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## **The IceCube Data Acquisition Software: Lessons Learned during Distributed, Collaborative, Multi-Disciplined Software Development.**

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In this experiential paper we report on lessons learned during the development of the data acquisition software for the IceCube project - specifically, how to effectively address the unique challenges presented by a distributed, collaborative, multi-institutional, multi-disciplined project such as this. While development progress in software projects is often described solely in terms of technical issues, our experience indicates that non- and quasi-technical interactions play a substantial role in the effectiveness of large software development efforts. These include: selection and management of multiple software development methodologies, the effective use of various collaborative communication tools, project management structure and roles, and the impact and apparent importance of these elements when viewed through the differing perspectives of hardware, software, scientific and project office roles. Even in areas clearly technical in nature, success is still influenced by non-technical issues that can escape close attention. In particular we describe our experiences on language selection, software requirements specification, and selection and use of development, framework and communication tools. Using both anecdotal and detailed software architecture descriptions, we make observations on what tools and techniques have and have not been effective in this geographically disperse (including the South Pole) collaboration and offer suggestions on how similarly structured future projects may build upon our experiences.

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