

◀ 巻末の付録USBメモリに詳細版を収録 ▶

## 第28部

### 分散型量子計算のネットワーク応用技術 (概要版)

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#### 第1章 AQUA

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The AQUA (Advancing Quantum Architecture) working group continued research activities advancing quantum computing and communication, especially quantum networking and distributed quantum computing systems. Our research contributes to planning for the long-term evolution of the computing and networking industries as Moore's Law comes to an end.

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#### 第2章 AQUA WG Activity Report 2012

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In 2012, AQUA members published seven papers in top-tier journals on a new means of executing logical gates on top of the favored surface code error correction mechanism; quantum computer architecture; workloads for quantum computers; and quantum repeater networks.

##### 2.1 Quantum Networks

In 2012, AQUA members two papers on quantum networks: an overview of the field in the widely-read magazine IEEE Network [Van Meter 2012], and a paper integrating the concepts of practical quantum repeaters with the abstract concept of quantum network coding, improving the practicality of network coding [Sato et al., Physical Review A 2012].

##### 2.2 Quantum Computation

The surface code is considered to be one of the most viable forms of quantum error correction, but the resource demands for it are high-\cite{raussendorf07:\_

topol\_fault\_toler\_in\_clust,van-meter10:dist\_arch\_ijqi}.

In 2011, we developed {\em lattice surgery}, which allows smaller numbers of qubits to be used for the surface code, and published a description in \emph{New Journal of Physics} in 2012.

A paper titled, ``A Blueprint for Building a Quantum Computer," has been accepted to Communications of the ACM [Van Meter and Horsman, 2013].

In 2012, in conjunction with a group from Stanford University, we published a description of a specific architecture using quantum dots. More importantly, this paper contains a decomposition of an architecture into layers, with specific responsibilities, much as a classical architecture has the device, micro- and macro-architectures [Jones et al., 2012].

Several other papers appeared during the year, and are listed in the full report.

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#### 第3章 Conclusion

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In 2012, the AQUA working group had a very strong year in publications, and expects to continue that success in 2013. Equally important, the ideas being created and tested in AQUA are starting to develop influence with experimentalists who are building larger and large systems. Finally, much industry activity has begun to ferment in the field, and 2013 promises to be an exciting, possibly watershed, year. WIDE will remain at the forefront.