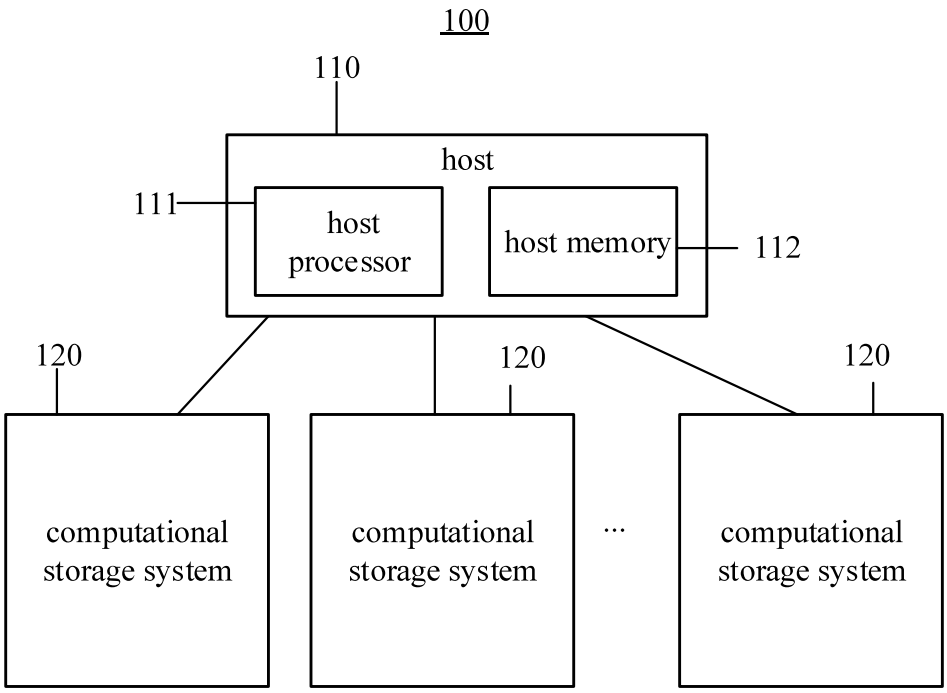

100
110
host
111
host processor
host memory
112
120
120
120
computational storage system
computational storage system
...
computational storage system

Fig.1

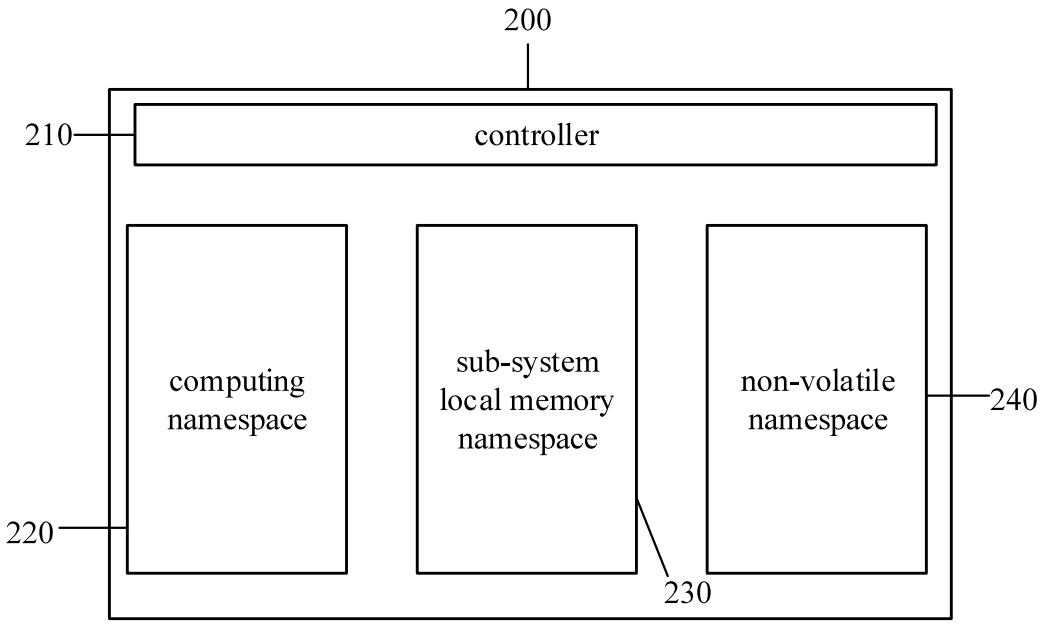

200
210
controller
computing namespace
sub-system local memory namespace
non-volatile namespace
240
220
230

Fig.2

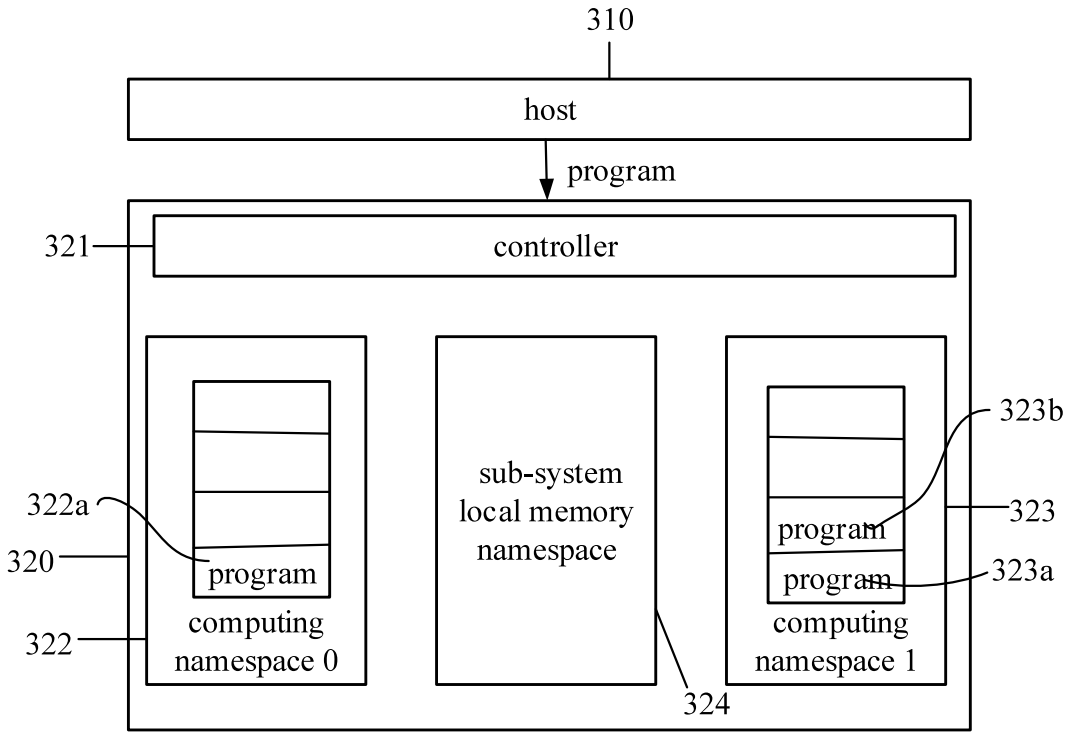

310
host
program
321
controller
322a
320
322
program
computing
namespace 0
sub-system
local memory
namespace
324
323b
323
323a
program
program
computing
namespace 1

Fig.3

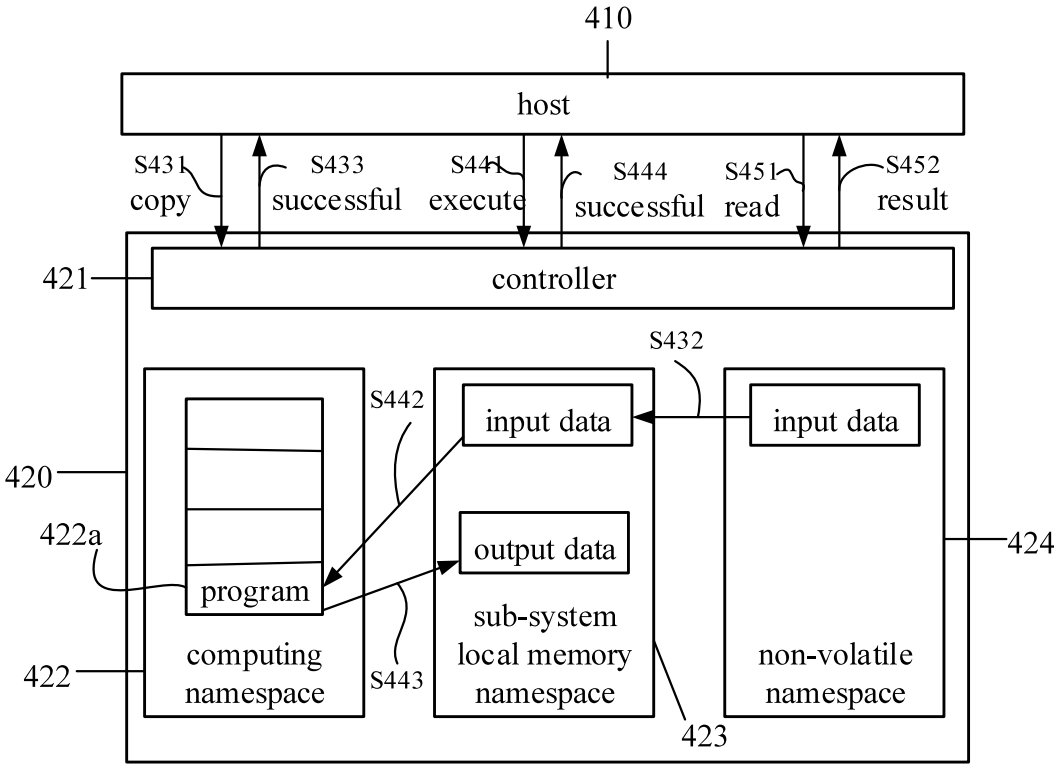

410
host
S431
copy
S433
successful
S441
execute
S444
successful
S451
read
S452
result
421
controller
S432
S442
input data
input data
420
422a
program
output data
424
computing
namespace
S443
sub-system
local memory
namespace
non-volatile
namespace
422
423

Fig.4

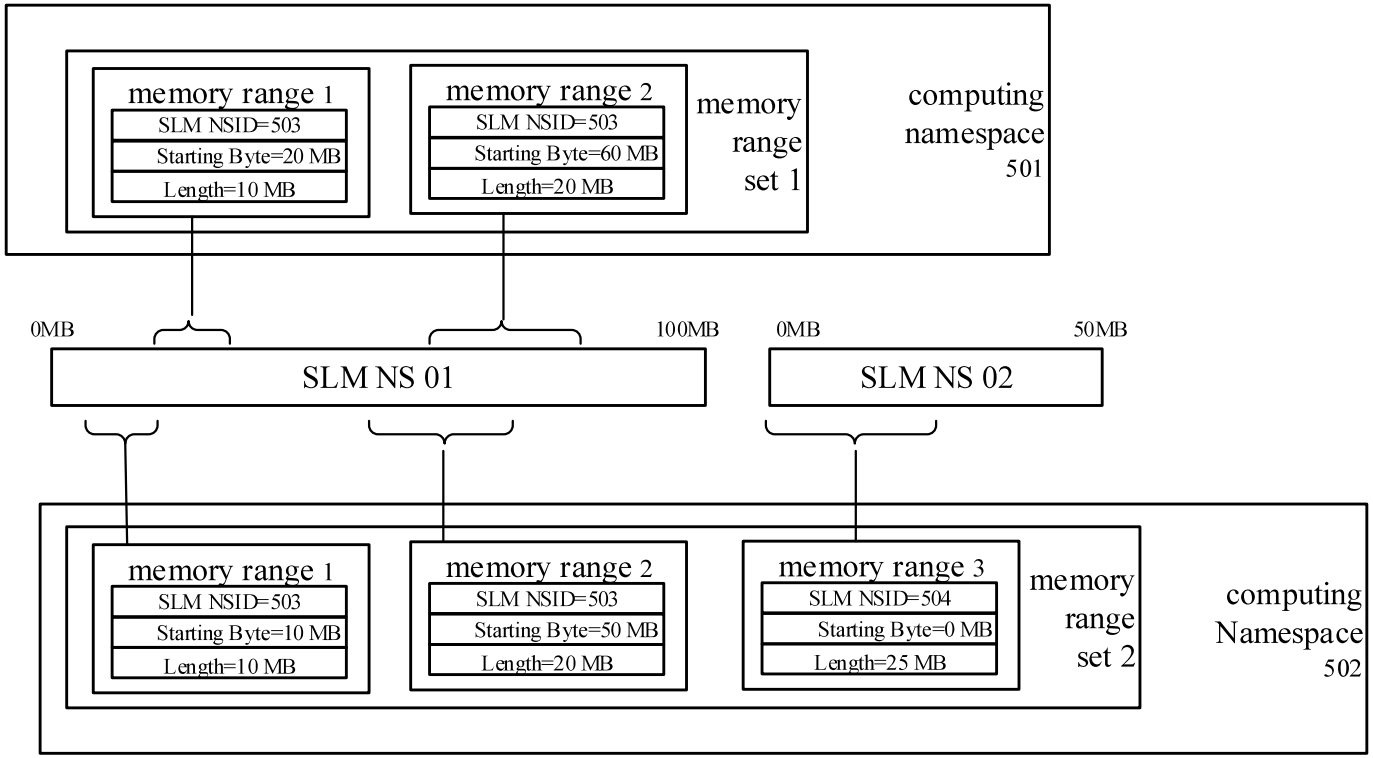

memory range 1
SLM NSID=503
Starting Byte=20 MB
Length=10 MB
memory range 2
SLM NSID=503
Starting Byte=60 MB
Length=20 MB
memory range set 1
computing namespace 501
0MB
100MB
0MB
50MB
SLM NS 01
SLM NS 02
memory range 1
SLM NSID=503
Starting Byte=10 MB
Length=10 MB
memory range 2
SLM NSID=503
Starting Byte=50 MB
Length=20 MB
memory range 3
SLM NSID=504
Starting Byte=0 MB
Length=25 MB
memory range set 2
computing Namespace 502

Fig.5

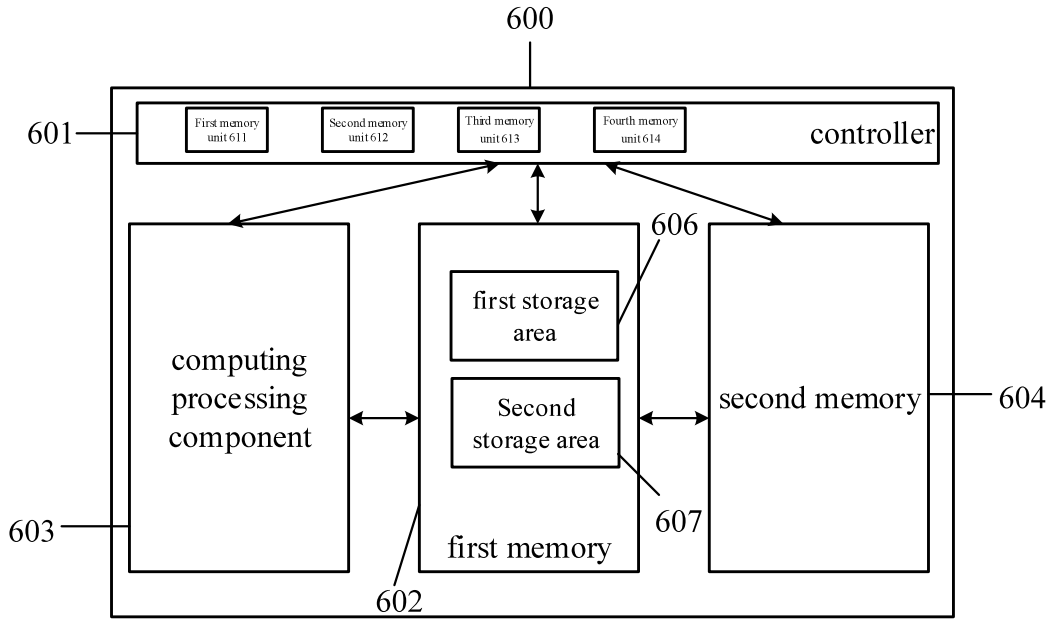

600
601
First memory unit 611
Second memory unit 612
Third memory unit 613
Fourth memory unit 614
controller
606
first storage area
computing processing component
Second storage area
second memory
604
603
607
first memory
602

Fig.6a

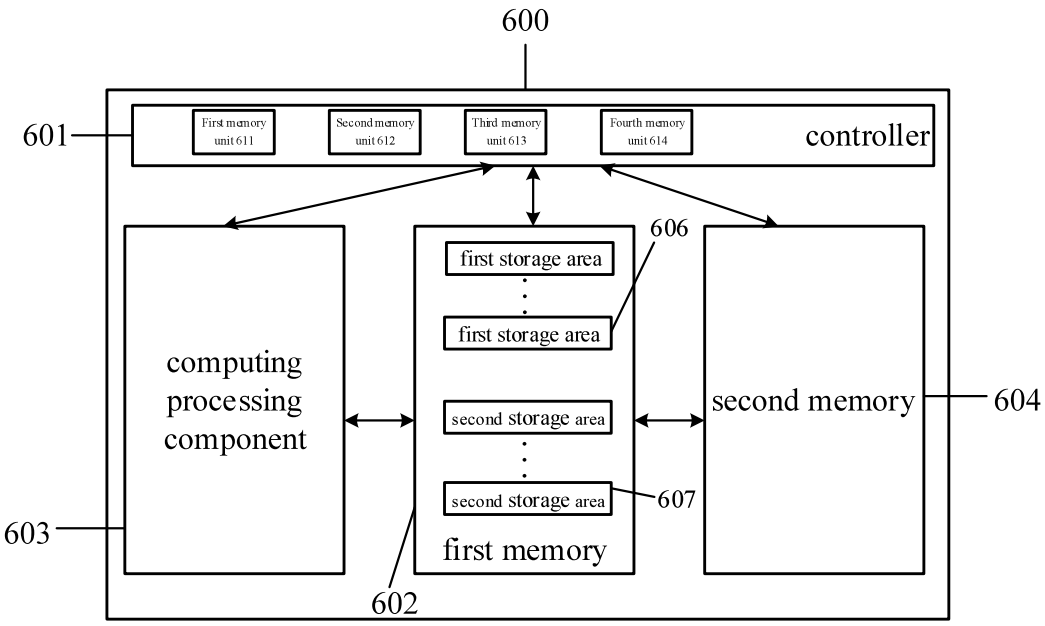

600
601
First memory unit 611
Second memory unit 612
Third memory unit 613
Fourth memory unit 614
controller
606
first storage area
first storage area
computing processing component
second storage area
second storage area
607
second memory
604
603
first memory
602

Fig.6b

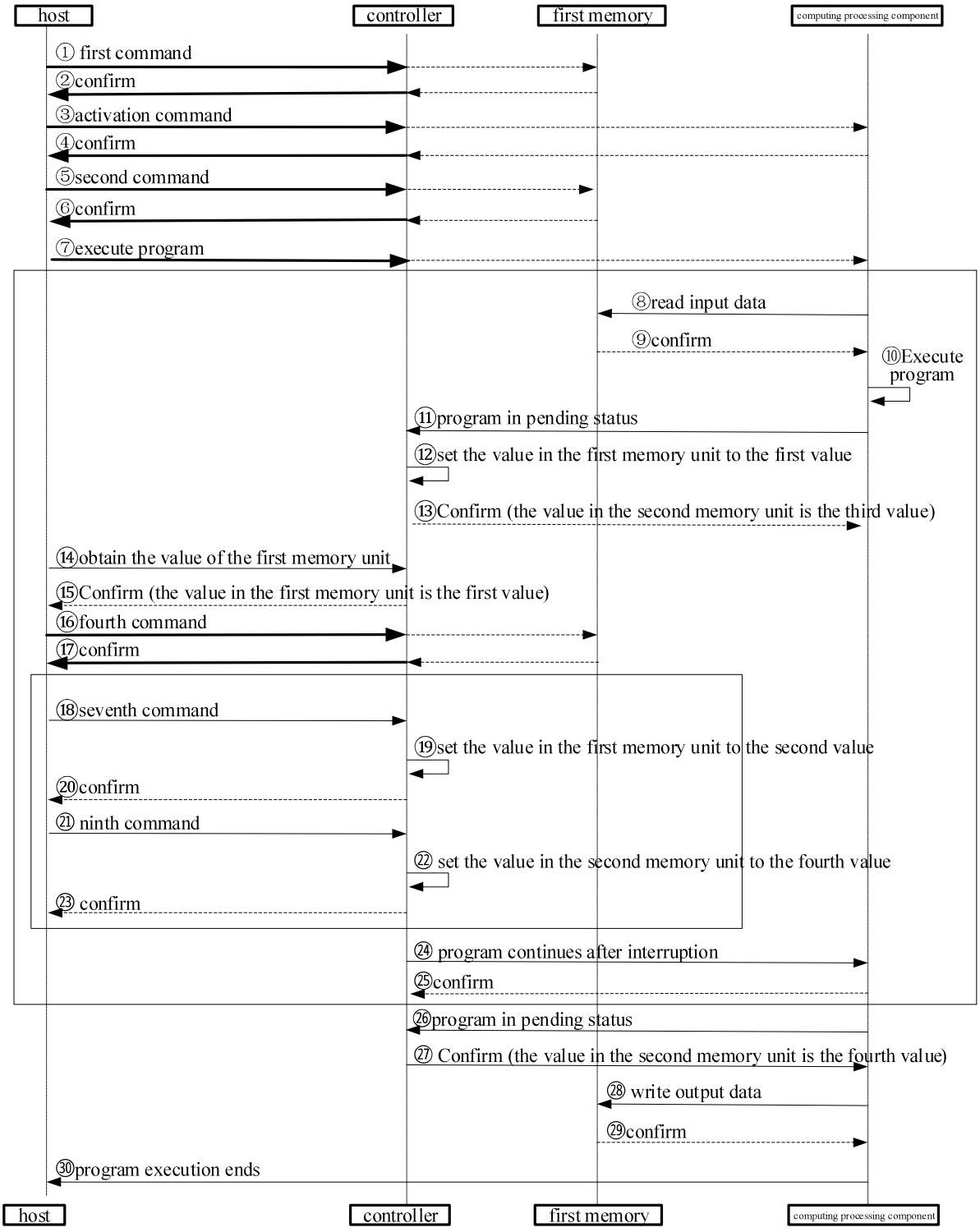

host
controller
first memory
computing processing component
① first command
②confirm
③activation command
④confirm
⑤second command
⑥confirm
⑦execute program
⑧read input data
⑨confirm
⑩Execute program
⑪program in pending status
⑫set the value in the first memory unit to the first value
⑬Confirm (the value in the second memory unit is the third value)
⑭obtain the value of the first memory unit
⑮Confirm (the value in the first memory unit is the first value)
⑯fourth command
⑰confirm
⑱seventh command
⑲set the value in the first memory unit to the second value
⑳confirm
㉑ ninth command
㉒ set the value in the second memory unit to the fourth value
㉓ confirm
㉔ program continues after interruption
㉕confirm
㉖program in pending status
㉗ Confirm (the value in the second memory unit is the fourth value)
㉘ write output data
㉙confirm
㉚program execution ends
host
controller
first memory
computing processing component

Fig.7

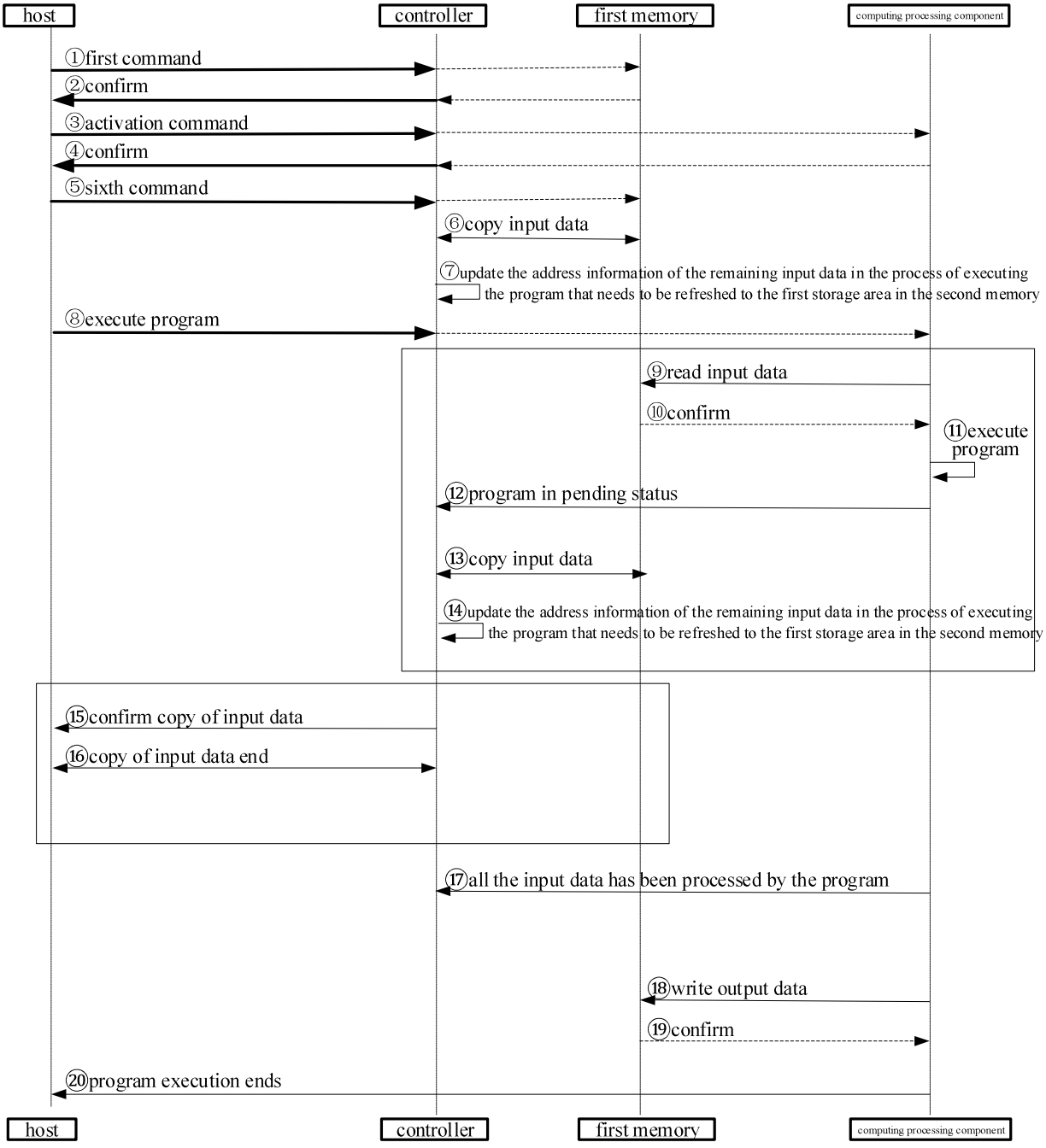

host
controller
first memory
computing processing component
①first command
②confirm
③activation command
④confirm
⑤sixth command
⑥copy input data
⑦update the address information of the remaining input data in the process of executing the program that needs to be refreshed to the first storage area in the second memory
⑧execute program
⑨read input data
⑩confirm
⑪execute program
⑫program in pending status
⑬copy input data
⑭update the address information of the remaining input data in the process of executing the program that needs to be refreshed to the first storage area in the second memory
⑮confirm copy of input data
⑯copy of input data end
⑰all the input data has been processed by the program
⑱write output data
⑲confirm
⑳program execution ends
host
controller
first memory
computing processing component

Fig.8

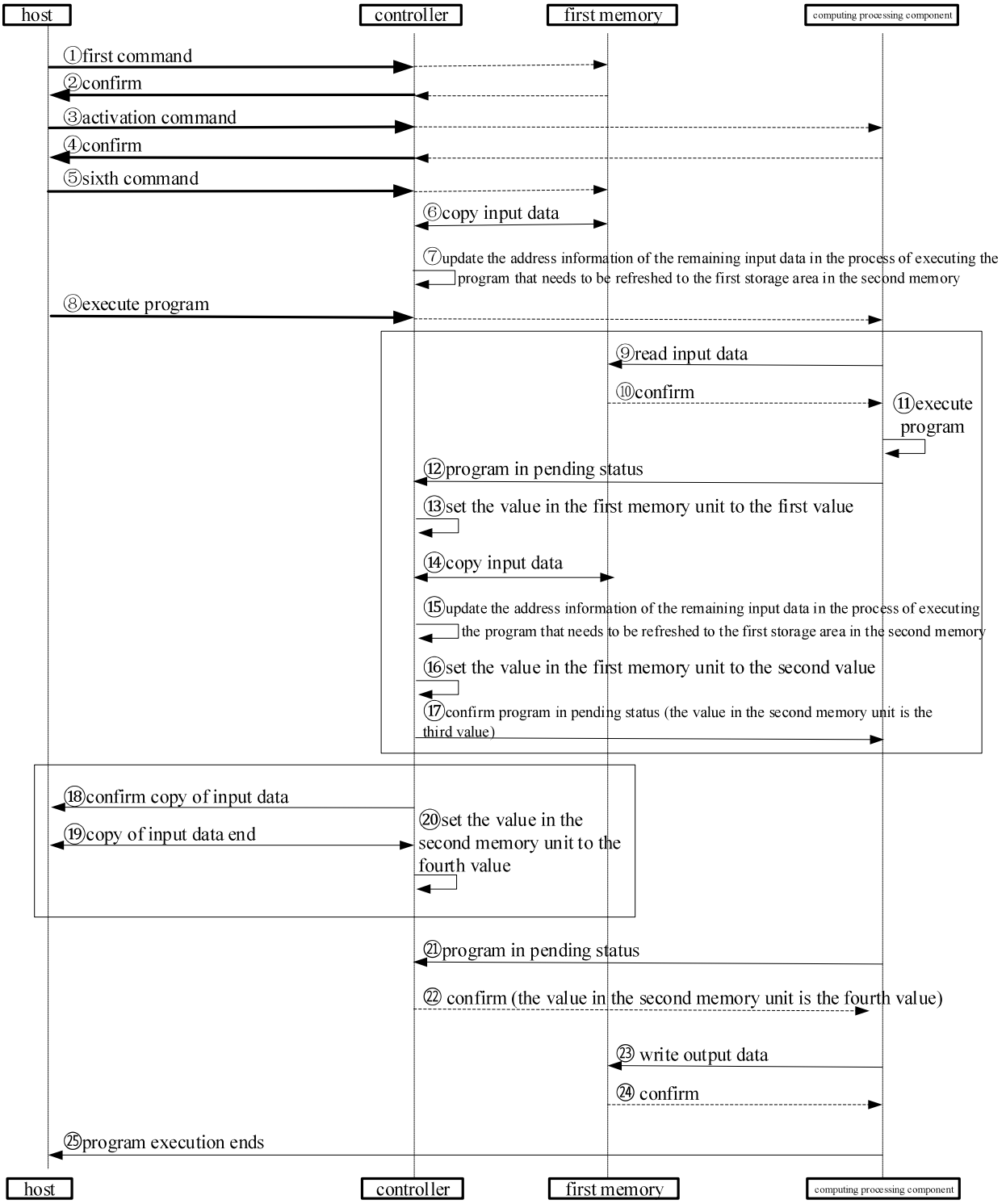

host
controller
first memory
computing processing component
①first command
②confirm
③activation command
④confirm
⑤sixth command
⑥copy input data
⑦update the address information of the remaining input data in the process of executing the program that needs to be refreshed to the first storage area in the second memory
⑧execute program
⑨read input data
⑩confirm
⑪execute program
⑫program in pending status
⑬set the value in the first memory unit to the first value
⑭copy input data
⑮update the address information of the remaining input data in the process of executing the program that needs to be refreshed to the first storage area in the second memory
⑯set the value in the first memory unit to the second value
⑰confirm program in pending status (the value in the second memory unit is the third value)
⑱confirm copy of input data
⑲copy of input data end
⑳set the value in the second memory unit to the fourth value
㉑program in pending status
㉒ confirm (the value in the second memory unit is the fourth value)
㉓ write output data
㉔ confirm
㉕program execution ends
host
controller
first memory
computing processing component

Fig.9

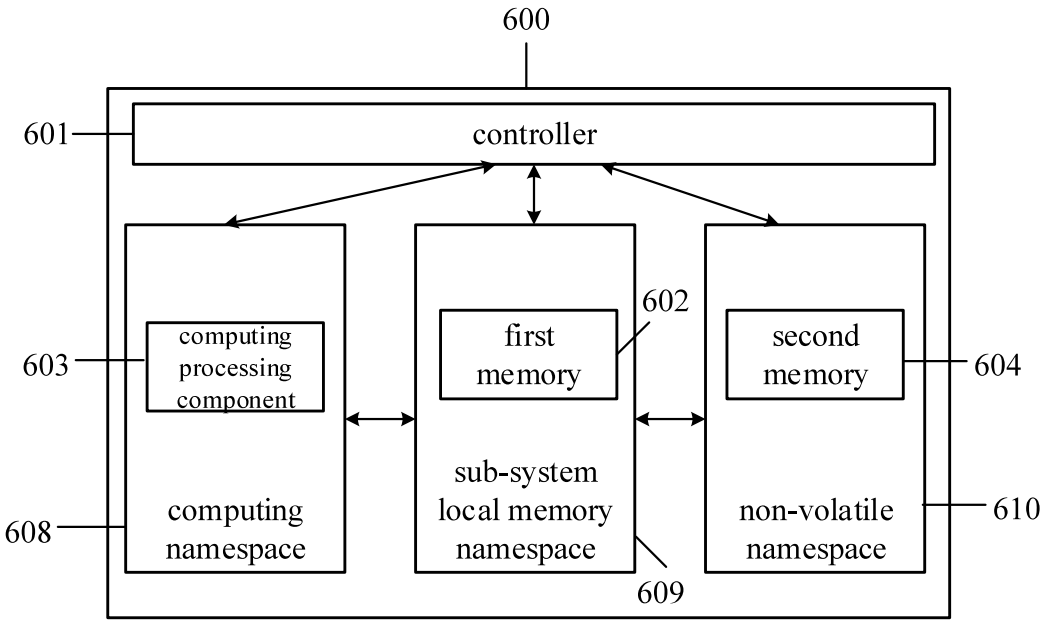

600
601
controller
603
computing processing component
602
first memory
second memory
604
sub-system local memory namespace
608
computing namespace
non-volatile namespace
610
609

Fig.10

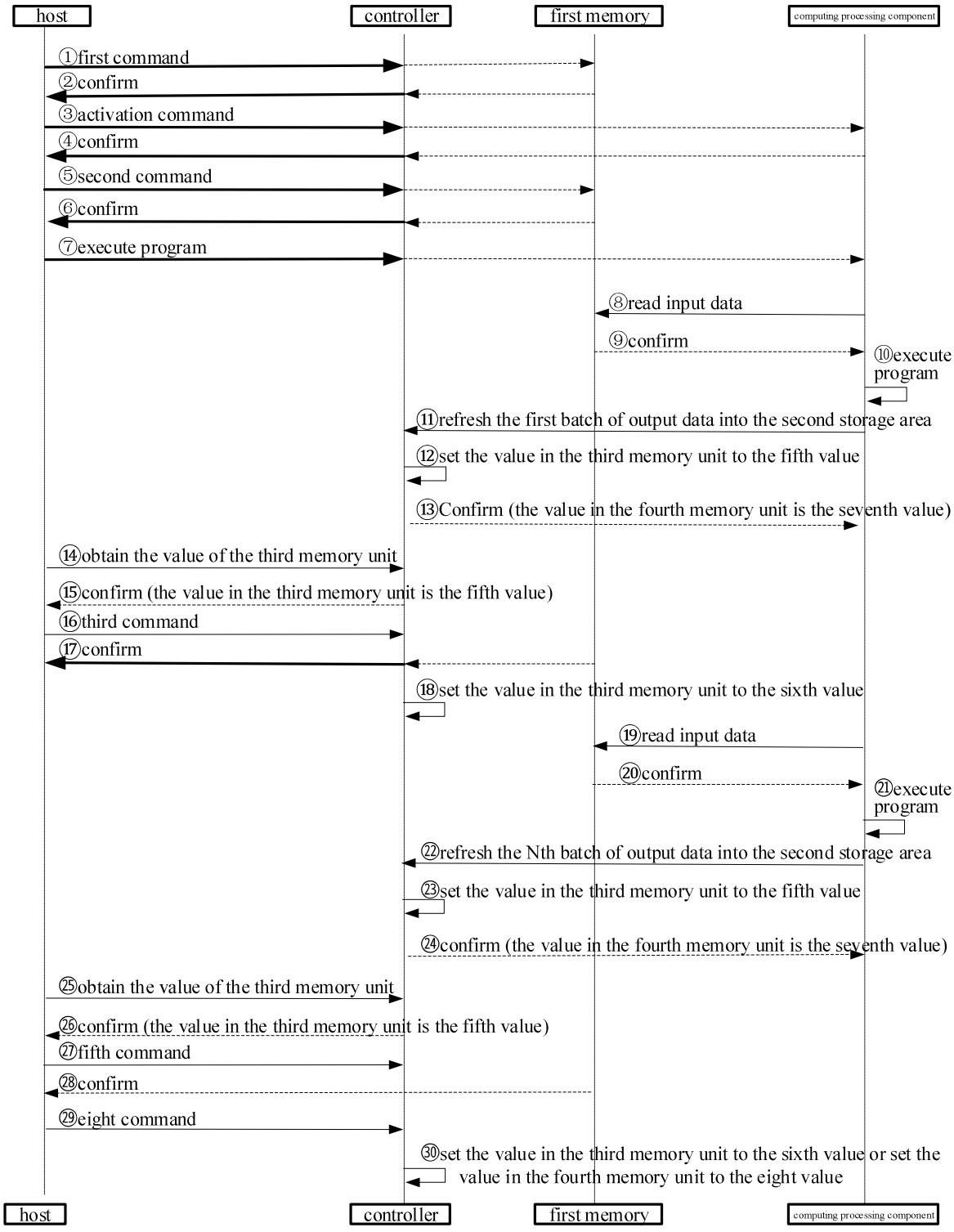

host
controller
first memory
computing processing component
①first command
②confirm
③activation command
④confirm
⑤second command
⑥confirm
⑦execute program
⑧read input data
⑨confirm
⑩execute program
⑪refresh the first batch of output data into the second storage area
⑫set the value in the third memory unit to the fifth value
⑬Confirm (the value in the fourth memory unit is the seventh value)
⑭obtain the value of the third memory unit
⑮confirm (the value in the third memory unit is the fifth value)
⑯third command
⑰confirm
⑱set the value in the third memory unit to the sixth value
⑲read input data
⑳confirm
㉑execute program
㉒refresh the Nth batch of output data into the second storage area
㉓set the value in the third memory unit to the fifth value
㉔confirm (the value in the fourth memory unit is the seventh value)
㉕obtain the value of the third memory unit
㉖confirm (the value in the third memory unit is the fifth value)
㉗fifth command
㉘confirm
㉙eight command
㉚set the value in the third memory unit to the sixth value or set the value in the fourth memory unit to the eight value
host
controller
first memory
computing processing component

Fig. 11

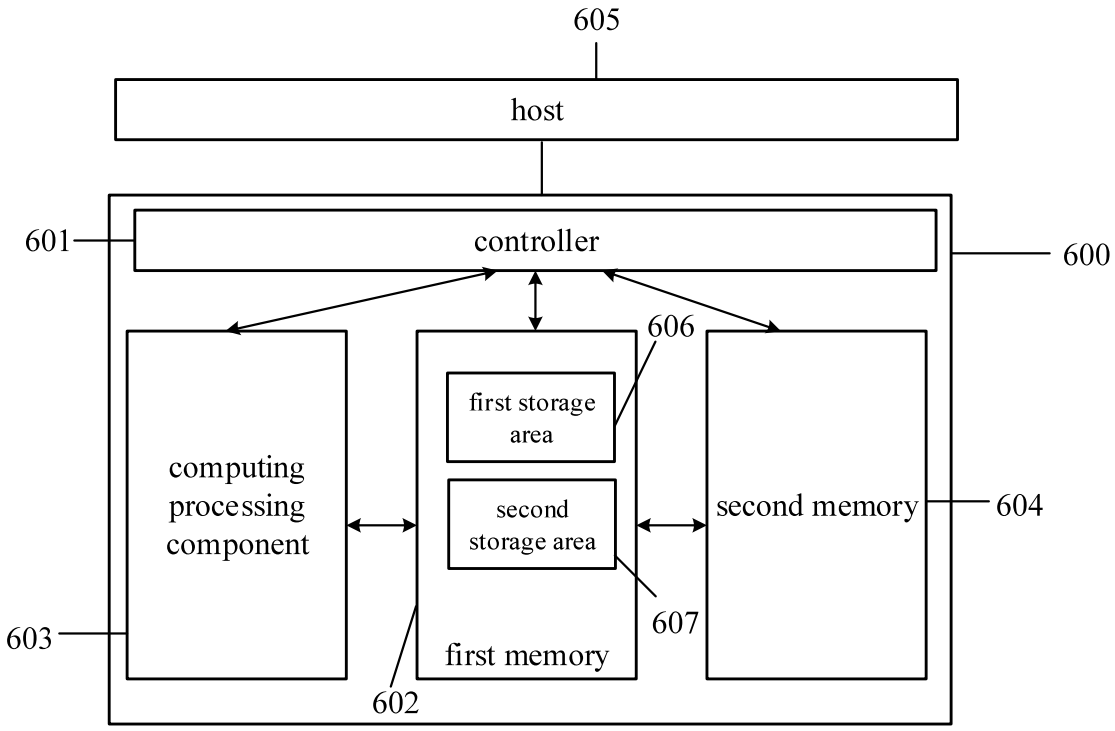

605
host
601
controller
600
606
first storage area
computing processing component
second storage area
second memory
604
607
603
first memory
602

Fig.12

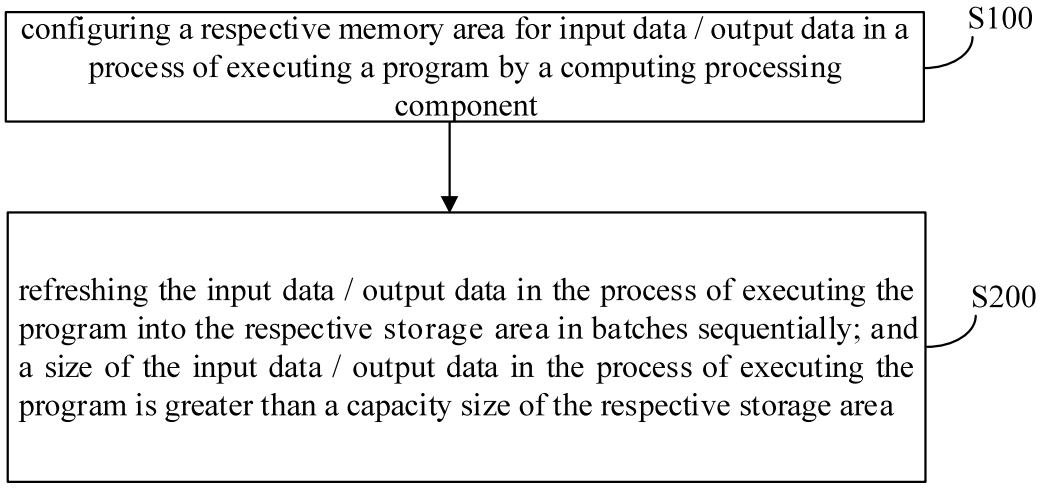

configuring a respective memory area for input data / output data in a process of executing a program by a computing processing component
S100
refreshing the input data / output data in the process of executing the program into the respective storage area in batches sequentially; and a size of the input data / output data in the process of executing the program is greater than a capacity size of the respective storage area
S200

Fig.13