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Title: A Concept for a Quantum-Classical Hybrid Computing System: From Low to High Layers

Abstract: In this presentation, I will introduce a concept for a quantum-classical hybrid computing system that I am currently studying. This concept is based on an idea I originally devised during my time as a researcher at Hitachi Ltd. Since the only systems we have successfully conceptualized as complete computing systems are for classical computation, I will first provide an overview of classical systems and then discuss how quantum computing can be integrated into that framework. In current quantum computing technology, the advantages of quantum computing are leveraged through specific execution units embedded within the CPU's ALU (Arithmetic Logic Unit). Furthermore, since the distinction between circuit-level and language-level abstractions remains undefined in quantum computing, gate-level netlists are programmable, requiring even front-end programmers to describe quantum logic circuits within their programs. In light of these constraints, I propose some concepts for the design of language processing systems (compilers), outlining the forms for both the input source program and the output object program.