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**QIA researchers create first Operating System  
for Quantum Networks**

*Breakthrough achievement paves the way for practical quantum internet applications*

**Delft, The Netherlands:** Quantum Internet Alliance (QIA) researchers at TU Delft, QuTech, University of Innsbruck, INRIA and CNRS recently announced the creation of the first operating system designed for quantum networks: QNodeOS. The research, published in [Nature](https://www.nature.com/articles/s41586-025-08704-w), marks a major step forward in transforming quantum networking from a theoretical concept to a practical technology that could revolutionize the future of the internet.

“The goal of our research is to bring quantum network technology to all. With QNodeOS we're taking a big step forward. We're making it possible – for the first time – to program and execute applications on a quantum network easily”, says Prof. Dr. Stephanie Wehner, Professor of Quantum Computer Science at TU Delft’s quantum technology research institute QuTech who led the study. “Our work also creates a framework opening entirely new areas of quantum computer science research.”

**Lowering barriers for developers**

The ability to easily program classical computing hardware such as laptops or phones has had a transformative impact on our world and enabled the creation of a wide range of applications. “The system is like the software on your computer at home: you don’t need to know how the hardware works to use it,” says Mariagrazia Iuliano, PhD student at QuTech.

By essentially removing the barrier between networking hardware and software, the operating system will allow developers to create applications with ease and across a large spectrum of hardware solutions, paving the way for the development of software that can bring quantum network technology to society.

**A fully programmable operating system**

The quantum network operating system, known as QNodeOS, is fully programmable, meaning that applications can be run at a high level, just like on classical operating systems such as Windows or Android. Unlike previous systems, which required coding specific to each experimental setup, QNodeOS makes it possible to operate quantum processors on a network with ease, regardless of the hardware platform used. “Such an architecture, which has never been created before for quantum networks, enables developers to focus on application logic rather than hardware details,” explains Bart van der Vecht, PhD student at QuTech. “This makes it easier to come up with new kinds of applications, some of which we may not even be able to imagine today.”

**Compatible with multiple types of hardware**

Quantum network applications differ from applications that run on a quantum computer, introducing unique challenges that the researchers had to overcome. Unlike quantum computers that run single programs, quantum network applications require separate programs to execute independently at different network nodes—like a client app on your phone and a server in the cloud. These programs must coordinate with each other through messages and quantum entanglement, a special type of quantum connection which gives quantum networks their power. QNodeOS solves the unique challenges posed by this different quantum execution paradigm.

The researchers demonstrated that QNodeOS can work with multiple types of quantum hardware, by connecting it to two very different types of quantum processors. “Our trapped ion processors work fundamentally differently than those based on color centers in diamond, yet we have shown QNodeOS can work with both of them”, says Tracy Northup, Professor at the University of Innsbruck, Austria.

**The future of quantum networks**

The creation of QNodeOS united experts from physics, computer science, and engineering in taking an important step in QIA's mission to build a scalable and useful quantum network that can support real-world applications. On this journey, the operating system will offer a crucial framework for continued study and experimentation.

As a next step, QIA is working to provide the world access to the technology’s software and hardware components. One of the ways to do this will be to employ QNodeOS on the Quantum Network Explorer, QuTech's quantum internet demonstrator. This will enable a far broader audience to experiment, innovate and create software for quantum networks, accelerating the evolution of the field.

To learn more about the research, visit [Nature](https://www.nature.com/articles/s41586-025-08704-w).

**About QIA**

The [Quantum Internet Alliance (QIA)](https://quantuminternetalliance.org/) is a European research initiative focused on building the world’s first full-stack quantum internet prototype network. By advancing technologies in quantum communication, including quantum repeaters and end nodes, QIA aims to integrate quantum systems to create a scalable, global quantum internet. With support from Horizon 2020 and Horizon Europe funding, QIA brings together more than 40 leading academic, industrial, and research organizations, all working toward the goal of realizing a functional quantum internet by 2030.

**About the Partners**

[*TU Delft*](https://www.tudelft.nl/)*:* Delft University of Technology - Department of Software Technology of the Faculty of Electrical Engineering Mathematics, and Computer Science.

[*QuTech*](https://qutech.nl/): Mission-driven research institute for quantum computing and quantum internet, part of TU Delft.

[*University of Innsbruck*](https://www.uibk.ac.at/en/), Austria - Department of Experimental Physics.

[*INRIA*](https://www.inria.fr/en)*:* French National Institute for Research in Computer Science and Automation.

[*CNRS*](https://www.cnrs.fr/en/the-cnrs)*:* French National Centre for Scientific Research.

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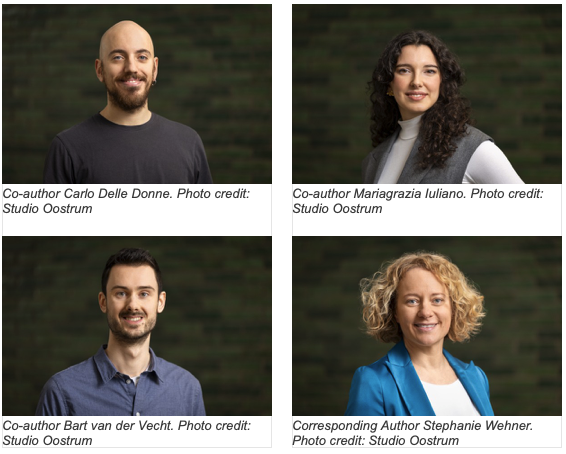
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**Pictures**

Download the press kit with the high res pictures [here](https://qutech.nl/wp-content/uploads/2025/03/QNodeOS_presskit.zip).

A group of people standing around a table with laptops

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*Corresponding author Stephanie Wehner and co-authors Mariagrazia Iuliano, Carlo Delle Donne and Bart van der Vecht against a backdrop of high-level application code that can be run on quantum network hardware through the QNodeOS stack. Photo credit: Studio Oostrum.*



A group of people posing for a photo

AI-generated content may be incorrect. A black box with a blue and purple light

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