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(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
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(27) Previously filed application:
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(54) **NETWORK ARCHITECTURES FOR BOUNDARY-LESS HIERARCHICAL INTERCONNECTS**

(57) Systems and methods for implementing boundary-less hierarchical networks including methods of generating such networks in accordance with embodiments of the invention are disclosed. In one embodiment, a hierarchical network in an integrated circuit that includes a plurality of computing elements, where the plurality of computing elements have M outputs and N inputs, and a plurality of switches arranged into stages of switches wherein the plurality of computing elements are connected to switches in a first stage, the switches in the first stage are connected to the plurality of computing elements and switches in a second stage, where the switches in the second stage are connected to the switches in the first stage, at least M+1 adjacent computing elements can connect to at least two nearest neighboring computing elements via a stage 1 switch, and every computing element can connect with every other computing element within the hierarchical network.

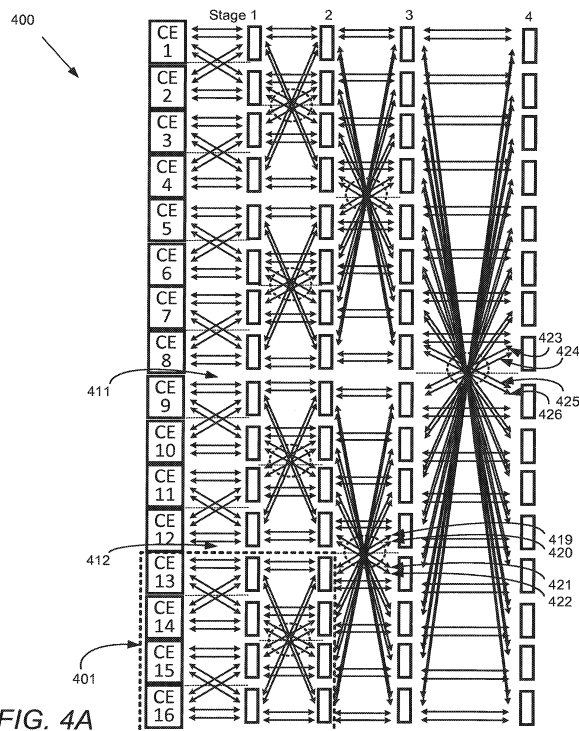


FIG. 4A

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EUROPEAN SEARCH REPORT

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 7 233 167 B1 (KAPTANOGLU SINAN [US]) 19 June 2007 (2007-06-19) * column 2, line 61 - column 12, line 51; figures 1-6 *	1-7	INV. H03K19/177 G06F17/50
X	US 8 098 081 B1 (TRIMBERGER STEPHEN M [US]) 17 January 2012 (2012-01-17) * column 1, line 58 - column 14, line 48; figures 1-11 *	1-7	
X	WO 99/33177 A1 (ADVANCED MICRO DEVICES INC [US]) 1 July 1999 (1999-07-01) * page 17, line 3 - page 44, line 2; figures 2-13 *	1-7	
			TECHNICAL FIELDS SEARCHED (IPC)
			H03K G06F
-The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 7 March 2019	Examiner Kassner, Holger
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03/02 (P04C01)



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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

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Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

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No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

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LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

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see sheet B

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All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

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As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

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Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

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None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

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1-7

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The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).



**LACK OF UNITY OF INVENTION
SHEET B**

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The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

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1. claims: 1-7

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A hierarchical network in an integrated circuit, the hierarchical network comprising: a plurality of computing elements, wherein a first plurality of computing elements have M outputs and N inputs and a second plurality of computing elements have M+1 outputs and N+1 inputs; and a plurality of switches arranged into stages of switches wherein: the plurality of computing elements are connected to switches in a first stage via routes; the switches in the first stage are connected to the plurality of computing elements and switches in a second stage via routes, wherein the switches in the second stage are connected to the switches in the first stage via routes; a plurality of switches in the first stage have M inputs and a plurality of switches in the first stage have M+1 inputs; and every computing element of the plurality of computing elements is configurable to connect with every other computing element within the hierarchical network via one or more stages of switches.

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2. claims: 8-15

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A method for transmitting data between computing elements of a hierarchical network where the switches (413, 418) in the second stage are connected to the switches (406, 407, 408, 409) in the first stage via routes (414, 415, 416, 417); and transmitting data from the stage 1 switch to another computing element where at least M+1 adjacent computing elements can transmit data to at least two nearest neighboring computing elements via a stage 1 switch (406, 407, 408, 409).

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

07-03-2019

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 7233167 B1	19-06-2007	US 7233167 B1	19-06-2007
		US 2007210829 A1	13-09-2007
		US 2008258763 A1	23-10-2008

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		US 8415976 B1	09-04-2013

WO 9933177 A1	01-07-1999	US 6275064 B1	14-08-2001
		WO 9933177 A1	01-07-1999

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82