PATENT ASSIGNMENT COVER SHEET

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SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	ASSIGNMENT

CONVEYING PARTY DATA

Name	Execution Date
DOUGLAS RAYE REED	11/12/2021
AL LOPER	11/12/2021
TERRY PARKS	11/12/2021

RECEIVING PARTY DATA

Name:	CENTAUR TECHNOLOGY, INC.
Street Address:	7600-C N. CAPITAL OF TEXAS HWY.
Internal Address:	SUITE 300
City:	AUSTIN
State/Country:	TEXAS
Postal Code:	78731

PROPERTY NUMBERS Total: 1

Property Type	Number
Application Number:	17581162

CORRESPONDENCE DATA

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ATTORNEY DOCKET NUMBER:	252203-1190
NAME OF SUBMITTER:	DAVID RODACK
SIGNATURE:	/David Rodack/
DATE SIGNED:	01/21/2022

Total Attachments: 5
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ASSIGNMENT
OF UTILITY PATENT APPLICATION

WHEREAS, the following parties:

Name	Address
Douglas Raye Reed	3800 Bailey Ln. #2 Austin, TX 78756
Al Loper	10724 Bay Laurel Trail Austin, TX 78750
Terry Parks	6 Carriage House Lane Austin, TX 78737

hereinafter referred to as ASSIGNOR, has/have invented certain new and useful improvements ("invention(s)") as described and set forth in the attached invention disclosure entitled:

Zero bits in L3 tags

which was:

☒ executed on even date herewith,
    ☐ filed with the United States Patent and Trademark Office (USPTO) on and assigned Serial No. , and
☐ further described in U.S. Provisional application entitled , filed with the USPTO on , and assigned Serial No. .

Note: Only one of the first two checkboxes will be checked. The third checkbox will be checked, only if appropriate.

WHEREAS, CENTAUR TECHNOLOGY, INC., having a place of business at 7600-C N. CAPITAL OF TEXAS HWY., SUITE 300, AUSTIN, TEXAS 78731, hereinafter referred to as ASSIGNEE, is desirous of acquiring ASSIGNOR'S interest in and to said invention(s), and any U.S., international, and foreign applications or patents covering the invention, including any utility applications, provisional applications, and any U.S. and foreign patents covering the invention.

NOW, THEREFORE, TO ALL WHOM IT MAY CONCERN: Be it known that, for good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged by ASSIGNOR, ASSIGNOR has sold, assigned and transferred and does hereby sell, assign and transfer unto ASSIGNEE, and ASSIGNEE'S successors and assigns, (a) the entire right, title and interest, for the United States of America, in and to said invention(s), and any U.S.,

international, and foreign applications covering the invention and all the rights and privileges in any application and under any and all patents that may be granted in the U.S. for said inventions, including all corresponding provisional, continuation, continuation-in-part, divisional, reissue, and reexamination applications; and (b) the entire right, title and interest in and to said invention(s), and any utility application and provisional application for all countries foreign to the U.S., including all rights of priority arising from them, and all the rights and privileges under any and all forms of protection, including patents, that may be granted in said countries foreign to the U.S. for them.

ASSIGNOR authorizes ASSIGNEE to make application for such protection in its own name and maintain such protection in any and all countries foreign to the U.S., and to invoke and claim for any application for patent or other form of protection for said Inventions, without further authorization from ASSIGNOR, any and all benefits, including the right of priority provided by any and all treaties, conventions, or agreements.
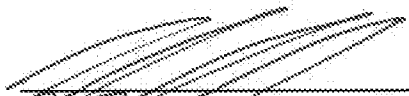
ASSIGNOR hereby consents that a copy of this assignment shall be deemed a full legal and formal equivalent of any document which may be required in any country in proof of the right of ASSIGNEE to apply for patent or other form of protection for said Inventions, said utility application, or said provisional application and to claim the aforesaid benefit of the right of priority.

ASSIGNOR requests that any and all patents for said inventions be issued to ASSIGNEE in the U.S. and to ASSIGNEE in all countries foreign to the U.S., or to such nominee as ASSIGNEE may designate.

ASSIGNOR covenants and agrees that, when requested, ASSIGNOR shall, without charge to ASSIGNEE but at ASSIGNEE'S expense, sign all papers, take all rightful oaths, and do all acts which may be necessary, desirable, or convenient in connection with the patent applications, patents, or other forms of protection of said invention(s), and for the defense and protection thereof if challenged in the court of law.

ASSIGNOR authorizes ASSIGNEE or its agents to insert, on ASSIGNOR's behalf, the filing date and/or serial number above pertaining to the utility application and/or the provisional application, if not known as of the date of execution of this document.

Date: __11/12/2021__

Douglas Raye Reed

Date: __11/12/2021__

Witness
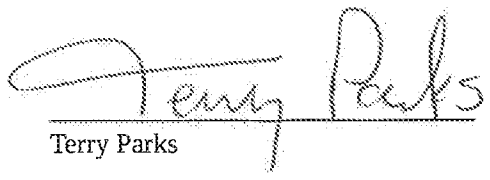
Date: 12 Nov 21

Al Lopez
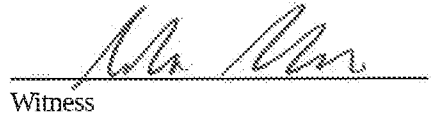
Date: Nov 12, 2021

Witness

Date: 11-13-21

Terry Parks

Date: 11-12-21

Witness

Inventors:
Doug Reed
Al Loper
Terry Parks

Idea: Zero-bits in L3 tags

This invention is an optimization to NCID (Noninclusive cache, inclusive directory)-style last-level caches. When the L3 directory has a cache line for which data is also present, a typical victim cache would require allocating space in the data array to hold the cached data. Rather than waste precious data array storage when the core is storing or evicting 0s, we propose adding a single "zero" bit to each cache line in the L3 directory.

When a core does a store or writeback of all 0s, the non-inclusive LLC can forego allocating data storage for the corresponding way, and can instead set the 0 bit instead. If the LLC already has data storage allocated for the cache line, the storage can be deallocated or preferentially chosen for reallocation for a later non-zero write. A subsequent read to this cache line in the LLC could forego enabling the data array and performing a costly data read while still returning the known-zero data. The LLC can detect zero writes with a NOR reduction of the received data, so this scheme is completely transparent to the core and coherent interconnect and doesn't require any new transaction types or instructions.