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A methodology for characterising and benchmarking quantum devices for resource usage

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Quantum Computing (QC) is undergoing a high rate of development, investment and research devoted to its improvement. However, before one can decide how to improve something, it is first necessary to define the criteria for success: what are the metrics or statistics that are relevant to the problem and the domain of use? As well as computational metrics, understanding resource requirements is also key in moving towards quantum utility. For practical use of quantum computers, there are likely to be strict resource constraints in terms of programming/optimisation time, runtime, environmental stability and power/energy consumption. The authors have developed a benchmarking methodology that uses the principles of Practice Based Research to highlight the need for detailed planning and adequate documentation in this area [1]. The methodology considers the full-stack architecture and guides the user to consider all hidden assumptions and parameter choices that are being made. This talk will present this methodology as a framework by which any user, developer or researcher can define, articulate and justify the success criteria, resource requirements and associated benchmarks that have been used to solve their problem or make their claim.

1. Park, J., Stepney, S. & D'Amico, I. A methodology for comparing and benchmarking quantum devices. in *Unconventional Computation and Natural Computation* 28–42 (Springer Nature Switzerland, Cham, 2024).

Theme

Theme 1. Energy advantage and cost of quantum technology

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