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ORIGINAL ARTICLE

# Scaling radio astronomy signal correlation on heterogeneous supercomputers using various data distribution methodologies

**Ruonan Wang · Christopher Harris**

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**Abstract** Next generation radio telescopes will require orders of magnitude more computing power to provide a view of the universe with greater sensitivity. In the initial stages of the signal processing flow of a radio telescope, signal correlation is one of the largest challenges in terms of handling huge data throughput and intensive computations. We implemented a GPU cluster based software correlator with various data distribution models and give a systematic comparison based on testing results obtained using the Fornax supercomputer. By analyzing the scalability and throughput of each model, optimal approaches are identified across a wide range of problem sizes, covering the scale of next generation telescopes.

**Keywords** Radio astronomy · Software correlator · GPU computing · Heterogeneous computing · Supercomputing · GPU cluster · OpenCL

## 1 Introduction

Signal correlation is one of the most computationally demanding and communication intensive tasks in the signal processing flow of a radio telescope array. It has been traditionally processed using field programmable gate arrays (FPGAs) to achieve excellent power efficiency. However, high development challenges and lack

R. Wang (✉)
ICRAR, M468, The University of Western Australia,
35 Stirling Highway, Crawley, WA 6009, Australia
e-mail: jason.wang@icrar.org

C. Harris
iVEC@UWA, M024, The University of Western Australia,
35 Stirling Highway, Crawley, WA 6009, Australia
e-mail: christopher.harris@uwa.edu.au