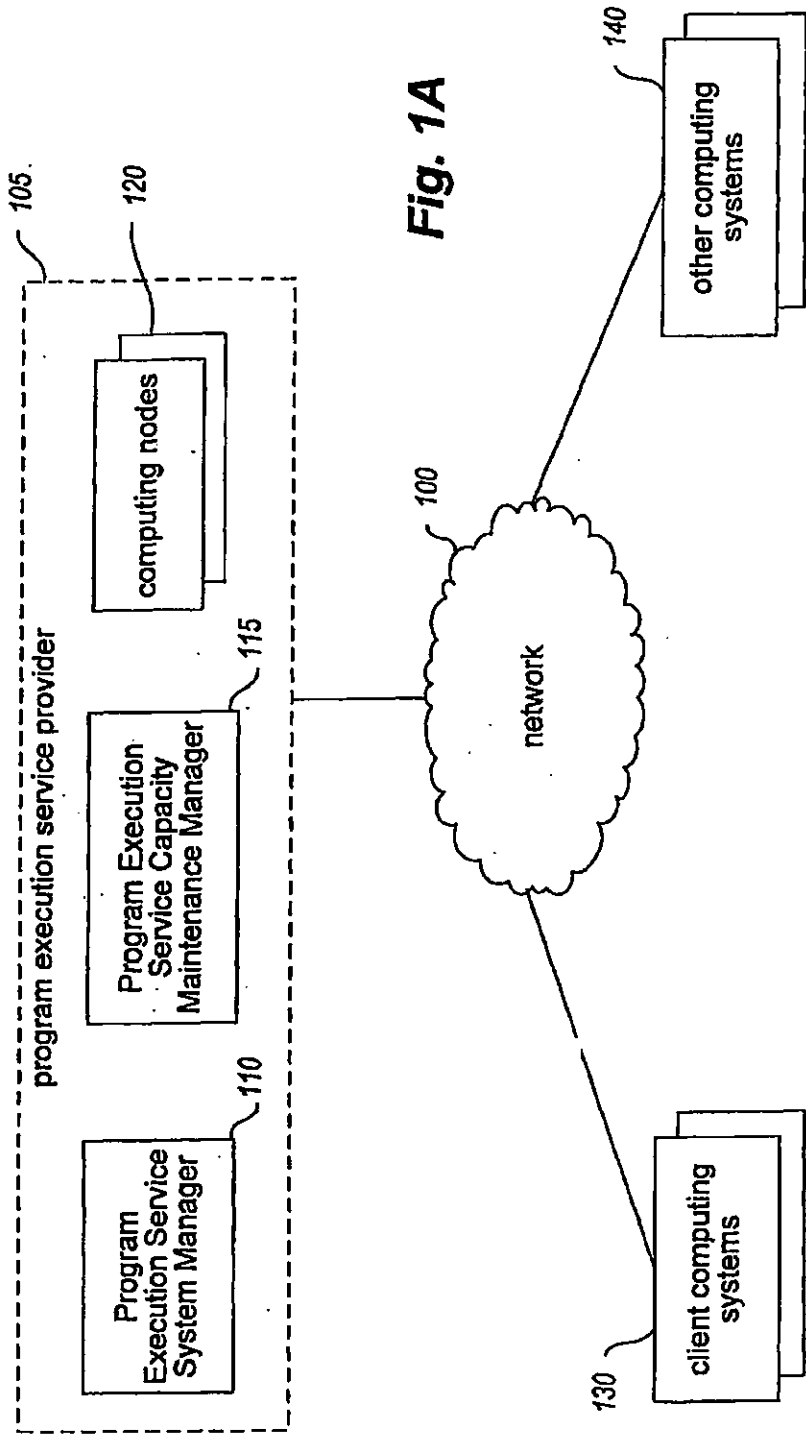
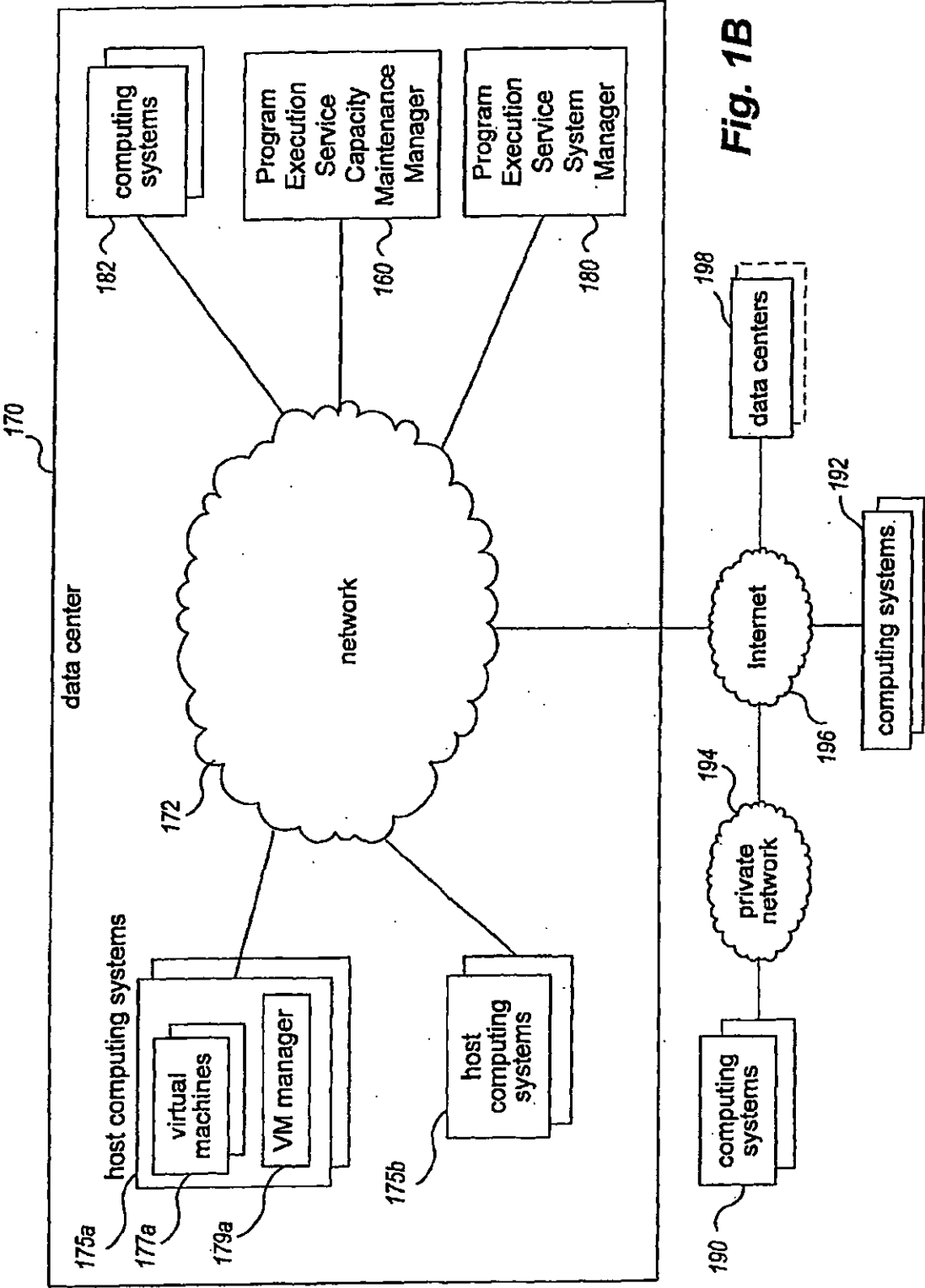






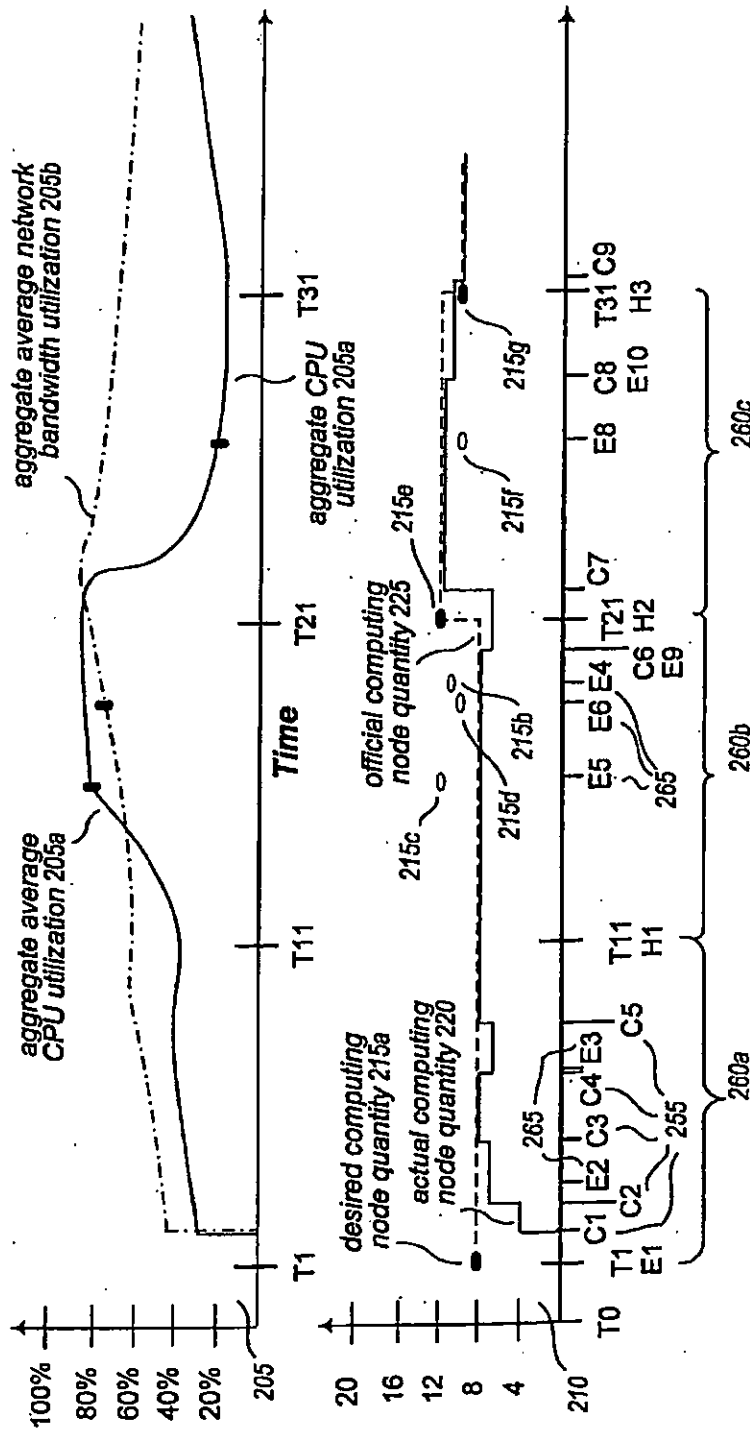


Fig. 2A

EXAMPLE TRIGGERS

- Trigger TR-1 – if aggregate CPU utilization $\geq 80\%$, then increase desired computing node quantity by 4
- Trigger TR-2 – if aggregate CPU utilization $\geq 90\%$, then increase desired computing node quantity by 6
- Trigger TR-3 – if aggregate CPU utilization $< 20\%$, then decrease desired computing node quantity by 2
- ⋮
- Trigger TR-N – if aggregate bandwidth utilization $\geq 75\%$, then increase desired computing node quantity by 2

4/9

Example Computing Node Group Changes Database

280	280a	280b	280c	280d	280e	280f	280g	280h	280i
	Change ID	Group ID	Change Type	Change Result	Change Details	Start Time	End Time	Time Period	Change-Event Nexus ID
285a	C01	Group1	computing node quantity		+4 nodes	T01	T02	H1	N1
285b	C02	Group1	computing node quantity		+3 nodes	T01	T03	H1	N1
285c	C10a	Group1	computing node quantity		+1 node	T01	-	H1	N1
285d	C10b	Group1	computing node quantity	terminate uninitialized node	-1 node	T04	T04	H1	N2
285e	C03	Group1	computing node quantity	add node	+1 node	T04	T05	H1	N3
285f	C04	Group1	computing node quantity	terminate unavailable node	-1 node	T07	T07	H1	N4
285g	C05	Group1	computing node quantity	add node	+1 node	T07	T09	H1	N5
285h	C06	Group1	computing node quantity	terminate unavailable node	-1 node	T20	T20	H2	N6
285i	C07	Group1	computing node quantity	add nodes	+5 nodes	T21	T22	H3	N7
285j	C08	Group1	computing node quantity	terminate unavailable node	-1 node	T28	T28	H3	N8
285k	C09	Group1	computing node quantity	remove node	-1 node	T31	T32	H4	N9
	:								

Fig. 2B

Example Computing Node Group Events Database

290	290a	290b	290c	290d	290e	290f	290g	290h	290i
	Event ID	Group ID	Event Type	Event Source	Time	Time Period			Change-Event Nexus ID
295a	E01	Group1	group initialization	user instruction	T01	H1			N1
295b	E02a	Group1	failed node initialization detected	system initiated	T04	H1			N2
295c	E02b	Group1	uninitialized node terminated	system initiated	T04	H1			N3
295d	E03a	Group1	unavailable node detected	system initiated	T07	H1			N4
295e	E03b	Group1	unavailable node terminated	system initiated	T07	H1			N5
295f	E05	Group1	increase desired quantity by 4	trigger TR-1	T16	H2			N7
295g	E06	Group1	increase desired quantity by 2	trigger TR-N	T18	H2			N7
295h	E04	Group1	increase desired quantity by 3	user instruction	T19	H2			N7
295i	E09a	Group1	unavailable node detected	system initiated	T20	H2			N6
295j	E09b	Group1	unavailable node terminated	system initiated	T20	H2			N7
295k	E08	Group1	decrease desired quantity by 2	trigger TR-3	T27	H3			N9
295l	E10a	Group1	unavailable node detected	system initiated	T28	H3			N8
295m	E10b	Group1	unavailable node terminated	system initiated	T28	H3			N9
	:								

5/9

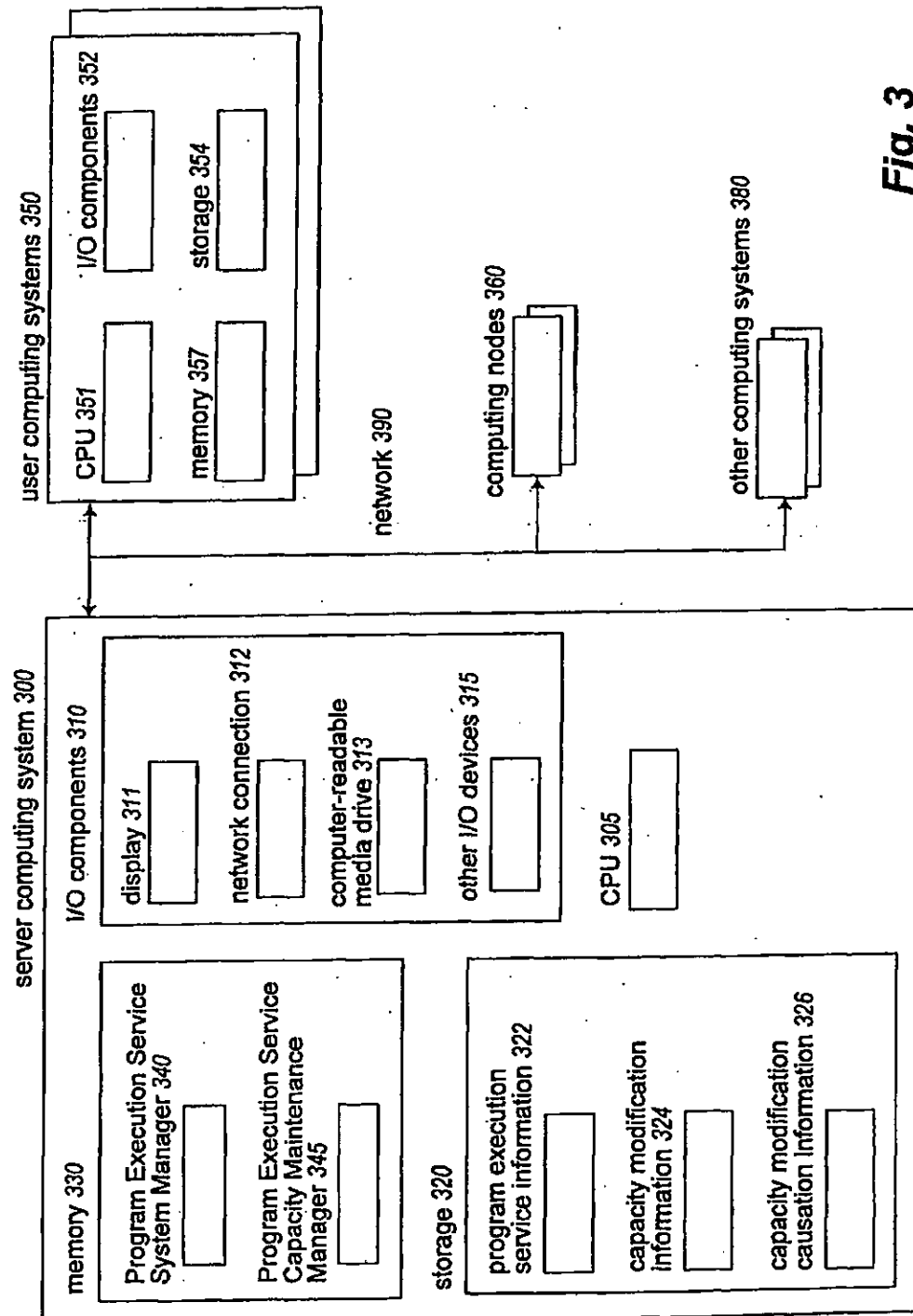
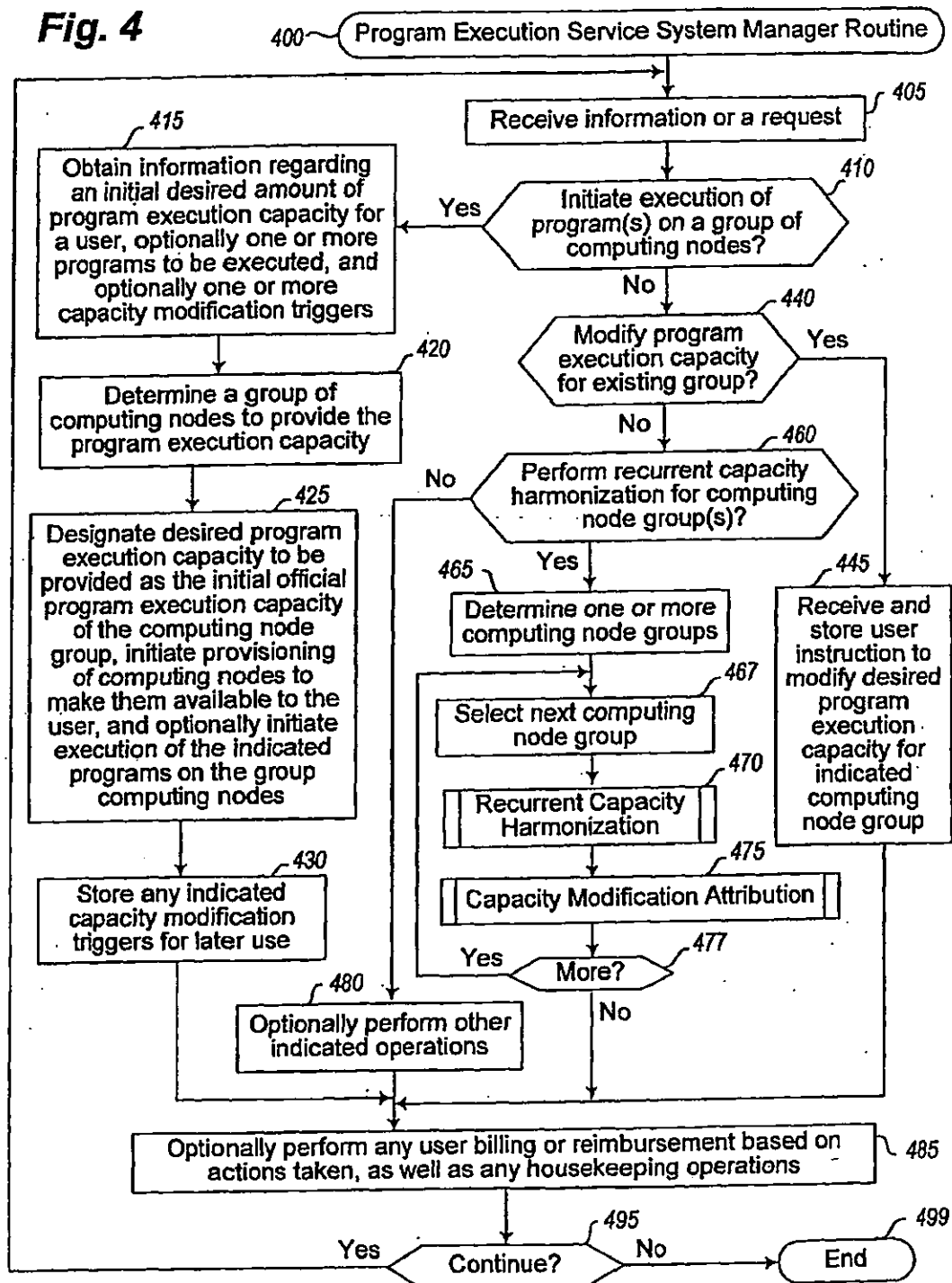
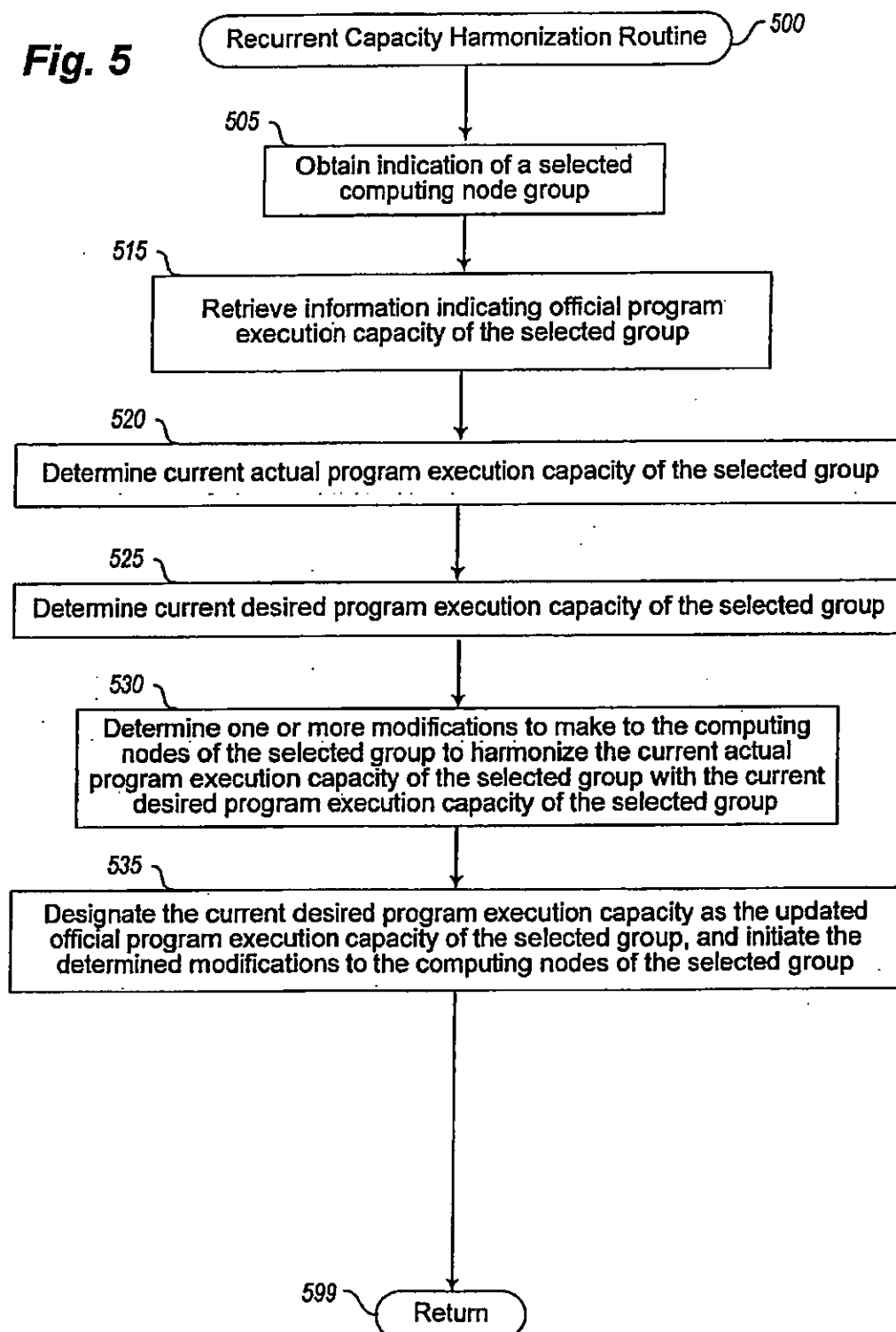


Fig. 3

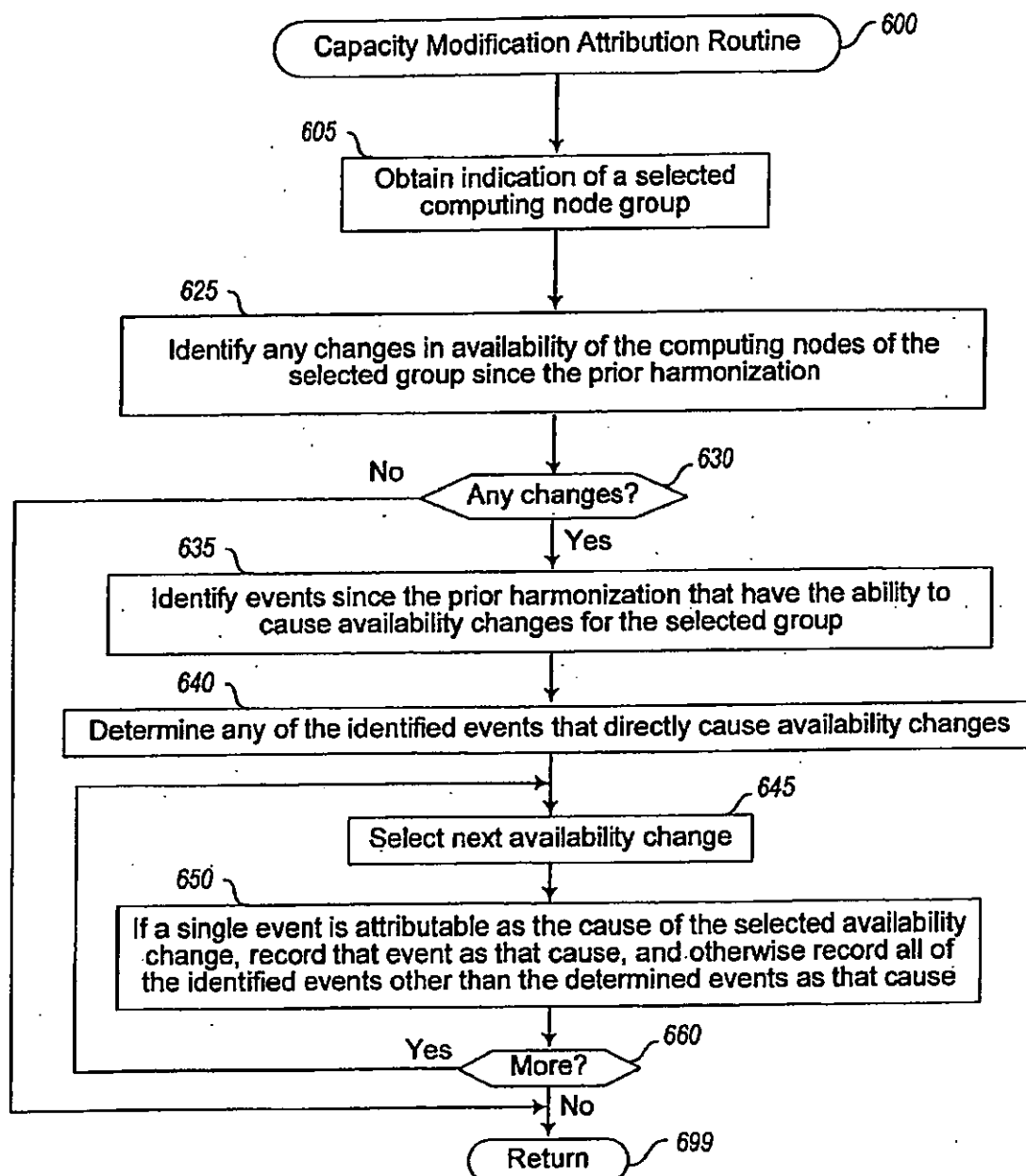
6/9

Fig. 4

7/9

Fig. 5

8/9

Fig. 6

9/9

Fig. 7