J., Wong-Leung, J., & Robin, S. (2023). Critical technology tracker. Who Is Leading the Critical Technology Race. A Project by the Australian Strategic Policy Institute. https://techtracker.aspi.org.au

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