

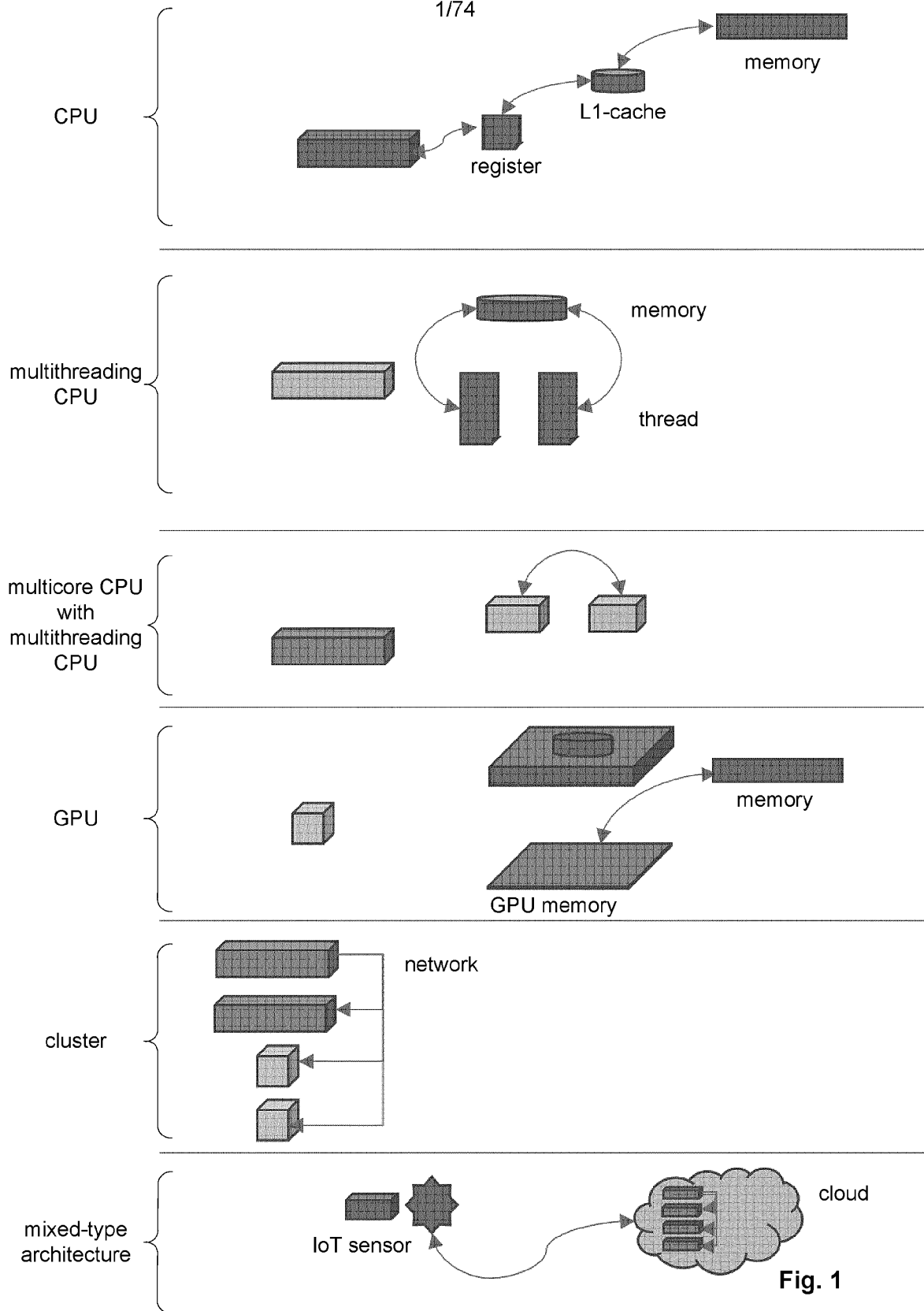
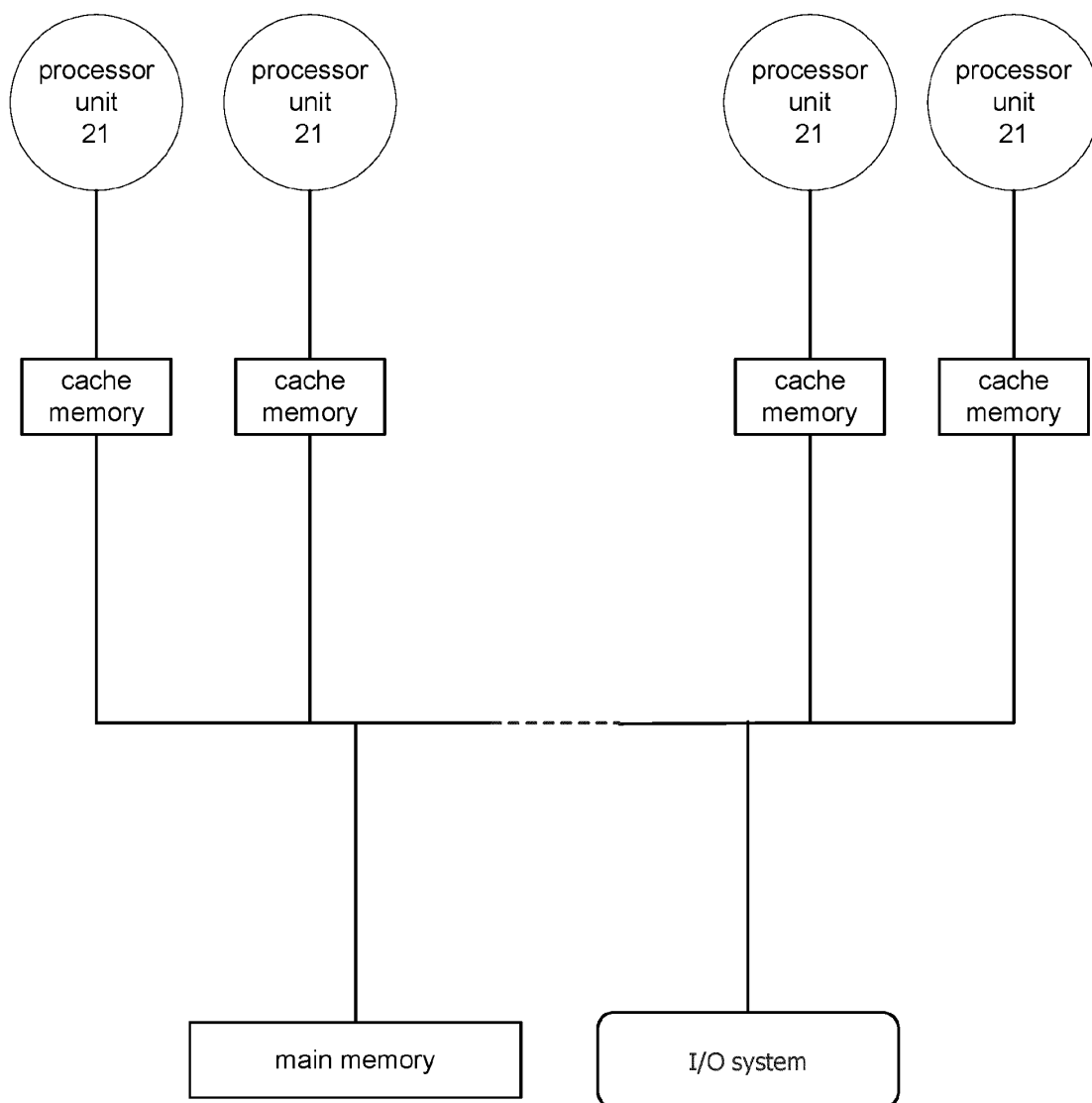


Fig. 1

2/74

**Fig. 2**

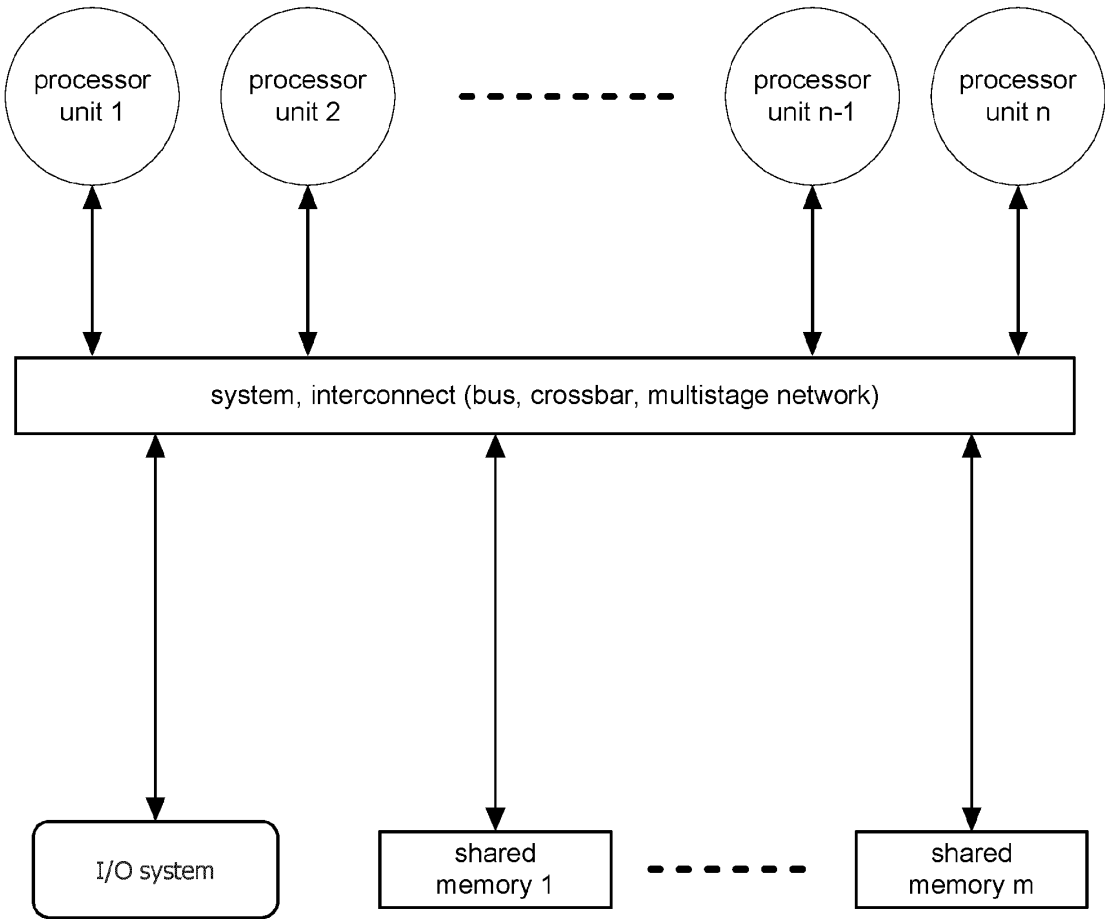
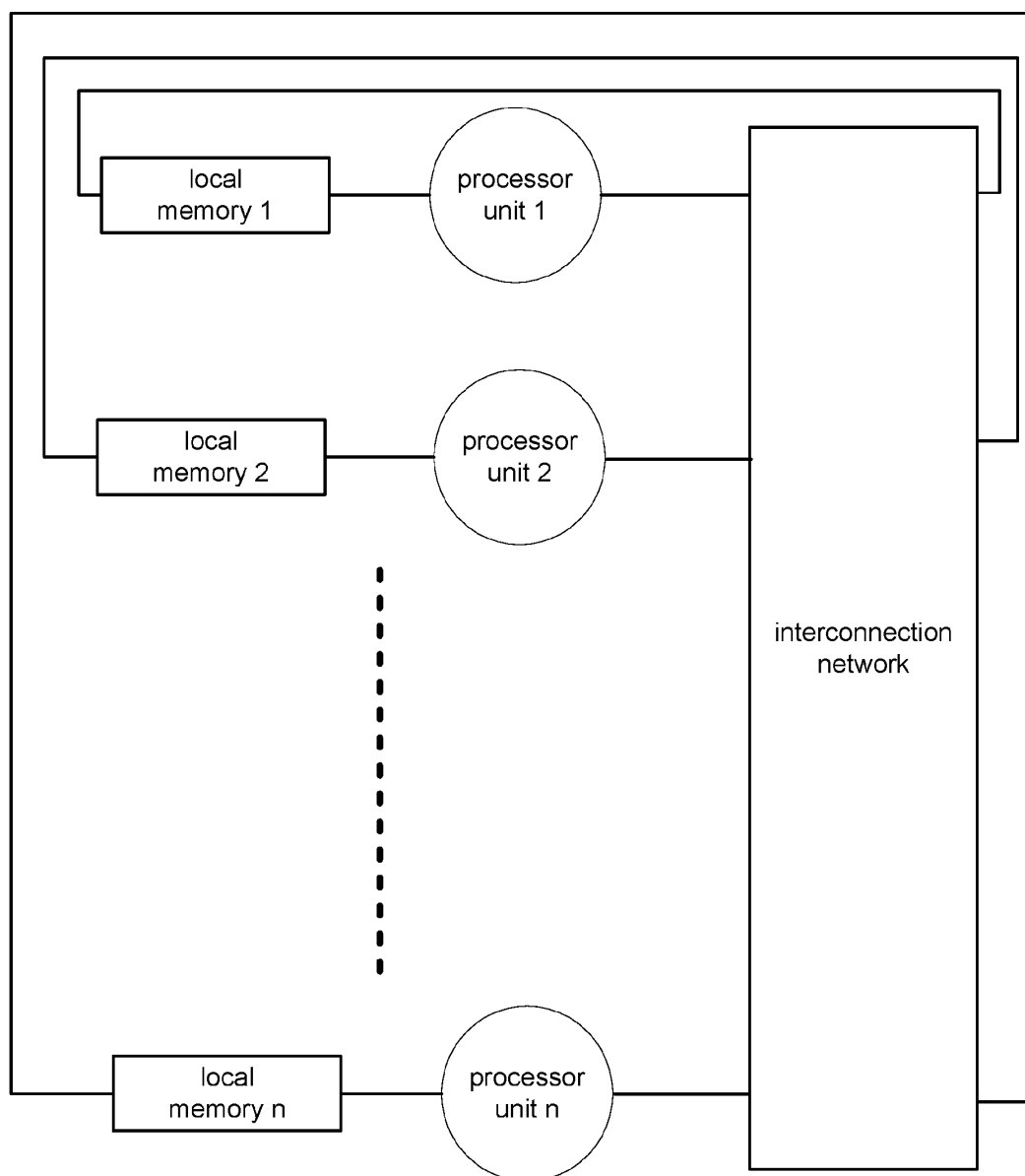
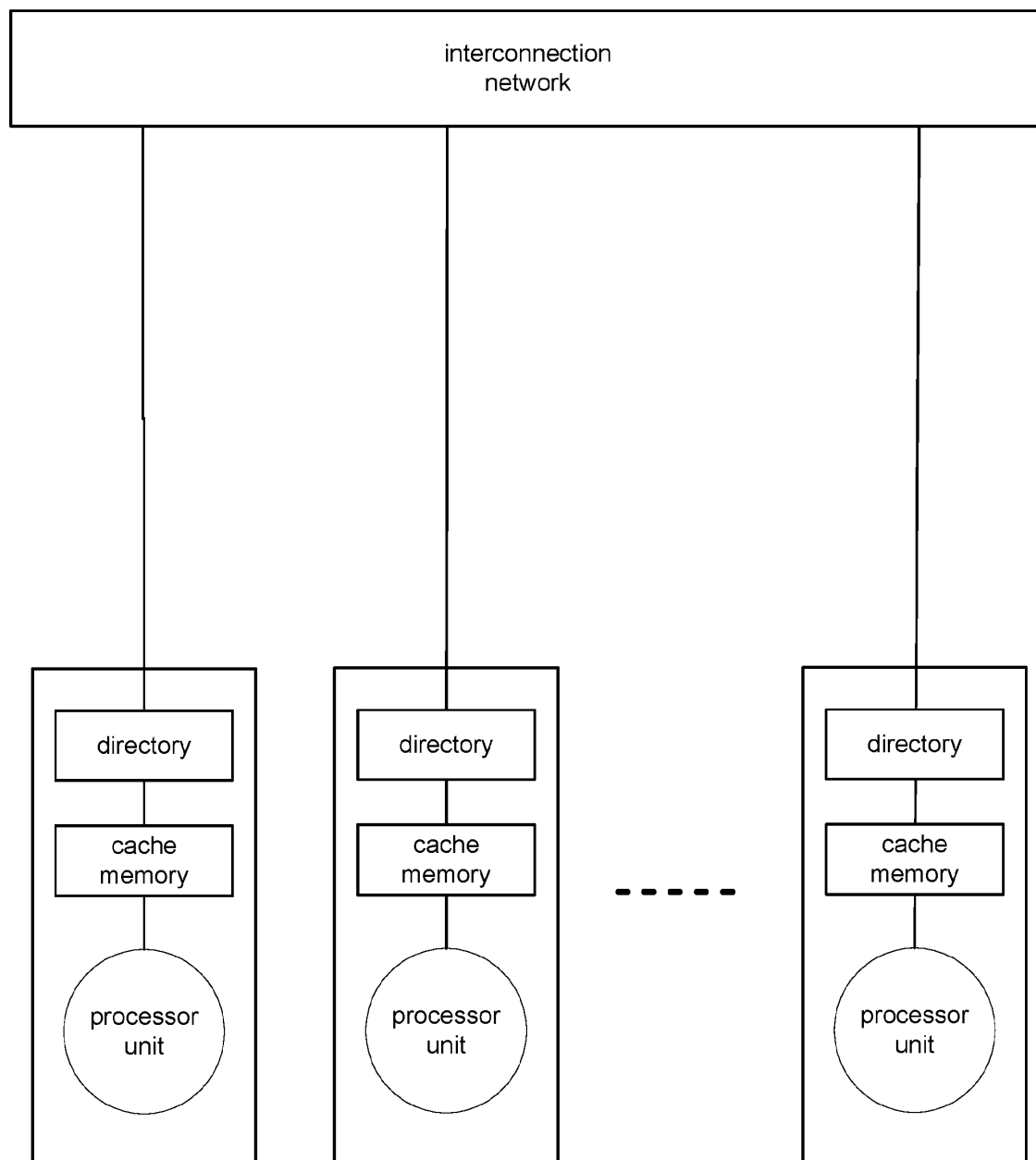


Fig. 3

**Fig. 4**

**Fig. 5**

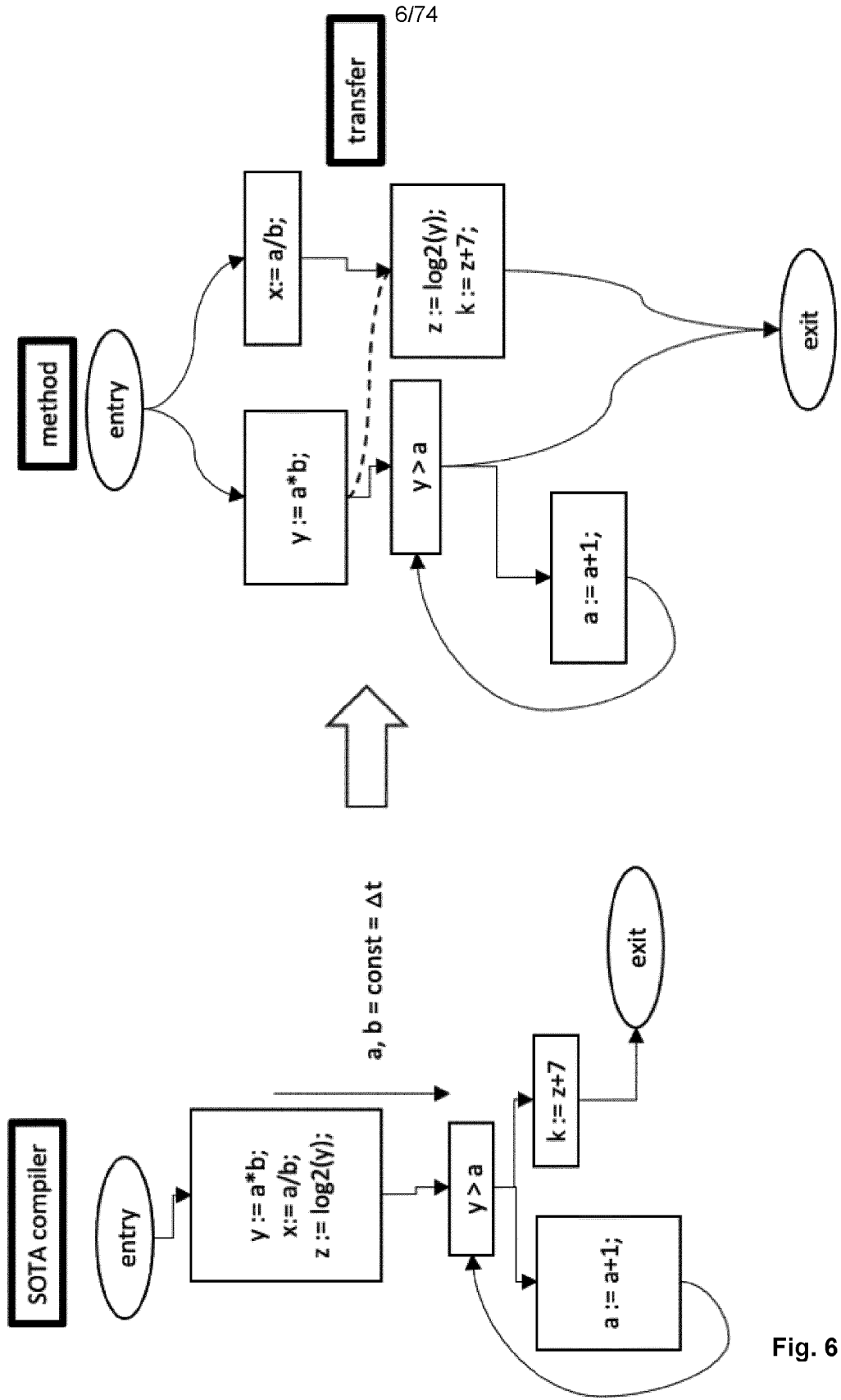


Fig. 6

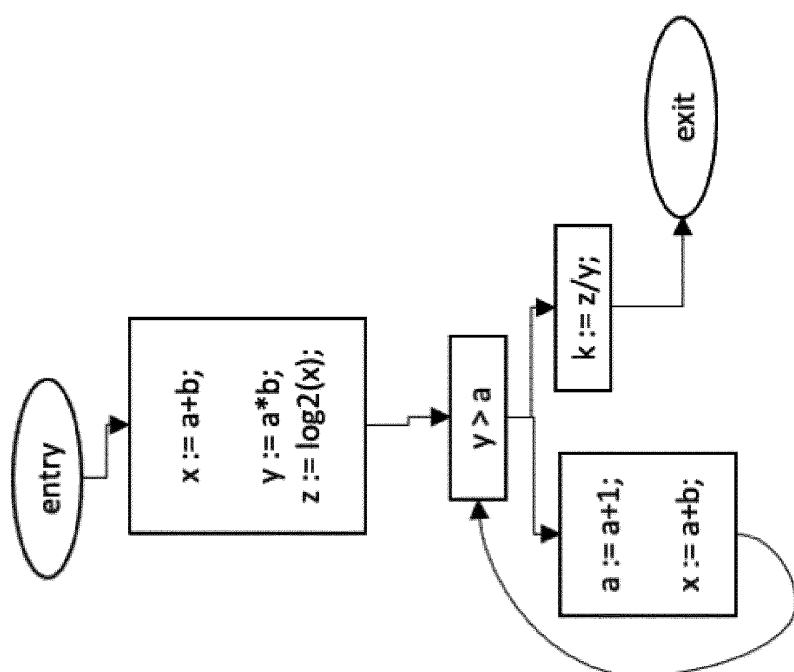
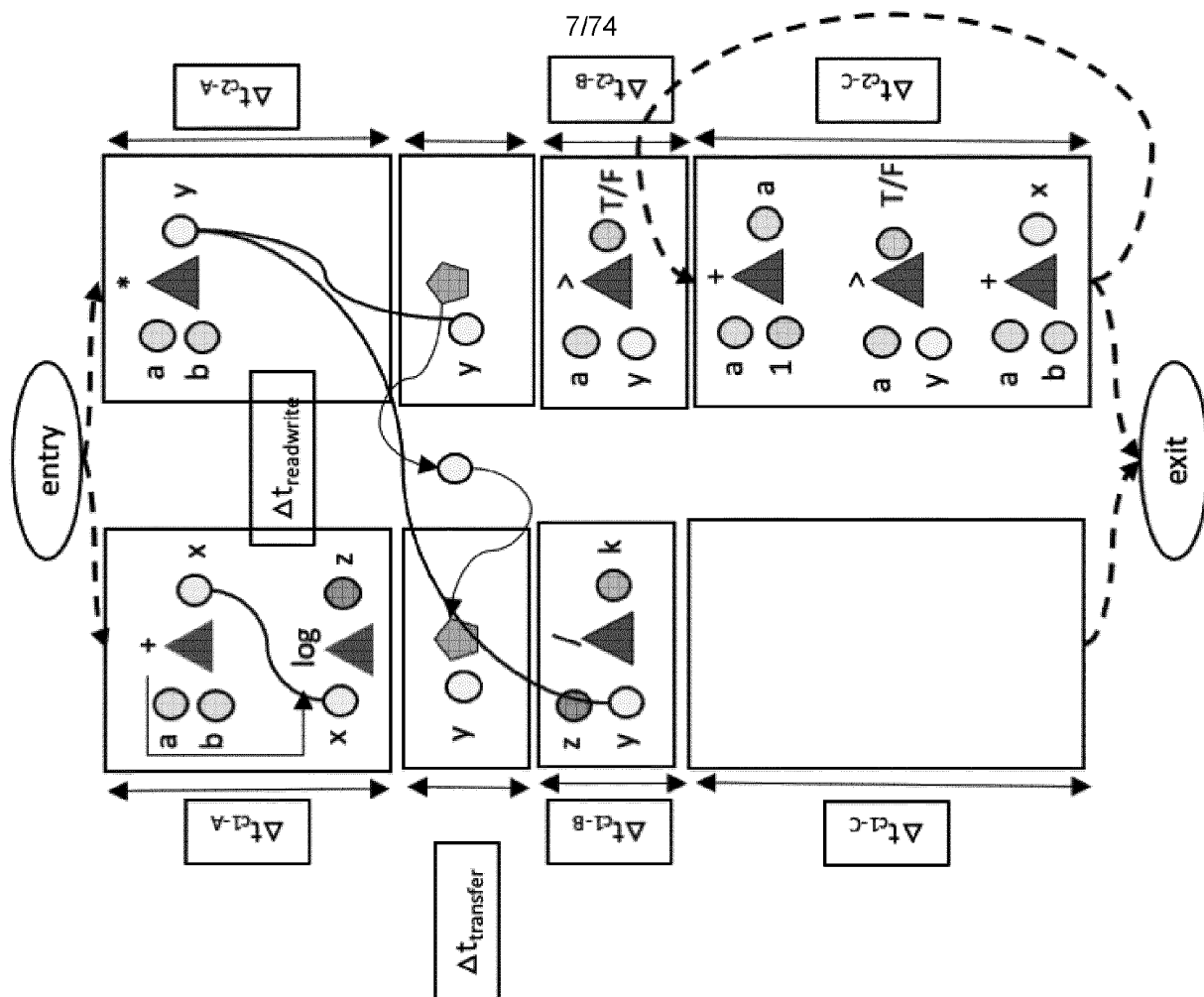


Fig. 7

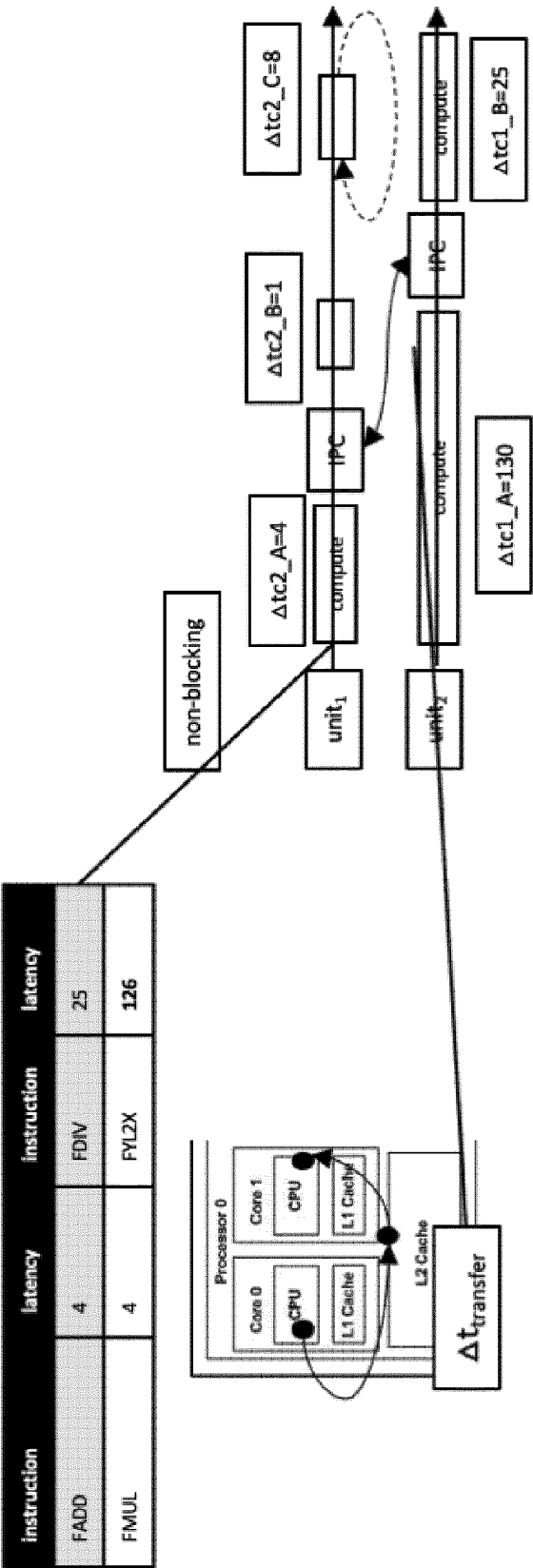


Fig. 8

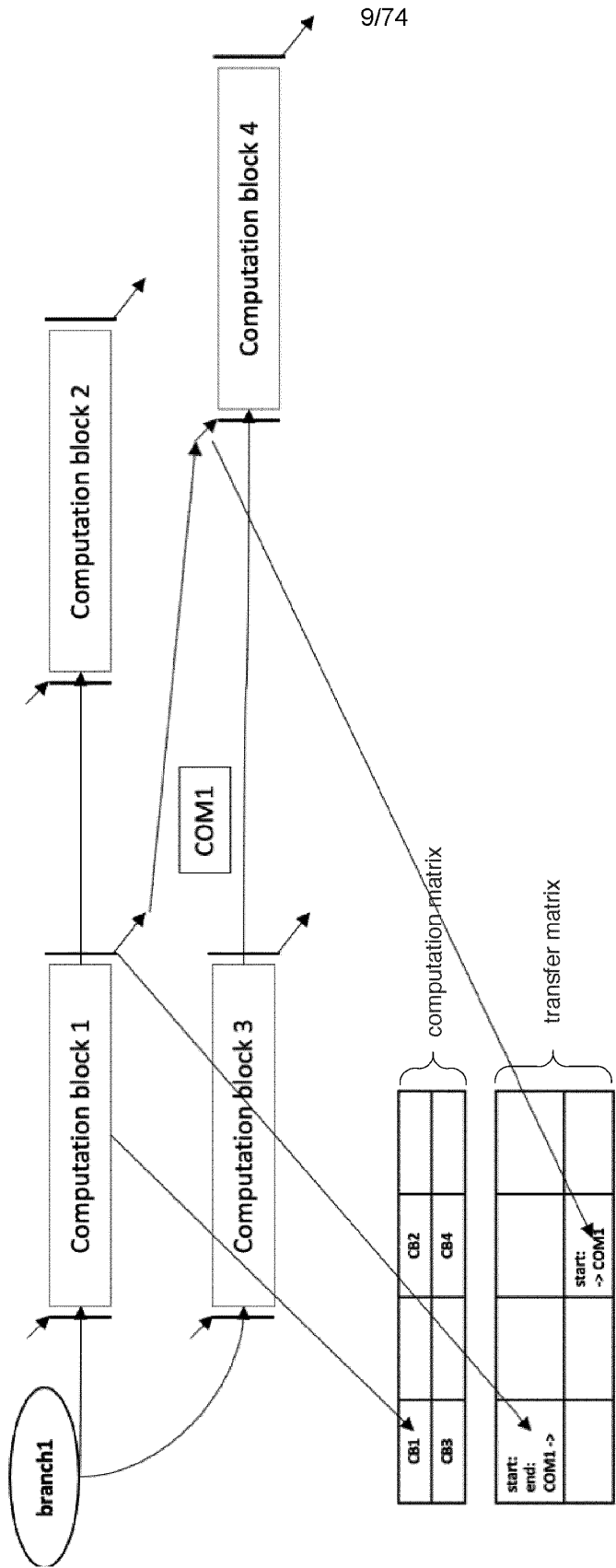


Fig. 9

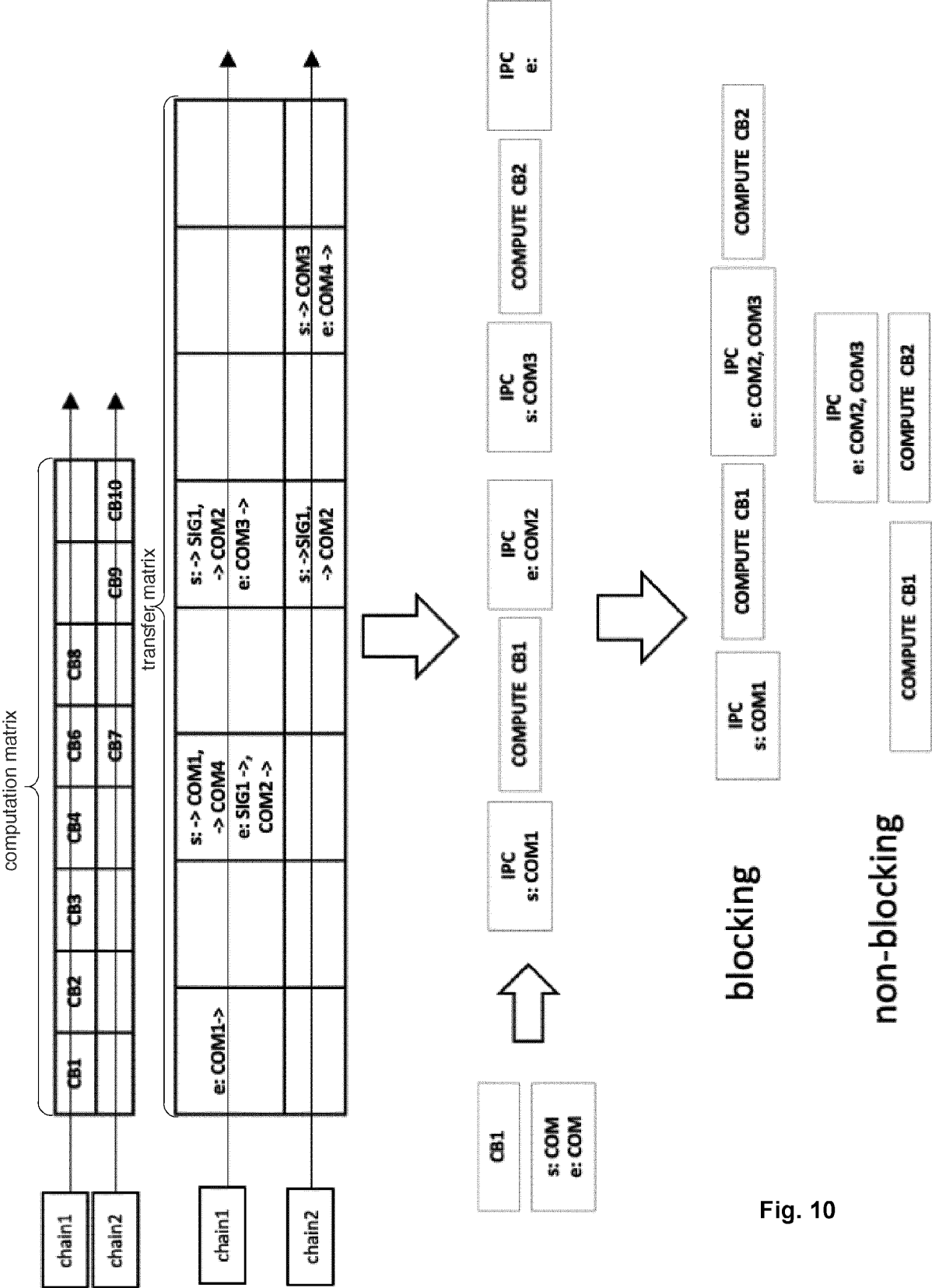


Fig. 10

11/74

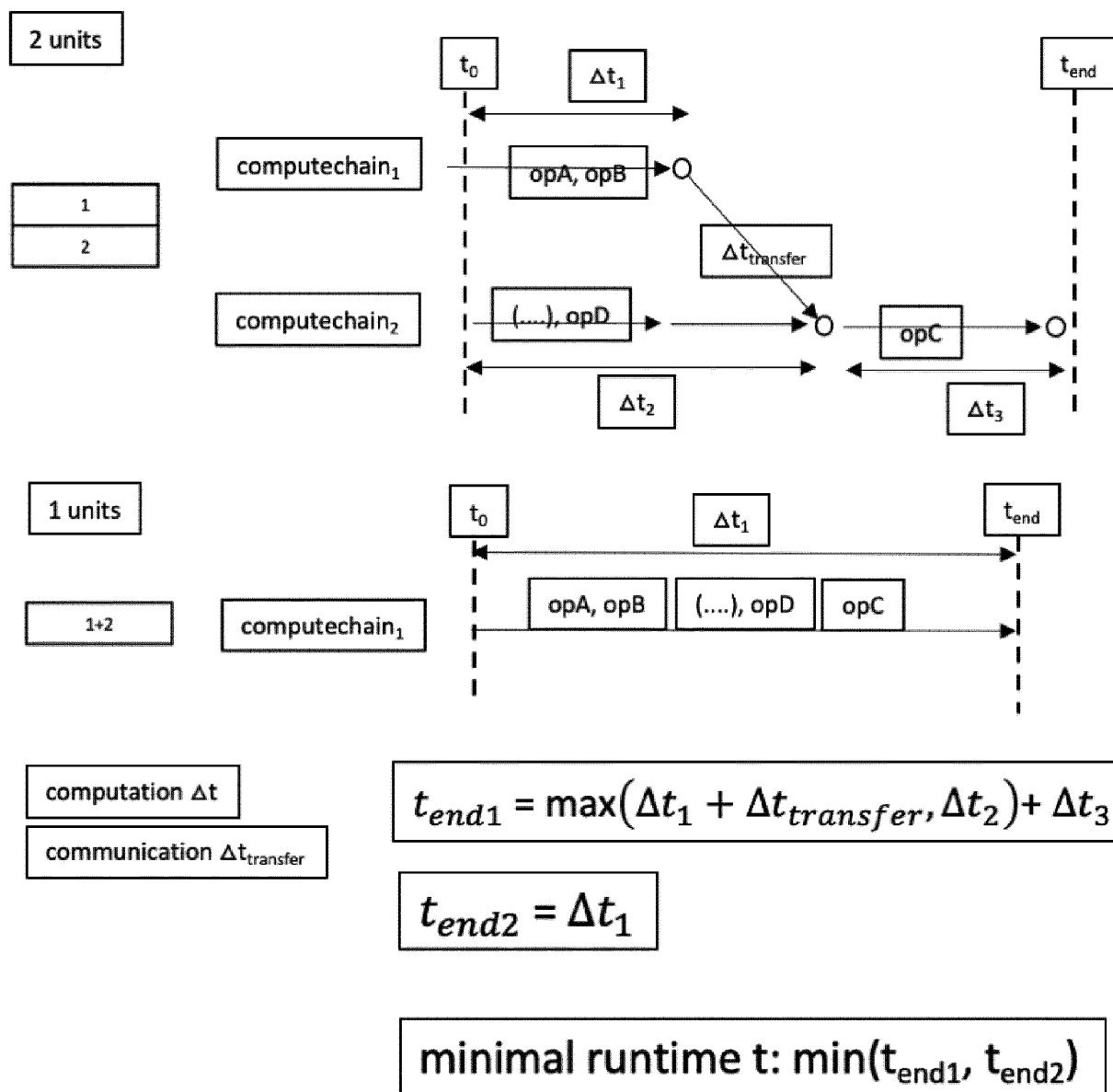
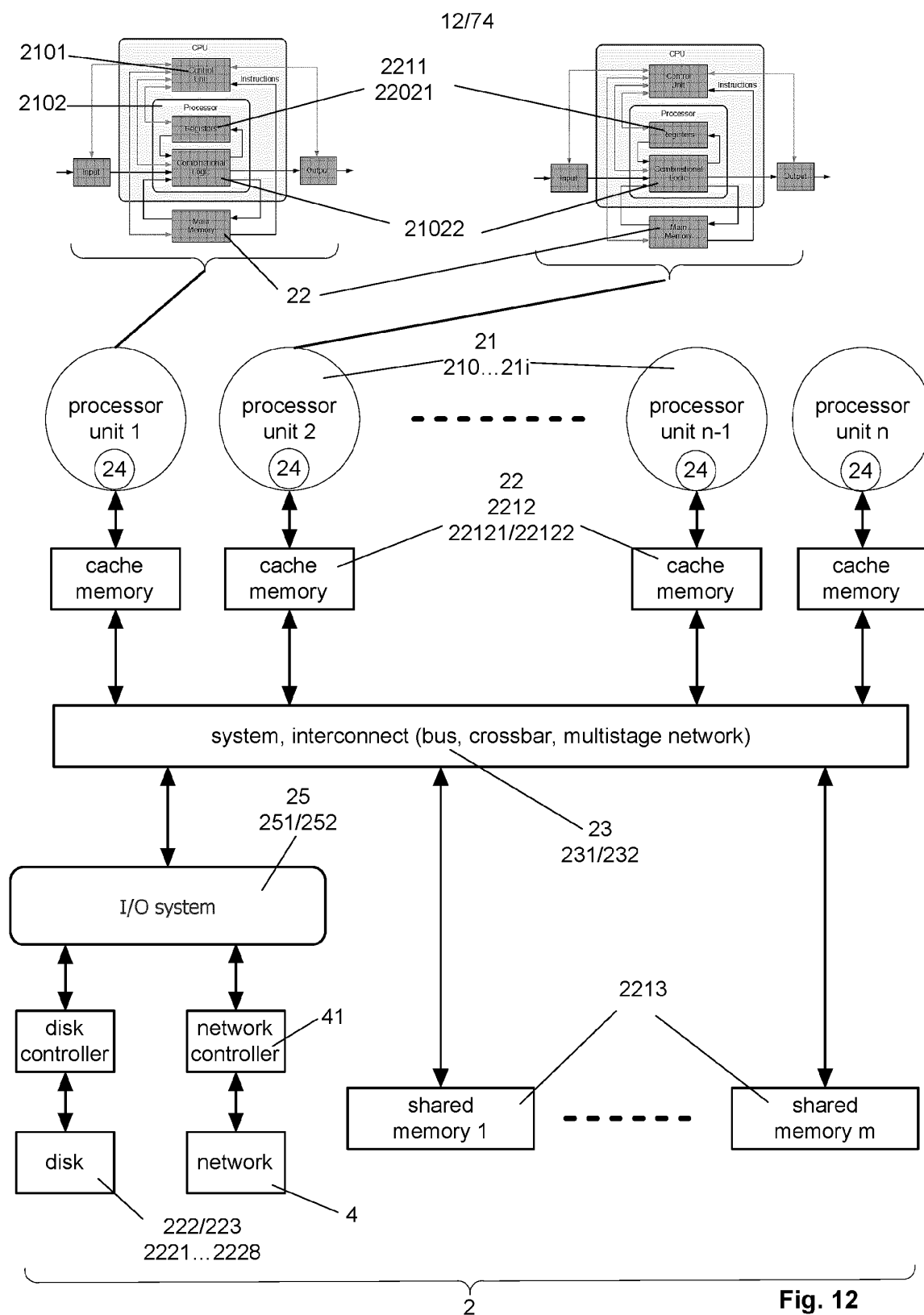


Fig. 11



13/74

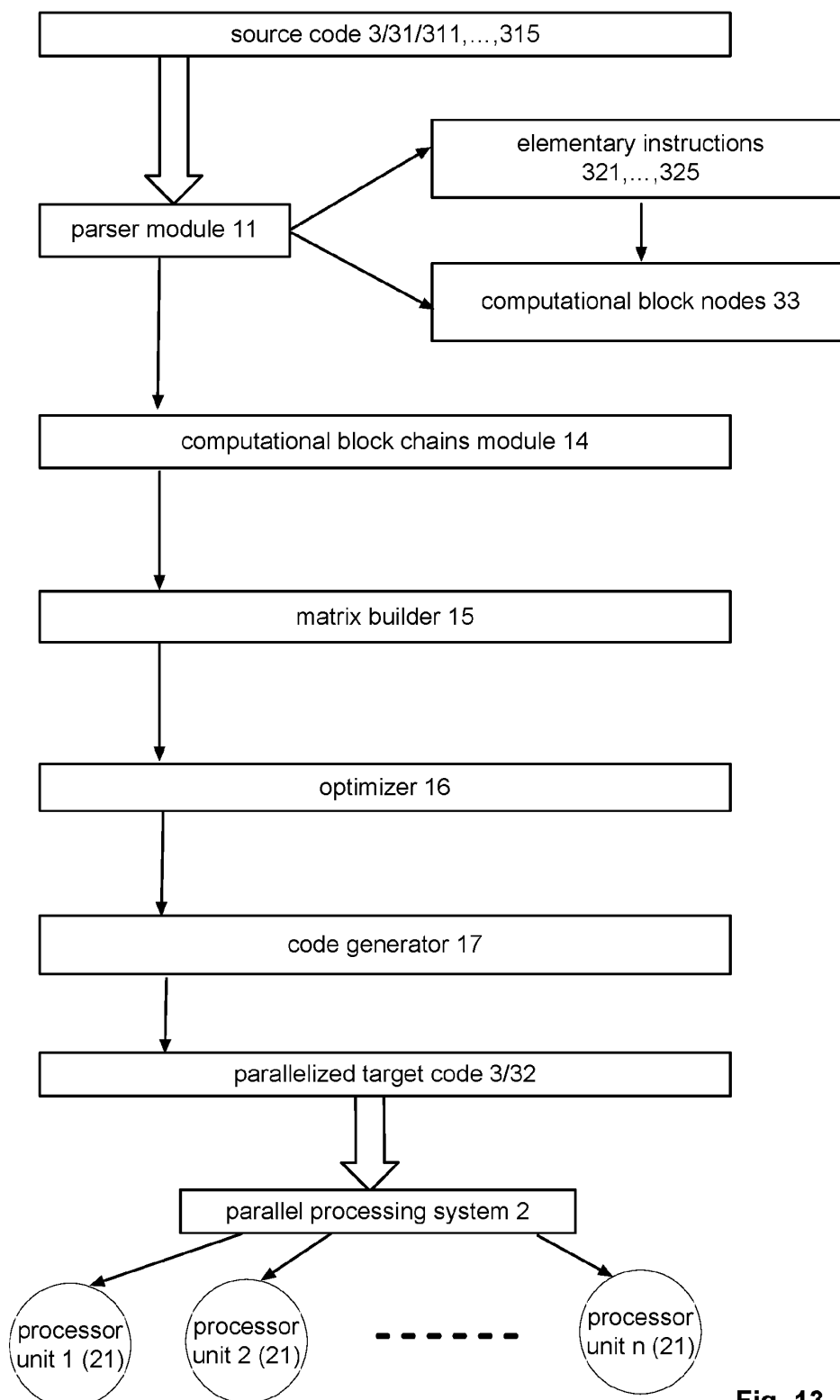


Fig. 13

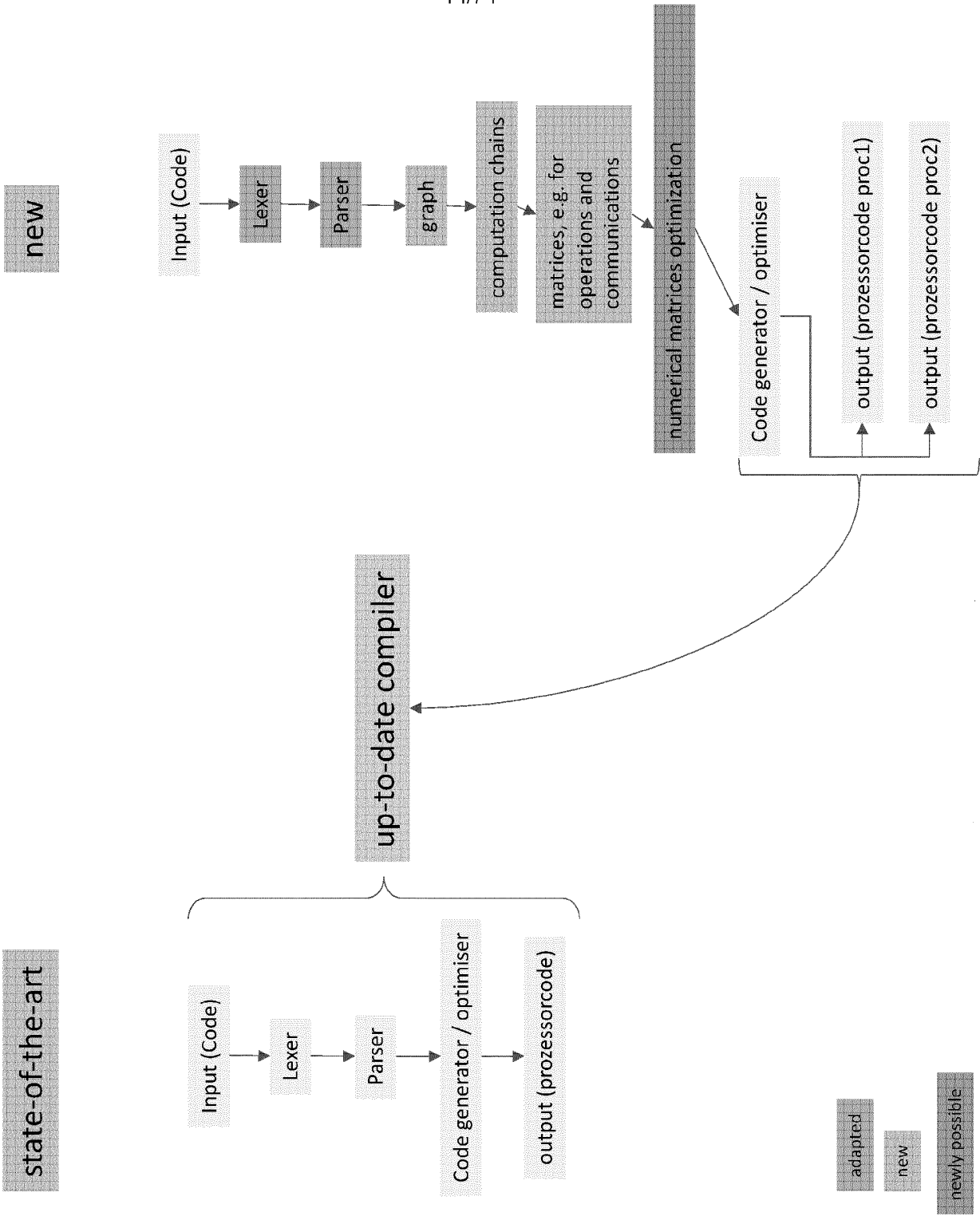


Fig. 14

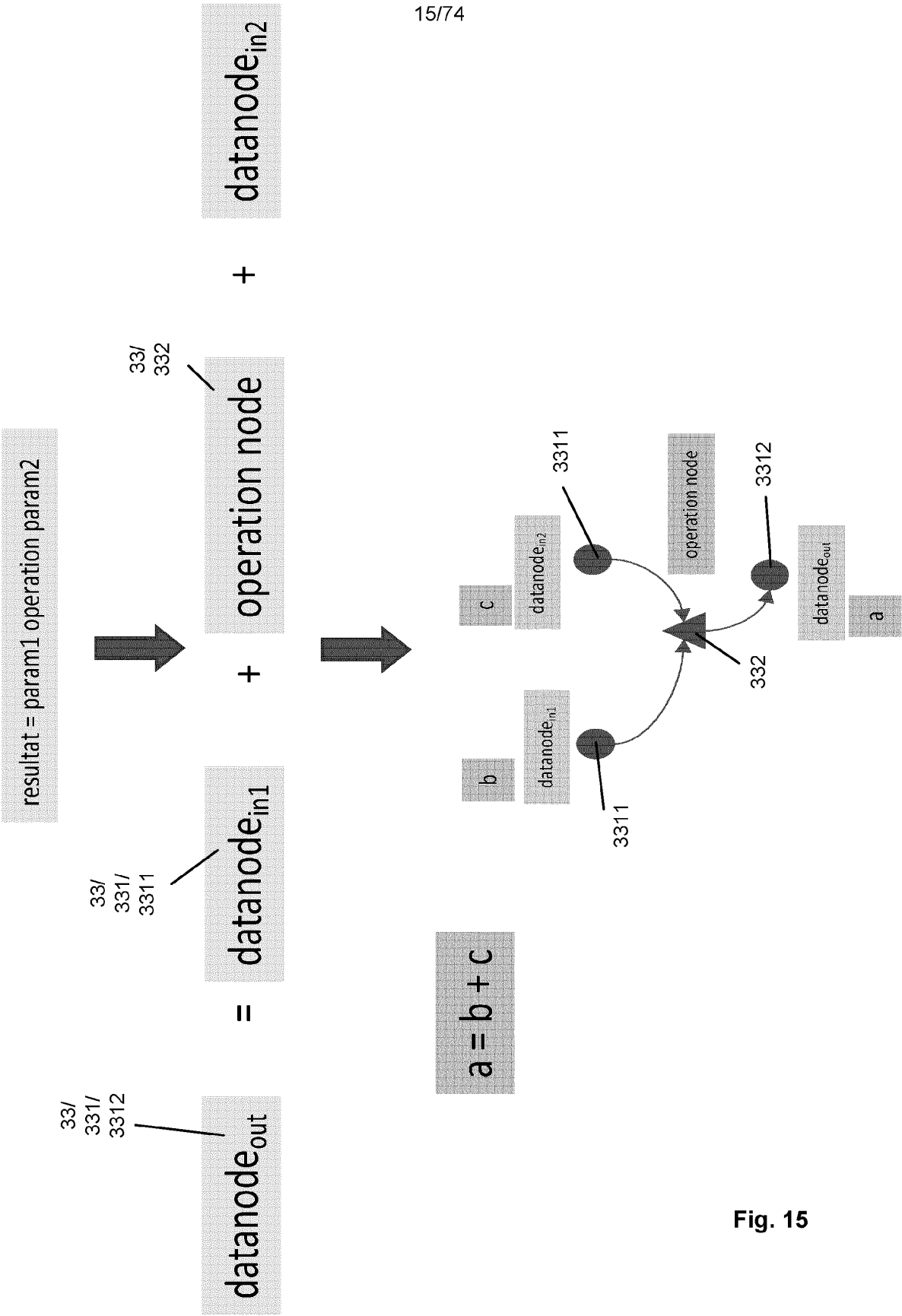
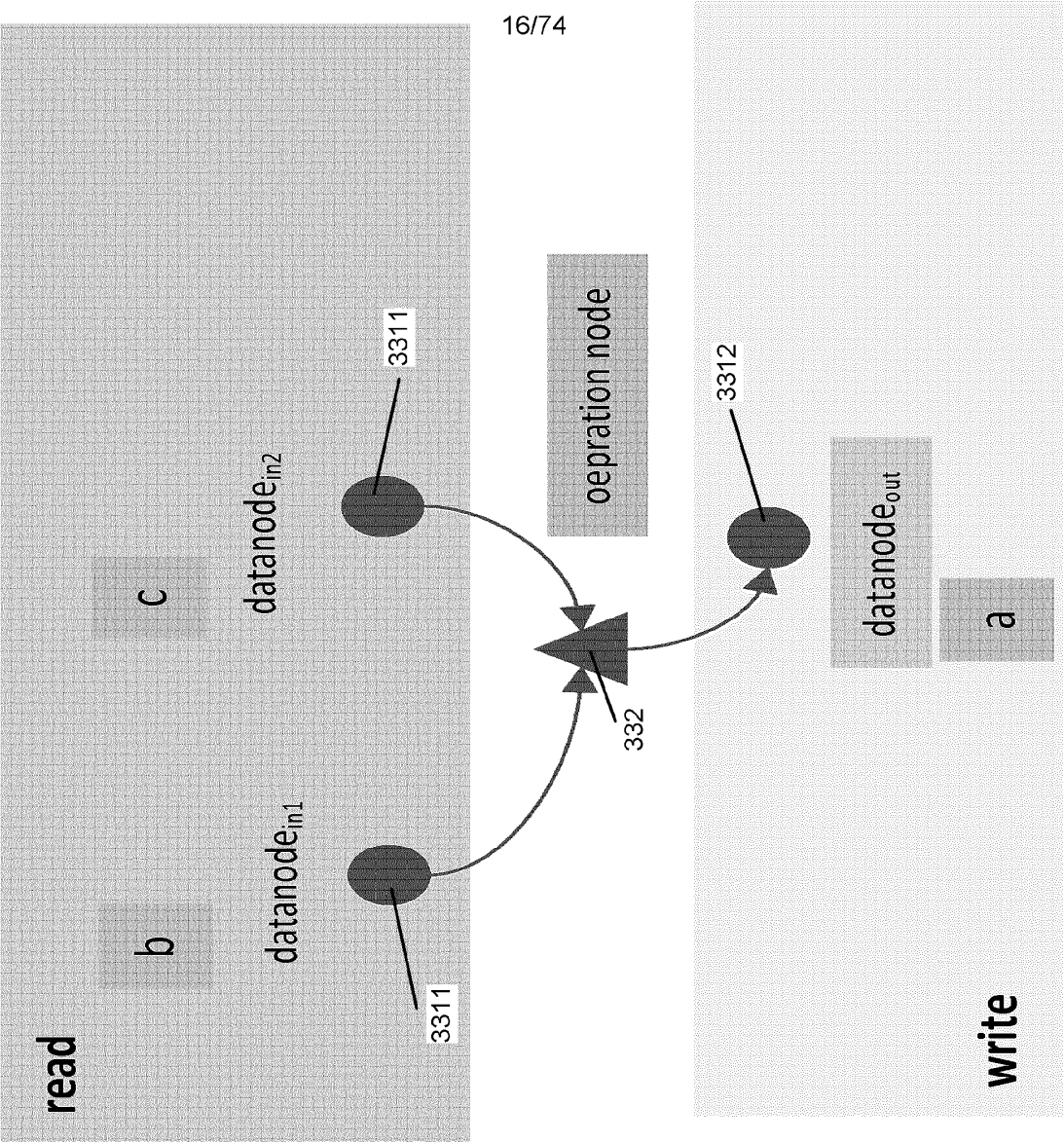
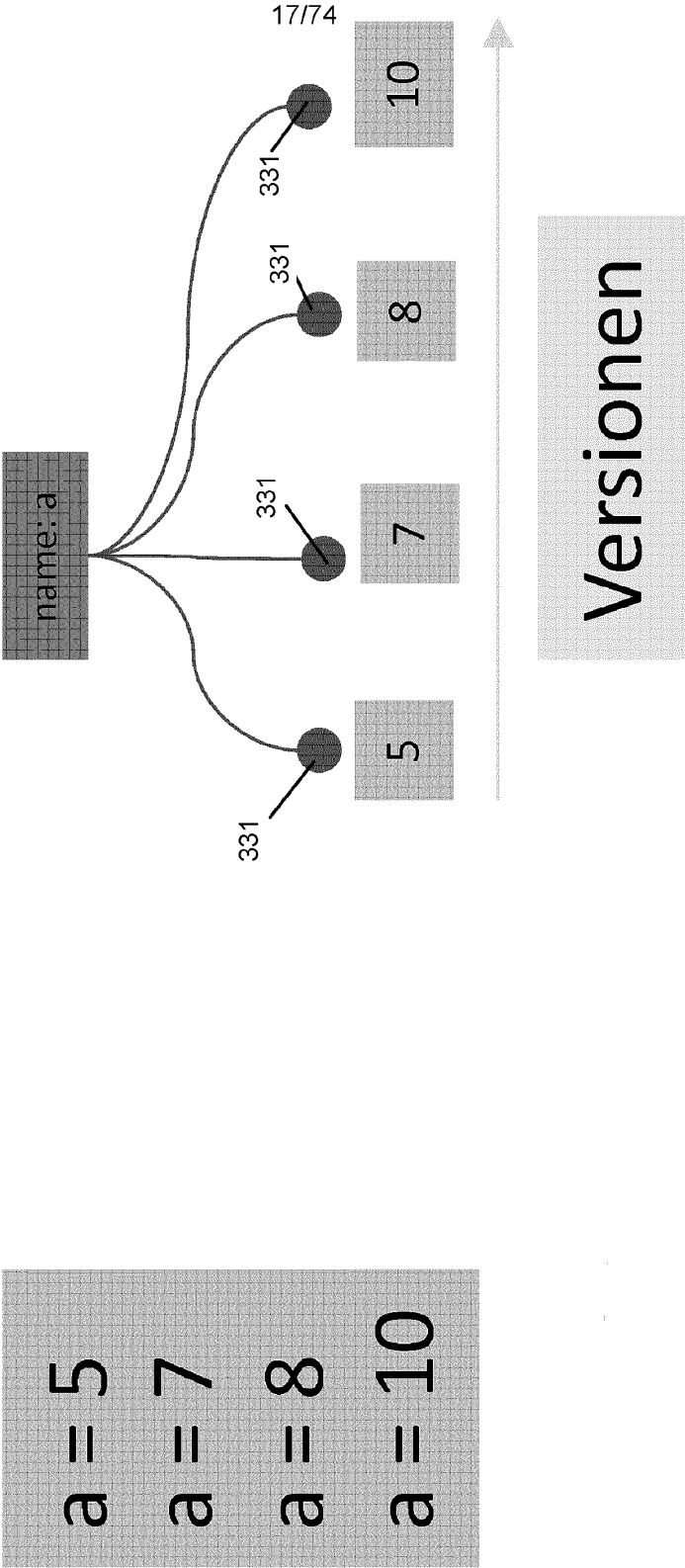


Fig. 15



$$a = b + c$$

Fig. 16



a = 5
a = 7
a = 8
a = 10

Fig. 17

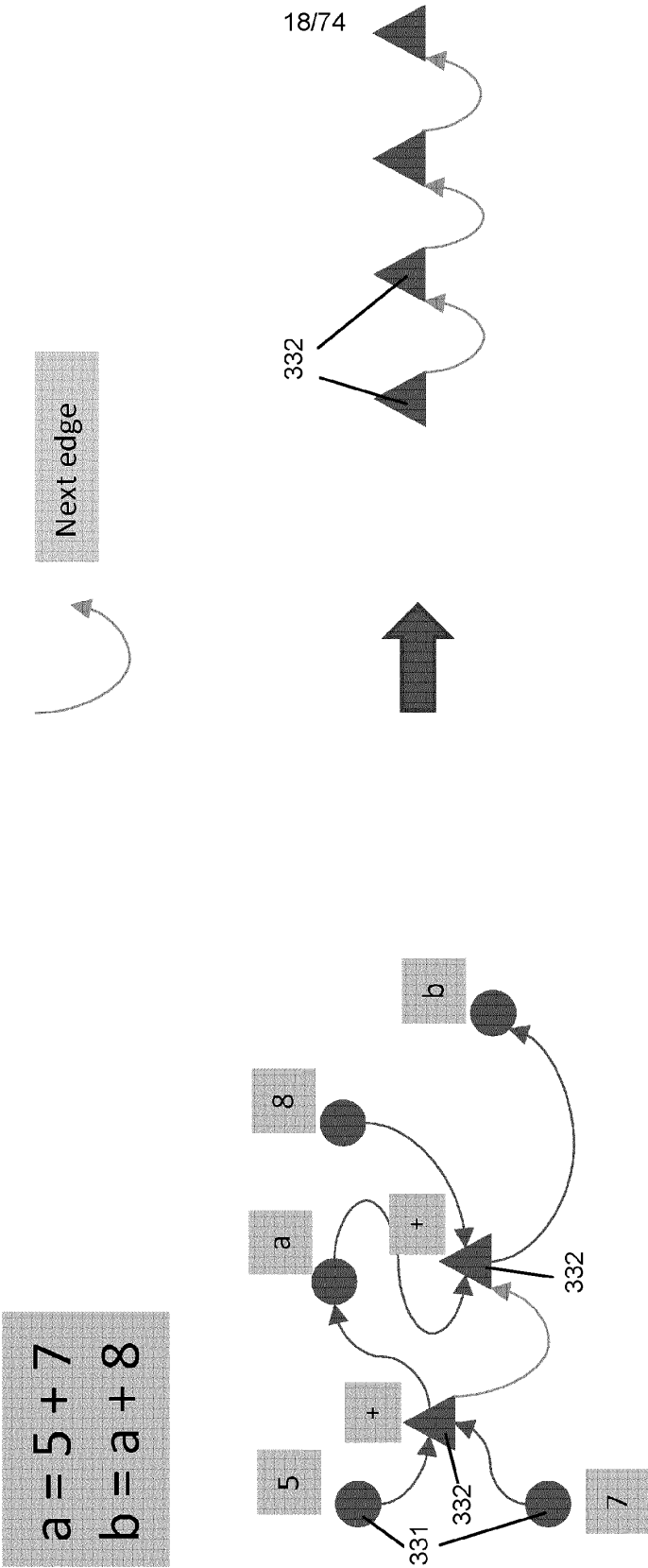


Fig. 18

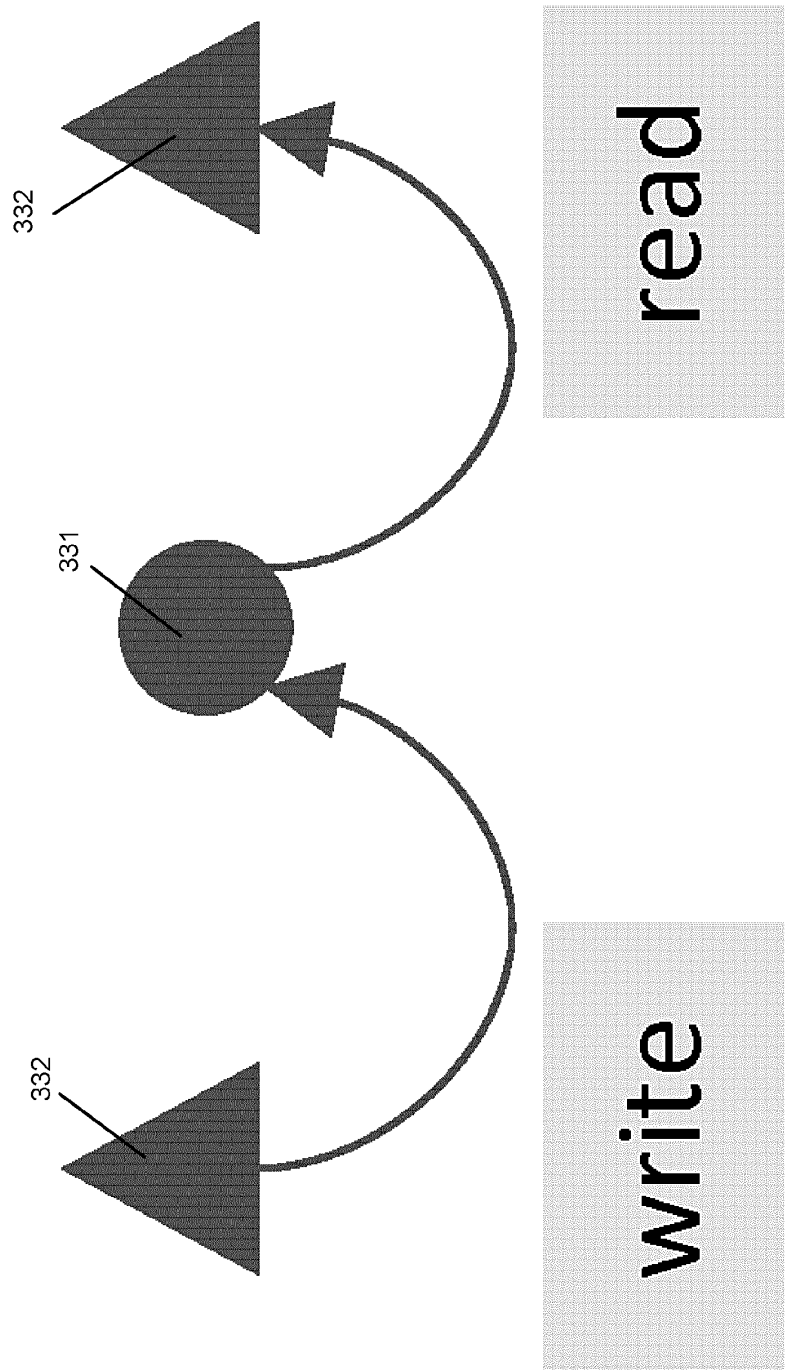
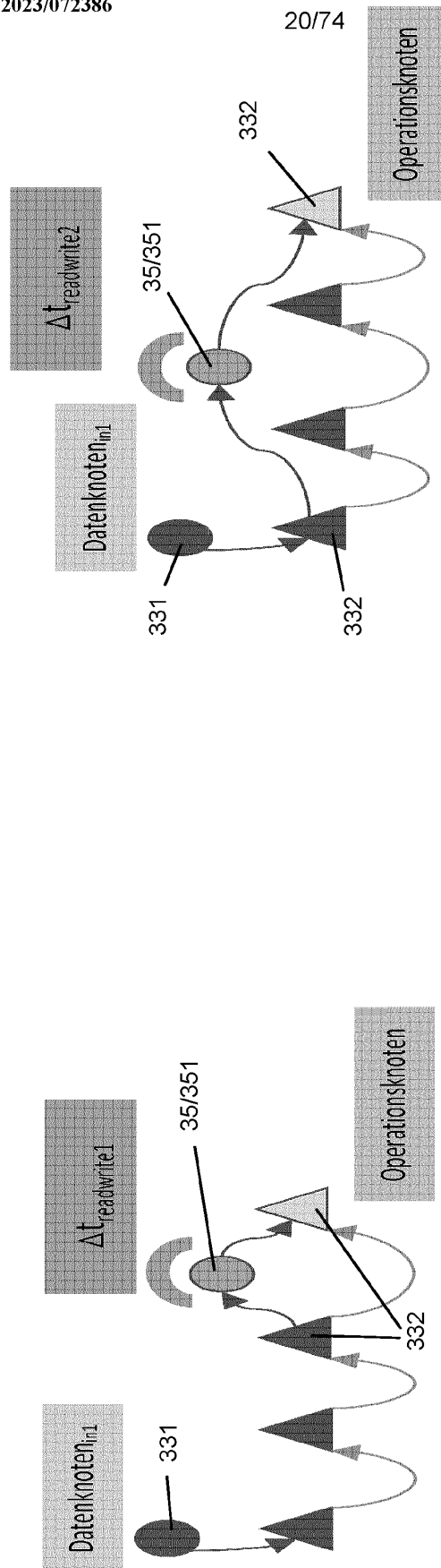


Fig. 19



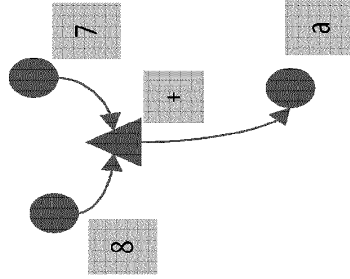
$\Delta t_{\text{read/write}}$ as an indicator what can be done with this data node

- $\Delta t_{\text{readwrite}}$ „sehr klein“: same cache_line or nearby
- $\Delta t_{\text{readwrite}}$ „mittel gross“: on same #cpu unit, use prefetch
- $\Delta t_{\text{readwrite}}$ „genug gross“: possible to transfer over network

Fig. 20

0-dependency

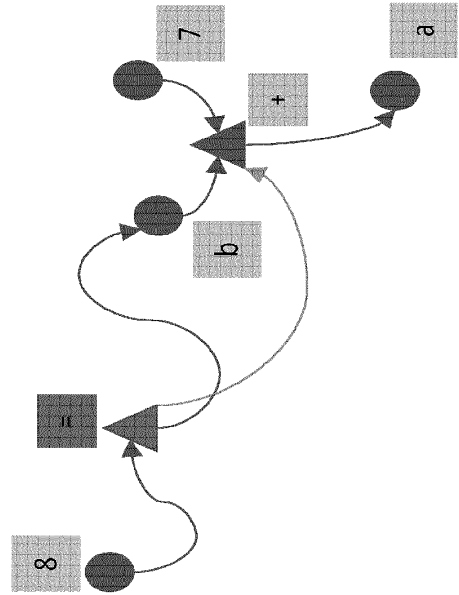
$$a = 8 + 7$$



1-dependency

$$b = 8$$

$$a = b + 7$$



2-dependency

$$c = 5 + 7$$

$$b = 7$$

$$a = b + c$$

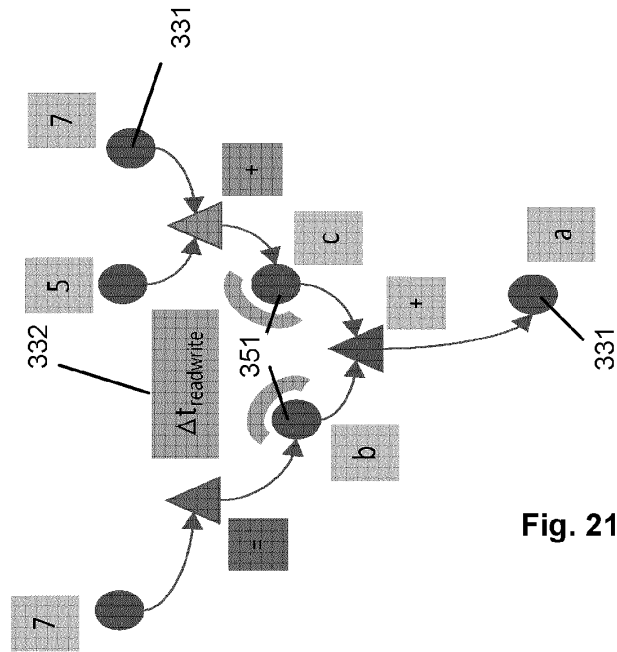


Fig. 21

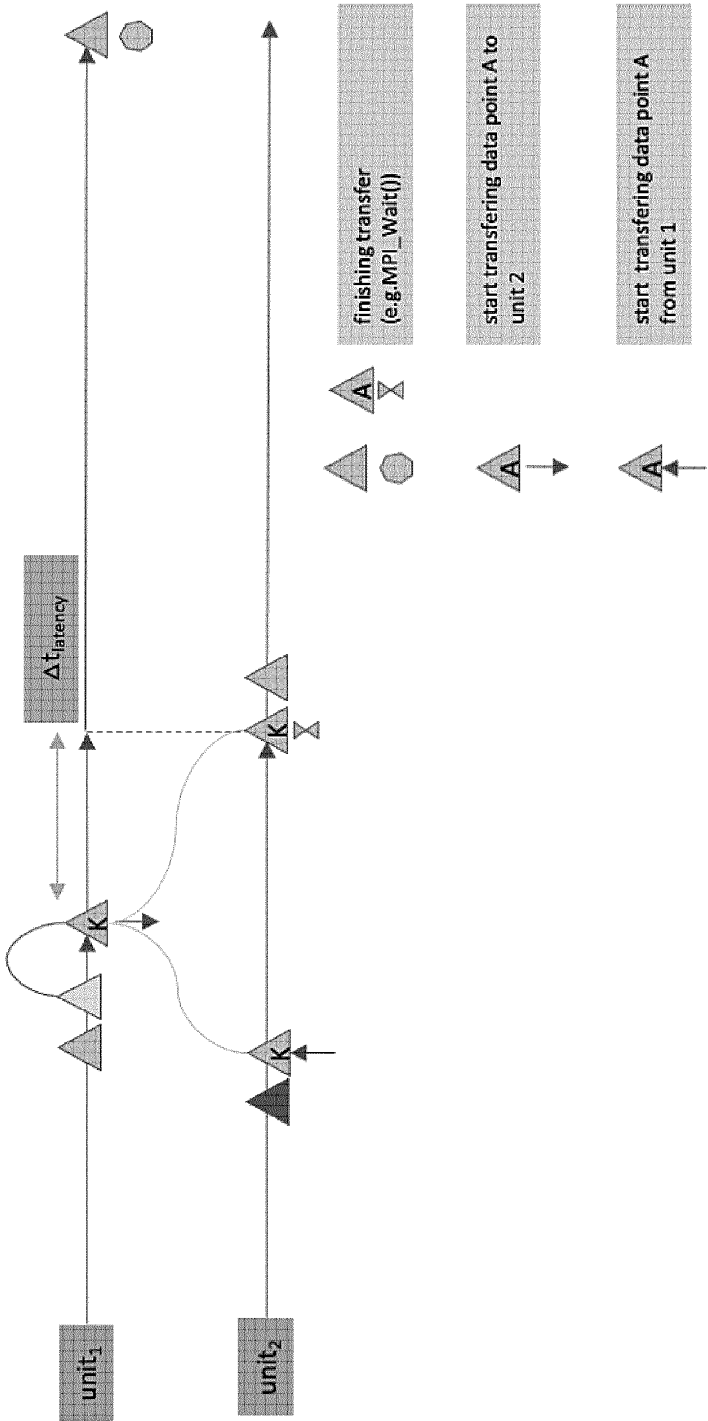
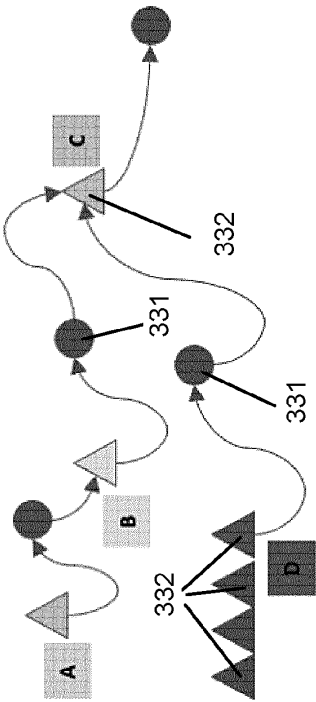


Fig. 22

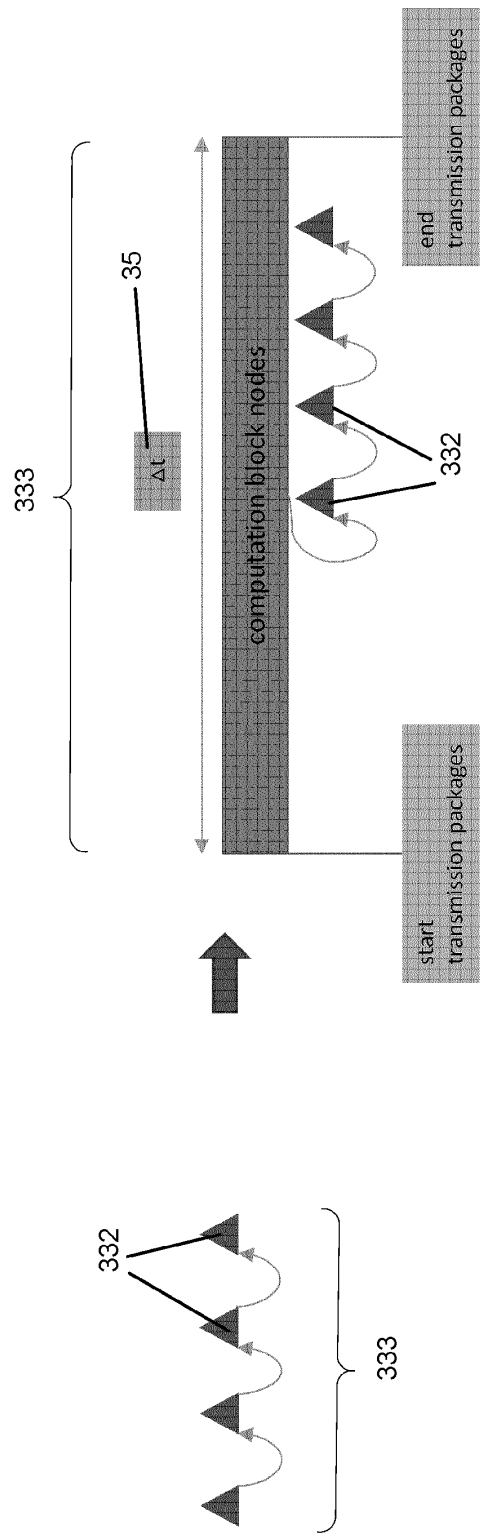


Fig. 23

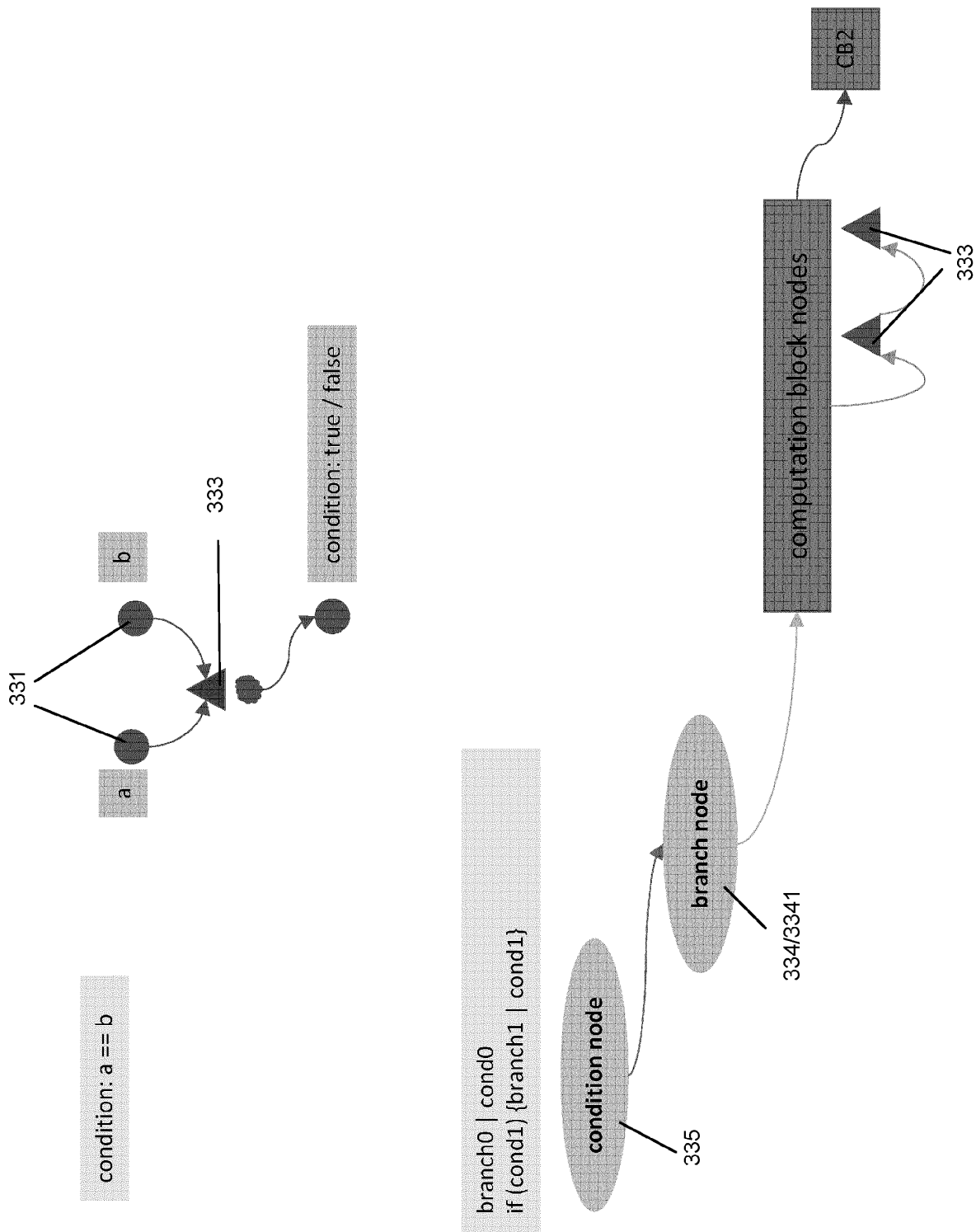
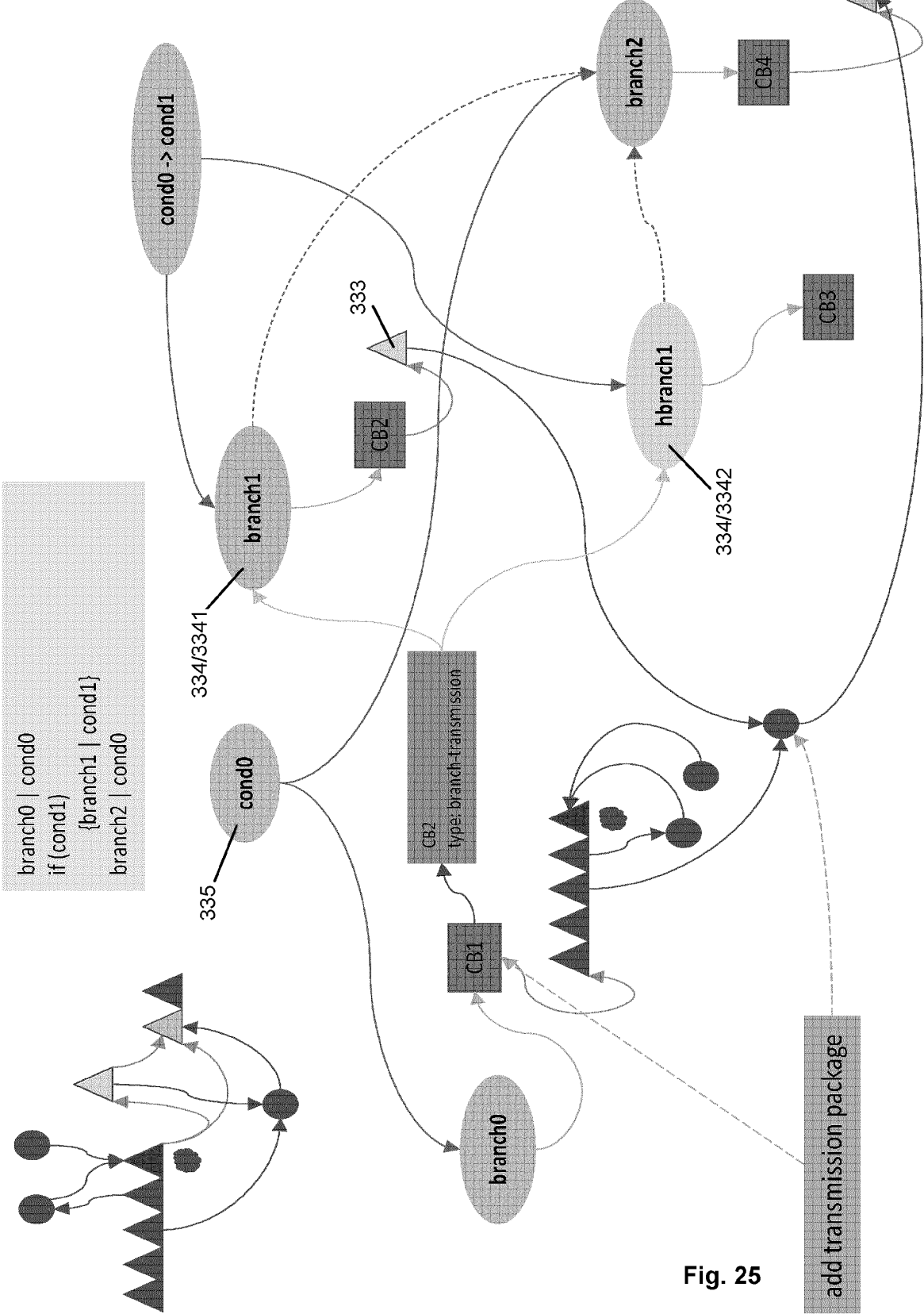


Fig. 24



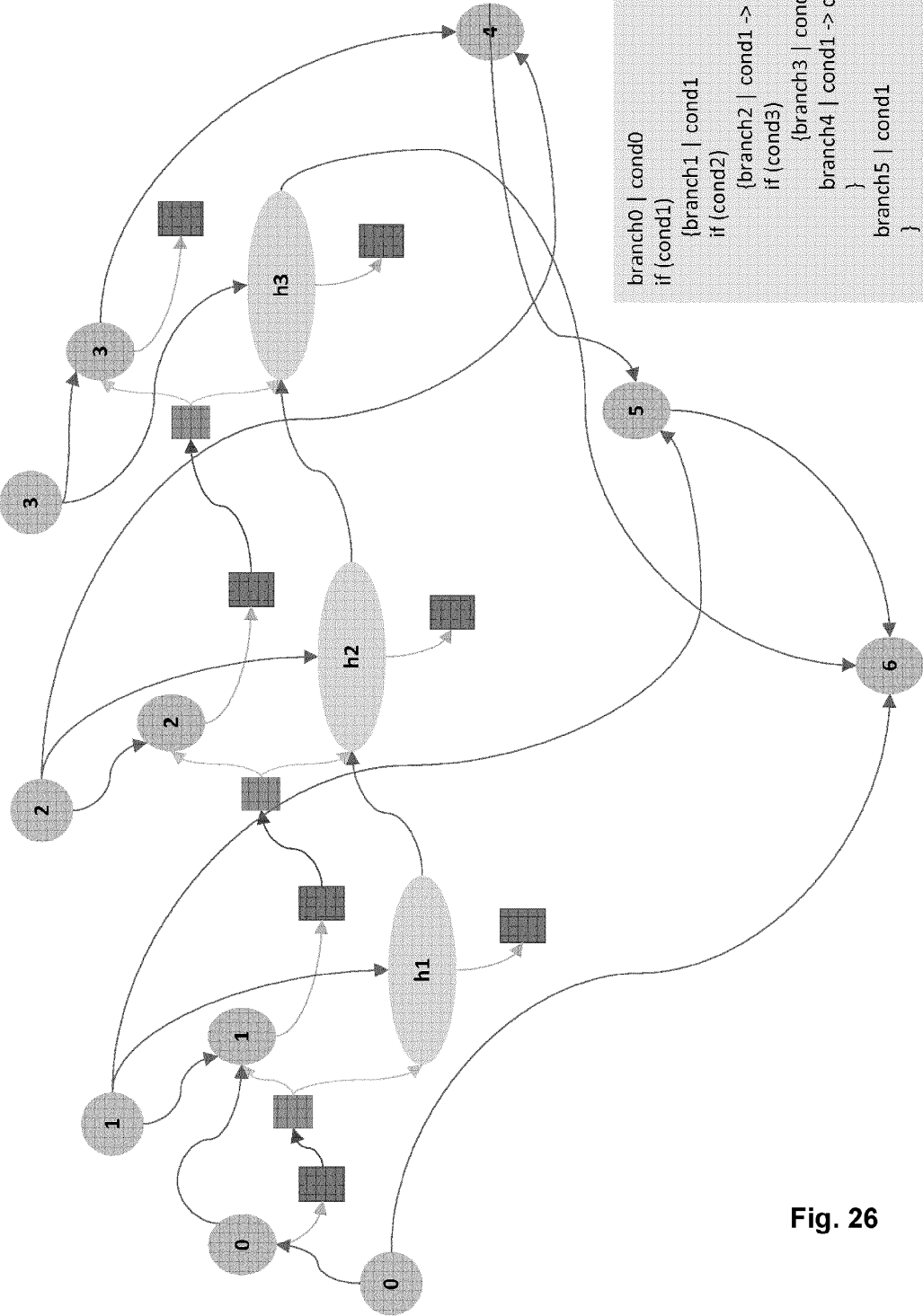


Fig. 26

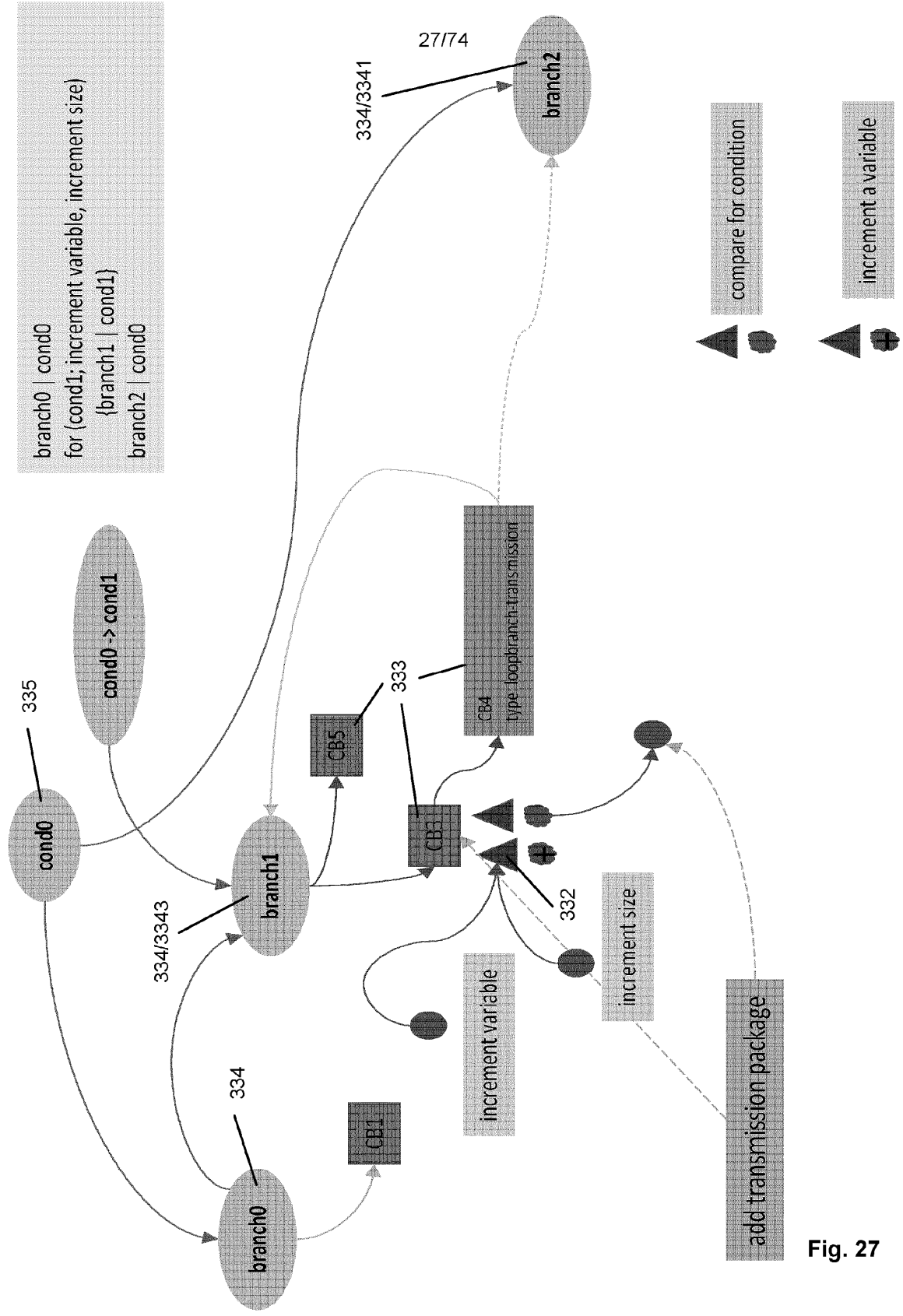


Fig. 27

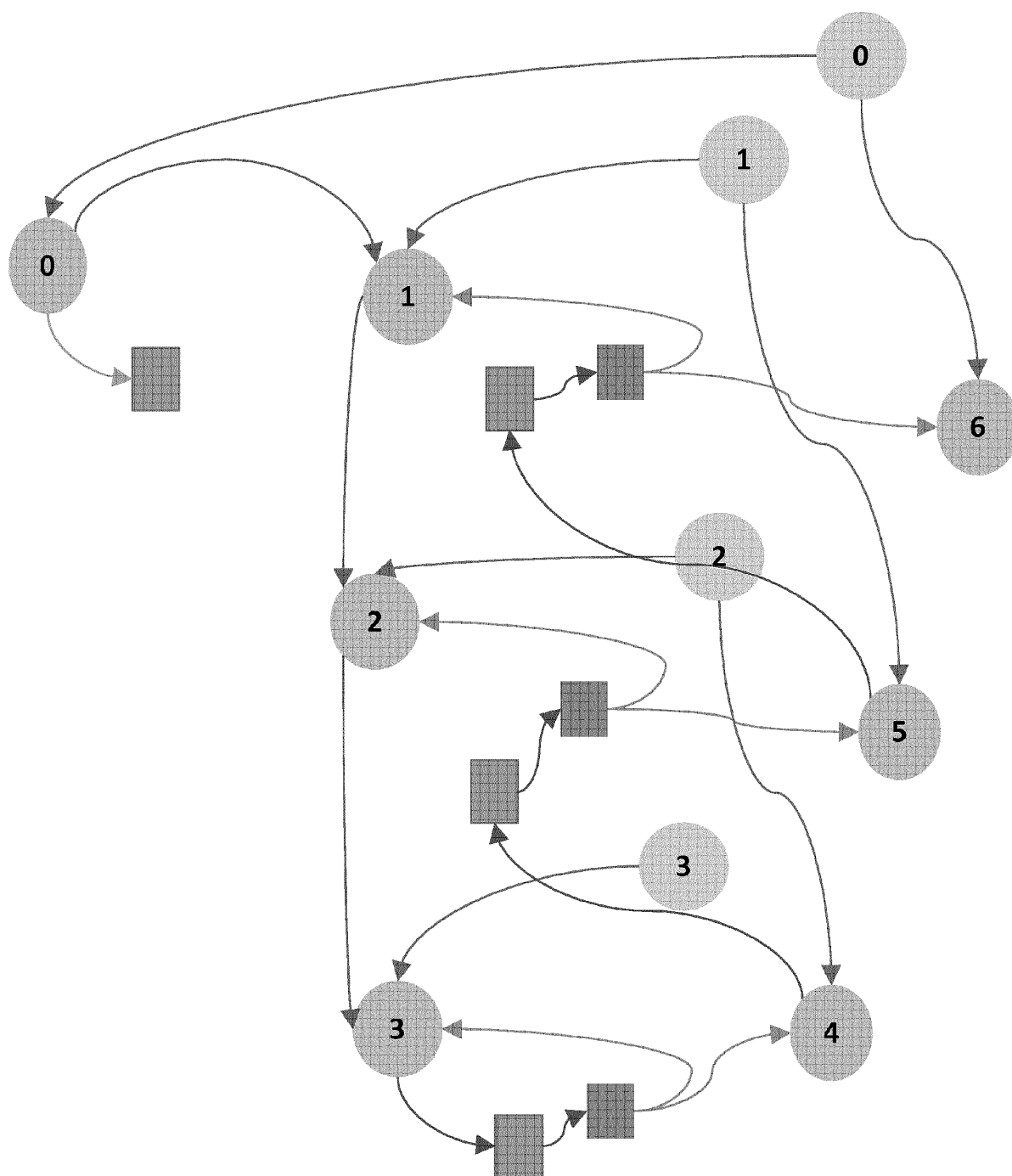


Fig. 28

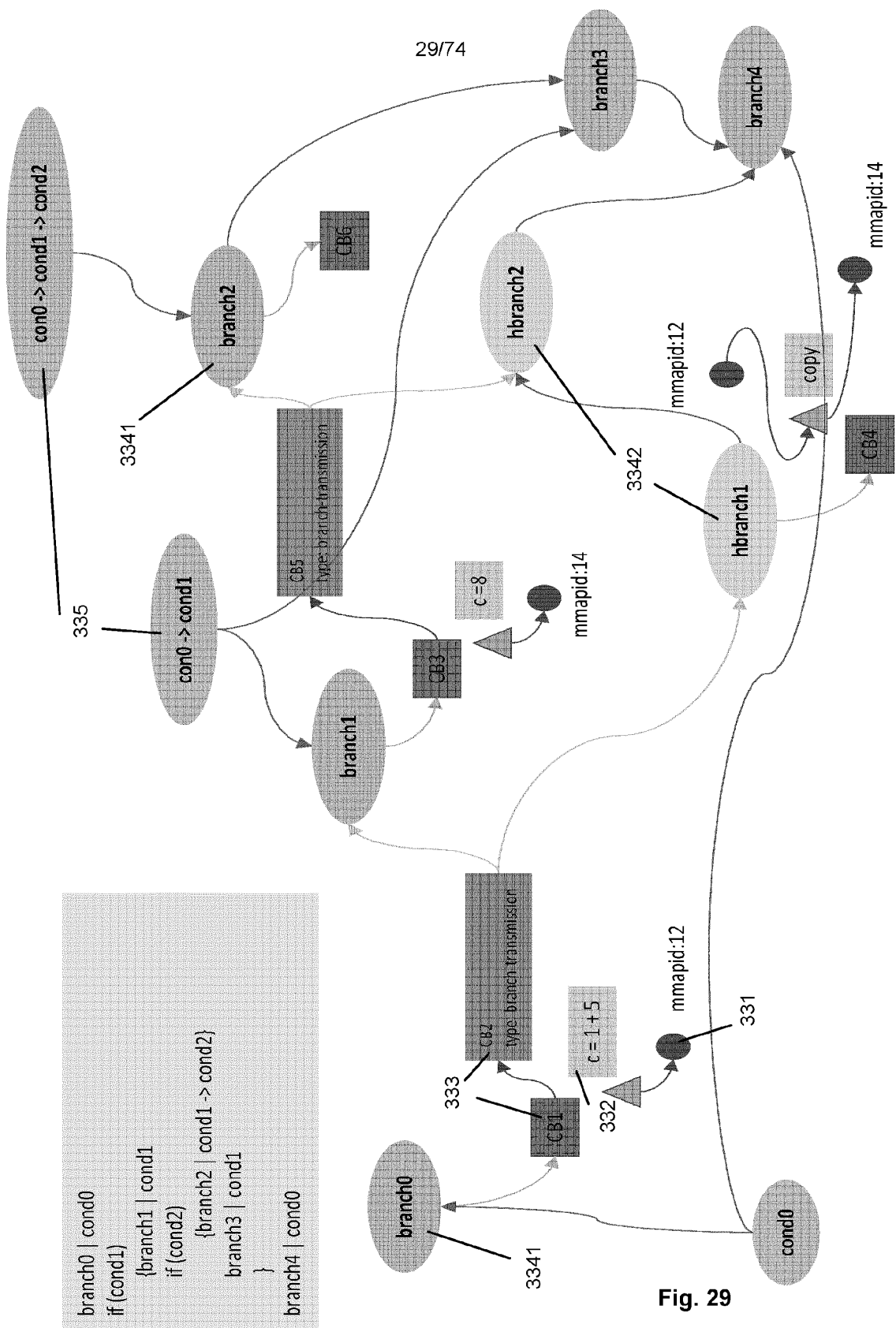


Fig. 29

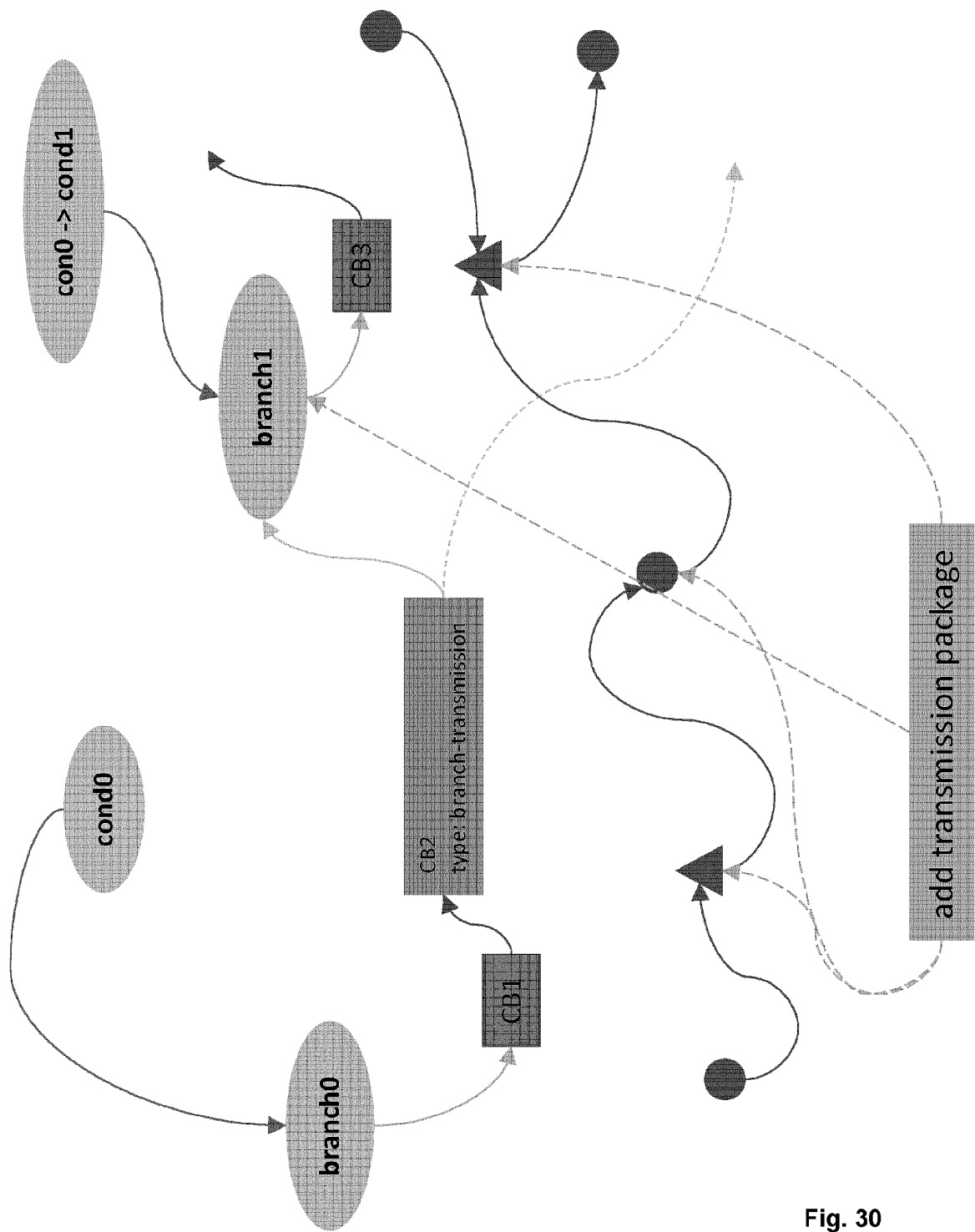


Fig. 30

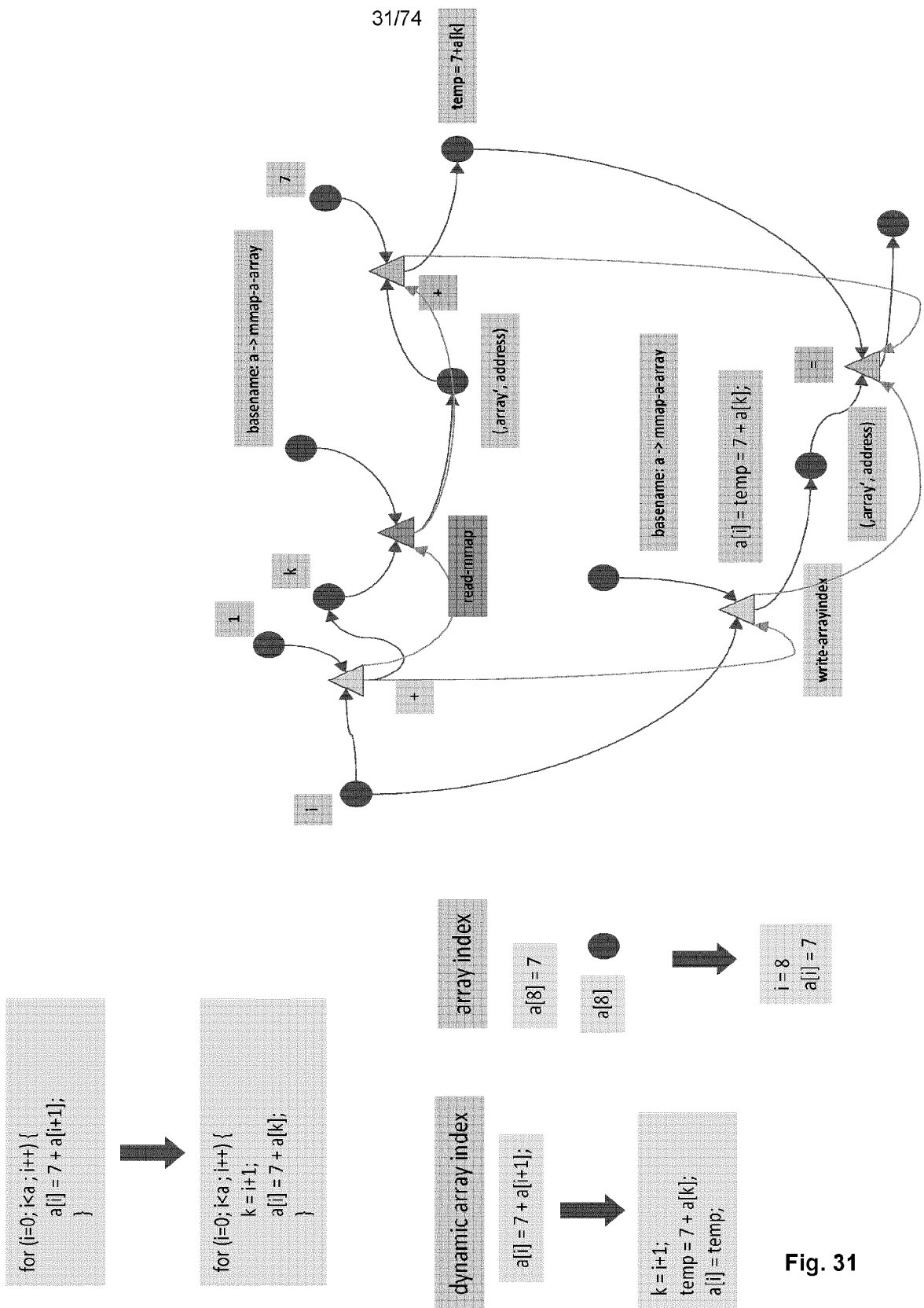


Fig. 31

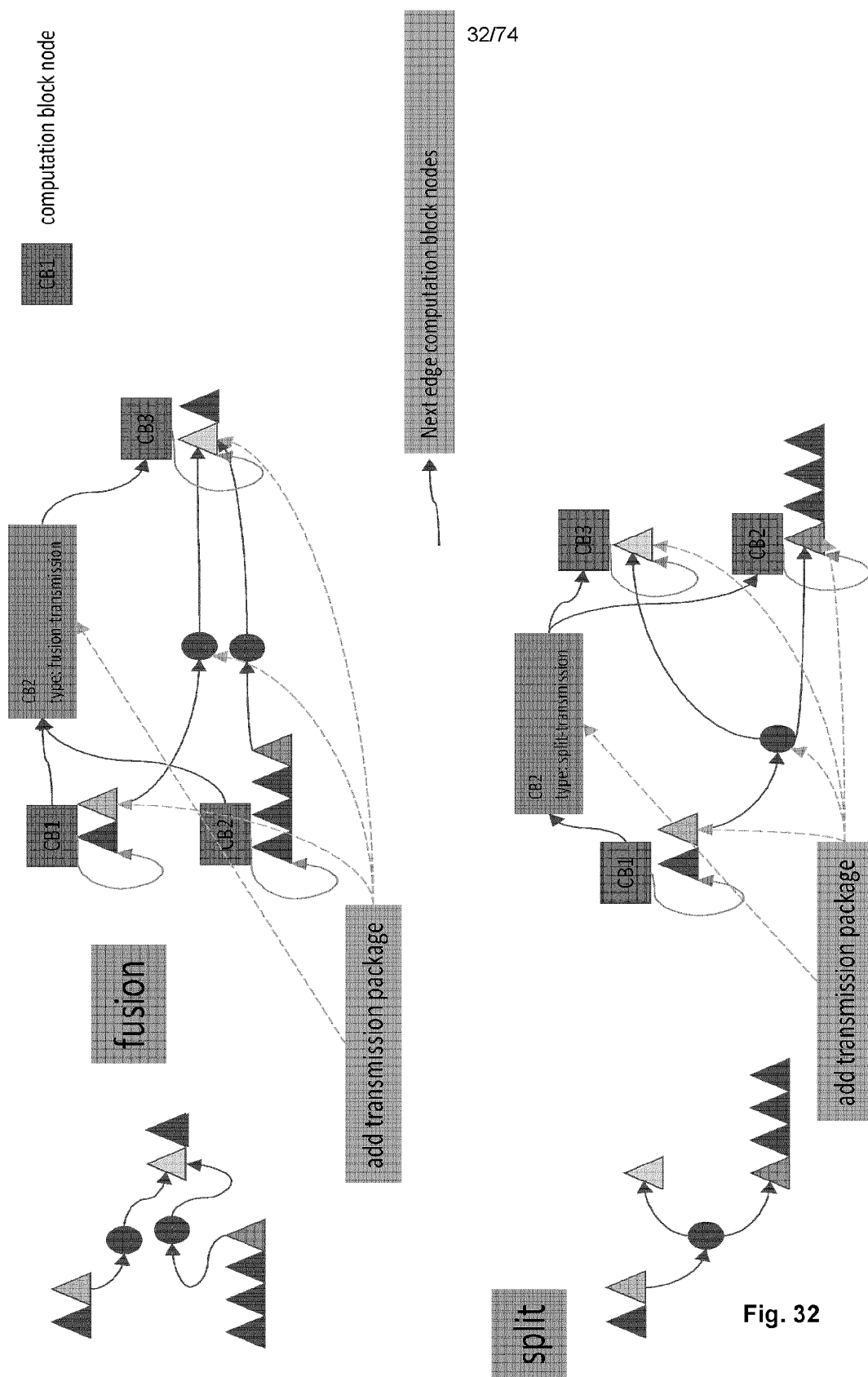


Fig. 32

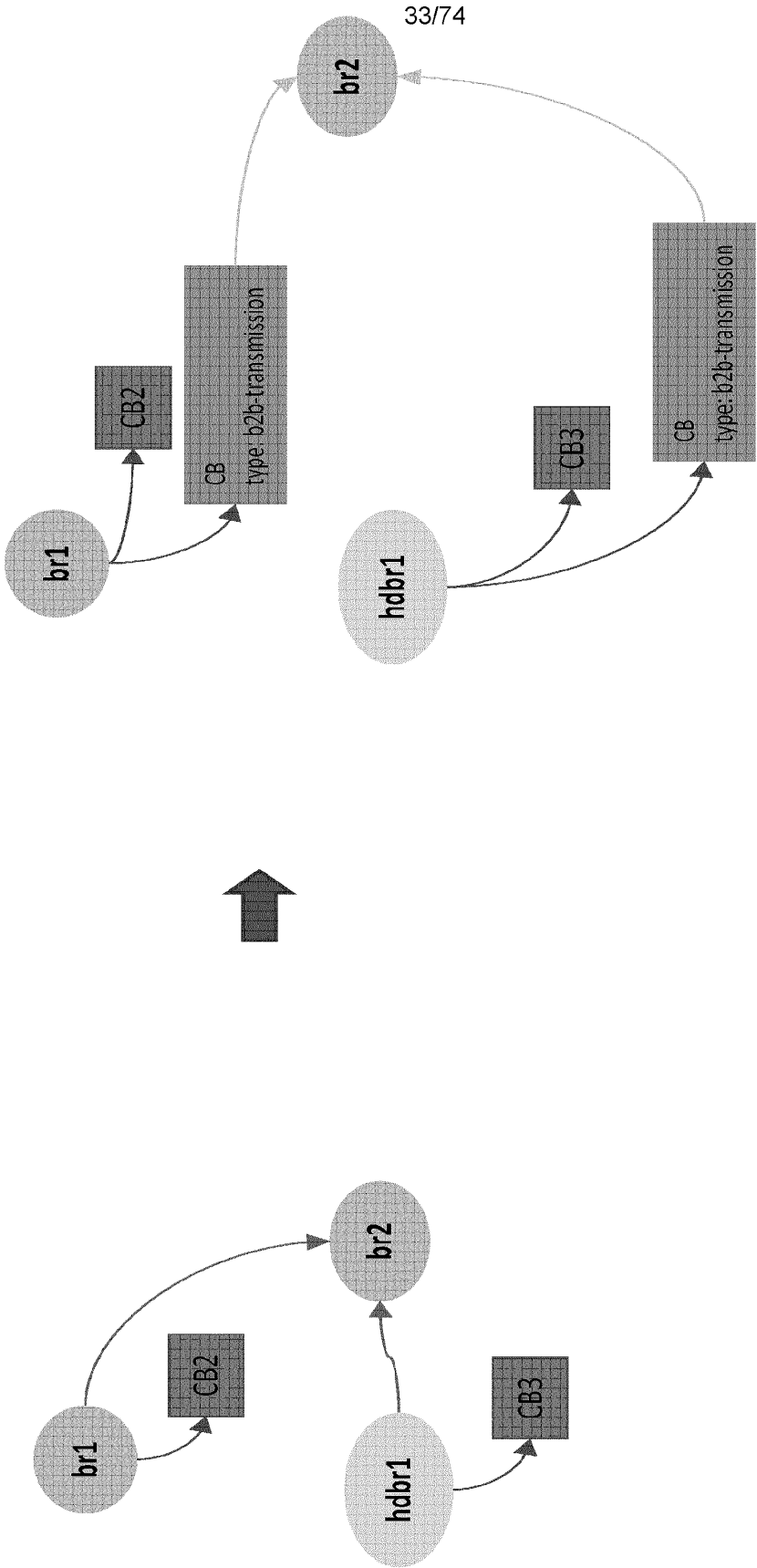


Fig. 33

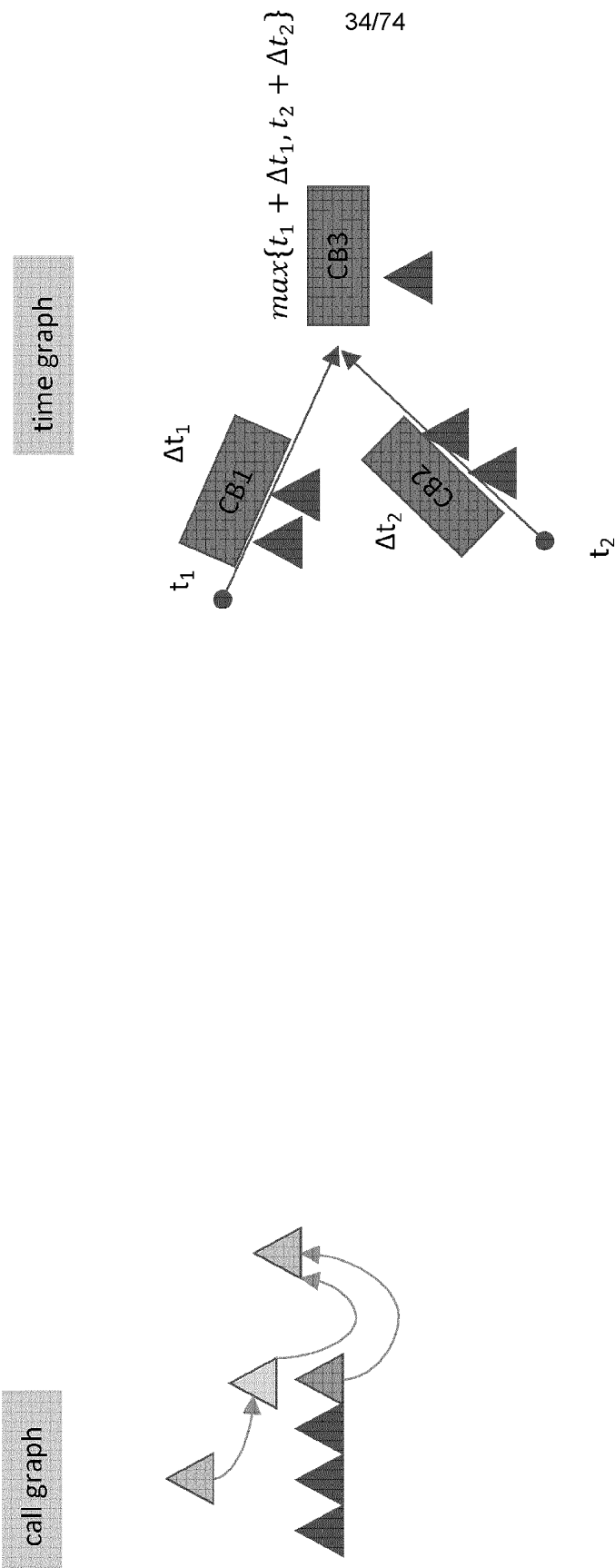
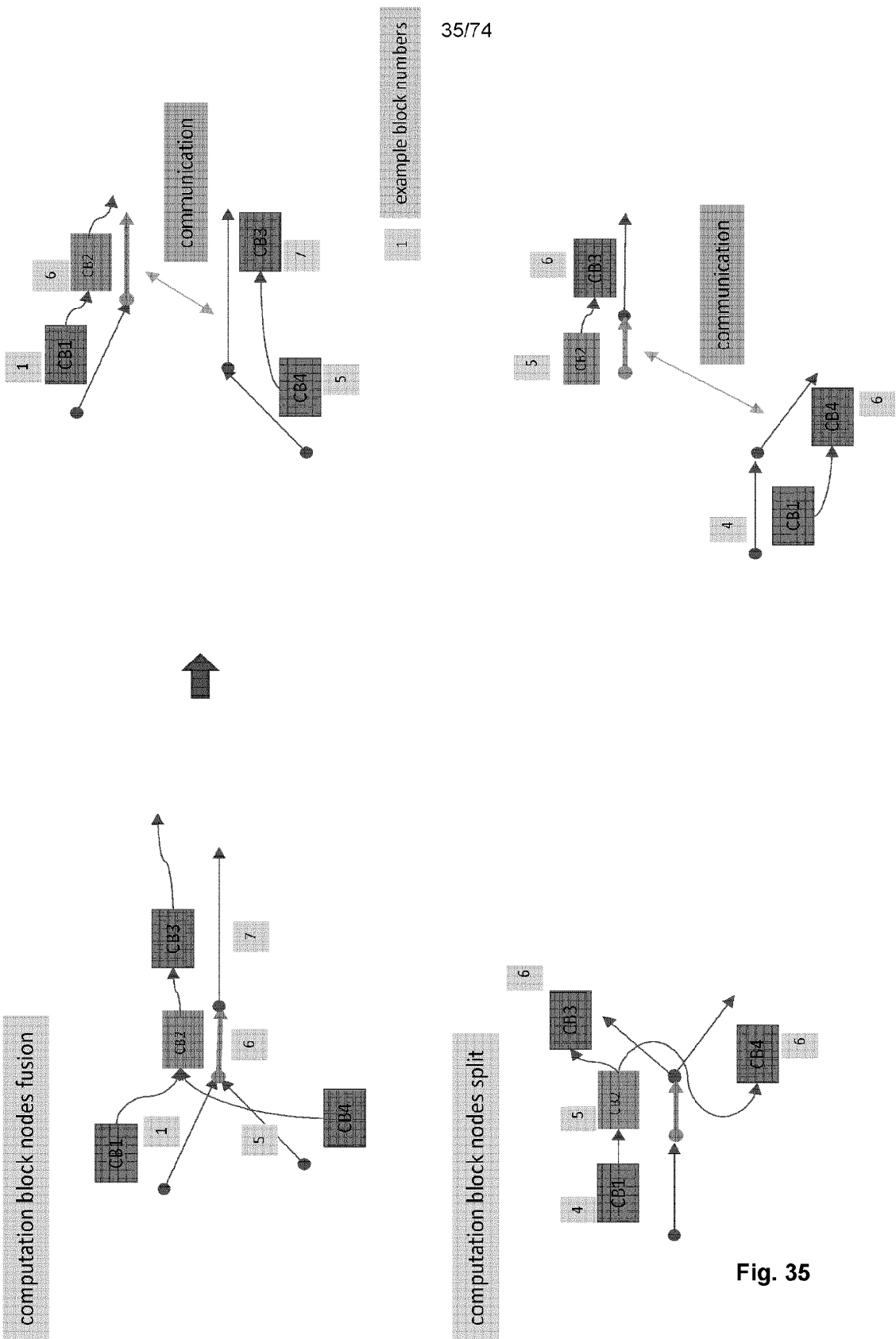
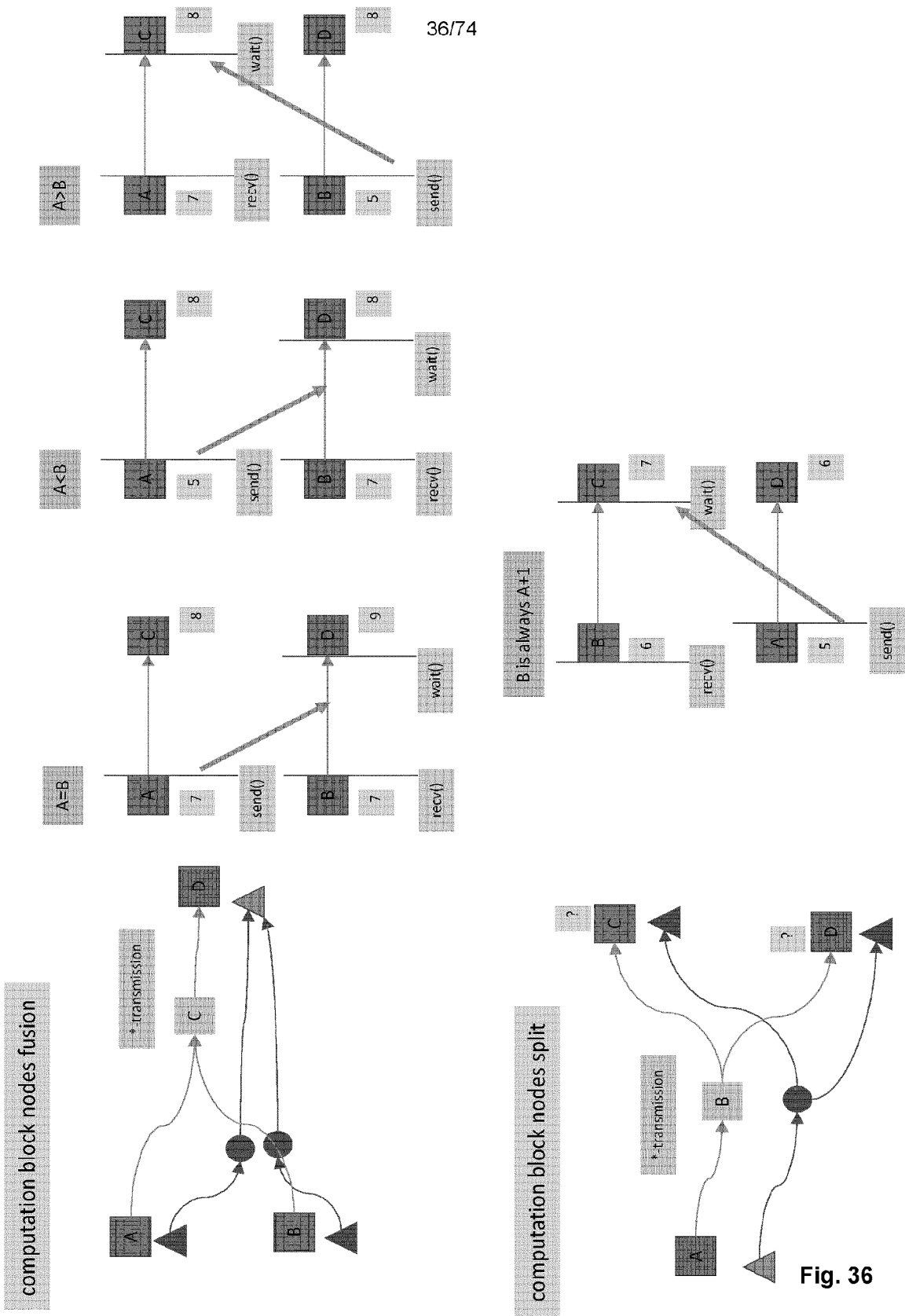
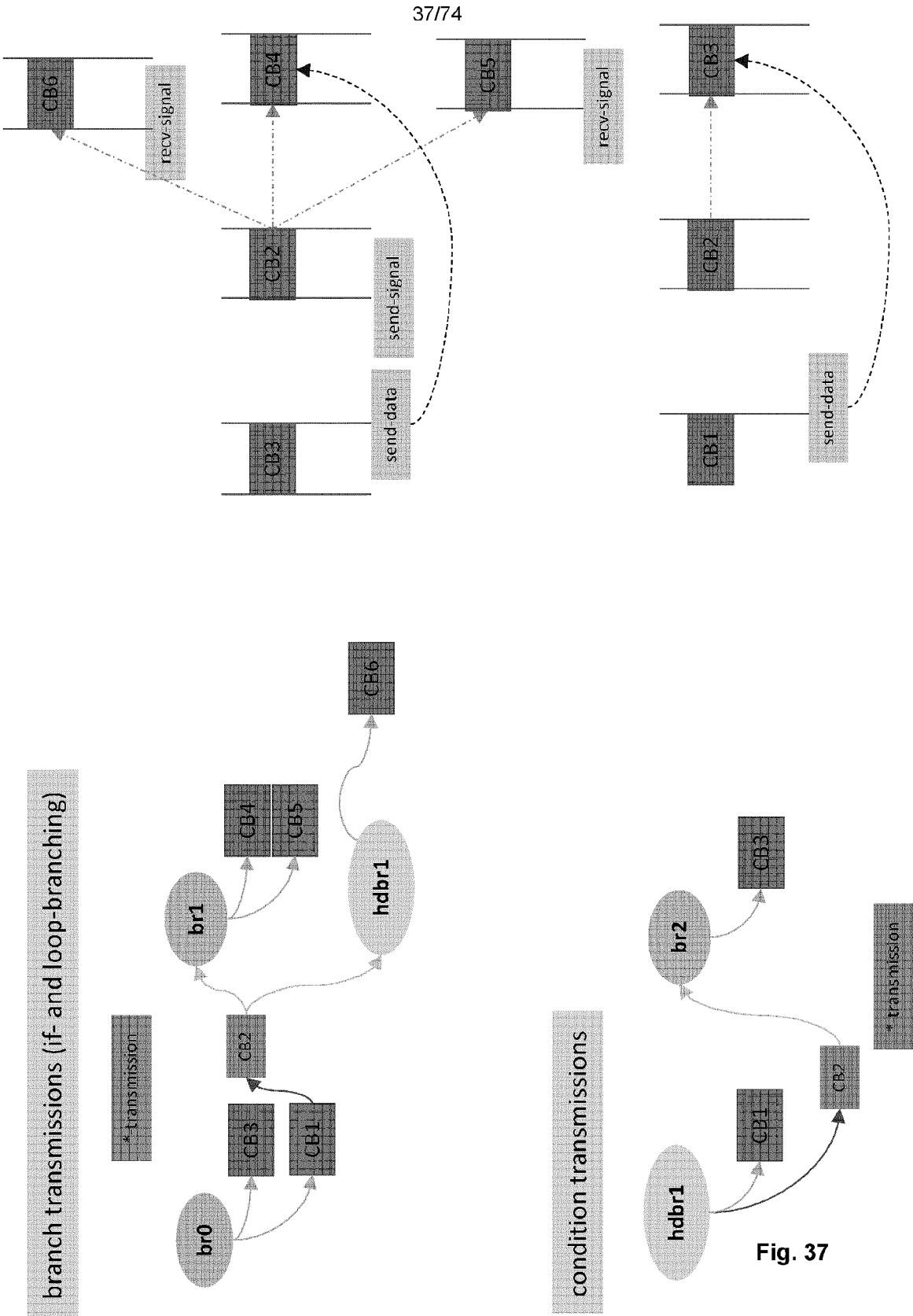
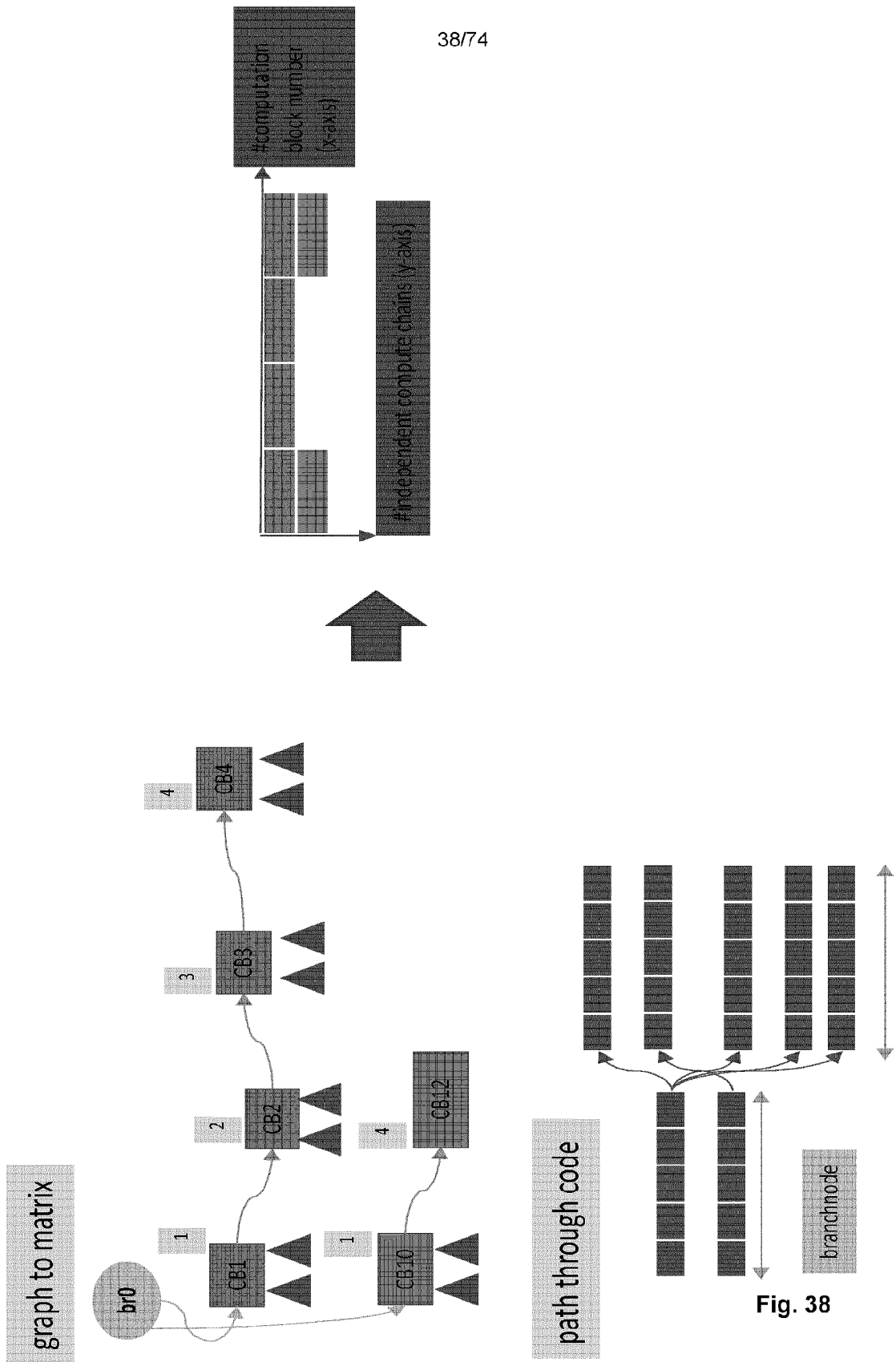


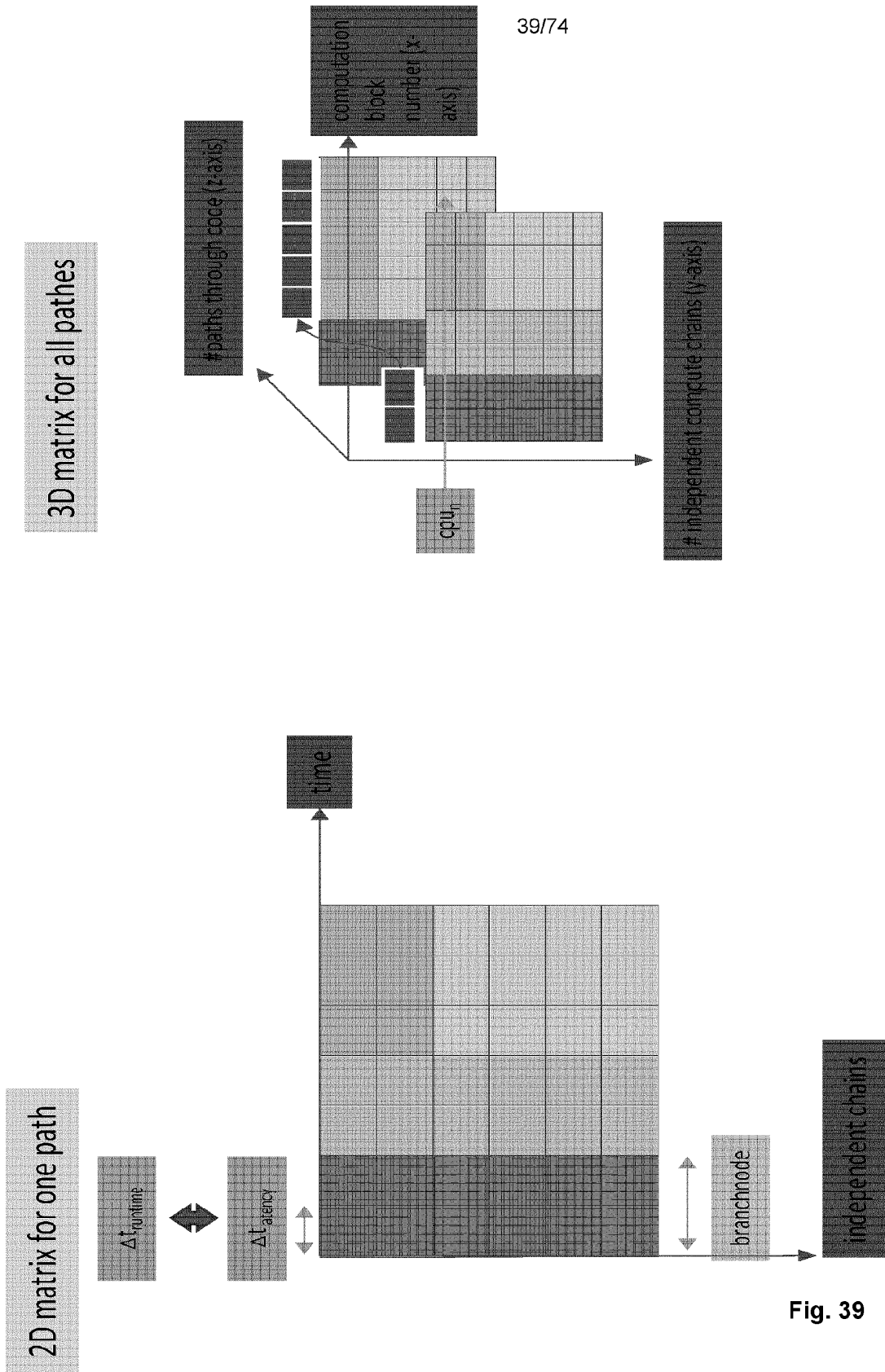
Fig. 34











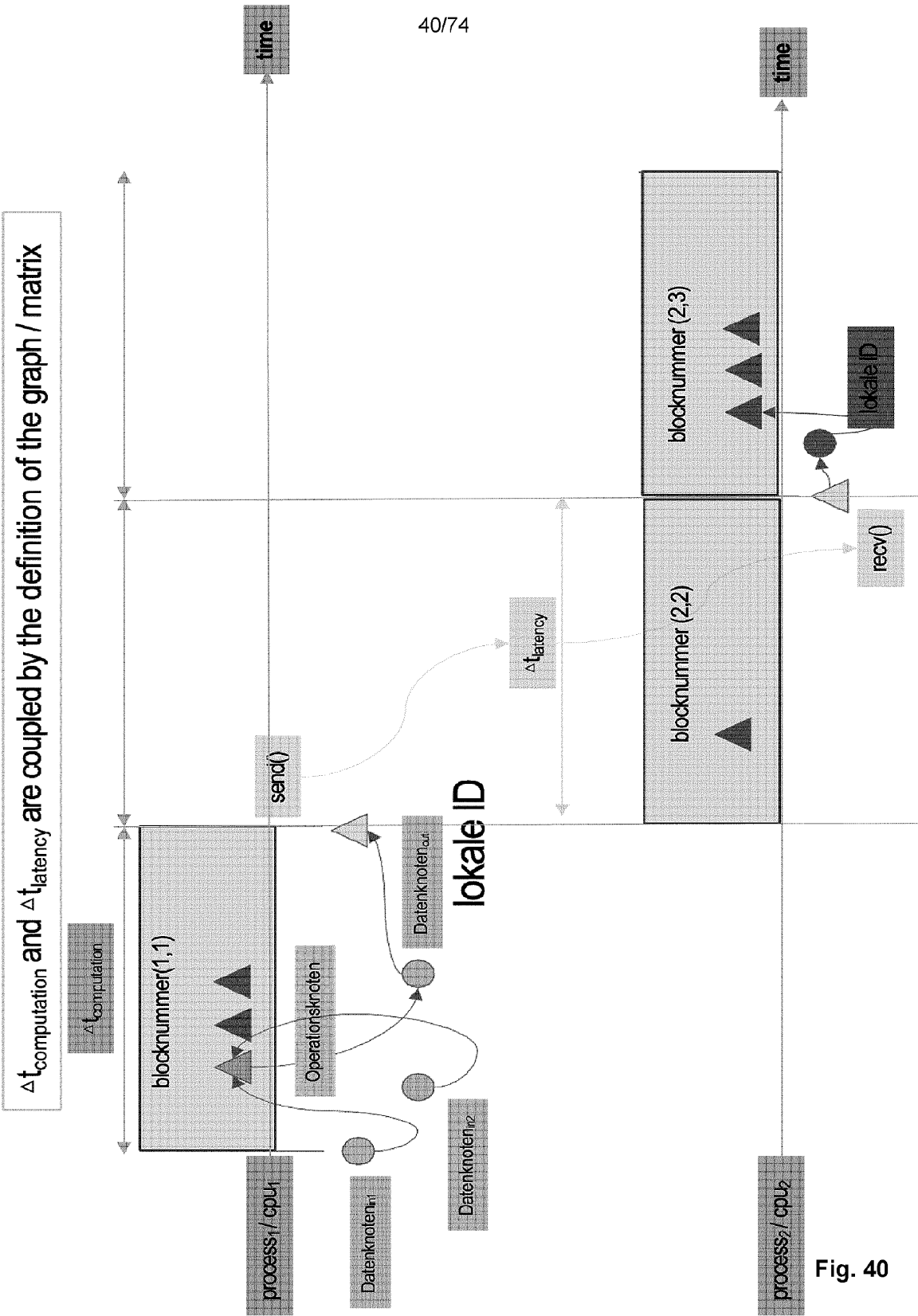


Fig. 40

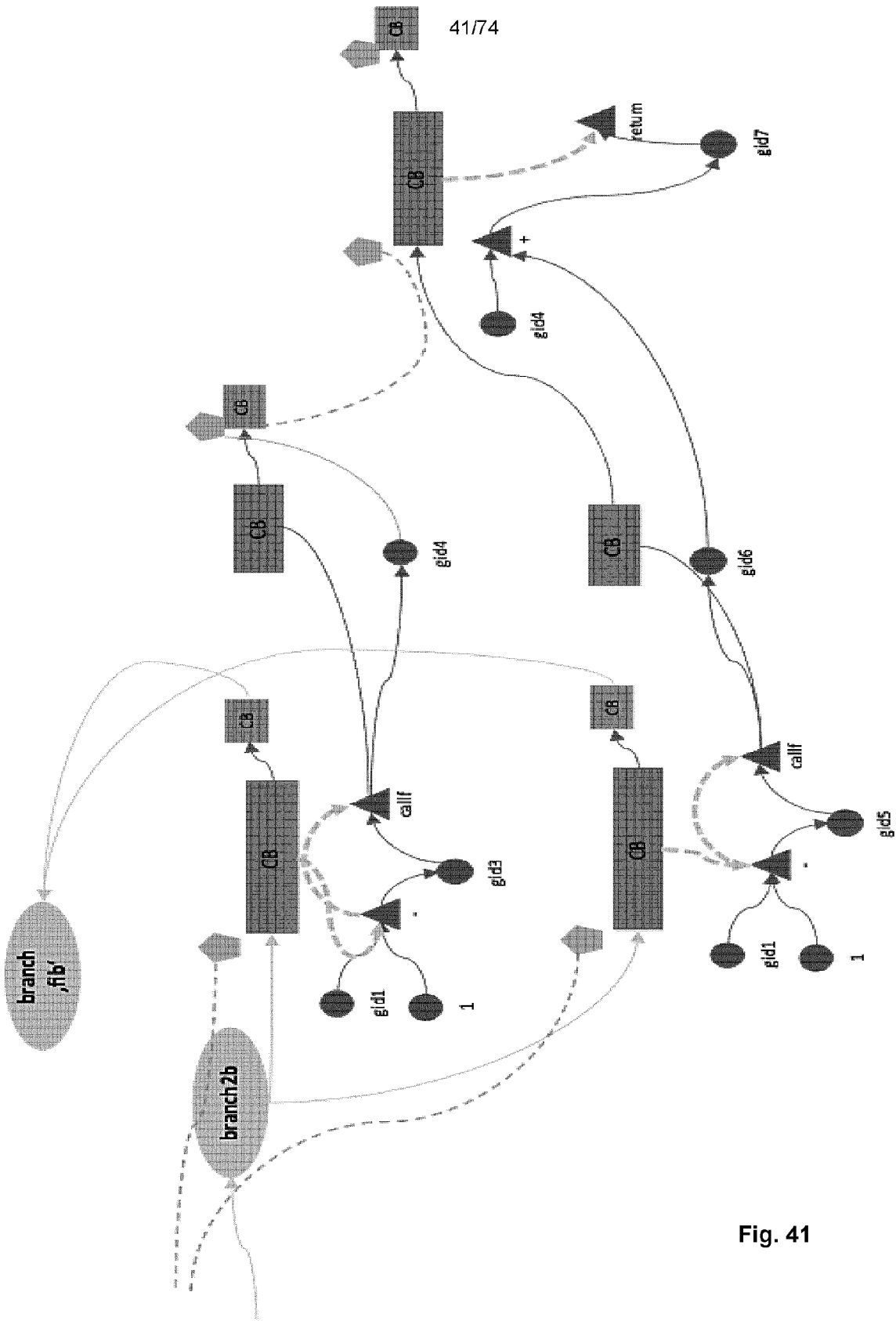


Fig. 41

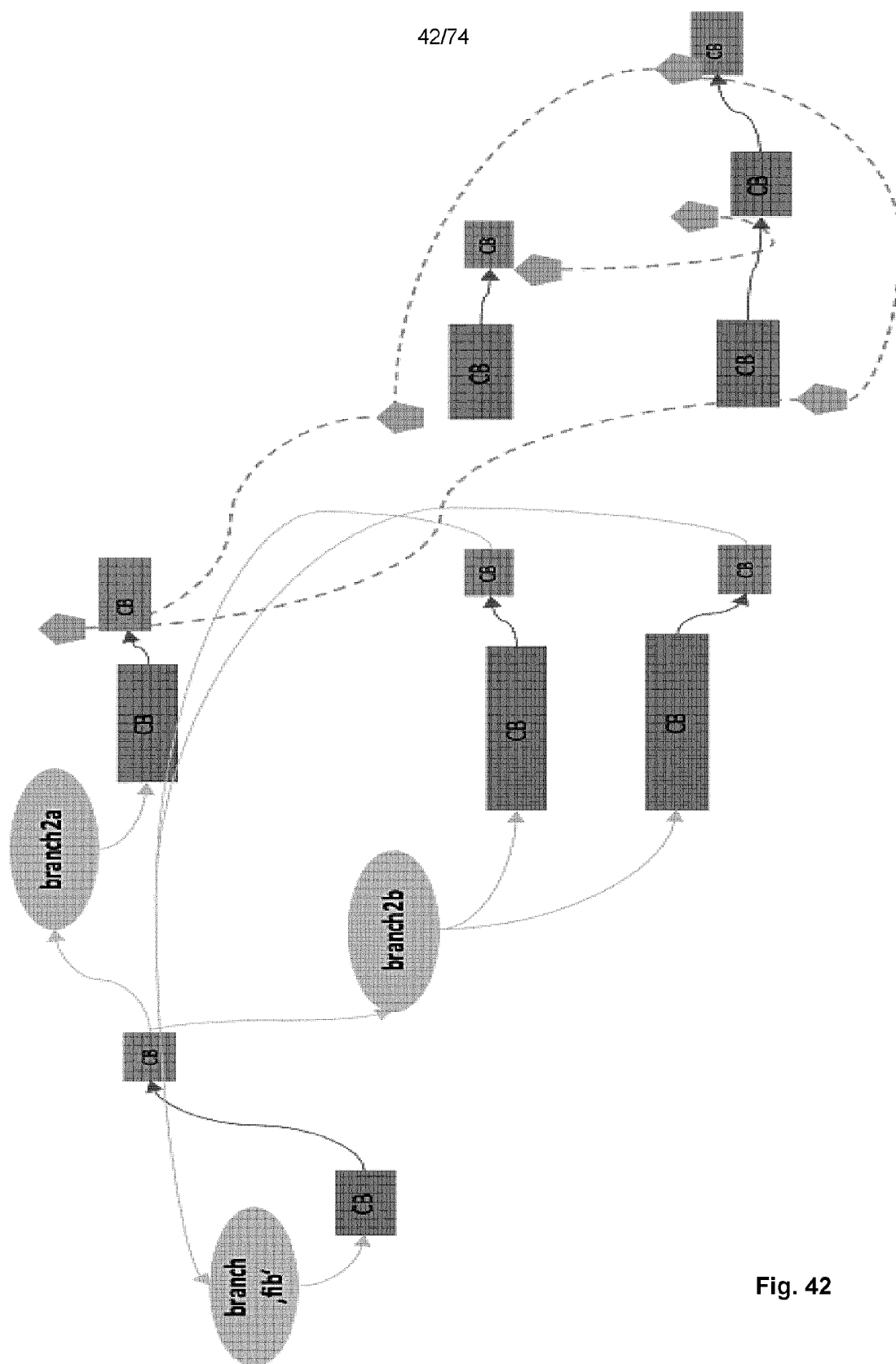


Fig. 42

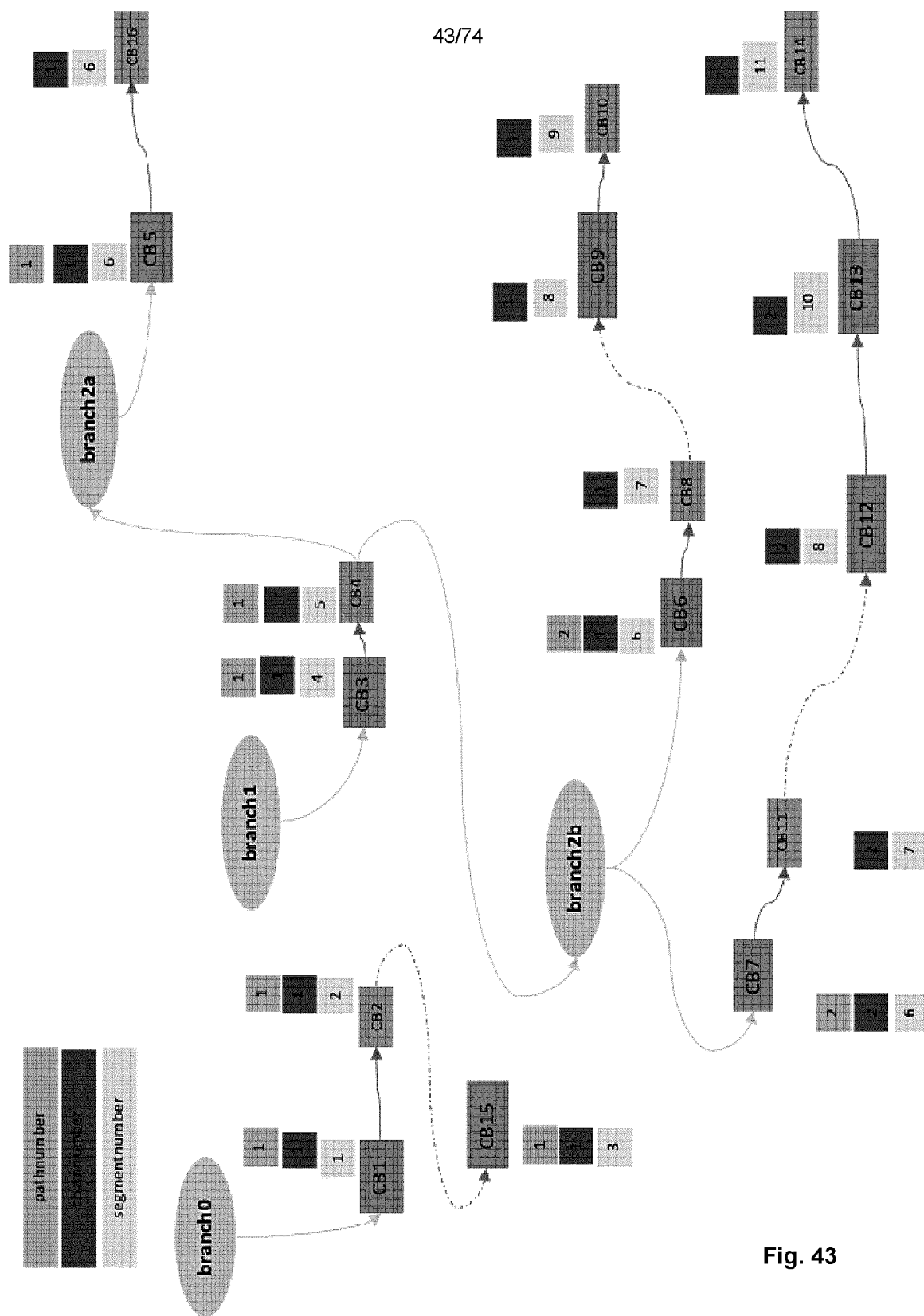


Fig. 43

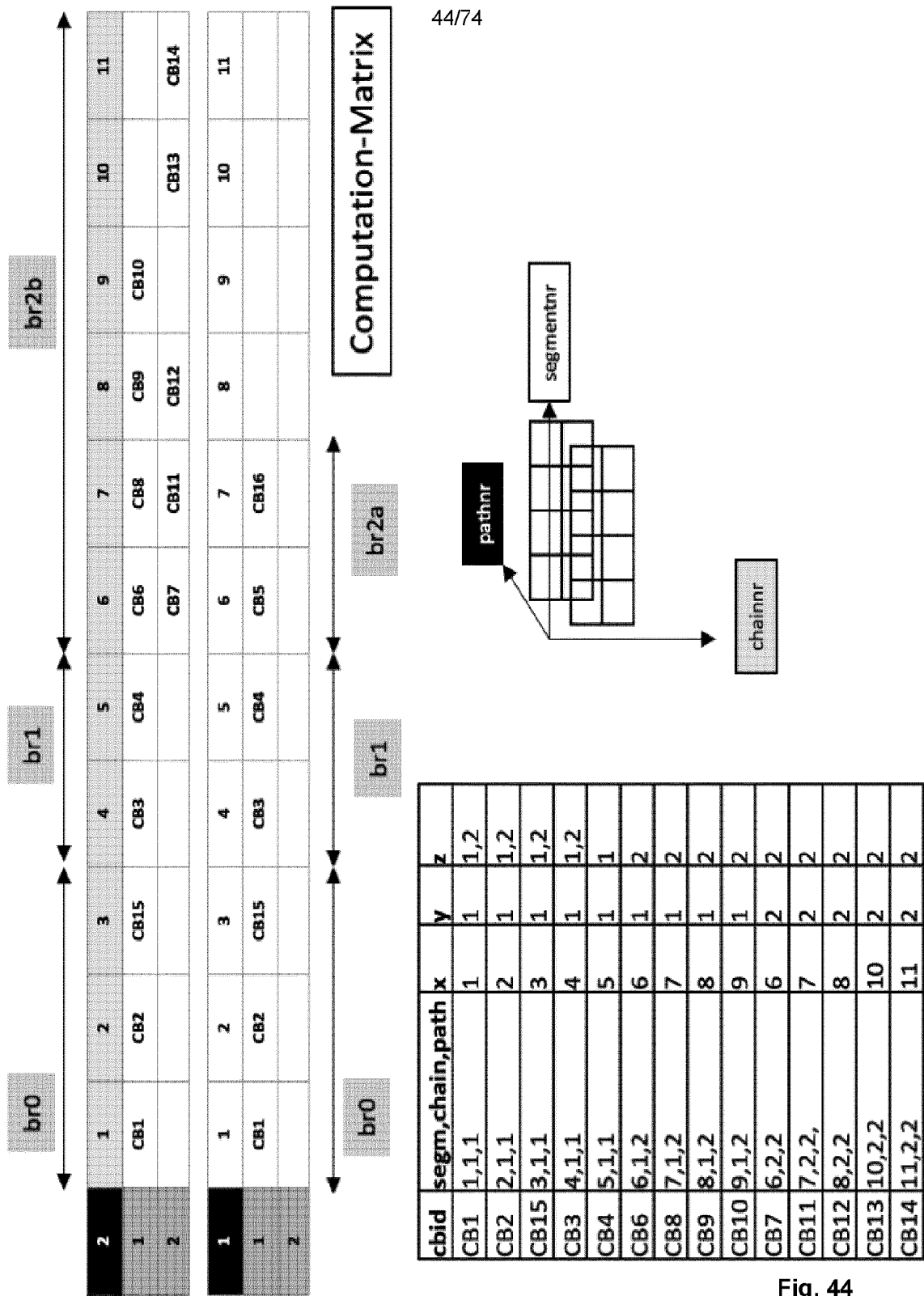


Fig. 44

Transfer-Matrix

	2	1	2	3	4	5	6	7	8	9	10	11
1		e: COM1->		s: ->COM10	e: SIG1-> COM2-> s: ->COM1 ->COM4 ->COM5		s: ->SIG1 ->COM2 e: COM4->		s: ->COM8	s: COM6->		
2							s: ->SIG1 ->COM2 e: COM5->		s: ->COM9		s: ->COM6	s: COM7->

	1	2	3	4	5	6	7	8	9	10	11
1		e: COM1->	s: ->COM10	e: SIG1-> COM2-> s: ->COM1 ->COM4 ->COM5		s: ->SIG1 ->COM2 e: COM3->					
2											

Fig. 45

	source cbid	start	target cbid	end	variable	direction
COM1	CB1 - (1,1,1)	CB3 - (4,1,1)			gid8, addr CB15	forward
SIG1	CB3 - (4,1,1)	CB5 - (6,1,1), CB6 - (6,1,2), CB7 - (6,2,2)			gid2	forward
COM2	CB3 - (4,1,1)	CB5 - (6,1,1), CB6 - (6,1,2), CB7 - (6,2,2)			gid1	forward
COM3	CB5 - (6,1,1)	CB15 / CB9 / CB12			gid1	
COM4	CB6 - (6,1,2)	CB3 - (4,1,1)			gid3, addr CB9	backward
COM5	CB7 - (6,2,2)	CB3 - (4,1,1)			gid5, addr CB12	backward
COM6	CB9 - (9,1,2)	CB10 - (10,2,2)			gid4	forward
COM7	CB13 - (10,2,2)	CB15 / CB9 / CB12			gid7	
COM8	1L	CB9 - (8,1,2)			gid4	
COM9	1L	CB12 - (8,2,2)			gid6	
COM10	1L	CB15 - (3,1,1)			gid9	

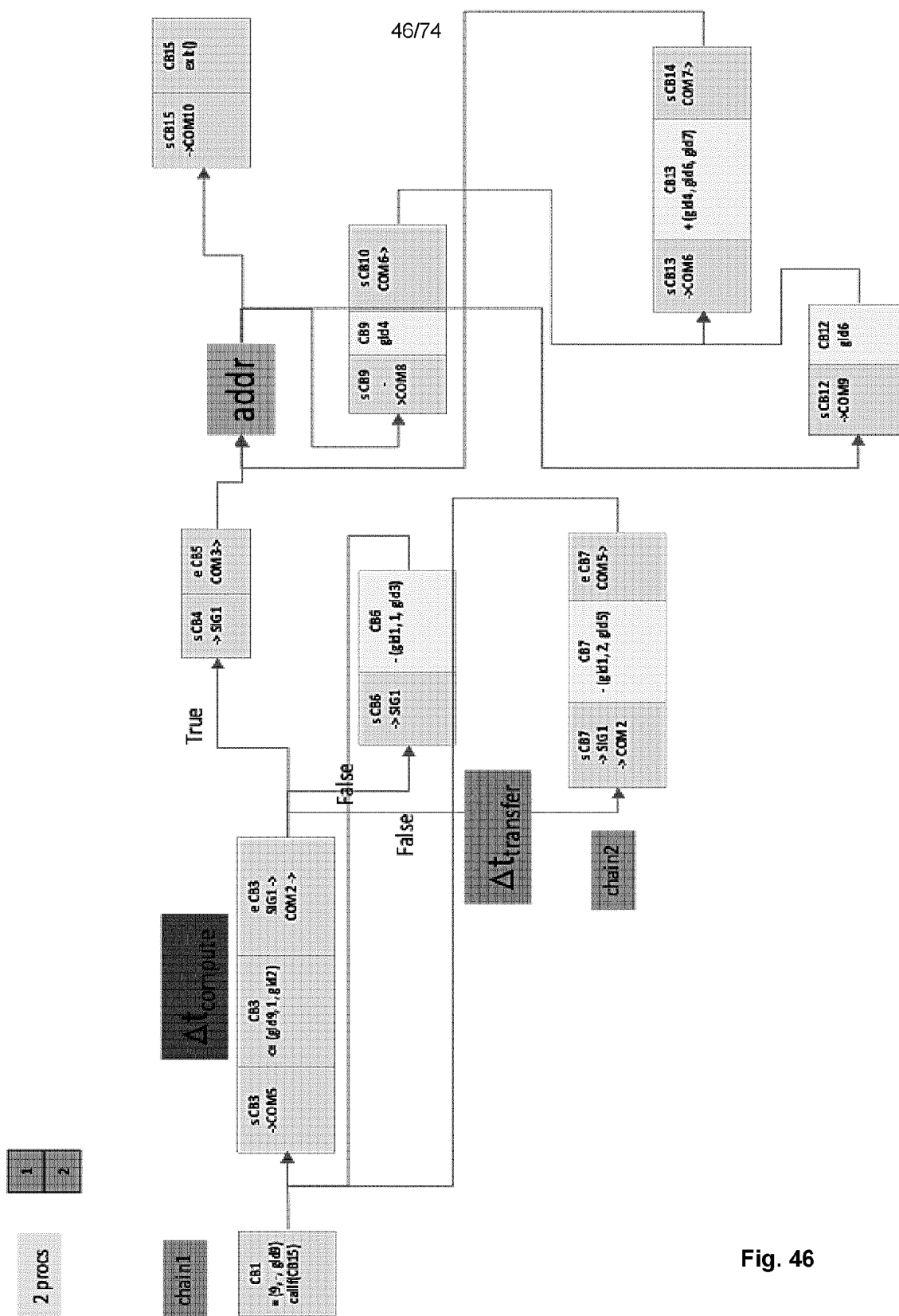
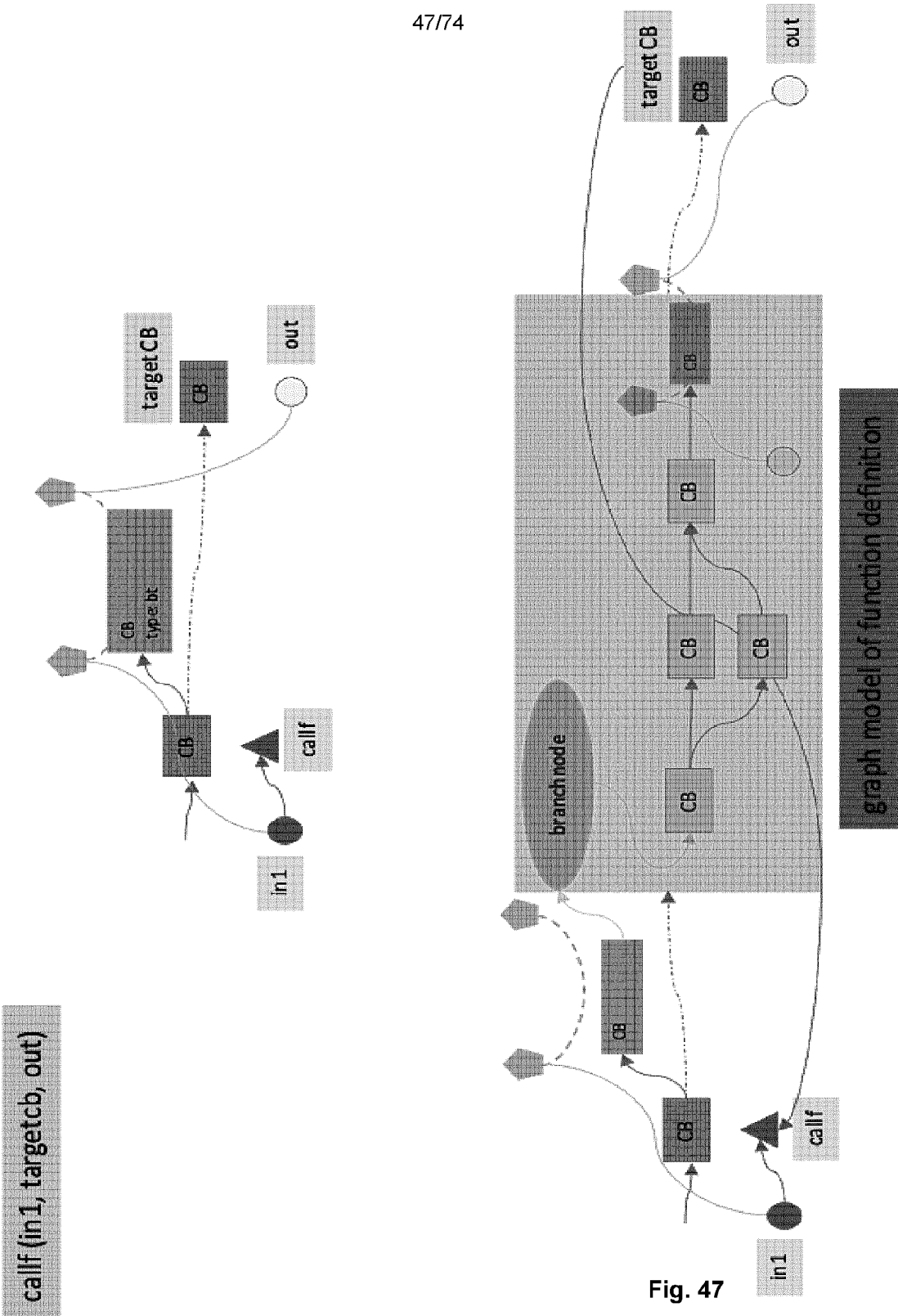


Fig. 46



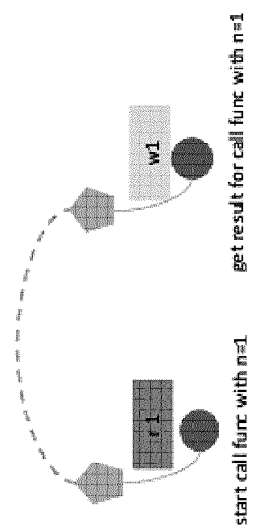
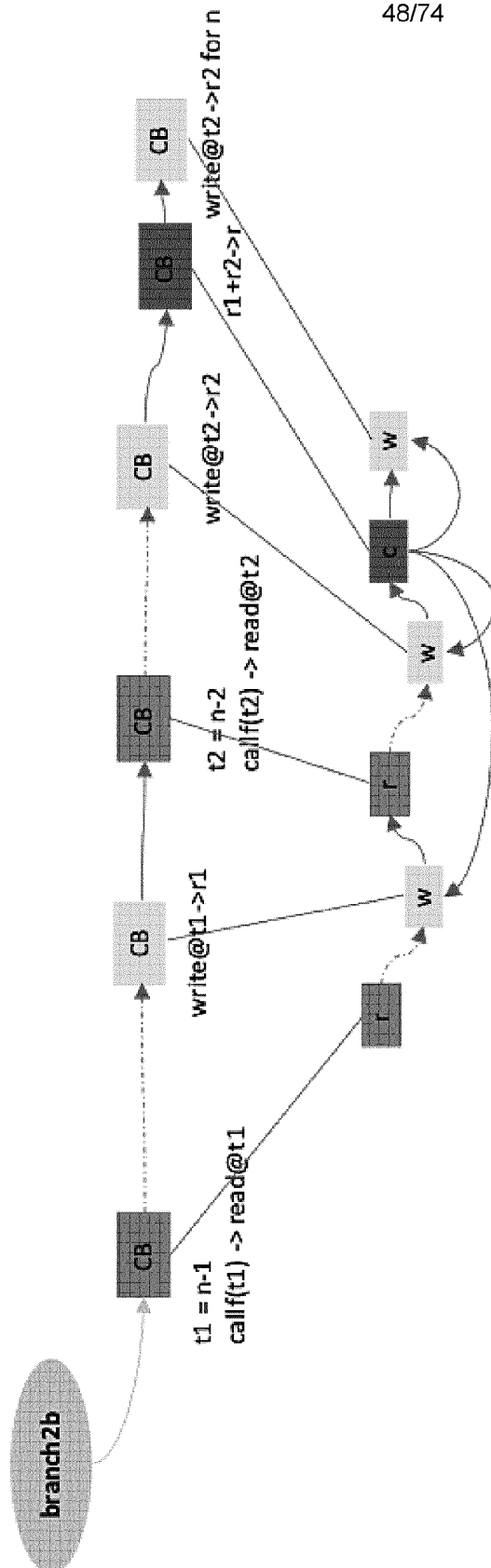
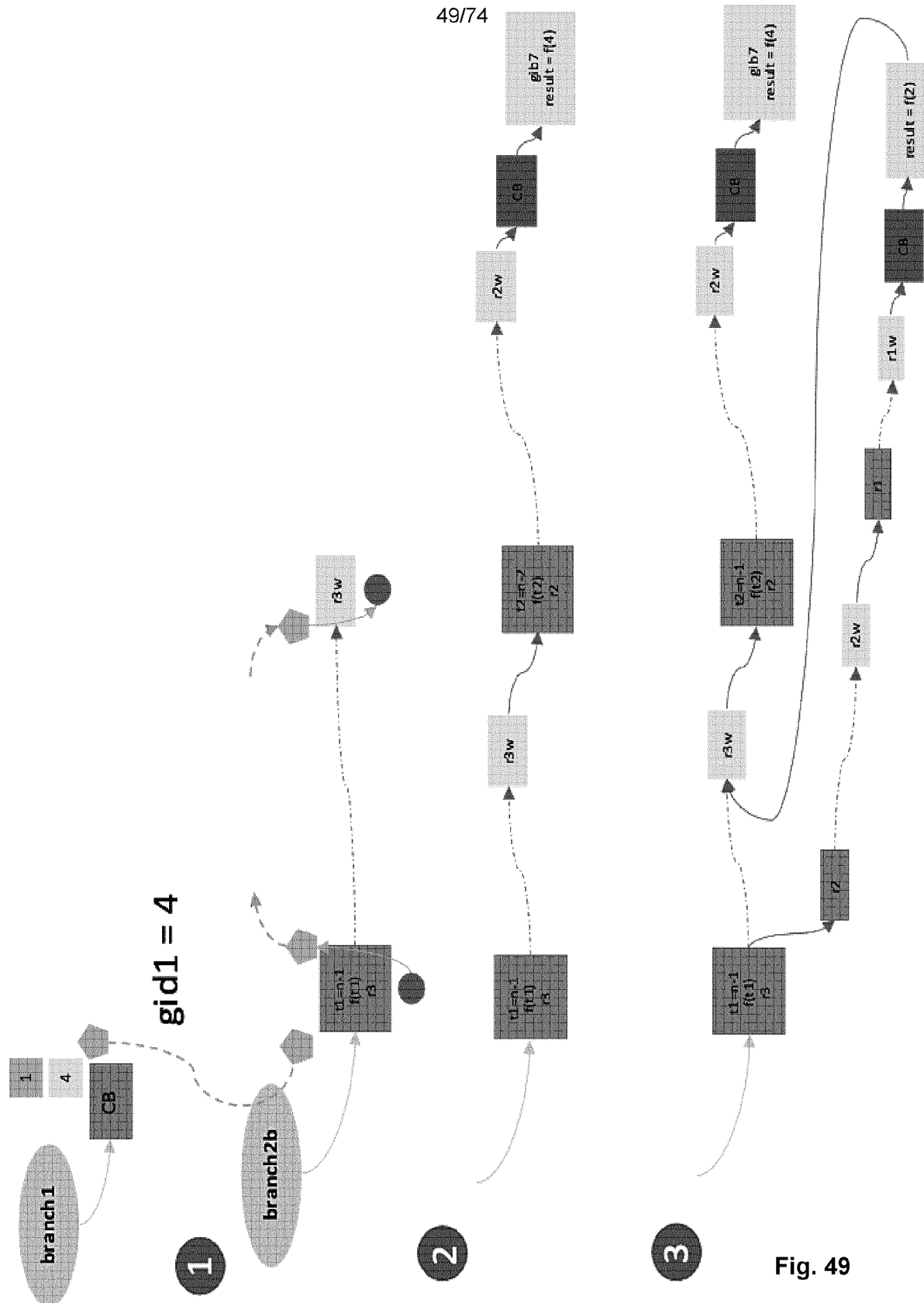


Fig. 48



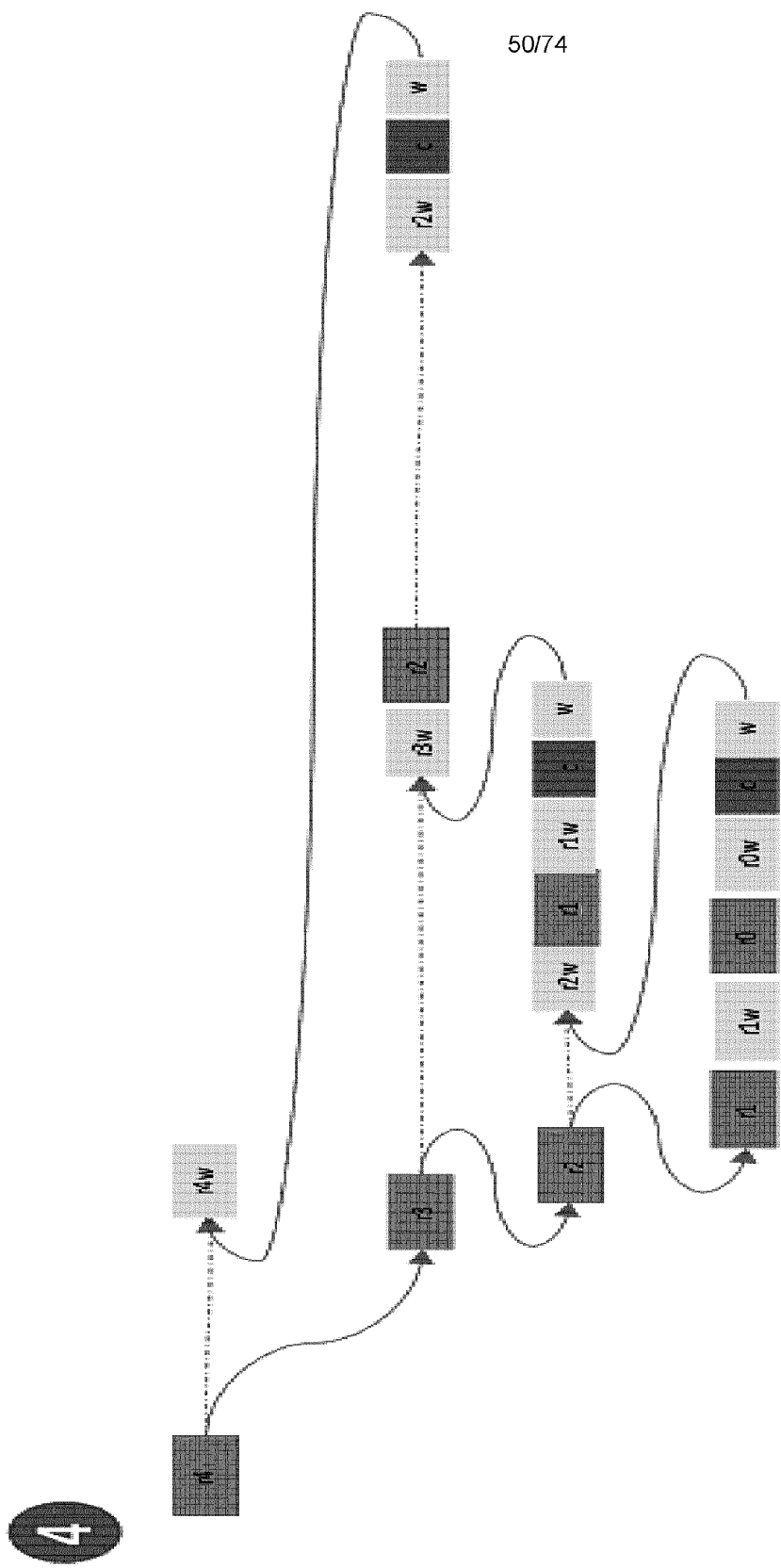


Fig. 50

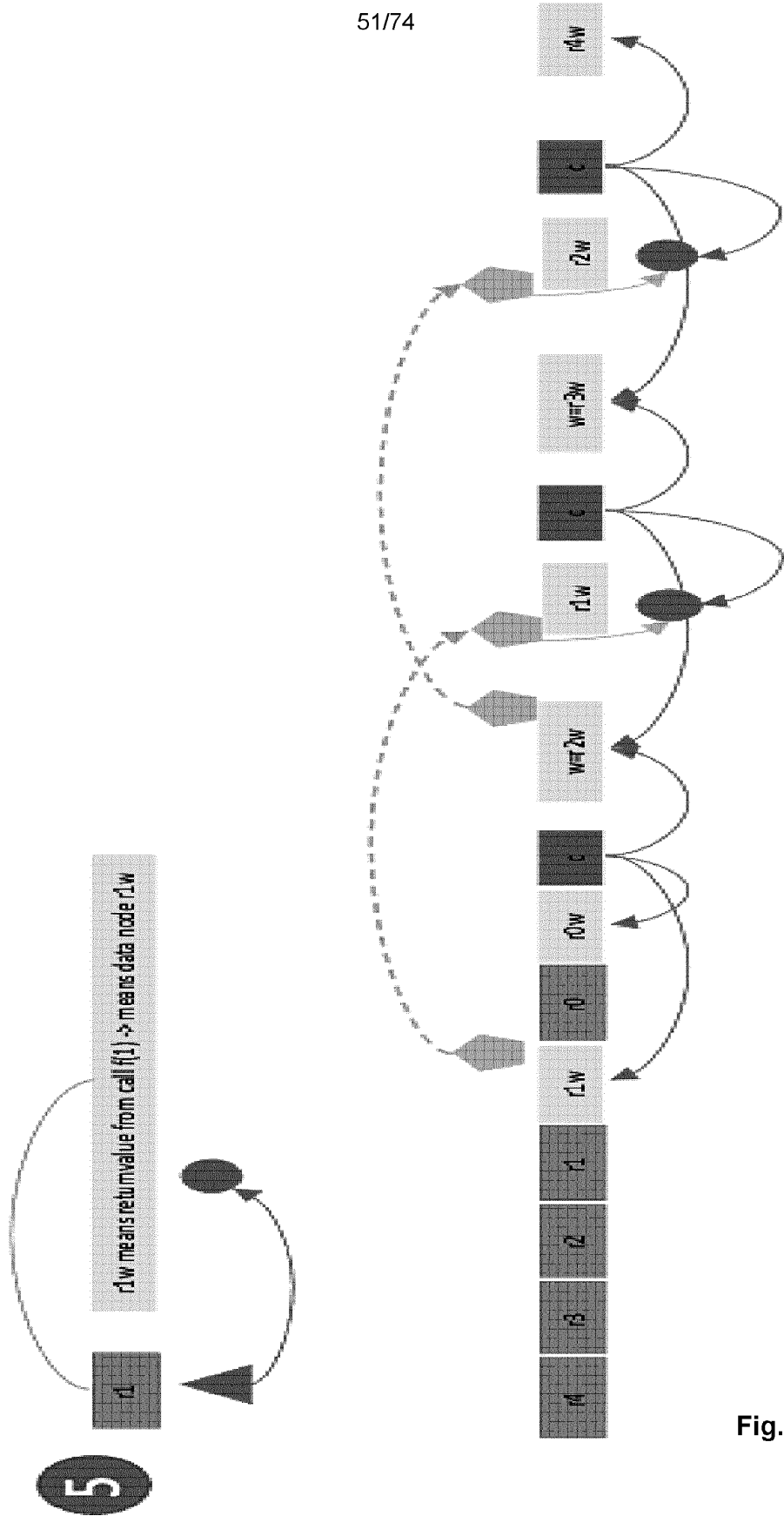
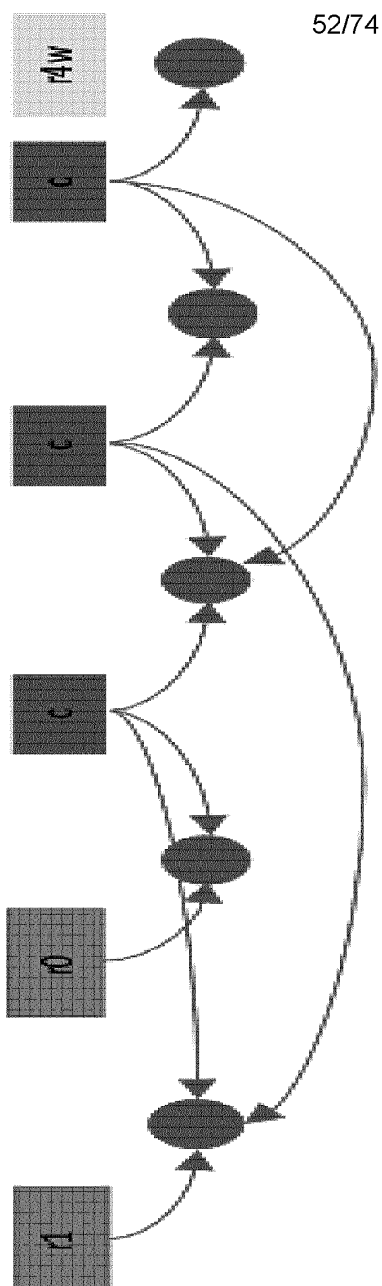


Fig. 51



52/74



Fig. 52

53/74

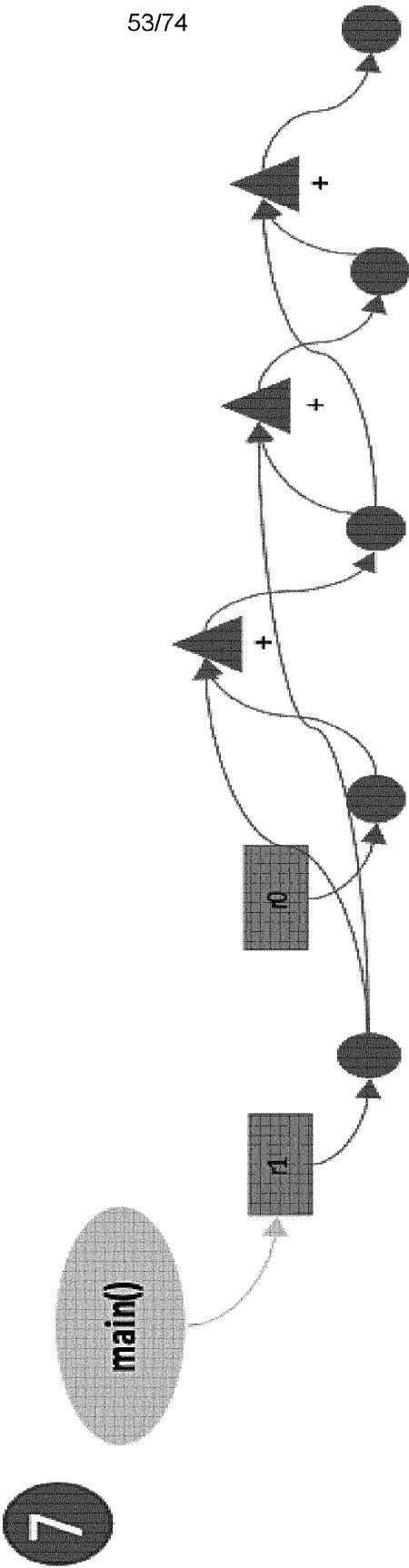


Fig. 53

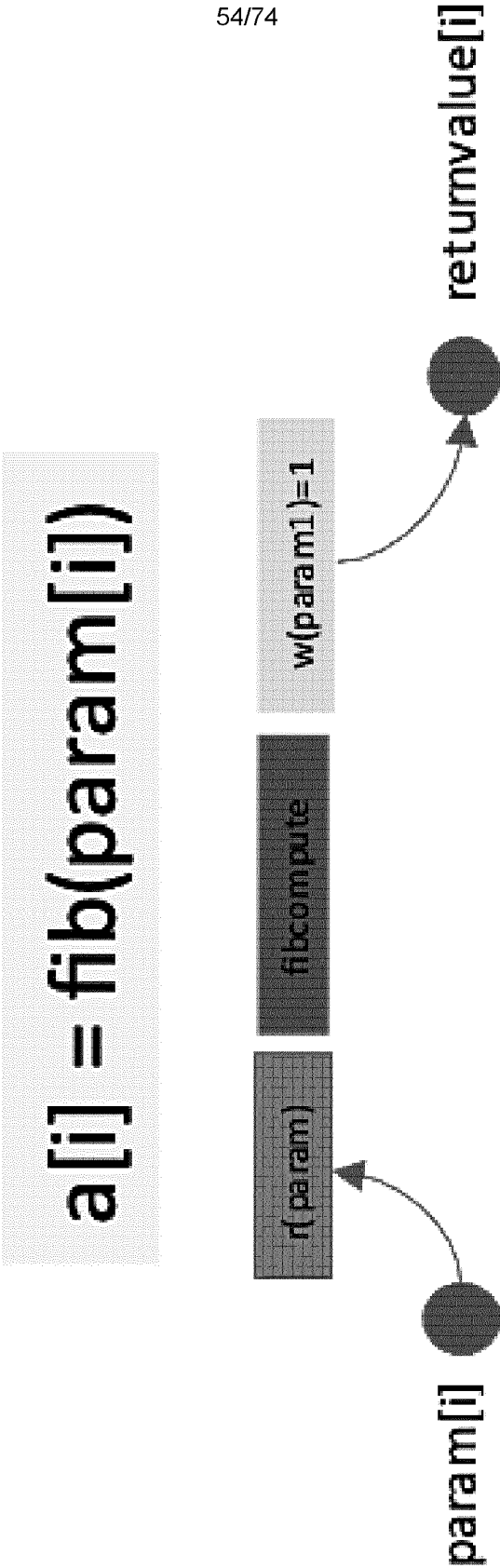


Fig. 54

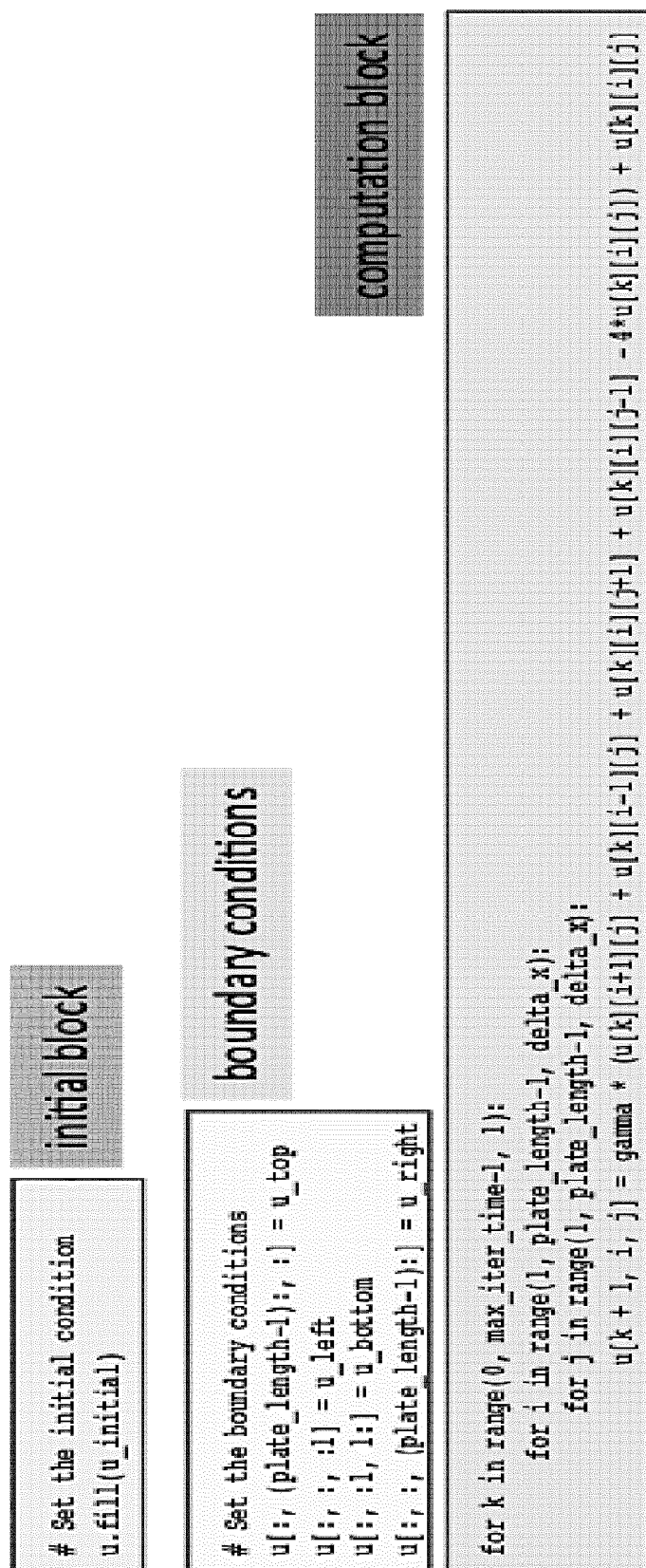


Fig. 55

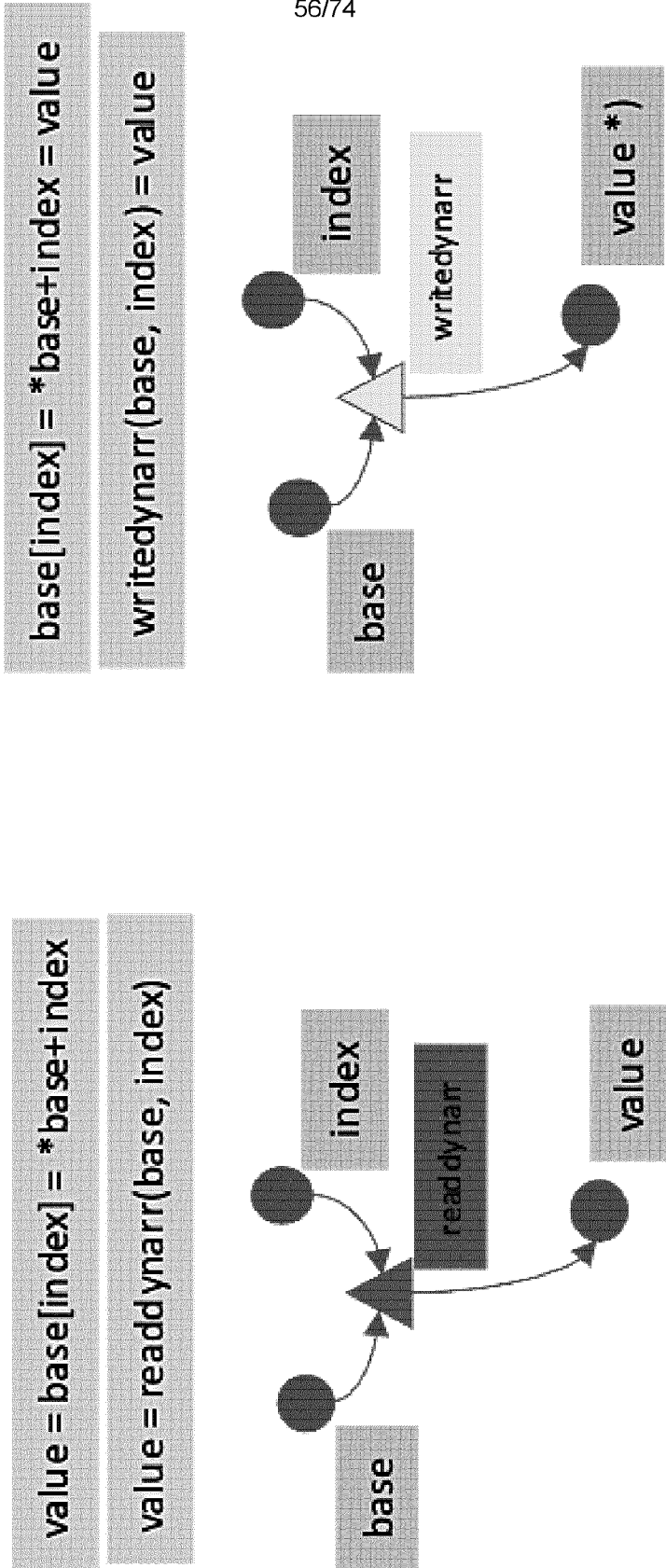


Fig. 56

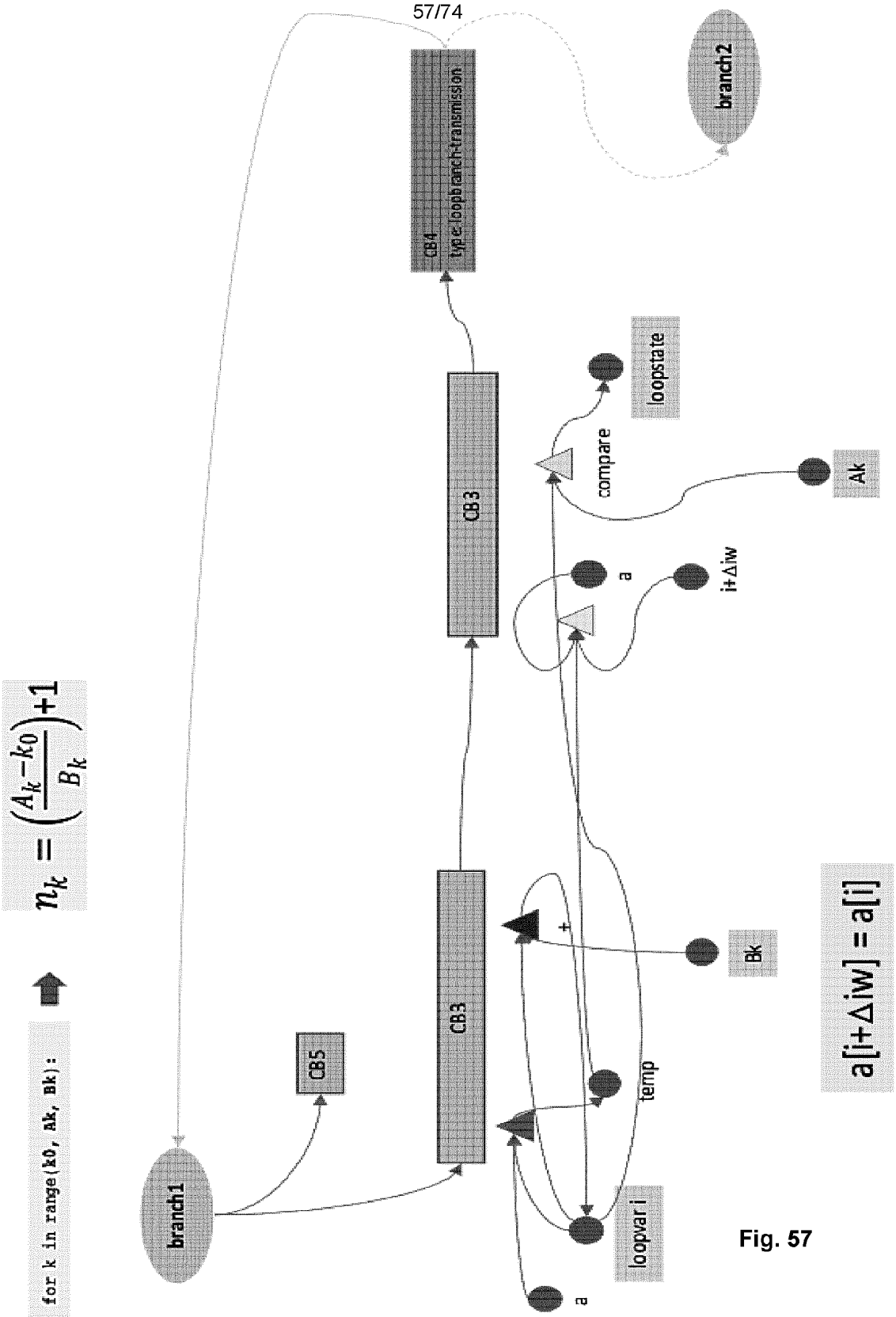


Fig. 57

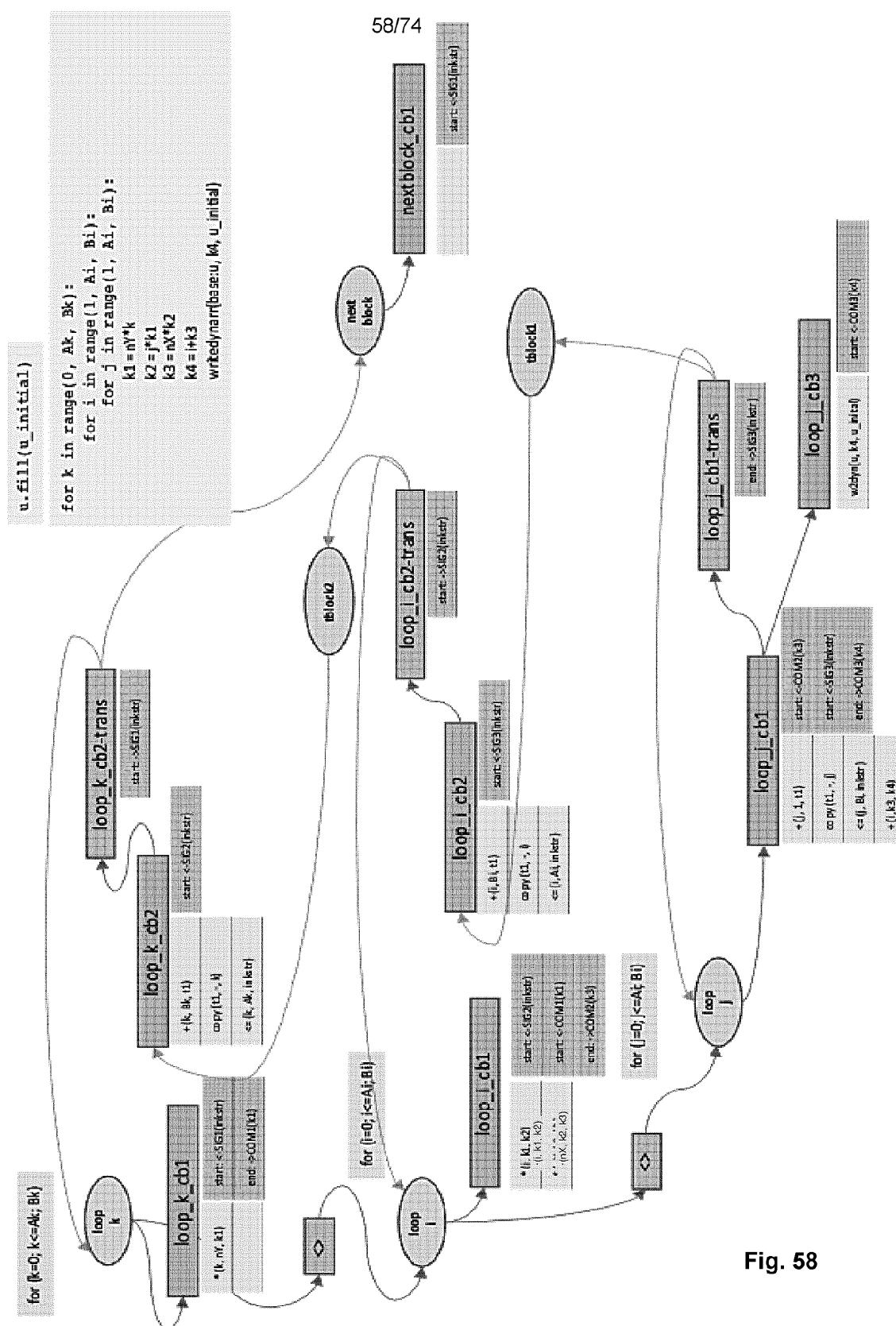
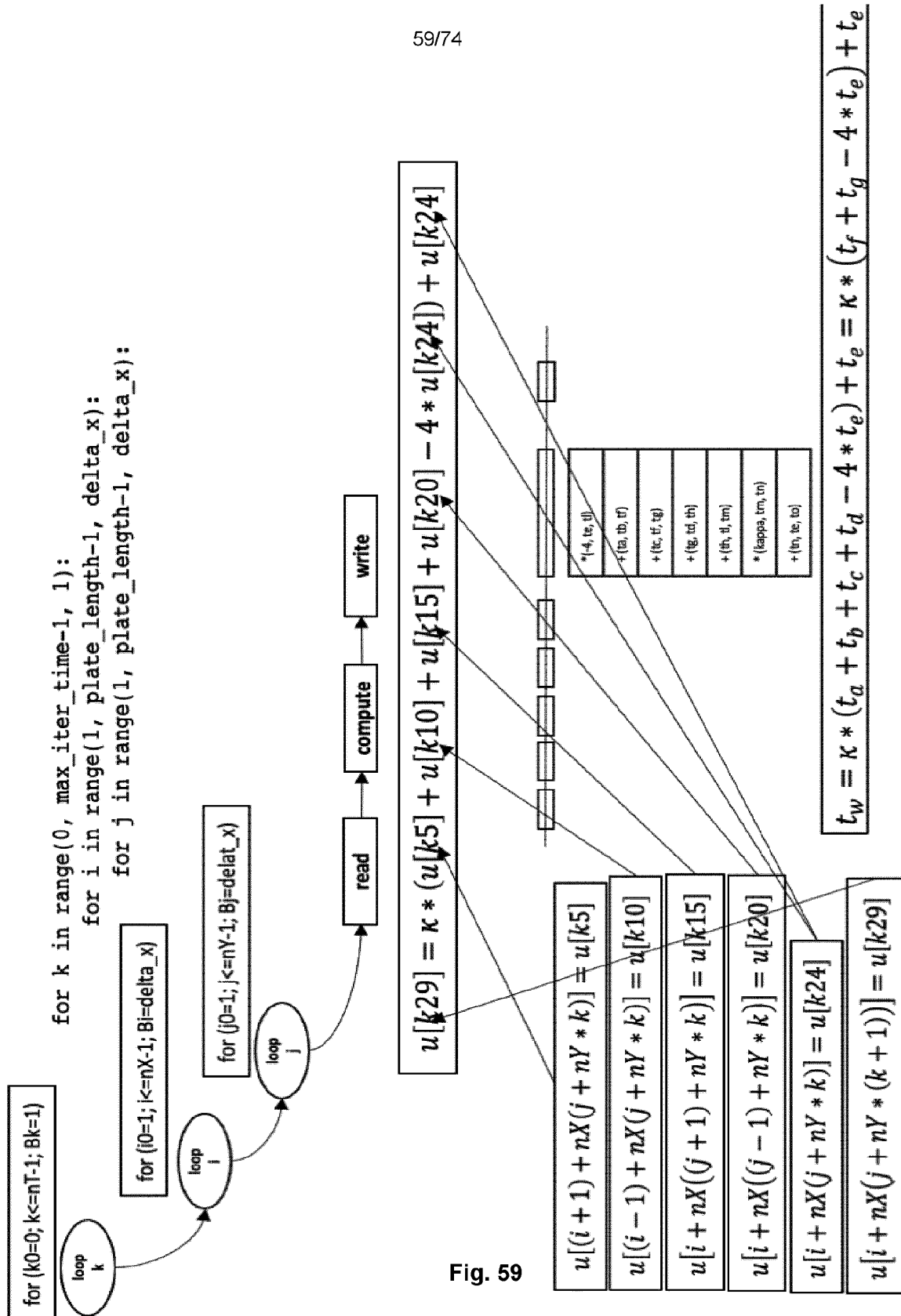


Fig. 58

59/74



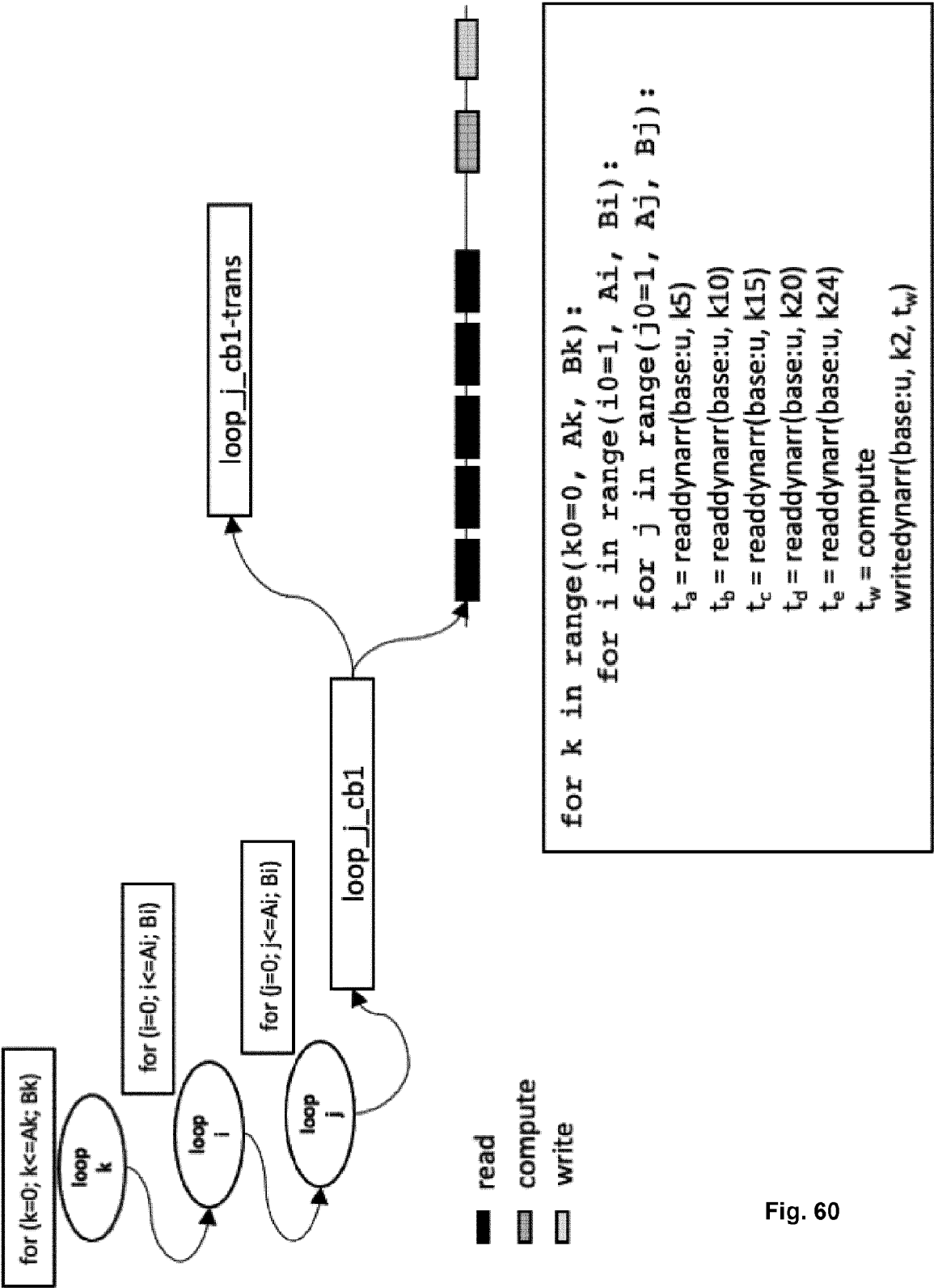


Fig. 60

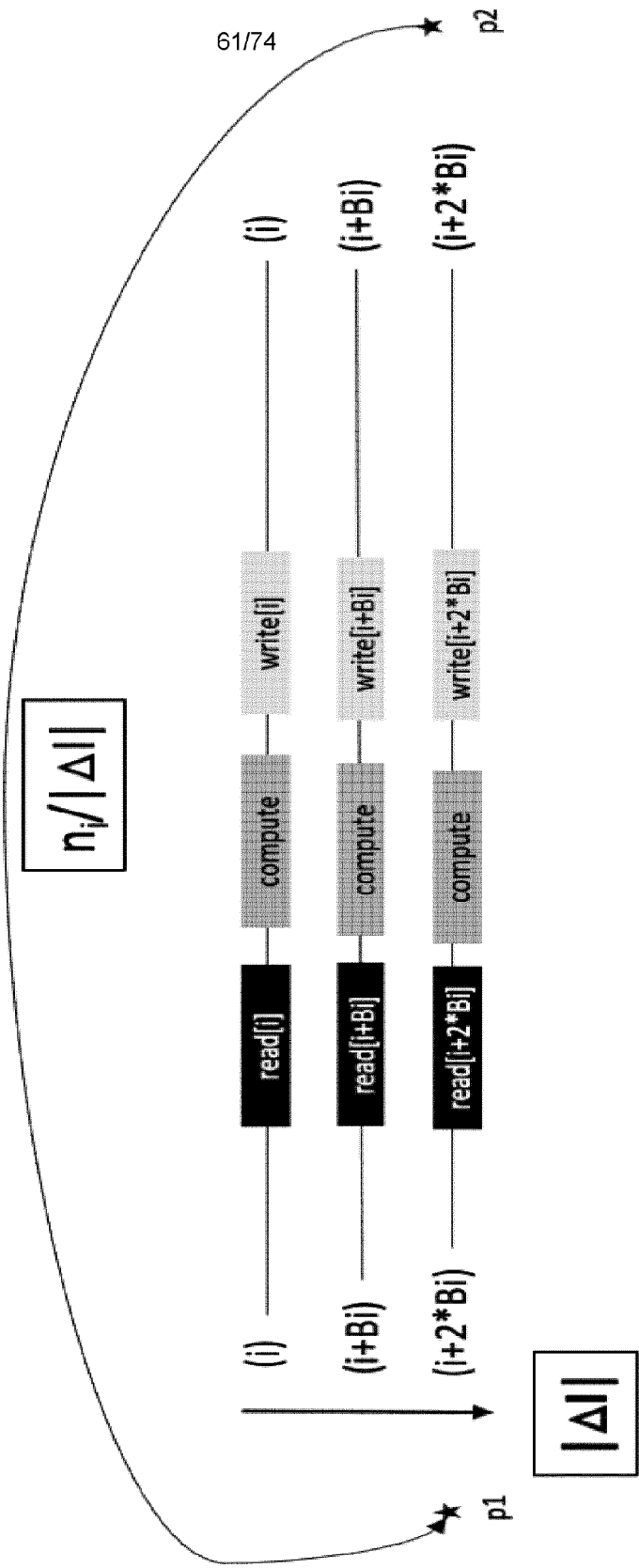


Fig. 61

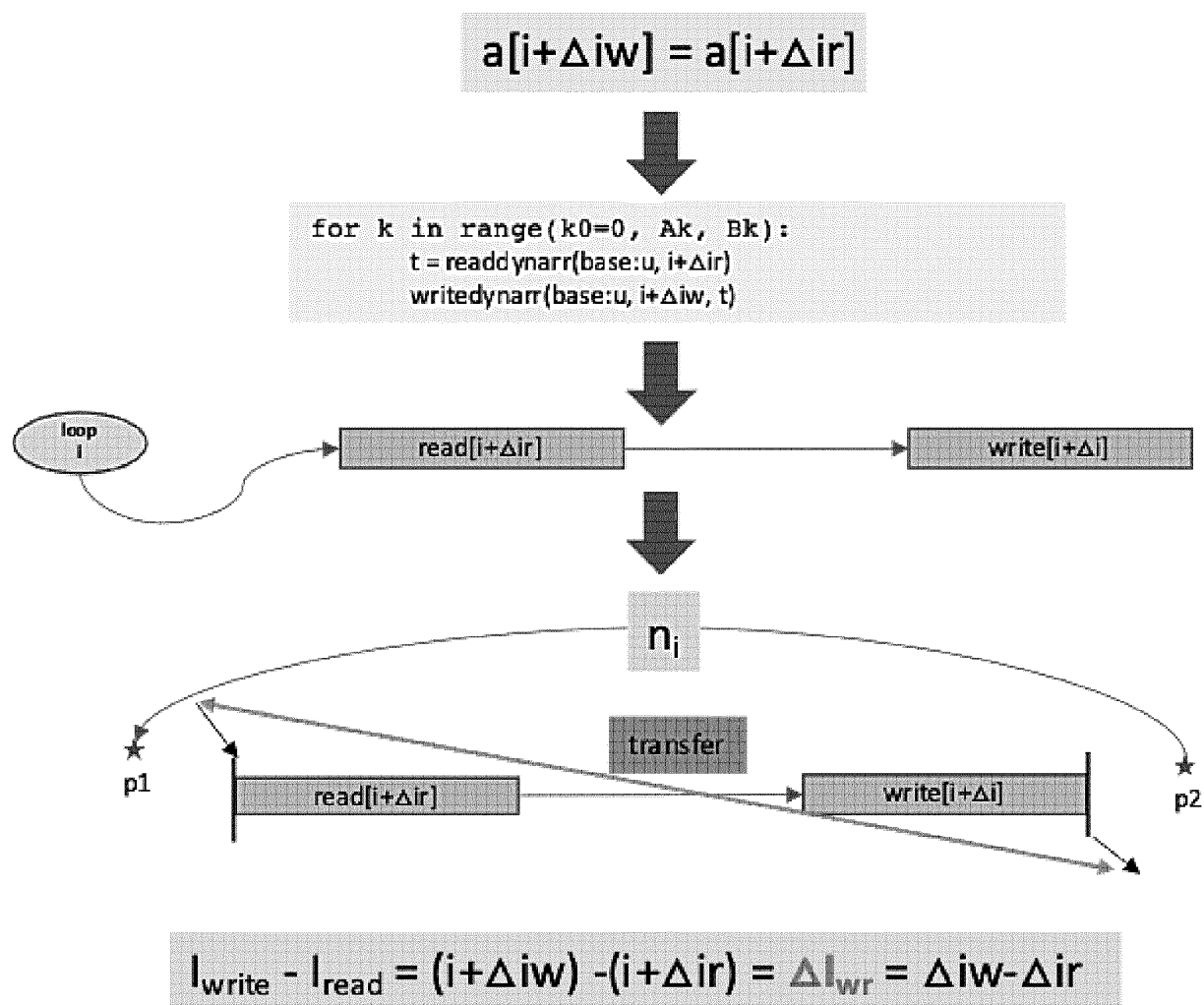


Fig. 62

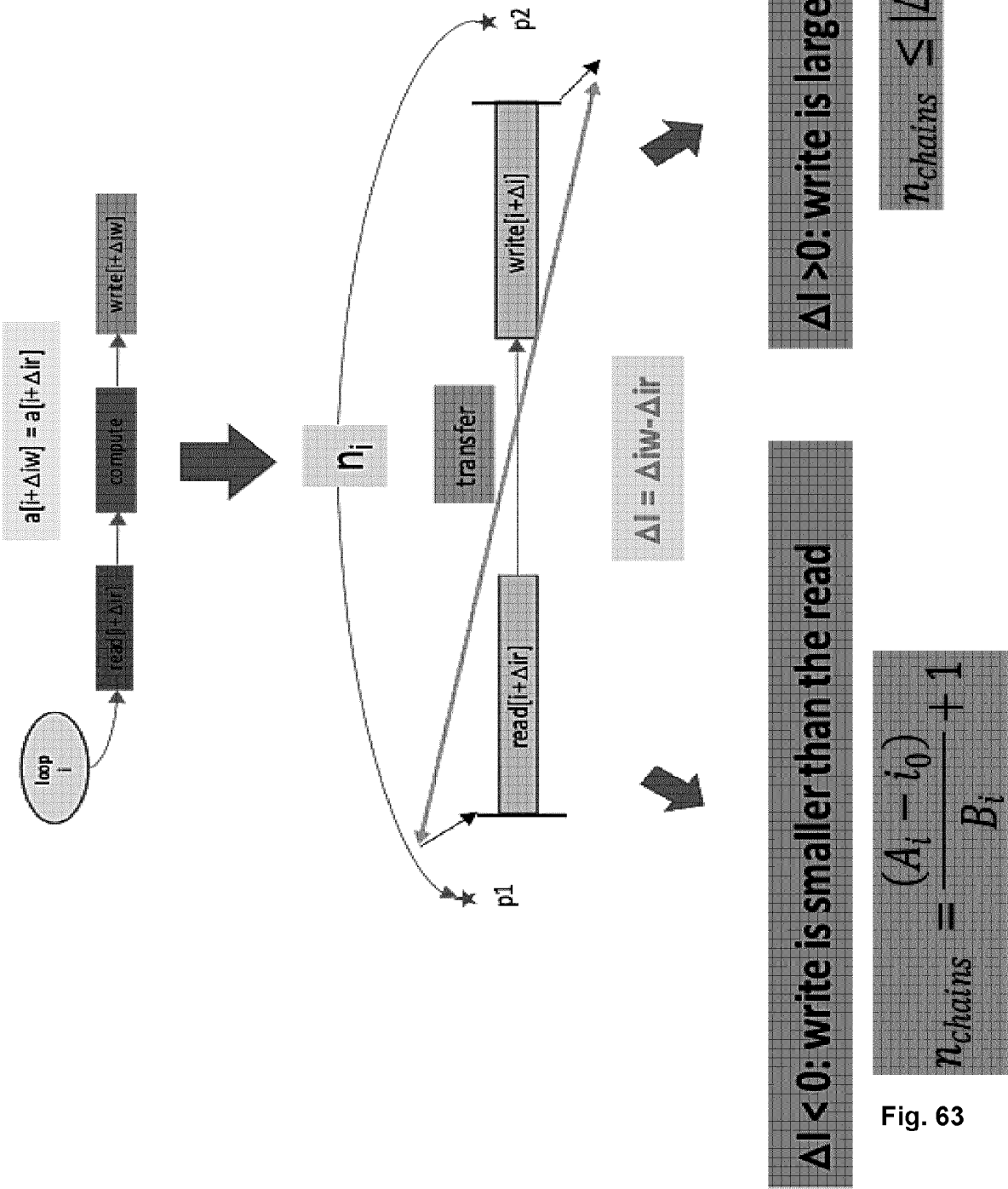


Fig. 63

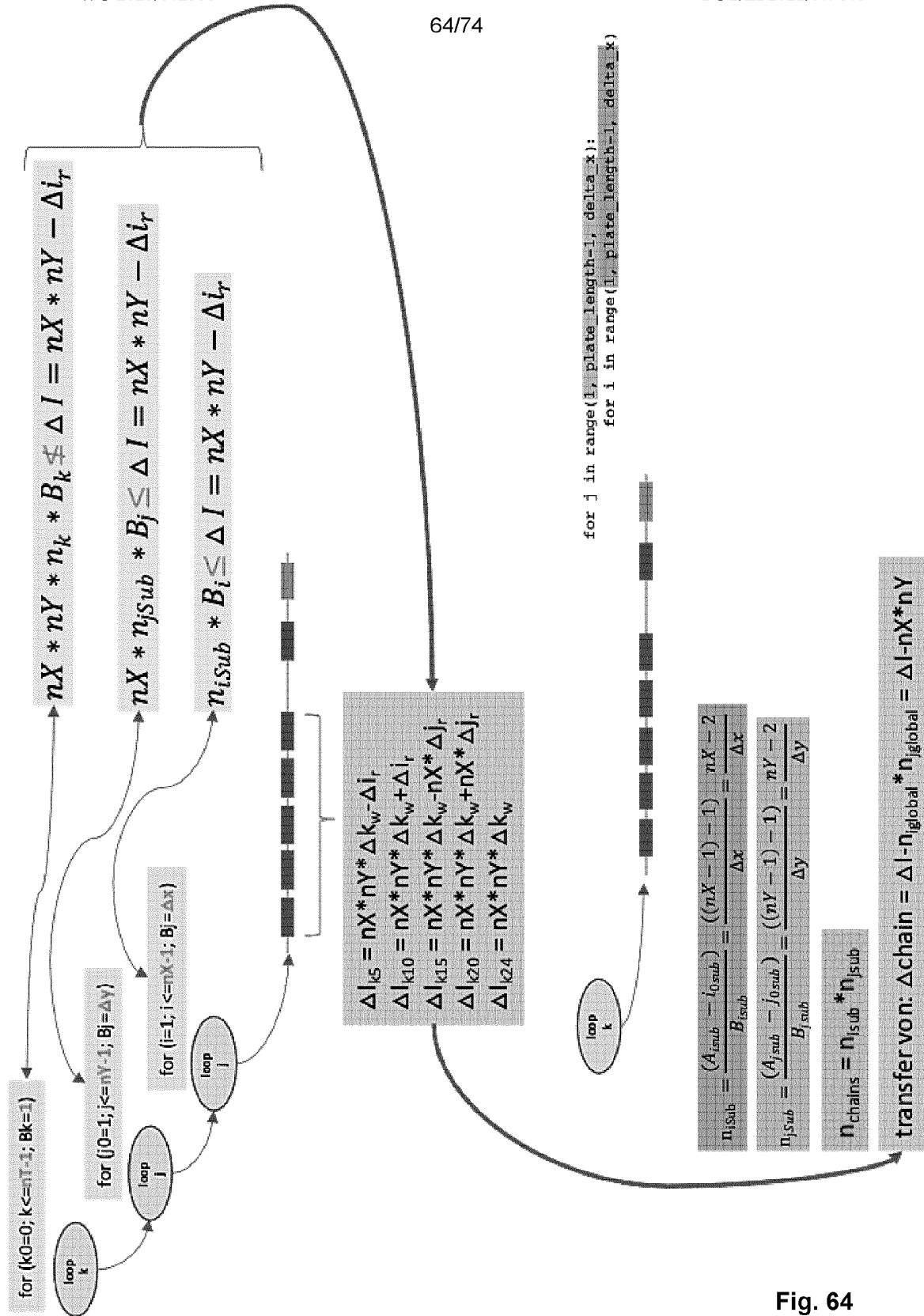


Fig. 64

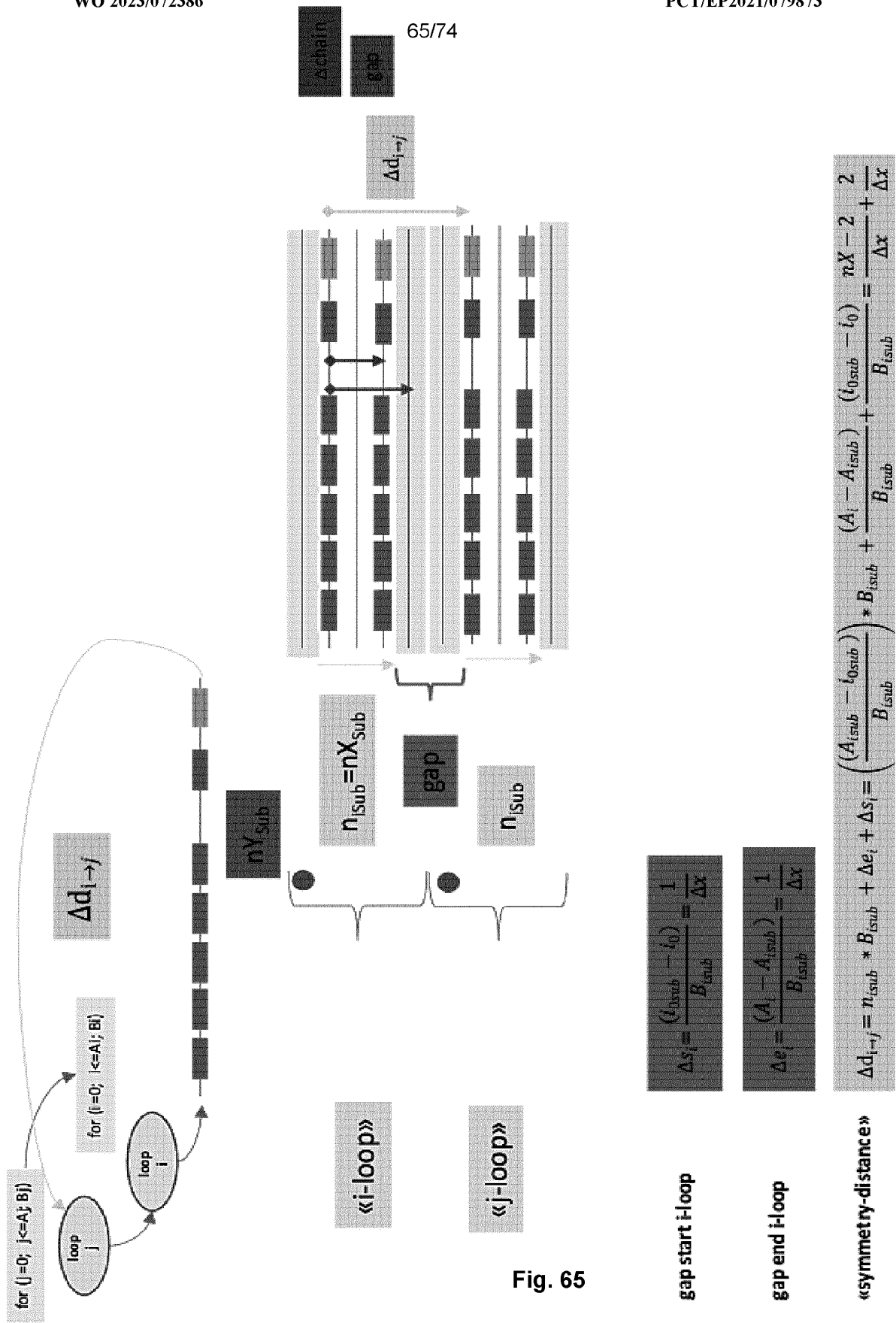
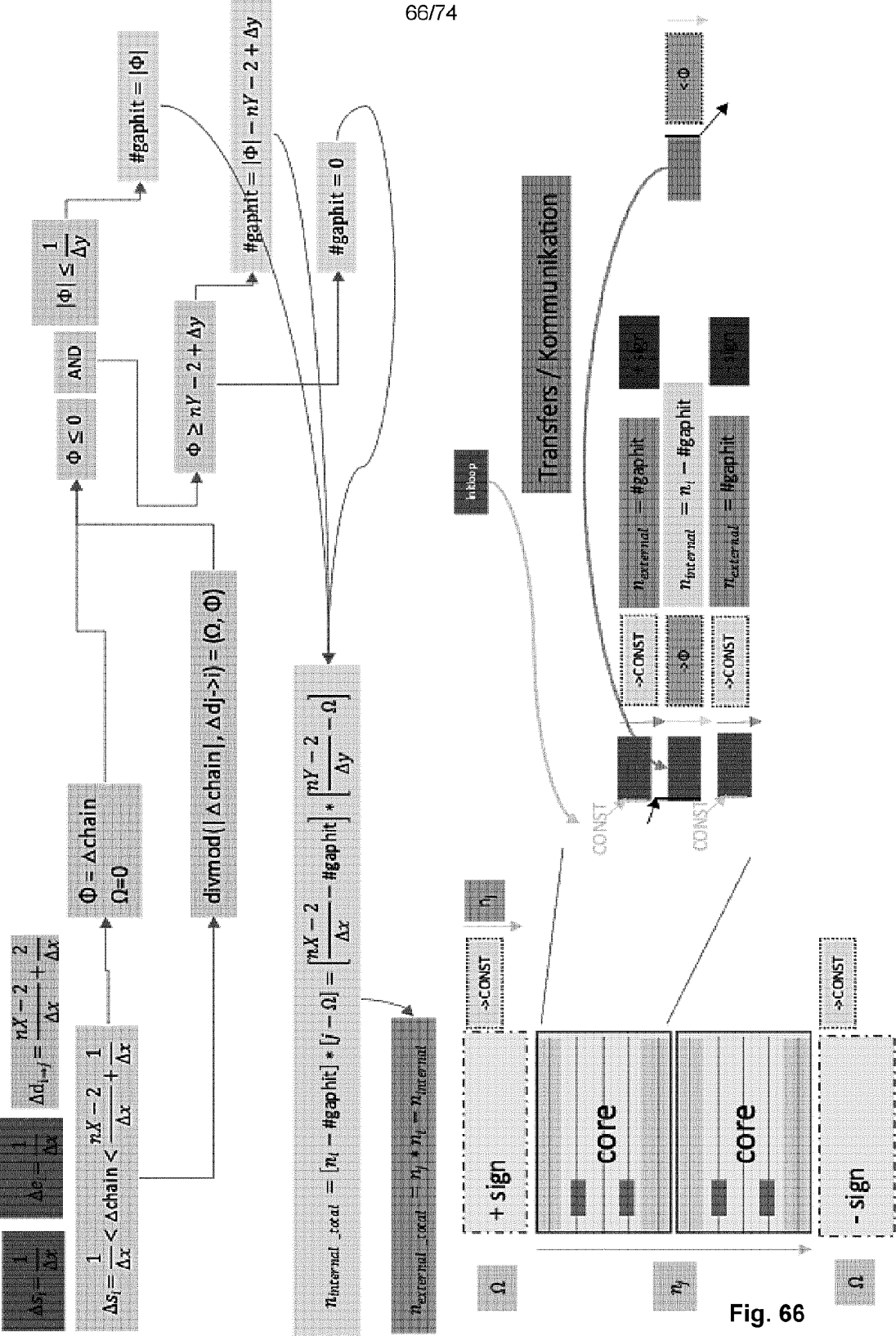


Fig. 65



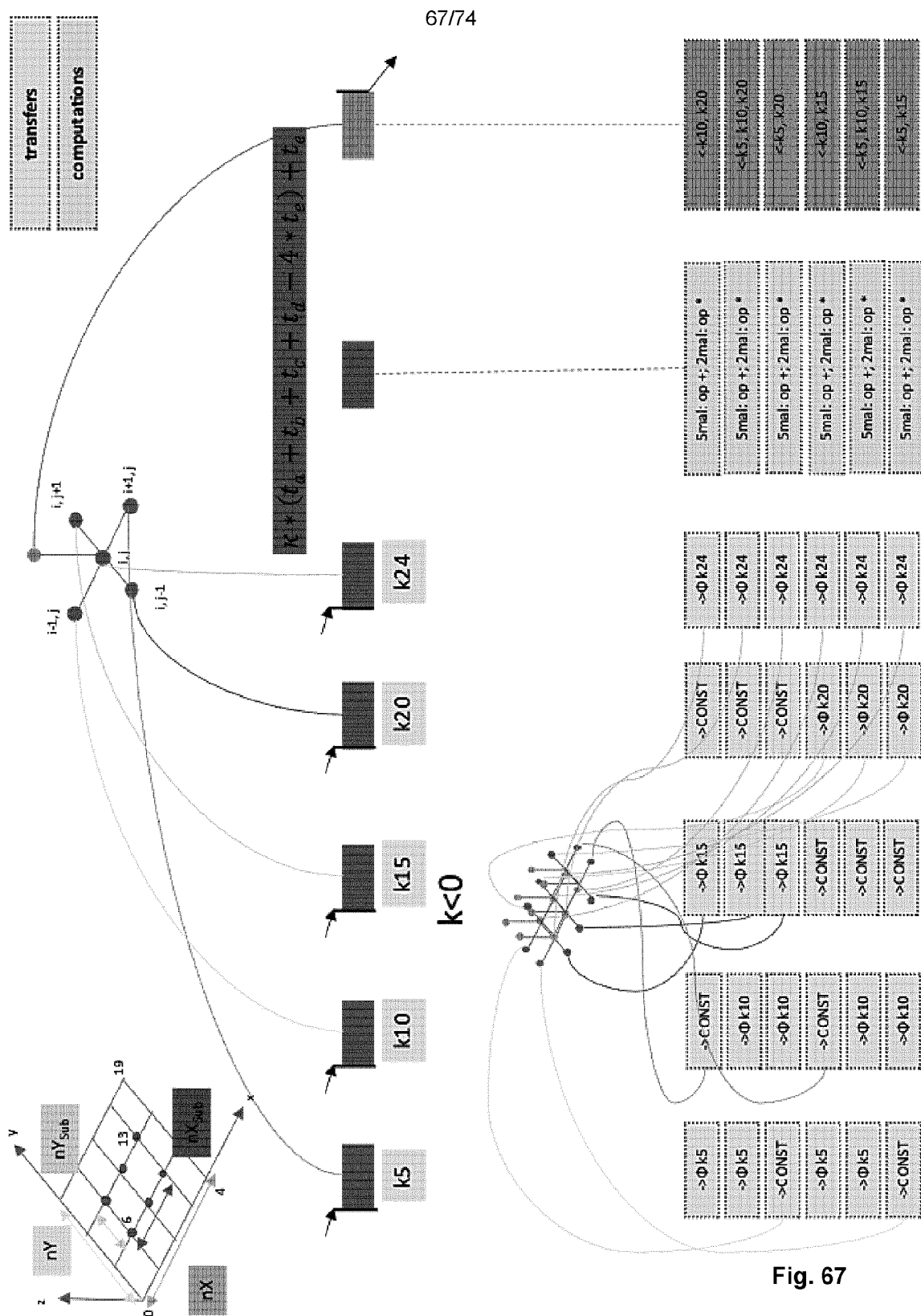


Fig. 67

68/74

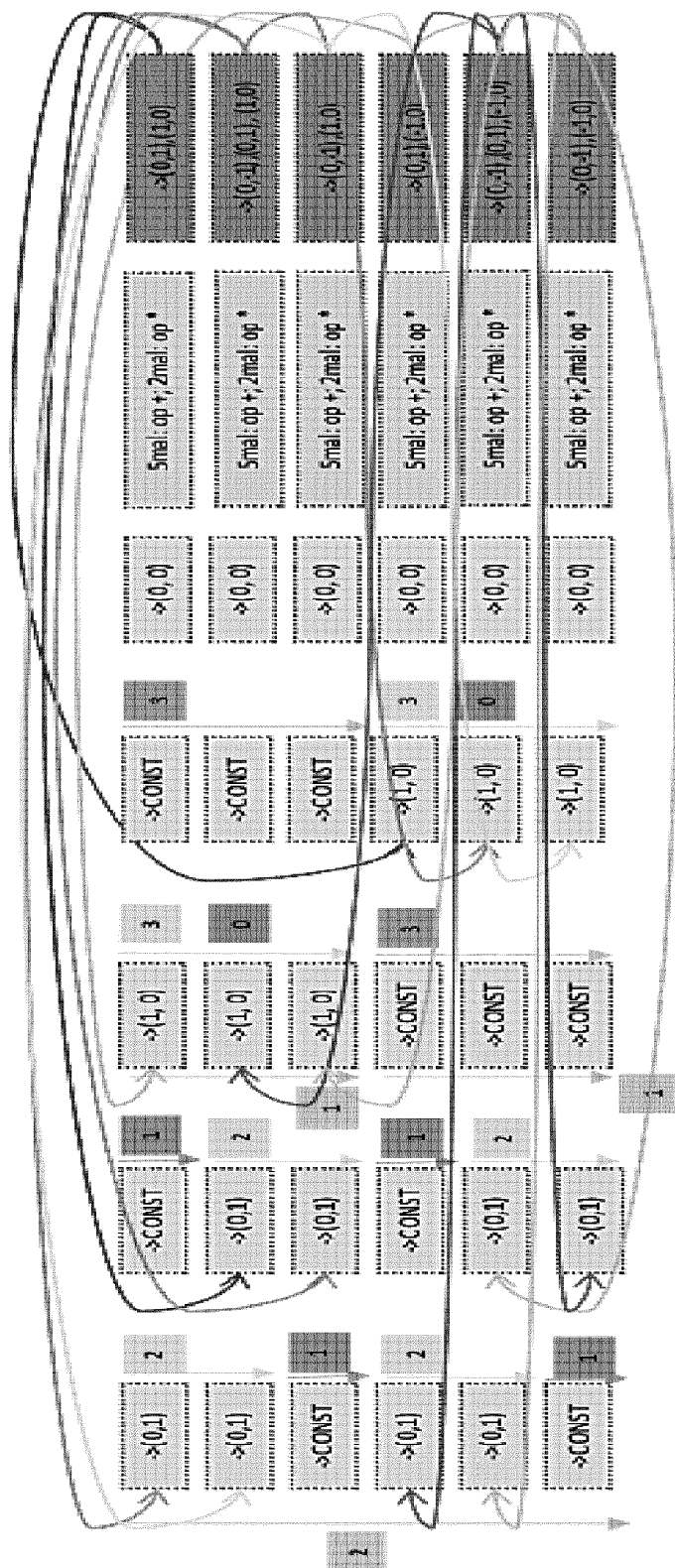


Fig. 68

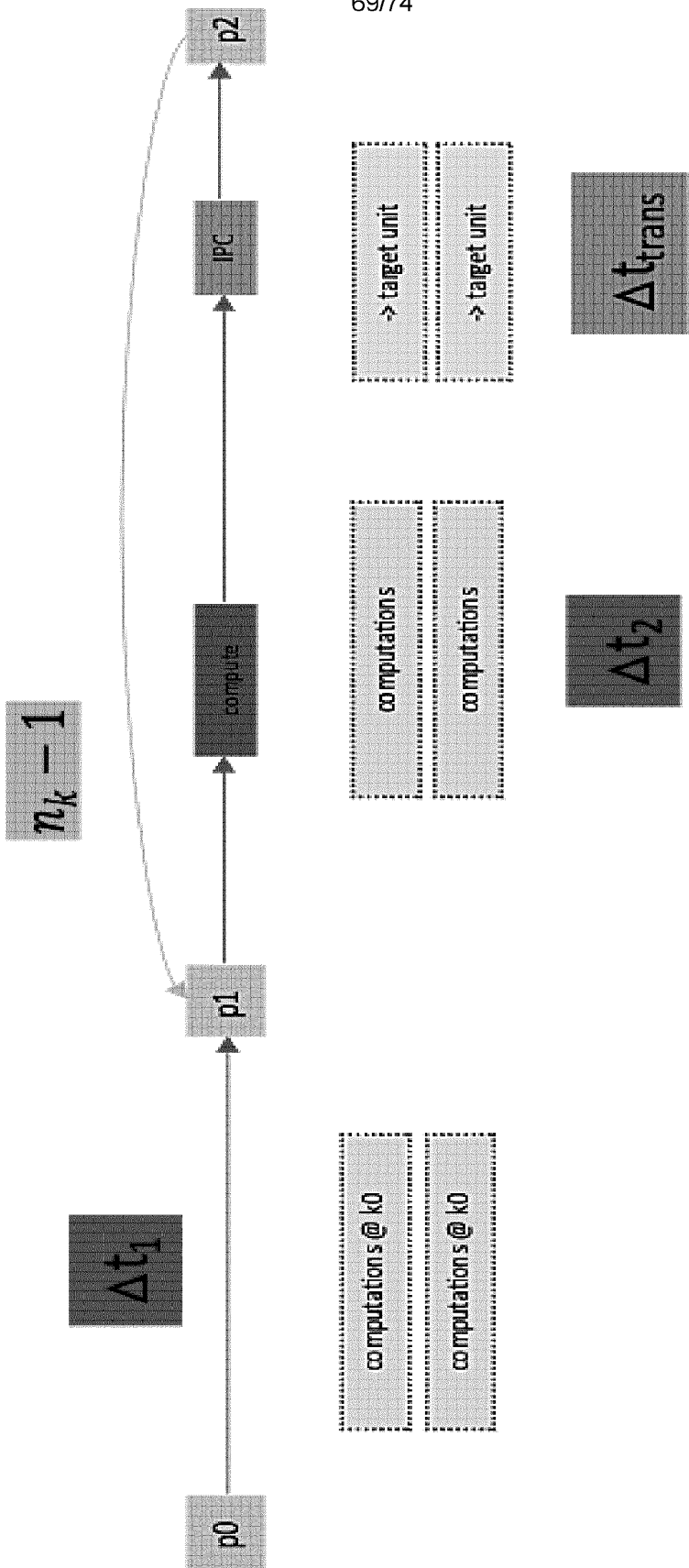
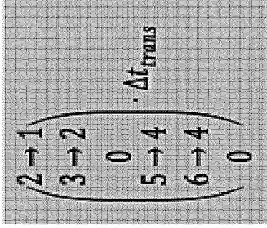
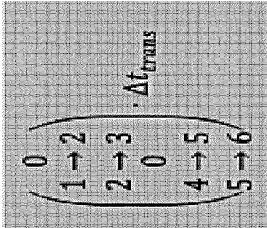
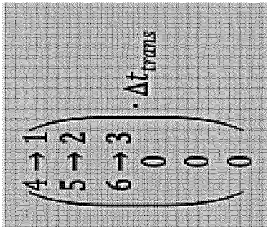
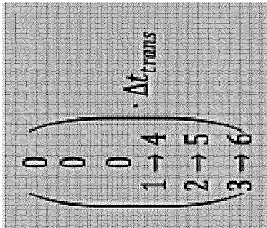
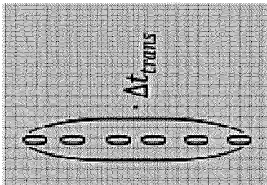
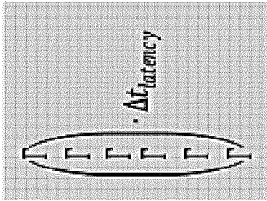


Fig. 69

2→1	0	4→1	0	1→1	5mal: op +, 2mal: op *	send: →2, →4
3→2	1→2	5→2	0	2→2	5mal: op +, 2mal: op *	send: →1, →3, →5
0	2→3	6→3	0	3→3	5mal: op +, 2mal: op *	send: →2, →6
5→4	0	0	1→4	4→4	5mal: op +, 2mal: op *	send: →4, →1
6→5	4→5	0	2→5	5→5	5mal: op +, 2mal: op *	send: →4, →6, →2
0	5→6	0	3→6	6→6	5mal: op +, 2mal: op *	send: →5, →3

70/74



$\Gamma = 5 + 2 *$

$transfer_size = float_size$

$cache_size = float_size$

meta-values

Fig. 70

full resolved

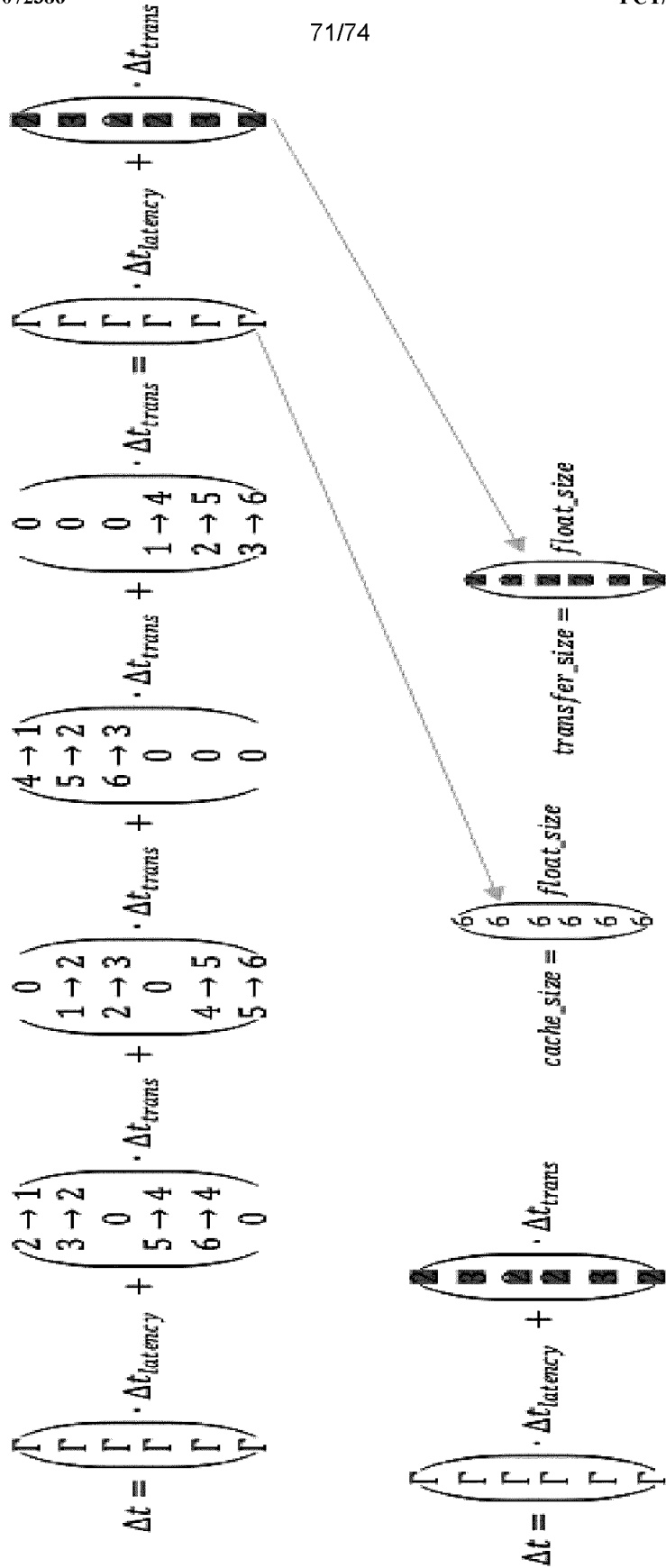
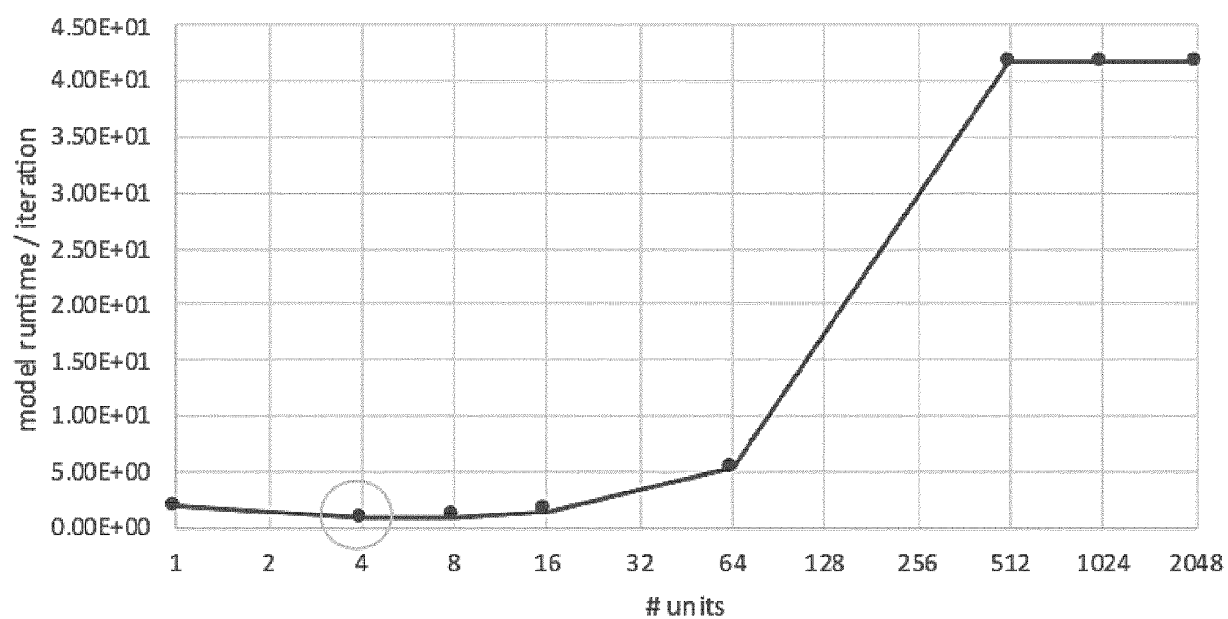


Fig. 71

Intel P5 Infiniband



Intel Haswell L3-cache

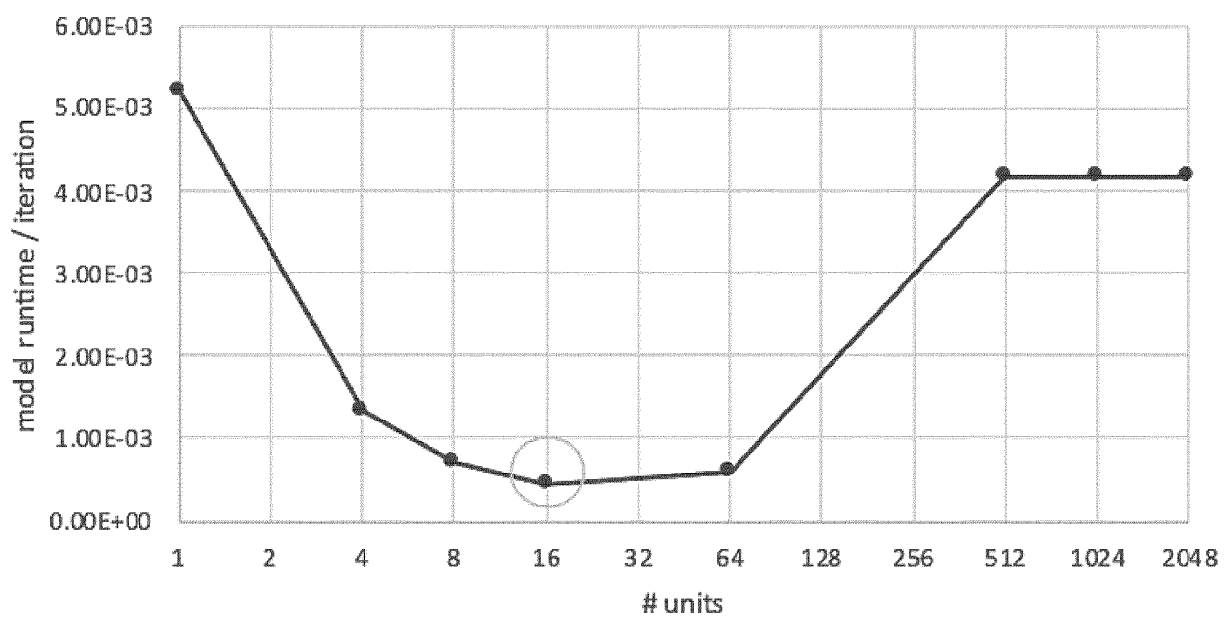


Fig. 72

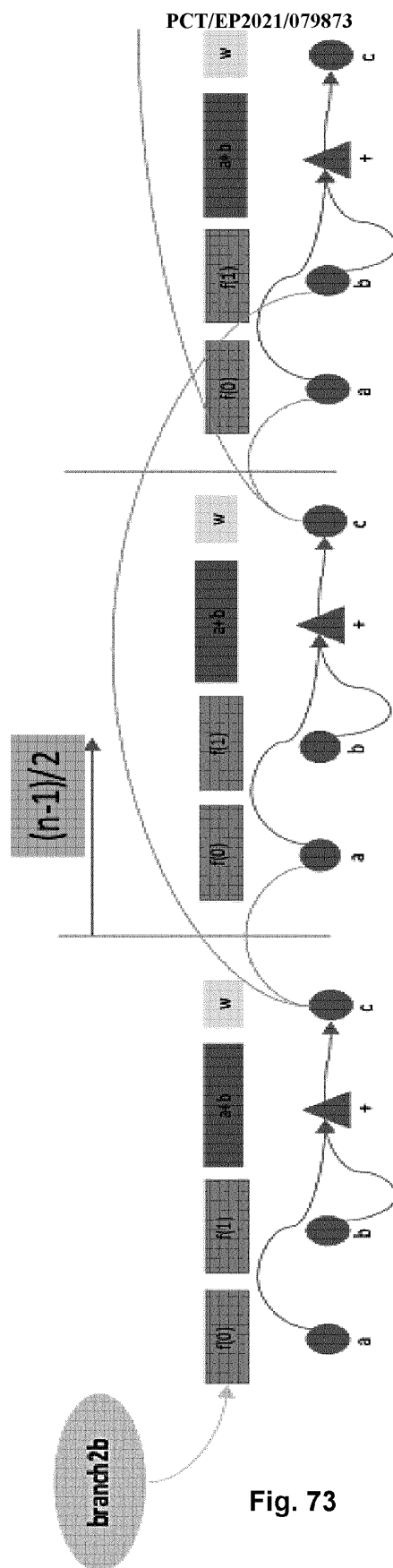
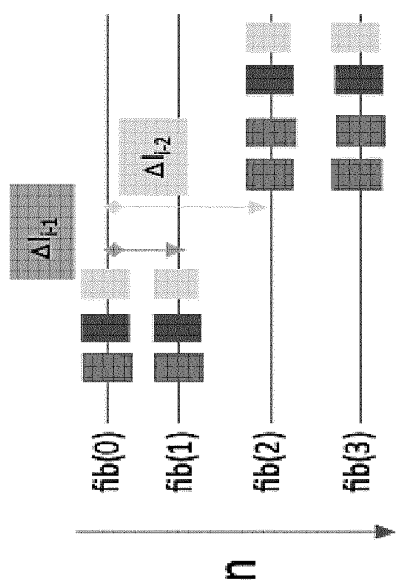


Fig. 73

