## Co-author declaration for the following joint paper:

This declaration should describe the research contribution of the candidate, the main supervisor (where he/she is an associate author) and the other two most central authors (the corresponding author must be among them). If applicable, the contributions from other PhD candidates who has or intend to include the paper in a thesis should be described. Contributions from master students should be described.

**Authors:  Jonas Markussen, Lars Bjørlykke Kristiansen, Pål Halvorsen, Halvor Kielland-Gyrud, Håkon Kvale Stensland, Carsten Griwodz**
**Title:        SmartIO: Zero-overhead Device Sharing through PCIe Networking**
**Journal:** *Transactions on Computer Systems, volume 38, issue 1-2 (2021)*

Jonas Markussen's independent contribution:
☒ First author ☒ Corresponding author ☐Other
The ideas for the SISCI API extension described in the paper grew out of Markussen's experiences. Markussen contributed with several new ideas for the design of this API, and implemented these. He collaborated on the effort of combining these ideas with previous work into the complete SmartIO system. Furthermore, Markussen came up with the idea for, designed, and implemented the prototype distributed NVMe driver using this API extension, including the queue offloading idea and support for running the driver on GPUs. Limitations in the initial API design were uncovered during this process, and Markussen made subsequent improvements to both design and implementation of the API throughout the development of the driver. Additionally, he designed and implemented several workloads for this NVMe driver using GPUs and Device Lending in order to demonstrate the novelty and completeness of the SmartIO solution, as well as the performance benefits. He conducted a thorough and exhaustive performance analysis of all components of the SmartIO system, as well as evaluating the entire system, and investigated and implemented solutions for eliminating performance overheads in the system. Finally, Markussen wrote most of the text for the paper, and also wrote the necessary tools and benchmarking programs for the evaluation, including the FIO integration for the NVMe driver and implementing GPU and NVMe test programs.

Lars Bjørlykke Kristiansen
☐ First author ☐ Main supervisor ☐ Corresponding author ☐ PhD candidate ☒ Other
Kristiansen contributed to the SISCI API extensions described in the paper and worked together with Markussen on integrating these with the previous Device Lending work. He also provided feedback on parts of the NVMe driver implementation, as well as reviewed the manuscript several times and provided suggestions for improvements on the text.

Carsten Griwodz
☐ First author ☐ Main supervisor ☐ Corresponding author ☐ PhD candidate ☒ Other
Griwodz reviewed the paper several times and provided valuable feedback and suggestions for improvements on parts of the text.

Pål Halvorsen
☐ First author ☐ Main supervisor ☐ Corresponding author ☐ PhD candidate ☒ Other
Halvorsen participated in the planning of the paper, and reviewed the paper several times and provided feedback and suggestions for improvements on figures and all parts of the text.

**UiO ⦂**

Håkon Kvale Stensland

☐ First author ☒ Main supervisor ☐ Corresponding author ☐ PhD candidate ☐ Other

Stensland participated in the planning of the paper, and provided feedback and several reviews of the paper text.

Has this paper been, or will this paper be part of another doctoral degree thesis?

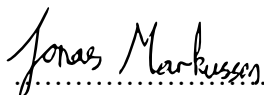Yes: ☐         No: ☒

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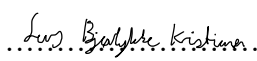
Contributions from master students:

Do you verify that Jonas Markussen has contributed to this joint paper as described above?

Yes: ☒         No: ☐

If no, specify:

**Co-author's signatures:**

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Jonas Markussen                      Lars B. Kristiansen                    Carsten Griwodz

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Pål Halvorsen                                          Håkon K. Stensland