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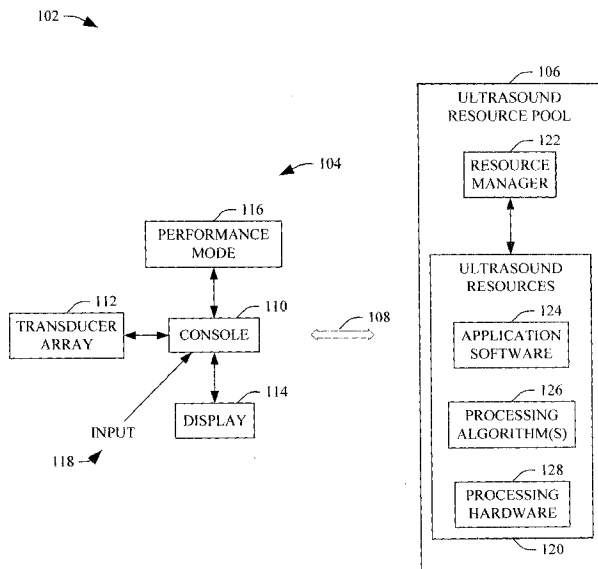


FIGURE 1

(57) Abstract: An ultrasound imaging system (102) includes an ultrasound sub-system (104) with at least a transducer array (112), and an ultrasound resource pool (106). The ultrasound sub-system and the ultrasound resource pool are separate entities. The ultrasound resource pool provides temporary access to ultrasound processing resources of the ultrasound resource pool on an on-demand basis, based on an identified performance mode of the ultrasound sub-system for a scan.

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ON DEMAND ULTRASOUND PERFORMANCE

TECHNICAL FIELD

The following generally relates to ultrasound and more particularly to on demand
5 ultrasound performance, and is described with particular application to ultrasound
imaging; however, the following is also amenable to one or more other ultrasound
apparatuses.

BACKGROUND

10 Ultrasound (US) imaging has provided useful information about the interior
characteristics of an object or subject under examination. An ultrasound imaging scanner
has included a transducer array of one or more transducer elements that produces and
transmits ultrasound signals and receives ultrasound data produced in response to the
ultrasound signals interacting with structure, hardware and/or software that processes the
15 received ultrasound data generating one or more images, and a display that visually
presents the one or more images.

With a hand held ultrasound imaging scanner, the transducer array, the hardware
and/or software, and the display have been housed in a same housing, which can be carried
around by a user in one or both hands and utilized to scan a subject or object. In another
20 configuration, the transducer array is included in a probe that connects, via a cable or the
like and/or wirelessly, to a local computing system such as a console or the like, which
includes the hardware and/or software that processes the ultrasound data and generates the
images. The display may be part of the console or separate from the console and
connected thereto via cable, and is used to display the images.

25 Unfortunately, with such ultrasound imaging scanner configurations, the consumer
has had to decide on performance (e.g., low end, mid-range, high end, premium, etc.) at
the time of purchase of the ultrasound imaging scanner. As a consequence, if the
consumer purchases a lower end ultrasound imaging scanner, the consumer will not have
the option of performing higher end scans with the lower end ultrasound imaging scanner.
30 Alternatively, if the customer purchases a higher end ultrasound imaging scanner, the
consumer will have paid a higher end price, even when the ultrasound imaging scanner is
used for lower end imaging.

SUMMARY

Aspects of the application address the above matters, and others.

In one aspect, an ultrasound imaging system includes an ultrasound sub-system with at least a transducer array, and an ultrasound resource pool. The ultrasound sub-system and the ultrasound resource pool are separate entities. The ultrasound resource pool provides temporary access to ultrasound processing resources of the ultrasound resource pool on an on-demand basis, based on an identified performance mode of the ultrasound sub-system for a scan.

In another aspect, a method receiving, at an ultrasound pool, a signal identifying a performance mode of a plurality of different available performance modes of an ultrasound sub-system for a scan. The ultrasound sub-system and the ultrasound resource pool are separate entities. The method further includes temporarily allocating a sub-set of processing resources of resources of the ultrasound resource pool to the ultrasound sub-system based on the performance mode identified in the received signal for processing of ultrasound data received by the ultrasound sub-system. The method further includes de-allocating the temporarily allocated sub-set of processing resources in response to the ultrasound sub-system no longer utilizing the temporarily allocated sub-set of processing resources. The de-allocated processing resources are no longer available to the ultrasound sub-system

In another aspect, a method includes receiving, by an ultrasound sub-system, data identifying a performance mode of a plurality of different available performance mode of the ultrasound sub-system for a scan. The method further includes conveying a signal indicating the identified performance mode to the ultrasound resource pool, which temporarily allocates processing resources based on the identified performance mode. The method further includes utilizing the temporarily allocated processing resources to process ultrasound data received by the ultrasound sub-system for the scan. The method further includes notifying the ultrasound resource pool that the temporarily allocated processing resources are no longer being utilized. The ultrasound resource pool de-allocates the temporarily allocated processing resources. The de-allocated processing resources are no longer available to the ultrasound sub-system.

Those skilled in the art will recognize still other aspects of the present application upon reading and understanding the attached description.

BRIEF DESCRIPTION OF THE DRAWINGS

The application is illustrated by way of example and not limitation in the figures of the accompanying drawings, in which like references indicate similar elements and in

5 which:

Figure 1 schematically illustrates an example ultrasound imaging system that includes an ultrasound sub-system interfaced with a separate ultrasound resource pool, which temporarily allocates ultrasound processing resources to the ultrasound sub-system on-demand, based on a performance mode of the ultrasound sub-system;

10 Figure 2 schematically illustrates an example in which the ultrasound imaging system includes a plurality of ultrasound sub-systems and the ultrasound resource pool;

Figure 3 schematically illustrates an example of cloud based ultrasound imaging processing resources;

15 Figure 4 schematically illustrates a single ultrasound sub-system operating in higher performance mode in connection with the cloud based ultrasound imaging processing resources;

Figure 5 schematically illustrates a single ultrasound sub-system operating in lower performance mode in connection with the cloud based ultrasound imaging processing resources;

20 Figure 6 illustrates an example method in accordance with the ultrasound resource pool;

Figure 7 illustrates an example method in accordance with the ultrasound sub-system;

25 Figure 8 illustrates an example method in accordance with the ultrasound imaging system; and

Figure 9 illustrates example operation in accordance with the ultrasound imaging system.

DETAILED DESCRIPTION

30 Figure 1 schematically illustrates an example ultrasound (US) system 102.

The ultrasound system 102 includes at least one ultrasound sub-system 104 and at least one ultrasound resource pool 106. The ultrasound sub-system 104 and the ultrasound

resource pool 106 are separate entities in that they are not part of the same physical ultrasound imaging scanner. Generally, the ultrasound sub-system 104 is a physical ultrasound imaging scanner but may not include all the processing resources to process ultrasound data, whereas the pool 106 includes such processing resources.

5 When not being used in connection with scanning, the ultrasound sub-system 104 is not provided with access to and/or allocated processing resources of the ultrasound resource pool 106 for scanning (which includes post-processing of ultrasound data). However, when the ultrasound sub-system 104 is used in connection with scanning, the ultrasound sub-system 104, via a communications path 108, is provided with and/or
10 allocated temporary access to utilize one or more of processing resources of the ultrasound resource pool 106 for the scanning. The one or more of processing resources are de-allocated and/or released back to the ultrasound resource pool 106 when no longer utilized by the ultrasound sub-system 104.

 As described in greater detail below, such access and/or allocation can be provided
15 on an on-demand basis (e.g., before, during, and/or after scanning with the ultrasound sub-system 104) based on a performance mode (of a plurality of performance modes of the ultrasound sub-system 104) being used by the ultrasound sub-system 104 for a scan. As such, the ultrasound sub-system 104 can be used for higher and lower performance scans, with the particular resources (e.g., higher or lower performance) for the scan allocated for
20 the scan and then de-allocated for use by other ultrasound sub-systems and/or the ultrasound sub-system 104 for another scan.

 The illustrated ultrasound sub-system 104 includes a console 110, a transducer array 112, and a display 114. Where the ultrasound sub-system 104 is a hand held scanner, the console 110, the transducer array 112 and the display 114 may be housed in a
25 same housing. Where the ultrasound sub-system 104 is not a hand held scanner, the console 110 and the transducer array 112 may be housed in a separated housings, with the display 114 either part of the console 110 apparatus or separate therefrom and in electrical communication therewith.

 In the later instance, the transducer array 112 may be housed in probe or the like.
30 The probe can include a communication port for connecting a communications cable thereto or a hard-wired communications cable. In either instance, the cable connects to the console 110. Additionally or alternatively, the probe includes a wireless interface for

interfacing with the console 110. The console 110 and the display 114 may be interfaced via a wired and/or wireless communications path. Other ultrasound sub-system configurations are also contemplated herein.

The transducer array 112 includes one or more transducer elements which can be configured as a one dimensional (1D), two dimensional (2D) or other dimensional array of transducer elements. For example, the transducer array 112, in one instance, includes a 1D array of 1 to 552 (e.g., 32, 64, 192, etc.) transducer elements. In another instance, the transducer array 112 includes more transducer elements. The transducer array 112 is configured so that one or more of the transducer elements can be excited in series or parallel to transmit ultrasound signals and/or receive ultrasound data.

The console 110 includes a controller that controls excitation of the transducer elements of the transducer array 112. In one instance, this may include controlling the phasing and/or time of actuation of each of the elements, which allows for steering and/or focusing the transmitted beam from a predetermined origin along the array and at predetermined angles. The controller also can control reception of ultrasound data and can be used to focus the received ultrasound data. For example, the controller may be used to delay and sum ultrasound data from the array elements to form scanlines.

In the illustrated embodiment, the console 110 alternatively operates in one of a plurality of different performance modes 116. Identification of a particular performance mode of the performance modes 116 for operation can be through an input 118 indicative of a user performance mode of interest, an imaging protocol, etc. For example, the input 118 can be generated via a mouse click on a menu option, a button press of a physical button of a physical keyboard/keypad, activation of a touch screen area of a touch screen monitor, voice recognition, and/or otherwise.

Non-limiting examples of performance modes include low end, mid-range, high end, premium, etc., which are discussed below in greater detail. Generally, the performance modes 116 correspond to different levels of hardware and/or software. The particular set of performance modes for a sub-system 104 can be default, user defined, and/or otherwise determined. The console 116 generates a signal indicating the identified performance mode for a scan, and conveys the signal to the ultrasound resource pool 106 and/or other device.

The ultrasound resource pool 106 includes ultrasound resources 120 and a resource manager 122.

5 The ultrasound resources 120 include a collection of application and/or processing resources that can be used in connection with the ultrasound sub-system 104 to form a complete scanner. The illustrated ultrasound resources 120 include at least one of application software 124, processing algorithms 126, or processing hardware 128. In another instance, the ultrasound resources 120 include more or less resources, including similar or different resources.

10 In one instance, the ultrasound resources 120 are part of a same computing device at a same location, which is separate from the ultrasound sub-system 104, as discussed herein. In another instance, the ultrasound resources 120 are distributed in that they reside at different geographical locations, are part of different computing systems, etc. Furthermore, the ultrasound resources 120 may be part of a “cloud” based system or like, such as a park(s) of interconnected servers making up computing clusters.

15 In one non-limiting instance, the ultrasound resources 120 are part of a network of computing resources that are accessed over a network such as the Internet, a wide area network (WAN), a local area network (LAN), and/or other network. Suitable network protocols include transmission control protocol (TCP), internet protocol (IP), Ethernet, and/or other network protocol. In this instance, the communication path 108 can be based on a wired technology (e.g., twisted pair, coaxial cable, fiber optics, etc.) and/or a wireless technology (e.g., radio frequency, cellular, satellite, etc.).

20 The resource manager 122 manages the application software 124, the processing algorithms 126, the processing hardware 128, and/or other resources of the pool 106. The resource manager 122 temporarily (e.g., until the ultrasound sub-system 104 is finished with them) allocates resources for the ultrasound sub-system 104 based on resources for a scan. For example, where the ultrasound sub-system 104 is operated in a higher performance mode, the resource manager 122 allocates resources suitable for higher performance, and where the ultrasound sub-system 104 is operated in a lower performance mode, the resource manager 122 allocates resources suitable for lower performance mode.

30 The resource manager 122, in one instance, identifies the performance mode for the ultrasound sub-system 104 based on the signal generated and conveyed by the console 110, which identifies a performance selected for the scan, the imaging protocol selected

for the scan, and/or other information. Other information may include, but is not limited to, an identification of the sub-system 104, a clinician using the sub-subsystem 104, a facility at which the sub-system 104 is being used, a department within the facility at which the sub-system 104 is being used, and/or other information.

5 It is to be appreciated that by separating the ultrasound system 102 into an ultrasound sub-system 104 (a physical scanner) and an ultrasound resource pool 106 (cloud or other remote computing system), a consumer can purchase a single sub-system 104, without having to decide whether to purchase higher or lower end performance at the time of purchase of the sub-system 104, and then access higher or lower end performance
10 features of the ultrasound resources 120 of the ultrasound resource pool 106 on an on-demand and/or otherwise basis for each scan performed using the ultrasound sub-system 104.

Thus, where the ultrasound sub-system 104 is operated in a lower performance mode, the resource manager 122 only needs to allocate resources that support the lower
15 performance mode, and where the same sub-system 104 is operated in a higher performance mode, the resource manager 122 allocates resources that support the higher performance mode.

When the allocated resources are no longer needed, they can be released. This can be determined via a signal indicating the resources are no longer needed, lapse of a
20 predetermined time duration, lack of use of the resources for a predetermined time duration, and/or otherwise. If the performance mode is changed during an imaging procedure, the allocated resources can be change to include higher or lower performance resources.

In one embodiment, the ultrasound resources 120 are accessed on a pay per use
25 basis. With this embodiment, the resource manager 122, after determining and/or grouping the resources for a scan, can provide an estimated cost to the console 110 and/or other device, which can be accepted, rejected and/or negotiated by the requester of the resources. As actual use and/or time may not be known until after the scan is finished, the cost or final cost can be provided once the resources are released from the ultrasound sub-
30 system 104.

In another embodiment, the ultrasound resource pool 106 is a subscription based system, fee or non-fee. This embodiment is similar to the pay per use, except that the cost

for different levels of performance are determined based on the subscription level. The subscription can be confirmed based on the signal from the console 110 and/or otherwise. Non-authorized users will not be provided with access to the ultrasound resources 120. Multiple levels of subscription may be provided, offering different levels of performance.

5 Figure 2 shows an embodiment in which multiple ultrasound sub-systems $104_1, \dots, 104_N$ share the ultrasound resources 120 of the ultrasound resource pool 106. Corresponding displays 114 and the performance modes 116 are not shown for sake for clarity, but can be included and operate similar to those discussed in connection with Figure 1. The ultrasound sub-system 104_1 is similar to that of ultrasound sub-system 104
10 described in connection with Figure 1, with a probe 112₁ including the transducer array probe 112, and the console 112₁ being similar to the console 112.

 The ultrasound sub-system 104_2 is similar to that of ultrasound sub-system 104 described in connection with Figure 1, except that a probe 112₂ can be alternatively employed with multiple consoles 112_{2A} or 112_{2b}. The consoles 112_{2A} or 112_{2b} may be
15 substantially similar with respect to physical form (e.g., size, capabilities, etc.) but located in different locations. Alternatively, the consoles 112_{2A} or 112_{2b} vary in physical form and be located at a same location or at located in different locations.

 The ultrasound sub-systems 104_N is similar to that of ultrasound sub-system 104 described in connection with Figure 1, except that multiple probes 112_{2A} and 112_{2B} can be
20 alternatively employed with a console 112_N. The probes 112_{2A} and 112_{2B} may be substantially similar with respect to physical form (e.g., size, capabilities, etc.) but located in different locations. Alternatively, the probes 112_{2A} and 112_{2B} vary in physical form and be located at a same location or at located in different locations.

 In one instance, the ultrasound sub-systems $104_1, \dots, 104_N$ individually and
25 sequentially access the ultrasound resources of the ultrasound resource pool 106. In another example, two or more of the ultrasound sub-systems $104_1, \dots, 104_N$ concurrently access the ultrasound resources of the ultrasound resource pool 106. With concurrent accesses, two or more of the ultrasound sub-systems $104_1, \dots, 104_N$ may compete for a same resource of the ultrasound resource 120.

30 In this embodiment, the ultrasound resource pool 106 further includes a conflict manager 202. The conflict manager 202 manages resource conflicts. For example, two or more of the ultrasound sub-systems $104_1, 104_2, \dots, 104_N$, may be used concurrently for

two high performance scans. In this instance, the two or more of the ultrasound sub-systems 104₁, 104₂, ..., 104_N, may compete for the same resources which may not be available for both of the two or more of the ultrasound sub-systems 104₁, 104₂, ..., 104_N. The conflict manager 202 manages such conflicts.

5 For example, in one instance, there may be enough resources in the ultrasound resources 120 to support two of the ultrasound sub-systems 104₁, 104₂, ..., 104_N concurrently in higher performance mode, but not three or more concurrently in higher performance mode. In instance, the conflict manager 202 decides which two are provided with access to the high performance resources. For example, the resources may be
10 allocated in order of the request for the resources, based on a priority level (e.g., of the procedure, the department, the clinician, etc.), and/or otherwise.

The ultrasound sub-system 104 not provided with access to the higher performance resources can be notified that high performances resources are not currently available, offered a lower level of performance resources (e.g., mid-range, low end, etc.), offered to
15 be placed in a waiting queue for the high performance resources, provided with an estimate of how long it will be before the high performance resources would become available, etc. The ultrasound sub-system 104 not provided with access may accept the lower level, send a subsequent request for higher performances resources, and/or otherwise respond, including not responding.

20 It is to be appreciated that the illustrated ultrasound sub-systems 104₁, 104₂, ..., 104_N are not limiting. For example, another suitable ultrasound sub-system 104 may be a combination of 104₂ and 104_N with multiple probes and multiple consoles. Furthermore, the communications paths 108_{2A} and 108_{2B} may be the same or different paths, including sub-paths or channels of a same path or different paths. Furthermore, one or more of the
25 ultrasound sub-systems 104₁, 104₂, ..., 104_N may be in communication with one or more other ultrasound resource pools 106.

Figures 3, 4 and 5 show example use case scenarios in which a single ultrasound sub-system 104 is operated in premium performance mode (Figure 4) and low end performance mode (Figure 5) utilizing available resources (Figure 3) from a cloud or
30 computer cluster based ultrasound resource pool 106 (Figures 3, 4 and 5).

Beginning with Figure 3, the ultrasound resources 120 include the following resources: channel support 302: 32, 64, 128 and 192 channels; beamforming 304:

sum/delay, zone synthetic aperture, and flash synthetic aperture; compounding 306: none, 3 angle, 5 angle, and synthetic aperture; filtering 308: none, simple, motion compensation, 4D; flow imaging 310: none, color flow mapping, 2D vector flow, 3D volume flow; additional features 312: biopsy guidance, needle tracking, real-time MRI fusion; and user
5 interfaces 314: I/F 1, I/F 2 and I/F 3, which represent different devices (e.g., desktop, tablet, etc.) and/or how data is presented. It is to be understood that the foregoing examples are provided for explanatory purposes and are not limiting.

Turning to Figure 4, a single ultrasound sub-system 104_J is being operated in “premium” performance mode.

10 The ultrasound sub-system 104_J conveys the signal indicating this mode to the resource manager 122 (Figures 1 and 2) of ultrasound resource pool 106 (Figures 1 and 2). The resources manager 122 provides the following resources of the resources 120 to the single ultrasound sub-system 104_J: 192 channels, flash synthetic aperture beamforming, synthetic aperture compounding, 4D filtering, 3D volume flow imaging, real-time, and I/F
15 3. Likewise, it is to be understood that the foregoing examples are provided for explanatory purposes and are not limiting.

Although the highest performance in each category is allocated to the single ultrasound sub-system 104_J, where high performance in all categories is not requested and/or needed, the resources in those categories are allocated accordingly, e.g., none
20 where none are requested and/or needed and lower performance where only lower performance is requested and/or needed.

Moving to Figure 5, a single ultrasound sub-system 104_J is being operated in “lower end” performance mode.

Again, the ultrasound sub-system 104_J conveys the signal indicating this mode to
25 the resource manager 122 (Figures 1 and 2) of ultrasound resource pool 106 (Figures 1 and 2). The resources manager 122 provides the following resources to the single ultrasound sub-system 104_J: 32 channels, sum/delay beamforming, simple filtering, and I/F 1. Similarly, it is to be understood that the foregoing examples are provided for explanatory purposes and are not limiting.

30 Likewise, although the lowest performance in a sub-set of the categories is allocated to the single ultrasound sub-system 104_J, where higher performance is request in at least one of the categories, the resources in that category are allocated accordingly. In

addition, low end performance from all the categories can alternatively be provided, where requested and/or needed.

With respect to Figures 4 and 5, in one instance, the allocated resources can be dynamically changed. For example, where a procedure starts off using lower performance mode and then switches to a higher performance mode, the resources allocated to the
5 ultrasound sub-system 104 change accordingly, based on availability, and are allocated as described herein and/or otherwise.

Figures 6, 7, and 8 illustrate example methods in accordance with the description herein.

10 It is to be appreciated, for any or all of the methods, that the order of the acts is provided for explanatory purposes and is not limiting. As such, one or more of the acts may occur in a different order. Furthermore, one or more of the acts may be omitted and/or one or more additional acts may be added.

Initially referring to Figure 6, an example method is described.

15 At 602, a signal identifying a performance mode of a plurality of different available performance modes of an ultrasound sub-system 104 for a scan is received by the ultrasound resource pool 106. The signal can be conveyed by the ultrasound sub-system 104 to the ultrasound resource pool 106 as described herein and/or otherwise.

20 At 604, the resource manager 122 of the ultrasound resource pool 106 temporarily allocates resources of the resources 120 of the ultrasound resource pool 106 to the ultrasound sub-system 104 based on the performance mode identified in the received signal.

At 606, the temporarily allocated resources are utilized by the ultrasound sub-system 104 performing a scan.

25 At 608, the resource manager 122 de-allocates or releases the temporarily allocated resources of the resources 120 back to the resources 120 in response to the ultrasound sub-system 104 no longer utilizing the resources. This can be determined through a notification signal, lack of using the processing resources, and/or otherwise.

Turning to Figure 7, another example method is described.

30 At 702, data identifying a performance mode of a plurality of different available performance mode of an ultrasound sub-system 104 for a scan is received by ultrasound

sub-system 104. The data can be generated by a user action (e.g., selection of a protocol, identification of the performance, etc.) as described herein and/or otherwise.

At 704, the ultrasound sub-system 104 conveys a signal indicating the performance mode to the ultrasound resource pool 106.

5 At 706, the ultrasound sub-system 104 utilizes resources of the ultrasound resource pool 106, which are temporarily allocated by the ultrasound resource pool 106 based on the performance mode identified in the signal.

10 At 708, the ultrasound sub-system 104 indicates that it no longer desires the allocated resources, which are then de-allocated or released backs to the ultrasound resource pool 106. This can be through a notification signal, no longer using the processing resources, and/or otherwise.

Next, another example method is described in connection with Figure 8.

15 At 802, the resource manager 122 of a cloud based on-demand ultrasound resource pool 106 receives requests from multiple ultrasound sub-systems 104 for a same set of resources, which cannot be concurrently shared by all of the multiple ultrasound sub-systems 104.

20 At 804, the conflict manager 202 determines a sub-set of the multiple ultrasound sub-systems 104, which is provided with access to the set of resources, where the sub-set of the multiple ultrasound sub-systems 104 can be concurrently shared by the sub-set of the multiple ultrasound sub-systems 104 and the other multiple ultrasound sub-systems 104 are not provided with access to the set of resources.

At 806, optionally, the conflict manager 202 offers an alternative to the set of resources for the multiple ultrasound sub-systems 104 which are not provided with access to the set of resources.

25 Example operation is illustrated in connection with Figure 9.

At 902, a user employing an ultrasound sub-system 104 selects a performance mode. This can be achieved by directly selecting the mode or indirectly, for example, by selecting an imaging protocol that identifies a performance mode for the protocol.

30 At 904, the ultrasound sub-system 104 generates a signal identifying the mode and conveys the signal to the ultrasound resource pool 106.

At 906, the resource manager 122 of the ultrasound resource pool 106 temporarily allocates resources of the resources 120 of the ultrasound resource pool 106 to the

ultrasound sub-system 104 based on the performance mode identified in the received signal.

At 908, the ultrasound sub-system 104 utilizes the temporarily allocated resources of the ultrasound resource pool 106 for a scan.

5 At 910, the temporarily allocated resources of the resources are de-allocated in response to the ultrasound sub-system 104 no longer requesting the resources.

The above may be implemented in connection with computer readable instructions, encoded or embedded on computer readable storage medium, which, when executed by a computer processor(s), cause the processor(s) to carry out one or more of the described
10 acts. Additionally or alternatively, at least one of the computer readable instructions is carried by a signal, carrier wave or other transitory medium.

The application has been described with reference to various embodiments. Modifications and alterations will occur to others upon reading the application. It is intended that the invention be construed as including all such modifications and
15 alterations, including insofar as they come within the scope of the appended claims and the equivalents thereof.

CLAIMS

What is claimed is:

1. An ultrasound imaging system (102), comprising:
5 an ultrasound sub-system (104), including at least a transducer array (112); and
an ultrasound resource pool (106), wherein the ultrasound sub-system and the
ultrasound resource pool are separate entities, and
wherein the ultrasound resource pool provides temporary access to ultrasound
processing resources of the ultrasound resource pool on an on-demand basis based on an
10 identified performance mode of the ultrasound sub-system for a scan.
2. The system of claim 1, wherein the performance mode is one of a low end, mid-
range, high end, premium performance mode, default mode, or user defined mode.
- 15 3. The system of claim 2, wherein the performance mode is identified based on an
imaging protocol of the ultrasound sub-system for the scan.
4. The system of claim 2, wherein the performance mode is identified based on a
mode signal identifying a performance mode of interest of a user of the ultrasound sub-
20 system.
5. The system of any of claims 2 to 4, wherein a different set of processing resources
corresponds to each of the performance modes.
- 25 6. The system of any of claims 1 to 5, wherein the ultrasound resource pool
temporarily allocates the ultrasound processing resources to the ultrasound sub-system.
7. The system of claim 6, wherein the ultrasound sub-system does not include the
temporarily allocated ultrasound processing resources.

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8. The system of any of claims 6 to 7, wherein the ultrasound resource pool de-allocates the ultrasound processing resources in response to the ultrasound sub-system no longer employing ultrasound processing resources.
- 5 9. The system of claim 8, wherein the ultrasound sub-system does not have access to the de-allocated ultrasound processing resources.
10. The system of any of claims 1 to 9, wherein the ultrasound processing resources are part of a cloud based resource pool.
- 10 11. The system of any of claims 1 to 9, wherein the ultrasound processing resources are part of one or more parks of interconnected computing systems.
12. The system of any of claims 1 to 11, the ultrasound resource pool, comprising:
15 a conflict manager (202) that manages a resource conflict between the ultrasound sub-system and at least one other ultrasound sub-system competing for a same set of processing resources.
13. The system of claim 12, where the conflict manager allocates the set of resources
20 to one of the ultrasound sub-system and the at least one other ultrasound sub-system and not the other.
14. The system of claim 13, where the conflict manager allocates the set of resources based on one of an order of request or a predetermined priority level of the scan.
- 25 15. A method, comprising:
receiving, at an ultrasound pool, a signal identifying a performance mode of a plurality of different available performance modes of an ultrasound sub-system for a scan, wherein the ultrasound sub-system and the ultrasound resource pool are separate entities;
30 temporarily allocating a sub-set of processing resources of resources of the ultrasound resource pool to the ultrasound sub-system based on the performance mode

identified in the received signal for processing of ultrasound data received by the ultrasound sub-system; and

de-allocating the temporarily allocated sub-set of processing resources in response to the ultrasound sub-system no longer utilizing the temporarily allocated sub-set of processing resources, wherein the de-allocated processing resources are no longer available to the ultrasound sub-system.

16. The method of claim 15, wherein the performance mode is one of a low end, mid-range, high end, premium performance mode, default mode, or user defined mode, and a different set of processing resources corresponds to each of the performance modes.

17. The method of any of claims 15 to 16, wherein the ultrasound sub-system does not include the temporarily allocated ultrasound processing resources.

18. The method of any of claims 15 to 17, wherein the ultrasound processing resources are part of a cloud based resource pool.

19. The method of any of claims 15 to 17, wherein the ultrasound processing resources are part of one or more parks of interconnected computing systems.

20. A method, comprising:
receiving, by an ultrasound sub-system, data identifying a performance mode of a plurality of different available performance mode of the ultrasound sub-system for a scan;
conveying a signal indicating the identified performance mode to the ultrasound resource pool, which temporarily allocates processing resources based on the identified performance mode, wherein the ultrasound sub-system and the ultrasound resource pool are separate entities;

utilizing the temporarily allocated processing resources to process ultrasound data received by the ultrasound sub-system for the scan; and

notifying the ultrasound resource pool that the temporarily allocated processing resources are no longer being utilized, wherein the ultrasound resource pool de-allocates

the temporarily allocated processing resources, and the de-allocated processing resources are no longer available to the ultrasound sub-system.

21. The method of claim 20, wherein the performance mode is one of a low end, mid-
5 range, high end, premium performance mode, default mode, or user defined mode, and a different set of processing resources corresponds to each of the performance modes.

22. The method of any of claims 20 to 21, wherein the ultrasound sub-system does not include the temporarily allocated ultrasound processing resources.

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23. The method of any of claims 20 to 22, wherein the ultrasound processing resources are part of a cloud based resource pool.

24. The method of any of claims 20 to 22, wherein the ultrasound processing resources
15 are part of one or more parks of interconnected computing systems.

25. The method of any of claims 20 to 24, wherein the data is generated by a user action identifying the performance mode.

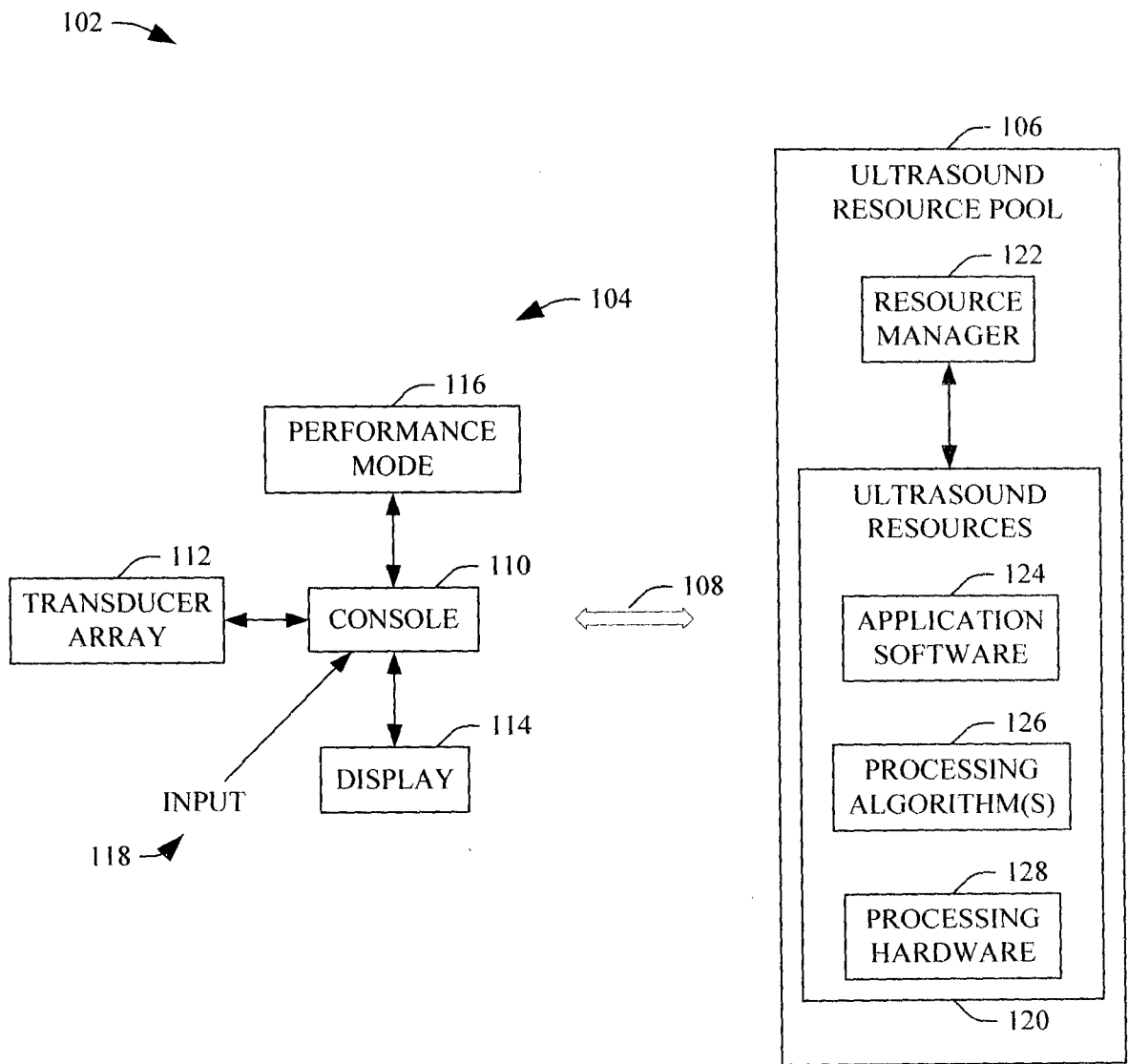


FIGURE 1

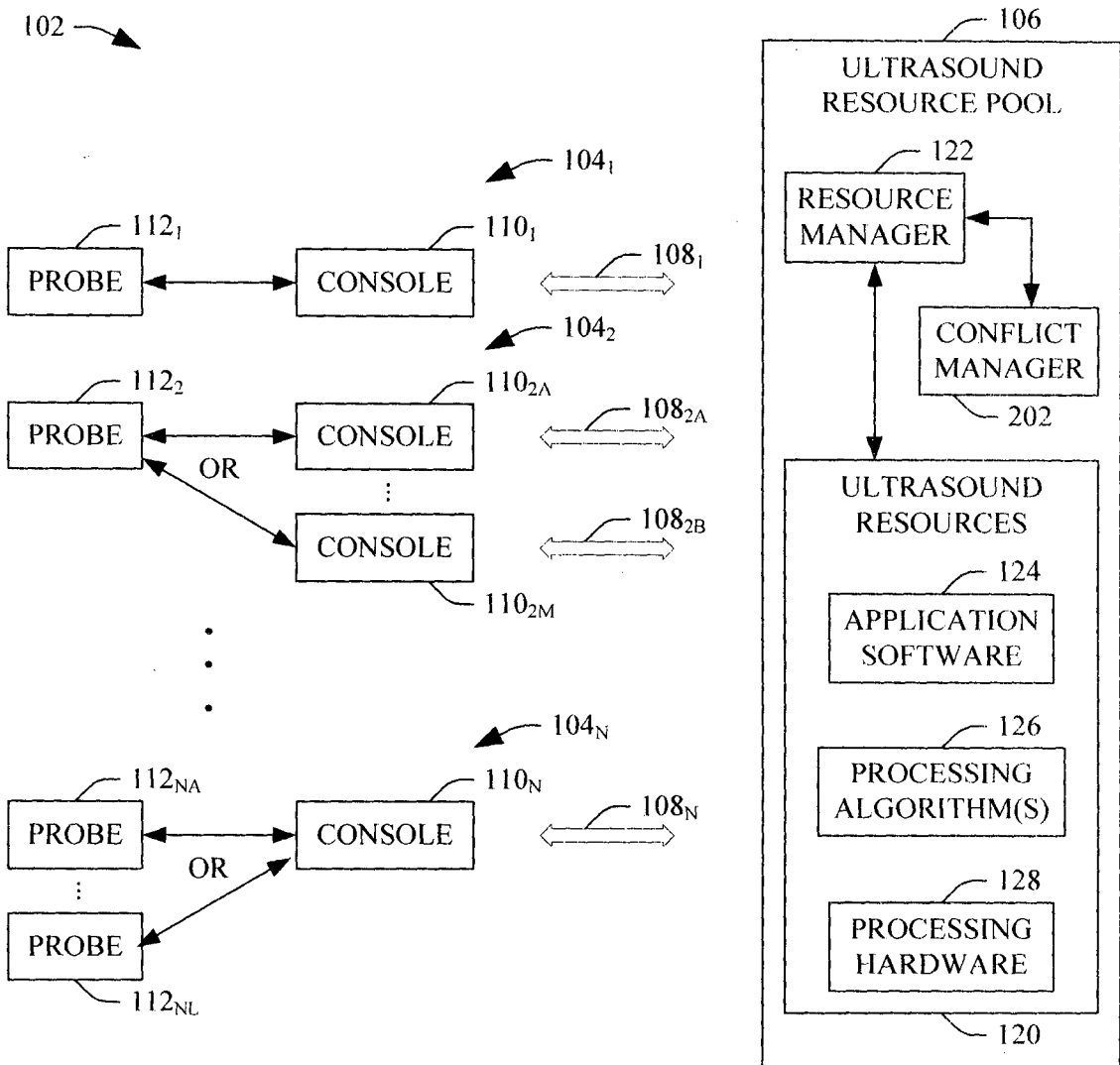


FIGURE 2

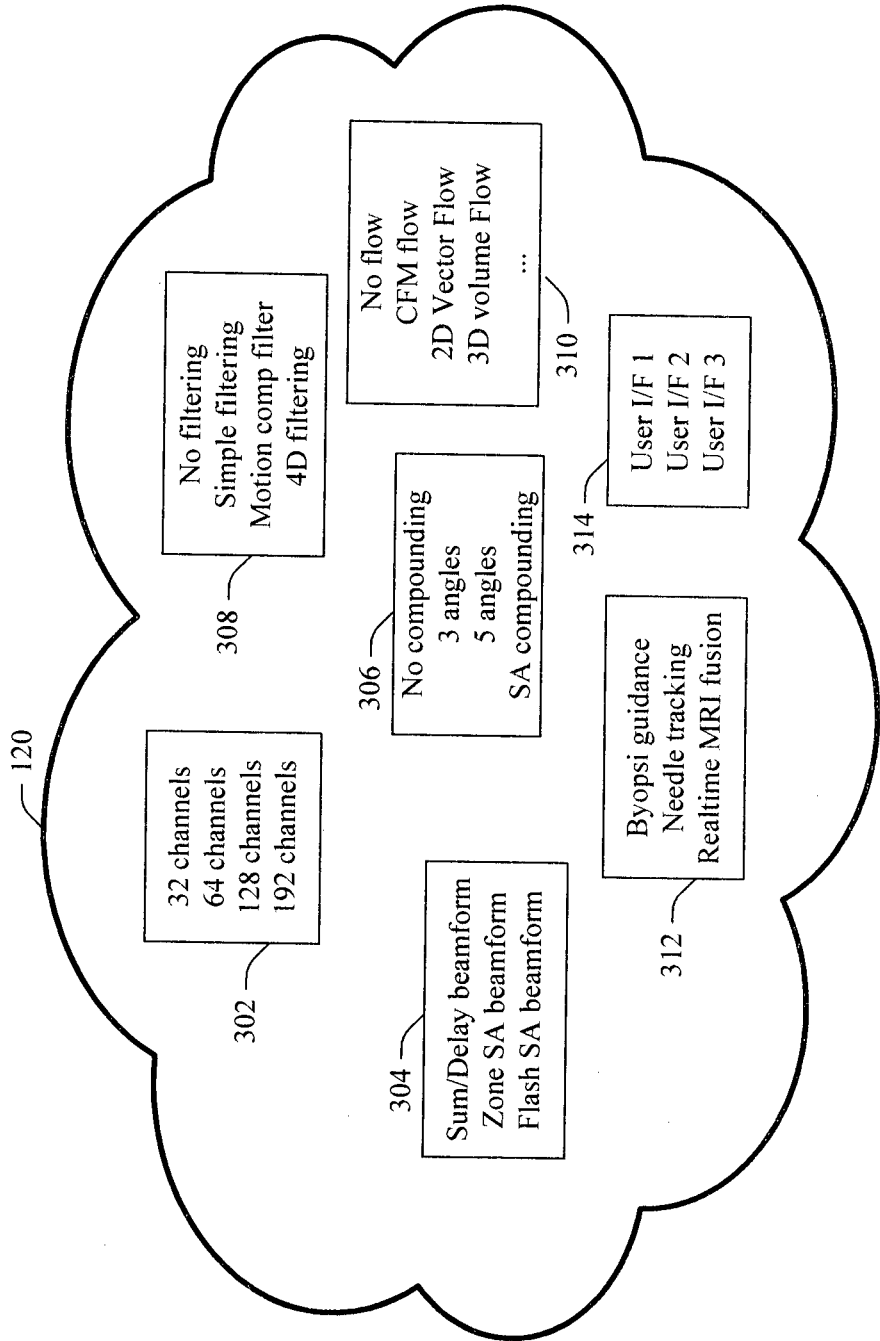


FIGURE 3

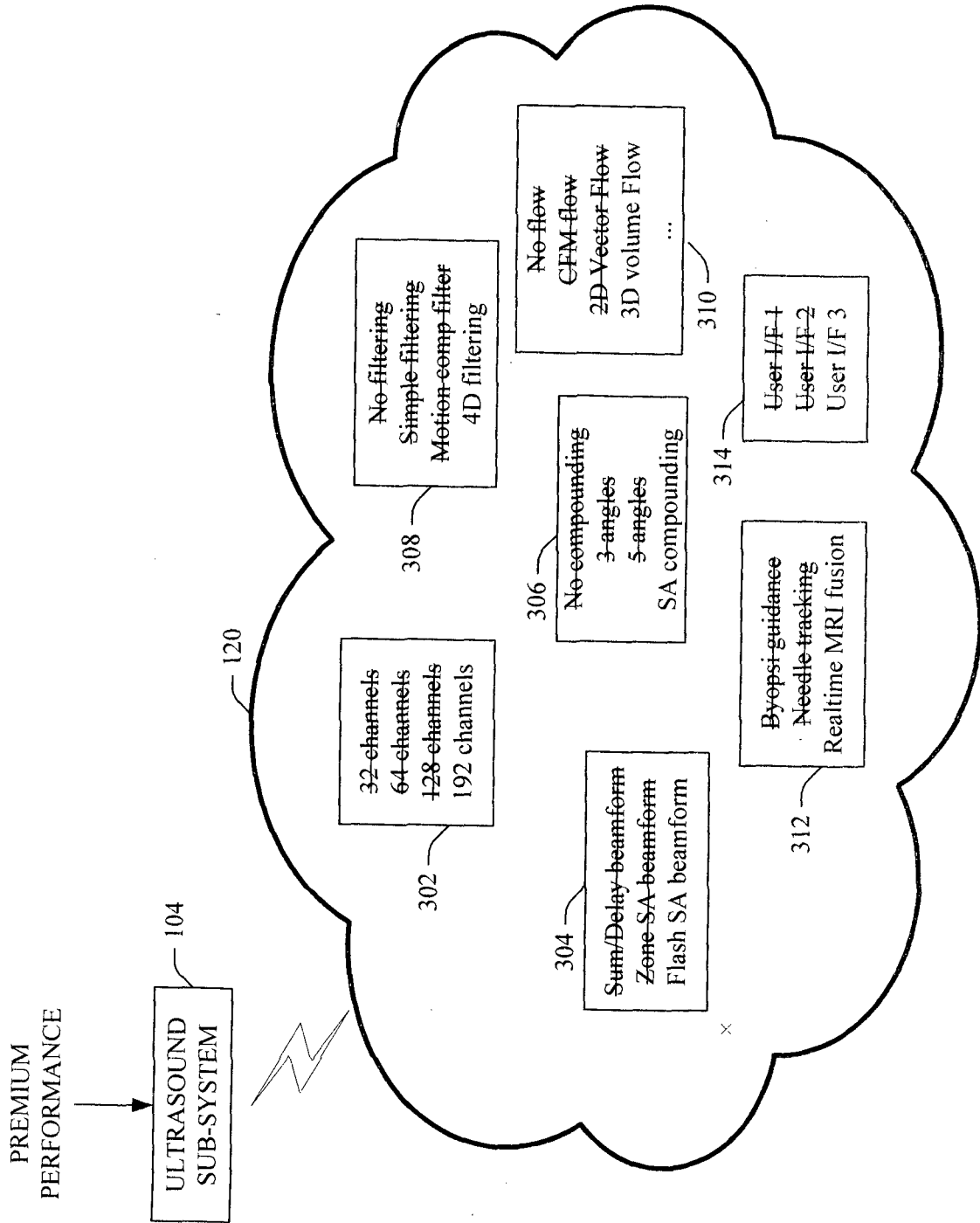


FIGURE 4

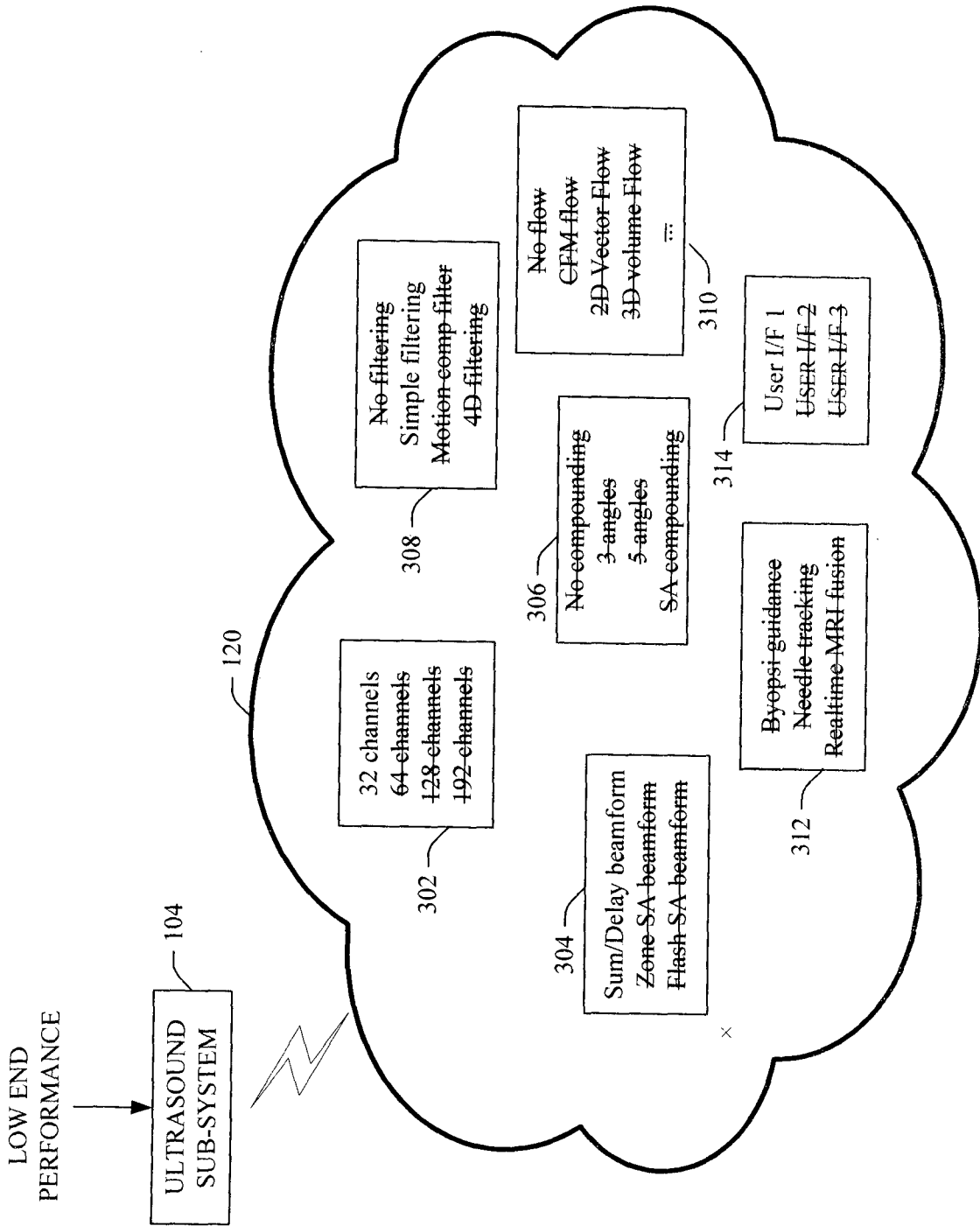


FIGURE 5

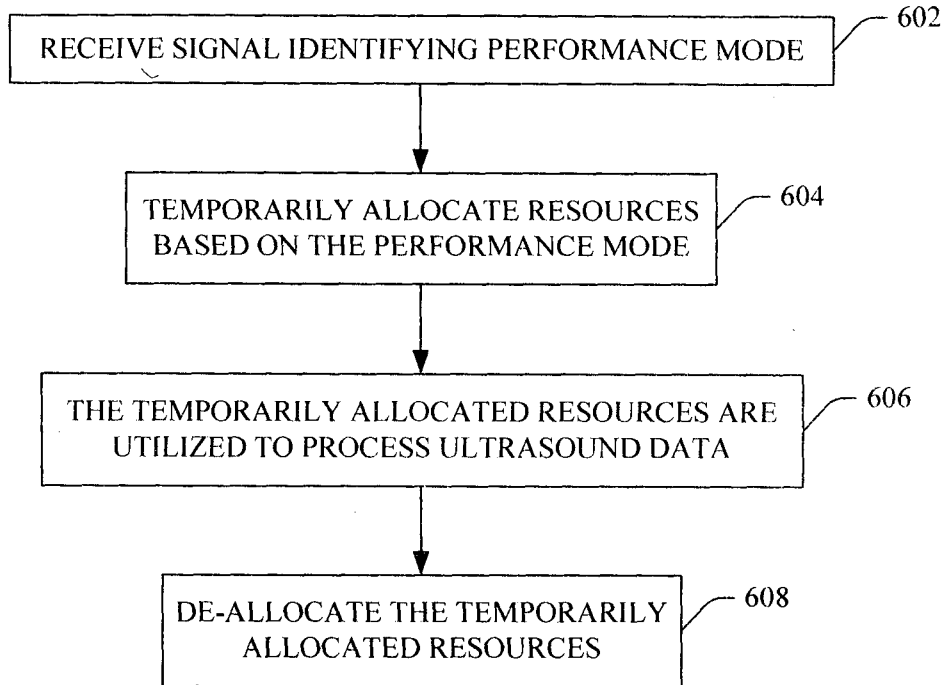


FIGURE 6

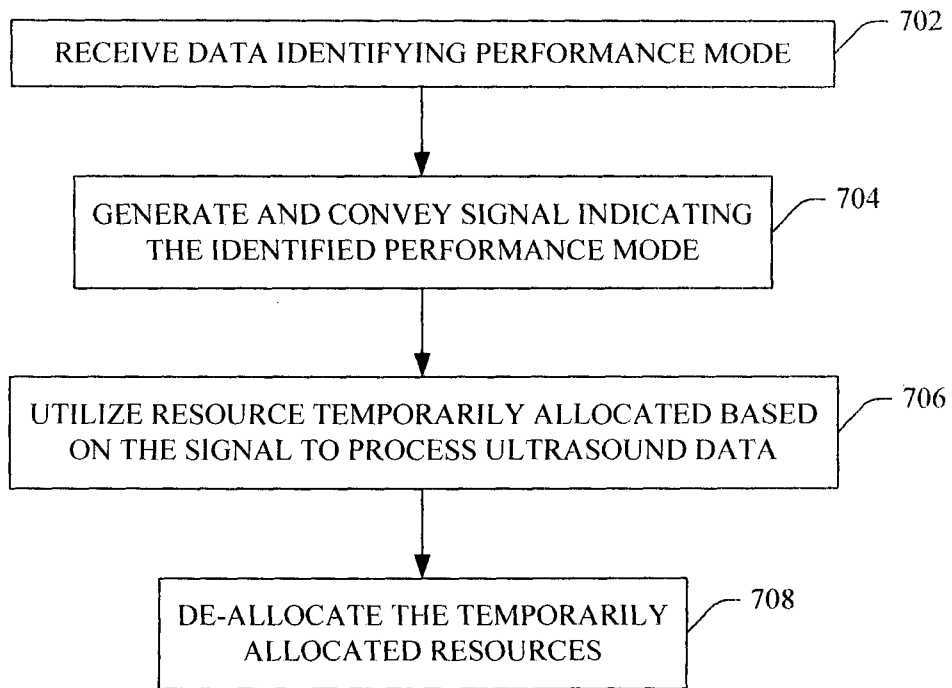


FIGURE 7

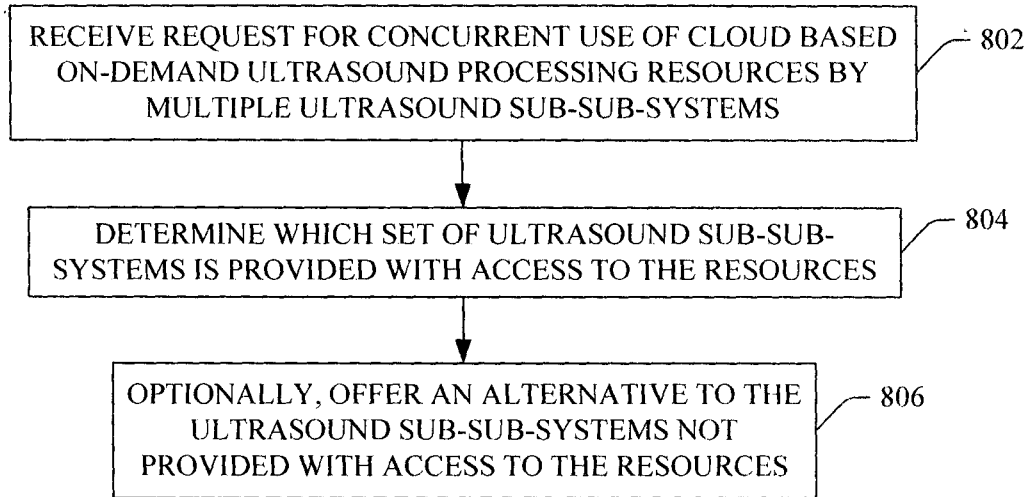


FIGURE 8

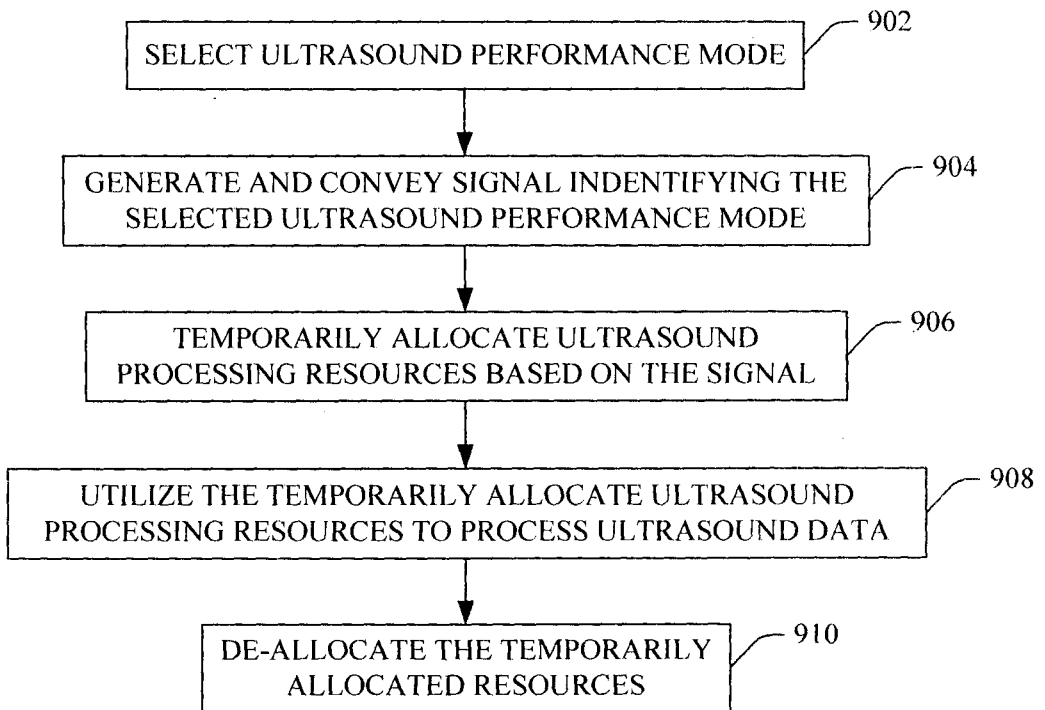


FIGURE 9

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2013/000191

A. CLASSIFICATION OF SUBJECT MATTER INV. G06F9/50 A61B8/00 ADD.		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) G06F A61B		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 01/22215 A1 (SUN MICROSYSTEMS INC [US]) 29 March 2001 (2001-03-29) page 11, line 15 - page 14, line 13 -----	1-25
A	US 2002/145941 A1 (POLAND MCKEE D [US] ET AL) 10 October 2002 (2002-10-10) paragraph [0016] - paragraph [0020] -----	1-25
A	US 2005/210245 A1 (ROLIA JERRY [CA] ET AL) 22 September 2005 (2005-09-22) paragraph [0054] - paragraph [0055] -----	12-14
A	US 2006/248372 A1 (AGGARWAL MANISHKUMAR [CA] ET AL) 2 November 2006 (2006-11-02) the whole document -----	1-25
A	US 2002/065464 A1 (MURPHY KIERAN P [US] ET AL) 30 May 2002 (2002-05-30) the whole document -----	1-25
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
* Special categories of cited documents :		
"A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family	
Date of the actual completion of the international search <p align="center">21 November 2013</p>	Date of mailing of the international search report <p align="center">02/12/2013</p>	
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer <p align="center">Mühlenbrock, Martin</p>	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2013/000191

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			WO 0122215 A1 29-03-2001

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			US 2002065464 A1 30-05-2002
			WO 0243557 A2 06-06-2002

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申请(专利权)人(译)	B-k医疗APS		
当前申请(专利权)人(译)	B-k医疗APS		
[标]发明人	MANIGOFF JESPER LOMBORG EIBYE MICHAEL KNUD		
发明人	MANIGOFF, JESPER, LOMBORG EIBYE, MICHAEL, KNUD		
IPC分类号	G06F9/50 A61B8/00		
CPC分类号	A61B8/565 A61B8/4438 A61B8/4472 A61B8/4494 A61B8/52 A61B8/54 A61B8/56 G06F9/5044 G06F9/5055 G06F2209/5011 G06Q10/06 G06T1/20		
外部链接	Espacenet		

摘要(译)

超声成像系统 (102) 包括具有至少换能器阵列 (112) 的超声子系统 (104) 和超声资源池 (106) 。超声子系统和超声资源池是分开实体。超声资源池基于用于扫描的超声子系统的识别的性能模式，按需提供对超声资源池的u超声处理资源的临时访问。