IEEE Quantum Initiative Support for Standards

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Overview

Until recently, quantum information was a research area where participants interacted solely by the principles of open publishing. While open research continues, a few companies are now selling quantum computers, or services based on them, and a larger number of companies are selling quantum information-specific components.

IEEE's associated standards organizations may have a key role once quantum information becomes big business. However, companies already in the quantum information field are taking steps to organize the marketplace, such as through the formation of the U. S. Quantum Economic Development Consortium (QED-C). QED-C and international counterparts have expressed interest to IEEE in developing standards appropriate for an emerging market.

IEEE supports both informal and formal standards. For example, the IEEE Wi-Fi standard 802.11 is a formal, complex, evolving standard enabling a large industry of interoperable products. We hope quantum computing will warrant such a standard someday, but informal activities are more appropriate right now. Here's how quantum information standards are likely to evolve over time:

Initial Stages

Consider a handful of researchers working on a common topic yet in different companies, universities, or countries. They may want to communicate on ways to measure hardware consistently, create common interfaces for software, or any of a million other topics. Informal communications by e-mail or face-to-face at conferences may evolve into the sharing of designs, data, software, and so forth. If the researchers want their common ideas to be widely available, they can post files on the Internet. This type of activity can be called an informal standards effort if the researchers choose to do so. The quantum initiative can offer advice at this stage.

IEEE Services, the Quantum Initiative, and Industry Connections

For more mature topics, the quantum initiative can facilitate informal standards through IEEE conferences and publications. Many conferences support topical sessions and tracks where a dozen or more people can meet in a room for a few hours to share slide decks or conduct a meeting, optionally publishing their results in the conference's proceedings. The quantum initiative will organize new conferences and publications in the quantum engineering area, actively seeking participation of individuals and groups.

IEEE has a structure called an "industry connection" specifically to incubate discussion on standards, write white papers, and propose formal standards.

Staff and volunteers associated with the quantum initiative are knowledgeable about IEEE's standards process and can serve as initial points of contact.

Formal Standards

The emerging industry supplying researchers with quantum-specific lab equipment and subsystems may be ready for formal standards. For example, both suppliers and researchers would benefit from products such as cryogenic refrigerators, "chandeliers," microwave amplifiers, software, and so forth being supplied competitively and meeting compatibility standards that assure products will work together once they get into the lab. Since money is changing hands, the standards meetings should follow the IEEE standards association's (IEEE-SA's) processes that allow competitors to meet without running afoul of anti-competition laws.

A formal, international quantum standard starts when individuals or companies working in an area approach IEEE with a proposal called a Project Authorization Request (PAR). For more information on IEEE's formal standards, see https://standards.ieee.org/develop/index.html or talk to IEEE staff or a volunteer associated with IEEE-SA or the quantum initiative.

Standards for a Mature Quantum Industry

The standards process becomes vastly more complex as markets grow, encompassing non-technical issues such as the management of international trade, patent positions, competition, anti-competitive behavior, and so forth. There seems to be a widespread understanding that it's too early to consider these issues for quantum computing, although some believe they may apply to quantum communications even today.

At times a group of companies will form an alliance to collaborate on industry standards. There is an IEEE-affiliated corporation, the Industry Standards and Technology Organization (ISTO), that services these industry alliances. For more information see https://ieee-isto.org/.

IEEE, IEEE-SA, and ISTO are all non-profit corporations. As such, the IEEE merely facilitates the creation of standards, passing expenses to participants through registration and other fees. Ideas and technical direction remain the property of the volunteers and their employers.

Current Quantum Standards Efforts

The following quantum standards efforts are now active:
P1913 - Software-Defined Quantum Communication
P7130 - Standard for Quantum Computing Definitions
P7131 - Standard for Quantum Computing Performance Metrics & Performance Benchmarking

For More Information

See https://quantum.ieee.org/standards.