

WOLTE 13 IEEE Superconducting and Quantum Information Activities

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IEEE's International Roadmap on Devices and Systems (IRDS; irds.ieee.org) included a small section on superconducting classical and quantum computing in its 2017 semiconductor roadmap. This section will become a top-level roadmap starting in the 2018 edition.

The IRDS is part of IEEE's Rebooting Computing initiative, whose International Conference on Rebooting Computing includes quantum, neuromorphic, and "Beyond Moore's Law" classical computing. IRDS is also part of the IEEE Standards Organization, which includes three standards directly related to quantum information. IEEE has published many articles and conference papers on quantum computing.

As a professional organization, IEEE is generally a neutral forum for technical and policy dialog on the advancement of technology. Quantum information is a new area yet unusual in both its extraordinary upside potential and the sincerity of its skeptics – making neutrality especially important and challenging.

The roadmap's scope includes quantum information and cryoelectronics, with the latter including both superconductor (JJ) electronics and semiconductors operating at cryogenic temperatures. A planning workshop in late 2017 found the following ultimate applications: (a) specialty sensors and associated (b) signal processing, (c) quantum computing with a specific branch for (d) quantum machine learning, and (e) entirely classical power-efficient computers for data centers. None of these are currently ready for large-scale development, so the roadmap includes intermediate milestones or systems of rising complexity.

Successes in quantum computer physics research are shifting the focus to engineering at scale. As quantum computers mature, they will need a control system that is likely to be far more complex than the strictly quantum portion of the system. The need for cryogenic temperatures establishes a topical connection between quantum computers the classical control electronics.

IRDS will apply processes and the experience developed since the early 1990s under its previous name International Technology Roadmap for Semiconductors. The process involves workshops with experts on subsets of the technology and editorial boards for each area who write comparative documents or schedules for improvement.

The talk will outline the history and plans for adding this new technology area to IEEE, illustrated by notions of the expected range of technology options, yet maintaining neutrality about any specific approach.

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